User Manual

4060B Series
Dual Channel Function/Arbitrary Waveform Generators

Safety Summary

The following safety precautions apply to both operating and maintenance personnel and must be followed during all phases of operation, service, and repair of this instrument.

⚠WARNING

Before applying power to this instrument:

- Read and understand the safety and operational information in this manual.
- Apply all the listed safety precautions.
- Verify that the voltage selector at the line power cord input is set to the correct line voltage. Operating the instrument at an incorrect line voltage will void the warranty.
- Make all connections to the instrument before applying power.
- Do not operate the instrument in ways not specified by this manual or by B&K Precision.

Failure to comply with these precautions or with warnings elsewhere in this manual violates the safety standards of design, manufacture, and intended use of the instrument. B&K Precision assumes no liability for a customer's failure to comply with these requirements.

Category rating

The IEC 61010 standard defines safety category ratings that specify the amount of electrical energy available and the voltage impulses that may occur on electrical conductors associated with these category ratings. The category rating is a Roman numeral of I, II, III, or IV. This rating is also accompanied by a maximum voltage of the circuit to be tested, which defines the voltage impulses expected and required insulation clearances. These categories are:

Category I (CAT I): Measurement instruments whose measurement inputs are not intended to be connected to the mains supply. The voltages in the environment are typically derived from a limited-energy transformer or a battery.

Category II (CAT II): Measurement instruments whose measurement inputs are meant to be connected to the mains supply at a standard wall outlet or similar sources. Example measurement environments are portable tools and household appliances.

Category III (CAT III): Measurement instruments whose measurement inputs are meant to be connected to the mains installation of a building. Examples are measurements inside a building's circuit breaker panel or the wiring of permanently-installed motors.

Category IV (CAT IV): Measurement instruments whose measurement inputs are meant to be connected to the primary power entering a building or other outdoor wiring.

⚠WARNING

Do not use this instrument in an electrical environment with a higher category rating than what is specified in this manual for this instrument.

⚠WARNING

You must ensure that each accessory you use with this instrument has a category rating equal to or higher than the instrument's category rating to maintain the instrument's category rating. Failure to do so will lower the category rating of the measuring system.

Electrical Power

This instrument is intended to be powered from a CATEGORY II mains power environment. The mains power should be 115 V RMS or 230 V RMS. Use only the power cord supplied with the instrument and ensure it is appropriate for your country of use.

Ground the Instrument

⚠WARNING

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical safety ground. This instrument is grounded through the ground conductor of the supplied, three-conductor AC line power cable. The power cable must be plugged into an approved three-conductor electrical outlet. The power jack and mating plug of the power cable meet IEC safety standards.

⚠WARNING

Do not alter or defeat the ground connection. Without the safety ground connection, all accessible conductive parts (including control knobs) may provide an electric shock. Failure to use a properly-grounded approved outlet and the recommended three-conductor AC line power cable may result in injury or death.

⚠WARNING

Unless otherwise stated, a ground connection on the instrument's front or rear panel is for a reference of potential only and is not to be used as a safety ground. Do not operate in an explosive or flammable atmosphere.

⚠WARNING

Do not operate the instrument in the presence of flammable gases or vapors, fumes, or finely-divided particulates.

⚠WARNING

The instrument is designed to be used in office-type indoor environments. Do not operate the instrument

- In the presence of noxious, corrosive, or flammable fumes, gases, vapors, chemicals, or finely-divided particulates.
- In relative humidity conditions outside the instrument's specifications.
- In environments where there is a danger of any liquid being spilled on the instrument or where any liquid can condense on the instrument.
- In air temperatures exceeding the specified operating temperatures.
- In atmospheric pressures outside the specified altitude limits or where the surrounding gas is not air.
- In environments with restricted cooling air flow, even if the air temperatures are within specifications.
- In direct sunlight.

This instrument is intended to be used in an indoor pollution degree 2 environment. The operating temperature range is 0°C to 40°C and 20% to 80% relative humidity, with no condensation allowed. Measurements made by this instrument may be outside specifications if the instrument is used in non-office-type environments. Such environments may include rapid temperature or humidity changes, sunlight, vibration and/or mechanical shocks, acoustic noise, electrical noise, strong electric fields, or strong magnetic fields.

Do not operate instrument if damaged

⚠WARNING

If the instrument is damaged, appears to be damaged, or if any liquid, chemical, or other material gets on or inside the instrument, remove the instrument's power cord, remove the instrument from service, label it as not to be operated, and return the instrument to B&K Precision for repair. Notify B&K Precision of the nature of any contamination of the instrument.

Clean the instrument only as instructed

⚠WARNING

Do not clean the instrument, its switches, or its terminals with contact cleaners, abrasives, lubricants, solvents, acids/bases, or other such chemicals. Clean the instrument only with a clean dry lint-free cloth or as instructed in this manual. Not for critical applications

⚠WARNING

This instrument is not authorized for use in contact with the human body or for use as a component in a life-support device or system.

Do not touch live circuits

⚠WARNING

Instrument covers must not be removed by operating personnel. Component replacement and internal adjustments must be made by qualified service-trained maintenance personnel who are aware of the hazards involved when the instrument's covers and shields are removed. Under certain conditions, even with the power cord removed, dangerous voltages may exist when the covers are removed. To avoid injuries, always disconnect the power cord from the instrument, disconnect all other connections (for example, test leads, computer interface cables, etc.), discharge all circuits, and verify there are no hazardous voltages present on any conductors by measurements with a properly-operating voltage-sensing device before touching any internal parts. Verify the voltage-sensing device is working properly before and after making the measurements by testing with known-operating voltage sources and test for both DC and AC voltages. Do not attempt any service or adjustment unless another person capable of rendering first aid and resuscitation is present.
Do not insert any object into an instrument's ventilation openings or other openings.

⚠WARNING

Hazardous voltages may be present in unexpected locations in circuitry being tested when a fault condition in the circuit exists.

⚠WARNING

Fuse replacement must be done by qualified service-trained maintenance personnel who are aware of the instrument's fuse requirements and safe replacement procedures. Disconnect the instrument from the power line before replacing fuses. Replace fuses only with new fuses of the fuse types, voltage ratings, and current ratings specified in this manual or on the back of the instrument. Failure to do so may damage the instrument, lead to a safety hazard, or cause a fire. Failure to use the specified fuses will void the warranty.

Servicing

⚠WARNING

Do not substitute parts that are not approved by B&K Precision or modify this instrument. Return the instrument to B&K Precision for service and repair to ensure that safety and performance features are maintained.

For continued safe use of the instrument

- Do not place heavy objects on the instrument.
- Do not obstruct cooling air flow to the instrument.
- Do not place a hot soldering iron on the instrument.
- Do not pull the instrument with the power cord, connected probe, or connected test lead.
- Do not move the instrument when a probe is connected to a circuit being tested.

Safety Symbols

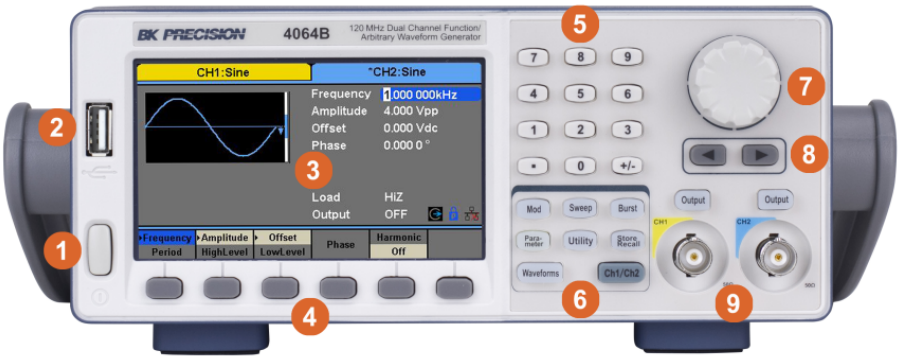
Symbol	Description
DANGER	indicates a hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	indicates a hazardous situation which, if not avoided, could result in death or serious injury
CAUTION	indicates a hazardous situation which, if not avoided, will result in minor or moderate injury
	Refer to the text near the symbol.
	Electric Shock hazard
	Alternating current (AC)
	Chassis ground
	Earth ground
	This is the In position of the power switch when instrument is ON.
	This is the Out position of the power switch when instrument is OFF.
NOTICE	is used to address practices not related to physical injury.

Contents

Quick Start

1.1 Front Panel

4060B Series front panel includes a touch screen, menu softkeys, numeric keyboard, knob, function keys, arrow keys, and channel control area as shown in **Figure 1.1**.



Item	Description
1	Power Switch
2	USB Port (load waveforms, store settings, etc...)
3	Touchscreen
4	Soft Keys
5	Number Pad
6	Function and Channel Keys
7	Knob and Selection Button
8	Arrow Keys
9	Channel Outputs

Figure 1.1 Front Panel View

1.2 Rear Panel

The rear panel shown in **Figure 1.2** provides multiple interfaces, including Counter, 10MHz In/Out, Aux In/Out, LAN, USB Device, Earth Terminal and AC Power Supply Input.

1.3 Touch Screen Display

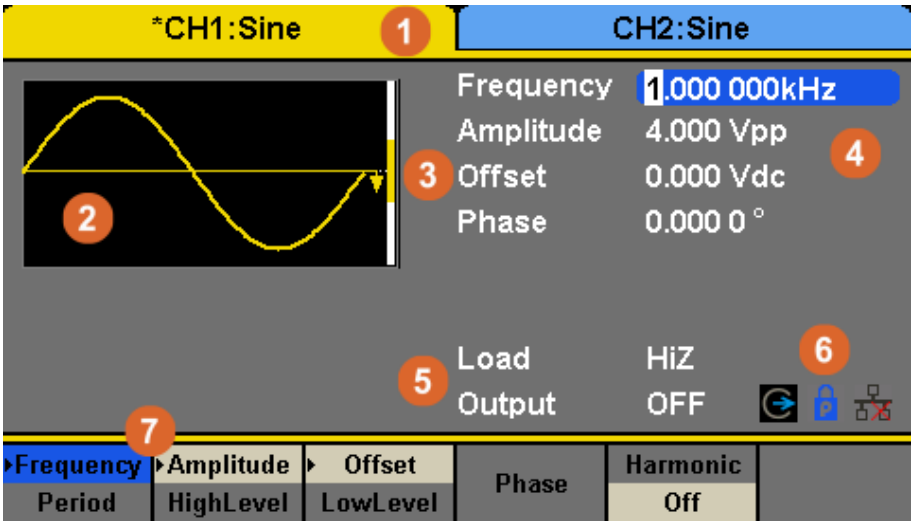
The screen displays the parameters and a the waveform for a single channel. Most of the fields can be accessed either through the function keys below the screen or by pressing their value on screen. **Figure 1.3** shows a view of Channel 1 with a simple waveform (sine wave). The values and parameters available on-screen change depending on the mode, options and waveform selected.

1.4 Waveform Selection and Setup

Press the "Waveform" button to open the waveform setup menu shown in **Figure 1.4**. The softkeys show the available waveforms for that page. The "Page 1/2" button accesses the other page of waveforms shown in the second image in **Figure 1.4**.

Item	Description
1	Power Input
2	USB
3	Ethernet
4	Counter Input
5	Auxillary Input/Output
6	Clock Input/Output (10 MHz)
7	Ground Connection

Figure 1.2 Rear Panel of 4060B Series



Item	Description
1	Channel Tab
2	Waveform
3	0 V reference
4	Parameters
5	Output Settings
6	Status indicators (clock, lock and network)
7	Settings menu

Figure 1.3 Touch Screen Display

1.5 Create a simple sine wave

By default, the generator starts configure with a 1 kHz, 4 V peak to peak, symmetric to the ground reference waveform starting at 0 degrees. All of these parameters are changeable.

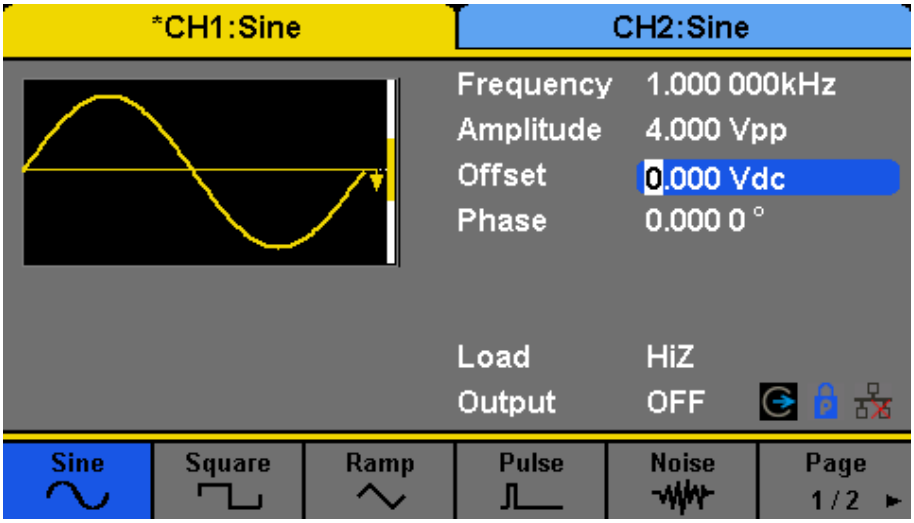


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Figure 1.4 Waveform Menu

1.5.1 Frequency and Phase

To set the frequency, press the first soft-key, the frequence value to the right of the waveform, or the word "frequency" above the first soft-key. The field, when ready for editing, is highlighted in blue as shown in **Figure 1.5**. Use the knob, arrow keys, and the number pad to set the desired frequency. As the value is changed the output will follow the changes as they occur if the output is on. Phase is modified in the same manner.

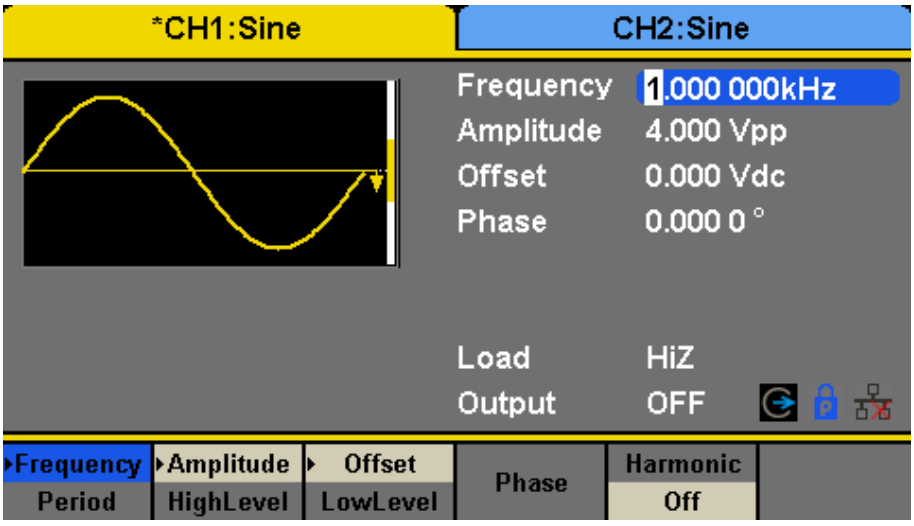


Figure 1.5 Frequency Setting

1.5.2 Amplitude, and Offset

Like setting the frequency, select the parameter to modify and use the knob and keys to change its value. The offset and amplitude are related through the effective maximum and minimum voltages. The waveform output is fully defined by either setting the amplitude and offset, or the high and low level. The high and low level define the peak values of the waveform.

1.6 To Turn On/Off Output

The two keys on the right side of the operation panel above each channel output are used to enable and disable the output. When enabled, the key will light up. When enabled and lit, pressing the button again disables the respective channel. Each key can also change the load impedance value by pressing and holding the key for 2 seconds.

Note: Load impedance is only modifies the signal voltage setting. HiZ expects an impedance much larger than 50, so the output voltage is the same as the internal driving source voltage. When set to 50, the displayed voltage is half of this value. If the wrong setting is chosen, the output voltage can by up to double, or down to half of the expected value. See **Section 13.19** for more.

1.6.1 Function Keys

Access to most of the configuration and machine setup is through the function keys. See **Figure 1.6**.

Figure 1.6 Function Keys

Mod. This is the waveform "Modulation" setup and enable key. When pressed, the modulation settings are applied to the current waveform. See **Section 9** for details.

Sweep This is the waveform "Sweep" frequency setup and enable key. This key also applies sweep settings to the current waveform when pressed. See **Section 10** for details.

Burst This is the waveform "Burst" setup and enable key. This key also applies burst settings to the current waveform when pressed. See **Section 11** for details.

Parameter This key returns the menu system to the current waveform parameter settings. This is the menu set that opens when selecting a "waveform".

Utility This key opens the main menu for configuring the system settings of the generator. Generator configuration such as the remote interface, clocking, synchronization, and other functions are accessed in this menu.

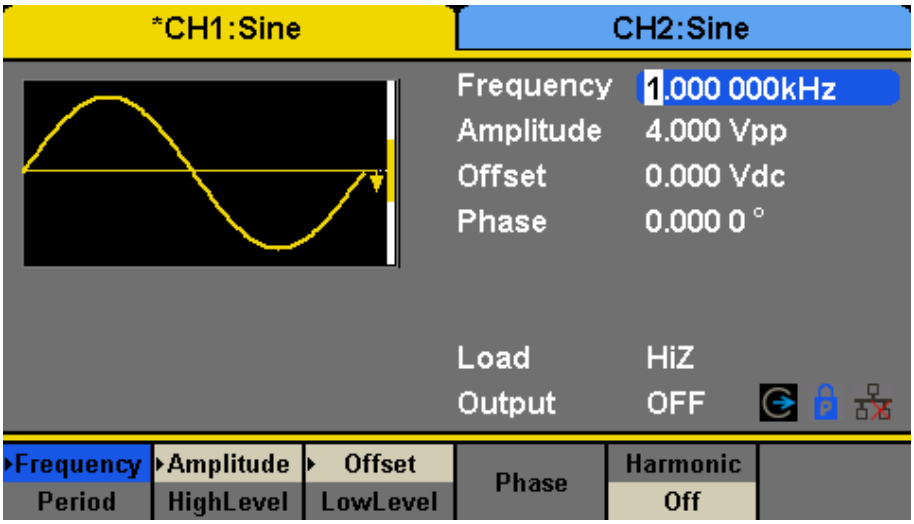
Store/Recall The file browser is opened by this key giving access to open, save and manage system setups.

Waveforms The set of waveform types is accessed in this menu.

Ch1/Ch2 This key, when pressed, changes the active waveform menu. See the color of the waveform and the tab brought to the foreground to verify which channel is selected.

Sine Waveform

Press the "Waveforms" key and then press the Sine softkey. The screen shown in **Figure 2.1** will open. The parameters available for sine waveforms include frequency, period, amplitude, high level, low level, offset and phase.



Parameter	Description
Frequency/Period	Set the signal frequency or period; The current parameter will be switched at a second press.
Amplitude/HighLevel	Set the signal amplitude or high level; The current parameter will be switched at a second press.
Offset/LowLevel	Set the signal offset or low level; The current parameter will be switched at a second press.
Phase	Set the phase of the signal.

Figure 2.1 Sine Wave Parameters

2.1 Frequency/Period

Frequency is one of the most important parameters of basic waveforms. For different instrument models and waveforms, the available ranges of frequency are different. For detailed information, please refer to "4060B Series Datasheet". The default frequency is 1 kHz.

1. Press Waveforms → Sine → Frequency, to set the frequency parameter. The frequency shown on the screen when the instrument is powered on is the default value or the set value of last power down. If Period (rather than Frequency) is the desired parameter, press Frequency/Period again to enter the Period mode. The current value for the waveform's period is now displayed in inverse color. Press the Frequency/Period key once again to return to the Frequency entry mode.

2. Input the desired frequency.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value.

Note: When using the numeric keyboard to enter the value, the left arrow key can be used to move the cursor backward and delete the value of the previous digit.

2.2 Amplitude

The amplitude setting range is limited by the "Load" and "Frequency/Period" settings. For detailed information, please refer to "4060B Series Datasheet".

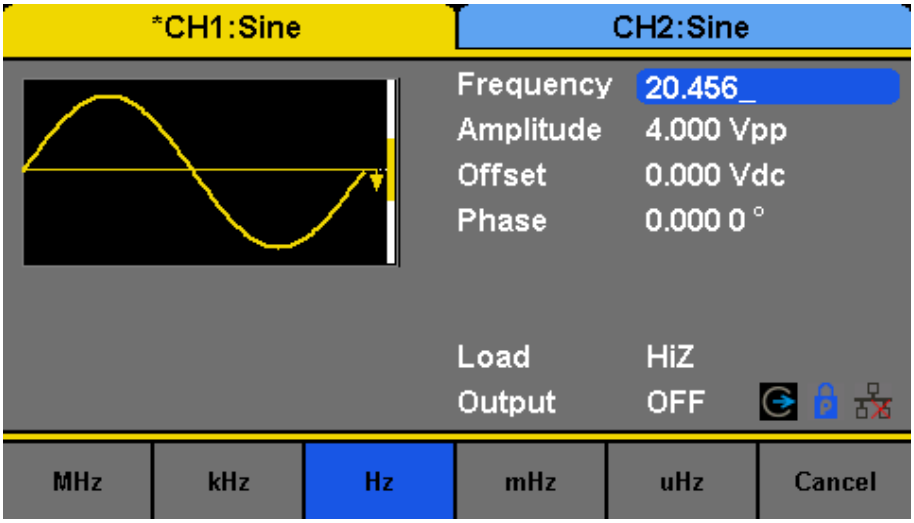


Figure 2.2 Set Frequency

1. Press Waveforms → Sine → Amplitude, to set the amplitude. The amplitude shown on the screen when the instrument is powered on is the default value or the set value of last power down. If setting the waveform's high level is desired, press the Amplitude/HighLevel key again to switch into the high level parameter (the current operation is displayed in inverse color).

2. Input the desired amplitude.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value.

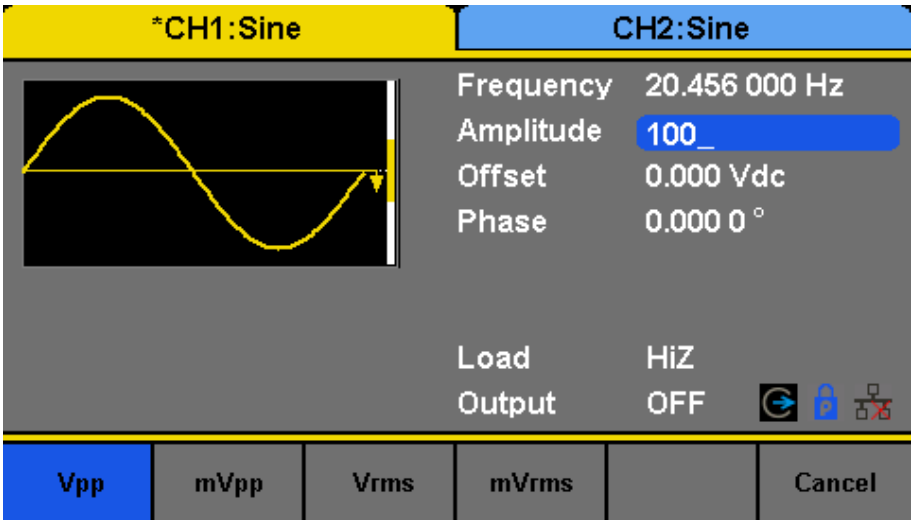


Figure 2.3 Set Amplitude

2.3 Offset

The offset setting range is limited by the "Load" and "Amplitude/HighLevel" settings. For detailed information, please refer to "4060B Series Datasheet". The default value is 0Vdc.

1. Press Waveforms → Sine → Offset, to set the offset. The offset shown on the screen when the instrument is powered on is the default value or the set value of last power down. If you want to set the waveform by low level, press the Offset/LowLevel key again, to switch into the low level parameter (the current operation is displayed in inverse color).

2. Input the desired offset.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value.

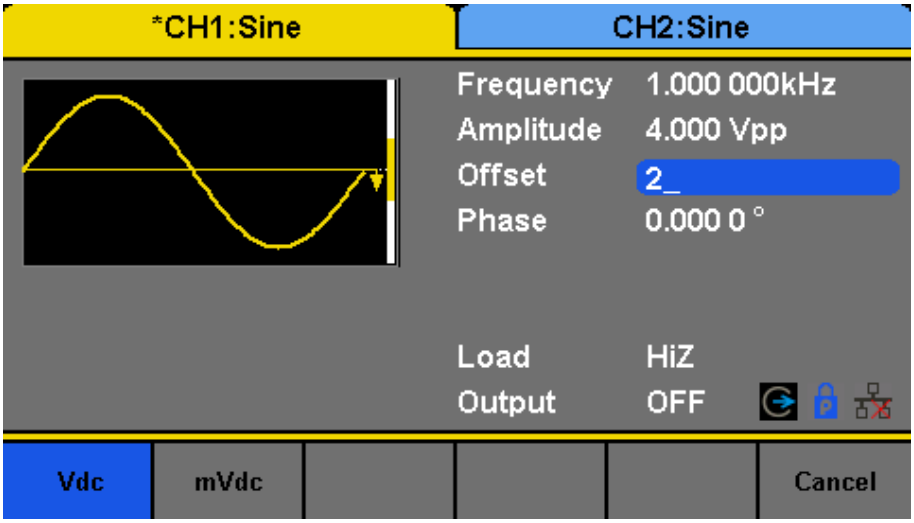


Figure 2.4 Set Offset

2.4 Phase

1. Press Waveforms → Sine → Phase, to set the phase. The Phase shown on the screen when the instrument is powered on is the default value or the set value of last power down.

2. Input the desired phase.

Use the numeric keyboard to input the parameter value directly and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value.

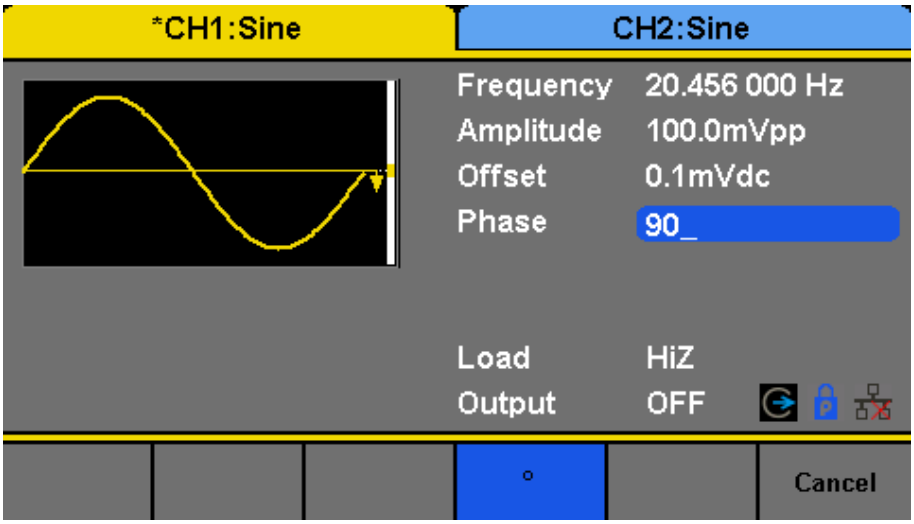


Figure 2.5 Set Phase

Note When the independent mode is enabled, the phase parameter cannot be modified

2.5 Harmonics

The 4060B Series can be used as a harmonic generator to output harmonics with specified order, amplitude and phase. According to the Fourier transform, a periodic time domain waveform is the superposition of a series of sine waveforms as shown in the equation below:

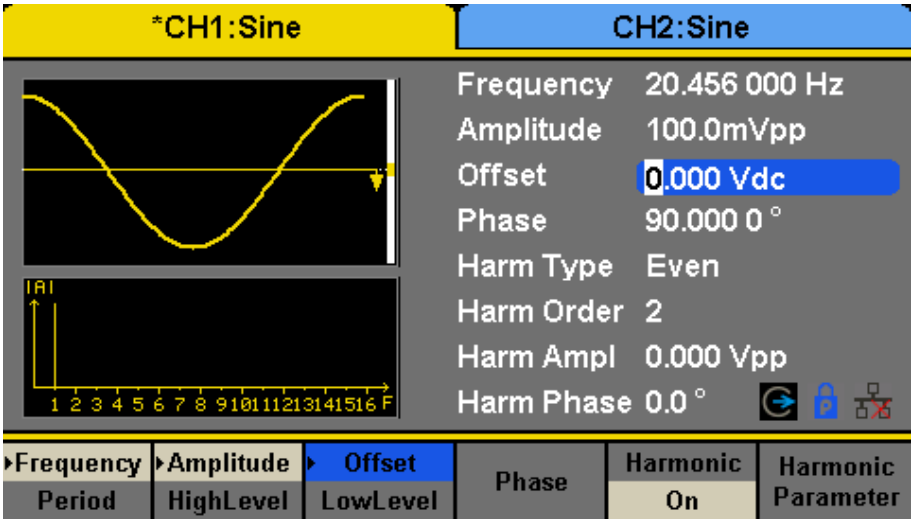
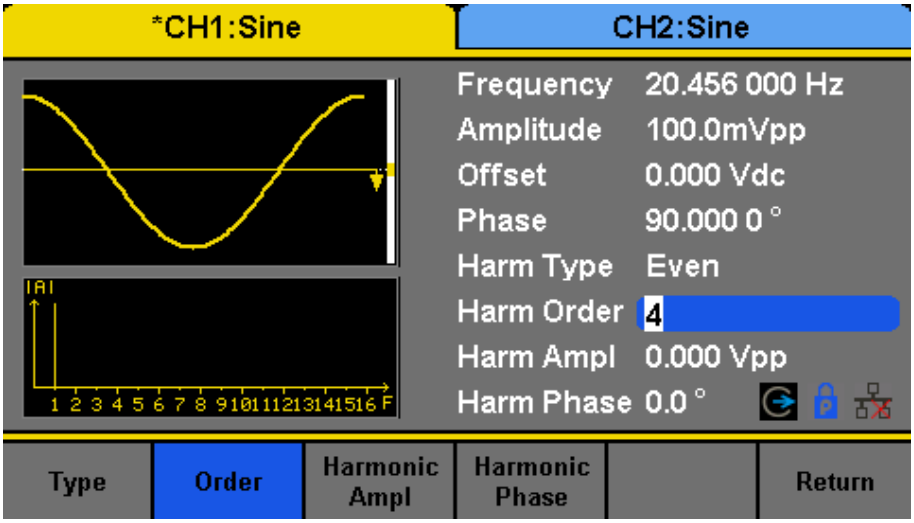


Figure 2.6

Press Waveforms → Sine → Harmonic and choose "On", then press



Item	Description
Type	Set the harmonic type to "odd", "ever" or "all".
Order	Set the order of the harmonic.
Harmonic Ampl	Set the amplitude of the harmonic.
Harmonic Phase	Set the phase of the harmonic.
Cancel	Return to the sine parameters menu.

Figure 2.7 Harmonic Interface

2.5.1 Harmonic Type

The 4060B Series can output odd harmonics, ever harmonics and user-defined orders of harmonics. After entering the harmonic setting menu, press Type to select the desired harmonic type.

1. Press Even, the instrument will output fundamental waveform and even harmonics.
2. Press Odd, the instrument will output fundamental waveform and odd harmonics.
3. Press All, the instrument will output fundamental waveform and all the user-defined orders of harmonics.

2.5.2 Harmonic Order

After entering the harmonic setting menu, press Order, the use the numeric keyboard or knob to input the desired value.

- The range is limited by the maximum output frequency of the instrument and current fundamental waveform frequency.
- Range: 2 to maximum output frequency of the instrument ÷ current fundamental waveform frequency The maximum is 10.

2.5.3 Harmonic Amplitude

After entering the harmonic setting menu, press Harmonic Ampl to set the harmonic amplitude of each order.

1. Press Order to select the sequence number of the harmonic to be set.
2. Press Harmonic Ampl to set the amplitude of the harmonic selected. Use the arrow keys and knob to change the value. Or use the numeric keyboard to input the amplitude value and then select the desired unit from the pop-up menu. The units available are Vpp, mVpp and dBc.

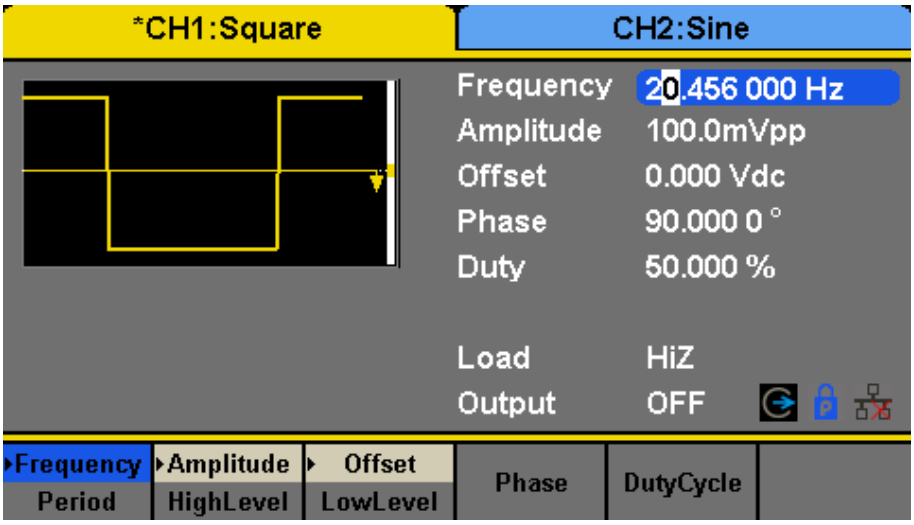
2.5.4 Harmonic Phase

After entering the harmonic setting menu, press Harmonic Phase to set the harmonic phase of each order.

1. Press Order to select the sequence number of the harmonic to be set.
2. Press Harmonic Phase to set the phase of the harmonic selected. Use the arrow keys and knob to change the value. Or use the numeric keyboard to input the phase value and then select the unit °.

Square Wave

Press Waveforms key to select the waveform function, and press the Square softkey. The square waveform parameters are set by using the Square operation menu.
The parameters of square waveforms include frequency/period, amplitude/high level, offset/low level, phase and duty. As shown in **Figure 3.1**, select DutyCycle. The duty cycle parameter area is highlighted in the parameter display window, and users can set the duty cycle value here.



Function	Description
Frequency/ Period	Set the signal frequency or period; The current parameter will be switched at a second press.
Amplitude/ HighLevel	Set the signal amplitude or high level; The current parameter will be switched at a second press.
Offset/ LowLevel	Set the signal offset or low level; The current parameter will be switched at a second press.
Phase	Set the phase of the signal.
DutyCycle	Set the duty cycle for square waveform.

Figure 3.1 Square Wave Parameters

1 Duty Cycle

The ratio of the amount of time the pulse is in the high state and the waveform's period.
The duty cycle setting range is limited by the "Frequency/Period" setting. For detailed information, please refer to "4060B Series Datasheet". The default value is 50%.

1. Press Waveforms → Square → DutyCycle, to set the duty cycle. The duty cycle shown on the screen when the instrument is powered on is the default value or the set value of last power down.

2. Input the desired Duty Cycle. Use the numeric keyboard to input the parameter value directly and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value. The generator will change the waveform immediately.

Note: The methods of setting other parameters of square signal are similar to sine waveform function.

3.1 Offset, High/Low Levels

3.2 Phase

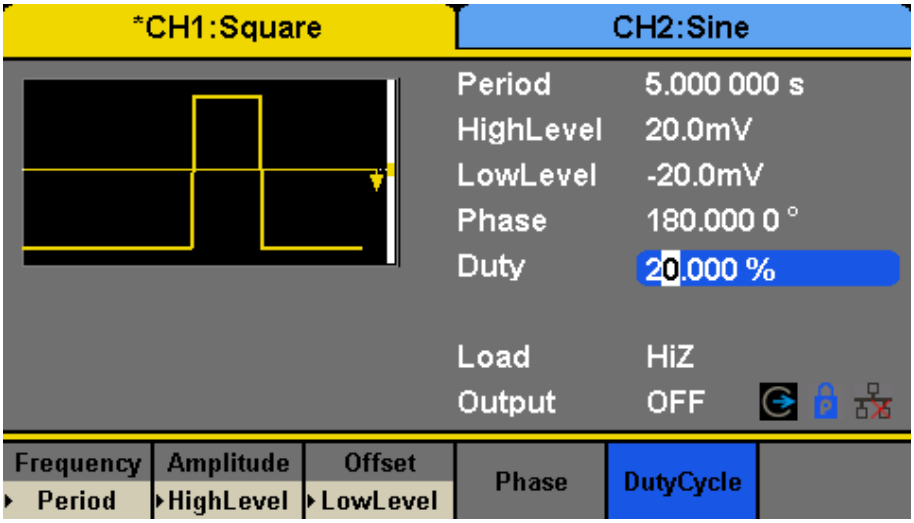


Figure 3.2 Set Duty Cycle

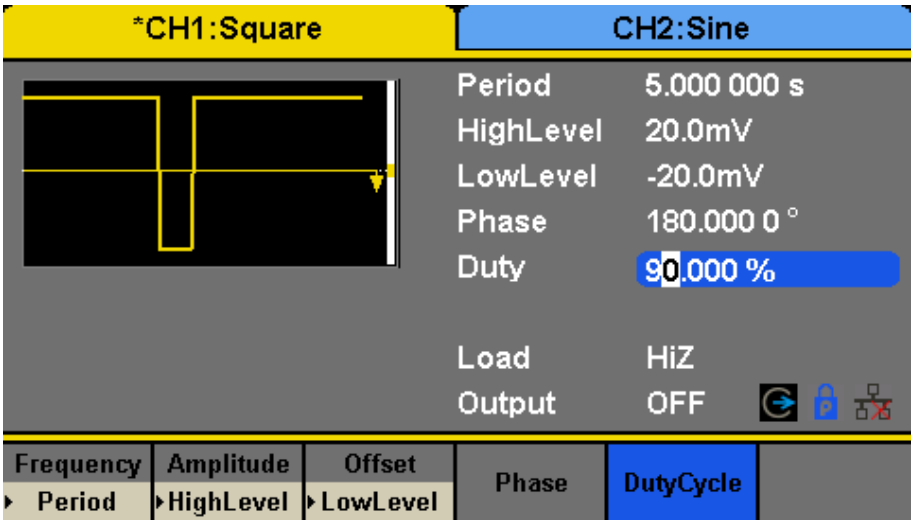


Figure 3.3 Set Duty Cycle

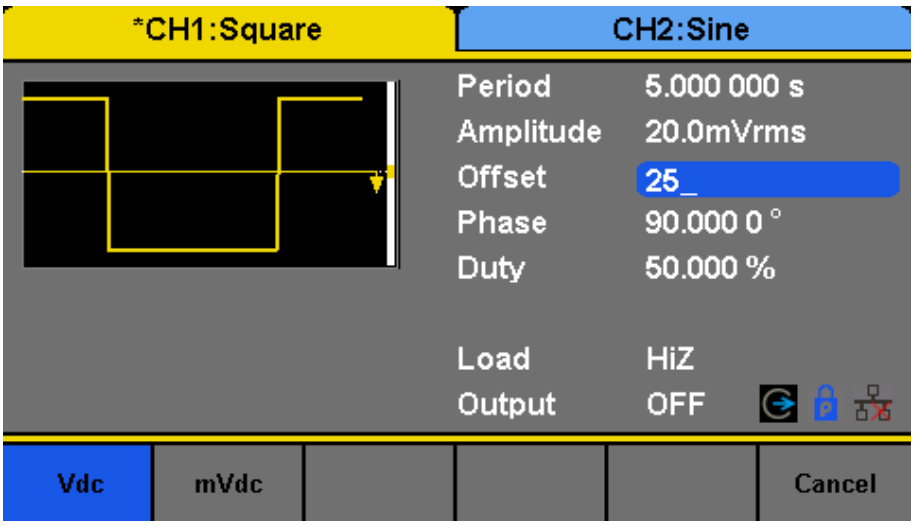


Figure 3.4 Set Offset

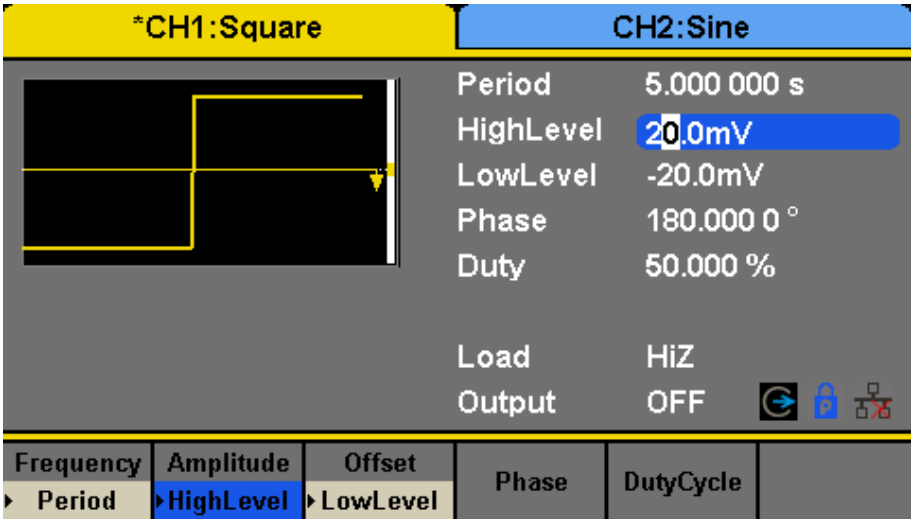


Figure 3.5 Set Hi Level

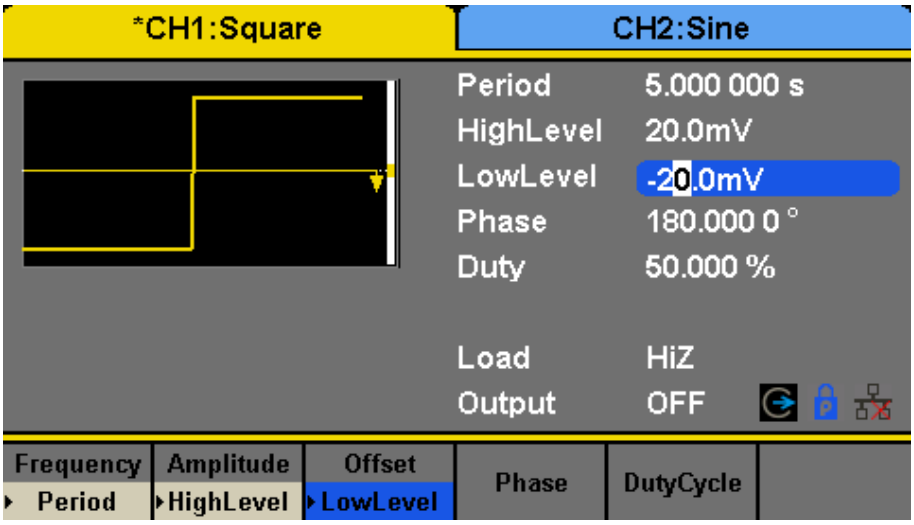


Figure 3.6 Set Low Level

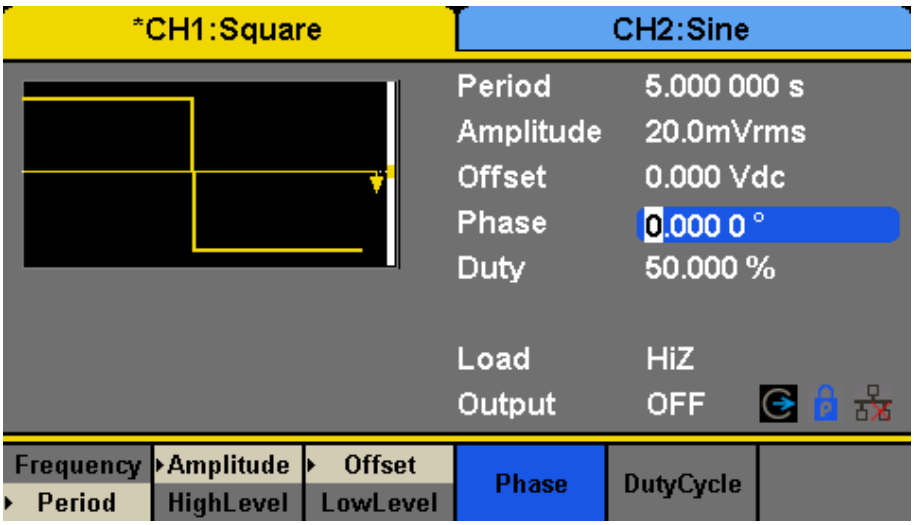


Figure 3.7 Set Phase

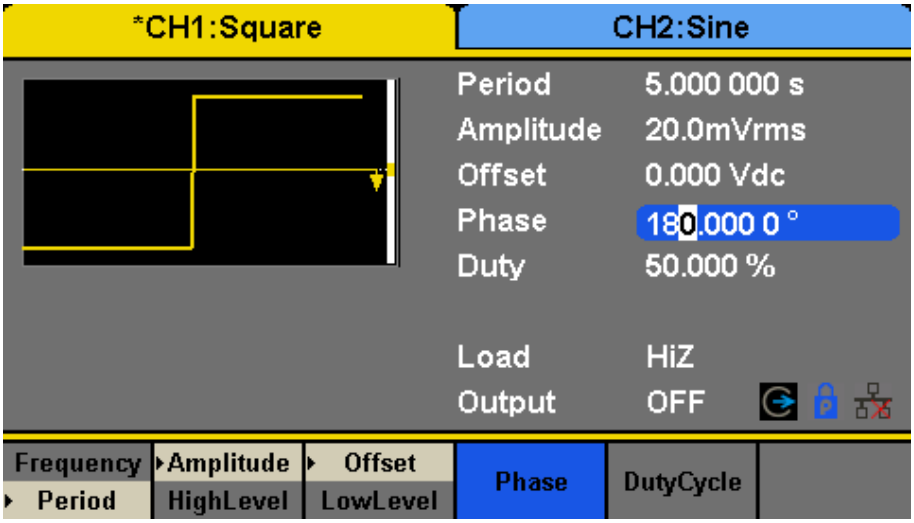


Figure 3.8 Phase at 180 degrees

Ramp Wave

Press Waveforms key to select the waveform function, and press the Ramp softkey. The ramp waveform parameters are set by using the ramp operation menu.
The parameters for ramp waveforms include frequency/period, amplitude/high level, offset/low level, phase and symmetry. As shown in **Figure 4.1**, in the soft key menu, select Symmetry. The symmetry parameter area is highlighted in the parameter display window, and users can set the symmetry value here.

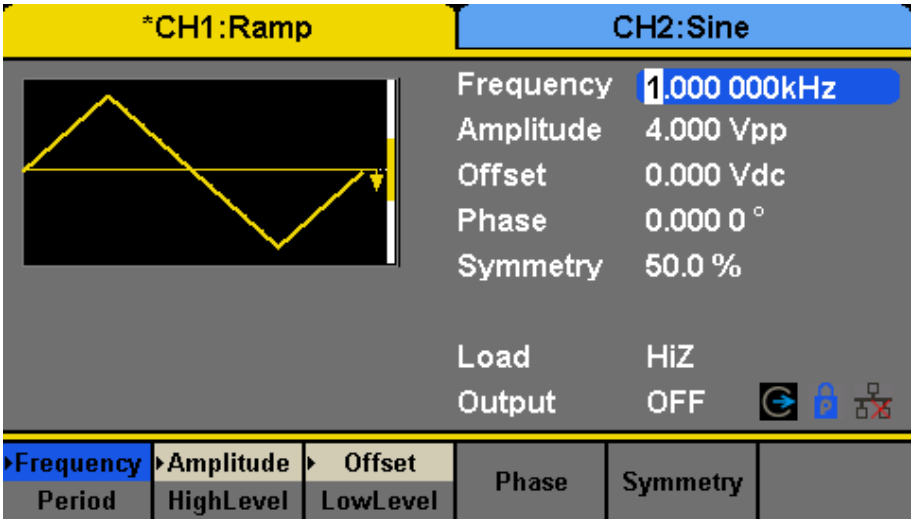


Figure 4.1 Ramp Waveform Main Screen

Frequency and Period Set the signal frequency or period; The current parameter will be switched at a second press.

Amplitude/ HighLevel Set the signal amplitude or high level; The current parameter will be switched at a second press.

Offset/ LowLevel Set the signal offset or low level; The current parameter will be switched at a second press.

Phase Set the phase of the signal.

Symmetry Set the symmetry for ramp waveform.

4.1 Frequency, Amplitude, Offset, High/Low level, and Phase

Set the frequency, amplitude, high level, low level, offset and phase as shown in **Figures 4.2**, **4.3**, **4.4**, **4.5**, **4.6**.

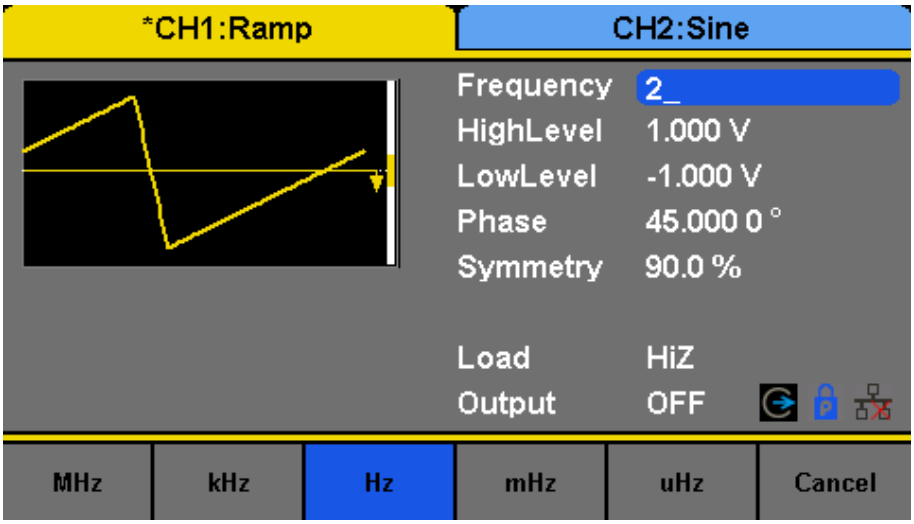


Figure 4.2 Set Frequency

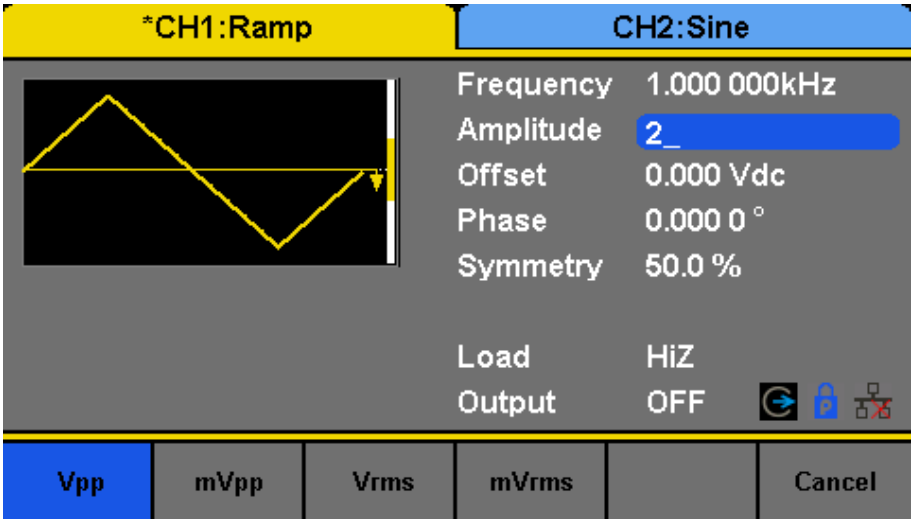


Figure 4.3 Set Amplitude

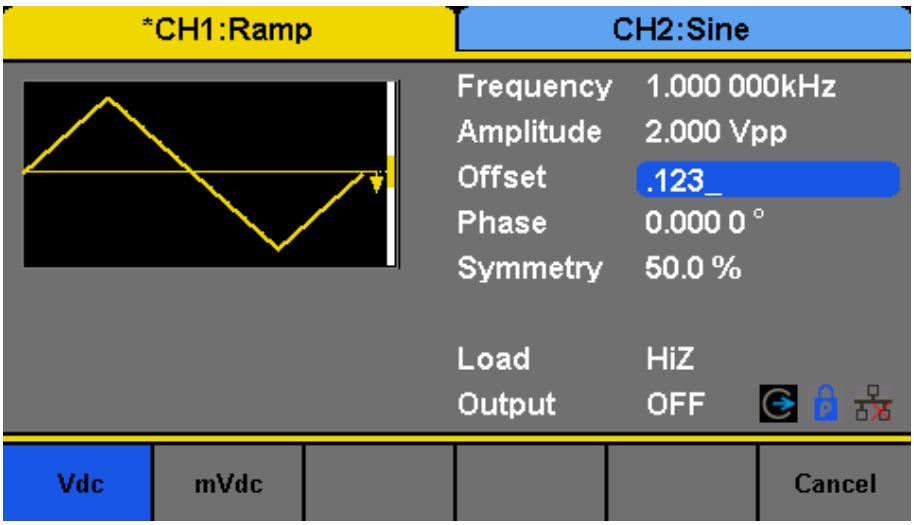


Figure 4.4 Set Offset

4.2 Symmetry

The percentage that the rising period takes up the whole Period.
Input Range: 0~100% Default Value: 50%

1. Press Waveforms → Ramp → Symmetry, to set the symmetry. The symmetry shown on the screen when the instrument is powered on is the default value or the set value of last power down.

2. Input the desired Symmetry.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value. The generator will change the waveform immediately.

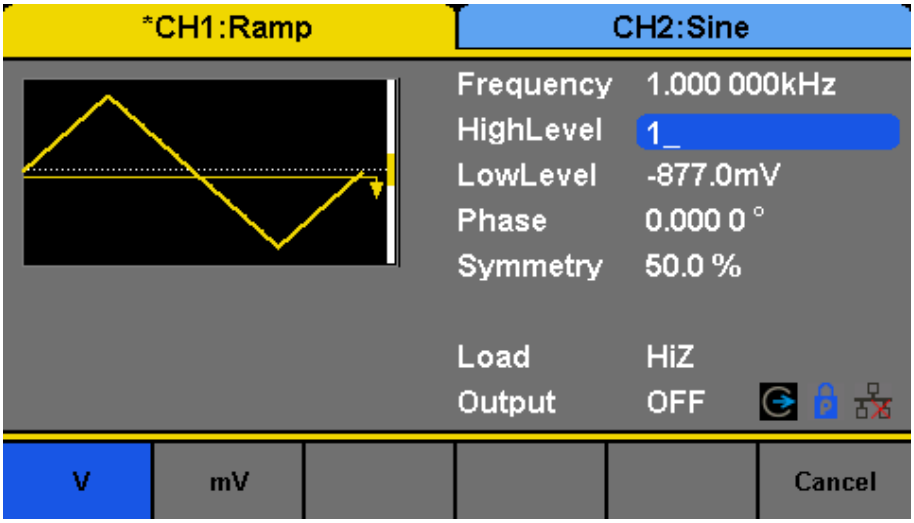


Figure 4.5 Set High Level

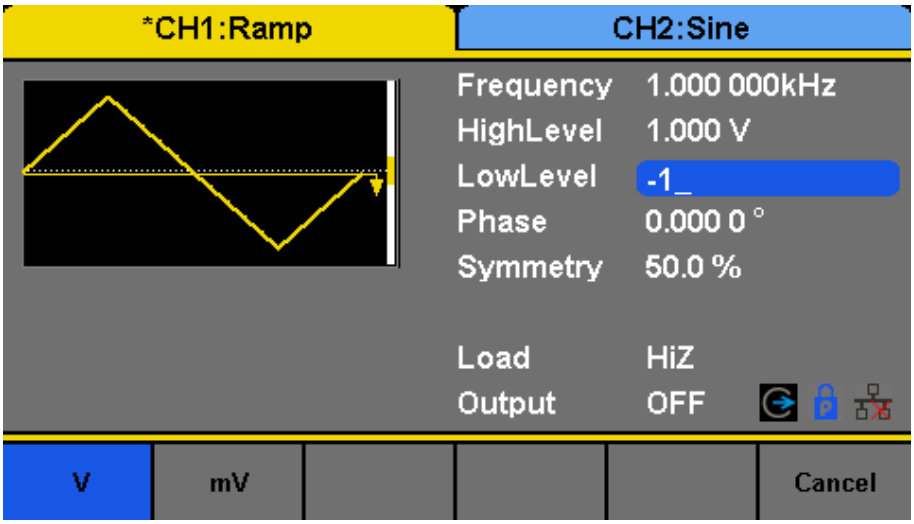


Figure 4.6 Set Low Level

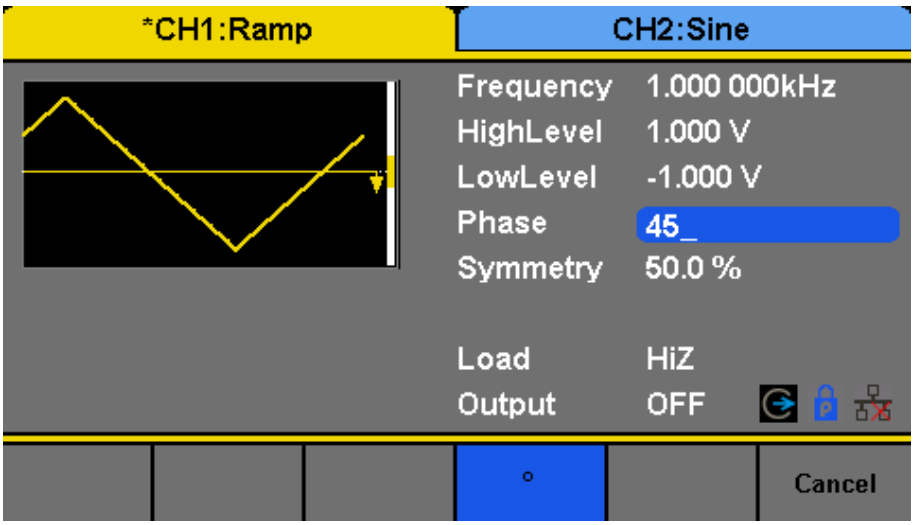


Figure 4.7 Set Phase

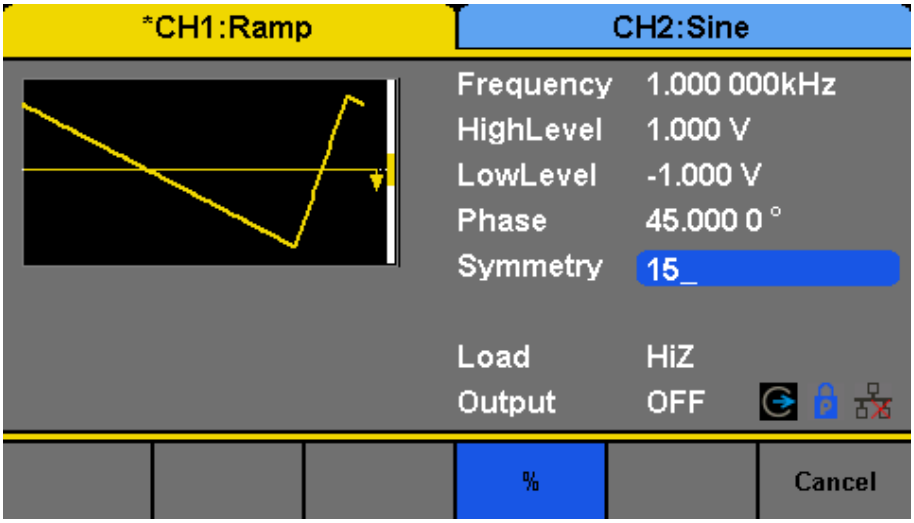


Figure 4.8 Set Symmetry 15%

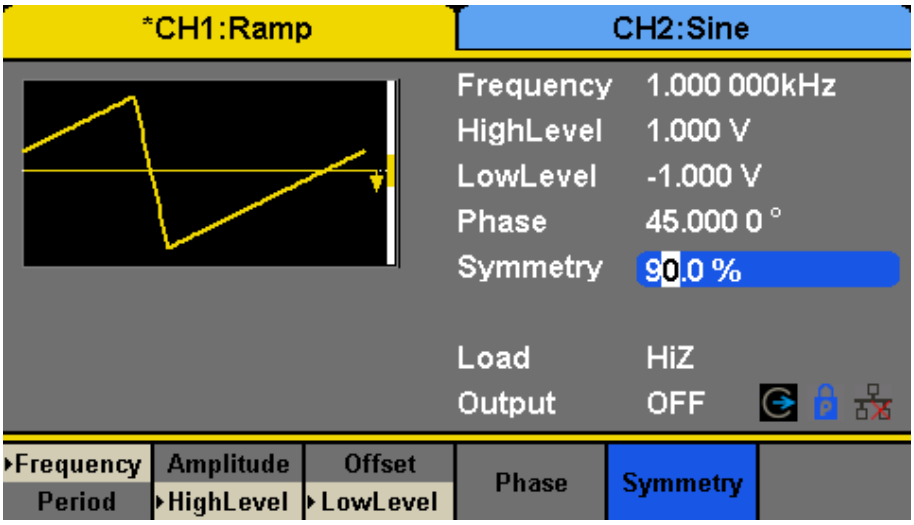


Figure 4.9 Set Symmetry 90%

Pulse Wave

Press Waveforms key to select the waveform function, and press the Pulse softkey. The pulse waveform parameters are set by using the pulse operation menu.
The parameters for pulse waveforms include frequency/period, amplitude/high level, offset/low level, width, rise/fall and delay. As shown in **Figure 5.1**, in the soft key menu, select PulWidth. The pulse width parameter area is highlighted in the parameter display window, and users can set the pulse width value here.

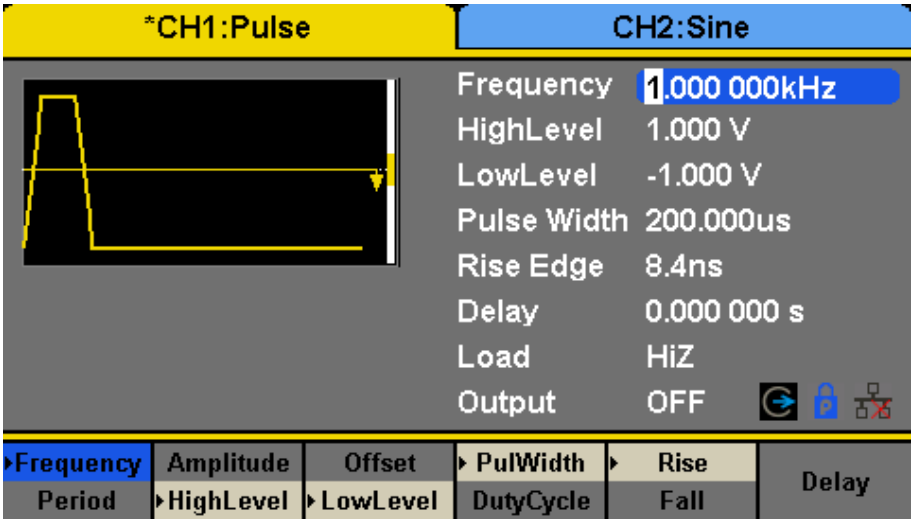


Figure 5.1 Pulse Waveform Main Screen

Frequency/ Period Set the signal frequency or period; The current parameter will be switched at a second press.

Amplitude/ HighLevel Set the signal amplitude or high level; The current parameter will be switched at a second press.

Offset/ LowLevel Set the signal offset or low level; The current parameter will be switched at a second press.

PulWidth/ DutyCycle Set the signal pulse width or duty cycle; The current parameter will be switched at a second press.

Rise/ Fall Setting the rise edge or fall edge for pulse waveform. The current parameter will be switched at a second press.

Delay Setting the delay for pulse waveform.

5.1 Frequency, Amplitude, Offset, High/Low level, and Phase

Set the frequency, amplitude, high level, low level, and offset as shown in **Figures 4.2**, **4.3**, **4.4**, **4.5**, **4.6**.

5.2 Pulse Width and DutyCycle

Pulse width is defined as the time from the 50% threshold of a rising edge amplitude to the 50% threshold of the next falling edge amplitude (as shown in the figure below). The pulse width setting range is limited by the "Minimum Pulse Width" and "Pulse Period" setting. For detailed information, please refer to "4060B Series Datasheet". The default value is 200s.
Pulse duty cycle is defined as the percentage that the pulse width takes up in the whole period. Pulse duty cycle and pulse width are correlative. Once a parameter is changed, the other will be automatically changed.

1. Press Waveforms→ Pulse → PulWidth, to set the pulse width. The pulse width shown on the screen when the instrument is powered on is the default value or the set value of last power down. If you want to set the waveform by duty, press the PulWidth/DutyCycle key again, to switch into the duty parameter (the current operation is displayed in inverse color).

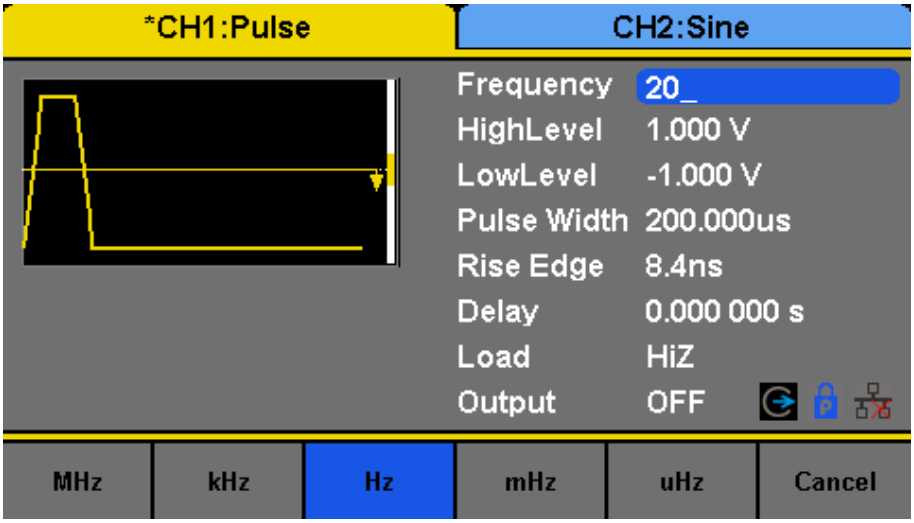


Figure 5.2 Set Frequency

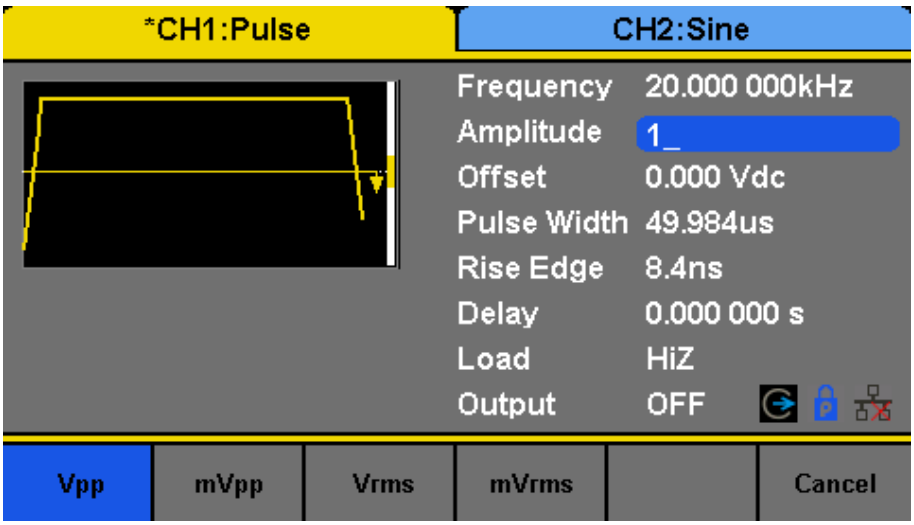


Figure 5.3 Set Amplitude

2. Input the desired Pulse Width.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value. The generator will change the waveform immediately.

5.3 Rising and Falling Edges

Rise edge time is defined as the duration of the pulse amplitude rising from 10% to 90% threshold, while fall edge time is defined as duration of the pulse amplitude moving down from 90% to 10% threshold. The setting of rise/fall edge time is limited by the currently specified pulse width limit. Users can set rise edge and fall edge independently.

1. Press Waveforms → Pulse → Rise to set the rise edge.
   The rise edge shown on the screen when the instrument is powered on is the default value or the set value of last power down. If you want to set the waveform by fall edge, press the Rise/Fall key again, to switch into the fall edge parameter (the current operation is displayed in inverse color).

2. Input the desired rise edge.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value. The generator will change the waveform immediately.

5.4 Delay

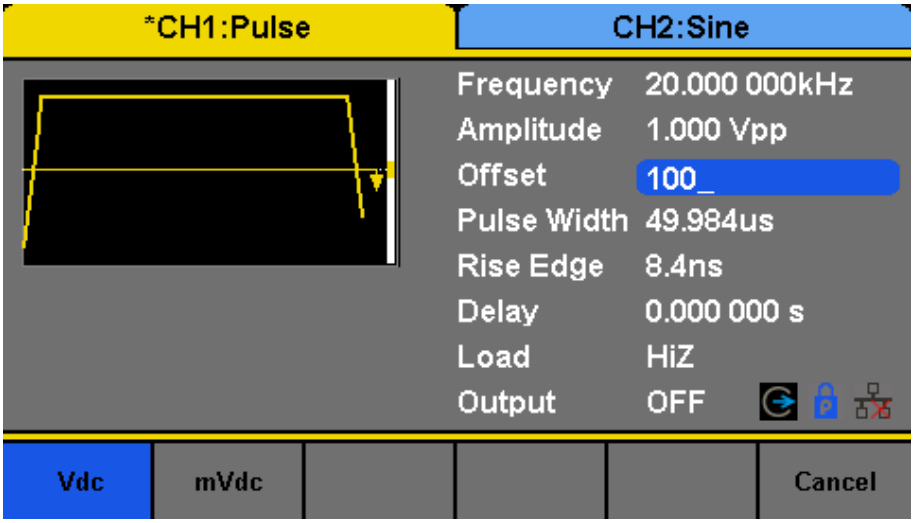


Figure 5.4 Set Offset

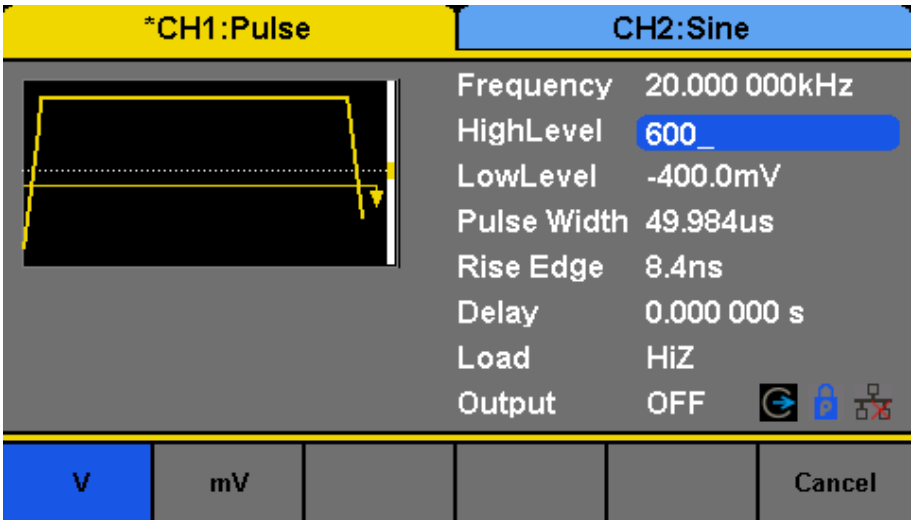


Figure 5.5 Set High Level

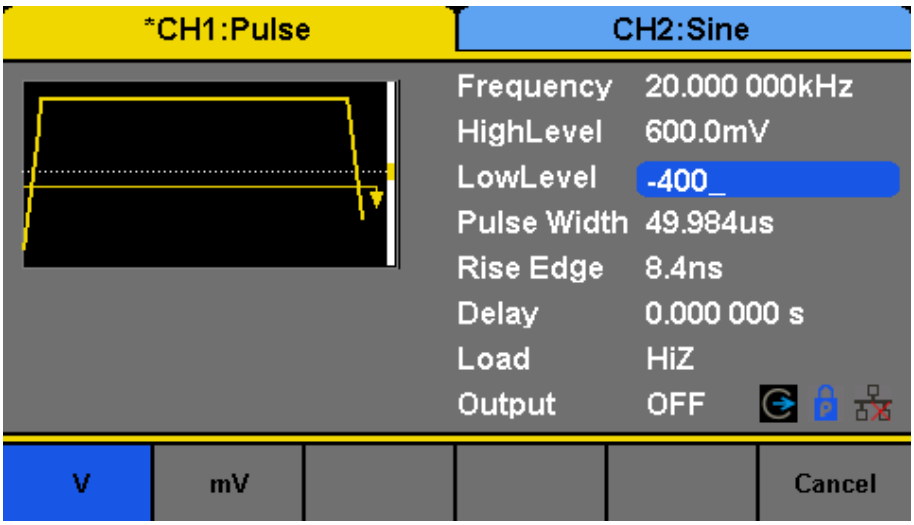


Figure 5.6 Set Low Level

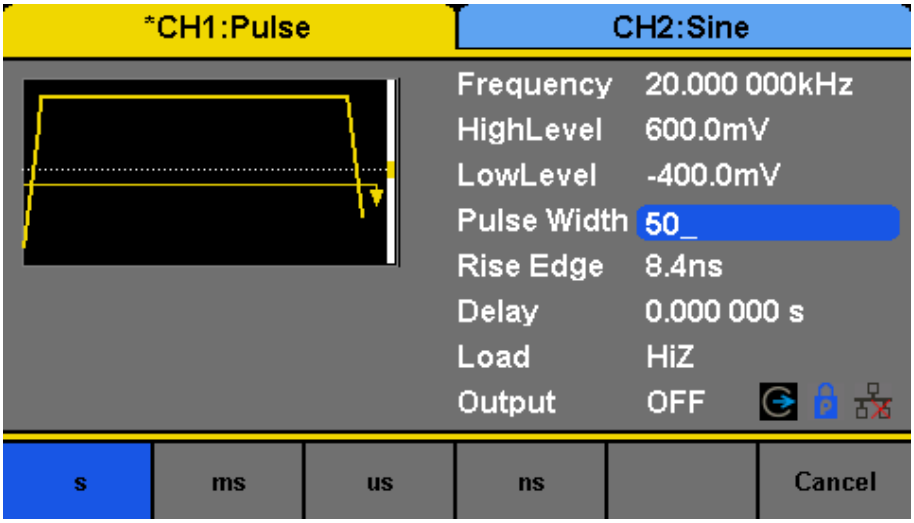


Figure 5.7 Set Pulse Width

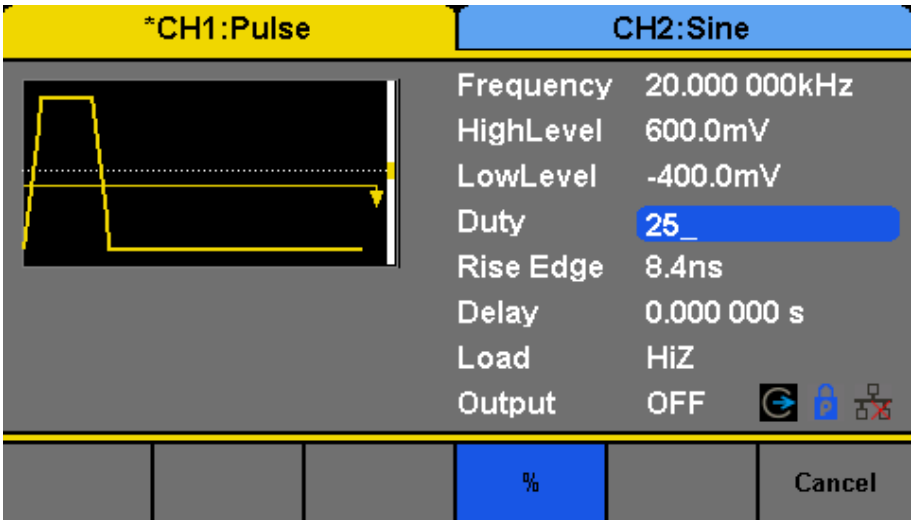


Figure 5.8 Set Duty Cycle

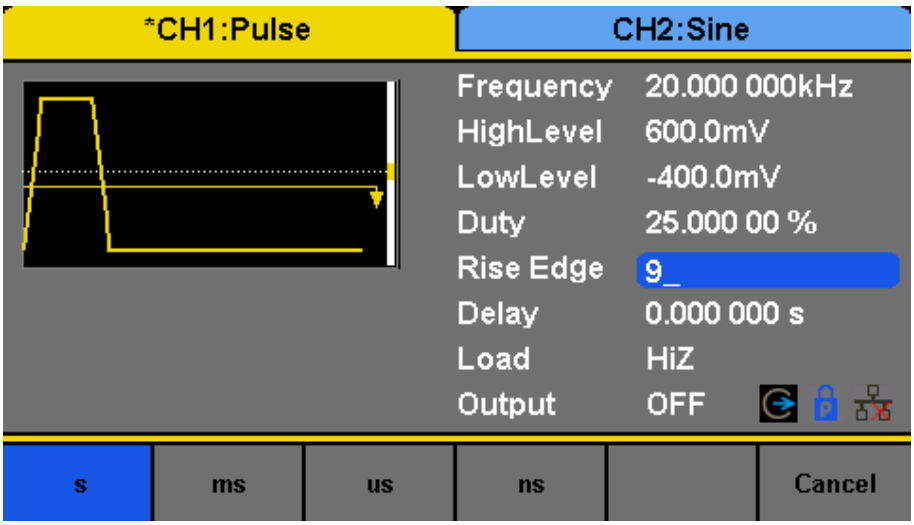


Figure 5.9 Setting the Risng Edge

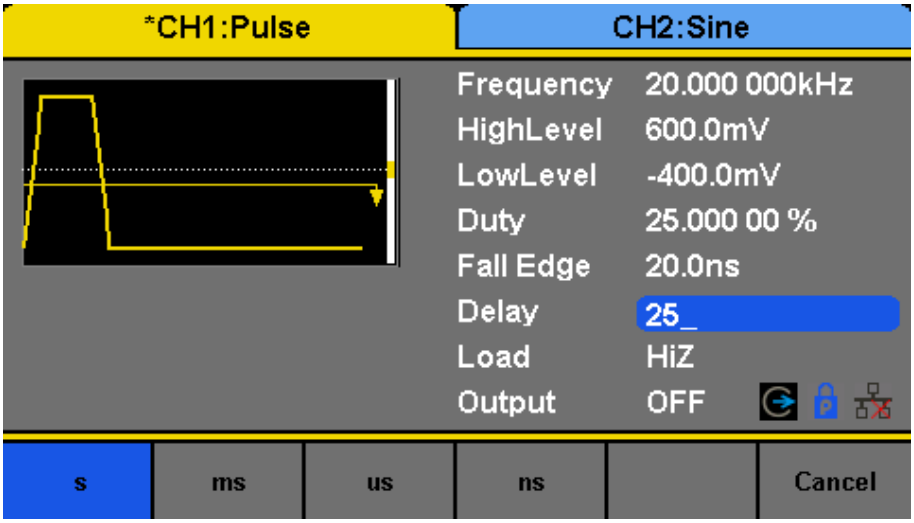


Figure 5.10 Pulse Delay

Noise Wave

Press Waveforms key to select the waveform function, and press the Noise softkey. The noise parameters are set by using the noise operation menu.
The parameters for noise include stdev, mean and bandwidth. As shown in **Figure 6.1**, in the soft key menu, select Stdev, The stdev parameter area is highlighted in the parameter display window, and users can set the stdev value here. Noise is non-periodic signal which has no frequency or period.

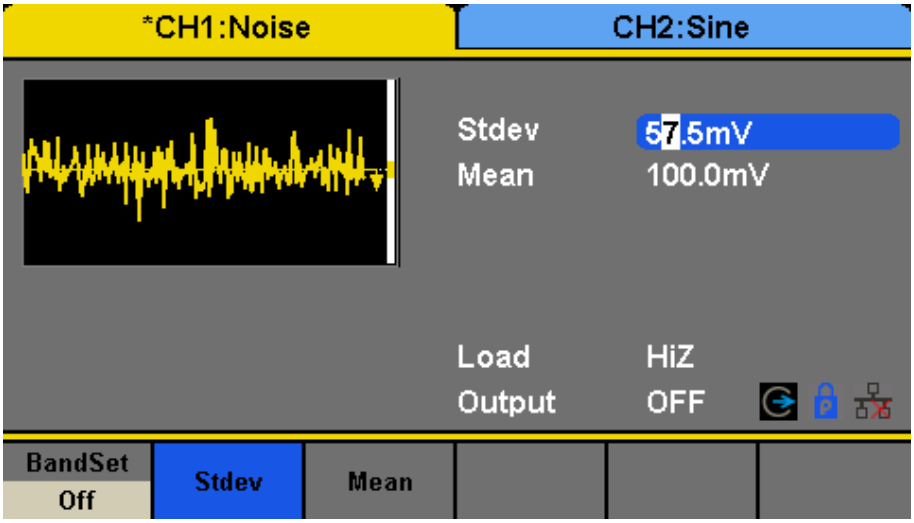


Figure 6.1 Noise Parameters Display Interface

BandSet Turn on/off the bandwidth setting.

Stdev Setting the stdev for noise waveform.

Mean Setting the mean for noise waveform.

Bandwidth Setting the bandwidth for noise waveform.

6.1 Standard Deviation

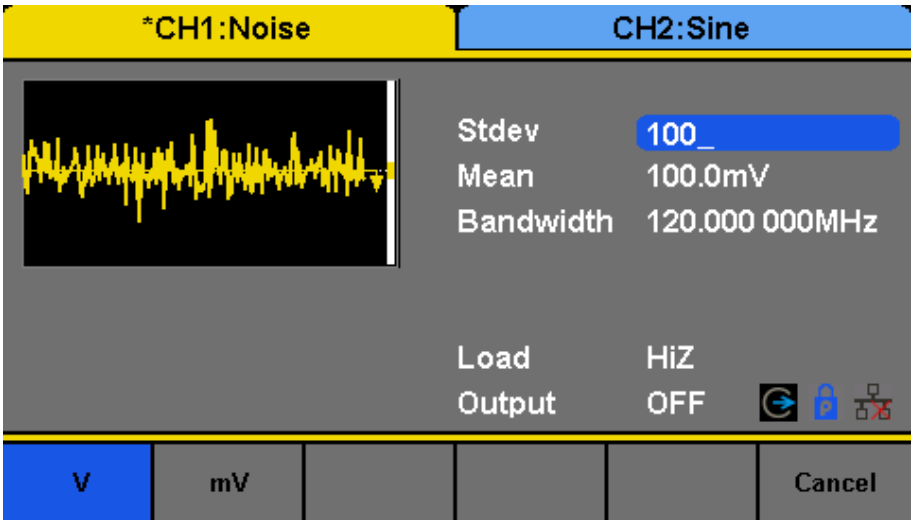


Figure 6.2 Setting the Stdev

1. Press Waveforms → Noise → Stdev, to set the stdev. The stdev shown on the screen when the instrument is powered on is the default value or the set value of last power down.

2. Input the desired stdev.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value.

6.2 Mean

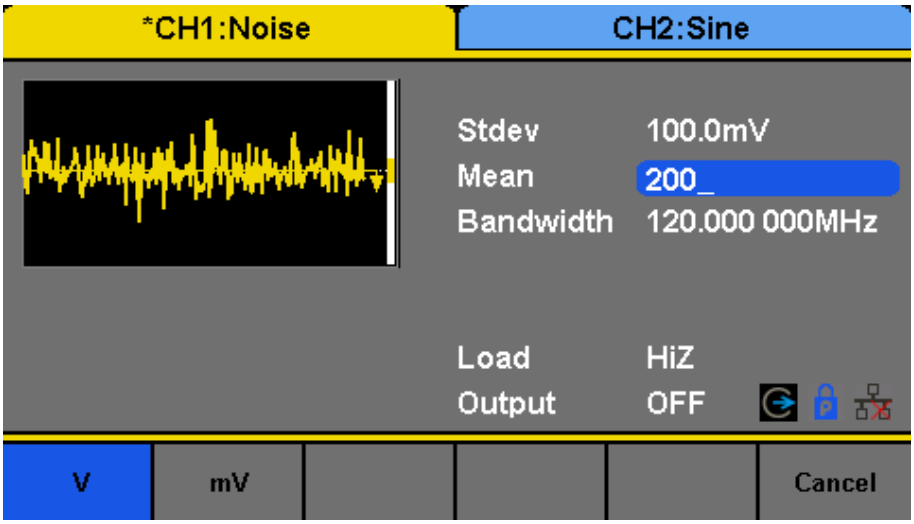


Figure 6.3 Setting the Mean

1. Press Waveforms → Noise → Mean, to set the mean.
   The mean shown on the screen when the instrument is powered on is the default value or the set value of last power down.

2. Input the desired mean.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or use the arrow keys to select the digit to edit, and then use the knob to change its value.

6.3 Bandwidth

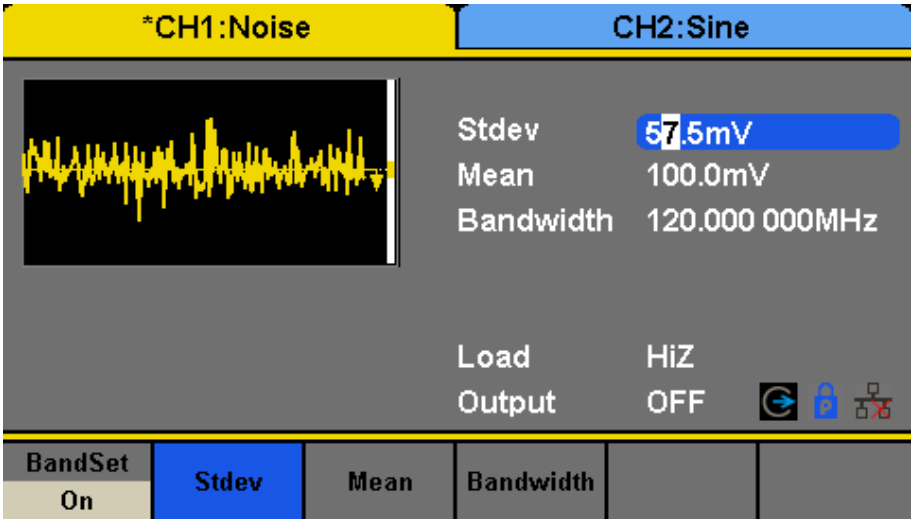


Figure 6.4 Setting the Bandwidth

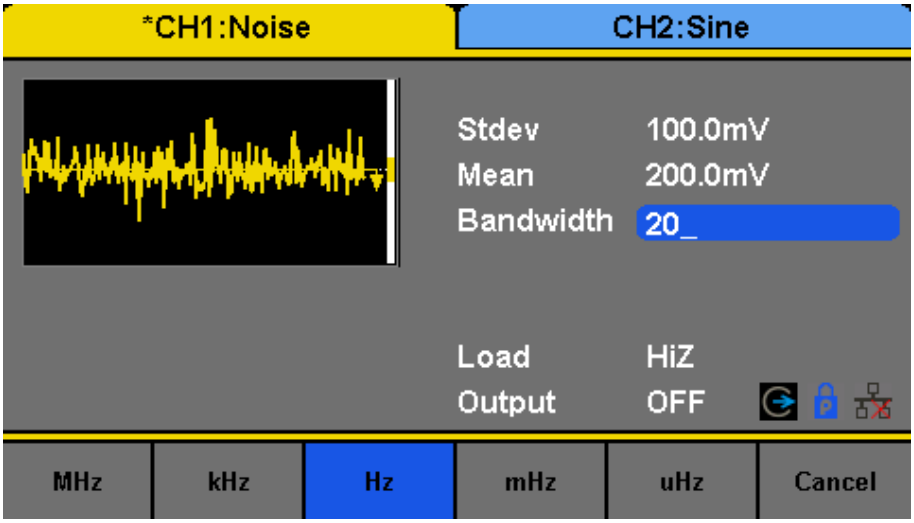


Figure 6.5 Setting the Bandwidth

1. Press Waveforms → Noise → BandSet and choose "On" to set the bandwidth.
   The bandwidth shown on the screen when the instrument is powered on is the default value or the set value of last power on. When changing the function, if the current value is valid for the new waveform, it will be used sequentially.

2. Input the desired bandwidth.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or you can use the arrow keys to select the digit you want to edit, and then use the knob to change its value.

DC Wave

Press Waveforms → Page 1/2 → DC, to enter the following interface. Please note that there is a 'DC offset' parameter at the middle of the screen.

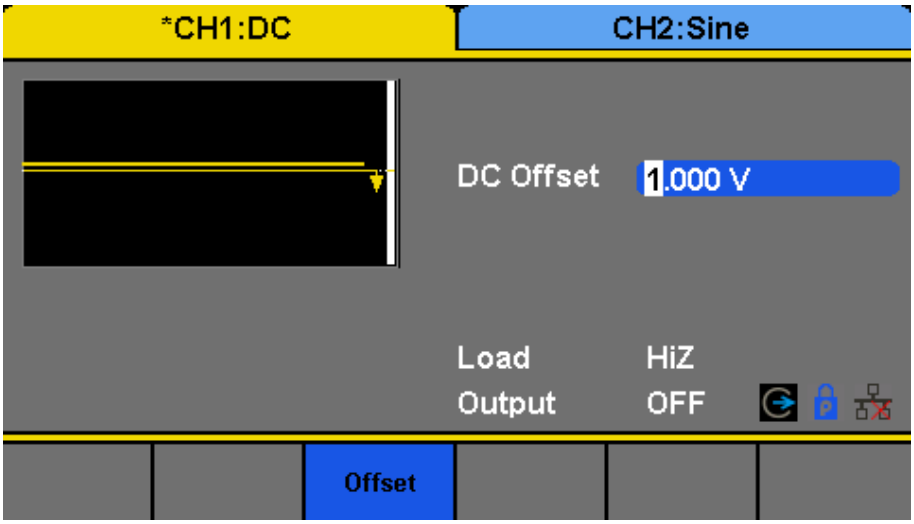


Figure 7.1 DC Setting Interface

Arbitrary Wave

The Arb signal consists of two types: the system's built-in waveforms and the user-defined waveforms. Built-in waveforms are stored in the internal non-volatile memory. Users may also edit the arbitrary waveform with 8 to 8M data points, namely 8pts to 8Mpts.

8.1 DDS

Choose Waveforms →Page 1/2 →Arb →Arb Mode and select the "DDS" output mode. The parameters include frequency/period, amplitude/high level, offset/low level and phase.

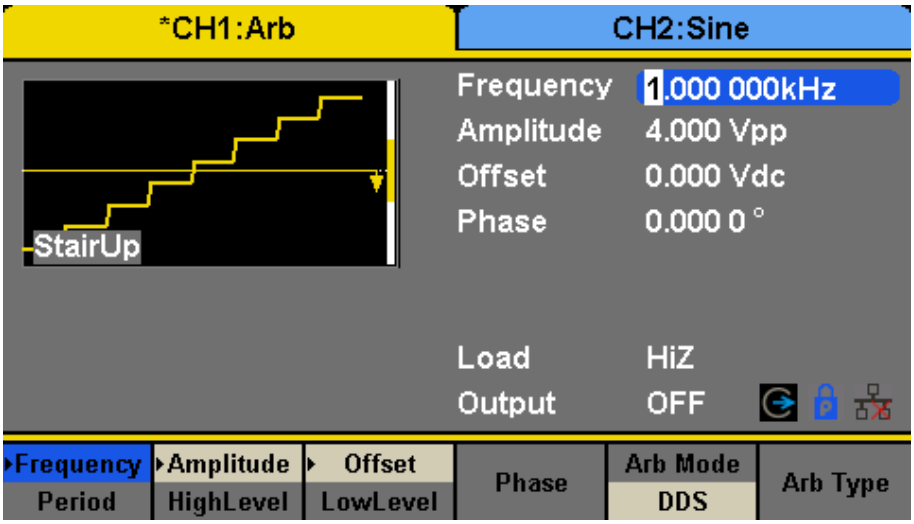


Figure 8.1 DDS

Frequency/Period Set the signal frequency or period; The current parameter will be switched at a second press.

Amplitude/HighLevel Set the signal amplitude or high level; The current parameter will be switched at a second press.

Offset/LowLevel Set the signal offset or low level; The current parameter will be switched at a second press.

Phase Set the phase of the signal.

In DDS output mode, users can set the frequency or period of the arbitrary waveform. The instrument outputs an arbitrary waveform which is made up of certain points according to the current frequency

8.2 TrueArb

Choose Waveforms →Page 1/2 →Arb →Arb Mode and select the "TrueArb" output mode. The parameters include sampling rate/frequency, amplitude/high level, offset/ low level and phase.

SRate/ Frequency Set the signal sampling rate or frequency; The current parameter will be switched at a second press.

Amplitude/ HighLevel Set the signal amplitude or high level; The current parameter will be switched at a second press.

Offset/ LowLevel Set the signal offset or low level; The current parameter will be switched at a second press.

Phase Set the phase of the signal.

In TrueArb output mode, users can set the sampling rate (the output points per second) or frequency of the arbitrary waveform. The instrument outputs an arbitrary waveform point by point according to the current sampling rate.

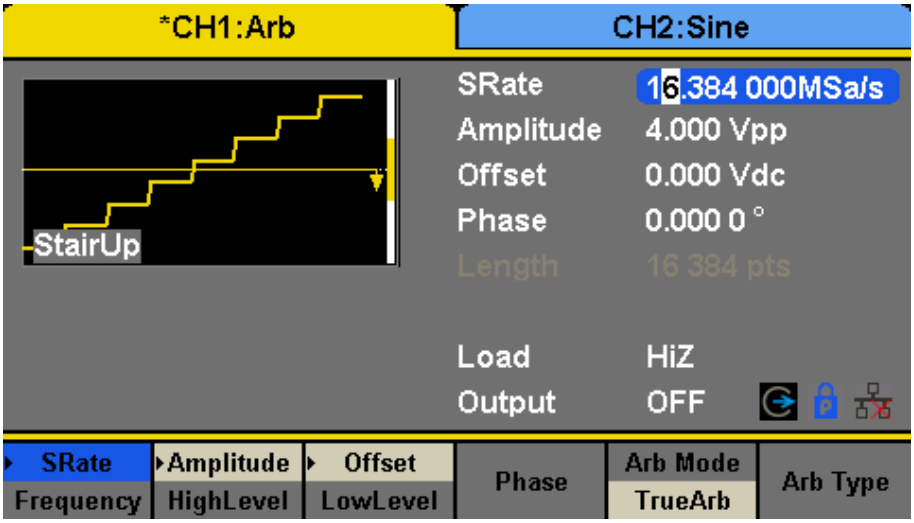


Figure 8.2 TrueArb

8.2.1 Sampling Rate

1. Press Waveforms →Page 1/2 →Arb →TureArb →Srate, to set the sampling rate parameter.
   The sampling rate shown on the screen when the instrument is powered on is the default value or the set value of last power on. When setting the function, if the current value is valid for the new waveform, it will be used sequentially. If you want to set the frequency for the waveform, press SRate/Frequency key again, to switch to the frequency parameter (the current operation is displayed in inverse color).

2. Input the desired sampling rate.

Use the numeric keyboard to input the parameter value directly, and press the corresponding key to select the parameter unit. Or you can use the arrow keys to select the digit you want to edit, and then use the knob to change its value.

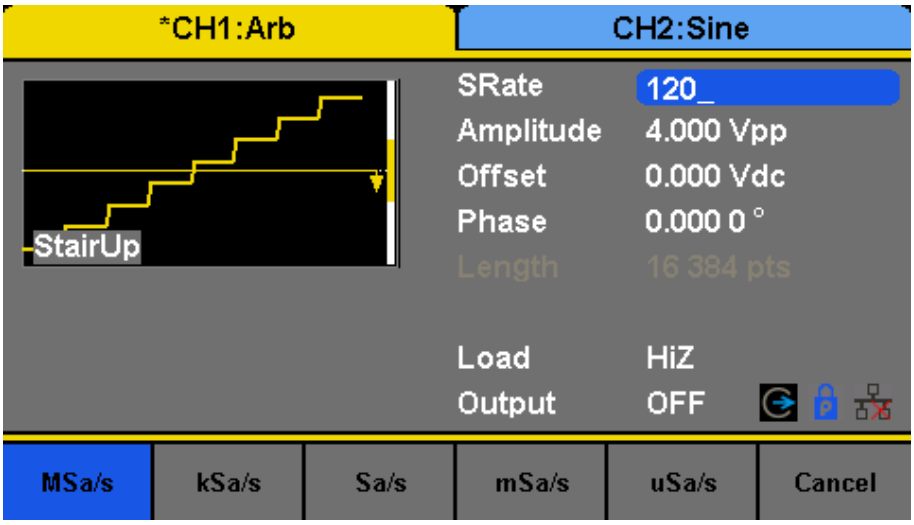


Figure 8.3 Set the Sampling Rate

Note: The methods of setting the parameters of arbitrary signal are similar to sine waveform function.

8.3 Waveform Selection

There are numerous built-in Arbitrary Waveforms and there is storage for user-defined Arbitrary Waveforms inside the generator.

8.4 Selecting a Built-in Waveform

Choose Waveforms →Page 1/2 →Arb →Arb Type →Built-In to enter the following interface, as shown in **Figure 8.4**. See **Chapter 20** for the set of available built-in waveforms.

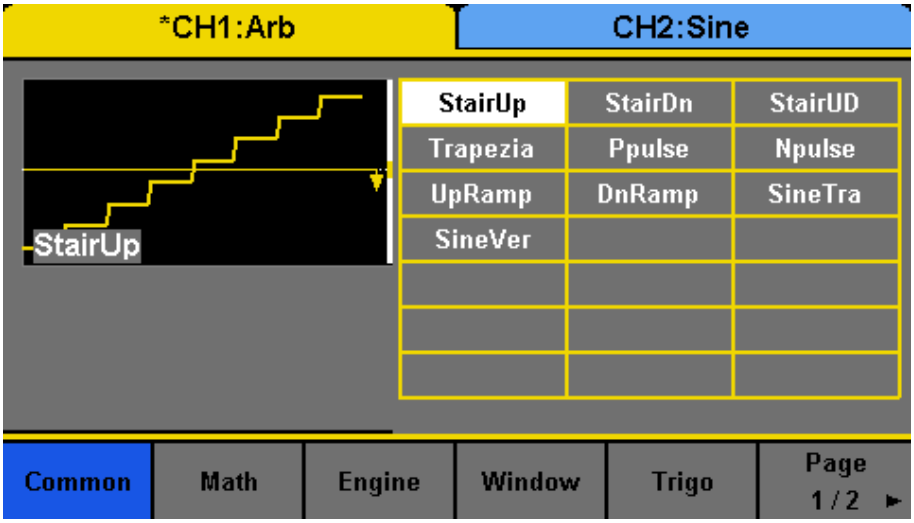


Figure 8.4 Built-in Arbitrary Waveforms

Press Common, Math, Engine, Window, Trigo or other menus to switch to the desired category (the selected category in the menu bar is highlighted), then rotate the knob or click the touch screen to choose the desired waveform (the selected waveform is highlighted). Select Accept or press the knob to recall the corresponding waveform.

8.5 Stored Waveform

Choose Waveforms →Page 1/2 →Arb →Arb Type →Stored Waveforms to enter the following interface, as shown in **Figures 8.5**, **8.6**.

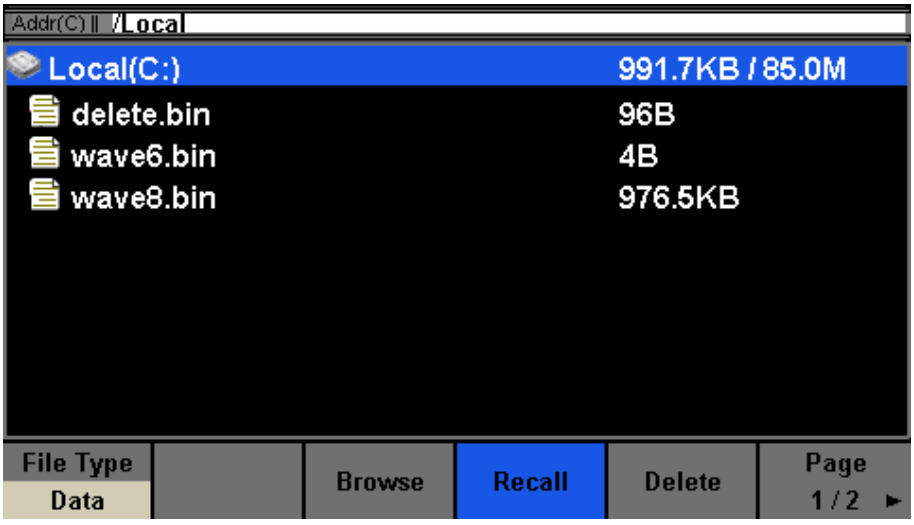


Figure 8.5 Stored Waveform Display Interface

Rotate the knob or touch the screen to choose the desired waveform. Then select Recall or press the knob to recall the corresponding waveform.

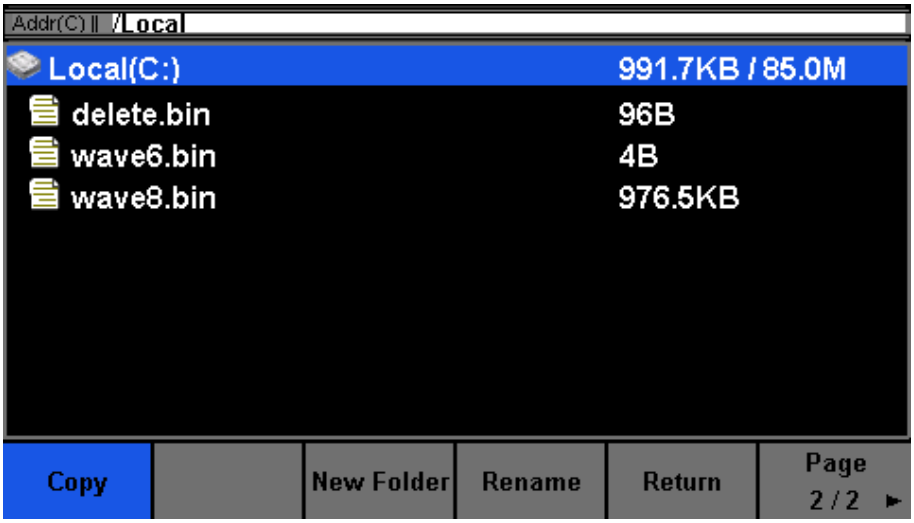


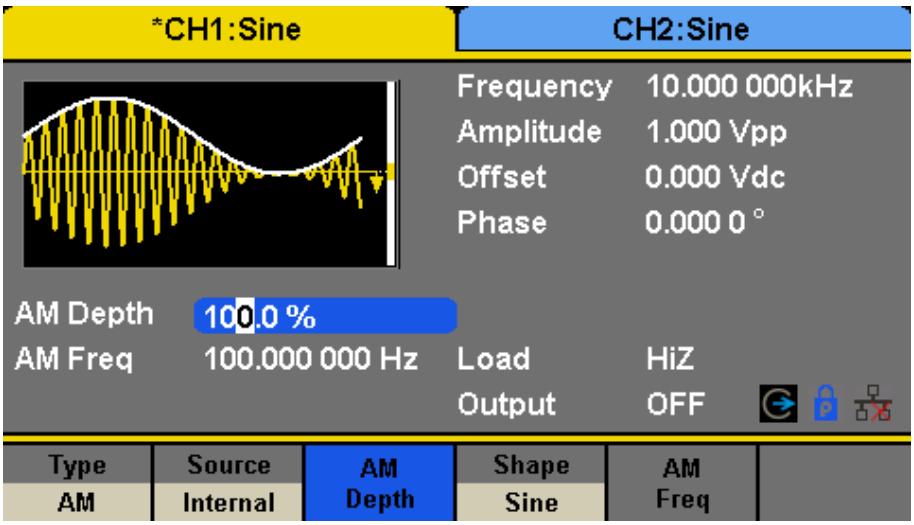
Figure 8.6 Stored Waveform Display Interface

Modulation Function

Use the Mod key to generate modulated waveforms. The 4060B Series can generate AM, FM, ASK, FSK, PSK, PM, PWM and DSB-AM modulated waveforms. Modulating parameters vary with the types of the modulation. In AM, users can set the source (internal/external), depth, modulating frequency, modulating waveform and carrier. In DSB-AM, users can set the source (internal/external), modulating frequency, modulating waveform and carrier. In FM, users can set the source (internal/external), modulating frequency, frequency deviation, modulating waveform and carrier. In PM, users can set the source (internal/external), phase deviation, modulating frequency, modulating waveform and carrier. In ASK, users can set the source (internal/external), key frequency and carrier. In FSK, users can set the source (internal/external), key frequency, hop frequency and carrier. In PSK, users can set the source (internal/external), key frequency, polarity and carrier. In PWM, users can set the source (internal/external), modulating frequency, width/duty cycle deviation, modulating waveform and carrier.
We will introduce how to set these parameters in details according to the modulation types.

9.1 AM

The modulated waveform consists of two parts: the carrier and the modulating waveform. In AM, the amplitude of the carrier varies with the instantaneous voltage of the modulating waveform.
Press Mod → Type → AM, the parameters of AM modulation are shown in **Figure 9.1**.



Function	Explanation	
Type	AM	Amplitude modulation
Source	Internal	The source is internal
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
AM Depth		Set the modulation depth.
Shape	Sine	Choose the modulating waveform.
	Square	
	Triangle	
	UpRamp	
	DnRamp	
	Noise	
	Arb	
AM Freq		Set the modulating waveform frequency. Frequency range: 1mHz~1MHz (internal source only).

Figure 9.1 Setting Interface of AM Modulation

9.1.1 To Select Modulation Source

The 4060B Series can accept modulating signal from an internal or external modulation source. Press Mod → AM → Source to select "Internal" or "External" modulation source. The default is "Internal".

9.1.2 Internal Source

When internal AM modulation source is selected, press Shape to select Sine, Square, Triangle, UpRamp, DnRamp, Noise or Arb as modulating waveform.

- Square: 50% duty cycle
- Triangle: 50% symmetry
- UpRamp: 100% symmetry
- DnRamp: 0% symmetry
- Arb: the arbitrary waveform selected of the current channel

Note: Noise can be used as modulating waveform but cannot be used as the carrier.

9.1.3 External Source

When external AM modulation source is selected, the generator accepts external modulating signal from the [Aux In/Out] connector at the rear panel. At this time, the amplitude of the modulated waveform is controlled by the signal level applied to the connector. For example, if the modulation depth is set to 100%, the output amplitude will be the maximum when the modulating signal is +6V and the minimum when the modulating signal is -6V.
The 4060B Series can use one channel as a modulating source for the other channel. The following example takes the output signal of CH2 as the modulating waveform.

1. Connect the CH2 output terminal to [Aux In/Out] connector on the rear panel using a dual BNC cable.
2. Select CH1 and press Mod to select the desired modulation type as well as set the corresponding parameters, and then select external modulation source.
3. Select CH2 and select the desired modulating waveform and set the corresponding parameters.
4. Press Output to enable the output of CH1.

9.1.4 Modulation Depth

Modulation depth expressed as a percentage indicates the amplitude variation degree. AM modulation depth varies from 1% to 120%. Press AM Depth to set the parameter.

- In the 0% modulation, the output amplitude is the half of the carrier's amplitude.
- In the 120 modulation, the output amplitude is the same with the carrier's amplitude.
- For an external source, the depth of AM is controlled by the voltage level on the connector connected to the [Aux In/Out]. ±6V correspond to 100% depth.
- When external modulation source is selected, this menu is hidden.

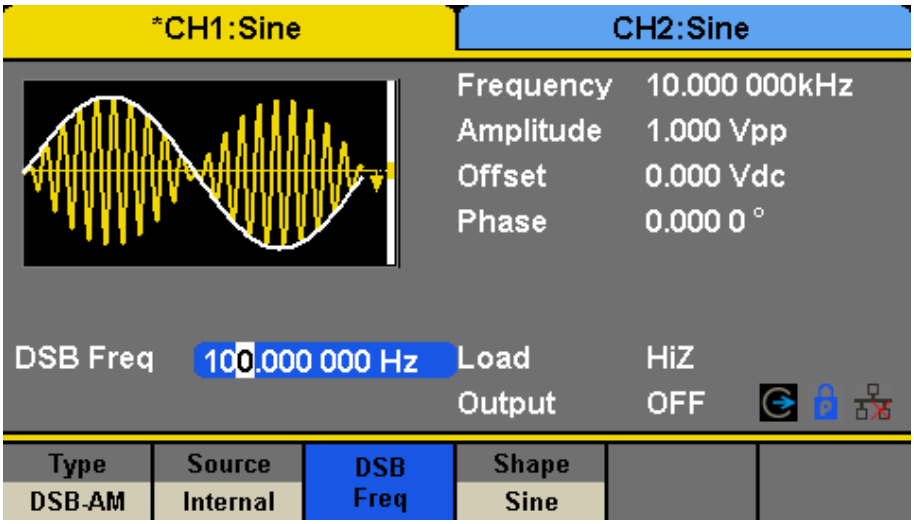
9.1.5 Modulation Frequency

When internal modulation source is selected, press AM Freq to highlight the parameter, then use the numeric keyboard or arrow keys and knob to input the desired value.

- The modulation frequency ranges from 1mHz to 1MHz.
- When external modulation source is selected, this menu is hidden.

9.1.5.1 DSB-AM

DSB-AM is an abbreviation for Double-Sideband Suppressed Carrier – Amplitude Modulation. Press Mod → Type → DSB-AM. The parameters of DSB-AM modulation are shown in **Figure 9.2**.



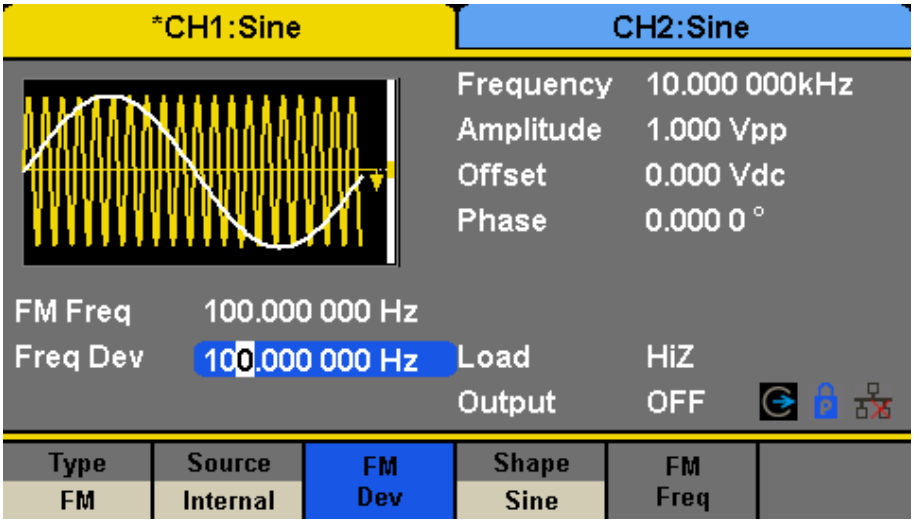
Function	Description	
Type	DSB-AM	DSB Amplitude modulation.
Source	Internal	The source is internal.
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
DSB Freq		Set the modulating waveform frequency. Frequency range: 1mHz~1MHz (internal source only).
Shape	Sine	Choose the modulating waveform.
	Square	
	Triangle	
	UpRamp	
	DnRamp	
	Noise	
	Arb	

Figure 9.2 Setting Interface of DSB-AM Modulation

Note: The methods of setting the parameters of DSB-AM are similar to AM.

9.1.5.2 FM

The modulated waveform consists of two parts: the carrier and the modulating waveform. In FM, the frequency of the carrier varies with the instantaneous voltage of the modulating waveform.
Press Mod → Type → FM, the parameters of FM modulation are shown in **Figure 9.3**.



Function	Explanation	
Type	FM	Frequency modulation
Source	Internal	The source is internal
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
Freq Dev		Set the frequency deviation
Shape	Sine	Choose the modulating waveform.
	Square	
	Triangle	
	UpRamp	
	DnRamp	
	Noise	
	Arb	
FM Freq		Set the modulating waveform frequency. Frequency range 1mHz~1MHz (internal source).

Figure 9.3 Setting Interface of FM Modulation

9.1.5.3 Frequency Deviation

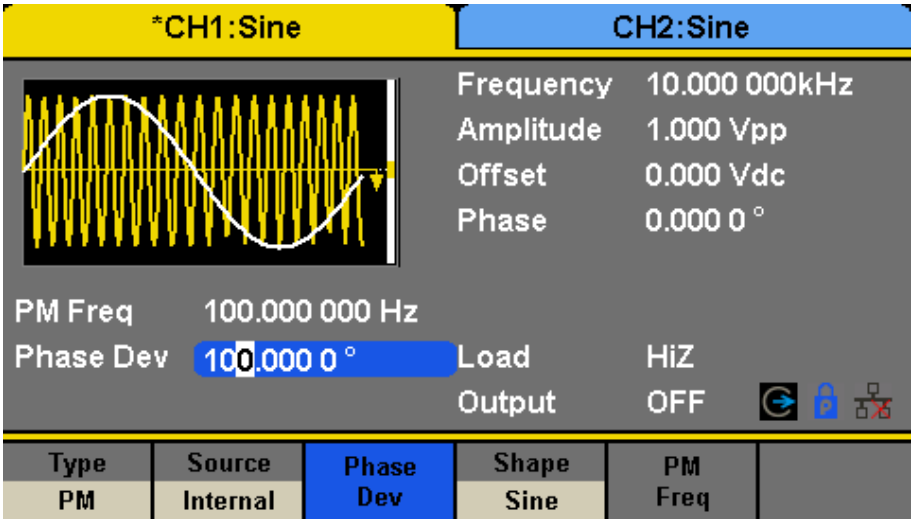
Press FM Dev to highlight the parameter, and then use the numeric keyboard or arrow keys and knob to input the desired value.

- The deviation should be equal to or less than the carrier frequency.
- The sum of the deviation and the carrier frequency should be equal to or less than maximum frequency of the selected carrier waveform.

Note: The methods of setting other parameters of FM are similar to AM.

9.1.5.4 PM

The modulated waveform consists of two parts: the carrier and the modulating waveform. In PM, the phase of the carrier varies with the instantaneous voltage level of the modulating waveform.
Press Mod → Type → PM, the parameters of PM modulation are shown in **Figure 9.4**.



Function	Explanation	
Type	PM	Phase modulation
Source	Internal	The source is internal
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
Phase Dev		Phase deviation ranges from 0° ~ 360°.
Shape	Sine	Choose the modulating waveform.
	Square	
	Triangle	
	UpRamp	
	DnRamp	
	Noise	
	Arb	
PM Freq		Set the modulating waveform frequency. Frequency range: 1mHz~1MHz.

Figure 9.4 Setting Interface of PM Modulation

9.1.5.5 Phase Deviation

Press Phase Dev to highlight the parameter, and then use the numeric keyboard or arrow keys and knob to input the desired value.

- Use the numeric keyboard or arrow keys and knob to input the desired value.
- The range of phase deviation is from 0° to 360° and the default value is 100°.

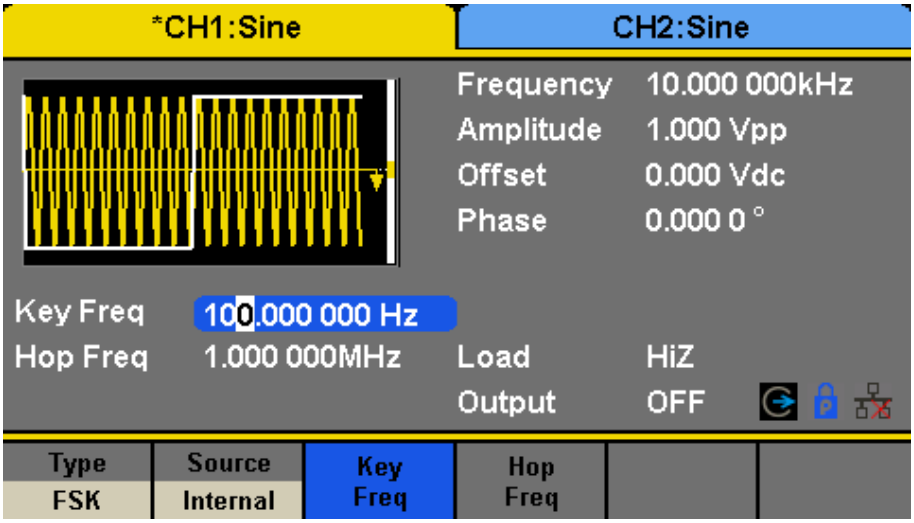
Note: The methods of setting other parameters of PM are similar to AM.

9.1.5.6 FSK

The FSK is Frequency Shift Keying, the output frequency of which switches between two preset frequencies (carrier frequency and the hop frequency or sometimes known as mark frequency (1) and space frequency (0)).
Press Mod → Type → FSK, the parameters of FSK modulation are shown in **Figure 9.5**.

9.1.6 Key Frequency

When internal modulation source is selected, press Key Freq to set the rate at which the output frequency shifts between "carrier frequency" and "hop frequency".



Function	Explanation	
Type	FSK	Frequency shift keying modulation.
Source	Internal	The source is internal.
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
Key Freq		Set the frequency at which the output frequency shifts between the carrier frequency and the hop frequency (internal modulation only): 1mHz~1MHz.
Hop Freq		Set the hop frequency.

Figure 9.5 Setting Interface of FSK Modulation

- Use the numeric keyboard or arrow keys and knob to input the desired value.
- The key frequency ranges from 1mHz to 1MHz.
- When external modulation source is selected, this menu is hidden.

9.1.7 Hop Frequency

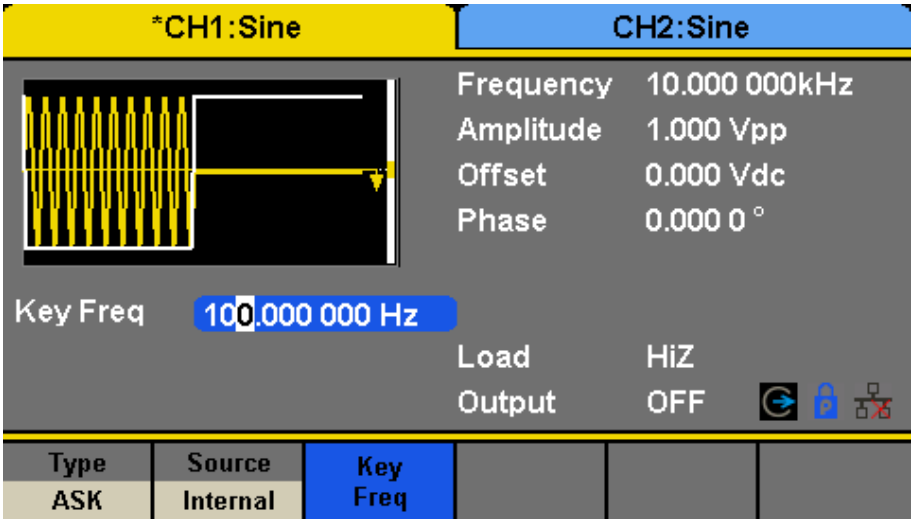
The range of the hop frequency depends on the carrier frequency currently selected. Press Hop Freq to highlight the parameter, and then use the numeric keyboard or arrow keys and knob to input the desired value.

- Sine: 1uHz~120MHz
- Square: 1uHz~25MHz
- Ramp: 1uHz~1MHz
- Arb: 1uHz~20MHz

Note: The methods of setting other parameters of FSK are similar to AM. In addition, the external modulating signal of FSK must be Square which complies with the CMOS level specification.

9.1.7.1 ASK

When using ASK (Amplitude Shift Keying), the carrier frequency and key frequency will need to be set. The key frequency is the shift rate of modulated waveform amplitude.
Press Mod → Type → ASK, the parameters of ASK modulation are shown in **Figure 9.6**.



Function	Explanation	
Type	ASK	Amplitude shift keying modulation.
Source	Internal	The source is internal.
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
Key Freq		Set the frequency at which the output amplitude shifts between the carrier amplitude and zero (internal modulation only): 1mHz~1MHz.

Figure 9.6 Setting Interface of ASK Modulation

Note: The methods for setting the parameters of ASK are similar to AM. In addition, the external modulating signal of ASK must be Square which complies with the CMOS level specification.

9.1.7.2 PSK

When using PSK (Phase Shift Keying), configure the generator to "shift" its output phase between two preset phase values (carrier phase and modulating phase). The default modulating phase is 180°.
Press Mod → Type → PSK, the parameters of PSK modulation are shown in **Figure 9.7**.

Note: The methods of setting the parameters of PSK are similar to AM. In addition, the external modulating signal of PSK must be Square which complies with the CMOS level specification.

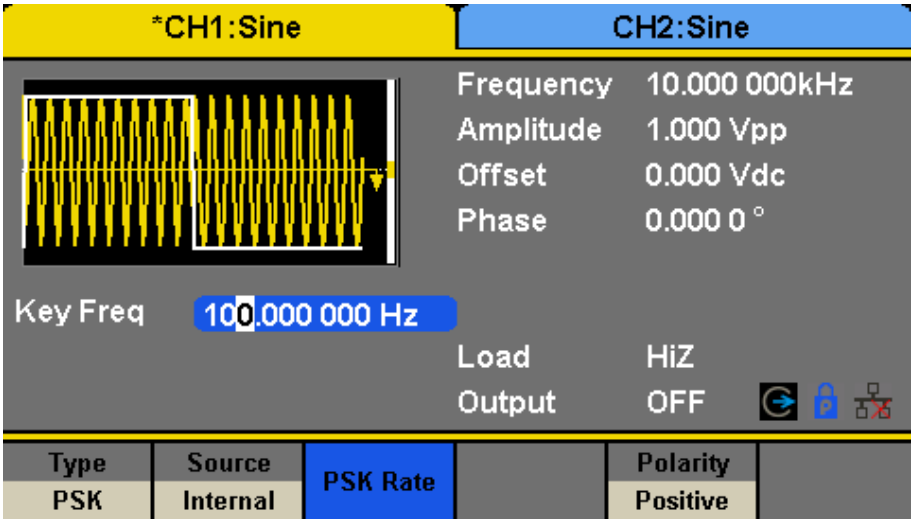
9.1.7.3 PWM

For only the "Pulse" a PWM (Pulse Width Modulation) is available. The pulse width of the pulse varies with the voltage of the modulating waveform. Especially when using an ARB waveform for modulation, a wide range of waveforms is possible.
Press Waveforms → Pulse → Mod, the parameters of PWM modulation are shown in **Figure 9.8**.

9.1.8 Pulse Width/Duty Deviation

Width Deviation represents the variation of the modulated waveform pulse width relative to the original pulse width. Press Width Dev to highlight the parameter, and use the numeric keyboard or arrow keys and knob to input the desired value.

- The width deviation cannot exceed the current pulse width.
- The width deviation is limited by the minimum pulse width and current edge time setting.



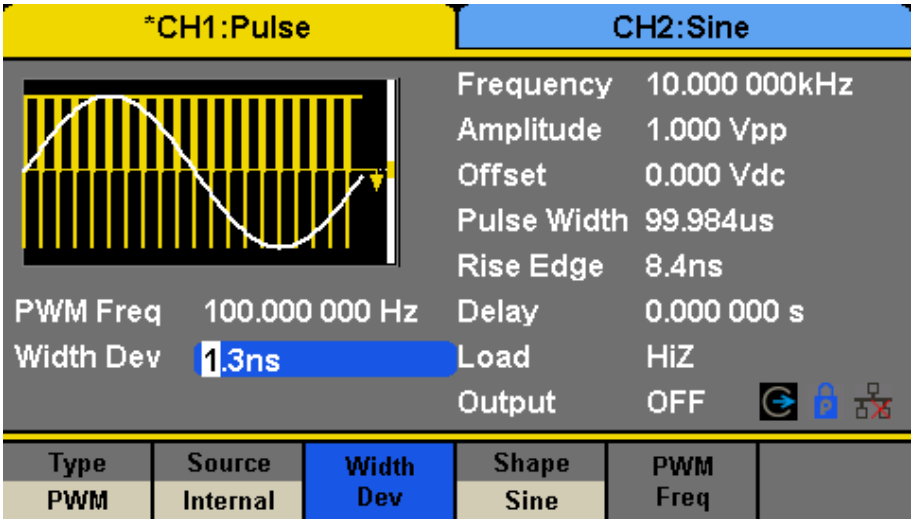
Function	Explanation	
Type	PSK	Phase shift keying modulation.
Source	Internal	The source is internal.
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
Key Freq		Set the frequency at which the output phase shifts between the carrier phase and 180° (internal modulation only): 1mHz~1MHz.
Polarity	Positive	Set the modulating polarity.
	Negative	

Figure 9.7 Setting Interface of PSK Modulation

Duty Deviation represents the variation (%) of the modulated waveform duty relative to the original duty. Press Duty Dev to highlight the parameter, and then use the numeric keyboard or arrow keys and knob to input the desired value, as shown in the Figure 2-33.

- The duty deviation cannot exceed the current pulse duty cycle.
- The duty deviation is limited by the minimum duty cycle and current edge time setting.
- Duty deviation and width deviation are correlative. Once a parameter is changed, the other will be automatically changed.

Note: The methods of setting other parameters of PWM are similar to AM.

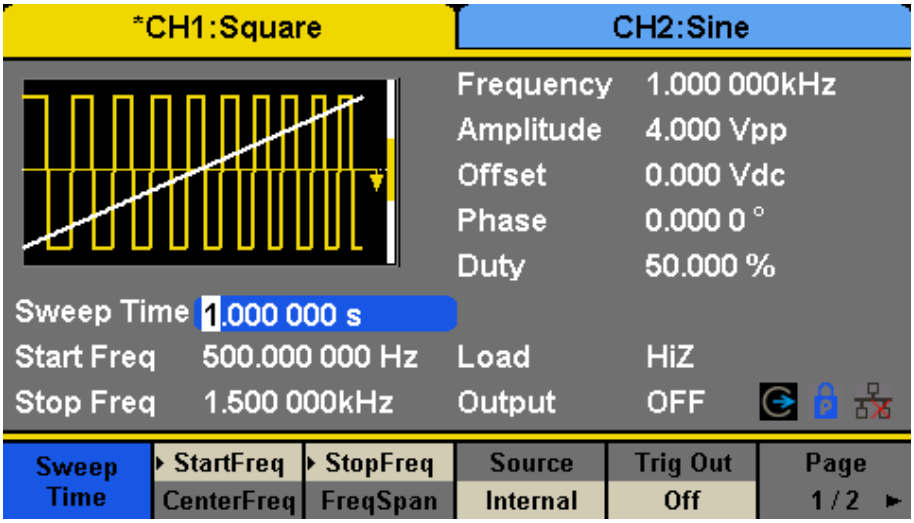


Function	Description	
Type	PWM	Pulse width modulation. The carrier is pulse.
Source	Internal	The source is internal.
	External	The source is external. Use the [Aux In/Out] connector at the rear panel.
Width Dev		Set the width deviation.
Duty Dev		Set the duty deviation.
Shape	Sine	Choose the modulating waveform.
	Square	
	Triangle	
	UpRamp	
	DnRamp	
	Noise	
	Arb	
PWM Freq		Set the modulating waveform frequency. Frequency range: 1mHz~1MHz (internal source only).

Figure 9.8 Setting Interface of PWM Modulation

Sweep Function

In the sweep mode, the generator steps from the start frequency to the stop frequency in the sweep time specified by the user. The waveforms that support sweep include sine, square, ramp and arbitrary.
Press Sweep key to enter the following menu. Set the waveform parameters by using the operation menu.



Function	Explanation	
Sweep time		Set the time span of the sweep in which the frequency changes from the start frequency to stop frequency.
Start Freq Mid Freq		Set the start frequency of the sweep; Set the center frequency of the sweep.
Stop Freq Freq Span		Set the stop frequency of the sweep; Set the frequency span of the sweep.
Source	Internal	Choose internal source as a trigger.
	External	Choose external source as a trigger. Use the [Aux In/Out] connector at the rear panel.
	Manual	Trigger a sweep by manual.
Trig Out	Off	Disable trigger out.
	On	Enable trigger out.
Page 1/2		Enter the next page.

Figure 10.1 Sweep Screen (Page 1/2)

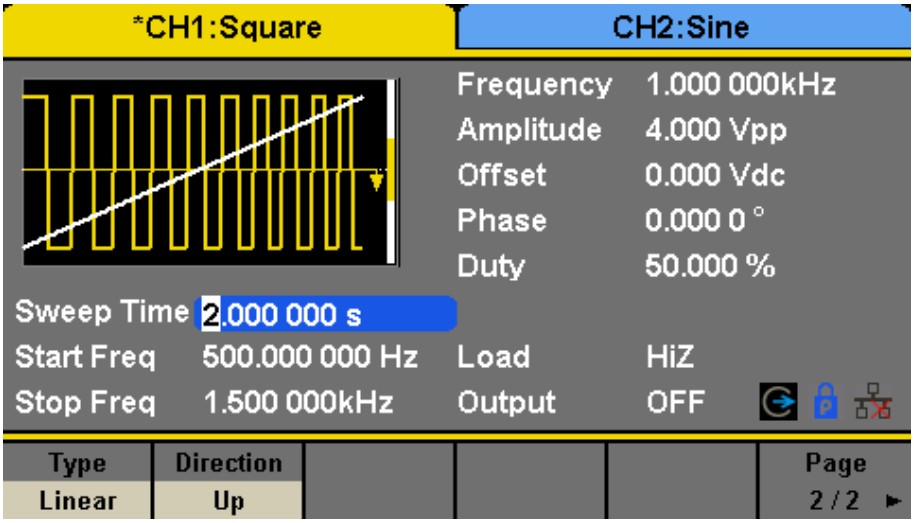
1 Sweep Frequency

Use start freq and stop freq or center freq and freq span to set the range of the frequency sweep. Press the key again to switch between the two sweep range modes.

2 Start Frequency and Stop Frequency

Start Frequency and Stop Frequency are the lower and upper limits of the frequency for sweep. Start Frequency Stop Frequency.

- Choose Direction → Up, the generator will sweep from Start frequency to Stop frequency.
- Choose Direction → Down, the generator will sweep from Stop frequency to Start frequency.



Function	Explanation	
Type	Linear	Set the sweep with linear profile.
	Log	Set the sweep with logarithmic profile.
Direction	Up	Sweep upward.
	Down	Sweep downward.
Page 2/2		Return to the previous page.

Figure 10.2 Setting Interface of Sweep (Page 2/2)

3 Center Frequency and Frequency Span

Center Frequency = (|Start Frequency + Stop Frequency|)/2
Frequency Span = Stop Frequency – Start Frequency

4 Sweep Type

4060B Series provides "Linear" and "Log" sweep profiles and the default is "Linear".

5 Linear Sweep

In linear sweep, the output frequency of the instrument varies linearly in the way of "a number of Hertz per second". Choose Sweep → Page 1/2 → Type → Linear, there is a straight line displayed on the waveform on the screen, indicating that the output frequency varies linearly.

6 Log Sweep

In log sweep, the output frequency of the instrument varies in a logarithmic fashion, that is, the output frequency changes in the way of "decade per second". Choose Sweep → Page 1/2 → Type → Log, there is an exponential function curve displayed on the waveform on the screen, indicating that the output frequency changes in a logarithmic mode.

7 Sweep Trigger Source

The sweep trigger source can be internal, external or manual. The generator will generate a sweep output when a trigger signal is received and then wait for the next trigger source.

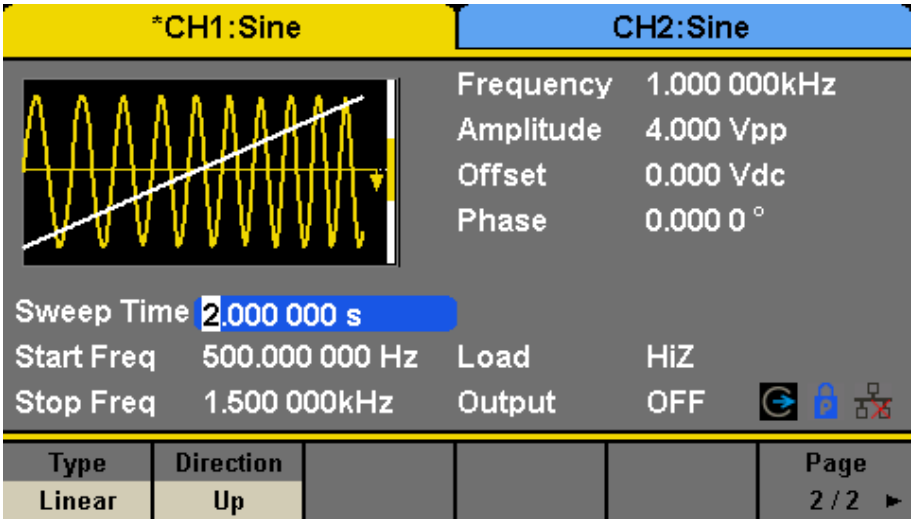


Figure 10.3 Linear Sweep Interface

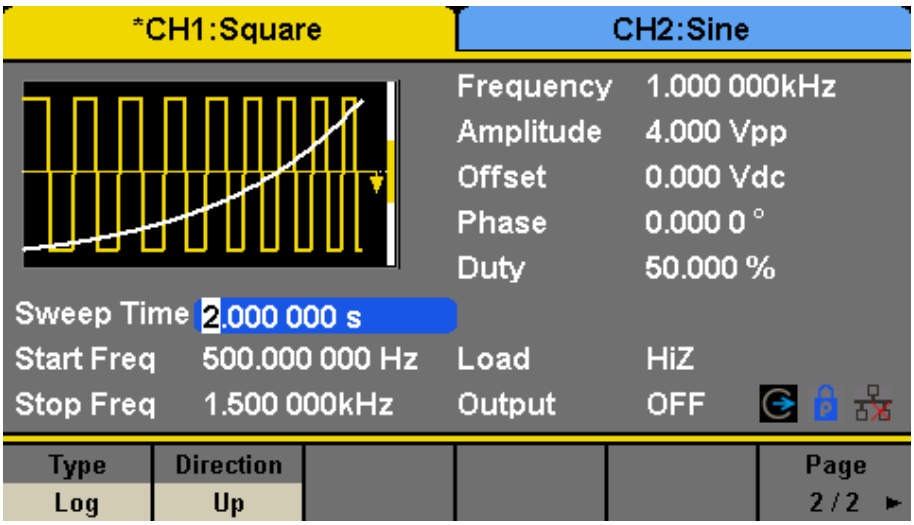


Figure 10.4 Log Sweep Interface

8 Internal Trigger

Choose Source → Internal, the generator outputs continuous sweep waveform when internal trigger is selected. The default is "Internal". Choose Trig Out → On, the [Aux In/Out] connector at the rear panel will output the trigger signal.

9 External Trigger

Choose Source → External, the generator accepts the trigger signal inputted from the [Aux In/Out] connector at the rear panel when external trigger is selected. A sweep will be generated once the connector receives a CMOS pulse with specified polarity. To set the CMOS pulse polarity, choose Edge to select "Up" or "Down".

10 Manual Trigger

Choose Source → Manual, a sweep will be generated from the corresponding channel when the Trigger softkey is pressed when manual trigger is selected. Choose Trig Out → On, the [Aux In/Out] connector at the rear panel will output the trigger signal.

Burst Function

The Burst function can generate versatile waveforms in n this mode. Burst times can last a specific number of waveform cycles (N-Cycle mode), or when an external gated signals (Gated mode) is applied. Any waveform (except DC) may be used as the carrier, but noise can only be used in Gated mode.

11.1 Burst Type

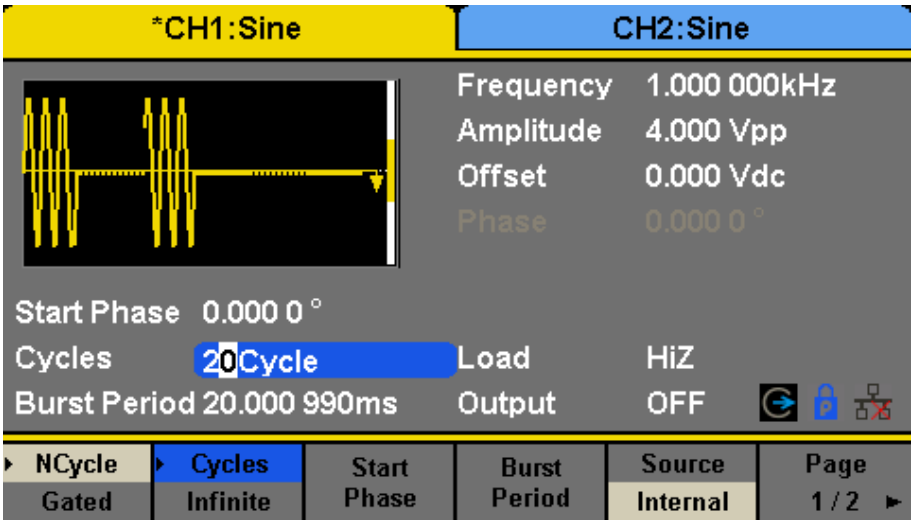
4060B Series provides three burst types including N-Cycle, Infinite and Gated.
The default is N-Cycle.

Burst Type	Trigger Source	Carrier
N-Cycle	Internal/External/ Manual	Sine, Square, Ramp, Pulse, Arbitrary.
Infinite	External/Manual	Sine, Square, Ramp, Pulse, Arbitrary.
Gated	Internal/External	Sine, Square, Ramp, Pulse, Noise, Arbitrary.

Table 11.1 2-20 Relations among burst type, trigger source and carrier

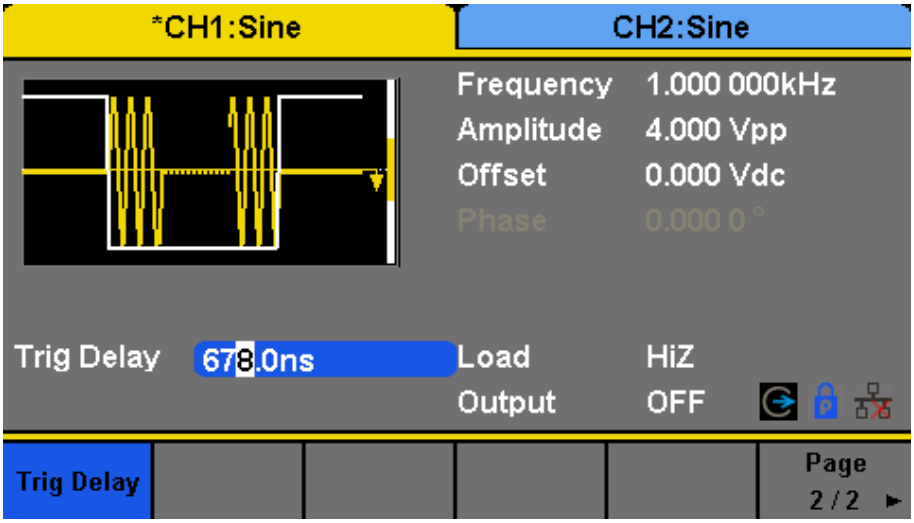
11.1.1 N-Cycle

In N-Cycle mode, the generator will output waveform with a specified number of cycles after receiving the trigger signal. Waveforms that support N-Cycle burst include sine, square, ramp, pulse and arbitrary.
Press Burst → NCycle → Cycles, and use the numeric keyboard or arrow keys and knob to input the desired cycles. Set the waveform parameters by using the operation menu, as shown in Figure 2-38 and Figure 2-39.



Function	Explanation	
NCycle		Use the N-Cycle mode.
Cycles Infinite		Set the number of the bursts in N-Cycle. Set the number of the bursts in N-Cycle to be infinite.
Start Phase		Set the start phase of the burst.
Burst Period		Set the burst period.
Source	Internal	Choose internal source as a trigger.
	External	Choose external source as a trigger. Use the [Aux In/Out] connector at the rear panel.
	Manual	Trigger a burst by manual.
Page 1/2		Enter the next page.

Figure 11.1 N-Cycle Burst Interface (Page 1/2)



Function	Explanation	
Delay		Set the delay time before the burst starts.
Trig Out	Off	Disable trigger out.
	On	Enable trigger out.
Page 2/2		Return to the previous page.

Figure 11.2 N-Cycle Burst Interface (Page 2/2)

11.1.2 Infinite

In infinite mode, the cycle number of the waveform is set as an infinite value.
The generator outputs a continuous waveform after receiving the trigger signal. Waveforms that support infinite mode include sine, square, ramp, pulse and arbitrary.
Press Burst → NCycle → Infinite, and set the trigger source to "external" or "manual". The screen will display an infinite cycle burst, as shown in **Figure 11.3**.

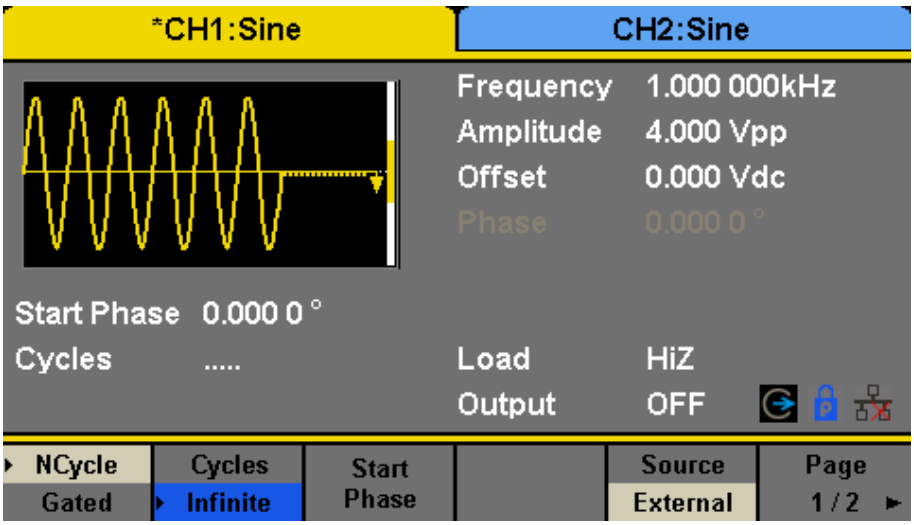
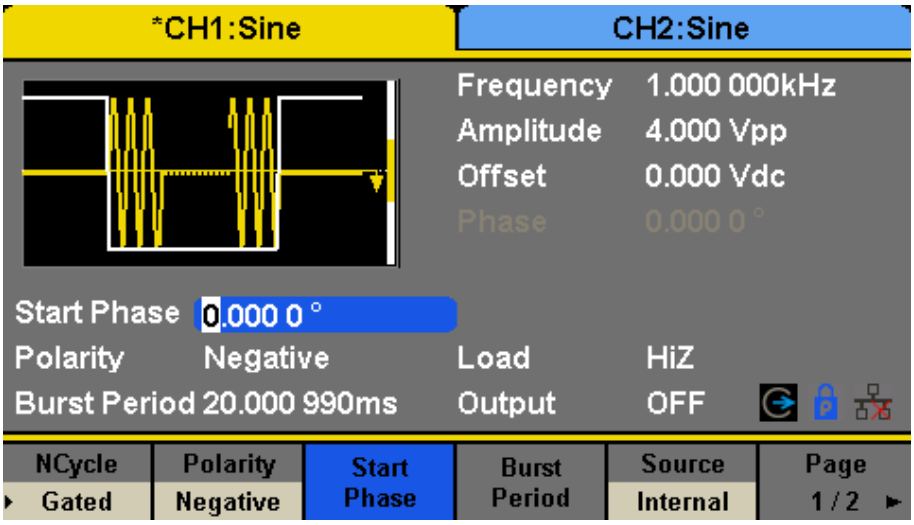


Figure 11.3 Infinite Burst Interface

11.1.3 Gated

In gated mode, the generator controls the waveform output according to the gate signal level. When the gated signal is "true", the generator outputs a continuous waveform. When the gated signal is "false", the generator first completes the output of the current period and then stops. Waveforms that support gated burst include sine, square, ramp, pulse, noise and arbitrary.

Press Burst → Gated, to enter the interface in **Figure 11.4**.



Function	Explanation	
Gated		Use the gated mode.
Polarity	Positive	Set the polarity for the gated signal.
	Negative	
Start Phase		Set the start phase of the burst.
Burst Period		Set the burst Period.
Source	Internal	Choose internal source as a trigger.
	External	Choose external source as a trigger. Use the [Aux In/Out] connector at the rear panel.

Figure 11.4 Gated Burst Interface

11.1.4 Start Phase

Define the start point in a waveform. The phase varies from 0° to 360°, and the default setting is 0°. For an Arbitrary Waveform, 0° is the first waveform point.

11.1.5 Burst Period

Burst Period is only available when the trigger source is internal. It is defined as the time from the start of a burst to the start of the next one. Choose Burst Period and use the numeric keyboard or arrow keys and knob to input the desired value.

- Burst Period 0.99s + carrier period × burst number
- If the current burst period set is too short, the generator will increase this value automatically to allow outputting the specified number of cycles.

11.1.6 Cycles/Infinite

Set the number of waveform cycle in an N-Cycle (1 to 50,000 or Infinite). If Infinite is chosen, then a continuous waveform will be generated once a trigger occurs.

11.1.7 Delay

Set the time delay between the trigger input and the start of the N-Cycle burst.

11.1.8 Burst Trigger Source

The burst trigger source can be internal, external or manual. The generator will generate a burst output when a trigger signal is received and then wait for the next trigger source.

11.1.9 Internal Trigger

Choose Source → Internal, the generator outputs continuous burst waveform when internal trigger is selected. Choose Trig Out as "Up" or "Down", the [Aux In/Out] connector at the rear panel will output a trigger signal with specified edge.

11.1.10 External Trigger

Choose Source → External, the generator accepts the trigger signal inputted from the [Aux In/Out] connector at the rear panel when external trigger is selected. A burst will be generated once the connector gets a CMOS pulse with specified polarity. To set the CMOS pulse polarity, choose Edge to select "Up" or "Down".

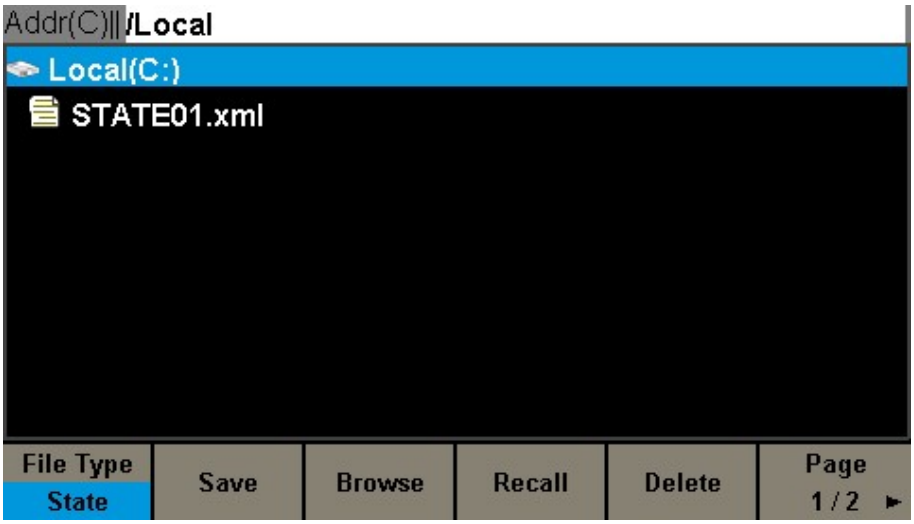
11.1.11 Manual Trigger

Choose Source → Manual, a burst will be generated from the corresponding channel when the Trigger softkey is pressed when manual trigger is selected.

Storage System

12.1 To Store and Recall

4060B Series can store the current instrument state and user-defined arbitrary waveform data in internal or external memory and recall them when needed.
Press Store/Recall to enter the interface shown in **Figures 12.1**, **12.2**.



Function	Description	
File Type	State	The setting of the generator;
	Data	Arbitrary waveform file
Browse		View the current directory.
Save		Save the waveform to the specified path.
Recall		Recall the waveform or setting information in the specific position of the memory.
Delete		Delete the selected file.
Page 1/2		Enter the next page.

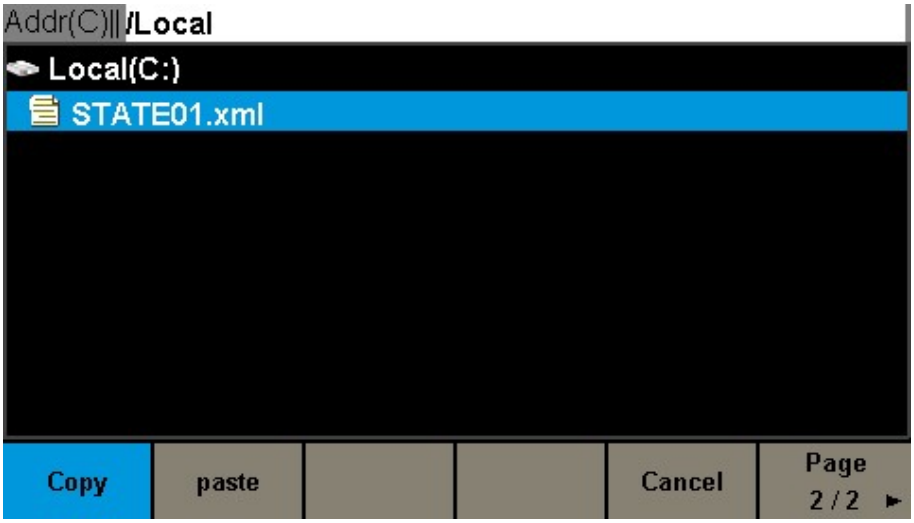
Figure 12.1 Store/Recall Interface (Page 1/2)

The 4060B Series provides an internal non-volatile memory (C Disk) and a USB Host interface for external memory.
1. Local (C:)
Users can store instrument states and arbitrary waveform files to C Disk.

12.1.1 USB Device (0:)

There is a USB Host interface located on the left side of the front panel which permits users to store/recall waveforms or update the firmware version by U-Disk. When the generator detects a USB storage device, the screen will show the drive letter "USB Device (0:)" and display a prompt message "USB device connected.", as shown in **Figure 12.3**. After removing the U-Disk, the screen will display a prompt message "USB device removed." And "USB Device (0:)" in the storage menu will disappear.

Note: The 4060B Series can only identify files of which filenames consist of English letters, number and underscore. If other characters are used, the name may be displayed in the store and recall interface abnormally.



Function	Description	
Copy		Copy the selected file.
Paste		Paste the selected file.
Cancel		Exit the Store/Recall interface.
Page 2/2		Return to the previous page.

Figure 12.2 Store/Recall Interface (Page 2/2)

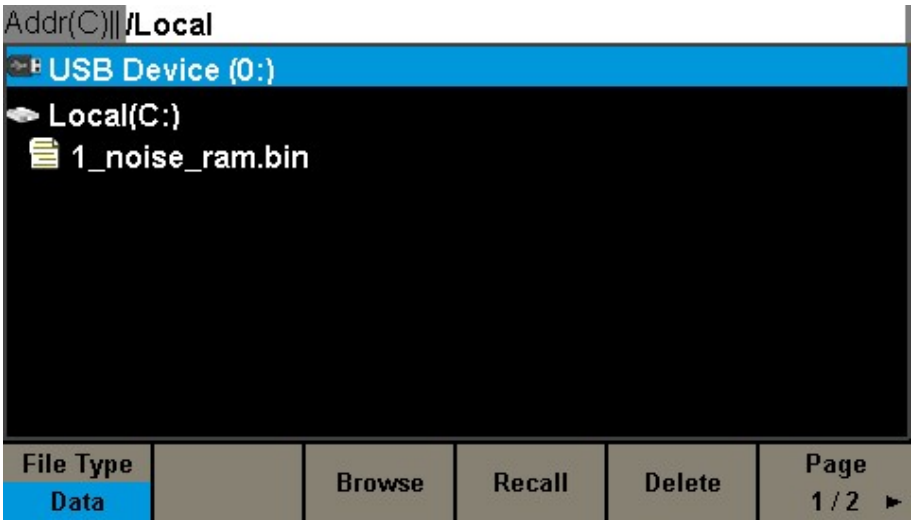


Figure 12.3 Storage System

12.1.2 Browse

- Use the knob to shift between the directories or click the corresponding location on the screen to choose Local (C:) or USB Device (0:). Choose Browse, press the knob or click the selected folder to open the current directory.
- Use the knob to switch between folder and files under the current directory. Choose Browse, press the knob or click the selected folder to open the subdirectory. Choose <up>, then choose Brower or press the knob to return to the upper level directory.

12.1.3 File Type

Choose Store/Recall → File Type to select the desired file type. Available file types are State File and Data File.

12.1.4 State File

Store the instrument state in internal or external memory in "*.xml" format. The state file stored includes waveform parameters and modulation, sweep, burst parameters of two channels and utility parameters.

12.1.5 Data File

The 4060B Series can recall the data files in "*.csv" or "*.dat" format from the external memory and transfer them into "*.bin" format then store them in the internal memory. When it is done, the generator will enter the arbitrary waveform interface automatically.
In addition, users can edit arbitrary waveforms with PC software — EasyWave, download them to the internal memory through remote interface and store them (in "*.bin" format) in the internal memory.

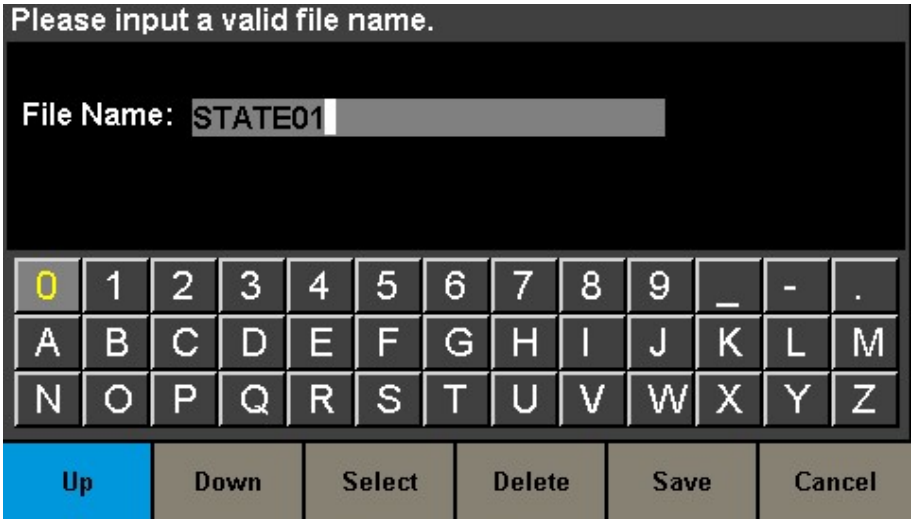
12.2 File Operation

12.2.1 To Save the Instrument State

Users can store the current instrument state in internal and external memories. The storage will save the selected function (including the basic waveform parameters, modulation parameters and other utility settings used.)
To save the instrument state, the procedures are given as followed:

1. **Choose the file type to store.**
   Press Store/Recall → File Type → State, and choose state as the storage type.
2. **Choose the location of the file.**
   Choose a desired location by rotating the knob or clicking the corresponding location on the touch screen.
3. **Name the file.**

Press Save, to enter the following interface.



Function	Description	
Up		Cursor upward to select.
Down	Cursor downward to select.	
Select	Select the current character.	
Delete	Delete the current character.	
Save	Store the file with the current name.	
Cancel	Return to the store/Recall interface.	

Figure 12.4 Filename Input Interface

12.2.2 Select the character

Users can select the desired character from the virtual soft keyboard by using the knob or Up and Down menus. Or touch the location of the character on the screen directly. Then choose Select to display the character selected in the filename area.

12.2.3 Delete the character

Use the left and right arrow keys to move the cursor in the file name. Then choose Delete to delete the corresponding character.

12.2.4 Save the file.

After finishing inputting filename, press Save. The generator will save the file under the currently selected directory with the specified filename.

12.2.5 To Recall State File or Data File

To recall the instrument state or arbitrary waveform data, the procedures are as follows:

1. **Choose the file type.**
   Press Store/Recall → File Type, and choose state or data as the storage type.
2. **Choose the file to be recalled.**
   Rotate the knob or click the touch screen to select the file you want to recall.
3. **Recall the file.**
   Choose Recall, press the knob or click the location of the file on the screen, the generator will recall the selected file and display corresponding prompt message when the file is read successfully.

12.2.6 To Delete File

To delete the instrument state or arbitrary waveform data, the procedures are as follows:

1. **Choose the file.**
   Rotate the knob or click the touch screen to select the file you want to delete.
2. **Delete the file.**

Choose Delete, the generator will display prompt message 'Delete the file?' Then press Accept, the generator will delete the currently selected file.

12.2.7 To Copy and Paste File

4060B Series supports the internal and external storage to copy files from each other. For example, copy an arbitrary wave file in the U-disk to the instrument, the procedure is as follows:

1. **Choose the file type.**
   Press Store/Recall → File Type, and choose "Data" as the storage type.
2. **Choose the file to be copied.**

Rotate the knob to select USB Device (0:) and press the knob to open its directory. Then rotate the knob to select the file you want to copy and press Page 1/2 → Copy.

3. **Paste the file.**

Rotate the knob to select Local (C:) and press the knob to open its directory.
Then press Paste.

Utility Function

With the Utility function, the user can set the parameters of the generator such as Sync, Interface, System Setting, Self Test and Frequency Counter, etc. Press Utility to enter the utility menu, as shown in **Figure 13.1**.

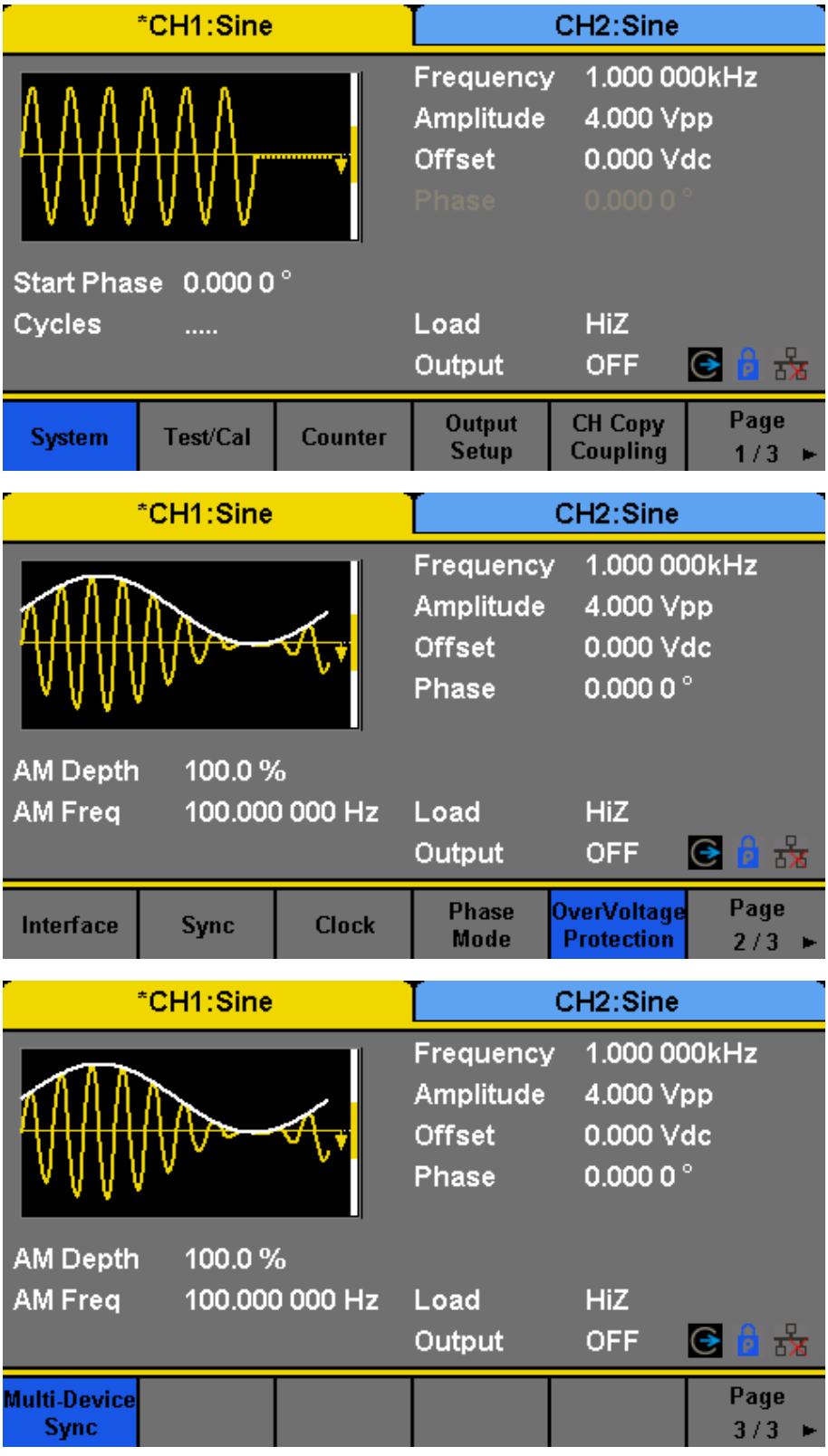


Figure 13.1 Utility Menu

System Set the system configuration.

Test/Cal Test and calibrate the instrument.

Counter Frequency counter setting.

Output Setup Set the output parameters of CH1 and CH2.

CH Copy Coupling Set the track, channel coupling or channel copy function.

Interface Set the parameters of remote interfaces.

Sync Set the sync output.

CLKSource Choose the system clock source, internal or external.

Help View the help information.

OverVoltage Protection Turn on/off the overvoltage protection function.

13.1 System Settings

Press Utility → System, to enter the following interface.

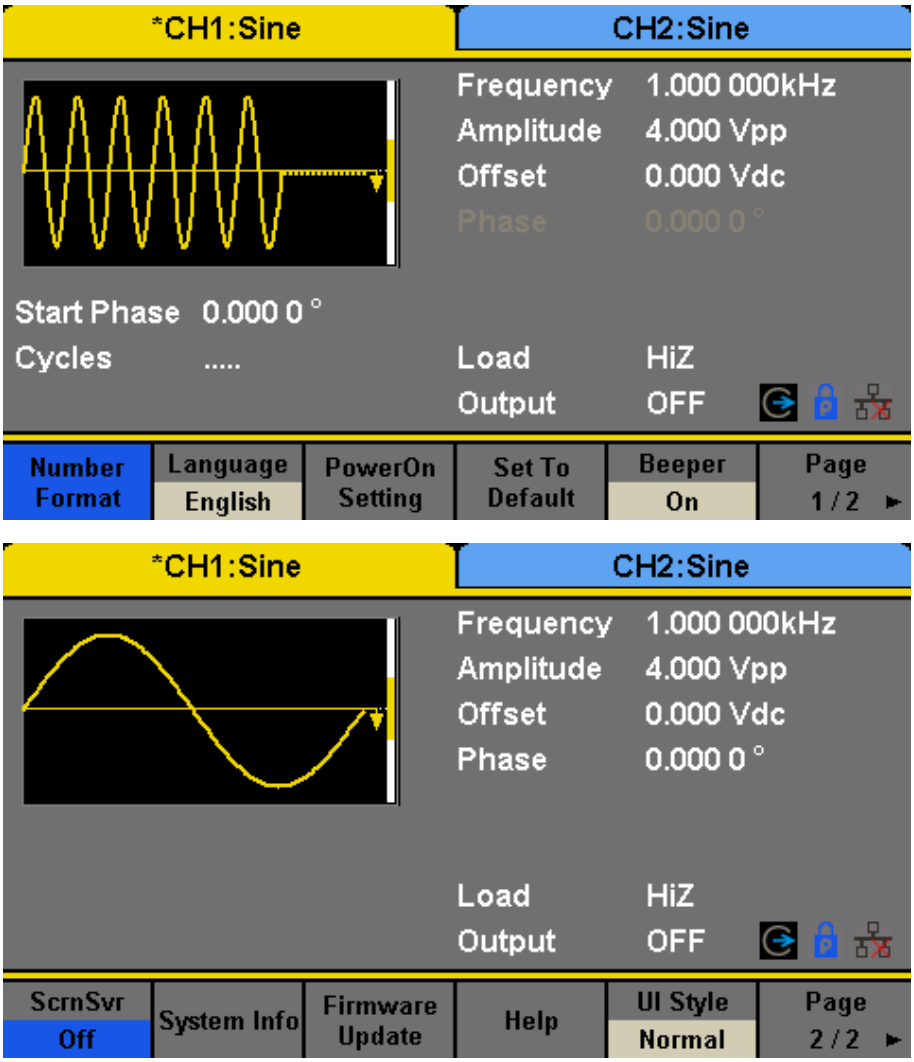


Figure 13.2 System Menu

Number format Set the number format.

Language Set the language by pressing the button to toggle between English and Chinese.

PowerOn Set the power on behavior to load the defaults, or last used settings.

Set to Default Set all the settings to default values.

Beeper Enable or Disable the beep.

ScrnSvr Enable or disable the screen saver and set the time.

System Info View the system information

Firmware Update Update the firmware by the U-disk.

Bandwidth Update Update the bandwidth of the generator.

Done Save the current settings and return to the Utility menu.

13.2 Number Format

Press Utility → System → Number Format, to enter the following interface.

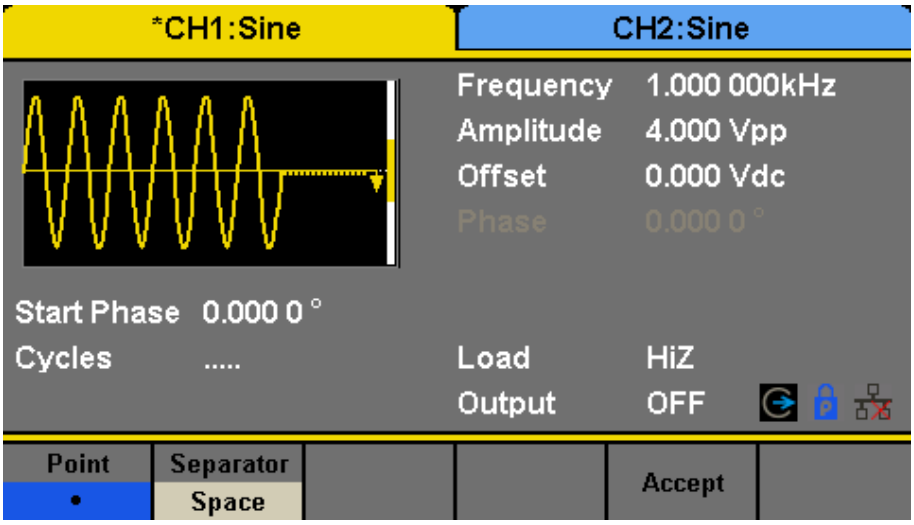


Figure 13.3 Set the Number Format

Point Select either "." or "," to represent a decimal point.

Separator Select either a space, comma or no separator to show in large numbers.

Done Save the current settings and return to the System menu.

According to the different choices of the decimal point and the separator, the format can have various forms.

13.3 Language Setup

The generator offers two languages (English and Chinese). Press Utility → System → Language, to select the desired language. This setting is stored in non-volatile memory and will not be influenced by the Set To Default operation.

13.4 Power On

Choose the 4060B Series's setting to load when the generator is powered on. Two choices are available: the default setting and the last settings set when the unit was last powered down. Once selected, the setting will be applied when

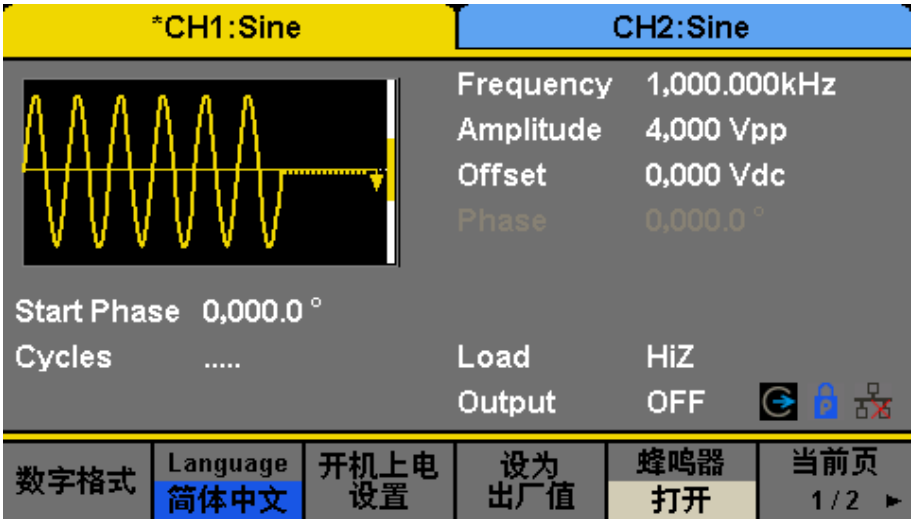


Figure 13.4 Chinese Interface

the instrument is powered on. This setting is stored in non-volatile memory and will not be influenced by the Set To Default operation.

Last includes all system parameters and states, except channel output state.

Default denotes the factory defaults except certain parameters (such as Language).

13.5 Set to Default

Press Utility → System → Set To Default, to set the system to the default setting. The default settings of the system are as shown in **Table 13.1**.

13.6 Beep

Enable or disable the beeper. Press Utility →System → Beeper to select "On" or "Off" and the default is "On".

13.7 Screen Saver

Enable or disable screen saver. Press Utility → System → Page 1/2 → ScrnSvr to select "On" or "Off" and the default is "Off". Screen saver will be on if no action is taken within the time that you have selected. Click the touch screen or Press any key to resume.

13.8 System Info

Select the System Info option of the utility menu to view the generator's system information, including startup times, software version, hardware version, model and serial number.

13.9 Software Update

The software version and configuration file of the generator can be updated directly via U-disk. Follow the steps below:

1. Insert U-disk with firmware update file (.ADS) and configuration file (.CFG) to USB host interface on the front panel of the generator.
2. Press Utility → Page 1/2 → Firmware Update. Or press Store/Recall directly.

Output	Default
Function	Sine Wave
Frequency	1kHz
Amplitude/Offset	4Vpp/0Vdc
Phase	0°
Load	High Z
Modulation	**Default**
Carrier	1kHz Sine Wave
Modulating	100Hz Sine Wave
AM Depth	100
FM Deviation	100Hz
ASK Key Frequency	100Hz
FSK Key Frequency	100Hz
FSK Hop Frequency	1MHz
PSK Key Frequency	100Hz
PM Phase Deviation	100°
PWM Width Dev	190s
Sweep	**Default**
Start/Stop Frequency	500Hz/1.5kHz
Sweep Time	1s
Trig Out	Off
Mode	Linear
Direction	↑
Burst	**Default**
Burst Period	10ms
Start Phase	0°
Cycles	1Cycle
Trig Out	Off
Delay	521ns
Trigger	**Default**
Source	Internal

Table 13.1 Default Settings

3. Select the firmware file (.ADS) and choose Recall to update the system software.

4. After the updating is finished, the generator will restart automatically.

Note: Powering off the generator during a firmware update can corrupt the unit.

Note: A confmguration file (.CFG) may or may not be included with a given firmware update. If a CFG file is not included with a firmware update then it will not be required for that update.

13.10 Built-in Help

The 4060B Series provides a built-in help system, by which users can view the help information at any time when operating the instrument. Press Utility → System → Page 1/2 → Help to enter the following interface.

UP Cursor upward to select.

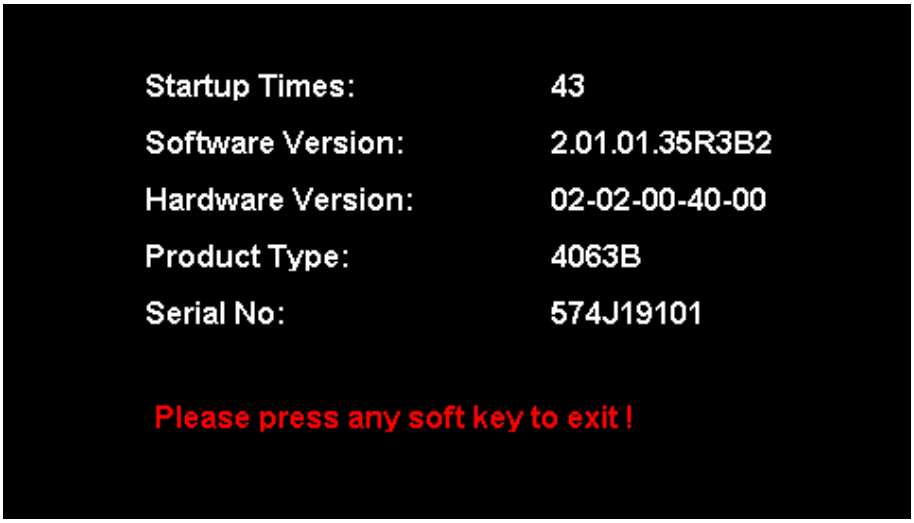


Figure 13.5 System Information Interface

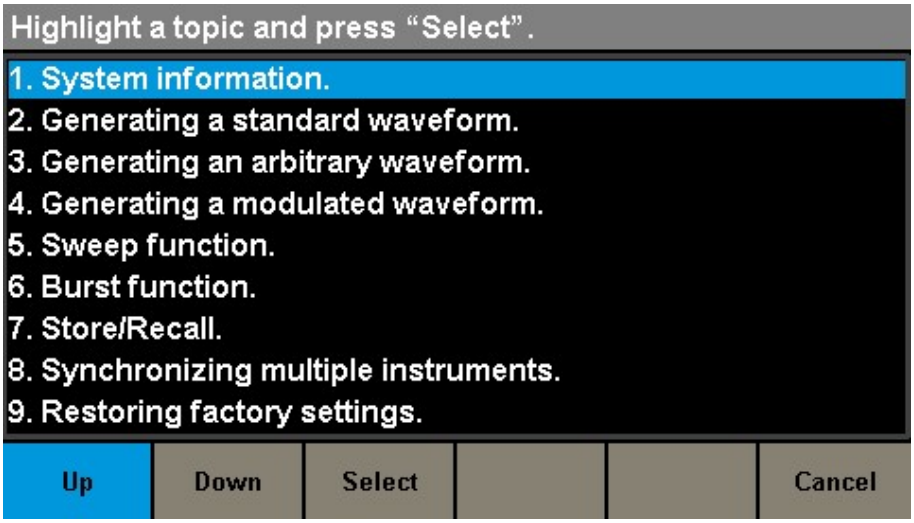


Figure 13.6 Help Menu

Down Cursor downward to select.

Select Read the currently selected help information.

Cancel Exit the built-in help system.

13.11 Test/Cal

Choose Utility → Test/Cal, to enter the following interface.

SelfTest Perform a system self-test.

TouchCal Do a touch screen calibration.

Return Return to the Utility menu.

13.11.1 Self Test

Press Utility → Test/Cal → SelfTest, to enter the following menu.

ScrTest Run screen test program.

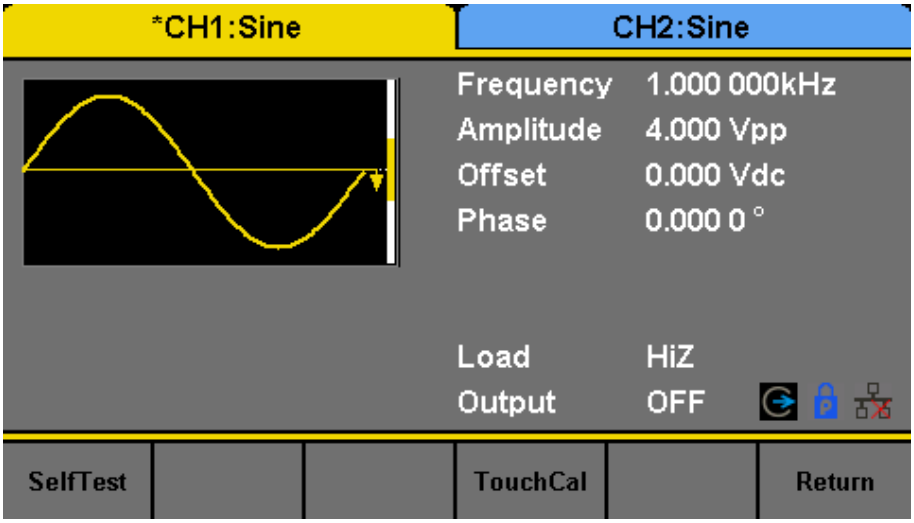


Figure 13.7 Test/Cal function Menu

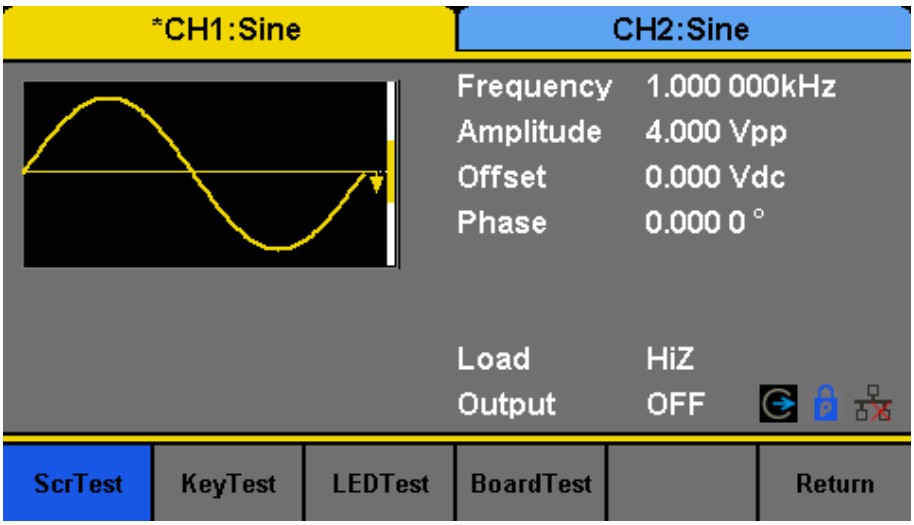


Figure 13.8 Self Test Interface

KeyTest Run keyboard test program.

LEDTest Run key indicator lights test program.

BoardTest Run hardware circuit self-test program.

Cancel Return to the Test/Cal menu.

13.11.2 Screen Test

Select "ScrTest" to enter the screen test interface. The prompt message 'Please press '7' key to continue, press '8' key to exit.' is displayed. Press the '7' key for test and observe if there is any serious color deviation, bad pixel or display error.

13.11.3 Key Test

Select KeyTest to enter the keyboard test interface, the on-screen white rectangle shapes represent the front panel keys. The circle between two arrows represents the knob. Test all keys and knob and also verify that all the backlight keys illuminate correctly.
The corresponding area of tested keys or knob would display in blue color.
The top of the screen displays 'Please press '8' key three times to exit.'

13.11.4 LED Test

Select LEDTest to enter the LED test interface, the on-screen white rectangle shapes represent the front panel keys. The prompt message 'Please press '7'
Key to continue, press '8' Key to exit.' is displayed. Press the '7' key continuously for testing and when a key is lighted, the corresponding area on the screen will display in blue color.

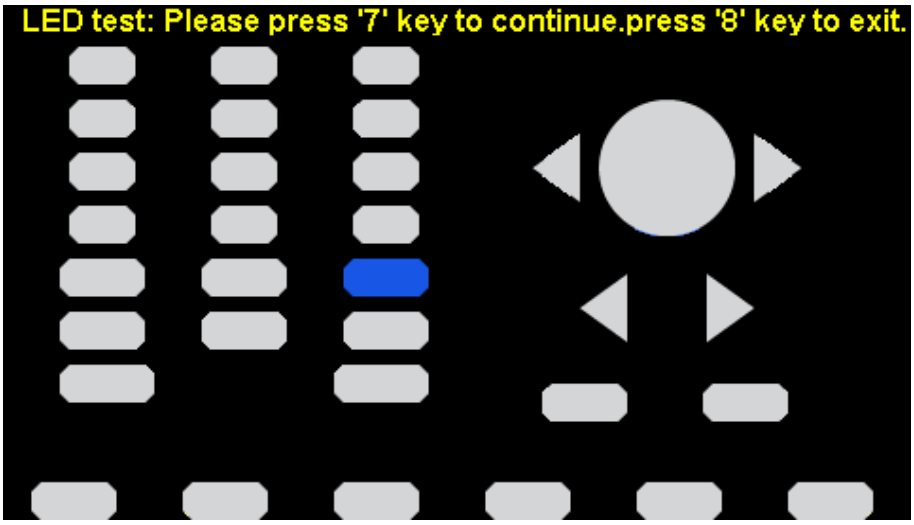


Figure 13.9 LED Test Interface

13.11.5 Board Test

Select BoardTest to enter the following interface.

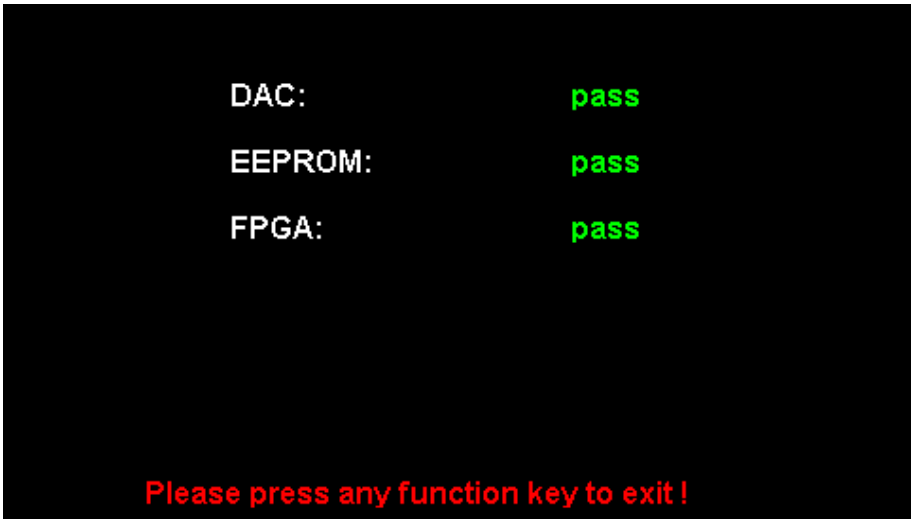


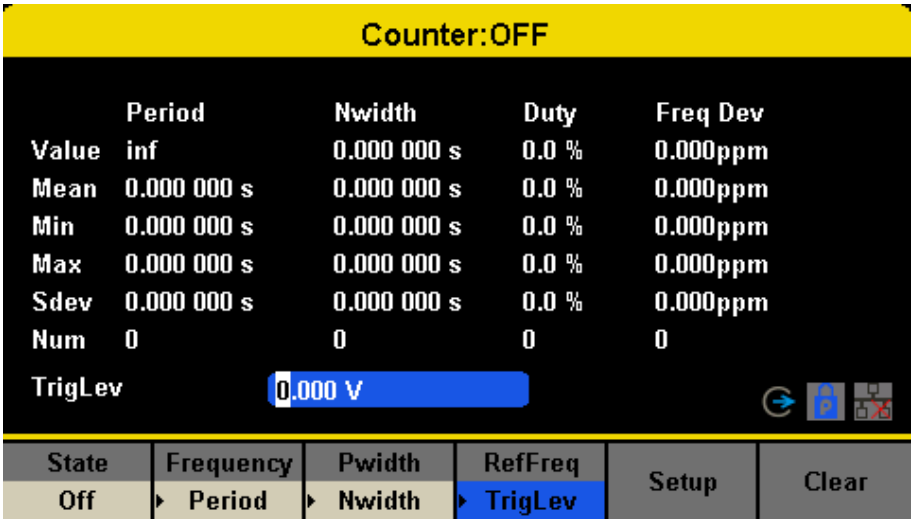
Figure 13.10 Board Test Interface

13.11.6 Touch Adjust

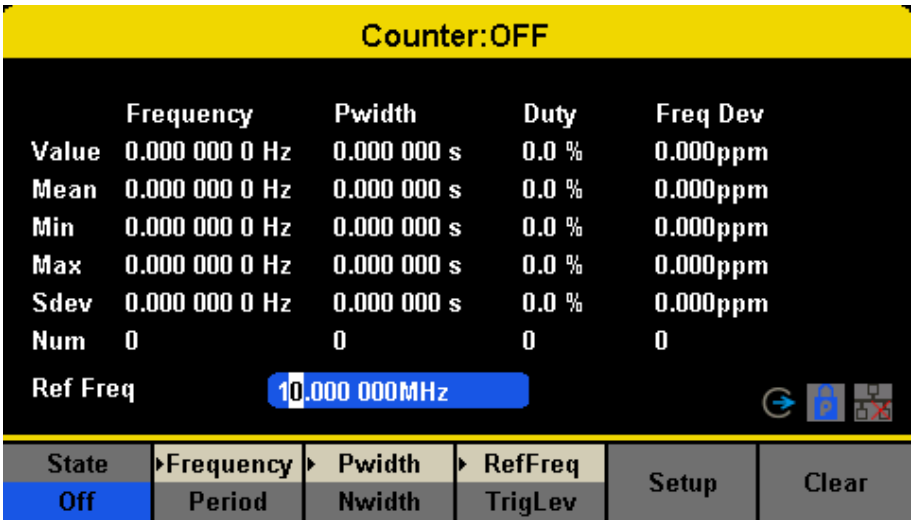
Use the function regularly to calibrate the touch screen, which makes it more accurate when the finger or touch pen touches the screen and avoids any misoperation.
Press Utility → Test/Cal → TouchCal, to enter the following interface.
According to the messages on screen, click the red circle on screen in sequence. After touch calibration is done, the system will display the following tip. Then press any key or touch the screen to exit the current interface.

13.12 Frequency Counter

The 4060B Series provides a frequency counter which could measure frequencies between 100mHz to 200MHz. The dual channels can still output normally when the counter is enabled. Press Utility → Counter, to enter the following interface.



Period Mode



Frequency Mode

Figure 13.11 Frequency Counter Interface

State Enable or Disable the counter.

Frequency Measured frequency.

Period Measured period.

PWidth Measured positive width.

NWidth Measured negative width.

RefFreq Set the reference frequency. System will calculate the deviation between the measured frequency and the reference frequency automatically.

TrigLev Set the trigger level voltage.

Duty Measured duty cycle.

Setup Set the counter configuration.

Cancel Exit the frequency counter.

13.12.1 Counter Setup

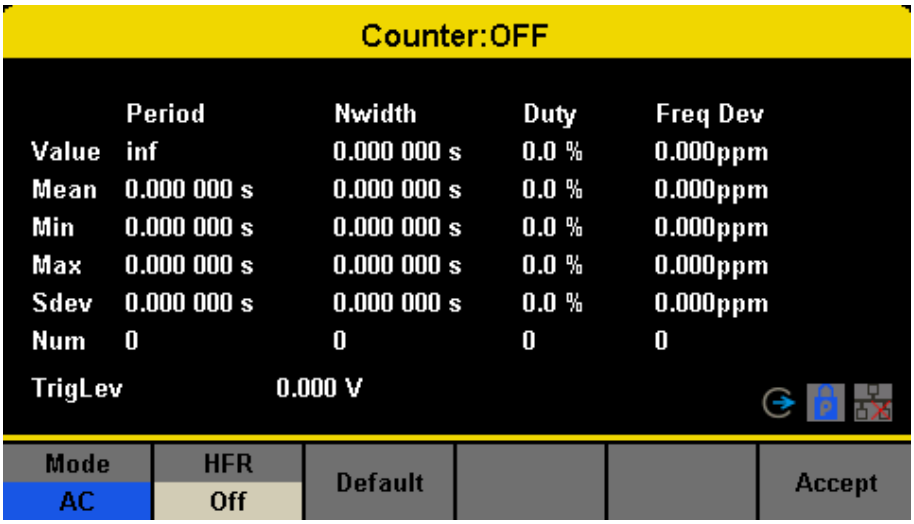


Figure 13.12 Counter Setup Interface

Mode Set the coupling mode to DC or AC

HFR High frequency rejection filter.

Default Set the frequency counter settings to default.

Done Save the current settings and return to the previous menu.

13.13 Parameters to be measured

The frequency counter on the 4060B Series can measure parameters including frequency, period, duty, positive pulse width and negative pulse width.

13.14 Reference Frequency

System will calculate the deviation between the measured frequency and the reference frequency automatically.

13.15 Trigger Level

Sets the trigger level of the measurement system. The system triggers and obtains the measurement readings when the input signal reaches the specified trigger level. The default is 0V and the available range is from -3V to 1.5V. Choose TrigLev and use the numeric keyboard to input the desired value and select the unit (V or mV) from the pop-up menu. Or use the knob and arrow keys to change the parameter value.

13.16 Coupling Mode

Sets the coupling model of the input signal to “AC” or “DC”. The default is “AC”.

13.17 High Frequency Rejection

High Frequency Rejection can be used to filter out the high-frequency components of a measured signal and improve the measurement accuracy in low-frequency signal measurement. Press HFR to enable or disable this function. The default is "Off".

- Enable High Frequency Rejection when low-frequency signal with lower than a 250kHz frequency is measured to filter out the high-frequency noise interference.
- Disable High Frequency Rejection when a signal with a frequency higher than 250 KHz is measured. The maximum frequency that can be counted is 200 MHz.

13.18 Output

Press Utility → Output to enter the following interface.

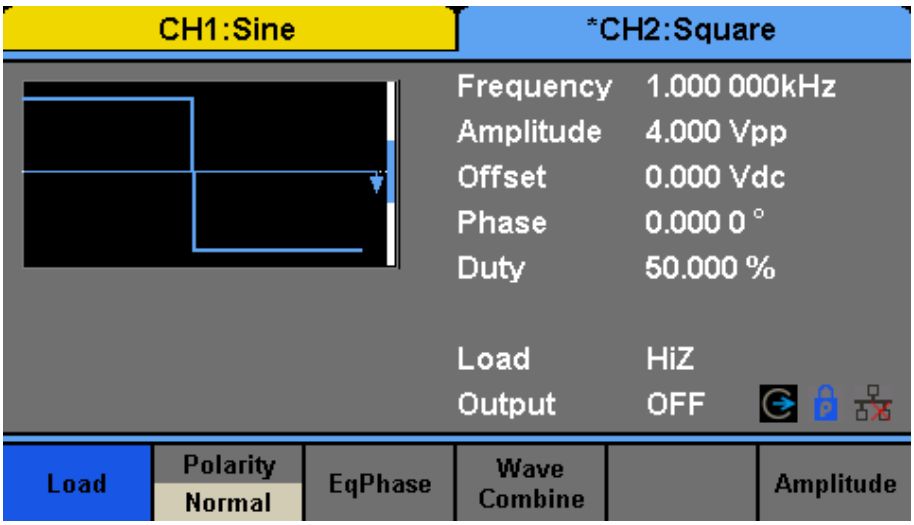


Figure 13.13 Output Setup Interface

13.19 Load

For the [CH1] and [CH2] connectors on the front panel, the generator has an output impedance of 50Ω. If the actual load does not match the set load, the displayed voltage will not be the same as the output voltage. This function is used to match the displayed voltage with the expected one. This setting does not actually change the output impedance to any other value.

13.19.1 Steps for setting the load:

Press Utility → Output Setup → Load, to set the output load. The load parameter shown on the down bottom is the default setting when the power is on or the pre-set load value.
High Impedance: displayed as HiZ;
Load: the default is 50Ωand the range is 50Ωto 100kΩ.

Note: Continue pressing the corresponding output key for two seconds to switch between High Impedance and 50Ω.

13.20 Polarity

Press Utility → Output Setup → Polarity to set the output signal as normal or inverted. The waveform's inversion is relative to the offset voltage, as shown in the following figure.

Note: The Sync signal related to the waveform is not inverted when the waveform is inverted.

13.21 EqPhase

Press Utility → Output Setup → EqPhase to align the phases of CH1 and CH2.
Choosing the menu will re-configure two channels and enable the generator to output with specified frequency and start phase. For two signals whose frequencies are the same or a multiple thereof, this operation will align their phases.

13.22 Waveforms Combination Mode

The CH1 output port of the 4060B Series outputs the waveform of CH1 in the general mode, while the waveform of CH1+CH2 can be output in the combined mode. Similarly, the CH2 output port of 4060B Series outputs the waveform of CH2 in the general mode while the waveform of CH1+CH2 can be output in the combined mode.
Press Utility → Output Setup → Wave Combine to enter the waveforms combining interface, as shown in the following figure.

CH1 Switch Output the waveform of CH1.

CH1+CH2 Output the waveform of CH1+CH2.

CH2 Switch Output the waveform of CH2.

CH1+CH2 Output the waveform of CH1+CH2.

Return Save the current operation and exit the current interface.

Note: When the waveforms combining function is enabled, the load of two channels will be set to the same automatically, default using the load value of the currently operated channel.

13.23 CH Copy/Coupling

The 4060B Series supports state and waveform copy function between its two channels. That is to say, it copies all parameters and states (including the channel output state) and arbitrary waveform data of one channel to the other one.
Press Utility → CH Copy Coupling → Channel Copy, to enter the following interface.

CH1=>CH2 Copy all parameters and states of CH1 to CH2.

CH2=>CH1 Copy all parameters and states of CH2 to CH1.

Accept Perform the current selection and return to the Utility menu.

Cancel Give up the current selection and return to the Utility menu.

Note: Channel coupling or track function and channel copy function are mutually exclusive. When channel coupling or track function is enabled, the menu Channel Copy is hidden.

13.23.1 Channel Coupling

The 4060B Series supports frequency, amplitude and phase coupling. Users can set the frequency deviation/ratio, amplitude deviation/ratio or phase deviation /ratio of the two channels. When coupling is enabled, CH1 and CH2 can be modified simultaneously. When the frequency, amplitude or phase of one channel (as the reference) is changed, the corresponding parameter of the other channel will be changed automatically and always keeps the specified frequency deviation/ratio, amplitude deviation/ratio or phase deviation /ratio relative to the base channel.
Press Utility → CH Copy Coupling → Channel Coupling, to menu.

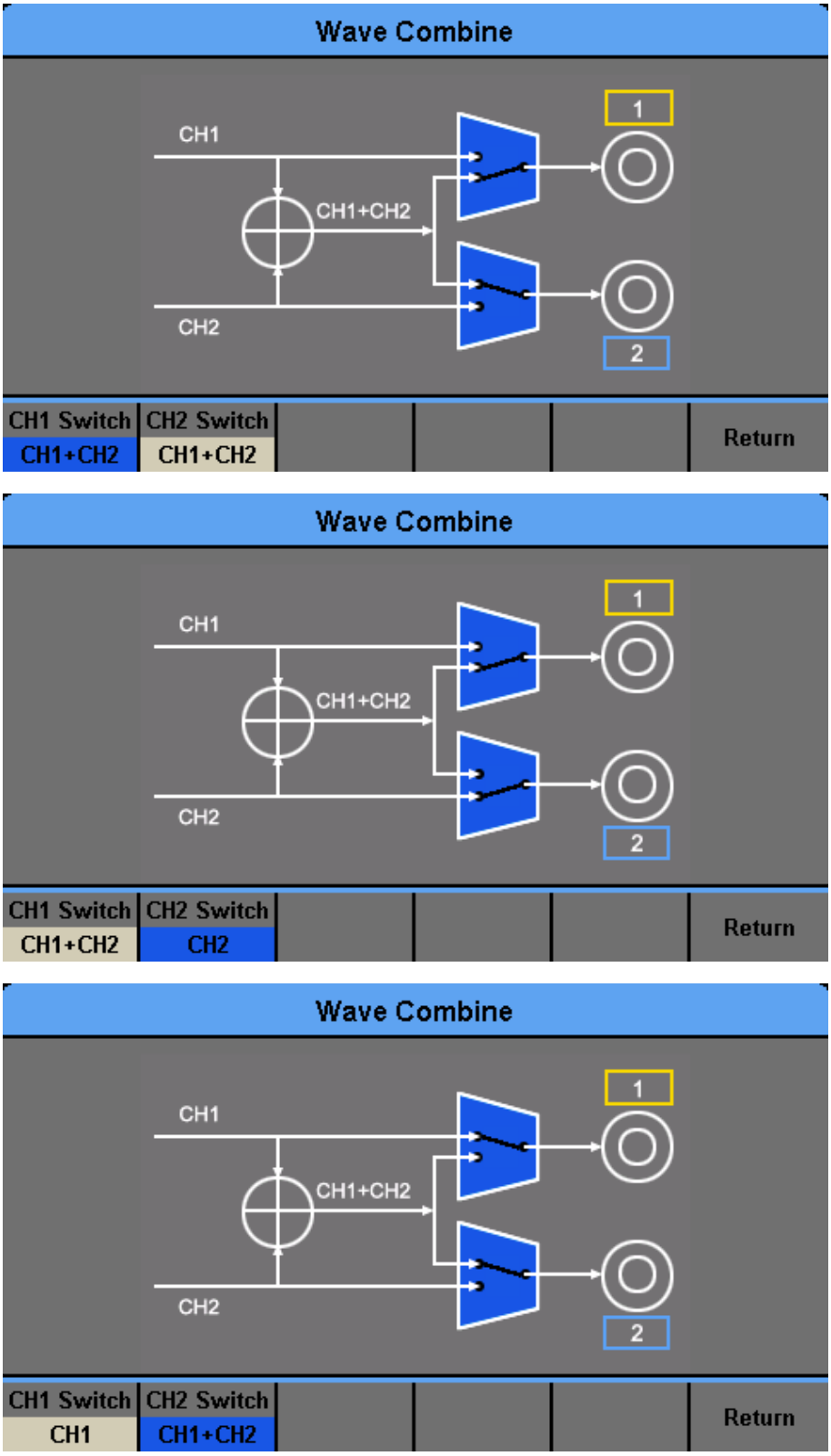


Figure 13.14 Waveforms Combining Interface

13.23.2 Frequency Coupling

1. To Enable Frequency Coupling Function: Press FreqCoup to turn frequency coupling "On" or "Off". The default is "Off".

2. To Select Frequency Coupling Mode: Press FreqMode to choose "Deviation" or "Ratio", and then use the numeric keyboard or knob and arrow keys to input the desired value.

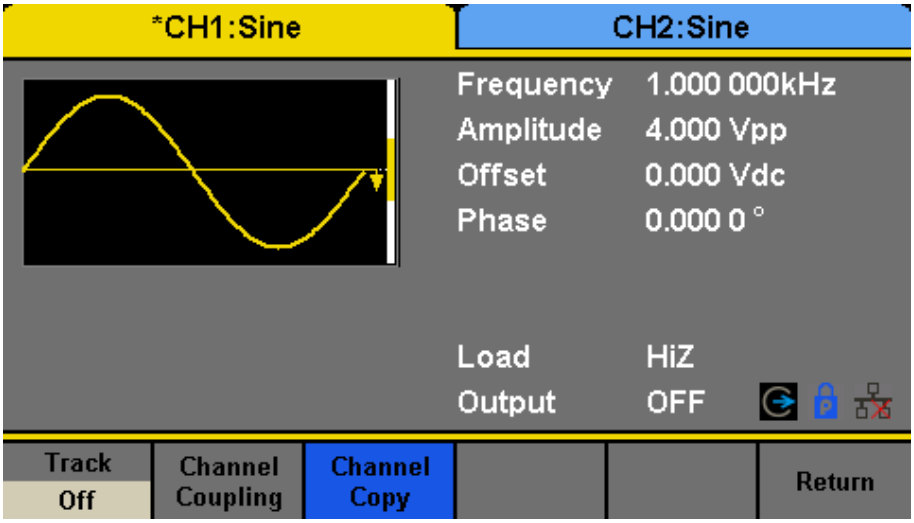


Figure 13.15 Channel Copy Interface

Deviation the frequency deviation between CH1 and CH2. $Freq_{CH2} - Freq_{CH1} = FreqDev.$

Ratio The frequency ratio of CH1 and CH2. $\frac{Freq_{CH2}}{Freq_{CH1}} = FreqRatio.$

13.23.3 Amplitude Coupling

1. To Enable Amplitude Coupling Function: Press AmplCoup to turn amplitude coupling "On" or "Off". The default is "Off".

2. To Select Amplitude Coupling Mode: Press AmplMode to choose "Deviation" or "Ratio", and then use the numeric keyboard or knob and arrow keys to input the desired value.

Deviation The amplitude deviation between CH1 and CH2. $Ampl_{CH2} - Ampl_{CH1} = AmplDev.$

Ratio the amplitude ratio of CH1 and CH2. $\frac{Ampl_{CH2}}{Ampl_{CH1}} = AmplRatio.$

13.23.4 Phase Coupling

1. To Enable Phase Coupling Function: Press PhaseCoup to turn phase coupling "On" or "Off". The default is "Off".

2. To Select Phase Coupling Mode: Press PhaseMode to choose "Deviation" or "Ratio", and then use the numeric keyboard or knob and arrow keys to input the desired value.

Deviation the phase deviation between CH1 and CH2. $\frac{Phase_{CH2}}{Phase_{CH1}} = PhaseDev$

Ratio the phase ratio of CH1 and CH2. $\frac{Phase_{CH2}}{Phase_{CH1}} = PhaseRatio.$

- Channel coupling is only available when both the waveforms of the two channels are basic waveforms including Sine, Square, Ramp and Arbitrary.

- When the Phase Coupling function is enabled, if the phase of one channel is changed, the phase of the other channel will be changed accordingly. At this point, aligning phase between the two channels can be achieved without executing the Eqphase operation.

- Channel coupling and channel function are mutually exclusive. When channel coupling is enabled, the menu Channel Copy is hidden.

13.24 Channel Tracking

When the track function is enabled, by changing the parameters or states of CH1, the corresponding parameters or states of CH2 will be adjusted to the same values or states automatically. At this point, the dual channels can output the same signal.

Choose Utility → CH Copy Coupling → Track to enable or disable the track function. When the track function is enabled, channel copy and coupling functions are disabled; the user interface is switched to CH1 and cannot be switched to CH2, as shown in the following figure.

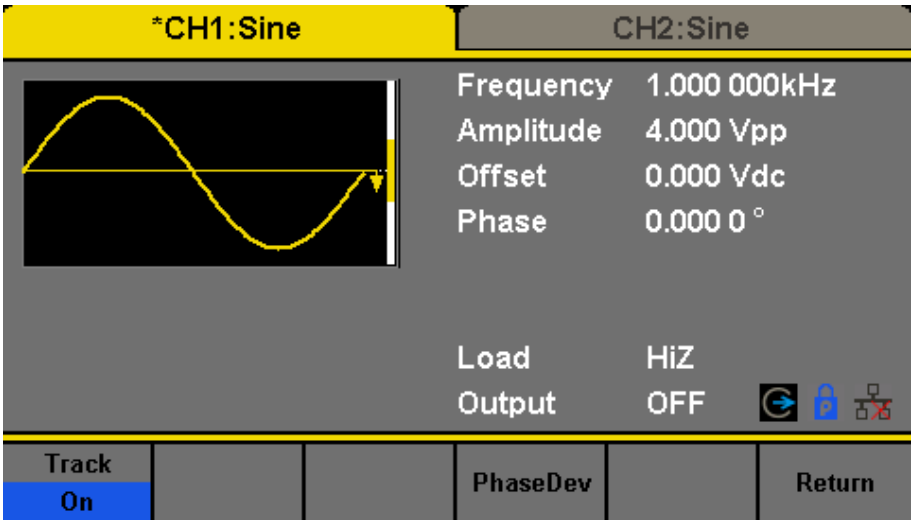


Figure 13.16 Track Interface

Press PhaseDev to enter the following interface. Then use the numeric keyboard or knob and arrow keys to input the desired value for the phase deviation between CH1 and CH2. The resulting signal is represented by: $Phase_{CH2}$-$Phase_{CH1}$=PhaseDev.

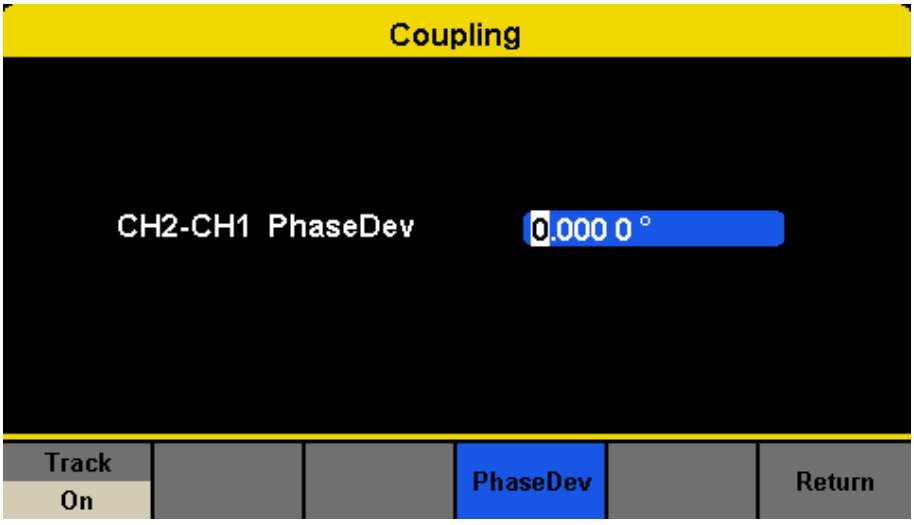
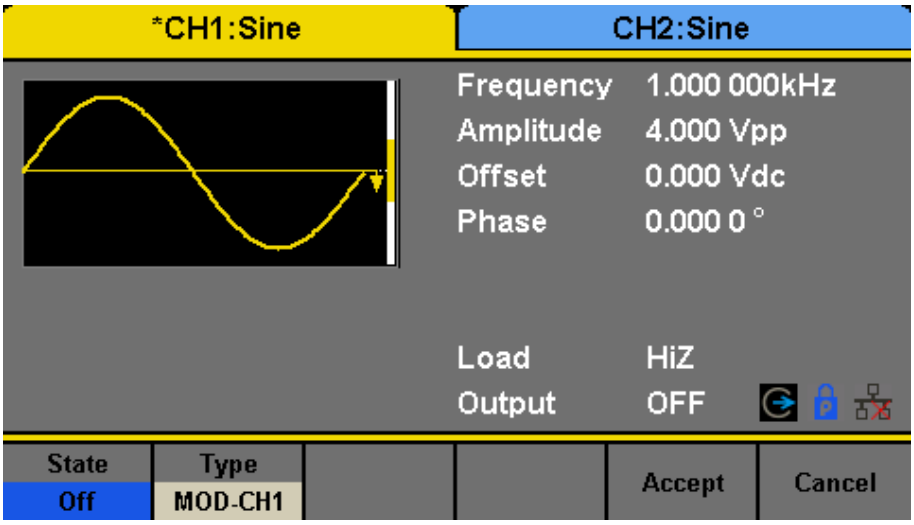


Figure 13.17 Phase Deviation Interface

Output Synchronization

The generator provides Sync output through the [Aux In/Out] connector on the rear panel. When the synchronization is on, the port can output a CMOS signal with the same frequency as basic waveforms (except Noise and DC), arbitrary waveforms, and modulated waveforms (except external modulation).



Function	Description	
State	Off	Close the sync output
	On	Open the sync output
Channel	CH1	Set the sync signal of CH1.
	CH2	Set the sync signal of CH2.
Accept		Save the current settings and return to the Utility menu.
Cancel		Give up the current settings and return to the Utility menu.

Figure 14.1 Sync Output Interface

14.1 Sync Signals of Different Waveforms

1. When the frequency of the waveform is less than or equal to 10MHz, the sync signal is a Pulse with 50ns pulse width and the same frequency as the waveform.
2. When the frequency of the waveform is greater than 10MHz, there is no sync signal output.
3. Noise and DC: there is no sync signal output.

14.1.1 Modulated Waveform

- When internal modulation is selected, the sync signal is a Pulse with 50ns pulse width.
  For AM, FM, PM and PWM, the frequency of the sync signal is the modulating frequency.
  For ASK, FSK and PSK, the frequency of the sync signal is the key frequency.
- When external modulation is selected, there is no sync signal output, for the [Aux In/Out] connector on the rear panel is used to input external modulating signal.

14.1.2 Sweep and Burst Waveform

When Sweep or Burst function is turned on, there is no sync signal output and the Sync menu is hidden.

Clock Source

The 4060B Series provides an internal 10MHz clock source. It also can accept external clock source form the [10 MHz In/Out] connector at the rear panel. It can also output the clock source from the [10 MHz In/Out] connector for other devices.
Press Utility → Page 1/2 → Clock → Source to select "Internal" or "External".
If "External" is selected, the instrument will detect whether a valid external clock signal is input from the [10MHz In/Out] connector at the rear panel. If not, the prompt message "No external clock source!" would be displayed and the clock source would be switched to "Internal".

15.1 Sync methods for two or more instruments:

Connect the [10MHz In/Out] connector of generator A (using internal clock) to the [10MHz In/Out] connector of generator B (using external clock) and set the output frequencies of A and B as a same value to realize synchronization.

15.2 Synchronization among multiple instruments

Divide the 10MHz clock source of a generator (using internal clock) into multiple channels, and then connect them to the [10MHz In/Out] connectors of other generators (using External clock), and finally set the output frequencies of all the generators as a same value to realize synchronization.

Channel Phase Mode

Press Utility → Page 1/2 → Mode to enter the mode setup Interface, as shown in **Figure 16.1**.

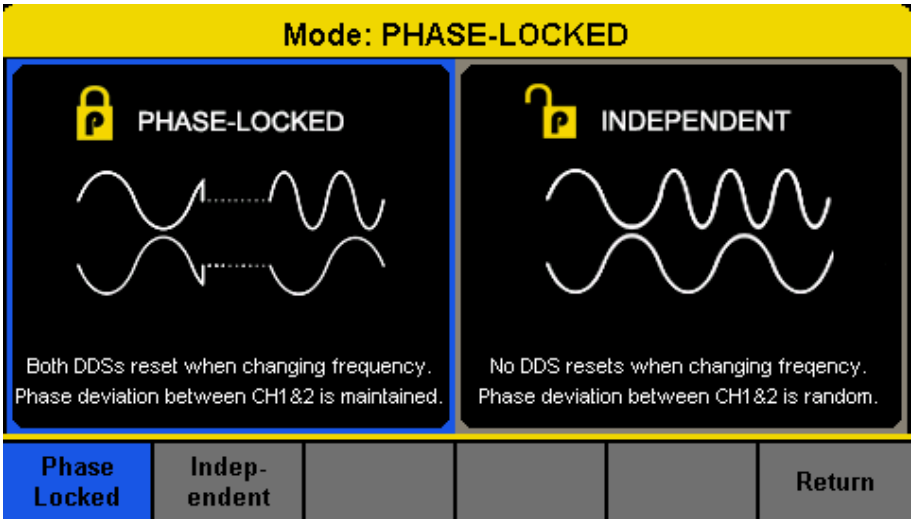


Figure 16.1 Mode Setup Interface

Phase-locked Mode When changing the frequency, the DDSs of both channels reset, and the phase deviation between CH1 and CH2 is maintained.

Independent Mode When changing the frequency, neither channels' DDS resets and the phase deviation between CH1 and CH2 changes at random. When the independent mode is enabled, the phase parameter cannot be modified and the menu Phase is hidden.

Overvoltage Protection

Choose Utility → Page 1/2 → OverVoltage Protection to turn on or off the function.
If the state is set to ON, overvoltage protection of CH1 and CH2 will take effect once any of the following conditions is met. When overvoltage protection occurs, a message will be displayed and the output is disabled.

- The absolute value of input voltage is higher than 11V±0.5V when the amplitude of the generator is higher than or equal to 3.2Vpp or the DC offset is higher than or equal to |2VDC|.
- The absolute value of input voltage is higher than 4V±0.5V when the amplitude of the generator is lower than 3.2Vpp or the DC offset is lower than |2VDC|.

Remote Interface

The 4060B Series can be controlled remotely via USB, LAN and GPIB (option) interfaces. Users can set the corresponding interface according to their needs.
Press Utility → Page 1/2 → Interface to open the following menu. The user can set LAN parameters or GPIB address.

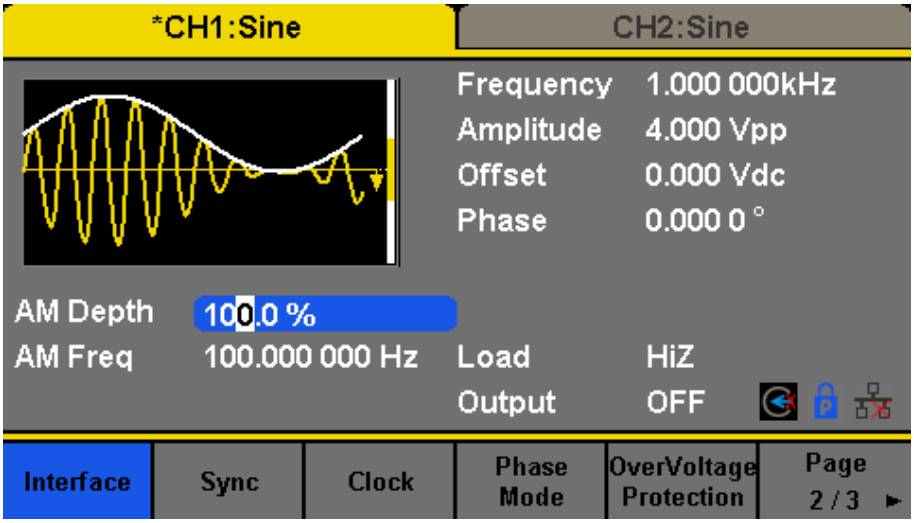


Figure 18.1 Interface Settings

GPIB Set the GPIB address.

LAN State Turn on LAN.

LAN Setup Set the IP address, subnet mask, gateway and DHCP.

Accept Save the current settings and return to the Utility menu.

The 4060B Series can be controlled remotely via the following two methods:

18.1 User-defined programming

Users can program and control the instrument by using the SCPI commands (Standard Commands for Programmable Instruments). For more information about the commands and programming, please refer to "Remote Control Manual".

18.2 Remote Control via USB

The 4060B Series can communicate with a PC through the USBTMC protocol.
You are suggested to do as the following steps.

1. Connect the device: Connect the USB Device interface at the rear panel of 4060B Series with the PC via a USB cable.

2. Install the USB driver: NI Visa is recommended.

3. Communicate with a remote PC: Open Measurement & Automation Explorer of NI and choose the corresponding resource name. Then click "Open VISA Test Panel" to turn on the remote command control panel through which you can send commands and read data.

18.3 Remote Control via GPIB

Each device connected to GPIB interface must have a unique address. The default value is 18 and values range from 1 to 30. The selected address is stored in non-volatile memory.
Choose Utility → Page 1/2 → Interface → GPIB to enter the following interface.

18.4 Remote Control via LAN

The 4060B Series can communicate with a PC through the LAN interface. Users can view and modify the LAN parameters. Choose Utility → Page 1/2 → Interface → LAN State to turn on LAN. Then choose LAN Setup to enter the interface configuration values. If available, DHCP (Dynamic Host Configuration Protocol), can set the appropriate values for networks that provide a DHCP server.

Specifications

Note: All specifications apply to the unit after:

1. A temperature stabilization time of 15 minutes over an ambient temperature range of 23 °C ± 5 °C.

2. Short correction operation performed before making measurement.

Specifications are subject to change without notice.

Specifications

Note: All specifications apply to the unit after a temperature stabilization time of 30 minutes over an ambient temperature range of 23 °C ± 5 °C.

Model	4062B	4063B	4064B
Channels	2		
Frequency Characteristics			
Sine	1 µHz to 40 MHz	1 µHz to 80 MHz	1 µHz to 120 MHz
Square	1 µHz to 25 MHz		
Triangle, Ramp	1 µHz to 1 MHz		
Pulse	1 µHz to 25 MHz		
Gaussian Noise (-3 dB)	> 120 MHz		
Arbitrary	1 µHz to 20 MHz		
Accuracy	± 1 ppm (1 year)		
Resolution	1 µHz		
Arbitrary Characteristics			
Built-in Waveforms	196		
Waveform Length	8 points to 8 M points		
Vertical Resolution	16 bits		
Sampling Rate	300 MSa/s (DDS mode) 75 MSa/s (true arbitrary mode)		
Minimum Rise/Fall Time (typical)	4.5 ns (DDS mode) 8.5 ns (true arbitrary mode)		
Jitter (rms)	< 150 ps (1 Vpp, into 50 Ω load, true arbitrary mode)		
Non-volatile Memory Storage	80 MB file system		
Output Characteristics			
Amplitude Range[1] (into open circuit)	2 mVpp to 20 Vpp (≤ 20 MHz) 2 mVpp to 10 Vpp (> 20 MHz)		
Amplitude Resolution	Up to 4 digits		
Amplitude Accuracy (10 kHz, 0 V offset)	± (1% + 1 mVpp)		
Amplitude Flatness (reference to 10 kHz Sine, 2.5 Vpp)	± 0.3 dB (50 Ω load, DC to 100 MHz) ± 0.4 dB (50 Ω load, 100 MHz to 120 MHz)		
Cross Talk	< -60 dBc (between channels)		
Offset Range (DC)	± 5 V (into 50 Ω load) ± 10 V (into open circuit)		
Offset Resolution (DC)	Up to 4 digits		
Offset Accuracy (DC)	± (1% + 2 mV), into open circuit		
Output Impedance (typical)	50 Ω		
Output Protection	Overvoltage (see user manual for details)		
Waveform Characteristics			
Harmonic Distortion (sine, 0 dBm input, typical)	DC to 10 MHz, < -65 dBc 10 MHz to 20 MHz, < -60 dBc 20 MHz to 40 MHz, < -55 dBc 40 MHz to 60 MHz, < -50 dBc 60 MHz to 80 MHz, < -45 dBc 80 MHz to 100 MHz, < -40 dBc 100 MHz to 120 MHz, < -38 dBc		

Waveform Characteristics (continued)	
Total Harmonic Distortion (sine)	< 0.075% (10 Hz to 20 kHz at 0 dBm)
Spurious (non-harmonic)	≤ 50 MHz, -70 dBc max. > 50 MHz, -65 dBc max.
Rise/Fall Time (square)	< 9 ns (10% to 90% at 1 Vpp, into 50 Ω load)
Variable Duty Cycle (square)	0.001% to 99.999% (depending on frequency setting)
Jitter (rms) Cycle to Cycle (square)	150 ps (1 Vpp, into 50 Ω load, typical)
Ramp Symmetry	0% to 100%
Ramp Linearity	< 1% of peak output (triangle, ramp at 1 kHz, 1 Vpp, 100% symmetry)
Pulse	
Pulse Width	16.3 ns minimum
Rise/Fall Time	8.4 ns to 22.4 s (1 Vpp, 10% to 90%, into 50 Ω load)
Duty Cycle Range	0.001% to 99.999% (depending on frequency setting)
Overshoot	< 3% (100 kHz, 1 Vpp)
Jitter (rms) Cycle to Cycle	150 ps (1 Vpp, into 50 Ω load)
Burst	
Waveform	Sine, square, ramp, pulse, arbitrary, noise
Type	Cycle (1 to 1,000,000 cycles), infinite, gated
Start/Stop Phase	0° to 360°
Internal Period	1 µs to 1000 s
Gated Source	Internal, external trigger
Trigger Source	Internal, external, manual
Phase Offset	
Range	-360° to 360°
Resolution	0.1°
AM, FM & PM Modulation Characteristics	
Carrier[2]	Sine, square, ramp, arbitrary
Source	Internal, external
Modulation Waveform	Sine, square, ramp, noise, arbitrary
AM Modulation Depth	0% to 120%
FM Frequency Deviation	0 to 0.5 x (maximum output frequency)
PM Phase Deviation	0° to 360°
ASK & FSK Modulation Characteristics	
Carrier[2]	Sine, square, ramp, arbitrary
Source	Internal, external
Modulation Waveform	50% duty cycle square waveform

(1) This specification will be divided by 2 while applied to a 50 Ω load.

(2) Modulation schemes not available in DC mode.

Specifications (continued)

Model	4062B, 4063B, 4064B
DSB-AM Modulation Characteristics	
Carrier[2]	Sine, square, ramp, arbitrary
Source	Internal, external
Modulation Waveform	Sine, square, ramp, noise, arbitrary
PWM Modulation Characteristics	
Source	Internal, external
Modulation Waveform[2]	Sine, square, ramp, noise, arbitrary
Internal Modulation Frequency	1 mHz to 1 MHz
Sweep Characteristics	
Waveforms[2]	Sine, square, ramp, arbitrary
Sweep Shape	Linear or logarithmic, up or down
Sweep Time	1 ms to 500 s
Sweep Trigger	Internal, external, manual
Harmonic Output Characteristics	
Maximum Order	16
Type	Even, odd, all
Auxiliary Input / Output	
Sync Out	TTL compatible[4] Output impedance: 100 Ω (typical) Maximum frequency: 10 MHz Minimum pulse width: 50 ns (typical)
Modulation Input	± 12 Vpp (typical) for 100% modulation Input impedance: 10 kΩ Frequency range: 0 kHz to 50 kHz
Trigger	
Input – Level	TTL compatible[3]
Input – Slope	Rising or falling, selectable
Input – Pulse Width	> 100 ns
Input – Impedance	> 100 kΩ
Input – Latency	100 ns maximum (sweep mode) 600 ns maximum (burst mode)
Output – Voltage Level	TTL compatible[4]
Output – Pulse Width	> 500 ns
Output – Impedance	100 Ω (typical)
Output – Maximum Frequency	1 MHz
Reference Clock	
Input	Frequency range: 10 MHz (typical) Minimum voltage input: 1.4 Vpp Input impedance: 5 kΩ
Output	Frequency range: 10 MHz (typical) Voltage level: 3.3 V (typical), 2 V (minimum) Output impedance: 50 Ω

Frequency Counter	
Measurement	Frequency, period, positive/negative pulse width, duty cycle
Measurement Range	100 mHz to 200 MHz (DC coupling) 10 Hz to 200 MHz (AC coupling)
Input Range	100 mVrms to ± 2.5 V (< 100 MHz, DC coupling) 200 mVrms to ± 2.5 V (100 MHz to 200 MHz, DC coupling) 100 mVrms to 5 Vpp (< 100 MHz, AC coupling) 200 mVrms to 5 Vpp (100 MHz to 200 MHz, AC coupling)
Input Impedance	1 MΩ (typical)
Coupling	AC, DC, HF REJ (≥ 250 kHz filter)
Environmental and Safety	
Temperature	Operating: 32 °F to 104 °F (0 °C to 40 °C) Storage: -4 °F to 140 °F (-20 °C to 60 °C)
Humidity	< 86 °F (30 °C), ≤ 90 % RH 104 °F (40 °C), ≤ 50 % RH
Altitude	Operating: below 10,000 ft (3,048 m) Storage: below 49, 212 ft (15,000 m)
Electromagnetic Compatibility	EMC Directive 2014/30/EU, EN61326-1:2013
Safety	Low voltage directive (LVD) 2014/35/EU, EN61010-1:2010
General	
Display	4.3" TFT color (24-bit) LCD touch screen
I/O Interfaces	USBTMC device, LAN, USB host port
Storage Memory	10 instrument settings
AC Input	100 to 240 VAC ± 10 %, 50/60 Hz 100 to 120 VAC ± 10 %, 400 Hz
Power Consumption	50 W maximum
Dimensions (W x H x D)	10.25" x 4.22" x 11.61" (260.3 x 107.2 x 295 mm)
Weight	7.6 lbs (3.43 kg)
Warranty	3 years
Standard Accessories	AC power cord, user manual (downloadable), USB type A-to-B cable, BNC coaxial cable, certificate of calibration
Optional Accessories	USB-to-GPIB adapter (model AK40G)

(2) Modulation schemes not available in DC mode.

(3) V_{IH} = 2 V to 5.5 V, V_{IL} = 0.5 V to 0.8 V

(4) V_{OH} = 3.8 V (I_{OH} = -8 mA), V_{OL} = 0.44 V (I_{OL} = 8 mA)

Appendix: Waveforms

1 Common Waveforms

StairUp	Stair waveform, rising
StairDn	Stair waveform, falling
StairUD	Stair waveform, rising and falling
Trapezia	Trapezoidal waveform
Ppulse	Positive pulse
Npulse	Negative pulse
UpRamp	UpRamp waveform
DnRamp	DnRamp waveform
SineTra	Sine-Tra waveform
SineVer	Sine-Ver waveform

20.1 Math Waveforms

ExpFall	Exponential Decay function
ExpRise	Exponential Rise function
LogFall	Logarhythmic Fall function
LogRise	Logarhythmic Rise function
Sqrt	Square Root function
Root3	Root3 function
X^2	X^2 function
X^3	X^3 function
Airy	Airy function
Besselj	Bessel I function
Bessely	Bessel II function
Dirichlet	Dirichlet function
Erf	Error function
Erfc	Complementary error function
ErfcInv	Inverted complementary error function
ErfInv	Inverted error function
Laguerre	4-times Laguerre polynomial

Legend	5-times Legend polynomial
Versiera	Versiera
Sinc	Sinc function
Gaussian	Gaussian function
Dlorentz	Dlorentz function
Haversine	Haversine function
Lorentz	Lorentz function
Gauspuls	Gauspuls signal
Gmonopuls	Gmonopuls signal
Tripuls	Tripuls signal
Weibull	Weibull distribution
LogNormal	LogNormal Gaussian distribution
Laplace	Laplace distribution
Maxwell	Maxwell distribution
Rayleigh	Rayleigh distribution
Cauchy	Cauchy distribution

20.2 Engine Waveforms

Cardiac	Cardiac signal
Quake	Analog quake waveform
Chirp	Chirp signal
TwoTone	TwoTone signal
SNR	SNR signal
AmpALT	Gain oscillation curve
AttALT	Attenuation oscillation curve
RoundHalf	RoundHalf Waveform
RoundsPM	RoundsPM Waveform
BlaseiWave	Time-velocity curve of explosive oscillation
DampedOsc	Time-displacement curve of damped oscillation
SwingOsc	Kinetic energy – time curve of swing oscillation
Discharge	Discharge curve of NI-MH battery
Pahcur	Current waveform of DC brushless motor
Combin	Combination function

SCR	SCR firing profile
TV	TV signal
Voice	Voice signal
Surge	Surge signal
Radar	Analog radar signal
Ripple	Ripple wave of battery
Gamma	Gamma signal
StepResp	Step-response signal
BandLimited	Bandwidth-limited signal
CPulse	C-Pulse
CWPulse	CW pulse
GateVibr	Gate self-oscillation signal
LFMPulse	Linear FM pulse
MCNoise	Mechanical construction noise

20.3 Window Waveforms

Hamming	Hamming window
Hanning	Hanning window
Kaiser	Kaiser window
Blackman	Blackman window
GaussiWin	GaussiWin window
Triangle	Triangle window (Fejer window)
BlackmanH	BlackmanH window
Bartlett-Hann	Bartlett-Hann window
Bartlett	Bartlett window
BarthannWin	Modified Bartlett-Hann window
BohmanWin	BohmanWin window
ChebWin	ChebWin window
FlattopWin	Flat top weighted window
ParzenWin	ParzenWin window
TaylorWin	TaylorWin window
TukeyWin	TukeyWin (tapered cosine) window

20.4 Trigonometric Waveforms

Tan	Tangent
Cot	Cotangent
Sec	Secant
Csc	Cosecant
Asin	Arc sine
Acos	Arc cosine
Atan	Arc tangent
ACot	Arc cotangent
CosH	Hyperbolic cosine
CosInt	Integral cosine
Coth	Hyperbolic cotangent
Csch	Hyperbolic cosecant
SecH	Hyperbolic secant
SinH	Hyperbolic sine
SinInt	Integral sine
TanH	Hyperbolic tangent
ACosH	Arc hyperbolic cosine
ASecH	Arc hyperbolic secant
ASinH	Arc hyperbolic sine
ATanH	Arc hyperbolic tangent
ACsch	Arc hyperbolic cosecant
ACoth	Arc hyperbolic cotangent

20.5 Square Waveforms

Square waveforms with duty cycle percentages from 1 to 99% are shown in a table after pressing the "Square" button. They are organized in 3 pages. If the desired percentage is higher than shown on screen, select the last field in the table "pageX" and press the knob to navigate to the next page. To return to a lower percentage than shown, do the same by selecting the first cell in the table showing "pageX" in the upper left corner of the table.

SquareDutyXX	Is the name of the waveform with XX defining the percentage duty cycle. "XX" is replaced by the desired percentage. For example, 10% is "SquareWave10".

20.6 Medical Waveforms

Waveform	Description
EOG	Electro-Oculogram

EEG	Electroencephalogram
EMG	Electromyogram
Pulseilogram	Pulseilogram
ResSpeed	Speed curve of the respiration
ECG1	Electrocardiogram 1
ECG2	Electrocardiogram 2
ECG3	Electrocardiogram 3
ECG4	Electrocardiogram 4
ECG5	Electrocardiogram 5
ECG6	Electrocardiogram 6
ECG7	Electrocardiogram 7
ECG8	Electrocardiogram 8
ECG9	Electrocardiogram 9
ECG10	Electrocardiogram 10
ECG11	Electrocardiogram 11
ECG12	Electrocardiogram 12
ECG13	Electrocardiogram 13
ECG14	Electrocardiogram 14
ECG15	Electrocardiogram 15
LFPulse	Waveform of the low frequency pulse electrotherapy
Tens1	Waveform 1 of the nerve stimulation electrotherapy
Tens2	Waveform 2 of the nerve stimulation electrotherapy
Tens3	Waveform 3 of the nerve stimulation electrotherapy

20.7 Modulated Waveforms

AM	Sectional sine AM signal
FM	Sectional sine FM signal
PFM	Sectional pulse FM signal
PM	Sectional sine PM signal I
PWM	Sectional PWM signal

20.8 Filter Waveforms

Butterworth	Butterworth filter
Chebyshev1	Chebyshev1 filter

Chebyshev2 Chebyshev2 filter

20.9 Demo Waveforms

demo1_375pts TureArb waveform 1 375 pts

demo1_16kpts TureArb waveform 1 16384 pts

demo2_3kpts TureArb waveform 2 3000 pts

demo2_16kpts TureArb waveform 2 16384 pts

Daily Maintenance

Do not store or leave the instrument in where the display screen will be exposed to direct sunlight for a long period of time.

CAUTION: To avoid damage to the instrument, do not expose it to spray, liquid, or solvent.

21.1 Cleaning

If the instrument requires cleaning, disconnect it from all power sources and clean it with a mild detergent and water. Make sure the instrument is completely dry before reconnecting it to a power source.
To clean the exterior surface, perform the following steps:

1. Remove loose dust on the outside of the instrument with a lint-free cloth. When cleaning the touch screen, be careful to avoid scratching the transparent plastic protective screen.

2. Use a soft cloth dampened with water to clean the instrument.

WARNING: To avoid any damage to the surface of the instrument, do not use any abrasive or chemical cleaning agents.

LIMITED THREE-YEAR WARRANTY

B&K Precision Corp. warrants to the original purchaser that its products and the component parts thereof, will be free from defects in workmanship and materials for a period of **three years** from date of purchase.
B&K Precision Corp. will, without charge, repair or replace, at its option, defective product or component parts. Returned product must be accompanied by proof of the purchase date in the form of a sales receipt.
To help us better serve you, please complete the warranty registration for your new instrument via our website

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. The warranty is void if the serial number is altered, defaced or removed.
B&K Precision Corp. shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitations of incidental or consequential damages. So the above limitation or exclusion may not apply to you.
This warranty gives you specific rights and you may have other rights, which vary from state-to-state.

Service Information

Warranty Service

Please go to the support and service section on our website at bkprecision.com to obtain an RMA #. Return the product in the original packaging with proof of purchase to the address below. Clearly state on the RMA the performance problem and return any leads, probes, connectors and accessories that you are using with the device.

Non-Warranty Service

Please go to the support and service section on our website at bkprecision.com to obtain an RMA #. Return the product in the original packaging to the address below. Clearly state on the RMA the performance problem and return any leads, probes, connectors and accessories that you are using with the device. Customers not on an open account must include payment in the form of a money order or credit card. For the most current repair charges please refer to the service and support section on our website.
Return all merchandise to B&K Precision Corp. with prepaid shipping. The flat-rate repair charge for Non-Warranty Service does not include return shipping. Return shipping to locations in North America is included for Warranty Service. For overnight shipments and non-North American shipping fees please contact B&K Precision Corp.

Include with the returned instrument your complete return shipping address, contact name, phone number and description of problem.

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