GSG-2000 Series

6 GHz Vector Signal / Signal Generator

FEATURES

- Frequency Range : 9 kHz to 6 GHz
- Frequency Resolution : 1 mHz
- Standard 10 ppm Frequency Stability, 2 ppm/year Aging Rate.
  (Optional: 10 ppb Frequency Stability with 0.1 ppm/year Aging Rate)
- Amplitude Range : -140 dBm to +20 dBm
- 0.01 dBm Amplitude Setting Resolution
- Amplitude Support dBm, dBμV, Vrms Unit
- Phase Noise : <-117 dBc/Hz (Typical) @1 GHz Output and 20 kHz Offset
- Frequency/Amplitude Switching Speed : < 5 ms
- Built-in LF Output, Pulse Output
- Built-in in AM, FM, PM Analog Modulation
- Support IQ Modulation Output (Only for GSG-2160)
  * Maximum 60 MHz Baseband I or Q Modulation Output
  * Maximum 120 MHz RF I+Q Modulation Output
  * Built-in ASK, PSK, APSK, QAM, FSK, MSK, User-define IQ, User-define FSK Modulation Signal
- Provide USB, LAN and GPIB (Opt.), Commands Comply with SCPI Standards

GW INSTEK
Simply Reliable

The GSG-2000 series is a basic RF vector signal/signal generator that covers a frequency range from 9 kHz to 6 GHz. It is suitable for applications in communications education, RF component testing (such as amplifiers, antennas, and filters), automotive electronic signal testing, and IoT applications. It meets the testing requirements of RF products during production and development stages. Compared to its main competitors, the GSG-2000 series offers superior specifications including a wide amplitude output range of +20 dBm to -140 dBm, lower phase noise of -117 dBc/Hz, and high frequency accuracy with 10ppm frequency stability and 2ppm aging rate. Users have the option to enhance frequency stability and aging rate by selecting the OCXO (Oven Controlled Crystal Oscillator) option, which provides 10ppb stability and 0.1ppm aging rate.

For the signal modulation, the entire series has built-in AM, FM, and PM analog modulation, and GSG-2160 features a digital signal modulation function with a maximum bandwidth of 60 MHz digital signal output, supporting ASK, PSK, APSK, QAM, FSK, MSK, User-defined IQ, User-defined FSK modulation signals.

Furthermore, the GSG-2000 series also provides LF signal and Pulse signal output. The LF signal allows users to output Sine, Square, Triangle/Ramp, Gaussian Noise signals, and the Pulse signal output can simulate pulse wave applications of various widths. In addition to the above signal outputs, GSG-2000 also provides AM/FM/digital IQ signal input, as well as independent output ports for digital I or Q signals.

GSG-2000 series adopts a seven-inch TFT LCD display that can fully display the parameters and status set by the user, and the series also provides USB, LAN, GPIB (option) communications interfaces, and provides standard SCPI-compatible commands to support remote control. GSG-2000 series is designed for 3 U high standard rack size.

SELECTION GUIDE

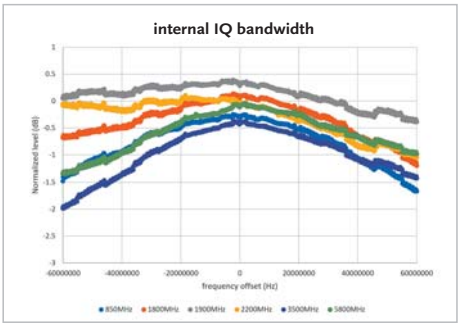
Model	GSG-2160	GSG-2060
Frequency Range	9 kHz to 6 GHz	9 kHz to 6 GHz
Analog Modulation	AM, FM, PM	AM, FM, PM
Digital Modulation	ASK, PSK, APSK, QAM, FSK, MSK, user define IQ, user define FSK	—
LF Output	V	V
Pulse Output	V	V

A. PROVIDES MULTIFUNCTIONAL OUTPUT SIGNALS

RF and LF Signal Output Ports

Pulse Signal Output Port

Digital Signal Output (GSG-2160 only)



Frequency Response Plot Generated by Internal Input IQ Signal.

Both GSG-2160 and GSG-2060 provide RF signal output from 9 kHz to 6 GHz. GSG-2060 supports analog RF signal output (such as AM, FM, PM), and GSG-2160 supports analog and digital RF signal output.

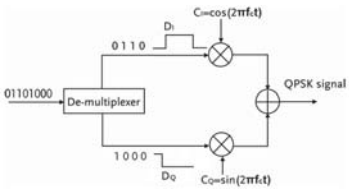
LF Output with Built-in Function Signal - Equipped with an LF function signal (Low Frequency function generator) that can be output independently, and the series provides waveforms such as Sine, Square, Triangle, Ramp, Gaussian noise, etc. Users can use it in conjunction with other input and output functions, or it can be used alone in applications such as circuit design and electronic component testing and other related applications.

Pulse Signal Output - GSG-2000 Series has a built-in Pulse signal output. Users can adjust the Pulse duty cycle, which is often used to test digital circuits such as TTL, CMOS, ECL, etc., or to simulate changes in switching signals.

Vector signal output (GSG-2160 only) - Frequency response plot generated by internal input IQ signal.

B. SUPPORTS VARIOUS SIGNAL INPUTS

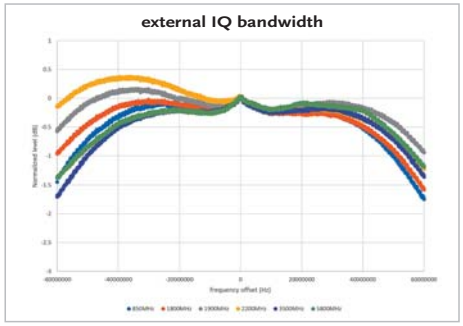
External IQ Signal & AM/FM Signal Input



I and Q input for QPSK Signal

Provides Input for External IQ Signal - Users can input I and Q data respectively, and then synthesize the required IQ vector signal through the internal RF signal output.

External AM/FM Signal Input - Users can input AM or FM signals externally for analog modulation related applications.



Frequency Response Diagram Generated by External Input IQ Signal

For example, in the QPSK signal in the diagram, after inputting the corresponding data from I and Q respectively, and selecting the QPSK function, QPSK output can be edited.

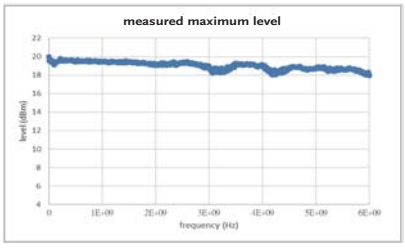
Frequency response diagram generated by external input IQ signal. (GSG-2160 only)

C. ACCURATELY SET RESOLUTION

0.01 dBm Setting Resolution

GSG-2000 provides a setting resolution as low as 1 mHz in frequency and a setting resolution in amplitude of 0.01 dBm, allowing users to process more complex signals.

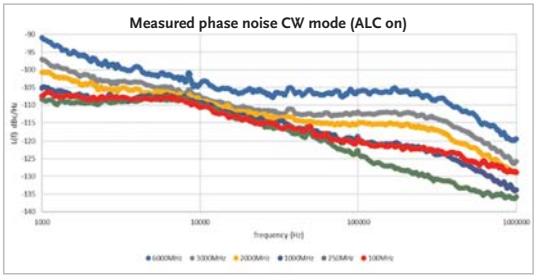
D. WIDE AMPLITUDE OUTPUT RANGE



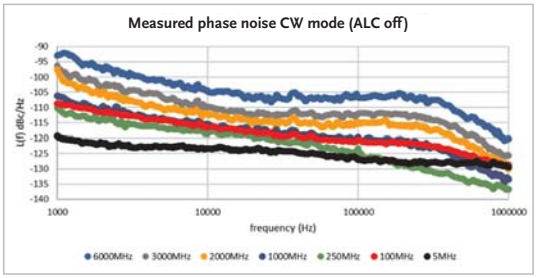
Guaranteed Specification Range

GSG-2000 provides a setting range from +20 dBm to -140 dBm, and a guaranteed specification range from +14 dBm to -110 dBm.

E. PURER SIGNAL OUTPUT



Measured Phase Noise CW mode (ALC on)

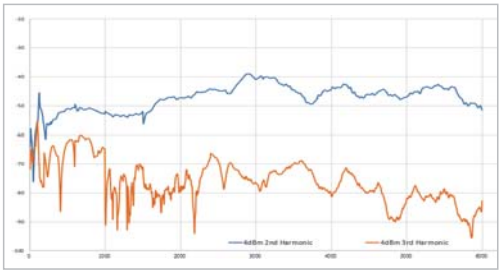


Measured Phase Noise CW mode (ALC off)

-117 dBc/Hz phase noise the output signal provided by GSG-2000 has an optimal phase noise of -117 dBc/Hz, which can be applied to a wider variety of applications, such as automotive digital signals, IoT industrial applications and other fields that require pure signals.

The phase noise at each frequency under ALC On and ALC Off.

The signal purity of its Harmonic and Spur is also close to the entry-level indicators of major European and American manufacturers.



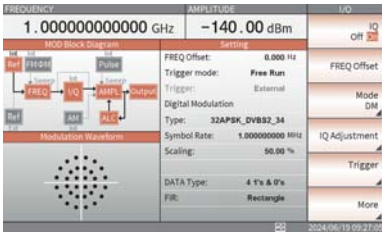
Harmonics <-35 dBc

Phase Noise @ 20kHz offset (dBc/Hz)			
	MHz	ALC On	ALC Off
Frequency Range	5	-	-122
	100	-112	-115
	250	-112	-117
	1000	-112	-117
	2000	-108	-112
	3000	-107	-110
	6000	-102	-105

Harmonics	
Range	Level ≤ 4 dBm
9 k ≤ Freq. < 6000 M	<-35 dBc

Non-Harmonics		
Level > -10 dBm, Offset > 10 kHz	<-35 dBc	1 M ≤ Freq. < 5 M
	<-70 dBc	5 M ≤ Freq. < 187.5 M
	<-75 dBc	187.5 M ≤ Freq. < 750 M
	<-72 dBc	750 M ≤ Freq. < 1500 M
	<-64 dBc	1500 M ≤ Freq. < 3000 M
	<-58 dBc	3000 M ≤ Freq. < 6000 M

F. GRAPHIC DISPLAY DESIGN



GSG-2000 utilizes a 7-inch large-size LCD display. All setting parameters, measurement results and current function information can be directly displayed, allowing users to quickly understand the current setting information.

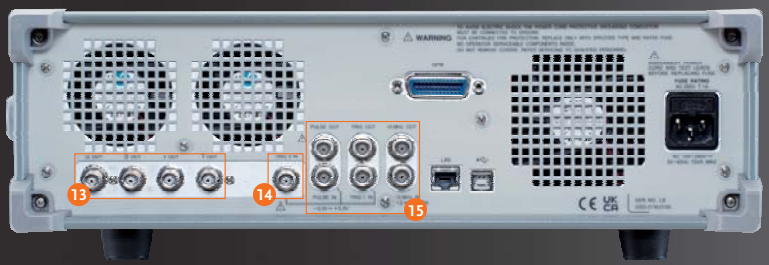
For the first innovation, icons and arrow connections are displayed directly on the screen, allowing users to understand the path of signal generation at a glance. For example, the PSK and QAM signal output in the picture above directly displays the block diagram, modulation signal pattern and corresponding parameters on the screen, allowing the user to set related parameters.

G. RICH COMMUNICATIONS INTERFACES

GSG-2000 series provides standard interface LAN and USBTMC output, and optional GPIB interface to meet the user's connection needs under various interfaces. The command supports the standard SCPI IEEE488.2 standard command set.

PANEL INTRODUCTION

CE USB GPIB LAN Mod In/Out Trg In/Out



1. Frequency, Amplitude, Sweep Setting Keys
2. Numeric Input Keys
3. Unit Selection Keys
4. F1~F5 Function Keys
5. Return Key
6. AM/FM/PM/Pulse Setting Keys
7. Trigger/LF/IQ Setting Keys
8. File/Save/Recall/Default/User Default/Utility Setting Buttons
9. LF On/Off; RF On/Off
10. I/Q Input Port (GSG-2160 only)
11. AM/FM Input Port
12. LF/RF Output Port
13. I/Q Output Port (GSG-2160 only)
14. Trigger 2 In
15. Pulse In/Out; Trigger 1 In/Trigger Out; 10 MHz In/Out

SPECIFICATIONS				
FREQUENCY RANGE				
Frequency Range	**9 kHz to 6 GHz**	**GSG-2160, GSG-2060**		
Frequency Resolution		1mHz		
Frequency Bands		Band	Frequency Range	N
		1	9 kHz to 5 MHz	digital synthesis
		1	<5 MHz to 187.5 MHz	1
		2	<187.5 MHz to 375 MHz	0.25
		3	<375 MHz to 750 MHz	0.5
		4	<750 MHz to 1500 MHz	1
		5	<1500 MHz to 3000 MHz	2
		6	<3000 MHz to 6000 MHz	4
Frequency Switching		≦5 ms		
SSB PHASE NOISE, CW at 20 kHz OFFSET (dBc/Hz)				
Frequency (MHz)		ALC on	ALC off	
	5	-	-122	
	100	-112	-115	
	250	-112	-117	
	1000	-112	-117	
	2000	-108	-112	
	3000	-107	-110	
	6000	-102	-105	
Residual FM (0.3 kHz to 3 kHz)(1 GHz CW)		<2Hz		
NON HARMONICS				
Non Harmonics	**Level > -10 dBm, Offset > 10 kHz**	<-65 dBc	1 M ≤ freq. ≤ 5 M	
		<-66 dBc,-70 dBc(typ)	5 M < freq. ≤ 187.5 M	
		<-75 dBc	187.5 M < freq.< 750 M	
		<-70 dBc, -74 dBc(typ)	750 M ≤ freq. < 1500 M	
		<-62 dBc, -66 dBc(typ)	1500 M ≤ freq. < 3000 M	
		<-58 dBc, -60 dBc(typ)	3000 M ≤ freq. < 6000 M	
HARMONICS				
Range		Level < 4 dBm		
9 k ≤ Freq < 6000 M		<-35 dBc		
FREQUENCY REFERENCE				
Frequency Reference		10 MHz		
Temperature Stability		<10 ppm, Standard	<10 ppb, OCXO Option	
Aging		2 ppm/year, Standard	0.1 ppm/year, OCXO Option	
Output		1 Vpp, 50 Ohm Load		
Input		-3 to 20 dBm, 50 Ohm Load		
Input Deviation		Standard: 3 ppm	OCXO Option: 0.5 ppm	
AMPLITUDE SPECIFICATIONS				
AMPLITUDE				
Setting Range		20 dBm to -140 dBm		
Resolution		0.01 dB		
Amplitude Unit		dBm, dBμV, Vrms		
AMPLITUDE ACCURACY				
Absolute Level Accuracy in CW Mode (ALC On)		-14 dBm to -60 dBm	-60 dBm to -90 dBm	-90 dBm to -110 dBm
	9 k < freq. < 3 GHz	±0.6 dB	±0.8 dB (±0.6 dB typical)	±1 dB (±0.7 dB typical)
	3GHz < freq.< 6GHz	±0.8 dB	±1 dB (±0.6 dB typical)	±1.2 dB (±0.7 dB typical)
Addition Level Accuracy in CW Mode (ALC Off, Power Search Run, Relative to ALC On)		0.15 dB		
VSWR (5 M to 3 GHz)		<1.8 (output ≤ -66 dBm)		
Amplitude Switching (ALC on, CW)		≦5 ms		
SWEEP SPECIFICATIONS				
SWEEP				
Mode		Frequency, amplitude, list		
Dwell Time		100 μs to 100 s		
Number of Points (Step)		2 to 65,535		
Number of Points (List)		1 to 4,096		
Triggering		Free, trigger key, external, timer		
ANALOG MODULATION SPECIFICATIONS				
FM				
Source		Internal, external		
Max. Deviation		N*1 MHz		
Rate	**freq ≧ 10 MHz**	0.1 Hz to 1 MHz		
	freq < 10 MHz	0.1 Hz to 100 kHz		
Resolution		1 mHz		
Accuracy (1 kHz rate, N*50 kHz deviation)		2 % setting + 20 Hz		
Distortion (1 kHz rate, N*50 kHz deviation)		0.4 %		
PM				
Source		Internal, external		
Max. Devitaion		N* 1 MHz/rate or 5 N rad		
Rate	**freq ≧ 10MHz**	0.1 Hz to 1 MHz		
	freq < 10MHz	0.1 Hz to 100 kHz		
Resolution		0.001 rad		
Accuracy (1 kHz rate)		1 % of setting + 0.1 rad		
Distortion (1 kHz rate, max deviation)		0.2 %		
Response		0.1 Hz to 1 MHz		
AM				
Source		internal, external		
Resolution		0.01 %		
Depth		0 to 100 %		
Accurcay (1 kHz, 0 dBm)	**<5 MHz**	1.5 % setting + 1 %		
	5 M to 4 GHz	3 % of setting + 1 %		
	4 GHz to 6 GHz	5 % of setting + 1 %		
Distortion (1 kHz, 80 %, <8 dBm)	**<5 MHz**	1.5 %		
	5 M to 4 GHz	2 %		
	4 GHz to 6 GHz	3 %		
Response		0.1 Hz to 20 kHz		

SPECIFICATIONS

PULSE SPECIFICATIONS		
PULSE		
Mode		Free-run, square, triggered, adjustable doublet, trigger doublet, gated, pulse train, and external pulse
Source		Internal, external
Pulse Input		-0.5 V to 5 V, V_{IL}=V_{IH}=1.5 V (typ)
Edge Time		<20 ns
On/Off Ratio		70 dB, 5 M to 3 GHz
		45 dB, 3 G to 6 GHz
Repitition Rate		0.1 Hz to 10 MHz
Pulse Period		100 ns to 42 s
Resolution		10 ns
Width		50 ns to period -10 ns
Pulse Train Number of Patterns		2047
LF PECIFICATIONS		
LF		
Waveform		Sine, square, triangle, ramp, gaussian noise
Frequency Range	**Sine**	0.1 Hz to 10 MHz
	Square, Triangle, Ramp	0.1 Hz to 1 MHz
	Gaussian Noise	10 MHz BW
Resolution		1 mHz
Output		2 mVpp to 6 Vpp
Impedance		50 Ohm
VECTOR MODULATION SPECIFICATIONS		
VECTOR MODULATION (GSG-2160 only)		
Source		Internal, external
Bandwidth (baseband)		60 MHz
Bandwidth (RF)		120 MHz
Carrier Frequency		<5 MHz to 6,000 MHz
Carrier Suppression	**25±5 ℃**	>50 dBc
Sideband Suppression	**25±5 ℃**	>50 dBc
Modulation Mode		ASK, PSK, APSK, QAM, FSK, MSK, user define IQ, user define FSK
ASK		2ASK(0 to 100 %), 4ASK, 8ASK, 16ASK, 32ASK
PSK		BPSK, QPSK, DQPSK, OQPSK, π/4 DQPSK, 8PSK, D8PSK, 16PSK
APSK		16APSK, 32APSK
QAM		16QAM, 32QAM, 64QAM, 128QAM, 256QAM
FSK		2FSK, 4FSK, 8FSK, 16FSK
Internal Modulation EVM		0.8 %, 10 MHz < freq < 3 GHz
(16 QAM, RRC filter, α =0.25, 4 Msps, level≦4 dBm, ALC off)		1.2 %, 3 GHz < freq < 5 GHz
IQ GENERATOR		
Resolution		16 bit
Sample Rate		10 kHz to 180 MHz
Baseband Bandwidth		60 MHz
ARB Memory	**Waveform Length**	16 Msa
	Storage Capacity	16 GB
Trigger Type		Free, single, gated, trigger and run
Trigger Source		External, trigger key
INTERNAL IQ ADJUSTMENT		
IQ Offset		±10 %
IQ Gain		±6 dB
IQ Skew		max 30 ps to 100 ps
EXTERNAL IQ OUTPUT		
Impedance		50 Ohm per output
Maximum per Output		0.5 Vpk
Bandwidth		60 MHz
Common Mode Offset		±1.25 V
Differential Mode Offset		±50 mV
EXTERNAL IQ INPUT		
Bandwidth		60 MHz
Full Scale		±1 V into 50 Ohm
IQ Offset		±10 % full scale
IQ Gain		±6 dB
SIMULTANEOUS MODULATION		
All modulation types (I/Q, FM, AM, ΦM, and pulse modulation) may be simultaneously enabled except: FM and phase modulation		
GENERAL SPECIFICATIONS		
Power Source		AC 100 to 240 V, 50 to 60 Hz
Power Consumption		90 VA Maximum
Display		7 inch TFT LCD, 1024(RGB)*600
Interface		GPIB (option), USB, LAN
Operating Temperature		0 to 50 ℃
Storage Temperature		-10 to 70 ℃
Humidity		85 % at 40 ℃
Altitude		Up to 2000m
Dimensions & Weight		430(W) x 140(H) x 540(D)mm ; Approx. 13 kg

Specifications subject to change without notice. GSG-2000_E_ID1BH

ORDERING INFORMATION

GSG-2160 6GHz Vector Signal Generator
GSG-2060 6GHz Signal Generator

ACCESSORIES

CD (User Manual) ×1, Power Cord ×1

OPTIONAL ACCESSORIES

ADP-001	N(M)-BNC(F) Adapter	**GTL-301**	N(M)-N(M) RF Cable
ADP-002	N(M)-SMA(F) Adapter	**GTL-303**	SMA(M)-SMA(M) RF Cable
GRA-447	Rack Mount Kit. 19", 3U Size		

OPTION

OCXO clock reference source

* GPIB and OCXO options can only be installed prior to the shipment. Please select these options while placing an order.

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GW INSTEK
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