



# AFG-125/125P/225/225P

## USB Modular Arbitrary Function Generator

### FEATURES

- Output Amplitude Range From 1mVpp to 2.5Vpp (into 50Ω)
- Wide Frequency Ranges From 1μHz ~ 25MHz (sine wave)
- 1μHz 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
- User Friendly 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
- USB Device Interface for Remote Control and Waveform Editing

The brand new AFG-100/200 Series 25MHz USB modular arbitrary function generator has four models for selections. The AFG-100/200 Series arbitrary function generator with many unique features such as light weight, handy, and USB interface compatible is an ideal choice for the applications at the general laboratories in applying stand-alone operation or collocation with the GDS-2000A Series digital oscilloscope.

The main features of the AFG-100/200 Series are output amplitude of 2.5Vpp (connecting with a load of 50 ohms), frequency range reaching 25MHz, frequency resolution of 1uHz, and built-in sine waveform, square waveform, triangle waveform, and noise signal. Square waveform can adjust the duty cycle from 1% to 99% and it can be utilized as pulse signal. Users, via the GDS-2000A FG APP, can select from the 66 built-in function waveforms to conduct arbitrary waveform editing. The AFG-100/200 series, with functions of AM/FM/PM/FSK/SUM modulation, frequency sweep, burst and coupling, is suitable for various communications applications.

The AFG-100/200 Series collocates with the FG APP of GDS-2000A digital oscilloscope through USB interface. While conducting stand-alone operation, the AFG-100/200 Series utilizes USB interface, which allows users to quickly set up their required tests by the simple connection feature. AWES (arbitrary waveform editing software) PC software is provided to enter settings speedily and easily for measurement. Users can select required waveforms from arbitrary waveform editor.

The model, channel, and power arrangements of the AFG-100/200 Series are as follows :

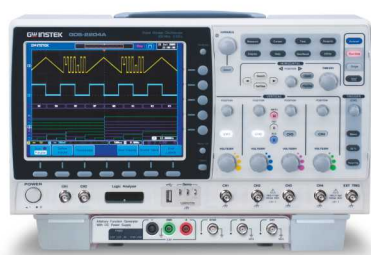
|                 | AFG-125 | AFG-125P | AFG-225 | AFG-225P |
|-----------------|---------|----------|---------|----------|
| <b>Channels</b> | 1       | 1        | 2       | 2        |
| <b>DC Power</b> | NA      | Yes      | NA      | Yes      |

DC power selections include 2.5V, 3.3V, and 5V.

**Power Supply Methods for the AFG-100/200 Series are as Follows :**

- For stand-alone operation, an external 5V power supply (GPA-501 is optional) is required.
- The USB interface of the GDS-2000A Series DSO provides power when AFG-125/225 collocates with GDS-2000A digital oscilloscope.
- An external 5V power supply (GPA-501 is optional) is required when AFG-125P/225P collocates with GDS-2000A digital oscilloscope.

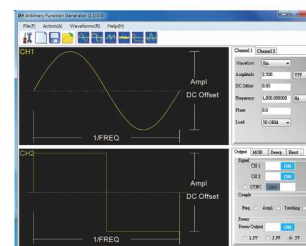
## A. FLEXIBILITY OF ARBITRARY WAVEFORM EDITING



**5-in-1 Multi-Functional Test System**



**Power Adapter Option**



**Stand-alone Operation With PC Software**

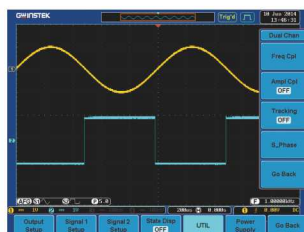
The AFG-100/200 Series provides arbitrary waveform sampling rate of 120 MSa/s, 10 bit resolution and the arbitrary waveform editing function with 4k point memory. The easy-to-use external AWES PC software interface allows users to quickly and conveniently operate the AFG-100/200 Series. Arbitrary waveforms can be produced through four methods as follows :

- \* The AFG-100/200 series collocates with the FG APP of GDS-2000A Series DSO to produce point-by-point output arbitrary waveforms.
- \* The AFG-100/200 series collocates with GDS-2000A series DSO to directly duplicate and produce retrieved waveform signals.

- \* Edit complicated waveforms via AWES PC software.
- \* Support programs such as MATLAB and Excel to upload CSV files into AWES PC software.

A seamless connection between the AFG-100/200 Series and the GDS-2000A Series DSO fulfills the possibility of realizing the five-in-one multi-functional test system, which includes oscilloscope, logic analyzer, digital voltage meter, function generator and power supply. The compact design of the AFG-100/200 Series truly saves a lot of laboratory space.

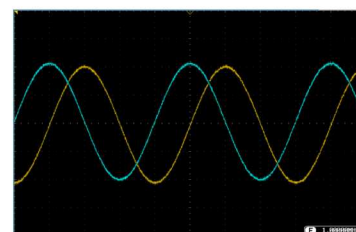
## B. CORRELATED FUNCTIONS OF DUAL-CHANNEL OUTPUT



**Equivalent Function in Dual-Channel**



**Differential Signal**



**Quadrature (Sine and Cosine) Signal**

AFG-225/225P dual channel models support independent channel or correlated channel applications. Three correlated functions are coupling, tracking and phase.

- \* The coupling function allows users to freely set ratio and offset values for frequency and amplitude of both channels to realize that all parameters are simultaneously effective for both channels. The measurement of the Third-Order Intercept Point for an amplifier and the simulations of two different frequency oscillators outputting signals are two application examples for the coupling function.

- \* The tracking function can produce 180 degree phase offset differential signals with same frequency and amplitude.
- \* The phase function allows users to freely set phase parameters for both channels such as sine and cosine waveform signals.

The sum modulation function can sum up two signals into one and output this signal via one channel. One of the related applications is to sum up sine waveform and noise to execute speaker distortion tests.

## USB MODULAR ARBITRARY FUNCTION GENERATOR SOLUTION FOR ORDERING

| MAIN FUNCTION \ MODEL                    | AFG-225P                         | AFG-225                          | AFG-125P                         | AFG-125                          |
|------------------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| Stand-alone Operation                    | GPA-501 option<br>GTL-246 option | GPA-501 option<br>GTL-246 option | GPA-501 option<br>GTL-246 option | GPA-501 option<br>GTL-246 option |
| Collocation with<br>GDS-2000A Series MSO | DH2-FH1 option<br>GPA-501 option | DH2-FH1 option                   | DH2-FH1 option<br>GPA-501 option | DH2-FH1 option                   |



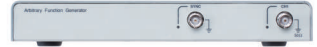
AFG-225P



AFG-225



AFG-125P



AFG-125

## USB MODULAR ARBITRARY FUNCTION GENERATOR SELECTION GUIDE

| MAIN FUNCTION \ MODEL | AFG-225P           | AFG-225            | AFG-125P           | AFG-125            |
|-----------------------|--------------------|--------------------|--------------------|--------------------|
| Analog Channel        | 2                  | 2                  | 1                  | 1                  |
| Frequency Range       | 25MHz              | 25MHz              | 25MHz              | 25MHz              |
| Frequency Resolution  | 1 $\mu$ Hz         | 1 $\mu$ Hz         | 1 $\mu$ Hz         | 1 $\mu$ Hz         |
| Sample Rate           | 120MSa/s           | 120MSa/s           | 120MSa/s           | 120MSa/s           |
| Vertical Resolution   | 10-bit             | 10-bit             | 10-bit             | 10-bit             |
| Memory Length         | 4k Points          | 4k Points          | 4k Points          | 4k Points          |
| Impedance Switch      | 50 $\Omega$ / Hi-Z | 50 $\Omega$ / Hi-Z | 50 $\Omega$ / Hi-Z | 50 $\Omega$ / Hi-Z |
| Sine/Square/Pulse     | ✓                  | ✓                  | ✓                  | ✓                  |
| Triangle/Ramp         | ✓                  | ✓                  | ✓                  | ✓                  |
| Noise                 | ✓                  | ✓                  | ✓                  | ✓                  |
| Burst                 | ✓                  | ✓                  | ✓                  | ✓                  |
| TTL/Sync Output       | ✓                  | ✓                  | ✓                  | ✓                  |
| Sweep                 | ✓                  | ✓                  | ✓                  | ✓                  |
| AM/FM/PM/FSK          | ✓                  | ✓                  | ✓                  | ✓                  |
| USB Device            | ✓                  | ✓                  | ✓                  | ✓                  |
| SUM                   | ✓                  | ✓                  | —                  | —                  |
| DC Power Supply       | ✓                  | —                  | ✓                  | —                  |

## PANEL INTRODUCTION





| SPECIFICATIONS              |                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |
|-----------------------------|---------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| MODEL                       |                                                                                                               | AFG-125/AFG-125P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | AFG-225/AFG-225P |
| OUTPUT CHANNELS WAVEFORMS   |                                                                                                               | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                |
| ARBITRARY FUNCTIONS         |                                                                                                               | Sine, Square, Ramp, Pulse, Noise, ARB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |
|                             | Sample Rate<br>Repetition Rate<br>Waveform Length<br>Amplitude Resolution<br>Non-Volatile Memory              | 120 MSa/s<br>60MHz<br>4k points<br>10 bits<br>4k points                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |
| FREQUENCY CHARACTERISTICS   | Range<br>Ramp<br>Resolution<br>Accuracy<br>Stability<br>Aging<br>Tolerance                                    | Sine/Square<br>1μHz~25MHz<br>1μHz~1MHz<br>1μHz<br>±20 ppm<br>±1 ppm, per 1 year<br>≤1 mHz                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |
| OUTPUT CHARACTERISTICS      | Amplitude<br>Range<br>Accuracy<br>Resolution<br>Flatness<br>Offset<br>Units<br>Range<br>Accuracy              | GPA-501 power supply:1mVpp~2.5Vpp(into 50Ω),2mVpp~5Vpp(open-circuit);USB power supply:1mVpp~2Vpp(into 50Ω),2mVpp~4Vpp(open-circuit)<br>±2% of setting ±1 mVpp (at 1 kHz)<br>1mV or 3 digits<br>±1%(0.1dB)≤100kHz, ±3%(0.3 dB)≤5MHz, ±5%(0.4 dB)≤12MHz, ±10%(0.9dB)≤25MHz (sine wave relative to 1kHz)<br>Vpp, Vrms, dBm<br>GPA-501 power supply: ±1.25 Vpk ac +dc (into 50Ω), ±2.5Vpk ac +dc (Open circuit)<br>USB power supply: ±1 Vpk ac +dc (into 50Ω), ±2 Vpk ac +dc (Open circuit)<br>2% of setting + 10mV+ 0.5% of amplitude |                  |
| WAVEFORM OUTPUT             | Impedance<br>Protection                                                                                       | 50Ω typical (fixed), > 10MΩ (output disabled)<br>Short-circuit protected. Overload relay automatically disables main output                                                                                                                                                                                                                                                                                                                                                                                                        |                  |
| SINE WAVE CHARACTERISTICS   | Harmonic<br>Distortion                                                                                        | ≤.50 dBc DC ~ 1MHz, Ampl >1Vpp<br>≤.35 dBc 1MHz ~ 5MHz, Ampl >1Vpp; ≤-30 dBc 5MHz ~ 25MHz, Ampl > 1Vpp                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |
| SQUARE WAVE CHARACTERISTICS | Rise/Fall Time<br>Overshoot<br>Asymmetry<br>Variable duty Cycle                                               | ≤10ns at maximum output. (into 50 Ω load)<br>≤2%<br>1% of period +5 ns<br>1.0% ~ 99.0% ≤100kHz; 10% to 90% ≤ 1MHz, 50% ≤ 25MHz                                                                                                                                                                                                                                                                                                                                                                                                     |                  |
| RAMP CHARACTERISTICS        | Linearity<br>Variable Symmetry                                                                                | < 0.1% of peak output<br>0% to 100% (0.1% Resolution)                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |
| PULSE CHARACTERISTICS       | Period<br>Pulse Width<br>Overshoot<br>Accuracy<br>Jitter                                                      | 40ns ~ 2000s<br>20ns ~ 1999.9s<br>≤2%<br>0.1%+20ns<br>20ppm +10ns                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |
| AM MODULATION               | Carrier Waveforms<br>Modulating Waveforms<br>Modulating Frequency<br>Depth<br>Source                          | Sine, Square, Ramp, Pulse, Arb<br>Sine, Square, Triangle, Upramp, Dnrmamp<br>2mHz ~ 20kHz<br>0% ~ 120.0%<br>Internal                                                                                                                                                                                                                                                                                                                                                                                                               |                  |
| FM MODULATION               | Carrier Waveforms<br>Modulating Waveforms<br>Modulating Frequency<br>Peak Deviation<br>Source                 | Sine, Square, Ramp,<br>Sine, Square, Triangle, Upramp, Dnrmamp<br>2mHz ~ 20kHz<br>DC to Max Frequency<br>Internal                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |
| SWEEP                       | Waveforms<br>Type<br>Start/Stop Freq<br>Sweep Time<br>Source                                                  | Sine, Square, Ramp,<br>Linear or Logarithmic<br>1μHz to Max Frequency<br>1ms ~ 500s<br>Internal / Manual                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |
| FSK                         | Carrier Waveforms<br>Modulating Waveforms<br>Modulation Rate<br>Frequency Range<br>Source                     | Sine, Square, Ramp, Pulse<br>50% duty cycle square<br>2mHz ~ 100 kHz<br>1μHz to Max Frequency<br>Internal                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |
| PM                          | Carrier Waveforms<br>Modulating Waveforms<br>Modulation Frequency<br>Phase deviation<br>Source                | Sine, Square, Ramp<br>Sine, Square, Triangle, Upramp, Dnrmamp<br>2mHz ~ 20kHz<br>0° ~ 360°<br>Internal                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |
| SUM                         | Carrier Waveforms<br>Modulating Waveforms<br>Modulation Frequency<br>SUM Depth<br>Source                      | Sine, Square, Ramp, Pulse, Noise<br>Sine, Square, Triangle, Upramp, Dnrmamp<br>2mHz to 20kHz<br>0% ~ 100.0%<br>Internal                                                                                                                                                                                                                                                                                                                                                                                                            |                  |
| SYNC OUTPUT                 | Type<br>Level<br>Assignment<br>Polarity<br>Fan-out<br>Impedance                                               | Sync, Sweep Marker, Burst Marker or Arbitrary Waveform Marker<br>TTL Compatible into 50Ω<br>Channel 1 or Channel 2<br>Normal or Inverted<br>≥4 TTL Load<br>50Ω Typical                                                                                                                                                                                                                                                                                                                                                             |                  |
| DUAL CHANNEL FUNCTION       | Phase<br>Track<br>Coupling                                                                                    | -180° ~180° (Square and Pulse can not be change, Phase is 0°), Synchronize phase<br>CH2=CH1 OR CH1=CH2<br>Frequency(Ratio or Difference), Amplitude & DC Offset                                                                                                                                                                                                                                                                                                                                                                    |                  |
| BURST                       | Waveforms<br>Frequency<br>Burst Count<br>Start/Stop Phase<br>Internal Period<br>Gate Source<br>Trigger Source | Sine, Square, Ramp, Arb<br>1uHz~15 MHz(sine), 1uHz~15 MHz(Square), 1uHz~1 MHz (Ramp)<br>1 ~ 65535 cycles or Infinite<br>-360 ~ +360<br>1ms ~ 500s<br>External Trigger<br>Single or Internal Rate                                                                                                                                                                                                                                                                                                                                   |                  |
| TRIGGER DELAY               | N-Cycle, Infinite                                                                                             | 0s to 655350ns                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |
| SAVE/RECALL                 |                                                                                                               | 10 Groups of Setting Memories                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |
| POWER OUTPUT                | Only AFG-125P/AFG-225P                                                                                        | Output Voltage : (2.5V/3.3V/5V)±5%, Output Current : 0.6A                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |
| INTERFACE                   |                                                                                                               | USB (Device)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                  |
| GENERAL SPECIFICATIONS      | Power Source<br>Power Consumption<br>Operating Environment<br>Operating Altitude<br>Storage Temperature       | DC 5V<br>10 W (Max)<br>Temperature to satisfy the specification:18~28 °C,Operating temperature:0~40 °C,Relative Humidity:< 80%,0~40 °C,Installation category:CAT II<br>2000 Meters<br>-10~70 °C, Humidity : ≤ 70%                                                                                                                                                                                                                                                                                                                  |                  |
| DIMENSIONS & WEIGHT         |                                                                                                               | 215(W) x 35 (H) x 107(D) mm, Approx. 1kg                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |

Specifications subject to change without notice. AFG-100200GD1BH

| ORDERING INFORMATION                                                |                                                                                 |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------|
| AFG-125                                                             | 25MHz Single Channel USB Modular Arbitrary Function Generator                   |
| AFG-225                                                             | 25MHz Dual Channel USB Modular Arbitrary Function Generator                     |
| AFG-125P                                                            | 25MHz Single Channel USB Modular Arbitrary Function Generator Plus Power Supply |
| AFG-225P                                                            | 25MHz Dual Channel USB Modular Arbitrary Function Generator Plus Power Supply   |
| ACCESSORIES                                                         |                                                                                 |
| Quick Start Guide x 1, CD-ROM with AFG Software and User Manual x 1 |                                                                                 |
| GTL-101                                                             | BNC-Alligator Test Lead x 1 (only AFG-125/125P)                                 |
| GTL-101                                                             | BNC-Alligator Test Lead x 2 (only AFG-225/225P)                                 |
| GTL-105A                                                            | Test Lead x 1 (only AFG-125P/225P)                                              |

| OPTIONAL ACCESSORIES |                                                     |
|----------------------|-----------------------------------------------------|
| DS2-FH1              | Module extension bay & USB Type A to Type A/B cable |
| GPA-501              | Power Adapter                                       |
| GTL-246              | USB Type A to Type B cable                          |
| GTL-201A             | Ground lead                                         |

GOOD WILL INSTRUMENT CO., LTD.

T +886-2-2268-0389 F +886-2-2268-0639

E-mail: marketing@goodwill.com.tw

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