

Service Manual

SDG1000 Series

Function/Arbitrary Waveform Generator

SM02010-E01B

Guaranty and Declaration

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Product Certification

SIGLENT guarantees this product conforms to the national and industrial standards in china as well as the ISO9001: 2008 standard and the ISO14001: 2004 standard. Other international standard conformance certification is in progress.

General Safety Summary

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

Only qualified technician should perform service procedures

Use Proper Power Line

Use only the special power line of the instrument that approved by local state.

Ground the Instrument

The instrument grounds through the protective terra conductor of the power line. To avoid electric shock, the ground conductor must be connected to the earth. Make sure the instrument is grounded correctly before connect its input or output terminals.

Connect the Signal Wire correctly

The potential of the signal wire is equal to the earth, so do not connect the signal wire to a high voltage. Do not touch the exposed contacts or components.

Look Over All Terminals' Ratings

To avoid fire or electric shock, please look over all ratings and sign instruction of the instrument. Before connecting the instrument, please read the manual carefully to gain more information about the ratings.

Not Operate with Suspected Failures

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

Avoid Circuit or Components Exposed

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

Safety Terms and Symbols

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

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

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

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

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



**Hazardous
Voltage**



**Protective
Earth Ground**



Warning



Earth Ground



**Power
Switch**

Overview for the Document

The document is for SDG1000 series arbitrary waveform generator, which will be mostly written as generator for short in the following text. The main contents described in this manual are:

SDG1000 Series Generator at a glance

This part introduces the main technology characteristics for SDG1000 generator.

The Front Panel at a glance

This part introduces briefly all the buttons and the knob on the front panel.

The Rear Panel at a glance

This part introduces all the ports for easy communication on the rear panel.

Specifications

Chapter 1 lists the generator's specifications.

Quick Start

Chapter 2 prepares the generator for use and helps you get familiar with a few of its front-panel features.

Calibration

Chapter 3 provides calibration, verification and adjustment procedures for the generator.

Assembly Procedures

Chapter 4 provides disassembly procedures for you to get an understanding of the structure of the generator, thus to install or replace some needed modules, or troubleshoot faults you encounter while operating it.

Troubleshooting

Chapter 5 provides troubleshooting procedures for the internal main board and power supply board, as well as the quick guide for general troubles. Before any operation, you should read the ESD Precautions to avoid personal injuries or damages to the generator

Maintainance

Chapter 6 provides information on maintenance, daily care and unpacking inspection of the instrument. The contact information is attached in the end in case of some unsolvable troubles you encounter.

Convention for the whole Contents

All the description for function and performance in this document are according to SDG1050 series generator, and apply to generator of the other types. The SDS1000 series contains the following types:

Type	Analog Bandwith	Channel
SDG1005	5 MHz	2
SDG1010	10 MHz	2
SDG1020	20 MHz	2
SDG1025	25 MHz	2
SDG1050	50 MHz	2

SDG1000 Series at a Glance

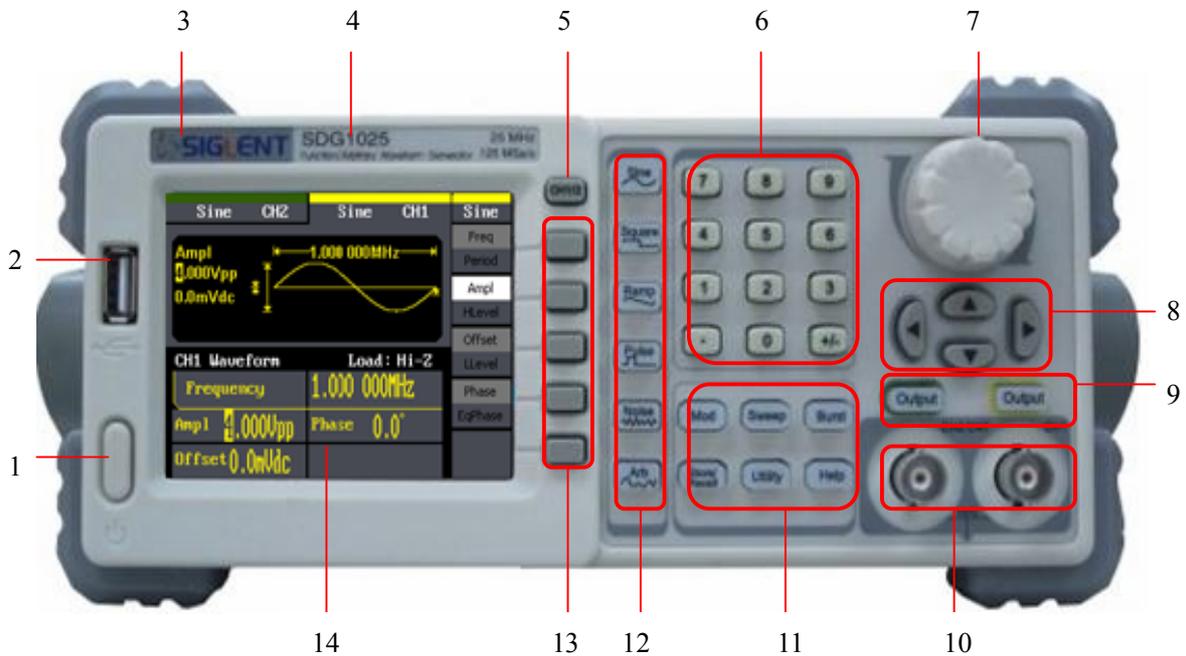
The SDG1000 series is a direct digital synthesized waveform generator with built-in arbitrary waveform and pulse capabilities. Its combination of excellent system features, easiness in usage and versatile functions makes this generator a perfect solution for your testing now and in the future.

Characteristics

- DDS technology provides precise, stable and low distortional output signal.
- 3.5" TFT color LCD display.
- 125MSa/s sampling rate, 14-bit resolution.
- Frequency characteristics:
 - Sine: 1 μ Hz to 50 MHz
 - Square: 1 μ Hz to 25 MHz
 - Ramp: 1 μ Hz to 300 kHz
 - Pulse: 500 μ Hz to 10MHz
 - White Noise: 50MHz bandwidth (-3dB)
 - Arbitrary: 1 μ Hz to 5MHz
- 5 standard waveforms: Sine, Square, Ramp, Pulse, Noise
- Self-defined arbitrary waveform
- Multiple modulation function, various modulated waveform: AM, DSB-AM, FM, PM, ASK, FSK, Sweep and Burst.
- Multiple I/O: external modulation source, external 10 MHz reference input, external trigger source, waveform output, synchronous signal output.
- Support USB storage device. Software updating could also be performed using USB devices.
- Up to 16k sample points of internal waveform depth, which can rebuild or simulate any complex waveform.
- Remote control is realized using the USB cable.
- Multiple interfaces: USB host & device
- Support the seamless connection with SIGLENT Series Digital Oscilloscopes; Be able to directly read and rebuild the stored waveform in the oscilloscopes.
- 2 languages (English and Chinese) user interface and built-in help system.

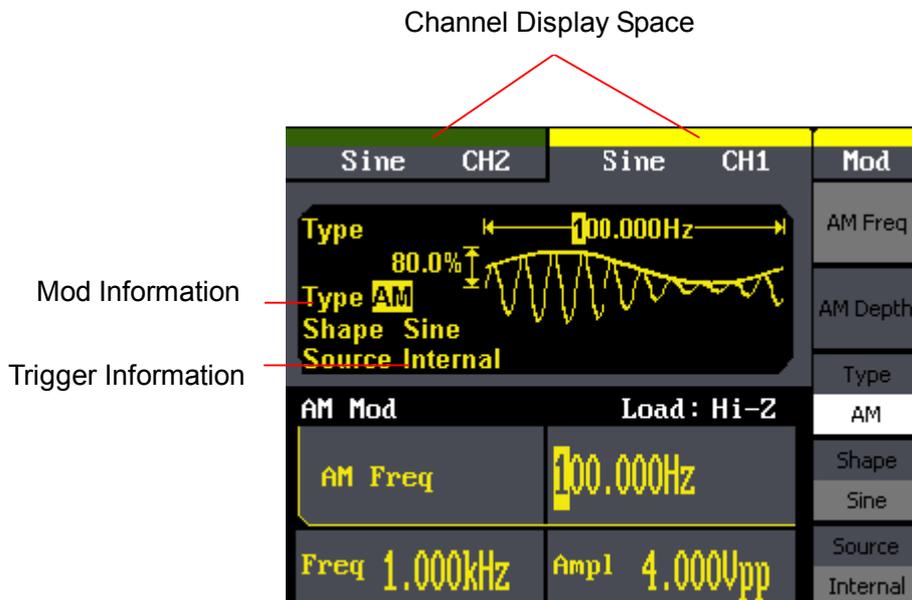
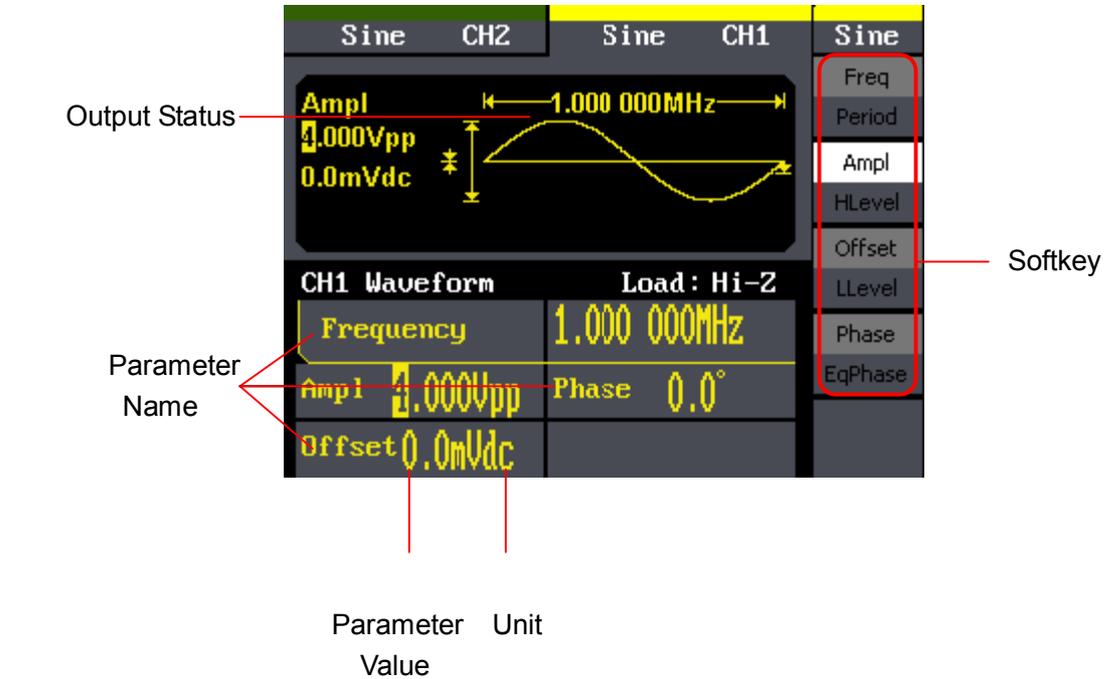
Note: All the specifications described in this manual are according to SDG1050.

The Front Panel at a Glance

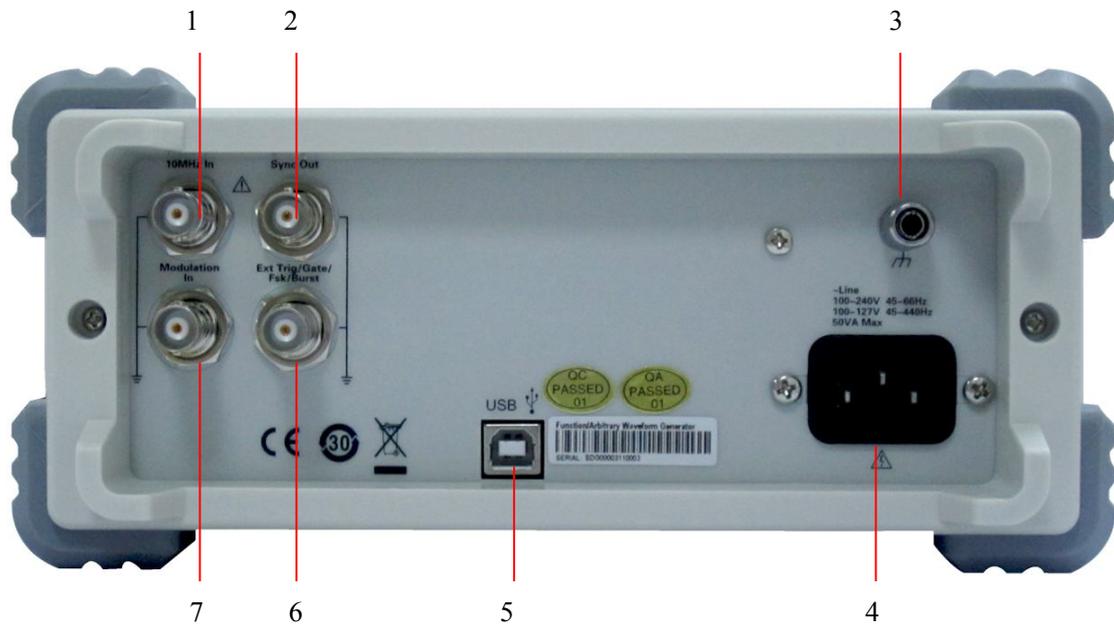


No.	Description	No.	Description
1	ON/OFF Switch	8	Direction Keys
2	USB Host	9	Output Control Keys
3	LOGO	10	BNC Connectors
4	Model	11	Function Keys
5	Menu ON/OFF Switch	12	Waveform Selection Keys
6	Digital Keypad	13	Menu Operation Keys
7	Universal Knob	14	LCD Display

The Front Panel Display at a Glance



The Rear Panel at a Glance



1. External 10 MHz Reference Input Terminal
2. Sync Output Terminal
3. Chassis Ground
4. Power Socket
5. USB Device
6. Ext Trig/Gate/FSK/Burst Terminal
7. External Modulation Input Terminal

WARNING: For protection from electric shock, the power cord ground must not be defeated. If only a two-contact electrical outlet is available, connect the instrument's chassis ground screw (see above) to a good earth ground.

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Specification

These specifications apply to SDG1000 series Arbitrary Waveform Generator. To verify that an oscilloscope meets specifications, it must first meet the following conditions:

- The generator must have been operating continuously for fifteen minutes within the specified operating temperature.
- You must perform the Self Adjust operation, accessible through the Utility menu, if the operating temperature changes by more than 5 °C.
- The oscilloscope must be within the factory calibration interval of one year.

Specifications

Model	SDG1005	SDG1010	SDG1020	SDG1025	SDG1050
Max.output frequency	5MHz	10MHz	20MHz	25MHz	50MHz
Output channels	2				
Sample rate	125 MSa/s				
Arbitrary waveform length	16 kpts				
Frequency resolution	1 μHz				
vertical resolution	14 bits				
Waveform	Sine, Square, Ramp, Pulse, Gaussian Noise, 46 types of built-in arbitrary waveform				
Sine	1μHz ~ 5MHz	1μHz ~ 10MHz	1μHz ~20MHz	1μHz ~ 25MHz	1μHz ~ 50MHz
Square	1μHz ~ 5MHz	1μHz ~ 10MHz	1μHz ~20MHz	1μHz ~ 25MHz	1μHz ~ 25MHz
Pulse	500μHz~5MHz		500μHz ~10MHz		
Ramp/Triangular	1μHz ~ 300KHz				
Gaussian white noise	5MHz (-3dB)	10MHz (-3dB)	20MHz (-3dB)	25MHz (-3dB)	50MHz (-3dB)
Arbitrary waveform	1μHz ~ 5MHz				
Modulation	AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst				
Frequency counter	Frequency range: 100mHz ~ 200MHz				
Standard interface	USB Host & Device				
Dimension	W x H x D=229mm x 105mm x 281mm				

Frequency Specification

	SDG1005	SDG1010	SDG1020	SDG1025	SDG1050
Waveform	Sine, Square, Ramp, Pulse, Noise, Arb				
Sine	1μHz ~5MHz	1μHz ~10MHz	1μHz ~ 20MHz	1μHz ~25MHz	1μHz ~50MHz
Square	1μHz ~ 5MHz	1μHz ~ 10MHz	1μHz ~ 20MHz	1μHz ~ 25MHz	1μHz ~ 25MHz
Pulse	500μHz~5MHz		500μHz ~ 10MHz		
Ramp	1μHz ~ 300kHz				
Gaussian white noise	5MHz (-3dB)	10MHz (-3dB)	20MHz (-3dB)	25MHz (-3dB)	50MHz (-3dB)
Arbitrary waveform resolution	1μHz ~5MHz	1μHz ~5MHz	1μHz ~5MHz	1μHz ~5MHz	1μHz ~ 5MHz
Accuracy	Within 90days±50 ppm within 1 year ±100 ppm 18°C ~ 28°C				
Temperature coefficient	<5 ppm/°C				

Sine Wave Spectrum Purity

Harmonic Distortion	CH1/CH2
DC ~ 1MHz	-60 dBc
1MHz ~5MHz	-53 dBc
5MHz ~25MHz	-35 dBc
25MHz ~50MHz	-32 dBc
Total harmonic waveform distortion	DC ~ 20 kHz, 1 Vpp <0.2%
Spurious signal (non-harmonic)	DC ~ 1 MHz: < -70 dBc 1 MHz ~ 10 MHz :< -70 dBc + 6 dB/spectrum phase
Phase noise	10kHz Offset, -108 dBc / Hz (typical value)

Square Wave

Rise/fall time	< 12 ns (10% ~ 90%, typical value, 1 kHz, 1 Vpp)	
Overshoot	< 5% (typical value, 1kHz, 1Vpp)	
Duty Cycle	1μHz ~ 10 MHz	20% ~ 80%
	10 MHz (exclude) ~ 20 MHz	40% ~ 60%
	20 MHz (exclude) ~ 25 MHz	50%
Asymmetric (50% Duty Cycle)	1% of period + 20 ns (typical value, 1 kHz, 1Vpp)	
Jitter	0.1% of period (typical value, 1 kHz, 1Vpp)	

Pulse Wave		
Pulse width	Max. 1998 s; Min. 16 ns; resolution 1 ns	
Rise/Fall time (10% ~ 90%, typical value, 1 kHz, 1Vpp)	7 ns	
Duty Cycle	(0.1% ~ 99.9%) 0.1% Resolution	
Overshoot	< 5%	
Jitter	8 ns	
Ramp Wave		
Linearity	< 0.1% of Peak value output (typical value, 1 kHz, 1Vpp, symmetric 100%)	
Symmetry	0% ~ 100%	
Arbitrary Waveform		
Waveform length	16 k points	
Vertical resolution	14 bits (include symbol)	
Sample rate	125 MSa/s	
Min. Rise/Fall time	7 ns (typical value)	
Jitter (RMS)	8 ns (typical)	
Storage in non-volatile RAM memory (10 in total)	10 waveforms	
Output Specification		
Output	CH 1	CH 2
Amplitude	2mVpp ~ 10Vpp (50 Ω, ≤10MHz)	
	2mVpp ~ 5Vpp (50 Ω, >10MHz)	
	4mVpp ~ 20Vpp (high resistance, ≤10MHz)	2mVpp ~ 3Vpp (50 Ω)
	4mVpp ~ 10Vpp (high resistance, >10MHz)	4mVpp ~ 6Vpp (high resistance)
Vertical resolution (100 kHz sine waveform)	± (0.3dB+1mVpp of setting value)	± (0.3dB+1mVpp of setting value)
Amplitude flatness (compared to 100 kHz sine waveform, 5 Vpp)	±0.3dB	
Channel phase deviation	< 400 ps (classic value, sine, 50MHz, 4Vpp)	
Cross talk	< -70 dBc	

DC

Range (DC)	$\pm 5\text{ V}$ ($50\ \Omega$) $\pm 10\text{ V}$ (high resistance)	$\pm 1.5\text{ V}$ ($50\ \Omega$) $\pm 3\text{ V}$ (high resistance)
Offset accuracy	$\pm (\text{setting offset value} 1\%+3\text{ mV})$	$\pm (\text{setting offset value} 1\%+3\text{ mV})$

Waveform Output

Impedance	$50\ \Omega$ (typical value)
Protection	short-circuit protection

AM Modulation (CH1/CH2)

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Source	Internal/External
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Modulation depth	0% ~ 120%

FM Modulation (CH1/CH2)

Carrier	Sine, Square, Triangle, Arbitrary (except DC)
Source	Internal/External
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Frequency deviation	0~0.5* bandwidth, 1mHz resolution

PM Modulation (CH1/CH2)

Carrier	Sine, Square, Triangle, Arbitrary (except DC)
Source	Internal/External
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Deviation	0 ~ 360°, 0.1° resolution

FSK Modulation (CH1/CH2)

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Source	Internal/External
Modulation waveform	50% duty-cycle square waveform (2 mHz ~ 50 kHz)

ASK Modulation (CH1/CH2)

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Source	Internal/External
Modulation waveform	50% duty-cycle square waveform (2 mHz ~ 50 kHz)

PWM Modulation (CH1/CH2)

Frequency	500 μ Hz ~ 20KHz
Source	Internal/External
Modulation waveform	Sine, Square, Ramp, Arbitrary (except DC)
External Modulation range	-6V ~ +6V (maximum width deviation)

Sweep (CH1/CH2)

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Type	linear/logarithmic
Direction	Up / down
Sweep time	1 ms ~ 500 s
Trigger source	Manual, external, internal

Burst (CH1/CH2)

Waveform	Sine, Square, Ramp, Pulse, Arbitrary(except DC)
Type	Count (1 ~ 50,000 cycles), infinite, Gated
Start/Stop phrase	0° ~ +360°
Internal cycle	1 μs ~ 500 s
Gated trigger	External trigger
Trigger source	Manuel, External or Internal

Rear Panel Connector

External modulation	±6 Vpk = 100% modulation 5KΩ input impedance
External trigger	TTL compatible

The external input voltage can't be over ±6V, otherwise instrument gets damaged.

Trigger Input

Voltage level input	TTL compatible
Slope	Up or down (optional)
Pulse width	> 100 ns
Input impedance	> 5 kΩ, DC coupling

Trigger Output

Voltage level	TTL compatible
Pulse width	> 400 ns (typical value)
Output impedance	50Ω (typical value)
Max. frequency	1 MHz

SYNC Output

Voltage level	TTL compatible
Pulse width	> 50 ns (typical value)
Output impedance	50Ω (typical value)
Max. frequency	2MHz

Frequency Counter

Measurement	Frequency, Period, Positive/negative pulse width, duty cycle		
Frequency range	Single Channel: 100 mHz ~ 200 MHz		
Frequency resolution	6 bit		
Voltage range and sensitivity(non-modulated signal)			
Manual	DC coupling	DC offset range	±1.5 VDC
		100 mHz ~ 100 MHz	50mVrms ~ ±2.5 V
	100 MHz ~ 200 MHz	100mVrms ~ ±2.5 V	
	AC coupling	1 Hz ~ 100 MHz	50m Vrms ~ 5 Vpp
		100 MHz ~ 200 MHz	100m Vrms ~ 5 Vpp
	Pulse width and duty measurement	1 Hz ~ 10 MHz (100 mVpp ~ 10 Vpp)	
Input adjustment	Input impedance	1 MΩ	
	Coupling methods	AC、DC	
	High-frequency rejection	ON/OFF	
Trigger level range	-3V ~ +1.8V		

General Specifications

Display

Display type	3.5" TFT-LCD
Resolution	320×RGB×240
Color depth	24 bit
Contrast (typical value)	350:1
Backlight intensity (typical)	300cd/m ²

Power

Voltage	100 ~ 240 VAC _{RMS} , 45 ~ 66 Hz, CATII 100 ~ 127 VAC _{RMS} , 45 ~ 440 Hz, CATII
Consumption	< 30W
Fuse	1.25A, 250V

Environment

Temperature	Operation: 0°C ~ 40°C Storage: -20°C ~ 60°C
Cooling method	natural cooling down
Temperature range	Below +35°C: ≤90% relative humidity +35°C ~ +40°C: ≤60% relative humidity
Altitude	Operation: below 3,000 meters Storage: below 15,000 meters

Others

Dimension	Width: 229mm
	Height: 105mm
	Depth: 281mm
Weight	N.W: 2.6 Kg
	G.W: 3.4 Kg

IP protection

IP2X

Calibration Cycle

1 year

Quick Start

One of the first things you will want to do with your generator is to become acquainted with the front panel. We have written the exercises in this chapter to prepare the instrument for use and help you get familiar with some of its front-panel operations. This chapter is divided into the following sections:

- To Prepare the Generator for Use
- To Adjust the Carrying Handle
- To Set the Output Frequency
- To Set the Output Amplitude
- To Set a DC Offset Voltage
- To Set the Duty Cycle of a Square Wave
- To Set the Symmetry of a Ramp Wave
- To Configure a Pulse Waveform
- To Configure a Noise Waveform
- To Select “DC Volts”
- To Output a Built-In Arbitrary Waveform
- To Use the Built-In Help System

Prepare the Generator for Use

1. Check the list of accessories

Accessories supplied with the instrument are listed below. If anything is missing or damaged, please contact your nearest **SIGLENT** Sales Office.

- A Quick Start
- A Certification
- A Guaranty Card
- A CD(EasyWave software, DataSheet and Manual)
- A power cord that fits the standard of destination country
- A USB cable

2. Connect the power cord and turn on the generator

The instrument runs a short power-on self test, which takes a few seconds.

The generator powers up in the *sine wave* function at 1 kHz with an amplitude of 4V_{peak-to-peak} (Channel 1). At power-on, the Output connector is disabled. To enable the Output connector, press the **Output** key.

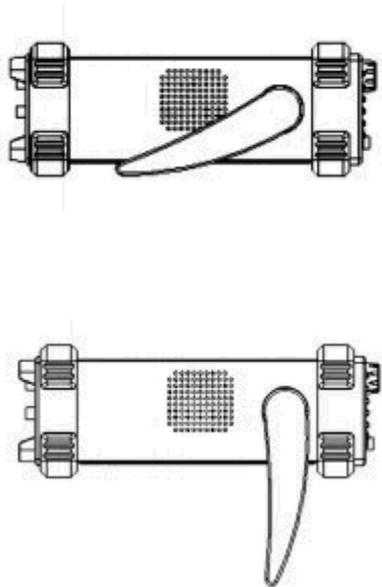
If the generator does not turn on, verify that the power cord is firmly connected to the power socket on the rear panel (the power-line voltage is automatically sensed at power-on). You should also make sure that the generator is connected to a power source that is energized.

Then, verify that the generator is turned on.

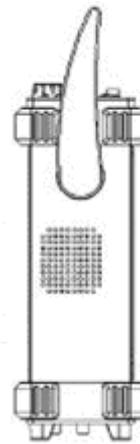
Note: *If the power-on self test fails, some error messages are displayed along with black screen. See Chapter 6 for information on self-test error codes, and for instructions on returning the generator to **SIGLENT** for service.*

Adjust the carrying Handle

To adjust the position, grasp the handle by the sides and pull outward. Then, rotate the handle to the desired position.



Pull the handle down



Pull the handle ahead for easy carrying

Set the Output Frequency

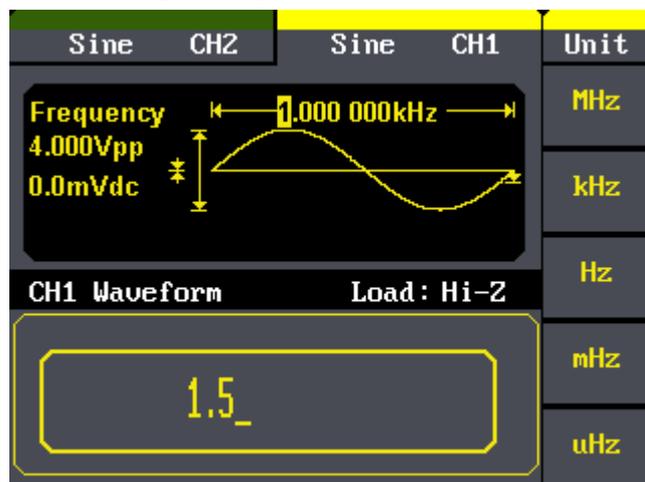
The following steps show you how to change the frequency to 1.5 MHz.

1. Press the **Freq/Period** softkey

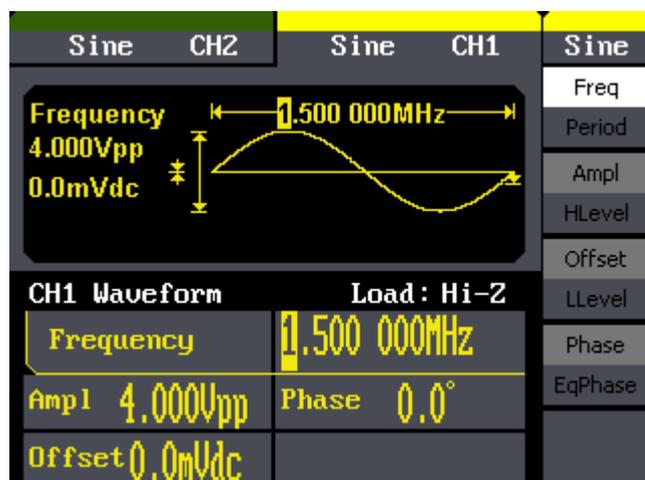
The displayed frequency is either the power-on value or the frequency previously selected. When you change the function, the same frequency is used if the current value is valid for the new waveform. If you want to set the period for the waveform, press the softkey again, to switch the period parameter (The current operation is displayed in inverse color).

2. Input the desired frequency

Use the digital keypad to input the value directly, enter the value “1.5”.



Then press the corresponding softkey to select the desired unit. For example, press **MHz**.



Note: You can also enter the desired value using the knob and direction keys.

Set the Output Amplitude

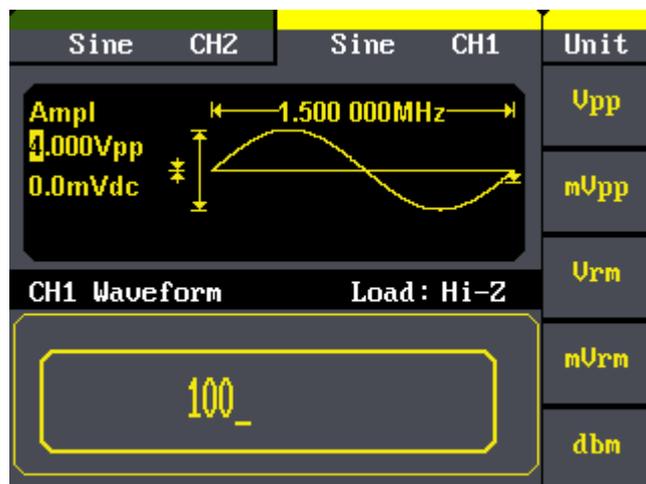
The following steps show you how to change the amplitude to 100mVrms.

1. Press the **Ampl/HLevel** softkey

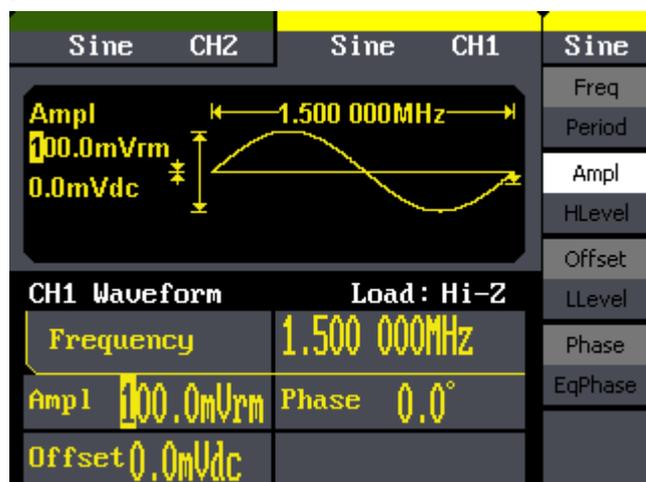
The displayed amplitude is either the power-on value or the amplitude previously selected. When you change the function, the same amplitude is used if the current value is valid for the new waveform. If you want to set the HLevel for the waveform, press the softkey again, to switch the HLevel parameter (The current operation is displayed in inverse color)

2. Input the desired amplitude

Use the digital keypad to input the value directly, enter the value “100”.



Then press the corresponding softkey to select the desired unit. For example, press **mVrm**.



Note: You can also enter the desired value using the knob and direction keys.

Set the DC offset

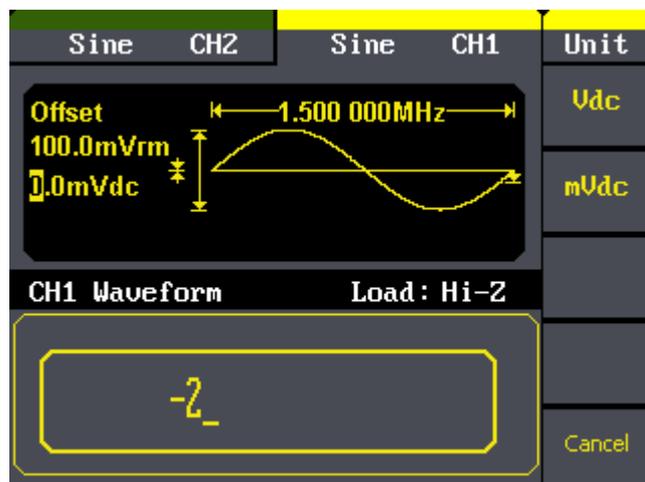
The following steps show you how to change offset to -2mVdc.

1. Press the **Offset/LLevel** softkey

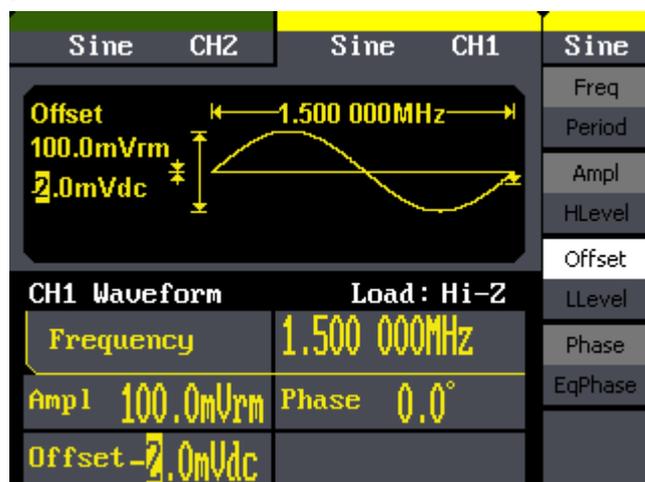
The displayed offset is either the power-on value or the offset previously selected. When you change the function, the same offset is used if the current value is valid for the new waveform. If you want to set the LLevel for the waveform, press the softkey again, to switch the LLevel parameter (The current operation is displayed in inverse color)

2. Input the desired offset

Use the digital keypad to input the value directly, enter the value “-2”.



Then press the corresponding softkey to select the desired unit. For example, press **mVdc**.



Note: You can also enter the desired value using the knob and direction keys

Set the Duty Cycle of a Square Wave

At power-on, the duty cycle for square wave is 50%. You can adjust the duty cycle from 20% to 80% for output frequencies up to 10 MHz. The following steps show you how to change the duty cycle to 30%.

1. Select the square wave function

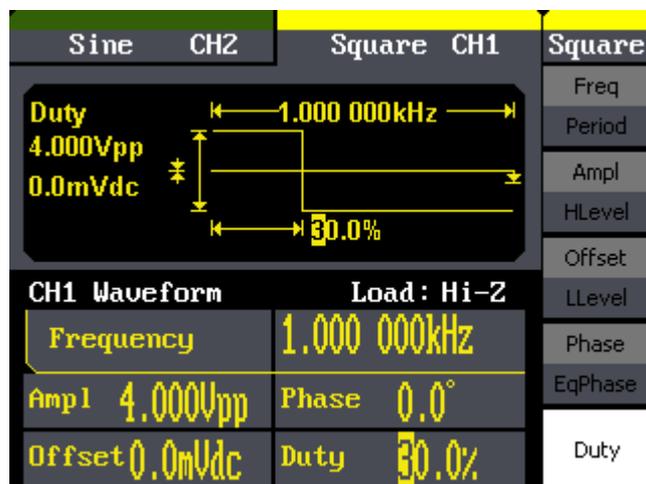
Press **Square** button and then select the desired output frequency to any value up to 10 MHz.

2. Press the **Duty** softkey

The displayed duty is either the power-on value or the percentage previously selected. The duty cycle represents the amount of time per cycle that the square wave is at a high level (note the icon on the up side of the display).

3. Input the desired duty

Use digital keypad to input the value directly, enter the value “30”, then press the corresponding softkey to select the desired unit “%”.



Set the Symmetry of a Ramp Wave

At power-on, the Symmetry for Ramp wave is 50%. You can adjust the symmetry from 0% to 100%.

The following steps show you how to change the symmetry to 60%.

1. Select the Ramp wave function

Press Ramp button and then select the desired output frequency to any value.

2. Press the Symmetry softkey

The displayed symmetry is either the power-on value or the percentage previously selected. The duty cycle represents the amount of time per cycle that the Ramp wave is at a Rise time(note the icon on the up side of the display).

3. Input the desired symmetry

Use digital keypad to input the value directly, enter the value “60”, then press the corresponding softkey to select the desired unit “%”.



Generate a Pulse Waveform

You can set the generator to output a pulse waveform with variable width and delay time. The following steps show you how to generate a 500 μs pulse waveform with a pulse width of 100 μs and delay time of 50 ns.

1. Select the pulse function

Press the Pulse button to select the pulse function and output a pulse waveform with the default parameters.

2. Set the Pulse period

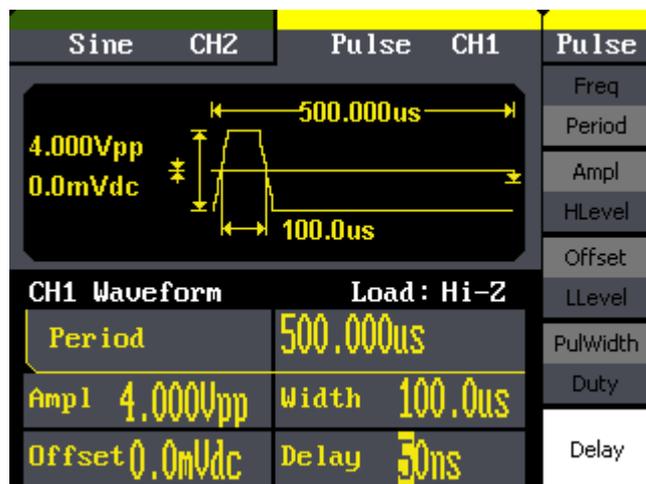
Press the Period softkey and then set the pulse period to 500 μs .

3. Set the Pulse Width

Press the PulWidth softkey and then set the pulse width to 100 μs . The pulse width represents the time from the 50% threshold of the rising edge to the 50% threshold of the next falling edge.

4. Set the Pulse Delay

Press the Delay softkey and then set the pulse delay to 50 ns.



Configure a Noise Waveform

You can set the generator to output a noise waveform with variance and mean. The following steps show you how to generate a noise waveform with 2V variance and 1mV mean.

1. Select the Noise function

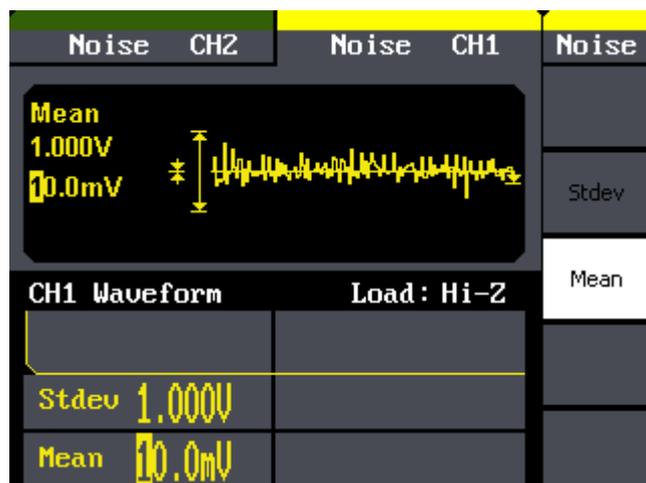
Press the **Noise** button to select the noise function and output a noise waveform with the default parameters.

2. Set the variance

Press the **Variance** softkey and then set the variance to 1V.

3. Set the mean

Press the **Mean** softkey and then set the mean to 10mV.



Set the DC Voltage

You can set the DC Voltage feature from the Utility Menu, and then set a dc voltage as an “Offset” value. The following steps show you how to set a dc voltage with +1Vdc.

1. Select the Utility function

Press the **Utility** button to select the Utility function.

2. Set the DC Voltage

Press the **DC ON** softkey and then enter the DC value 1Vdc.



You can enter any dc voltage from -10Vdc to +10Vdc (Only Channel 1).

Output a Built-In Arbitrary Waveform

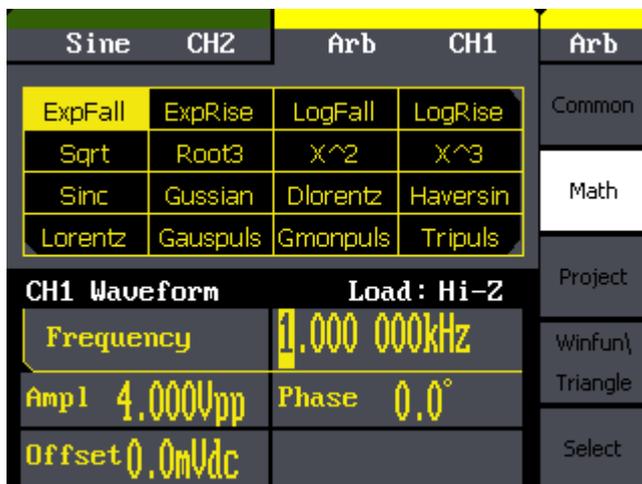
There are 48 built-in arbitrary waveforms stored in non-volatile memory. The following steps show you how to output the built-in “exponential fall” waveform from the front panel.

1. Select the arbitrary waveform function

Press the **Arb** button to select the arbitrary waveform function. Then press the **1/2 ↓** softkey, and press the **Load Wform** softkey.

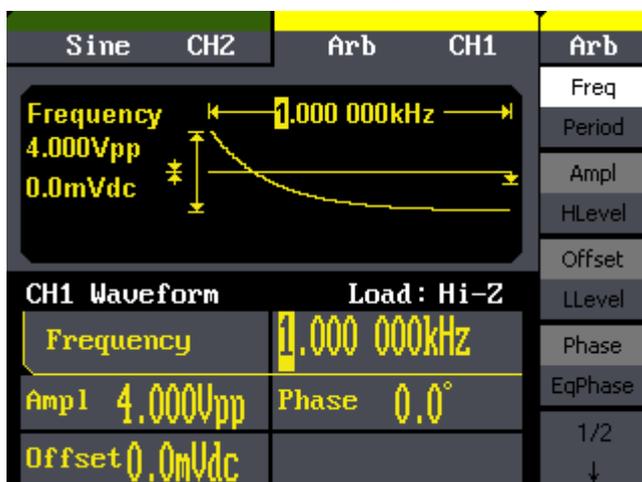
2. Select the built-in waveform

Press the **Built-In** softkey and press the **math** softkey to enter the arbitrary waveform interface. You will see the mathematic waveform as below.



3. Output the exponential fall waveform

Use the knob to select the ExpFall waveform and press the **Select** softkey. The waveform is output using the present settings for frequency, amplitude and offset unless you change them.

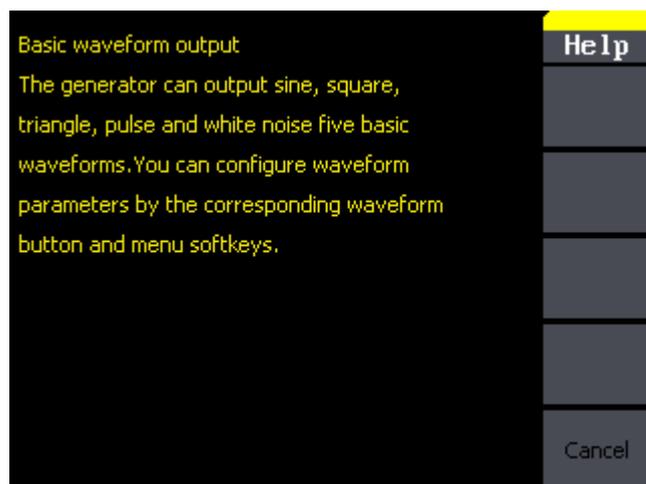
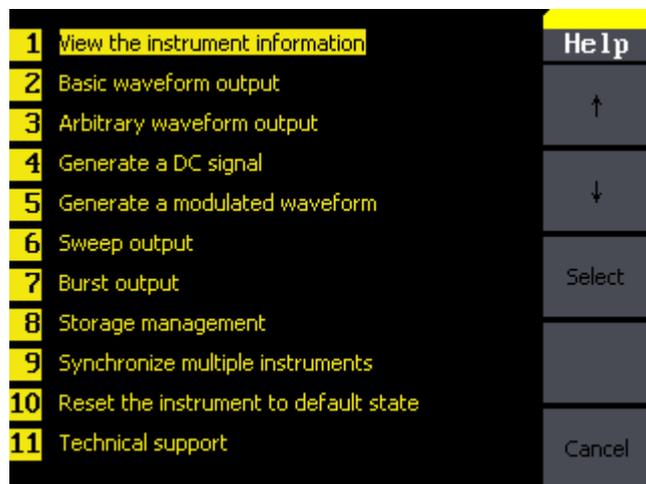


Use the Built-In Help System

The built-in help system is designed to provide context-sensitive assistance of some functions. A list of help topics is also available to assist you with several operations.

1. View the help information for SDG1000

Press **Help** button, you will see the list of help topics. Use the knob and directional keys to select the help title. Then press the **Select** softkey to view the help information.



2. Press **Help** button or any function button to exit help system.

Calibration

This calibration procedure contains performance verification procedure and adjustment procedure. After receiving a generator, you should firstly verify if its performance applies to the limits, and then perform adjustment in case of abnormal testing results.

Calibration Interval

The instrument should be calibrated on a regular interval determined by the measurement accuracy requirements of your application. A 1-year interval is adequate for most applications. Accuracy specifications will remain valid only if adjustment is made at regular calibration intervals. Accuracy specifications are not valid beyond the 1-year calibration interval. SIGLENT does not recommend extending calibration intervals beyond 2 years for any application.

Adjustment is Recommended

Specifications are valid only within the period from the last adjustment. Whatever calibration interval you select, SIGLENT recommends that re-adjustment should be always performed within the calibration interval. This is necessary to ensure the accuracy of the performance data measured during the calibration interval.

Automating Calibration Procedures

You can automate the complete verification and adjustment procedures outlined in this chapter if you have access to programmable test equipment. You can program the instrument configurations specified for each test over the remote interface. You can then enter read-back verification data into a test program and compare the results to the appropriate test limit values.

You can also adjust the instrument from the remote interface. Remote adjustment is similar to the local front-panel procedure. You can use a computer to perform the adjustment by first selecting the required function and range. The adjustment command is sent to the instrument and then the adjustment is initiated over the remote interface.

Recommended Test Equipment

The test equipment recommended for the performance verification and adjustment procedures is listed below. If the exact instrument is not available, substitute calibration standards of equivalent accuracy.

Instrument	Requirements	Recommended Model
Digital Multimeter(DMM)	dc volts accuracy: 100ppm resolution: 100 μ V	Agilent 34401A
Power Meter	Frequency: 10KHz to 50MHz	Agilent U2004
GPIB cable		GPIB (IEEE488)
Frequency Counter	Accuracy: 1ppm	
Digital Oscilloscope	Bandwidth 100MHz	Agilent MSO7012B

Test Considerations

For optimum performance, all procedures should comply with the following recommendations:

- Assure that the calibration ambient temperature is stable and between 18 °C and 28°C. Ideally, the calibration should be performed at 23°C \pm 1°C.
- Assure ambient relative humidity is less than 80%.
- Allow a half an hour warm-up period before verification or adjustment.
- Keep the measurement cables as short as possible, consistent with the impedance requirements.
- Use a 50 Ω cable.

Performance Verification Test

Use the performance verification tests to verify the measurement performance of the instrument. The performance verification tests use the instrument's specifications listed in the "Specifications" chapter.

You can perform two different levels of performance verification tests:

- **Self Adjust** A series of internal verification tests that give high confidence that the instrument is operational.
- **Performance Verification Tests** An extensive set of tests that are recommended as an acceptance test when you first receive the instrument or after performing adjustments.

Self Adjust

A brief power-on Self Test occurs automatically whenever you turn on the instrument. This limited test assures that the instrument is operational.

To perform a complete self Adjust:

1. Press **Utility** button on the front panel and enter to page 2.
2. Select the **Test/Cal** softkey, then select the **Self Adjust** softkey.

The instrument will automatically perform the complete Self Adjust procedure when you release the key. The Self Adjust will complete in approximately 20 seconds.

- There is a progress bar show on the screen during the Self Adjust.
- If the Self Adjust is successful, "100%" is displayed over the progress bar.
- If the Self Adjust fails, the progress halts at some values.
- If repair is required, see chapter 6, "Service", for further details.

Performance Verification Tests

The performance verification tests are recommended as acceptance tests when you first receive the instrument. The acceptance test results should be compared against the specifications given in chapter 1. After acceptance, you should repeat the performance verification tests at every calibration interval.

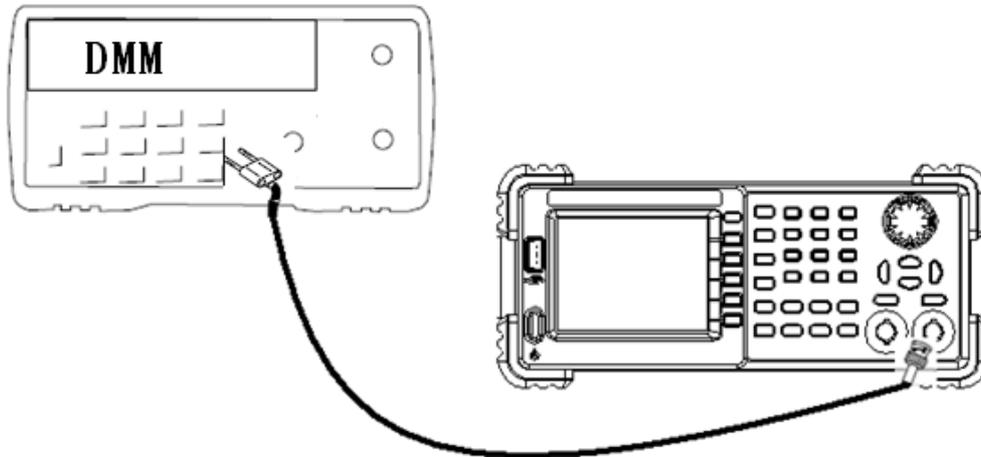
If the instrument fails performance verification, adjustment or repair is required.

Adjustment is recommended at every calibration interval. If adjustment is not made, you must guard band, using no more than 80% of the specifications listed in chapter 1, as the verification limits.

DC Output Verification

This test checks if the DC offset listed in the table below are within the spec range using a DMM.

1. Set the DMM to measure DC voltage. Connect the DMM to the channel 1 output of the generator as shown below.



2. Turn on channel 1 and select DC system under the Utility menu.
3. Set the instrument to each output value described in the table below and measure the output voltage with the DMM. Be sure the generator output impedance is set to High-Z and the output is enabled.

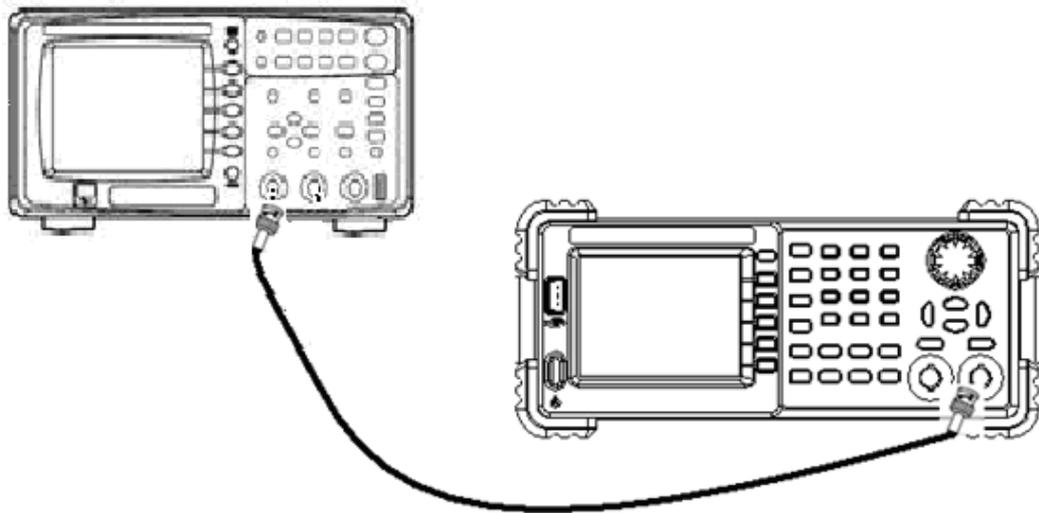
DC Offset	CH1	CH2	Spec Range $\pm (1\%+3\text{mv})$
0mv			-3mv ~ 3mv
10mv			6.9mv ~ 13.1mv
100mv			96mv ~ 104mv
1v			0.987v ~ 1.013v
3v			2.967v ~ 3.033v
10v			9.897v ~ 10.103v
-10mv			-13.1mv ~ 6.9mv
-100mv			-104mv ~ 96mv
-1v			-1.013v ~ 0.987v
-3v			-3.033v ~ 2.967v
-10v			-10.103v ~ 9.897 v

4. Compare the measured voltage to the spec range shown in the table above.

Duty Cycle Verification for Square

This test checks if the Square Duty Cycle listed in the table below is within the spec range using a digital oscilloscope.

1. Turn on the generator and choose CH1 as the operating channel. Select Square waveform and set the frequency to 100 kHz, amplitude to 4Vpp, duty to 20%.
2. Turn on the digital oscilloscope, and connect it to the CH1 output of the generator as shown below.



3. Press “AUTO” on the front panel of the oscilloscope to obtain a perfect displaying. Select the “+Dut” to display duty under “Time” measurement in MEASURE system.
4. Change the duty to 80% and measure it on the oscilloscope in the same way as step 3.
5. Remove the BNC cable to CH2 output and perform the same verification as channel1.

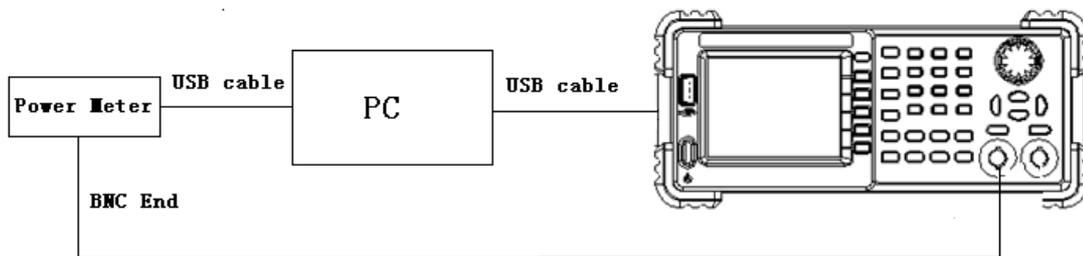
Channel	Duty Cycle	The Spec range
1	20%	19% ~ 21%
1	80%	79% ~ 81%
2	20%	19% ~ 21%
2	80%	79% ~ 81%

6. Compare the measured duty to the spec range shown in the table above.

Frequency Response Verification

This test checks if the value in dB format translated from output amplitude is within the spec range response to different frequency using a Power Meter.

1. Turn on the generator and choose CH1 as the operating channel. Set the load to 50Ω in OUTPUT SETUP system under the Utility menu.
2. Connect the Power Meter, PC and generator as shown below.



3. Select Sine waveform of the generator and set the amplitude to 1V and 2.5V, frequency to the values listed below in sequence.

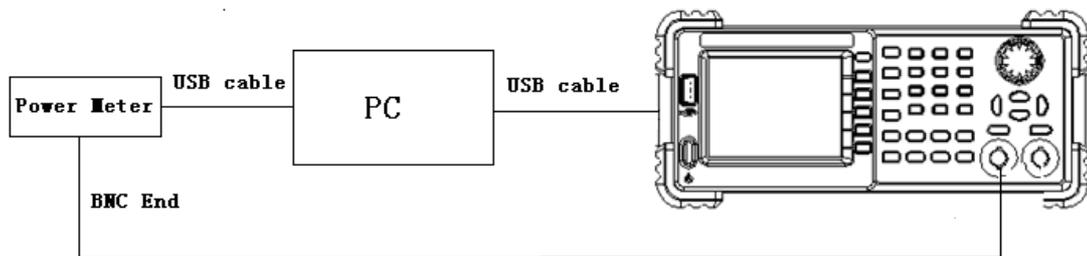
Output Voltage	1V			2.5V		
	CH1	CH2	the Spec Range (dBm)	CH1	CH2	the Spec Range (dBm)
10KHz			3.8794 ~ 4.0794			11.84 ~12.04
100KHz			3.8294 ~ 4.1294			11.79 ~12.09
1MHz			3.8294 ~ 4.1294			11.79 ~12.09
5MHz			3.6794 ~ 4.2794			11.64 ~12.24
10MHz			3.6794 ~ 4.2794			11.64 ~12.24
15MHz			3.6794 ~ 4.2794			11.64 ~12.24
20MHz			3.6794 ~ 4.2794			11.64 ~12.24
25MHz			3.6794 ~ 4.2794			11.64 ~12.24
50MHz			3.6794 ~ 4.2794			11.64 ~12.24

4. Remove the BNC cable to CH2 output and perform the same verification as channel1.
5. Compare the value measured from Power Meter to the spec range shown in the table above.

AC Amplitude Verification

This test checks the ac amplitude output accuracy at the frequency of 100 kHz using a Power Meter.

1. Turn on the generator and choose CH1 as the operating channel. Set the load to 50Ω in OUTPUT SETUP system under the Utility menu.
2. Connect the Power Meter, PC and generator as shown below.



3. Select Sine waveform of the generator and set the amplitude to the values listed below in sequence.

Amplitude	CH1 (dBm)	CH2 (dBm)	the Spec Range (dBm)
40mv			-24.50 ~ -23.46
200mv			-10.34 ~ -9.65
500mv			-2.35 ~ -1.72
2v			9.69 ~ 10.3
5v		None	17.65 ~ 18.26

4. Remove the BNC cable to CH2 output and perform the same verification as channel1.
5. Compare the value measured from Power Meter to the spec range shown in the table above.

General Adjustment Procedure

This chapter explains how to adjust the SDG1000 series generator for optimum operating performance. The following contents are the four adjustment steps:

- **Feedback channel Adjustment** which act as a standard calibration module, providing the accuracy assurance for Self Adjust.
- **Channel Self Adjustment** which includes internal control channel adjustment and signal channel adjustment
- **Square Adjustment** which adjust the square duty to limit its error to the minimum
- **Frequency Response Adjustment** which could properly compensate the amplitude as the frequency increases.

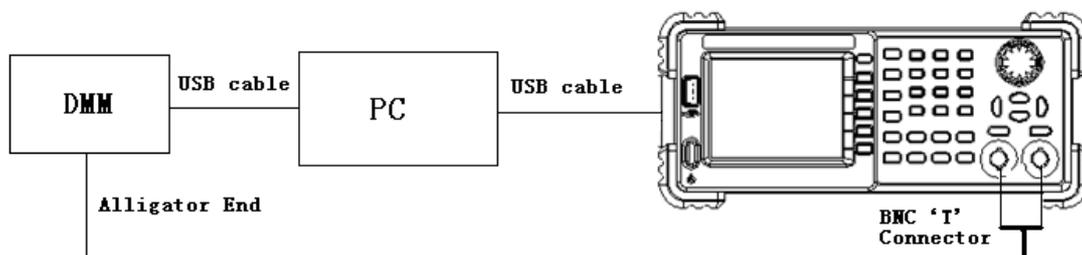
Warming up

Before performing the adjustment procedures, you must let the oscilloscope and other test equipments warm up for at least 15 minutes in an ambient temperature between 20 °C and 30 °C. Adjustments performed prior to warm-up or outside this temperature range may result in poor performance.

Feedback Channel Adjustment

The internal feedback channel receives the feedback signal from all the other channels that are performing self adjustment. This adjustment acts as a standard test module and must be performed prior to Self Adjust to make sure it is performed based on a best adjusting accuracy.

1. Turn on the generator.
2. Connect the DMM, PC and SDG1000 generator as shown below:



3. Open the EasyTest software on the desktop, and run the feedback channel script prepared previously. The CH2 will be automatically turned on upon running of the script.

Channel Self Adjustment

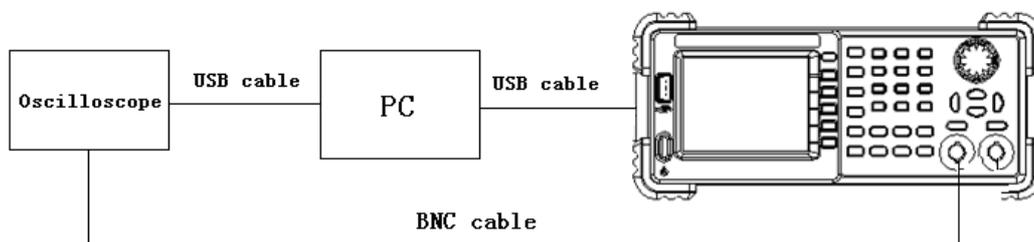
This adjustment is for internal control channel and signal channel. Through feedback circuits of the feedback channel and signal channel, this adjustment helps to obtain the actual working performance for components from signal channels.

1. After the feedback channel adjustment completed, disconnect the two BNC cables on channel 1 and channel 2.
2. Select “Self Adjust” to perform the channel Self Adjustment in Test/Cal system under the Utility menu.
3. Once the “Self Adjust” begins, the generator turns to adjustment interface and the progress bar displays on the screen. In about 15 seconds it will reach to 100%, which indicates completing of the self-adjust. You could press any functional button to exit.

Square Adjustment

This procedure adjusts the square duty to limit its error in the range of $\pm 1\%$.

1. Connect the Digital oscilloscope, PC and SDG1000 generator as shown below:
2. Open the EasyTest software on the desktop, and run the square adjustment script prepared previously. After the generator completes adjustment for channel 1, the prompt message displays on the screen will indicate you to remove the BNC cable to channel 2 to start adjustment.

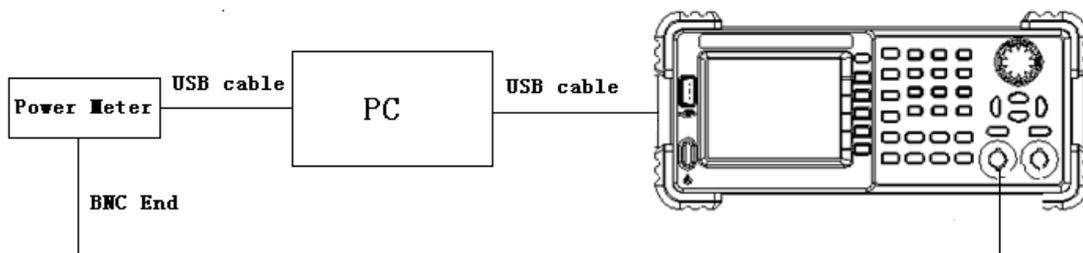


3. After the two channel adjustment completed, please disconnect all connections.

Frequency Response Adjustments

This adjustment aims to obtain the actual frequency response characteristic of signal channel, thus to perform appropriate compensation. Since the waveform amplitude will decrease as the input frequency increases, it is essential to compensate for the amplitude to match it to the frequency.

1. Turn on the generator and connect it to PC using a USB cable.
2. Connecting the USB end of the Power Meter to the USB port of the PC, upon which the Power Meter indicator light will be brightened. Only after the indicator light goes out from red, could it be connected to the generator output.
3. Open the EasyTest software on the desktop, and run the corresponding script prepared previously. In about 10 seconds the prompt message will display on the screen to indicate you to connect the Power Meter. After the generator completes adjustment for channel 1, the prompt message displays on the screen will indicate you to remove the BNC cable to channel 2 to start adjustment.



4. After the two channel adjustment completed, please disconnect all connections.

Assembly Procedures

This chapter describes how to remove the major modules from the SDG1000 series Generator. To install the removed modules or replace new modules, please follow corresponding operating steps in reverse order.

The following contents are what mainly included in this chapter:

- **Security Consideration** which describes security information needed to considerate while operating.
- **List of Module** in which the modules to remove are listed.
- **Required Tool** which describes the tools needed to perform the procedures
- **Disassembly Procedures** which describes in detail how to remove and install the modules

Security Consideration

Only qualified personnel should perform the disassembly procedures. Whenever possible, disconnect the power before you begin to remove or replace the modules. Otherwise, any personal injuries or damages to the components may occur.

Avoid Electric Shock Hazardous voltages exist on the LCD module and power supply module. To avoid electrical shock, you should firstly disconnect the power cord from the oscilloscope, and then wait at least three minutes for the capacitors in the oscilloscope to discharge before you begin disassembly.

Preventing ESD Almost all electrical components can be damaged by electrostatic discharge (ESD) during handling. Component damages can occur at electrostatic discharge voltages as low as 50 volts. The following guidelines will help preventing ESD damage when servicing the instrument or any electronic device.

- ◆ Disassemble instruments only in a static-free work area.
- ◆ Use a conductive work area to reduce static charges.
- ◆ Use a conductive wrist strap to reduce static charge accumulation.

- ◆ Minimize handling.
- ◆ Keep replacement parts in original static-free packaging.
- ◆ Remove all plastic, foam, vinyl, paper and other static-generating materials from the immediate work area.
- ◆ Use only anti-static solder suckers.

List of Modules

The following removable modules are listed in the order of performing disassembly procedures.

Number of Module	Module
1	Handle
2	The main Metal Shell and Rear Cabinet
3	Front Shell
4	Display Module
5	Rear Metal Cover

Required Tools

Use these tools to remove or replace the modules in the oscilloscope:

- PH2 philips head screw drivers

Disassembly Procedures

This section describes how to remove and install the modules listed above in the generator in detail. Complete disassembly will be best achieved through the following operating steps.

A view of the whole Instrument

The disassembly drawing are shown as below for you to disassemble the generator in right steps. Before disassembling, please cut the power to avoid any personal injuries or damages to inside components. Since some modules of the instrument are sharp, you should also take care while operating to prevent being scratched.

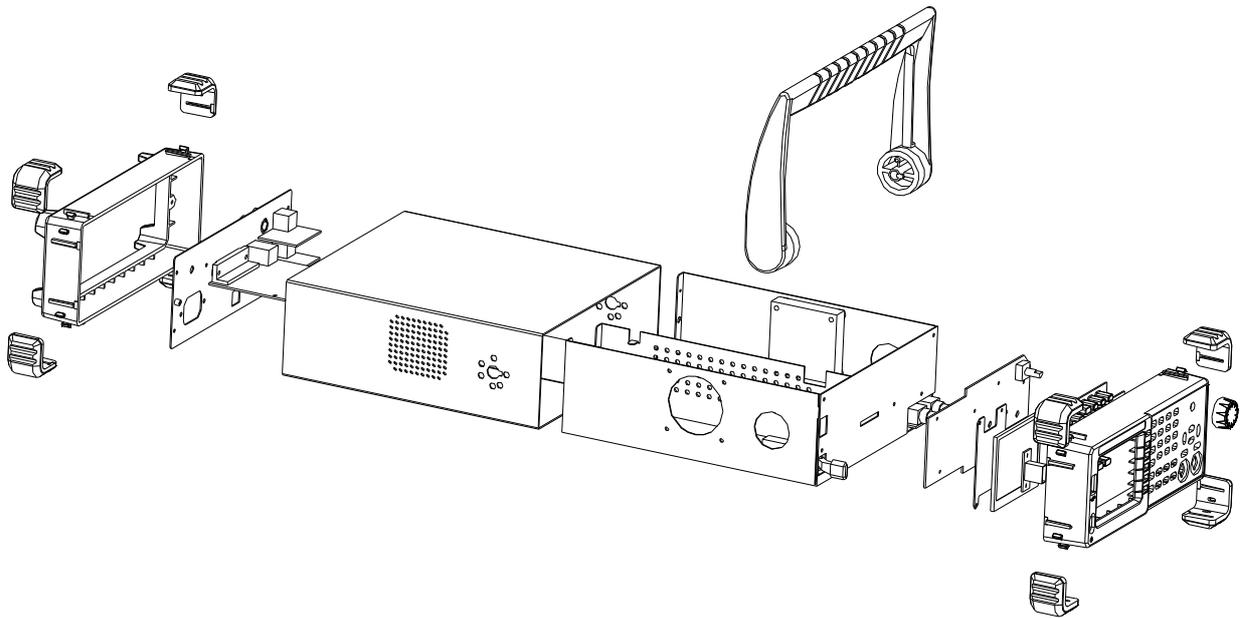


Table 4-1 A view of the whole instrument

Removing the Handle

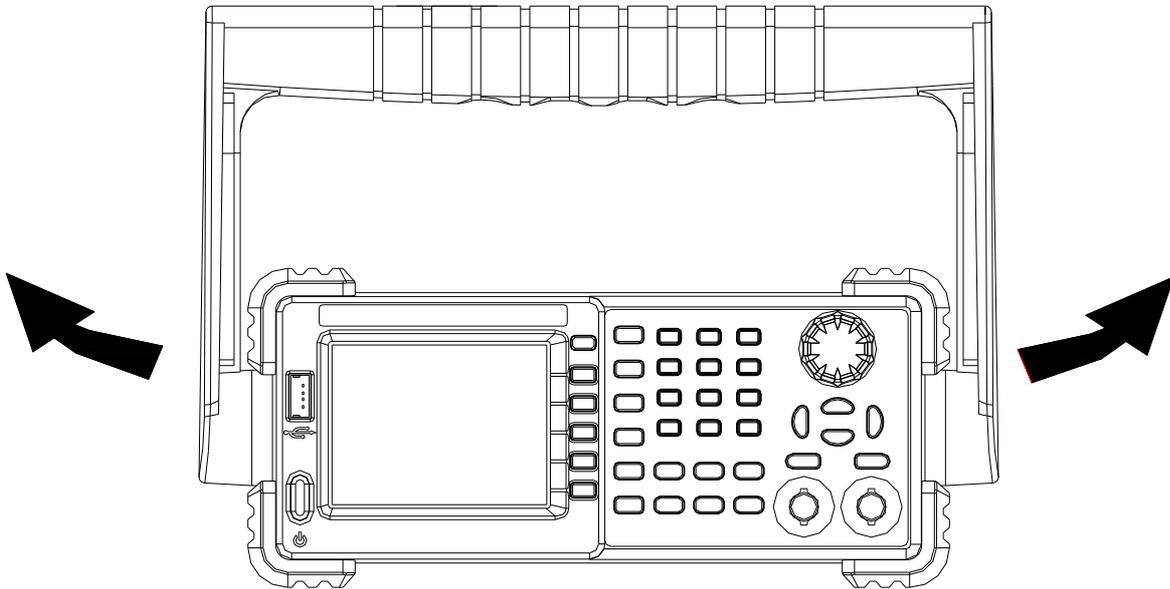


Table 4-2 Removing the handle

Removing steps:

Pull down the handle hard from the two sides of the generator.

To install the handle, please operate as the reverse steps.

Removing the Metal Shell and Rear Cabinet

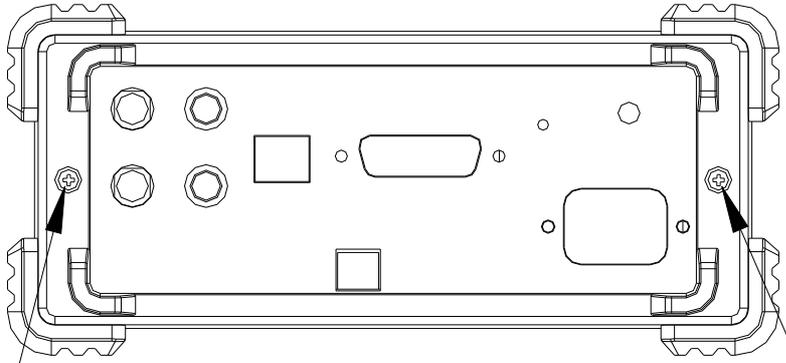


Table 4-3 Removing the rear cabinet screws

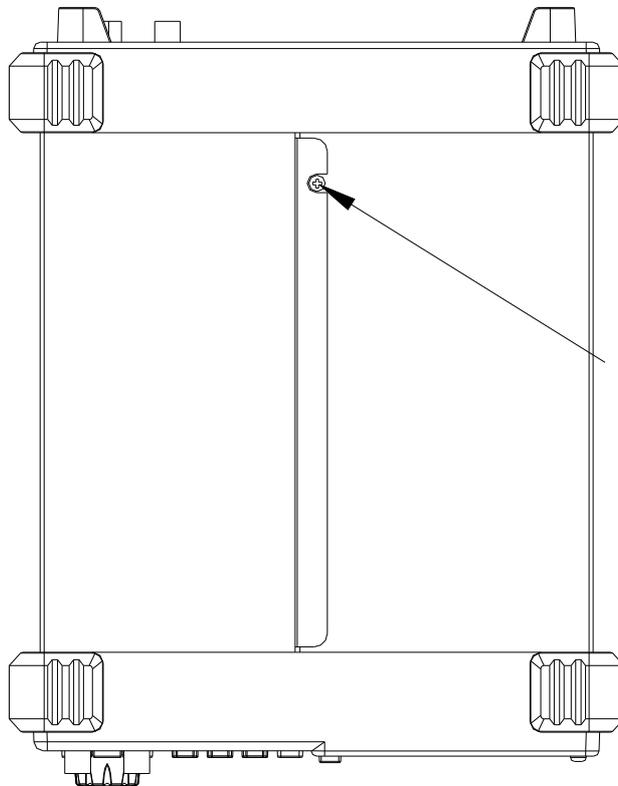


Table 4-4 Removing the metal shell screw

Removing steps:

1. Remove the two screws from the rear cabinet of the generator using a PH2 philips screw driver.
2. Remove the screw from the bottom of the generator using the screw driver.
3. Remove the rear cabinet and metal shell from the main body.

To install the metal shell and rear cabinet, please operate as the reverse steps.

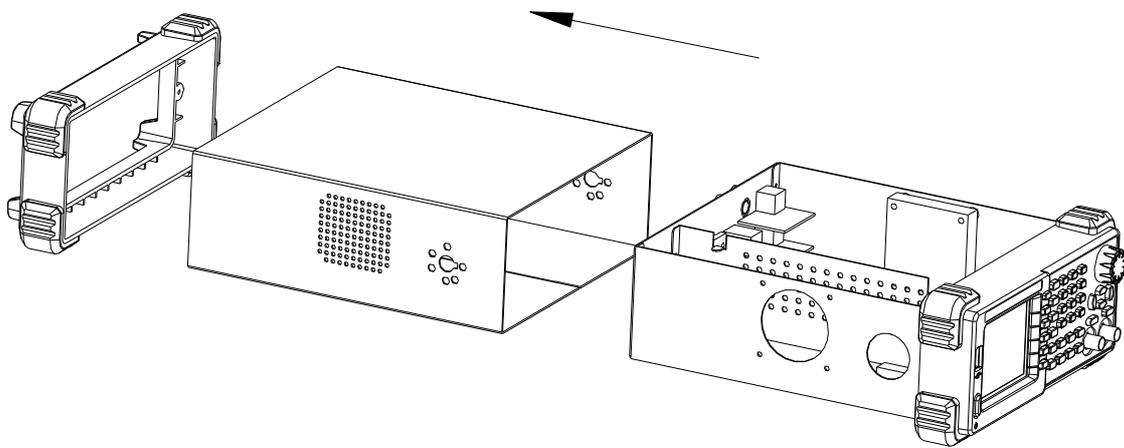


Table 4-5 Disassembled into three parts

Removing the Front Cabinet

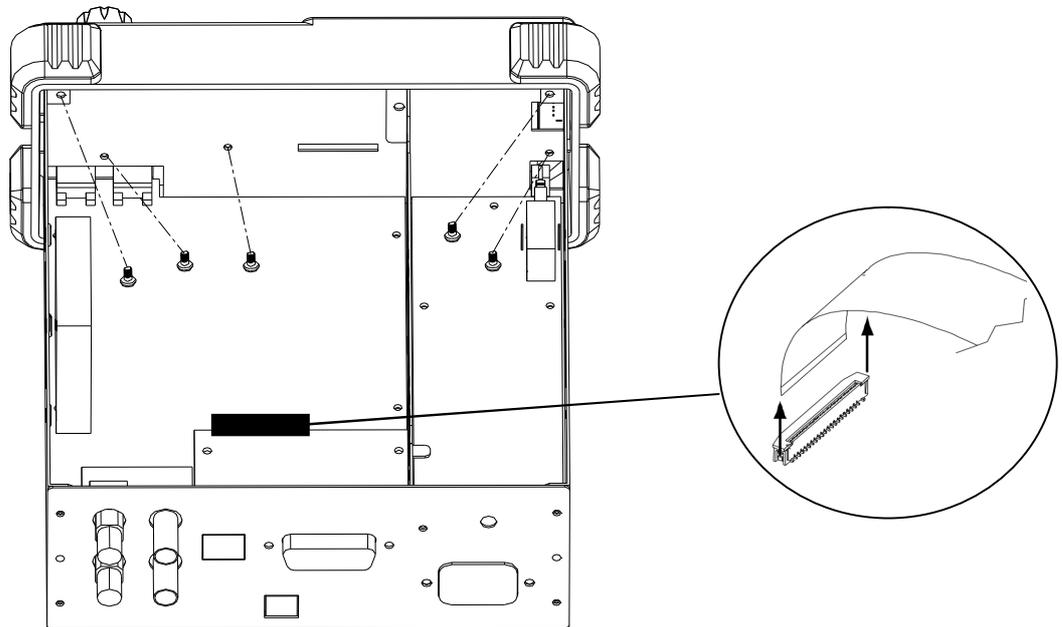


Table 4-6 Removing the front cabinet

Removing steps:

1. Remove the front module cable connected to the main board.
2. Remove the screws from the front cabinet using a PH2 philips screw driver.
3. Separate the front cabinet from the main body of the generator.

To install the front cabinet, please operate as the reverse steps.

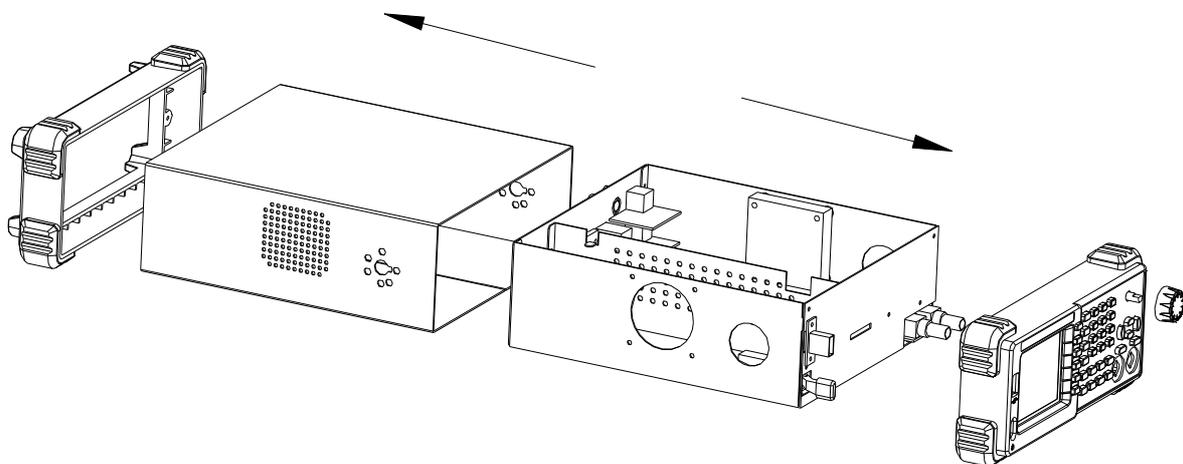


Table 4-7 Disassembled into three parts

Removing the Display Module

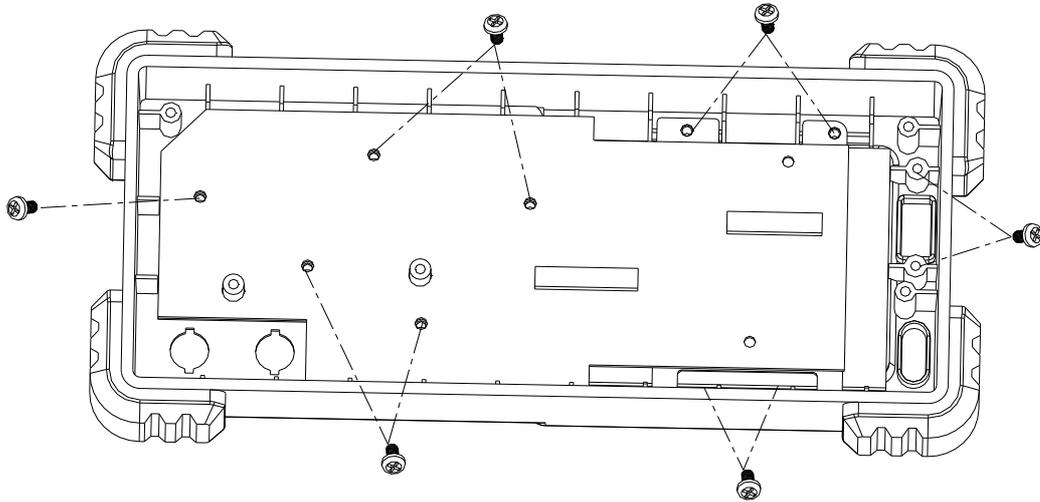


Table 4-8 Removing the display module screws

Removing steps:

1. Remove the screws from the keypad circuit board using a PH2 philips screw driver.
2. Remove the keypad circuit board, soft keypad and LCD screen from the front cabinet in sequence.
3. Remove the front cabinet universal knob by firmly pull it out.

To install the display module, please operate as the reverse steps.

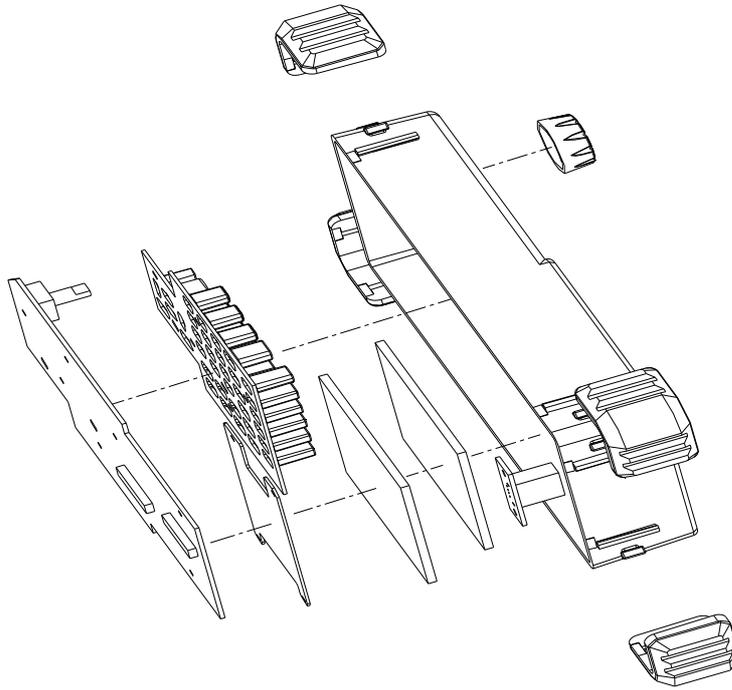


Table 4-9 Removing the front cabinet module

Removing the Main Body

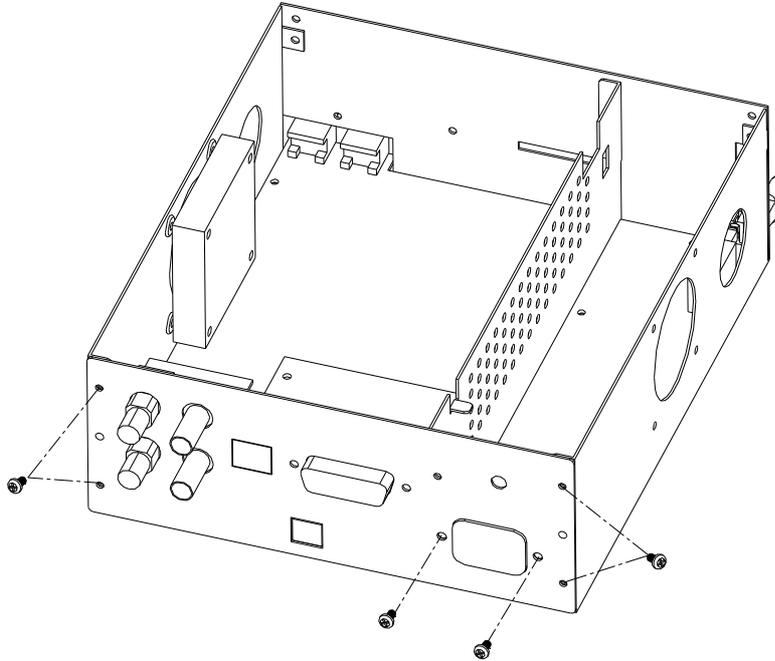


Table 4-10 Removing the main body

Removing steps:

1. Remove the screws from the rear metal cover using the screw driver.
2. Remove the rear metal cover from the main body of the generator.
3. Remove the screws from the main board and power supply board and using the screw driver.
4. Separate the rear metal cover, main board and power supply in sequence board from the main body of the generator.

To install the main body, please operate as the reverse steps.

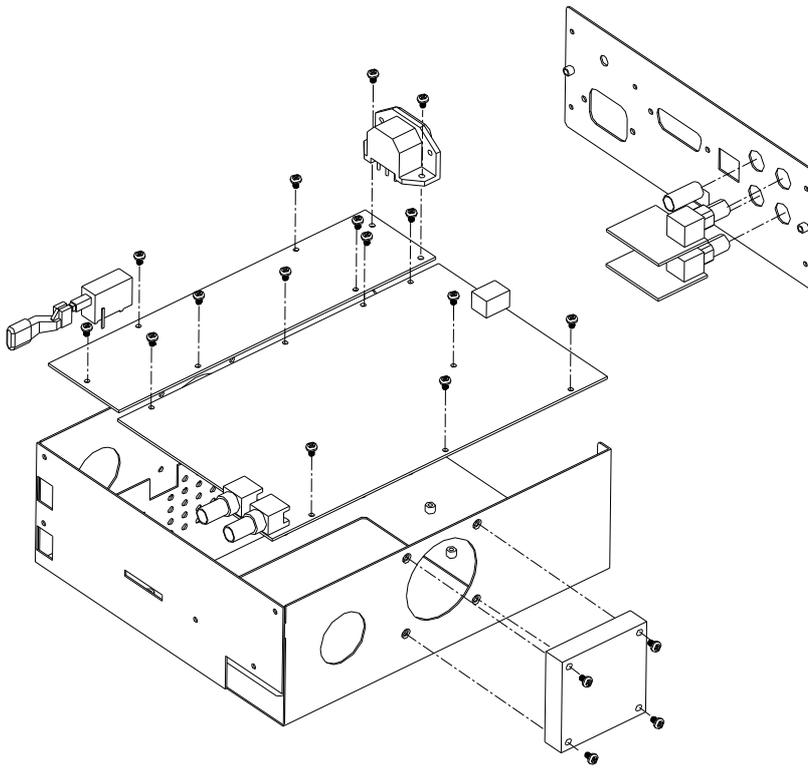


Table 4-11 Assembly drawing of the main body

Troubleshooting

The internal structure of the generator consists of main board, power supply board and keypad circuit board, and they are linked through cables or connectors. This chapter explains the main checking procedures for main board and power supply by measuring the pointed test points on them to help you decide the reason for the failure you encounter while operating SDG1000 series arbitrary waveform generator.

ESD Precautions

While performing any internal testing of the generator, please refer to the following precautions to avoid damages to internal modules or components result from ESD.

- Touch circuit boards by the edges as possible as you can.
- Reduce handling of static-sensitive modules when necessary .
- Wear a grounded antistatic wrist strap to insulate the static voltage from your body while touching these modules.
- Operate static-sensitive modules only at static-free areas. Avoid handling modules in areas that allow anything capable of generating or holding a static charge.

Required Equipments

The equipments listed in the table are required to troubleshoot the generator.

Table 5-1 Required equipments

Equipment	Critical Specifications	Example
Digital Multimeter	Accuracy $\pm 0.05\%$ 1 mV resolution	Agilent 34401A
Oscilloscope	100MHz Bandwidth	MSO7012B

Main Board Drawing

Please refer to the following drawing to quickly locate the test points on the main board for easy resolution of the failures you encounter.

Check the Power Supply

Before performing the power supply testing procedure, please make sure that the generator is grounded correctly through the protective lead of the power cord. Take care not to touch or even disassemble the power supply module without any safety precautions, or you may probably suffer from electric shock or burn. Here are procedures for testing the power supply:

1. Disconnect the power cord of the generator and then check whether the fuse has been burnt out.
2. Remove metal shell of the generator using a driver, and then disconnect the power connector connected to the main board.
3. Focus on the Power Connector which contains 6 pins from Pin1 to Pin6. Since two of the six pins are ground wire, you can respectively test the other four pins marked with blue, yellow, red and white to check whether the voltage value is within the corresponding specified range using a digital multimeter. The voltage parameters to be tested are listed in table below:

Table 5-2 Voltage parameters of the power connector

Voltage value	Pins	Error limit
20V	VH+(red)	20%
-20V	VH-(white)	20%
6.8V	VL+(yellow)	10%
-6.8V	VL-(blue)	10%

If each tested voltage value is within the corresponding spec range referring to the table above, then the power supply works normally. Otherwise, it proves to be faulted, please return it to the factory to have it repaired or contact SIGLENT.

Note: *The main power supply provides an input fuse to protect against the danger of fire in the event of a failure of the power supply circuitry. However, this fuse will not fail ("open" or "blow") in normal power supply operation except that a significant overload occurs. Replace the entire main power supply assembly if the input fuse fails.*

Check the Main Board

If you want to remove the main board from the metal shelf inside the generator, you'd better place it on a clean, insulated mat. In addition, to avoid some chips or components on the main board being damaged for overheating, it is essential to cool the main board whenever possible using a fan. Here are procedures for testing the main board:

1. Several kinds of connectors including Fan Connector, Power Connector and Keypad Connector are located on the main board. Check if all these connectors are connected properly.
2. Make sure that the connectors on the main board are properly connected, then connect the generator to AC power and turn it on. Check if the voltage values at all test points are within the spec range using a digital multimeter. The voltage parameters to be tested are listed in table below:

Table 5-3 Voltage parameters of the main board

Test point	Voltage value	Error limit
+15V	15V	±5%
-15V	-15V	±5%
-5V	-5V	±5%
+5V	5V	±5%
VCC3.3V	3.3V	±5%
VCC5V	5V	±5%
LED_ANODE	5V	±10%
VCC5V_U	5V	±5%
VCC1.2V	1.2V	±5%
12V_FAN	12V	±10%

If each tested voltage value is within the corresponding spec range referring to the table above, then the main board works normally. Otherwise, the failure may also come from power supply board except the main board, please return the generator to the factory to have it repaired or contact SIGLENT.

In addition to power supply test points listed in the table above, the following three signal test points are recommended for you to decide the main board failure. Since the signal from these points is AC signal, you should measure them using a digital oscilloscope.

Table 5-4 Signal test points for the main board

Test point	Voltage/Frequency	Error limit
TA15	1.5V (Sine wave)	±10%
TA16	1.5V (Sine wave)	±10%
T4(clock signal)	25MHz	±50ppm

TA15 is tested for CH1 output waveform. In the case of abnormal display of channel 1 on the oscilloscope screen, if the tested voltage is within the spec range, then the failure results from analog channel. Otherwise, the failure may result from FPGA.

TA16 is tested for CH2 output waveform. In the case of abnormal display of channel 2 on the oscilloscope screen, if the tested voltage is within the spec range, then the failure results from analog channel. Otherwise, the failure may result from FPGA.

T4 is the mainboard clock signal. Please test its frequency using an oscilloscope. If the tested frequency is not 25MHz, the mainboard clock proves to be faulted.

Quick Guide for General Failures

The general hardware failures are described as below. Reading the following information can help you quickly handle some easy hardware failures with more convenience.

1. No start-up after pressing the Power button:

- (1) Check if the power cord is correctly connected.
- (2) Check if the power button is usable.
- (3) Check whether the fuse has been burnt out. If the fuse needs to be changed, please contact SIGLENT as soon as possible and return the instrument to the factory to have it repaired by qualified personnel.
- (4) Check if the power connector is properly connected to the main board.
- (5) If the instrument still does not work normally, please contact SIGLENT.

2. The instrument starts up with a dark screen:

- (1) Check if the power connector is properly connected to the main board.
- (2) Test if the voltages on the test points marked “-5V” and “LED_ANODE” are within the spec range.
- (3) If the instrument still does not work normally, please contact SIGLENT.

3. No response after pressing any button or abnormal display of the screen:

- (1) Check if the two end of the connector between the keypad circuit board and the main board is properly connected.
- (2) If the instrument still does not work normally, please contact SIGLENT.

4. The output frequency measured on the oscilloscope is incorrect:

- (1) Check if the frequency on the test point marked “T4” is correct.
- (2) Refer to “Check the Main Board” or contact SIGLENT.

Maintenance

Maintain Summary

SIGLENT warrants that the products it manufactures and sells are free from defects in materials and workmanship for a period of three years from the date of shipment from an authorized **SIGLENT** distributor. If a product or CRT proves defective within the respective period, **SIGLENT** will provide repair or replacement as described in the complete warranty statement.

To arrange for service or obtain a copy of the complete warranty statement, please contact your nearest **SIGLENT** sales and service office.

Except that as provided in this summary or the applicable warranty Statement, **SIGLENT** makes no warranty of any kind, express or implied, including without limitation the implied warranties of merchantability and fitness for a particular purpose. In no case shall **SIGLENT** be liable for indirect, special or consequential damages.

Repackaging for Shipment

If the unit needs to be shipped to **SIGLENT** for service or repair, be sure to:

1. Attach a tag to the unit identifying the owner and indicating the required service or repair.
2. Place the unit in its original container with appropriate packaging material for shipping.
3. Secure the container with strong tape or metal bands.

If the original shipping container is not available, place your unit in a container which will ensure at least 4 inches of compressible packaging material around all sides for the instrument. Use static-free packaging materials to avoid additional damage to your unit.

Contact SIGLENT

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