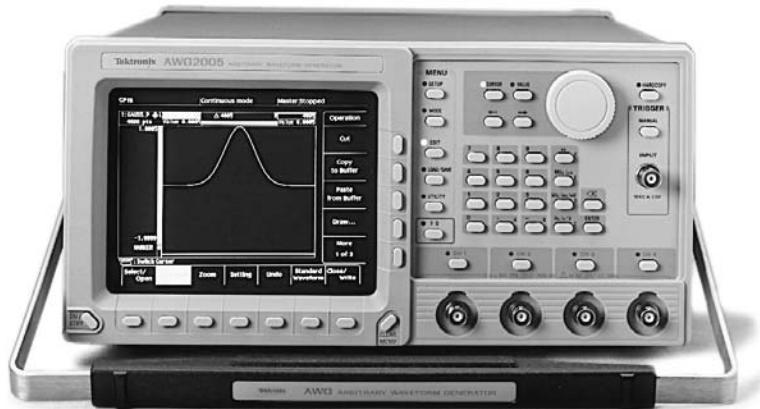


# Arbitrary Waveform Generator

## ▶ AWG2005



## ▶ AWG2005.

The AWG2005 offers 20 MS/s and 64 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 AWG2005 configuration provides two independent 10 V outputs or a third and fourth 10 V output (Option 02) each with 12-Bits vertical resolution. Option 04 adds TTL digital levels with (2) 12-Bit, 100 MS/s ports and combines with the marker outputs to provide a total of 28-Bits wide.

The built-in sweep generator (Option 05) provides even more flexibility by offering linear and logarithmic swept frequencies, but even more significantly the AWG2005

has user definable sweep capability. This allows creation of digitally modulated signals at IF frequencies.

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

The AWG2005 easily simulates signals where moderate point definition and long records are required for simulating complex waveform conditions. Direct waveform transfer capability makes the AWG2005 the perfect complement to selected Tektronix oscilloscopes.

## ▶ Features & Benefits

20 MS/s (50 ns) Clock Rate Provides up to 10 MHz Waveforms

Up to Four Channels of 64 k Record Length

12-Bit (1/4096) Vertical Resolution

Direct DSO Waveform Transfers

Region Shift Provides 50 ps Edge Placement

24-Bit Channel, TTL Digital Data Generator (Opt. 04)

Linear, Log and User Definable Sweep Generation TBR (Opt. 05)

Built-in 1.44 MB, 3.5 in. Floppy Disk

FFT Editor (Opt. 09) Frequency Domain Editing

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

Formula Entry Waveforms

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

## ▶ Applications

Analog & Digital Modulation

Digital Baseband Modulation

Sonar Testing

Transducer Simulation

Motor Control

Automotive

Education

Industrial

Sensors

Semiconductor/Logic

COMPUTING

COMMUNICATIONS

VIDEO

# Arbitrary Waveform Generator

▶ AWG2005

## ▶ Characteristics

### Standard Waveshapes

Sine, square, triangle, ramp, noise, arbitrary, linked sequence, and DC.

### Arbitrary Waveforms

**Execution Memory** – Waveform: 64 k (65,535) for each channel. Marker: 64 k for each channel. Waveform Size: 16 to 64 k in multiples of 16.

**Real-time Sequence Memory** – 8 k individual waveforms.

### Loop Counter –

Waveform: 1 to 64 k repeats.

Sequence: 1 to 64 k repeats.

**Catalog Memory** – 2 MB.

### Catalog Memory Clock

**Frequency Range** – 0.01 Hz to 20 MHz.

### Resolution –

Standard: 4 digits.

With Option 05: 7 digits.

### Accuracy –

Standard: 50 ppm (+15 °C to +30 °C).

Option 05: 5 ppm (+15 °C to +30 °C).

### Operating Modes

**Continuous** – Output waveform/sequence continuous at programmed parameters.

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

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

### Seq/Wfm Advance –

Continuous: Continuously outputs the waveform/sequence in the Sequence file. The next trigger advances to the next waveform/sequence. Master/Slave Operation.

**Step** – Output quiescent until triggered; then execute the next waveform/sequence in the Sequence file. When the loop count reaches its value, output stops and waits for next trigger.

### Auto Step –

Continuous: Continuously outputs the waveform/sequence in the Auto Step file. Step: Output quiescent until triggered.

**Master** – Provides Point Rate Clock and Trigger to a slave arbitrary waveform generator for phase synchronous parallel operation.

**Slave** – Receives Clock and Trigger from a system clock for parallel operation.

### Main Output

**Digital-to-Analog Resolution** – 12 Bits.

**Output Impedance** – 50 Ω.

**Amplitude (1 MHz Clock, 000 and FFF Waveform Data, Norm, No Filter, No Offset, Excluding and ADD Operation) –**

Range: 0.05 V to 10 V<sub>p-p</sub> into 50 Ω.

Resolution: 1 mV (4 digits).

DC Accuracy: 0.050 V to 0.999 V, ±(0.5% of amplitude + 5 mV); 1.000 V to 10.000 V, ±(1% of amplitude + 50 mV).

### Offset –

Range: –5.0 V to +5.0 V into 50 Ω (–200 mA to +200 mA).

Resolution: 5 mV (4 digits).

Accuracy (1 MHz clock, 7FF waveform data, norm, no filter, amplitude range 0.05 V): – ±(1% of offset + 10 mV).

**Pulse Response (20 MHz clock, 000 and FFF waveform data, norm, no filter, amplitude 5 V, no offset) –**

Rise/Fall Time: <35 ns.

Flatness: Within ±3% after 150 ns from rise/fall edges.

Aberrations: Within ±7%.

**Cross Talk Between Channels** – 512-point sine, 20 MHz clock, norm, no filter, amplitude offset. <70 dBc.

### Noise Floor –

20 MHz clock, 7FFF waveform data, norm, no filter, no offset.

0.5 V: ≤110 dBm/Hz at 1 MHz.

5.0 V: ≤95 dBm/Hz at 1 MHz.

**Sinewave Characteristics** – Function Generator mode, 100 Hz to 200 kHz, no offset. Flatness (1 V amplitude, 1 kHz reference): Within –4%. T.H.D. (Including up to 4th harmonics): ≤55 dBc at 5.0 V.

### Auxiliary Outputs

#### Marker –

Amplitude: >2 V into 50 Ω.

Impedance: 50 Ω.

Marker to signal delay: 35 ns.

#### Clock –

Amplitude: >2 V into 50 Ω.

Impedance: 50 Ω.

#### Control Sig. –

Amplitude: >2 V into 50 Ω.

Impedance: 50 Ω.

#### Sweep (Opt. 05) –

Waveshape: Same waveshape as selected sweep.

Amplitude: 0 to 5 V (amplitude is dependent upon start and stop frequencies with a 5 V maximum limit).

Impedance: 600 Ω.

**Digital Data Out (Opt. 04 eliminates RS-232 interface) –**

Output signals (CH 1 and CH 2): D0 to D11, Clock. Level: TTL.

Amplitude: 2 V into 50 Ω.

Skew between data: Within ±10 ns.

Clock to data delay: Within ±10 ns.

Impedance: 50 Ω.

## Auxiliary Inputs

### Trigger –

Threshold Level: –5 V to +5 V.  
 Resolution: 0.1 V.  
 Accuracy:  $\pm(5\%$  of Level + 0.1 V).  
 Minimum Pulse Width: 150 ns.  
 Minimum Input Swing:  $0.2 V_{p-p}$ .  
 Maximum Input Volts:  $\pm 10$  V (DC + peak AC).  
 Impedance: 10 k $\Omega$ .  
 Trigger to Signal Delay: Internal Clock, 400 ns  
 (excluding clock sweep mode).

### AM (512-point Sine, 20 MHz Clock, AM, No Filter, 5 V Amplitude, No Offset) –

Range:  $2 V_{p-p}$  (–1 V to +1 V) for 100% modulation.  
 Amplitude Accuracy: Within 5%.  
 Maximum Input Volts: –5 V (DC + peak AC).  
 Impedance: 10 k $\Omega$ .

### ADD (512-point Sine, 20 MHz Clock, Add, No Filter, 5 V Amplitude, No Offset) –

Range:  $10 V_{p-p}$  (–5 V to +5 V).  
 Amplitude Accuracy: Amplitude specification plus 5%.  
 Maximum Input Volts: –5 V (DC + peak AC).  
 Impedance: 50  $\Omega$ .

### Control Sig. –

Threshold Level: TTL level (0.8 V to 2.0 V).  
 Minimum Pulse Width: 40 ns.  
 Maximum Input Volts: 5 V to 0 V.  
 Impedance: 10 k $\Omega$ .

### Clock –

Threshold Level: TTL level (0.8 V to 2.0 V).  
 Minimum Pulse Width: 20 ns.  
 Maximum Input Volts: 5 V to 0 V.  
 Impedance: External Clock, 330  $\Omega$ ; Slave Mode, 10 k $\Omega$ .  
 Frequency Range: 1 Hz to 20 MHz.

### Sweep (Opt. 05 only) –

Type: Linear, log, arbitrary.  
 Mode: Continuous, triggered, gated.  
 Update Rate: 1 s to 65,535 ms.  
 Points per Sweep: 8 K maximum.

## Function Generator

**Waveform Shape** – (Predefined 100 pt. waveforms).  
 Sine, Triangle, Square, Ramp, Pulse (1 MHz filter is inserted when Sine is selected).

**Frequency** – 1.000 Hz to 200 kHz.

**Duty Cycle** – 0% to 100%, Pulse only.

## Programmable Interface

**GPIB** – IEEE 488.2-1987 compatible.

**RS-232** – 9-Pin D connector.

See Mixed Signal Sources Intro for Environmental Characteristics.

## ▶ Ordering Information

### AWG2005

Programmable Arbitrary Waveform Generator.

**Includes:** User/Programmer's Manual  
 070-8958-05/070-8657-05, GPIB Programming  
 Examples Disk, Sample Waveform Library Disk,  
 Cal. Certificate, Power Cord.

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.

**Service Manual** – Order 070-8962-07.

**Rackmount Kit** – Order 040-1444-00.

**GPIB Cable** – Order 012-0991-00.

**50  $\Omega$  BNC Cable** – Order 012-1342-00.

**12-Bit Word Generator Cable (Opt. 04)** – Order  
 174-3192-00.

**SMA to BNC Adapter** – Order 015-0554-00.

**50  $\Omega$  Termination** – Order 011-0049-02.

## Options

**Opt. 02** – Add Two Channels (Four Total).

**Opt. 04** – 24-Bit, TTL Digital Data Out\*<sup>1</sup>,\*<sup>2</sup>.

**Opt. 05** – Add Clock Sweep.

**Opt. 09** – Add FFT Editor. Allows editing waveforms in the frequency domain\*<sup>1</sup>.

**Opt. 1R** – Rackmount. Floppy Drive Access Moved to Front.

**Opt. B1** – Service Manual.

**Opt. L0** – English Manual.

## 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.

\*<sup>1</sup>Options 04 and 09 are mutually exclusive.

\*<sup>2</sup>Option 04 eliminates RS-232 interface.

# Arbitrary Waveform Generator

▶ AWG2005

## Contact Tektronix:

**ASEAN / Australasia / Pakistan** (65) 6356 3900

**Austria** +43 2236 8092 262

**Belgium** +32 (2) 715 89 70

**Brazil & South America** 55 (11) 3741-8360

**Canada** 1 (800) 661-5625

**Central Europe & Greece** +43 2236 8092 301

**Denmark** +45 44 850 700

**Finland** +358 (9) 4783 400

**France & North Africa** +33 (0) 1 69 86 80 34

**Germany** +49 (221) 94 77 400

**Hong Kong** (852) 2585-6688

**India** (91) 80-2275577

**Italy** +39 (02) 25086 1

**Japan** 81 (3) 3448-3010

**Mexico, Central America & Caribbean** 52 (55) 56666-333

**The Netherlands** +31 (0) 23 569 5555

**Norway** +47 22 07 07 00

**People's Republic of China** 86 (10) 6235 1230

**Poland** +48 (0) 22 521 53 40

**Republic of Korea** 82 (2) 528-5299

**Russia, CIS & The Baltics** +358 (9) 4783 400

**South Africa** +27 11 254 8360

**Spain** +34 (91) 372 6055

**Sweden** +46 8 477 6503/4

**Taiwan** 886 (2) 2722-9622

**United Kingdom & Eire** +44 (0) 1344 392400

**USA** 1 (800) 426-2200

**USA** (Export Sales) 1 (503) 627-1916

For other areas contact Tektronix, Inc. at: 1 (503) 627-7111

Updated 20 September 2002

Our most up-to-date product information is available at:  
[www.tektronix.com](http://www.tektronix.com)



Product Area Assessed: The planning, design/development and manufacture 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.

Copyright © 2003, Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks or registered trademarks of their respective companies.

05/03 HB/SFI

76W-10020-2