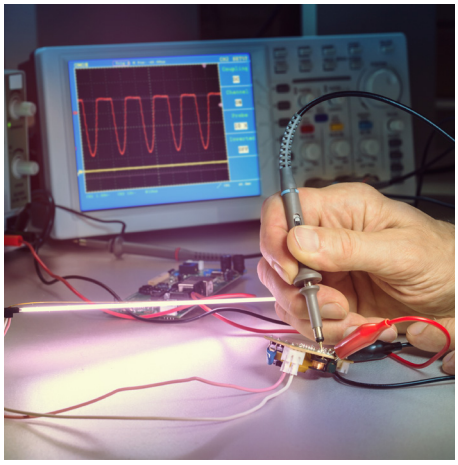
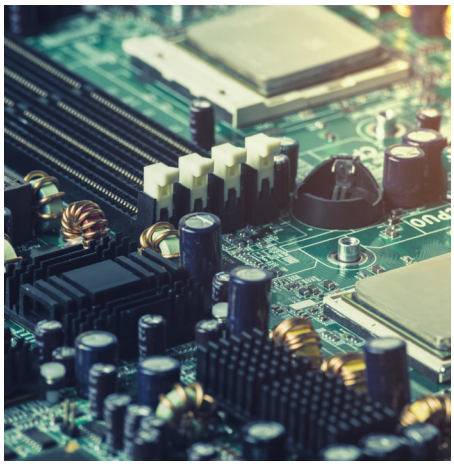
Model 676 High Performance Arbitrary Waveform Generator





Features

- 2 Analog Channels
- 2.5 GS/s 14 Bit Vertical Resolution
- 300 MHz Bandwidth
- Up to 64 Mpts Waveform Memory per Channel
- Rise and fall time less than 1.1 ns

Applications

- Aerospace and Defense
- Institute and University Research
- Semiconductor Tests
- Automative
- IOT and Industry 4.0

Model 676

Arbitrary High Performance Wave Form Generator

Model 676 Arbitrary Waveform Generator

Model 676

Description

The Model 676 offers premium signal integrity with the easiest to use touch screen display interface. Model 676 Graphical User Interface (GUI), the EXPERT RIDER, lets the user quickly generate complex arbitrary waveforms and complex modulations in few clicks. With the Expert Rider, the designers can take advantage of all the AWG mode features with the possibility of adding noise, filters and importing large sets of modulated data like RF or I/Q waveforms.

The Model 676 is an affordable waveform generation platform that helps to stretch the specifications of your project to the limit, offering not just analog output but also digital channels. The analog output voltage can be adjusted in Amplified mode up to 5 Vpp into a 50-Ω load. With up to 1 GHz analog bandwidth, the performing edges down to 350 ps with minimal overshoot and ringing.

The Model 676 also boasts a 100 S/s (Sample/second) to 2.5 GS/s with a 14-bit vertical resolution, providing outstanding signal integrity. A 16/32 digital output option is also available, with each digital output providing up to a 1.25 Gb/s data rate in LVDS format. Digital output, combined and synchronized with analog output signals making it the ideal generator for the most demanding technical applications.
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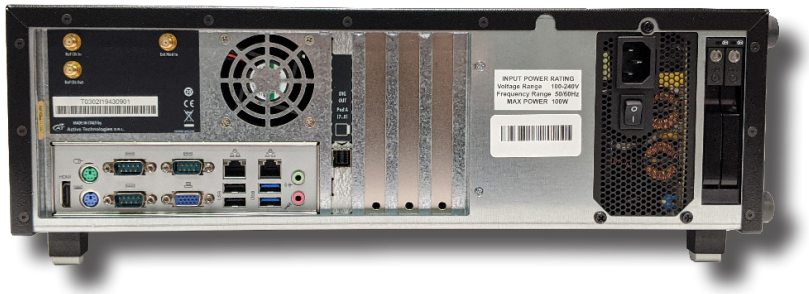
Model 676 Front

Model 676 Back



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Model 676

Model 676 User Interface

Model 676 user interface is designed for touch and it has been developed to put all the capabilities of modern Waveform Generators right at your fingertips. All instrument controls and parameters are accessed through an intuitive UI that recalls the simplicity of modern a tablet computer or smart phones: touch features and gestures are available to engineers and scientists to create advanced waveforms or digital patterns in few touches.

- The swipe gesture gives easy access to the output waveform parameters
- A touch-friendly virtual numeric keypad has been designed to improve the user experience on entering the data.
- Time saving shortcuts and intuitive icons simplify the instrument setup.

Model 676 Interface

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Model 676

Advanced Mode

In Advanced mode, users can define complex waveforms with up to 16,384 entries of analog waveforms and digital patterns in a sequence, in terms of loops, jumps, and conditional branches.

In the Multi-sequence mode, two sequences can be defined to control Channel 1 and Channel 2 (and the corresponding digital channels) separately as generators.

Best in Class Performance in its Price Range

The Model 676 gives users access to the best-in-class DAC technology at an affordable price. It provides up to 2.5 GS/s sampling rate and 14-bit vertical resolution help users generate ultra wideband communication signals with 1GHz modulation bandwidth (2GHz in I/Q modulation) and < -60 dBc SFDR across each channel. The analog channels can be configured to output as differential, single ended, or AC coupled, eliminating the needs of baluns or hybrids in the test path

Mixed-Signal Generation

The Model 676 has optional 16 or 32-bit digital outputs, synchronized with the corresponding analog channels in two 16-bit groups. Each group can be configured as 8-bit full speed (bit rate at half the sampling rate) or 16-bit low speed (bit rate at 1/4 of the sampling rate). The mixed signal generation is a great solution for digital designs and validation, system synchronization and DAC/ADC tests.

The digital output pin meets native LVDS standards, and a digital cable to SMA adapter is available For slower speed application, LVDS to LVTTL converters are available as well.

System Extension with Multi-Unit Synchronization

Up to four instruments can be synchronized together in order to build a real 8 channel waveform generator system, which is extremely useful in the applications where multiple channels are needed, like MIMO

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Model 676 Applications

Automotive

Today's cars rely on highly sophisticated electronic control units with very sensitive electronic components. The Model 676, combining 2.5 GS/s with a 14-bit vertical resolution, is an ideal tool for successfully addressing the new testing challenges in automotive.

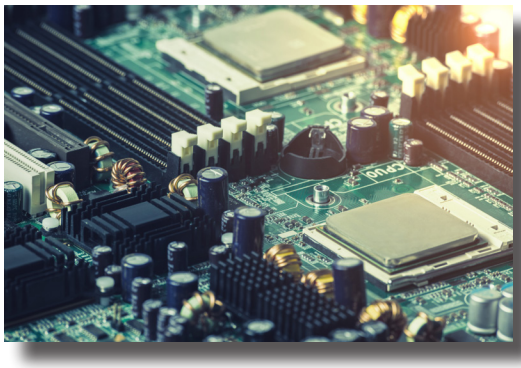
- CAN, CAN-FD,LIN, Flexray,SENT emulation
- EMI debugging, troubleshooting and testing
- Electrical standards emulation up to 20V
- Power MOSFET circuitry in automotive electronics optimization

IoT and Ind 4.0 perfect RF Modulator

The Model 676 has the capacity to emulate complex RF I/Q modulation and test against wireless devices for Internet of Things or Industry 4.0 Applications. Engineers can import waveforms to emulate devices under test, imposing distortions on the waveform (such as noise) to test whether devices comply with standards.

Semiconductor Testing

Semiconductor engineers will also find the ability to emulate noisy or distorted waveforms useful for testing the compliance of their components. The fast edges and pulse generation of the Model 676 can be used to track the parameters of fast power devices.



- Clock and Sensor signals generation
- MOSFET gate drive amplitude signal emulation
- Power up sequences of IC using the low impedance feature (5 Ω output impedance)

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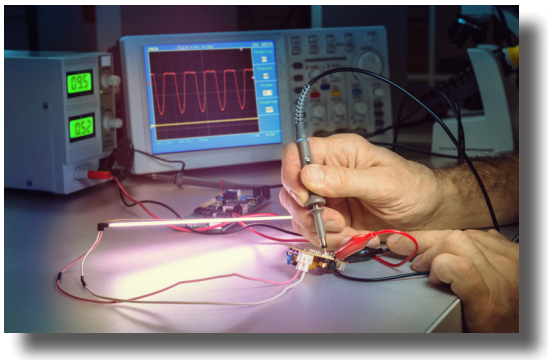
Model 676 Arbitrary Waveform Generator

Model 676

Research Applications

Research centers and universities are key users of the Model 676, which can produce complex waveforms, multilevel signals, and pulse emulation based on variable edges. The Model 676's combination of fast edge generation, excellent dynamic range and simple user interface meets the demands of scientists and engineers working on intensive experiments such as accelerators, tokamak, or synchrotrons, all while saving on the cost of creating specific test boards.

- Emulation of detectors
- Emulation of signal sources adding noise
- Generation/playback of real-world signals
- Emulation of long PRBS sequences
- Modulating and driving laser diode



Aerospace and Defense Applications

The Model 676 works perfectly with electronic warfare signals, such as those produced by Radar or Sonar systems. This generator can also be fitted into a modular system for radio or I/Q signal modulation, as well as create pulses useful in applications such as pulse electron beams, x-ray sources, flash x-ray radiography, lightning pulse simulators, and high power microwave modulators.

- Frequency response, intermodulation distortion and noise-figure measurements
- Phase Locked Loop (PLL) pull-in and hold range characterization
- Radar base-band signals emulation

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Model 676

Model 676 Specifications

Model 676 Specifications	
Number of Channels	
Analog	2
Digital Out	16 or 32-bit
Marker Out	2
Operating Mode	AFG Mode True Arb Mode
Basic Operation Mode (DDS Mode)	
Standard Waveforms	Sine, Square, Pulse, Ramp, more (Noise, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine Continuous, modulation, sweep, burst
Run Modes	Sampling clock: 2.5 GS/s, fixed Vertical resolution: 14-bit
Arbitrary Waveforms	Waveform length: 16,384 points
Advanced Operation Mode	
Run Modes	Continuous, sequencer, triggered, gated
Vertical Resolution	14 bit
Waveform Length	64 to 64 M points (1 M = 220) in multiple of 64 points for length < 320 points, in multiple of 16 points for length ≥ 320 points Standard: 1 M points; Optional: 16 M, 32 M, 64 M points
General Characteristics – Basic mode	
Output Channels	
Connectors	SMAs for DC AMP on front panel
Output Type	Single-ended or differential
Output Impedance	50 Ω (Single-ended) or 100 Ω (differential)
Frequency Range	
Sine	1 µHz to 600 MHz
Square, Pulse	1 µHz to 330 MHz
Ramp, Exponential Rise, Exponential Decay	1 µHz to 30 MHz
Sin(x)/X, Gaussian, Lorentz, Haversine	1 µHz to 60 MHz
Arbitrary	1 µHz to 400 MHz
Frequency Resolution	
Sine, Square, Pulse, Arbitrary Amp, Sin(x)/X, Gausian, Lorentz, Exponential Rise,	1 µHz or 15 digits
Exponential Decay, Haversine	1 µHz or 14 digits
Frequency Accuracy	
Non-ARB	±10e^{-6} of setting
ARB	±10e^{-6} of setting ±1 µHz
Sine Waves	
Flatness (1 V_{p-p}, relative to 1 kHz, typical)	DC to 600 MHz : ±0.5 dB

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Harmonic Distortion (1 V_{p-p})	1 µHz to ≤ 10 MHz: < -60 dBc > 10 MHz to ≤ 50 MHz: < -55 dBc > 50 MHz to ≤ 200 MHz: < -40 dBc > 200 MHz to ≤ 600 MHz: < -28 dBc
Total Harmonic Distortion (1 V_{p-p}, typical)	10 Hz to 20 kHz: < 0.1%
Spurious (1 V_{p-p})	1 µHz to ≤ 10 MHz: < -65 dBc >10 MHz to ≤ 330 MHz: < -55 dBc > 330 MHz to ≤ 500 MHz: < -50 dBc > 500 MHz to ≤ 600 MHz: < -40 dBc
Phase Noise (1 V_{p-p}, 10 kHz offset, typical)	1MHZ: < -115 dBc/Hz 10 MHZ: < -110 dBc/Hz 100 MHZ: < -105 dBc/Hz 600 MHZ: < -90 dBc/Hz
Square Waves	
Rise/Fall Time (typical)	1 ns
Overshoot (1 Vp-p, typical)	< 2%
Jitter (rms, typical)	< 10 ps
Pulse Waves	
Pulse Width	1 ns to (Period - 1 ns)
Resolution	10 ps or 15 digits
Pulse Duty	0.1% to 99.9% (limitations of pulse width apply)
Leading/trailing Edge Transition Time	800 ps to 1000 s
Resolution	1 ps or 15 digits
Overshoot (1 Vp-p, typical)	< 2%
Jitter (rms, typical)	< 10 ps with leading/trailing edge transition time ≥1 ns
Ramp Waves	
Linearity (< 10 kHz, 1 Vp-p, 100% Symmetry, typical)	≤ 0.1%
Symmetry	0% to 100%
Other Waves	
Noise Bandwidth (-3 dB, typical)	400 MHz
Noise Add	When activated, output signal amplitude is reduced to 50%
Level	0.0% to 50% of amplitude (Vp-p) setting
Resolution	0.1%
Arbitrary	
Number of Samples	2 to 16,384
Analog Bandwidth (-3 dB, typical)	400 MHz
Rise/Fall Time (typical)	< 800ps
Jitter (rms, typical)	400 ps
DC	
Range (50 Ω, single-ended)	-2.5 V to 2.5 V
Accuracy	±(1% of |setting| + 5 mV)
Amplitude	
Range (50 Ω, single-ended)	1 µHz ~ 350 MHz: 5 mV_{p-p} to 5 V_{p-p} 350 MHz ~ 550 MHz: 5 mV_{p-p} to 3 V_{p-p} 550 MHz ~ 600 MHz: 5 mV_{p-p} to 2 V_{p-p}
Range (100 Ω, differential)	1 µHz ~ 350 MHz: 10 mV_{p-p} to 10 V_{p-p} 350 MHz ~ 550 MHz: 10 mV_{p-p} to 6 V_{p-p} 550 MHz ~ 600 MHz: 10 mV_{p-p} to 4 V_{p-p}

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Model 676

Amplitude Accuracy	
(1 kHz sine wave, 0 V offset, > 5 mVp-p amplitude, 50 Ω load)	±(1% of setting + 5 mV)
Resolution	1 mV_{p-p} or 4 digits
Output Impedance	Single-ended: 50 Ω, Differential: 100 Ω
Vocm	
Range (50 Ω load, single-ended)	-2.5 V to +2.5 V
Range (High Z load, single-ended)	-5 V to +5 V
Accuracy (50 Ω load, single-ended)	±(1% of |setting| ±5 mV)
Resolution	1 mV or 4 digits
Offset	
Range (50 Ω load, singleended)	±(2.5 Vpk - Amplitude ÷ 2)
Range (High Z load, singleended)	±(5 Vpk - Amplitude ÷ 2)
Accuracy (50 Ω load, singleended)	±(1% of |setting| + 5 mV)
Resolution	1 mV or 4 digits
Window	
Range (50 Ω load, single-ended)	1 µHz ~ 350 MHz: -5 V to +5 V 350 MHz ~ 550 MHz: -4 V to +4 V 550 MHz ~ 600 MHz: -3.5 V to +3.5 V
Range (100 Ω, differential)	1 µHz ~ 350 MHz: -10 V to +10 V 350 MHz ~ 550 MHz: -8 V to +8 V 550 MHz ~ 600 MHz: -7 V to +7 V
Range (High Z, single-ended)	1 µHz ~ 350 MHz: -10 V to +10 V 350 MHz ~ 550 MHz: -8 V to +8 V 550 MHz ~ 600 MHz: -7 V to +7 V
Amplitude Modulation (AM)	
Carrier Waveforms	Internal or external
Modulation Source	Internal or external
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	Internal: 500 µHz to 50 MHz, External: 10 MHz maximum
Depth	0.00% to 120.00%
Frequency Modulation (FM)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal or external
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	Internal: 500 µHz to 50 MHz, External: 10 MHz maximum
Peak Deviation	DC to 300 MHz
Phase Modulation (PM)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal or external
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	Internal: 500 µHz to 50 MHz, External: 10 MHz maximum
Phase Deviation Range	0° to 360°
Frequency Shift Keying (FSK)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal or external
Internal Modulating Waveforms	Square
Key Rate	Internal: 500 µHz to 50 MHz, External: 10 MHz maximum

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Model 676 Arbitrary Waveform Generator

Hop Frequency	1 µHz to 600 MHz
Number of Keys	2
Phase Shift Keying (PSK)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation source	Internal or external
Internal Modulating Waveforms	Square
Key Rate	Internal: 500 µHz to 50 MHz, External: 10 MHz maximum
Hop Frequency	0° to +360°
Number of Keys	2
Pulse Width Modulation (PWM)	
Carrier Waveforms	Pulse
Modulation Source	Internal or external
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	Internal: 500 µHz to 50 MHz, External: 10 MHz maximum
Deviation Range	0% to 50% of pulse period
Sweep	
Type	Linear, Logarithmic, staircase, and user defined
Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Sweep Time	50 µs to 2000 s
Hold/return Times	0 to (2000 s - 50 µs)
Sweep/Hold/Return Time Resolution	20 ns or 12 digits
Total Sweep Time Accuracy (typical)	≤ 0.4%
Start/Stop Frequency Range	Sine: 1 µHz to 600 MHz, Square: 1 µHz to 300 MHz
Trigger Source	Internal/External/Manual
Burst	
Waveforms	Standard waveforms (except DC and Noise), ARB
Type	Trigger or gated
Burst Count	1 to 1,000,000 cycles or Infinite
Internal Trigger Delay	0 to 100 s
Internal Trigger Delay Accuracy (typical)	±(0.1% setting + 5 ps)
Internal Trigger Rate	0 to 500 s
Internal Trigger Interval Range	1 µs to 500 s
Internal Trigger Resolution	2 ns or 12 digits
General characteristics – Advanced mode	
Output Channels	
Connectors	SMAs for AMP, DAC, and AC modes on front panel
Output Type	AMP and DAC modes: single-ended or differential, AC mode: single-ended
Output Impedance	50 Ω single-ended, 100 Ω differential
Channels Skew (Skew between positive and negative outputs (typical)	
Skew Control (between channels) – Range	≤ 20 ps
Skew Control (between channels) – Resolution	0 to 240,000 ps
Skew Control (between channels) – Accuracy	10 ps
Initial Skew	±(10% of setting + 20 ps) < 200 ps from 1.25 GS/s to 2.5 GS/s, < 1 ns below 1.25 GS/s

Model 676 Arbitrary Waveform Generator

Marker Skew	
Range	0 to 101,790 ps
Resolution	78 ps
Accuracy (typical)	±(10% of setting + 140 ps)
Initial Skew	< 1.4 ns from 1.25 GS/s to 2.5 GS/s < 2 ns from 100 MS/s to 1.25 GS/s < 4.5 ns below 100 MS/s
Calculated Bandwidth (0.35 / rise or fall time, typical)	
AMP	460 MHz
DAC	1 GHz
AC	1 GHz
Amplitude Range (single-ended, 50 Ω load)	
AMP	0 to 5 Vp-p (doubled in case of differential or High Z load)
DAC	0 to 0.8 Vp-p (doubled in case of differential or High Z load)
AC	0 to 2 Vp-p (doubled in case of High Z load)
Amplitude Accuracy	
AMP DAC (1 kHz sine, offset 0 V)	±(1% of setting + 5 mVp-p)
AC (100 MHz sine, offset 0 V, typical)	±(2% of setting + 5 mVp-p) - 0.1% of |setting| x temperature deviation
Amplitude Resolution	
AMP, DAC, and AC	0.1 mV or 5 digits
Offset Range (single-ended, 50 Ω load)	
AMP	-2.5 V to +2.5 V (doubled in case of differential or High Z load)
DAC	-0.35 V to +0.35 V (doubled in case of differential or High Z load)
Offset Accuracy	
AMP, DAC	±(1% of |setting| + 5 mV)
Offset Resolution	
AMP, DAC	10 mV or 3 digits
Vocm Range (single-ended, 50 Ω load)	
AMP	-2.5 V to +2.5 V (doubled in case of differential or High Z load)
DAC	-0.35 V to +0.35 V (doubled in case of differential or High Z load)
Vocm Accuracy	
AMP	±(1% of setting + 5 mV)
DAC	±(6% of Vocm range + 5 mV)
Vocm Resolution	
AMP, DAC	10 mV or 3 digits
Voltage Window Range (single-ended, 50 Ω load)	
AMP	1 µHz to 300 MHz: -5 V to 5 V > 300 MHz to 550 MHz: -4 V to 4 V > 550 MHz to 600 MHz: -3.5 V to 3.5 V (doubled in case of differential or High Z load)
DAC	-0.4 V to 0.4 V (doubled in case of differential or High Z load)
AC	-1 V to 1 V (doubled in case of High Z load)

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Harmonic Distortion (Sine wave 32 points at 2.5 GS/s, 78.125 MHz, typical)	
AMP (1 V_{p-p} single-ended)	< -56 dBc (single-ended or differential)
DAC (0.5 V_{p-p} single-ended)	< -60 dBc (single-ended or differential)
AC (1 V_{p-p} single-ended)	< -56 dBc
Spurious (Sine wave 32 points at 2.5 GS/s, 78.125 MHz, typical)	
AMP (1 V_{p-p} single-ended)	< -62 dBc (single-ended or differential)
DAC (0.5 V_{p-p} single-ended)	< -62 dBc (single-ended or differential)
AC (1 V_{p-p} single-ended)	< -55 dBc
SFDR (Sine wave 32 points at 2.5 GS/s, 78.125 MHz, typical)	
AMP (1 V_{p-p} single-ended)	< -56 dBc (single-ended or differential)
DAC (0.5 V_{p-p} single-ended)	< -60 dBc (single-ended or differential)
AC (1 V_{p-p} single-ended)	< -55 dBc
Rise/Fall Time (10% to 90%, typical)	
AMP (1 V_{p-p} single-ended)	< 800 ps
DAC (0.5 V_{p-p} single-ended)	< 350 ps
AC (1 V_{p-p} single-ended)	< 350 ps
Overshoot (typical)	
AMP (1 V_{p-p} single-ended)	< 2% 800 ps
DAC (0.5 V_{p-p} single-ended)	< 1% 450 ps
AC (1 V_{p-p} single-ended)	< 2% 450 ps
Timing and Clock	
Random Jitter on Clock Pattern (rms, typical)	
AMP, DAC	< 5 ps
Total Jitter on Random Pattern (peak-to-peak at 625 Mb/s, PRBS 15 data pattern, typical)	
AMP, DAC	< 150 ps
Digital Outputs (Optional)	
Output Channels	
Connectors	Mini-SAS HD connector on front panel
Number of Connectors	2
Number of Outputs	32-bits (16-bits x 2 groups)
Output Impedance	100 Ω differential
Output Type	LVDS
Rise/Fall Time (10% to 90%, typical)	600 ps
Initial Skew Between Digital Outputs (typical)	< 500 ps between group A and B
Jitter (peak-to-peak, 2.5 GS/s, 1.25 Gb/s, PN15 pattern, BER = 1e-12)	150 ps
Maximum Update Rate	1.25 Gbps (full speed mode, maximum 16-bit) 625 Mbps (low speed mode, maximum 32-bit)
Memory Depth (optional)	Half of analog waveform length (full speed mode), One fourth of analog waveform length (low speed mode)

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8 bit LVDS to LVTTL Converter Probe (Optional AT-DLL8)	
Output Connector	20 position 2.54 mm 2 Row IDC Header
Output Type	LVTTL
Output Impedance	50 Ω nominal
Output Voltage	0.8V to 3.8V programmable in group of 16 bits
Maximum Update Rate	125 Mbps@0.8V and 400 Mbps@3.6V
Dimensions	2in x 0.9in x 3in [52mm x 22mm x 76mm]
Input Connector	Proprietary standard
Cable Length	1 meter
Cable Type	Proprietary standard
Proprietary Mini SAS HD to SMA cable (Optional)	
Output Connector	SMA
Output Type	LVDS
Number of SMA	16 (8 bits)
Cable Type	Proprietary standard
Cable Length	1 meter
Auxiliary Input and Output Characteristics (Marker out)	
Connector Type	SMA on front panel
Number of Connectors	2 (1 for each analog output)
Output Impedance	50 Ω
Output Level (into 50 Ω)	1 V to 2.5 V
Resolution	10 mV
Accuracy (typical)	±(2% setting + 10 mV)
Variable Delay Control	0 to 60606 ps
Resolution	78 ps
Accuracy (typical)	±(10% of setting + 140 ps)
Rise/Fall Time (10% to 90%, 2.5 V, typical)	800 ps
Total Jitter on Random Pattern (peak-to-peak, 2.5 GS/s, 1.25 Gb/s, PN15 pattern, output level 2.5 V, BER = 1e-12)	155 ps
Trigger/Gate Input	
Connector	SMA on the Front Panel
Input Impedance	1.1 kΩ

Model 676 Arbitrary Waveform Generator

Model 676

Slope/Polarity	Positive or negative selectable
Input Damage Level	< -15 V or > +15 V
Threshold Control Level	-10 V to 10 V
Resolution	50 mv
Threshold Control Accuracy (typical)	±(10% of |setting| + 0.2 V)
Input Voltage Swing	0.5 Vp-p minimum
Minimum Pulse Width	12 ns
Initial Trigger/Gate Delay to Analog Output	Basic mode: 384.6 ns ± 50 ps Advanced mode: 20 ns + 2288 sampling clock cycles ±1 sampling clock cycle
Trigger In to Output Jitter (typical)	< 50 ps
Auxiliary Input and Output Characteristics	
Sync In/Out	
Connector Type	Infiniband 4X connector on rear panel
Master to Slave Delay (typical)	48.6 ns
Reference Clock Input	
Connector Type	SMA on rear panel
Input Impedance	50 Ω, AC coupled
Input Voltage Range	-5 dBm to 4 dBm sine or square wave
Damage Level	+8 dBm or ±15 VDC Max
Variable Input Frequency Range	10 MHz to 80 MHz
Reference Clock Output	
Connector Type	SMA on rear panel
Output Impedance	50 Ω, AC coupled
Frequency	10 MHz
Accuracy	± 1.0 x $10e^{-6}$
Aging	± 1.0 x $10e^{-6}$/year
Amplitude (typical)	1.6 Vp-p into 50 Ω, 3.2 Vp-p into Hi-Z
Jitter (rms, typical)	11.5 ps
External Sampling Clock Input	
Connector Type	SMA on rear panel
Input Impedance	50-Ω, AC coupled
Number of Inputs	2 (1 for each channel)
Frequency Range	1.25 GHz to 2.5 GHz
Input Voltage Range	-5 dBm to 4 dBm
Damage Level	+8 dBm or ±15 VDC Max
External Modulation Input	
Connector Type	SMA on rear panel
Input Impedance	10 KΩ
Number of Inputs	2 (1 for each channel)
Bandwidth (typical)	10 MHz with 50 MS/s sampling rate
Input Voltage Range	-1 V to +1 V (except FSK, PSK) FSK, PSK: 3.3 V
Vertical Resolution	14-bit
Power	
Voltage Range	100-240 VAC ±10%

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Frequency Range	47-63 Hz
Max Power Consumption	120 W
Environmental Characteristics	
Temperature (operating)	+32 ºF to 122 ºF [+0 ºC to +50 ºC]
Temperature (non-operating)	-4 ºF to 185 ºF [-20 ºC to +85 ºC]
Humidity (operating)	8% to 90% relative humidity with a maximum wet-bulb temperature of 29 ºC at or below +50 ºC, (upper limit derates to 20.6% relative humidity at +50 ºC). Non-condensing.
Humidity (non-operating)	5% to 98% relative humidity with a maximum wet-bulb temperature of 40 ºC at or below +60 ºC, upper limit derates to 29.8% relative humidity at +60 ºC. Non-condensing.
Altitude (operating)	10,000 ft [3,048 m]
Altitude (non-operating)	39,370 ft [12,000 m]
EMC and Safety	
Safety	UL61010-1, CAN/CSA C22.2 No.61010-1, EN61010-1, IEC61010-1
Emissions	CISPR 11, Class A, EN61000-3-2:2006, EN 61000-3-3:1995
Immunity	EN 61326-1:2006, IEC 61000-4-2:2001, IEC 61000-4-3:2002, IEC 61000-4-4:2004, IEC 61000-4-5:2001, IEC 61000-4-6:2003, IEC 61000-4-11:2004
Regional Certifications	
European Union	EN61326-1
Australia / New Zealand	CISPR 11:2003
General Characteristics	
Display	7 inch, 1024x600, capacitive touch LCD
Operative System	Windows 10
External Dimensions	17.5in x 5.3in x 12.5in [445mm x 135mm x 320mm] (3U 19” rackmount)
Weight	21.4 lbs (9.7 Kg)
Front Panel Connectors	CH1 OUTPUT+ (SMA) CH1 OUTPUT- (SMA) CH1 AC (SMA) CH2 OUTPUT+ (SMA) CH2 OUTPUT- (SMA) CH2 AC (SMA) MARKER OUT 1 (SMA) MARKER OUT 2 (SMA) TRG.IN (SMA) DIGITAL POD A[7..0] DIGITAL POD B[7..0] DIGITAL POD C[7..0] DIGITAL POD D[7..0] 2 USB 3.0 ports

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Model 676 Arbitrary Waveform Generator

Model 676

Rear Panel Connectors	Ref. Clk. IN (SMA) Ext.Clk.In Ch1 (SMA) Ext.Clk.In Ch2 (SMA) Ext.Mod.In Ch1 (SMA) Ext.Mod.In Ch2 (SMA) Ref.Clk.Out (SMA) Sync. Out (Infiniband 4X) Sync. In (Infiniband 4X) Pattern Jump In (DSUB-15) External Monitor ports (DVI, VGA) 4 USB 2.0 ports 2 USB 3.0 ports Ethernet port (10/100/1000BaseT Ethernet, RJ45 port) Audio In/Out ports 2 PS/2 keyboard and mouse ports
Hard Disk	256 GB SSD
Processor	Intel® I3-4170, 3.7 Ghz (or better)
Processor Memory	8 GB

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