

Arbitrary Function Generator

AFG1000 Series Datasheet



The AFG1000 Series Arbitrary Function Generator provides a waveform generation tool with the best price performance ratio. It includes dual channel, up to 60 MHz bandwidth and up-to 10 V_{p-p} output amplitude. The four run modes, 50 built-in frequently-used waveforms and the built-in 200 MHz frequency counter cover most waveform generation needs in your experiment and test jobs. The 3.95-inch TFT LCD, short-cut buttons, USB interface and PC software provide the most intuitive ways to configure the instrument.

Features and benefits

- Dual-channel, 25/60 MHz sine wave, and 12.5/30 MHz square/pulse wave provides a cost effective solution for basic education and other applications
- Up to 300 MS/s sampling rate and 14-bit vertical resolution enable great signal fidelity
- 1 mV_{p-p} to 10 V_{p-p} output amplitude from 1 μHz to 25 MHz
- The intuitive user interface shortens the learning curve for students and other users
- Up to 1 M-point length of memory for user-defined arbitrary waveforms
- 64-MByte internal non-volatile memory for arbitrary waveform storage
- Standard USB host/device for memory expansion and remote control
- Continuous, sweeping, burst, and modulation modes (AM, FM, PM, ASK, FSK, PSK, PWM) covers most requirements for students and other users to get the experiments/test job done
- Built-in 200 MHz counter with 6-digit resolution offers an easy and precise way of frequency/period/pulse width/duty cycle measurement
- Menu and online help are in English and Simplified Chinese

- Compact form factor for stacking on other bench instruments to save valuable bench space
- Free ArbExpress makes user defined waveforms editing extremely easy
- Compatible with TekSmartLab™ for easy teaching and learning
- Standard 5-year warranty

Applications

- Electric and electronics experiments
- Communications experiments
- Sensor simulation
- Functional test

Performance and features

1 μHz to 25 MHz/60 MHz sine waveform range, with 12-digit or 1 μHz resolution and a ±1 ppm drift high stability time base, provides great signal fidelity in the frequency domain. With 1 mV_{p-p} to 10 V_{p-p} output amplitude range, and 14-bit or 1 mV_{p-p} resolution over the whole frequency range, there is no need to compromise between output amplitude and frequency any more.

Four different run modes and four modulation modes cover most use cases with a cost effective solution. 50 most-frequently used standard and arbitrary waveforms are built-in for easy access. Up to 1 M Points arbitrary waveforms memory enables users to replicate real world signals captured with a Tektronix oscilloscope or defined with ArbExpress. The built-in 200 MHz and 6 digit resolution frequency counter is an easy and precise way to measure frequencies/periods/pulse widths/duty cycles.

Ease of use

The high-resolution 3.95-inch color TFT display shows relevant settings and parameters in both text and graphic formats, which give users full confidence in their settings, and let them focus on the task at hand. The front panel shortcut buttons and rotary knob make accesses to most frequently used functions and settings with minimum effort and time. The built-in 64-MByte non-volatile memory together with USB stick memory interface, provide unlimited space for user-defined waveform storage.

Software and solutions

Compatible with ArbExpress, the user-defined arbitrary waveforms generated by the free software can be loaded on the AFG1022 easily with a USB memory stick.

As a building block of Tektronix educational solution, the AFG1022 can be embedded into TekSmartLab and enable a cost efficient and effective way of teaching, learning, and lab management.

Specifications

All specifications apply to all models unless noted otherwise.

Channels

Number of channels 2

Built-in waveforms

Built-in waveforms Sine, Square, Pulse, Ramp, Noise, and 45 frequently used arbitrary waveforms

General characteristics

Sine waves

	AFG1022	AFG1062
Range	1 μ Hz to 25 MHz	1 μ Hz to 60 MHz
Sine wave in burst mode	2 mHz to 25 MHz	2 mHz to 30 MHz
Effective maximum frequency out	25 MHz	60 MHz
Amplitude flatness (1 V_{p-p}), typical		
<10 MHz	± 0.2 dB	± 0.2 dB
≥ 10 MHz	± 0.3 dB	± 0.3 dB
Harmonic distortion (1 V_{p-p})		
≤ 10 MHz	< -65 dBc	
>10 MHz	< -50 dBc	
Total harmonic distortion	< 0.2% (10 Hz to 20 kHz, 1 V_{p-p})	
Spurious (1 V_{p-p})		
≤ 25 MHz	< -45 dBc	< -50 dBc
>25 MHz	-	< -40 dBc
Phase noise, typical	1 MHz: < -110 dBc/Hz at 10 kHz offset, 1 V_{p-p}	
Residual clock noise, typical	-57 dBm	

General characteristics

Square wave

	AFG1022	AFG1062
Range	1 μ Hz to 12.5 MHz	1 μ Hz to 30 MHz
Rise/fall time	<12 ns	<9 ns
Jitter (rms), typical	<1 ns	<500 ps
Overshoot	<5%	

Ramp wave

	AFG1022	AFG1062
Range	1 μ Hz to 1 MHz	1 μ Hz to 2 MHz
Linearity, typical	\leq 0.1% of peak output at 10% - 90% of amplitude range, at 1 kHz, 1 V _{p-p} , 50% symmetry	
Symmetry	0.0% to 100.0%	

Pulse wave

	AFG1022	AFG1062
Range	1 μ Hz to 12.5 MHz	1 μ Hz to 30 MHz
Pulse width range	40.00 ns to 999 ks	20.00 ns to 999 ks
Pulse width resolution	10 ps or 5 digits	
Pulse duty	<1 MHz, 0.1% to 99.9% (limitations of pulse duty width apply)	
	\geq 1 MHz, 50% fixed	\geq 1 MHz, 50% fixed
Edge transition time	<12 ns, fixed	<9 ns, fixed
Overshoot, typical	<5%	
Jitter (rms), typical	<500 ps	< 1 ns

Noise

	AFG1022	AFG1062
Noise bandwidth (-3 dB)	25 MHz	60 MHz
Noise type	White Gaussian	

DC

	AFG1022	AFG1062
Range	-5 V to +5 V, 50 Ω load	
	10 V to + 10 V, open circuit or high Z load	

Arbitrary waveform

	AFG1022	AFG1062
Range	1 μ Hz to 10 MHz	1 μ Hz to 30 MHz
Arbitrary waveform in burst mode	2 mHz to 10 MHz	2 mHz to 15 MHz
Effective analog bandwidth (-3 dB)	30 MHz	60 MHz
Non-volatile memory	64 MByte	

General characteristics

Memory

Length	2 to 8,192	2 to 1 M-point
Sampling rate	125 MS/s	300 MS/s
Vertical resolution	14 bits	
Rise and fall time	< 10 ns	
Jitter (rms), typical	< 6 ns	< 500 ps

Frequency

	AFG1022	AFG1062
Resolution	1 μ Hz or 12 digits	
Internal reference stability	\pm 1 ppm at 0 - 40 °C	
Internal reference aging	\pm 1 ppm per year	

Amplitude

Range (50 Ω load)

	AFG1022	AFG1062
\leq25 MHz	1 mV _{p-p} to 10 V _{p-p}	1 mV _{p-p} to 10 V _{p-p}
>25 MHz	-	1 mV _{p-p} to 5 V _{p-p}

Range (Open circuit or high Z load)

\leq25 MHz	2 mV _{p-p} to 20 V _{p-p}	2 mV _{p-p} to 20 V _{p-p}
>25 MHz	-	2 mV _{p-p} to 10 V _{p-p}

Accuracy	\pm (1% of setting +1 mV _{p-p}), (1 kHz sine waveform, 0 V offset)
Resolution	1 mV _{p-p} , 1 mV _{rms} or 4 digits
Units	V _{p-p} , V _{rms}
Output impedance	50 Ω (typical)
Local impedance setting	Selectable: 50 Ω , 1 Ω to 10.000 k Ω , High Z (adjusts displayed amplitude according to selected load impedance)
Isolation	No floating ground, signal ground connected to chassis ground
Signal output protection	Short-circuit tolerance, main output automatically disabled when over current

DC offset

Range	\pm (5 V _{pk} - Amplitude _{pp} /2), 50 Ω load \pm (10 V _{pk} - Amplitude _{pp} /2), open circuit or high Z load
Accuracy	\pm (1% of setting + 1 mV + 0.5% of amplitude (V _{p-p}))
Resolution	1 mV or 4 digits

Modulation

Modulation, sweeping, and burst modes are only available for channel 1 on the AFG1022.

Amplitude modulation

Carrier waveforms	Sine, square, ramp, arbitrary, except DC and noise
Source	Internal / external
Internal modulating waveforms	Sine, square, ramp, noise, arbitrary
Internal AM frequency	2 mHz to 20 kHz
Depth	0.0% to 100.0%

Frequency modulation

Carrier waveforms	Sine, square, ramp, arbitrary, except DC and noise
Source	Internal / external
Internal modulating waveforms	Sine, square, ramp, noise, arbitrary
Internal modulating frequency	2 mHz to 20 kHz
Frequency deviation	(limited by carrier waveform type)

AFG1022	AFG1062
2 mHz to 12.5 MHz	2 mHz to 30 MHz

Phase modulation

Carrier waveforms	Sine, square, ramp, arbitrary, except DC and noise
Source	Internal / external
Internal modulating waveforms	Sine, square, ramp, noise, arbitrary
Internal PM frequency	2 mHz to 20 kHz
Phase Deviation	0° to 180°

Amplitude shift keying

	(AFG1062 only)
Carrier waveforms	Sine, square, ramp, arbitrary, except DC and noise
Source	Internal / external
Internal modulating waveforms	50% duty cycle square
ASK rate	2 mHz to 20 kHz

Frequency shift keying

Carrier waveforms	Sine, square, ramp, arbitrary, except DC and noise
Source	Internal / external
Internal modulating waveforms	50% duty cycle square
FSK rate	2 mHz to 100 kHz

Phase shift keying

	(AFG10622 only)
Carrier waveforms	Sine, square, ramp, arbitrary, except DC and noise
Source	Internal / external
Internal modulating waveforms	50% duty cycle square
PSK rate	2 mHz to 20 kHz

Modulation

Pulse width modulation	(AFG10622 only)
Carrier waveforms	Pulse, ≤1 MHz
Source	Internal / external
Internal modulating waveforms	Sine, square, ramp, arbitrary, except DC and noise
PWM frequency	2 MHz to 20 kHz
Deviation	0.0% to 50.0% of pulse period

Sweeping

Modulation, sweeping, and burst modes are only available in channel 1.

Carrier waveforms	Sine, square, ramp, arbitrary (AFG1062 only)
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Minimum start-stop frequency	1 μHz
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Maximum start-stop frequency

	AFG1022	AFG1062
Sine	25 MHz	60 MHz
Square	12.5 MHz	30 MHz
Ramp	1 MHz	2 MHz

Type	Linear, logarithmic
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Direction	Up / down
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Sweep time	1 ms to 500 s ± 0.1%
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Trigger sources	Internal, external, or manual
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Burst

Modulation, sweeping, and burst modes are only available in channel 1.

Waveforms	Sine, square, ramp, pulse, arbitrary except DC and noise
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Types	AFG1022: count (1 to 50,000 cycles), infinite, gated AFG1062: count (1 to 100,000 cycles), infinite, gated
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Start phase	-360° to +360°
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Trigger sources	Internal, external, or manual
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Internal trigger interval	(40 ns or (cycles x period) to 500 s) ± 1%
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Gate source	External trigger
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Frequency counter

Function	Frequency, period, positive pulse width, duty cycle
Frequency range	100 mHz to 200 MHz
Frequency resolution	6 digits
Coupling mode	AC, DC
Voltage Range and Sensitivity, DC coupled (non-modulation signal)	
100 mHz to 100 MHz	250 mV _{p-p} to 5 V _{p-p} (AC + DC)
100 MHz to 200 MHz	450 mV _{p-p} to 3 V _{p-p} (AC + DC)
Voltage range and sensitivity, AC coupled (non-modulation signal)	
1 Hz to 100 MHz	250 mV _{p-p} to 5 V _{p-p}
100 MHz to 200 MHz	450 mV _{p-p} to 4 V _{p-p}
Pulse width and duty cycle measure	1 Hz to 10 MHz
Input impedance	1 M Ω in parallel with 100 pF
High frequency noise restraint (HFR)	On / Off (HFR frequency = 500 kHz)
Sensitivity	Low, middle, or high
Trigger level range	-2.5 V to +2.5 V

Auxiliary inputs and outputs

External modulation input	
Input frequency range	DC to 20 kHz
Input voltage range	All except FSK: ± 1 V full scale, FSK: 3.3 V logic level
Input impedance	12 k Ω (typical)
External trigger input	
Level	TTL-compatible
Slope	Rising or falling (selectable)
Pulse Width	>100 ns
External reference clock input	
(Shared with Frequency Counter Input)	
Impedance	400 Ω , AC coupled
Requested Input voltage swing	100 mV _{p-p} to 5 V _{p-p}
Locking range	10 MHz \pm 9 kHz
External reference clock output	
Frequency	10 MHz
Impedance	50 Ω , DC coupled
Amplitude	1.6 V _{p-p} into 50 Ω load

Auxiliary inputs and outputs

Communication interface

USB	Host and device, USB TMC compliance
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Display

Display type	3.95-inch
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Display resolution	480 by 320
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Display colors	65,536
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Menu and online help languages

Menu and online help languages	English and Simplified Chinese
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Power source

Supply	220-240 VAC, 100-120 VAC, 50/60 Hz, CAT II
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Consumption	AFG1022: Less than 28 W AFG1062: Less than 35 W
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Fuse	110 V: 250 V, F1AL 220 V: 250 V, F0.5AL
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Warm-up time	30 minutes (typical)
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Physical characteristics

Dimensions (W, H, D)	235 × 110 × 295 mm (9.2 × 4.33 × 11.61 in)
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Weight

Net	3.4 kg (7.4 lbs)
Shipping	4.7 kg (10.3 lbs)

EMC environment and safety

Temperature

Working	0 °C to 40 °C (32 °F to 104 °F)
Storage	-20 °C to 60 °C (-4 °F to 144 °F)

Relative humidity (non-condensing)

Operating: ≤ 80%, +0 °C to +40 °C (+32 °F to +104 °F)
Non-operating: 5% to 90%, < +40 °C (+104 °F)
Non-operating: 5% to 80%, ≥ +40 °C (+104 °F) to ≤ +60 °C (+140 °F)

Altitude

Operating: up to 3,000 m (9842 ft.)
Non-operating: up to 12,000 m (39,368 ft)

Cooling method

Fan cooling

EMC environment and safety

EMC compliance

European Union	EN 61326-1
Australia/NZ	CISPR 11, Class A

Safety compliance

UL 61010-1
CAN/CSA-C22.2 No. 61010-1
EN 61010-1
IEC 61010-1

Ordering information

Models

AFG1022	Arbitrary Function Generator
AFG1062	Arbitrary Function Generator

Instrument options

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years

Probes and accessories are not covered by the warranty and Service Offerings. Refer to the datasheet of each probe and accessory model for its unique warranty and calibration terms.

Accessories

Standard Accessories

- AFG1000 Arbitrary/Function Generator Safety and Compliance Instructions; printed document
- AFG1000 Documentation CD containing the following PDF documents:
 - AFG1000 Arbitrary/Function Generators Quick Start User Manual, English
 - AFG1000 Arbitrary/Function Generators Quick Start User Manual, Simplified Chinese
 - AFG1000 Arbitrary/Function Generators Programmer Manual
 - AFG1000 Arbitrary/Function Generators Specifications and Performance Verification Manual
- Packing list
- Power cord, specified by country
- Certificate of calibration ; printed document
- USB cable x 1, Type A to Type B
- BNC cable x 2
- Tektronix Supplemental Information Sheet For the Peoples Republic of China: China RoHs; printed document
- Fuse, cartridge; 5 x 20 mm, 0.5 A, 250 V, time-delay
- Fuse, cartridge; 5 x 20 mm, 1 A, 250 V, time-delay

Warranty

- Five year warranty on parts and labor

Recommended accessories

- 174-4401-xx, USB cable, type A to type B cable – three feet
- 174-5194-xx, USB cable, type A to type B cable – six feet
- 012-1732-xx, BNC cable assembly, 0 to 1 GHz, shielded – three feet
- 159-0568-xx, Fuse, cartridge; 5 x 20 mm, 0.5 A, 250 V, time-delay
- 159-0569-xx, Fuse, cartridge; 5 x 20 mm, 1 A, 250 V, time-delay



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product Area Assessed: The planning, design/development and manufacture of electronic Test and Measurement instruments.

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17 Jul 2015 75W-60160-0

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