

# 20 MHz/10MHz/7MHz/4MHz DDS FUNCTION GENERATOR



**SFG-2100 Series (20/10/7/4 MHz)**



**SFG-2000 Series (20/10/7/4 MHz)**



## FEATURES

- \* DDS Technology and FPGA Chip Design
- \* Frequency Range: 0.1Hz~4/7/10/20 MHz
- \* High Frequency Accuracy :  $\pm 20$ ppm
- \* High Frequency Stability :  $\pm 20$ ppm
- \* Frequency Resolution : 100mHz
- \* Low Distortion Sine Wave : -55dBc, 0.1Hz ~ 200kHz
- \* Front Panel Setting Save/Recall with 10 Groups of Setting Memories
- \* Built-in 9 Digits, 150MHz/High Resolution Counter (SFG-2100 Series Only)
- \* INT/EXT AM/FM Modulation (SFG-2100 Series Only)
- \* LIN/LOG Sweep Mode (SFG-2100 Series Only)

Based on Direct Digital Synthesized (DDS) technology and unique FPGA design, SFG-2000/2100 Series Function Generators are built with exceptionally high performance far exceeding that of any conventional function generators, at a very competitive price. Stable output frequency, low distortion, and fine frequency resolution are the most remarkable characteristics of this product series.

SFG-2000/2100 Series include three members in each family at 4MHz, 7MHz, 10MHz and 20MHz bandwidth, respectively. SFG-2100 Series has additional functions of Sweep, AM/FM modulation, and External Counter. As a result of the  $\pm 20$ ppm stability level and output waveform accuracy, SFG-2000/2100 Series well fits a wide variety of applications, such as signal generator for experiment labs, reference signal for PLL (Phase Locked Loop), and calibration and adjustment source for electronic devices.

## SPECIFICATIONS

MAIN	SFG-2000 Series				SFG-2100 Series			
	SFG-2004	SFG-2007	SFG-2010	SFG-2020	SFG-2104	SFG-2107	SFG-2110	SFG-2120
<b>Frequency</b>	0.1Hz~4MHz	0.1Hz~7MHz	0.1Hz~10MHz	1Hz~20MHz	0.1Hz~4MHz	0.1Hz~7MHz	0.1Hz~10MHz	1Hz~20MHz
Range(For Sine, Square)	0.1Hz~1MHz (1Hz ~ 1MHz for SFG-2020/2120)							
Range(For Triangle)	0.1Hz (1Hz for SFG-2020/2120)							
Resolution	0.1Hz (1Hz for SFG-2020/2120)							
Stability	$\pm 20$ ppm							
Accuracy	$\pm 20$ ppm							
Aging	$\pm 5$ ppm / year							
Output Function	Sine, Square, Triangle							
Amplitude Range	2mV ~ 10Vpp(into 50 $\Omega$ load)							
Impedance	50 $\Omega$ $\pm 10\%$							
Attenuator	-20dB $\pm 1$ dB $\times 2$							
DC Offset	< -5V ~ > +5V(into 50 $\Omega$ load)							
Duty Control	20% to 80% , 2Hz ~ 1MHz (Square wave only)							
Range Resolution	1%							
Display	9 digits LED display							
<b>SINE WAVE</b>								
Harmonics Distortion	-55dBc, 0.1Hz~200kHz; -40dBc, 0.2MHz~4MHz; -30dBc, 4MHz~10MHz							
Flatness(Relative to 1kHz)	(Specification applied to both TTL/CMOS OFF and from MAX. to 1/10 level) $\leq \pm 0.3$ dB, 0.1Hz~1MHz; $\leq \pm 0.5$ dB, 1MHz~4MHz; $\leq \pm 2$ dB, 4MHz~10MHz							
<b>TRIANGLE WAVE</b>								
Linearity	$\geq 98\%$ , 0.1Hz~100kHz; $\geq 95\%$ , 100kHz~1MHz							
<b>SQUARE WAVE</b>								
Symmetry	$\pm 1\%$ of period + 4ns, 0.1Hz~100kHz							
Rise or Fall Time	$\leq 25$ ns at maximum output.(into 50 $\Omega$ load)							
<b>CMOS OUTPUT</b>								
Level	4Vpp $\pm 1$ Vpp~15Vpp $\pm 1$ Vpp adjustable; Rise or FallTime $\leq 120$ ns							
<b>TTL OUTPUT</b>								
Level	$\geq 3$ Vpp; Fan Out: 20 TTL load; Rise or FallTime: $\leq 25$ ns							
<b>SWEEP OPERATION</b>								
Rate	—				100:1 ratio max. and adjustable(*)			
Time	—				1Sec~30Sec adjustable(**)			
Mode	—				Lin./Log. switch selector			
<b>AMPLITUDE MODULATION</b>								
Depth & Modulation	—				0~100% ; 400Hz(INT), DC~1MHz(EXT)			
Frequency	—				100Hz~5MHz(-3dB)			
Carrier BW	—				$\leq 10$ Vpp for 100% modulation			
EXT Modulation Sensitivity	—							
<b>FREQUENCY MODULATION</b>								
Deviation & Modulation	—				$\geq 0$ ~ $\pm 50$ kHz, center at 1MHz,			
Frequency	—				400Hz fixed(INT), 1kHz fixed(EXT)			
EXT Modulation Sensitivity	—				$\leq 10$ Vpp for 10% modulation(center at 1MHz)			
<b>FREQUENCY COUNTER</b>								
Range	—				5Hz~150MHz			
Accuracy	—				Time base accuracy $\pm 1$ count			
Time base	—				$\pm 20$ ppm(23 $^{\circ}$ C $\pm 5$ ^ $^{\circ}$ C) after 30 minutes warm up			
Resolution	—				The maximum resolution is 100nHz for 1Hz and 0.1Hz for 100MHz			
Input Impedance	—				1M $\Omega$ /150pf			
Sensitivity	—				$\leq 35$ mVrms (5Hz~100MHz) $\leq 45$ mVrms (100MHz~150MHz)			



SFG-2000 Series

Rear Panel



SPECIFICATIONS	SFG-2000 Series				SFG-2100 Series			
	SFG-2004	SFG-2007	SFG-2010	SFG-2020	SFG-2104	SFG-2107	SFG-2110	SFG-2120
STORE/RECALL FUNCTION	10 groups of Setting memories							
POWER SOURCE	AC115V ±10%, AC230V+10%/-15%, 50/60Hz							
ACCESSORIES	User manual x1, Power Cord x1, GTL-101 x1				User manual x1, Power Cord x 1, GTL-101 x 2			
DIMENSION & WEIGHT	266(W)×107(H)×293(D) mm; Approx. 3.1kg				266(W)×107(H)×293(D) mm; Approx. 3.2kg			

**ORDERING INFORMATION**

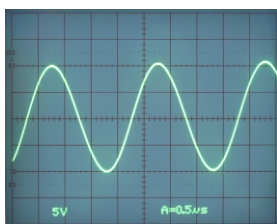
- SFG-2004** 4MHz DDS Function Generator
- SFG-2007** 7MHz DDS Function Generator
- SFG-2010** 10MHz DDS Function Generator
- SFG-2020** 20MHz DDS Function Generator
- SFG-2104** 4MHz DDS Function Generator with Counter, Sweep & AM, FM Modulation
- SFG-2107** 7MHz DDS Function Generator with Counter, Sweep & AM, FM Modulation
- SFG-2110** 10MHz DDS Function Generator with Counter, Sweep & AM, FM Modulation
- SFG-2120** 20MHz DDS Function Generator with Counter, Sweep & AM, FM Modulation

Note : 1. (\*) In order to get maximum sweep span, the sweep time needs to be tuned on when adjust sweep span.  
 2. (\*\*\*) When the sweep time is too long, the stop frequency will reach and stay at the maximum frequency of instrument until the end of the sweep cycle.

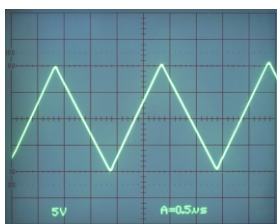
**SELECTION GUIDE**

FREQUENCY RANGE	4MHz		7MHz		10MHz		20MHz	
MODEL	SFG-2004	SFG-2104	SFG-2007	SFG-2107	SFG-2010	SFG-2110	SFG-2020	SFG-2120
DUTY	✓	✓	✓	✓	✓	✓	✓	✓
TTL/CMOS	✓	✓	✓	✓	✓	✓	✓	✓
DC OFFSET	✓	✓	✓	✓	✓	✓	✓	✓
LIN/LOG SWEEP		✓		✓		✓		✓
AM/FM MODULATION		✓		✓		✓		✓
EXT COUNTER		✓		✓		✓		✓

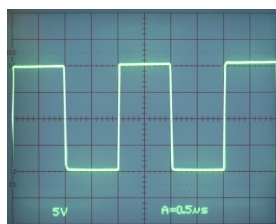
## A. OUTPUT WAVEFORM



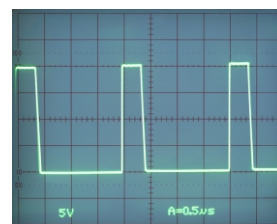
Sine Waveform



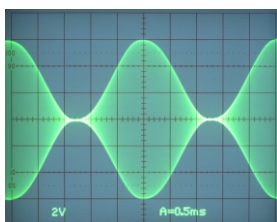
Triangle Waveform



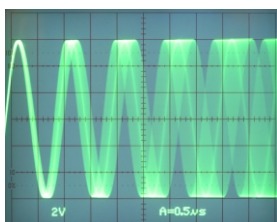
Square Waveform



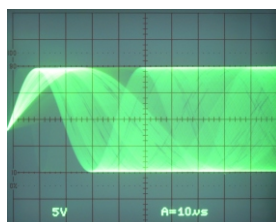
Pulse Waveform



AM Modulated Waveform



FM Modulated Waveform

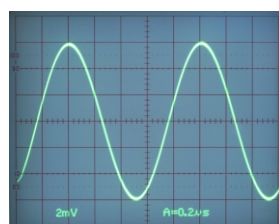


Sweep Waveform

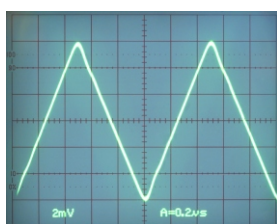
SFG-2000/2100 Series provides Sine, Triangle and Square waveforms with DC offset and variable duty cycle at  $\pm 20$ ppm frequency stability and accuracy. The low drift rate and  $-55$ dBc low distortion of the sine wave output significantly extend the application range of the product to various market sectors.

The TTL/CMOS output is also available to fulfill various application requirements in the market. Besides the basic functions, SFG-2100 Series further provides additional functions of AM/FM modulation, sweep mode, and Built-In Frequency Counter.

## B. DDS FG VS. CONVENTIONAL FG



GW Instek SFG DDS Sine Wave & Triangle Wave



Conventional Function Generator Sine Wave & Triangle Wave

The signal of SFG-2000/2100 is generated by continuously delivering a series of sampling values from a sine waveform table (stored in RAM) to DAC (Digital to Analog Converter) for waveform construction. With low pass filter circuit to filter out the harmonics of DAC output and smooth the signal, the SFG-2000/2100 is able to provide a stable output with very low waveform distortion. This is very different from the way a conventional FG generates a signal. As a conventional FG

needs to obtain its signal by switching current sources to go positive and negative directions alternately all the time, the "Ringing" distortion occurs at the peak of the signal waveform when the switching is activated. This distortion is comparatively serious when the output amplitude is low. For SFG-2000/2100 DDS FG, however, the waveform distortion remains low even when the output amplitude is at only 2mVpp.