



# AFG-2225

## 25MHz True Dual Channel Arbitrary Function Generator

### FEATURES

- Wide Frequency Ranges From 1 $\mu$ Hz ~ 25MHz (sine wave)
- 1  $\mu$ Hz Resolution in Full Range
- Built-in Standard 120MSa/s, 10bit, 4k Points Arbitrary Function for Both Channels
- True Dual-Channel Output, CH2 Provides the Same Characteristics as CH1
- Dual-Channel Supports Couple, Tracking, Phase Operations
- 1% ~ 99% Adjustable Duty Cycle for Square Waveform
- Friendly User Interface for Easy Parameter Setting and Parameters Display
- Multiple Editing Methods to Edit Arbitrary Waveform Easily
- Built-in Standard AM/FM/PM/FSK/SUM/Sweep/Burst and Frequency Counter
- USB Host/Device Interface for Remote Control and Waveform Editing

**GW INSTEK**  
Simply Reliable

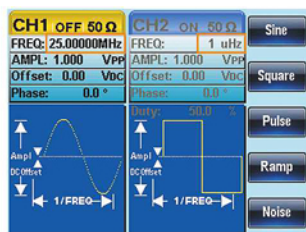
# Equivalent Dual-Channel Provides Augmented Value for Customers

GW Instek is launching AFG-2225, its first basic level dual-channel arbitrary function generator, which provides superior features in its class. Both channels are equipped with same characteristics to adapt dual-signal applications such as differential signaling or IQ modulation. The outstanding cost-performance value makes the AFG-2225 a practical instrument to accelerate the development process.

The major features for both channels include 10Vpp output amplitude; 25MHz frequency bandwidth with 1 $\mu$ Hz resolution; built-in waveforms of Sine, Square, Ramp (Triangle) and Noise. As to the 1%~99% adjustable duty cycle of Square waveform can be used as pulse signal sources. For the arbitrary waveform, user can edit the 66 built-in waveforms or create a whole new one. Moreover, AFG-2225 carries features of AM/FM/PM/FSK/SUM Modulation, Sweep, Burst and Frequency Counter, which can be applied to various communication fields.

In addition to the intuitive and friendly user interface, the 3.5-inch color LCD displays the comprehensive operation information including the true waveform presented at the output. USB Host and Device interfaces are equipped to link the AFG-2225 with other devices, which provide the flexibility of waveform generation for more practical usages. With link to GW Instek GDS-series Digital Storage Oscilloscopes (DSOs), the waveforms of interest can be captured and reconstructed. User can also use the arbitrary waveform PC software to edit the waveform and then send to AFG-2225 directly, or save the waveform into flash drive and then transfer to AFG-2225.

## A. FREQUENCY RANGES AND OFFERS MULTIPLE STANDARD WAVEFORMS



### Wide Frequency Range

AFG-2225 offers signal output by DDS technique. The maximum frequency is 25 MHz and offers full-range 1 $\mu$ Hz frequency resolution. The built-in functions include Sine, Square, Ramp/Triangle, Pulse, and Noise.

## B. FULL-FUNCTIONS EQUIPPED DUAL-CHANNEL SIGNAL OUTPUT CAPABILITY



### The Equivalent Function in Dual-Channel

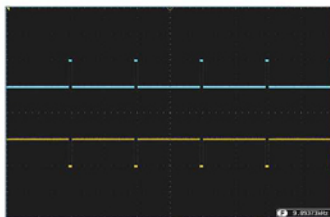
In most two-channel signals applications, such as digital modulation and vehicle electronic simulation signals, the similar or identical waveform capabilities are required for both channel outputs. Unlike other dual-channel AFG in this class, AFG-2225 is fully equipped with equal capabilities on dual outputs. Most of dual-channel arbitrary waveform generators in this basic level cluster offer one major channel and one minor channel, in which the minor channel only provides less functions or inferior performances. This sort of non-full-function dual-channel AFGs cannot meet the requirements of reality.

## C. CORRELATED FUNCTIONS OF DUAL-CHANNEL OUTPUTS

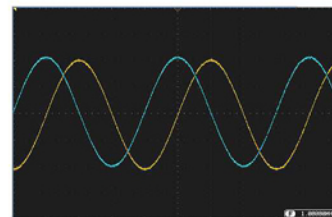


### Correlated Functions of Dual-Channel

The two channels can be used in either independent or correlated configuration. AFG-2225 provides three correlated functions which are Couple, Tracking and Phase functions. For Couple function, two signals with a ratio or offset in amplitude or frequency can be generated. One of two signals with adjustable offset frequency is an example which can form the two-tone signals for testing the third order inter-modulation distortion of an amplifier. With Tracking function, two differential signals with equal-frequency, equal-amplitude but inverted phase can be produced. Examples



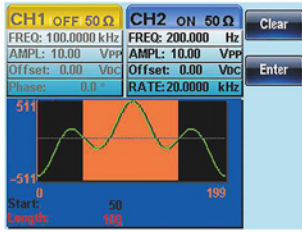
### Differential Signals



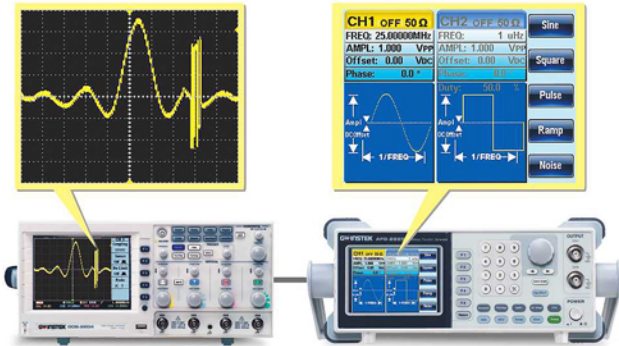
### Quadrature (Sine and Cosine) Signals

such as PECL, LVPECL and LVDS digital signals or automotive sensors like temperature, speed signals are all able to be simulated by tracking function. The Phase function is designed to create two signals with specified phase offset. When user wants to create two quadrature (sine and cosine) signals, the phase offset is set to be 90 degrees in the Phase function. In conclusion, compared with other arbitrary function generators only equipped with phase function, AFG-2225 provides great convenience to fulfill the various challenges coming from modern electronic industries.

## D. HIGH-FLEXIBILITY OF ARBITRARY WAVEFORMS EDITING



Direct Panel Operation



Direct Waveform Reconstruction (DWR) Capability

AFG-2225 provides 120MSa/s sampling rate, 10-bit vertical resolution, 4k-point waveform length, and the maximum waveform repeated rate of 60MHz, regarded as an outstanding arbitrary waveform capability. There are four ways for AFG-2225 to generate customized arbitrary waveforms, which are editing waveform via PC software, point-by-point editing on the panel, loading CSV file and loading the captured waveform from GWInstek GDS-Series Oscilloscopes.

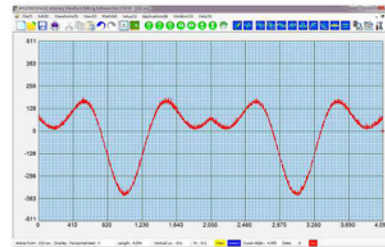
The PC software editing and point-by-point editing particularly provide the way to create the user-defined and post-modification waveform.

gpcsin	A	B	C
1	Start:	0	
2	Length:	629	
3	Sample Rate:	20000000	
4		0	
5		328	
6		655	
7		983	
8		1310	

```
% sine wave generation program
result=round(2*15*sin(0.01:2*pi));
save gpcsin.csv result /ascii;
% end
```

```
Start: 0
Length: 629
Sample Rate: 200000000
0
328
655
983
1310
1638
```

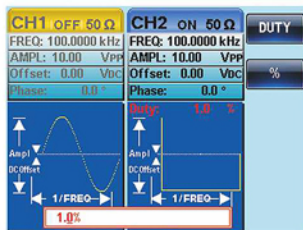
Supports CSV file upload



Arbitrary Waveform Editing PC Software

CSV file loading capability allows AFG-2225 to produce the waveforms with complicated math operation result. Engineer can use PC math software to process the integral result and then send the results in CSV format to AFG-2225. With the link to GWInstek GDS-Series Digital Storage Oscilloscopes (DSOs), the waveforms of interest can be captured by DSO and then reconstructed by AFG-2225. User can capture the waveform during the operation and then reconstructed by AFG-2225 for further analysis or diagnosis in the laboratory. Thus, plus the dual-channel feature, numerous derivative applications of capturing signal can be achieved.

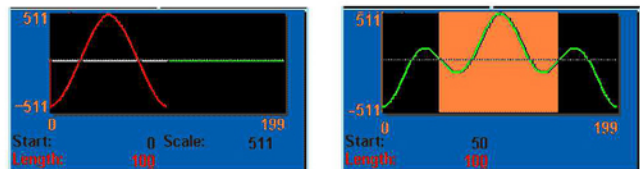
## E. 1%~99% ADJUSTABLE DUTY CYCLE OF SQUARE WAVE



1% Duty Cycle of Square Wave

Inheriting the advantage of AFG-2000 Series, AFG-2225 provides a 1%~99% variable duty cycle for its Square waveform within 100kHz bandwidth, which is considered practical for the tests such as simulating pulse and transient signals without purchasing extra advanced function generator and pulse generator.

## F. FRIENDLY OPERATING INTERFACES AND INSTANT PARAMETER DISPLAY



High-Flexible Editing/Output Method

AFG-2225 provides friendly panel operation setting as well as What You See Is What You Get operating way. From editing to output, the process can be manipulated via panel. Besides equipped with highly-flexible editing method, the immediate diagram is capable for users to understand the current waveform status and the output waveform contents under the storage/output setup.

## G. 66 BUILT-IN ARBITRARY WAVEFORMS



66 frequently used function waveforms in all fields are built in arbitrary waveform memory for user's selection. They are categorized into four groups, Common, Math, Window and Engineer. The trigonometric derivative functions, Blackman, Chebyshev, Bessel, Gamma, Gauss ... can be selected and developed by further editing.

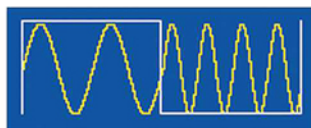
## H. IMPEDANCE SWITCH FUNCTION



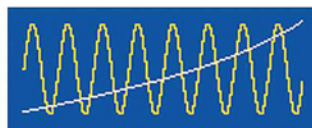
### 50 Ω / High Z Impedance Switch Function

Majority of users are using oscilloscope to observe the waveforms of function generators. However, the differences of input impedance of function generators and oscilloscopes are not the same, and the oscilloscope will not necessarily be equipped with built-in input impedance switch function; the correct amplifier can only be received through computing. AFG-2225 provides 50 Ω and high-input impedance switching modes, which can efficiently enhance the accuracy while users reading the results.

## I. SUPPORT MULTI-CHANGE SIGNAL APPLICATION



FSK



Sweep



Burst

AFG-2225 owns built-in functions, such as Modulation, Sweep, Burst, and RF Counter. The modulation waveforms contain AM, FM, PM, FSK, SUM, and either an internal signal or an external signal can be selected to perform the modulation. Sweep Function includes two sweep ways, linear and log mode, which can also perform sweep function in internal or external. Burst

function supports two modes, Gate and N-Cycle, which can be used to control parameters such as phase angles, duration frequency, and duration time. The built-in Frequency Counter is available to provide the maximum 150MHz frequency range without additional purchase.

## J. PROVIDE USB HOST/DEVICE INTERFACE



### USB Host & USB Device

The USB Host/Device Interfaces are located at the rear panel of AFG-2225. The USB Host is mainly used for directly reconstruction of waveforms of GW Instek GDS-Series Oscilloscope, thus, it can be stored and recalled at portable

USB Flash Drive; as to USB Device, which is used to connecting with PC, besides controlling through software on PC, USB Device also supports IEEE488.2 Command List for users to process customized functional control.

## PANEL INTRODUCTION



1. LCD Display
2. Function Keys, Return Key
3. Scroll Wheel
4. Arrow Keys
5. Output Terminals
6. Channel Select Key
7. Power Switch
8. Output key
9. Operation Keys
10. Number Pad
11. Power Socket Input
12. Fan
13. Input Terminals
14. Trigger Output
15. USB Host Port
16. USB Device Port

## SPECIFICATIONS

		CH1	CH2
<b>WAVEFORMS</b>		Sine, Square, Ramp, Pulse, Noise, ARB	
<b>ARBITRARY FUNCTION</b>	<b>Sample Rate</b> <b>Repetition Rate</b> <b>Waveform Length</b> <b>Amplitude Resolution</b> Non-Volatile Memory	120MSa/s 60MHz 4k point 10 bit 4k points	
<b>FREQUENCY CHARACTERISTICS</b>	<b>Range</b> <b>Resolution</b> <b>Accuracy</b>	<b>Sine/Square Ramp</b> 1μHz ~ 25MHz 1MHz 1μHz <b>Stability</b> ±20ppm <b>Aging</b> ±1 ppm, per 1 year <b>Tolerance</b> ≤1mHz	
<b>OUTPUT CHARACTERISTICS</b>	<b>Amplitude</b> <b>Offset</b> <b>Waveform Output</b>	<b>Range</b> 1mVpp~10Vpp(into 50Ω), 2mVpp~20Vpp(open-circuit) 1mVpp~5Vpp(into 50Ω) for 20MHz~25MHz; 2mVpp~10pp(open-circuit) for 20MHz~25MHz ±2% of setting ±1mVpp(at 1kHz) 1mV or 3digits <b>Accuracy</b> ±1% (0.1dB) ≤100kHz, ±3% (0.3 dB) ≤5MHz, ±5% (0.4 dB) ≤12MHz, ±10% (0.9dB) ≤25MHz (sine wave relative to 1kHz) <b>Units</b> Vpp, Vrms, dBm <b>Range</b> ±5Vpk ac+dc(into 50Ω); ±10Vpk ac+dc(open circuit); ±2.5Vpk ac+dc(into 50Ω) for 20MHz~25MHz ±5Vpk ac+dc(open circuit) for 20MHz~25MHz <b>Accuracy</b> 2% of setting + 5mV+ 0.5% of amplitude <b>Impedance</b> 50Ω typical (fixed); >10MΩ (output disabled) <b>Protection</b> Short-circuit protected; Overload relay automatically disables main output	
<b>SINE WAVE CHARACTERISTICS</b>	<b>Harmonic Distortion</b>	≤-55 dBc, DC ~ 200kHz, Ampl > 0.1Vpp; ≤-50 dBc, 200kHz ~ 1MHz, Ampl > 0.1Vpp ≤-35 dBc, 1MHz ~ 5MHz, Ampl > 0.1Vpp; ≤-30 dBc, 5MHz ~ 25MHz, Ampl > 0.1Vpp	
<b>SQUARE WAVE CHARACTERISTICS</b>	<b>Rise/Fall Time</b> <b>Overshoot</b> <b>Asymmetry</b> <b>Variable Duty Cycle</b>	≤25ns at maximum output (into 50Ω load) 5% 1% of period + 5 ns 1.0%~99%≤100kHz; 10.0%~90.0%≤1MHz; 50.0%≤25MHz	
<b>RAMP CHARACTERISTICS</b>	<b>Linearity</b> <b>Variable Symmetry</b>	< 0.1% of peak output 0%~100%(0.1% Resolution)	
<b>PULSE CHARACTERISTICS</b>	<b>Period</b> <b>Pulse Width</b> <b>Overshoot</b> <b>Jitter</b>	40ns ~ 2000s 20ns ~ 1999.9s <5% 20ppm + 5ns	
<b>AM MODULATION</b>	<b>Carrier Waveforms</b> <b>Modulating Waveforms</b> <b>Modulating Frequency</b> <b>Depth</b> <b>Source</b>	Sine, Square, Ramp, Pulse, Arb Sine, Square, Triangle, Up ramp, Dn ramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT)	Sine, Square, Ramp, Pulse, Arb Sine, Square, Triangle, Up ramp, Dn ramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT)

## SPECIFICATIONS

		CH1	CH2
<b>FM MODULATION</b>	Carrier Waveforms Modulating Waveforms Modulating Frequency Peak Deviation Source	Sine, Square, Ramp Sine, Square, Triangle, Upramp, Dnramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT) DC ~ Max Frequency Internal / External	Sine, Square, Ramp Sine, Square, Triangle, Upramp, Dnramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT) DC ~ Max Frequency Internal / External
<b>PM</b>	Carrier Waveforms Modulating Waveforms Modulation Frequency Phase Deviation Source	Sine, Square, Ramp Sine, Square, Triangle, Upramp, Dnramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT) 0° ~ 360° Internal / External	Sine, Square, Ramp Sine, Square, Triangle, Upramp, Dnramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT) 0° ~ 360° Internal / External
<b>FSK</b>	Carrier Waveforms Modulating Waveforms Modulation Frequency Phase Deviation Source	Sine, Square, Ramp, Pulse 50% duty cycle square 2mHz ~ 100 kHz (INT); DC ~ 100 kHz (EXT) 1μHz ~ Max Frequency Internal / External	Sine, Square, Ramp, Pulse 50% duty cycle square 2mHz ~ 100 kHz (INT); DC ~ 100 kHz (EXT) 1μHz ~ Max Frequency Internal / External
<b>SUM</b>	Carrier Waveforms Modulating Waveforms Modulation Frequency Phase Deviation Source	Sine, Square, Ramp, Pulse, Noise Sine, Square, Triangle, Upramp, Dnramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT) 0% ~ 100.0% Internal / External	Sine, Square, Ramp, Pulse, Noise Sine, Square, Triangle, Upramp, Dnramp 2mHz ~ 20kHz (INT); DC ~ 20kHz (EXT) 0% ~ 100.0% Internal / External
<b>SWEEP</b>	Waveforms Type Start/Stop Freq Sweep Time Source	Sine, Square, Ramp Linear or Logarithmic 1μHz to Max Frequency 1ms ~ 500s Internal / External/Manual	Sine, Square, Ramp Linear or Logarithmic 1μHz to Max Frequency 1ms ~ 500s Internal / External/Manual
<b>BURST</b>	Waveforms Frequency Burst Count Start/Stop Phase Internal Period Gate Source Trigger Source N-Cycle, Infinite	Sine, Square, Ramp 1μHz ~ 25MHz 1 ~ 65535 cycles or Infinite -360 ~ +360 1ms ~ 500s External Trigger Single, External or Internal Rate 0s ~ 655350ns	Sine, Square, Ramp 1μHz ~ 25MHz 1 ~ 65535 cycles or Infinite -360 ~ +360 1ms ~ 500s External Trigger Single, External or Internal Rate 0s ~ 655350ns
<b>FREQUENCY COUNTER</b>	Range Accuracy Time Base Resolution Input Impedance Sensitivity	5Hz ~ 150MHz Time Base accuracy: ±1 count ±20ppm (23°C ± 5°C) after 30 minutes warm up The maximum resolution is : 100nHz for 1Hz, 0.1Hz for 100MHz 1kΩ/1pf 35mVrms ~ 30Vms (5Hz ~ 150MHz)	
<b>DUAL CHANNEL FUNCTION</b>	Phase Tracking Coupling DSOLink	-180° ~ 180°, Synchronize phase CH2=CH1 Frequency(Ratio or Difference)Amplitude & DC Offset ✓	-180° ~ 180°, Synchronize phase CH1=CH2 Frequency(Ratio or Difference)Amplitude & DC Offset ✓
<b>EXTERNAL TRIGGER INPUT</b>	Type Input Level Slope Pulse Width Input Impedance	For FSK, Burst, Sweep TTL Compatibility Rising or Falling(Selectable) >100ns 10kΩ, DC coupled	
<b>EXTERNAL MODULATION INPUT</b>	Type Voltage Range Input Impedance Frequency	For AM, FM, PM, SUM ±5V full scale 10kΩ DC ~ 20kHz	
<b>TRIGGER OUTPUT</b>	Type Level Pulse Width Maximum Rate Fan-out Impedance	For Burst, Sweep, Arb TTL Compatible into 50Ω >450ns 1MHz ≥4 TTL Load 50Ω Typical	
<b>SAVE/RECALL</b>	10 Groups of Setting Memories		
<b>INTERFACE</b>	USB (Host & Device)		
<b>DISPLAY</b>	3.5" TFT LCD		
<b>POWER SOURCE</b>	AC100 ~ 240V, 50 ~ 60Hz		
<b>POWER CONSUMPTION</b>	25W (Max.)		
<b>OPERATING ENVIRONMENT</b>	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		
<b>OPERATING ALTITUDE</b>	2000 meters		
<b>STORAGE TEMPERATURE</b>	-10~70°C, Humidity: ≤70%		
<b>DIMENSIONS &amp; WEIGHT</b>	266(W)x107(H)x293(D) mm ; Approx. 2.5 kg		

\* The specifications apply when the function generator is powered on for at least 30 minutes under +18°C~+28°C.

Specifications subject to change without notice.

FG-2225GD1BH

### ORDERING INFORMATION

**AFG-2225** 25MHz True Dual Channel Arbitrary Function Generator

### ACCESSORIES

User Manual CD x 1, Quick Start Manual x 1, GTL-101 Test Lead x 2, Power Cord x 1

### OPTIONAL ASSESSORIES

**GTL-110** BNC(M)-BNC(M) RF Cable  
**GTL-246** USB Cable, USB 2.0 Type A – Type B, 4P

### FREE DOWNLOAD

**PC Software** Arbitrary Waveform Editing Software

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Simply Reliable

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