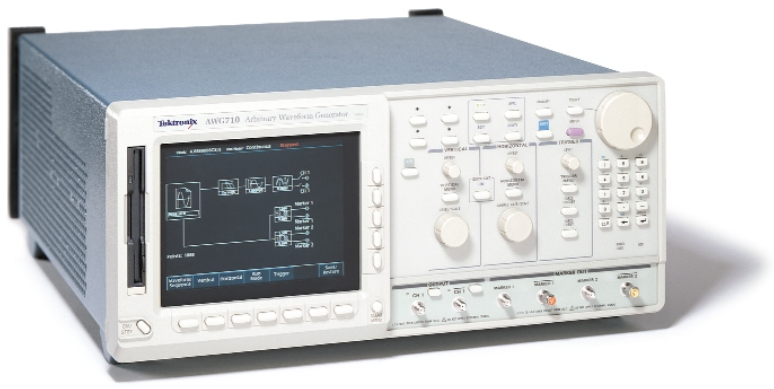
Arbitrary Waveform Generator

AWG710



AWG710.

The AWG710 Arbitrary Waveform Generator Delivers World-class Signal Fidelity at 4.0 GS/s to Solve Ever-increasing Measurement Challenges

The AWG710 combines world-class signal fidelity with ultra high-speed mixed signal simulation, a powerful sequencing capability and graphical user interface with flexible waveform editor, to solve the toughest measurement challenges in the disk drive, communications and semiconductor design/test industries.

Standard Waveforms for Communications

ITU-T	STM1E, E5 CEPT, E4, E3, E2, E1
TI.102	STS-3, STS-1, DS4NA, DS3, DS2, DS1/1C/1A
Fibre Channel	FC1063E, FC531E, FC266E, FC133E
SDH/SONET	OC-48/STM-16, OC-36, OC-24, OC-18, OC-12/STM-4, OC-3/STM-1, OC-1/STM-0
Other	D2, D1, FDD-1, 100Base-TX, Gigabit Ethernet

Features & Benefits

4.0 GS/s Sample Rate Simulates Real-world Signals Up To 2.0 GHz

2 Markers With 1.6 ps_{RMS} Jitter Deliver Ultra-stable Timing to the Device-under-test (DUT)

16 M or 32 M Point Record Length Provide Longer Serial or Rotational Media Data Streams

8-bit Vertical Resolution for Precise Signal Replication

Analog Bandwidth to 2 GHz (Option 02, Calculated Based on Rise Time) Provides the Highest Signal Fidelity of All High-speed AWGs

EZ Function Generator Mode Allows Quick Creation and Edit of Sine, Square, Triangle, Ramp, Pulse and DC Waveforms

Waveform Quick Editor with 300 fs Edge Timing Resolution Delivers Output Edge Control with Near Real-time Precision

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

GPIB and LAN (10/100Base-T) Interfaces

Applications

Disk Drive Read/Write Design and Test

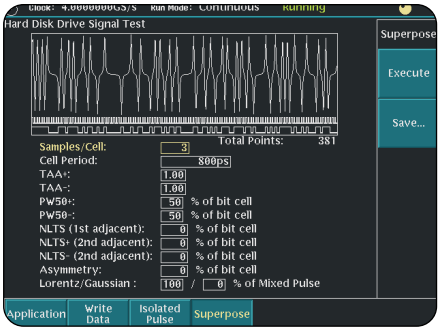
Communications Design and Test
- Arbitrary IF Baseband Signals
- Standard Waveforms for Communications

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

Mixed Signal Design and Test

Real-world Simulations
- Corruption and Enhancement of Ideal Waveforms
- Timing and Amplitude Signal Impairments
- Waveforms Imported from MathCad, MATLAB, Excel and Others

Tektronix
Enabling Innovation



▶ *The built-in signal applications enable you to easily create standard waveforms for disk drive, communications and semiconductor applications. A disk drive read channel is shown here.*

▶ Characteristics

Arbitrary Waveforms

Waveform Length – 960 to 16,200,000 points (or 32,400,000 points, option 01) in multiples of four.

Sequence Length – 1 to 8,000 steps.

Sequence Repeat Counter – 1 to 65,536 or infinite.

Function Generator Waveforms

Operation Mode – Continuous mode only.

Waveform Shape – Sine, Triangle, Square, Ramp, Pulse or DC.

Frequency – 1.000 Hz to 400.0 MHz.

Amplitude –
Range: 0.020 V_{p-p} to 2 V_{p-p} into 50 Ω.
Resolution: 1 mV.

Offset –
Range: –0.500 V to +0.500 V into 50 Ω.
Resolution: 1 mV.

DC Level – DC waveform only.
Range: –0.500 V to +0.500 V into 50 Ω.
Resolution: 1 mV.

Polarity – Normal, Invert.

Duty Cycle –
Range: 0.1% to 99.9%, Pulse waveform only.
Resolution:
1.000 Hz to 4.000 MHz: 0.1% step.
4.001 MHz to 20.00 MHz: 0.5% step.
20.01 MHz to 40.00 MHz: 1% step.
40.01 MHz to 80.00 MHz: 2% step.
80.01 MHz to 100.0 MHz: 2.5% step.
100.1 MHz to 160.00 MHz: 4% step.
160.1 MHz to 200.0 MHz: 5% step.
200.1 MHz to 400.0 MHz: 10% step.

Marker Out –
Marker1 Pulse Width:
Hi/Lo: 20%/80% of Period.
Marker2 Pulse Width:
Hi/Lo: 50%/50% of Period, except 100.1 MHz to 160.0 MHz.
Hi/Lo: 52%/48% of Period, at 100.1 MHz to 160.0 MHz.
Marker Level:
Hi Level: 2 V into 50 Ω.
Lo Level: 0 V into 50 Ω.

Clock Generator

Sampling Frequency – 50.000000 kHz to 4.0000000 GHz.

Resolution – 8 digits.

Internal Clock – Accuracy: ±1 ppm.

Phase Noise – (data clock is 1/4th of the output sample rate)
At 1 GS/s, 10 kHz offset: –80 dBc/Hz.
At 1 GS/s, 100 kHz offset: –100 dBc/Hz.

Operating 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.

Enhanced – Waveform is output as defined by the sequence.

Internal Trigger Generator

Internal Trigger Rate –
Range: 1.0 µs to 10.0 s.
Resolution: 3 digits, 0.1 µs minimum.
Accuracy: ±0.1%.

Main Output

Output Signal – Complementary; CH1 and channel inverse.

Digital to Analog Converter –
Resolution: 8-bits.
Differential Non-linearity: ±1/2-LSB.
Integral Non-linearity: ±1-LSB.

Output Connector – Front Panel SMA.

Normal Out*1

Amplitude –
Output Voltage: –1.5 V to +1.5 V into 50 Ω.
Amplitude: 20 mV to 2.0 V into 50 Ω.
Resolution: 1 mV.
DC Accuracy: ±(2.0% of Amplitude + 2 mV) at offset = 0 V.

Offset –
Range: –0.500 V to +0.500 V into 50 Ω.
Resolution: 1 mV.
Accuracy: ±1.5% of offset ±10 mV at 20 mV amplitude.

Pulse Response – (–1 and 1 waveform data, 0 V offset, through filter at 1 V_{p-p}, clock 1 GS/s):
Rise Time: (10% to 90%): ≤480 ps.
Fall Time: (10% to 90%): ≤480 ps.
Aberrations: At 1.0 V_{p-p}.
Amplitude: ±6%.
Flatness: (after 20 ns from rise/fall edge) ±3%.

Sine Wave Characteristics (4.0 GS/s clock, 32 waveform points, 125 MHz signal frequency, 1.0 V amplitude, 0 V offset, through filter) –
Harmonics: ≤-40 dBc, DC to 1000 MHz.
Noise: ≤-50 dBc, DC to 1000 MHz.
Phase Noise: ≤–85 dBc/Hz at 10 kHz offset.

Filter*1

Type – 20, 50, 100, 200 MHz Bessel low-pass.

Rise Time (10% to 90%) – 20 MHz, 17 ns; 50 MHz, 7.0 ns; 100 MHz, 3.7 ns; 200 MHz, 2.0 ns.

Group Delay – 20 MHz, 18 ns; 50 MHz, 8 ns; 100 MHz, 4.7 ns; 200 MHz, 3 ns.

Direct D/A Out*1

Amplitude – 20 mV_{p-p} to 1.0 V_{p-p} into 50 Ω.

Resolution – 1 mV.

DC Accuracy – ±(2% of Amplitude + 2 mV).

Offset – no function.

DC Offset Accuracy – 0 V ±10 mV at 20 mV amplitude (waveform data = 0).

Pulse Response (–1 and 1 waveform data, at 0.5 V_{p-p}) –
Rise Time (10% to 90%): ≤280 ps.
Fall Time (10% to 90%): ≤280 ps.

Output Impedance – 50 Ω.

*1 Option 02 eliminates the ability to switch between normal and direct D/A out, as well as filter and offset control.

Extended Bandwidth Output (Option 02)

Amplitude – 500 mV_{p-p} to 1.0 V_{p-p} into 50 Ω.

Resolution – 1 mV.

DC Accuracy – ±(2.0% of amplitude + 2 mV).

Offset – No function.

Filter – No function.

DC Offset Accuracy – 0 V ±10 mV (waveform data = 0).

Pulse Response – (–1 and 1 waveform data, at 1.0 V_{p-p}).

Rise Time – (10% to 90%): ≤175 ps.

Fall Time – (10% to 90%): ≤175 ps.

Output Impedance – 50 Ω.

Auxiliary Outputs

Marker

Number – 2 (complementary).

Level –
Hi/Lo: –1.1 V to 3.0 V into 50 Ω (Max. 2.5 V_{p-p}).
-2.2 V to 6.0 V into 1 MΩ. (Max. 2.5 V_{p-p}).
Amplitude: 2.5 V_{p-p} max. into 50 Ω.

Resolution – 0.05 V.

DC Accuracy – Within ±0.1 V ±5% of setting into 50 Ω.

Rise/Fall Time (20% to 80%) – 150 ps (2 V_{p-p}, Hi +1 V, Lo –1 V) into 50 Ω.

Period Jitter –
At 4 GS/s 1.6 ps_{RMS}.
At 2 GS/s 1.9 ps_{RMS}.
At 1 GS/s 2.5 ps_{RMS}.

Cycle-to-Cycle Jitter –
At 4 GS/s 3.1 ps_{RMS}.
At 2 GS/s 3.2 ps_{RMS}.
At 1 GS/s 3.1 ps_{RMS}.

Delay (between analog output and marker output) -
Marker Level: 2 V_{p-p} (Hi +1 V/Lo –1 V).
Analog Output: At 1 V_{p-p}.
Normal Output: 3 ns (Offset 0 V, Filter = "Through.")
Direct Output, –500 ps.

Marker Skew – 70 ps (typical).

Connector – Front-panel SMA.

10 MHz Reference Clockout

Amplitude – 1.2 V_{p-p} into 50 Ω. Max 2.5 V_{p-p} open.

Impedance – 50 Ω, AC coupling.

Connector – Rear-panel BNC.

1/4 Clock Out

Level – ECL 100 K compatible.

Period Jitter –
At 4 GS/s 2.6 ps_{RMS}.
At 2 GS/s 2.4 ps_{RMS}.
At 1 GS/s 1.9 ps_{RMS}.

Cycle-to-Cycle Jitter –
At 4 GS/s 4.8 ps_{RMS}.
At 2 GS/s 3.7 ps_{RMS}.
At 1 GS/s 3.1 ps_{RMS}.

Connector – Rear-panel BNC.

Trigger In

Impedance: 1 kΩ or 50 Ω.
Polarity: POS or NEG.
Connector: Rear-panel BNC.

Input Voltage Range –
1 kΩ: ±10 V.
50 Ω: ±5 V.

Threshold –
Level: –5.0 V to 5.0 V.
Resolution: 0.1 V.
Accuracy: ±5% of level + 0.1 V.

Trigger Mode –
Minimum Pulse Width: 10 ns, 0.2 V amplitude.
Trigger Holdoff: ≥109.5 clocks + 500 ns.
Delay to Analog Out: 211.5 clocks + 17 ns (Normal Output, Filter "Through").

Gate Mode –
Minimum Pulse Width (0.2 V amplitude): 1152 clocks + 10 ns.
Gate Hold Off: ≤1920 clocks + 20 ns.
Delay to Analog Out: 1355 to 1499.5 clocks + 9 ns (Normal Output, Filter "Through").

Event Trigger Input –
Number of Events: 4-bits.
Input Signals: 4 event bits, strobe.
Threshold: TTL level.
Maximum Input: 0 V to +5 V (DC + peak AC).
Impedance 1 kΩ, pull-up to +3.3 V.
Connector: Rear-panel 9-Pin D-sub.

Enhanced Mode –
Minimum Pulse Width: 320 clocks + 10 ns.
Event Hold Off: ≤896 clocks + 20 ns.
Delay to Analog Out (Jump timing: Async):
Strobe: ON, 1627.5 clocks + 7 ns.
Strobe: OFF, 1883.5 clocks + 5 ns.
Event Input to Strobe Input:
Setup Time: 192 clocks + 10 ns.
Hold Time: 192 clocks + 10 ns.

Reference 10 MHz Clock IN –
Input Voltage Range: 0.2 V to 3.0 V_{p-p}, ±10 V maximum.
Impedance: 50 Ω, AC coupled.
Frequency Range: 10 MHz ±0.1 MHz.
Connector: Rear-panel BNC.

General Characteristics

Display – Color TFT LCD.

Display Area – Horizontal: 13.06 cm (5.14 in.), Vertical: 9.70 cm (3.81 in.)

Resolution – 640x480.

Data Storage

Internal Hard Disk – 10.0 GB.

Flash Disk – 256 MB.

Floppy Disk – 3.5", 1.44 MB.

Environment

Temperature –
Operating: 10 °C to +40 °C.
Nonoperating: –20 °C to +60 °C.

Humidity –
Operating: 20% to 80%.
Nonoperating: 5% to 90%.

Altitude (Hard Disk Restriction)-
Operating: Up to 3,000 m (10,000 ft.).
Nonoperating: Up to 12,000 m (40,000 ft.).

Random Vibration –
Operating: 0.27 G_{RMS}, 5 Hz to 500 Hz, 10 minutes.
Nonoperating: 2.28 G_{RMS}, 5 Hz to 500 Hz, 10 minutes.

Shock – Nonoperating: 294 m/s^2 (30 G), half-sine, 11 ms duration (three times each axis, in each direction, 18 total).

EMC Compliance – EC Council Directive 89/336/EEC (EC-92), AS/NZS2064-1/2.

Safety – UL 3111-1, CSA C22.2 No. 1010.1, EN61010-1, IEC61010-1.

Power Supply

Rating – 100 to 240 VAC.

Range – 90 to 250 VAC.

Maximum Power and Current – 220 VA and 5 A.

Frequency – 48 to 63 Hz.

Physical Characteristics

Dimensions	**mm**	**in.**
Height	193	7.60
Width	433	17.05
Depth	508	20.00
Weight	**kg**	**lbs.**
Without package	14.1	31.10
With package	24.5	54.00

Interfaces – GPIB, Ethernet: 10/100Base-T, RJ-45.

PC Keyboard – 6-Pin mini-DIN, rear.

▶ Ordering Information

AWG710

4.0 GS/s, 8-bit, 16 M point, single-channel arbitrary waveform generator.

Includes: User manual (070-A828-00), programmer's manual (070-A829-00), GPIB programming examples (062-A258-00), sample waveform library disk (062-A271-00), performance verification (062-A273-00), Certificate of Calibration (no charge), Arb-Link™ software utility (062-A270-00), 50 Ω SMA male terminators (2) (015-1022-01), power cable. Please specify power plug when ordering.

Options

Opt. 01 – 32 M points waveform memory.

Opt. 02 – Extends analog bandwidth to 2 GHz (calculated based on rise time).

Opt. 10 – Flash disk and standby switch (alternative for standard hard disk drive).

Opt. 1R – Rackmount.

Service

Opt. C3 – Calibration Service 3 years.

Opt. D1 – Calibration Data Report.

Opt. D3 – Calibration Data Report 3 years (with Option C3).

Opt. R3 – Repair Service 3 years.

Recommended Accessories

Service Manual – Order 070-A830-00.

Protective Cover – Order 200-3696-01.

Power Cord Options

Opt. A0 – U.S. plug, 115 V, 60 Hz.

Opt. A1 – Euro plug, 220 V, 50 Hz.

Opt. A2 – UK plug, 240 V, 50 Hz.

Opt. A3 – Australian plug, 240 V, 50 Hz.

Opt. A5 – Swiss plug, 220 V, 50 Hz.

Opt. A99 – No power cord.

Opt. AC – China plug, 50 Hz.

Software

Arb-Link – (062-A270-01) PC-based waveform creation utility.

Warranty

One year parts and labor.

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