

# AFG-4000 Series

## Arbitrary Function Generator

### FEATURES

- Provide Single-channel or Dual-channel Output  
Single Channel : AFG-4125E/4125AE(25MHz)  
Dual Channel : AFG-4225E/4235/4260/4280/4210H/4225H(25/35/60/80/100/250MHz)
- Built-in Sine, Square, Triangle, Ramp, Pulse, Noise, Harmonic Wave, Arbitrary Wave
- Min. Resolution : 1 $\mu$ Hz
- Sampling Rate : AFG-4225H : 1.25GSa/s; AFG-4235/4260/4280/4210H : 500MSa/s;  
AFG-4125E/4125AE/4225E : 125MSa/s
- Amplitude Resolution : AFG-4125E/4125AE/4225E : 14bits;  
AFG-4235/4260/4280/4210H/4225H : 16bits
- Memory Length : AFG-4225E/4235/4260/4280/4210H/4225H : 10M/per channel;  
AFG-4125E/4125AE : 16k/per Channel
- Modulation : AM,DSB-AM,FM,PM,PWM,ASK,PSK,BPSK,QPSK,FSK,FSK,4FSK,OSK,SUM
- Built-in Sweep, Burst, Counter Function
- AFG-4125AE Built-in Power Amplifier Function
- Communication Interface : AFG-4235/4260/4280/4210H/4225H Provide USB, LAN Interface  
AFG-4125E/4125AE/4225E Provide USB Interface
- 8" TFT LCD Display, 800 x 480 Resolution
- Multi-Touch Display : AFG-4235/4260/4280/4210H/4225H

**GW INSTEK**  
Simply Reliable

# 25MHz~250MHz Frequency Bandwidth Selections to Meet Diverse Signal Generation Needs!

AFG-4000 arbitrary function generator series is GW Instek's first arbitrary function generator series to be equipped with an 8" large touch screen. The frequency bandwidth of the single-channel models is 25MHz, and dual-channel models feature 250MHz/100MHz/80MHz/60MHz/35MHz/25MHz frequency bandwidth selections. The entire series provides high resolution of 10Hz and has built-in standard waveforms such as sine wave, square wave, triangle wave, pulse wave, noise wave, harmonic wave, etc. The highest bandwidth 250MHz model provides 1.25GSa/s sample rate; the mid-range models ranging from 35MHz ~ 100MHz provide 500MSa/s sample rate; and the 25MHz entry-level models have a sampling rate of 125MSa/s. For vertical resolution, the 35MHz ~ 250MHz models feature 16-bit resolution, and 25MHz entry-level models provide 14-bit resolution. In addition, in terms of memory depth, dual channel 25MHz ~ 250MHz models provide 10M memory depth, and entry-level single channel 25MHz models provide arbitrary waveform editing function with 16k memory depth. The entire series has built-in 146 arbitrary waveforms for editing and output.

The dual-channel models provide dual-channel related settings such as frequency coupling, amplitude coupling and tracking, allowing users to quickly set the output related to the two channels. In terms of modulation function, the AFG-4000 series provides AM, DSB-AM, FM, PM, PWM, ASK, PSK, BPSK, QPSK, FSK, 3FSK, 4FSK, OSK, SUM and other modulation signal outputs. Standard functions include Sweep and Burst outputs and the Counter function. AFG-4125AE has a built-in power amplifier. The power output of the amplifier reaches 10W, and the amplification factor reaches 10 times to produce a maximum output of 22V. The independent input/output power amplifier provides a bandwidth range from 5Hz to 100 kHz, which can be used for audio signal and other application requirements.

The AFG-4000 series is equipped with an 8-inch high-resolution TFT LCD, and models above 35MHz are equipped with the touch screen function. The configuration of touch screen makes inputting parameters more convenient. Users only need to touch parameters such as Frequency, Amplitude or DC offset, and a numeric input window will appear on the screen. Users can intuitively input parameters through this window or the numeric keys on the AFG-4000 panel. Through the 8" large screen, touch screen and diverse built-in waveforms, users can control it at will to meet their signal generation needs.

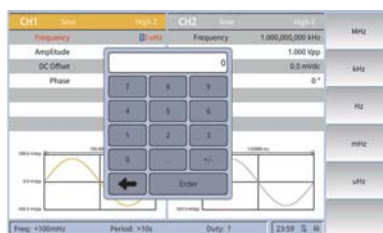
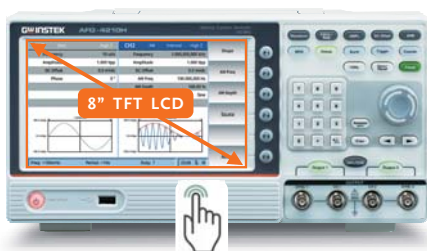
As for the interfaces, the 25MHz models: AFG-4125E/4125AE/ 4225E have a built-in USB Host/Device interfaces, and the models with higher bandwidths ranging from 35MHz to 250MHz come standard with USB Host/Device and LAN interfaces.

## SELECTION GUIDE

Model	AFG-4125E	AFG-4125AE*	AFG-4225E	AFG-4235	AFG-4260	AFG-4280	AFG-4210H	AFG-4225H
No. of Channel	Single		Dual					
Frequency Range (Sine)	25MHz		25MHz	35MHz	60MHz	80MHz	100MHz	250MHz
Sample Rate (Sa/s)	125M			500M				1.25G
Amplitude Resolution	14 bits			16 bits				
Memory Length	16k/CH		10M/CH					
Touch Panel	N/A			Yes				
Communication Interface	USB(Host, Device)			USB(Host, Device), LAN				

\*AFG-4125AE built-in power amplifier function

### A. 8" TOUCH SCREEN DISPLAY



The AFG-4000 series is equipped with an 8-inch high-resolution TFT LCD, and models above 35MHz are equipped with the touch screen function. The configuration of touch screen makes inputting parameters more convenient. Users only need to touch parameters such as Frequency, Amplitude or DC offset, and a numeric input window will appear on the screen. They can intuitively enter setting parameters through this window or the numeric keys on the AFG-4000.

## B. WIDE FREQUENCY SELECTION

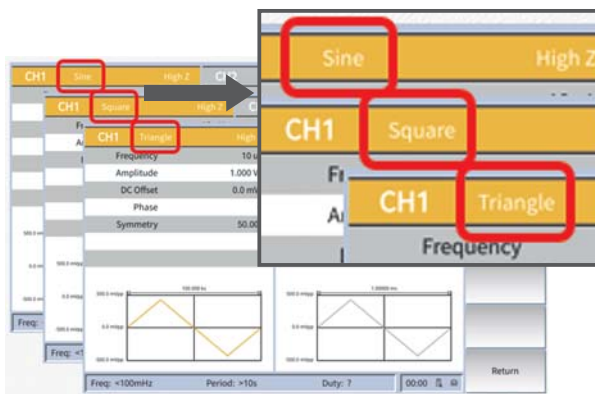
Channel	Model	Display	Main Output
Dual-CH	AFG-2225	3.5" TFT LCD	25MHz
	AFG-4225E	8" TFT LCD	25MHz
	MFG-2230M	4.3" TFT LCD	30MHz
	AFG-4235	8" TFT LCD Touch Screen	35MHz
	AFG-4260	8" TFT LCD Touch Screen	60MHz
	MFG-2260M	4.3" TFT LCD	60MHz
	MFG-2260MFA	4.3" TFT LCD	60MHz
	MFG-2260MRA	4.3" TFT LCD	60MHz
	AFG-4280	8" TFT LCD Touch Screen	80MHz
	AFG-4210H	8" TFT LCD Touch Screen	100MHz
	MFG-2220HM	4.3" TFT LCD	200MHz
	AFG-4225H	8" TFT LCD Touch Screen	250MHz

Channel	Model	Display	Main Output
Single-CH	AFG-2005	3.5" 3-color LCD	5MHz
	AFG-2012	3.5" 3-color LCD	12MHz
	AFG-2025	3.5" 3-color LCD	25MHz
	AFG-2105	3.5" 3-color LCD	5MHz
	AFG-2112	3.5" 3-color LCD	12MHz
	AFG-2125	3.5" 3-color LCD	25MHz
	MFG-2110	4.3" TFT LCD	10MHz
	MFG-2120	4.3" TFT LCD	20MHz
	MFG-2120MA	4.3" TFT LCD	20MHz
	AFG-4125E	8" TFT LCD	25MHz
	AFG-4125AE	8" TFT LCD	25MHz
	MFG-2130M	4.3" TFT LCD	30MHz
	MFG-2160MF	4.3" TFT LCD	60MHz
	MFG-2160MR	4.3" TFT LCD	60MHz

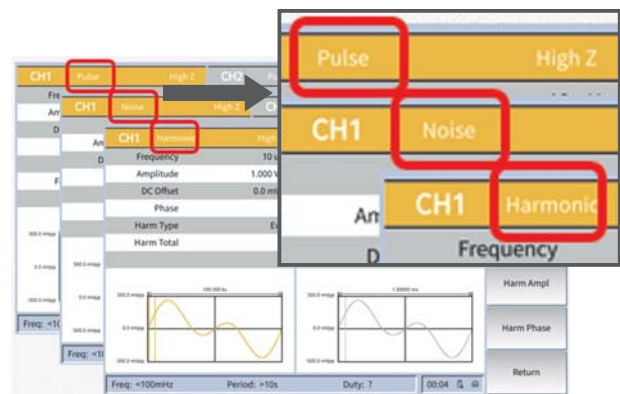
The bandwidth range covers from 25MHz to 250MHz. Combined with the original AFG/MFG series, GW Instek signal source selections are rich and

diverse, which can meet users' usage habits and diverse testing needs.

## C. BUILT-IN VARIOUS STANDARD WAVEFORMS

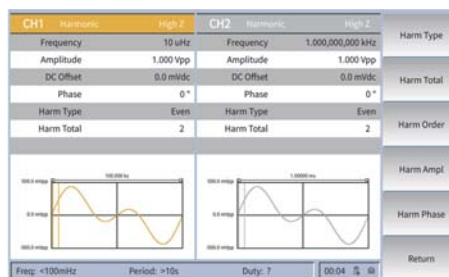


Various standard waveforms are built-in, such as sine wave, square wave, triangle wave, pulse wave, noise wave, harmonics, etc., allowing users to



easily select and set to generate the waveforms required for their applications.

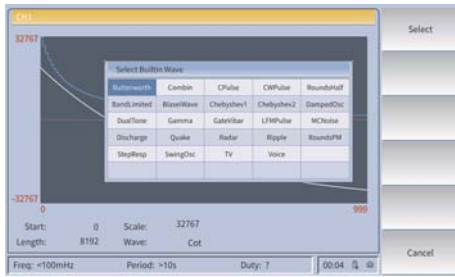
## D. HARMONIC SIGNAL GENERATOR



The harmonic signal generator can simulate the harmonic signal of the switching power supply and test the characteristics of the EMI power filter.

Users can set the amplitude and phase of each order signal to achieve the desired signal. AFG-4000 can set and generate up to 16th order harmonics.

## E. RICH BUILT-IN ARBITRARY WAVEFORM SELECTIONS

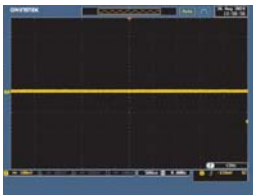


Users can use the built-in 146 application arbitrary waveforms for signal editing and output.

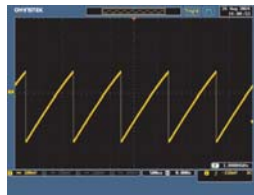
ARB's built-in waveforms include Common, Medical, Standard, or Math and Trigonometric, Window, Engineer, and Segmented Modulation related waveforms.

From the panel, users can select built-in waveforms and edit, save, recall and output arbitrary waveforms..

### COMMON WAVEFORMS INCLUDE DC AND ABSINEHALF WAVEFORMS

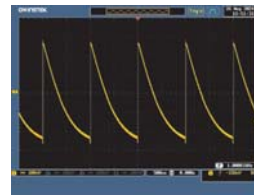


DC

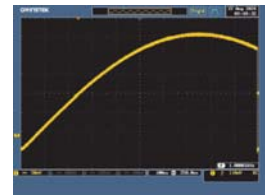


ABSinehalf

### MATH WAVEFORMS INCLUDE AIRY AND BESSELJ WAVEFORMS



Airy

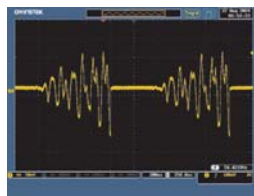


Besselj

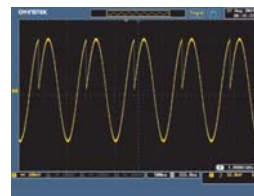
### ENGINEERING WAVEFORMS INCLUDE TV, VOICE, CWPULSE, SWINGOSC, ROUNDHALF AND OTHER WAVEFORMS



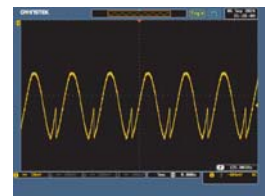
TV



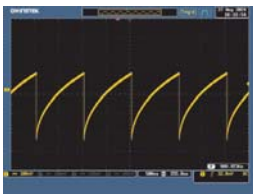
Voice



Cwpulse



SwingOsc



Roundhalf



Bandlimit

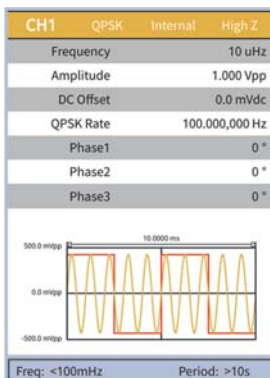


Blaseiwave

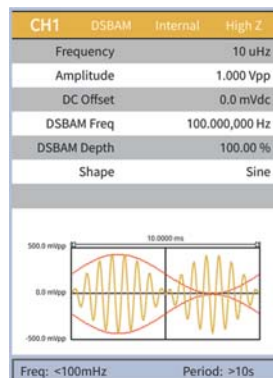


DepandOSC

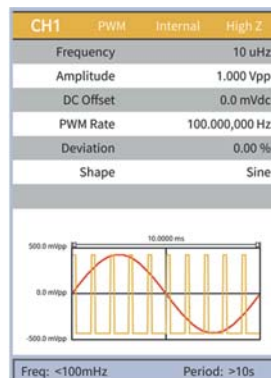
## F. BUILT-IN RICH MODULATION WAVEFORMS



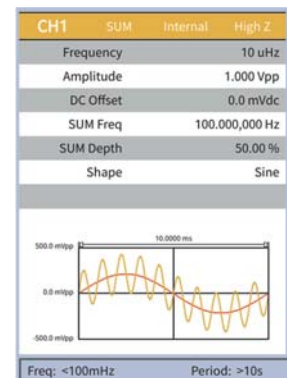
QPSK



DSBAM



PWM

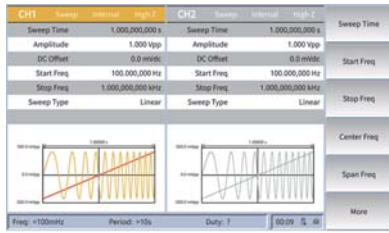


SUM

Provides a wide range of modulation signals, including analog and digital modulation, such as AM, DSB-AM, FM, PM, PWM, ASK, PSK, BPSK, QPSK, FSK, 3FSK, 4FSK, OSK, SUM and other modulation signals.

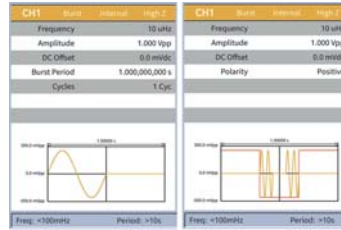
Suitable for various tests such as fundamental frequency function of communications system, motor control and lighting adjuster, etc.

## G. PROVIDES SWEEP, BURST, COUNTER FUNCTIONS



Sweep

Frequency sweeping function can be set to sine wave, square wave, triangle wave and arbitrary wave mode. Linear/logarithmic output can be set to meet various application requirements with different sweeping methods. Frequency sweep can test the frequency response of electronic components such as filters and low-frequency amplifiers, etc.



Burst

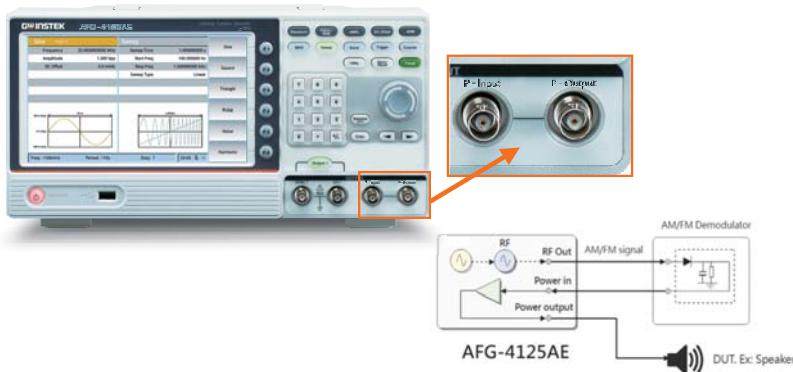
Supports N-cycle or Gate mode triggering, and can adjust its duration, operating frequency, waveform polarity and internal or external triggering to achieve discontinuous output related applications.



Counter

Provides 100mHz ~ 200MHz frequency counter function

## H. POWER AMPLIFIER



AFG-4125AE features a power amplifier with a built-in amplifier that can independently input/output 10W power and has a gain of 10 times.

This power amplifier has a bandwidth of 5Hz-100kHz and can be used as an audio amplifier; or for a power component characteristic test; for a drive amplifier for piezoelectric components (collocate with an impedance transformer, 10W output).

Users can connect the AFG-4125AE's low-frequency amplifier to a speaker and use it as the driver source for the speaker, which is a common educational application.

## PANEL INTRODUCTION



1. 8" Display
2. Menu Soft Keys
3. Function Keys
4. Numeric Input Keys
5. Selection Knob
6. Arrow Keys
7. Power Button
8. USB Host Port
9. Channel 1 Output Key
10. Sync 1 Output Port
11. Channel 1 Output Port
12. CH1/CH2 Setting Switch Key
13. Channel 2 Output Key
14. Channel 2 Output Port
15. Sync 2 Output Port
16. LAN Port (Available for Models Above 35MHz)
17. USB Device Port
18. Security Lock Hole
19. 10MHz In/Out/Counter Connector
20. Mod/FSK/Trig Connector

\* No.12-15 for dual CH model only.

SPECIFICATIONS									
Models	AFG-4125E	AFG-4125AE	AFG-4225E	AFG-4235	AFG-4260	AFG-4280	AFG-4210H	AFG-4225H	
Channels	1		2						
Waveforms	Sine, Square, Triangle, Ramp, Pulse, Noise, Harmonic wave, Arbitrary wave								
Arbitrary Functions	Built-in								
ARB Function	Built-in								
Sample Rate(*1)	125MSa/s		500MSa/s				1.25GSa/s		
Repetition Rate (Arbitrary Wave)	15MHz		30MHz						
Waveform Length	2 ~ 16K points		2 ~ 10M points						
Amplitude Resolution	14 bits		16 bits						
Minimum Rise and Fall Time	< 10 ns		< 8ns				< 5ns		
Jitter			8ns				32MB		
Non-Volatile Memory									
User-defined Output Section	From point 2 ~ 16,384		From point 2 ~ 10,240,000						
User-defined Output Marker Section	From point 2 ~ 16,384		From point 2 ~ 10,240,000						
Output Mode	1 ~ 1,000,000 cycles or infinite mode								
Frequency Characteristics									
Sine	25MHz		35MHz		60MHz		80MHz		100MHz
Square	5MHz		15MHz		30MHz		50MHz		250MHz
Pulse	5MHz		15MHz		25MHz				
Triangle, Ramp	1MHz		3MHz		5MHz				
Noise (-3dB)	25MHz BW		35MHz BW		60MHz BW		80MHz BW		100MHz BW
Harmonic Wave	12.5MHz		17.5MHz		30MHz		40MHz		50MHz
Resolution	1 μHz or 10 significant figures								
Accuracy Stability	±2 ppm at 25°C ± 5°C				±1 ppm, per 1 year				±1 ppm at 0 ~ 40°C
Aging									
Tolerance	±1 ppm								
Output Characteristics(*2)									
Output Amplitude Into 50Ω	1mVpp ~ 10Vpp, for ≤ 25MHz; 1mVpp ~ 5Vpp, for ≤ 60MHz; 1mVpp ~ 2.5Vpp, for ≤ 100MHz		1mVpp ~ 10Vpp, for ≤ 40MHz; 1mVpp ~ 5Vpp, for ≤ 80MHz; 1mVpp ~ 2.5Vpp, for ≤ 120MHz; 1mVpp ~ 1Vpp, for ≤ 250MHz						
Open-circuit	2mVpp ~ 20 Vpp, for ≤ 25MHz; 2mVpp ~ 10 Vpp, for ≤ 60MHz; 2mVpp ~ 5 Vpp, for ≤ 100MHz		2mVpp ~ 20 Vpp, for ≤ 40MHz; 2mVpp ~ 10 Vpp, for ≤ 80MHz; 2mVpp ~ 5 Vpp, for ≤ 120MHz; 2mVpp ~ 2 Vpp, for ≤ 250MHz						
Bandwidth Flatness	≤ 10MHz: ±0.2dB; ≤ 60MHz: ±0.3dB; ≤ 100MHz: ±0.5dB; (relative to 100 kHz Sine wave, 1 Vpp, 50Ω)		≤ 10MHz: ±0.2dB; ≤ 60MHz: ±0.3dB; ≤ 100MHz: ±0.5dB; (relative to 100 kHz Sine wave, 1 Vpp, 50Ω)						
Accuracy	± (2% of setting + 1 mVpp)(1kHz sine, 0V offset, >10mVpp)								
Resolution	0.1mVpp or 4 digits (The amplitude ≥ 1Vpp is 1mVpp)								
Output Impedance	50Ω (Typical)								
Output protection	Short circuit protection, the output will be automatically turned off when overloaded								
DC Offset	± (10 Vpk - Amplitude Vpp / 2), (High resistance)								
Range	± (3 % of [setting] + 5 mV + amplitude Vpp * 0.5%)		± (1 % of [setting] + 5 mV + amplitude Vpp * 0.5%)						
Accuracy									
Resolution	0.1 mVpp or 4 digits (The amplitude > 1 Vpp is 1 mVpp)								
Sine Wave Characteristics									
Harmonic Distortion(*3)	DC-1MHz: <65dBc; 1MHz-10MHz: <60dBc; 10MHz-60MHz: <55dBc; 60MHz-100MHz: <50dBc Typical (0dBm)				DC-1MHz: <65dBc; 1MHz-10MHz: <60dBc; 10MHz-120MHz: <50dBc; 120MHz-250MHz: <45dBc Typical (0dBm)				
Total Harmonic Distortion	< 0.05 %, 10 Hz to 20 kHz, 1 Vpp								
Non-harmonic Distortion	≤ 10MHz: < -70dBc; > 10MHz: < -70dBc + 6dB/sound interval; Typical (0dBm)								
Phase Noise	10MHz: ≤ -110dBc/Hz Typical (0dBm, 10kHz offset)								
Square Wave Characteristics									
Rise/Fall Time	< 30ns		< 8ns				< 5ns		
Overshoot	Typical (100 kHz, 1 Vpp) < 5%, (1 Vpp, 50Ω)		Typical (100 kHz, 1 Vpp) < 3%, (1 Vpp, 50Ω)						
Duty Cycle	50.00% (fixed)								
Ramp Wave Characteristics									
Linearity	< 0.1% of peak output (typical 1 kHz, 1 Vpp, symmetry 50%)								
Symmetry	0.0% ~ 100.0%								
Pulse Wave Characteristics									
Period	200ns-1000ks		66.667ns-1000ks		40ns-1000ks		20ns-1000ks		
Pulse Width	≥ 48ns		≥ 18ns		≥ 12ns		≥ 7ns		
Duty cycle	0.1% ~ 99.9% (limited by the frequency setting)								
Rise and fall time	≥ 32ns (limited by the pulse width setting)		≥ 8ns (limited by the pulse width setting)				≥ 7ns (limited by the pulse width setting)		
Overshoot	Typical (100 kHz, 1 Vpp) < 5%		Typical (100 kHz, 1 Vpp) < 3%						
Jitter	< 2ns		≤ 5MHz: 2ppm + 300ps, > 5MHz: 300ps (rms), typical (1Vpp, 50Ω)						
Noise Wave Characteristics									
Types	Gaussian white noise								
Bandwidth (-3dB)	25MHz BW		35MHz BW		60MHz BW		80MHz BW		100MHz BW
Harmonic Wave Characteristics									
Harmonic number	≤ 16								
Frequency Range	1μHz-12.5MHz		1μHz-17.5MHz		1μHz-30MHz		1μHz-40MHz		1μHz-50MHz
Harmonic type	Odd, even, sequential, custom								
Harmonic amplitude	Each harmonic amplitude can be set								
Harmonic phase	Each harmonic phase can be set								
Advanced Waveform Characteristics									
Modulation Function	AM, DSB-AM, FM, PM, PWM, ASK, PSK, BPSK, QPSK, FSK, 3FSK, 4FSK, OSK, SUM								
Sweep Function	Support type: Linear, logarithmic, Step								
Burst Function	Support type: count (1 ~ 1000,000 cycles), Infinite, gated								
Counter Function	Support frequency range: 100 mHz ~ 200 MHz								
Power Amplifier Function	- Built-in -								
Input/Output Characteristics									
Channel Coupling	Channel copy, amplitude syn, frequency syn, align phase								
Input	External modulation input, External trigger input, External clock input								
Output	Internal clock output, Sync Output								
General Specifications									
Display	Type		8-inch color LCD display						
	Resolution		800 Horizontal × 480 Vertical pixels						
	Color		65,536 colors, 16 bits, TFT						
	Touch Screen Capacitive		Multi-touch						
Communication Interface	USB Host, USB Device		USB Host, USB Device, LAN						
Power	Source		100 ~ 240 V (±10%), 50/60 Hz						
	Power Consumption		Less than 50VA						
	Fuse		250V, F2AL						
Operating Environment	Temperature to Satisfy		18 °C ~ 28 °C						
	Operating Temperature		0 °C ~ 40 °C						
	Relative Humidity		Less than 35°C: ≤ 90% relative humidity; 35°C ~ 40°C: ≤ 60% relative humidity						
	Installation Category		CAT II						
	Operating Altitude		Operating 3,000 meters; Non-operation 12,000 meters						
Storage Temperature	-20 °C ~ 60 °C, Humidity: ≤ 70%								
Pollution Degree	IEC 61010 degree 2, Indoor use								
Safety Designed	EN61010-1								
Cooling Method	Smart fan cooling								
Dimensions & Weight	340 (W) × 177 (H) × 90 (D) mm; Approx. 2.5kg								

Note: \*1. The User's available range of the sample rate is from 1 μSa/s to 75 MSa/s. (AFG-4125E/4125AE/4225E is from 1 μSa/s to 30MSa/s) Specifications subject to change without notice. AFG-4000D1\_E\_BH\_202409  
\*2. Not specifically labeled, the load defaults to 50Ω. \*3. DC offset set to zero.

ORDERING INFORMATION	
AFG-4125E	25MHz, 1-Channel Arbitrary Function Generator
AFG-4125AE	25MHz, 1-Channel Arbitrary Function Generator, Plus Power Amplifier
AFG-4225E	25MHz, 2-Channel Arbitrary Function Generator
AFG-4235	35MHz, 2-Channel Arbitrary Function Generator
AFG-4260	60MHz, 2-Channel Arbitrary Function Generator
AFG-4280	80MHz, 2-Channel Arbitrary Function Generator
AFG-4210H	100MHz, 2-Channel Arbitrary Function Generator
AFG-4225H	250MHz, 2-Channel Arbitrary Function Generator

ACCESSORIES	
USB Cable x 1, Power Cord x 1	
AFG-4125E/4125AE: Test Lead, BNC to Alligator Clips Cable x 1	
AFG-4225E/4235: Test Lead, BNC to Alligator Clips Cable x 2	
AFG-4260/4280/4210H/4225H: Test Lead, BNC Cable x 2	
OPTIONAL ACCESSORIES	
GTL-101	Test Lead, BNC (P/M) to Alligator, approx. 1100mm
GTL-110	BNC Cable, BNC (P/M) to BNC (P/M), approx. 1000mm

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