The AWG400 Series performs a wide range of modulated (I&Q) and mixed signal simulations (analog & digital) for wireless and wired data communication, in addition to semiconductor device characterization.

The AWG400 is ideal for design or manufacturing test engineers who need to replicate marginal and erroneous mixed signal conditions. The only product in its class offering 200 MS/s, 16-Bit vertical resolution, 1, 2 or 3 channel configurations and optional digital outputs (16, 32 or 48), the AWG400 is a superior choice for those who need an additional channel, longer memory or higher vertical resolution. The color display, graphical user interface and stand-alone Microsoft Windows-based waveform creating utility supports quick creation, editing and output of custom or imported waveforms.

**Features & Benefits**

- 1, 2 or 3 Independent Waveform Channels
- 16-Bit (1/65536) Vertical Resolution
- 200 MS/s Sample Rate
- Up to 16 M Record Length
- Optional 16/32/48-Bit 100 MHz (CMOS) Digital Data Generator for Mixed-signal Device Testing
- 2, 4 or 6 Digital Marker Outputs
- Channel Internal Independent Noise Generator
- Independent Channel Skew Control
- Independent Channel External Signal ADD-INPUT
- External Clock and External Reference Inputs

**Applications**

- Designing, Testing and Deploying
- Quadrature Digitally Modulated I&Q Signals and Displays
- Mixed (Analog/Digital) Signals
- Stimulus Signals for Imaging Display and Recording Devices (CCD, LCD)
- Enhanced/Corrupted Playback of DSO Captured Signals
- Simulation Waveform Vectors Imported from Mathcad, Matlab, Excel and Others
- Network Communications Physical Layer Testing
- ITU-T (E1, E2, E3)
- T1.102 (DS1, DS1A, DS1C)
- Fibre Channel (FC133E)
- SDH/SONET (OC1/STM0, OC3/STM1)
- D2
- 100Base-TX

**Modulation Standards and Display Types**

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The AWG400 Series Arbitrary Waveform Generators

AWG400 Series

The AWG400 Series Arbitrary Waveform Generators by Tektronix
**Characteristics**

**AWG400 Product Specification Guide**

**Arbitrary Waveforms**
- Waveform Length – 64 to 4,050,000 points (64 to 16,200,000 points with Opt. 01).
- Waveform Segment Length – >64 points, in multiple of 1.
- Sequence Steps – 1 to 8,000 steps (All channels operate the same sequence).
- Repeat Counter – 1 to 65,536 or infinite.

**Clock Generator**
- Sample Frequency – 10.00000 kS/s to 200.0000 MS/s.
- Resolution Accuracy – 7 digits / ±2 ppm (±0.0002%).
- Period Jitter (rms) – 7 ps at 200 MHz (typical).
- Cycle Jitter (rms) – 12 ps at 200 MHz (typical).

**Main Analog Output**
- Number of Outputs – AWG430 – 3, AWG420 – 2, AWG410 – 1.
- Output Style – Complementary (standard), Single-ended (Opt. 05).
- Output Connector / Impedance – BNC front panel (50 Ω).
- Vertical Resolution – 16-Bit.
- D/A Converter (DNL/INL) – ±3 LSB at 25°C / ±4 LSB at 25°C.
- Skew Time Between Channels – ≤±100 ps (Relative to Ch1).
- Variable Delay (Range/Resolution/Accuracy) – -2.52 ns to +2.52 ns / 70 ps / ±70 ps at 25°C.

**Complementary Output**
- Amplitude / Range – -2.0 V to +2.0 V (into 50 Ω) / 20 mV to 2.0 Vp-p (into 50 Ω).
- Resolution / DC Accuracy – ±1.5% of setting + 2 mV (Offset = 0 V).
- Step Response (10% – 90%) – (-1 and 1 waveform data, 0 V offset, filter “Through”).
- Rise Time – ≤4.0 ns.
- Fall Time – ≤4.0 ns.
- Setting Time – ±3% (after 50 ns from rise/fall edges).
- Aberration – ±10% (amplitude >1.0 V), ±7% (amplitude ≤1.0 V).
- SFDR – (Signal frequency: 1.0 MHz, amplitude: 1.0 V, offset: 0 V, filter “Through”) -74 dB (50 MS/s), -74 dB (100 MS/s), -62 dB (150 MS/s).

**Single-ended Output (Option 05)**
- Range / Amplitude – -5.0 V to +5.0 V (into 50 Ω) / 20 mV to 5.0 V (into 50 Ω).
- Resolution / DC Accuracy – ±1.5% of setting + 2 mV (Offset = 0 V).
- Step Response (10% – 90%) – (-1 and 1 waveform data, 0 V Offset, Filter “Through”).
- Rise Time – ≤5.0 ns.
- Fall Time – ≤5.0 ns.
- Setting Time – ±3% (after 50 ns from rise/fall edges).
- Aberration – ±10% (amplitude >1.0 V), ±7% (amplitude >1.0 V).
- SFDR – (Signal frequency: 1.0 MHz, amplitude: 1.0 V, offset: 0 V, filter “Through”) -72 dB (at 50 Ms/s), -70 dB (at 100 Ms/s), -60 dB (at 150 Ms/s).

**Filter**
- Type – Bessel low pass filter 1 MHz, 5 MHz, 20 MHz, 50 MHz.
- Rise Time (10% – 90%) – 350 ns, 70 ns, 18 ns, 7 ns.
- Delay From Trigger – 350 ns, 70 ns, 18 ns, 7 ns (Group Delay).

**Direct Output (Standard)**
- Range / Amplitude – -0.25 V to +0.25 V (into 50 Ω) / 20 mV to 0.5 V (into 50 Ω).
- Resolution / DC Accuracy – ±1.5% of setting + 2 mV (Offset = 0 V).
- Step Response (10% – 90%) – Rise/Fall Time ≤3.0 ns / ≤3.0 ns (filter “Through”).
**AWG400 Series Arbitrary Waveform Generators**

**Marker**
- Maximum Data Rate = 200 Mb/s.

**Number of Outputs**
- AWG430: 6.
- AWG420: 4.
- AWG410: 2 (2 per channel).

**Level / Impedance**
- Hi: ≥2.4 V, Lo: ≤0.1 V (into 50 Ω) LVC541 output driver / 50 Ω.

**Rise Time (10% – 90%)**
- ≤4 ns maximum.

**Output Skew**
- ≤±100 ps.

**Output Connector**
- BNC rear panel.

**Noise (Ch1, Ch2, Ch3 independent)**
- Range / Resolution = -130 dBm/Hz to -95 dBm/Hz / ±0.1%.

**Accuracy / Type**
- ±0.1%.

**Rise Time**
- ≤4 ns (typical) (between clock signals at ≤1 Vp-p input).

**Delay to Analog Out**
- ≤50 ns + 1 clock.

**Output Connector**
- Part of analog front panel BNC.

**Digital Data (output from P4116, Option 03)**
- Number of Outputs = Ch 1 = 16, Ch 1 + 2 = 32, Ch 1+2+3 = 48.

**Input Range**
- -1 V to 1 V (DC + peak AC) / ±50 MHz.

**Frequency Range**
- 10 kHz to 2 MHz / 50 Hz.

**Add**
- Number of ADD In = Ch1, Ch 2, Ch 3 Independent.

**10 MHz Reference**
- Amplitude / Impedance = 1 Vp-p (into 50 Ω). 3 Vp-p max (into 1 MΩ) / Impedance: 50 Ω AC coupled.

**Display Monitor**
- Format / Connector = VGA / D-sub 9-Pin, rear panel.

**Auxiliary Outputs**

**Trigger**
- Impedance / Polarity = 1 kΩ or 50 Ω / positive or negative.

**Input Range / Threshold**
- -1 Ω ±10 V or 50 Ω ±5 V / -5.0 V to 5.0 V.

**Accuracy / Resolution**
- ±(5% of setting level + 0.1 V) / ±0.1 V.

**Minimum Pulse Width / Dead Time**
- 10 ns / 0.2 V @ Amplitude / ≤65 clock + 200 ns maximum.

**Delay to Analog Out**
- 50 ns + 1 clock.

**Connector**
- BNC rear panel.

**Internal Trigger Generator**
- Range / Resolution / Accuracy = 1.0 μs to 10.0 s / 3 digits, minimum 0.1 μs / ±0.1%.

**Event In**
- Number of Events In / Input Signal = 4-Bit / 4 event bits + strobe.

**Threshold / Min. Pulse Width**
- TTL level / >0.1 V / >0.1 Ω.

**Input Range / Impedance**
- ±10 V / 50 Ω.

**Number of Inputs**
- Option 03)

**Add**
- Number of ADD In = Ch1, Ch 2, Ch 3 Independent.

**10 MHz Reference**
- Input Range / Impedance = -1 V to 1 V (DC + peak AC) / ±50 MHz.

**Band Width (–3 dB) / Level Accuracy**
- >50 MHz.

**Connector**
- 9-Pin D-sub rear panel.

**Data Storage**
- Internal Hard Disk = 10.0 GB.
- Flash Disk (Option 10) = 128 MB.
- Floppy Disk = 3.5", 1.44 MB.

**Environment**
- Temperature - Operating / Nonoperating: +10°C to +40°C / -20°C to +60°C.
- Humidity - Operating / Nonoperating: 20% to 90%.
- Altitude - Operating / Nonoperating: Up to 3,000 m (10,000 ft.) / up to 12,000 m (40,000 ft.).
- Vibration - Operating / Nonoperating: 0.27 gmax, 5 Hz to 50 Hz / 2.28 gmax, 5 Hz to 500 Hz.
- Shock - Nonoperating: 294 ms² (30 G), half-sine, 11 ms duration (three time each axis).

**EMC**

**Power Supply**
- Rating / Range = 100 to 240 VAC / 90 to 250 VAC.

**Physical Characteristics**

**AWG410**

**Dimensions**
- mm: 193
- in.: 7.6

**Height**
- 433
- 16.69

**Weight**
- kg: 13.7
- lb.: 30.2

**AWG420**

**Dimensions**
- mm: 193
- in.: 7.6

**Height**
- 433
- 16.69

**Weight**
- kg: 14.1
- lb.: 31.1

**AWG430**

**Dimensions**
- mm: 193
- in.: 7.6

**Height**
- 433
- 16.69

**Weight**
- kg: 14.4
- lb.: 31.7

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

**PC Keyboard**
- 6-Pin mini-DIN, serial communication port.

Waveform Generators • www.tektronix.com
AWG400 Series Arbitrary Waveform Generators

AWG400 Series

Ordering Information

AWG410
200 MS/s, 16-Bit One Channel Arbitrary Waveform Generator.
Includes: User/programmer’s manual 070-A809-00, GPIB programming examples 062-A258-00, sample waveform library disk 062-A257-00, performance verification 062-A270-00, Cal. Certificate no charge, Arb-link software utility 062-A270-00, power cable (U.S. 115 V).

AWG420
200 MS/s, 16-Bit Two Channel Arbitrary Waveform Generator.
Includes: User/programmer’s manual 070-A809-00, GPIB programming examples 062-A258-00, sample waveform library disk 062-A257-00, performance verification 062-A270-00, Cal. Certificate no charge, Arb-link software utility 062-A270-00, power cable (U.S. 115 V).

AWG430
200 MS/s, 16-Bit Three Channel Arbitrary Waveform Generator.
Includes: User/programmer’s manual 070-A809-00, GPIB programming examples 062-A258-00, sample waveform library disk 062-A257-00, performance verification 062-A270-00, Cal. Certificate no charge, Arb-link software utility 062-A270-00, power cable (U.S. 115 V).

Options

Opt. 01 – 16 M point waveform memory.
Opt. 03 – CMOS Digital Data Outputs - 16/32/48-Bit (number of digital output bits depends on AWG400 model).
Note: Option 10 is for ATE and system usage needing 7x24 hour operation. Also adds capability to power on/off by rear panel main switch.
Opt. 1R – Rackmount.

Service Options
Opt. R3 – Repair warranty extended to cover three years.

Recommended Accessories

Power Cord Options
Opt. AC – China.

Software
Arb-Link™ – PC-based stand-alone waveform creation utility.

Warranty
One year parts and labor.

Service Options
Opt. R3 – Repair warranty extended to cover three years.

Recommended Accessories

Power Cord Options
Opt. AC – China.

Software
Arb-Link™ – PC-based stand-alone waveform creation utility.

Warranty
One year parts and labor.

Contact Tektronix:
ASEAN Countries (65) 356-3900
Australia & New Zealand (61) 2888-0100
Austria, Central Eastern Europe, Greece,
Turkey, Malta & Cyprus +43 2236 8092 0
Belgium +32 (2) 715 89 70
Brazil and South America 55 (11) 3741-8360
Canada 1 (800) 661-5625
Denmark +45 (44) 850 700
Finland +358 (9) 4783 400
France & North Africa +33 1 69 86 81 81
Germany +49 (221) 94 77 400
Hong Kong (852) 2585-6688
India (91) 80-2775577
Italy +39 (2) 25086 501
Japan (Sony/Tektronix Corporation) 81 (3) 3448-3111
Mexico, Central America & Caribbean 52 (5) 666-6333
The Netherlands +31 23 56 95555
Norway +47 22 07 07 00
People’s Republic of China 86 (10) 6235 1230
Poland (48) 2 521 5340
Republic of Korea 82 (2) 528-5299
South Africa (27 11) 254-8360
Spain & Portugal +34 91 372 6000
Sweden +46 8 477 65 00
Switzerland +41 (41) 729 36 40
Taiwan 886 (2) 2722-9622
United Kingdom & Eire +44 (0)344 392000
USA 1 (800) 426-2200

For other areas, contact: Tektronix, Inc. at 1 (503) 627-1924

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