

Standard Signal Generators

# SG-7000 SERIES

1.3GHz FM/AM Standard signal generator

## SG-7130

2GHz FM/AM Standard signal generator

## SG-7200

### OUTLINE

Liberalized communication's market has led to rapid expansion for cordless communication's market including pocket pagers and cellular phones for car and portable use, thus causing a flood of portable street terminals. The SG-7000 Series are standard signal generators optimized for development, assembly, quality control, maintenance and servicing in the mobile communications field, and include cellular phones, cordless phones and pagers. Developed in order to achieve reduction both in power consumption and price based on excellent basic performance and operability, it is a standard signal generator featuring multiple and high functionality with high cost efficiency.



**SG-7000 SERIES****FEATURES****Enriched Basic Performance**

The SG-7200 covers a wide band from 100 kHz to 2 GHz (100 kHz to 1.3 GHz with the SG-7130) and its output level can be varied between -133 and +13 dBm with a high resolution in 0.1 dB steps. The available modulation includes FM, AM, AM/FM, and FM/FM simultaneous modulation as well as DC-FM modulation, which can provide frequency accuracy with an even higher stability. In addition, up to 100 front panel setting conditions including frequencies, output levels and modulation methods can be stored and recalled.

These features make the SG-7000 series a production measuring tool for the communications field, providing enriched basic performance together with high cost efficiency.

**Excellent Operability**

Features for eliminating operation mistakes and improving the ease of use include; 1) independent control of the frequency output levels using two rotary knobs; 2) key layout for minimizing operation mistakes adopted for frequently-used keys such as the RF ON/OFF, FM/AM modulation ON/OFF, memory and UP/DOWN keys; 3) direct selection of FM, AM, DC-FM, FM-FM (FM 2-tone) modulation, and so on.

**Continuously Variable Output Level**

The output level can be varied continuously and uninterruptedly from a desired point without the need for switching an internal attenuator.

This is specially convenient in squelch sensitivity testing, etc.

**Highly Stable DC-FM Modulation**

The DC-FM modulation featuring a high carrier frequency stability of

$\pm$  (Reference oscillation  $\pm$  250 Hz) at <10 kHz deviation is of optimum performance for the pager (because the DC-FM modulation used with the pager should have a high carrier stability).

**100-Step Sequence Memory**

The sequence memory can be divided into 10 groups and copied to an instrument of the same model. As the GP-IB and remote control connectors are provided as standard, the SG-7000 series can be accommodated in an automated measuring system for use in production automation.

# PROGRAMMABLE FM/AM STANDARD SIGNAL GENERATORS

## SPECIFICATIONS

Figures inside [ ] are the values for the SG-7130; all other values are common.

### Frequency

Range	100kHz to 2GHz [1.3GHz]
Resolution	10Hz (fc < 1.02GHz) 20Hz (fc > 1.02GHz fc: carrier frequency)
Accuracy	Same as reference oscillator
Display	9 digits
Switching speed	50ms (standard), Maximum :150ms
Reference oscillator	
Frequency	50MHz
Stability	Temperature stability : $\pm 5 \times 10^{-5}$ (5 to 35 °C) Aging rate : $\pm 2 \times 10^{-6}$ /Week

### External reference input

Frequency	10MHz $\pm$ 200Hz
Level	0.15Vrms or more (50Ω load)
Maximum input voltage	5V (DC + ACpeak)

### External reference output

Frequency	10MHz
Level	0.15Vrms or more ( 50Ω load)

### Output level

Setting range	- 133dBm to + 13dBm - 26dBμ to + 120dBμ - 20EMF dBμ to + 126EMF dBμ (The maximum output level range during AM modulation is up to -6dB of the above range)
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Units	dBm (0dB = 1mW, 50Ω load) dBμ (0dB = 1μV) EMF dBμ (0dB = 1μV, open-circuit)
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Resolution	0.1dB
Display	4 digits digital display
Frequency response	$\pm 1$ dB (fc < 1.02GHz) $\pm 1.5$ dB (fc > 1.02GHz) (output level :0dBm)

### Output level accuracy

At 100kHz fc 130MHz	$\pm 1$ dB ( - 10dBm) $\pm 1.5$ dB ( - 120dBm) $\pm 2$ dB ( - 127dBm)
At 130MHz < fc 1.02GHz	$\pm 1$ dB ( - 10dBm) $\pm 1.5$ dB ( - 120dBm) $\pm 2$ dB ( - 123dBm)
At fc > 1.02GHz	$\pm 1.5$ dB ( - 93dBm) $\pm 2$ dB ( - 103dBm) $\pm 3$ dB ( - 110dBm)

Output impedance	50Ω (N-connector)
VSWR	1.3 max. (fc < 1GHz) 1.8 max. (fc > 1GHz) (at output level : - 13dBm or less)
Reverse power protection	Max. 25W, DC25V

### Signal purity

Spurious output	(at output level :0dB max., fundamental wave = 0dBc)
Higher harmonic	- 30dBc max.
Subharmonic	- 50dBc max. (1.02GHz fc 1.7GHz[1.3GHz]) - 40dBc max. (fc > 1.7GHz [1.3GHz])

Non-harmonic	- 60dBc maximum when the 0dBm output level is at least $\pm 5$ kHz from the carrier in CW mode (Band: 500MHz 100kHz fc 130MHz) - 40dBc max.
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	(Band: > 500MHz 100kHz fc 130MHz) - 60dBc max. (130MHz < fc 1.02GHz) - 54dBc max. (fc > 1.02GHz)
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SSB phase noise	At offset frequency 20kHz - 120dBc/Hz max. (100kHz fc 130MHz) - 130dBc/Hz max. (130MHz < fc 255MHz) - 125dBc/Hz max. (255MHz < fc 510MHz) - 120dBc/Hz max. (510MHz < fc 1.02GHz) - 115dBc/Hz max. (1.02GHz < fc 2GHz [1.3GHz])
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### Vestigial modulation (S/N)

Vestigial FM	At demodulation band : 0.3 to 3kHz, deviation : 3.5kHz 12Hz(49dB) max. (100kHz fc 130MHz) 3Hz(61dB) max. (130MHz < fc 255MHz) 6Hz(55dB) max. (255MHz < fc 510MHz) 12Hz(40dB) max. (510MHz < fc 1.02GHz) 24Hz(43dB) max. (1.02GHz < fc 2MHz) unit ; rms (vestigial FM) dB : relative value for 3.5kHz deviation At demodulation band :50Hz to 15kHz deviation : 75kHz 16Hz(73dB) max. (100kHz fc 130MHz) 50μs de-emphasis : ON dB : relative value for 3.5kHz deviation
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Vestigial AM	0.03% (60dB) max. (dB : relative value for 30% modulation) CW mode, demodulation band 50Hz to 15kHz (at 30% modulation)
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### Modulation

Internal modulation frequency	1kHz $\pm$ 3% 400Hz $\pm$ 3% (Dependent on 1kHz and 400Hz changeover)
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### External modulation input

Input impedance	Approx. 10kΩ (unbalanced)
Input voltage	2Vp-p (0V center)
Maximum voltage	15V (DC + ACpeak)

### FM modulation (AC-FM)

Display	3digits, digital display
Frequency deviation setting range and resolution	
fc	range
100kHz fc 127.5MHz	
Frequency deviation	0 to 9.99kHz 10 ~ 99.9kHz 100 ~ 250kHz
Resolution	10Hz 100Hz 1kHz
127.5MHz fc 260MHz	
Frequency deviation	0 to 9.99kHz 10 to 60kHz
Resolution	10Hz 100Hz
260MHz fc 520MHz	
Frequency deviation	0 to 9.99kHz 10 to 99.9kHz 100 to 125kHz
Resolution	10Hz 100Hz 1kHz
520MHz fc 1.04GHz	
Frequency deviation	0 to 9.99kHz 10 to 99.9kHz 100 to 250kHz
Resolution	10Hz 100Hz 1kHz
1.04GHz fc 2GHz [1.3GHz]	
Frequency deviation	0 ~ 4.99kHz 5 ~ 49.9kHz 50 ~ 500kHz
Resolution	10Hz 100Hz 1kHz

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Accuracy	± 5% of the maximum frequency shift in the above range (but 1kHz modulation frequency does not include the residual FM component, and the guaranteed range is $f_c \times 10\%$ of the frequency range when $f_c = 2.5\text{MHz}$ , up to a maximum frequency shift of 400kHz)	Functions	
External modulation frequency response	± 1dB (External modulation frequency 20Hz to 70kHz, 1kHz standard, and 22.5kHz deviation)	Simultaneous modulation	FM-AM Simultaneous modulation FM-FM Simultaneous modulation
Modulation distortion	0.5% max. (demodulation band : 50Hz to 15kHz, modulation frequency : 1kHz, deviation : 22.5kHz)	Hi-Lo monitor function with a width of ± 2% of the external modulation input	
Parasitic AM	0.5% max. (demodulation band : 50Hz to 15kHz, modulation frequency : 1kHz, 75kHz(60kHz) deviation : $f_c > 500\text{kHz}$ )	Continuously variable output level function	Continuously variable output (except during AM modulation) in 0.1dB steps between ± 5dB of any selected point, without main attenuator changeover or short break
DC-FM	(at FM deviation : less than 10kHz)	RF•ON/OFF function	RF output ON/OFF switching by RF OFF key
Frequency accuracy	± (reference oscillator + 500Hz) (100kHz $< f_c < 130\text{MHz}$ ) ± (reference oscillator + 125Hz) (130MHz $< f_c < 255\text{MHz}$ ) ± (reference oscillator + 250Hz) (255MHz $< f_c < 510\text{MHz}$ ) ± (reference oscillator + 500Hz) (510MHz $< f_c < 1.02\text{GHz}$ ) ± (reference oscillator + 1kHz) (1.02GHz $< f_c < 2\text{GHz}$ [ 1.3GHz ])	Special functions	Memory protect, internal modulation frequency changeover, FM-FM modulation preset, frequency offset mode, special function initial settings, etc.
Stability	100Hz/60 minute max. (except fluctuations of standard oscillator)	Set function	Various settings with numeric pad and rotary knob (cursor location) and various settings with step keys and preset keys
External modulation frequency response	± 1dB (External modulation frequency DC to 70kHz, 1kHz standard, and 22.5kHz deviation)	Memory function	100-point memory (frequency, output level, degree of modulation, and other items), which can be used as 10 points $\times$ 10 or 100 continuous points, and a backup memory function
AM modulation		Dump function	Can transfer contents of 100-point memory to the same models
Settable range	0 to 99.9%	Remote control function	Same control of operation as from front panel, except for power ON/OFF
Modulation factor guaranteed range	0 to 80% (at output level : 7dBm max.)	GP-IB Interface	SH1, AH1, T3, L4, SR0, RL1, PP0, DC1, DT0, C0
Resolution	0.1%	Environmental condition	
Display	3 digits digital display	Temperature/humidity for operation	0 to 40 °C 90% max.
Accuracy	(display value ± 5%) modulation factor 80%, (at modulation frequency : 1kHz)	Temperature/humidity for characteristics in spec.	5 to 35 °C 85% max.
External modulation frequency response	± 1dB (External modulation frequency 20Hz to 70kHz, 1kHz standard, and 22.5kHz deviation)	Leakage interference	Maximum signal leakage of 1 $\mu$ V at 50 $\Omega$ terminal voltage, measured with a 25mm-diameter, dual-loop attenuator located 25mm from the front panel
Modulation distortion	1.5% max. ( $f_c < 1.02\text{GHz}$ ) 2.5% max. ( $f_c > 1.02\text{GHz}$ ) (at demodulation band : 50Hz to 15kHz, modulation Frequency : 1kHz, 30% modulation)	General	
Parasitic FM	200Hz peak max. ( $f_c < 1.02\text{GHz}$ ) 400Hz peak max. ( $f_c > 1.02\text{GHz}$ ) (demodulation band : 0.3 ~ 3kHz, modulation Frequency : 1kHz, 30% modulation, output level : + 7dBm max.)	Power requirements	AC90 to 250V 50Hz/60Hz
		Power consumption	Approx. 38W
		Case dimensions	426(W) $\times$ 99(H) $\times$ 400(D)mm
		Maximum dimensions	431(W) $\times$ 115(H) $\times$ 466(D)mm
		Weight	Approx. 11kg
		Factory option	
		(1) High stability crystal oscillator ( $\pm 5 \times 10^{-8}$ ) OP-18	
		(2) High stability crystal oscillator ( $\pm 5 \times 10^{-7}$ ) OP-17	
		(3) Variable oscillator OP-16	
		20Hz to 6.5KHz : resolution 0.1Hz	
		6.5kHz to 65kHz : resolution 1Hz	