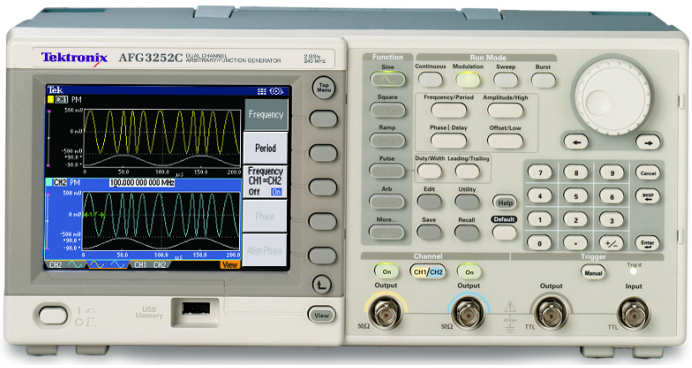
Arbitrary/Function Generators

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_{p-p} 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 tmes
- 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 [1]

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 µHz to 10 MHz	1 µHz to 25 MHz	1 µHz to 50 MHz
Sine wave in Burst Mode	1 µHz to 5 MHz	1 µHz to 12.5 MHz	1 µHz to 25 MHz
Effective maximum frequency out	10 MHz	25 MHz	50 MHz
Amplitude flatness (1 V_{p-p})	<5 MHz: ±0.15 dB ≥5 MHz to 10 MHz: ±0.3 dB	<5 MHz: ±0.15 dB ≥5 MHz to 20 MHz: ±0.3 dB ≥20 MHz to 25 MHz: ±0.5 dB	<5 MHz: ±0.15 dB ≥5 MHz to 45 MHz: ±0.3 dB ≥45 MHz to 50 MHz: ±0.5 dB
Amplitude flatness (1 V_{p-p}), typical	<5 MHz: ±0.11 dB ≥5 MHz to 10 MHz: ±0.2 dB	<5 MHz: ±0.06 dB ≥5 MHz to 25 MHz: ±0.02 dB	<5 MHz: ±0.06 dB ≥5 MHz to 50 MHz: ±0.02 dB
Harmonic distortion (1 V_{p-p})	10 Hz to 20 kHz: < -60 dBc ≥20 kHz to 1 MHz: < -55 dBc ≥1 MHz to 5 MHz: < -45 dBc ≥5 MHz to 10 MHz: < -45 dBc	10 Hz to 20 kHz: < -70 dBc ≥20 kHz to 1 MHz: < -60 dBc ≥1 MHz to 10 MHz: < -50 dBc ≥10 MHz to 25 MHz: < -40 dBc	10 Hz to 20 kHz: < -70 dBc ≥20 kHz to 1 MHz: < -60 dBc ≥1 MHz to 5 MHz: < -50 dBc ≥5 MHz to 50 MHz: < -40 dBc
Harmonic distortion (1 V_{p-p}), typical	10 Hz to 20 kHz: < -73 dBc ≥20 kHz to 1 MHz: < -72 dBc ≥1 MHz to 5 MHz: < -65 dBc ≥5 MHz to 10 MHz: < -56 dBc	10 Hz to 20 kHz: < -77 dBc ≥20 kHz to 1 MHz: < -72 dBc ≥1 MHz to 25 MHz: < -55 dBc	10 Hz to 20 kHz: < -75 dBc ≥20 kHz to 1 MHz: < -72 dBc ≥1 MHz to 5 MHz: < -65 dBc ≥5 MHz to 50 MHz: < -56 dBc
THD	≤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 ≥1 MHz to 10 MHz: < -50 dBc	10 Hz to 1 MHz: < -60 dBc ≥1 MHz to 25 MHz: < -50 dBc	10 Hz to 1 MHz: < -60 dBc ≥1 MHz to 50 MHz: < -50 dBc
Spurious(1 V_{p-p}), typical	10 Hz to 1 MHz: < -61 dBc ≥1 MHz to 10 MHz: < -68 dBc	10 Hz to 1 MHz: < -71 dBc ≥1 MHz to 25 MHz: < -68 dBc	10 Hz to 1 MHz: < -71 dBc ≥1 MHz to 50 MHz: < -69 dBc
Phase noise, typical	< -110 dBc/Hz at 10 MHz, 10 kHz offset, 1 V_{p-p}	< -110 dBc/Hz at 20 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 µHz to 5 MHz	1 µHz to 25 MHz	1 µHz to 40 MHz
Rise/fall time	≤50 ns	≤9 ns	≤7 ns

1 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 µHz to 100 kHz	1 µHz to 500 kHz	1 µHz to 800 kHz
Linearity, typical	≤0.2% of peak output	≤0.1% of peak output	≤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 µHz to 100 kHz	1 µHz to 500 kHz	1 µHz 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 Ω)	-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_{p-p} to 20 V_{p-p}	10 mV_{p-p} to 10 V_{p-p}	10 mV_{p-p} to 10 V_{p-p}
Range (open circuit or High Z)	40 mV_{p-p} to 40 V_{p-p}	20 mV_{p-p} to 20 V_{p-p}	20 mV_{p-p} to 20 V_{p-p}
Accuracy	±(2% of setting +2 mV) (1 kHz sine wave, 0 V offset, >20 mV_{p-p} amplitude)	±(1% of setting +1 mV) (1 kHz sine wave, 0 V offset, >10 mV_{p-p} amplitude)	
Accuracy, typical	±(1% of setting +5 mV) (1 kHz sine wave, 0 V offset, >20 mV_{p-p} amplitude)	±(0.5% of setting +0.5 mV) (1 kHz sine wave, 0 V offset, >10 mV_{p-p} amplitude)	
Resolution	0.1 mV_{p-p}, 0.1 mV_{RMS}, 1 mV, 0.1 dBm or 4 digits		
Units	V_{p-p}, V_{RMS}, 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_{pk} 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_{pk} - $Amplitude_{p-p}$ ÷ 2)	±(5 V_{pk} - $Amplitude_{p-p}$ ÷ 2)	±(5 V_{pk} - $Amplitude_{p-p}$ ÷ 2)
Range (open circuit or High Z)	±(20 V_{pk} - $Amplitude_{p-p}$ ÷ 2)	±(10 V_{pk} - $Amplitude_{p-p}$ ÷ 2)	±(10 V_{pk} - $Amplitude_{p-p}$ ÷ 2)
Accuracy	±(2% of |setting| + 10 mV + 1% of amplitude (V_{p-p}))	±(1% of |setting| + 5 mV + 0.5% of amplitude (V_{p-p}))	
Resolution	1 mV		

General characteristics (AFG3100 & AFG3200 series)

Sine waves

	AFG3101C, AFG3102C	AFG3151C, AFG3152C	AFG3251C, AFG3252C
Frequency range	1 µHz to 100 MHz	1 µHz to 150 MHz	1 µHz to 240 MHz
Sine wave in Burst Mode	1 µHz to 50 MHz	1 µHz to 75 MHz	1 µHz to 120 MHz
Effective maximum frequency out	100 MHz	150 MHz	240 MHz
Amplitude flatness (1 V_{p-p})	<5 MHz: ±0.15 dB ≥5 MHz to 25 MHz: ±0.3 dB ≥25 MHz to 100 MHz: ±0.5 dB	<5 MHz: ±0.15 dB ≥5 MHz to <25 MHz: ±0.3 dB ≥25 MHz to ≤150 MHz: ±0.5 dB	<5 MHz: ±0.15 dB ≥5 MHz to 25 MHz: ±0.3 dB ≥25 MHz to 100 MHz: ±0.5 dB ≥100 MHz to 200 MHz: ±1.0 dB ≥200 MHz to 240 MHz: ±2.0 dB
Amplitude flatness (1 V_{p-p}), typical	<5 MHz: ±0.03 dB ≥5 MHz to 50 MHz: ±0.02 dB ≥50 MHz to 100 MHz: ±0.03 dB	>5 MHz: ±0.04 dB ≥5 MHz to 50 MHz: ±0.02 dB ≥50 MHz to 150 MHz: ±0.03 dB	<5 MHz: ±0.03 dB ≥5 MHz to 50 MHz: ±0.02 dB ≥50 MHz to 100 MHz: ±0.02 dB ≥100 MHz to 200 MHz: ±0.03 dB ≥200 MHz to 240 MHz: ±0.04 dB
Harmonic distortion (1 V_{p-p})	10 Hz to 1 MHz: < -60 dBc ≥1 MHz to 5 MHz: < -50 dBc ≥5 MHz to 100 MHz: < -37 dBc	<5 MHz: ±0.15 dB ≥5 MHz to 25 MHz: ±0.3 dB ≥25 MHz to ≤150 MHz: ±0.5 dB	10 Hz to 1 MHz: < -60 dBc ≥1 MHz to 5 MHz: < -50 dBc ≥5 MHz to 25 MHz: < -37 dBc ≥25 MHz to 240 MHz: < -30 dBc
Harmonic distortion (1 V_{p-p}), typical	10 Hz to 1 MHz: < -72 dBc ≥1 MHz to 5 MHz: < -66 dBc ≥5 MHz to 100 MHz: < -43 dBc	10 Hz to 1 MHz: < -72 dBc ≥1 MHz to 5 MHz: < -66 dBc ≥5 MHz to 100 MHz: < -42 dBc ≥100 MHz to 150 MHz: < -48 dBc	10 Hz to 1 MHz: < -67 dBc ≥1 MHz to 5 MHz: < -74 dBc ≥5 MHz to 25 MHz: < -57 dBc ≥25 MHz to 240 MHz: < -43 dBc
THD	≤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 ≥1 MHz to 25 MHz: < -50 dBc ≥25 MHz to 100 MHz: < - 50 dBc + 6 dBc/ octave	10 Hz to 1 MHz: < -60 dBc ≥1 MHz to 25 MHz: < -50 dBc ≥25 MHz to 150 MHz: - 50 dBc + 6 dBc/ octave	10 Hz to 1 MHz: < -50 dBc ≥1 MHz to 25 MHz: < -47 dBc ≥25 MHz to 240 MHz: < - 47 dBc + 6 dBc/ octave
Spurious(1 V_{p-p}), typical	10 Hz to 1 MHz: < -71 dBc ≥1 MHz to 25 MHz: < -63 dBc ≥25 MHz to 50 MHz: < -87 dBc ≥50 MHz to 100 MHz: < - 52 dBc	10 Hz to 1 MHz: < -70 dBc ≥1 MHz to 25 MHz: < -54 dBc ≥25 MHz to 50 MHz: < -66 dBc ≥50 MHz to 100 MHz: < - 68 dBc ≥100 MHz to 150 MHz: < - 38 dBc	10 Hz to 1 MHz: < -63 dBc ≥1 MHz to 25 MHz: < -57 dBc ≥25 MHz to 50 MHz: < -51 dBc ≥50 MHz to 100 MHz: < - 69 dBc ≥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 µHz to 50 MHz	1 µHz to 100 MHz	1 µHz to 120 MHz
Rise/fall time	≤5 ns	≤3.5 ns	≤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 µHz to 1 MHz	1 µHz to 1.5 MHz	1 µHz to 2.4 MHz
Linearity, typical	≤0.15% of peak output	≤0.15% of peak output	≤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 µHz to 1 MHz	1 µHz to 1.5 MHz	1 µHz 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 Ω)	-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_{p-p} to 10 V_{p-p}	≤100 MHz: 20 mV_{p-p} to 10 V_{p-p} >100 MHz: 20 mV_{p-p} to 8 V_{p-p}	≤200 MHz: 50 mV_{p-p} to 5 V_{p-p} >200 MHz: 50 mV_{p-p} to 4 V_{p-p}
Range (open circuit or High Z)	40 mV_{p-p} to 20 V_{p-p}	≤100 MHz: 40 mV_{p-p} to 20 V_{p-p} >100 MHz: 40 mV_{p-p} to 16 V_{p-p}	≤200 MHz: 100 mV_{p-p} to 10 V_{p-p} >200 MHz: 100 mV_{p-p} to 8 V_{p-p}
Accuracy	±(1% of setting +1 mV) (1 kHz sine wave, 0 V offset, >10 mV_{p-p} amplitude)		
Accuracy, typical	±(0.5% of setting +0.5 mV) (1 kHz sine wave, 0 V offset, >10 mV_{p-p} amplitude)		
Resolution	0.1 mV_{p-p}, 0.1 mV_{RMS}, 1 mV, 0.1 dBm or 4 digits		
Units	V_{p-p}, V_{RMS}, 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_{pk} 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_{pk} DC	±5 V_{pk} DC	±2.5 V_{pk} DC
Range (open circuit or High Z)	±10 V_{pk} DC	±10 V_{pk} DC	±5 V_{pk} DC
Accuracy	±(1% of |setting| + 5 mV + 0.5% of amplitude (V_{p-p}))		
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

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%

Main output — 50 Ω

Remote programming: configuration times, max, typical — GPIB, LAN 10BASE-T / 100BASE-TX, USB 1.1

Compatible with SCPI-1999.0 and IEEE 488-2 standards

	USB	LAN	GPIB
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

Remote programming: data download time for 4000 point waveform data, typical

USB	LAN	GPIB
47 ms	78 ms	320 ms

Power source — 100-240 V, 47-63 Hz, or 115 V, 360-440 Hz

Power consumption — Less than 120 W

Warm up time, typical — 20 minutes

Power on self-diagnosis, typical — <10 s

Acoustic noise, typical — <50 dBA

Display — 5.6 in. Color TFT LCD

User interface and Help languages — English, French, German, Japanese, Korean, Portuguese, Simplified and Traditional Chinese, Russian (user selectable)

Modulation characteristics

AM, FM, PM

- **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

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

Max FM peak deviation

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

Frequency shift keying

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

Sweep

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

Sweep: max start/stop frequency

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

Burst

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

Modulation characteristics

Internal trigger rate	1 µs to 500.0 s
Gate and trigger sources	Internal, external, remote interface

Auxiliary input characteristics

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

External Triggered/Gated Burst input	
Level	TTL compatible
Impedance	10 kΩ
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)

10 MHz reference input	
Impedance	1 kΩ, AC coupled
Required input voltage swing	100 mV_{p-p} to 5 V_{p-p}
Lock range	10 MHz ±35 kHz

External channel 1 add input	AFG3101C, AFG3102C, AFG3151C, AFG3152C, AFG3251C, AFG3252C only
Impedance	50 Ω
Input range	-1 V to +1 V (DC + peak AC)
Bandwidth	DC to 10 MHz (-3 dB) at 1 V_{p-p}

Auxiliary output characteristics

Trigger output (Channel 1)	
Level	Positive TTL level pulse into 1 kΩ
Impedance	50 Ω
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)

Auxiliary output characteristics

Clock reference out (10 MHz)	AFG3011C, AFG3101C, AFG3102C, AFG3151C, AFG3152C, AFG3251C, AFG3252C only
Impedance	50 Ω, AC coupled
Amplitude	1.2 V_{p-p} into 50 Ω load

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

EMC environmental and safety characteristics

Temperature	
Operating	0 °C to +50 °C
Non-operating	-30 °C to +70 °C
Humidity	
Operating	≤ +40 °C: ≤80% > +40 °C to 50 °C: ≤60%
Altitude	Up to 3,000 m (10,000 ft.)
EMC compliance	
European Union	EU Council Directive 2004/108/EC
Safety	UL 61010-1:2004 CAN/CSA C22.2 No. 61010-1:2004 IEC 61010-1:2001

Ordering information

Arbitrary function generators

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

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

CE

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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