

# GF-858

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## DUAL-CHANNEL ARBITRARY WAVEFORM GENERATOR














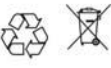


Version	Date
1.0	July 2016

## SAFETY RULES

- \* Use Proper Power Cord. Use only the power cord supplied with the product and certified to use in your country.
- \* Product Grounded. This instrument is grounded through the power cord grounding conductor. To avoid electric shock, the grounding conductor must be grounded. 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.
- \* Use Proper Fuse. Use only the specified type and rating fuse for this instrument. Do not place the equipment on damp or wet surfaces.
- \* 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.

**\* Symbols related with safety:**

	DIRECT CURRENT		ON (Supply)
	ALTERNATING CURRENT		OFF (Supply)
	DIRECT AND ALTERNATING		DOUBLE INSULATION (Class II protection)
	GROUND TERMINAL		CAUTION (Risk of electric shock)
	PROTECTIVE CONDUCTOR		CAUTION REFER TO MANUAL
	FRAME TERMINAL		FUSE
	EQUIPOTENTIALITY		EQUIPMENT OR COMPONENT TO BE RECYCLED

**Descriptive Examples of Over-Voltage Categories**


**Cat I** Low voltage installations isolated from the mains.

**Cat II** Portable domestic installations.

**Cat III** Fixed domestic installations.

**Cat IV** Industrial installations.

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# DUAL-CHANNEL ARBITRARY WAVEFORM GENERATOR

## GF-858

### 1 INTRODUCTION

#### 1.1 Description

These products are dual-channel 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. Support USB storage device. Provide more alternative solutions for users.

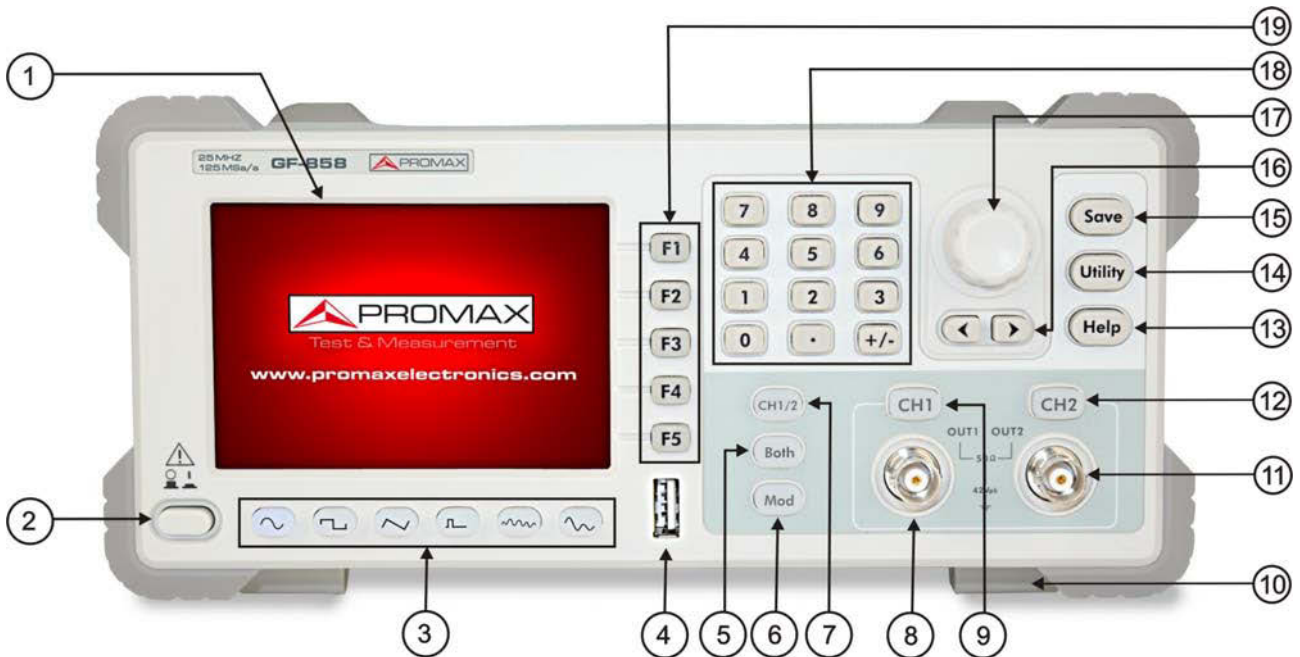
#### 1.2 Main Features

- 3.9 inch high resolution (480 × 320 pixels) TFT LCD display;
- Advanced DDS technology, max. 60 MHz frequency output;
- Max. Sample rate: 250 MSa/s, Frequency resolution: 1  $\mu$ Hz;
- Vertical resolution: 14 bits, max. 1 M waveform record length;
- Abundant waveform output: 5 basic waveforms and 45 built-in arbitrary waveforms output;
- Exponential rise, Exponential fall,  $\text{Sin}(x)/x$ , 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 port, USB (type B) connector.



## 2 GETTING STARTED



### 2.1 Front Panel



**Figure 1.** Front panel description.

- ① **LCD:** Display the user interface.
- ② **Power button:** Turn on/off the generator.
- ③ **Waveform selection buttons:** Include: Sine , Square , Ramp , Pulse , Noise and Arbitrary waveform. When a waveform is selected, the backlight of the button turns on.
- ④ **USB port:** Connect with an external USB device, such as connect a USB device to the instrument.
- ⑤ **Both button:** Display the editable parameters of both channels. When the function is enabled, the backlight of the button turns on.
- ⑥ **DC button:** Enter DC settings screen of current channel.
- ⑦ **CH1/2 button:** Switch channel displayed on the screen between CH1 and CH2.
- ⑧ **CH1 Output:** Output signal of CH1.
- ⑨ **CH1 Output Control:** Turn on/off the output of CH1. The backlight will be lighted when CH1 is tuned on.
- ⑩ **Foot stool:** Make the instrument to be tilted for ease of operation.



- 11 **CH2 Output:** Output signal of CH2.
- 12 **CH2 Output Control:** Turn on/off the output of CH2. The backlight will be lighted when CH2 is tuned on.
- 13 **Help button:** View the build-in help information.
- 14 **Utility button:** Set the auxiliary system function.
- 15 **Save button:** Store/recall the user-defined arbitrary waveform data.
- 16 **Direction key:** Move the cursor of the focused parameter or select the file locations.
- 17 **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.  
Press this knob to enter Channel Copy menu.
- 18 **Number keys:** Input parameters, include: number, point and plus/minus sign.
- 19 **Menu selection buttons:** Include 5 buttons:  - , activate the corresponding menu.



2.2 Rear Panel



Figure 2. Rear panel description.

- 1 **Ref Clk Out connector:** To synchronize generators. Output a clock signal generated by the crystal inside the generator.
- 2 **Ref Clk connector:** To accept an external clock signal.
- 3 **Ext Trig/Burst/Fsk In connector:** This signal can be used as external signal source in Sweep, Burst and FSK mode.
- 4 **Ext Mod In Connector:** External modulation input, use it as external signal source.
- 5 **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.
- 6 **Power switch:** Switch between 110 V and 220 V.
- 7 **Fuse:** The rating is 250 V, F2AL.
- 8 **Power socket:** AC input connector.





2.3 Display

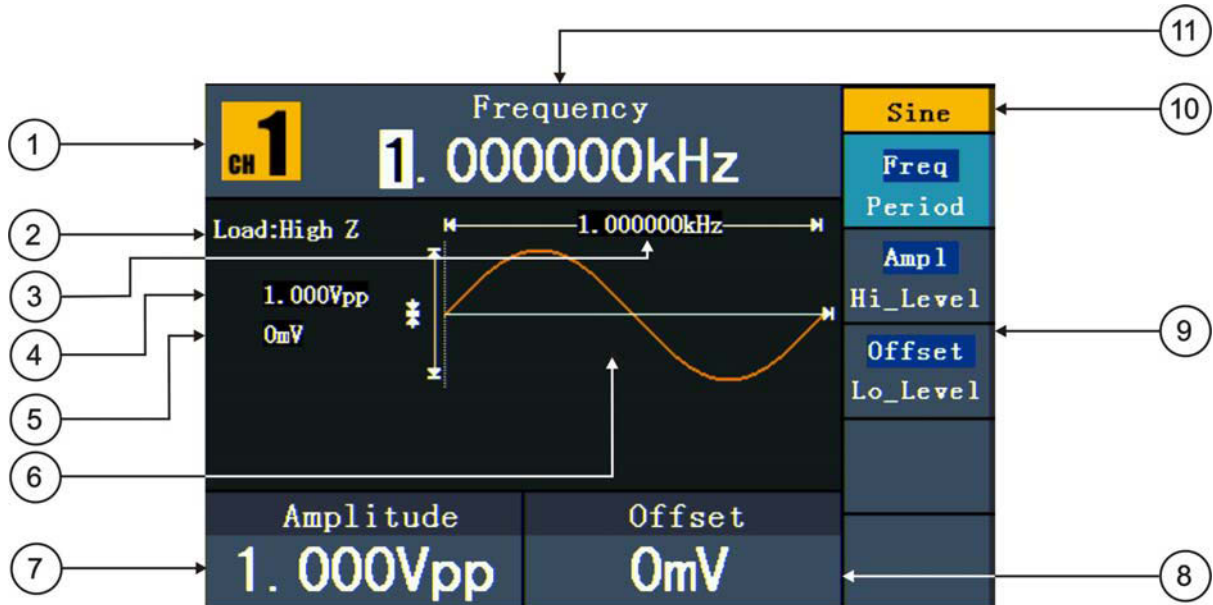


Figure 3. User Interface description.

- ① Current channel.
- ② Load, High Z represents high resistance.
- ③ Frequency/period, depends on the highlighted menu item on the right.
- ④ Amplitude/high level, depends on the highlighted menu item on the right.
- ⑤ Offset/low level, depends on the highlighted menu item on the right.
- ⑥ Display current waveform.
- ⑦ Parameter 2, display parameter and edit the focused parameter.
- ⑧ Parameter 3, display parameter and edit the focused parameter.
- ⑨ The setting menu of current signal or mode.
- ⑩ Current signal type or mode.
- ⑪ Parameter 1, display parameter and edit the focused parameter.



## 2.4 **General Inspection**

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

### **Check whether there is any damage caused by transportation**

If it is found that the packaging carton or the foamed plastic protection cushion has suffered serious damage, do not throw it away first till the complete device and its accessories succeed in the electrical and mechanical property tests.

### **Check the Accessories**

The supplied accessories have been already described in the "Appendix A: Enclosure" of this Manual. You can check whether there is any loss of accessories with reference to this description. If it is found that there is any accessory lost or damaged, please get in touch with the distributor of PROMAX responsible for this service or the PROMAX local offices.

### **Check the Complete Instrument**

If it is found that there is damage to the appearance of the instrument, or the instrument can not work normally, or fails in the performance test, please get in touch with the PROMAX distributor responsible for this business or the PROMAX local offices. If there is damage to the instrument caused by the transportation, please keep the package.

### **Foot Stool Adjustment**

Unfold the foot stools on the bottom of the generator, as shown at number 10 of frontal panel figure.

### 2.4.1 **AC Power Input Setting**

#### **AC Power Input Setting**

Adopt 110 V / 220 V AC power source. Users should regulate the voltage scale of the **Power Switch** according to the standards in their own country at the rear panel and use an appropriate fuse.

Voltage	Fuse
110 V	125 V, F4AL
220 V	250 V, F2AL



To change the voltage scale of the instrument, do the following steps:

- 1 Turn off the power button at the front panel and remove the power cord.
- 2 Check if the fuse installed before leaving factory (250 V, F2AL) can match with the selected voltage scale; if not, pry the cover open using a straight screwdriver, change the fuse.
- 3 Regulate the Power Switch to the desired voltage scale.

#### 2.4.2 Power On

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



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

- 2 Press down the power button at the front panel, the screen shows the boot screen.



### 3 PANEL OPERATION

#### 3.1 To set channels

▶ **To Switch Channels for Display**

Press **CH1/2** button to switch channel displayed on the screen between CH1 and CH2.

▶ **To Display/Edit Both Channels**

Press **Both** button to display the parameters of both channels.

**To switch channel:** Press **CH1/2** to switch the editable channel.

**To select waveform:** Press **Waveform selection buttons** to select waveform of current channel.

**To select parameter:** Press **F2** ~ **F5** to choose the **Parameter 1** to **Parameter 4**; Press it again to switch the current parameter such as Frequency/Period.

**To edit parameter:** Turn the **knob** to change the value of cursor position. Press **◀/▶** direction key to move the cursor. (The number keys can not be used to input).

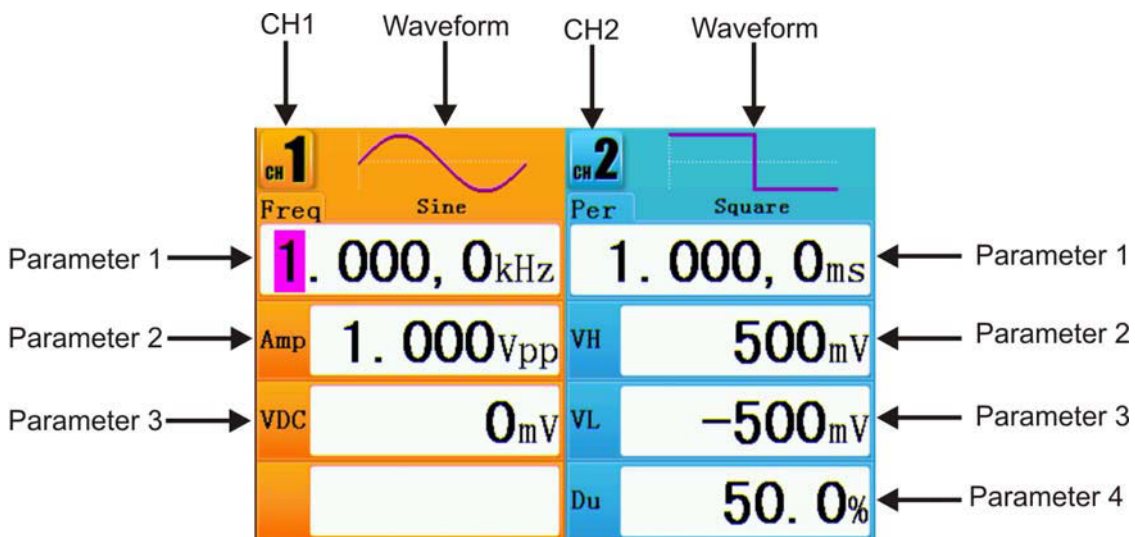


Figure 4. The User Interface or Both button.

▶ **To Turn On/Off Output of Channels**







Press **CH1** or **CH2** to turn on/off output of the corresponding channel. The indicator will be lighted when the corresponding channel is tuned on.



▶ **Channel Copy**

- 1 In signal output interface, press the knob on the front panel to enter Channel Copy menu.
- 2 Press **F1** to select From **CH2** To **CH1**, or press **F2** to select From **CH1** to **CH2**.

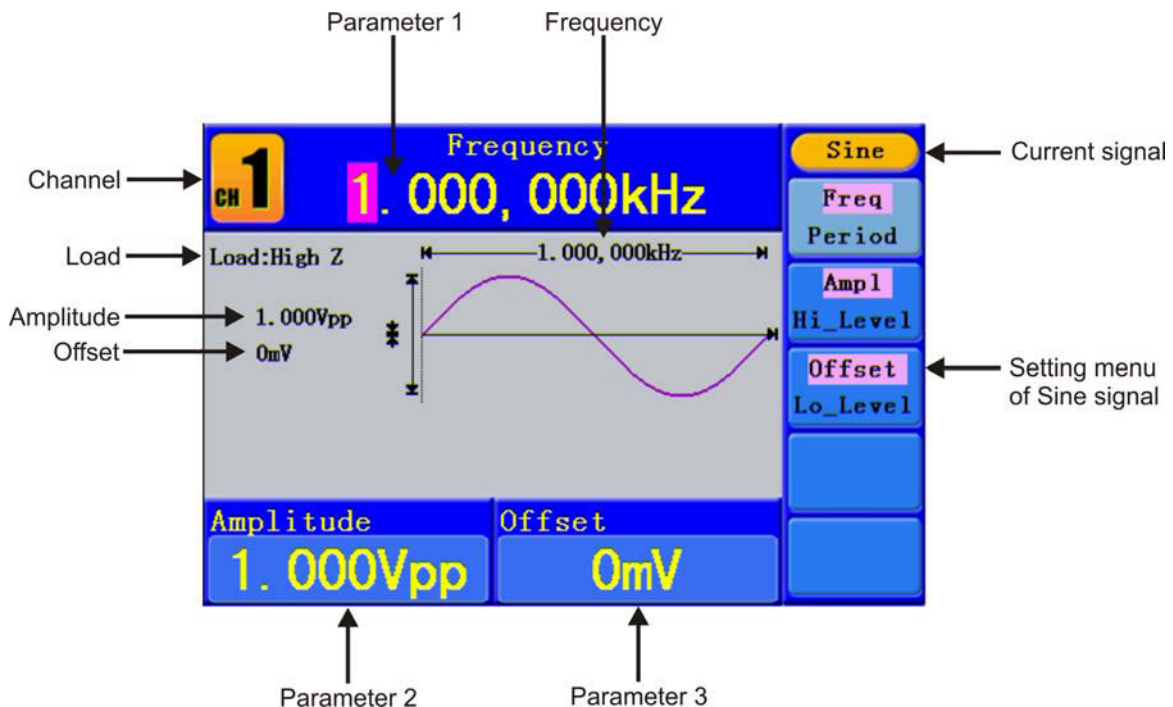
**3.2 To set signals**

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

**3.2.1 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.** The User Interface of Sine Signal.



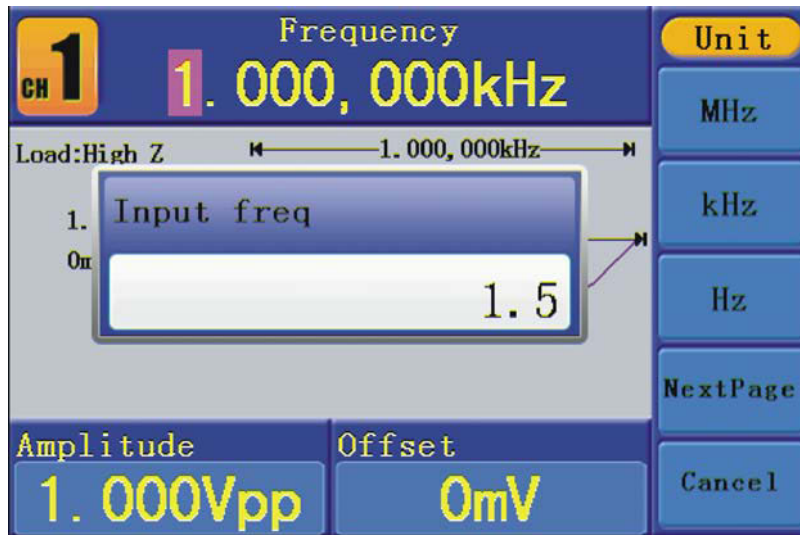
► **To Set the Frequency/Period**

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.

The frequency range is 1  $\mu$ Hz~25 MHz; the period range is 40 ns~1 Ms.



**Figure 6.** 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.

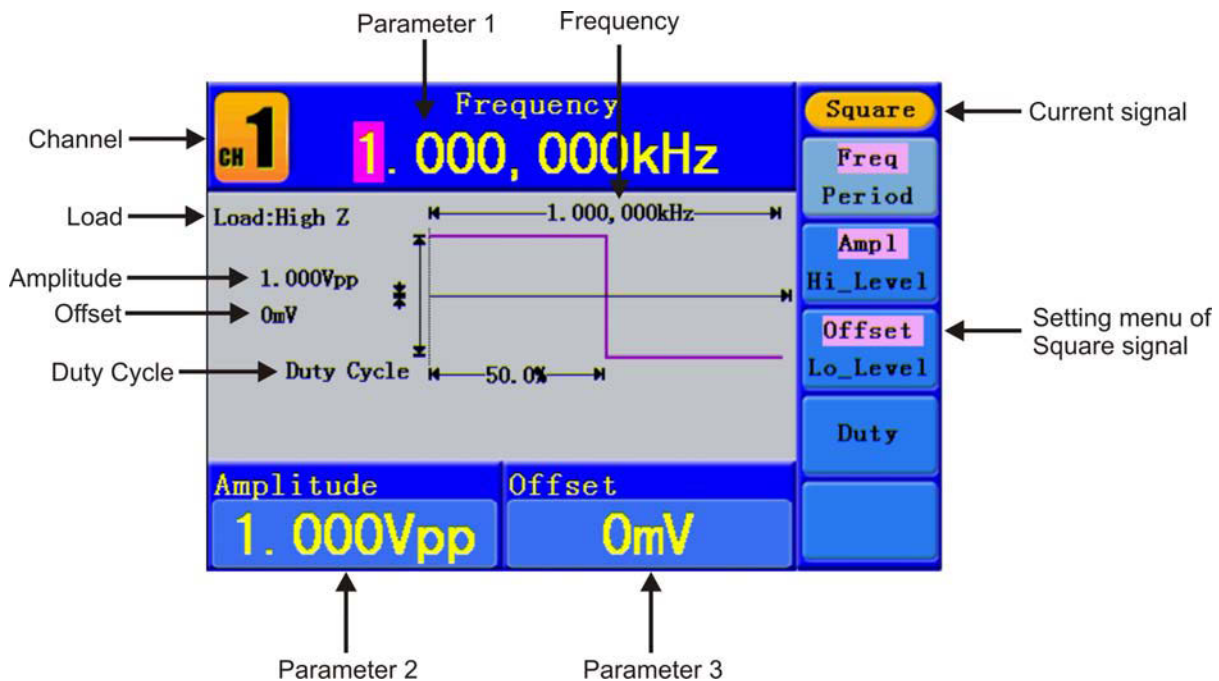
**3.2.2 To Output Square Signals**

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**. 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 "To Output Sine Signals").

The frequency range is 1  $\mu$ Hz ~ 5 MHz; the period range is 200 ns ~ 1 Ms.



**Figure 7.** The User Interface of Square Signal.



**Term Explanation**

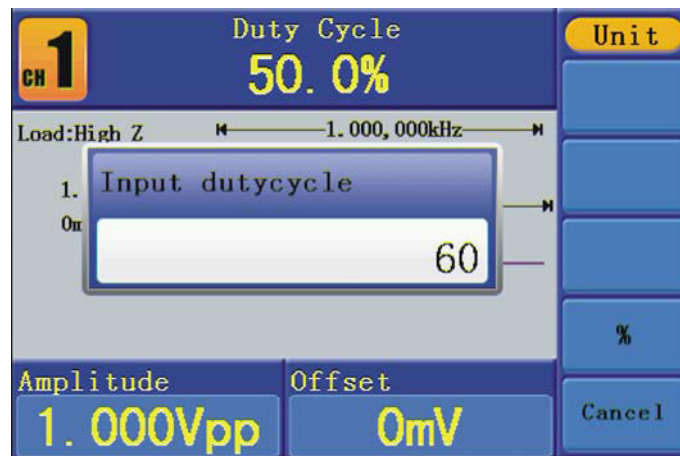
**Duty Cycle:** The percentage that the High Level takes up the whole Period.

▶ **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 "%".

For a frequency less than 1 MHz, the Duty cycle range is 20 % ~ 80 %.

For a frequency  $\geq$  1 MHz, the Duty cycle is 50 %.




**Figure 8.** Set the Duty cycle of Square signal.





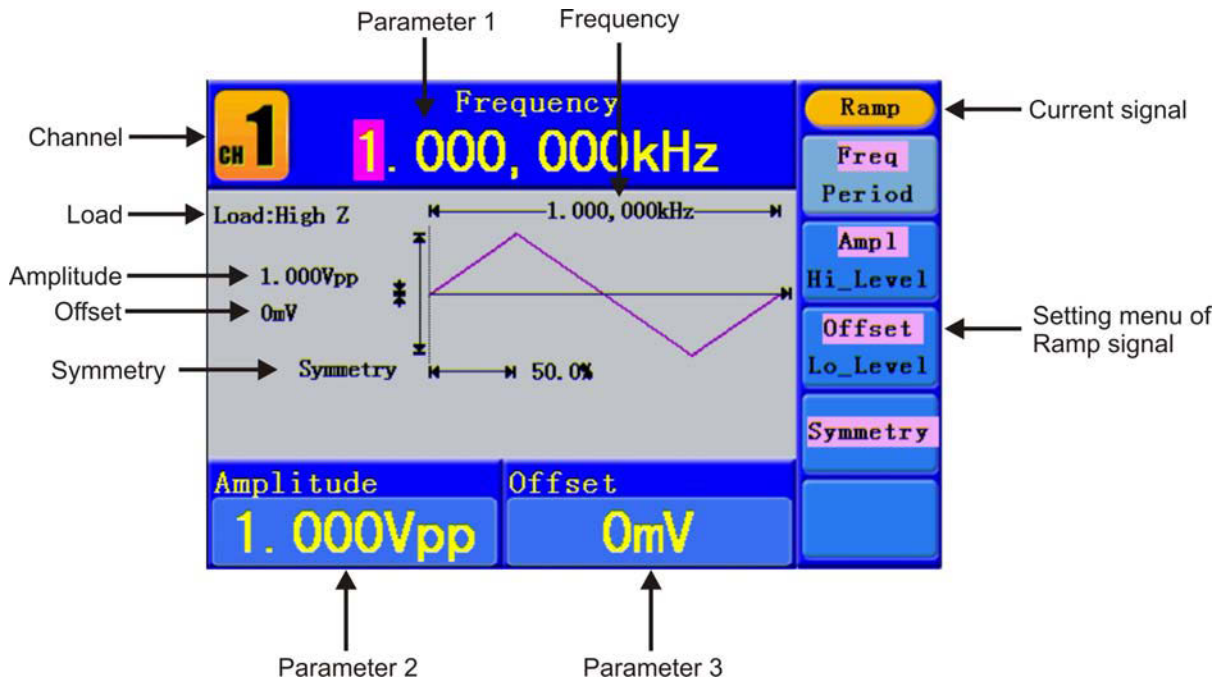
**3.2.3 To Output Ramp Signals**

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 "To Output Sine Signals".

The frequency range is 1  $\mu$ Hz ~ 1 MHz; the period range is 1 us ~ 1 Ms.



**Figure 9.** The User Interface of Ramp signal.

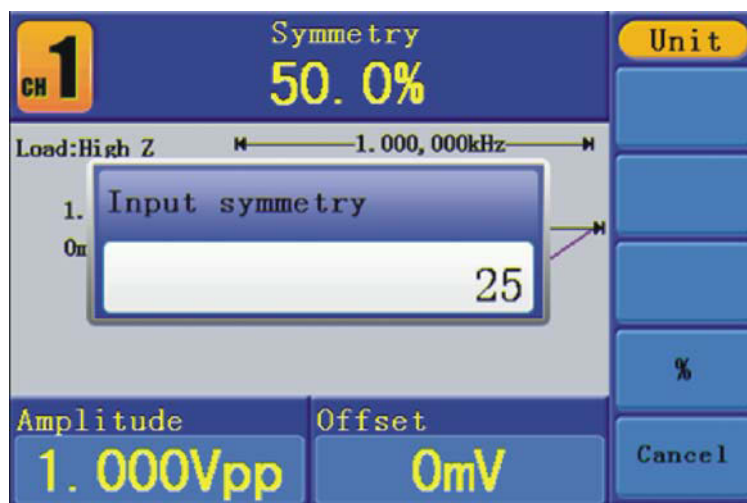


**Term Explanation**

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

▶ **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 10.** Set the symmetry of Ramp signal

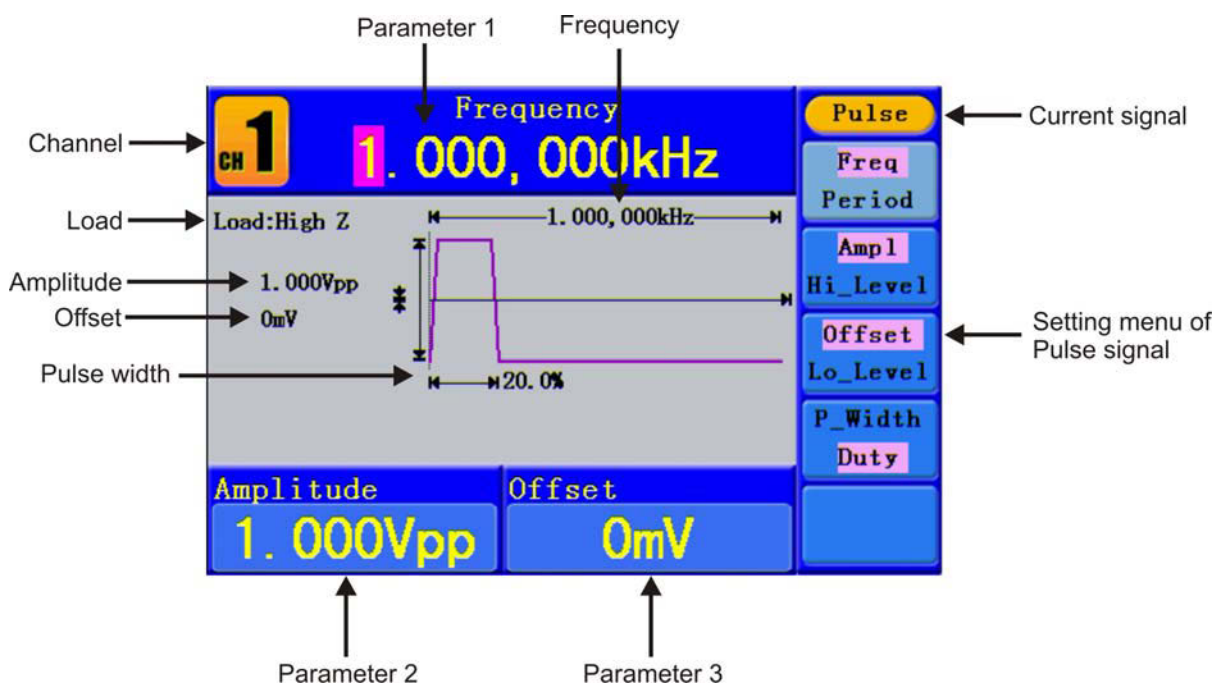


**3.2.4 To Output Pulse Signals**

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 "To Output Sine Signals".



**Figure 11.** The User Interface of Pulse Signal.

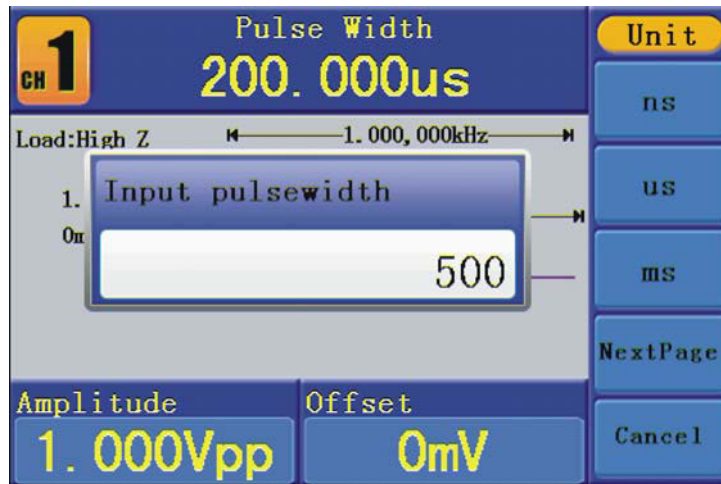
**Term Explanation**

**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 12.** Set the Pulse Width of Pulse signal.



### 3.2.5 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 "To Output Sine Signals".

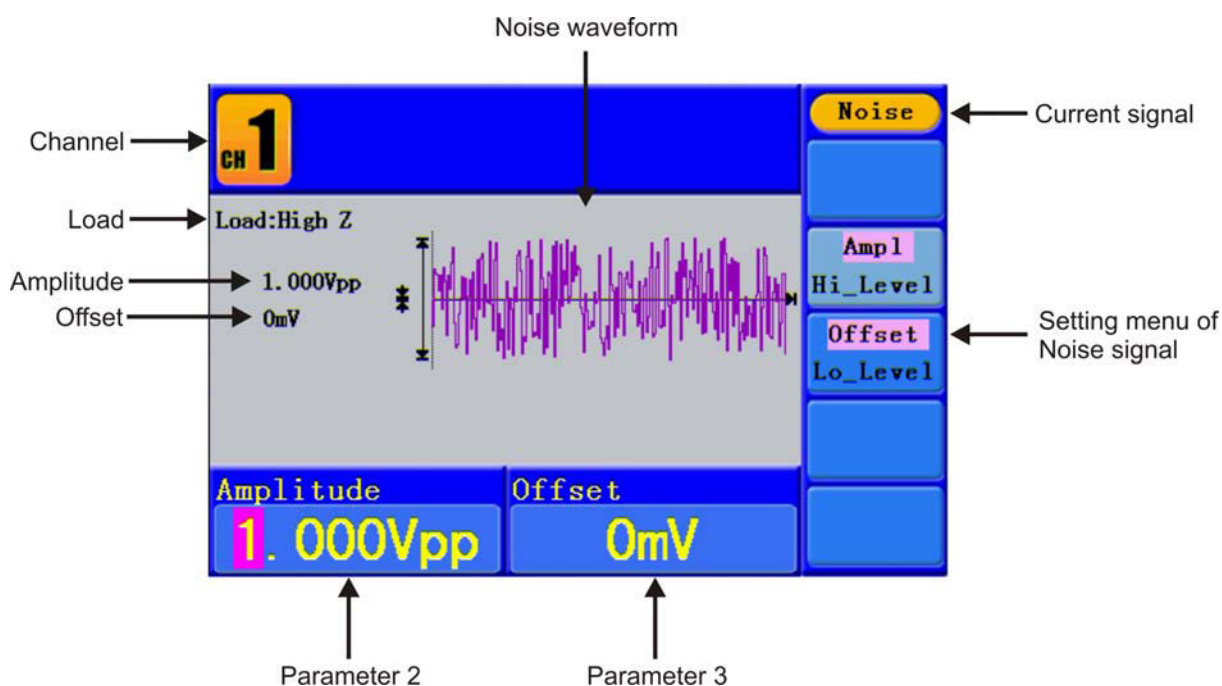



Figure 13. The User Interface of Noise Signal.

### 3.2.6 To Output Arbitrary Signals

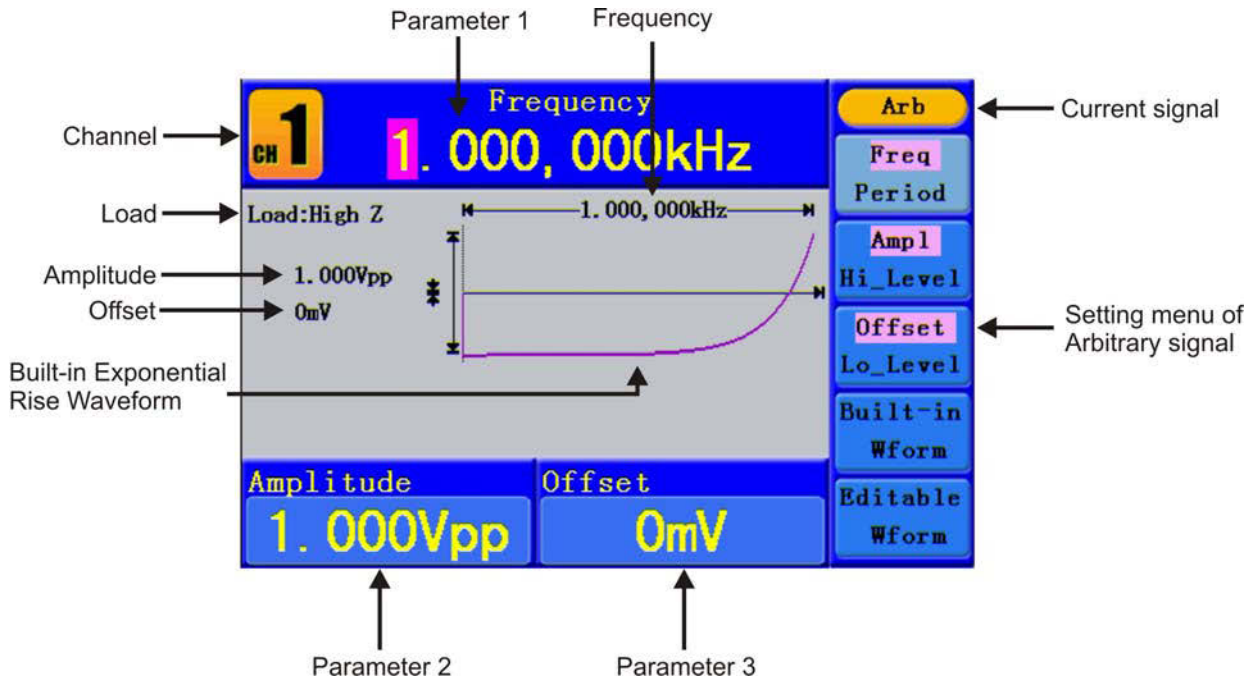
Press  button to call the user interface of Arbitrary signal, the Arbitrary waveform parameters can be set by operating the Arbitrary setting menu on the right.

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 "To Output Sine Signals".



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



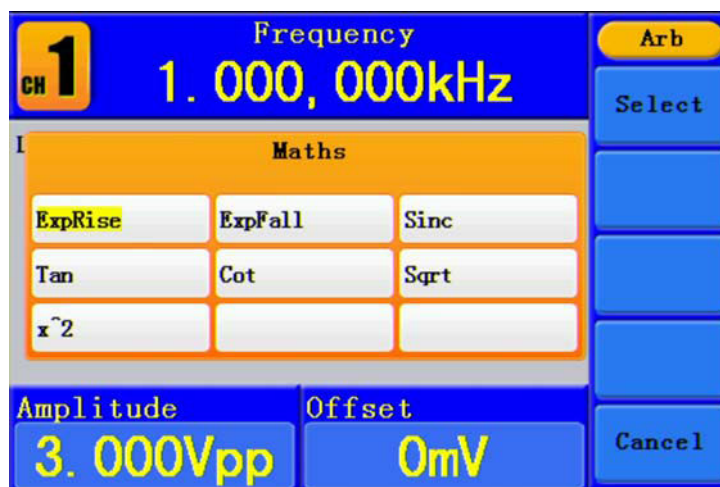
**Figure 14.** The User Interface of Arbitrary Signal.

► **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.



**Figure 15.**



- 3 Turn the knob or press  $\langle / \rangle$  direction key to choose the desired waveform. E.g. select **ExpRise**. Press  $\text{F1}$  to output the Exponential Rise waveform.

### Built-in Waveform Table

Name	Explanation
<b>Common</b>	
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
<b>Maths</b>	
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
In	Natural logarithm function
Cubic	Cubic function
Cauchy	Cauchy distribution
Besselj	BesselI function





Bessely	BesselII function
Erf	Error function
Airy	Airy function
<b>Windows</b>	
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)
<b>Others</b>	
DC	DC signal
Heart	Heart signal
Round	Round signal
LFMPulse	Linear FM pulse
Rhombus	Rhombus signal
Cardiac	Cardiac signal

### ▶ The User-Definable Waveform

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

Menu item	Instruction
<b>Create Wform</b>	Create a new waveform.
<b>Select Wform</b>	Select the waveform stored in internal storage (FLASH) or U disk (USBDEVICE).
<b>Edit Wform</b>	Edit the stored waveform.

### How to Create a New Waveform

#### 1 Enter the operation menu:

Press  → **Editable Wform** → **Select Wform**.


#### 2 Set the number of waveform points: Press 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 ~ 1000,000.






- 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 U disk is connected, press **</>** direction key to select the storage. "USBDEVICE" is the U Disk 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**.

### 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**.

### How to edit 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 suppress**.

### 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**.



### 3.2.7 To Output DC

- 1 Press **CH1/2** to select the channel that you want to output **DC**.
- 2 Press  button, then press **F4** to enter the **Built-in Wform** menu.
- 3 Press **F4** to select **Others**. Select DC. Press **F1** to output DC.
- 4 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 and choose the unit.

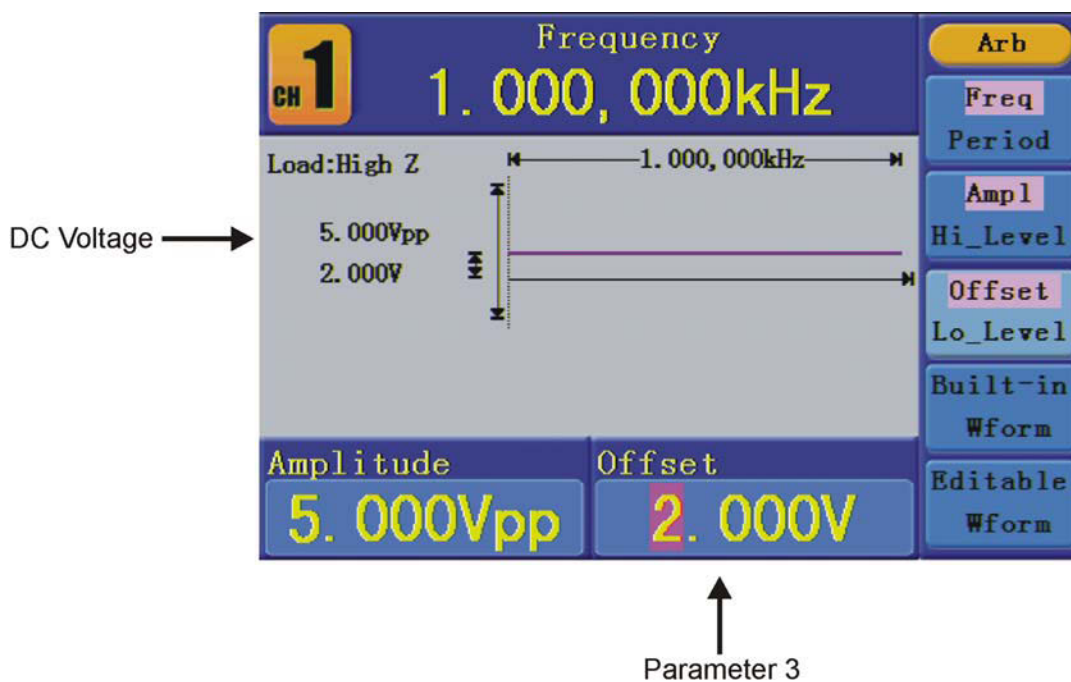


Figure 16. The DC Setting Interface.

### 3.2.8 To recall wave file

This function can read the waveform file with suffix of (\*.ota) and saved to U disk or cut by the software of oscilloscope.

► **How to cut wave:**

- 1 Connect U-disk to oscilloscope.
- 2 Press **Save** to call out the save menu.
- 3 Press the H1 button, the Type menu will display at the left of the screen, turn the M knob to choose **Cut Wave** for type.
- 4 Move cursor1 and cursor2 to choose the range of wave to be cut.



- 5 Press the **H2** button, and the input keyboard will pop up. The default name is the current system date. Turn **M knob** to choose the keys, and press **M knob** to input the chosen keys. Choose and press **Enter** key of the keyboard to end the input and store the file with the current name to U-disk.

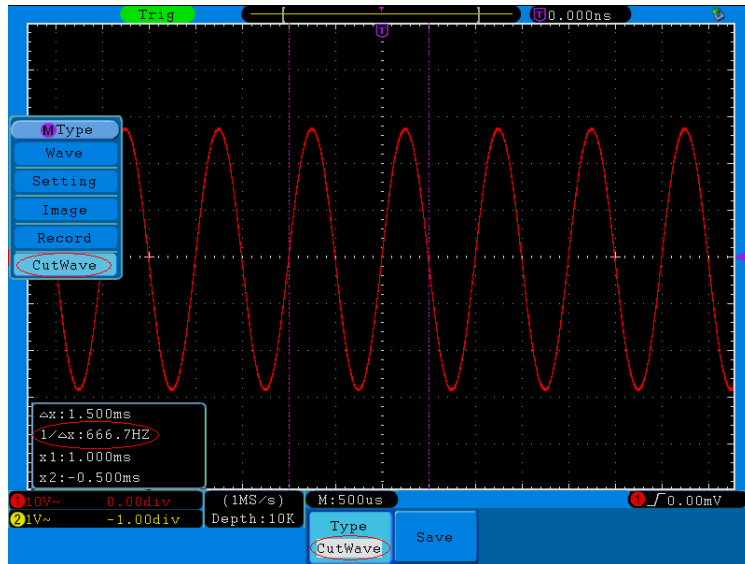



Figure 17. Cut Wave.

► **Use waveform generators to recall wave:**

- 1 Enter the operation menu: Press  **Editable Wform** → **SelectWform**. Enter the following interface:

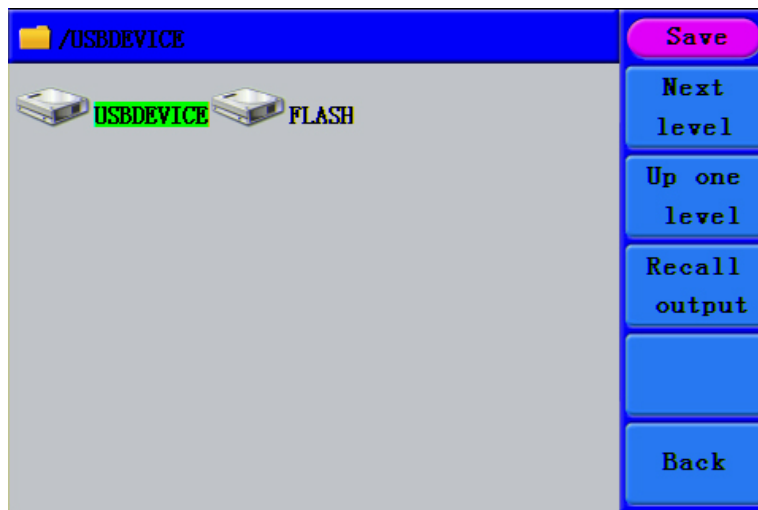
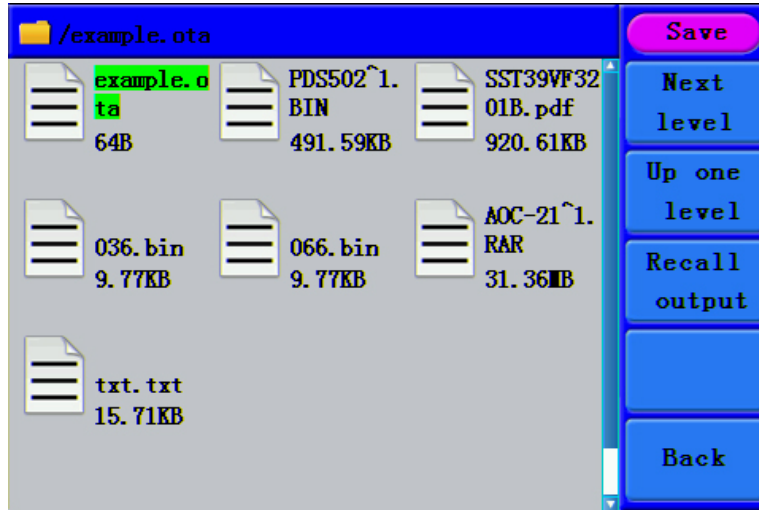


Figure 18. Choose storage device.

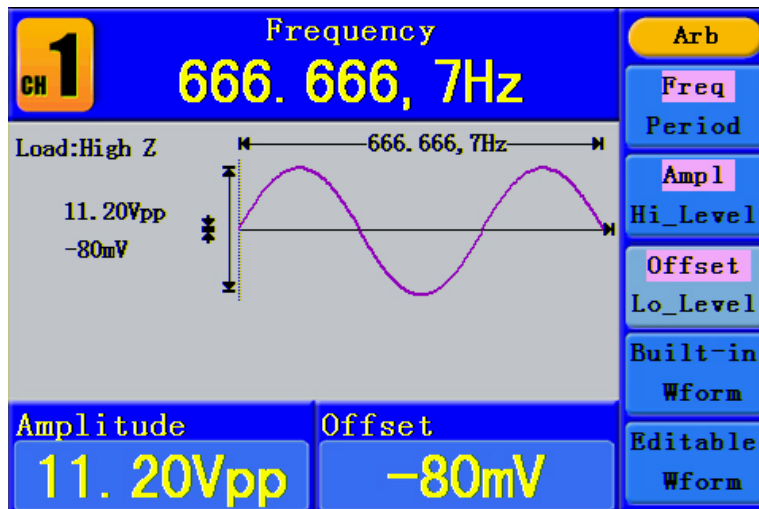


- 2 Select **USBDEVICE**, enter **The Next Level**, turn the **knob** or press **</>** direction key to select the saved **example.ota** waveform file.



**Figure 19.** Choose the .ota file.

- 3 Choose Recall output. And the tip "Read file successfully" will show on the interface.



**Figure 20.** Read file.

**Tips:**

- 1 Normally the frequency, amplitude, and offset of the recalled wave are the same as the wave being cut, but when the frequency, amplitude, and offset are set out of the limit range, then the waveform generator would use the current parameter, which leads to the recalled wave not totally the same as the cut wave.



- 2 The max data number of the waveform generator ARB is 8192. When the wave cut from oscilloscope contains data number more than 8192, the waveform generator will compress data. On the contrary if the data number is less than 8192, the waveform generator will use linear interpolation.

### 3.3 To Generate the Modulated Waveform

Modulation function is only used for CH1. Press the Mod button, then press **F1** to select Mod to generate modulated waveform. The waveform generator can modulate waveform using AM, FM, PM, FSK. To turn off the modulation, press the Mod button.

#### 3.3.1 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.

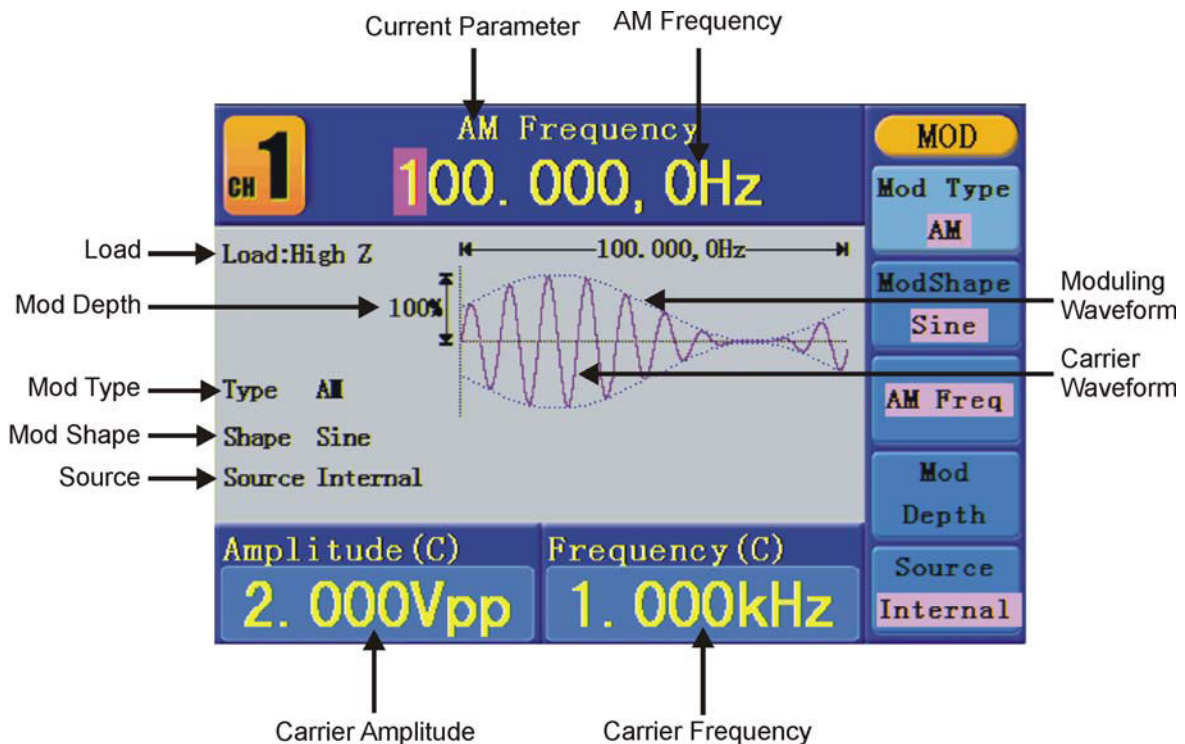




Figure 21: The User Interface of AM



► **How to set the parameters of AM**

- 1 Press **Mod** function button, then press **F1** to select Mod.
- 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 To Output Sine Signals on page 12. 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
<p><b>AM Frequency:</b> The frequency of modulating waveform.</p> <p><b>Mod Depth:</b> 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. +5V corresponds to the currently set depth 100%.</p>

### 3.3.2 **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.

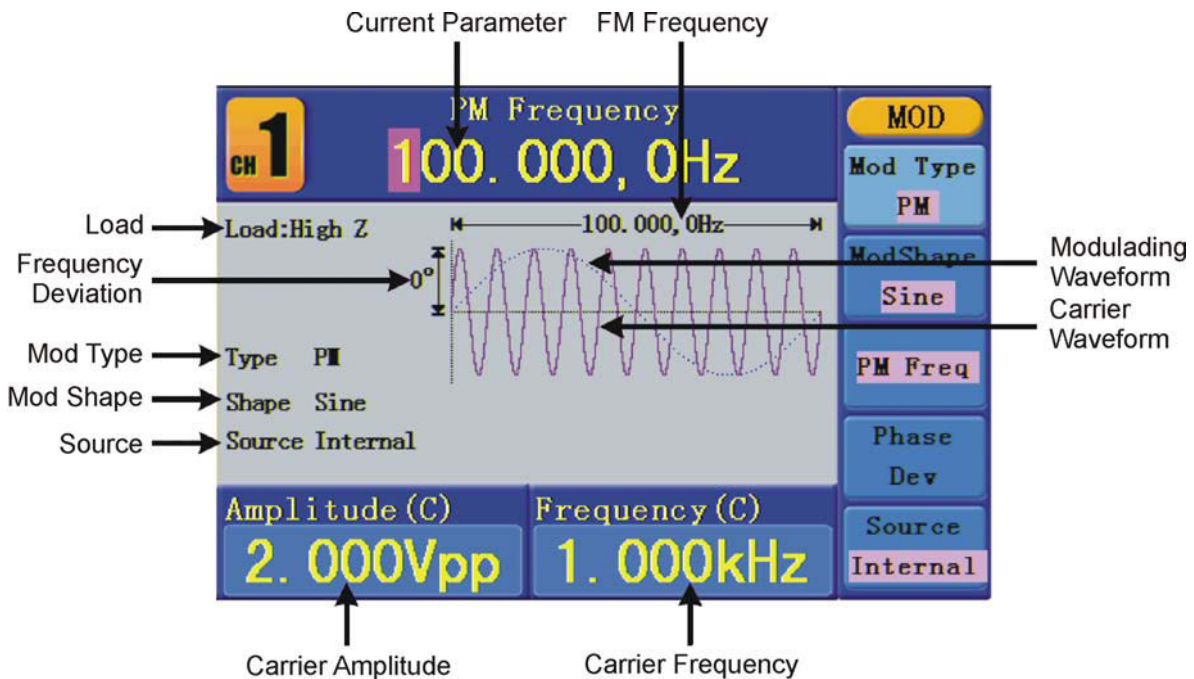


Figure 22: The User Interface of FM

► **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 *To Output Sine Signals* on page 12. 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 or Ramp.
- 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



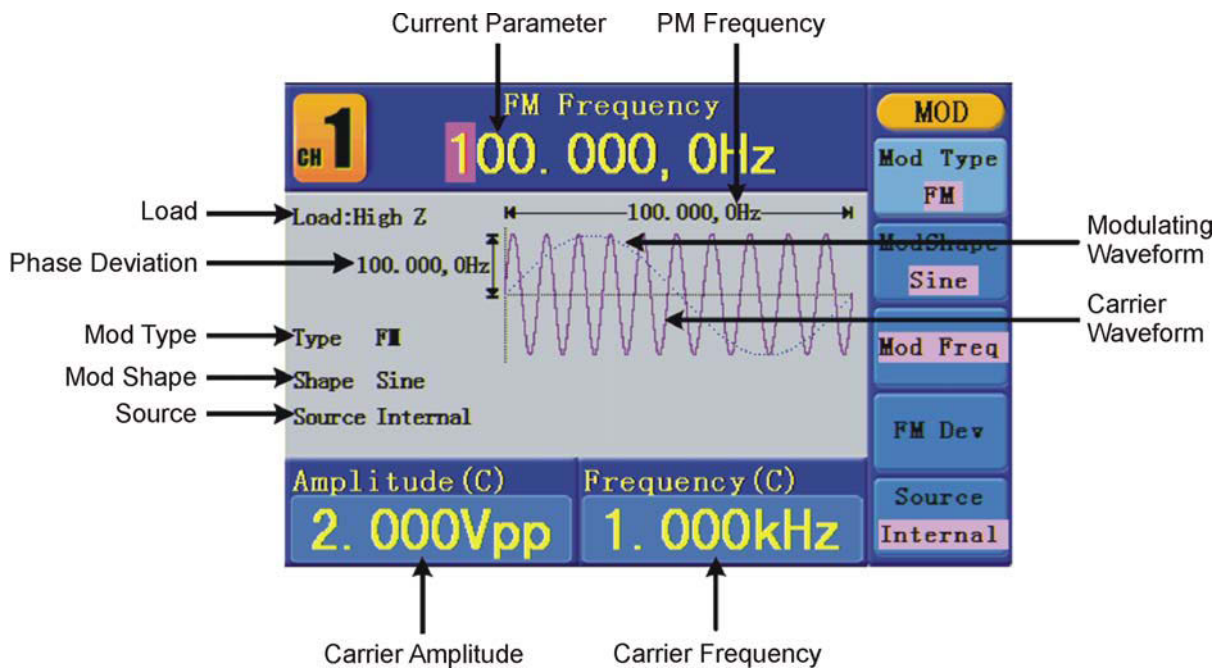


**NOTE:** The Sum of the Deviation and the Carrier Frequency should be equal to or less than maximum frequency of the selected function plus 1 kHz.

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. +5 V corresponds to the selected Deviation and -5 V to the negative selected Deviation.

### 3.3.3 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 23:** The User Interface of PM

► **How to set the parameters of PM**

- 1 Press **Mod** function button, then press **F1** to select **Mod**.
- 2 Press **F1** to switch **Mod Type** to **PM**. If the Carrier Waveform is not Sine, the system will switch it to Sine automatically

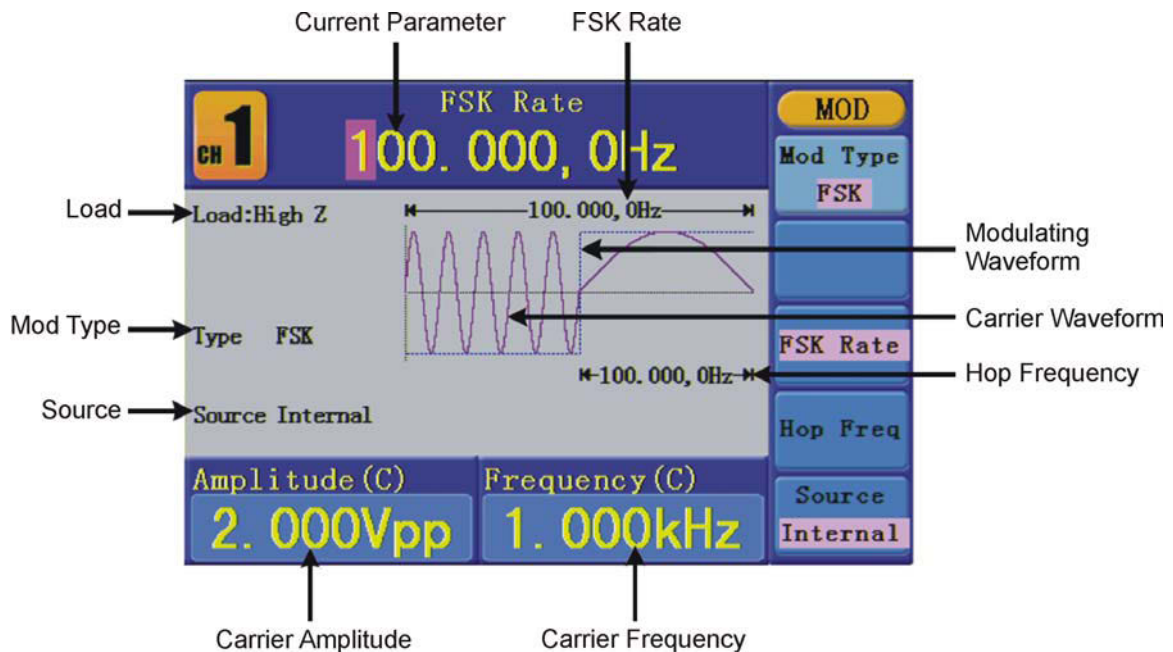




- 3 Press  button to display the waveform and parameters of the Carrier Waveform. You can change the parameters, please refer to *To Output Sine Signals* on page 12. Press  button again to return to the Modulation mode interface.
- 4 Press **F5** to select the source. If the source is **External**, use 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 or Ramp.
- 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°.

**3.3.4 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 24:** The User Interface of FSK



► **How to set the parameters of FSK**

- 1 Press **Mod**, a continuación pulse la tecla **F1** para seleccionar **Mod**.
- 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 *To Output Sine Signals* on page 12. 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 **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.

<b>Term Explanation</b>
<p><b>FSK Rate:</b> The frequency at which the output frequency shifts between the carrier frequency and the Hop frequency (Internal Modulation only).</p>



### 3.4 To Generate Sweep

Sweep function is only used for CH1. 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.

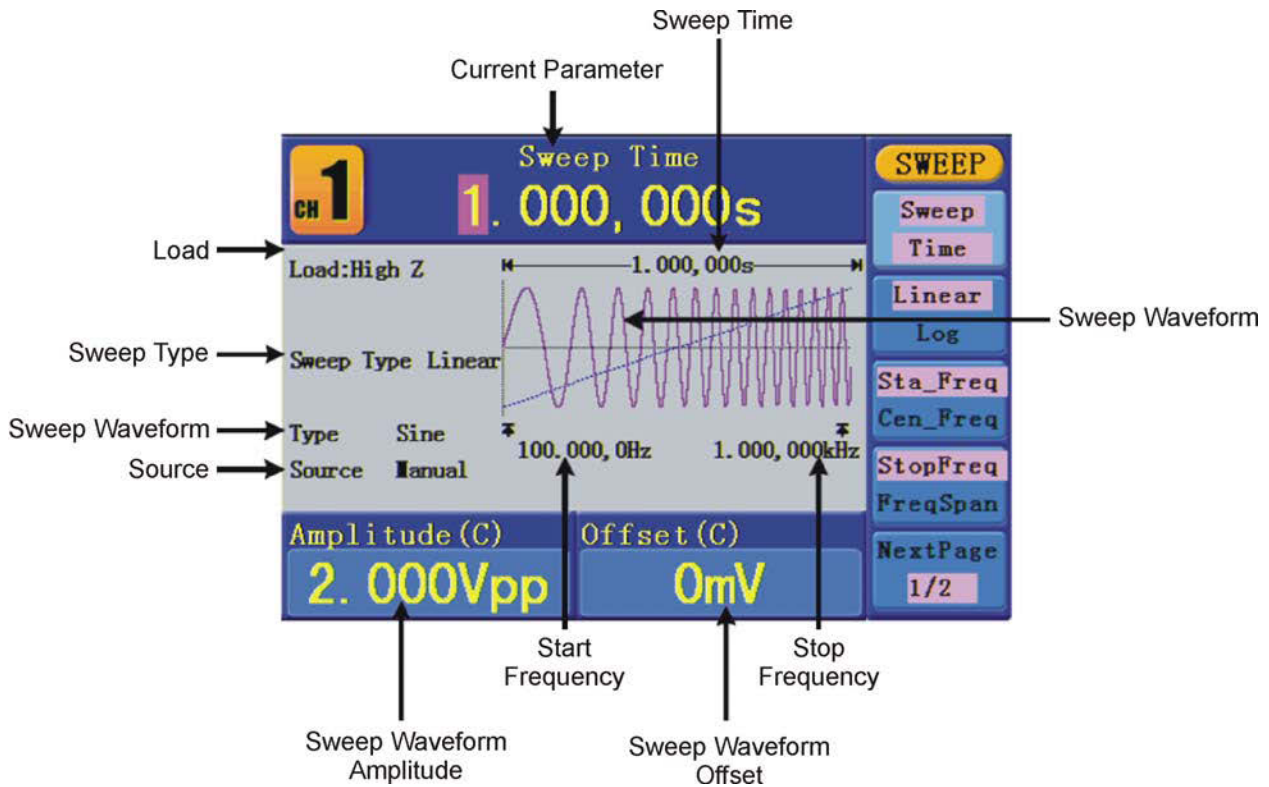







Figure 25: The User Interface of Sweep Mode

#### ► 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 *To set signals* on page 12. 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.

### 3.5 To Generate Burst

Burst function is only used for CH1. Press the **Mod** button, then press **F3** to select **Burst** 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). Burst 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:**

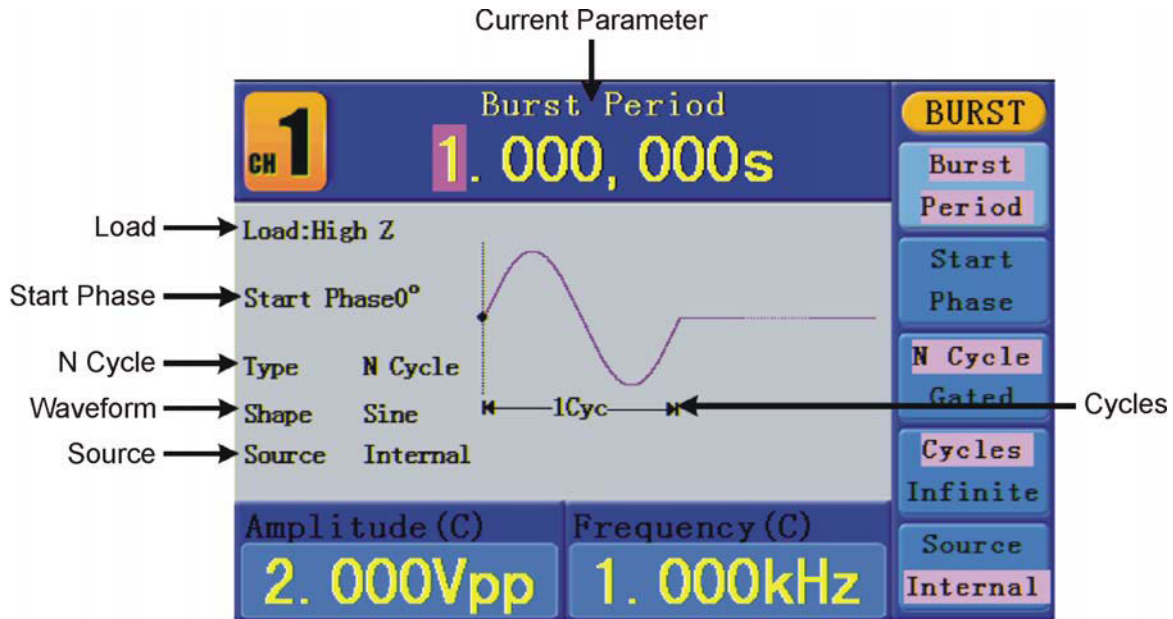
N-Cycle has specific number of waveform cycles, and every burst is activated by a trigger event.

**Gated Burst:**








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



► **Set the N-Cycle Burst**



**Figure 26:** The User Interface of N-Cycle Burst

- 1 When the output signal is Sine, Square, Ramp, Pulse or Arbitrary waveform, press the **Mod** button, then press **F3** to select **Burst**.
- 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 *To set signals* on page 12. 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  $-360^\circ$  to  $+360^\circ$ . For an Arbitrary Waveform,  $0^\circ$  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).

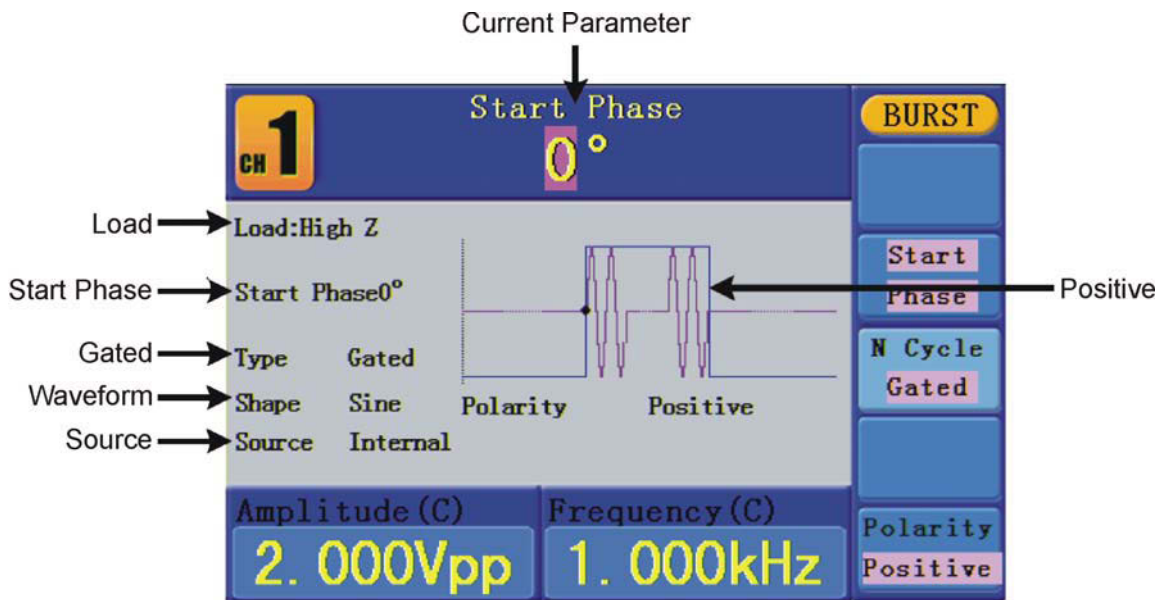


**NOTE:** If needed, Burst Period will increase to cater to the specific number of cycles.

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.

► **Set the Gated Burst**



**Figure 27:** The User Interface of Gated Burst

- 1 When the output signal is Sine, Square, Ramp, Pulse or Arbitrary waveform, press the **Mod** button, then press **F3** to select **Burst**.
- 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 To set signals on page 12. 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  $-360^{\circ}$  to  $+360^{\circ}$ . For an Arbitrary Waveform,  $0^{\circ}$  is the first waveform point.
- 5 Press **F5** to switch between **Positive/Negative**. Set the Polarity for the Gated Signal.

### 3.6 **To Save and Recall**

Press **Save** function button to enter the file system.

#### ▶ **To Use USB Storage**

The storage location is divided into the internal storage (FLASH) and the U disk storage (USBDEVICE). When a U disk is connected, the storage menu will show "USBDEVICE" and "FLASH". Otherwise, the storage menu will show "FLASH" only.

- 1 **Install the U disk:** insert a USB disk into the "**USB Host port**" on the rear panel and the screen will show "Detect USB device". Press **Save** function button to enter the file system, the storage menu will show "USBDEVICE" and "FLASH".
- 2 **Enter the storage:** Turn the **knob** or press **◀/▶** direction key to choose the desired storage. Press **F1** to enter the chosen storage. Provide operations as **Next level, Up one level, New folder, Delete, Rename, Copy, Paste**.
- 3 **Remove the U disk:** Remove the U disk from the **USB Host port** on the rear panel. The system will inform you "The USB device is removed", and the "USBDEVICE" in the storage menu will disappear.





► **To 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 28.** Read file.

- 1 Turn the knob or press / direction key to move the cursor left and right in the keyboard. Press  $\hat{F3}$  to switch between capital and small of the characters.
- 2 Press  $\hat{F1}$  to enter the current character. Press  $\hat{F2}$  to delete the last character.
- 3 Press  $\hat{F4}$  to finish editing and save the file. Press  $\hat{F5}$  to cancel the save operation.

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





### 3.7 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.

#### 3.7.1 To Set Display Parameter

##### ▶ To Set the Bright




- 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 mleft 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%.

##### ▶ 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	

##### ▶ 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.

### 3.7.2 To Set the Counter

The counter can measure the signal with frequency form 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 level 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.



### 3.7.3 To Set Output Parameter

#### ► To Set the Output Load

For either of CH1 Output and CH2 Output on the Front panel, the Generator has a built-in 50Ω series impedance. 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 one.

Steps for setting the Load of each channel

- 1 Press Utility and choose Output Setup. Press **F1** to select CH1Load, or press **F2** to select CH2Load; press it again to select HighZ or \*Ω ("\*" represents a value).
- 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 either of CH1 Output and CH2 Output on the Front panel, the waveform generator has a fixed 50 Ω Series Impedance. 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.



#### ► To Set the Phase Deviation

You can set the phase deviation of the two channels.

- 1 Press **Utility** and choose Output Setup, press **F3** to select PhaseDev.
- 2 Press **F3** to switch between On/Off.
- 3 If On is selected, you can set the value of phase deviation. 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 degree, press **F4** to select the unit. The phase deviation range is 0 - 360°.



### 3.7.4 To Set the System

#### ▶ Language Setting

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

#### ▶ 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.

#### ▶ 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 Vp-p / 0 Vdc

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



<b>Modulation</b>	<b>Default</b>
Carrier	1 kHz Sine Wave
Modulating	100 Hz Sine Wave
AM Depth	100%
FM Deviation	100 Hz
PM Phase Deviation	0°
FSK Hop Frequency	100 Hz
FSK Frequency	100 Hz
Source	Internal

<b>Sweep</b>	<b>Default</b>
Start/Stop Frequency	100 Hz/1 kHz
Time	1 sec
Mode	Linear

<b>Burst</b>	<b>Default</b>
Frequency	1 kHz
Count	1 Cycle
Period	1 sec
Phase	0°

<b>Others</b>	<b>Default</b>
Brightness	95%
Separator	Comma
Screen Saver time	100 minutes
Load	High Z
Phase Deviation	0°
Clock Source	Internal
Channel Output Control	Off



▶ **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.

▶ **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.

▶ **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.

### 3.8 **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.




## 4 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\PROMAX\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  in the software to open the help document.





## 5 SCPI

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



## 6 TROUBLESHOOTING

### 1. The instrument is powered on but no Display.

- a. Check if the power is connected properly.
- b. Check if the Power Switch is in the proper voltage scale.
- c. 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).
- d. Restart the instrument after the steps above.
- e. If the problem still exists, please contact PROMAX for our service.

### 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".

If you encounter other problems, try to reset the settings (refer to "To Return to Default Setting") or restart the instrument. If it still can not work properly, please contact PROMAX for our service.



## 7 INSTRUCTIONS FOR RETURNING BY MAIL

Instruments returned for repair or calibration, either within or out of the warranty period, should be sent with the following information: Name of the Company, name of the contact person, address, telephone number, receipt (in the case of coverage under warranty) and a description of the problem or the service required.



## 8 TECHNICAL SPECIFICATIONS

All these specifications apply to the Waveform Generator unless otherwise explanation. To reach these specifications, the instrument must have been operating continuously for more than 30 minutes within the specified operating temperature.

All the specifications are guaranteed unless those marked with "typical".

Specifications		
Frequency output	25 MHz	
Simple rate	125 MS/s	
Vertical resolution	14 bits	
Waveform (output)	Standard	Sine, Square, Ramp, Pulse and Noise
	Arbitrary	Exponential Rise, Exponential Fall, Sin(x)/x, Step Wave and others, total 48 built-in waveforms and user-defined arbitrary waveform

Frequency resolution	
Sine	1 μHz—25MHz
Square	1 μHz—5MHz
Ramp	1 μHz—1MHz
Pulse	1 μHz—5MHz
White Noise	25 MHz (-3dB) (typical)
Arbitrary waveform	1 μHz—10 MHz

Amplitude	
Amplitude	1 m Vpp - 10 Vpp (50 Ω) 1 m Vpp - 20 Vpp (high impedance)
Resolution	1 m Vpp or 14 bits

DC Offset	
DC Offset	±5 V (50 Ω), ±10 V (High Z)
Resolution	1 mV
Load impedance	50 Ω (typical)



<b>Arbitrary waveform</b>	
Wave Length	2 pts to 8 K pts, 2 pts to 1 M pts
Non-volatile Memory	26 waveforms

<b>Modulation</b>	
Modulation Waveform	AM, FM, PM, FSK, Sweep and Burst
Modulation Frequency	2 mHz to 20 kHz (FSK 2 mHz - 100 kHz)

<b>Counter</b>	
Function	Frequency Period, +Width, -Width, +Duty, and -Duty
Frequency Range	100 mHz to 200 MHz
Resolution	6 digits

<b>Input/output</b>	
Display	4" (480 x 320 pixels) LCD
Type	External referente clock input/output External trigger input/output External modulation input/output

<b>Communication Interface</b>	USB host, USB device, LAN (support remote control)
<b>Accessories</b>	PC Software, quick referente guide, USB cable, power cord

<b>Mechanical features</b>	
Dimensions	235 (W.) x 110 (H.) x 295 (D.) mm
Weight	3 kg

Periodic adjustment:

It is recommended to calibrate once a year.



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**PROMAX ELECTRONICA, S. L.**