

20 MHz Dual Channel Function / Arbitrary Generator Model 4047B



The 4047B Dual Channel Function/Arbitrary Waveform Generator is capable of generating stable and precise sine, square, triangle, pulse, and arbitrary waveforms. CH1 and CH2 outputs are fully independent with individual on/off buttons and can both be varied from 0 to 10 Vpp into 50 ohms (up to 20 Vpp into open circuit). The generator provides linear and logarithmic sweep capabilities, AM/FM/PM/FSK/PWM modulation, and a continuously variable DC offset to inject signals directly into circuits at the

correct bias level. Separate output amplitude and DC offset amplifiers let you set a large DC offset (e.g. ± 4.99 V) with a small amplitude output signal (e.g. 10 mV).

The 4047B seamlessly integrates with B&K Precision's waveform editing software WaveXpress, allowing users to generate complex arbitrary waveforms that can be output via the instrument's 14-bit, 125 MSa/s, 16 kpts arbitrary waveform generator.

Features & Benefits

- Dual-channel operation with each channel providing the rated amplitude (10 Vpp) over the entire frequency range
- Sine and square waveforms up to 20 MHz
- True point-by-point 14-bit, 125 MSa/s, 16-kpt arbitrary waveform generator
- Bright color display with waveform preview
- Synchronize the phase of both channels with the push of a button
- Linear and logarithmic sweep
- AM, FM, PM, FSK, and PWM internal and external modulation capabilities
- Gate and burst mode
- Independent output and DC offset amplifiers allow for small amplitude output signals with large DC offsets
- Low-jitter square wave generation for simulating reliable clock signals, generating triggers, or validating serial data buses
- USB interface
- SCPI-compliant command set
- Internal/external triggering
- Gate and burst mode
- Built-in counter
- Short circuit protection for resistive and capacitive loads on outputs and overvoltage protection on inputs

Dual architecture design

The 4047B's dual architecture, a feature typically only found in more expensive generators, provides all the benefits of a DDS and a true point-by-point arbitrary waveform generator (AWG) combined, without any limitations imposed by either technology. The DDS chip produces standard sine and triangle waveforms with high frequency resolution and at a low cost. The true point-by-point AWG implementation (Fig 2) offers improved signal integrity for arbitrary waveforms by producing significantly less jitter and distortion compared to a DDS-based architecture. Custom arbitrary waveform generation is implemented with a variable clock signal to reproduce each point stored in memory without skipping or repeating data points, a problem typically found in DDS based designs with fixed reference clocks.

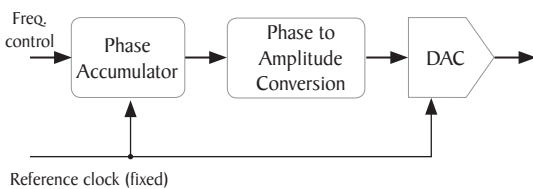


Fig 1 - DDS

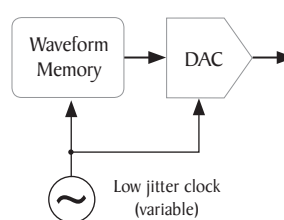


Fig 2 - point-by-point AWG

Applications

This generator is suitable for a wide range of applications including electronic design, sensor simulation, functional test, or serial data bus validation.



For more information, visit www.bkprecision.com/WaveXpress

Technical data subject to change
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CALRIGHT INSTRUMENTS

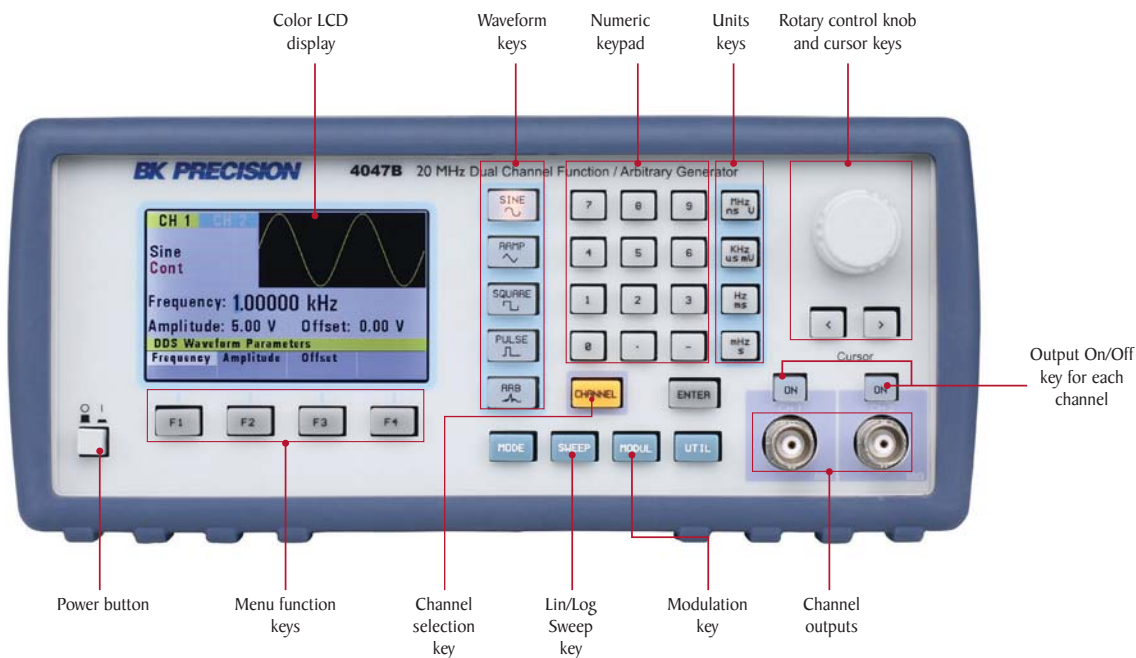
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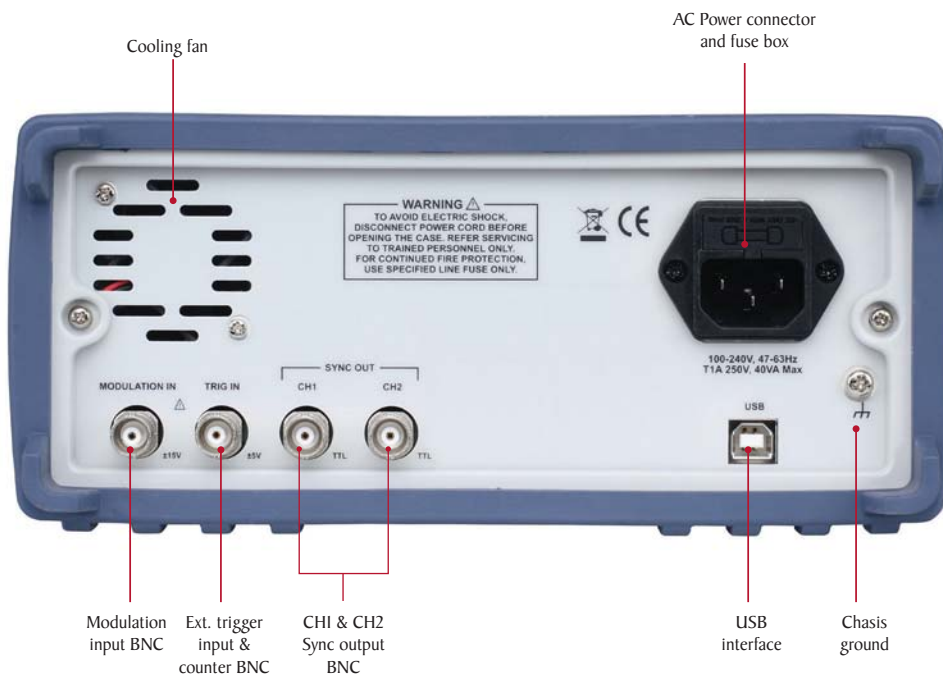
Front panel

Intuitive user interface

Easily adjust all waveform parameters using the intuitive menu-driven front panel keypad with dedicated channel selection keys, numeric keypad, and rotary control knob.

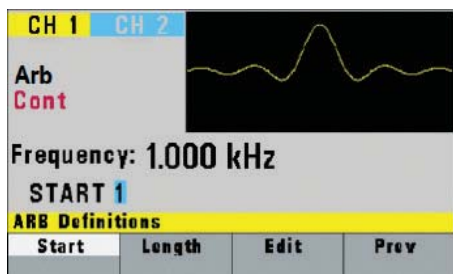


Rear panel



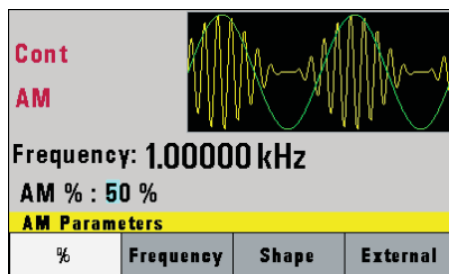
Flexible operation

Front panel arbitrary waveform generation



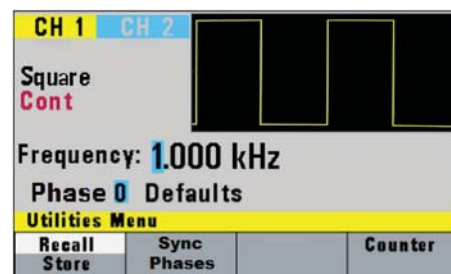
From the front panel, waveforms can be defined from scratch by entering data point-by-point or by loading and modifying predefined waveforms.

Versatile features



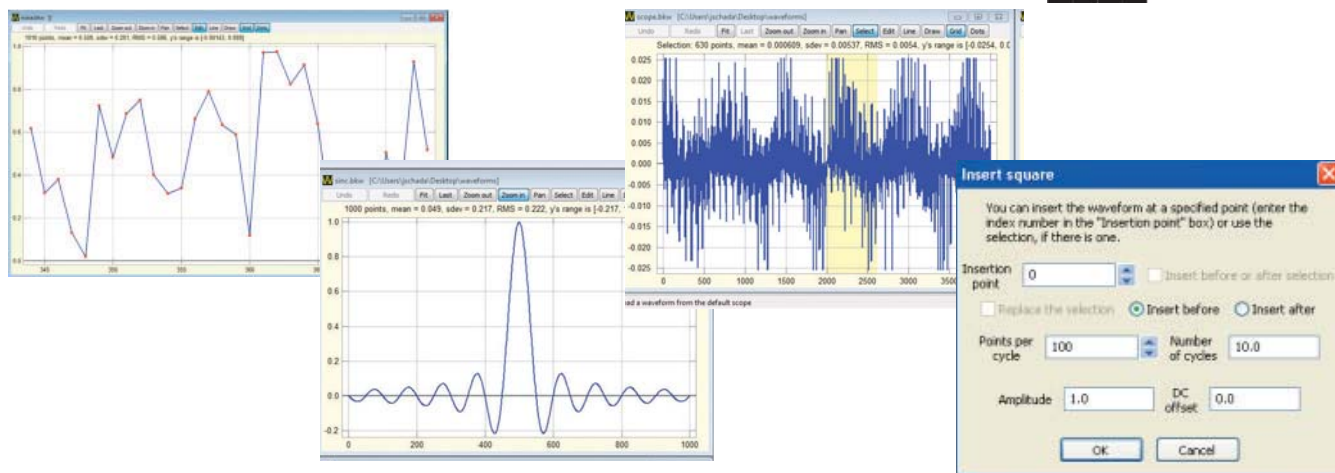
The 4047B provides AM, FM, PM, FSK, and PWM modulation along with linear/logarithmic sweep and built-in counter capabilities. Internal and external sources can be used for triggering and modulating the signal.

Channel phase synchronization



Easily synchronize the phase of both channels with the push of the Sync Phases button to ensure the desired output signal timing.

Powerful waveform editing tool



WaveXpress is a comprehensive stand-alone application allowing users to easily generate, edit, and upload custom arbitrary waveforms to the generator via the remote interface. Use the software to generate waveforms by importing a csv file or define via freehand, point draw, and waveform math functions.

Features & Benefits

- Import waveforms from B&K scopes
- Autoscan function automatically detects instruments connected via RS232, USB, or GPIB
- Insert commonly used waveforms and different types of noise
- Numerous transformations for changing a waveform. User-defined transformations can be added in the python programming language
- Dialog settings are remembered for faster repetitive work
- Undo/redo functions allow quick experimentation

Specifications	4047B
Channels	2
Frequency Characteristics	
Sine	0.01 Hz - 20 MHz
Square	0.01 Hz - 20 MHz
Triangle	0.01 Hz - 2 MHz
Pulse	0.01 Hz - 20 MHz
Resolution	up to 8 digits
Accuracy	0.001% (10 ppm) at < 500 Hz: 0.001% + 0.006 Hz
Output Characteristics	
Amplitude Range	10 mVpp to 10 Vpp (into 50 Ω); 20 mVpp to 20 Vpp (open circuit)
Amplitude Resolution	3 digits (1,000 counts)
Amplitude Accuracy	± 2% ± 20 mV of programmed output from 1.01 V - 10 V
Flatness	± 0.5 dB to 1 MHz ± 1 dB to 20 MHz
Offset Range	-4.99 V to 4.99 V (into 50 Ω)
Offset Resolution	10 mV, 3 digits
Offset Accuracy	± 2% ± 10 mV (into 50 Ω)
Output Impedance	50 Ω ± 2%
Output Protection	Protected against short circuit or accidental voltage practically available in electronic laboratories, applied to the main output connector
Waveform Characteristics	
Harmonic Distortion (3 Vp-p into 50 Ω)	0 - 1 MHz, < -60 dBc 1 MHz - 5 MHz, < -50 dBc 5 MHz - 12 MHz, < -45 dBc 12 MHz - 20 MHz, < 50 dBc
Rise/Fall Time (square, pulse)	≤ 20 ns (10% to 90% at full amplitude into 50 Ω)
Variable Duty Cycle/Symmetry	Square: 20% - 80% to 2 MHz Triangle: 1% - 99% in 1% steps, up to 200 kHz
Symmetry Accuracy at 50%	± 1%
Pulse Width (period 100 s - 50 ns)	10 ns to <(Period - 10 ns), 10 ns resolution
Variable Edge Time	100 ns to Width/0.625 (50 % duty cycle) 10 ns resolution
Jitter (square, pulse)	< 50 ps rms (cycle-to-cycle, typical)
Arbitrary Waveform Characteristics	
Sampling Rate	8 ns to 100 s
Vertical Resolution	14 bits
Accuracy	0.001%
Resolution	4 digits
Waveform Length	2 to 16,382 points
Jitter	< 50 ps rms (cycle-to-cycle, typical)
Operating Modes	
Continuous	Output continuous at programmed parameters
Triggered	Output quiescent until triggered by an internal or external trigger, at which time one waveform cycle is generated to programmed parame- ters. Frequency of waveform cycle is limited to 1 MHz.
Gate	Same as triggered mode, except waveform is executed for the dura- tion of the gate signal. The last cycle started is completed.
Burst	2-65535 cycles
Trigger Source	Trigger source may be internal, external, or manual. Internal trigger rate 0.1 Hz - 1 MHz (1 us - 10 s)

Modulation Characteristics		
Amplitude Modulation (AM)	Carrier	Sine, Square, or Triangle
	Source	Internal, External
	Internal Modulation	0.1 Hz - 20 kHz
Frequency Modulation (FM)	Depth	0% to 100%
	Carrier	Sine, Square, or Triangle
	Source	Internal, External
Frequency Shift Keying (FSK)	Internal Modulation	0.1 Hz - 20 kHz
	Deviation	1 μHz to max frequency/2
	Carrier	Sine, Square, or Triangle
Phase Modulation (PM)	Source	Internal, External
	Internal Modulation	0.01 Hz - 20 kHz
	Deviation	0 - 360 °, 0.1 ° resolution
Pulse Width Modulation (PWM)	Carrier	Sine, Square, or Triangle
	Source	Internal, External
	Internal Modulation	0.01 Hz - 100 kHz
Width	1% to 99%	
Sweep Characteristics		
Sweep Shape	Linear or Logarithmic, up or down	
Sweep Time	10 ms to 100 s	
Input and Output		
Trigger IN	TTL compatible Maximum rate 1 MHz Minimum width > 50 ns Input impedance 1 kΩ	
Sync OUT	TTL pulse at programmed frequency; 50 Ω source impedance	
Modulation IN	5 Vp-p for 100% modulation 10 kΩ input impedance DC to > 20 kHz minimum bandwidth	
Counter Characteristics		
Range	50 Hz to 50 MHz	
Resolution	Auto ranging, up to 8 digits	
Accuracy	± 0.02% ± 2 digits	
Sensitivity	25 mVrms typical	
General		
Memory Storage	20 instrument settings	
Arbitrary Memory	16,382 points in flash memory	
Power Requirements	100 V - 240 V AC ± 10%, 47-63 Hz	
Max. Power Consumption	< 30 VA	
Operating Temperature	32 °F to 122 °F (0 °C to 50 °C)	
Storage Temperature	14 °F to 158 °F (-10 °C to 70 °C)	
Humidity	95% R.H. 0 °C to 30 °C	
Dimensions (W x H x D)	8.39" x 3.46" x 8.27" (213 x 88 x 210 mm)	
Weight	5.5 lbs (2.5 kg)	
Safety and EMC Standards	EN55011 for radiated and conducted emissions EN55082, EN61010, CE approved	
Three-Year Warranty		
Included Accessories	Power cord, USB (type A to B) interface cable, certificate of calibration	

Note: All specifications apply to the unit after a temperature stabilization time of 15 minutes over an ambient temperature range of 23 °C ± 5 °C. Specifications are subject to change without notice.