# Arbitrary Waveform Generator

## ▶ AWG7000 Series (AWG7102, AWG7101, AWG7052, AWG7051)

### The AWG7000 Series of Arbitrary Waveform Generators Delivers the Industry's Best Mixed Signal Stimulus Solution for Ever-increasing Measurement Challenges

The AWG7000 Series Arbitrary Waveform Generator delivers a unique combination of superior signal stimulus, unrivaled sample rate, bandwidth and signal fidelity and uncompromised usability.

This family offers the industry's best solution to the challenging signal stimulus issues faced by designers verifying, characterizing and debugging sophisticated electronic designs.

With sample rates from 5 GS/s to 20 GS/s (10-Bits), together with 1 to 2 output channels, the toughest measurement challenges in the disk drive, communications, digital consumer and semiconductor design/test industries can be easily solved. The open Windows (Windows XP)-based instruments deliver ease of use and allow connectivity with peripherals and compatibility with third-party software.

### Application Examples

The need for performance arbitrary waveform generation is broad and spans over a wide array of applications. With the AWG7000 Series, Tektronix' 3rd generation of industry leading Arbitrary Waveform Generators represent a new benchmark in performance, sample rate, signal fidelity and timing resolution.

The ability to create, generate or replicate either ideal, distorted or "real-life" signals is essential in the design and testing process. Signal generation with controllable rise and fall times, noise or jitter; pre-emphasis, multi-level and mixed signals; wideband RF and fast changing signals are just some of the capabilities of the AWG7000 Series.

## ▶ Features & Benefits

10 GS/s (20 GS/s) and 5 GS/s models

1 or 2 Arbitrary Waveform Outputs
- Accurate Timing with only 20 $ps_{pk-pk}$ Total Jitter (at $10^{-12}$ BER, Typical)
- 45 ps Tr/Tf (20% to 80%)
- ±100 ps Range (1 ps Resolution) Inter Channel Skew Control

2 or 4 Variable Level Marker Outputs
- Accurate Timing with only 30 $ps_{pk-pk}$ Total Jitter (at $10^{-12}$ BER, Typical)
- 45 ps Tr/Tf (20% to 80%)
- Up to 300 ps Range (1 ps Resolution) Delay Control

Vertical Resolution up to 10-Bit Available: 10-Bits (No Marker Output) or 8-Bits (with Two Marker Outputs)

Up to 64 M (64,800,000) Point Record Length Provides Longer Data Streams

Down to 100 fs Resolution Edge Timing Shift Control

Real-time Sequencing Creates Infinite Waveform Loops, Jumps and Conditional Branches

Intuitive User Interface Shortens Test Time

Integrated PC Supports Network Integration and Provides a Built-in DVD, Removable Hard Drive, LAN and USB Ports

## ▶ Applications

Disk Drive (Magnetic/Optical) Read/Write:
- Up to 5 Gbps Data Rate (2-point/cell) or 50 ps Timing Resolution

Telecom/Data Communications:
- Up to 10 Gbps Data Rate (Binary, Pre-/De-emphasis and Multi-level Logic)

Wireless Communications:
- Up to 5 GHz (4-waveform points/cycle) Arbitrary RF/IF and Wide-bandwidth Modulation I and Q Baseband Signals

Mixed Signal Design and Test:
- 2-channel Analog plus 4-channel Marker Outputs

High-speed, Low-jitter Data/Pulse and Clock Source

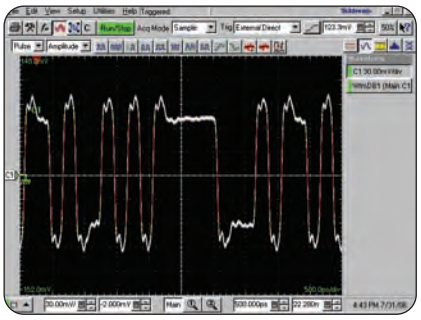
Real-world, Ideal or Distorted Signal Generation – Including All the Glitches, Anomalies and Impairments

Enhanced/Corrupted Playback of DSO Captured Signals

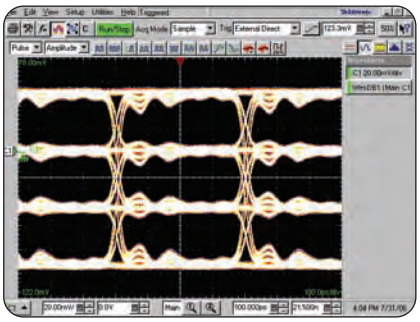
Waveform Vectors Imported from Third-party Tools such as MathCAD, MATLAB, Excel and Others

Tektronix

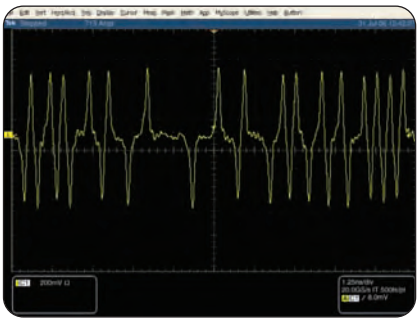
Enabling Innovation



► Figure 1. 5 Gbps pre/de-emphasized signal.



► Figure 2. 20 Gbps 4PAM signal (5 GS/s; AWG7101).



► Figure 3. Hard disk read channel signal (5 Gbps 2 points per cell); AWG7101 with 10 GS/s.

### Pre/De-Emphasized Signal Generation

With increasing transmission speeds and to compensate for frequency characteristics of "lossy" media, the technique of pre/de-emphasis is increasingly applied. Serial data standards such as PCI Express and others have also included pre/de-emphasis tests as a requirement to meet the respective compliance test specification.

The basic theory of pre-emphasis is that for any series of bits of the same value, the first bit always has a higher voltage level than the following bits. By doing so, frequency characteristics of transmission lines can be compensated, thus the signal fidelity at the receiver side increased.

The AWG7000 Series, with its performance and analog output, enables users to directly generate pre/de-emphasized signals for next-generation serial data standards. It also enables users to generate 3-level signals as required for SATA Out-of-Band (OOB) testing.

The direct generation of such signals provides an increased signal quality and avoids cumbersome signal generation via multiple channels and power combiner. See Figure 1.

### Multi-level Signal Generation

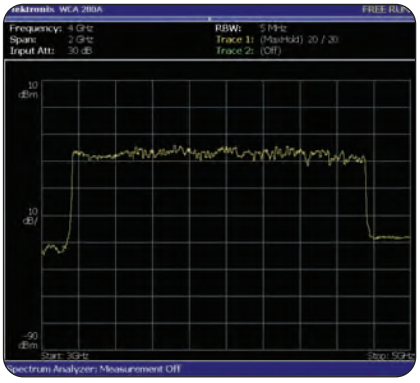
The requirements for serial interfaces are continuously increasing. Higher and higher data rates are required, and the performance of cables and circuits is moving closer to their theoretical limits. One technique to increase the data rate without increasing the transition rate is by applying multi-level signals, wherein a signal can assume more than the standard binary 2 levels.

In multi-level signaling one can think of multi-level discrete amplitudes of a signal. This phenomenon is known as pulse-amplitude-modulation or PAM. A 4PAM signal, a signal with 4 different amplitudes, increases the data rate by four without increasing the transition rate of the signal. Multi-level signals are not only applied for data transmission. Multi-level memory chips, storing more than a single bit in an individual memory element, are being produced and multi-level coding of data for storage on optical disks is being considered as an efficient way to increase storage capacity.

The AWG7000 Series enables you to test your latest design by generating any kind of mixed or multi-level signal.

### Signal Generation for Storage Device Testing

Increasing capacity requirements for storage devices leads to the development of new and faster read-and-write strategies for magnetic as well as optical storage devices. Multi-level coding of data for storage on optical disks is also being considered as an efficient way to increase storage capacity.




► Figure 4. UWB (MBOA) three band (480 Mbps 1795 MAC bytes 96 symbol payload); 3.168 GHz to 4.752 GHz; AWG7102; Interleave at 15.84 GS/s; 0.5$V_{pk\text{-}pk}$.

The AWG7000 Series, with its ability to generate an accurate reproduction of the read-and-write signals, enables users to design, develop and test the latest storage devices. With sample rates up to 20 GS/s and the generation of up to 6 signals (2 analog plus 4 marker) with a clock timing resolution of 100 ps, the AWG7000 Series is representing a new benchmark in the industry. See Figure 3.

### Wideband RF-Signal Generation

In the RF world, technologies ranging from a wireless mouse to a satellite image require test equipment that can provide enough sample rate and resolution to re-create even the most complex RF behavior. The latest digital RF technologies

often exceed the capabilities of current test equipment to generate wide bandwidth and fast changing signals that are increasingly seen in many wireless applications such as radar, UWB and others. The AWG7000 Series enables the direct generation of RF signals and their output via the D/A converter for signals up to a carrier frequency of 5 GHz and a bandwidth of 5.8 GHz. The direct generation of IF or RF signals avoids I/Q degradations and lengthy adjustments associated with traditional generation using I/Q modulators. The AWG7000 Series with its maximum sample rate of 20 GS/s is the sole solution that allows a direct RF signal generation for up to 5 GHz. See Figure 4.

# ▸ Characteristics

## ▸ Arbitrary Waveforms

| | AWG7102 | AWG7101 | AWG7052 | AWG7051 |
|---|---|---|---|---|
| Waveform Length | 2 to 32,400,000 points (or 2 to 64,800,000 points, Option 01) in multiples of 64<br>Interleave:<br>2 to 64,800,000 points (or 2 to 129,600,000 points, Option 01) in multiples of 128 | 2 to 32,400,000 points (or 2 to 64,800,000 points, Option 01) in multiples of 64 | | |
| Number of Waveforms | 1 to 16,000 | | | |
| Sequence Length | 1 to 4,000 steps | | | |
| Sequence Repeat Counter | 1 to 65,536 or infinite | | | |
| Sequence Control | Repeat count, Wait for Trigger, Go-to-N and Jump | | | |
| Jump Mode | Synchronous and Asynchronous | | | |
| Run Modes | | | | |
| Continuous | Waveform is iteratively output. If a sequence is defined, the sequence order and repeat functions are applied | | | |
| Triggered | Waveform is output only once when an external, internal, GPIB, LAN or manual trigger is received | | | |
| Gated | Waveform begins output when gate is true and resets to beginning when false | | | |
| Sequence | Waveform is output as defined by the sequence | | | |
| Interleave Operation | Up to 20 GS/s sample rate (Option 06) | N/A | | |
| Clock Generator | | | | |
| Sampling Frequency | 10 MS/s to 10 GS/s (10 GS/s to 20 GS/s at interleave) | 10 MS/s to 10 GS/s | 10 MS/s to 5 GS/s | |
| Resolution | 8 digits | | | |
| Internal Clock | | | | |
| Accuracy | Within ±(1 ppm+Aging), Aging: within ±1 ppm/year | | | |
| Clock Phase Noise | Less than –90 dBc/Hz at 100 kHz offset | | | |
| Internal Trigger Generator<br>Internal Trigger Rate | | | | |
| Range | 1.0 µs to 10.0 s | | | |
| Resolution | 3 digits, 0.1 µs minimum | | | |
| Skew Control Between Outputs | | | | |
| Range | –100 ps to +100 ps | N/A | –100 ps to +100 ps | N/A |
| Resolution | 1 ps | N/A | 1 ps | N/A |
| Skew Accuracy | ±(10% of setting +10 ps) | N/A | ±(10% of setting +10 ps) | N/A |

## ► Main Arbitrary Waveform Output

| | AWG7102 | AWG7101 | AWG7052 | AWG7051 |
|---|---|---|---|---|
| Digital to Analog Converter | | | | |
| Resolution | 10-Bit (no marker output) or 8-Bit (2 ch markets available): each channel selectable | | | |
| Standard Output (into 50 Ω) | | | | |
| Number of Arb Outputs | 2 | 1 | 2 | 1 |
| Output Style | Differential | | | |
| Output Impedance | 50 Ω | | | |
| Connector | SMA Front | | | |
| Amplitude | | | | |
| Amplitude | Normal: 50 $mV_{pk-pk}$ to 2.0 $V_{pk-pk}$, Direct: 50 $mV_{pk-pk}$ to 1.0 $V_{pk-pk}$ | | | |
| Resolution | 1 mV | | | |
| DC Accuracy | ±(3.0% of Amplitude+2 mV) at offset=0 V | | | |
| Offset | | | | |
| Range | Normal: –0.5 V to + 0.5 V, Direct: N/A | | | |
| Resolution | 1 mV | | | |
| Accuracy | ±(2% of offset ±10 mV) at minimum amplitude | | | |
| Pulse Response | (–1 and 1 waveform data, 0 V offset, through filter at 1 $V_{pk-pk}$) | | | |
| Rise/Fall Time (20 to 80%) | Normal: 350 ps (at 2.0 $V_{pk-pk}$), Direct: 75 ps (at 1.0 $V_{pk-pk}$) | | | |
| Overshoot | Less than 10% (at 1.0 $V_{pk-pk}$ amplitude) | | | |
| Bandwidth (–3dB) | Normal: 750 MHz, Direct: 3.5 GHz | | | |
| Timing Skew | Less than 20 ps (direct output between each channel (+) Pos and (–) Neg output) | | | |
| Low Pass Filter | Normal: 50 MHz, 200 MHz (Bessel type), Direct: N/A | | | |
| Delay from Marker Output | Normal: 50 MHz (9.7 ns), 200 MHz (3.9 ns), Through (2.1 ns), Direct (0.5 ns) | | | |
| Sine Wave Characteristics (up to 5th harmonic) | (10 GS/s clock, 32 waveform points, 312.5 MHz signal frequency, 1.0 V amplitude) | | (10 GS/s clock, 32 waveform points, 156.25 MHz signal frequency, 1.0 V amplitude) | |
| Harmonic Distortion | Normal: ≤–35 dBc, Direct: ≤–42 dBc | | Normal: ≤–40 dBc, Direct: ≤–45 dBc | |
| Non-harmonic Spurious | Normal: ≤–50 dBc (DC to 5 GHz) | | Normal: ≤–50 dBc (DC to 2.5 GHz) | |
| SFDR (Typical) | (10 GS/s clock, amplitude: 1$V_{pk-pk}$, offset: 0 V, filter: "through," 10-Bit DAC operation mode, DC to 5 GHz) | | (5 GS/s clock, amplitude: 1 $V_{pk-pk}$, offset: 0 V, filter: "through," 10-Bit DAC operation mode, DC to 2.5 GHz) | |
| | Normal: 45 dB, Direct: 45 dB (at 312.5 MHz) | | Normal: 51 dB, Direct: 51 dB (at 156 MHz) | |
| Phase Noise ≤ | (10 GS/s clock, amplitude: 1 $V_{pk-pk}$, offset: 0 V, 312.5 MHz) –90 dBc/Hz at 10 kHz offset | | (5 GS/s clock, amplitude: 1$V_{pk-pk}$, offset: 0 V, 156 MHz) ≤–90 dBc/Hz at 10 kHz offset | |
| Random Jitter (Typical) | 1010 clock pattern | | | |
| RMS | Normal: 1.6 ps, Direct: 0.9 ps | | Normal: 1.6 ps, Direct: 0.9 ps | |
| Total Jitter (Typical) | $2^{15-1}$ PN data pattern (@ $10^{-12}$ BER) | | | |
| Peak-to-Peak | Normal: 50 ps at 0.5 Gbps, Direct: 30 ps at 1 G to 6 Gbps | | Normal: 50 ps at 0.5 Gbps, Direct: 30 ps at 1 G to 5 Gbps | |

## ▶ Option 02: High Bandwidth Output Option (Remove Standard Output)

| | AWG7102 | AWG7101 | AWG7052 | AWG7051 |
|---|---|---|---|---|
| Output Style | Differential | | | |
| Output Impedance | 50 Ω | | | |
| Connector | SMA Front | | | |
| Amplitude (into 50 Ω) | | | | |
| Amplitude | 500 $mV_{pk-pk}$ to 1.0 $V_{pk-pk}$ | | | |
| Resolution | 1 mV | | | |
| DC Accuracy | ±(2.0% of Amplitude+2 mV) | | | |
| Offset | N/A | | | |
| Pulse Response | (–1 and 1 waveform data, 1 $V_{pk-pk}$) | | | |
| Rise/Fall Time: (20 to 80%) | 45 ps | | | |
| Overshoot | Less than 3% (at 1.0 $V_{pk-pk}$ amplitude) | | | |
| Bandwidth (–3dB) | 5.8 GHz | | | |
| Timing Skew | Less than 20 ps (between each channel (+) Pos and (–) Neg output) | | | |
| Delay from Marker Output | 0.2 ns | | | |
| Sine Wave Characteristics (up to 5th harmonic) | (10 GS/s clock, 32 waveform points, 312.5 MHz signal frequency, 1.0 V amplitude) | | (10 GS/s clock, 32 waveform points, 156.25 MHz signal frequency, 1.0 V amplitude) | |
| Harmonic Distortion (Typical) | ≤–42 dBc | | ≤–45 dBc | |
| Non-harmonic Spurious (Typical) | ≤–50 dBc, DC to 5 GHz | | ≤–50 dBc, DC to 2.5 GHz | |
| SFDR (Typical) | (10 GS/s clock, amplitude: 1 $V_{pk-pk}$, 10-Bit DAC operation mode, DC to 5 GHz) 44 dB (at 312.5 MHz) | | (5 GS/s clock, amplitude: 1 $V_{pk-pk}$, 10-Bit DAC operation mode, DC to 2.5 GHz) 48 dB (at 156 MHz) | |
| Phase Noise | (10 GS/s clock, amplitude: 1 $V_{pk-pk}$, 312.5 MHz) | | (5 GS/s clock, amplitude: 1 $V_{pk-pk}$, 156 MHz) | |
| | ≤–90 dBc/Hz at 10 kHz offset | | ≤–90 dBc/Hz at 10 kHz offset | |
| Random Jitter (Typical) | 1010 clock pattern | | | |
| RMS | 0.9 ps | | 0.9 ps | |
| Total Jitter (Typical) | $2^{15-1}$ PN data pattern (@ $10^{-12}$ BER) | | | |
| Peak-to-Peak | 20 $ps_{pk-pk}$: at 2 G to 10 Gbps | | 20 $ps_{pk-pk}$: at 2 G to 5 Gbps | |

### ► Option 06: Interleaved High Bandwidth Output in Addition Option 02 (Remove Standard Output) Available for only AWG7102

| | AWG7102 |
|---|---|
| Output Style | Differential |
| Output Impedance | 50 Ω |
| Connector | SMA Front |
| Zeroing Control | On or Off |
| Amplitude (into 50 Ω) | |
| Amplitude | Zeroing On: 250 $mV_{pk-pk}$ to 0.5 $V_{pk-pk}$, Zeroing Off: 500 $mV_{pk-pk}$ to 1.0 $V_{pk-pk}$ |
| Resolution | 1 mV |
| DC Accuracy (Typical) | ±(8.0% of Amplitude+2 mV) at offset = 0 V |
| Offset | N/A |
| Pulse Response | |
| Rise/Fall Time: (20 to 80%) | 45 ps |
| Overshoot | Less than 10% (at 1.0 $V_{pk-pk}$ amplitude) |
| Bandwidth (–3 dB) | 5.8 GHz |
| Delay from Marker Output | 1.0 ns |
| Sine Wave Characteristics (Up to 5th harmonic) | (20 GS/s clock, 32 waveform points, 625 MHz signal frequency) |
| Harmonics Distortion | Zeroing On: ≤–40 dBc (0.5 $V_{pk-pk}$), Off: ≤–40 dBc (1 $V_{pk-pk}$) |
| Non-harmonic Spurious | DC to 5 GHz, Zeroing On: ≤–45 dBc (0.5 $V_{pk-pk}$), Off: ≤–45 dBc (1 $V_{pk-pk}$) |
| SFDR (Typical) | (20 GS/s clock, 10-Bit DAC operation mode, DC to 10 GHz)<br>2.5 GHz: Zeroing On: 30 dB, Off: 40 dB |
| Phase Noise | (20 GS/s clock, 625 MHz) |
| | At 10 KHz offset: Zeroing On: ≤–85 dBc/Hz (0.5 $V_{pk-pk}$), Off: ≤–85 dBc/Hz (1 $V_{pk-pk}$) |

## ▶ Auxiliary Outputs

| | AWG7102 | AWG7101 | AWG7052 | AWG7051 |
|---|---|---|---|---|
| Marker Output | | | | |
| Number of Outputs | 4 (2 per channel) | 2 | 4 (2 per channel) | 2 |
| Output Style | Differential | | | |
| Output Impedance | 50 Ω | | | |
| Connector | SMA Front | | | |
| Level (into 50 Ω) (Twice for Hi_Z Input) | | | | |
| Output Window | –1.4 V to +1.4 V | | | |
| Amplitude | 0.5 $V_{pk-pk}$ to 1.4 $V_{pk-pk}$ | | | |
| Resolution | 10 mV | | | |
| External Termination | –2.8 V to +2.8 V | | | |
| Level Accuracy | ±(10% of setting+50 mV) | | | |
| Rise/Fall Time (20% to 80%) | 45 ps (1.0 $V_{pk-pk}$, Hi+1.0 V, Lo 0 V) | | | |
| Marker Timing Skew | | | | |
| Intra Skew | <13 ps (between each channel (+) Pos and (–) Neg output) (typical) | | | |
| In Same Channel | <30 ps (between Marker 1 and Marker 2 output) (typical) | | | |
| Delay Control Between Markers | | | | |
| Range | 0 to 300 ps | | | |
| Resolution | 1 ps | | | |
| Accuracy | ±(5% of setting+50 ps) | | | |
| Random Jitter (Typical) | 1010 clock pattern | | | |
| RMS | 1 ps | | 1 ps | |
| Total Jitter (Typical) | 2^15-1 PN data pattern (@ $10^{-12}$ BER) | | | |
| Peak-to-Peak | 30 $ps_{pk-pk}$ | | 30 $ps_{pk-pk}$ | |
| 10 MHz Reference Out | | | | |
| Amplitude | 1.2 $V_{pk-pk}$ into 50 Ω. Max 2.5 $V_{pk-pk}$ open | | | |
| Impedance | 50 Ω, AC coupling | | | |
| Connector | BNC Rear | | | |
| DC Outputs | | | | |
| Number of Outputs | 4: Independently controlled outputs | | | |
| Range | –3.0 to +5.0 V | | | |
| Resolution | 10 mV | | | |
| Max. current | ±30 mA | | | |
| Connector | 2x4-Pin header on front panel | | | |

Arbitrary Waveform Generator
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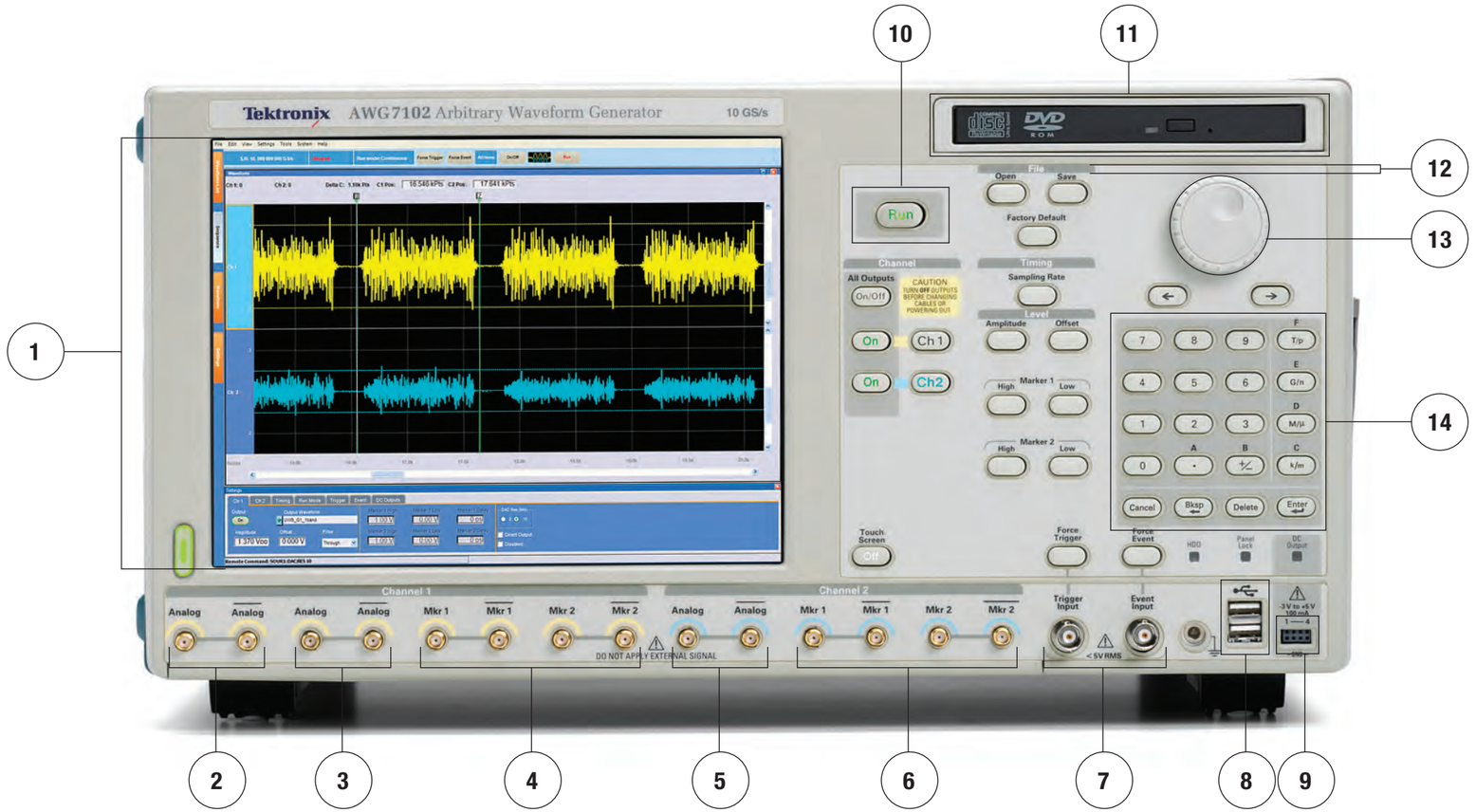


| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10.4-inch Touch Screen | CH 1 Analog (interleave) | CH 1 Analog | CH 1 Marker 1/2 | CH 2 Analog | CH 2 Marker 1/2 | Input: Trigger, Event | USB: For Memory, Mouse, Keyboard | 4-channel DC Output | RUN Channel Selection | CD-RW, DVD-ROM Drive | File Manage Output Setting | Rotary Knob | Keypad |

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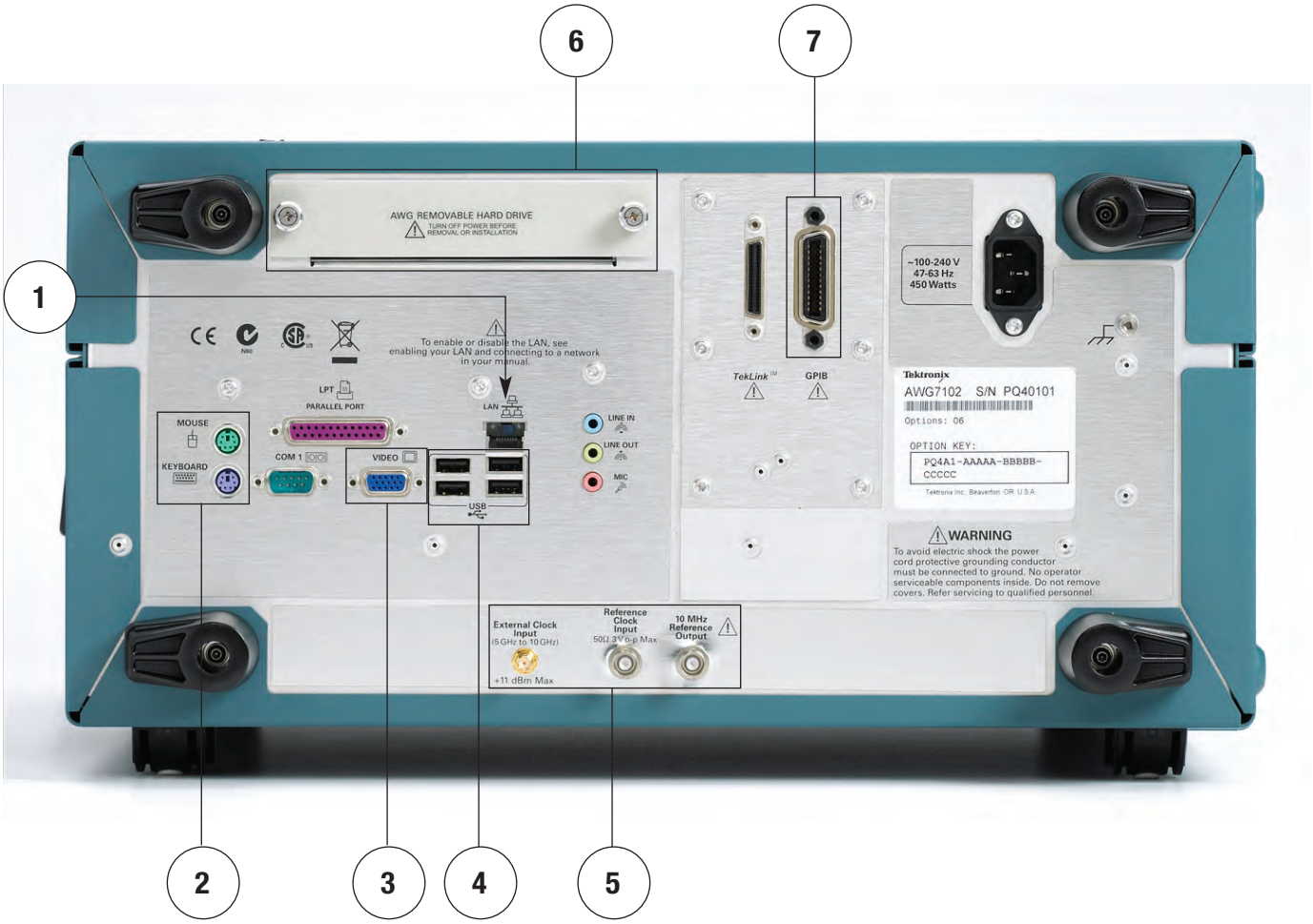


| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| LAN (10/100Base-T) | PS/2 Keyboard/ Mouse | VGA Monitor Out | USB Port x 4 | Reference Input (fixed and variable)<br>Reference Output<br>External Clock Input | 3.5-inch Removable HDD | GPIB |

## ▸ Auxiliary Inputs

| | AWG7102 | AWG7101 | AWG7052 | AWG7051 |
|---|---|---|---|---|
| Trigger/Gate In | | | | |
| Impedance | 1 kΩ or 50 Ω | | | |
| Polarity | POS or NEG | | | |
| Connector | BNC Front | | | |
| Input Voltage Range | 1 kΩ: ±10 V. 50 Ω: ±5 V | | | |
| Threshold | | | | |
| Level | –5.0 V to 5.0 V | | | |
| Resolution | 0.1 V | | | |
| Trigger to Output Uncertainty | | | | |
| Asynchronies Between Internal/Exernal Clock and Trigger Timing (typical) | 2.2 ns at 10 GS/s, 2.6 ns at 7 GS/s, 3.4 ns at 5 GS/s | | | |
| Synchronize Between External Clock and Trigger Timing (typical) | 10 GS/s, x1 clock divider: 8 clock + 50 $ps_{pk-pk}$<br>10 GS/s, x1 clock divider with specific timing: 50 $ps_{pk-pk}$, 10 $ps_{RMS}$<br>The ambient temperature variant allows only ±5_ | | | |
| Synchronize Between External 10 MHz Reference and Trigger Timing (typical) | 10 GS/s setting: 8 clock + 150$ps_{pk-pk}$<br>10GS/s setting with specific timing: 150 $ps_{pk-pk}$, 30 $ps_{RMS}$<br>The ambient temperature variant allows only ±5_ | | | |
| Trigger Mode | | | | |
| Minimum Pulse Width: | 20 ns | | | |
| Trigger Hold-off | 832 * sampling_period–100 ns | | | |
| Delay to Analog Out | 128 * sampling_period+250 ns | | | |
| Gated Mode | | | | |
| Minimum Pulse Width | 1024 * sampling_period+10 ns | | | |
| Delay to Analog Out | 640 * sampling_period+260 ns | | | |
| Event Input | | | | |
| Impedance | 1 kΩ or 50 Ω | | | |
| Polarity | POS or NEG | | | |
| Connector | BNC Front | | | |
| Input Voltage Range | 1 kΩ: ±10 V. 50 Ω: ±5 V | | | |
| Threshold Level | –5.0 V to 5.0 V | | | |
| Resolution | 0.1 V | | | |
| Sequence Mode | | | | |
| Minimum Pulse Width | 20 ns | | | |
| Event Hold Off | 900 * sampling_period+150 ns | | | |
| Delay to Analog Out | 1024 * sampling_period+280 ns (Jump timing: Asynchronous jump) | | | |
| External Clock IN | | | | |
| Input Voltage Swing: | +5 to +11 dBm | | | |
| Impedance | 50 Ω, AC coupled | | | |
| Frequency Range | 5 GHz to 10 GHz: (acceptable frequency drift is ±0.5%) | | | |
| Clock Divider | 1/1, 1/2, 1/4……1/256 | | 1/2, 1/4……1/256 | |
| Connector | SMA Rear | | | |
| Fixed Reference Clock IN | | | | |
| Input Voltage Range | 0.2 $V_{pk-pk}$ to 3.0 $V_{pk-pk}$ | | | |
| Impedance | 50 Ω, AC coupled | | | |
| Frequency Range | 10 MHz, 20 MHz, 100 MHz (with ±0.1%) | | | |
| Connector | BNC Rear | | | |
| Variable Reference Clock IN | | | | |
| Input Ranges | 5 MHz to 800 MHz (acceptable frequency drift is ±0.1%) | | | |
| Input Voltage Range | 0.2 $V_{pk-pk}$ to 3 $V_{pk-pk}$ | | | |
| Impedance | 50 Ω, AC coupled | | | |
| Multiplier Rate | 1 to 2000<br>(2 to 4000 at interleave) | 1 to 2000 | 1 to 1000 | |
| Connector | BNC Rear | | | |

## ▶ AWG7000 Series Common Features

| | |
|---|---|
| Waveform File Import Capability | Tektronix DPO7000/TDS5000/6000/7000 (*.wfm) |
| | AWG400s/500s/610/615/710/710B (*.wfm, *.pat, *.seq) |
| | Text data file (3rd party software creation waveform data: MatLab, MathCad, Excel) |
| S/W Driver for Third Party S/W | IVI-com driver |
| Instrument Control/Data Transfer Ports | |
| GPIB | Remote control and data transfer. (Conforms to IEEE-Std 488.1, compatible with IEEE 488.2 and SCPI-1999.0) |
| Ethernet (10/100/1000Base-T) | Remote control and data transfer. (Conforms to IEEE 802.3). RJ-45 |
| Computer System and Peripherals | Windows XP Professional, 512 MB SDRAM, 20 GB removable Hard Drive at rear (available front mount kit), CD-RW/DVD drive at front, included USB compact keyboard and mouse |
| PC I/O Ports | USB 2.0 compliant ports (6 total, 2 front, 4 rear), PS/2 mouse and keyboard connectors (rear panel), RJ-45 Ethernet connector (rear panel) supports 10/100/1000Base-T, XGA out |
| Display Characteristics | 10.4 inch, LCD color display with touch screen, 1024 (H) x 768 (V) (XGA) |
| **Mechanical Cooling** | |
| Required Clearance | |
| Top and Bottom | 2 cm (0.8 inch) |
| Side | 15 cm (6 inch) |
| Rear | 7.5 cm (3 inch) |
| Power Supply | 100 to 240 VAC, 47 to 63 Hz |
| Power Consumption | 450 W |
| Safety | UL61010-1, CAN/CSA-22.2, No.61010-1-04, EN61010-1, IEC61010-1 |
| Emissions | EN 55011 (Class A), IEC61000-3-2, IEC61000-3-3 |
| Immunity | IEC61326, IEC61000-4-2/3/4/5/6/8/11 |
| Regional Certifications | |
| Europe | EN61326 |
| Australia/New Zealand | AS/NZS 2064 |

## ▶ AWG7000 Series Common Features (continued)

Physical Characteristics

| Dimension | mm | in. |
|---|---|---|
| Height | 245 | 9.6 |
| Width | 465 | 18.0 |
| Length | 500 | 19.7 |
| **Weight (approx.)** | **kg** | **lbs.** |
| Net | 19 | 41.9 |
| Net with Package | 28 | 61.7 |

| Environmental | Operation | Non-operation |
|---|---|---|
| Temperature | +10° C to +40° C | –20° C to +60° C |
| Humidity | 5% to 80% relative humidity (% RH) at up to +30° C, 5% to 45% RH above +30° C up to +50° C | 5% to 90% RH (Relative Humidity) at up to +30° C, 5% to 45% RH above +30° C up to +50° C |
| Altitude | Up to 3,048 meters (10,000 feet) | Up to 12,192 meters (40,000 feet) |
| Random Vibration | 0.27 GRMS, 5 to 500 Hz, 10 minutes per axis | 2.28 GRMS, 5 to 500 Hz, 10 minutes per axis |
| Sine Vibration | 0.33 $mm_{pk\text{-}pk}$ (0.013 $inch_{pk\text{-}pk}$) constant displacement, 5 to 55 Hz | — |
| Mechanical Shock | Half-sine mechanical shocks, 30 g peak amplitude, 11 msec duration, 3 drops in each direction of each axis | — |

# ▸ Ordering Information

| | AWG7102, 7101, 7052, 7051 | | AWG7101, 7052, 7051 | AWG7102 | |
|---|---|---|---|---|---|
| | Standard | | Option 02 | Option 06 (Including Option 02) | |
| | Normal Out | Direct Out | High Bandwidth | High Bandwidth Non Interleave | High Bandwidth with Interleave |
| Maximum Amplitude | 2 $V_{pk-pk}$ | 1 $V_{pk-pk}$ | 1 $V_{pk-pk}$ | 1 $V_{pk-pk}$ | 1 $V_{pk-pk}$ (0.5 $V_{pk-pk}$) |
| Minimum Amplitude | 50 $mV_{pk-pk}$ | 50 $mV_{pk-pk}$ | 500 $mV_{pk-pk}$ | 500 $mV_{pk-pk}$ | 500 $mV_{pk-pk}$ (250 $mV_{pk-pk}$) |
| Offset | ±500 mV | N/A | N/A | N/A | N/A |
| Tr/Tf (20 to 80%) | 350 ps | 75 ps | 45 ps | 45 ps | 45 ps |
| Output Bandwidth | 750 MHz | 3.5 GHz | 5.8 GHz | 5.8 GHz | 5.8 GHz |

### Arbitrary Waveform Generator Mainframe

#### AWG7102

10.0 GS/s (20 GS/s interleaved), 8/10-Bit, 32 M point, 2-channel arbitrary waveform generator.

#### AWG7101

10.0 GS/s, 8/10-Bit, 32 M point, 1-channel arbitrary waveform generator.

#### AWG7052

5.0 GS/s, 8/10-Bit, 32 M point, 2-channel arbitrary waveform generator.

#### AWG7051

5.0 GS/s, 8/10-Bit, 32 M point, 1-channel arbitrary waveform generator.

All models include: Accessory pouch, front cover, USB mouse, compact USB keyboard, lead set for DC Output, stylus for touch screen 2 each, Windows XP operating system restore DVD and instructions, AWG7000 Series product software CD and instructions, Document CD with Browser, Quick Start User Manual, registration card, Certificate of Calibration, power cable. 50 Ω SMA Terminator 3 each (015-1022-01).

Please specify power cord and language option when ordering.

### Instrument Options

**Product Options, AWG7102**

**Opt. 01 –** Waveform Length Expansion (from 32 M to 64 M).

**Opt. 06 –** High Bandwidth output with 20 GS/s interleaved including Option 02 features (alternative for standard output).

**Product Options, AWG7101, AWG7052, AWG7051**

**Opt. 01 –** Waveform Length Expansion (from 32 M to 64 M).

**Opt. 02 –** High Bandwidth output (alternative for standard output).

### Common Options

**International Power Plugs**

**Opt. A0 –** North America power.

**Opt. A1 –** Universal Euro power.

**Opt. A2 –** United Kingdom power.

**Opt. A3 –** Australia power.

**Opt. A5 –** Switzerland power.

**Opt. A6 –** Japan power.

**Opt. A10 –** China power.

**Opt. A99 –** No power cord or AC adapter.

**Opt. A11 –** India power.

### Language Options

**Opt. L0 –** English.

**Opt. L5 –** Japanese.

### Service

**The following service options and programs are available for AWG7000s (AWG7102, 7101, 7052, 7051).**
**Option: (e.g., AWG7102 Opt. C3).**

**Opt. CA1 –** A single calibration event.

**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. R3 –** Repair service 3 years.

**Opt. R5 –** Repair service 5 years.

**Service post-sales offering: (e.g., AWG7102-CA1).**

**CA1 –** A single calibration event.

**R3DW –** Repair service coverage 3 years.

**R5DW –** Repair service coverage 5 years.

**R2PW –** Repair service coverage 2 years post warranty.

**R1PW –** Repair service coverage 1 year post warranty.

**Product Upgrade, AWG7102**
- AWG70UP.
- Opt. M12 Waveform Length Expansion from 32 M point to 64 M point.

**Product Upgrade, AWG7052**
- AWG70UP.
- Opt. M02 Waveform Length Expansion from 32 M point to 64 M point.

**Product Upgrade, AWG7101**
- AWG70UP.
- Opt. M11 Waveform Length Expansion from 32 M point to 64 M point.

**Product Upgrade, AWG7051**
- AWG70UP.
- Opt. M01 Waveform Length Expansion from 32 M point to 64 M point.

### Recommended Accessories

**Transition Time Converter –**
150 ps (10% to 90%). Order 015-0710-00.
250 ps (10% to 90%). Order 015-0711-00.
500 ps (10% to 90%). Order 015-0712-00.
1000 ps (10% to 90%). Order 015-0713-00.
2000 ps (10% to 90%). Order 015-0714-00.

**Pin Header SMA Cable –** 102 cm (40 inch). Order 012-1690-00.

**Pin Header SMB Cable –** 51 cm (20 inch). Order 012-1503-00.

**Rackmount Kit –** Rackmount Kit with instruction. Order 016-1983-00.

**Replacement Hard Disk –** SATA disk assembly (no software installation). Order 065-0753-00.

**Quick Start User Manual –** English. Order 071-1851-00.

**Quick Start User Manual –** Japanese. Order 071-1852-00.

**Service Manual –** Service Manual, English. Order 071-1854-00.

### Warranty

One year parts and labor.

## Arbitrary Waveform Generator

► **AWG7000 Series (AWG7102, AWG7101, AWG7052, AWG7051)**


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Updated 08 May 2007


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

Product(s) are manufactured in ISO registered facilities.

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




5/07 HB/WOW 76W-19779-1


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