

## Data Sheet

# 20 MHz DDS Sweep Function Generator with Arb Function

## Model 4045B



The model 4045B is a high-performance 20 MHz DDS (direct digital synthesis) function generator with arbitrary waveform capability. Generating stable and precise sine, square, triangle, and arbitrary waveforms, this instrument provides variable output voltages from 0 to 10 Vpp into 50  $\Omega$  (up to 20 Vpp into open circuit), linear and logarithmic sweep, AM/FM modulation, a built-in counter, and a continuously variable DC offset that allows the output to be injected directly into circuits at the correct bias level. Separate output amplitude and DC offset amplifiers let you set a large DC offset (e.g.  $\pm 4.99$  V) with a small amplitude output signal (e.g. 10 mV), a feature typically found in more expensive generators.

The 4045B combines a traditional DDS and a true arbitrary generator in one unit, giving users the benefits of both technologies. Using DDS technology, waveforms can be generated with high frequency resolution at a low price. Due to the inherent limitations of this architecture, not all points from the waveform memory are used, and points may be skipped at higher frequencies. This leads to significantly more jitter and higher

distortions on non-repetitive waveforms and sometimes small details of the waveforms stored internally will be missing from the output signal. The true arbitrary waveform section generates point by point waveforms with lower jitter, high resolution, and true representation of the required waveform.

Due to the arbitrary waveform capability of the 4045B, the instrument is able to generate low-jitter square waves with greater edge stability. The improved signal integrity allows these generators to be used for simulating reliable clock signals, generating triggers, or validating serial data buses.

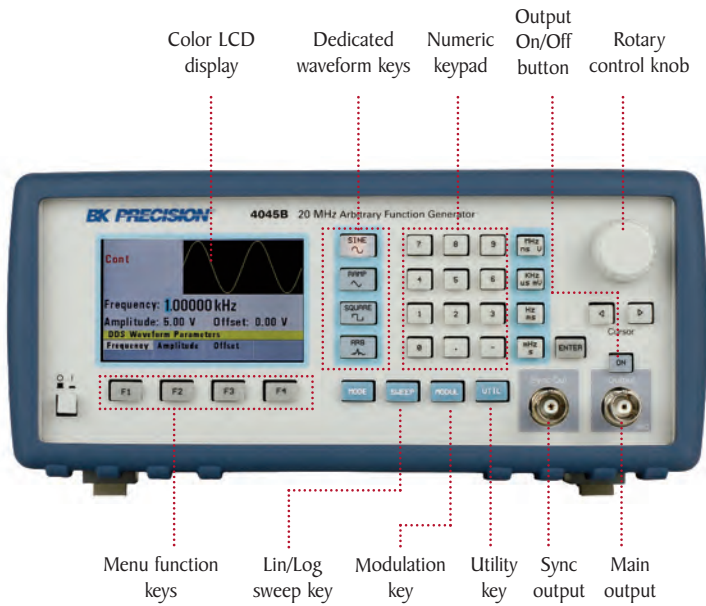
This model is suitable for education and other applications that require DDS function generators with sweep, modulation, and arbitrary waveform capabilities.

### Features & Benefits

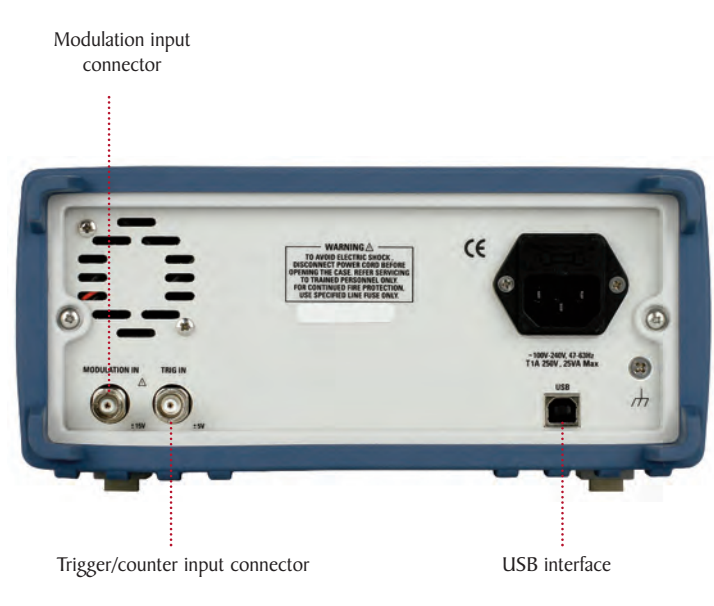
- 12-bit, 50 MSa/s, 1k point arbitrary waveform generator
- Sine and square waveforms up to 20 MHz
- Triangle/ramp waveforms up to 2 MHz
- Bright color display with waveform preview
- Linear and logarithmic sweep
- AM/FM modulation
- Independent output and DC offset amplifiers allow for small amplitude output signals with large DC offsets
- Low-jitter square wave generation
- Adjustable duty cycle
- Output ON/OFF button
- Internal/external triggering
- Gate and burst mode
- Built-in counter
- USB interface
- SCPI-compliant command set
- Arbitrary waveform editing software and remote control application software included
- Short circuit and overvoltage protection on all inputs and outputs

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**Front panel**



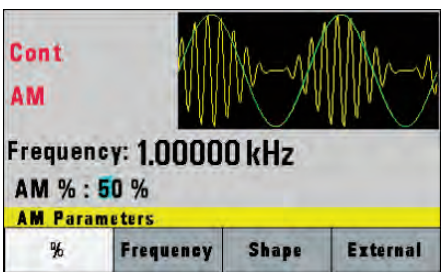
**Rear panel**



**Intuitive user interface**

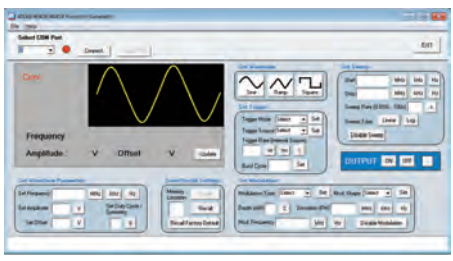
Easily change all waveform parameters using the intuitive menu-driven front panel keypad, rotary control knob, and large color LCD display that shows a preview of the output waveform. Convenient waveform and range selection buttons let users make quick and precise adjustments to the output signal.

**Versatile tools**



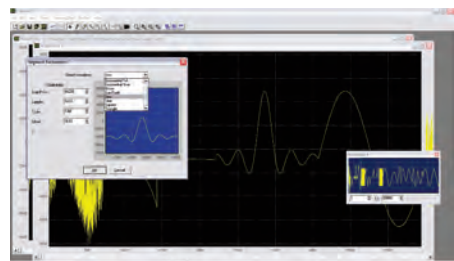
The 4045B provides AM and FM modulation along with linear/logarithmic sweep and built-in counter capabilities. Internal and external sources can be used for triggering and modulating the signal.

**Easy PC connectivity**



The signal generator can be programmed remotely via the USB (virtual COM) interface using SCPI commands. B&K Precision also offers application software (available for download at [www.bkprecision.com](http://www.bkprecision.com)) that provides virtual front panel emulation, allowing users to remotely control their instrument without the need for programming.

**Generate waveforms with ease**



The included Wave-X software allows you to easily generate, edit, and download custom arbitrary waveforms. Generate waveforms by importing a text file, or define via freehand, point draw, or waveform math. Waveforms can also be loaded from the generator for documentation purposes.

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Specifications		4045B
<b>Frequency Characteristics</b>		
Sine	0.01 Hz to 20 MHz	
Square	0.01 Hz to 20 MHz	
Triangle	0.01 Hz to 2 MHz	
Resolution	6 digits* or 10 mHz	
Accuracy	0.001% (10 ppm) at < 500 Hz: 0.001% + 0.006 Hz	
<b>Output Characteristics</b>		
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	
DC Offset Range	-4.99 V to 4.99 V (into 50 Ω)	
DC Offset Resolution	10 mV, 3 digits	
DC Offset Accuracy	± 2% ± 10 mV (into 50 Ω)	
Output Impedance	50 Ω ± 2%	
Output Protection	Protected against short circuit or accidental voltage applied to the main output connector	
<b>Waveform Characteristics</b>		
Harmonic Distortion (for sine wave at 5 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, < -60 dBc	
Square Rise/Fall Time	≤ 20 ns (10% to 90% at full amplitude into 50 Ω)	
Duty Cycle	Square: 20% - 80% to 2 MHz Triangle: 1% - 99% in 1% steps, up to 200 kHz	
Symmetry Accuracy at 50%	± 1%	
Jitter (square)	< 100 ps rms (cycle-to-cycle, typical)	
<b>Arbitrary Waveform Characteristics</b>		
Sampling Rate	20 ns to 50 s	
Vertical Resolution	12 bits	
Accuracy	0.001%	
Resolution	4 digits	
Waveform Length	2 to 1000 points	
<b>Operating Modes</b>		
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 parameters. Frequency of waveform cycle is limited to 1 MHz.	
Gate	Same as triggered mode, except waveform is executed for the duration 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)	

\*For square wave, resolution is up to 4 digits when frequency is > 20 kHz.

<b>Modulation Characteristics</b>	
Amplitude Modulation	
Internal	0.1 Hz – 20 kHz sine, square, or triangle waveform
External	5 Vp-p for 100% modulation, 10 kΩ input impedance
Frequency Modulation	
Internal	0.1 Hz – 20 kHz sine, square, or triangle waveform
External	5 Vp-p for 100% modulation, 10 kΩ input impedance
<b>Sweep Characteristics</b>	
Sweep Shape	Linear or Logarithmic, up or down
Sweep Time	10 ms to 100 s
<b>Input and Output</b>	
Trigger IN	TTL compatible Maximum rate 1 MHz Input impedance 1 kΩ Minimum width > 50 ns
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
<b>Counter Characteristics</b>	
Range	50 Hz to 50 MHz
Resolution	Auto ranging, up to 8 digits
Accuracy	± 0.02% ± 2 digits
Sensitivity	25 mVrms typical
<b>General</b>	
Memory Storage	20 instrument settings
Arbitrary Memory	1,000 points in flash memory
Power Requirements	100 V – 240 V AC ± 10%, 47-63 Hz
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)
Electromagnetic Compatibility	Meets EMC Directive 2004/108/EC, EN55011, EN55082
Safety	Meets Low Voltage Directive 2006/95/EC, EN61010
<b>Three-Year Warranty</b>	
Included Accessories	Instruction manual on CD, 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.