GW INSTEK
Simply Reliable

# GSG-2000 Series

## 6 GHz Vector Signal Generator
## 6 GHz Signal Generator

CE | RS-232 | USB | GPIB | LAN | Mod In/Out | Trg In/Out

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 10 ppm frequency stability and 2 ppm aging rate. Users have the option to enhance frequency stability and aging rate by selecting the OCXO (Oven Controlled Crystal Oscillator) option, which provides 10 ppb stability and 0.1 ppm 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 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 is designed for 3 U high standard rack size.

## 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
* 0.01dBm 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 : < 5ms
* 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.), Compatible SCPI Command Standard

## APPLICATIONS

* Educations
* Automotive
* Electronic Component
* IoT

| 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 |

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## 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 μ s 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

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|---|---|---|
| **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, $\alpha$ =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_ID1DH

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

## 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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