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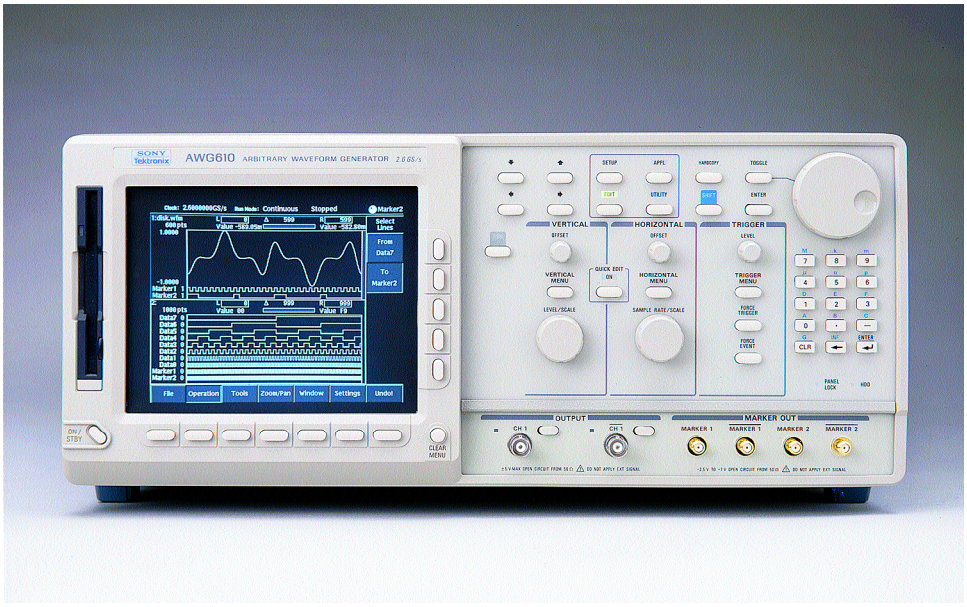
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Tektronix

AWG 610
High Performance Arbitrary Waveform Generator



FEATURES AND BENEFITS

Sample Rate to 2.6 GS/s Tests High-speed Devices and Subsystems

Output Bandwidths Available to Over 800 MHz

Record Length to 8 M Words for Longest Signal Playtimes

Vertical Resolution 8 Bits for Precise Signal Replication

Channel 1 and Complementary Output

Marker Output 2 per Channel, Variable and Complementary for Mixed Signals

400 fs Resolution Edge Shift Control for Greater Timing Precision

Applications

Disk Drive Read/Write Design and Test – Head, Pre-amplifier, Read/Write and servo test.

Communications Design and Test –

The AWG 610 generates predefined waveforms that simulate pseudo random bit streams (PRBS) for physical layer testing to the following electrical standards:

ITU-T	T1.102	Fibre Channel	SDH/Sonet	Misc
STM1E	STS-#	FC1063E	OC/STM16	D2
E5 CEPT	STS-1	FC531E	OC36	D1
E4	DS4NA	FC266E	OC24	FDD1
E3	DS3	FC133E	OC18	100 Base-TX
E2	DS2		OC12/STM4	Gigabit Ethernet
El	DS1/1C/1A		OC3/STM1	
			OC1/STM0	

Applications include characterization of designs for new and emerging standards by simulating "real" physical layer conditions. Margin testing includes nominal and impaired signals that simulate amplitude and timing impairments like:

- Cross talk
- Intersymbol effects
- Reflections
- Ground Bounce
- Noise simulations
- Jitter testing, and more.

Pulse generation –

Duty cycle ranges from 0% to 100% for NRZ data.

Testing clock/gating width variations.

FAMILY FEATURES

Direct Waveform Transfers from DSO

File Transfers from GPIB, Floppy Disk, or 10 Base-T Ethernet

On-Screen Waveform Creation and Editing for Ease-of-Use

Arbitrary or Standard Waveform Generation for Flexible Use

Unique Real-Time Sequencing Effectively Extends Records for Virtually Infinite Record Lengths

Programmable via GPIB and 10 Base-T Ethernet

Built-in Hard Drive for Mass Data Storage

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Real-world simulations –

Corrupt ideal waveforms.

Timing and amplitude signal impairments.

Jitter profiles.

Playback captured waveform by a DPO or DSO.

Replace standard function and sweep generators in wide range of applications.

High Performance AWG Family

The High performance AWG family of Arbitrary Generators from Tektronix can create ideal signals conforming to specific standards or "real-world" signals with speed, precision and ease. They provide the highest clock speeds from 1 GS/s to 2.6 GS/s, 10 or 8 bit DAC resolution and up to 8 Mega bytes of memory depth. They combine waveform generation and editing in one package that enables you to:

- create a waveform from scratch
- automatically transfer a waveform from a DPO or DSO
- download signals created via computer simulation tools
- modify a signal using the built-in editors

These instruments can simulate "real-world" signal impairments such as Noise, Jitter, Fading and more.

Their unique design integrates a graphical editing display with the most powerful hardware output capabilities available. This allows on-screen viewing of waveform editing and simplifies "what-if" test scenarios by easily allowing the creation of composite signals. The family uses a graphical user interface to overcome the historical difficulties associated with developing arbitrary and complex waveforms. Several intuitive and powerful techniques are built-in to develop and edit custom waveforms.

AWG 610

As a premier member of the Tektronix family of arbitrary generators, the AWG 610 is an easy-to-use, high performance, flag-ship product. The AWG 610 provides the world's fastest and deepest memory with its 2.6 GS/s sample clock rate and 8 Mega-points of execution memory.

The AWG 610 provides up to 2 V output or 4 V into a differential input with the complementary output with 460 MHz bandwidth at normal mode (1 V output or 2 V into differential input with the complementary output with 875 MHz bandwidth at direct out), each with 8-Bits vertical resolution. The AWG 610 also provides 2-channels complementary 2.5 V variable marker (Tr/Tf : <150 ps @2 V_{p-p}) data 100 ps deskew resolution at up to 2.6 GHz.

System Considerations

The high performance AWG 610 is fully programmable via GPIB. For throughput critical applications, the AWG 610 is also programmable via the 10-Base-T Ethernet port and provides an order of magnitude faster data transfers. Its GPIB reduces the programming effort required. As a result, it is the ideal addition to provide standard and arbitrary waveform generation for your system environment. An optional rack mount is available for easy hardware integration into your test system.

AWG 610 Characteristics

ARBITRARY WAVEFORMS

Waveform Length – 512 to 8,100,032 points in multiples of eight.

Sequence Length – 1 to 8,000 steps.

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

CLOCK GENERATOR

Sampling Frequency – 50.000000 kHz to 2.6000000 GHz.

Resolution – 8 digits.

Internal Clock – Accuracy: ±1 ppm.

Phase Noise – (data clock is 1/4th of the output sample rate)
At 650 MHz, 10 kHz offset:–80 dBc/Hz.
At 650 MHz, 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 and 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 bit.
Integral Non-Linearity: ±1 bit.

Output Connector – Front Panel SMA.

NORMAL OUT

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

Offset –
Range:–1.000 V to +1.000 V into 50 Ω.
Resolution: 1 mV.
Accuracy: ±(1% of offset + 10 mV) at amplitude = 20 mV.

AWG 610 Characteristics Continued

Pulse Response (–1 and 1 waveform data, 0 V offset, Through filter at 1V_{p-p}):
Rise time (10 to 90%): ≤750 ps.
Fall time (10 to 90%): ≤750 ps.
Aberrations (at 1000 MHz): At 1.0 V_{p-p} Amplitude: ±10%.
Flatness (after 20ns from rise/fall edge): ±3%.

Sinewave Characteristics (2.6 GS/s clock, 32 waveform points, 81.25 MHz signal frequency, 0.5 V amplitude, 0 V offset, Through filter)–
Harmonics – ≤ –40 dBc, DC to 800 MHz.
Noise – ≤ –50 dBc, DC to 800 MHz.
Phase Noise – ≤ –85 dBc/Hz at 10 kHz offset.

FILTER

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, 3.5 ns; 200 MHz, 1.75 ns.

Delay from trigger – 20 MHz, 50 ns + 22 clock; 50 MHz, 40 ns + 22 clock; 100 MHz, 35 ns + 22 clock; 200 MHz, 33 ns + 22 clock; Through, 30 ns + 22 clock.

DIRECT DA OUT AMPLITUDE

Output Voltage – -0.5 V to +0.5 V into 50 Ω.

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 (waveform data = 0).

Pulse Response (–1 and 1 waveform data, at 0.5 V_{p-p}) –
Rise time (10 to 90%): ≤ 400 ps.
Fall time (10 to 90%): ≤ 400 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. 5 V_{p-p}).

Resolution – 0.05 V.

Accuracy – Within ± 0.1 V +5% of setting.

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

Variable Delay –
Range: 0 ns to +1.5 ns.
Accuracy:–30% to +10% at 1.5ms setting.
Resolution: 100 ps.
Marker Skew: 70 ps (typical).

Connector – Front-panel SMA.

10 MHz Reference Clockout –
Amplitude: ≥1 V_{p-p} into 50 Ω. Max 3 V_{p-p} open.
Impedance: 50 Ω, AC coupling.
Connector: Rear-panel BNC.

1/4 Clock Out –
Level: ECL 100 K compatible.
Connector: Rear-panel BNC.

Trigger In –
Impedance: 1 kΩ or 50 Ω.
Polarity: POS or NEG.

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).
Pulse Width (0.2 V amplitude): 10 ns minimum.
Trigger Holdoff: ≥576 clock + 450 ns.
Delay to Marker: 28ns + 22 clock.
Delay to Analog Out: (typical)
(filter through)
30 ns + 22 clock (trigger)
30 ns + 880 clock (gate)
Connector: Rear-panel BNC.

Event Trig Input –
Number of Events: 4 bits.
Input Signals: 4 event bits, strobe.
Threshold: TTL level.
Pulse Width: 128 clocks minimum.
Maximum Input: 0 V to +5 V (DC + peak AC).
Delay to Analog Out: 850 clock + 20ns (ASYNC mode).
Impedance 2.2 kΩ, pull-up to +5 V.
Connector: Rear-panel 9-Pin D-sub.

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.

AWG 610 General Characteristics

DISPLAY

Area – 13.2 cm (5.2 in.) horizontal by 9.9 cm (3.9 in.) vertical.

Resolution – 640 horizontal by 480 vertical pixels.

DATA STORAGE

Internal Hard disk Drive – 2.1 Gbytes. (standard)

Floppy Disk Drive – 3.5 inches, 1.44 Mbytes

Option 10 – Flash Disk replaces HDD, 78Mbytes.

ENVIRONMENTAL, EMC, SAFETY

Temperature –
Operating: 10°C to +40°C.
Non-operating: –20°C to +60°C.

Humidity –
Operating: 20 to 80%, non-condensing.
Non-operating: 5 to 90%, non-condensing.

Altitude –
Operating: Up to 4,500 m. (15,000 ft). Maximum operating temperature decreases 1°C per 300 m above 1.5 km.
Non-operating: Up to 15,000 m (50,000 ft.).

Vibration (test limits) –
Operating: 0.27 g RMS from 5 to 500 Hz, 10 minutes.
Non-operating: 2.28 g RMS from 5 to 500 Hz, 10 minutes.

Shock (test limits) –
Non-operating: 294 m/s^2 (30 g), half-sine, 11 ms duration.

EMC Compliance –
EN50081-1., EN50082-1.
AS/NZS 20641/2.

Safety Compliance –
UL 3111-1., CSA C22.2 No. 1010.1.
EN61010-1 with second amendment.

AWG 610 General Characteristics Continued

POWER

Source Power –
Line Voltage Range: 100 to 240 VAC.
Line Frequency: 48 to 63 Hz.

Power Consumption – 600 W at 8 A .

PHYSICAL CHARACTERISTICS

Dimensions	mm	in.
Height	178	7.6
Width	422	16.6
Depth	560	22.0
Weight	**kg**	**lb.**
Net	17	37.5

WARRANTY

One year parts and labor.

OTHER

Programmable Interface –
GPIB: 24-Pin IEEE488.1 connector.
Ethernet: 10Base-T, RJ-45 connector.
Keyboard Connector – 6-Pin mini-DIN connector.

AWG 610 Ordering Information

AWG 610 –

2.6 GS/s, Single-channel Arbitrary Waveform Generator.

Includes: User Manual (071-0554-00), Programmer Manual (071-0555-00), GPIB Programming Examples Disk (063-3216-00), Sample Waveform Library Disk (063-3217-00), Performance Verification Disk (063-3218-00), Power Cable (U.S. 115 V), Fuse (159-0407-00).

AWG 610 Options

Option 1O- Flash Disk (78 Mbyte) remove HDD and STBY switch.

Option 1R – Rack mount.

Option D1 – Calibration data certificate.

Option C3 – Service; 3 years of Calibration services.

Option D3 – Test Data; Requires C3.

Option R3 – 3 Year extended repair warranty.

International Power Cord Options

Option A1 – Universal Euro 220 V, 50 Hz.

Option A2 – UK 240 V, 50 Hz.

Option A3 – Australian 240 V, 50 Hz.

Option A4 – North American 240 V, 60 Hz.

Option A5 – Switzerland 220 V, 50 Hz.

AWG 610 Recommended Accessories

Service Manual – 071-0556-00.

Protective Cover – 200-3696-01.

GPIB Cable – 012-0991-01.

50 Ω BNC Cable – 012-1342-00.

50 Ω BNC Cable – 012-1256-00.

50 Ω SMB Cable – 012-1458-00.

50 Ω SMB-to-BNC Cable – 012-1459-00.

50 Ω BNC Termination – 011-0049-01.

50 Ω BNC Power Divider – 015-0660-00.

50 Ω SMA Cable (20 inches) – 174-1427-00.

50 Ω SMA Cable (1.0 m) – 174-1341-00.

50 Ω SMA Cable (60 inches) – 174-1428-00.

SMA Precision Cable (1 ns) – 015-0562-00.

SMA Precision Cable (2 ns) – 015-0560-00.

SMA Precision Cable (5 ns) – 015-0561-00.

SMA T Connector – 015-1016-00.

50 Ω SMA Termination – 015-1022-00.

50 Ω SMA Power Divider – 015-1014-00.

SMA(Ma) – BNC(Fe) connector – 015-0554-00.

SMA(Fe) – BNC(Ma) connector – 015-0572-00.

SMA Kit – 020-01693-00.

400 MHz BNC Low-Pass Filter – 015-0659-00.

200 MHz BNC Low-Pass Filter – 015-0658-00.

100 MHz BNC Low-Pass Filter – 015-0657-00.

Instrument Cart – K420.

Additional Accessories

AC Current probe (Transformer) – 1 GHz –CT1.

AC Current probe (Transformer) – 200 MHz –CT2.

AC Current probe (Transformer) – 2 GHz –CT6.

Rack Mount Conversion Kit – 016-1675-00.

WaveWriter Software – Order S3FT400.

For further information, contact Tektronix:

Worldwide Web: for the most up-to-date product information visit our web site at: www.tektronix.com

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