Function/Arbitrary Waveform Generator

SMG1011F

User Manual

scientific

Information in this manual supersedes all corresponding previous released material.

Scientific continues to improve products and reserves rights to amend part or all of the specifications, procedures, equipment at any time without notice.

Rev 1.00/ 0520

Table of Contents

1. General Safety Requirements

Before any operations, please read the following safety precautions to avoid any possible bodily injury and prevent this product or any other products connected from damage. In order to avoid any contingent danger, this product is only used within the range specified.

Check AC power input setting according to the standards in your country (see page 13, *AC Power Input Setting*).

To avoid Fire or Personal Injury:

- **Use Proper Power Cord.** Use only the power cord supplied with the product and certified to use in your country.
- **Product Grounding.** This instrument is grounded through the grounding conductor of power cord. To avoid electric shock, the product must be grounded properly before any connection with its input or output terminal.
- **Check all Terminal Ratings.** To avoid fire or shock hazard, check all ratings and markers of this product. Refer to the user's manual for more information about ratings before connecting to the instrument.
- **Do not operate without covers**. Do not operate the instrument with covers or panels removed or open.
- **Use Proper Fuse.** Use only the specified type and rating fuse for this instrument.
- **Avoid exposed circuit**. Do not touch exposed junctions and components when the instrument is powered.
- **Do not operate if in any doubt.** If you suspect damage occurs to the instrument, have it inspected by qualified service personnel before further operations.
- **Use your instrument in a well-ventilated area.** Make sure the instrument installed with proper ventilation, refer to the user manual for more details.
- **Do not operate in wet conditions.**
- **Do not operate in an explosive atmosphere.**
- **Keep product surfaces clean and dry.**

2. Safety Terms and Symbols

Terms used on the instrument. Terms may appear on the instrument:

DANGER: Indicates an injury or hazard that may immediately happen.

WARNING: Indicates an injury or hazard that may not immediately happen.

CAUTION: Indicates that a potential damage to the instrument or other property might occur.

Symbols used on the instrument. Symbols may appear on the instrument:


Hazardous Voltage


Refer to Manual


Protective Earth Terminal


Chassis Ground


Test Ground

3. Introduction of SMG1011F

The product is a multi-function generator which combines Arbitrary Waveform Generation and Function Generation. The product introduces Direct Digital Synthesizer (DDS) technology to provide stable, precise, pure and low distortion signal. The user-friendly interface design and panel layout bring exceptional user experience. Provide more alternative solutions for users.

Key Features:

- 4 inch high resolution (480 × 320 pixels) TFT LCD display;
- Advanced DDS technology;
- Max. Sample rate: 125 MSa/s,
- Frequency resolution: 1 μHz;
- Vertical resolution: 14 bits, 8192 waveform record length;
- Abundant waveform output: 5 basic waveforms and 45 built-in arbitrary waveforms output;
- Exponential rise, Exponential fall, Sin(x)/x, Staircase, etc. 45 built-in waveforms and user defined arbitrary waveform;
- Abundant modulation functions along with output liner/logarithm sweep and pulse string waveform ;
- Standard interface: USB (type B) connector.

4. Quick Start

This chapter will deal with the following topics mainly:

- Front/Rear Panel Overview
- User Interface Overview
- How to Implement General Inspection
- How to Adjust the Foot Stools
- How to Implement Power-On Check

4.1 Front/Rear Panel and User Interface

4.1.1 Front Panel

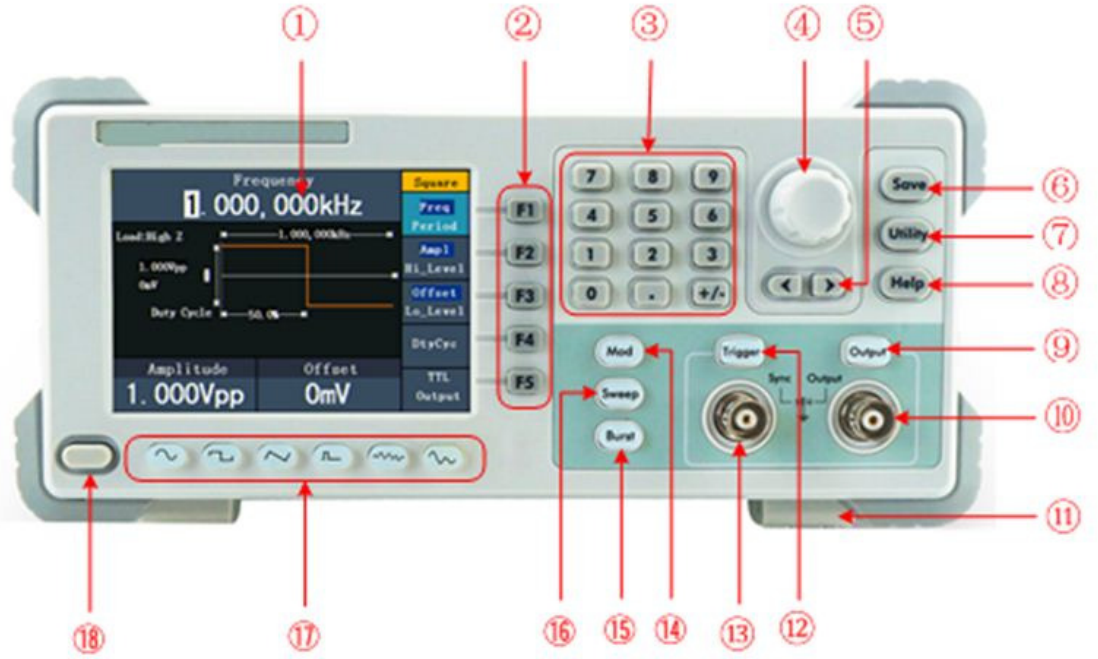


Figure 4-1 Front panel overview

①	**LCD**	Display the user interface
②	**Menu selection buttons**	Include 5 buttons: F1 - F5, activate the corresponding menu
③	**Number keys**	Input parameters, include: number, point and plus/minus sign
④	**Knob**	Change the current highlighted number, also can be used to select file location or switch the character of the soft keyboard when entering file name. In Sweep and N-Cycle Burst, if you choose Source as "Manual", every time you press this knob, the generator will be triggered once.
⑤	**Direction key**	Move the cursor of the focused parameter or select the file locations
⑥	**Save button**	Manage the waveform files in the file system
⑦	**Utility button**	Set the auxiliary system function.
⑧	**Help button**	View the build-in help information
⑨	**Output key**	Activate or deactivate the output signal. The button is lit when it is in the On state.
⑩	**Main Output Terminal**	Output main signal

⑪	**Foot stool**	Make the instrument to be tilted for ease of operation
⑫	**Trigger Key**	Activate or deactivate the sync signal output. The button is lit when it is in the On state.
⑬	**Sync output terminal**	Output sync signal (see P41, "To Set the Sync Output")
⑭	**Modulation (Mod)**	Generate the Modulated waveforms
⑮	**Burst**	Generate burst for Sine, Square, Ramp, Pulse and Arbitrary waveform
⑯	**Sweep**	Sweep Sine, Square or Ramp waveform
⑰	**Waveform selection buttons**	Include: Sine, Square, Ramp, Pulse, Noise and Arbitrary waveform. When a waveform is selected, the backlight of the button turns on.
⑱	**Power button**	Turn on/off the generator

4.1.2 Rear Panel

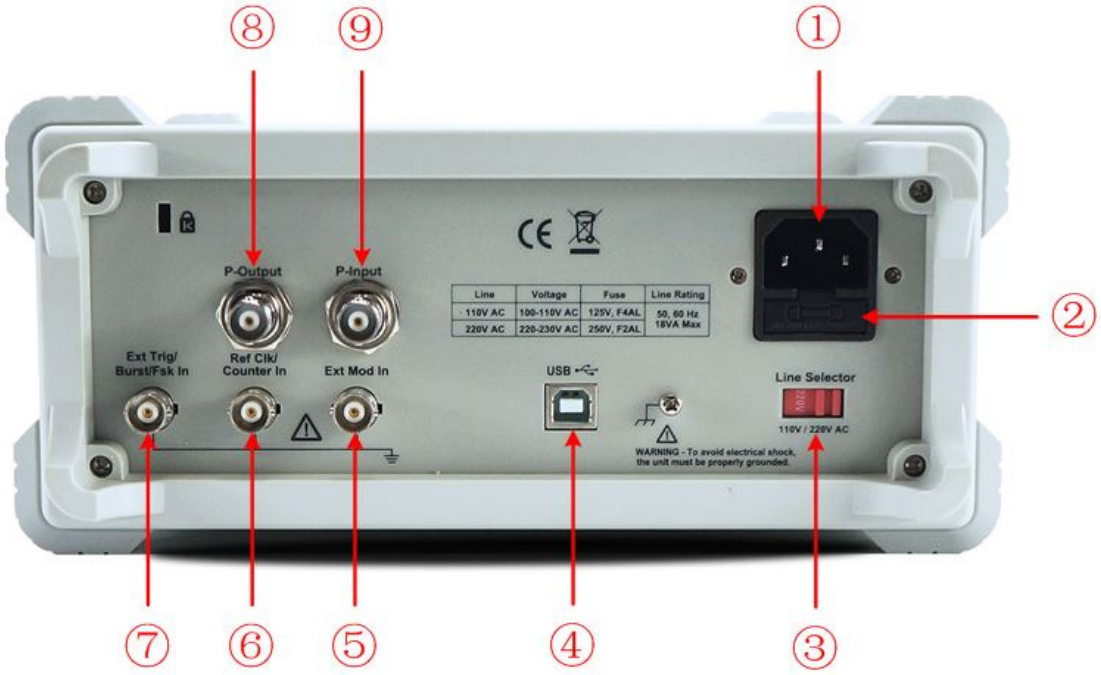


Figure 4-2 Rear panel overview

①	**Power socket**	AC input connector
②	**Fuse**	The rating is 100 - 120 V: 250 V, F1AL 220 - 240 V: 250 V, F0.5AL
③	**Power switch**	Switch between 110 V and 220 V.
④	**USB (type B) connector**	This can be used to connect a USB type B controller. Connect with an external device, such as connected to a PC and controlled via PC software.
⑤	**Ext Mod In Connector**	External modulation input, use it as an external signal source.
⑥	**Ref Clk/Counter In connector**	This signal can be used as external signal source in Sweep, Burst and FSK mode.
⑦	**Ext Trig/Burst/ Fsk In connector**	This signal can be used as external signal source in Sweep, Burst and FSK mode.
⑧	**P-Output connector**	Signal output for the Power Amplifier. See page 42, *5.14 To Use the Power Amplifier (*Optional)
⑨	**P-Input connector**	Signal input for the Power Amplifier. See page 42, *5.14 To Use the Power Amplifier (*Optional)

4.1.3User Interface

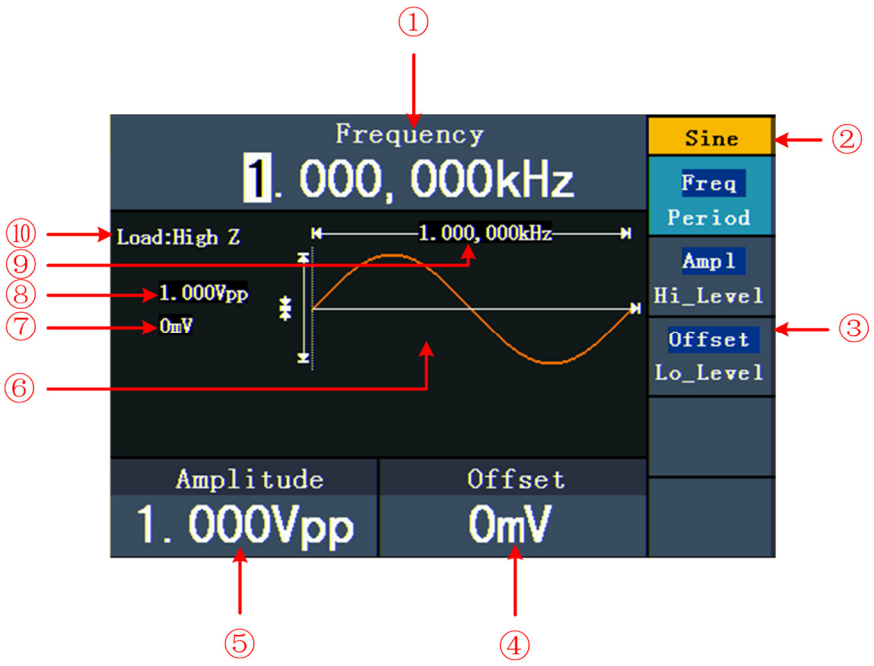


Figure 4-3 User interface (take Sine for instance)

①	Parameter 1, display parameter and edit the focused parameter
②	Current signal type or mode
③	The setting menu of current signal or mode
④	Parameter 3, display parameter and edit the focused parameter
⑤	Parameter 2, display parameter and edit the focused parameter
⑥	Display current waveform
⑦	Offset/low level, depends on the highlighted menu item on the right
⑧	Amplitude/high level, depends on the highlighted menu item on the right
⑨	Frequency/period, depends on the highlighted menu item on the right
⑩	Load, High Z represents high impedance

4.2 General Inspection

After you get a new Waveform Generator, it is recommended to check the instrument according to the following steps:

1. **Check whether there is any damage caused by transportation.**

   If it is found that the packaging carton is damaged, take photographs of box, immediately and inform to freight forwarder or your distributor and our company.
   If there is damage to the instrument caused in transportation, please keep the package.

2. **Check the Accessories**

   The supplied accessories have been listed in Technical Specifications page of this manual. Check receipt of all accessories. If any accessory is missing or damaged, inform your distributor or our company.

3. **Check the Complete Instrument**

   If it is found that there is damage to the instrument, or the instrument is not performing as per its intended use, please inform distributor and our company. If there is damage to the instrument caused by the transportation, please keep the package.

4.3 Foot Stool Adjustment

Unfold the foot stools on the bottom of the generator, as shown in *Figure 4-1* ⑪.

4.4 Power-On Check

AC Power Input Setting

User should set the voltage scale of the **Power Switch** according to the standards in their own country (see *Figure 4-2*) at the rear panel.

To change the voltage scale of the instrument, follow below steps:

(1) Set the **Power Switch** to the desired voltage scale.

(2) Connect the instrument to the AC supply using the supplied power cord. Adopt 220 - 240 VAC power source.

Warning:
To avoid electric shock, the instrument must be grounded properly.

(3) Press the power button on the front panel, the screen shows the boot screen.

Power On

Connect the instrument to the AC supply using the supplied power cord.

5. Front Panel Operation

This chapter deals with the following main topics:

- How to Turn on/off Signal Output
- How to Output Sine Signals
- How to Output Square Signals
- How to Output Ramp Signals
- How to Output Pulse Signals
- How to Output Noise Signals
- How to Output Arbitrary Signals
- How to Output DC
- How to Generate the Modulated Waveform
- How to Generate Sweep
- How to Generate Burst
- How to manage file
- How to Set the Utility Function
- How to set Sync Output
- How to use Power Amplifier (Optional)
- How to Use Built-in Help

5.1 Channel Output On/Off

Press **Output** to turn on/off signal output. The button is lit when it is in the On state. You can configure the signal with the outputs off to minimize the chance of sending a problematic signal.

To set Signals

The following describes how to set and output Sine, Square, Ramp, Pulse, Noise, Arbitrary, DC signals and copy channel.

5.2 To Output Sine Signals

Press button to call the user interface of Sine signal, the Sine waveform parameters can be set by operating the Sine setting menu on the right.
The parameters of Sine waveform are: Frequency/Period, Amplitude/High Level, Offset/Low Level. You can operate the menu by using the menu selection buttons on the right.

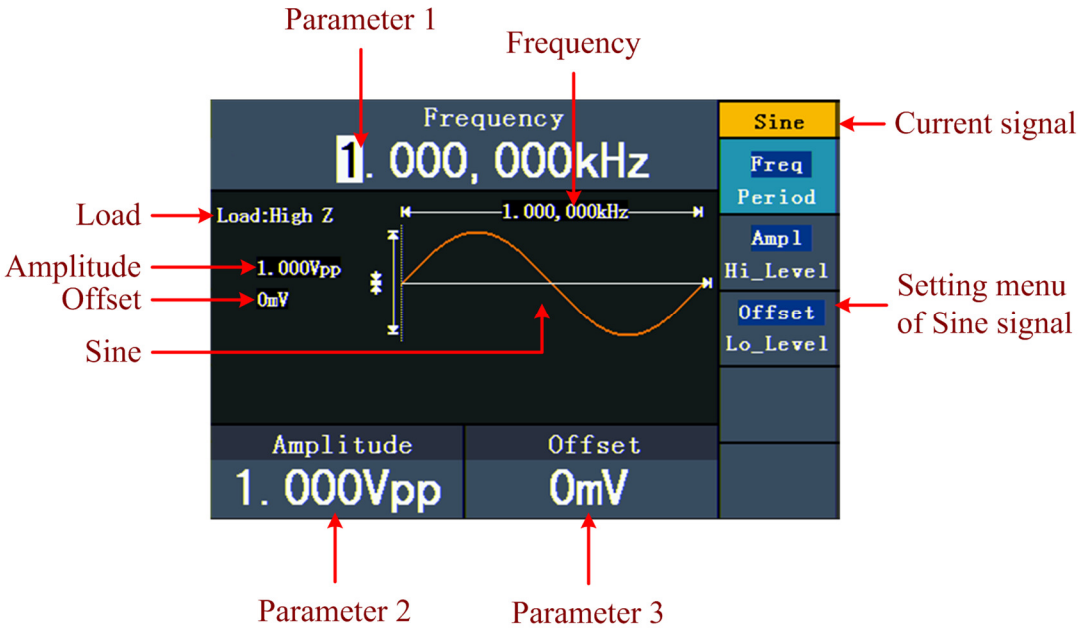


Figure 5-1: The User Interface of **Sine Signal**

➢ To Set the Frequency/Period

Press **F1** button, the chosen menu item is highlighted, the focused parameter is displayed in **Parameter 1**. Press **F1** button to switch between Frequency/Period.

Two methods to change the chosen parameter:

- Turn the **knob** to change the value of cursor position. Press ◀/▶

direction key to move the cursor.

- Press a number key in the front panel, an input box will pop up; keep going to input the value. Press ◀ direction key to delete the last number. Press **F1** - **F3** to choose the unit, or press **F4** to go to next page and choose other units. Press **F5** to cancel the input.

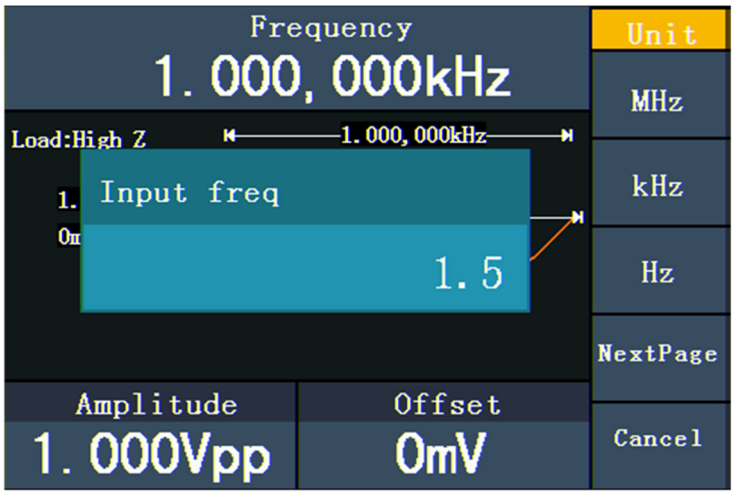


Figure 5-2: Set the frequency using number keys

➢ To Set the Amplitude

Press **F2**, confirm whether the "**Ampl**" menu item is highlighted; if not, press **F2** to switch into "**Ampl**". In **Parameter 2**, a cursor appears under the value of amplitude. Use the **knob** or the number keys to set the desired value.

➢ To Set the Offset

Press **F3**, confirm whether the "**Offset**" menu item is highlighted; if not, press **F3** to switch into "**Offset**". In **Parameter 3**, a cursor appears under the value of offset. Use the **knob** or the number keys to set the desired value.

➢ To Set the High Level

Press **F2**, confirm whether the "**Hi_Level**" menu item is highlighted; if not, press **F2** to switch into "**Hi_Level**". In **Parameter 2**, a cursor appears under the value of amplitude. Use the **knob** or the number keys to set the desired value.

➢ To Set the Low Level

Press **F3**, confirm whether the "**Lo_Level**" menu item is highlighted; if not, press **F3** to switch into "**Lo_Level**". In **Parameter 3**, a cursor appears under the value of offset. Use the **knob** or the number keys to set the desired value.

5.3 To Output Square Signals

Press button to call the user interface of Square signal, the Square waveform parameters can be set by operating the Square setting menu on the right.

The parameters of Square waveform are: Frequency/Period, Amplitude/High Level, Offset/Low Level, Duty, TTL Output. You can operate the menu by using the menu selection buttons on the right.

To set the Frequency/Period, Amplitude/High Level, Offset/Low Level, please refer to *Output Sine Signals on Page 15*.

Press **F5** button to select TTL Output, TTL level will be outputted. When the load is High Z, the output signal is set to 5Vpp amplitude and 2.5V offset. When the load is 50 Ω, the output signal is set to 2.5Vpp amplitude and 1.25V offset.

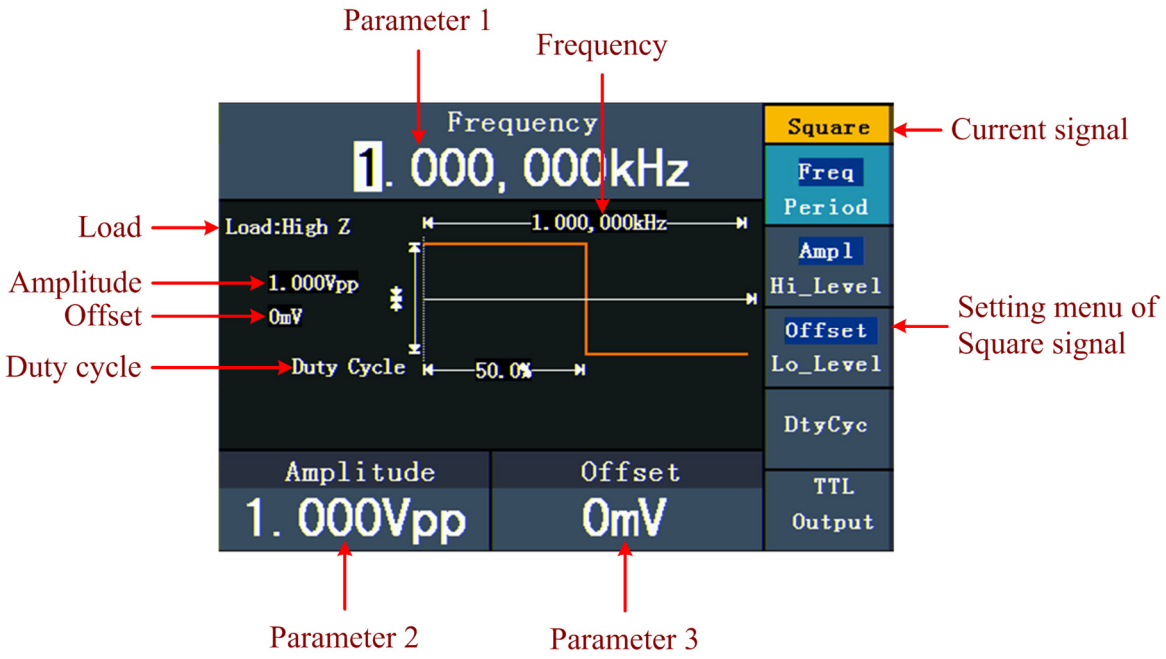


Figure 5-3: The User Interface of Square Signal

➢ To Set the Duty Cycle

(1) Press **F4** button, the "Duty" menu item is highlighted, the current value of the Duty cycle is displayed in **Parameter 1**.

(2) Turn the **knob** to change the value directly or press the number keys to input the desired value, press **F4** to choose "%".

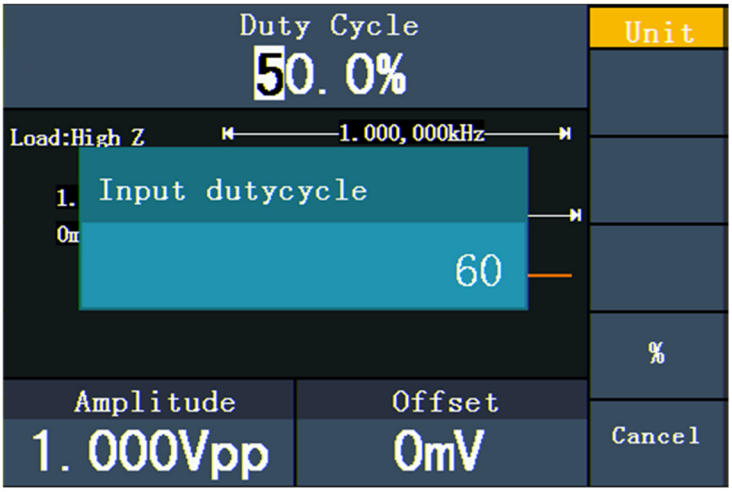


Figure 5-4: Set the Duty cycle of Square signal

Term Explanation

Duty Cycle:
The percentage that the High Level takes up the whole Period.

5.4 To Output Ramp Signals

Press button to call the user interface of Ramp signal, the Ramp waveform parameters can be set by operating the Ramp setting menu on the right.

The parameters of Ramp waveform are: Frequency/Period, Amplitude/High Level, Offset/Low Level, Symmetry. You can operate the menu by using the menu selection buttons on the right.

To set the Frequency/Period, Amplitude/High Level, Offset/Low Level, please refer to *Output Sine Signals on Page 15*.

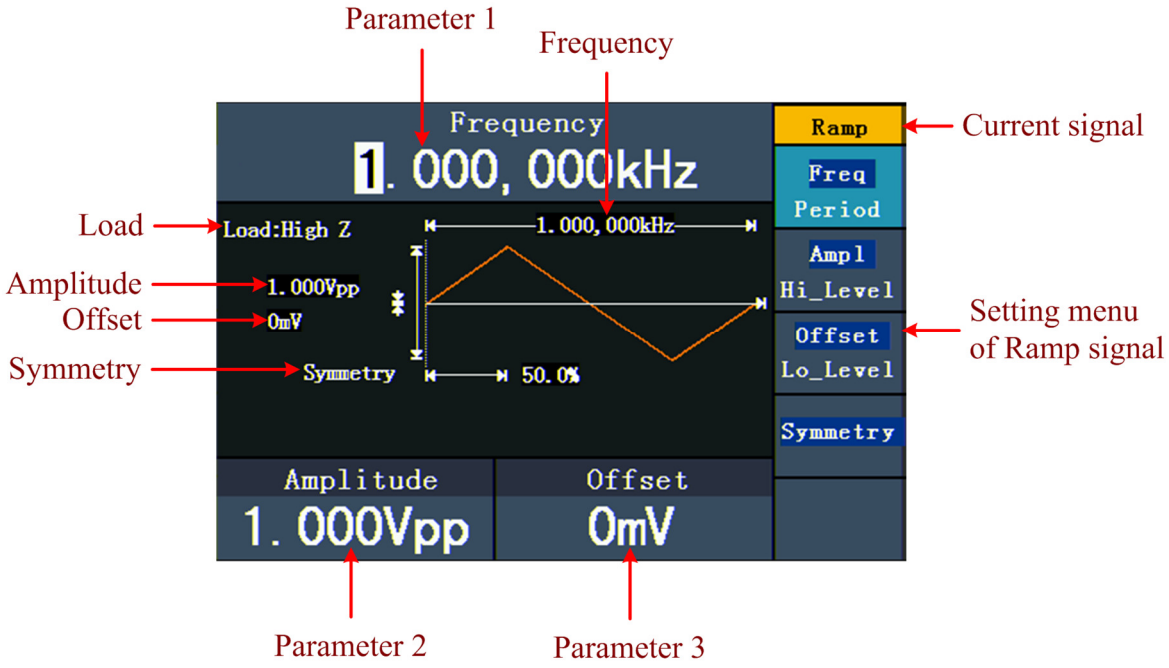


Figure 5-5: The User Interface of Ramp Signal

➢ To Set the Symmetry

(1) Press **F4** button, the "Symmetry" menu item is highlighted, the current value of the symmetry is displayed in **Parameter 1**.

(2) Turn the **knob** to change the value directly or press the number keys to input the desired value, press **F4** to choose "%".

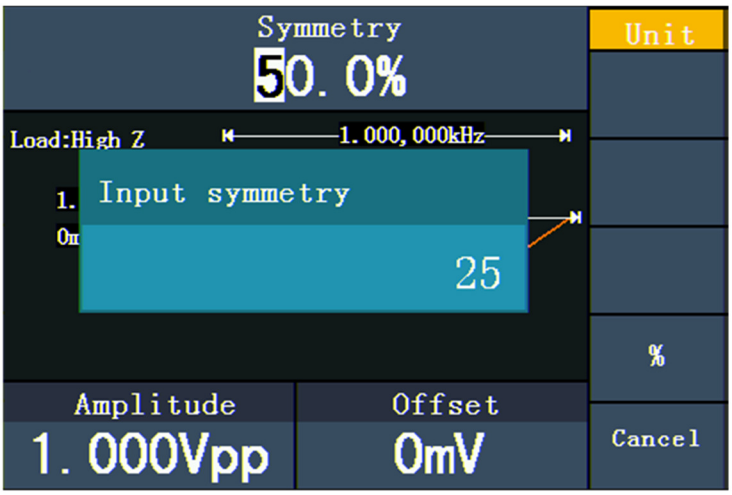


Figure 5-7: Set the symmetry of Ramp signal

Term Explanation

Symmetry:
The percentage that the Rising Period takes up the whole Period.

5.5 To Output Pulse Signals

Press button to call the user interface of Pulse signal, the Pulse waveform parameters can be set by operating the Pulse setting menu on the right.

The parameters of Pulse waveform are: Frequency/Period, Amplitude/High Level, Offset/Low Level, Pulse Width/Duty. You can operate the menu by using the menu selection buttons on the right.

To set the Frequency/Period, Amplitude/High Level, Offset/Low Level, please refer to refer to *Output Sine Signals on Page 15*.

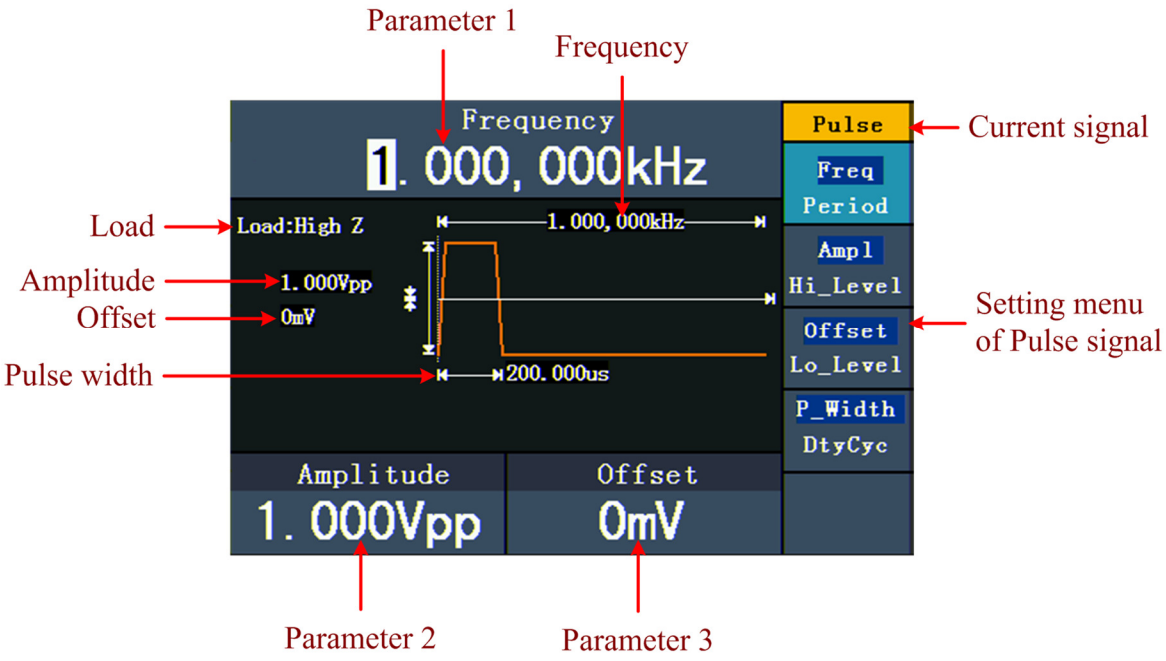


Figure 5-7: The User Interface of Pulse Signal

Term Explanation

Pulse Width:
There are two kinds of Pulse Width—positive and negative.
Positive Pulse Width is the time span between thresholds of 50% of the rising edge amplitude to the next 50% of the falling edge amplitude.
Negative Pulse Width is the time span between thresholds of 50% of the falling edge amplitude to the next 50% of the rising edge amplitude.
Pulse Width is determined by Period and Duty Cycle;
the formula is: Pulse Width = Period * Duty Cycle.

➢ To Set the Pulse Width / Duty Cycle

(1) Press **F4** button, the chosen menu item is highlighted, the focused parameter is displayed in **Parameter 1**. Press **F4** to switch between Pulse Width/Duty.

(2) Turn the **knob** to change the value directly; or press the number keys to input the desired value and choose the unit.

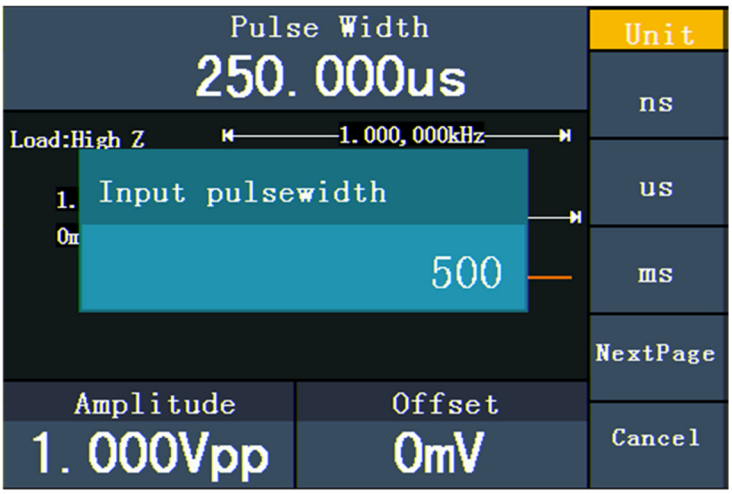


Figure 5-9: Set the Pulse Width of Pulse signal

5.6 To Output Noise Signals

The noise signal which the generator output is white noise. Press button to call the user interface of Noise signal, the Noise waveform parameters can be set by operating the Noise setting menu on the right.

The parameters of Noise waveform are: Amplitude/High Level, Offset/Low Level. You can operate the menu by using the menu selection buttons on the right.

To set the Amplitude/High Level, Offset/Low Level, please refer to refer to *Output Sine Signals on Page 15*.

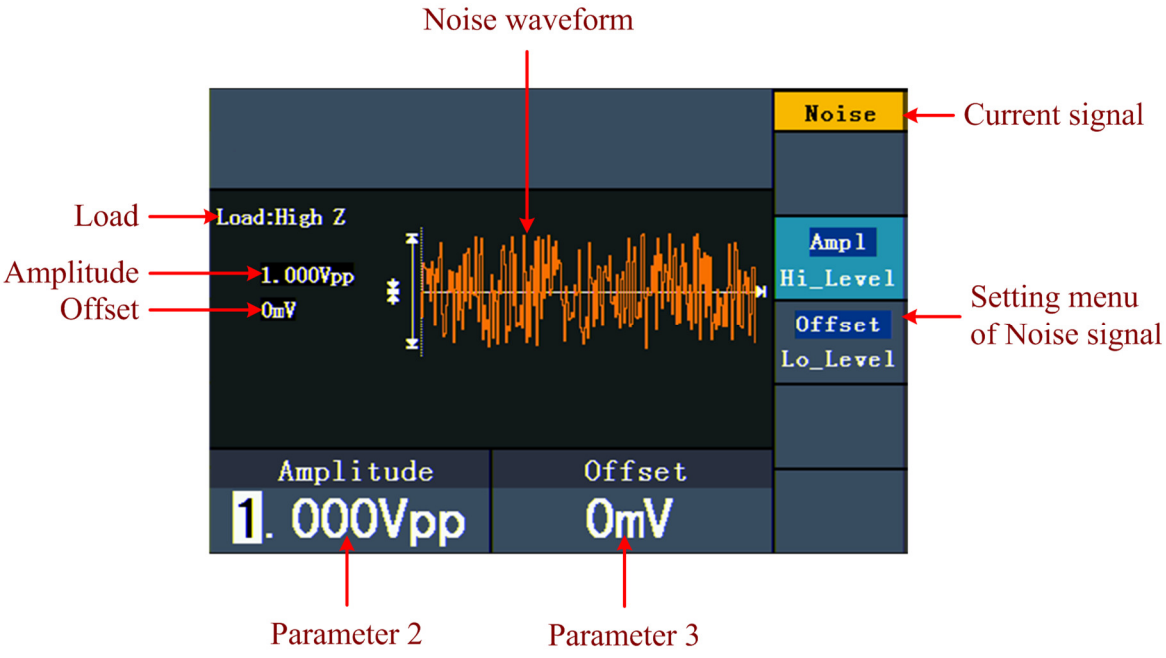


Figure 5-9: The User Interface of Noise Signal

5.7 To Output Arbitrary Signals

Press button to call the user interface of Arbitrary signal, the Arbitrary waveform parameters can be set by operating the Arbitrary setting menu on the right.

The menu items of Arbitrary waveform are: Frequency/Period, Amplitude/High Level, Offset/Low Level, Built-in Waveform, Editable Waveform. You can operate the menu by using the menu selection buttons on the right.

To set the Frequency/Period, Amplitude/High Level, Offset/Low Level, please refer to refer to *Output Sine Signals on Page 15*.

The Arbitrary signal consists of two types: the system built-in waveform and the user-definable waveform.

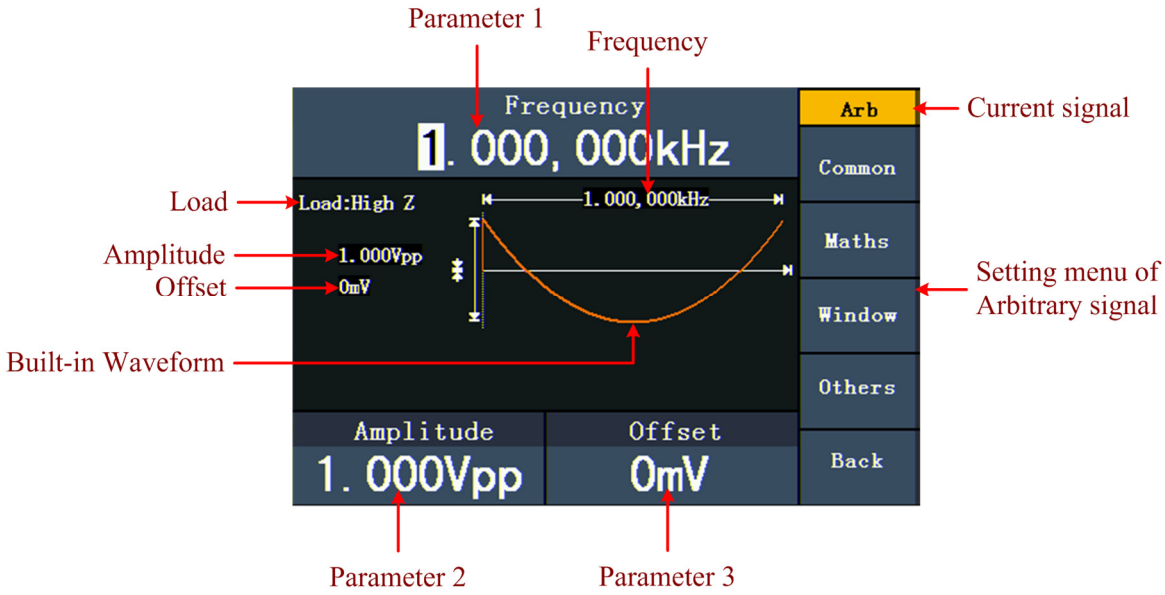


Figure 5-10: The User Interface of Arbitrary Signal

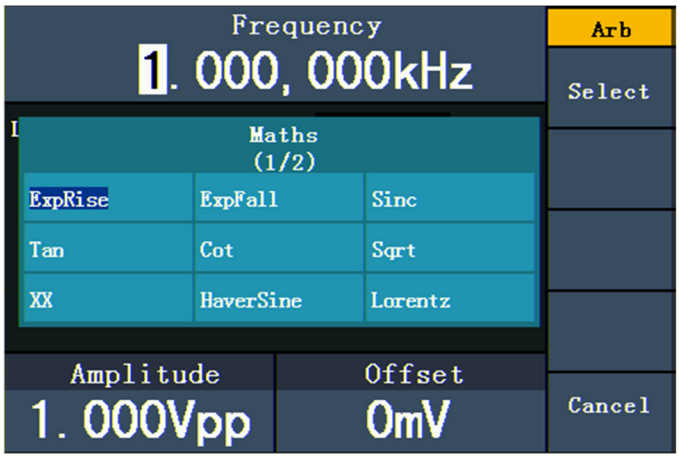
5.7.1 To Select the Built-in Waveform

There are 45 built-in Arbitrary waveforms.

Steps for selecting the built-in waveform:

(1) Press button, then press **F4** to enter the **Built-in Wform** menu.

(2) Press **F1** - **F4** to select Common, Maths, Window or Others. E.g. select Maths to enter the following interface.



(3) Turn the **knob** or press ◀/▶ direction key to choose the desired waveform. E.g. select ExpRise. Press **F1** to output the Exponential Rise waveform.

Built-in Waveform Table

Name	Explanation
Common	
StairD	Stair-down waveform
StairU	Stair-up waveform
StairUD	Stair-up and stair-down waveform
Trapezia	Trapezoid waveform
RoundHalf	RoundHalf wave
AbsSine	Absolute value of a Sine
AbsSineHalf	Absolute value of half a Sine
SineTra	Sine transverse cut
SineVer	Sine vertical cut
NegRamp	Negative ramp
AttALT	Gain oscillation curve
AmpALT	Attenuation oscillation curve
CPulse	Coded pulse
PPulse	Positive pulse
NPulse	Negative pulse
Maths	
ExpRise	Exponential rise function
ExpFall	Exponential fall function
Sinc	Sinc function
Tan	Tangent
Cot	Cotangent
Sqrt	Square root
XX	Square function
HaverSine	HaverSine function
Lorentz	Lorentz function
ln	Natural logarithm function
Cubic	Cubic function
Cauchy	Cauchy distribution

Besselj	BesselI function
Bessely	BesselII function
Erf	Error function
Airy	Airy function
Windows	
Rectangle	Rectangle window
Gauss	Gauss distribution
Hamming	Hamming window
Hann	Hanning window
Bartlett	Bartlett window
Blackman	Blackman window
Laylight	Laylight window
Triang	Triangle window (Fejer window)
Others	
DC	DC signal
Heart	Heart signal
Round	Round signal
LFMPulse	Linear FM pulse
Rhombus	Rhombus signal
Cardiac	Cardiac signal

5.7.2 The User-Definable Waveform

Press button and press **F5** to select "Editable Wform".

Menu item	Instruction
Create Wform	Create a new waveform.
Select Wform	Select the waveform stored in internal storage (FLASH) or USB device (USBDEVICE).
Edit Wform	Edit the stored waveform.

5.7.3 How to Create a New Waveform

(1) **Enter the operation menu:** Press →Editable Wform →Create Wform.

(2) **Set the number of waveform points:** Press **F1** to select "Wform Points", turn the **knob** or press the number keys to input the desired value and choose the unit. X1, XK, XM respectively represent 1, 1000, 1000,000. The waveform points range is 2 – 8k points.

(3) **Set the interpolation:** Press **F2** to switch between On/Off. If you choose On, the points will be connected with beelines; otherwise, the voltages between two consecutive points will not change, and the waveform looks like a step-up one.

(4) **Edit the waveform points**: Press **F3** to enter the operation menu.

- Press **F1** to choose "Points", input the number of the point to be

edited.

- Press **F2** to choose "Voltage", input the voltage for the current point.
- Repeat the step above, set all the points to your needs.
- Press **F4** to choose "Store", enter the file system. If a USB device is connected, press ◀/▶ direction key to select the storage. "USBDEVICE" is the USB device storage, "FLASH" is the internal storage. Choose Next level, enter the desired storage path, choose Save, an input keyboard pops up, input the file name, and then choose DONE.

5.7.4 How to Select a Stored Waveform

(1) **Enter the operation menu:** Press → Editable Wform → Select Wform.

(2) Enter the storage path of the desired waveform file. Turn the **knob** or press ◀/▶ direction key to select the desired waveform file.

(3) Choose Recall output.

5.7.5 How to Edit a Stored Waveform

(1) **Enter the operation menu:** Press → Editable Wform → Edit Wform.

(2) Enter the storage path of the desired waveform file. Turn the **knob** or press ◀/▶ direction key to select the desired waveform file.

(3) Choose Recall suppress.

5.7.6 How to Delete a Stored Waveform

(1) Press **Save** function button to enter the file system.

(2) Enter the storage path of the desired waveform file. Turn the **knob** or press ◀/▶ direction key to select the desired waveform file.

(3) Choose Delete.

5.7.7 To Output DC

(1) Press button, then press **F4** to enter the **Built-in Wform** menu.

(2) Press **F4** to select Others. Select DC. Press **F1** to output DC.

(3) Press **F3**, confirm whether the "**Offset**" menu item is highlighted; if not, press **F3** to switch into "**Offset**". A cursor appears under the value of offset. Use the **knob** or the number keys to set the desired value and choose the unit.

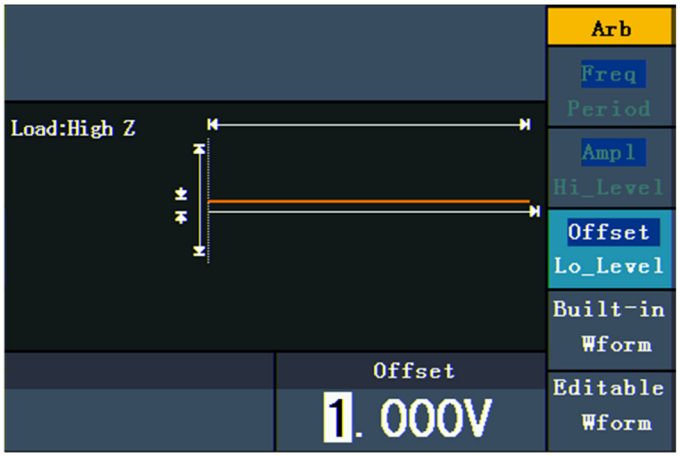


Figure 5-12: The DC Setting Interface

5.8 To Generate the Modulated Waveform

Press the **Mod** button, then press **F1** to select Mod to generate modulated waveform. The waveform generator can modulate waveform using AM, FM, PM and FSK. To turn off the modulation, press the **Mod** button.

5.8.1 AM (Amplitude Modulation)

The modulated waveform consists of two parts: the Carrier Waveform and the Modulating Waveform. The Carrier Waveform can only be Sine. In AM, the amplitude of the Carrier Waveform varies with the instantaneous voltage of the modulating waveform. The user interface of the AM is shown as below.

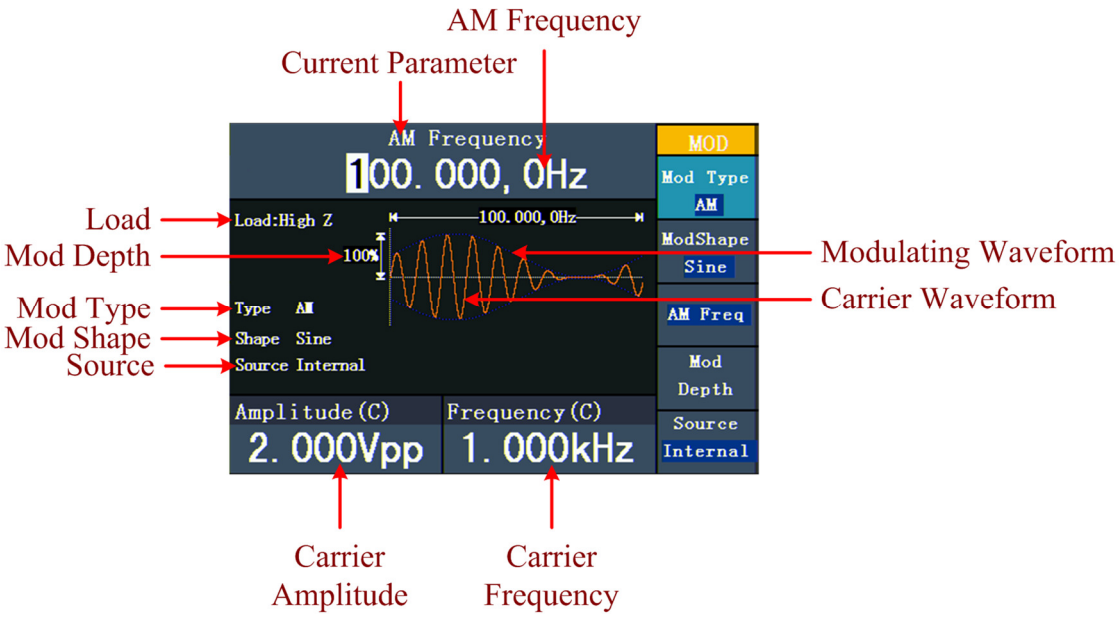


Figure 5-12: The User Interface of AM

➢ How to set the parameters of AM

(1) Press **Mod** function button.

(2) Press **F1** to switch Mod Type to AM. If the Carrier Waveform is not Sine, the system will switch it to Sine automatically.

(3) Press ∿ button to display the waveform and parameters of the Carrier Waveform. You can change the parameters, please refer to refer to *Output Sine Signals on Page 15*. Press ∿ button again to return to the Modulation mode interface.

(4) Press **F5** to select the source. If the source is External, use the **Ext Mod In** connector in the rear panel to input the external signal, the setting of AM is finished. If you choose Internal, continue to the steps below.

(5) Press **F2** to choose Mod Shape, you can choose Sine, Square or Ramp.

(6) Press **F3** to set AM Frequency. The range is 2 mHz - 20 kHz (Internal source only).

(7) Press **F4** to set Mod Depth. The range is 0% - 100%.

Term Explanation
AM Frequency: The frequency of modulating waveform. **Mod Depth:** The Amplitude Range of modulating waveform. In the 0% Modulation, the output amplitude is the half of the set one. In the 100% Modulation, the output amplitude is the same with the set one. For an external source, the depth of AM is controlled by the voltage level of the signal connected to the **Ext Mod In** connector in the rear panel. +1V corresponds to the currently set depth 100%.

5.8.2 FM (Frequency Modulation)

The modulated waveform consists of two parts: the Carrier Waveform and the Modulating Waveform. The Carrier Waveform can only be Sine. In FM, the frequency of the Carrier Waveform varies with the instantaneous voltage of the modulating waveform. The user interface of the FM is shown as below.

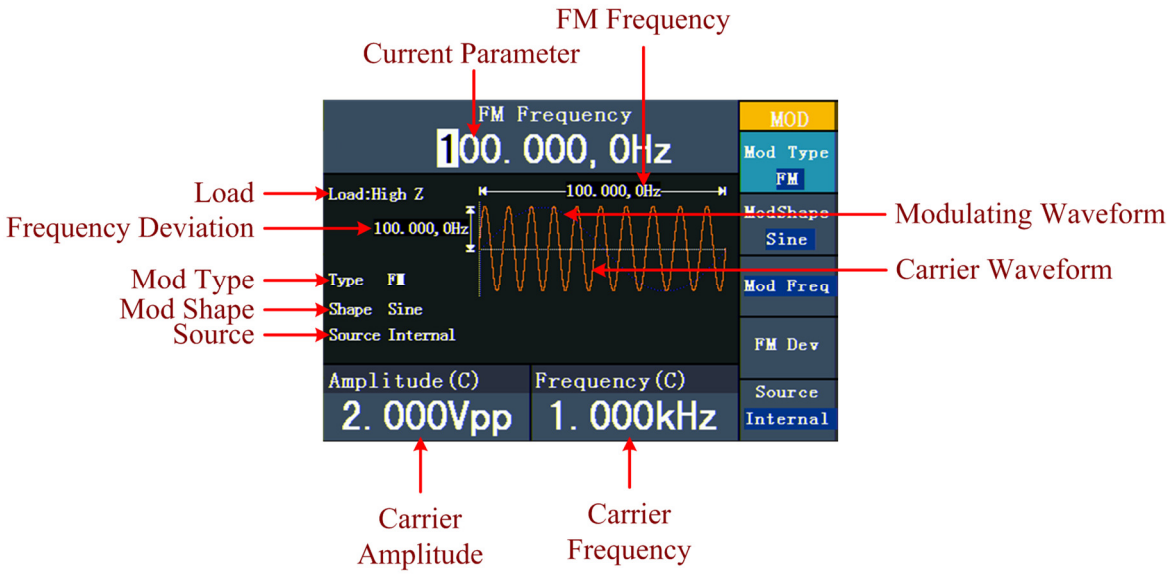


Figure 5-13: The User Interface of FM

➢ How to set the parameters of FM

(1) Press **Mod** function button, then press **F1** to select Mod.

(2) Press **F1** to switch Mod Type to FM. If the Carrier Waveform is not Sine, the system will switch it to Sine automatically.

(3) Press ∿ button to display the waveform and parameters of the Carrier Waveform. You can change the parameters, please refer to refer to *Output Sine Signals on Page 15*. Press ∿ button again to return to the Modulation mode interface.

(4) Press **F5** to select the source. If the source is External, use the **Ext Mod**

In connector in the rear panel to input the external signal, then skip ahead to step (6). If you choose Internal, continue to the steps below.

(5) Press **F2** to choose Mod Shape, you can choose Sine, Square ,Ramp, Noise or Arb .

(6) Press **F3** to set Mod Frequency. The range is 2 mHz - 20 kHz (Internal source only).

(7) Press **F4** to set FM Deviation. The Deviation should be less than the Carrier Waveform Frequency.

Note:
The Sum of the Deviation and the Carrier Frequency must be less than or equal to the sum of upper limit of current carrier frequency and 1kHz.

For an External Source, the Deviation is controlled by the voltage Level of the signal connected to the **Ext Mod In** connector in the rear panel. +1 V corresponds to the selected Deviation and -1 V to the negative selected Deviation.

5.8.3 PM (Phase Modulation)

The modulated waveform consists of two parts: the Carrier Waveform and the Modulating Waveform. The Carrier Waveform can only be Sine. In PM, the phase of the Carrier Waveform varies with the instantaneous voltage level of the modulating waveform. The user interface of the PM is shown as below.

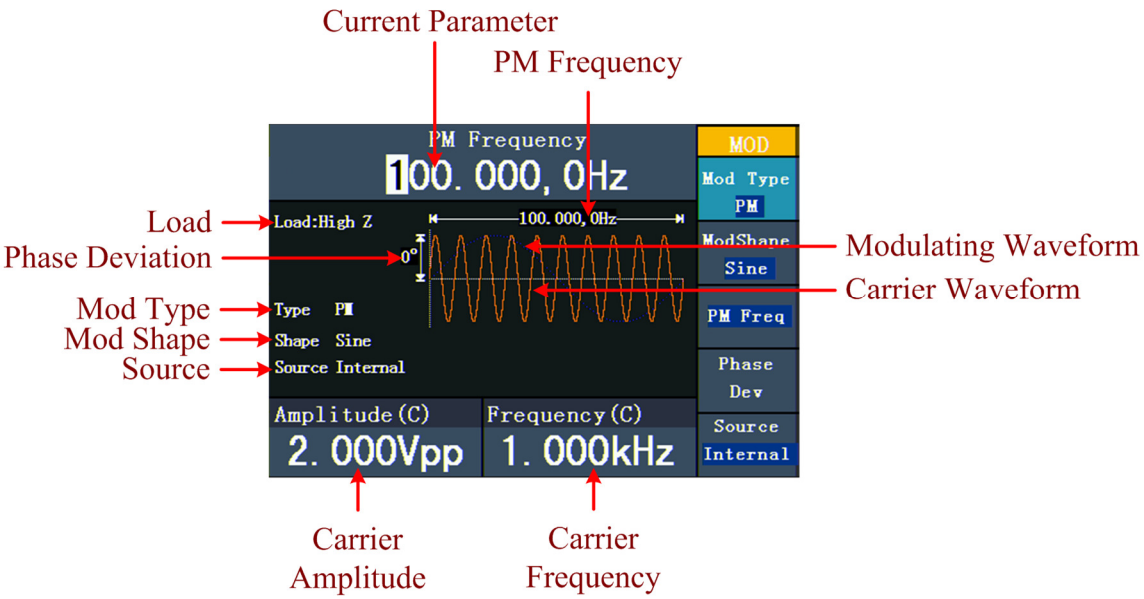


Figure 5-14: The User Interface of PM

➢ How to set the parameters of PM

(1) Press **Mod** function button.

(2) Press **F1** to switch Mod Type to PM. If the Carrier Waveform is not Sine, the system will switch it to Sine automatically.

(3) Press ∿ button to display the waveform and parameters of the Carrier Waveform. You can change the parameters, please refer to refer to *Output Sine Signals on Page 15*. Press ∿ button again to return to the Modulation mode interface.

(4) Press **F5** to select the source. If the source is External, use the **Ext Mod In** connector in the rear panel to input the external signal, then skip ahead to step (6). If you choose Internal, continue to the steps below.

(5) Press **F2** to choose Mod Shape, you can choose Sine, Square ,Ramp, Noise or Arb .

(6) Press **F3** to set PM Frequency. The range is 2 mHz - 20 kHz (Internal source only).

(7) Press **F4** to set Phase Deviation. The Phase Deviation between the Modulating Waveform and the Carrier Waveform ranging from 0° to 180°.

5.8.4 FSK (Frequency Shift Keying)

The FSK Modulation is a modulation method, the output frequency of which switches between two the pre-set frequencies (Carrier Waveform Frequency and the Hop Frequency). The Frequency of the Output Frequency switch between the carrier waveform frequency and the Hop frequency is called the **FSK rate**. The frequency by which the output frequency switch from each other is determined by the Internal Frequency generator or the Signal Voltage Level offered by the **Ext Trig/Burst/Fsk In** connector in the rear panel. The Carrier Waveform can only be Sine. The user interface of the FSK is shown as below.

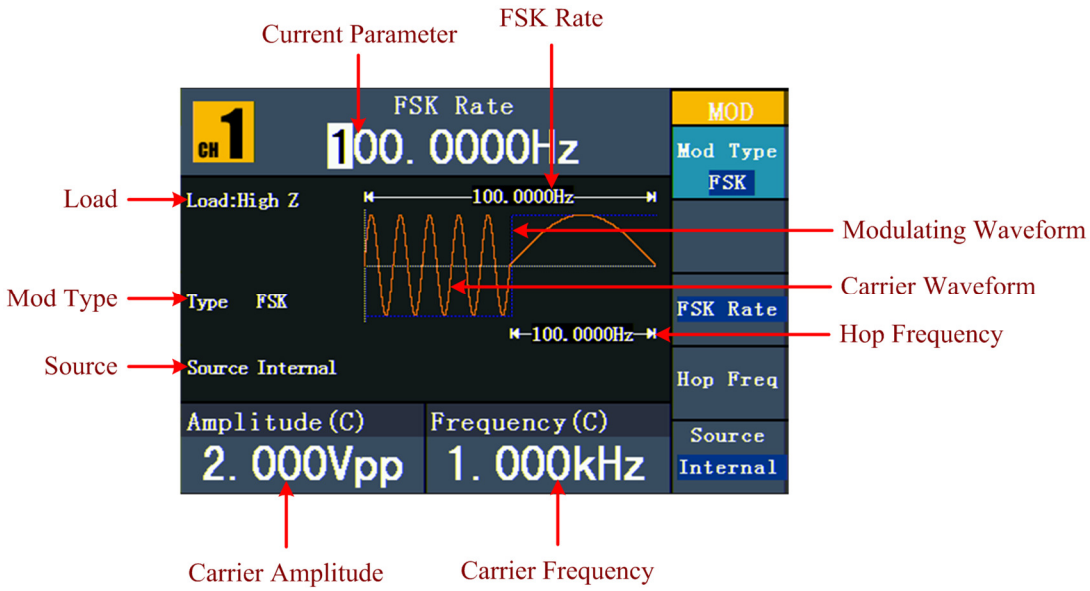


Figure 5-15: The User Interface of FSK

➢ How to set the parameters of FSK

(1) Press **Mod** function button.

(2) Press **F1** to switch Mod Type to FSK. If the Carrier Waveform is not Sine, the system will switch it to Sine automatically.

(3) Press ∿ button to display the waveform and parameters of the Carrier Waveform. You can change the parameters, please refer to refer to *Output Sine Signals on Page 15*. Press ∿ button again to return to the Modulation mode interface.

(4) Press **F5** to select the source. If the source is External, use the Ext Trig/Burst/Fsk In connector in the rear panel to input the external signal, then skip ahead to step (5). If you choose Internal, continue to the steps below.

(5) Press **F3** to set the FSK Rate. The range is 2 mHz - 100 kHz (Internal source only).

(6) Press **F4** to set Hop Frequency. The range is 2 mHz - 25 kHz.

Term Explanation

FSK Rate:
The frequency at which the output frequency shifts between the carrier frequency and the Hop frequency (Internal Modulation only).

5.9 To Generate Sweep

In the frequency sweep mode, the generator "steps" from the start frequency to the stop frequency at the sweep rate you specify. Sweep can be generated by Sine, Square or Ramp Waveforms.

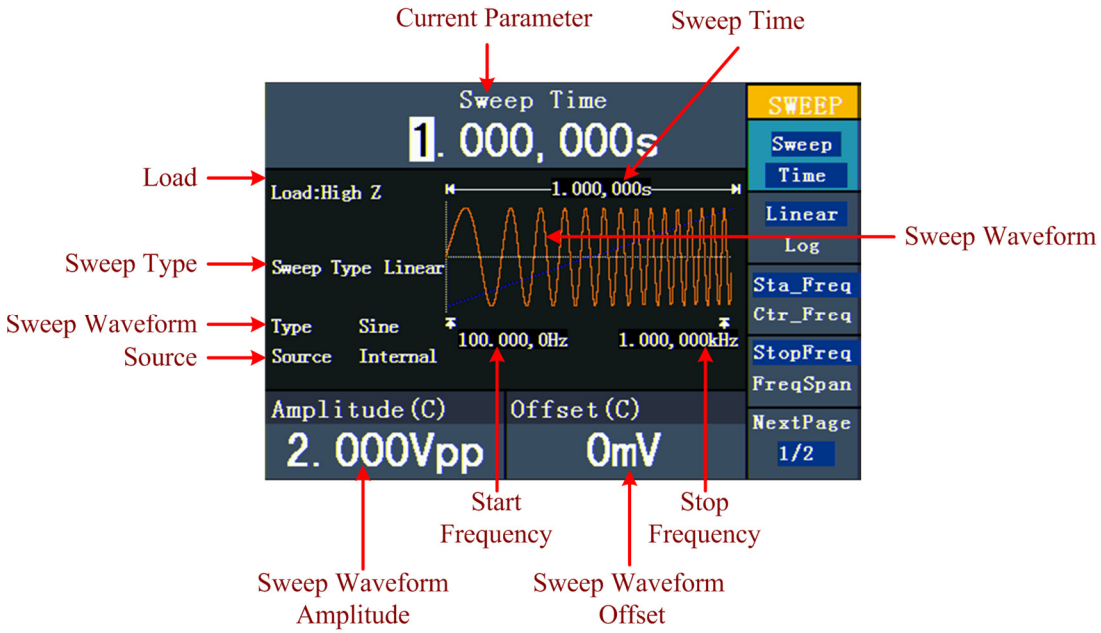


Figure 5**Error! No text of specified style in document.**-16: The User Interface of Sweep Mode

➢ How to set the parameters of Sweep

(1) When the output signal is Sine, Square or Ramp waveform, press the **Mod** button, then press **F2** to select Sweep to enter the Sweep mode.

(2) Press ∿, ⊓, or ⩘ button to choose the waveforms. Take Sine for instance, press ∿ to display the waveform and parameters. You can change the parameters, please refer to ***Error! Reference source not found.*** on page **Error! Bookmark not defined.**. Press ∿ button again to return to the Sweep mode interface.

(3) Press **F1** to set Sweep Time, the Time Span of the Sweep for which the Frequency changes from the Start Frequency to Stop Frequency.

(4) Press **F2** to select the Sweep Type. Linear means setting the Sweep with linear spacing; Log means setting the Sweep with logarithmic spacing.

(5) Use Start Freq and Stop Freq or Center Freq and Freq Span to set the range of the frequency. Press **F3** to select Sta_Freq or Cen_Freq, and set the desired value.

(6) Press **F4** to select StopFreq or FreqSpan, and set the desired value.

(7) Press **F5** to select NextPage, press it again to enter the next page.

(8) Press **F1** to select the source. Internal means using the internal source. External means using the **Ext Trig/Burst/Fsk In** connector in the rear panel to input the external signal. Manual means choosing manual trigger; in Sweep interface, press the **knob** on the front panel to trigger a Sweep.

5.10 To Generate Burst

Press the **Burst** button to generate versatile waveforms in burst. Burst can last for certain times of waveform cycle (N-Cycle Burst), or to be controlled by external gated signals (Gated Burst). Bust can apply to Sine, Square, Ramp, Pulse and Arbitrary waveforms (Noise can not be used).

Term Explanation

Burst:
Output Waveforms with set cycle times. Generally it is called BURST function within every Signal Generator.

N-Cycle Burst:
N-Cycle has specific number of waveform cycles, and every burst is activated by a trigger event.

Gated Burst:
Gated burst use external source to control burst as when to be activated.

5.10.1 Set the N-Cycle Burst

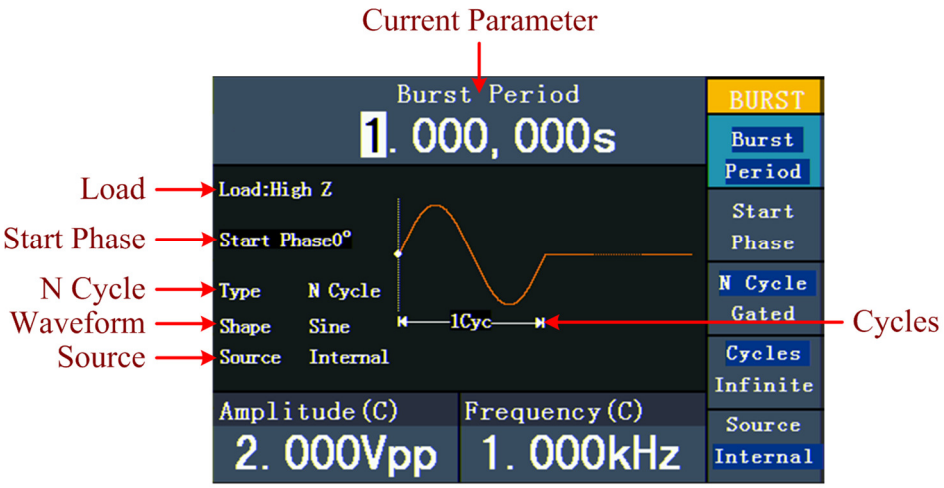


Figure 5-17: The User Interface of N-Cycle Burst

(1) When the output signal is Sine, Square, Ramp, Pulse or Arbitrary

waveform, press the **Burst** button.

(2) Press , , , , or button to choose the waveform. Take Sine for instance, press to display the waveform and parameters. You can change the parameters, please refer to refer to *Output Sine Signals on Page 15*. Press button again to return to the Burst mode interface.

(3) Press **F3** to switch to N Cycle.

(4) Press **F1** to select Burst Period, set it to the desired value.

(5) Press **F2** to select Start Phase (if current waveform is Pulse, skip this step), define the Start and the Stop Point in a waveform. The phase varies from -360° to +360°. For an Arbitrary Waveform, 0° is the first waveform point.

(6) Press **F4** to select Cycles or Infinite. Set the number of Waveform Cycle in an N-Cycle (from 1 to 50,000). If you choose Infinite, then a continuous waveform will be generated which will not stop until a trigger event happens (the **knob** on the front panel is pressed).

Note:
- If needed, Burst Period will increase to cater to the specific number of cycles.
- For an infinite-cycle Burst, External or Manual Trigger is needed to activate burst.

(7) Press **F5** to select the source. Internal means using the internal source. External means using the **Ext Trig/Burst/Fsk In** connector in the rear panel to input the external signal. Manual means choosing manual trigger; in N-Cycle Burst interface, press the **knob** on the front panel to output a burst signal.

5.10.2 Set the Gated Burst

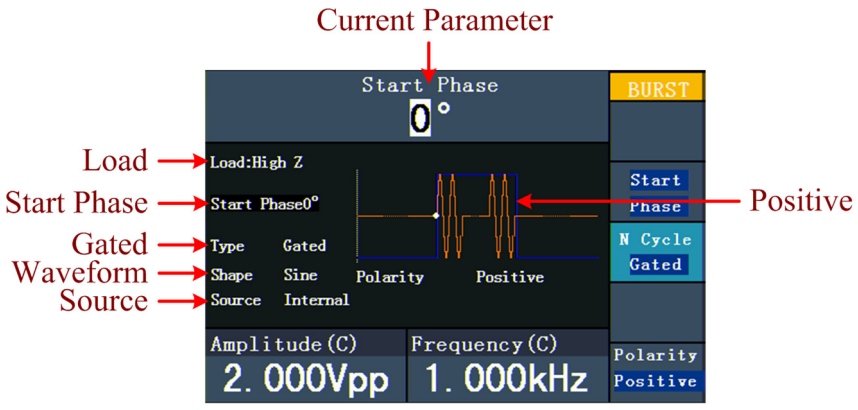


Figure 5-18: The User Interface of Gated Burst

(1) (1) When the output signal is Sine, Square, Ramp, Pulse or Arbitrary

waveform, press the Burst button.

(2) Press , , , , or button to choose the waveforms. Take Sine for instance, press to display the waveform and parameters. You can change the parameters, refer to *Output Sine Signals on Page 15*. Press button again to return to the Burst mode interface.

(3) Press **F3** to switch to Gated.

(4) Press **F2** to select Start Phase, define the Start and the Stop Point in a waveform. The phase varies from -360° to +360°. For an Arbitrary Waveform, 0° is the first waveform point.

(5) Press **F5** to switch between Positive/Negative. Set the Polarity for the Gated Signal.

5.11 To Save File

Press **Save** function button to enter the file system. You can view the waveform files, create a new folder, and perform the file operations such as delete, rename, copy and paste.

5.11.1To Edit the File Name

In file system, the user can edit the name of a file or a folder. When the system needs the user to input a name, an input keyboard will appear.

Figure 5-17: Edit the File Name

(1) Turn the **knob** or press ◀ / ▶ direction key to move the cursor left and right in the keyboard. Press **F3** to switch between capital and small of the characters.

(2) Press **F1** to enter the current character. Press **F2** to delete the last character .

(3) Press **F4** to finish editing and save the file. Press **F5** to cancel the save operation.

Note: The length of file name is up to 15 characters.

5.12 To Set the Utility Function

Press **Utility** function key to enter the Utility Menu. You can set the parameters of the Generator such as: Display Parameter, Counter Parameter, Output Parameter and System Setting. Press **Utility** again to exit the Utility Menu.

5.12.1 To Set Display Parameter

5.12.1.1 To Set the Brightness

(1) Press **Utility** and choose Disp Setup, press **F1** to select Bright.

(2) Turn the **knob** to change the value, press ◀/▶ direction key to move the cursor left and right; or press the number keys to input the desired value in percent, press **F4** to select the unit. The bright range is 0% - 100%.

5.12.1.2 To Set the Separator

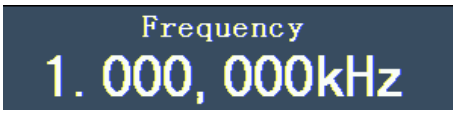
The user can set the separator of the displayed parameter.

(1) Press **Utility** and choose Disp Setup, press **F2** to select Sep.

(2) Press **F2** to switch between Comma, Space, Off.

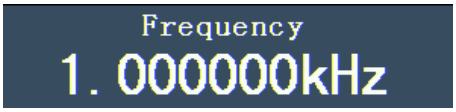
Take the Frequency parameter for instance:

Comma



Space

Off



5.12.1.3 To Set the Screen Saver

The screen saver will run automatically if no operation is taken for any key within the set time. Press any button to resume.

(1) Press **Utility** and choose Disp Setup, press **F3** to select Scrn Svr.

(2) Press **F3** to switch between On/Off.

(3) If On is selected, you can set the screen saver time. Turn the **knob** to change the value, press ◀ / ▶ direction key to move the cursor left and right; or press the number keys to input the desired time in minutes, press **F4** to select the unit. The screen saver time range is 1 - 999 minutes.

5.12.2 To Set the Counter

The counter can measure the signal with frequency from 100 mHz to 200 MHz.

The operation steps:

(1) Press **Utility** and choose Counter.

(2) Connect the signal to the connector [**Ref Clk**/**Counter In**] on the rear panel.

(3) Press **F3** to choose Set, enter measurement setting menu.

- **To set the coupling mode**: Press **F1** to switch Coupling as AC/DC.
- **To set the sensitivity**: Press **F2** to switch Sens as Low/Middle/High. For low amplitude signal, the “Middle” or “High” sensitivity should be used.
  For low frequency signal with high amplitude and slower rising edge, low sensitivity is a better choice.
- **To set the high frequency restrain on/off**: Press **F3** to switch HFR as ON/OFF.
  High frequency restrain is used for filtering the high frequency signal in measuring the low frequency signal, and improve the measure accuracy.
  To measure low frequency signal lower than 1 kHz, you should put on the high frequency restrain to filter the high frequency noise disturb. To measure high frequency signal higher than 1 kHz, you should put off the high frequency restrain.
- **To set the trig level**: Press **F4** to choose TrigLev. Turn the **knob** to change the value, press ◀ / ▶ direction key to move the cursor left and right; or press the number keys to input the desired value and choose the unit. The range of trig levle is -2.5 V - 2.5 V.
- Press **F5** to choose Back to previous menu, view the result.

After all the set was done, the counter will measure the signal according to the current set. If the reading is unsteady, please repeat the above step until it is steady.

(4) Press **F1** to switch to view the measure result of **frequency** or **period**. Press **F2** to switch to view the measure result of **positive width** or **duty**.

5.12.3 To Set Output Parameter

To Set the Output Load

For the **Main output terminal** on the Front panel, the Generator has a built-in 50Ωseries impendence. If the actual load does not match the set one, the displayed amplitude and offset are incorrect. This function is used to match the displayed voltage with the expected load.

Steps for setting the Load of each channel:

(1) Press **Utility** and choose Output Setup**.** Press **F1** to select HighZ or *Ω

(2) To change the load value, after selecting *Ω, turn the **knob** to change the value, press ◀/▶ direction key to move the cursor left and right; or press the number keys to input the desired value. Press **F3** or **F4** to select the unit. The load range is 1 Ω - 10 kΩ.

Note:
For **Output** terminal on the Front panel, the waveform generator has a fixed 50Ω Series Impendence. No matter what Value the set parameter is, if the real load is different from the set one, the displayed voltage will not equal the real voltage.

5.12.4 To Set the System

5.12.4.1 Language Setting

Press **Utility** and choose System, press **F1** to switch display languages.

5.12.4.2 Power On Setting

(1) Press **Utility** and choose System, press **F2** to select Power On.

(2) Press **F2** to switch between Default/Last. Default means that all the settings return to default when powered. Last means that all the settings return to the last one when powered.

5.12.4.3 To Return to Default Setting

Press **Utility** and choose System, press **F3** to select Set to Default, press **F1** to confirm. All the settings will be set to default. The default settings of the system are as follows:

Output	**Default**
Function	Sine Wave
Frequency	1 kHz
Amplitude/Offset	1 V_{p-p} / 0 Vdc

Waveforms	**Default**
Frequency	1 kHz
Amplitude	1 V_{p-p}
Offset	0 Vdc
Duty Cycle of Square	50%
Symmetry of Ramp	50%
Pulse Width of Pulse	200 us
Duty Cycle of Pulse	20%

Modulation	**Default**
Modulation waveform	100 Hz, Sine Wave (except FSK) 100 Hz, Square Wave (FSK)
AM Depth	100%
FM Deviation	100 Hz
PM Phase Deviation	0°
PWM deviation	0.0%
FSK Hop Frequency	100 Hz
FSK Rate	100 Hz
ASK Rate	100 Hz
PSK Rate	100 Hz
Source	Internal

Sweep	**Default**
Start/Stop Frequency	100 Hz/1 kHz
Time	1 sec
Mode	Linear

Burst	**Default**
Frequency	1 kHz
Count	1 Cycle
Period	1 sec
Phase	0°

Others	**Default**

Brightness	100%
Separator	Comma
Screen Saver time	30 minutes
Load	High Z
Phase Deviation	0°
Clock Source	Internal
Channel Output Control	Off

5.12.4.4 To Set the Beep

(1) Press **Utility** and choose System, enter the second page of the menu.
(2) Press **F1** to select Beep.
(3) Press **F1** to switch between On/Off. On is to activate the sound when the system informs you. Off is to deactivate it.

5.12.4.5 View System Information

(1) Press **Utility** and choose System, enter the second page of the menu.
(2) Press **F2** to select Sys info. You can view the Version and Serial number.

5.12.4.6 To Set the Clock Source

The waveform generator provides an internal clock source and also accepts external clock source input from the [**Ref Clk**/**Counter In**] connector at the rear panel. It can also output a clock source from the [**Ref Clk Out**] connector for other device to use.

Note:
The amplitude of the [**Ref Clk**/**Counter In**] input signal must be over 1 V.

(1) Press **Utility** and choose System, enter the second page of the menu.
(2) Press **F3** to select CLK Sou.
(3) Press **F3** to switch between Internal/External.

5.13 To Set the Sync Output

The Generator provides Sync output through the **Sync output terminal** on the Front Panel. All standard output functions (except DC and Noise) have a corresponding Sync Signal.

Press **Trigger** button to activate or deactivate the Sync Signal on the **Sync output terminal** on the front panel. When it is deactivated, the output Voltage of the **Sync output terminal** is Level Low.

Note:
When the amplitude is relatively low, disabling Sync Signal can reduce the distortion in output.

The Instructions of the Sync Signal in certain situations:

- In the Inverse Mode, the Waveform that corresponds to the Sync Signal does not Inverse.
- For Sine, Square, Ramp and Pulse Signal, the Sync Signal is a Square Signal with 50% Duty Cycle. When the output is positive, The Sync Signal is TTL Level High compared to 0 V Voltage or DC Offset; when the output is negative, The Sync Signal is TTL Level Low compared to 0 V Voltage or DC Offset.
- For Arbitrary Waveform, the Sync Signal is a Square Waveform with 50% Duty Cycle. At the time when the first output waveform point is generated, the Sync Signal Voltage is TTL Level High.
- For Internal Modulating AM, FM, and PM, the Sync Signal reference is the Modulated Signal (not the Carrier Signal). The Sync Signal is a Square Waveform with 50% Duty Cycle. In the first half modulation period, the Sync Signal is TTL Level High. For External Modulation, the Sync Signal reference is the Carrier Signal (not the Modulated Signal). The Sync Signal is also a Square Waveform with 50% Duty Cycle.
- For FSK, the Sync Signal Reference is the Hop Frequency, and the Sync Signal is a Square Waveform with 50% Duty Cycle. For the Hop Frequency, at the hopping point, the Sync Signal is TTL Level High.
- For a Sweep which disables the Mark function, the Sync Signal is a Square Waveform with 50% Duty Cycle. When the Sweep starts, the Sync Signal is TTL Level High and turns Low at the Center of the Sweep. The Sync Frequency equals the specific Sweep time. For a Sweep that enables the Mark Function, the Sync Signal is TTL Level High at the beginning of the Sweep and turns Low at the Mark Frequency.
- For the Burst, when the burst starts, the Sync Signal is Level High. At the specific point when the Cycle Number ends, the Sync Signal turns Level Low (If the Waveform has a relative starting phase, it may be not zero intersections). For an infinite burst, the Sync Signal is the same with the Sync Signal of the continuous Signal.
- For the External Gated Burst, the Sync Signal follows the External Gated Signal. But, please note that this signal will not turn Level Low until the end of the last period (If the Waveform has a relative starting phase, it may be not zero intersections).

5.14 To Use the Power Amplifier (Optional)

The Power Amplifier module is optional for the generator, can be used in power circuit test, power components measurement, constant voltage output, magnetization characteristic measurement, scientific research and education.

Features:

- Gain: X10;
- Virtual Value of Sine Output Power: 10W;
- Input Impedance: 50 kΩ;
- The integrated output protection circuit (overcurrent protection and internal temperature abnormal protection) provided with ensures the instrument is working stably and safely;
- Full power bandwidth: DC – 100 kHz.

How to Use:

Connect the input signal to the **P-Input** connector on the rear panel; the **P-Output** connector outputs the amplified signal.

5.15 To Use Built-in Help

(1) Press **Help** function button, the catalog will display in the screen.

(2) Press **F1** or **F2** to choose help topic, or just turn the **knob** to choose.

(3) Press **F3** to view the details about the topic; press **F5** to go back to the catalog.

(4) Press **Help** again to exit the help, or just do other operations.

6. Communication with PC

The Waveform Generator supports communications with a PC through USB port. You can use the ultrawave communication software to set the parameters, control the output of the Waveform Generator.
The Waveform Generator supports communications with a PC by SCPI commands through USB port.
Here is how to connect with PC. Install the ultrawave communication software on the supplied CD.

(1) **Connection:** Use a USB data cable to connect the **USB (type B) connector** on the rear panel of the Waveform Generator to the USB port of a PC.
(2) **Install the driver:** When the Waveform Generator is turned on, a dialog will appear on the PC screen and guide you to install the USB driver. The driver is in the "USBDRV" folder under the directory where the ultrawave communication software is installed, such as "C:\Program Files\ultrawave\USBDRV".
(3) **Port setting of the software:** Run the ultrawave software; click "Communications" in the menu bar, choose "Ports-Settings", in the setting dialog, choose "Connect using" as "USB". After connect successfully, the connection information in the bottom right corner of the software will turn green.

To learn about how to operate the software, press F1 in the software to open the help document.

SCPI

The waveform generator supports SCPI, and the users can operate and control the device by USB port.

7. Troubleshooting

1. The instrument is powered on but no Display.

- Check if the power is connected properly.
- Check if the Power Switch is in the proper voltage setting.
- Check if the fuse which is below the AC Power socket is used appropriately and in good condition (the cover can be pried open with a straight screwdriver).
- Restart the instrument after the steps above.

2. The measured value of output signal amplitude disaccords to the displayed value:

Check if the actual load matches the set one. Please refer to *To Set the Output* Load on page 38.

8. Technical Specifications

All these specifications apply to the Waveform Generator SMG1011F. To meet these specifications, the instrument must be ON continuously for more than 30 minutes within the specified operating temperature.

Waveforms		
Standard Waveforms	Sine, Square, Ramp, Pulse, Noise	
Arbitrary Waveforms	Exponential rise, Exponential fall, Sin(x)/x, Staircase, etc. 45 built-in waveforms, User-Definable Waveform	
Frequency Characteristic **Max sampling rate 125 MSa/s; Frequency resolution is 1 µHz**		
Sine	1 µHz—10 MHz	
Square	1 µHz—5 MHz	
Ramp	1 µHz—1MHz	
Pulse	1 µHz—5 MHz	
White Noise	5 MHz bandwidth (-3 dB) (typical)	
Arbitrary	1 µHz—5 MHz	
Amplitude Characteristic		
Output Amplitude	High Z	1 mVPP - 25 VPP
	50 Ω	1 mVPP – 12.5 VPP
Amplitude Resolution	0.1 mVpp or 4 digits	
Amplitude Accuracy	±(1% of setting + 1 mVpp) （Typical value 1kHz Sine, 0V offset）	
DC Offset Range (AC+DC)	±6.25 V (50 Ω) ±12.5 V (High Z)	
DC Offset Resolution	1 mV or 4 digits	
DC Offset Accuracy	±(1 % of |setting| + 1 mV + amplitude Vpp *0.5%)	
Output Impedance	50 Ω (typical)	
Waveform Characteristic		
Sine		
Flatness (when the Amplitude is 1.0 V_{p-p} (+4 dBm), relative to 1 kHz)	1 µHz to 5 MHz：0.2 dB	
Harmonic Distortion (when the Amplitude is 1.0 V_{p-p})	<-40 dBc	
Total Harmonic Distortion (when the Amplitude is 1 V_{p-p})	10 Hz to 20 kHz： <0.2 %	
Phase Noise	-110 dBc/Hz at 1 MHz frequency, 10 kHz offset, 1 V_{p-p}, typical	
Residue Clock Noise	-57 dBm (typical)	
Square		
Rise/Fall Time	<25 ns (10% - 90%) (typical, 1 kHz, 1 V_{p-p})	
Jitter (rms)	< 1 ns	
Non-symmetry (below 50% Duty Cycle)	1% of period+ 5 ns	
Overshoot	< 5%	

Duty Cycle	50% fixed
Ramp	
Linearity	< 0.1% of peak output (typical, 1 kHz, 1 V_{p-p}, Symmetry 50%)
Symmetry	0% to 100%
Pulse	
Pulse Width	100 ns to 1000 ks
Accuracy	10 ns
Rising/Falling Edge Time	< 25 ns
Overshoot	< 5%
Jitter	< 1 ns
Arbitrary	
Waveform Length	2 – 8k points
Sample Rate	125 MSa/s
Amplitude Accuracy	14 bits
Minimum Rise/Fall Time	35 ns (typical)
Jitter (RMS)	6 ns + 30 ppm
Modulated Waveform	
AM	
Carrier Waveforms	Sine
Source	Internal/ External
Internal Modulating Waveforms	Sine, Square, Ramp, White Noise, Arbitrary
Internal AM Frequency	2 mHz - 20 kHz
Depth	0.0% - 100.0%
FM	
Carrier Waveforms	Sine
Source	Internal/ External
Internal Modulating Waveforms	Sine, Square, Ramp, White Noise, Arbitrary
Internal Modulating Frequency	2 mHz - 20 kHz
Frequency Deviation	2 mHz - 1 kHz
PM	
Carrier Waveforms	Sine
Source	Internal/ External
Internal Modulating Waveforms	Sine, Square, Ramp, White Noise, Arbitrary
Internal PM Frequency	2 mHz - 20 kHz
Phase Deviation	0° - 180°
FSK	
Carrier Waveforms	Sine
Source	Internal/ External
Internal Modulating Waveforms	50% duty cycle square
FSK Rate	2 mHz - 100 kHz
Sweep	
Type	Linear, Logarithmic
Carrier Waveforms	Sine, Square, Ramp

Direction	Up / Down	
Sweep Time	1 ms to 500 s ± 0.1%	
Source	Source, External or Manual	
Burst		
Waveforms	Sine, Square, Ramp, Pulse, Arbitrary	
Types	Count (1 to 50,000 periods), infinite, gated	
Start Phase	-360° - +360°	
Internal Period	(10 ms - 500 s) ± 1%	
Gated Source	External Trigger	
Trigger Sources	Source, External or Manual	
Counter Specification		
Function	Frequency, period, positive Pulse width, Duty cycle	
Frequency Range	Single channel: 100 mHz - 200 MHz	
Frequency Resolution	6 digits	
Voltage Range and Sensitivity (non-modulation signal)		
DC coupled	DC offset range	±1.5 VDC
	100 mHz - 100 MHz	250 mV_{p-p} - 5 V_{p-p} (AC+DC)
	100 MHz - 200 MHz	450 mV_{p-p} - 3 V_{p-p} (AC+DC)
AC coupled	1 Hz - 100 MHz	250 mV_{p-p} - 5 V_{p-p}
	100 MHz - 200 MHz	450 mV_{p-p} - 4 V_{p-p}
Pulse width and Duty cycle Measure	1 Hz - 10 MHz (100 m V_{p-p} - 10 V_{p-p})	
Input adjust	Input impedance	1 MΩ
	Coupling mode	AC, DC
	High frequency restrain	High frequency noise restrain (HFR) On or Off
	sensitivity	Low, Middle, High
Trigger level range	±2 V	
Input/Output		
Front Panel		
Output terminal	Output main signal	
Sync terminal	Output sync TTL signal	
	Rise time	< 50 ns
Rear Panel		
Interfaces	USB (type B) connector	
External Modulation Input		
Input Frequency Range	DC-20 kHz	
Input Voltage Range	± 1 Vpk	
Input Impedance	10 kΩ (typical)	
External Trigger Input		
Level	TTL-compatible	
Slope	Rising or falling (selectable)	
Pulse Width	>100 ns	
External Reference Clock Input		
Impedance	1 kΩ, AC coupled	
Requested Input voltage swing	100 mV_{p-p} to 5 V_{p-p}	

Locking range	10 MHz ± 35 kHz	
Counter Input		
DC coupled	DC offset range	±1.5 VDC
	100 mHz - 100	250 mV_{p-p} - 5 V_{p-p} (AC+DC)
	100 MHz - 200	450 mV_{p-p} - 3 V_{p-p} (AC+DC)
AC coupled	1 Hz - 100 MHz	250 mV_{p-p} - 5 V_{p-p}
	100 MHz - 200	450 mV_{p-p} - 4 V_{p-p}
Power Amplifier Specification (Optional)		
Input Impedance	50 kΩ	
Output Impedance	< 2 Ω	
Gain	X 10	
Max Input Voltage	2.2 V_{p-p}	
Max Output Power	10 W	
Max Output Voltage	22 V_{p-p}	
Full Power Bandwidth	DC - 100 kHz	
Slew Rate	10 V/us	
Overshoot	< 7%	
Display		
Display Type	4 inch colored LCD (Liquid Crystal Display)	
Display Resolution	480 (Horizontal) × 320 (Vertical) Pixels	
Display Colors	65536 colors, 16 bits, TFT screen	
Power		
Supply	220 - 240 VAC, 100 - 120 VAC, 50/60 Hz, CAT Ⅱ	
Consumption	< 18 W (For the model with Power Amplifier, < 35 W)	
Fuse	100 - 120 V	250 V, F1AL
	220 - 240 V	250 V, F0.5AL
Environment		
Temperature	Working temperature: 0℃ - 40℃ Storage temperature: －20℃ - 60℃	
Relative Humidity	≤ 90%	
Height	Operating: 3,000 m Non-operating: 15,000 m	
Cooling Method	Natural cooling	
Mechanical Specifications		
Dimension	235 mm × 110 mm × 295 mm (W*H*D)	
Weight	3 kg	
Standard Accessories	Power Cord, USB Cable, CD, Output Cable	
Calibration Interval		
One year is recommended for the calibration interval period.		

9. Service & Maintenance

Maintenance

There are no user serviceable parts inside the unit. Your Arbitrary Waveform generator is thoughtfully engineered for ease of use, accuracy and reliability. The instrument is carefully tested and calibrated using standards traceable to National Laboratories. Take care of your instrument by cleaning the exterior of the instrument regularly with a dusting brush. Dirt which is difficult to remove on the casing & plastic parts, can be removed with a moist cloth (99% water, 1% mild detergent) spirit or washing benzene(petroleum ether) can be used to remove greasy dirt. The display may be cleaned with water or washing benzene (but not with spirit- alcohol solvents), it must then be wiped with a dry clean lint-free cloth. Under no circumstances the cleaning fluid should get into the instrument. The use of cleaning agents can attack the plastic & paint surfaces.

Dispatch Procedure for Service

No user serviceable parts are inside the instrument, should it become necessary to send back the instrument to factory for service, please observe the following procedure:

1. Before dispatching the instrument please write to us giving full details of the model number, serial number, fault noticed and contact details of concerned person.
2. After receipt of your communication, our service department will advise you whether it is necessary to send the instrument back to us for repairs or the adjustment is possible in your premises.
3. Dispatch the instrument (only on the receipt of our advice) securely packed in original packing duly insured and freight paid along with accessories and a copy of the faults details noticed at our Service Center listed on last page of this manual, nearest to you.

10. Warranty Conditions

Scientific warrants all its Instruments to be free from defects in material and workmanship when used under normal operating conditions in accordance with the instructions given in the manual for a period of 12 (Twelve) months from date of purchase from Scientific or its authorized dealers.

The service during the warranty period will be rendered on return to factory / service center basis.

1. Its obligation under this warranty is limited to repairing or replacing at its own discretion. This warranty shall not apply to any defect, failure or damage caused by accident, negligence, mis-application, alteration or attempt to repair, service or modify in any way.
2. This warranty does not include display, fuses, batteries or accessories. This warranty is only valid with the original purchaser who must have properly registered the product within 15days from date of purchase. No other warranty is expressed or implied.
3. When it becomes necessary to return the instrument to our Factory facility, kindly pack it carefully in the original carton or equivalent and ship it duly insured, transportation charges prepaid.
4. Your Scientific instrument is a complex electronic device and deserves the best service available by technicians thoroughly familiar with its service and calibration procedures.