15M/25M/40M/60M

Two-channel Function/ Arbitrary Waveform Generator

User's Manual

Contents

Introduction to Two-channel Function/ Arbitrary

Waveform Generator

These series two-channel function/arbitrary waveform generator is equipped with direct digital synthesis (DDS) technology which enables output signal to be stable and accurate.

Instrument output channel sets CH1 channel output and CH2 channel output. CH1 channel is major output channel for output of all the following functions; CH2 channel is an auxiliary channel for output of basic waveform and arbitrary wave.User can switch channel major and auxiliary relationships in the utility.

Key Features

- 3.5-inch 480×320TFT LCD with clear graphic interface
- Chinese / English menu available
- Press key for help and information
- File management supporting USB flash disk and local storage
- Two-channel output with the highest output frequency is "15M type" Model is 15MHz,"25M type" Model is 25MHz, "40M type" Model is 40MHz, "60M type"Model is 60MHz.
- Sampling rate: 200MSa/S, vertical resolution: 13 bit and storage depth: 8k
- 5 basic waveforms and 32 arbitrary waveforms in-built
- Pulse wave output set in edge time
- Internal/external AM, FM, PM, ASK, FSK and PSK modulation function
- Output of linear/logarithmic frequency sweep and burst waveform
- Frequency meter of high precision of 100MHz and 32-bit counter
- With RS232 interface, USB Device, USB Host interface supporting USB flash disk storage (USB Host Optional)
- Multi-functional arbitrary waveform editing software equipped

Product Model

These series has four models, namely "15M type","25M type" ,"40M type" and "60M type" . The manual takes "40M type" as an example, in which specifications have covered all the functions and performances of these series.

1. Quick Start

1.1 Introduction to Front and Rear Panels

This section describes front and rear panels of this instrument for your quick understanding of function and usage.

Front panel includes liquid crystal, keys and output terminal and so on. Keys include: Function/mode, reusable keys, numeric keys and direction keys/knobs.
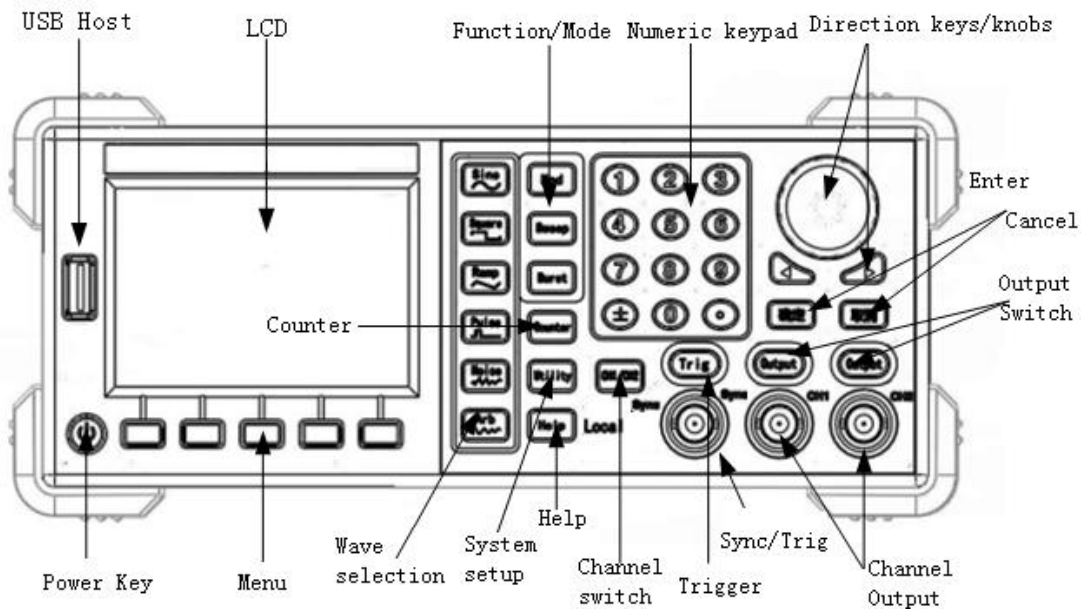
Figure 1-1 Front panel

The rear panel consists of input terminal, communication interface and power interface.

Figure 1-2 Rear Panel

1.2　Introduction to Interface

Basic operation interface is shown in Figure 1-3.

Figure 1-3 Interface

1.3 Waveform Setup

There is a series of keys with waveform displaying on the right of the operation panel, which are sine wave, square wave, ramp wave, pulse wave, noise wave and arbitrary wave. There is a common key as well: switch of CH1/CH2 channels.

The following routine will guide you gradually familiar with the setup of these keys.

Waveform keys   Channel switch
Figure 1-4 Key Selection

1. Press [Sine], waveform display area will turn to sine signal and show Sine in the status area. Sine waves of different parameter values are accessible through the setup of frequency/cycle, amplitude/high-level, offset/low-level and phase.
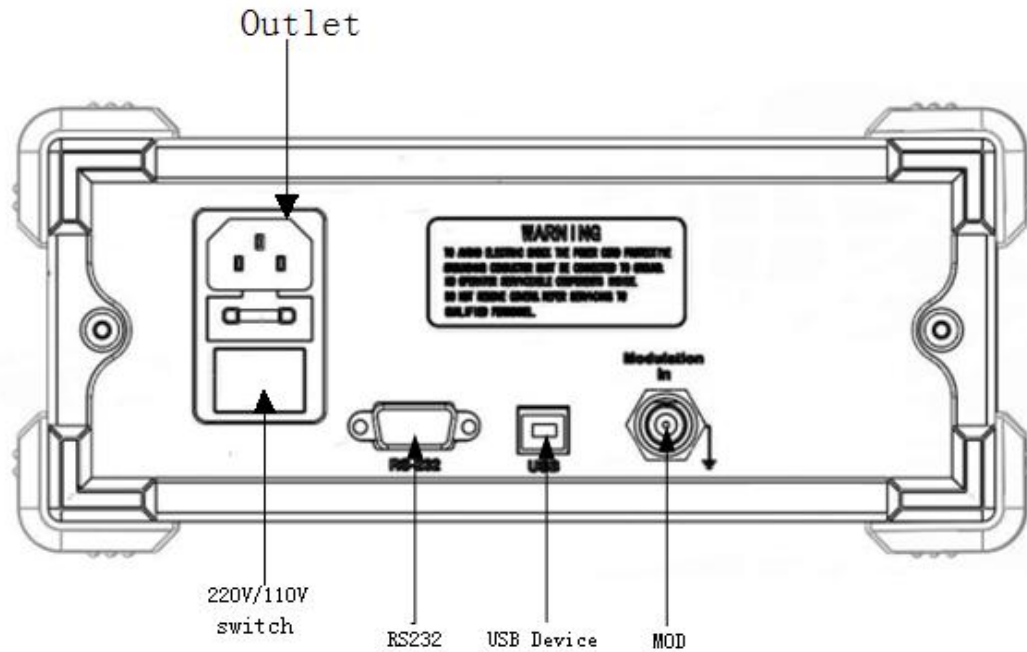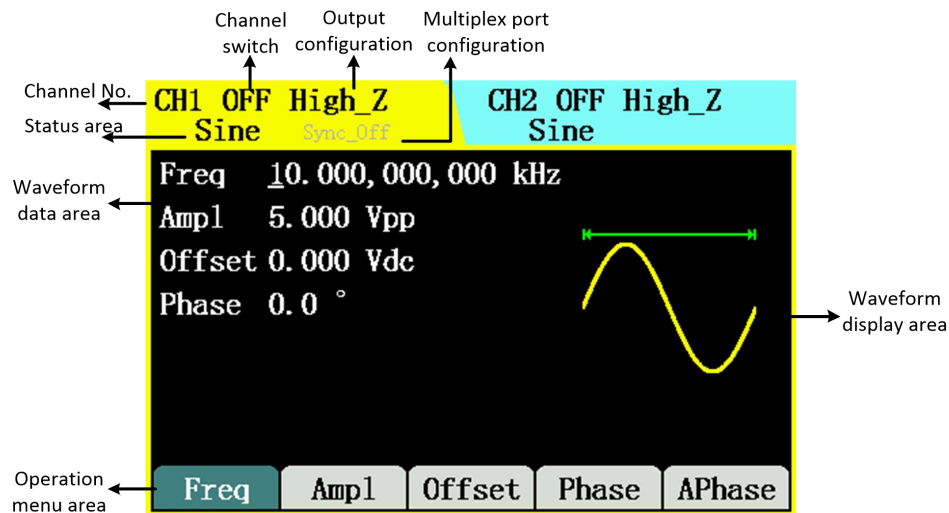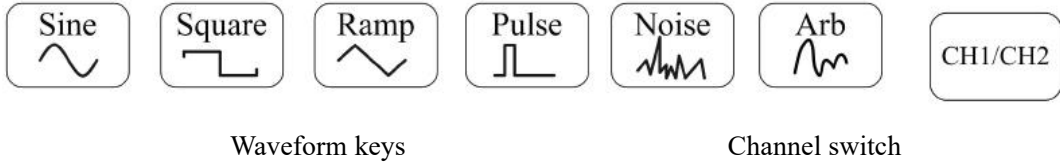
2. Press [Square], waveform display area will turn to square signal and show Square in the status area. Square waves of different parameter values are accessible through the setup of frequency/cycle, amplitude/high level, offset/low level, duty cycle and phase.

3. Press [Ramp], waveform display area will turn to ramp signal and show Ramp in the status area. Ramp waves of different parameter values are accessible through the setup of frequency/cycle, amplitude/high-level, offset/low-level, symmetry and phase.

4. Press [Pulse], waveform display area will turn to pulse signal and show Pulse in the status area. Pulse waves of different parameter values are accessible through the setup of frequency/cycle, amplitude/high-level, offset/low-level, symmetry and rising/trailing edge.

5. Press [Noise], waveform display area will turn to noise signal and show Noise in the status area. Noise waves of different parameter values are accessible through the setup of amplitude/high level and offset/low level.

6. Press [Arb], waveform display area will turn to arbitrary signal and show Arb in the status area. Arbitrary waves of different parameter values are accessible through the setup of frequency/cycle, amplitude/high-level, offset/low-level and phase.

7. Press [CH1/CH2] to switch channels. The selected channel is for parameter setup. Background color of liquid crystal changes in compliance with the switch of channels.

1.4 Output Setup

As shown in Figure 1-5, there are two Output keys at the bottom right of the front panel for

channel output control and one Trig key for trigger output. The following examples will offer you guidance on these functions.
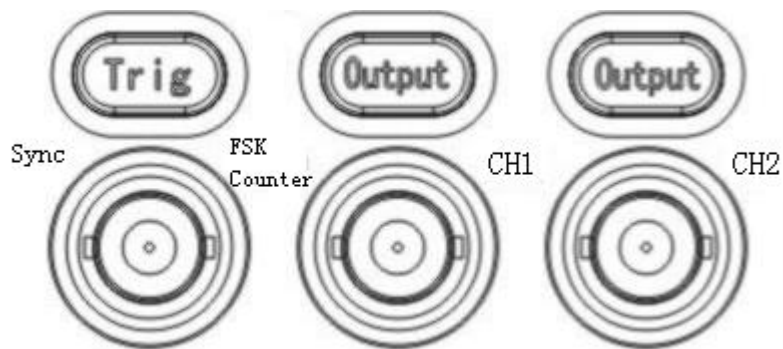
Figure 1-5 Channel Output

1. Press Output to start or forbid output signal of output connector in the front panel. The channel pressed Output displays ON and is lit.

2. When sweep and burst output, if Channel 1 is in output status and trigger is manual, trigger outputs signal for once if pressing the trigger key. For non-manual trigger, manual trigger would realized by pressing the trigger key.

1.5 Modulation/Frequency Sweep/Burst Output Setup

Three keys on the right side of waveform are for the output of modulation, frequency sweep and burst respectively, which function is for major channel only(default Channel 1). The following specifications will offer you guidance on the setup of these functions.

Figure 1-6 Keys of Modulation/Frequency Sweep/Burst
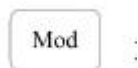
1. Press [Mod] to output modulated waveform. Change output waveform through the change in parameters such as type, internal modulation/external modulation, depth, frequency and modulated wave.

Modulation types include AM, FM, PM, ASK, FSK and PSK. Modulating signals include sine wave, square wave, ramp wave, up-ramp and down-ramp.

2. Press [Sweep] to conduct frequency sweep on sine wave, square wave, ramp wave, pulse wave or arbitrary waveform.

In the frequency sweep mode, the frequency of output waveform is in constant change from the

start frequency to the stop frequency at a sweep rate.

3. Press [Burst] and it will generate burst waveform of sine wave, square wave, ramp wave, pulse wave or arbitrary waveform.

1.6 Introduction to Digital Input

As shown in Figure 1-7, two sets of keys are on the front panel, which are numeric keypad, left-right direction keys and knobs and confirmation/cancellation key. The following specifications will offer you guidance on the use of digital input.
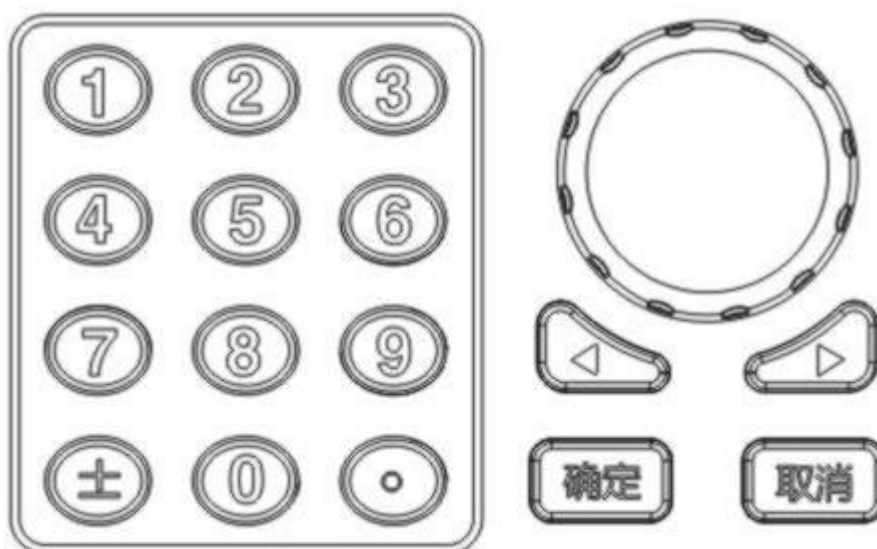
Figure 1-7 Numeric keypads, direction keys and knobs and confirmation/cancellation key

Direction keys

Switch of digits and system setup interface for menu selection. The left key is applicable to backspace under numeric keypad input.

Knobs

● Digit Alternation. Make a clockwise rotation to plus 1 and an anticlockwise one to minus 1 if the change is within the range of 0~9.

● Switch of internal waveform type, system setup interface for selection of menu and characters input of file name.

Numeric keypad

Input the desired value directly and alter the size of parameters.

1.7 Introduction to Functions of Frequency

Meter/System Setup/Help

As shown in Figure 1-8, three keys are below keys of modulation/frequency sweep/burst on the front panel to set frequency meter, system setup and help respectively. The following

specifications will offer you guidance on the setup of these functions.

Counter

Utility
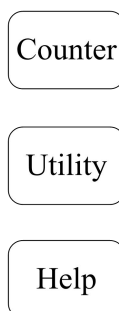
Help

Figure 1-8 Keys of Frequency Meter/System Setup/Help

1. Press **Counter** to check the current measured value of the frequency meter.

2. Press **Utility** to set output parameters of Channel 1 and 2,channel major and auxiliary relationships, buzzer switch, language switch, file storage, interface information and system information; execute instrument calibration and system update.

3. Press **Help** to check assistance information list.

2.Advanced Operation Instructions

You have acquired preliminary knowledge on the functions of keys and knobs of all functional areas on the front panel of "40M type" and are able to make basic operation on function/arbitrary waveform generator through previous introduction.

This section is introduction to basic waveform setup, arbitrary waveform setup, modulating waveform setup, frequency sweep waveform setup, burst waveform output, and use of frequency meter, system function setup and assistance in use.

2.1 Basic Waveform Setup

2.1.1 Sine wave setup

Press **Sine** and operation menu of sine wave will be displayed at the bottom of the screen. Channel basic information is displayed on the upper left, including channel switch, output impedance and name of current waveform. Set output waveform of sine wave through its

operation menu.

Parameters of setup sine wave include frequency/cycle, amplitude/high-level, offset/low-level and phase. Different sine waves are obtained through alteration of these parameters. As shown in Figure 2-1, select Frequency in the operation menu and cursor will be in the location of frequency parameter in the parameter display area, in which user could alter the frequency value of sine wave through numeric keypad, direction keys or knobs.
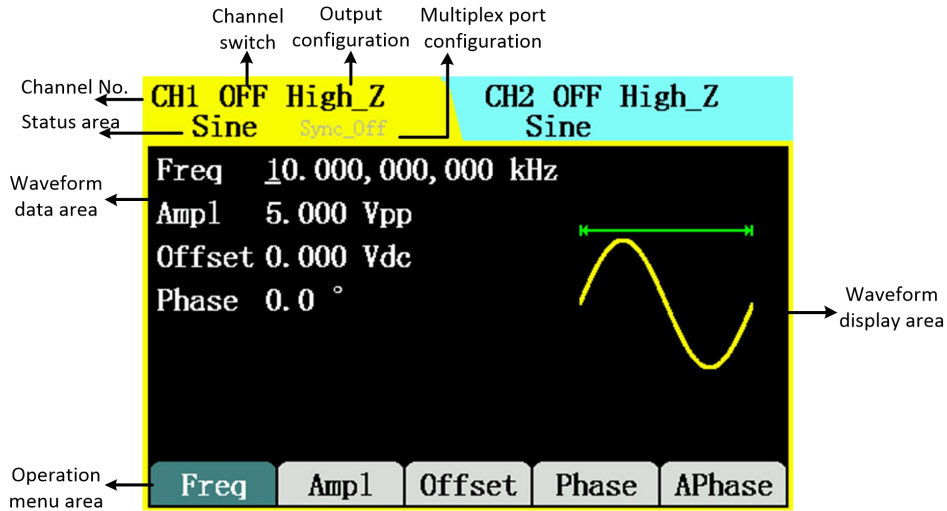
Figure 2-1 Display Interface of Setup of Sine Wave Parameters

Table 2-1 Sine Waveform Menu Description

Functional menu	Setup	Description
Frequency/cycle	——	Set waveform frequency or cycle
Amplitude/high-level	——	Set waveform amplitude or high-level
Offset/low-level	——	Set waveform offset or low-level
Phase	——	Set initial phase of sine wave

Note: 1. The in-phase in the operation menu is applicable to the synchronization in two-channel output only. It is unnecessary for single-channel waveform.

2. The "——" in setup column represents no setup item, hereinafter inclusive.

Set output frequency/cycle

1. Press [Sine] →frequency to set frequency parameter value.

The displayed frequency is either the power-on default value or the frequency previously selected., Use the current value if the frequency value is valid for the new waveform when changing parameters. To set waveform cycle, press the soft key of Frequency once again and switch to the Cycle soft key (current option is in inverse display).

2. Enter the desired frequency value.

Use the numeric keypad to enter the desired parameter value. Select the unit desired by frequency and press the soft key corresponding to the desired units. Or use left-right key to specify

the digit of parameter value to be amended and use knobs to alter the digit.
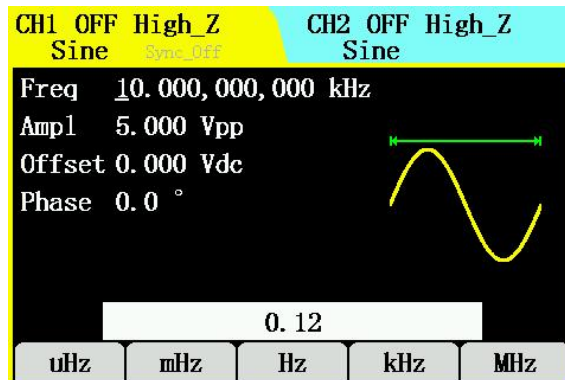
Figure 2-2 Input Frequency Parameters

Note:

● To input value through numeric keypad, use left direction key for backspace to delete previous digit; press the cancellation key to cancel digit input for misoperation.

● To input value through knobs, use direction keys to alter the digit with the subscript of horizontal bar for tracking. Then turn the knob to alter the digit to obtain the desired value.

Set output amplitude

1. **Press** [Sine] →amplitude to set the parameter value of amplitude.

The displayed amplitude is either the power-on default value or the amplitude previously selected. Use the current value if the amplitude is valid for the new waveform when changing parameters. To use high/low level to set amplitude, press the softkey of Amplitude or Offset once again and switch to the softkey of High-level and Low-level (current option is in inverse display).

2. Enter the desired amplitude

Use numeric keypad or knobs to enter the desired parameter value. Select the unit desired by amplitude and press the softkey corresponding to the desired unit.

Figure 2-3 Setup Parameter Value of Amplitude

Note:

The maximum amplitude will turn to 10Vpp if frequency is higher than 10MHz under Hign_Z output.

The maximum amplitude will turn to 5Vpp if frequency is higher than 30MHz under Hign_Z output.

Set offset voltage

1. Press [Sine] →offset to set parameter value of offset voltage.

The displayed offset voltage is either the power-on default value or the offset previously selected. Use the current value if the offset is valid for the new waveform when changing parameters.

2. Enter the desired amplitude

Use numeric keypad or knobs to enter the desired parameter value. Select the unit desired by offset and press the softkey corresponding to the desired unit.
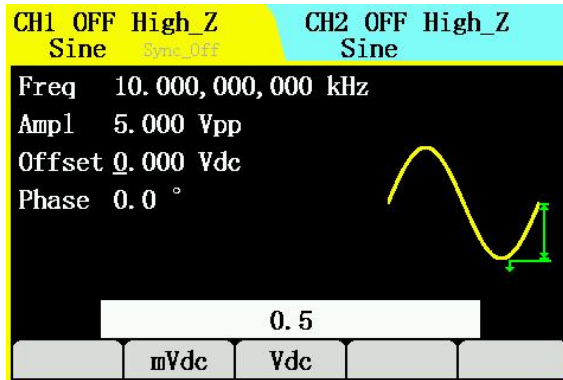
Figure 2-4 Setup Parameter Value of Offset

Set initial phase

1. Press [Sine] →phase to set parameter value of initial phase.

The displayed initial phase is either the power-on default value or the phase previously selected. Use the current value if the phase is valid for the new waveform when changing parameters.

2. Enter the desired amplitude

Use numeric keypad or knobs to enter the desired value and then select the unit.
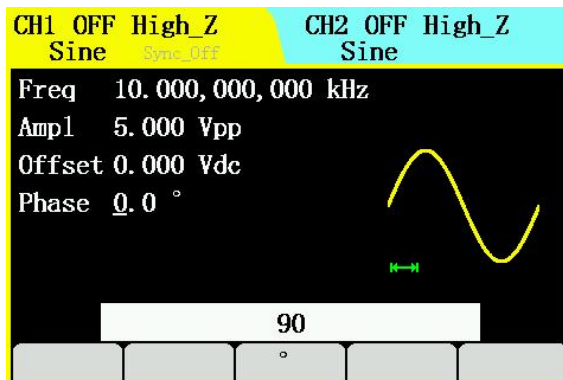
Figure 2-5 Setup Parameter Value of Initial Phase

2.1.2 Square wave setup

Press ![Square] and the operation menu of square wave will be displayed at the bottom of the screen. Use operation menu of square wave to set its output waveform parameters.

Major parameters of square wave include frequency/cycle, amplitude/high level, offset/low level, duty cycle and phase. Different square waves are obtained by altering these parameters. As shown in Figure 2-6, select **duty cycle** in the menu of softkey and the parameter value corresponding to duty cycle will be selected in the parameter display area, in which users could alter the value of duty cycle of square wave.

Figure 2-6 Display Interface of Setup of Square Wave Parameters

Table 2-2 Square Waveform Menu Description

Functional Menu	Setup	Description
Frequency/cycle	——	Set waveform frequency or cycle
Amplitude/high-level	——	Set waveform amplitude or high-level
Offset/low-level	——	Set waveform offset or low-level
Duty cycle	——	Set duty cycle of square wave
Phase	——	Set initial phase of waveform

Note:

Duty cycle: the percentage of square wave high level in the whole cycle.

≤100kHz ：   1%~99%

100kHz~5MHz :   20%~80%

5MHz~15MHz :   40%~60%

Set duty cycle

1. Press ![Square] →duty cycle to set the parameter value of duty cycle.

The displayed duty cycle is either the power-on default value or the value previously selected.

Use the current value if it is valid for the new waveform when changing parameters.

2. Enter the desired duty cycle

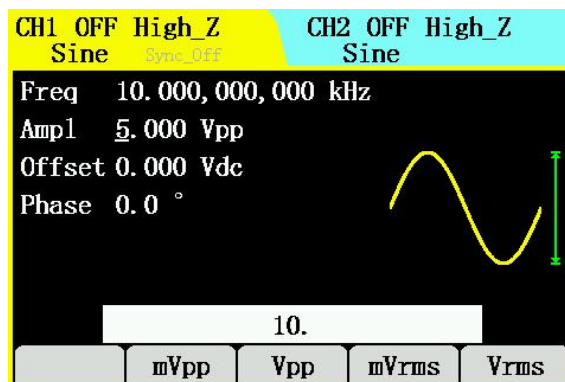Use numeric keypad or knobs to enter the desired parameter value. Select the unit desired by duty cycle and press the softkey corresponding to the desired unit. Signal generator will immediately adjust duty cycle and output square wave in the desired value.

Figure 2-7 Setup Parameter Value of Duty Cycle

2.1.3 Set ramp wave

Press ![Ramp] and the operation menu of ramp wave will be displayed at the bottom of the screen. Use operation menu of ramp wave to set its output waveform parameters.

Major parameters of ramp wave include frequency/cycle, amplitude/high level, offset/low level, symmetry and phase. Different ramp waves are obtained by altering these parameters. As shown in Figure 2-8, select Symmetry in the menu of softkey and the parameter value corresponding to symmetry will be selected in the parameter display area, in which users could alter the value of symmetry of ramp wave.
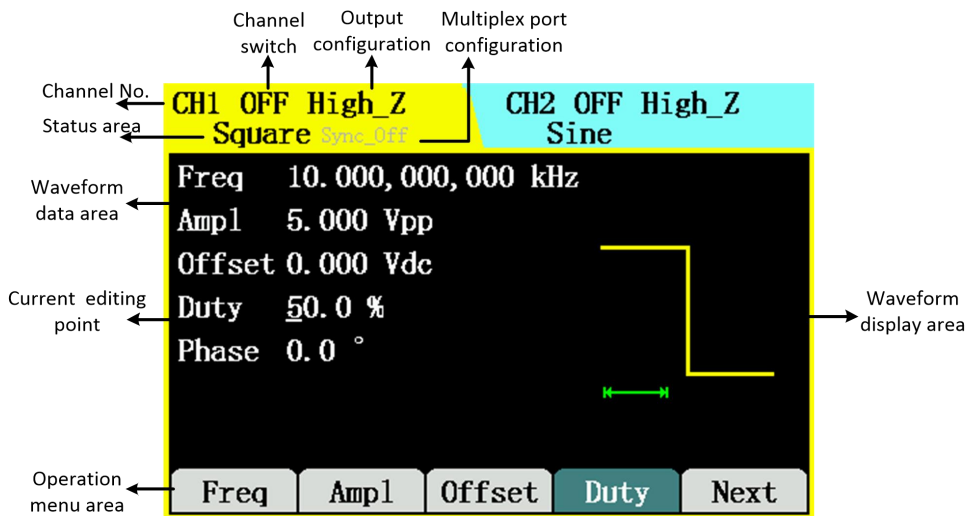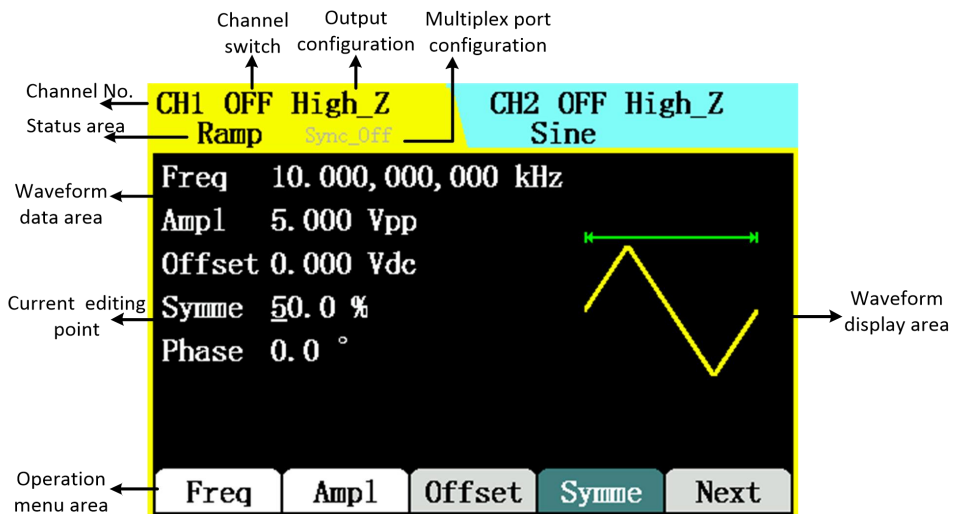
Figure 2-8 Display Interface of Setup of Parameter Values of Ramp Waveform

Table 2-3 Ramp Waveform Menu Description

Functional menu	Setup	Description
Frequency/cycle	——	Set waveform frequency or cycle
Amplitude/high-level	——	Set waveform amplitude or high-level
Offset/low-level	——	Set waveform offset or low-level
Symmetry	——	Set symmetry of ramp wave
Phase	——	Set initial phase of waveform

Note:

Symmetry: the percentage of setup ramp waveform in rise in the whole cycle.

Range: 0~100%

Set symmetry

1. Press ![Ramp] →symmetry to set parameter value of symmetry.

The displayed symmetry is either the power-on value or the percentage previously selected. Use the current value if it is valid for the new waveform when changing parameters.

2. Enter the desired symmetry

Use numeric keypad or knobs to enter the desired parameter value. Select the unit desired by symmetry and press the softkey corresponding to the desired unit. Signal generator will immediately adjust symmetry and output ramp wave in the desired value.
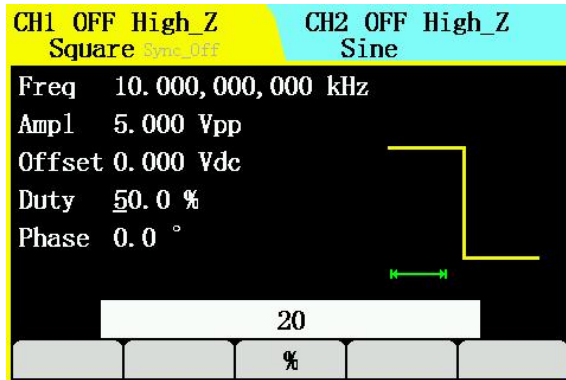

Figure 2-9 Setup parameter value of symmetry

2.1.4 Set pulse wave

Press ![Pulse] and the operation menu of pulse wave will be displayed at the bottom of the screen. Use operation menu of pulse wave to set its output waveform parameters.

Major parameters of pulse wave include frequency/cycle, amplitude/high-level, offset/low-level, pulse width/duty cycle and rising edge/falling edge. Different pulse waves are obtained by altering these parameters. Specific interface is shown in Figure 2-10
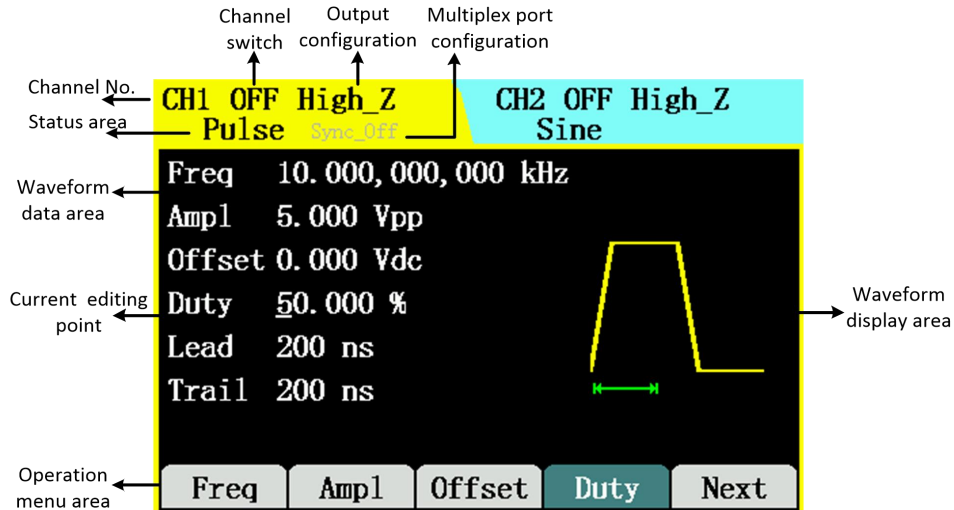
Figure 2-10 Interface for Setup of Pulse Waveform Parameters

Table 2-4 Pulse waveform menu description

Functional menu	Setup	Description
Frequency/cycle	——	Set waveform frequency or cycle
Amplitude/high-level	——	Set waveform amplitude or high level
Offset/low-level	——	Set waveform offset or low-level
Duty cycle/pulse width	——	Set duty cycle or pulse width of pulse wave
Rising edge/falling edge	——	Set rising and falling edge of waveform

Note:

Pulse width: it represents the interval time from the 50% threshold value in the range of rising edge and to the 50% threshold value in the range of next falling edge.

Set pulse width

1. Press ⬚Pulse →duty cycle/pulse width→pulse width.

The displayed pulse width on screen is either the power-on default value or the pulse width previously selected. Use the current value if it is valid for the new waveform when changing parameters.

2. Enter the desired pulse width.

Use numeric keypad or knobs to enter the desired parameter value. Select the unit desired by pulse width and press the softkey corresponding to the desired unit. Signal generator will immediately adjust pulse width and output pulse wave in the desired value.
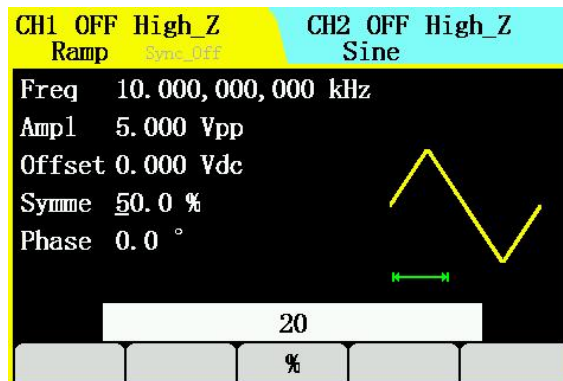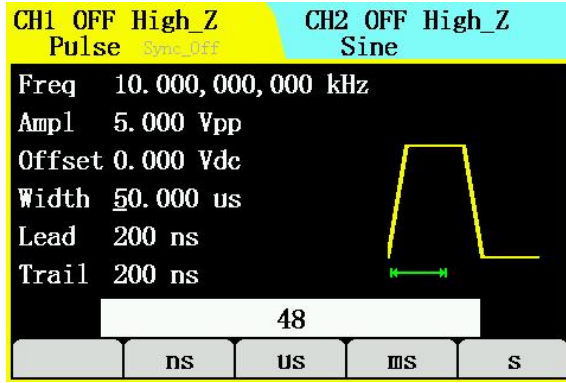
Figure 2-11 Setup Parameter Value of Pulse Width

Note:

1. Pulse width is restricted by minimum pulse width and pulse period

Minimum pulse width: 20ns;

Pulse width ≥ minimum pulse width;

Pulse width ≤ pulse period-minimum pulse width

2. Pulse duty cycle is restricted to minimum pulse width and pulse period

Pulse duty cycle ≥ 100 × minimum pulse width ÷ pulse period

Pulse duty cycle ≤ 100 × (1- minimum pulse width ÷ pulse period)

3. Pulse width is pertinent to the setup of duty cycle

One will vary based on the variation of the other. For example, current cycle is 1ms, pulse is 500us and duty cycle is 50%, duty cycle will turn to 20% after pulse width is set to 200us.

Set rising/falling edge

1. Press [Pulse] →leading edge.

2. Enter the desired pulse rising edge.

3. Press [Pulse] →rising /falling edge→falling edge.

4. Enter the desired pulse falling edge.

2.1.5 Set noise wave

Press [Noise] and the operation menu of noise wave will be displayed at the bottom of the screen. Use operation menu of noise wave to set its output waveform parameters.

Major parameters of noise wave include: amplitude/high level and offset/low level. Different noise waves are obtained by altering these parameters. Noise is random signal without frequency and periodicity. Specific interface is shown in Figure 2-12.
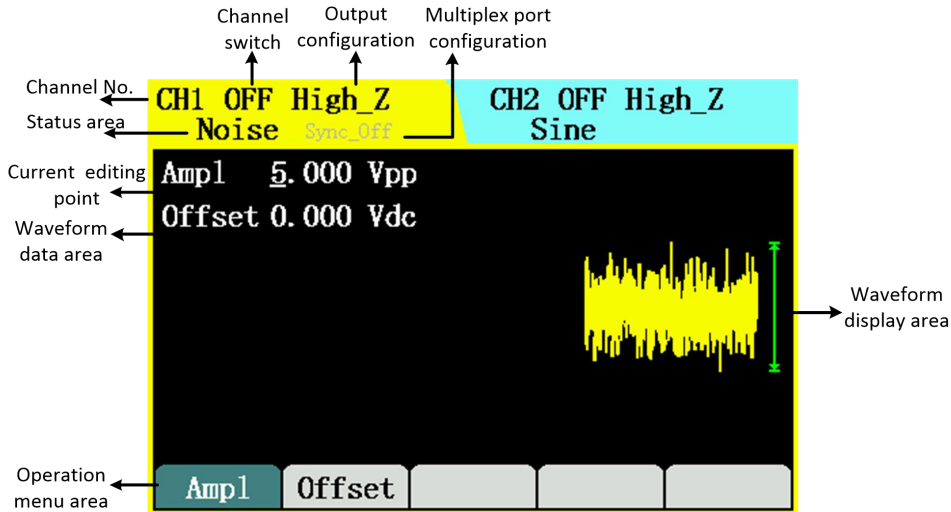
Figure 2-12 Display Interface for Setup of Parameter Values of Noise Waveform

Table 2-5 Noise Waveform menu Description

Functional menu	Setup	Description
Amplitude/high-level	——	Set waveform amplitude or high-level
Offset/low-level	——	Set waveform offset or low-level

2.1.6 Set arbitrary wave

Press [Arb] and the operation menu of arbitrary wave will be displayed at the bottom of the screen. Use operation menu of arbitrary wave to set its output waveform parameters.

Major parameter of arbitrary waveform include: frequency/period, amplitude/high-level, offset/low-level and phase. Different arbitrary waves are obtained by altering these parameters. Specific interface is shown in Figure 2-13.
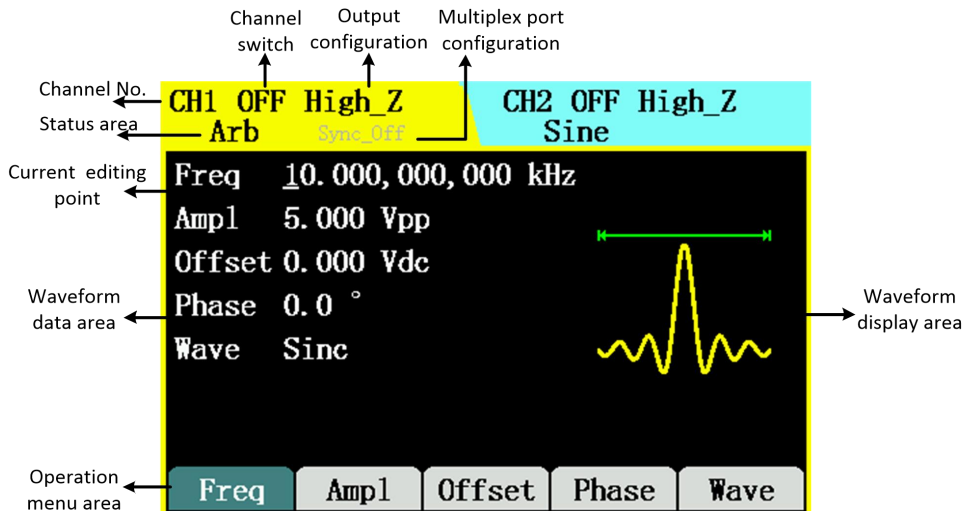
Figure 2-13 Display Interface for Setup of Parameter Values of Arbitrary Waveform

Table 2-6 Arb Waveform Menu
Description

Functional menu	Setup	Description
Frequency/Period	——	Set waveform frequency/period
Amplitude/High-level	——	Set the waveform amplitude/high-level
Offset/Low-level	——	Set the waveform offset/low-level
Phase	——	Set arbitrary wave initial phase
Wavefor	——	Load, create and edit the user arbitrary wave

**Arbitrary wave loading**

32 arbitrary waves are built in the signal generator which also provides 50 nonvolatile storage locations and arbitrary waveform the storage user defined.

To select one of the arbitrary waves, press [Arb ⌒⌒] → Waveforms → Load and enter the following interface.
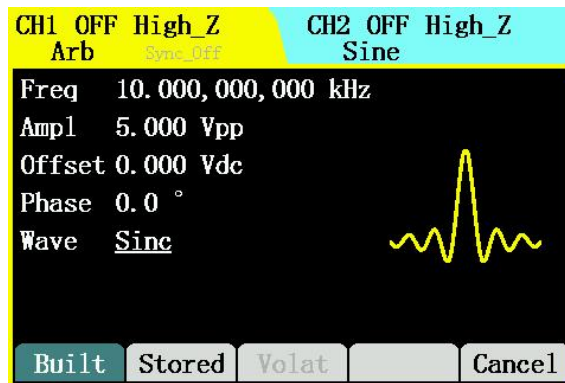
Figure2-14 Arbitrary Wave Loading

Table 2-7 Loading Arbitrary Wave Selection Menu Description

Functional menu	Setup	Description
Built-i	——	Select one of the 32 kinds of arbitrary waves built-in
Storag	——	Select arbitrary waveforms stored in the nonvolatile
Volatile wave	——	Select arbitrary waveforms stored in the volatile storage, and the old wave will be overwritten when a new one stored in.
Cance	——	Cancel arbitrary wave loading

Note:

When there are no waveforms stored in the volatile storage, volatile wave is not optional.

Select built-in waveforms

1. Press [Arb ⌒⌒] → Waveforms →Loading →Built-in and enter the following interface.

2. Position the desired waveform by the knobs or direction keys.

3. Select the waveform.
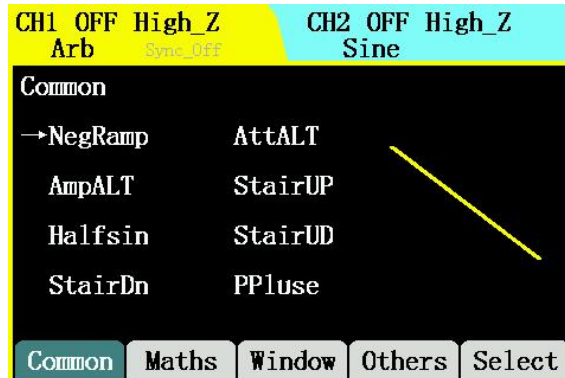
Figure 2-15 Built-in Arbitrary Waves

Table 2-8 Built-in Waveforms of Arbitrary Waveform

Functional	Setup	Description
Common	NegRamp/AttALT/AmpALT/StairUP/ Halfsin/StairUD/StairDn/PPluse	Select common waveforms
Mathematics	ExpRise/ExpFall/Tan/Cot/ Sqrt/Arb_X2/Sinc/Gauss	Select common mathematical functions
Window functions	Boxcar/Barlett/Triang/Blackman/ Hamming/Hanning/Kaiser	Select common window functions
Others	DC/Composite/Tanh/Coth/Gamma/ Legendre/chebyshev/Bessel/StepResp	Select other waveforms
Selection	——	Select the selected waveform

Note: 32 kinds name of Built-in waveform

NegRamp	Boxcar
AttALT	Barlett
AmpALT	Triang
StairUP	Blackman
Halfsin	Hamming
stairUD	Hanning
stairDn	Kaiser
PPluse	DC
ExpRise	Comp
ExpFall	Tanh
Tan	Coth
Cot	Gamma
Sqrt	Lerendre
X^2	Chebyshev
Sinc	Bessel
Gauss	StepResp

Choose stored arbitrary waveforms

1. Press $\widehat{\wedge}^{Arb}$ → Waveforms →Loading → Storage and enter the following interface.

2. Choose the way of local or U disk.

3. Position the desired waveform by the knobs or direction keys.

4. Read waveform data.
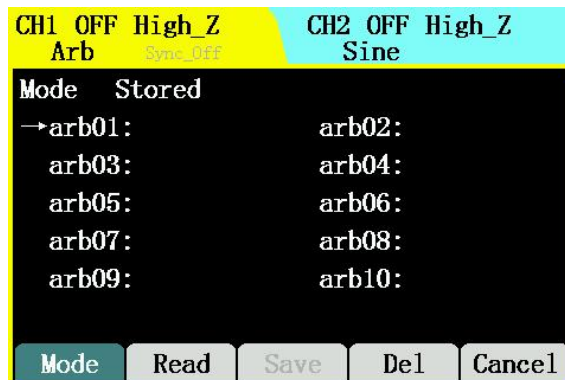
Figure 2-16 Read Stored Waveforms

Table 2-9 Stored Arbitrary Waveform Menu Description

Functional	Setup	Description
Mode	Local/U-disk	Switch storage mode
Read	——	Read the stored arbitrary waveform.
Storage	——	Store the arbitrary waveforms stored in the volatile

Create user-defined waveforms

Signal generator can edit arbitrary waveform, and users can create any new waveforms by point initialization operations. Specific operations are as follows.

Press Arb → Waveforms → Creation and enter the following interface.
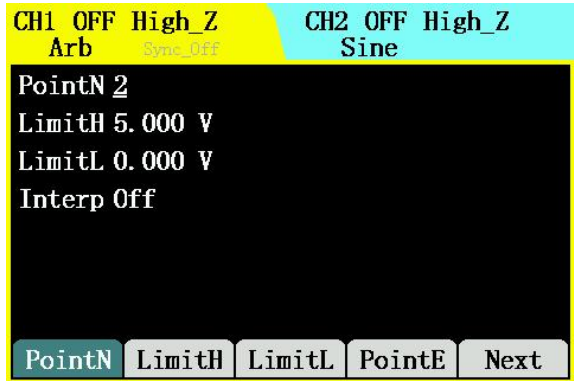
Table 2-17 User Arbitrary Waveform Creation Interface

Table 2-10 Arbitrary Waveform Creation Menu Description

Functional	Setup	Description
Points	——	Set the points of waveforms needing edit.
Upper limit	——	Set a creating point voltage upper limit.
Lower limit	——	Set a creating point voltage lower limit.
Point edit	——	Start waveform editor
Storage	——	Store the user-defined arbitrary waves edited.
Interpolation	linearity ON/OFF	Enable or disable linear interpolation between defined points of the waveforms

Point edit

Define waveforms by specifying voltage value for each waveform point. Select point edit and enter the interface as shown in Figure 2-18. First, edit the first point. Press Voltage to edit the voltage value of the current point.

When completing the edition of all the points, press Done to exit the current interface and return to the previous one.
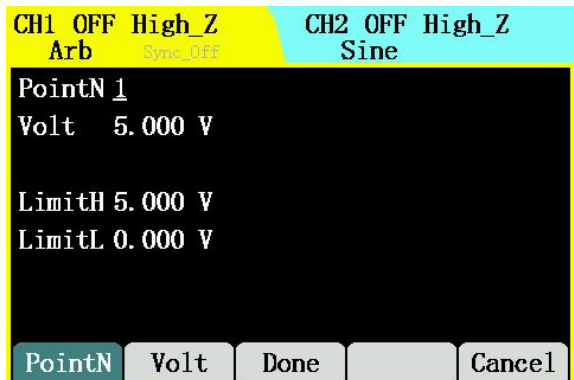
Figure 2-18 Point Edit Interface

Store waveforms

After waveforms created, press Store to enter the storage function interface, as shown in Figure 2-19, and store the waveform in nonvolatile memory or external memory.
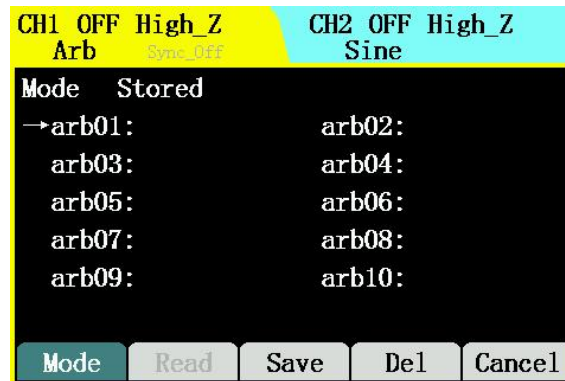
Figure 2-19 Store Edited Arbitrary Waveforms

Note:

In the nonvolatile storage, only one waveform can be stored in each waveform storage location, and the old wave will be overwritten when a new one stored in.

Edit waveforms

Press [Arb] → Waveform→ Edit to enter edit interface.
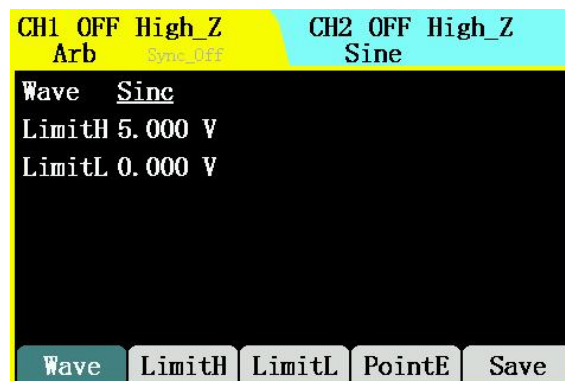
Figure 2-20 Arbitrary Wave Edit Interface

Table 2-11 Arbitrary Wave Edit Menu Description

Functional	Setup	Description
Select	——	Select arbitrary waveforms need to be edited, which can be built-in arbitrary waveforms, arbitrary waveforms or volatile waveforms stored in the volatile storage.
Upper limit	——	Set create point voltage upper limit.
Lower limit	——	Set create point voltage lower limit.
Point Edit	——	Start waveform editor
Storage	——	Store the user-defined arbitrary waves edited.

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function generator user's manual

2.2 Modulation Waveform Setup

Press [Mod] to output modulated waveforms. These series function signal generators can output modulation waveforms of AM, FM, PM, ASK, FSK and PSK. Set different modulation parameters according to different modulation types.

1 In amplitude modulation, internal modulation/external modulation, frequency, depth and modulation waveforms can be set.

2 In frequency modulation, internal modulation/external modulation, frequency, frequency deviation and modulation waveforms can be set.

3 In phase modulation, internal modulation/external modulation, frequency, phase deviation and modulation waveforms can be set.

4 In ASK modulation, internal modulation/external modulation, frequency and modulation amplitude can be set.

5 In FSK modulation, internal modulation/external modulation, frequency and frequency-hopping can be set.

6 In PSK modulation, internal modulation/external modulation, frequency and modulation phase can be set.

Settings of various modulation parameters will be introduced respectively in the following parts, based on modulation types.

2.2.1 Amplitude Modulation（AM）

Modulated waveforms consist of carrier waves and modulation waveforms. In AM (Amplitude Modulation), the amplitude of the carrier wave changes with the instantaneous voltage of the modulation waveform.

The carrier wave for amplitude modulation can be set through the function keys of [Sine] [Square] [Ramp] [Pulse] [Arb] on the front panel.

Press [Mod]→ Type→ AM and enter the interface as shown in Figure 2-21.

Figure 2-21 AM Waveform Parameter Setup Interface

Table 2-12 AM Parameter Setup Menu Description

Functional	Setup	Description
Types	AM	Select AM
Signal source	Internal/external	Select internal modulation/external modulation
Internal modulation	Frequency	Set modulation wave frequency (2mHz~20kHz)
	Depth	Set amplitude variation depth (0%~120%)
	Modulation wave	Select internal modulation signal Sine/Square/Triangle/UpRamp/DnRamp
External modulation	Depth	When selecting external modulation, the modulation signal can be input by the [Modulation In] on the rear panel, and only Depth needs to be set here.

Note:

Modulation depth refers to amplitude variation range (also called Percentage Modulation) settings. Modulation depth can vary from 0% to 120%.

- Modulation at 0%, the output amplitude is half of the specified value.

- Modulation at 100%, the output amplitude equals to the specified value.

- Modulation at 100% above, the output of the instrument will not exceed 20Vpp.

Internal modulation signal description:

Signals	Description
Sine	Sine wave
Square	Square wave of 50% duty cycle
Triangle	Ramp (Triangle) of 50% symmetry
UpRamp	Up Ramp
DownRamp	Down Ramp

2.2.2 Frequency Modulation（FM）

Modulated waveforms consist of carrier waves and modulation waveforms. In FM (Frequency Modulation), the frequency of the carrier wave changes with the instantaneous voltage of the modulation waveform.

The carrier wave for frequency modulation can be set with the function keys of [Sine] [Square] [Ramp] [Pulse] [Arb] on the front panel.

Press [Mod]→ Type→ FM and enter the interface as shown in Figure 2-22.
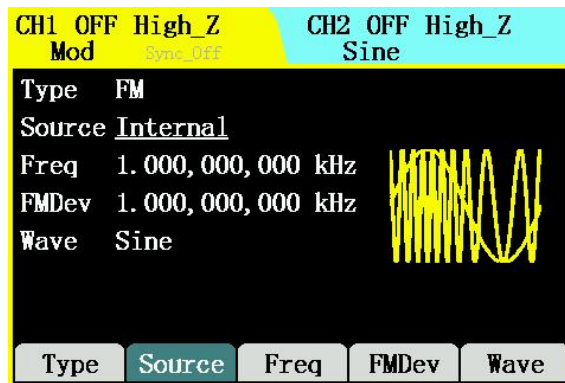
Figure 2-22 FM Waveform Parameter Setup Interface

Table 2-13 FM Parameter Setup Menu Description

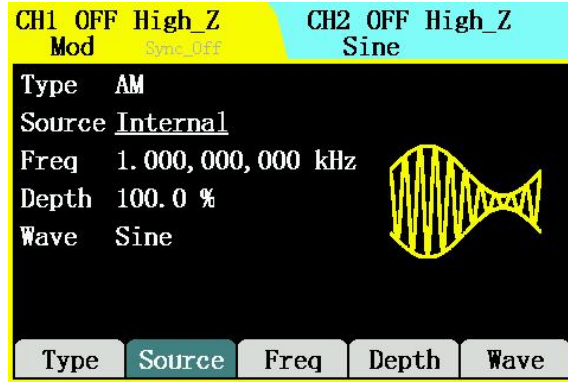| Functional	Setup	Description
Types	FM	Select FM
Signal source	Internal/extern	Select internal/external modulation
Internal modulation	Frequency	Set modulation wave frequency (2mHz~20kHz)
	Frequency offset	Set the offset between the frequency of modulation and the carrier.
	Modulation wave	Select internal modulation signal: Sine/Square/Triangle/UpRamp/DnRamp
External modulation	Frequency offset	When external modulation is selected, the modulation signal is input by the [Modulation In] on the rear panel. And only the parameters of Offset is needed setting here.

Frequency offset note:

● Offset must be less than or equal to carrier frequency;

● Sum of the offset and carrier frequency must be less than or equal to (the maximum frequency + 1kHz) of the function selected.

For the external source, offset is controlled by the ±2.5V level on the [Modulation In] connector.

+2.5 V plus the selected offset, lower external signal levels generate less offset and negative signal levels reduce the frequency below the carrier frequency.

2.2.3 Phase Modulation（PM）

Modulated waveforms consist of carrier waves and modulation waveforms. In PM (Phase Modulation), the phase of the carrier wave changes with the instantaneous voltage of the modulation waveform.

The carrier wave for phase modulation can be set with the function keys of [Sine] [Square] [Ramp] [Pulse] [Arb] on the front panel.

Press [Mod]→ Type→ PM and enter the interface as shown in Figure 2-23.
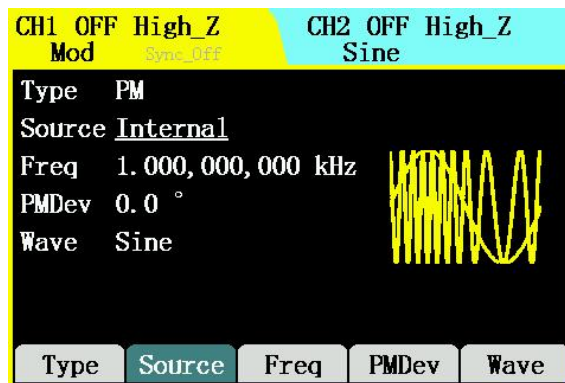
Figure 2-23 PM Waveform Parameter Setup Interface

Table 2-14 PM Parameter Setup Menu Description

Functional	Setup	Description
Types	PM	Select PM
Signal source	Internal/extern	Select internal/external modulation
Internal modulation	Frequency	Set modulation wave frequency (2mHz~20kHz)
	Phase offset	Set the offset between the phase of modulation and the carrier.
	Modulation wave	Select internal modulation signal: Sine/Square/Triangle/UpRamp/DnRamp
External modulation	Phase offset	When external modulation is selected, the modulation signal is input by the [Modulation In] on the rear panel. And only the parameters of Offset is needed setting here.

Phase offset note:

● Phase offset can vary from 0° to 360°.

● For the external source, offset is controlled by the ±2.5V level on the [Modulation

In] connector. +2.5 V plus the selected offset, lower external signal levels generate less offset .

2.2.4 Amplitude Shift Keying（ASK）

ASK modulation is to shift its output amplitude between two preset values (Carrier Amplitude and Modulation Amplitude). The amplitude at which the output shifts between carrier amplitude and modulation amplitude is called ASK amplitude. The frequency at which the output shifts between these two amplitudes is determined by the internal frequency generator or the signal level on the front-panel [Sync/FSK/Counter] connector.

When the internal modulation is selected, the frequency at which the output shifts between carrier amplitude and modulation amplitude is determined by the specified ASK frequency.

When the external modulation is selected,ASK frequency cannot be adjusted and is determined by the signal level on the front-panel [Sync/FSK/Counter] connector. When a logic high level is present, the larger value between carrier amplitude and modulation amplitude is output. With a logic low level, the smaller value is output.

The carrier wave for ASK modulation can be set with the function keys of [Sine] [Square] [Ramp] [Pulse] [Arb] on the front panel.

Press [Mod] → Type→ ASK and enter the interface as shown in Figure 2-24.

Figure 2-24 ASK Waveform Parameter Value Setup Interface

Table 2-15 ASK Parameter Setup Menu Description

Functional	Setup	Description
Types	ASK	Select ASK
Signal	Internal/external	Select internal modulation/external modulation
Internal modulation	Frequency	Set modulation wave frequency (2mHz~1MHz)
	Modulation amplitude	The modulating signal of internal modulation is a 50% duty cycle square wave. Set modulation amplitude range

		When the external modulation is selected, the modulation signal is input by the [Sync/FSK/Counter] on the front panel. Only Modulation amplitude parameters need to be set.
External modulation	Modulation amplitude	

Note:

Modulation amplitude refers to the difference between carrier amplitude and modulation amplitude.

Therefore, the minimum modulation amplitude is 0, and the maximum is the carrier amplitude.

During external modulation, the multiplexing port needs to be set as digital input in the utility, and the corresponding status will display "Sync_Off ", indicating that the multiplexing port synchronous output is closed, which is the digital signal input status.

The range of input amplitude is 2V ~ 20vpp, and DC coupling or AC coupling can be selected.

When the multiplexing port is synchronous output "Sync_On", the level of input over 5V will be forced to switch to signal input "Sync_Off".

2.2.5 Frequency Shift Keying（FSK）

FSK modulation is to shift its output frequency between two preset values (Carrier Frequency and the Hop Frequency). The frequency at which the output shifts between carrier frequency and hop frequency is called FSK frequency. The frequency at which the output shifts between these two frequencies is determined by the internal frequency generator or the signal level on the front-panel [Sync/FSK/Counter] connector.

● When the internal modulation is selected, the frequency at which the output shifts between carrier frequency and hop frequency is determined by the specified FSK frequency.

● When the external modulation is selected, FSK frequency cannot be adjusted and is determined by the signal level on the front-panel [Sync/FSK/Counter] connector. When a logic high level is present, the carrier frequency is output. With a logic low level, the hop frequency is output.

The carrier wave for FSK modulation can be set with the function keys of [Sine] [Square] [Ramp] [Pulse] [Arb] on the front panel.

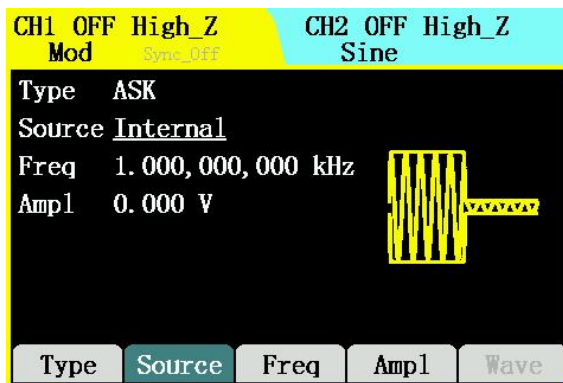Press [Mod] → Type→ FSK and enter the interface as shown in Figure 2-25.

Figure 2-25 FSK Waveform Parameter Value Setup Interface

Table 2-16 FSK Parameter Setup Menu Description

Functional menu	Setup	Description
Types	FSK	Select FSK
Signal source	Internal/external	Select internal modulation/external modulation
Internal modulation	Frequency	Set modulation wave frequency (2mHz~1MHz)
	Hop frequency	The modulating signal of internal modulation is a 50% duty cycle square wave. Set hop range (not exceed carrier frequency)
External modulation	Hop frequency	When the external modulation is selected, the modulation signal is input by the [Sync/FSK/Counter] on the front panel. Only Hop Frequency parameters need to be set.

Note:

Modulation amplitude refers to the difference between carrier amplitude and modulation amplitude.

Therefore, the minimum modulation amplitude is 0, and the maximum is the carrier amplitude.

During external modulation, the multiplexing port needs to be set as digital input in the utility, and the corresponding status will display "Sync_Off ", indicating that the multiplexing port synchronous output is closed, which is the digital signal input status.

The range of input amplitude is 2V ~ 20vpp, and DC coupling or AC coupling can be selected.

When the multiplexing port is synchronous output "Sync_On", the level of input over 5V will be forced to switch to signal input "Sync_Off".

2.2.6 Phase Shift Keying（PSK）

PSK modulation is to shift its output phase between two preset values (Carrier Phase and the Modulation Phase). The phase at which the output shifts between carrier phase and modulation phase is called PSK phase. The frequency at which the output shifts between these two phases is

determined by the internal frequency generator or the signal level on the front-panel [Sync/FSK/Counter] connector.

● When the internal modulation is selected, the frequency at which the output shifts between carrier phase and modulation phase is determined by the specified PSK frequency.

● When the external modulation is selected, PSK frequency cannot be adjusted and is determined by the signal level on the front-panel [Sync/FSK/Counter] connector. When a logic high level is present, the carrier phase is output. With a logic low level, the modulation phase is output.

The carrier wave for PSK modulation can be set with the function keys of [Sine] [Square] [Ramp] [Pulse] [Arb] on the front panel.

Press [Mod]→ Type→ PSK and enter the interface as shown in Figure 2-26.
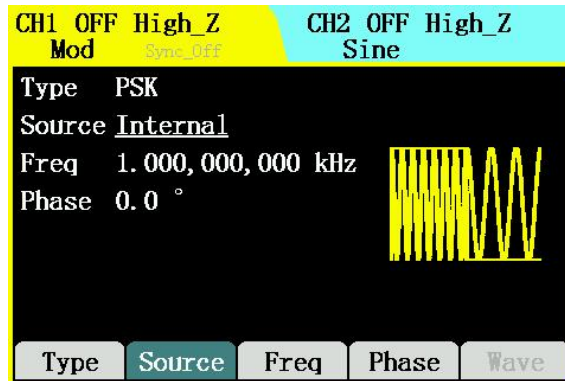
Figure 2-26 PSK Waveform Parameter Value Setup Interface

Table 2-17 PSK Parameter Setup Menu Description

Functional menu	Setup	Description
Types	PSK	Select PSK
Signal source	Internal/external	Select internal modulation/external modulation
Internal modulation	Frequency	Set modulation wave frequency (2mHz~1MHz)
	Modulation phase	The modulating signal of internal modulation is a 50% duty cycle square wave. Set modulation phase range
External modulation	Modulation phase	When the external modulation is selected, the modulation signal is input by the [Sync/FSK/Counter] on the front panel. Only Modulation phase parameters need

Note:

Modulation amplitude refers to the difference between carrier amplitude and modulation amplitude.

Therefore, the minimum modulation amplitude is 0, and the maximum is the carrier amplitude.

During external modulation, the multiplexing port needs to be set as digital input in the utility, and the corresponding status will display "Sync_Off ", indicating that the multiplexing port synchronous output is closed, which is the digital signal input status.

The range of input amplitude is 2V ~ 20vpp, and DC coupling or AC coupling can be selected.

When the multiplexing port is synchronous output "Sync_On", the level of input over 5V will be forced to switch to signal input "Sync_Off".

2.3 Frequency Sweep Waveform Setup

In frequency sweep mode, the instrument outputs variously from the start frequency to the stop frequency in specified time. Sweep waveform can be produced with sine, square, ramp, pulse, or arbitrary waveforms (noise and DC are not allowed to be scanned).

Press Sweep , and the system will display the operation menu as shown in Figure 2-27. Set the output waveform parameters of the sweep wave by operating the sweep menu.
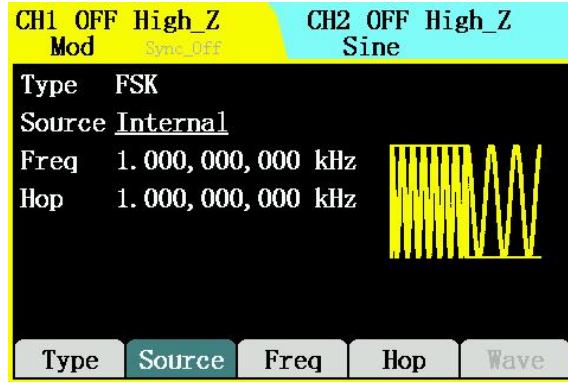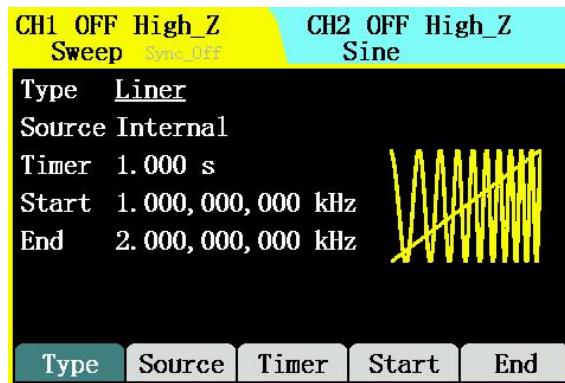

Figure 2-27 Sweep Mode Parameter Value Setup Interface

Table 2-18 Sweep Parameter Setup Menu Description

Functional menu	Setup	Description
Types	Linearity/Logarithm	Select sweep mode of linearity or logarithm sweep
Signal source	Internal/external/manual	Select Trigger Source Internal: select internal trigger source External: select external trigger source with [Sync/FSK/Counter] connector on front-panel Manual: select manual trigger, and each time you press Trig, a sweep will start, and a continuous press of the key will trigger the signal generator once again.
Time	— —	Set the number of seconds needed from the start frequency to the stop frequency
Start	—	Set the start frequency
Stop	—	Set the stop frequency

Note:

- To sweep up in frequency, set the start frequency < the stop frequency

- To sweep down in frequency, set the start frequency > the stop frequency

- In manual trigger mode, switch of Channel 1 (major channel) should be in the open state.

2.4 Burst Waveform Setup

Burst key can provide users with burst output of various waveform function, and it can output waveforms of specific number (N-cycle burst) continuously; when applying to external gate signal (gated burst), any wave function (except noise and DC) can be used.

Press [Burst] to set the output waveform parameters in burst mode by operating the burst operation menu.

Set N-cycle burst

Press [Burst] → Type→ N-cycle and enter the interface as shown in Figure 2-28.
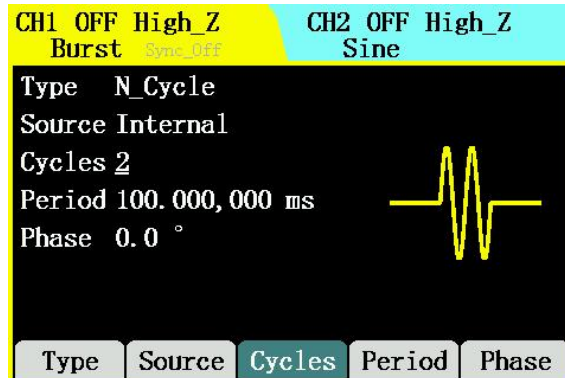
Figure 2-28 N-cycle Burst Setup Interface

Table 2-19 N-cycle Burst Parameter Setup Menu Description

Functional	Setup	Description
Types	N-cycle/infinite/gated	Select burst output type: N-cycle
Signal source	Internal/external/manual	Select Trigger Source Internal: select internal trigger source External: select external trigger source, use [Sync/FSK/Counter] connector on front-panel Manual: select manual trigger, and each time you press Trig, a burst will be output, and a continuous press of the key will trigger the signal generator once again.

Cycle number	——	Set the cycle number of each N-cycle burst
Period	——	Set the burst period
Phase	——	Set the burst initial phase

Cycle number

Set the output cycle number of each N-cycle burst string (1 - 65535). If necessary, the burst period will increase to adapt the specified number of cycles.

Phase

Define the start and stop points of the burst. The phase can be set from 0 to 360°, with default of 0°. For arbitrary waveforms, 0° is the first waveform point.

Period

Set time from the start of an N-cycle burst to the start of next burst. If necessary, the burst period will increase to allow a specified number of cycles of each burst.

Period > single waveform period × the number of burst

Set infinite burst

Press $\boxed{\text{Burst}}$→ Type→ Infinite and enter the interface as shown in Figure 2-29.
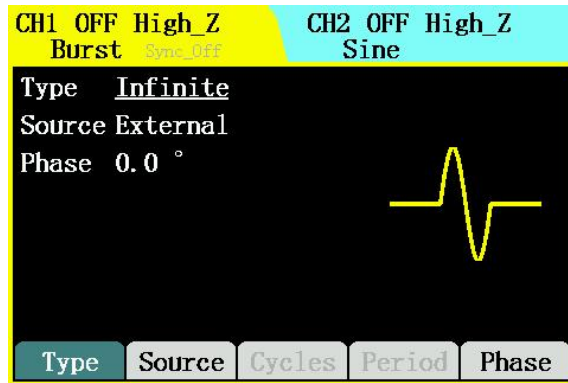
Figure 2-29 Infinite Burst Setup Interface

Table 2-20 Infinite Burst Parameter Setup Menu Description

Functional menu	Setup	Description
Types	N-cycle/infinite/gated	Select burst output type: infinite
Signal source	External/manual operating	Select Trigger Source: External: select external trigger source, use [Sync/FSK/Counter] connector on front-panel Manual: select manual trigger, and each time you press Trig, a burst will output, and a continuous press of the key will trigger the signal generator once again.
Phase	——	Set the burst initial phase

Set gated burst

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Press $\boxed{\text{Burst}}$→ Type→ Gated and enter the interface as shown in Figure 2-30.
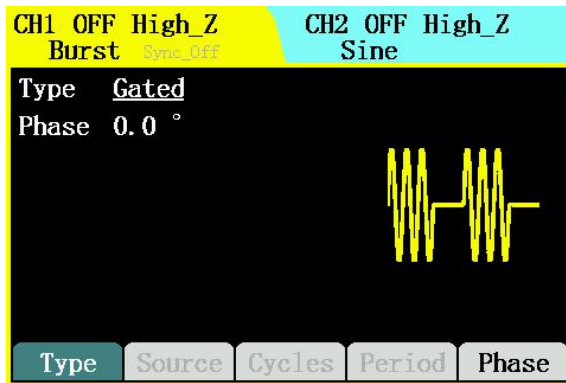
Figure 2-30 Gated Burst Setup Interface

Table 2-21 Gated Burst Parameter Setup Menu Description

Functional	Setup	Description
Types	N-cycle/infinite/gate	Select burst string output type: Gated
Phase	—	Set the burst initial phase

Gated Burst use [Sync/FSK/Counter] connector on front-panel.

2.5 Sync Output

The synchronous output provides the synchronous output of the major channel, and all standard functions (except DC and noise) have a related sync signal. The major channel defaults to CH1.

The output sync signal terminal is the front panel [Sync/FSK/Counter] connector. Before use, you need to set the direction to sync output in the reuse port of the utility. "Sync_On" will be displayed under the corresponding main channel Title interface. When the multiplexing port is synchronous output "Sync_On", the level of input over 5V will be forced to switch to signal input "Sync_Off".

When sine wave and triangle wave are outputted, the sync signal is square wave with 50% duty cycle. When waveform output is positive, relative to 0V voltage (or DC offset), and the sync signal is TTL high-level.

When square wave and pulse wave are outputted, the duty cycle of sync signal is same as that of the waveform. When waveform output is positive, relative to 0V voltage (or DC offset), and the sync signal is TTL high-level.

For arbitrary wave,the sync signal is square waves of 50% duty cycle.

For internal modulated AM, FM and PM, the sync signal takes modulation waves (not carrier) as references, and the sync signal is square waves of 50% duty cycle. During the first half modulation waveform period, the sync signal is a TTL High-level.

For external modulated AM, FM and PM, the sync signal takes carriers (not modulation wave) as references, and the sync signal is square waves of 50% duty cycle.

For ASK, the sync signal takes the modulation amplitude as a reference, and the sync signal is square waves of 50% duty cycle. For the modulation amplitude, at the time of conversion, the sync signal is a TTL high-level.

For FSK, the sync signal takes the hop frequency as a reference, and the sync signal is square waves of 50% duty cycle. For the hop frequency, at the time of conversion, the sync signal is a TTL high-level.

For PSK, the sync signal takes the modulation phase as a reference, and the sync signal is square waves of 50% duty cycle. For the modulation phase, at the time of conversion, the sync signal is a TTL high-level.

For internal sweep waveform,the sync signal is square waves of 50% duty cycle.

2.6 Frequency Meter

Frequency meter adopts single-channel frequency measurement, with measurable signal range of 1Hz - 100MHz.

Press [Counter] to enter the interface shown below, and the frequency values measured is shown in the central screen. The external signal is input by the [Sync/FSK/Counter] interface on the front panel.

Set frequency meter function

Press [Counter]→ Func set frequency meter as shown in Figure 2-31.
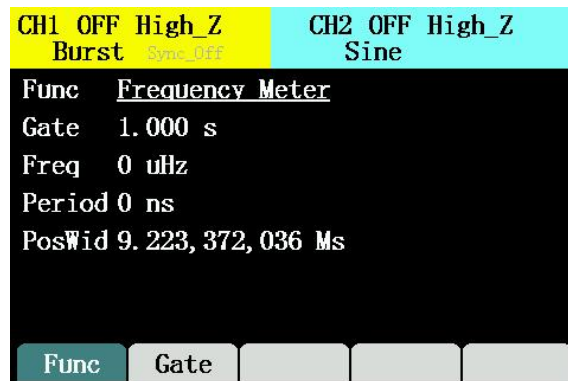
Figure 2-31 Frequency Meter Interface

Table 2-22 Frequency Meter Setup Menu Description

Functional menu	Setup	Description
Func	Frequency Meter /Counter	Choose the function of Frequency Meter or Counter
Gate	——	Set gate time ,0.01s~10s。
Freq	——	Show the frequency,with measurable signal

		range of 1Hz - 100MHz
Period	——	Show the period.
PosWid	——	Show positive pulse width.

Note:

When there is an external frequency signal input, the screen value will refresh regularly; if the external frequency signal is disconnected, the refresh stops, and the screen retains the last frequency value.

Set Counter function

Press [Counter] → Func set frequency meter as shown in Figure 2-32.
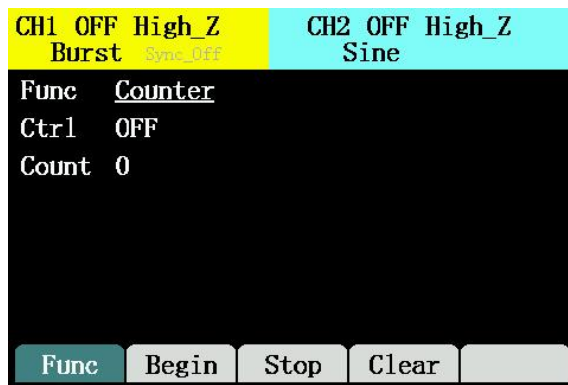
Figure 2-32 Counter Interface

Table 2-23 Counter Setup Menu Description

Functional menu	Setup	Description
Func	Frequency Meter /Counter	Choose the function of Frequency Meter or Counter
Begin	——	Press "Begin",display ON,counter begins to count.
Stop	——	Press "Stop",display OFF,counter stops.
Clear	——	Press "Clear",counter clears.

2.7 Assist System Function Setup

Press [Utility] to set the channel output parameters,multiplexing port settings,system configuration information, file storage, check interface information, perform machine calibration and system upgrades, and inspect system information.
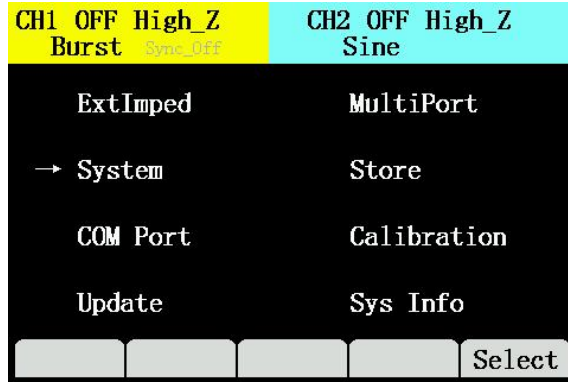
Figure 2-33 Assist System Function Setup Interface

● Channel output parameters include load/impedance setup of Channel 1 and Channel 2

● System setup provides buzzer switch, Chinese-English switch and screen brightness;

● File storage can store and read the state files inside the function signal generator, and also support the creating and deleting operations to the state and data files on the USB storage device;

● Interface information provides USB Device and RS232 interface information inquiries;

● Calibration provides the amplitude and offset calibration of the machine itself;

● System upgrades include front panel upgrade, communication module upgrade and FPGA procedure upgrade;

● System information can inquire some basic information about the machine.

2.7.1 Channel 1/2 output parameter setup

Output impedance of Channel 1 and Channel 2 are set independently, which can be set as load/impedance.

Press [Utility] → ExtImped enter impedance setup interface,as shown in Figure 2-34.

Figure   2-34 Output impedance

Press CH1,switch 50 Ω   or High_Z of channel 1;

Press CH2,switch 50Ω or High_Z of channel 2;

Table 2-24 Output impedance Menu Description

Functional menu	Setup	Description
CH1	50Ω/High_Z	According to the actual connected load, set the output impedance of channel 1 as 50Ω or High_Z.
CH2	50Ω/High_Z	According to the actual connected load, set the output impedance of channel 2 as 50Ω or High_Z.

Note：

The output impedance of the instrument channel itself is always 50Ω. The impedance of the external load is set here. It needs to be set according to the actual load connected.

2.7.2 Multiplex port

Press [Utility] → Multiport,enter the interface of multiplex port setting.

Digit input setting

The multiplexing port is set as digital input for external signal source input of ASK, FSK and PSK, external signal source input of Sweep and Burst, and signal source of frequency meter / counter. As shown in Figure 2-35.
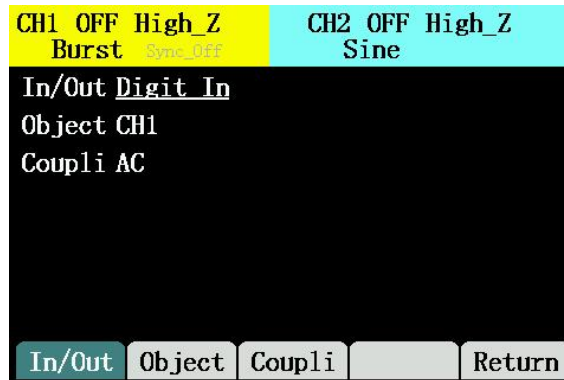
Figure 2-35 multiplex port interface input setting

Table 2-25 Digital input setting Menu Description

Functional menu	Setup	Description
In/Out	Digit In/Sync Out	Set the direction of multiplex port.
Object	CH1/CH2	Set the relationship of the channel. The major channel has the function of multiplexing port, while another channel can only output basic waveform.
Coupling	AC/DC	Coupling mode of input.

Sync Output Setting

Figure 2-36 multiplex port interface output setting

Table 2-26 Digital input setting Menu Description

Functional menu	Setup	Description
In/Out	Digit In/Sync Out	Set the direction of multiplex port.
Object	CH1/CH2	Set the relationship of the channel. The major channel has the function of multiplexing port, while another channel can only output basic waveform.

Note：

This setting will not be saved if reset, and it will be restored to digital input in case of power failure and restart. CH1 is the major channel with AC coupling.

2.7.3 System setup

Press [Utility]→ System → Select and enter the following interface.
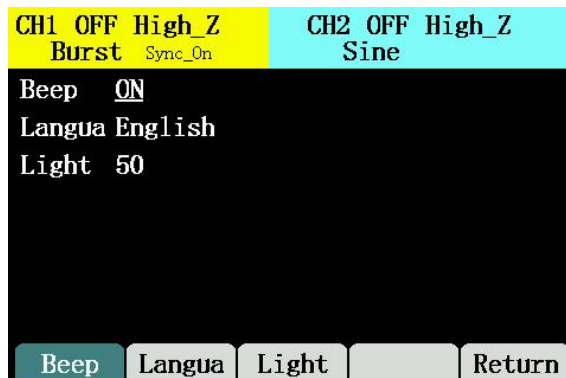
Figure 2-37 System Setup Interface

Table 2-27   System Setup Menu

Functional	Setup	Description
Buzzer	ON/OFF	Set switch of buzzer.

Language	中文/English	Set the display language.
Light	——	Set the screen brightness,1~100.

Select Language

"40M type" is equipped with a user interface in both Chinese and English for users to choose.

To select the language displayed by the OS, [Utility] → System → Language and adjust language types in screen operation.

2.7.4 File storage

Press [Utility] → File Storage → Select, the screen displays file storage interface as shown below, by which you can store and read the state files inside the function signal generator, and also support creating and deleting operations to the state and data files on the USB storage device. The file name support only capital English letters and numeric input.
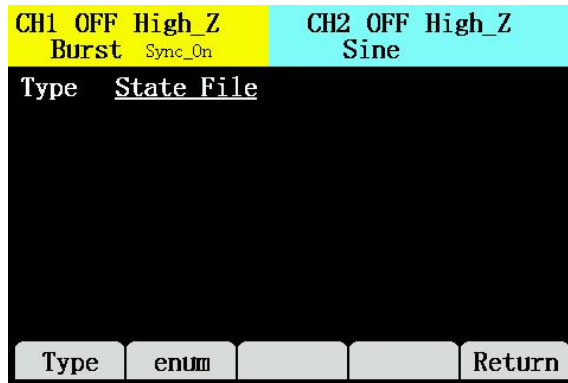
Figure 2-38 File Storage Interface

Table 2-28 File Storage Menu

Functional menu	Setup	Description
Types	State/Arb Files	Set the file types needed to be operated State File: Instrument state files Arb File: Arbitrary wave files
Contents	—	Enter Contents interface
Return	—	Back to the previous interface

Storage Instrument State

Users can store the instrument state at any one of the 100 non-volatile storage locations. The state storage feature "remembers" the selected function (including arbitrary waveform), frequency, amplitude, offset voltage, duty cycle, symmetry, phase and any other modulation parameters used.

Specific operations of instrument state storage are as follows:

1. Select the state file type, press type → state → contents and enter the instrument state storage interface.

2. Select the file storage location. There are 100 local storage locations state1: state2: ... state100:

and select any storage location in the knobs.

3. Press Store to name and save the file. After input is completed, press Finish, and the file is stored.
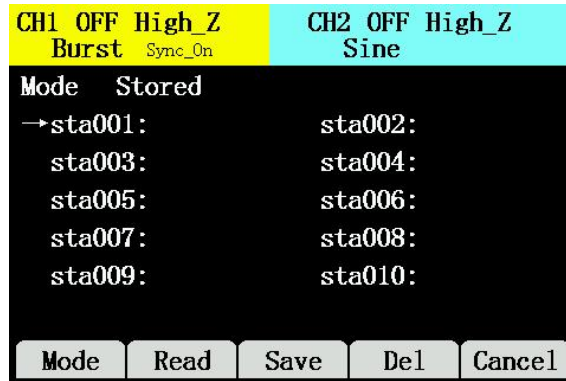
Figure 2-39 Instrument State Storage Interface

Arb Data Files Storage

Users can store the Arb data file at any one of the 50 non-volatile storage locations. There already exists data file at the currently selected location, and then the new data file will overwrite the old ones.

Specific operations for Arb data files storage are as follows:

1. Select arb File Type, press Type → arb → Contents, and enter the arb file storage interface.

2 Select the file storage location. There are 50 local storage locations arb1: arb2: ... arb50: and select any storage location in knobs.

3. Press Read to get the file.
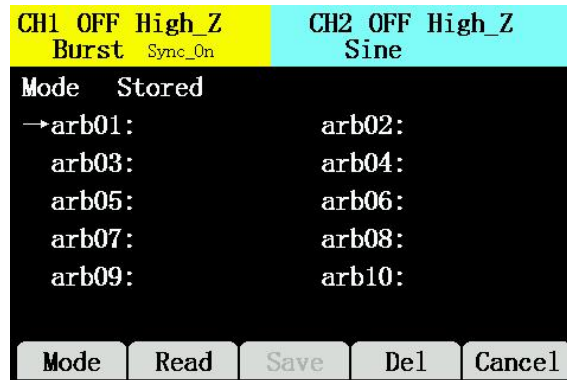
Figure 2-40 Arb Data Storage Interface

U-disk storage usage

As shown in the figure, the interface mode is divided into local and U disk. The left side of the front panel is equipped with a USB interface, when the USB storage is inserted, the upper right corner of the interface will show ⬢.

1. Install the Removable Storage

Insert the removable storage into the USB interface on the front panel, and the upper right corner of the screen will display ⬢ to prompt that the system detects a U-disk.

2. Select U-disk Storage

Select the file type as State File or Arb File, and press Contents to enter the contents interface. Press Mode→ U-disk storage → Store, confirm after input the name of the file, and you can store the file in the U-disk.

3.Eject the U-disk

In the file storage interface, if there is currently insert U-disk, there will be Ejection option and press the Ejection key to eject the U-disk. After the U-disk ejected, the ⌒ pattern disappears.
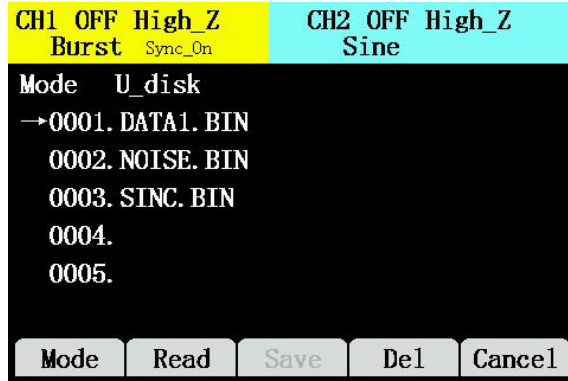
Figure 2-41 USB Storage Usage

Note: If not remove USB Safely,USB data may fail to store.

File name Input

The file name input supports only English characters, and in U-disk storage, the input characters will be automatically converted to capital letters. Specific interface is shown in Figure 2-42.

Figure 2-42 File Name Input

1. Use the knob to adjust the left and right positions of the input keyboard cursor, when the letter is selected, press the Select key to input the desired file name;

2. When editing an wrong file name, use the left and right keys to move the cursor to select the wrong letters you want to delete, press the Delete soft key to delete and re-edit the file name to be input;

3. Select Done ending the file name inputting.

2.7.5 Interface

Press [Utility] → Interface → Select, enter the interface shown below to check the basic information of USB interface and RS232 interface.
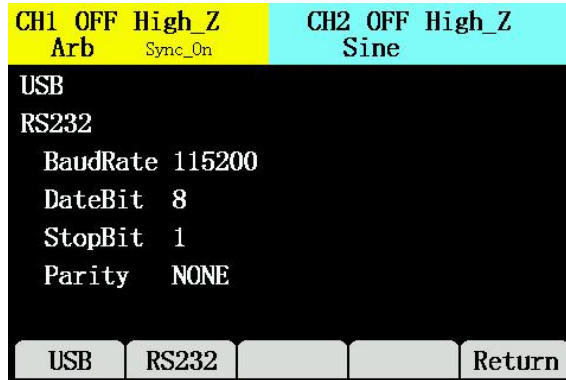
Figure   2-43 Interface Information

2.7.6 Calibration

Signal generator has been calibrated when leaving the factory. We do not recommend users to calibrate individually. Contact the local dealer for calibration services.

2.7.7 System upgrade

System upgrade contains two modules: data picture font module and software module.
Insert USB to upgrade, and relevant upgrade package is required.
After the upgrade is finished, please restart the device to complete the upgrade
Note:
Be cautious to upgrade the system, please download from the company's official website or contact local dealer if you need upgrade file package.

2.7.8 System information

System information includes the serial number of the machine and version number of the software and hardware.

2.8 Help

These series function signal generator has a built-in help system to provide related help for some common operations, and users can use a list of help topics to get operational guidelines about some of the keys on the front panel.

Press the Help key to enter the built-in help menu. Select the help information need to be read; press Select to read the corresponding help information.

1. How to produce basic waveforms

Take Channel 1 output sine as an example:

1) Press the Sine key to enter the Sine editing interface

2) Use the reusable keys to select the parameter to change

3) Data can be modified by the knobs or numeric keys

4) Press the Channel 1 Output key to output waveforms

2. How to generate modulation signal

Take the carrier and sine as an example:

1) Enter the Sine wave editing interface to edit the waveform

2) Press the Mod key to enter the modulation interface to edit parameters

3) Press the Channel 1 Output key to output

4) To change carrier data, press the carrier key to enter the carrier interface for editing

3. How to set the output impedance

Examine how to set up the device output impedance of channel 1 and channel 2.

4. Create arbitrary waveforms

1) Press Arb to enter arbitrary waveform editing interface

2) Select Wave to enter the waveform operating interface

3) Select Create to enter arbitrary waveform creation interface

4) Create basic information of arbitrary waveforms

5) Select Point Edit to enter the point editing interface

6) Edit voltage value point by point, preserve after finishing

7) Output preserved arbitrary waveform

5. How to get help

Check how to get help.

6. Technical support

For technical support, please contact the local dealer.

2.9 Telecommunication

"40M type" supports standard USB or RS232 interface to communication with the computer to realize arbitrary waveform downloading.

When the instrument is working in remote mode, there is an icon $\boxed{\text{LOCK}}$ on the upper right corner of the user interface, and the front panel keys are locked. Here, you can return to the local operating mode by pressing the $\boxed{\text{Help}}$ key.

2.9.1 Establishment of communication between instrument and the PC

Using USB to connect PC requires CH340 driver.

Connect the PC with standard RS232 cable

RS232 interface is shown below.
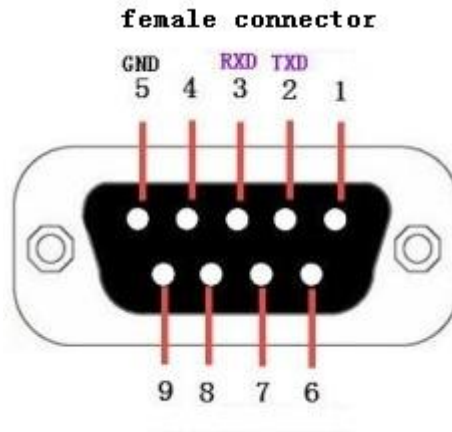
图 2-41　RS232 (hole)

Both USB and RS232 are UART serial ports.

Interface parameters configuration:

- Baud rate: 115200

- Data bits: 8

- Stop bit: 1

- Parity bit: NONE

Note：

Do not use USB and RS232 interface at the same time.

3. Product Technical Indicators

Unless specified otherwise, all technical specifications apply to the Series two-channel function/arbitrary waveform generators. Signal generator must meet the following requirements at first to meet these specification standards:

● The instrument must work continuously in a specified operating temperature (18 ℃ - 28 ℃) for more than 30 minutes.

● All technical specifications can be met at a temperature change of less than 5 ℃.

3.1 Technical Specifications

Frequency Characteristics				
MODEL	15M type	25M type	40M type	60M type
Sine	1μHz ~ 15MHz	1μHz ~ 25MHz	1μHz ~ 40MHz	1μHz ~ 60MHz
Square	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz
Triangle	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz	1μHz ~ 15MHz
Pulse	100μHz ~ 6MHz	100μHz ~ 6MHz	100μHz ~ 6MHz	100μHz ~ 6MHz
Arbitrary	1μHz ~ 6MHz	1μHz ~ 6MHz	1μHz ~ 6MHz	1μHz ~ 6MHz
Noise （-3dB）	7MHz Bandwidth			
Frequency Resolution	1μHz			
Frequency Accuracy	±5ppm			
Frequency Stability	±1ppm/3hour			
Frequency Characteristics				
Waveform Types	Sine, square, triangle, pulse, noise and arbitrary waves (including DC). There are 32 kinds of arbitrary waves and 50 kinds of user-defined waves.			
Waveform Length	8192 points			
Waveform Sampling Rate	200 MSa/s			
Waveform Vertical Resolution	13 bits			
Sine Wave Characteristics				
Sine Wave	Harmonic Distortion	≥45dBc(<1MHz); ≥40dBc(1MHz~20MHz)		
	Total Harmonic Distortion	<0.8%(20Hz ~ 20kHz, 0dBm)		
Square Wave Signal Characteristics				

Square Wave	Rise/Fall	<20ns
	Overshoot	<5%
	Duty Cycle	freq<100kHz: 1%~99%; 100kHz≤freq<5MHz: 20% ~ 80%; 5MHz≤freq: 40% ~ 60%(0.1% resolution)

Pulse Wave Characteristics

Pulse Wave	Pulse Width	Min 20ns; 1ns resolution
	Edge Transition Time	Min 20ns;
	Overshoot	<5%
	Jitter	6ns+0.1% Period

Ramp Wave Characteristics

Ramp Wave	Linearity Degree	≥98%(0.01Hz~10kHz)
	Symmetry	0.0 ~ 100.0%(resolution 0.1%)

Output Characteristics

Amplitude			
Amplitude Range	freq＜10MHz	10MHz≤freq＜30MHz	30MHz≤freq
	2mVpp ~ 20Vpp	2mVpp ~10Vpp	2mVpp ~5Vpp
Amplitude Resolution	1mV		
Amplitude Stability	±1% set value±1mVpp（1kHz Sine，0 offset，>10mVpp）		
Amplitude Flatness (relative to 1K Sine, 1 Vpp)	±0.4dB ＜10MHz ; ±1.0dB ≥10MHz。		
Output Impedance	50Ω±10%（Typical）		
Protection	All the signal output terminal can be shorted within 60s		

DC Offset

	Output Amplitude>0.1V	2mV<Output Amplitude≤0.1V
Offset Adjusting Range	±10Vpk，ac + dc	±0.250Vpk，ac + dc
Offset Resolution	1mV	

Phase characteristics

Phase Adjusting Range	0~359.9°
Phase Resolution	0.1°

External Measurement Function

Frequency Meter	Frequency measurement range	1Hz ~ 100MHz
	Measurement accuracy	Gate time continuously adjusted between0.01s~10s
Counter Function	Counting region	0 ~ 4294967295
	Control mode	Manual operation

Input Signal Voltage Range	2Vpp~20Vpp
Coupled Mode	AC or DC
Pulse Width Measurement	1ns (resolution), 20s (MAX measuring time)
Period Measurement	1ns (resolution), 20s (MAX measuring time)
SYNC Output	
Output Channel	CH1 or CH2, default CH1
Level	TTL
Impedance	50 Ω
Rise/Fall Time	< 25ns
Maximum Frequency	25MHz
AM Modulation	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	Sine, square, triangle and ramp
Modulation Frequency	2mHz~20kHz
Modulation Depth	0%~120%
FM Modulation	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	Sine, square, triangle and ramp
Modulation Frequency	2mHz~20kHz
Frequency Offset	0~Maximum carrier frequency
PM Modulation	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	Sine, square, triangle and ramp
Modulation Frequency	2mHz~20kHz
Phase Offset	0° ~ 360°
ASK Modulation	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	Square wave of 50% duty ratio

Keying Frequency	2mHz~1MHz
Modulation Amplitude	0~Carrier Amplitude
FSK Modulation	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	Square wave of 50% duty ratio
Keying Frequency	2mHz~1MHz
Hop Frequency	Carrier frequency range
PSK Modulation	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Source	Internal/External
Modulation Wave	Square wave of 50% duty ratio
Keying Frequency	2mHz~1MHz
Modulation Phase	0° ~ 360°
Frequency Sweep	
Output Channel	CH1 or CH2, default CH1
Types	Linearity/Logarithm
Sweep Frequency Time	1ms ~ 500.000s
Start/Stop Frequency	1μHz~Maximum carrier frequency
Sweep Direction	Forward, Backward
Trigger Source	Manual operating, internal, external
Burst Characteristics	
Output Channel	CH1 or CH2, default CH1
Carrier Wave	Sine, square, ramp, pulse and arbitrary waveforms (excluding DC)
Pulse Count	1~65535 or infinite, gated
Start/Stop Phase	0~360°
Internal Period	1μs~500s
Gating Source	External
Trigger Source	Internal, external, manual operating
Trigger Input	
Signal Range	2Vpp~20Vpp
Coupling	AC or DC
Pulse Width	>100ns
Reaction Time	<500ns（Burst）
	<10μs（Sweep）
Modulation Input	
Impedance	1MΩ

Signal range	±2.5V ac+dc

3.2 General Technical Specifications

Power Supply	
Supply Voltage	220V±10%，45~65Hz，Or Optional 110V±10%，45~65Hz
Power Consumption	<15W
Display	
Types	3.5-inch TFT LCD screen
Resolution	480×320
Color	16M color
Environment	
Temperature Range	Operation: 10℃~+40℃ Non-operation: -10℃~+60℃
Cooling Methods	Natural cooling
Humidity Range	Below +35℃: ≤90％ relative humidity +35℃ ~ +40℃: ≤60％ relative humidity
Interface	RS232,USB Device;USB Host(Optional)

4. Appendices

Appendix A: Accessories

Standard accessories:

- 1 piece of 30A51 three-wire power line;
- 1 piece of 33A52 BNC coaxial cable;
- 1 CD-ROM

Optional accessories:

- BNC alligator clip line (33P01);

- Cabinet installation suit (32P02);

- RS232 serial line (32P04);

- USB data line (32P05).

Appendix B: Maintenance and Cleaning

General maintenance

Please do not place the instrument subjected to sunlight exposure for a long time.

Cautions:

Do not make any corrosive liquid stain on the instrument, so as not to damage the instrument.

Cleaning

Clean the instrument regularly based on practice. Specific methods are as follows:

1. Disconnect power

2. Wipe the dust outside of the instrument with a damp but not dripping soft cloth (mild cleaner or water can be used). When cleaning the LCD, be careful not to scratch the transparent LCD protective screen.

Warning:

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