SDG1000X Plus Arbitrary Waveform Generator

Quick Start

EN01B

Copyright Information

Contents

General Safety Summary

Carefully read the following safety precautions to avoid any personal injury or damage to the instrument and any products connected to it. To avoid potential hazards, please use the instrument as specified.

To Avoid Fire or Personal Injure

Use the Proper Power Cord

Only the power cord designed for the instrument and authorized by local government regulations should be used.

Ground the Instrument

The instrument is grounded through the protective earth conductor of the power cord. To avoid electric shock, please make certain the instrument is grounded correctly before connecting its input or output terminals.

Connect the Signal Cable Correctly

The potential of the signal cable ground is equal to the earth ground. Do not connect the signal wire to a high voltage.

Look Over All Terminal Ratings

To avoid fire or electric shock, please look over all ratings and sign instructions of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.
Equipment Maintenance and Service.
In the event of an equipment failure, please do not dismantle the machine for maintenance. The equipment contains capacitors, power supply, transformers and other energy storage devices which may cause high voltage damage. The internal devices of the equipment are sensitive to static electricity and direct contact can easily cause irreparable damage to the equipment. It is necessary to return to the factory or to the company's designated maintenance organization for maintenance. Be sure to pull out the power cord before repairing the equipment. Live line operation is strictly prohibited. The equipment can only be powered on when the maintenance is completed and the maintenance is confirmed to be successful.

Identification of Normal State of Equipment

After the equipment is started, there will be no alarm information and error information at the interface under normal conditions. The curve of the interface will scan from left to right freely; if there is a button in the scanning process or there is alarm or error prompt, the device may be in an abnormal state. You need to view the specific prompt information. You can try to restart the setting. If the fault information is still in place, do not use it for testing. Contact the manufacturer or the maintenance department designated by

the manufacturer to carry out maintenance to avoid the wrong test data caused by the use of the fault or endanger the personal safety.

Do Not Operate with Suspected Failures

If you suspect that there is damage to the instrument, please let only qualified service personnel check it.

Avoid Exposed Circuits, Wire, or Components

Do not touch exposed contacts or components when the power is on.

Do not operate in wet/damp conditions

Do not operate in an explosive atmosphere.

Keep the surface of the instrument clean and dry

Only lithium batteries with the same specification could be used to replace the battery on the main board.

The responsible body or operator should refer to the instruction manual to preserve the protection afforded by the equipment. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Any parts of the device and its accessories are not allowed to be changed or replaced, other than authorized by the manufacturer or agent.

Safety Terms and Symbols

Terms in this manual. Terms may appear in this manual:

⚠ WARNING Warning statements indicate the conditions and behaviors that could result in injury or loss of life.

⚠ CAUTION Caution statements indicate the conditions and behaviors that could result in damage to this product or other properties.

Terms used in this product. These terms may appear in the product:

DANGER	Indicates direct injury or hazards that may happen.
WARNING	Indicates potential injury or hazards that may happen.
CAUTION	Indicates potential damage to the instrument or other property that may happen.

Symbols used in this product. These symbols may appear on the product:

Hazardous Voltage

Warning

Protective Earth Ground

Terminal Ground

Power Switch

Allgemeine Sicherheitsübersicht

Lesen Sie die folgenden Sicherheitshinweise sorgfältig durch, um Verletzungen oder Schäden am Gerät und an den daran angeschlossenen Produkten zu vermeiden. Um mögliche Gefahren zu vermeiden, verwenden Sie das Gerät bitte wie angegeben.

Verwenden Sie ein geeignetes Netzkabel

Verwenden Sie nur das für das Gerät vorgesehene und im jeweiligen Land zugelassene Netzkabel.

Erden Sie das Gerät

Das Gerät ist über den Schutzleiter der Netzleitung geerdet. Um einen elektrischen Schlag zu vermeiden, vergewissern Sie sich bitte, dass das Gerät korrekt geerdet ist, bevor Sie die Eingangs- oder Ausgangsklemmen des Geräts anschließen.

Schließen Sie das Messkabel richtig an

Die Kabelschirmung (Masse) des Messkabels ist gleich dem Potential der Erde, schließen Sie das Messkabel also nicht an eine hohe Spannung an.

Überprüfen Sie die Nennwerte aller Klemmen

Um Feuer oder einen elektrischen Schlag zu vermeiden, beachten Sie bitte alle Angaben und Hinweise auf dem Gerät. Bevor Sie das Gerät anschließen, lesen Sie bitte das Handbuch sorgfältig durch, um weitere Informationen über die Nennwerte zu erhalten.

Verwenden Sie einen ordnungsgemäßen Überspannungsschutz

Stellen Sie sicher, dass keine Überspannung (z. B. durch ein Gewitter) an das Gerät gelangen kann, da sonst die Gefahr eines elektrischen Schlages besteht.

Schutz vor Elektrostatik

Betreiben Sie das Gerät in einer Umgebung, die vor elektrostatischer Entladung geschützt ist, um Schäden durch statische Entladung zu vermeiden. Erden Sie vor dem Anschließen immer sowohl den Innen- als auch den Außenleiter des Kabels, um statische Aufladung abzubauen.

Für gute Belüftung sorgen

Eine unzureichende Belüftung kann zu einem Temperaturanstieg führen, der schließlich das Gerät beschädigt. Sorgen Sie daher für eine gute Belüftung und überprüfen Sie regelmäßig die Ansaugung und den Lüfter.

Vermeiden Sie freiliegende Schaltkreise oder Komponenten

Berühren Sie keine freiliegenden Kontakte oder Bauteile, wenn das Gerät eingeschaltet ist.

Richtige Sicherung verwenden

Verwenden Sie nur die angegebene Sicherung.

Betreiben Sie das Gerät nicht ohne Abdeckungen

Betreiben Sie das Gerät nicht, wenn Abdeckungen oder Verkleidungen entfernt sind.

Betreiben Sie das Gerät nicht bei vermuteten Defekten

Wenn Sie vermuten, dass das Gerät beschädigt ist, lassen Sie es vor dem weiteren Betrieb von qualifiziertem Servicepersonal überprüfen. Jegliche Wartung, Einstellung oder Austausch, insbesondere von Schaltkreisen oder Zubehör, muss von SIGLENT autorisiertem Personal durchgeführt werden.

Nicht in feuchter Umgebung betreiben

Um einen Kurzschluss im Geräteinneren oder einen elektrischen Schlag zu vermeiden, betreiben Sie das Gerät nicht in feuchter Umgebung.

Betreiben Sie das Gerät nicht in explosionsgefährdeten Umgebungen

Um Schäden am Gerät oder Personenschäden zu vermeiden, ist es wichtig, das Gerät nicht in explosionsgefährdeter Umgebung zu betreiben.

Halten Sie die Produktoberflächen sauber und trocken

Um den Einfluss von Staub und/oder Feuchtigkeit in der Luft zu vermeiden, halten Sie die Oberfläche des Geräts bitte sauber und trocken.

Sicherheit bei der Handhabung

Bitte behandeln Sie das Gerät während des Transports vorsichtig, um Schäden an Tasten, Drehknopfschnittstellen und anderen Teilen auf den Bedienfeldern zu vermeiden.

Es dürfen nur Tastköpfe verwendet werden, die den Spezifikationen des Herstellers entsprechen

Bei Verwendung von 2X/.../10000X-Sondenbaugruppen müssen die Sondenbaugruppen durch eine doppelte oder verstärkte Isolierung von den gemessenen Stromkreisen isoliert sein.

Alle Sondenbaugruppen sollten die Anforderungen von UL 61010-031 und CAN/CSA-C22.2 Nr. 61010-031-07 erfüllen.

Das Gerät darf nicht so positioniert werden, dass es schwierig ist, die Trennvorrichtung (abnehmbarer Stecker) zu bedienen.

Wenn das Gerät auf eine Weise verwendet wird, die nicht vom Hersteller angegeben ist, kann der Schutz, den das Gerät bietet, beeinträchtigt warden.

Sicherheitsbegriffe und Symbole

Begriffe in diesem Handbuch. Diese Begriffe können in diesem Handbuch vorkommen:

⚠WARNUNG	Warnhinweise weisen auf Bedingungen oder Praktiken hin, die zu Verletzungen oder zum Verlust des Lebens führen können.
⚠ VORSICHT	Vorsichtshinweise weisen auf Bedingungen oder Praktiken hin, die zu Schäden an diesem Produkt oder anderen Gegenständen führen können.

Begriffe auf dem Produkt. Diese Begriffe können auf dem Produkt erscheinen:

GEFAHR	Weist auf direkte Verletzungen oder Gefahren hin, die auftreten können.
WARNUNG	Weist auf mögliche Verletzungen oder Gefährdungen hin, die auftreten können.
VORSICHT	Weist auf mögliche Schäden am Gerät oder an anderen Gegenständen hin, die eintreten können.

Symbole auf dem Produkt. Diese Symbole können auf dem Produkt erscheinen:

Hazardous Voltage

Warning

Protective Earth Ground

Terminal Ground

Power Switch

Wenn Sie solche Symbole auf dem Produkt finden, ziehen Sie das Handbuch zu Rate, um die Art der potenziellen Gefahr und die zu ergreifenden Maßnahmen zu erfahren

General Care and Cleaning

Care:

Do not store or leave the instrument in direct sunshine for extended periods.

To avoid damage to the instrument or probes, please do not expose them to fog, liquid, or solvents.

Cleaning:

Please perform the following steps to clean the instrument and probes.

1. Disconnect the instrument from all power sources and then clean it with a soft damp cloth.
2. Clean the loose dust on the outside of the instrument and probe with a soft cloth.

To avoid damage to the surface of the instrument and probe, please do not use any corrosive liquid or chemical cleansers.

Make sure that the instrument is completely dry before restarting it to avoid potential short circuits or personal injury.

General Inspection

- **Inspect the shipping container**

Keep the original shipping container and cushioning material until the contents of the shipment have been completely checked and the instrument has passed both electrical and mechanical tests.

The consigner or carrier will be responsible for damages to the instrument resulting from shipment.

SIGLENT will not provide free maintenance or replacement if the instrument has been damaged in shipment.

- **Inspect the instrument**

If there are instruments found damaged, defective, or have failed any electrical and / or mechanical tests, please contact SIGLENT.

- **Check the accessories**

Please check the accessories according to the packing list. If the accessories are incomplete or damaged, please contact your SIGLENT sales representative.

First steps

Delivery Checklist

First, verify that all items listed on the packing list have been delivered. If you note any omissions or damage, please contact your nearest **SIGLENT** customer service center or distributor as soon as possible. If you fail to contact us immediately in case of omission or damage, we will not be responsible for replacement.

Quality Assurance

The instrument has a 3-year warranty (1-year warranty for probe attachments) from the date of shipment, during normal use and operation. **SIGLENT** can repair or replace any product that is returned to the authorized service center during the warranty period. We must first examine the product to make sure that the defect is caused by the process or material, not by abuse, negligence, accident, abnormal conditions or operation.

SIGLENT shall not be responsible for any defect, damage, or failure caused by any of the following:

a) Attempted repairs or installations by personnel other than **SIGLENT**.

b) Connection to incompatible devices/incorrect connection.

c) For any damage or malfunction caused by the use of non-**SIGLENT** supplies. Furthermore, **SIGLENT** shall not be obligated to service a product that has been modified. Spare, replacement parts, and repairs have a 90-day warranty.

The instrument's firmware has been thoroughly tested and is presumed to be functional. Nevertheless, it is supplied without warranty of any kind covering detailed performance. Products not made by **SIGLENT** are covered solely by the warranty of the original equipment manufacturer.

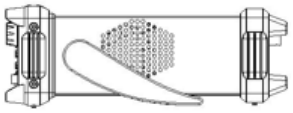
Maintenance Agreement

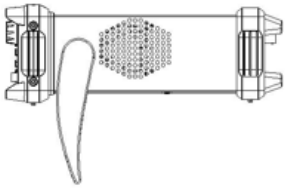
We provide various services on the basis of maintenance agreements. We offer extended warranties as well as installation, training, enhancement and on-site maintenance and other services through specialized supplementary support agreements. For details, please consult your local SIGLENT customer service center or distributor.

Preparation before Use

Adjust the Supporting Legs

Adjust the supporting legs properly to use them as stands to tilt the instrument upwards for stable placement as well as easier operation and observation of the instrument.





Horizontal Position

Carrying Position

Adjust the Handle

Connecting to Power Supply

The standard power supply for the instrument is 100~240 V, 50/60 Hz. Please use the power cord provided with the instrument to connect it to AC power.

Panel Introduction

The Front Panel

1. Power Key

This key is used to turn on/off the AWG. When the power key is off, the AWG is in the power off state.

2. USB Host

SDG1000X Plus supports U-Disk using FAT format. It's used to read waveforms or state files from a U-Disk or store the current state of the instrument to the U-Disk. Users can update the firmware through U-Disk.

3. Numeric Keyboard

Consists of numbers from 0 to 9, radix points "." and symbol keys "+/−", which are used to input parameters.

Note: To enter a negative number, you need to enter a symbol "−" at first.

4. Knob

It is used to increase (clockwise) or decrease (counterclockwise) the current numerical value when setting parameters.

It is also used to switch characters in the soft keyboard when inputting a file name.

When saving or reading files, rotate the knob to choose a position to save a file or choose a file to be read; press the knob to open a selected folder or file.

When choosing Waveforms → Page 1/2 → Arb → Arb Type → Built-in rotate the knob to select a desired built-in or stored waveform.

Long press the knob to take a screenshot and save it to a local directory or USB drive.

5. Arrow Keys

When using the knob to set parameters, the arrow keys can be used to select the digit to be modified.

When using the numeric keyboard to set parameters, the left arrow key is used as a Backspace function.

When inputting a file name, they are used to move the position of the cursor.

6. Channel Control Area

CH1 Control/Output Key

The Output key on the left is used to turn on/off the CH1 output.

The nominal output impedance of the BNC connector is 50Ω.

When pressing Output (the key backlight turns on), the connector outputs the waveform according to the current configuration of CH1.

CH2 Control/Output Key

The Output key on the right is used to turn on/off the CH2 output.

The nominal output impedance of the BNC connector is 50Ω.

When pressing Output (the key backlight turns on), the connector outputs the waveform according to the current configuration of CH2.

⚠ CAUTION

Overvolltage 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 and the DC offset is lower than |2VDC|.

Choose Utility → Page 1/3 → OverVoltage Protection to turn on/off the function.

7. Channel Select Key

This key is used to switch the current selected channel between CH1 and CH2.

The Rear Panel

1. Counter

BNC connector. The input impedance is 1MΩ. This connector is used to accept the signal measured by the frequency counter

2. Aux In/Out

BNC connector. The function of this connector is determined by the current operating mode of the instrument.

- Sweep/Burst trigger signal input port of external trigger.
- Sweep/Burst trigger signal output port of internal/manual trigger.
- Burst gating trigger input port.
- ASK/FSK external modulation signal input port.
- Synchronization output port. When 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).
- AM, DSB-AM, FM, PM and PWM external modulation signal input port.

3. 10 MHz Clock Input Port

BNC connector. The instrument uses external clock source, the connector accepts an external 10MHz clock source.

4. Earth Terminal

Used to ground the instrument.

5. AC Power Supply Input

SDG1000X Plus can accept two different types of AC input power.

AC power: 100-240V, 50/60Hz or 100-120V, 400Hz.

Fuse: 1.25A, 250V.

6. 10 MHz Output Port

BNC connector. The instrument uses internal clock source, the connector outputs the 10MHz clock signal generated by the crystal oscillator inside the generator.

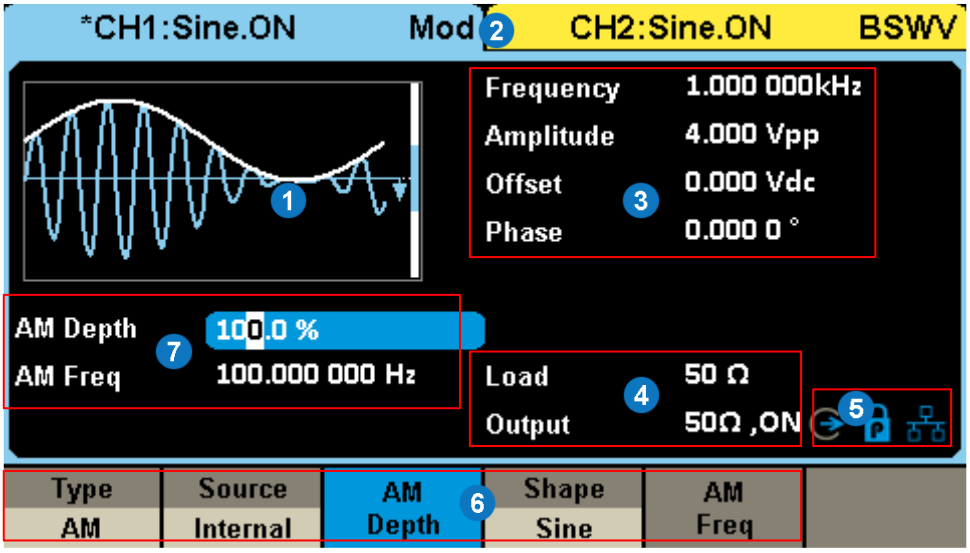
7. USB Device

Used when connecting the instrument to an external computer to allow waveform editing (such as EasyWaveX) and remote control.

8. LAN Interface

Through this interface, the generator can be connected to your computer or network for remote control. An integrated testing system may be built, as the generator conforms to the VXI-11 class standard of LAN-based instrument control.

User Interface



1. Waveform Display Area

Displays the currently selected waveform of each channel.

2. Channel Status Bar

Indicates the selected status and output configuration of the channels.

3. Basic Waveform Parameters Area

Shows the current waveform's parameters of each channel. Press Parameter and select the corresponding softkey to highlight the parameter to configure. Then use number keys or knob to change the parameter value.

4. Channel Parameters Area

Displays the load and output settings of the currently selected channel.

5. Prompt

From left to right are the clock source prompt, phase mode prompt, and LAN connection status prompt, respectively.

6. Menu

Display the operation menu corresponding to the currently selected function, and select the corresponding function through the menu soft key.

7. Modulation Parameters Area

Display the parameters of the current channel modulation function.

Basic Operations

This manual provides instructions for the basic operations of the instrument. For more advanced operations, please refer to the User Manual of the product.

Basic Waveform Output

Basic operation instructions: Text with boxes represents the corresponding buttons, such as Waveforms representing Waveforms buttons; The gray background text, such as Sine , indicates the corresponding function in the menu bar. You can use the menu software below it to select the corresponding function.

Using a 10MHz, 2Vpp, 1V offset sine wave as an example, explain the operation method of waveform output.

1. Ch1/Ch2 allows you to switch and select the channel to output the waveform. Each press will switch back and forth between the two channels.
2. Select Waveforms → Sine .
3. Select Frequency , use the number keys to enter 1 0 , and then select MHz .
4. Select amplitude , use the number keys to enter 2 , and then select Vpp .
5. Select offset , use the number keys to enter 1 , and then select Vdc .
6. Press Output to output 10MHz, 2Vpp, 1V offset sine waves. Connect the BNC interface of the corresponding channel to the oscilloscope, and the output waveform can be observed.

To output other waveforms, you can select Waveforms and then select the desired waveform from the menu bar. Different waveforms can have different parameters set.

Basic Waveform Setting

Taking sine wave as an example, explain some basic parameter settings of standard waveform.

Select Waveforms → Sine , and a sine wave operation menu will appear in the display area. By setting the waveform parameters of the sine wave, the corresponding waveform can be output. The parameters for setting sine waves mainly include: frequency/period, amplitude/high level, offset/low level, phase/delay.

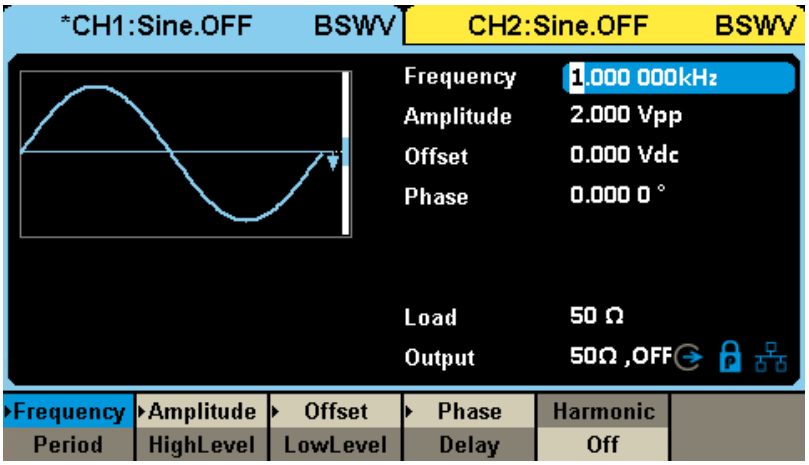


Table 1 Basic waveform operation menu description

Function menu	Setting instructions
Sine/Square/Pulse/Ramp/PRBS	
Frequency/Period	Set the frequency/period of the signal. The unit of frequency is Hz, and the unit of period is s. The relationship between the two is: frequency=1/period. Press the corresponding function button to switch up and down.
Amplitude/HighLevel Offset/LowLevel	Set the amplitude/offset of the signal to be linked with high/low levels. The amplitude value refers to the difference between the highest point (high level, unit V) and the lowest point (low level, unit V) of a signal. The supported units include Vpp, Vrms, and dBm (available when the load ≠ HiZ); The offset refers to the DC component superimposed on the signal waveform, measured in volts; The relationship between several parameters is: Amplitude value (Vpp) = high low level - low level Offset = (high level + low level)/2 Press the corresponding function button to switch up and down.
Phase/Delay	The phase/delay of the signal is only meaningful when the dual channel phase mode is phase locked, used to set the phase relationship between two channels. The unit of phase is °, and the unit of delay is s. The relationship between the two is: Delay= (period x phase/360 °) Press the corresponding function button to switch up and down.
Square	
Duty	Set the ratio of the positive pulse width to the period of the square wave, The unit is %.
Pulse	
Width/Duty	Pulse width refers to the positive pulse width of a pulse, measured in seconds; Duty cycle refers to the ratio of positive pulse width to cycle, measured in%. The relationship between the two is: Pulse width= period x duty cycle Press the corresponding function button to switch up and down
Rise/Fall	The rising edge refers to a rising time of 10% to 90%, and the falling edge refers to a falling time of 90% to 10%, both of which are measured in seconds. The rising and falling edges are independent of each other and can be set separately. Press the corresponding function button to switch up and down
Ramp	
Symmetry	The ratio of the time and period during which a triangular wave is rising, The unit is %.
DC	
Offst	The "offset" parameter of the same sine wave, i.e. the DC level.
Noise	
Stdev	Standard deviation of noise sequence.
Mean	Mean value of noise sequence (mathematical expectation).
Bandwidth	-3dB bandwidth of noise.
PRBS	
BitRate/Period	The bit rate/symbol period of PRBS sequence, with the unit of bit rate being bps and the unit of symbol period (UI) being s. The relationship between the two is: Bit rate=1/symbol period
Logic Level	Used to quickly set the amplitude to some standard levels.
Length	PRBS-3~32 can be set, corresponding to lengths (2^3-1)~(2^32-1).
edge	Refers to a rise time of 10% to 90% and a decrease time of 90% to 10%, expressed in seconds. Setting both rising and falling edges simultaneously.

Arbitrary Waveform Setting

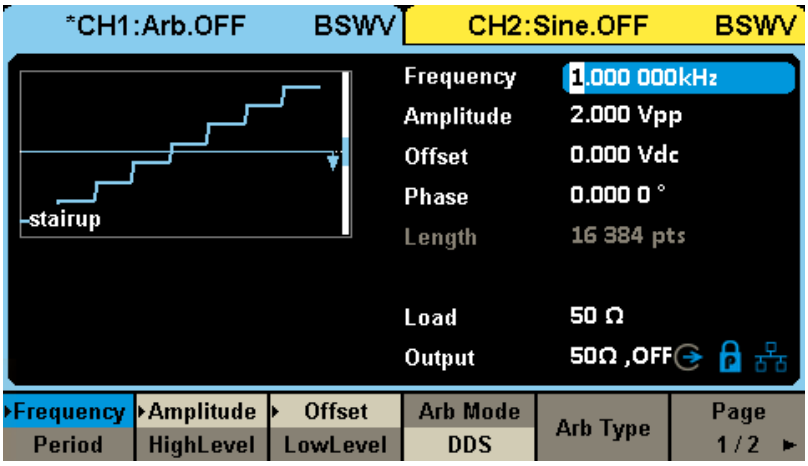


Table 2 Explanation of any wave operation menu

Function menu	Setting instructions
Frequency/Period	Same basic waveform (DDS mode).
SRate/Frequency	The sampling rate/frequency of the signal. The unit of sampling rate is Sa/s, which refers to the rate at which waveform points are captured; The unit of frequency is Hz. The relationship between the two is: Sampling rate=frequency x number of waveform points Press the corresponding function button to switch up and down
Amplitude/HighLevel	Same basic waveform.
Offset/LowLevel	Same basic waveform.
Phase/Delay	Same basic waveform.
Interpolation	The interpolation methods for waveforms can be either "zero order preservation" or "linear interpolation".
Arb Mode	Set any wave output mode, with two modes: "DDS" and "point by point output".
Arb Type	View saved waveforms or built-in waveforms.

Multi pulse setting

The SDG1000X Plus has a built-in multi pulse output function, which facilitates the testing of the switching characteristics of power devices.

Select Waveforms → Current Page 1/2 → Multi Pulse . The parameters for setting multi pulse waves mainly include: sampling rate, amplitude/high level, offset/low level, delay, number of pulses, rising edge, falling edge, positive pulse width, negative pulse width.

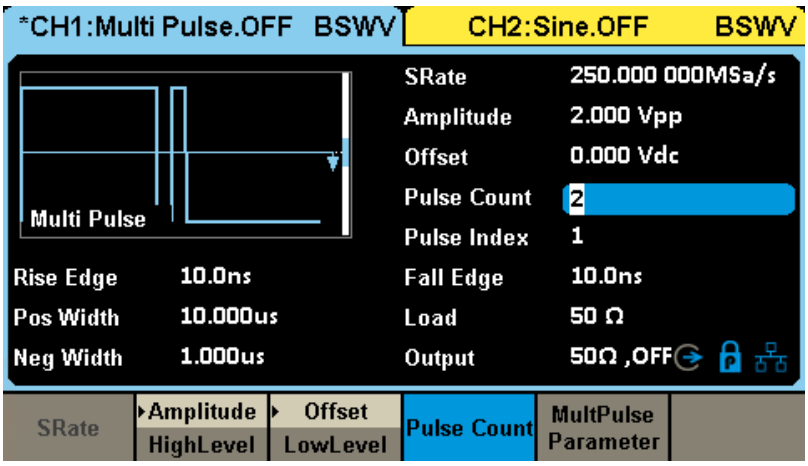


Table 3 Explanation of Multi pulse Wave Operation Menu

Function menu		Setting instructions
SRate		Set the sampling rate for waveform output. Low sampling rate can output waveforms with longer cycles, while high sampling rate can output steeper edges.
Amplitude/ HighLevel		Same basic waveform.
Offset/ LowLevel		Same basic waveform.
Pulse Count		Set the number of multi pulse waveform pulses.
MultPulse Parameter	Rise edge	Set the rising edge time for the pulse.
	Fall edge	Set the falling edge time for the pulse.
	Pos Width	Set positive pulse width time.
	Neg Width	Set negative pulse width time.

Sequence Waveform setting

SDG1000X Plus can output sequence waveforms, and the sequence waveform and output sequence can be user-defined. The maximum number of total waveform points for a sequence wave is 8 Mpts. The edited sequence waveform can be stored in the instrument's internal or external memory.

Select Waveforms → Current Page 1/2 → Sequence . The parameters for setting sequence waves mainly include: sampling rate, amplitude scaling/offset, offset/low level, delay, number of pulses, rising edge, falling edge, positive pulse width, negative pulse width.

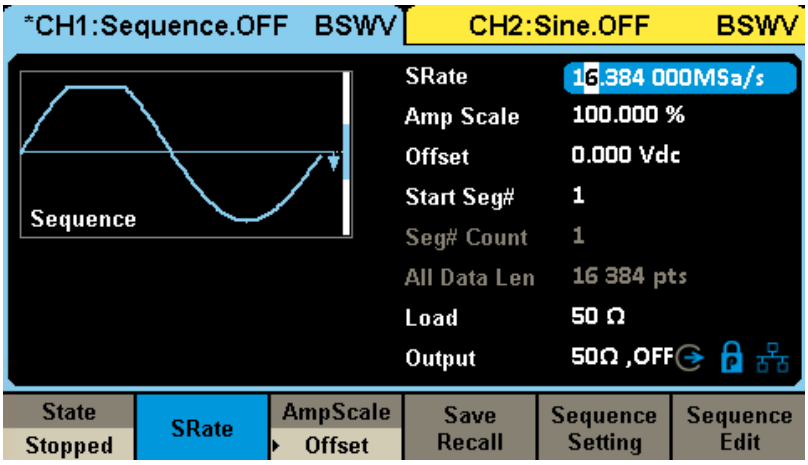


Table 4 Explanation of Sequence Wave Operation Menu

Function menu			Setting instructions
State	Stopped		Start or stop the sequence wave output, press the corresponding function button to switch between stop and play. The waveform is only output when the status is running and the Output is turned on.
	Runing		
SRate			Set the sampling rate for waveform output.
AmpScale			Set the amplitude of each waveform segment separately in waveform editing, and the amplitude scaling setting here will reduce the amplitude of all waveform segments proportionally.
Offset			Set the offset level of the entire sequence waveform.
Sequence Setting	Run mode		It can switch between continuous and single step operation modes. Continuous mode is where each waveform segment is played in the set order after departure, and repeated after completion. Single step mode outputs a waveform each time it is triggered.
	interpolation		Setting interpolation method refers to the interpolation strategy for the entire sequence waveform when the set sampling rate is below 250MSa/s. Two methods can be set: "zero order preservation" or "linear interpolation".
	Source		Set the trigger signal source. There are two types of trigger sources in single step mode: manual and external. In continuous mode, it is fixed as an internal trigger source.
	Idle level		The output level value during the idle time when a waveform is not triggered or when a waveform is played, and the next waveform is not played, has three states: termination value, intermediate value, and starting value.
	Start seg		Set which waveform segment the sequence wave starts playing from.
	Value drawing strategy		The user can edit the waveform length, and when the set waveform length is less than the length of the original waveform file, the sampling method used is. Supports three sampling methods: linear sampling, tail truncation, and head truncation.
	Interpolation strategy		The interpolation method used when the set waveform length is greater than the length of the original waveform file. Supports four interpolation methods: linear interpolation, zero padding, last value preservation, and periodic repetition.
	Trigger Edge		When the triggering source is external, the rising or falling edge can be selected for triggering.
Sequence Edit	ADD Seg		Add a waveform at the end of the sequence.
	Del Seg		Delete the current waveform segment.
	Insert Seg		Insert a waveform before the current position.
	Clear List		Clear all segments of the sequence waveform.
	Seg Setting	Length	Set the length of the current waveform segment.
		Loop	Set the number of repetitions of the current waveform segment.
		Goto	Set the waveform to be played in the next segment after the current waveform is played.

		Data Source	Select a waveform file, which can be either a saved waveform or a built-in waveform.
		Amplitude/ HighLevel	Set waveform amplitude/high level, press the corresponding function button to switch up and down.
		Offset/ LowLevel	Set waveform offset/low level, press the corresponding function button to switch up and down.
Save/Recall			Save the current sequence wave file or load a stored sequence wave file.

Modulation

SDG1000XPlus supports commonly used analog modulation (AM/DSB-AM/FM/PM/PWM, etc.) and digital keying (ASK/FSK/PSK, etc.). The modulation source can be selected from both internal and external sources.

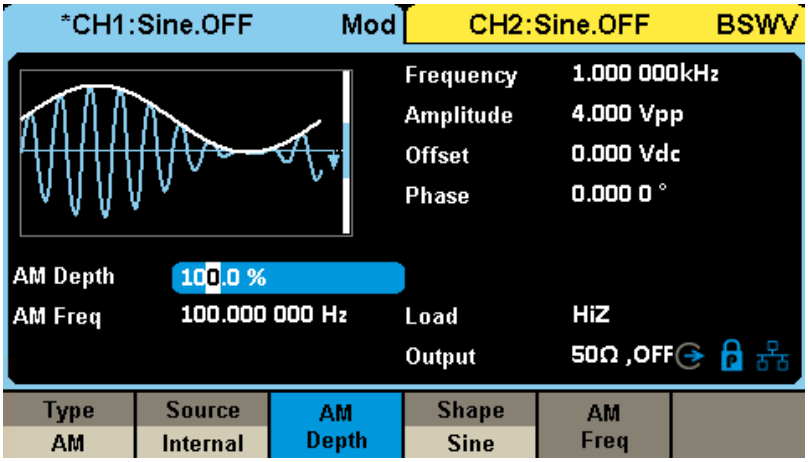


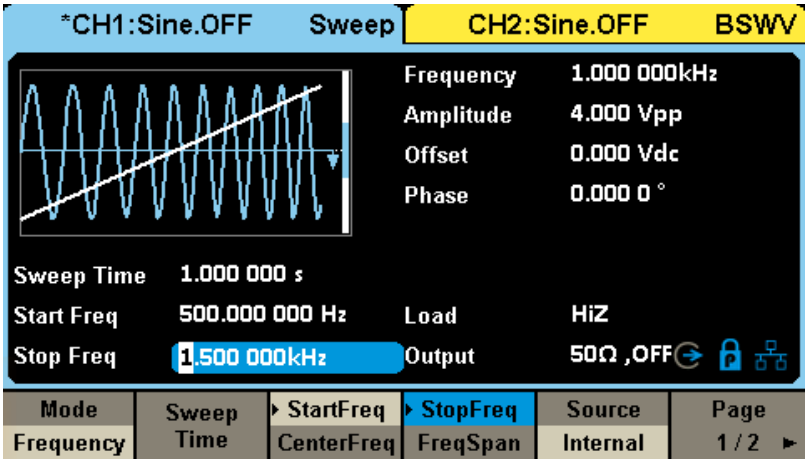
Table 5 Modulation Menu Description

Function menu	Setting instructions
Type	Choose modulation types, including AM, DSB-SC, FM, PM, ASK, FSK, PSK, PWM, and the modulation types supported by different carriers are the same.
Source	Set modulation source, can choose internal or external modulation source.
AM Depth	AM modulation parameters, also known as amplitude modulation coefficient (m), Determined by the maximum value $U_{cm,max}$ and minimum value $U_{cm,min}$ of the amplitude modulation wave envelope: $$m=\frac{U_{cm,max}-U_{cm,min}}{U_{cm,max}+U_{cm,min}}$$ When the source is internal or channel, this value can be directly set; When the signal source is external, it is determined by the amplitude of the external modulation input.
FM Dev	FM modulation parameters. The maximum value Δf of instantaneous frequency deviation from carrier frequency f_c, When the frequency deviation reaches, it corresponds to the maximum or minimum amplitude of the modulation waveform. The modulated carrier frequency varies within the range of $f_c \pm \Delta f$. When the source is internal or channel, this value can be directly set; When the signal source is external, it is determined by the amplitude of the external modulation input, and the full amplitude of the external modulation corresponds to the set frequency deviation.
Phase Dev	PM modulation parameters. The maximum value of instantaneous phase $\varphi_c(t)$ when the instantaneous phase deviates from the carrier without modulation $\Delta\phi$, When the phase

	deviation reaches, it corresponds to the maximum or minimum amplitude of the modulation waveform. The modulated carrier phase varies within the range of $\varphi_c(t) \pm \Delta\varphi$. When the source is internal or channel, this value can be directly set; When the signal source is external, it is determined by the amplitude of the external modulation input, and the full amplitude of the external modulation corresponds to the set phase deviation.
Hop Freq	FSK modulation parameters. The output frequency varies between carrier frequencies f_c and f_c-f_{hop}.
Polarity	PSK modulation parameters, Positive/Negative. When in positive phase, the phase is 0 ° when changing from 0 to 1; When changing from 1 to 0, the phase is 180 °; When reversed, it is opposite.
Width Dev	PWM modulation parameters, the deviation of positive pulse width from the maximum value of positive pulse width without modulation, and when the deviation of pulse width reaches, it corresponds to the maximum or minimum value of modulation waveform amplitude. When the source is internal or channel, this value can be directly set; When the signal source is external, it is determined by the amplitude of the external modulation input, and the full amplitude of the external modulation corresponds to the set pulse width deviation.
Shape	The shape of the modulated wave. When the source is internal, this value can be directly set; When the signal source is external, it is determined by the waveform of the externally modulation input.
Mod Freq	The frequency of the modulation waveform. When the source is internal, this value can be directly set; When the signal source is external, it is determined by the external modulation input frequency.
Key Freq	ASK/FSK/PSK modulation parameters. The bit rate of a binary sequence. When the signal source is internal, this value can be directly set, and the internal source is a clock sequence with a specified frequency; When the source is external, it is determined by the 0/1 state of the auxiliary input.

Sweep

Scanning belongs to special frequency modulation (FM) or amplitude modulation (AM). When the frequency sweep is turned on, the carrier output frequency or amplitude can vary according to the set pattern (linear/logarithmic) and can be controlled by the trigger signal.



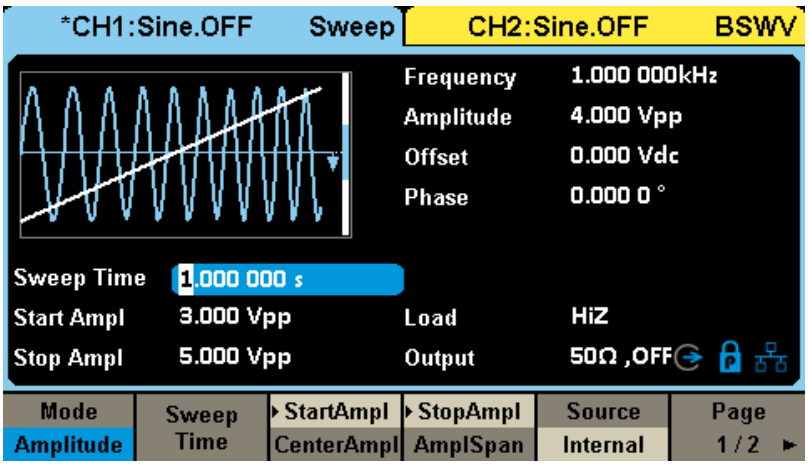


Table 6 Scan Operation Menu Description

Function menu	Setting instructions
Mode	Supports two sweeping modes: frequency sweeping or amplitude sweeping. Press the corresponding function button to switch up and down.
Sweep Time	Set the time required for a sweeping.
StartFreq/CenterFreq StopFreq/FreqSpan	Sweeping frequency parameters. The relationship is as follows: CenterFreq = (StartFreq + StopFreq) / 2 FreqSpan = | StopFreq - StartFreq | Press the corresponding function button to switch up and down.
StartAmpl/CenterAmpl StopAmpl/AmplSpan	The amplitude parameter of the sweeping. The relationship is as follows: CenterAmpl = (StartAmpl + StopAmpl) / 2 AmplSpan = | StopAmpl - StartAmpl | Press the corresponding function button to switch up and down.
Source	Three trigger sources are available: internal, external, and manual.
Trig Out	When the trigger source is internal or manual, the trigger output interface on the rear panel can output a trigger signal, and the rising edge of the trigger signal corresponds to the start of sweeping.
Type	Supports two types of sweeping: Linear sweeping: FM/AM with modulation waves as sawtooth waves. Its frequency/amplitude changes linearly from the starting frequency/amplitude to the ending frequency/amplitude during the sweeping period. Logarithmic sweeping: The frequency change follows a 10x rule and is commonly used for frequency response testing in some channels. The frequency response is generally plotted in logarithmic coordinates (10 octaves), so in order to see a uniform distribution of samples on the logarithmic coordinate plot, logarithmic sweeping (only frequency sweeping is supported) is needed.
Direction	There are three modes: up, down, and up and down. Up represents sweeping frequency from low to high; Downward represents sweeping frequency from high to low; The up and down mode is only applicable to linear sweeping, which sweeps from the start frequency to the end frequency within the sweep time, and then sweeps back to the start frequency. This method is equivalent to using a triangular waveform for frequency modulation, and the symmetry of the triangular waveform can be set, corresponding to different up sweeping times and down sweeping times (the amplitude parameters are also the same during amplitude sweeping).
Sym	When the sweeping direction is "up and down", set the symmetry of the modulation triangular waveform.

Burst

Burst is a triggering signal. Triggering the output of a certain number of carrier cycles through a certain control signal.

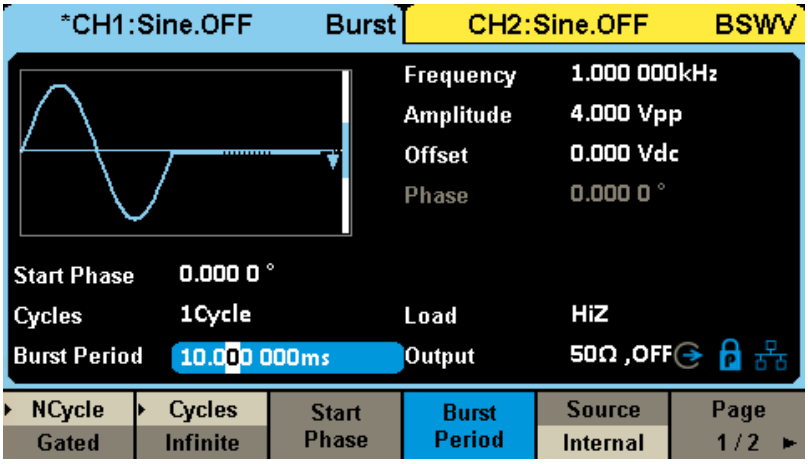


Table 7 Description of Pulse Train Operation Menu

Function menu	Setting instructions
NCycle/Gated	Supports two Burst types. NCycle: Output a specified number of carrier cycles (N) each burst signal. Gated: When the gate control signal is effective, the carrier is output; otherwise, it is not output. The gate control signal can be high or low effective. Press the corresponding function button to switch up and down.
Cycle/Infinite	Under the NCycle type, set the number of cycles for each N-loop burst train. Press the corresponding function button to switch up and down.
Start Phase	Set the Initial phase at the start of the burst.
Burst Period	This parameter is used to set the period of the burst signal (i.e. time interval between burst trains). It only effective when the trigger source is internal or manual.
Source	Three trigger sources are available: internal, external, and manual.
Trig Delay	Set the delay time from triggering the NCycle burst train to starting output.
Edge	Set the trigger signal edge, rising edge, or falling edge.
Burst Counter	Set the number of burst trains output when the trigger source is external and manual under N cycles.
Polarity	Set the gate signal to "positive" or "negative" to output a burst signal.

Counter

Used to measure the frequency, period, duty cycle, and other parameters of the current signal.

Select Utility > Counter > State to the on state to enable the frequency meter function.

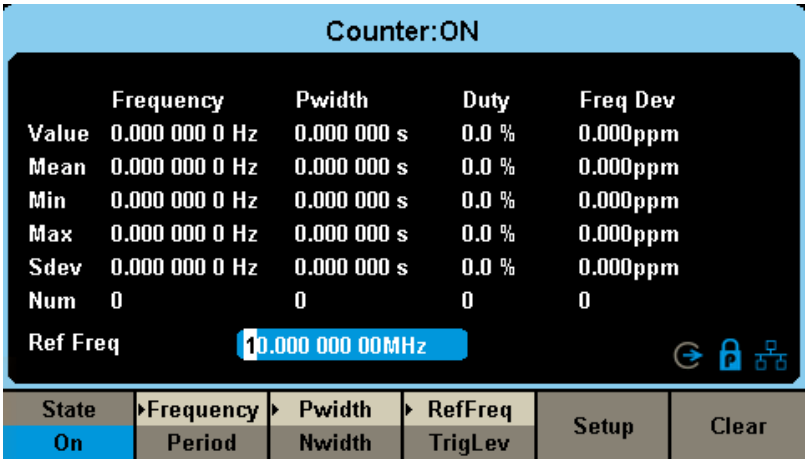


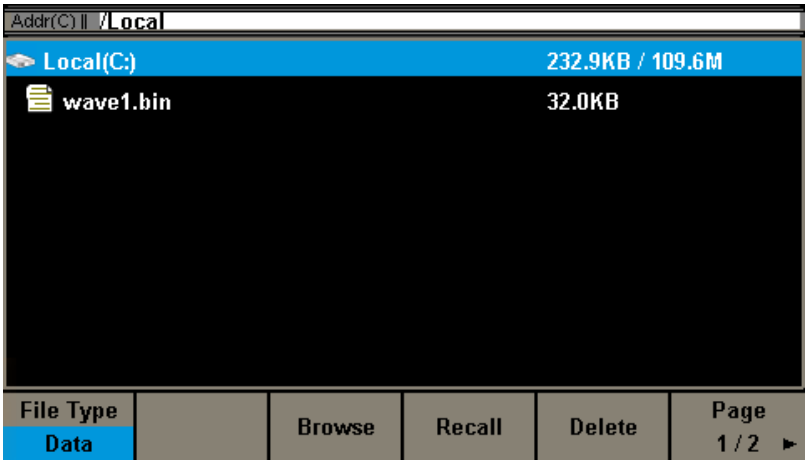
Table 8 Frequency Meter Operation Menu Description

Function menu		Setting instructions
State		Turn on or off the frequency meter function, press the corresponding function button to switch up and down.
Frequency/Period		Choose whether to measure frequency or cycle parameters, and press the corresponding function button to switch up and down.
Pwidth/Nwidth		Choose whether to measure positive or negative pulse width parameters, and press the corresponding function button to switch up and down.
RefFreq/TrigLev		Reference frequency: Set the reference frequency of the measured signal, and calculate the frequency deviation based on this reference frequency. Trigger level: After comparing the input signal with the trigger level, a counting pulse is generated. The trigger level is generally recommended to be set at 50% of the signal amplitude. Press the corresponding function button to switch up and down.
Clear		Clear current measurement statistics and recalculate.
Setup	Mode	Set the coupling mode of the input signal, DC coupling or AC coupling.
	HFR	Turn on or off the high-frequency suppression function to suppress high-frequency noise signals during low-frequency signal measurement.
	Default	Restore the frequency meter settings to default values: Turn off the frequency meter and modify the measurement parameters to frequency, positive pulse width, reference frequency set to 10MHz, coupling mode set to AC coupling, turn off high-frequency suppression, and trigger level set to 0V.

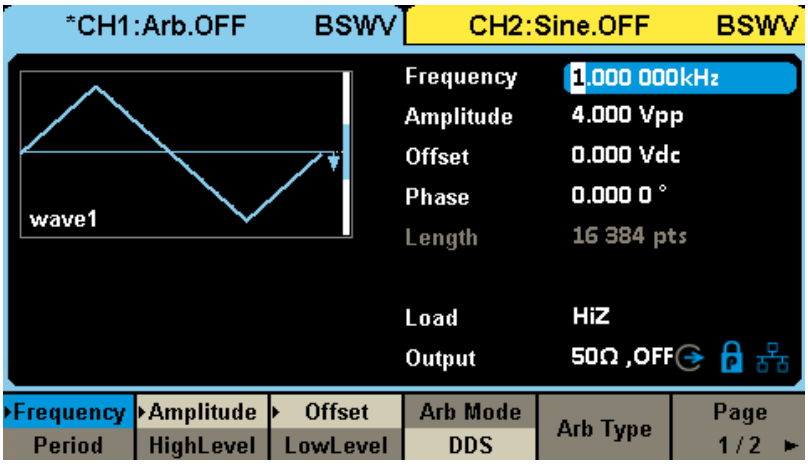
Save & Recall

SDG1000X Plus supports storing and calling status files, waveform files, and firmware upgrade files. The storage and retrieval locations include internal memory (Local) and external USB storage devices (such as USB drives). Storage and invocation operations are implemented through a file manager.

Select Store/Recall → File Type , switch to Data Type, and use the knob to select the corresponding waveform file.



Then select Read , You can import the waveform file into the device.



Troubleshooting

1. If the power switch is pressed, the SDG1000X Plus series function/any waveform generator LCD screen still appears black. Please follow the following steps to handle it:
   - Check if the power supply is powered on
   - Check if the power switch is properly connected
   - Restart the instrument
   - If you still cannot use this product normally, please contact SIGLENT and let us serve you

2. If the settings are correct but there is no waveform output, please follow the following steps to handle it:
   - Check if the signal connection wire is properly connected to the Output port;
   - Check if the BNC cable is properly connected;
   - Check if the channel output is turned on;
   - After completing the above checks, set the power on setting to the previous setting and restart the instrument

Headquarters:

SIGLENT Technologies Co., Ltd

Add: Bldg No.4 & No.5, Antongda Industrial Zone,

3rd Liuxian Road, Bao'an District,

Shenzhen, 518101, China

Tel: + 86 755 3688 7876

Fax: + 86 755 3359 1582

Email: sales@siglent.com

Website: int.siglent.com

North America:

SIGLENT Technologies NA, Inc

Add: 6557 Cochran Rd Solon, Ohio 44139

Tel: 440-398-5800

Toll Free:877-515-5551

Fax: 440-399-1211

Email: support@siglentna.com

Website: www.siglentna.com

Europe:

SIGLENT Technologies Germany GmbH

Add: Staetzlinger Str. 70

86165 Augsburg, Germany

Tel: +49(0)-821-666 0 111 0

Fax: +49(0)-821-666 0 111 22

Email: info-eu@siglent.com

Website: www.siglenteu.com

Malaysia:

SIGLENT Technologies (M) Sdn.Bhd

Add: NO.6 Lorong Jelawat 4

Kawasan Perusahaan Seberang Jaya

13700, Perai Pulau Pinang

Tel: 006-04-3998964

Email: sales@siglent.com

Website: int.siglent.com

Follow us on
Facebook: SiglentTech

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