

# Data Sheet

## 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 V<sub>pp</sub> into 50 Ω (up to 20 V<sub>pp</sub> 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.

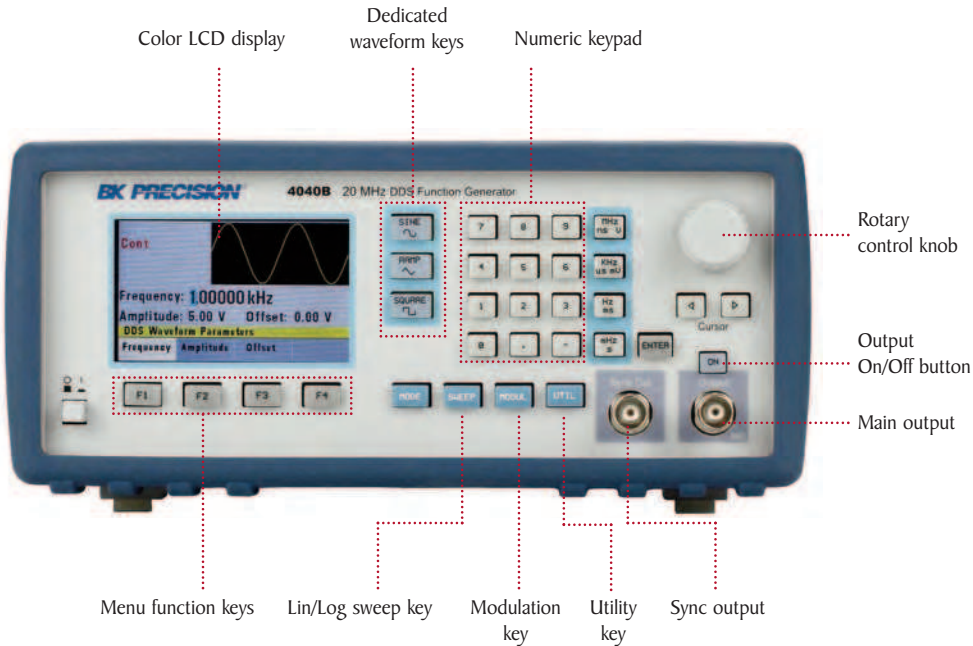
These models are suitable for education and other applications that require digital function generators with sweep and modulation capabilities.

### 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  |

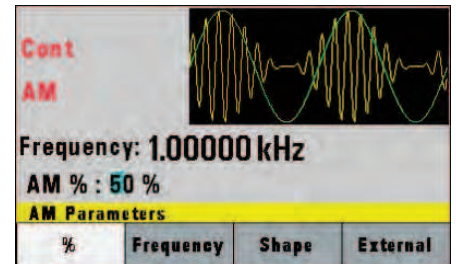
## Front panel



### Intuitive user interface

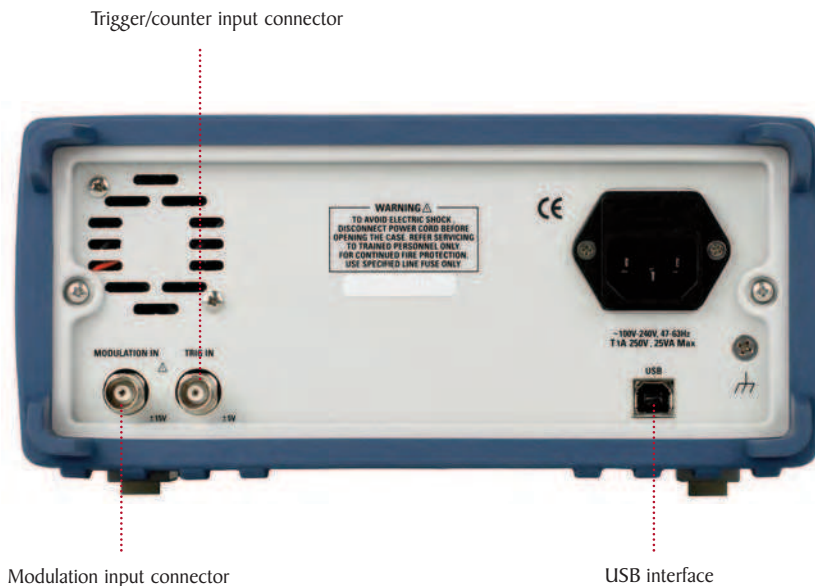
Easily change all waveform parameters using the intuitive menu-driven front panel keypad, rotary control knob, and large color LCD display that shows a preview of the output waveform. Convenient waveform and range selection buttons let users make quick and precise adjustments to the output signal.

### Versatile tools

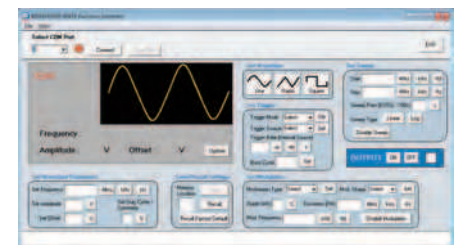


Both models provide AM and FM modulation along with linear/logarithmic sweep and built-in counter capabilities. Internal and external sources can be used for triggering and modulating the signal.

## Rear panel



### 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](http://www.bkprecision.com)) that provides virtual front panel emulation, allowing users to remotely control their instrument without the need for programming.

DDS Function Generators  
Models 4014B and 4040B

| Specifications  | 4014B   | 4040B   |
|---|---|---|
| <b>Frequency Characteristics</b>                        |   |   |
| 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  |   |
| <b>Output Characteristics</b>                           |   |   |
| Amplitude Range   | 10 mVpp to 10 Vpp (into 50 Ω);<br>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<br>± 1 dB to 12 MHz   | ± 0.5 dB to 1 MHz<br>± 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<br>1 MHz – 5 MHz, < -50 dBc<br>5 MHz – 12 MHz, < -45 dBc   | 0 – 1 MHz, < -60 dBc<br>1 MHz – 5 MHz, < -50 dBc<br>5 MHz – 12 MHz, < -45 dBc<br>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<br>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>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 μs – 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 °C ± 5 °C. Specifications are subject to change without notice.

|                                   |   |  |
|-----------------------------------|---|--|
| <b>Modulation Characteristics</b> |   |  |
| 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   |  |
| <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<br>Maximum rate 1 MHz<br>Input impedance 1 kΩ<br>Minimum width > 50 ns               |  |
| Sync OUT                          | TTL pulse at programmed frequency; 50 Ω source impedance  |  |
| Modulation IN                     | 5 Vp-p for 100% modulation<br>10 kΩ input impedance<br>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                    | 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   |  |
| <b>Three-Year Warranty</b>        |   |  |
| Included Accessories              | Instruction manual on CD, power cord, USB (type A to B) interface cable, certificate of calibration |  |