

DDS Sweep Function Generators
Models 4014B and 4040B



Models 4014B and 4040B are 12 MHz and 20 MHz DDS (direct digital synthesis) function generators that generate stable and precise sine, square, and triangle waveforms. Both models provide variable output voltages from 0 to 10 Vpp into 50 Ω (up to 20 Vpp into open circuit), linear and logarithmic sweep, AM/FM modulation, 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. ± 4.99 V) with a small amplitude output signal (e.g. 10 mV), a feature typically found in more expensive generators.

The 4014B and 4040B are both designed with a dual technology architecture, combining traditional DDS technology with a low-jitter square wave generator. The instruments

generate a 2-point waveform to simulate the amplitude and use a high accuracy PLL (phase-locked loop) circuit for timing. Compared to signals generated by typical low-cost DDS function and arbitrary waveform generators, this implementation significantly minimizes jitter and improves edge stability of square waves. The improved signal integrity allows these generators to be used for simulating reliable clock signals, generating triggers, or validating serial data buses.

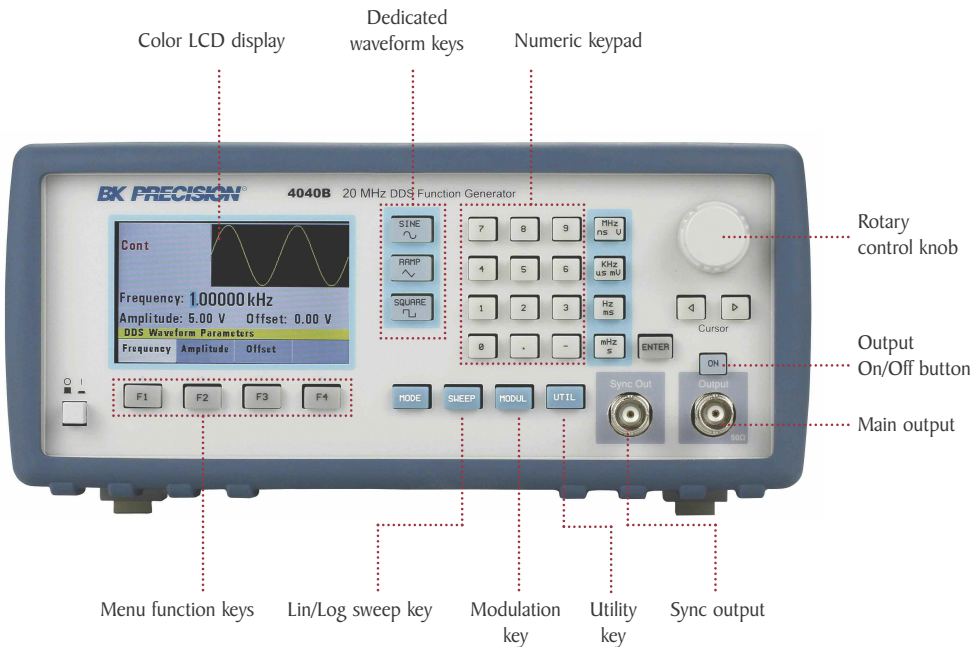
These models are suitable for education and other applications that require digital function generators with sweep and modulation capabilities.

Features & Benefits

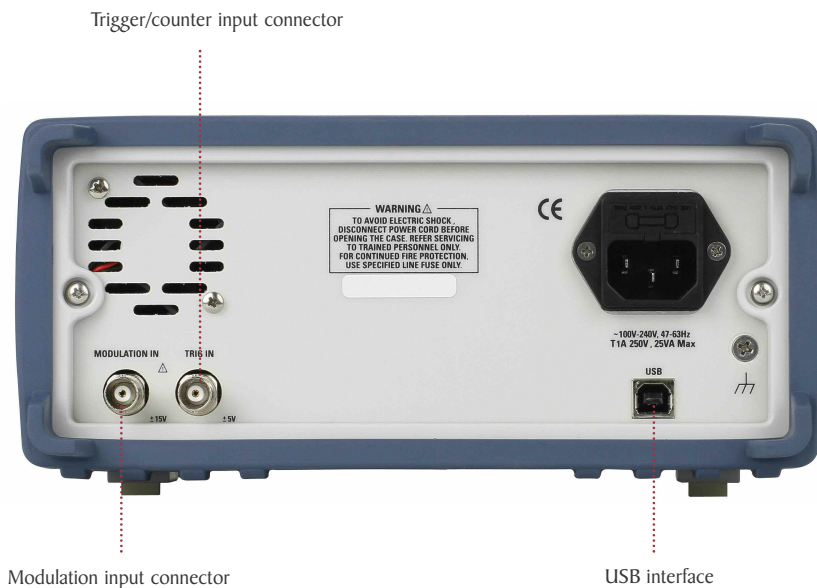
- Sine and square waveforms up to 12 MHz (4014B) or 20 MHz (4040B)
- Triangle/ramp waveforms up to 1 MHz (4014B) or 2 MHz (4040B)
- Bright color display with waveform preview
- Linear and logarithmic sweep
- AM/FM modulation
- Independent output and DC offset amplifiers allow for small amplitude output signals with large DC offsets
- Low-jitter square wave generation
- Adjustable duty cycle
- Output ON/OFF button
- Internal/external triggering
- Gate and burst mode (4040B only)
- Built-in counter
- USB interface
- SCPI-compliant command set
- Short circuit and overvoltage protection on all inputs and outputs

Model	4014B	4040B
Sine and square frequency range	0.01 Hz - 12 MHz	0.01 Hz - 20 MHz
Triangle/ramp frequency range	0.01 Hz - 1 MHz	0.01 Hz - 2 MHz

Front panel



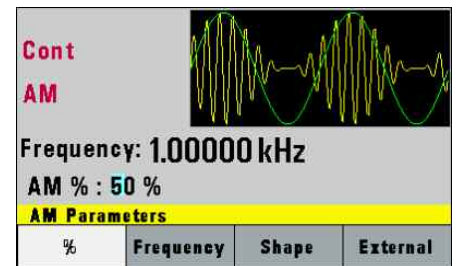
Rear panel



Intuitive user interface

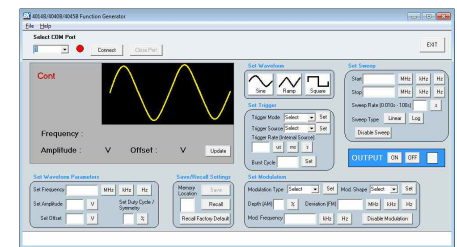
Easily change all waveform parameters using the intuitive menu-driven front panel keypad, rotary control knob, and large color LCD display that shows a preview of the output waveform. Convenient waveform and range selection buttons let users make quick and precise adjustments to the output signal.

Versatile tools



Both models provide 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 function generators 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) that provides virtual front panel emulation, allowing users to remotely control their instrument without the need for programming.

DDS Function Generators
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Specifications	4014B	4040B
Frequency Characteristics		
Sine	0.01 Hz to 12 MHz	0.01 Hz to 20 MHz
Square	0.01 Hz to 12 MHz	0.01 Hz to 20 MHz
Triangle	0.01 Hz to 1 MHz	0.01 Hz to 2 MHz
Resolution	6 digits* or 10 mHz	
Accuracy	0.01% ± 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 12 MHz	± 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	
Waveform Characteristics		
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	0 – 1 MHz, < -60 dBc 1 MHz – 5 MHz, <-50 dBc 5 MHz – 12 MHz, <-45 dBc 12 MHz – 20 MHz, <-50 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)	
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 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.

Note: All specifications apply to the unit after a temperature stabilization time of 15 minutes over an ambient temperature range of 23 $^{\circ}$ C $\pm$ 5 $^{\circ}$ C. Specifications are subject to change without notice.

Modulation Characteristics		
Amplitude Modulation		
Internal	0.1 Hz – 20 kHz sine only	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 only	0.1 Hz – 20 kHz sine, square, or triangle waveform
External	5 Vp-p for 100% modulation, 10 kΩ input impedance	
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 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	
Counter Characteristics		
Range	50 Hz to 25 MHz	
Resolution	Auto ranging, up to 8 digits	
Accuracy	± 0.02% ± 2 digits	
Sensitivity	100 mVrms typical	
General		
Memory Storage	10 instrument settings	20 instrument settings
Power Requirements	100 V – 240 V AC ± 10%	
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	
Three-Year Warranty		
Included Accessories	Instruction manual on CD, power cord, USB (type A to B) interface cable, certificate of calibration	