

AFG-3000 Series Arbitrary Function Generators

New Product Announcement

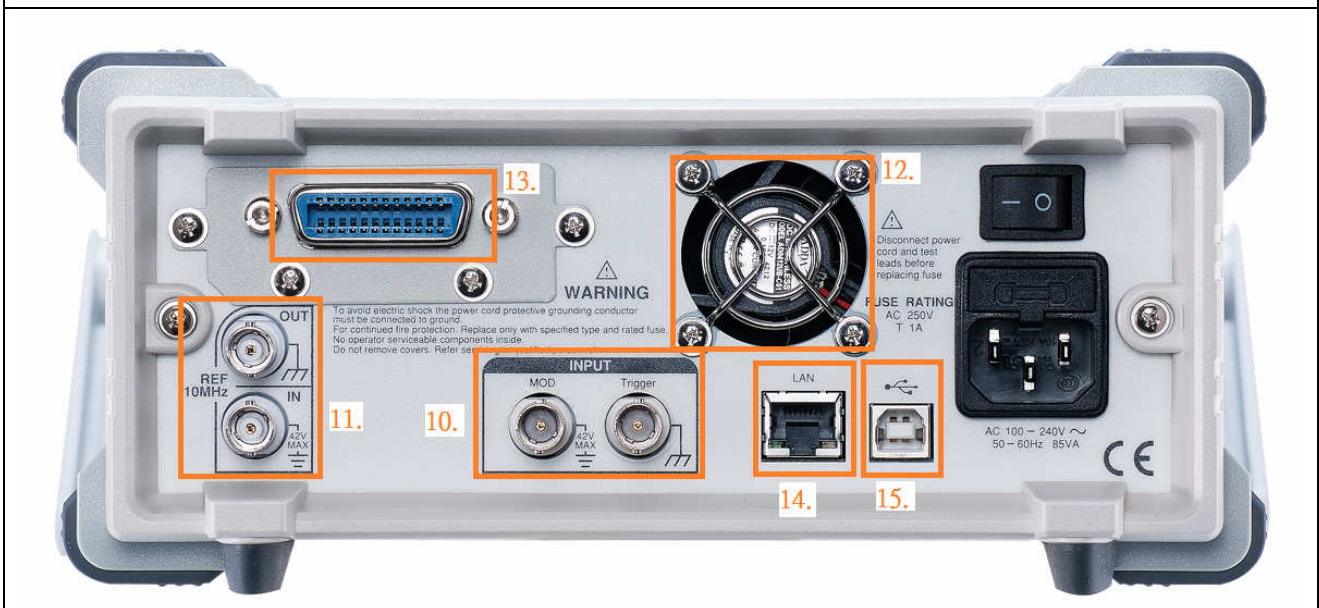
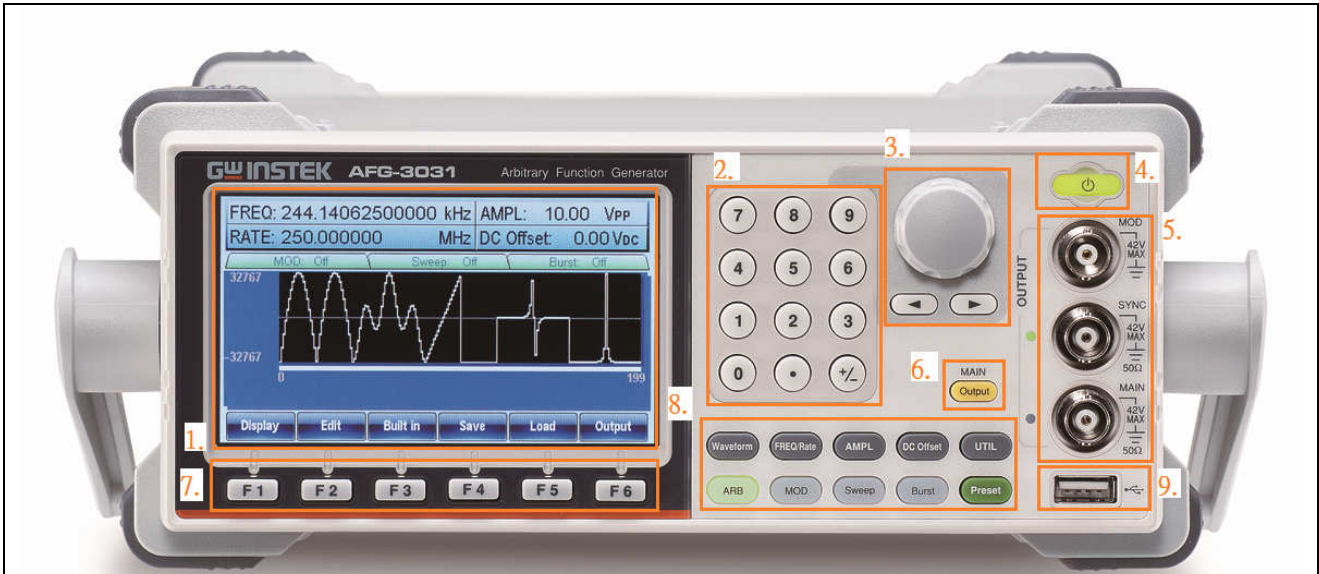
GW Instek rolls out the new AFG-3000 series arbitrary function generators, including 20MHz/30MHz single channel and dual channel models, designed to meet industry, scientific research, and education applications. In the design of isolated output, all output channels are earth ground isolation, which is suitable for test applications of floating circuit. For instance, connecting an AFG-3000 with a power supply's DC voltage, the maximum AC-DC cascaded output reaches +42V or -42V. Each channel of dual channel models can be operated independently or multi units can simultaneously function without taking grounding reference into consideration. Applications are, for instance, the ignition control or transmission device of automotive electronics. The series features sample rate of 250MSa/s, 16-bit resolution, and 8M point memory depth for arbitrary waveform generation. Users not only can save the edited waveforms to the memory to build arbitrary waveforms, but also rebuild waveforms by the AFG-3000's built-in DSOLink function with a GW Instek digital storage oscilloscope.



The AFG-3000 series supports synchronized phase for multi channel operation up to 6 units and 12 channels. A reference input connector is available allowing an external 10 MHz time base to synchronize the internal clock and elevate the frequency output accuracy. The series supports frequency sweep and amplitude sweep that can also integrate other functions, including linear/logarithm, one-way (saw tooth)/two-way (triangle), continuous/single trigger/gated trigger to meet various application requirements by applying different sweep methods. Frequency sweep tests the frequency response of electronic components such as filter and low frequency amplifier. Amplitude sweep simulates vibration tests (requires a vibration tester), and it also conducts aging tests of various materials and linearity tests of low frequency amplifier.

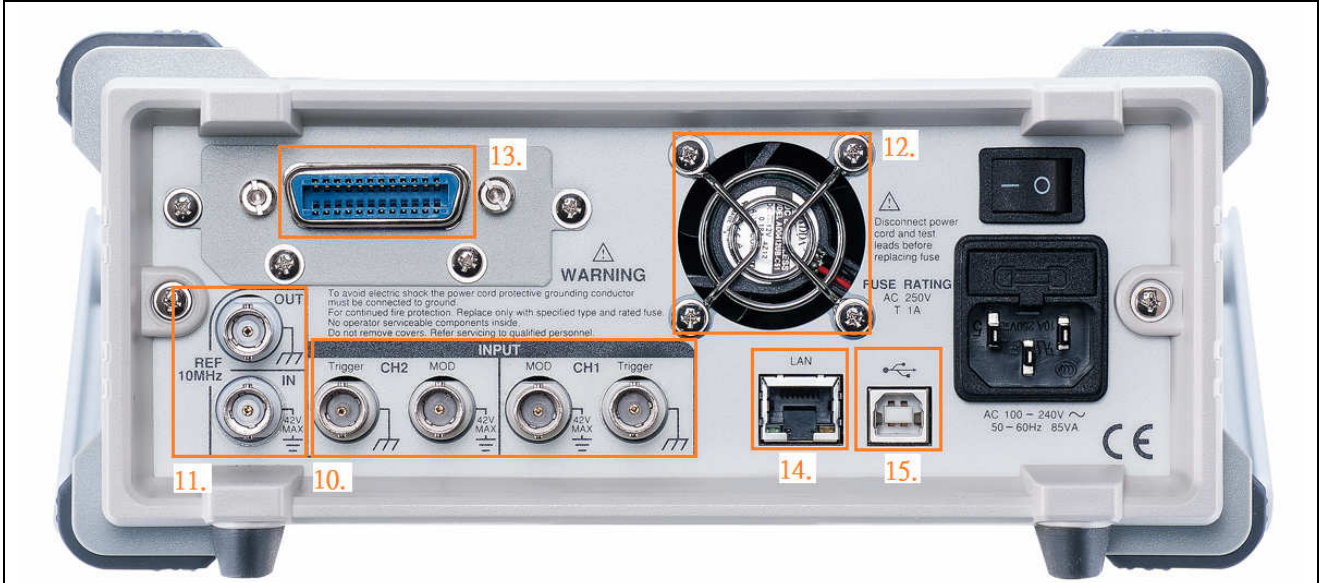
The main features of the AFG-3000 series include output amplitude from 1mVpp to 10Vpp (connected with a 50 ohm load); frequency range from 1uHz to 20MHz or 30MHz; 1uHz frequency resolution; and built-in sine, square, pulse, triangle, ramp, DC voltage, harmonic and noise. The waveform width, rise edge time and fall edge time of pulse waveform can be adjusted flexibly. Pulse waveform, with duty cycle from 0.017% to 99.983%, can be applied as trigger signals. Users can conduct arbitrary editing via 65 built-in function waveforms. The series supports AM/FM/PM/FSK/PWM modulation, frequency sweep, amplitude sweep and burst to satisfy industrial application requirements. Dual channel models provide SUM modulation, coupling, tracking, and phase to meet the test requirements of differential signal, phase control and amplifier distortion. Built-in 8th harmonic signal generator simulates harmonic signal of switching power supplies and it also tests EMI power filter characteristics. The AFG-3000 series provides free arbitrary waveform editing software (AWES) for users to quickly edit waveforms from the built-in diagrams so as to execute measurements.

AFG-3031/3021 Panel Introduction



| | | |
|--|--|---|
| <p>1. TFT LCD Panel 2. Number Panel 3. Scroll Knob & Selection Key 4. Power Switch 5. Output Terminals</p> | <p>6. Main Output Switch 7. Function Keys 8. Operation Keys 9. USB Host 10. Trigger & Modulation Input</p> | <p>11. 10MHz REF Input & Output 12. Fan 13. GPIB 14. LAN 15. USB Device</p> |
|--|--|---|

AFG-3032/3022 Panel Introduction



| | | |
|--|--|---|
| <p>1. TFT LCD Panel 2. Number Panel 3. Scroll Knob & Selection Key 4. Power Switch 5. Output Terminals</p> | <p>6. Main Output Switch 7. Function Keys 8. Operation Keys 10. Trigger & Modulation Input</p> | <p>11. 10MHz REF Input & Output 12. Fan 13. GPIB 14. LAN 15. USB Device</p> |
|--|--|---|

Product Introduction

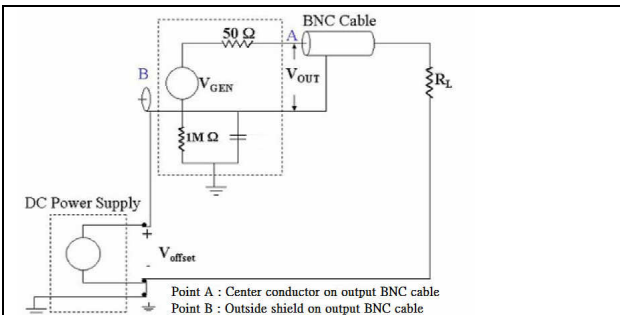
The AFG-3000 series comes with four models. Model number and channel (s) are listed as follows:

| Model | AFG-3031 | AFG-3032 | AFG-3021 | AFG-3022 |
|-----------------|----------------|-----------------|-----------------|-----------------|
| Frequency range | 1 uHz to 30MHz | 1 uHz to 30 MHz | 1 uHz to 20 MHz | 1 uHz to 20 MHz |
| Channel | 1 | 2 | 1 | 2 |

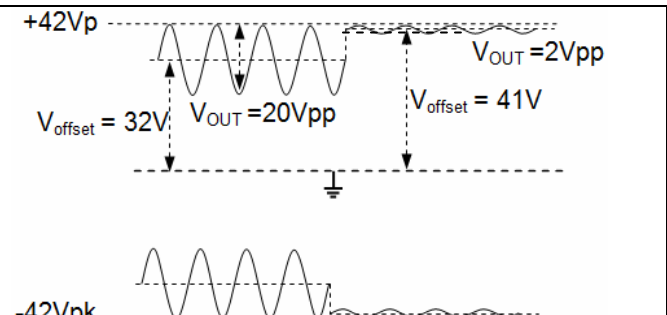
Circuit Design for Ground Isolation among Output/Input Terminal, Instrument Chassis, and Dual Channels



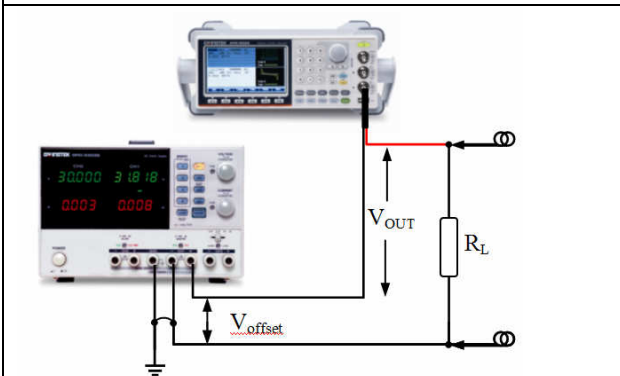
Channel 1, channel 2, reference 10 MHz input, synchronization and modulation input/output connector grounding are isolated from instrument chassis. The output channels of dual channel models are independently isolated. These connectors can sustain maximum isolation voltage up to $\pm 42\text{Vpk}$ (DC+ AC peak value) to earth ground that is ideal for floating circuit tests. Multi units output can be executed without factoring in grounding reference issue. The built-in DC bias voltage of the AFG-3000 series can be applied on various waveforms. The DC bias voltage is $\pm 5\text{V}$ under 50 ohm load. Automotive electronic applications such as ignition controller or transmission devices require higher DC bias voltage. As shown in the following diagrams, when the V_{offset} of the power supply is 32Vdc, the maximum output of the AFG is 20Vpp, and the maximum voltage output to the ground is 42V. If V_{offset} is 41Vdc, the maximum output of the AFG is 2Vpp and the maximum voltage output to the ground remains to be 42V. Therefore, an external power supply can be used to bring up the DC bias voltage to $\pm 42\text{Vpk}$ (DC+ AC peak value).



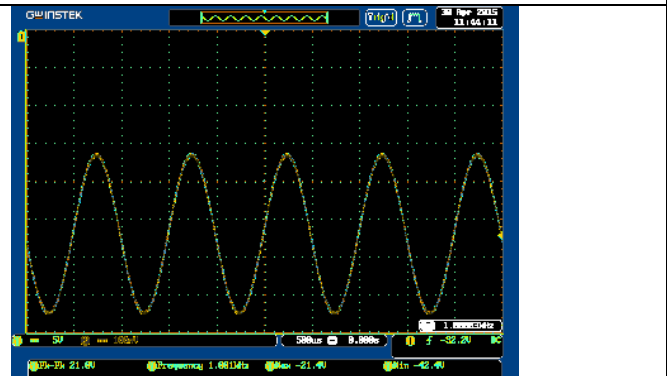
Connection diagram for AFG connecting with power supply to increase D.C. bias.



The V_{out} of AFG is 20/2 Vpp when DC bias is 32/41 Vdc.



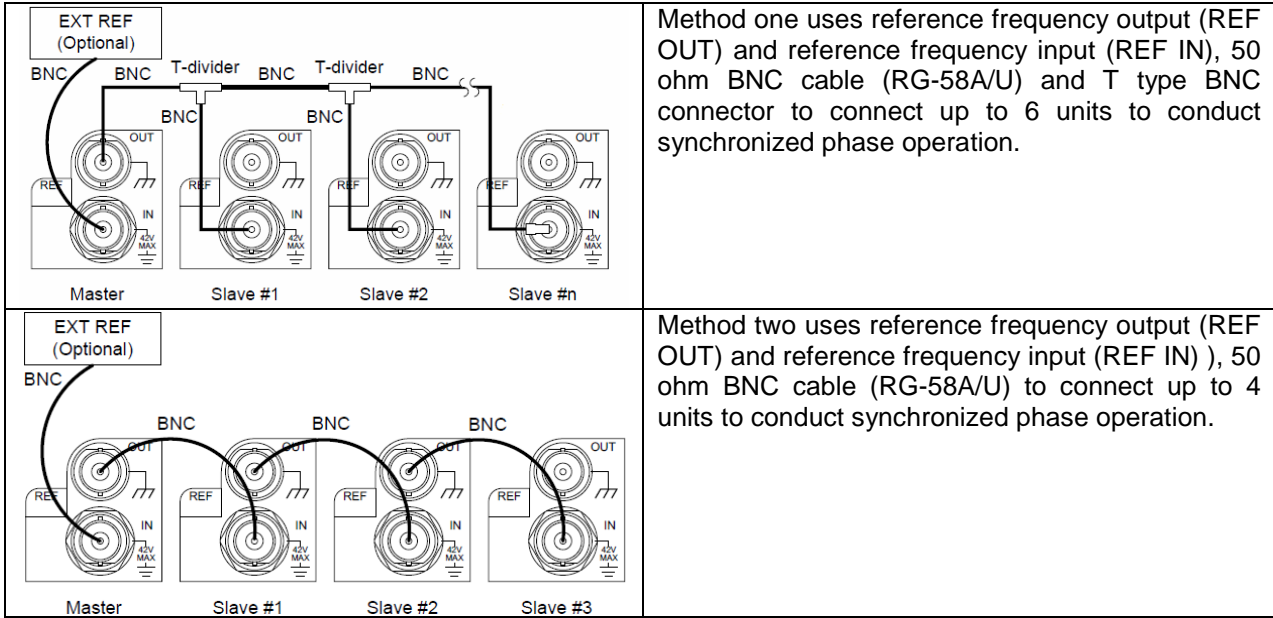
Test settings: power supply output -31.8V, and AFG-3032 output 20Vpp, 1kHz sine wave.



The test result obtained from an oscilloscope (high impedance load). The lowest voltage was -42.4V.

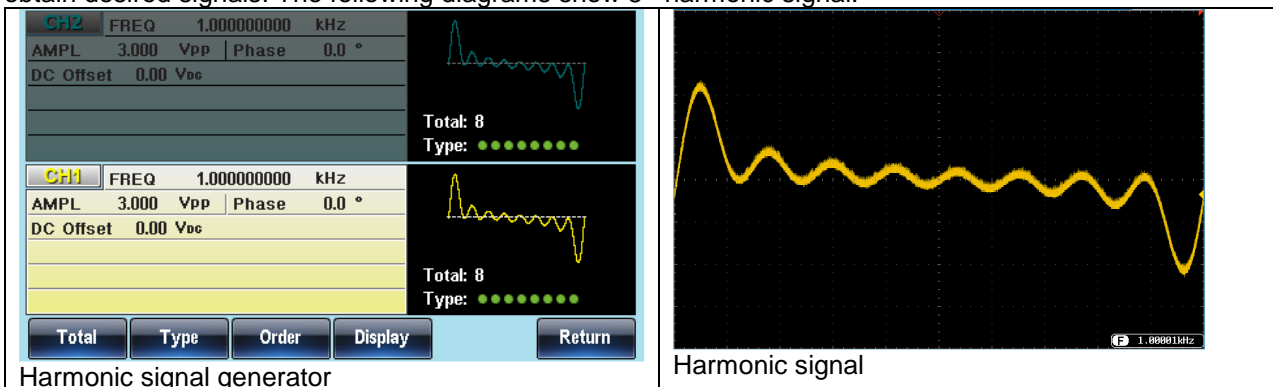
Multi Channel Synchronized Phase Operation

Users can implement multi channel synchronized-phase operation up to 6 units and 12 channels (AFG-3032/3022). There are two methods to execute synchronized phase applications. Under different multiple frequency settings, master unit can synchronize the phase of each channel of the slave units. At 10 MHz reference frequency input (REF IN) connector, users can input 10 MHz atomic clock frequency standard via external signal source to increase frequency output accuracy.



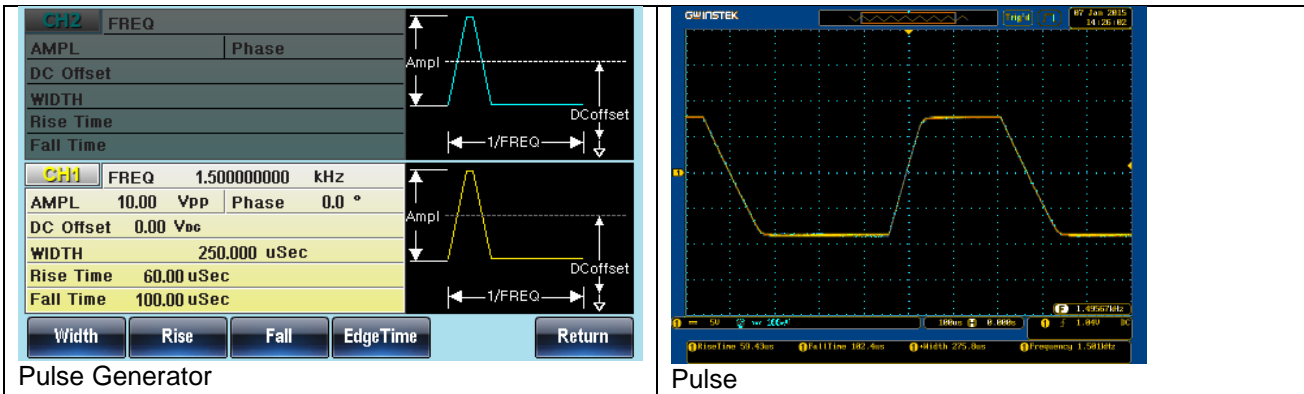
Harmonic Signal Generator

Harmonic signal generator simulates the harmonic signal of switching power supplies and conducts characteristics tests on EMI power filter. Users can set order number and phase for harmonic signals to obtain desired signals. The following diagrams show 8th harmonic signal.



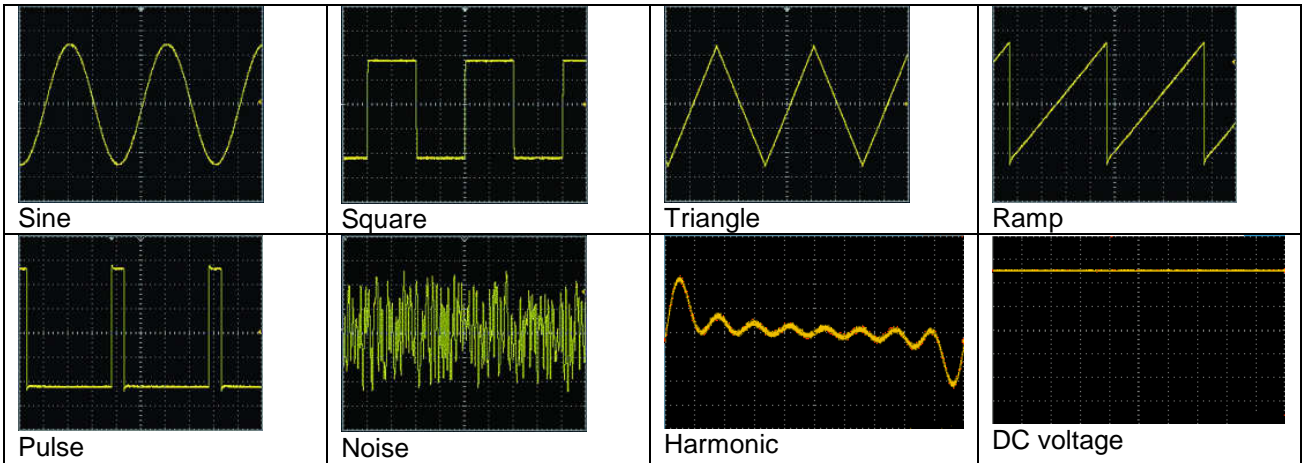
Pulse Generator

The output frequency for pulse reaches 25 MHz and its duty cycle is from 0.017% to 99.983%. Users can set pulse width, duty cycle, rise edge time, fall edge time and edge time to support trigger signal. The following diagrams show settings for pulse signal.



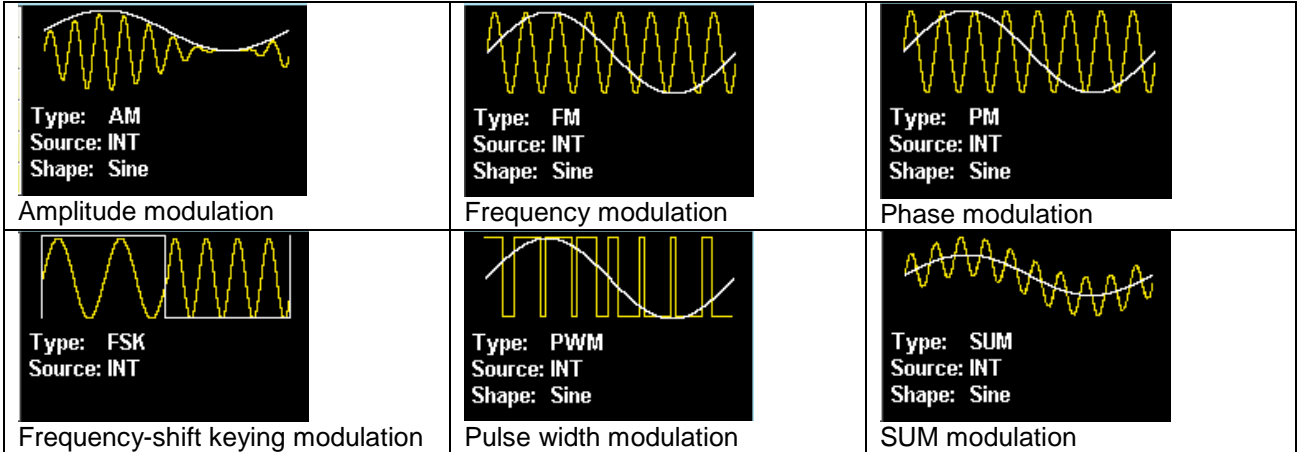
Versatile Output Waveform Selections

65 built-in function waveforms include engineering applications, medical electronics, mathematics, and standard waveforms such as sine, square, triangle, ramp, pulse, noise, harmonic, and DC voltage that allow users to easily select desired waveforms. Users can select and edit 65 function waveforms from the arbitrary function.



Modulation Function

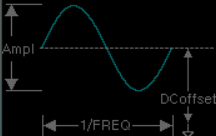
The series supports AM, FM, PM, FSK, PWM and SUM modulation. Modulation source can be from inside or outside. Applications include the baseband of communications systems, motor control and light adjustment.



Burst Function

The series supports N-period or gated trigger. Phase angle, duration time, frequency, waveform infinite can be adjusted to meet non-continuous output applications.

| | | | |
|------------|-------|-------------|-------------|
| CH2 | FREQ | 1.000000000 | kHz |
| AMPL | 3.000 | Vpp | Phase 0.0 ° |
| DC Offset | 0.00 | Vdc | |

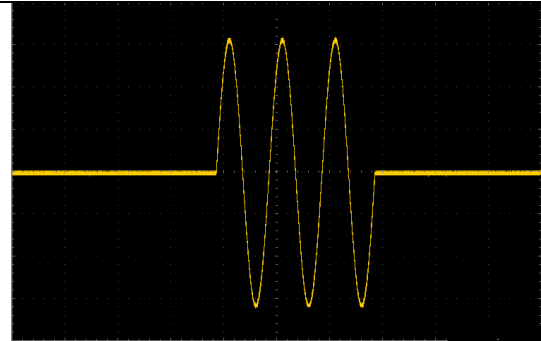


| | | | |
|------------|--------|-------------|-------------|
| CH1 | FREQ | 1.000000000 | kHz |
| AMPL | 3.000 | Vpp | Phase 0.0 ° |
| DC Offset | 0.00 | Vdc | |
| Cycles: | 3 Cyc | | |
| Delay: | 0.00 | uSEC | |
| Period: | 10.000 | mSEC | |

Type: N Cycle
Source: INT

Cycles Infinite Phase Period TRIG setup Return

Burst setting

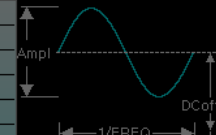


Burst signal

Sweep Function

The series supports frequency sweep and amplitude sweep that can also integrate other functions, including linear/logarithm, one-way (saw tooth)/two-way (triangle) waveforms, continuous/single trigger/gated trigger to meet various application requirements by different sweep methods. Frequency sweep carries out tests on the frequency response of electronic components such as filter and low frequency amplifier. Amplitude sweep simulates vibration tests (requires a vibration tester), and it also conducts aging tests of various materials and linearity tests of low frequency amplifier.

| | | | |
|------------|-------|-------------|-------------|
| CH2 | FREQ | 1.000000000 | kHz |
| AMPL | 3.000 | Vpp | Phase 0.0 ° |
| DC Offset | 0.00 | Vdc | |

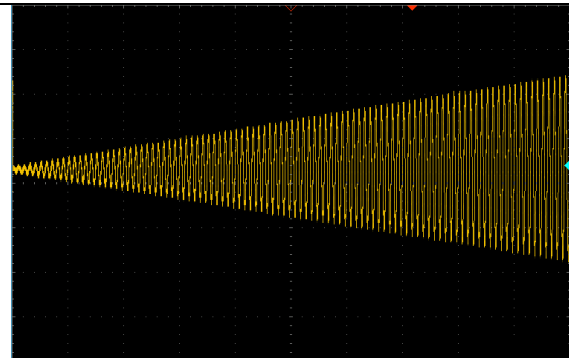


| | | | |
|-------------|-------|-------------|-------|
| CH1 | FREQ | 1.000000000 | kHz |
| AMPL | ---- | | Phase |
| DC Offset | 0.00 | Vdc | |
| Start: | 1.000 | Vpp | |
| Stop: | 3.000 | Vpp | |
| Sweep Time: | 1.000 | SEC | |

Mode: Cont
Trigger Source: INT
Trig Time: 1.000 SEC

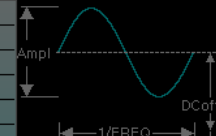
TRIG Type Type/MOD Start Stop SWP Time

Amplitude sweep setting



Amplitude sweep signal

| | | | |
|------------|-------|-------------|-------------|
| CH2 | FREQ | 1.000000000 | kHz |
| AMPL | 3.000 | Vpp | Phase 0.0 ° |
| DC Offset | 0.00 | Vdc | |

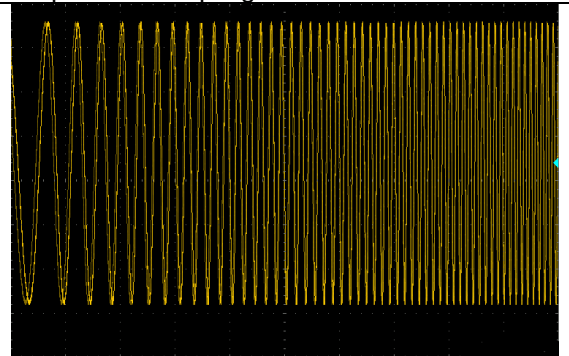


| | | | |
|-------------|-------------|------|-------|
| CH1 | FREQ | ---- | |
| AMPL | 3.000 | Vpp | Phase |
| DC Offset | 0.00 | Vdc | |
| Start: | 100.0000000 | Hz | |
| Stop: | 1.000000000 | kHz | |
| Sweep Time: | 1.000 | SEC | |

Mode: Cont
Trigger Source: INT
Trig Time: 1.000 SEC

Linear Log Return

Frequency sweep setting

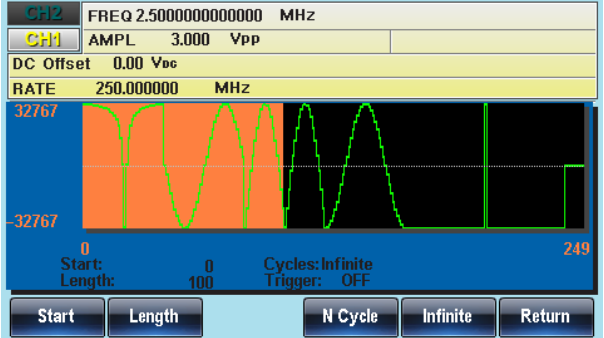


Frequency sweep signal

Flexible Arbitrary Waveform Editing

Four methods to obtain arbitrary waveforms

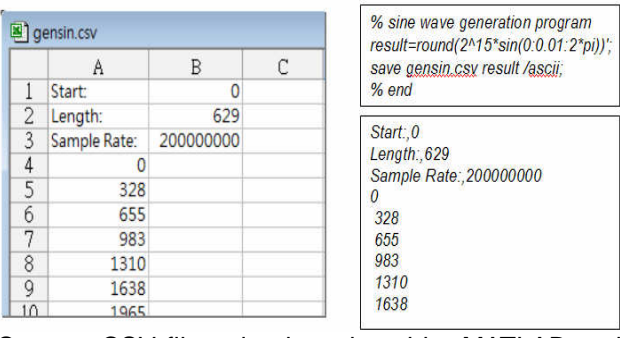
Front Panel Operation



CH2 FREQ 2.500000000000 MHz
CH1 AMPL 3.000 Vpp
DC Offset 0.00 Vdc
RATE 250.000000 MHz
32767
-32767
0 Start: 0 Cycles: Infinite
Length: 100 Trigger: OFF
249
Start Length N Cycle Infinite Return

Via single unit's panel, arbitrary waveforms can be selected, edited, stored, recalled, output, triggered from 65 built-in waveforms.

CSV File Upload




| | A | B | C |
|----|--------------|------|-----------|
| 1 | Start: | | 0 |
| 2 | Length: | | 629 |
| 3 | Sample Rate: | | 200000000 |
| 4 | | 0 | |
| 5 | | 328 | |
| 6 | | 655 | |
| 7 | | 983 | |
| 8 | | 1310 | |
| 9 | | 1638 | |
| 10 | | 1965 | |

```
% sine wave generation program
result=round(2^15*sin(0:0.01:2*pi));
save gensin.csv result /ascii;
% end

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

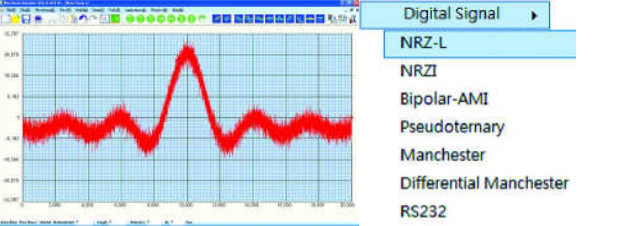
Support CSV file upload produced by MATLAB and Excel.

Direct Waveform Reconstruction



Collocate with GDS series digital oscilloscopes to retrieve waveforms and upload them to arbitrary generator to achieve direct waveform reconstruction.

Arbitrary Waveform Editing PC Software

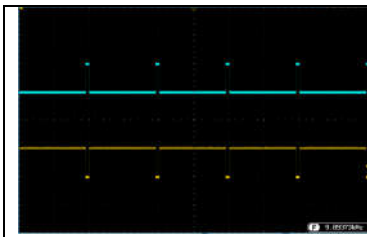


Use AWES to edit complex waveforms. The software supports waveform mathematical operation. The waveform series includes Uniform Noise, Gaussian Noise, Rayleigh Noise, various digital codes such as non zero code, Manchester and RS-232, etc.

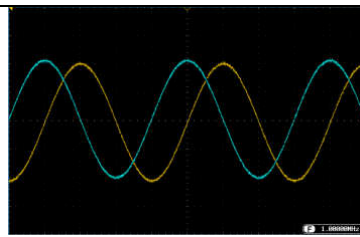
Correlated Functions of Dual Channel Outputs

AFG-3032/3022 models support independent channel or correlated channel applications. Four correlated functions are provided including SUM modulation, coupling, tracking, and phase.

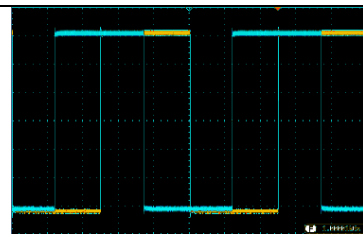
- SUM modulation combines two signals and outputs the signal via one single channel. Combining noise and sine waveform to execute speaker's distortion test is one of the applications.
- Coupling function arbitrarily sets ratio and difference for frequency and amplitude between two channels to realize a simultaneous effect for all parameters of dual channel. The example is amplifier using third order interpolation point (IP3) measurement to simulate signal output of two different frequency oscillators.
- Tracking function produces differential signal with same frequency, same amplitude, and 180 degree phase difference.
- Phase function arbitrarily sets phase parameters between two channels such as simulating sine/cosine/square signal phase adjustment.



Differential signal



Sine and cosine signal



Square signal phase adjustment

Features/Advantages/Benefits

| Features | Advantages | Benefits |
|--|---|---|
| Circuit Design for earth ground isolation among output/input terminal, instrument chassis, and dual channels | Connectors can sustain maximum isolation voltage up to $\pm 42\text{Vpk}$ (DC+ AC peak value). | The external power supplies can bring up the DC bias voltage to $\pm 42\text{Vpk}$, ideal for floating circuit tests. Multi units output can be achieved without factoring in grounding reference issue. |
| Harmonic signal generator | Simulate the harmonic signals of switching power supplies. | Satisfy the test requirements of switching power supplies and EMI filters. |
| 10 MHz reference frequency input and output | Enhance accuracy for frequency output and connect multi units for synchronization operation. | Satisfy phase synchronization operation for maximum 12 channel signal sources. |
| Amplitude sweep | Increase sweep application range. | Conduct aging tests of various materials and linearity tests of low frequency amplifier. |
| Dual channel AFG output | Can be operated as two single-channel AFGs. | Satisfy test requirements for differential signal, phase control, amplifier's distortion. |
| Four correlated functions for dual channel outputs | Arbitrarily sets ratio and difference for frequency and amplitude. Produce 180 degree phase difference. | Satisfy test requirements for baseband simulation, sound frequency, digital signal and vibration. |
| Independently set pulse parameter | Simulate trigger signal applications. | Applied as an economical pulse generator. |
| 250MSa/s, 16 bit resolution, 8M point arbitrary waveform function | Support various arbitrary editing methods. | Satisfy the requirements of educational and industrial markets. |
| Waveform reconstruction function | Simple operation to obtain signals retrieved by GDS series digital oscilloscopes. | A trouble shooting tool for users. |

Major Specifications and Functions

- 1uHz to 20 or 30MHz, 20Vpp. 1 or 2 channel (s)
- Arbitrary waveform 250MSa/s, 16-bit resolution, 8M memory depth
- Isolation channel circuit design
- Synchronized phase operates up to 6 units and 12 channels
- Harmonic signal generator
- Dual channel models support SUM modulation, coupling, tracking, and phase functions
- Pulse waveform parameters can be set independently
- Built-in AM/FM/PM/FSK/PWM/SUM modulation, sweep and burst functions
- Provide USB/LAN/GPIB (optional) instrument control interface

Target Markets

The target markets of AFG-3031/3032/3021/3022 are automotive electronics, electronic products and parts, communications and stereo system products, machine and control, etc.

| | |
|---|--|
| Automotive electronics | Gear rotation signal simulation, accuracy work for turbo chargers, inverter evaluation, ABS and power-steering device testing, ECU and sensor operation testing |
| Electronic products and parts | Differential/balanced input testing, LCD panel operation testing, digital circuit evaluation testing, harmonic signals of switching power supply simulation |
| Communications and stereo system products | Baseband signal of communications systems testing , audio amplifier and speaker frequency response and linearity measurement, and wireless communications equipment evaluation testing |
| Machine and controls | Industrial robot and servo system testing, motor driving, building vibration experiments (for incorporating vibration testers), material fatigue testing |
| Other applications | Simulation of biological signal, battery charge/discharge testing, three-phase power source simulation, power source modulation testing, experiments and science projects in universities and technical colleges |

Position

AFG-3031/3021 is 30/20MHz single channel model and AFG-3032/3022 is 30/20MHz dual channel arbitrary function generator. Isolation channel design is for the entire series, aimed at automotive electronics and industrial markets. Major competitors are Keysight 33500B series and Tektronix AFG3021C/3022C.

AFG-3032/3022 vs. AFG-2225

The following chart shows the comparison between the two products.

| | AFG-3032/3022 | AFG-2225 |
|---------------------------------------|--|--|
| Frequency Range | 1uHz to 30 MHz or 20MHz | 1uHz to 25 MHz |
| Amplitude Range (into 50 ohm load) | 1mVpp to 10 Vpp | 1mVpp to 10 Vpp |
| Arbitrary waveform characteristics | 250MSa/s, 16-bit resolution, 8M points | 120MSa/s, 10-bit resolution, 4k points |
| Modulation types | AM/FM/PM/FSK/PWM/SUM | AM/FM/PM/FSK/SUM |
| Sweep types | Amplitude / Frequency | Frequency |
| Square waveform duty cycle | 20% to 80% | 1% to 99% |
| Frequency counter | No | Yes |
| Modulation Input port | Yes | Yes |
| Trigger Input port | Yes | Yes |
| Trigger Output port | No | Yes |
| SYNC Output port | Yes | No |
| 10 MHz REF Input/Output port | Yes | No |
| Harmonic signal generator | Yes | No |
| Independently set pulse parameter | Yes | No |
| Isolation circuit design (up to ±42V) | Yes | No |
| Remote control interface | USB / LAN / GPIB (Optional) | USB |

Competitors Information

Major competitors are Keysight 33500B series and Tektronix AFG3021C/3022C. The comparison chart is as follows: Keysight 33521B/33522B/33511B/33512B (V) vs GW Instek AFG-3031/3032/3021/3022 (O)

| Carrier waveform | AM | FM | PM | FSK | BPSK | PWM | SUM | Burst | Sweep |
|------------------|-----|-----|-----|-----|------|-----|-----|-------|-------|
| Sine | V O | V O | V O | V O | V | | V O | V O | V O |
| Square | V O | V O | V | V O | V | O | V | V O | V O |
| Pulse | V O | V | V | V | V | V | V O | V O | V |
| Triangle/Ramp | V O | V O | V O | V O | V | | V O | V O | V O |
| Noise | V O | | | | | | V O | V O | |
| PRBS | V | V | V | | | | V | V | |
| ARB | V O | V | V | | V | | V | V | V |
| Sequence | V | | | | | | V | | |

- The sequence function will be released in Q2/2016 via firmware upgrade.
-

| Vendor | Keysight | | GW Instek | | Tektronix | |
|--|--|-----------------|---|-----------------|--|-----------------|
| Model | 33521B | 33522B | AFG-3031 | AFG-3032 | AFG3021C | AFG3022C |
| Channel | 1 | 2 | 1 | 2 | 1 | 2 |
| Input/output connectors grounding are isolated from instrument chassis | Yes | | Yes | | Yes | |
| Dual channel ground isolation | - | Together | - | Independent | - | Together |
| Waveforms | Sine, Square, Ramp, Pulse, Gaussian Noise, Triangle, PRBS, DC, 9 types ARB built-in waveform | | Sine, Square, Ramp, Pulse, Gaussian Noise, Triangle, Harmonic, DC, 65 types ARB built-in waveform | | Sine, Square, Pulse, Ramp, Triangle, Sin(x)/x, Exponential Rise and Decay, Gaussian, Lorentz, Haversine, DC, Noise | |
| Arbitrary waveform Characteristics | | | | | | |
| Sample rate | 250 MSa/s | | 250 MSa/s | | 250 MSa/s | |
| Repetition rate | N.A | | 125 MHz | | N.A | |
| Waveform length | 1M points (16M Optional) | | 8M points | | 128k points | |
| Amplitude resolution | 16-bits | | 16-bits | | 14-bits | |
| User define Marker Output | Yes | | No | | No | |
| Frequency Characteristics | | | | | | |
| | Sine | 1 uHz to 30 MHz | 1 uHz to 30 MHz | 1 uHz to 30 MHz | 1 uHz to 25 MHz | 1 uHz to 25 MHz |
| | Square | 1 uHz to 30 MHz | 1 uHz to 30 MHz | 1 uHz to 30 MHz | 1 uHz to 25 MHz | 1 uHz to 25 MHz |

| | | | | |
|---|---------------|---|---|---|
| | Pulse | 1 uHz to 30 MHz | 1 uHz to 25 MHz | 1 mHz to 25 MHz |
| | Triangle/Ramp | 1 uHz to 200 kHz | 1 uHz to 1 MHz | 1 uHz to 500 kHz |
| Accuracy | Stability | ±2 ppm of setting ±15 pHz, 0 to 55° C ±1 ppm of setting ±15 pHz, 18 to 28° C ±0.1 ppm of setting ±15 pHz, 0 to 55° C (optional) | ±1 ppm, 0 to 50° C ±0.3 ppm, 18 to 28° C | All except ARB: ±1 ppm, 0 °C to 50 °C ARB: ±1 ppm ± 1 µHz, 0 °C to 50 °C |
| | Aging | No available | ±1 ppm, per year | ±1 ppm, per year |
| Output Characteristics | | | | |
| Amplitude | Range | 1 mVpp to 10Vpp (50Ω load) 2 mVpp to 20Vpp (High Z) | 1 mVpp to 10Vpp(50Ω load) 2 mVpp to 20Vpp (High Z) | 10mVpp to 10Vpp(50Ω load) 20mVpp to 20Vpp (High Z) |
| | Flatness | ± 0.1dB <100 kHz ± 0.15 dB 100 kHz to 5 MHz ± 0.3 dB 5 MHz to 20 MHz ± 0.4 dB 20 MHz to 30 MHz | ±0.1dB, <10 MHz ±0.2 dB, 10 MHz to 30 MHz | <5 MHz: ±0.15 dB ≥5 MHz to 20 MHz: ±0.3 dB ≥20 MHz to 25 MHz: ±0.5 dB |
| Square waveform rise/fall time | | 8.4ns | 8ns | 9ns |
| Pulse waveform rise/fall time | | 8.4ns to 1us | 9.32 ns to 799,900s | 9ns to 625s |
| Sine waveform total harmonic distortion | | < 0.04% | < 0.2%+0.1mVrms | <= 0.2% |
| Remote control interface | | GPIO, LAN (LXI-C), USB | GPIO (optional) , LAN, USB | GPIO, USB, LAN |
| Display | | 4.3 inch TFT LCD | 4.3 inch TFT LCD | 5.6 inch TFT LCD |
| Trigger output port | | No | No | Yes |
| SYNC output port | | CH 1 No | CH 1 No | No No |
| Modulation types | | AM, FM, PM, FSK, BPSK, PWM, Sum | AM, FM, PM, FSK, PWM, Sum | AM, FM, PM, FSK, PWM |
| Sweep types | | Frequency | Frequency, Amplitude | Frequency |
| Harmonic signal generator | | No | Yes | No |
| Multi units synchronized operation | | Yes | Yes | Yes |
| Sequence | | Yes | will be released in Q2/2016 | No |
| Combined | | Yes | No | No |
| Square waveform duty cycle | | 0.01% to 99.99% | 20% to 80% | N.A |
| Pulse waveform duty cycle | | 0.01% to 99.99% | 0.017% to 99.983% | 0.001% to 99.999% |
| Square jitter | | < 40ps rms | 0.01%+525ps < 2 MHz 0.1% +75ps > 2 MHz | 500ps rms |

Key Dates for Product Announcement

1. Global Market Announcement (April 6, 2016)
2. Order Queue Open (April 6, 2016)

Service Policy

1. **One (1) year warranty.** AFG-3031/3032/3021/3022 carries a standard warranty for 1 year.
2. **Service Support.** The PCB of the series includes single-channel main board, dual-channel main board, output board, keyboard, and optional GPIO. Nowadays, most electronic parts are getting very powerful and their sizes are getting smaller and smaller, and a tremendous amount of automatic digital compensation technology is utilized on product designs. In the meantime, the SMD part density level on PCB module blocks is very high, therefore, malfunctioned PCB can not be done by conventional soldering method, which replaces a few parts and goes through several simple calibration procedures to complete the repairing process. Hence, for the series, the malfunctioned single-channel main board, dual-channel main board, and output board require maintenance units certified by GW Instek to conduct PCB swapping. Detailed explanations are as follows:

| | Single-channel main board | Dual-channel main board | Dual-channel output board | Maintenance method |
|----------|---------------------------|-------------------------|---------------------------|---|
| AFG-3031 | √ | | | PCB swapping |
| AFG-3032 | | √ | √ | When Ch1 is malfunctioned, only replace dual-channel main board. When Ch2 is malfunctioned, both PCBs must be delivered to the maintenance unit. Because the replaced PCB must be calibrated along with the functional PCB. |
| AFG-3021 | √ | | | Same as AFG-3031 |
| AFG-3022 | | √ | √ | Same as AFG-3032 |

Keyboard and GPIB will be repaired according to the actual malfunction situation.

- The service manual clearly elaborates the required equipment, procedures, and maintenance instruction for certified maintenance units to carry out PCB swapping. The parts-swapping service support is provided by Good Will Instrument to facilitate the repair jobs done at the distributor's site.
- Marcom Material and Service Manual download through Website.** Good Will Instrument continues to provide after sales support through its website. The most updated version of service manual and Marcom material of AFG-3031/3032/3021/3022 will be posted on the distributor zone of GW Instek's website at <http://www.gwinstek.com>

Specifications

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

| | AFG-3031 | AFG-3032 | AFG-3021 | AFG-3022 |
|--|--|----------|----------|----------|
| Channels | 1 | 2 | 1 | 2 |
| Features | | | | |
| I/O signal ground for the instrument chassis | Isolation | | | |
| Connector shells for channel output(s), Sync output, 10MHz REF Input, Mod Input and Mod output are isolated from the instrument's chassis. Maximum allowable voltage on isolated connector shells is ±42 Vpk. (DC + AC Peak) | | | | |
| Each of the signal ground of CH1 & CH2 | - | Isolated | - | Isolated |
| Standard Waveforms | Sine, Square, Triangle, Ramp, Pulse, Noise, Harmonic | | | |
| Arbitrary Waveforms | | | | |
| Sample Rate | 250 MSa/s | | | |
| Repetition Rate | 125MHz | | | |
| Waveform Length | 8M points | | | |
| Amplitude Resolution | 16 bits | | | |
| Non-Volatile Memory | Ten 8M waveforms (1) | | | |
| User define Output Section | Any section from 2 to 8M points | | | |
| Trigger | External | | | |

| | | | |
|------------------------------|--|--|-------------------------|
| Built-in Arbitrary Waveforms | | Sine, Square, Ramp, Sinc,Pulse, DC, Sin(x)/x, Exponential Rise, Exponential Fall, Negative Ramp, Absatan, Havers cosine, Sinever, Abssin, Haversine, Stair_down, Abssinehalf, N_pulse, Stair_UD, Ampalt, Negramp, Stair_up, Attalt, Rectpuls1, Stepresp, Diric_even, Roundhalf, Trapezia, Diric_odd, Sawtoot, Tripuls1, Gauspuls1, Sinetra, Dlorentz, In, Sqrt, Expорise, Lorentz, Xsquare, Expofall, Gauss, Since, Arccos, Arc tan, Sech, Arccot, Arc tanh, Sinh, Arccsc, Cosh, Tan, Arcsec, Cot, Tanh, Arcsin, Csc, Arcsinh, Sec, Barthannwin, Chebwin, Kaiser, Bartlett, Flattopwin, Triang, Blackman, Hamming, Tukeywin, Bohmanwin, Hann | |
| Frequency Characteristics | | | |
| | Sine / Square | 1uHz to 30MHz | 1uHz to 20MHz |
| | Pulse | 1uHz to 25MHz | 1uHz to 20MHz |
| | Triangle / Ramp | 1uHz to 1MHz | |
| Resolution | | 1uHz | |
| Accuracy | Stability | ±1 ppm 0 to 50°C | |
| | | ±0.3 ppm 18 to 28°C | |
| | Aging | ±1 ppm, per 1 year | |
| | Tolerance | ≤ 1 uHz | |
| Output Characteristics (2) | | | |
| Amplitude | Range | 1 mVpp to 10 Vpp (into 50Ω) | |
| | | 2 mVpp to 20 Vpp (into open-circuit) | |
| | Accuracy | ± 1% of setting ±1 mVpp | |
| | | (at 1 kHz / into 50Ω without DC offset) | |
| | Resolution | 0.1 mV or 4 digits | |
| Flatness | 0.1dB <10 MHz | | |
| | 0.2 dB 10 MHz to 30 MHz (sinewave relative to 1 kHz/into 50Ω) | | |
| | Units | Vpp, Vrms, dBm, | |
| Offset | Range | ±5 Vpk ac +dc (into 50Ω) | |
| | | ±10Vpk ac +dc (into open circuit) | |
| | Accuracy | 1% of setting + 2 mV+ 0.5% of amplitude | |
| Waveform Output | Impedance | 50Ω typical (fixed) | |
| | | > 10MΩ (output disabled) | |
| | Protection | Short-circuit protected | |
| | | Overload relay automatically disables main output | |
| SYNC Output | Level | TTL-compatible into>1kΩ | 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 | |

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|------------------------------------|--|---------------------------|
| | -30 dBc 5MHz~30 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~30MHz (AFG-3031/3032) | |
| Phase Noise | < -110dBc/Hz typical,15 kHz offset, fc = 10MHz, | |
| 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 to 30MHz | 20.0% to 80.0% , ≤ 20 MHz |
| Jitter | 0.01%+525ps < 2 MHz 0.1%+75ps > 2 MHz | |
| Ramp Characteristics | | |
| Linearity | < 0.1% of peak output | |
| Variable Symmetry | 0% to 100% (0.1% resolution) | |
| Pulse Characteristics | | |
| Pulse Width | 20ns to 999,830s | |
| | Period ≥ Width-0.625 [(Rise Time-0.6ns)+(Fall Time-0.6ns)] | |
| Duty setting range | 0.017% to 99.983% | |
| Period | 40ns to 1,000,000s | |
| Rise Time and Fall Time | 9.32 ns to 799,900s (0.01ns or 3 digit resolution) | |
| Resolution | 0.0001% | |
| Overshoot | <5% | |
| Jitter | 100 ppm + 50 ps | |
| Harmonic | | |
| Harmonic order | ≤ 8 | |
| Harmonic Type | Even, Odd, All, User Amplitude and Phase can be set for all harmonics | |
| AM | | |
| 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 | | |
| 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 30 MHz (1uHz resolution) | DC to 20 MHz (1uHz resolution) | | |
| Source | Internal / External | | | |
| PM | | | | |
| Carrier Waveforms | Sine, Triangle, Ramp | | | |
| Modulating Waveforms | Sine, Square, Triangle, Up/Dn Ramp | | | |
| Phase Deviation | 0° to 360°, 0.1° resolution | | | |
| Modulating Frequency | 2 mHz to 20 kHz | | | |
| Source | Internal | | | |
| 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, 0.1% resolution | | | |
| Source | Internal / External | | | |
| Additive modulation (Sum) | | | | |
| Carrier Waveforms | Sine, Triangle, Ramp, Pulse, Noise | | | |
| Modulating Waveforms | Sine, Square, Triangle, Up/Dn Ramp | | | |
| Ratio | 0% to 100% of carrier amplitude, 0.01% resolution | | | |
| Modulating Frequency | 2 mHz to 20 kHz | | | |
| Source | Internal / External | | | |
| FSK | | | | |
| Carrier Waveforms | Sine, Square, Triangle, Ramp | | | |
| Modulating Waveforms | 50% duty cycle square | | | |
| Internal Rate | 2 mHz to 1 MHz | | | |
| Frequency Range | DC to 30 MHz | DC to 30MHz | DC to 20MHz | DC to 20MHz |
| Source | Internal / External | | | |
| SWEEP | | | | |
| Waveforms | Frequency Sweep: Sine, Square, Triangle, Ramp Amplitude Sweep: Sine, Square, Triangle, Ramp, Pulse, Noise, ARB | | | |
| Type | Frequency, Amplitude | | | |
| Functions | Linear or Logarithmic | | | |
| Direction | Up or Down | | | |
| Start F / Stop FREQ | Any frequency within the waveform's range | | | |
| Sweep Time | 1 ms to 500 s (1 ms resolution) | | | |
| Trigger Mode | Single, External, Internal | | | |
| Trigger Source | Internal / External | | | |
| BURST | | | | |

| | | |
|----------------------------------|--|----------------------------|
| Waveforms | Sine, Square, Triangle, Ramp, Pulse, Noise | |
| Frequency | 1 uHz to 30 MHz (4) | 1uHz to 20MHz |
| Burst Count | 1 to 1,000,000 cycles or Infinite | |
| Start / Stop Phase | -360.0° to +360.0° (0.1° resolution) | |
| Internal Period | 1 us to 500 s | |
| Gate Source | External Trigger (pulse waveforms can only be used in gate mode) | |
| Trigger Source | Single, External or Internal Rate | |
| Trigger Delay | N-Cycle, Infinite: 0us to 100s (1us resolution) | |
| External Modulation Input | | |
| Type | AM, FM, PWM | |
| Voltage Range | ± 5V full scale | |
| Input Impedance | 10kΩ | |
| Frequency | DC to 20 kHz | |
| Modulation Output | | |
| Type | AM, FM, PM, PWM, SUM, Sweep | |
| Amplitude Range | ≥ 1Vpp | |
| Impedance | > 10kΩ typical | |
| External Trigger Input | | |
| Type | For FSK, Burst, Sweep, N Cycle ARB | |
| Input Level | TTL Compatibility | |
| Slope | Rising or Falling (Selectable) | |
| Pulse Width | > 100 ns | |
| Input rate | DC to 1 MHz | |
| Input Impedance | 10kΩ, DC coupled | |
| Latency | Sweep | < 10 us (typical) |
| | Burst | < 100 ns (typical) |
| Jitter | Sweep | 2.5 us |
| | Burst | 1 ns; except pulse, 300 ps |
| 10MHz Reference Output | | |
| Output voltage | 1 Vp-p / 50 Ω square wave | |
| Output Impedance | 50 Ω, AC coupled | |
| Output Frequency | 10MHz | |
| 10MHz Reference Input | | |
| Input Voltage | 0.5Vpp to 5Vpp | |
| Input Impedance | 1k Ω, unbalanced, AC coupled | |
| Input Frequency | 10MHz ± 10Hz | |
| Waveform | Sine or Square (50±5% duty) | |
| Ground Isolation | 42Vpk max. | |
| External-Sync | | |

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|---|---|------|------|------|
| Phase Delay (max.) | Series Connection: $39+(N-2)*39 \pm 25nS$ Parallel connection: $(N-1)*6 \pm 25nS$ (where N=number of connected units) | | | |
| Maximum number of connected units | Series Connection: 4 Parallel Connection: 6 | | | |
| Applicable Functions | Sine, Square, Triangle, Pulse, Ramp, Harmonic, MOD, Sweep, Burst | | | |
| Store/Recall | 10 Groups of Setting Memories | | | |
| Interface | GPIB(Optional), LAN, USB | | | |
| Display | 4.3 inch TFT LCD, 480 x 3 (RGB) x 272 | | | |
| General Specifications | | | | |
| Power Source | AC 100~240V , 50~60Hz | | | |
| Power Consumption | 50VA | 85VA | 50VA | 85VA |
| 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) | Bench Top : 265 (W) x 107 (H) x 374 (D) | | | |
| Weight | Approx. 4kg | | | |
| Safety Designed to | EN61010-1 | | | |
| EMC Tested to | IEC-61326, EN 55011 | | | |
| Accessories | Test cable(GTL-110x1 for AFG-3031/AFG-3021, GTL-110x2 for AFG-3032/AFG-3022), User Manual Compact Disk x 1, Quick Start Guide x 1, Power cord x 1 | | | |
| (1). A total of ten waveforms can be stored. (Every waveform can composed of 8M 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" count. | | | | |
| (5). Harmonic distortion and Spurious noise at low amplitudes is limited by a -70 dBm floor. | | | | |

Ordering Information

AFG-3031, 30MHz Single channel Arbitrary Function Generator

AFG-3032, 30MHz Dual channel Arbitrary Function Generator

AFG-3021, 20MHz Single channel Arbitrary Function Generator

AFG-3022, 20MHz Dual channel Arbitrary Function Generator

Option

Opt 01, GPIB Interface

Standard Accessories

GTL-101, BNC-Alligator Test Lead *1 (only AFG-3031/AFG-3021)

GTL-101, BNC-Alligator Test Lead *2 (only AFG-3032/AFG-3022)

Quick Start Guide *1, CD-ROM with AFG software and user manual *1

Optional Accessories

GTL-246, USB Type A to Type B cable

Free Download

Arbitrary Waveform Editing Software

Please do not hesitate to contact us if you have any queries on the announcement, or product information of the AFG-3031/3032/3021/3022 arbitrary function generator.

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