**Data Sheet**

# Dual Channel Function/Arbitrary Waveform Generators
## 4060B Series


The 4060B Series Dual Channel Function/Arbitrary Waveform Generators are capable of producing precise sine, square, triangle, pulse, and arbitrary waveforms. This series combines the cost saving benefits of both DDS and true point-by-point arbitrary architectures to meet a wide range of applications that require high signal fidelity and low jitter arbitrary waveform generation capabilities.

### Dual architecture operation

The 4060B Series arbitrary waveform generator (AWG) architecture can be toggled between conventional DDS or true arbitrary mode. Compared to DDS (Fig. 1), true point-by-point AWG implementation offers improved signal integrity by producing lower jitter and less distortion (Fig. 2). All models are capable of generating 16-bit waveforms up to 300 MSa/s in DDS or 75 MSa/s in true arbitrary mode.

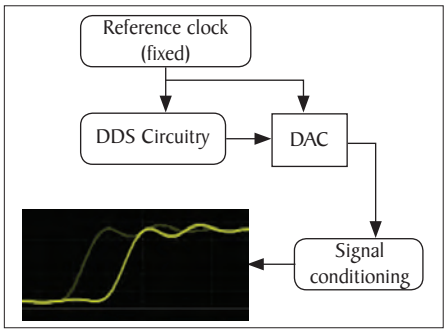



Fig. 1: DDS mode

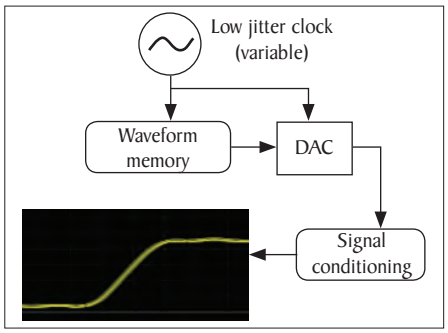



Fig. 2: True point-by-point arbitrary mode

The intuitive touchscreen display simplifies control of many features including extensive waveform modulation schemes, linear/logarithmic sweep, burst mode, and variable DC offset. These generators provide system integrators with auxiliary triggering capabilities, and a 10 MHz reference clock for synchronizing multiple instruments.

196 built-in arbitrary waveforms offer a variety of arbitrary test signals for both simple and complex applications. Generate custom arbitrary waveforms and download them to the instrument using the included application software. Alternatively, use the included LabVIEW™ drivers to load .csv or .txt waveform data files directly into the generator's internal memory.

| Model | 4062B | 4063B | 4064B |
|---|---|---|---|
| Sine frequency range | 1 µHz to 40 MHz | 1 µHz to 80 MHz | 1 µHz to 120 MHz |
| Square frequency range | 1 µHz to 25 MHz | | |

### Features and benefits

- 16-bit resolution, 8 Mpts, 300 MSa/s (DDS), 75 MSa/s (true point-by-point) arbitrary waveform generator
- Up to 1.2 GSa/s sample rate for sine, square, triangle, and pulse waveforms
- Two independent channels with one-button phase synchronization
- Channel copy, track, and waveform combine functions
- Generate sine waves up to 120 MHz
- Harmonic generator function
- Linear sweep, logarithmic sweep, and burst functions
- Precise pulse width and rise/fall time adjustments
- Supports AM/DSB-AM/FM//PM/PSK/FSK/ASK and PWM modulation types
- DC signal level up to ±10 V into a high-z load or ±5 V into a 50 Ω load
- Variable DC offset
- Adjustable duty cycle
- Frequency counter
- Internal/external triggering
- 196 built-in predefined arbitrary waveforms
- Store/recall up to 10 instrument settings
- LAN and USB device port (USBTMC-compliant)
- GPIB connectivity with optional USB-to-GPIB adapter
- Front-panel USB host port
- Arbitrary waveform editing software included
- LabVIEW™ driver is available

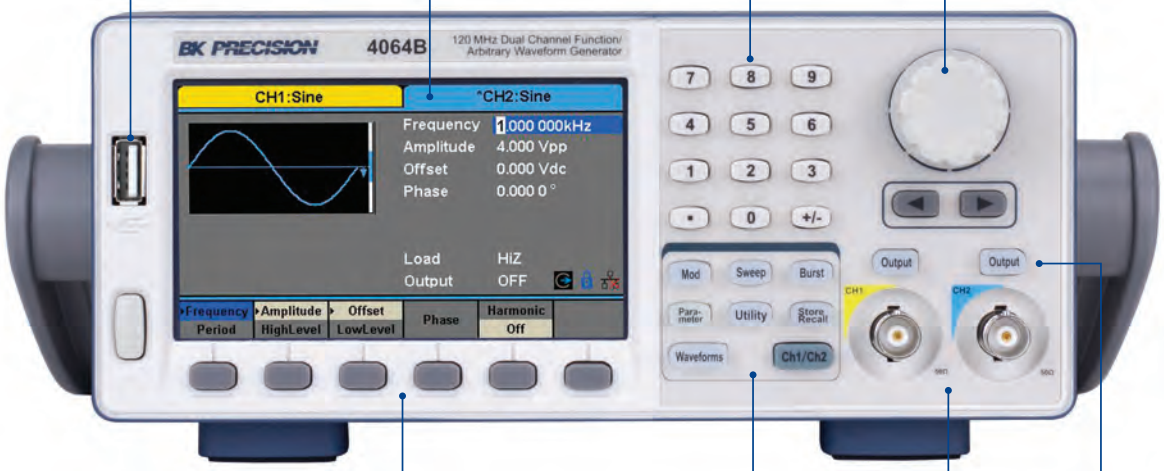
## Front panel

**USB host port**
Save/recall waveforms and instrument setups

**4.3-inch LCD**
Anti-smudge touch screen display makes it easy to jump to different parameters on screen.

**Numeric keypad**
Input values directly

**Rotary control knob**
Increment and decrement values quickly and precisely




**Function keys**
Adjust waveform parameters and access built-in waveforms

Waveforms and channel selection keys

Channel outputs

Dedicated channel output buttons

## Rear panel

**Counter input**
Measure frequencies up to 200 MHz

**Auxiliary input/output**
Sync output, modulation input, external trigger input/output

**10 MHz reference clock input/output**
Synchronize output signals to a master time base


LAN interface

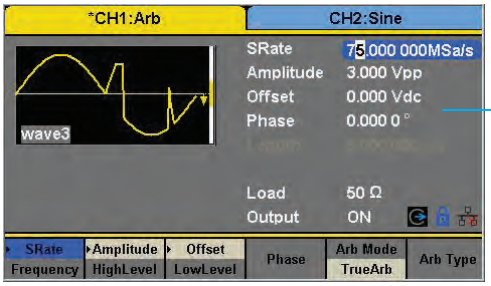
USB interface

Chassis ground

**Universal AC input**
No need to change fuses, switches, or jumpers

# Operation highlights

### Generate precise true arbitrary waveforms

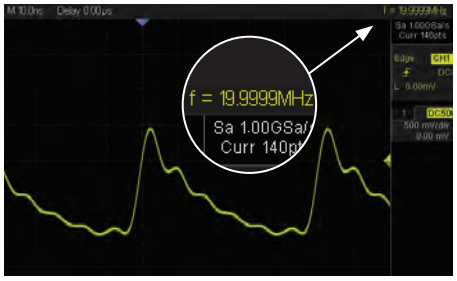



Custom true arbitrary waveform at 75 MSa/s, 8 Mpts

True arbitrary mode oscilloscope view

True arbitrary mode uses a variable clock signal to generate precise custom arbitrary waveforms without skipping data points. As shown in the oscilloscope view above, the 8 million point arbitrary waveform is accurately reproduced with high signal fidelity.

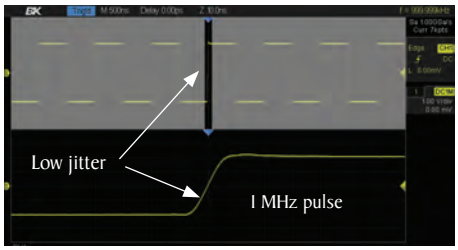
### Versatile DDS operation




Built-in arbitrary waveform at 20 MHz, 300 MSa/s

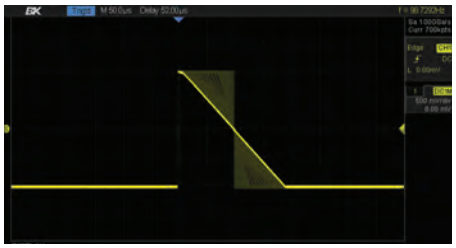
In DDS mode, these generators are capable of producing arbitrary waveforms at a frequency up to 20 MHz. DDS arbitrary waveforms can also be combined with modulation, sweep, and burst functions.

### High-performance pulse generator



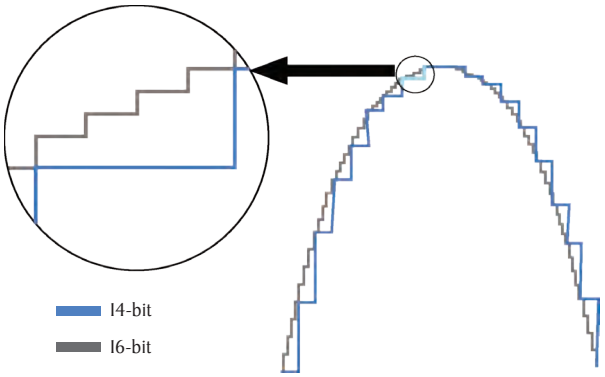

This series is equipped with advanced digital signal processing to reduce jitter and produce clean pulse waveforms.

The pulse width is adjustable to a minimum of 16.3 ns. Shown above is the oscilloscope view of the pulse width being incremented using the generators rotary control knob.



Sharp rise/fall times can be set from 8.4 ns up to 22.4 s with adjustment steps as small as 100 ps.

### 16-bit vertical resolution




The 4060B Series uses 16-bit sampling for enhanced resolution resulting in lower distortion and more accurate waveforms.

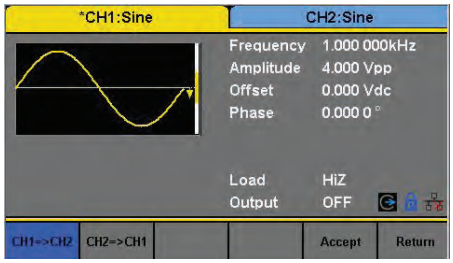
### Modulation types and operating modes

| Carrier | AM/DSB-AM/FM/ PM/PSK/FSK/ASK | PWM | Burst | Sweep |
|---|---|---|---|---|
| Sine and Square | √ | | √ | √ |
| Triangle / Ramp | √ | | √ | √ |
| Pulse | | √ | √ | |
| Noise | | | √ | |
| Arbitrary | √ | | √ | √ |

These generators are capable of many different modulation types for various applications.

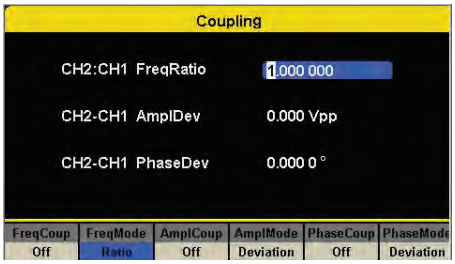
# Operation highlights

### Channel copy and sync function



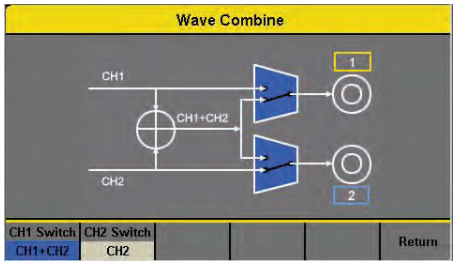

With the push of a button, all waveform parameters can be quickly copied between channels. Phase between channels can be adjusted.

### Channel tracking function



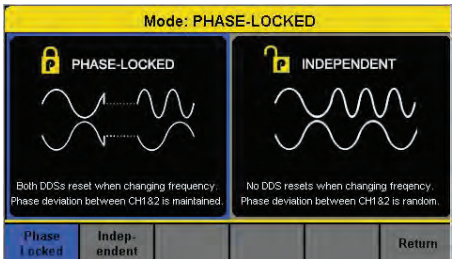

Customize channel coupling using frequency, amplitude, and phase. Enable automatic tracking between channels using deviation or ratio.

### Channel combine function



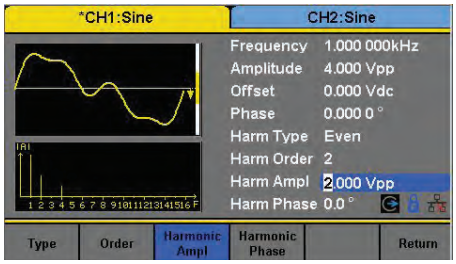

Create complex waveforms by internally adding each channel's waveform and outputting the combined waveform on channel 1 or 2.

### Flexible phase control



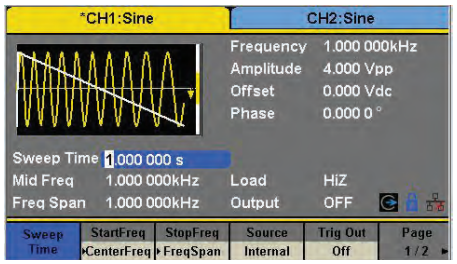

Phase-lock maintains phase deviation over both channels. In independent mode, the phase deviation between CHI and CH2 changes at random allowing for smoother frequency transitions.

### Harmonics function



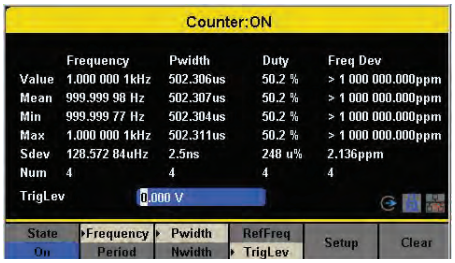

Quickly output harmonics up to the 16th order with independent amplitude and phase settings.

### Sweep



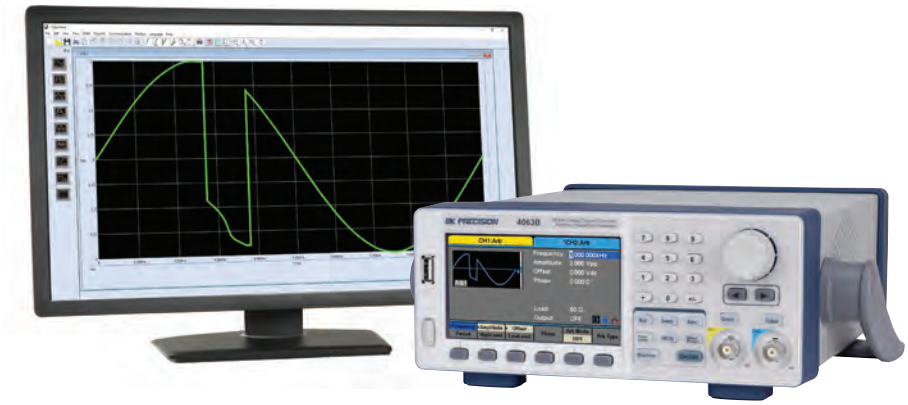

Perform linear or log sweep functions with up or down directional control. The sweep source can be set to internal, external, or manual.

### Frequency counter




Displays mean, min, max, and many other frequency characteristics with an input frequency range of 0.1 Hz to 200 MHz.

### Generate waveforms with ease



The provided waveform editing software can be used to create point-by-point arbitrary waveforms via freehand or waveform math functions. The standard LAN and USBTMC-compliant interfaces on the rear panel allow users to easily interface with a PC to load these waveforms into internal memory. The front panel also offers a convenient USB host port to save/recall instrument settings and waveform files on a USB flash drive.

# Specifications

Note: All specifications apply to the unit after a temperature stabilization time of 30 minutes over an ambient temperature range of 23 °C ± 5 °C.

| Model | 4062B | 4063B | 4064B |
|---|---|---|---|
| Channels | 2 | | |
| **Frequency Characteristics** | | | |
| Sine | 1 µHz to 40 MHz | 1 µHz to 80 MHz | 1 µHz to 120 MHz |
| Square | 1 µHz to 25 MHz | | |
| Triangle, Ramp | 1 µHz to 1 MHz | | |
| Pulse | 1 µHz to 25 MHz | | |
| Gaussian Noise (-3 dB) | > 120 MHz | | |
| Arbitrary | 1 µHz to 20 MHz | | |
| Accuracy | ± 1 ppm (1 year) | | |
| Resolution | 1 µHz | | |
| **Arbitrary Characteristics** | | | |
| Built-in Waveforms | 196 | | |
| Waveform Length | 8 points to 8 M points | | |
| Vertical Resolution | 16 bits | | |
| Sampling Rate | 300 MSa/s (DDS mode)<br>75 MSa/s (true arbitrary mode) | | |
| Minimum Rise/Fall Time (typical) | 4.5 ns (DDS mode)<br>8.5 ns (true arbitrary mode) | | |
| Jitter (rms) | < 150 ps (1 Vpp, into 50 Ω load, true arbitrary mode) | | |
| Non-volatile Memory Storage | 80 MB file system | | |
| **Output Characteristics** | | | |
| Amplitude Range[1] (into open circuit) | 2 mVpp to 20 Vpp ( ≤ 20 MHz)<br>2 mVpp to 10 Vpp ( > 20 MHz) | | |
| Amplitude Resolution | Up to 4 digits | | |
| Amplitude Accuracy (10 kHz, 0 V offset) | ± (1% + 1 mVpp) | | |
| Amplitude Flatness (reference to 10 kHz Sine, 2.5 Vpp) | ± 0.3 dB (50 Ω load, DC to 100 MHz)<br>± 0.4 dB (50 Ω load, 100 MHz to 120 MHz) | | |
| Cross Talk | < -60 dBc (between channels) | | |
| Offset Range (DC) | ± 5 V (into 50 Ω load)<br>± 10 V (into open circuit) | | |
| Offset Resolution (DC) | Up to 4 digits | | |
| Offset Accuracy (DC) | ± (1% + 2 mV), into open circuit | | |
| Output Impedance (typical) | 50 Ω | | |
| Output Protection | Overvoltage (see user manual for details) | | |
| **Waveform Characteristics** | | | |
| Harmonic Distortion (sine, 0 dBm input, typical) | DC to 10 MHz, < -65 dBc<br>10 MHz to 20 MHz, < -60 dBc<br>20 MHz to 40 MHz, < -55 dBc<br>40 MHz to 60 MHz, < -50 dBc<br>60 MHz to 80 MHz, < -45 dBc<br>80 MHz to 100 MHz, < -40 dBc<br>100 MHz to 120 MHz, < -38 dBc | | |

| Waveform Characteristics (continued) | |
|---|---|
| Total Harmonic Distortion (sine) | < 0.075% (10 Hz to 20 kHz at 0 dBm) |
| Spurious (non-harmonic) | ≤ 50 MHz, -70 dBc max.<br>> 50 MHz, -65 dBc max. |
| Rise/Fall Time (square) | < 9 ns (10% to 90% at 1 Vpp, into 50 Ω load) |
| Variable Duty Cycle (square) | 0.001% to 99.999% (depending on frequency setting) |
| Jitter (rms) Cycle to Cycle (square) | 150 ps (1 Vpp, into 50 Ω load, typical) |
| Ramp Symmetry | 0% to 100% |
| Ramp Linearity | < 1% of peak output (triangle, ramp at 1 kHz, 1 Vpp, 100% symmetry) |
| **Pulse** | |
| Pulse Width | 16.3 ns minimum |
| Rise/Fall Time | 8.4 ns to 22.4 s (1 Vpp, 10% to 90%, into 50 Ω load) |
| Duty Cycle Range | 0.001% to 99.999% (depending on frequency setting) |
| Overshoot | < 3% (100 kHz, 1 Vpp) |
| Jitter (rms) Cycle to Cycle | 150 ps (1 Vpp, into 50 Ω load) |
| **Burst** | |
| Waveform | Sine, square, ramp, pulse, arbitrary, noise |
| Type | Cycle (1 to 1,000,000 cycles), infinite, gated |
| Start/Stop Phase | 0° to 360° |
| Internal Period | 1 µs to 1000 s |
| Gated Source | Internal, external trigger |
| Trigger Source | Internal, external, manual |
| **Phase Offset** | |
| Range | -360° to 360° |
| Resolution | 0.1° |
| **AM, FM & PM Modulation Characteristics** | |
| Carrier[2] | Sine, square, ramp, arbitrary |
| Source | Internal, external |
| Modulation Waveform | Sine, square, ramp, noise, arbitrary |
| AM Modulation Depth | 0% to 120% |
| FM Frequency Deviation | 0 to 0.5 x (maximum output frequency) |
| PM Phase Deviation | 0° to 360° |
| **ASK & FSK Modulation Characteristics** | |
| Carrier[2] | Sine, square, ramp, arbitrary |
| Source | Internal, external |
| Modulation Waveform | 50% duty cycle square waveform |

(1) This specification will be divided by 2 while applied to a 50 Ω load.

(2) Modulation schemes not available in DC mode.

## Specifications (continued)

| Model | 4062B, 4063B, 4064B |
|---|---|
| **DSB-AM Modulation Characteristics** | |
| Carrier[2] | Sine, square, ramp, arbitrary |
| Source | Internal, external |
| Modulation Waveform | Sine, square, ramp, noise, arbitrary |
| **PWM Modulation Characteristics** | |
| Source | Internal, external |
| Modulation Waveform[2] | Sine, square, ramp, noise, arbitrary |
| Internal Modulation Frequency | 1 mHz to 1 MHz |
| **Sweep Characteristics** | |
| Waveforms[2] | Sine, square, ramp, arbitrary |
| Sweep Shape | Linear or logarithmic, up or down |
| Sweep Time | 1 ms to 500 s |
| Sweep Trigger | Internal, external, manual |
| **Harmonic Output Characteristics** | |
| Maximum Order | 16 |
| Type | Even, odd, all |
| **Auxiliary Input / Output** | |
| Sync Out | TTL compatible[4]<br>Output impedance: 100 Ω (typical)<br>Maximum frequency: 10 MHz<br>Minimum pulse width: 50 ns (typical) |
| Modulation Input | ± 12 Vpp (typical) for 100% modulation<br>Input impedance: 10 kΩ<br>Frequency range: 0 kHz to 50 kHz |
| Trigger | |
| Input – Level | TTL compatible[3] |
| Input – Slope | Rising or falling, selectable |
| Input – Pulse Width | > 100 ns |
| Input – Impedance | > 100 kΩ |
| Input – Latency | 100 ns maximum (sweep mode)<br>600 ns maximum (burst mode) |
| Output – Voltage Level | TTL compatible[4] |
| Output – Pulse Width | > 500 ns |
| Output – Impedance | 100 Ω (typical) |
| Output – Maximum Frequency | 1 MHz |
| **Reference Clock** | |
| Input | Frequency range: 10 MHz (typical)<br>Minimum voltage input: 1.4 Vpp<br>Input impedance: 5 kΩ |
| Output | Frequency range: 10 MHz (typical)<br>Voltage level: 3.3 V (typical), 2 V (minimum)<br>Output impedance: 50 Ω |

| | |
|---|---|
| **Frequency Counter** | |
| Measurement | Frequency, period, positive/negative pulse width, duty cycle |
| Measurement Range | 100 mHz to 200 MHz (DC coupling)<br>10 Hz to 200 MHz (AC coupling) |
| Input Range | 100 mVrms to ± 2.5 V (< 100 MHz, DC coupling)<br>200 mVrms to ± 2.5 V (100 MHz to 200 MHz, DC coupling)<br>100 mVrms to 5 Vpp (< 100 MHz, AC coupling)<br>200 mVrms to 5 Vpp (100 MHz to 200 MHz, AC coupling) |
| Input Impedance | 1 MΩ (typical) |
| Coupling | AC, DC, HF REJ (≥ 250 kHz filter) |
| **Environmental and Safety** | |
| Temperature | Operating: 32 °F to 104 °F (0 °C to 40 °C)<br>Storage: -4 °F to 140 °F (-20 °C to 60 °C) |
| Humidity | < 86 °F (30 °C), ≤ 90 % RH<br>104 °F (40 °C), ≤ 50 % RH |
| Altitude | Operating: below 10,000 ft (3,048 m)<br>Storage: below 49, 212 ft (15,000 m) |
| Electromagnetic Compatibility | EMC Directive 2014/30/EU, EN61326-1:2013 |
| Safety | Low voltage directive (LVD) 2014/35/EU, EN61010-1:2010 |
| **General** | |
| Display | 4.3" TFT color (24-bit) LCD touch screen |
| I/O Interfaces | USBTMC device, LAN, USB host port |
| Storage Memory | 10 instrument settings |
| AC Input | 100 to 240 VAC ± 10 %, 50/60 Hz<br>100 to 120 VAC ± 10 %, 400 Hz |
| Power Consumption | 50 W maximum |
| Dimensions (W x H x D) | 10.25" x 4.22" x 11.61" (260.3 x 107.2 x 295 mm) |
| Weight | 7.6 lbs (3.43 kg) |
| Warranty | 3 years |
| Standard Accessories | AC power cord, user manual (downloadable), USB type A-to-B cable, BNC coaxial cable, certificate of calibration |
| Optional Accessories | USB-to-GPIB adapter (model AK40G) |

(2) Modulation schemes not available in DC mode.

(3) $V_{IH}$ = 2 V to 5.5 V, $V_{IL}$ = 0.5 V to 0.8 V

(4) $V_{OH}$ = 3.8 V ($I_{OH}$ = -8 mA), $V_{OL}$ = 0.44 V ($I_{OL}$ = 8 mA)