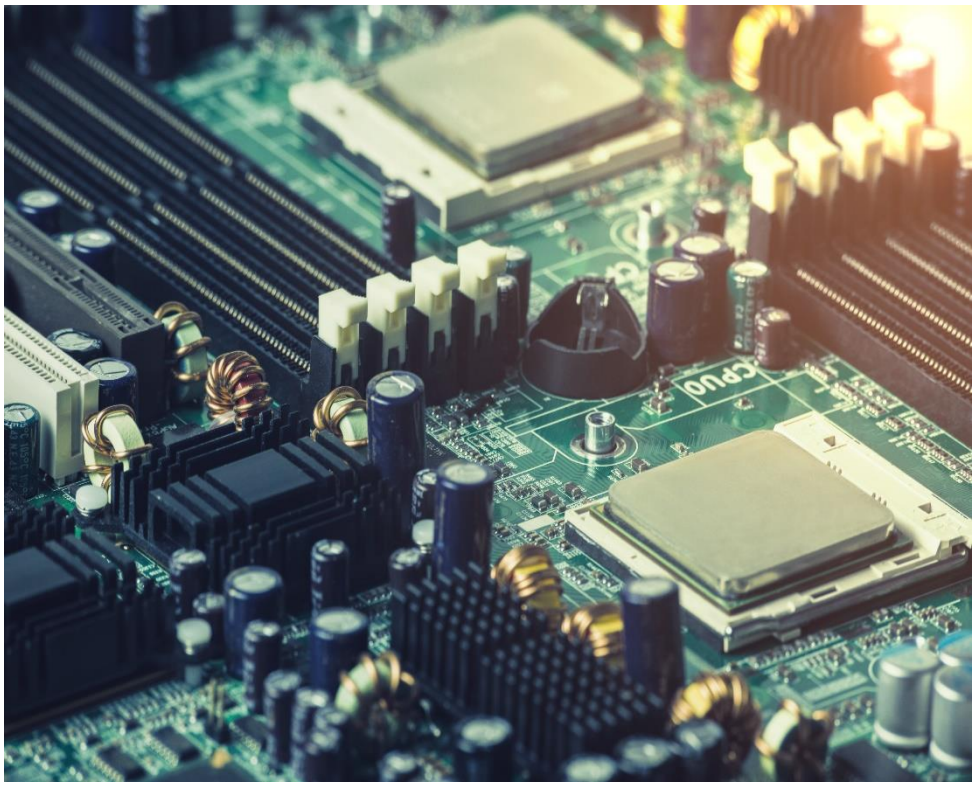
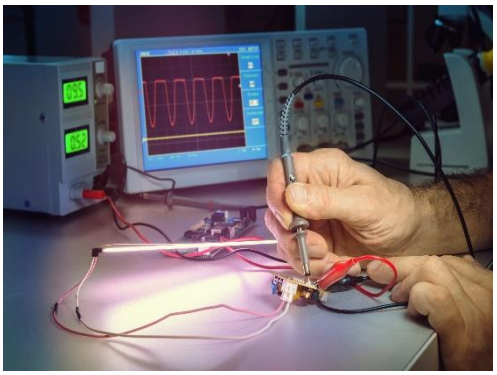
Model 670C | 180 MHz 600 MS/s

Performance Arbitrary Waveform Generator





Features

- 2 or 4 Analog Channels
- 600 MS/s (1.2 GS/s with x2 interpolation)
- 16-bit Vertical Resolution
- Up to 12Vp-p into 50Ω load
- 180 MHz Bandwidth
- Up to 512 Mpts Waveform Memory per Channel
- 8 Digital Channels in synchronous with analog Generation

Applications

- Aerospace and Defense
- Institute and University Research
- Semiconductor Tests
- Automotive
- IoT

Model 670C | 180 MHz 600 MS/s
Arbitrary Waveform Generator

Model 670C Arbitrary Waveform Generator

Model 670C

Description

The Model 670C is a simple-to-use arbitrary waveform generator that operates on Windows based platform with 7” touch screen, front panel buttons and knob. The instrument has two operation modes - Simple Rider AFG (DDS AFG mode) and True Arb (variable clock Arbitrary AWG mode) which make the instrument easier to control. Model 670C supports the standard Ethernet interface for remote control and easy customized instrument programming.

The Model 670C comes with a 180 MHz arbitrary frequency generator and four analog channels operating up to 12 Vp-p into 50 Ω load impedance. An 8 digital output option is also available with each digital output providing up to a 600 Mb/s data rate in LVDS output format. The Model 670C also boasts a 1 S/s (Sample/second) to 600 MS/s (1 S/s to 1.2 GS/s with 2x interpolation) with 16-bit vertical resolution, providing outstanding signal integrity with a rise time/fall time of less than 1 ns.

Model 670C Front

Model 670C Rear

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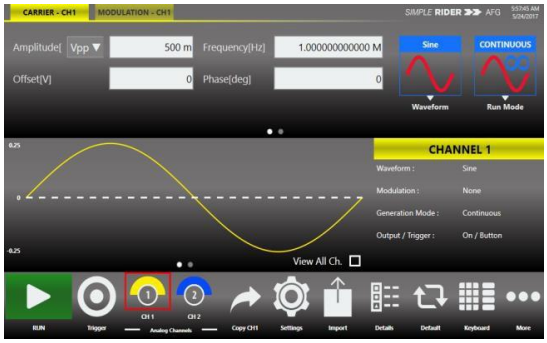
Model 670C

Model 670C User Interface

Simple Rider AFG: Function Generator Mode Interface

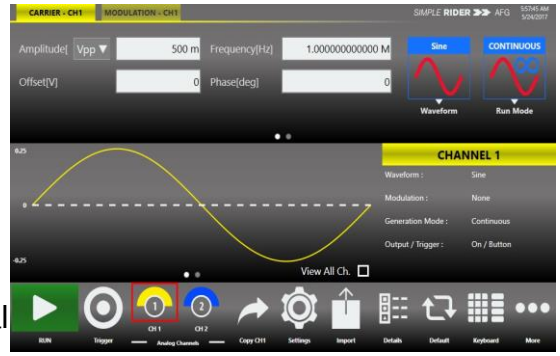
Simple Rider AFG UI is designed for touch and it has been developed to put all the capabilities of modern Waveform Generators right at your fingertips. All instrument controls and parameters are accessed through an intuitive UI that recalls the simplicity of Tablets and modern smart phones: touch features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



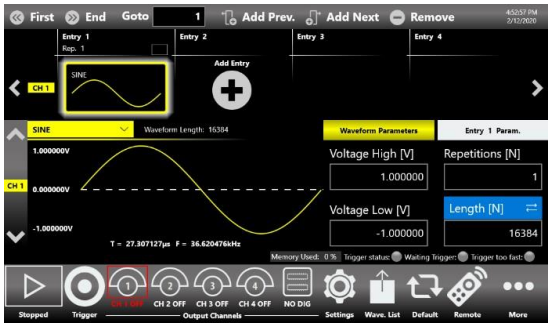
- The swipe gesture gives easy access to the output waveform parameters
- A touch-friendly virtual numeric keypad has been designed to improve the user experience on entering the data.
- Time saving shortcuts and intuitive icons simplify the instrument setup.

Simple Rider TrueArb: AWG and DPG Mode Interface

In **Simple Rider TrueArb** interface, the users can define complex waveforms with up to 16,384 sequence entries of analog waveforms and digital patterns, define their execution flow by means of loops, jumps and conditional branches.



Digital output combined and synchronized with analog output signals represent an ideal tool to troubleshoot and validate digital design. The waveform memory length of up to 512 Mpoints on each channel combined with up to 16,384 and up to 4,294,967,294 repetitions, make the Model 670C the ideal generator for the most demanding technical applications.



Thanks to the intuitive and easy waveform sequencer user interface, the most complex waveform scenarios can be created with just few screen touches.

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Model 670C

Model 670C Applications

Automotive

Today's cars are including a lot of highly sophisticated electronic control unit with very sensitive electronic components. The Model 670C combining 600 MS/s (1.2 GS/s with 2x interpolation) with 16-bit vertical resolution, represents an ideal tool for successfully addressing the new testing challenges in automotive.

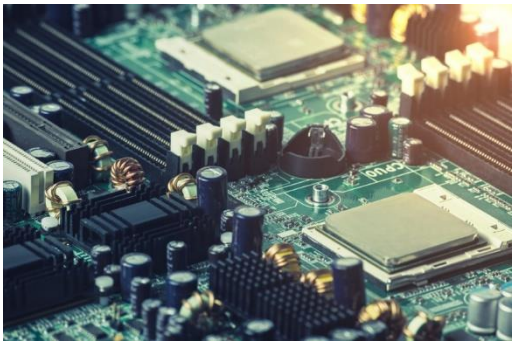
- CAN, CAN-FD,LIN, Flexray,SENT emulation
- EMI debugging, troubleshooting, and testing
- Electrical standards emulation up to 12Vp-p
- Power MOSFET circuitry in automotive electronics optimization

IoT and Ind 4.0 Perfect RF Modulator

The Model 670C will be the iconic instrument for this application. The possibility to emulate complex RF I/Q modulation for simulation and Test vs wireless devices or working on Internet of things of industry 4.0 applications. Each engineer may use the possibility to import waveform to emulate devices under test, impose distortion on waveform (such noise) to test the ability of devices to be compliant to the 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 670C 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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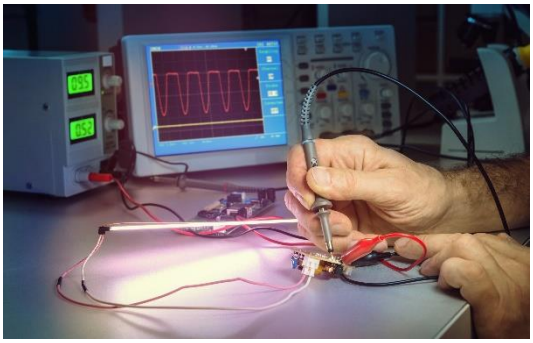
Research Applications

Research centers and universities are key users of the Model 670C, which can produce complex waveforms, multilevel signals, and pulse emulation based on variable edges. The Model 670C'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, to emulate signals without creating specifics 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 670C 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 670C Specifications

All specifications are typical unless noted otherwise. The guaranteed performances are referred to a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 5°C to 40°C and after a 45-minute warm up period. Within ±10°C after auto-calibration

General Specifications		
Number of Channels	**Model 670C-2C**	**Model 670C-4C**
Analog	2	4
Digital Out	0 / 8 optional	0 / 8 optional
Marker Out	1	1
Operating Mode	AFG Mode True Arb Mode	
Amplitude		
Range (50 Ω into 50 Ω)[1]	0 to 6V_{p-p} (12 V_{p-p} optional)	
Accuracy (1kHz sine wave, 0V offset, > 5mV_{p-p} amplitude, 50Ω load) (guaranteed)	±(1% of setting [V_{p-p}] + 5 mV)	
Resolution	<0.5 mV_{p-p} or 5 digits	
Output impedance	Single-ended: 50 Ω, Low Impedance: 0 Ω	
DC		
Amplitude range (50Ω into 50Ω) [1]	-3 V to 3 V (-6 V to 6 V optional)	
Amplitude accuracy (guaranteed)	±(1% of |setting| + 10 mV)	
Output attenuator	0 dB or 20 dB selectable	
AFG Mode Specifications		
Output Channels		
Connectors	BNC on front panel	
Output type	Single-ended	
Output Impedance	50 Ω or 0 Ω (low impedance) programmable	
General Specifications		
Operating mode	DDS mode	
Standard Waveforms	Sine, Square, Pulse, Ramp, more (Noise, DC, Sin(x)/x, Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine)	
Run Modes	Continuous, modulation, sweep, burst	
Arbitrary Waveforms	Vertical resolution: 16-bit Waveform length: 16,384 points	
Internal Trigger Timer Range Resolution Accuracy	 13.4 ns to 100 s 104 ps ±(0.1% setting + 5 ps)	
	Model 670C-2C	**Model 670C-4C**
Sine Waves		
Frequency Range Sine (50 Ω into 50 Ω)	1 µHz to ≤ 150 MHz: 6 V_{p-p} >150 MHz to ≤ 180 MHz: 5 V_{p-p} HV option: 1 µHz to ≤ 50 MHz: 12 V_{p-p} >50 MHz to ≤ 60 MHz: 10 V_{p-p} >60 MHz to ≤ 100 MHz: 8 V_{p-p} >100 MHz to ≤ 150 MHz: 6 V_{p-p} >150 MHz to ≤ 180 MHz: 5 V_{p-p}	

[1] Amplitude doubles into HiZ load

Max Frequency Value	180 MHz
Flatness (1 V_{p-p}, relative to 1 kHz)	DC to 180 MHz: ±0.5 dB
Harmonic Distortion (1 V_{p-p})	1 µHz to ≤ 20 kHz: <-75 dBc >20 kHz to ≤ 1 MHz: <-70 dBc >1 MHz to ≤ 10 MHz: <-65 dBc >10 MHz to ≤ 50 MHz: <-55 dBc >50 MHz to ≤ 120 MHz: <-45 dBc >120 MHz to ≤ 180 MHz: <-40 dBc
Total Harmonic Distortion (1 V_{p-p})	10 Hz to 20 kHz: < 0.04%
Spurious (1 V_{p-p}) (excluding f_{Sa} - f_{out}, f_{Sa} - 2*f_{out})	1 µHz to ≤ 10 MHz: <-80 dBc >10 MHz to ≤ 180 MHz: <-80 dBc + 6 dBc/octave
Phase Noise (1 V_{p-p}, 10 kHz offset)	10 MHZ: < -127 dBc/Hz typ. 100 MHZ: < -115 dBc/Hz typ.
Square Waves	
Frequency Range	1 µHz to 80 MHz: 6V_{p-p} HV option: 1 µHz to ≤ 30 MHz: 12V_{p-p} >30 MHz to ≤ 50 MHz: 11V_{p-p} >50 MHz to ≤ 70 MHz: 10V_{p-p} >70 MHz to ≤ 80 MHz: 9V_{p-p}
Rise/Fall Time	4 ns
Overshoot (1 V_{p-p})	< 1%
Jitter (rms)	< 2 ps
Pulse Waves	
Frequency Range	1 µHz to 80 MHz: 6V_{p-p} HV option: 1 µHz to ≤ 3 MHz: 12V_{p-p} >3 MHz to ≤ 10 MHz: 11V_{p-p} >10 MHz to ≤ 70 MHz: 10V_{p-p} >70 MHz to ≤80 MHz: 9V_{p-p}
Pulse Width	5 ns to (Period – 5 ns)
Pulse width Resolution	20 ps or 15 digits
Leading/trailing edge transition time	4 ns to 1000 s
Transition time Resolution	2 ps or 15 digits
Pulse Duty Cycle	0% to 100%, 14 digits (limitations of pulse width apply)
Overshoot (1 V_{p-p})	< 1%
Jitter (rms, with rise and fall time ≥4ns)	< 2 ps
Double Pulse Waves	
Frequency Range	1 µHz to ≤ 3 MHz: 12V_{p-p} >3 MHz to ≤ 50 MHz: 6V_{p-p} where V_{p-p} = $\|V_{p-p}1\|$ + $\|V_{p-p}2\|$ HV option: 1 µHz to ≤ 3 MHz: 24V_{p-p} >3 MHz to ≤ 10 MHz: 11V_{p-p} >10 MHz to ≤ 50 MHz: 10V_{p-p} where V_{p-p} = $\|V_{p-p}1\|$ + $\|V_{p-p}2\|$
Other Pulse Parameters	Same as Pulse Waves
Ramp Waves	
Frequency Range	1 µHz to 5 MHz
Linearity (< 10 kHz, 1 V_{p-p}, 100%)	≤ 0.1%

Symmetry	0% to 100%
Other Waves	
Frequency Range Exponential Rise, Exponential Decay Sin(x)/x, Gaussian, Lorentz, Haversine	 1 µHz to 5 MHz 1 µHz to 10 MHz
Additive Noise Bandwidth (-3 dB) Level Resolution	 > 200 MHz 0 V to 6 V – | carrier max value [V_{pk}] | 1 mV
Arbitrary	
Number of Samples	2 to 16,384
Frequency range	1 µHz to ≤ 80 MHz
Analog Bandwidth (-3 dB)	87.5 MHz
Rise/Fall Time	4 ns
Jitter (rms)	< 2 ps
Frequency Resolution	
Sine, square, pulse, arbitrary, Sin(x)/x	1 µHz or 15 digits
Gaussian, Lorentz, Exponential Rise, Exponential Decay, Haversine	1 µHz or 14 digits
Frequency Accuracy	
Non-ARB	±2.0 x 10^{-6} of setting
ARB	±2.0 x 10^{-6} of setting ±1 µHz
Modulations	
Amplitude Modulation (AM)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	500 µHz to 48 MHz
Depth	0.00% to 120.00%
Frequency Modulation (FM)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	500 µHz to 48 MHz
Peak Deviation	DC to 180 MHz
Phase Modulation (PM)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	500 µHz to 48 MHz
Phase Deviation Range	0° to 360°
Frequency Shift Keying (FSK)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation Source	Internal
Internal Modulating Waveforms	Square
Key Rate	500 µHz to 48 MHz

Model 670C

Hop Frequency	1 µHz to 180 MHz
Number of Keys	2
Phase Shift Keying (PSK)	
Carrier Waveforms	Standard waveforms (except Pulse, DC and Noise), ARB
Modulation source	Internal
Internal Modulating Waveforms	Square
Key Rate	500 µHz to 48 MHz
Hop Frequency	0° to +360°
Number of Keys	2
Pulse Width Modulation (PWM)	
Carrier Waveforms	Pulse
Modulation Source	Internal
Internal Modulating Waveforms	Sine, Square, Ramp, Noise, ARB
Modulating Frequency	500 µHz to 48 MHz
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	40 ns to 2000 s
Hold/return Times	0 to (2000 s - 40 ns)
Sweep/Hold/Return Time Resolution	20 ns or 12 digits
Total Sweep Time Accuracy	≤ 0.4%
Start/Stop Frequency Range	Sine: 1 µHz to 180 MHz Square: 1 µHz to 80 MHz
Trigger Source	Internal / External / Manual
Burst	
Waveforms	Standard waveforms (except DC and Noise), ARB
Type	Triggered or Gated
Burst Count	1 to 4,294,967,295 cycles or Infinite
True Arb Mode Specifications	
Output Channels	
Connectors	BNC on front panel
Output Type	Single-ended DC coupled
Output Impedance	50 Ω or 0 Ω (low impedance)
General specifications	
Operating Mode	Variable clock (True Arbitrary)
Run Modes	Continuous, Triggered Continuous, Single/Burst, Stepped, Advanced
Vertical Resolution	16 bit
Waveform Length	16 to 2 MSamples per channel (up to 256 MSamples optional)
Waveform Granularity	1 if the entry length is >384 samples 8 if entry length is ≥16 and ≤384 samples
Sequence Length	1 to 16,384
Sequence Repeat Counter	1 to 4,294,967,295 or infinite

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Model 670C Arbitrary Waveform Generator

Timer Range Resolution Range Resolution	 23.52 ns to 7 s ±1 sampling clock period
Analog Channel to Channels skew	
Range	0 to 6.59 us (depending on internal sampling rate)
Resolution	Channel 1/2 to Channel 3/4: ≤ 5 ps, Channel 1/3 to Channel 2/4: 1 DAC sampling period
Accuracy	±(1% of setting + 20 ps)
Initial skew	< 200 ps
Calculated bandwidth (0.35 / rise or fall time) [2]	≥ 160 MHz
Harmonic distortion (Sine wave 32 pts, 1 V_{p-p})	< -62 dBc (@ 600MS/s, 18.75 MHz)
Spurious (Sine wave 32 pts, 1 V_{p-p}	< -80 dBc (@ 600MS/s, 18.75 MHz)
SFDR (Sine wave 32 pts, 1 V_{p-p}, including Harmonics)	< -62 dBc (@ 600MS/s, 18.75 MHz)
Rise/fall time (1 V_{p-p} single-ended 10% to 90%) [2]	≤ 2.2 ns
Overshoot (1 V_{p-p} single-ended)[2]	< 2%
Timing and Clock	
Sampling Rate	
Range	1 S/s to 600 MS/s (1 S/s to 1.2 GS/s with x2 interpolation)
Resolution	16 Hz
Accuracy	±2.0 ppm
Random jitter on clock pattern (rms)	< 2 ps
Digital outputs (Optional)	
Output Channels	
Connectors	Mini-SAS HD connector on rear panel (Non-standard pin-out)
Number of connectors	1
Number of outputs	8 bits
Output impedance	100 Ω differential
Output type	LVDS
Rise/fall time (10% to 90%)	< 1 ns
Jitter (rms)	20 ps
Maximum update rate	600 Mbps
Memory depth	2 MSamples per digital channel (up to 512MSamples
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	0.8 V to 3.8 V programmable
Maximum Update Rate	125 Mbps@0.8V and 400 Mbps@3.6V

[2] 2x interpolation OFF

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Model 670C Arbitrary Waveform Generator

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Dimensions	W 2in x H 0.9in x D 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		
	Model 670C-2C	**Model 670C-4C**
Marker Output		
Connector Type	BNC on front panel	BNC on rear panel
Number of Connectors	1	
Output Impedance	50 Ω	
Output Level (into 50 Ω)		
Amplitude	1 V to 2.5 V	
Resolution	10 mV	
Accuracy	±(2% setting + 10 mV)	
Rise/Fall Time (10% to 90%, 2.5 V_{p-p})	<700 ps	
Jitter (rms)	20 ps	
Marker out to analog channel skew		
Range	True Arb Mode: 0 to 3 µs AFG Mode: 0 to 14 s in Continuous Mode 0 to 3 µs in Triggered Mode	
Resolution	True Arb Mode: 78 ps AFG Mode: 39 ps	
Accuracy	±(1% of setting + 140 ps)	
Initial skew	< 1 ns	
Trigger/Gate Input		
Connector	BNC on front panel	BNC on rear panel
Input Impedance	50 Ω / 1 kΩ programmable	
Slope/Polarity	Positive or negative or both	
Input Damage Level	< -15 V or > +15 V	
Threshold Control Level	-10 V to 10 V	
Resolution	10 mv	
Threshold Control Accuracy	±(10% of |setting| + 0.2 V)	
Input Voltage Swing	0.5 V_{p-p} minimum	
Minimum Pulse Width (1V_{p-p})	3 ns	

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Initial Trigger/Gate Delay to Analog Output	AFG mode: <400 ns (<460 ns in triggered sweep mode) True Arb mode: <131*DAC sampling period + 22.5 ns (<143*DAC sampling period+22.5 ns with 2x interpolation)
Trigger In to Output Jitter	AFG mode: <45 ps True Arb mode: 0.29*DAC sampling period
Maximum Frequency	AFG mode: 65 MTps on Rising/Falling Edge, 80 MTps on Both Edges True Arb mode: 42.5 MTps where MTps = Mega Transitions per second
Reference Clock Input	
Connector Type	SMA on rear panel
Input Impedance	50 Ω, AC coupled
Input Voltage Range	-4 dBm to 11 dBm sine or square wave (rise time T10-90 <1ns and duty cycle from 40% to 60%)
Damage Level	+14 dBm
Frequency Range	5 MHz to 100 MHz
Reference Clock Output	
Connector Type	SMA on rear panel
Output Impedance	50 Ω, AC coupled
Frequency	10 MHz
Accuracy	± 2.0 x $10e^{-6}$
Aging	± 1.0 x $10e^{-6}$/year
Amplitude	1.65 V
Jitter (rms)	<20 ps
Power	
Source Voltage and Frequency	100 to 240 VAC ±10% @ 45 Hz to 66 Hz
Max. power consumption	100 W
Environmental characteristics	
Temperature (operating)	+41 ºF to 104 ºF [+5 ºC to +40 ºC]
Temperature (non-operating)	-4 ºF to 140 ºF [-20 ºC to +60 ºC]
Humidity (operating)	5% to 80% relative humidity with a maximum wet bulb temperature of 84°F at or below +104°F, (upper limit de–rates to 20.6% relative humidity at +104°F). Non-condensing.
Humidity (non-operating)	5% to 95% relative humidity with a maximum wet bulb temperature of 104°F at or below +140°F, upper limit de–rates to 29.8% relative humidity at +140°F. Non-condensing.
Altitude (operating)	9,842 feet (3,000 meters) maximum at or below 77°F
Altitude (non-operating)	39,370 feet (12,000 meters) maximum
EMC and Safety	
Compliance	CE compliant
Safety	EN61010-1
Main Standards	EN 61326-1:2013 – Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
Immunity	EN 61326-1:2013

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Model 670C Arbitrary Waveform Generator

Model 670C

System specifications		
	Model 670C-2C	**Model 670C-4C**
Display	7”, 1024x600, capacitive touch LCD	
Operative System	Windows 10	
External Dimensions	W 362 mm – H 143 mm – D 258 mm (3U 10” rackmount)	
Weight	6.25 kg	
Front panel connectors	CH1, CH2 OUTPUT (BNC) MARKER OUT (BNC) TRIGGER IN (BNC)	CH1, CH2 OUTPUT (BNC) CH3, CH4 OUTPUT (BNC)
Rear panel connectors	REF CLK IN (SMA) REF CLK OUT (SMA) External Monitor ports DIGITAL POD A[7..0] 1 USB 2.0 ports or more Ethernet port (10/100/1000BaseT Ethernet, RJ45 port) 2 PS/2 keyboard and mouse ports	REF CLK IN (SMA) REF CLK OUT (SMA) MARKER OUT (BNC) TRIGGER IN (BNC) External Monitor ports DIGITAL POD A[7..0] 1 USB 2.0 ports or more Ethernet port (10/100/1000BaseT Ethernet, RJ45 port) 2 PS/2 keyboard and mouse ports
Hard Disk	240 GB SSD or better	
Processor	Intel® Celeron J1900, 2 GHz (or better)	
Processor Memory	4 GB or better	

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