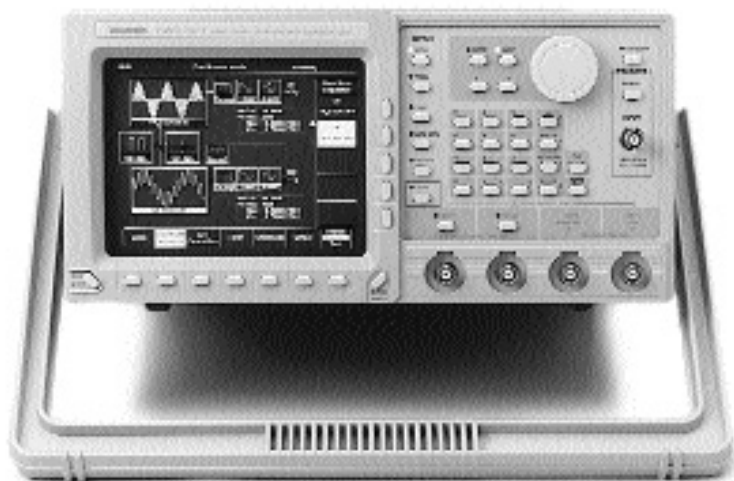# Arbitrary Waveform Generator

▶ AWG2021

▶ *AWG2021.*

The AWG2021 offers 250 MS/s and 256 k deep memory. As with the entire AWG2000 Series, the graphical user interface allows on-screen viewing of waveform editing, simplifying "what if" test scenarios by allowing the easy creation of composite signals.

The standard AWG2021 configuration provides one 5 V output or a second independent 5 V output (Opt. 02) each with 12-Bit vertical resolution. Frequency of channel 2 is also independently programmable. Option 03 adds a 12-Bit wide differential ECL digital port which can be used in conjunction with the marker outputs for data generation up to 14 Bits wide at up to 250 MHz. Or if you prefer, Option 04 provides TTL digital levels with up to two 12-Bit, 100 MS/s ports for a total of 28 Bits wide.

The built-in frequency domain (FFT) editor (Opt. 09) is a perfect addition for customers performing proprietary or standard modulation simulations, filter design or in physical layer testing. Real-time waveform sequencing extends the effective record length output to over a billion points!

The AWG2021 easily simulates signals where moderate point definition and long records are required for simulating very complex waveform conditions. Direct waveform transfer capability makes the AWG2021 the perfect complement to selected Tektronix oscilloscopes.

▶ Features & Benefits

250 MS/s Clock Rate Provides up to 125 MHz Waveforms

256 k Memory Depth

12-Bit Vertical Resolution

Direct DSO Waveform Transfers

Region Shift Function Provides 4 ps Edge Placement

Optional 12-Bit 250 MHz (ECL) or 12/24-Bit 100 MHz (TTL) Digital Data Generator

Built-in 1.4 MB, 3.5 in. Floppy Disk

FFT Frequency Domain Editor (Opt. 09)

Real-time Waveform Sequencer to Easily Create Automatic Test Sequences and Extremely Long Patterns

Formula Entry of Waveforms

Channel Summing (with Opt. 02)

Fully Programmable from Front Panel, RS-232 and GPIB (IEEE-488.2)

▶ Applications

Analog and Digital Modulation

Wireless Communication

All Forms of Fading Simulation

Navigation

I and Q Impairment

Audio

Computer Peripherals

Automotive

D/A and A/D Converter Testing

Filter Design

Semiconductor Logic (ASIC/DSP/FPGA)

CCD, LCD

Tektronix

Enabling Innovation

Arbitrary Waveform Generator

▶ AWG2021

▶ Characteristics

Standard Waveshapes
Sine, square, triangle, ramp, pulse, arbitrary, linked sequence and DC.

Arbitrary Waveforms
Execution Memory –
Waveform: 256 Kwords.
Marker: 256 Kwords x 2 Bits.
Data Points of Waveform Size: 64 to 256 K in multiples of 8.

Real-time Sequencer Memory –
8 K individual waveforms.
Loop Counter: 1 to 65,535 repeats.
Burst Mode Counter: 1 to 64 K cycles.

Catalog Memory Clock
Frequency Range – 10 Hz to 250 MHz.

Resolution – 4 digit.

Accuracy – 50 ppm (+15 ºC to +30 ºC).

Skew between CH. 1 and CH. 2 (Opt. 02 only) – Within 4 ns.

Operating Modes
Continuous – Output continuous at programmed waveshape, frequency, amplitude and offset.

Triggered – Output quiescent until triggered by an external, GPIB or manual trigger; then generates a sequence only one time.

Gated – Same as triggered mode except period is executed only for the duration of the gated signal until the sequence started is completed.

Burst – Output quiescent until triggered by an external, GPIB or manual trigger; then generates "n" sequences or cycles.

Waveform Advance – Continuously generates the waveform in a predefined sequence; the next trigger advances to the next waveform in sequence.

Autostep – Generates the predefined waveform once in the Autostep File; the next trigger advances the waveform.

Main Output
Amplitude (Excluding ADD and Multiply Operation) –
Digital-to-Analog Resolution: 1/4096 (12-Bit).
Range: 0.05 V to 5 V_{p-p} into 50 Ω DC.
Accuracy: 0.05 V to 0.5 V, ±(0.5% of amplitude +5 mV); 0.501 V to 5 V, ±(1% of amplitude +25 mV).

Offset –
Range: –2.5 V to +2.5 V into 50 Ω, (–100 mA to +100 mA).
Resolution: 0.2 mA.
Accuracy: ±(1% of offset +0.2 mA).

Pulse Response –
15 ºC to +30 ºC: Flatness, within 3% after 20 ns from rise/fall edges; Aberrations, within 7% +10 mV.
+10 ºC to +40 ºC: Rise/Fall time, <4.2 ns; flatness, within 5% after 20 ns from rise/fall edges; aberrations, within 9% +10 mV.

Impedance – Typically 50 Ω.

Sinewave (Amplitude 1 V, 100 kHz Reference) –
Flatness: Within 4%.
THD: 1.0 V, ≤50 dBc, 0.5 V, ≤66 dBc.
Spurious: ≤66 dBc.

Channel Summing (Opt. 02 only)
AM (Multiply) –
Output: Within 5%.
Frequency Response: DC to 30 MHz.

External AM –
Sensitivity: 2 V_{p-p} (±5%) signal produces 100% modulation.
Frequency Response: CH 1, DC to 30 MHz; Ext. Signal, DC to 4 MHz.

Add –
Output: Within 5%.
Frequency Response: DC to 30 MHz.

Filters
3 dB Cutoff Frequency –
1 MHz: Within 20%.
5 MHz: Within 20%.
20 MHz: Within 20%.
50 MHz: Within 20%.

Delay –
1 MHz: Typically 390 ns.
5 MHz: Typically 78 ns.
20 MHz: Typically 18 ns.
50 MHz: Typically 11 ns.

Auxiliary Outputs
Markers 1 and 2 –
Amplitude:
  Marker 1 >1.2 V into 50 Ω, >2.4 V into open circuit.
  Marker 2 >1.2 V into 50 Ω, >2.4 V into open circuit.
Impedance: 50 Ω.
Marker to Signal Delay: Within 15 ns.

Sync –
Amplitude: >1.2 V into 50 Ω, >2.4 V into open circuit.
Impedance: 50 Ω.
Sync to Signal Delay: Within 15 ns.

Clock –
Amplitude: 1 V ±0.3 V into 50 Ω.
Impedance: 50 Ω.

Digital Data Out (Opt. 03, eliminates RS-232 Interface) –
Level: Differential ECL compatible.
Output Signals: Data (D0 to D11).
Skew Between Data: Within 1 ns.
Clock to Data Delay: Within 3 ns.
Connector: 68-Pin mini-D sub.

Auxiliary Inputs
Trigger –
Threshold Level: –5 V to +5 V.
Resolution: 0.1 V.
Accuracy: ±(5% x Level + 0.1 V).
Pulse Width: 15 ns minimum.
Input Swing: 0.2 V minimum.
Maximum Input Volts: 10 V_{p-p} when 1 MΩ selected; 5 V_{RMS} when 50 Ω selected.
Impedance: 1 MΩ with 30 pF max.
Trigger to Output Signal Delay: External clock, 100 ns maximum +1 clock.

Trigger Holdoff – 5 µs maximum.

AM (Opt. 02 only) –
Range: 2 V_{p-p} (–1 V to +1 V) for 100% modulation.
Maximum Input: ±5 V_{p-p}, 10 kΩ impedance.

System Clock –
Threshold Level: 0.3 V ±0.1 V.
Input Swing: 0.8 V minimum.
Pulse Width: 2 ns minimum.
Maximum Input Voltage: ±2 V_{p-p}.
Impedance: 50 Ω.
Frequency Range: Up to 250 MHz phase coherent.

Programmable Interface
GPIB – IEEE 488.2-1987 compatible.

RS-232 – 9-Pin D connector.

Environmental

Temperature –
Operating: +10 ºC to +40 ºC.
Nonoperating: −20 ºC to +60 ºC.

Temperature Change –
Operating: +15 ºC per hour (no condensation).
Nonoperating: +30 ºC per hour (no condensation).

Humidity –
Operating: 20% to 80% (no condensation).
Nonoperating: 5% to 90% (no condensation).

Altitude –
Operating: To 4.5 km (15,000 ft.). Maximum operating temperature decreases 1 ºC for each 300 m above 1.5 km.
Nonoperating: To 15 km (50,000 ft.).

Vibration – Operating: 0.33 mm p-p, 10 Hz to 55 Hz for 15 minutes.

Shock – Nonoperating: 30 G (1/2 sine) 11 ms duration.

Bench Handling – Operating: Drop from 10 cm (4 in.) tilt or 45º, whichever is less.

EMC –
Emissions: Within limits of FCC CFR 47, Part 15, Subpart B, Class A; VFG 243; EN55022, B; EN6055-2.
Immunity: Within limits of IEC 801-3, IEC 801-2, IEC 801-4.

Electrical Discharge – Operating max test voltage: 15 kV (150 pF through 150 Ω).
Safety – UL1244, CSA231, EN61010-1, IEC61010-1.

Power

Source Power –
Voltage Ranges: 90 to 127 V AC or 90 to 250 V AC.
Line Frequency: 90 to 127 V, 48 to 440 Hz; 90 to 250 V, 48 to 63 Hz.

Maximum Current – 4 A at 50 Hz, 90 V.

Maximum Power Dissipation – 300 W.

Fuse Rating – UL 198.6 (3AG): 6 AFAST, 250 V.
IEC 127:5 A (T), 250 V.

Physical Characteristics

Dimensions	mm	in.
Height (with feet)	164	6.4
Width (with handle)	362	14.3
Length (with front cover)	491	19.25
Length (with handle extended)	576	22.2
Weight	**kg**	**lbs.**
Net	10.7	23.6

Ordering Information

AWG2021

250 MS/s Arbitrary Waveform Generator.

Includes: User/Programmer's Manual (070-9097-05/070-8657-05), GPIB programming examples disk, sample waveform library disk, Cal. Certificate, power cable.

Please specify power plug and manual version when ordering.

Recommended Accessories

Accessory Pouch – Order 016-1159-00.

Front Cover – Order 200-3232-01.

RS-232-C Cable – 9-Pin to 25-Pin. Order 174-1453-00.

Rackmount Kit – Order 040-1444-00.

12-Bit Digital Cable –
Opt. 03: Order 012-1408-00 ECL Digital Cable.
Opt. 04: Order 174-3129-00 TTL Digital Cable.

GPIB Cable – Order 012-0991-00.

Options

Opt. 02 – Independent, 256 K second channel.

Opt. 03[1],[3] **–** ECL digital cable. Order 012-1408-00.

Opt. 04[1],[2],[3] **–** TTL digital cable. Order 174-3192-00.

Opt. 09[1] **–** Add FFT editor. Allows editing waveforms in the frequency domain.

Opt. 1R – Rackmount. Floppy moved to front.

Opt. L0 – English manual.

[1] Options 03, 04 and 09 are mutually exclusive.

[2] 12-Bit with single channel, 24-Bit with dual channel (Opt. 02).

[3] Eliminates RS-232 interface.

Power Plug Options

Opt. A0 – North America Power.

Opt. A1 – Universal EURO Power.

Opt. A2 – United Kingdom Power.

Opt. A3 – Australia Power.

Opt. A4 – 240 V, North America Power.

Opt. A5 – Switzerland Power.

Service

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 Option C3).

Opt. D5 – Calibration Data Report 5 Years (with Option C5).

Opt. R3 – Repair Service 3 Years.

Opt. R5 – Repair Service 5 Years.

Warranty

One year parts and labor.

Arbitrary Waveform Generator
▶ AWG2021

Our most up-to-date product information is available at:
www.tektronix.com

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

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

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Enabling Innovation