AFG-3000 Arbitrary Function Generator
New Product Announcement

Good Will Instrument is announcing an Arbitrary Waveform and Digital-Synthesized Function Generator, AFG-3000 Series, to the market. This is the new generation of GW Instek digital function and arbitrary waveform generator, migrating from the technology of its popular product, SFG-830, into an advanced arena.

The AFG-3000 Series is designed for industrial, scientific research and educational applications. The series comes with a bandwidth of 80MHz for AFG-3081 and 50MHz for AFG-3051. The AFG-3000 Series, featuring 200Msa/s sampling rate, 16 bit vertical resolution and 1M point waveform length, is a very useful and flexible signal source to meet diversified application needs in the market today.

The user-friendly operation, the On-Screen Help, and the multiple ways of arbitrary waveform editing make AFG-3000 just a plug-and-play equipment. The point by point waveform data entry or standard waveform clip piling through front panel operation, the CSV file waveform data download, the direct waveform reconstruction through DSO waveform data import, and the PC software edited waveform download are the 4 ways available for arbitrary waveform editing.

A 4.3-inch high resolution TFT LCD in the AFG-3000 front panel is used to display waveform and setting parameters. The large and high-resolution screen is especially useful when the arbitrary waveform construction is done through front panel operation. The impedance of AFG-3000 can be selected between 50 Ohm and Hi-Z to ensure right impedance compatibility between AFG and DUT.

WIDE FREQUENCY RANGE FROM 1µHZ to 80/50MHz

The AFG-3000 Series Arbitrary Waveform/ Function Generator employs direct digital synthesis (DDS) technology to generate and output a variety of stable and precise waveforms. The frequency operates at up to 80MHz (AFG-3081) or 50MHz (AFG-3051), with a maximum resolution of 1µHz for the entire frequency range. The built-in standard waveforms include sine, square, triangle, ramp, pulse, noise and other types of waveforms.
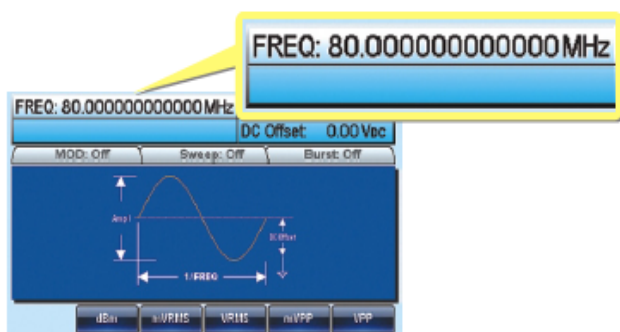
The Finest 1µHz Resolution
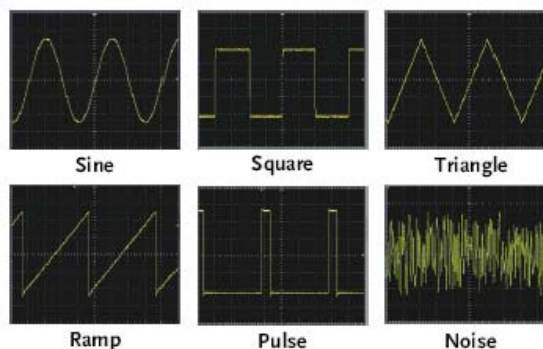
MODULATION, SWEEP and BURST FUNCTIONS

The Modulation functions, including AM, FM, FSK and PWM, are provided to cover a broad range of market requirements. A dedicated terminal for the modulating signal output is available in the front panel for modulation monitoring or other control purposes. Either an internal signal or an external signal can be selected to perform modulation.

FSK is a frequency modulation scheme in which digital information is transmitted through signal frequency variation. The BFSK (binary FSK) modulation, using two frequencies to represent data 1 and 0 respectively, is commonly applied for Call ID and Remote Metering applications.

PWM is a digital modulation scheme that can be used to adjust the output power level by controlling the pulse width of the driving signal. The examples include the speed control of motor rotation and the luminance control of LED lighting instrument. Changing the pulse width of driving signal via PWM, the rotating speed of motor and the luminance of LED will change accordingly.

AM

FM

FSK

PWM to Control & Test the Motor Speed

PWM

The Sweep function supports three trigger modes: INT, EXT and manual, and two sweep modes: LOG and LIN. Each time a sweep signal is perceived, the function generator will start to sweep through the user-defined frequency range by the frequency variation of either Log curve or Linear curve.
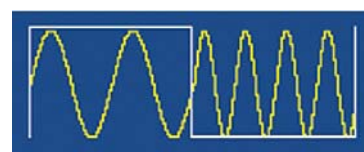
Sweep

The Burst function supports two modes, "Gate" and "N Cycle". To run burst function, the burst repetitive rate has to be set first, then the time duration of each burst has to be defined under Gate mode, or the number of the waveform cycles in each burst has to be set under N Cycle mode. Under both Gate mode and N Cycle mode, the burst waveform polarity and phase can be controlled.
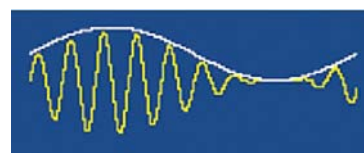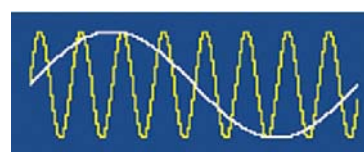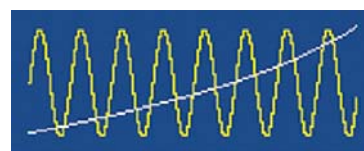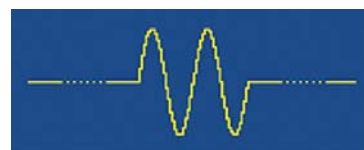
Burst

200MSa/s SAMPLING RATE & 16 Bit Amplitude Resolution

The profile of arbitrary waveform is composed of a series of data. The frequency of arbitrary waveform is derived from sampling rate divided by the number of points constructing a complete waveform, i.e. frequency = sampling rate / the number of points in a waveform. Based on the above, the higher the sampling rate, the higher the arbitrary waveform frequency can be available. At a specific waveform frequency, AFG-3000 gives a 5ns horizontal resolution for the output waveform, better than that a low sampling rate unit can provide.

The 16 bit amplitude resolution can display smooth waveforms, while a lower bit resolution will display only jagged or less smooth waveforms. To generate the maximum level of 10V Ramp Waveform as an example, AFG-3000 with 16 bit D/A converter gives a 0.15mV resolution. Whilst a signal source with 12 bit D/A converter will give only a 2.4mV resolution. The advantage of 16 bit resolution is to provide straight line waveform with fine resolution.

However, the lower bit resolution can only provide a ladder shape waveform under the same output setting.

16 bit Allows Greater Details

OUTPUT FROM ANY SECTION OF 1M-POINT-LONG WAVEFORMS

The AFG-3000 Series provides 10 sets of memory for user save and recall applications. Each set of memory is able to store a set of front panel setting and a set of 1M-point arbitrary waveform data. With 1M long memory, AFG-3000 can store more complex waveforms consisted of more data.

Furthermore, any section of waveform within each 1M memory can be edited or output independently. This is a unique feature allowing users to do waveform storage and extraction with more flexibility, and at the same time giving users the maximum utilization of the overall memory capacity.
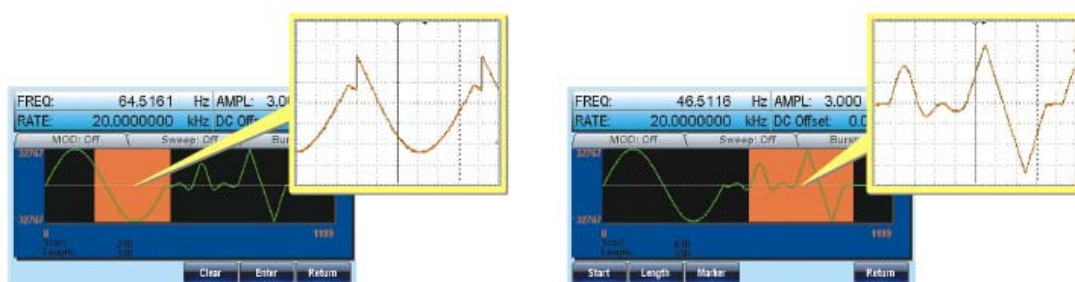

Arbitrary Editing / Output

EASY OPERATION AND FLEXIBLE ARBITRARY WAVEFORM EDITING

The AFG-3000 presents four methods of Arbitrary Waveforms generation, including direct front panel operation, PC software editing and download, CSV file download, and GDS-2000 Series oscilloscope direct input.

Front Panel Operation

Everything from waveform editing, I/O configuring, to panel setting storage and recall, can be completed directly through front panel operation. The point by point waveform data entry and standard waveform clip piling are both feasible. Front panel operation allows users to edit arbitrary waveform, which is correspondingly updated on the screen. A feature of "What You See is What You Get".
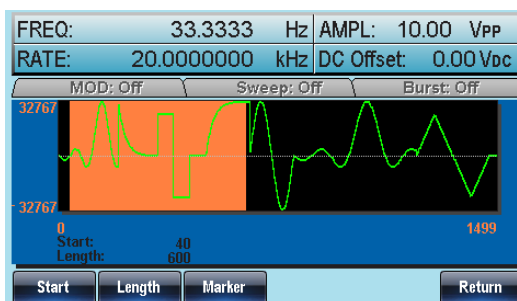
Panel Operation

CSV file uploading

AFG-3000 supports CSV file editing for arbitrary waveform generation. The CSV file can be created in many ways, including using EXCEL spreadsheet, PC client software, front panel editing or math computing software. The computing result of math software, Octave for example, can be saved into CSV file. Edited CSV file can be downloaded from either USB flash or PC to AFG-3000 for arbitrary waveform output.

Supports CSV file

From Math Computing Software, Program and Result in CSV File

Direct Waveform Reconstruction (DWR) Capability

The AFG-3000 can be directly connected to a GW Instek GDS-2000 Series DSO with USB cable for waveform data download. Under "DSO Link" mode of AFG-3000, the DSO will transfer the captured waveform data from its memory to AFG-3000 for creating a correspondent waveform output.
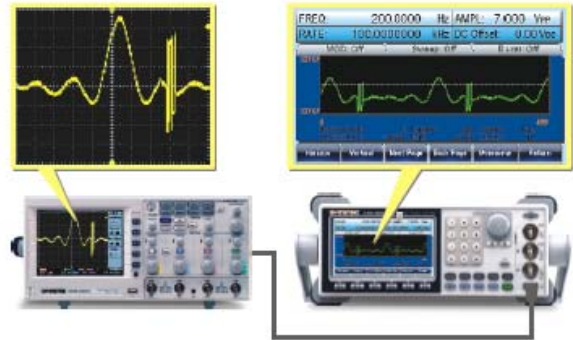
Arbitrary Waveform Editing PC Software

A PC software for AFG-3000 waveform editing is supported. The software contains not only waveform drawing tools but also a wide variety of waveform editing functions, such as waveform arithmetic operations. The most commonly used waveforms, including Rayleigh, Gaussian, Normal Noise, Pseudo Ternary, Bipolar AMI, Manchester, Differential Manchester, RS-232, and NRZ etc., are available in the library for user to tailor specific waveforms as needed.
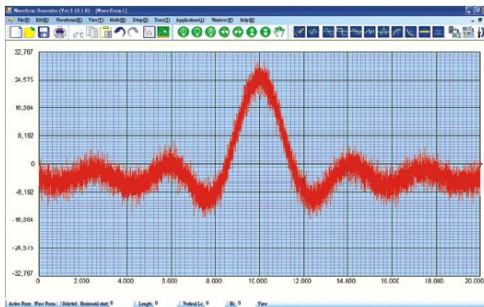
A Sinc Waveform with Gaussian Noise   Gaussian Noise   Digital Signal
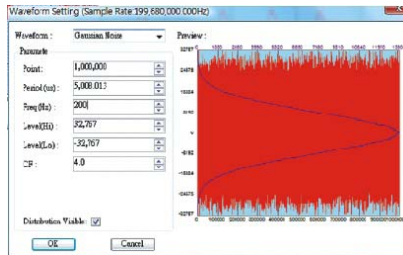
IMPEDANCE SWITCH & ON-SCREEN HELP

AFG-3000 allows users to select the suitable impedance between 50 ohm and High-Z, ensuring right impedance compatibility between AFG-3000 and DUT.

The built-in On-Screen Help allows users to understand the AFG-3000 operations and the definition of each function key easily.

Interface: USB
GPIB Address: 10
RS232 Baud Rate: 115200
RS232 Parity/Bits: None

Load: 50 OHM
Language: English
Beep: On

| 50 OHM | High Z | | Return |

Impedance Switch

Example:

Freq: 200Hz
Rate: 20KHz
Built in: Sine
Display Start: 0
Display Length: 200
Output Start: 50
Output Length: 100
Marker Start: 25
Marker Length: 50

Next page to view the output waveform

FREQ: 200.0000 Hz AMPL: 10.00 VPP
RATE: 20.0000000 kHz DC Offset: 0.00 VDC

MOD: Off   Sweep: Off   Burst: Off

Start: 25
Length: 50

| Start | Length | | Return |

| | Return |

On-Screen Help

STANDARD COMMUNICATION INTERFACES

The AFG-3000 Series provides GPIB, RS-232, and USB as standard communication interfaces. AFG-3000 supports IEEE 488.2 protocol and command for users to integrate system or remotely control the instrument.
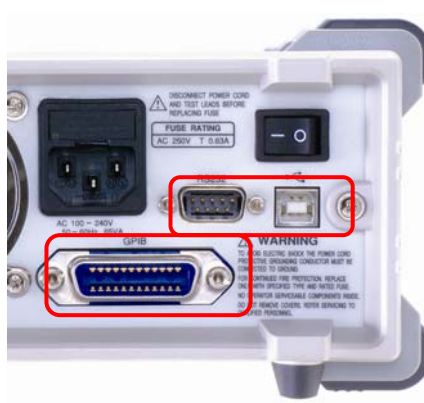
4.3" HIGH RESOLUTION LCD DISPLAY

The AFG-3000 Series is equipped with a 4.3" LCD screen of 480 x 272 resolutions. In addition to displaying all of the settings on the screen, the large graphic display also allows users to observe complete waveforms at a glance.

AFG-3000 Series Product Description

AFG-3081, 80MHz Arbitrary Waveform Generator

AFG-3051, 50MHz Arbitrary Waveform Generator

Key Features

- Wide frequency range from 1µHz ~ 80/50MHz
- 1µHz Frequency Resolution throughout Full Range
- Standard waveform: Sine, Square, Triangle, Ramp, Pulse, Noise
- Built-in AM, FM, PWM, FSK, Sweep, Burst Functions
- 16-bit, 200MSa/s, 1M-point deep arbitrary waveform
- DWR (Direct Waveform Reconstruction) Capability
- Arbitrary Waveform Editing PC Software
- 4.3" high resolution LCD display
- USB, RS-232, GPIB Standard Interface

Product Position & Competition

Product Position

Among available AFGs in the mid-range market, AFG-3000 possesses the richest ARB functions as well as the lowest Total Cost per Ownership.

Competitions

80MHz Main Competition

		GW AFG-3000	Agilent 33250A
Product			
Main Frequency		50 / 80MHz	80MHz
Amplitude		10Vpp/50ohm	10Vpp/50ohm
Display		4.3" TFT LCD	9*3cm Color LCD
ARB	Sample rate	200MHz	200MHz
	Vertical	16bit	12bit
	Horizontal	1M	64k
Channel		1CH	1CH
Sweep		LIN/LOG	LIN/LOG
Modulation		AM, FM, FSK, PSK, PWM	AM, FM, FSK, PSK
Mark		V	X
Trigger / Gate / Burst		V	V
Interface		RS232, GPIB, USB	RS232, GPIB(Optional)

50MHz Main Competition

Product		GW AFG-3000	Picotest G5100A
Main Frequency		**50 / 80MHz**	50MHz
Amplitude		10Vpp/50ohm	10Vpp/50ohm
Display		**4.3" TFT LCD**	9*3cm Color LCD
ARB	Sample rate	200MSa/S	125MSa/S
	Vertical	**16bit**	14bit
	Horizontal	**1M**	256k
Channel		1CH	1CH
Sweep		LIN/LOG	LIN/LOG
Modulation		AM, FM, FSK, PSK, PWM	AM, FM, PM, PSK, FSK, PWM
Mark		**V**	X
Trigger / Gate / Burst		V	V
Interface		**RS232, GPIB, USB**	USB, LAN, GPIB(Optional)

Target Market and Associated Features

1. **R&D and Testing of Switching Power Supply, Adapter, Inverter, Electric Power and IC Design**
2. **Educational and Research Labs**
3. **ATE Systems**

Industry	Applications	Key Features needed
Power Supply /Transformer	• Inverter Testing • Noise Simulation • Surge Simulation	• Less than 5% duty cycle • Various kinds of noise simulation
LCD industries	• Integration Testing • Back light inverter signal simulation (Automatic control is needed)	• Less than 5% duty cycle • Support all kinds of noise simulation • Complete command set
Electric Power & Electric industries	• Motor PWM test • Speed simulation	• Noise simulation • Built-in application waveform
IC industry	• Digital signal simulation • Component Testing	• Signal modulation function

Specifications

The specifications apply when the function generator is powered on for at least 30 minutes under +20°C~+30°C.

Waveforms	AFG-3051	AFG-3081
	Sine, Square, Ramp, Pulse, Noise, DC, Sin(x)/x, Exponential Rise, Exponential Fall, Negative Ramp	
Arbitrary Waveforms		
ARB Function	Built in	
Sample Rate	200 MSa/s	
Repetition Rate	100MHz	
Waveform Length	1M points	
Amplitude Resolution	16 bits	
Non-Volatile Memory	Ten 1M waveforms(1)	
User defined Output Section	Any section from 2 to 1M points	
User define Mark Output	Any section from 2 to 1M points	

Frequency Characteristics			
Range	Sine	50MHz	80MHz
	Square	50MHz	80MHz
	Triangle, Ramp	1MHz	
Resolution		1μHz	
Accuracy	Stability	±1 ppm 0 to 50˚C ±0.3 ppm 18 to 28˚C	
	Aging	±1 ppm, per 1 year	
	Tolerance	≤ 1 μHz	

Output Characteristics(2)		
Amplitude	Range	10 mVpp to 10 Vpp(into 50Ω) 20 mVpp to 20 Vpp(open-circuit)
	Accuracy	± 1% of setting ±1 mVpp (at 1 kHz,>10 mVpp)
	Resolution	0.1 mV or 4 digits
	Flatness	± 1%　(0.1dB)　<10 MHz ± 2% (0.2 dB)　10 MHz to 50 MHz ± 10% (0.9 dB)　50 MHz to 70 MHz ± 20% (1.9 dB)　70 MHz to 80 MHz (sinewave relative to 1 kHz)
	Units	Vpp, Vrms, dBm,
Offset	Range	±5 Vpk ac +dc (into 50Ω) ±10Vpk ac +dc (Open circuit)
	Accuracy	1% of setting + 2 mV + 0.5% Amplitude
Waveform Output	Impedance	50Ω typical (fixed) > 10MΩ (output disabled)
	Protection	Short-circuit protected Overload relay auto-matically disables main output
Sync Output	Level	TTL-compatible into>1kΩ
	Impedance	50Ω nominal

Sine wave Characteristics		
	Harmonic distortion(5)	–60 dBc, DC～1 MHz, Ampl＜3 Vpp –55 dBc, DC～1 MHz, Ampl＞3 Vpp –45 dBc, 1MHz～5 MHz, Ampl＞3 Vpp –30 dBc, 5MHz～80 MHz, Ampl＞3 Vpp
	Total Harmonic Distortion	< 0.2%+0.1mVrms DC to 20 kHz
	Spurious (non-harmonic)(5)	–60 dBc, DC～1 MHz –50 dBc, 1MHz～20MHz –50 dBc+ 6 dBc/octave, 1MHz～80MHz
	Phase Noise	＜-65dBc typical, 10MHz, 30 kHz band ＜-47dBc typical, 80MHz, 30 kHz band

Square wave Characteristics		
	Rise/Fall Time	<8 ns(3)
	Overshoot	<5%
	Asymmetry	1% of period +1 ns
	Variable duty Cycle	20.0% to 80.0%　≤ 25 MHz 40.0% to 60.0%　25～50MHz 50.0%(Fixed)　　50～80MHz
	Jitter	0.01%+525ps　＜ 2 MHz 0.1%+75ps　＞ 2 MHz

Ramp Characteristics		
	Linearity	0.1% of peak output
	Variable Symmetry	0% to 100%

Pulse Characteristics		
	Period	20ns ~ 2000s

	Pulse Width	8ns～ 1999.9s Minimum Pulse Width: 　　8nS when FREQ≦50MHz 　　5% of setting period when FREQ≦6.5MHz 　Resolution: 　　1nS when FREQ≦50MHz 　　1% of setting period when FREQ≦6.5MHz	
	Overshoot	<5%	
	Jitter	100 ppm +50 ps	

AM Modulation

	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse, Arb	
	Modulating Waveforms	Sine, Square, Triangle, Up/Dn Ramp	
	Modulating Frequency	2 mHz to 20 kHz	
	Depth	0% to 120.0%	
	Source	Internal / External	

FM Modulation

	Carrier Waveforms	Sine, Square, Triangle, Ramp	
	Modulating Waveforms	Sine, Square, Triangle, Up/Dn Ramp	
	Modulating Frequency	2 mHz to 20 kHz	
	Peak Deviation	DC to 50 MHz	DC to 80 MHz
	Source	Internal / External	

PWM

	Carrier Waveforms	Square	
	Modulating Waveforms	Sine, Square, Triangle, Up/Dn Ramp	
	Modulating Frequency	2 mHz to 20 kHz	
	Deviation	0% ～ 100.0% of pulse width	
	Source	Internal / External	

FSK

	Carrier Waveforms	Sine, Square, Triangle, Ramp, Pulse	
	Modulating Waveforms	50% duty cycle square	
	Internal Rate	2 mHz to 100 kHz	
	Frequency Range	DC to 50 MHz	DC to 80 MHz
	Source	Internal / External	

Sweep

	Waveforms	Sine, Square, Triangle, Ramp	
	Type	Linear or Logarithmic	
	Direction	Up or Down	
	Start/Stop Freq	100 µHz to 50 MHz	100 µHz to 80 MHz
	Sweep Time	1 ms to 500s	
	Trigger	Single, External, Internal	
	Marker	Falling edge of Mark signal (Programmable frequency)	
	Source	Internal / External	

Burst

	Waveforms	Sine, Square, Triangle, Ramp	
	Frequency	1 µHz to 50 MHz(4)	1 µHz to 80 MHz(4)
	Burst Count	1 to 1000000 cycles or Infinite	
	Start/Stop Phase	-360.0° to +360.0°	
	Internal Period	1 ms to 500 s	
	Gate Source	External Trigger	
	Trigger Source	Single, External or Internal Rate	
Trigger Delay	N-Cycle, Infinite	0s to 85s	

External Modulation Input

	Type	For AM, FM, Sweep, PWM	
	Voltage Range	± 5V full scale	
	Input Impedance	10kΩ	
	Frequency	DC to 20kHz	

External Trigger Input

	Type	For FSK, Burst, Sweep	

	Input Level	TTL Compatibility
	Slope	Rising or Falling (Selectable)
	Pulse Width	>100ns
	Input Impedance	10kΩ, DC coupled
Latency	Sweep	<10us (typical)
	Burst	<100ns (typical)
Jitter	Sweep	2.5 us
	Burst	1 ns; except pulse, 300 ps

Modulation Output

	Type	For AM, FM, Sweep, PWM
Amplitude	Range	≥1Vpp
	Impedance	> 10kΩ typical (fixed)

Trigger Output

	Type	For Burst, Sweep
	Level	TTL Compatible into 50Ω
	Pulse Width	>450 ns
	Maximum Rate	1 MHz
	Fan-out	≥4 TTL load
	Impedance	50Ω Typical

Marker Output

	Type	For ARB, Sweep
	Level	TTL Compatible into 50Ω
	Fan-out	≥4 TTL load
	Impedance	50Ω Typical
Store/Recall		10 Groups of Setting Memories
Interface		GPIB, RS232, USB
Display		4.3 inch TFT LCD 480 × 3 (RGB) × 272

System Characteristics

	Configuration Times (typical)	Function Change: Standard---->102ms Pulse-------->660ms Built-In Arb->240ms Frequency Change: 24ms Amplitude Change: 50ms Offset Change: 50ms Select User Arb: < 2s for 1M points Modulation Change: < 200ms

Arb Download Times (typical)	Binary Code		ASCII Code
	GPIB/RS232 (115 Kbps)	USB Device	USB Host
1M points	189 sec	34 sec	70 sec
512K points	95 sec	18sec	35 sec
256K points	49 sec	9 sec	18 sec
64K points	16 sec	3 sec	6 sec
16K points	7 sec	830ms	1340 ms
8K points	6 sec	490ms	780ms
4K points	6 sec	365ms	520 ms
2K points	5 sec	300ms	390 ms

General Specifications

	Power Source	AC100~240V, 50~60Hz
	Power Consumption	65 VA
	Operating Environment	Temperature to satisfy the specification : 18 ~ 28˚C Operating temperature : 0 ~ 40˚C Relative Humidity: ≤ 80%, 0 ~ 40˚C ≤ 70%, 35 ~ 40˚C Installation category : CAT Ⅱ
	Operating Altitude	2000 Meters

Pollution Degree	IEC 61010 Degree 2, Indoor Use
Storage Temperature	-10~70˚C, Humidity: ≤70%
Dimensions (WxHxD)	265(W) x 107(H) x 374(D)
Weight	Approx. 4kg
Safety Designed to	EN61010-1
EMC Tested to	EN 55011, IEC-61326
Accessories	User Manual x 1, Power Cord x 1, GTL-110× 1

(1) A total of ten waveforms can be stored. (Every waveform can be composed of 1M points maximum.)
(2) Add 1/10th of output amplitude and offset specification per ∘C for operation outside of 0∘C to 28∘C range (1-year specification).
(3) Edge time decreased at higher frequency.
(4) Sine and square waveforms above 25 MHz are allowed only with an "Infinite" burst count.
(5) Harmonic distortion and Spurious noise at low amplitudes is limited by a -70 dBm floor.

Key Dates for Product Announcement

1. Order-queue Open (August 6th, 2010)

2. Distributor Announcement (August 6th, 2010)

3. Global Market Announcement (Beginning of August)

4. Demo Units Shipped to Distributors (Beginning of August)

5. Mass quantity order fulfillment (Beginning of September)

Service Policy

1. **1 year warranty**

2. **Service Support**

    The service instructions in the Service Manual will help distributors repair defective units promptly. Should the board replacement is necessary to fix the defective unit, the board swapping service support is provided by Good Will Instrument to facilitate the repair jobs done at the distributor's site.

3. GW Instek continuously provides the after-sales support through its Website. The latest version of service manual and Marcom material of AFG-3000 will be posted on the distributor zone of GW Instek Website at http://www.gwinstek.com.

Ordering Information

AFG-3081 80MHz Arbitrary Function Generator

AFG-3051 50MHz Arbitrary Function Generator

ACCESSORIES
User Manual x 1, Power Cord x 1 GTL-110 Test Lead x 1

Sincerely Yours;

Overseas Sales Department

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