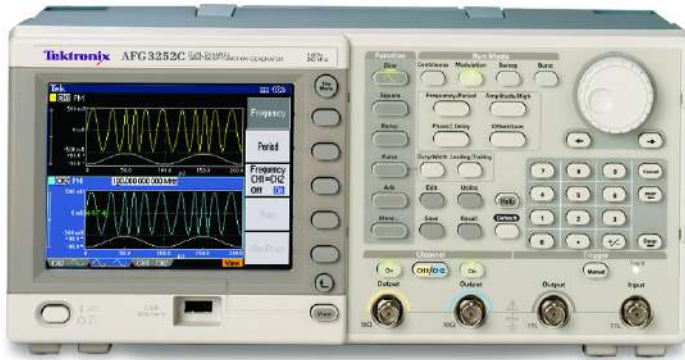


# Arbitrary/Function Generators

## AFG3000C Series Datasheet



Unmatched performance, versatility, intuitive operation, and affordability make the AFG3000C Series of Function, Arbitrary Waveform, and Pulse Generators the most useful instruments in the industry.

### Key performance specifications

- 10 MHz, 25 MHz, 50 MHz, 100 MHz, 150 MHz, or 240 MHz sine waveforms
- 14 bits, 250 MS/s, 1 GS/s, or 2 GS/s arbitrary waveforms
- Amplitude up to 20 V<sub>p-p</sub> into 50 Ω loads

### Key features

- 5.6 in. display for full confidence in settings and waveform shape
- Multi-language and intuitive operation saves setup time
- Pulse waveform with variable edge times
- AM, FM, PM, FSK, PWM
- Sweep and burst
- Dual-channel models save cost and bench space
- USB connector on front panel for waveform storage on memory device
- USB, GPIB, and LAN
- LabVIEW and LabWindows/IVI-C drivers

### Applications

- Electronic test and design
- Sensor simulation
- Functional test
- Education and training

### Superior performance and versatility

Users can choose from 12 different standard waveforms. Arbitrary waveforms can be generated up to 128 K in length at high sampling rates. On pulse waveforms, leading and trailing edge time can be set independently. External signals can be connected and added to the output signal. Dual-channel models can generate two identical or completely different signals. All instruments feature a highly stable time base with only ±1 ppm drift per year.

### Intuitive user interface shows more information at a single glance

Color TFT LCD screen on all models shows all relevant waveform parameters and graphical wave shape at a single glance. This gives full confidence in the signal settings and lets you focus on the task at hand. Shortcut keys provide direct access to frequently used functions and parameters. Others can be selected conveniently through clearly structured menus. This reduces the time needed for learning and relearning how to use the instrument. Look and feel are identical to the world's most popular TDS3000 Oscilloscopes.

### ArbExpress™ software included for creating waveforms with ease

With this PC software waveforms can be seamlessly imported from any Tektronix oscilloscope, or defined by standard functions, equation editor, and waveform math.

# Specifications <sup>1</sup>

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

## Model overview

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Channels	1	1 / 2	1 / 2	1 / 2	1 / 2	1 / 2
Waveforms	Sine, Square, Pulse, Ramp, Triangle, Sin(x)/x, Exponential Rise and Decay, Gaussian, Lorentz, Haversine, DC, Noise					

## General characteristics (AFG3000 series)

### Sine waves

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Frequency range	1 $\mu$ Hz to 10 MHz	1 $\mu$ Hz to 25 MHz	1 $\mu$ Hz to 50 MHz
Sine wave in Burst Mode	1 $\mu$ Hz to 5 MHz	1 $\mu$ Hz to 12.5 MHz	1 $\mu$ Hz to 25 MHz
Effective maximum frequency out	10 MHz	25 MHz	50 MHz
Amplitude flatness (1 $V_{p-p}$ )	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to 10 MHz: $\pm 0.3$ dB	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to 20 MHz: $\pm 0.3$ dB $\geq 20$ MHz to 25 MHz: $\pm 0.5$ dB	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to 45 MHz: $\pm 0.3$ dB $\geq 45$ MHz to 50 MHz: $\pm 0.5$ dB
Amplitude flatness (1 $V_{p-p}$ ), typical	<5 MHz: $\pm 0.11$ dB $\geq 5$ MHz to 10 MHz: $\pm 0.2$ dB	<5 MHz: $\pm 0.06$ dB $\geq 5$ MHz to 25 MHz: $\pm 0.02$ dB	<5 MHz: $\pm 0.06$ dB $\geq 5$ MHz to 50 MHz: $\pm 0.02$ dB
Harmonic distortion (1 $V_{p-p}$ )	10 Hz to 20 kHz: < -60 dBc $\geq 20$ kHz to 1 MHz: < -55 dBc $\geq 1$ MHz to 5 MHz: < -45 dBc $\geq 5$ MHz to 10 MHz: < -45 dBc	10 Hz to 20 kHz: < -70 dBc $\geq 20$ kHz to 1 MHz: < -60 dBc $\geq 1$ MHz to 10 MHz: < -50 dBc $\geq 10$ MHz to 25 MHz: < -40 dBc	10 Hz to 20 kHz: < -70 dBc $\geq 20$ kHz to 1 MHz: < -60 dBc $\geq 1$ MHz to 5 MHz: < -50 dBc $\geq 5$ MHz to 50 MHz: < -40 dBc
Harmonic distortion (1 $V_{p-p}$ ), typical	10 Hz to 20 kHz: < -73 dBc $\geq 20$ kHz to 1 MHz: < -72 dBc $\geq 1$ MHz to 5 MHz: < -65 dBc $\geq 5$ MHz to 10 MHz: < -56 dBc	10 Hz to 20 kHz: < -77 dBc $\geq 20$ kHz to 1 MHz: < -72 dBc $\geq 1$ MHz to 25 MHz: < -55 dBc	10 Hz to 20 kHz: < -75 dBc $\geq 20$ kHz to 1 MHz: < -72 dBc $\geq 1$ MHz to 5 MHz: < -65 dBc $\geq 5$ MHz to 50 MHz: < -56 dBc
THD	$\leq 0.2\%$ (<0.15%, typical), 10 Hz to 20 kHz, 1 $V_{p-p}$		
Spurious(1 $V_{p-p}$ )	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 10 MHz: < -50 dBc	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 25 MHz: < -50 dBc	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 50 MHz: < -50 dBc
Spurious(1 $V_{p-p}$ ), typical	10 Hz to 1 MHz: < -61 dBc $\geq 1$ MHz to 10 MHz: < -68 dBc	10 Hz to 1 MHz: < -71 dBc $\geq 1$ MHz to 25 MHz: < -68 dBc	10 Hz to 1 MHz: < -71 dBc $\geq 1$ MHz to 50 MHz: < -69 dBc
Phase noise, typical	< -110 dBc/Hz at 10 MHz, 10 kHz offset, 1 $V_{p-p}$		
Residual clock noise	-63 dBm	-63 dBm	-63 dBm

### Square waves

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Frequency range	1 $\mu$ Hz to 5 MHz	1 $\mu$ Hz to 25 MHz	1 $\mu$ Hz to 40 MHz
Rise/fall time	$\leq 50$ ns	$\leq 9$ ns	$\leq 7$ ns

<sup>1</sup> The given typical values are not warranted. But 80% or more manufactured units will perform to the level indicated at room temperature (approximately 25 °C).

**General characteristics (AFG3000 series)**

Jitter (RMS)	500 ps	500 ps	300 ps
Jitter (RMS), typical	<210 ps	<60 ps	<60 ps

**Ramp waves**

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Frequency range	1 $\mu$ Hz to 100 kHz	1 $\mu$ Hz to 500 kHz	1 $\mu$ Hz to 800 kHz
Linearity, typical	$\leq$ 0.2% of peak output	$\leq$ 0.1% of peak output	$\leq$ 0.1% of peak output
Symmetry	0% to 100.0%		

**Pulse waves**

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Frequency range	1 mHz to 5 MHz	1 mHz to 25 MHz	1 mHz to 40 MHz
Pulse width	80.00 ns to 999.99 s	16 ns to 999.99 s	12 ns to 999.99 s
Resolution	10 ps or 5 digits		
Pulse duty	0.001% to 99.999% (Limitations of pulse width apply)		
Edge transition time	50 ns to 625 s	9 ns to 625 s	7 ns to 625 s
Resolution	10 ps or 4 digits		
Lead delay: range	(Continuous Mode): 0 ps to Period (Triggered/Gated Burst Mode): 0 ps to Period - [Pulse Width + 0.8 * (Leading Edge Time + Trailing Edge Time)]		
Lead delay: resolution	10 ps or 8 digits		
Overshoot, typical	<5%		
Jitter (RMS)	500 ps	500 ps	300 ps
Jitter (RMS), typical	<210 ps	<60 ps	<60 ps

**Other waveforms**

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Frequency range	1 $\mu$ Hz to 100 kHz	1 $\mu$ Hz to 500 kHz	1 $\mu$ Hz to 800 kHz
Noise bandwidth (-3 dB)	10 MHz	25 MHz	50 MHz
Noise type:	White Gaussian		
Internal noise add	When activated, output signal amplitude is reduced to 50%		
Level	0.0% to 50% of amplitude ( $V_{p-p}$ ) setting		
Resolution	1%		
DC (into 50 $\Omega$ )	-10 V to +10 V	-5 V to +5 V	-5 V to +5 V

**General characteristics (AFG3000 series)**

Arbitrary waveforms

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Frequency range	1 mHz to 5 MHz	1 mHz to 12.5 MHz	1 mHz to 25 MHz
Arbitrary waveforms in Burst Mode	1 mHz to 2.5 MHz	1 mHz to 6.25 MHz	1 mHz to 12.5 MHz
Effective analog bandwidth (-3 dB)	8 MHz	70 MHz	
Nonvolatile memory	4 waveforms		
Memory: Sample rate (1K=1024 points)	2 to 128 K: 250 MS/s	2 to 128 K: 250 MS/s	2 to 16 K: 1 GS/s >16 K to 128 K: 250 MS/s
Vertical resolution	14 bits		
Rise/fall time	≤80 ns	≤14 ns	≤10 ns
Jitter (RMS)	4 ns	4 ns	1 ns at 1 GS/s 4 ns at 250 MS/s

Amplitude

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Range, 50 Ω Load	20 mV <sub>p-p</sub> to 20 V <sub>p-p</sub>	10 mV <sub>p-p</sub> to 10 V <sub>p-p</sub>	10 mV <sub>p-p</sub> to 10 V <sub>p-p</sub>
Range (open circuit or High Z)	40 mV <sub>p-p</sub> to 40 V <sub>p-p</sub>	20 mV <sub>p-p</sub> to 20 V <sub>p-p</sub>	20 mV <sub>p-p</sub> to 20 V <sub>p-p</sub>
Accuracy	±(2% of setting +2 mV) (1 kHz sine wave, 0 V offset, >20 mV <sub>p-p</sub> amplitude)	±(1% of setting +1 mV) (1 kHz sine wave, 0 V offset, >10 mV <sub>p-p</sub> amplitude)	
Accuracy, typical	±(1% of setting +5 mV) (1 kHz sine wave, 0 V offset, >20 mV <sub>p-p</sub> amplitude)	±(0.5% of setting +0.5 mV) (1 kHz sine wave, 0 V offset, >10 mV <sub>p-p</sub> amplitude)	
Resolution	0.1 mV <sub>p-p</sub> , 0.1 mV <sub>RMS</sub> , 1 mV, 0.1 dBm or 4 digits		
Units	V <sub>p-p</sub> , V <sub>RMS</sub> , dBm (sine wave only) and Volt (high/low setting)		
Output impedance	50 Ω		
Load impedance setting	Selectable: 50 Ω, 1 Ω to 10.0 kΩ, High Z (Adjusts displayed amplitude according to selected load impedance)		
Isolation	42 V <sub>pk</sub> maximum to earth		
Short-circuit protection	Signal outputs are robust against permanent shorts against floating ground		
External voltage protection	To protect signal outputs against external voltages use fuse adapter 013-0345-xx		

DC offset

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C
Range (50 Ω load)	±(10 V <sub>pk</sub> - Amplitude <sub>p-p</sub> ÷ 2)	±(5 V <sub>pk</sub> - Amplitude <sub>p-p</sub> ÷ 2)	±(5 V <sub>pk</sub> - Amplitude <sub>p-p</sub> ÷ 2)
Range (open circuit or High Z)	±(20 V <sub>pk</sub> - Amplitude <sub>p-p</sub> ÷ 2)	±(10 V <sub>pk</sub> - Amplitude <sub>p-p</sub> ÷ 2)	±(10 V <sub>pk</sub> - Amplitude <sub>p-p</sub> ÷ 2)
Accuracy	±(2% of  setting  + 10 mV + 1% of amplitude (V <sub>p-p</sub> ))	±(1% of  setting  + 5 mV + 0.5% of amplitude (V <sub>p-p</sub> ))	
Resolution	1 mV		

## General characteristics (AFG3100 &amp; AFG3200 series)

## Sine waves

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 $\mu$ Hz to 100 MHz	1 $\mu$ Hz to 150 MHz	1 $\mu$ Hz to 240 MHz
Sine wave in Burst Mode	1 $\mu$ Hz to 50 MHz	1 $\mu$ Hz to 75 MHz	1 $\mu$ Hz to 120 MHz
Effective maximum frequency out	100 MHz	150 MHz	240 MHz
Amplitude flatness (1 $V_{p-p}$ )	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to 25 MHz: $\pm 0.3$ dB $\geq 25$ MHz to 100 MHz: $\pm 0.5$ dB	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to <25 MHz: $\pm 0.3$ dB $\geq 25$ MHz to $\leq 150$ MHz: $\pm 0.5$ dB	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to 25 MHz: $\pm 0.3$ dB $\geq 25$ MHz to 100 MHz: $\pm 0.5$ dB $\geq 100$ MHz to 200 MHz: $\pm 1.0$ dB $\geq 200$ MHz to 240 MHz: $\pm 2.0$ dB
Amplitude flatness (1 $V_{p-p}$ ), typical	<5 MHz: $\pm 0.03$ dB $\geq 5$ MHz to 50 MHz: $\pm 0.02$ dB $\geq 50$ MHz to 100 MHz: $\pm 0.03$ dB	>5 MHz: $\pm 0.04$ dB $\geq 5$ MHz to 50 MHz: $\pm 0.02$ dB $\geq 50$ MHz to 150 MHz: $\pm 0.03$ dB	<5 MHz: $\pm 0.03$ dB $\geq 5$ MHz to 50 MHz: $\pm 0.02$ dB $\geq 50$ MHz to 100 MHz: $\pm 0.02$ dB $\geq 100$ MHz to 200 MHz: $\pm 0.03$ dB $\geq 200$ MHz to 240 MHz: $\pm 0.04$ dB
Harmonic distortion (1 $V_{p-p}$ )	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 5 MHz: < -50 dBc $\geq 5$ MHz to 100 MHz: < -37 dBc	<5 MHz: $\pm 0.15$ dB $\geq 5$ MHz to 25 MHz: $\pm 0.3$ dB $\geq 25$ MHz to $\leq 150$ MHz: $\pm 0.5$ dB	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 5 MHz: < -50 dBc $\geq 5$ MHz to 25 MHz: < -37 dBc $\geq 25$ MHz to 240 MHz: < -30 dBc
Harmonic distortion (1 $V_{p-p}$ ), typical	10 Hz to 1 MHz: < -72 dBc $\geq 1$ MHz to 5 MHz: < -66 dBc $\geq 5$ MHz to 100 MHz: < -43 dBc	10 Hz to 1 MHz: < -72 dBc $\geq 1$ MHz to 5 MHz: < -66 dBc $\geq 5$ MHz to 100 MHz: < -42 dBc $\geq 100$ MHz to 150 MHz: < -48 dBc	10 Hz to 1 MHz: < -67 dBc $\geq 1$ MHz to 5 MHz: < -74 dBc $\geq 5$ MHz to 25 MHz: < -57 dBc $\geq 25$ MHz to 240 MHz: < -43 dBc
THD	$\leq 0.2\%$ (<0.15%, typical), 10 Hz to 20 kHz, 1 $V_{p-p}$		
Spurious(1 $V_{p-p}$ )	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 25 MHz: < -50 dBc $\geq 25$ MHz to 100 MHz: < -50 dBc + 6 dBc/octave	10 Hz to 1 MHz: < -60 dBc $\geq 1$ MHz to 25 MHz: < -50 dBc $\geq 25$ MHz to 150 MHz: -50 dBc + 6 dBc/octave	10 Hz to 1 MHz: < -50 dBc $\geq 1$ MHz to 25 MHz: < -47 dBc $\geq 25$ MHz to 240 MHz: < -47 dBc + 6 dBc/octave
Spurious(1 $V_{p-p}$ ), typical	10 Hz to 1 MHz: < -71 dBc $\geq 1$ MHz to 25 MHz: < -63 dBc $\geq 25$ MHz to 50 MHz: < -87 dBc $\geq 50$ MHz to 100 MHz: < -52 dBc	10 Hz to 1 MHz: < -70 dBc $\geq 1$ MHz to 25 MHz: < -54 dBc $\geq 25$ MHz to 50 MHz: < -66 dBc $\geq 50$ MHz to 100 MHz: < -68 dBc $\geq 100$ MHz to 150 MHz: < -38 dBc	10 Hz to 1 MHz: < -63 dBc $\geq 1$ MHz to 25 MHz: < -57 dBc $\geq 25$ MHz to 50 MHz: < -51 dBc $\geq 50$ MHz to 100 MHz: < -69 dBc $\geq 100$ MHz to 240 MHz: < -55 dBc
Phase noise, typical	< -110 dBc/Hz at 20 MHz, 10 kHz offset, 1 $V_{p-p}$		
Residual clock noise	-57 dBm		

## Square waves

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 $\mu$ Hz to 50 MHz	1 $\mu$ Hz to 100 MHz	1 $\mu$ Hz to 120 MHz
Rise/fall time	$\leq 5$ ns	$\leq 3.5$ ns	$\leq 2.5$ ns
Jitter (RMS)	200 ps	150 ps	100 ps
Jitter (RMS), typical	<35 ps	<35 ps	<35 ps

**General characteristics (AFG3100 & AFG3200 series)**

Ramp waves

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 $\mu$ Hz to 1 MHz	1 $\mu$ Hz to 1.5 MHz	1 $\mu$ Hz to 2.4 MHz
Linearity, typical	$\leq 0.15\%$ of peak output	$\leq 0.15\%$ of peak output	$\leq 0.2\%$ of peak output
Symmetry	0% to 100.0%		

Pulse waves

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 mHz to 50 MHz	1 mHz to 100 MHz	1 mHz to 120 MHz
Pulse width	8.00 ns to 999.99 s	5.00 ns to 999.99 s	4.00 ns to 999.99 s
Resolution	10 ps or 5 digits		
Pulse duty	0.001% to 99.999% (Limitations of pulse width apply)		
Edge transition time	5 ns to 625 s	3 ns to 625 s	2.5 ns to 625 s
Resolution	10 ps or 4 digits		
Lead delay: range	(Continuous Mode): 0 ps to Period (Triggered/Gated Burst Mode): 0 ps to Period - [Pulse Width + 0.8 * (Leading Edge Time + Trailing Edge Time)]		
Lead delay: resolution	10 ps or 8 digits		
Overshoot, typical	<5%		
Jitter (RMS)	200 ps	150 ps	100 ps
Jitter (RMS), typical	<35 ps	<25 ps	<35 ps

Other waveforms

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 $\mu$ Hz to 1 MHz	1 $\mu$ Hz to 1.5 MHz	1 $\mu$ Hz to 2.4 MHz
Noise bandwidth (-3 dB)	100 MHz	180 MHz	240 MHz
Noise type:	White Gaussian		
Internal noise add	When activated, output signal amplitude is reduced to 50%		
Level	0.0% to 50% of amplitude ( $V_{p-p}$ ) setting		
Resolution	1%		
DC (into 50 $\Omega$ )	-5 V to +5 V	-5 V to +5 V	-2.5 V to +2.5 V

Arbitrary waveforms

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 mHz to 50 MHz	1 mHz to 100 MHz	1 mHz to 120 MHz
Arbitrary waveforms in Burst Mode	1 mHz to 25 MHz	1 mHz to 50 MHz	1 mHz to 60 MHz
Effective analog bandwidth (-3 dB)	100 MHz	180 MHz	225 MHz
Nonvolatile memory	4 waveforms		

**General characteristics (AFG3100 & AFG3200 series)**

Memory: Sample rate (1K=1024 points)	2 to 16 K: 1 GS/s >16 K to 128 K: 250 MS/s	2 to 16 K: 1 GS/s >16 K to 128 K: 250 MS/s	2 to 16 K: 2 GS/s >16 K to 128 K: 250 MS/s
Vertical resolution	14 bits		
Rise/fall time	≤8 ns	5 ns	≤3 ns
Jitter (RMS)	1 ns at 1 GS/s 4 ns at 250 MS/s	750 ps at 1 GS/s 4 ns at 250 MS/s	500 ps at 2 GS/s 4 ns at 250 MS/s

**Amplitude**

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Range, 50 Ω Load	20 mV <sub>p-p</sub> to 10 V <sub>p-p</sub>	≤100 MHz: 20 mV <sub>p-p</sub> to 10 V <sub>p-p</sub> >100 MHz: 20 mV <sub>p-p</sub> to 8 V <sub>p-p</sub>	≤200 MHz: 50 mV <sub>p-p</sub> to 5 V <sub>p-p</sub> >200 MHz: 50 mV <sub>p-p</sub> to 4 V <sub>p-p</sub>
Range (open circuit or High Z)	40 mV <sub>p-p</sub> to 20 V <sub>p-p</sub>	≤100 MHz: 40 mV <sub>p-p</sub> to 20 V <sub>p-p</sub> >100 MHz: 40 mV <sub>p-p</sub> to 16 V <sub>p-p</sub>	≤200 MHz: 100 mV <sub>p-p</sub> to 10 V <sub>p-p</sub> >200 MHz: 100 mV <sub>p-p</sub> to 8 V <sub>p-p</sub>
Accuracy	±(1% of setting + 1 mV) (1 kHz sine wave, 0 V offset, >10 mV <sub>p-p</sub> amplitude)		
Accuracy, typical	±(0.5% of setting + 0.5 mV) (1 kHz sine wave, 0 V offset, >10 mV <sub>p-p</sub> amplitude)		
Resolution	0.1 mV <sub>p-p</sub> , 0.1 mV <sub>RMS</sub> , 1 mV, 0.1 dBm or 4 digits		
Units	V <sub>p-p</sub> , V <sub>RMS</sub> , dBm (sine wave only) and Volt (high/low setting)		
Output impedance	50 Ω		
Load impedance setting	Selectable: 50 Ω, 1 Ω to 10.0 kΩ, High Z (Adjusts displayed amplitude according to selected load impedance)		
Isolation	42 V <sub>pk</sub> maximum to earth		
Short-circuit protection	Signal outputs are robust against permanent shorts against floating ground		
External voltage protection	To protect signal outputs against external voltages use fuse adapter 013-0345-xx		

**DC offset**

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Range (50 Ω load)	±5 V <sub>pk</sub> DC	±5 V <sub>pk</sub> DC	±2.5 V <sub>pk</sub> DC
Range (open circuit or High Z)	±10 V <sub>pk</sub> DC	±10 V <sub>pk</sub> DC	±5 V <sub>pk</sub> DC
Accuracy	±(1% of  setting  + 5 mV + 0.5% of amplitude (V <sub>p-p</sub> ))		
Resolution	1 mV		

**System characteristics**

Frequency resolution	1 μHz or 12 digits
Internal frequency reference	
Stability	All except ARB: ±1 ppm, 0 °C to 50 °C ARB: ±1 ppm ± 1 μHz, 0 °C to 50 °C
Aging	±1 ppm per year
Phase (except DC, noise, pulse)	
Range	-180° to +180°
Resolution	0.01° (sine), 0.1° (other waveforms)

## System characteristics

<b>Internal noise add</b>	When activated, output signal amplitude is reduced to 50%		
Level	0.0% to 50% of amplitude ( $V_{p-p}$ ) setting		
Resolution	1%		
<b>Main output</b>	50 $\Omega$		
<b>Remote programming: configuration times, max, typical</b>	GPIB, LAN 10BASE-T / 100BASE-TX, USB 1.1 Compatible with SCPI-1999.0 and IEEE 488-2 standards		
	<b>USB</b>	<b>LAN</b>	<b>GPIB</b>
Function change	81 ms	81 ms	81 ms
Frequency change (except Pulse)	2.5 ms	6 ms	3.2 ms
Frequency change (Pulse)	40 ms	37 ms	32 ms
Amplitude change	90 ms	97 ms	90 ms
Select user ARB (4k points from USB Memory)	48 ms	50 ms	49 ms
Select user ARB (128k points from USB Memory)	260 ms	266 ms	240 ms
<b>Remote programming: data download time for 4000 point waveform data, typical</b>	<b>USB</b>	<b>LAN</b>	<b>GPIB</b>
	47 ms	78 ms	320 ms
<b>Power source</b>	100-240 V, 47-63 Hz, or 115 V, 360-440 Hz		
<b>Power consumption</b>	Less than 120 W		
<b>Warm up time, typical</b>	20 minutes		
<b>Power on self-diagnosis, typical</b>	<10 s		
<b>Acoustic noise, typical</b>	<50 dBA		
<b>Display</b>	5.6 in. Color TFT LCD		
<b>User interface and Help languages</b>	English, French, German, Japanese, Korean, Portuguese, Simplified and Traditional Chinese, Russian (user selectable)		

## Modulation characteristics

<b>AM, FM, PM</b>	
Carrier waveforms	All except Pulse, Noise, and DC
Source	Internal/external
Internal modulating waveform	Sine, square, ramp, noise, ARB (AM: maximum waveform length 4,096; FM/PM: maximum waveform length 2,048)
Internal modulating frequency	2 mHz to 50.00 kHz
AM modulation depth	0.0% to +120.0%
Min FM peak deviation	DC
Max FM peak deviation	See following table,
PM phase deviation	-360.0° to +360.0°



**Modulation characteristics****Pulse width modulation**

<b>Carrier waveform</b>	Pulse
<b>Source</b>	Internal/external
<b>Internal modulating waveform</b>	Sine, square, ramp, noise, ARB (maximum waveform length 2,048)
<b>Internal modulating frequency</b>	2 MHz to 50.00 kHz
<b>Deviation</b>	0% to 50.0% of pulse period

**Max FM peak deviation**

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
<b>Sine</b>	5 MHz	12.5 MHz	25 MHz	50 MHz	75 MHz	120 MHz
<b>Square</b>	2.5 MHz	12.5 MHz	20 MHz	25 MHz	50 MHz	60 MHz
<b>ARB</b>	2.5 MHz	6.25 MHz	12.5 MHz	25 MHz	50 MHz	60 MHz
<b>Others</b>	50 kHz	250 kHz	400 kHz	500 kHz	750 kHz	1.2 MHz

**Frequency shift keying**

<b>Carrier waveforms</b>	All, except Pulse, Noise, and DC
<b>Source</b>	Internal/external
<b>Internal modulating frequency</b>	2 MHz to 1,000 MHz
<b>Number of keys</b>	2

**Sweep**

<b>Waveforms</b>	All, except Pulse, Noise, and DC
<b>Type</b>	Linear, logarithmic
<b>Sweep time</b>	1 ms to 300 s
<b>Hold/return time</b>	0 ms to 300 s
<b>Max total sweep time</b>	300 s
<b>Resolution</b>	1 ms or 4 digits
<b>Total sweep time accuracy, typical</b>	≤0.4%
<b>Min start/stop frequency</b>	All except ARB: 1 μHz ARB: 1 mHz
<b>Max start/stop frequency</b>	See chart, below

**Sweep: max start/stop frequency**

	AFG3011C	AFG3021C, AFG3022C	AFG3051C, AFG3052C	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
<b>Sine</b>	10 MHz	25 MHz	50 MHz	100 MHz	150 MHz	240 MHz
<b>Square</b>	5 MHz	25 MHz	40 MHz	50 MHz	100 MHz	120 MHz
<b>ARB</b>	5 MHz	12.5 MHz	25 MHz	50 MHz	100 MHz	120 MHz
<b>Others</b>	100 kHz	500 kHz	800 kHz	1 MHz	1.5 MHz	2.4 MHz

**Burst**

<b>Waveforms</b>	All, except Noise and DC
<b>Type</b>	Triggered, gated (1 to 1,000,000 cycles or Infinite)

**Modulation characteristics**

Internal trigger rate	1 $\mu$ s to 500.0 s
Gate and trigger sources	Internal, external, remote interface

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**Auxiliary input characteristics**

Modulation inputs	Channel 1, Channel 2
Input range	All except FSK: $\pm 1$ V FSK: 3.3 V logic level
Impedance	10 k $\Omega$
Frequency range	DC to 25 kHz (122 kS/s)

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**External Triggered/Gated Burst input**

Level	TTL compatible
Impedance	10 k $\Omega$
Pulse width	100 ns minimum
Slope	Positive/negative, selectable
Trigger delay	0.0 ns to 85.000 s
Trigger delay resolution	100 ps or 5 digits
Jitter (RMS), typical	Burst: <500 ps (trigger input to signal output)

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**10 MHz reference input**

Impedance	1 k $\Omega$ , AC coupled
Required input voltage swing	100 mV <sub>p-p</sub> to 5 V <sub>p-p</sub>
Lock range	10 MHz $\pm$ 35 kHz

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**External channel 1 add input** AFG3101C, AFG3102C, AFG3151C, AFG3152C, AFG3251C, AFG3252C only

Impedance	50 $\Omega$
Input range	-1 V to +1 V (DC + peak AC)
Bandwidth	DC to 10 MHz (-3 dB) at 1 V <sub>p-p</sub>

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**Auxiliary output characteristics**

**Trigger output (Channel 1)**

Level	Positive TTL level pulse into 1 k $\Omega$
Impedance	50 $\Omega$
Jitter (RMS), typical	AFG3011C/21C/22C: 500 ps AFG3051C/52C: 300 ps AFG3101C/02C: 200 ps AFG3151C/52C: 150 ps AFG3251C/52C: 100 ps
Max frequency	4.9 MHz (4.9 MHz to 50 MHz: A fraction of the frequency is output; >50 MHz: no signal is output)

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**Auxiliary output characteristics**

Clock reference out (10 MHz)	AFG3011C, AFG3101C, AFG3102C, AFG3151C, AFG3152C, AFG3251C, AFG3252C only
Impedance	50 $\Omega$ , AC coupled
Amplitude	1.2 V <sub>p-p</sub> into 50 $\Omega$ load

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**Physical characteristics**

Benchtop configuration

**Dimensions**

Height	156 mm (6.2 in.)
Width	329.6 mm (13.0 in.)
Depth	168.0 mm (6.6 in.)

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**Weight**

Net	4.5 kg (9.9 lb.)
Shipping	5.9 kg (12.9 lb.)

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**EMC environmental and safety characteristics****Temperature**

Operating	0 °C to +50 °C
Non-operating	-30 °C to +70 °C

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**Humidity**

Operating	$\leq +40$ °C: $\leq 80\%$ > +40 °C to 50 °C: $\leq 60\%$
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**Altitude**

Up to 3,000 m (10,000 ft.)

**EMC compliance**

European Union	EU Council Directive 2004/108/EC
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**Safety**

UL 61010-1:2004  
CAN/CSA C22.2 No. 61010-1:2004  
IEC 61010-1:2001

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**Ordering information****Arbitrary function generators**

AFG3011C	1 $\mu$ Hz to 10 MHz sine wave, 1-channel arbitrary function generator
AFG3021C	1 $\mu$ Hz to 25 MHz sine wave, 1-channel arbitrary function generator
AFG3022C	1 $\mu$ Hz to 25 MHz sine wave, 2-channel arbitrary function generator
AFG3051C	1 $\mu$ Hz to 50 MHz sine wave, 1-channel arbitrary function generator
AFG3052C	1 $\mu$ Hz to 50 MHz sine wave, 2-channel arbitrary function generator
AFG3101C	1 $\mu$ Hz to 100 MHz sine wave, 1-channel arbitrary function generator

AFG3102C	1 $\mu$ Hz to 100 MHz sine wave, 2-channel arbitrary function generator
AFG3151C	1 $\mu$ Hz to 150 MHz sine wave, 1-channel arbitrary function generator
AFG3152C	1 $\mu$ Hz to 150 MHz sine wave, 2-channel arbitrary function generator
AFG3251C	1 $\mu$ Hz to 240 MHz sine wave, 1-channel arbitrary function generator
AFG3252C	1 $\mu$ Hz to 240 MHz sine wave, 2-channel 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

### Manual options

Opt. L0	English (071-1631-xx)
Opt. L1	French (071-1632-xx)
Opt. L2	Italian (071-1669-xx)
Opt. L3	German (071-1633-xx)
Opt. L4	Spanish (071-1670-xx)
Opt. L5	Japanese (071-1634-xx)
Opt. L6	Portuguese (071-3042-xx)
Opt. L7	Simple Chinese (071-1635-xx)
Opt. L8	Traditional Chinese (071-1636-xx)
Opt. L9	Korean (071-1637-xx)
Opt. L10	Russian (071-1638-xx)
Opt. L99	No manual

**Service options**

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. R5	Repair Service 5 Years (including warranty)
Opt. R5DW	Repair Service Coverage 5 Years (includes product warranty period). 5-year period starts at time of instrument purchase
Opt. SILV400	Standard warranty extended to 5 years

**Standard accessories****Accessories**

—	AFG3000C Series Generators Compliance and Safety Instructions
—	Power cord
—	USB cable
—	BNC cables
—	CD-ROM with quick start user manual, specifications and performance verification manual, programmer manual, service manual, and links to download the LabView and IVI drivers
—	CD-ROM with ArbExpress™ software
—	NIST-traceable calibration certificate
—	3-year warranty on parts and labor

**Warranty**

Three-year warranty on parts and labor.

**Recommended accessories****Accessories**

Rackmount kit	RM3100
BNC cable shielded, 3 ft.	012-1732-xx
GPIB cable, double shielded	012-0991-xx
50 Ω BNC terminator	011-0049-02



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



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

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**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tek.com](http://www.tek.com).

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