

Product Datasheet - Technical Specifications



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Arbitrary/Function Waveform Generators

4078C Series



The 4078C Series Arbitrary/Function Waveform Generators are versatile, high-performance dual-channel arbitrary waveform generators with 16-bit amplitude resolution. They provide variable output voltages from 0 to 10 Vp-p into 50 ohms, up to 20 Vp-p into an open circuit, and a continuously variable DC offset to bias the output signal at a desired level.

Custom arbitrary waveform generation is implemented with a true point-by-point design, offering improved signal integrity by producing significantly less jitter and distortion compared to a DDS based architecture.

AWG Applications

True point-by-point AWG capabilities make these generators suitable for simulating clock signals, generating triggers, or validating serial data buses. Applications include electronic design, sensor simulation, and other applications requiring precise arbitrary waveform generation.

Generate high resolution true arbitrary waveforms up to 250 MSa/s without skipping points. Use the provided software to edit waveforms and convert them from .txt, .csv and .bin files to .arb files for download to the instrument. Alternatively, custom waveforms can be created from the front panel using the built-in waveform editor.

Extensive features such as internal or external AM, FM, and FSK modulation along with versatile sweep capabilities and variable edge pulse generation make these generators suitable for a wide range of applications.

AWG Software

Download the 407XC software to convert any text, binary, or CSV file into an arbitrary waveform file. Upload files directly to the instrument via USBTMC or LAN, or export the file to a USB flash drive and recall it from the front panel.

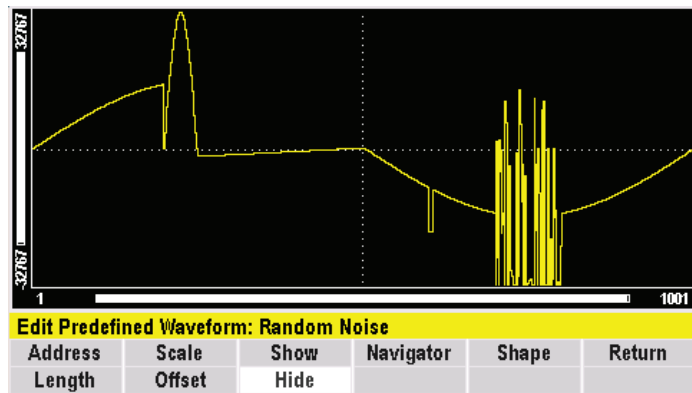
Features and benefits

- Generate waveforms up to 30 MHz (4078C) and 50 MHz (4079C)
- 2 channels with dedicated output ON/OFF buttons for each channel
- Up to 250 MSa/s sampling rate
- Waveform length up to 4 Mpts/ch
- Amplitude range of 0 to 10 Vpp into 50 Ω or up to 20 Vpp into an open circuit
- 16-bit amplitude resolution
- Linear and logarithmic sweep
- Modulation techniques include: AM, FM, PM, BPSK, and FSK
- Adjustable duty cycle
- Continuous, triggered, burst, and gate modes
- Internal/external triggering and programmable markers
- Variable DC offset ± 5 V
- Low jitter < 25 ps
- NISPOM-compliant sanitization to securely restore factory settings
- USB (USBTMC-compliant) and LAN interfaces standard
- 4.3-inch LCD and Internal memory to store/recall instrument setups
- Closed-case calibration
- Overload protection of the outputs
- cTUVus certification mark fulfills CSA and UL safety standards

Model	4078C	4079C/4079C-GPIB
Frequency Range	30 MHz	50 MHz

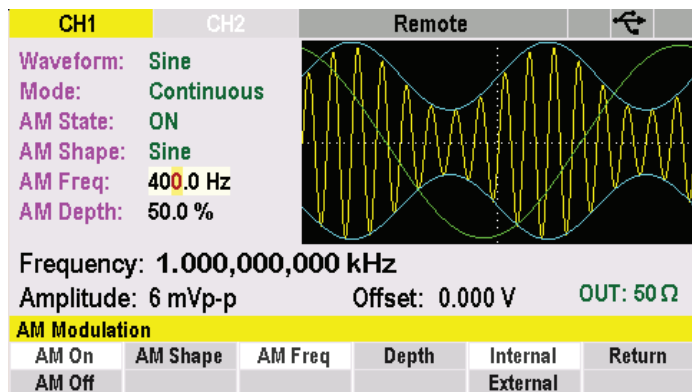
Operation Highlights

Arbitrary waveform



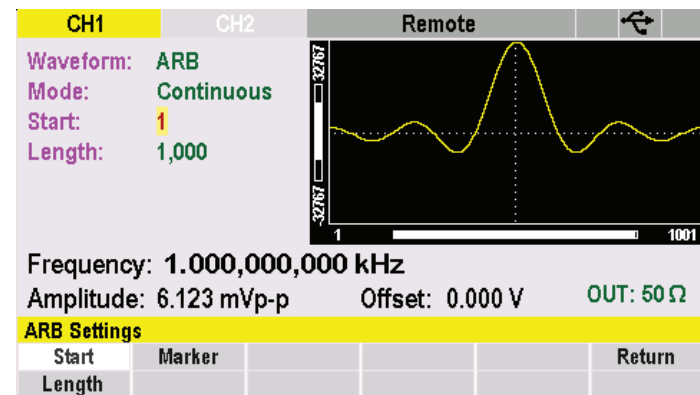
From the front panel, arbitrary waveforms can be defined from scratch by entering data point-by-point or by loading and modifying predefined waveforms.

Modulation



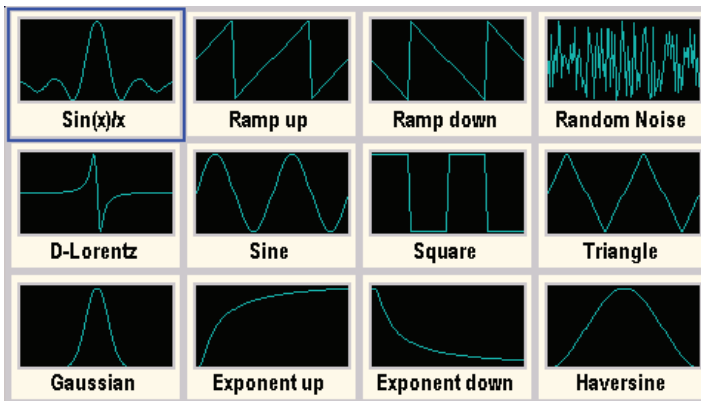
These generators provide a variety of modulation schemes along with combined AM plus FM capabilities. Simulate analog VCOs and VCAs by applying a voltage to the external modulation input.

AWG/Function generator output



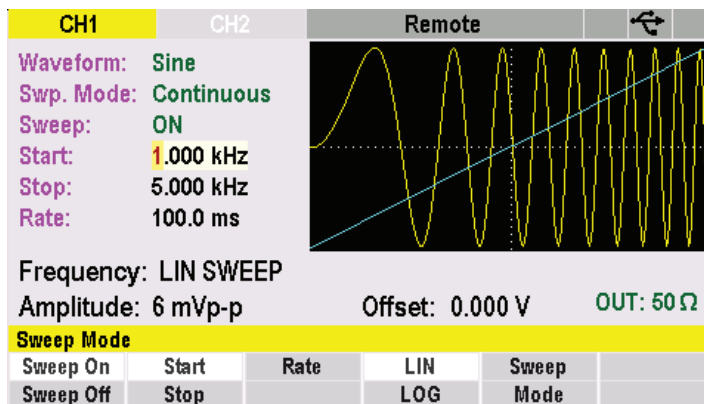
Individual output channels and configuration interfaces offer intuitive control over both AWG/Function output parameters to meet a variety of general purpose testing needs.

Predefined waveforms



Select from 12 different predefined arbitrary waveforms or store and recall up 13 additional custom waveforms from the internal memory.

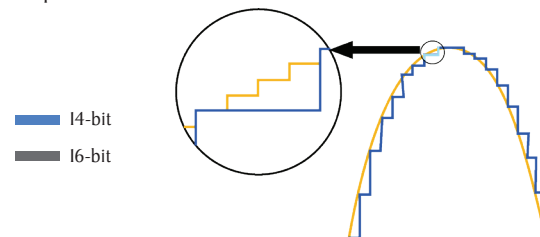
Frequency sweep



Perform linear or logarithmic sweeps continuously, on trigger, or in burst. Sweep the frequencies at any rate between 1 ms to 500 seconds.

True AWG characteristics

- ▶ 16-bit sampling for enhanced resolution resulting in lower distortion and more accurate waveforms
- ▶ Deep arbitrary waveform length adjustable from 2 points up to 4 million points
- ▶ Sampling rate up to 250 MSa/s



16-bit amplitude resolution

Operation highlights

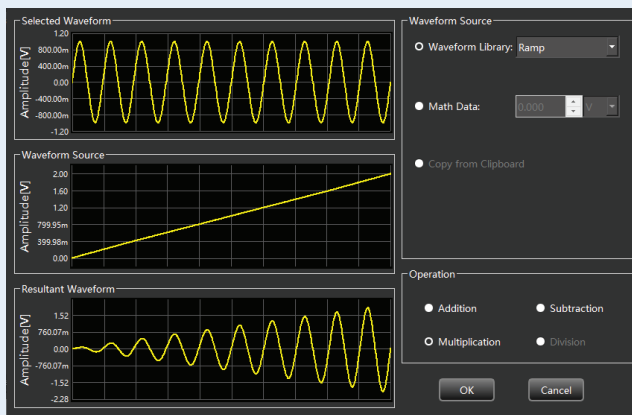
Versatile arbitrary waveform generation tools

The 4078C series offer several ways to generate and download custom arbitrary waveforms to the instrument:

Waveform creation and editing

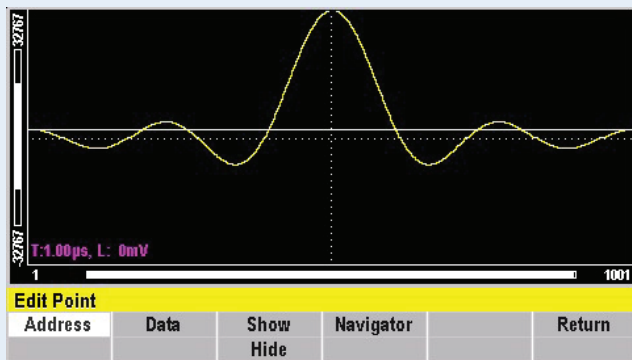
Create and edit custom arbitrary waveforms with the provided software tools (EasyWaveX and WaveXpress) or enter waveform data directly from the instrument's front panel.

Software



Generate complex arbitrary waveforms with tools that allow you to draw, edit, and combine waveforms.

Front panel



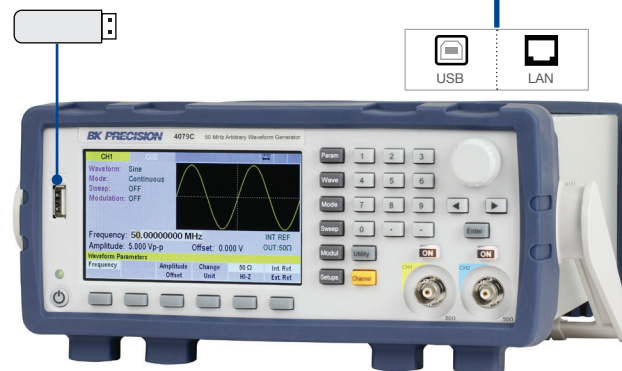
Create or edit arbitrary waveforms directly from the front panel by defining individual points, lines, or copying and pasting sections.

Uploading custom waveforms

Use the 407XC software utility to import waveform data in .txt or .csv format for download to the instrument for execution. Waveform data can be directly uploaded via USB or LAN interface or by saving it in *.arb format to a USB drive.



Save/Recall custom .arb files

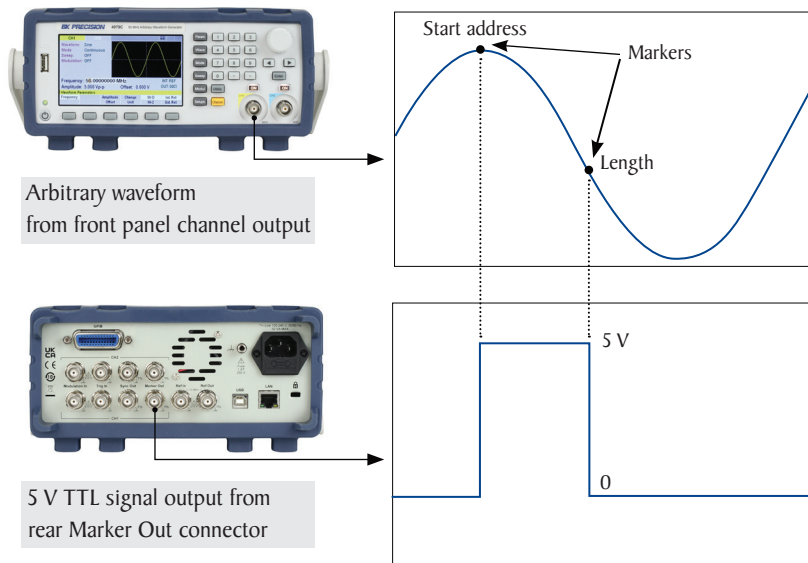


Operation highlights

Programmable markers

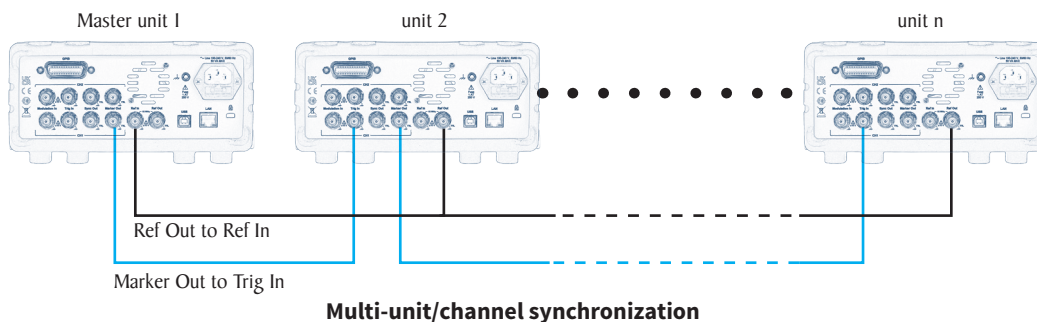
Markers can be added to custom arbitrary waveforms for applications requiring precise synchronization between two signals.

The figure illustrates how a separate 5 V TTL signal is generated from the rear panel marker out BNC for the designated section of the arbitrary waveform. The maximum length of the marker is determined by the length of the arbitrary waveform. This feature is also useful for triggering another signal at a specific time or event in the arbitrary waveform signal.



Special application

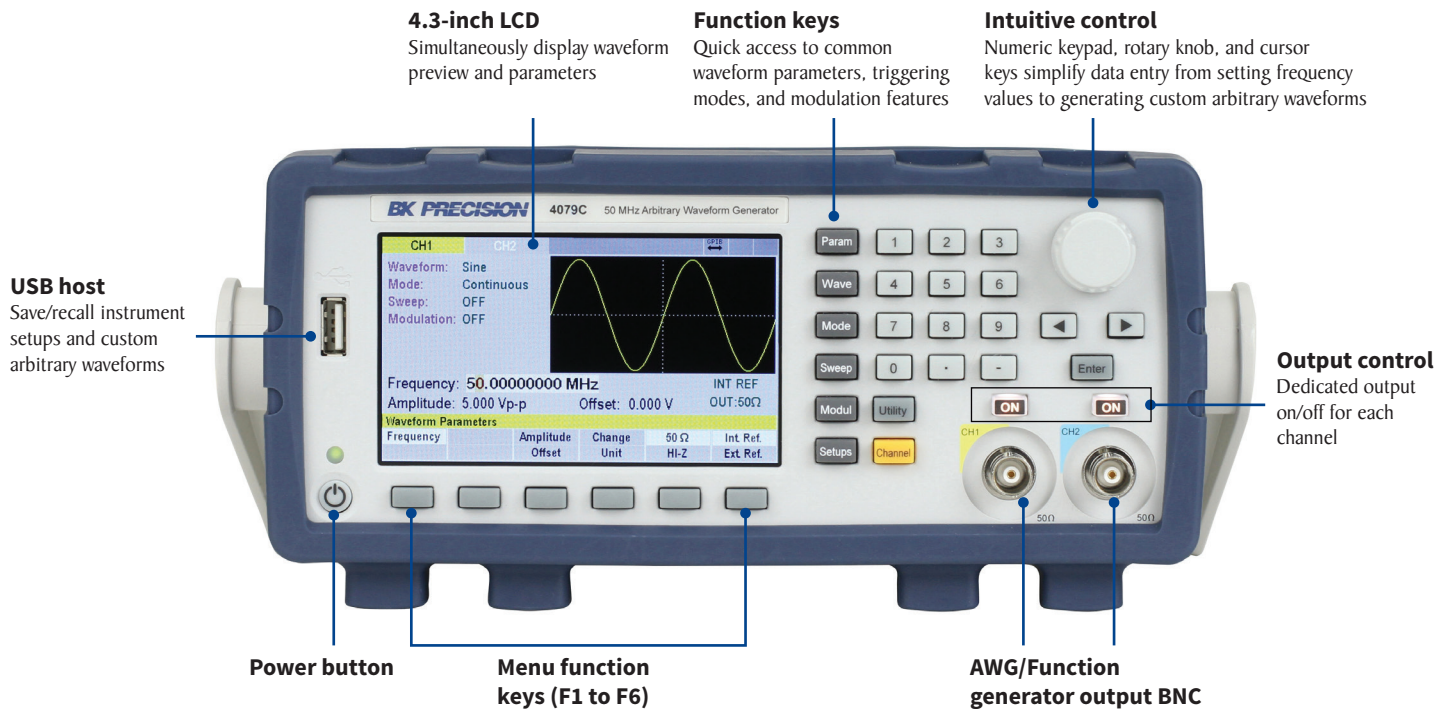
Multi-unit/channel synchronization capabilities allow for simulation of a real world 3-phase or multi-phase AC network where one of the phases is degraded.



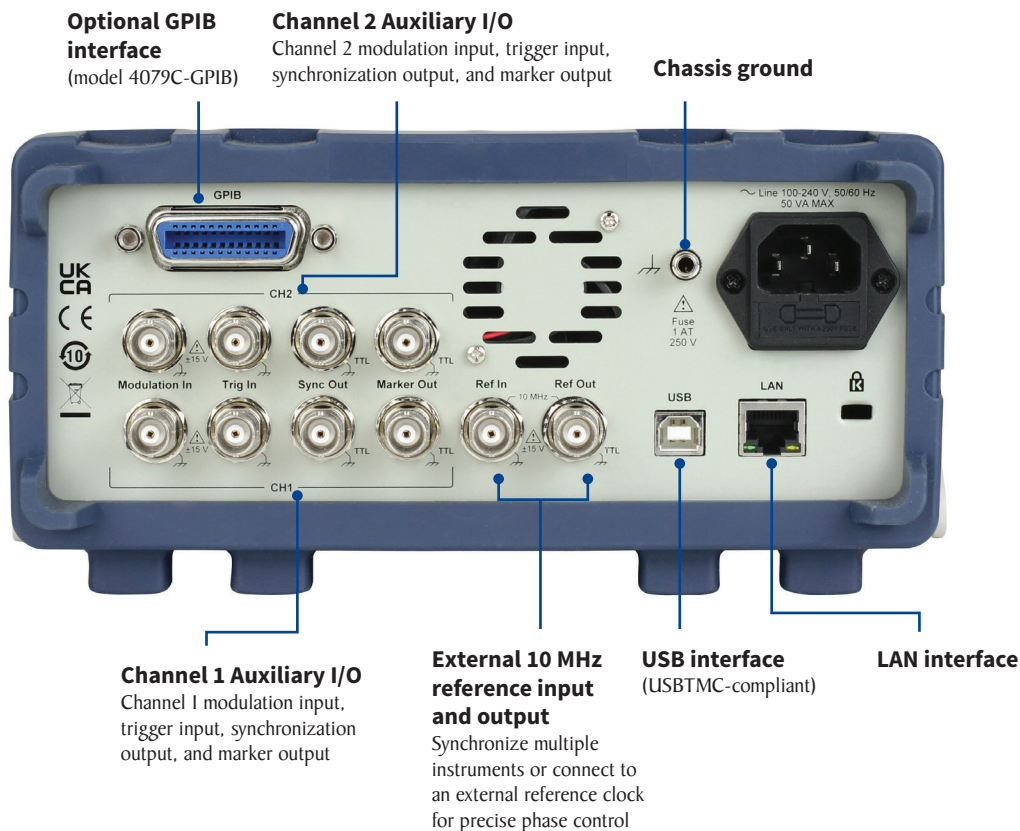
AWG/Function Generator Modulation, Burst, and Sweep Capabilities

Carrier	AM	FM	PM	FSK	BPSK	Burst	Sweep
Sine	√	√	√	√	√	√	√
Square	√	√	√	√	√	√	√
Triangle	√	√	√	√	√	√	√
Pulse	√	--	--	--	--	√	--
Arbitrary	√	--	--	--	--	√	--

Front panel



Rear panel



AWG/Function Generator Specifications

Model	4078C	4079C
Maximum Frequency	30 MHz	50 MHz
Waveforms		
Standard	Sine, Square, Triangle/Ramp, Pulse	
Built-in Arbitrary	Sine, Triangle, Square, Noise, Ramp Up, Ramp Down, Sine(X)/X, Exponential Up, Exponential Down, Gaussian, Lorentz, Haversine	
User-defined Arbitrary	4 Mpts	
Operating Modes		
Operating Modes	Continuous, Triggered, Burst, Gated, Phase	
Triggered	Frequency of waveform cycle is limited to 10 MHz	
Sine		
Frequency Range	1 MHz to 30 MHz	1 MHz to 50 MHz
Resolution	1 μ Hz	
Amplitude Flatness (relative to 1 kHz, 5 Vpp output)		
$f_{out} \leq 5$ MHz	± 0.15 dB	
f_{out} : 5 MHz to 20 MHz	± 0.3 dB	
f_{out} : 20 MHz to 30 MHz	± 0.4 dB	
f_{out} : 30 MHz to 50 MHz	± 1 dB	
Harmonic Distortion (typical)		
$f_{out} \leq 20$ kHz	≤ -60 dBc	
$f_{out} \leq 10$ MHz	≤ -45 dBc	
$f_{out} \leq 20$ MHz	≤ -40 dBc	
$f_{out} \leq 50$ MHz	≤ -30 dBc	
THD: 20 Hz to 20 kHz	$< 0.04\%$	
Spurious		
$f_{out} \leq 1$ MHz	-70 dBc	
$f_{out} \geq 2$ MHz	-70 dBc to 1 MHz, increasing +20 dB/decade above 1 MHz	
Phase Noise ($f_{out}=10$ MHz)		
10 kHz offset	-110 dBc	
Square		
Frequency Range	1 MHz to 30 MHz	1 MHz to 50 MHz
Rise & Fall Time	< 5 ns (10% to 90%) at full amplitude into 50 Ω	
Overshoot (typical)	$< 2\%$	
Variable Duty Cycle Range	$f_{out} \geq 10$ MHz : Set duty = 50 % $f_{out} \geq 100$ kHz: Set duty 20% to 80% $f_{out} < 100$ kHz: Set duty 5% to 95%	
Duty Cycle Resolution	0.1%	
Duty Cycle Accuracy	$\pm 0.1\% \pm 5$ ns	
Jitter (rms)	< 40 ps rms	

Ramp & Triangle	
Frequency Range	1 MHz to 5 MHz
Resolution	1 μ Hz
Variable Duty Cycle	0%-100% to 500 kHz 20%-80% to 2 MHz Fixed 50% to 5 MHz
Duty Cycle Resolution	0.1%
Linearity	$< 0.1\%$ of signal amplitude from 5%-95%, up to 200 kHz
Pulse	
Frequency Range	1 MHz to 10 MHz
Resolution	1 μ Hz
Pulse Width	20 ns minimum, 1 ns resolution, 999 s max
Variable Edge Time	< 10 ns to pulse period (depending on pulse width)
Jitter (rms)	< 25 ps
Arbitrary Waveform Characteristics	
Waveform Length	2 pts to 4,194,305 pts
Sampling Rate	250 MSa/s, point execution rate adjustable from 4 ns to 100 s
Voltage Resolution	16 bits (65,536 levels)
Noise	Programmable 1% to 100% or added to arbitrary waveform
Bandwidth	50 MHz max (2-point waveform length)
Frequency	Accuracy: ± 10 ppm
	Rate Resolution: 10 ps, up to 8 digits
Rise & Fall Time	6 ns minimum
Jitter (rms)	< 40 ps (rms)
Sweep Characteristics	
Sweep Shape	Linear and Logarithmic, up or down
Sweep Time	10 ms to 100 s
Sweep Trigger Mode	Internal, External, Continuous, or Burst

AWG/Function Generator Specifications (cont.)

Output Characteristics	
Signal Output	
Output Impedance	50 Ω (typical)
Output Protection	Protected against short circuit or nominal accidental voltages applied to the main output connector
Output ON-OFF Feed-through	> 80 dB at 10 MHz
Amplitude	
Range	2 mV to 20 Vpp into open circuit
Resolution	1 mV, 4 digits (10,000 counts)
Units	Vpp, Vrms, or dBm selectable
Accuracy ⁽¹⁾ (at 1 kHz)	$\pm 1\%$ of setting ± 1 mVpp
DC Offset	
Range	± 5 V into 50 Ω
Resolution	1 mV, 4 digits resolution
Accuracy	$\pm 1\%$ of offset setting $\pm 0.25\%$ of amplitude setting ± 2 mVpp
Frequency	
Accuracy	± 2 ppm, 0 to 50° C
Aging	± 1 ppm/year
Burst Characteristics	
Waveforms	Sine, Square, Triangle, Pulse, Arb
Count	1-999,999 cycles
Trigger Source	Manual, Internal, External
Inputs and Outputs	
Trigger IN	TTL Compatible Maximum rate: 20 MHz Minimum width: 20 ns Input impedance: 10 k Ω nominal
Sync OUT	TTL pulse at programmed frequency, 50 Ω impedance
Modulation IN	2.5 Vpp for 100% modulation 1 k Ω input impedance DC to 50 kHz bandwidth
Marker OUT	Positive TTL pulse, user programmable in arbitrary waveform, 50 Ω impedance
External Reference OUT	10 MHz clock for synchronization, TTL, 50 Ω impedance
External Reference IN	10 MHz from an external source, > 1 k Ω impedance, > 1 Vpp

(1) Add 1/10 of the specification per °C for operation at temperatures < 18 °C or > 28 °C

Modulation Characteristics	
Modulation Types	AM, FM, PM, PWM, FSK, BPSK
Amplitude Modulation (AM)	
Carrier	Sine, Square, or Triangle
Source	Internal, External
Depth	0% to 100%
Frequency Modulation (FM)	
Carrier	Sine, Square, or Triangle
Source	Internal, External
Deviation	1 μ Hz to max frequency/2
Frequency-shift Keying (FSK)	
Carrier	Sine, Square, or Triangle
Source	Internal, External
Rate	0.01 Hz to 1 MHz
Phase Modulation (PM)	
Carrier	Sine, Square, or Triangle
Source	Internal, External
Deviation	0 to 360°, 0.1° resolution
Binary Phase-shift (BPSK)	
Carrier	Sine, Square, or Triangle
Source	Internal, External
Rate	0.01 Hz to 1 MHz
Internal Modulation	
Waveform	Sine, Square, or Triangle
Frequency	0.01 Hz to 20 kHz
Resolution	4 digits
Internal Trigger	
Repetition	1 μ s to 100 s (0.01 Hz to 1 MHz)
Resolution	4 digits
Accuracy	± 10 ppm

General

General		
Display Resolution	4.3" color LCD with IPS technology, 480 x 272 dots	
I/O interfaces	USB (USBTMC-compliant), LAN, GPIB (optional)	
Storage Memory	99 full panel settings at power-off, including last working set-up 128 MB flash file system for arbitrary waveform storage	
Dimensions (W x H x D)	8.5" x 3.5" x 12" (214 mm x 88 mm x 300 mm)	
Weight	5.5 lbs (2.5 kg)	
AC Input	100 to 240 VAC (< 50 VA)	
Temperature	Operation	32 °F to 122 °F (0 °C to 50 °C)
	Storage	-4 °F to 158 °F (-20 °C to 70 °C)
Humidity	95% RH, 0 °C to 30 °C	
Warranty	3 Years	
Standard Accessories	Power cord, USB cable, test report, and certificate of calibration	

Regulatory Compliance	
Safety	Low Voltage Directive (LVD) 2014/35/EU, EN61010-1:2010 cTUVus certification mark ⁽¹⁾ fulfills US (UL 61010-1:2012) R7.19 and Canadian (CAN/CSA-C22.2 NO. 61010-1-12+ GII + GI2 (R2017) + AI) safety standards
Electromagnetic Compatibility	EMC Directive 2014/30/ EU EN61326-1:2013

(1) Tested and certified by a Nationally Recognized Testing Laboratory (NRTL), accredited by OSHA

Ordering Information

Model	Description
4078C	30 MHz Arbitrary Waveform Generator
4079C	50 MHz Arbitrary Waveform Generator
4079C-GPIB	50 MHz Arbitrary Waveform Generator with GPIB