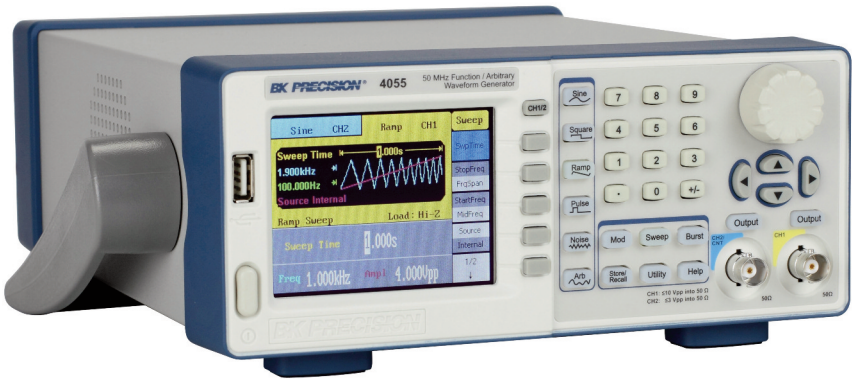


Dual Channel Function/Arbitrary Waveform Generators
4050 Series



The 4050 Series Dual Channel Function/Arbitrary Waveform Generators are capable of generating stable and precise sine, square, triangle, pulse, and arbitrary waveforms. With easy-to-read color displays and an intuitive user interface with numeric keypad, these instruments offer plenty of features including linear/logarithmic sweep, built-in counter, extensive modulation and triggering capabilities, a continuously variable DC offset, and a high performance 14-bit, 125 MSa/s arbitrary waveform generator. The main output voltage can be varied from 0 to 10 Vpp into 50 ohms (up to 20 Vpp into open circuit) and the secondary output can be varied from 0 to 3 Vpp into 50 ohms (up to 6 Vpp into open circuit).

Easily create custom arbitrary waveforms using the included waveform editing software or output any of the 48 built-in predefined arbitrary waveforms. Up to 10 user-defined 16 kpt arbitrary waveforms can be saved to the instrument.

Extensive modulation capabilities include amplitude and frequency modulation (AM/FM), double sideband amplitude modulation (DSB-AM), amplitude and frequency shift keying (ASK/FSK), phase modulation (PM), and pulse width modulation (PWM).

The standard external 10 MHz reference clock input allows the instrument to be synchronized to an external 10 MHz source or another generator. This feature is typically not found in function generators at this price point. Additionally, the phase of both output channels can be conveniently synchronized with the push of a button.

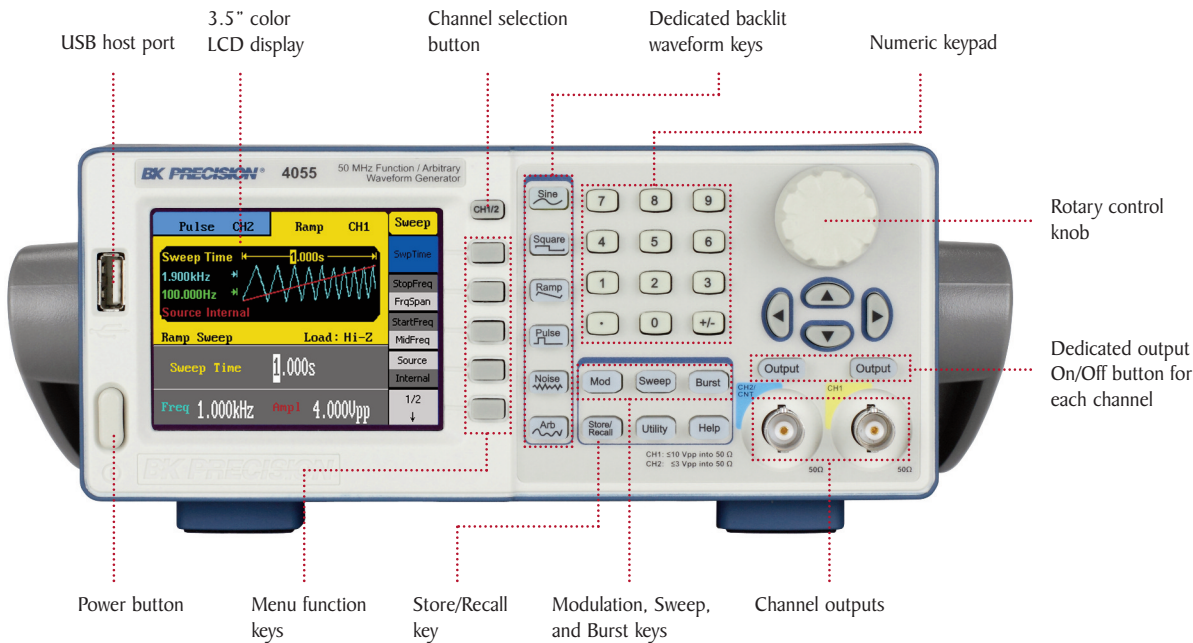
These versatile function/arbitrary waveform generators are suitable for education and other applications that require high signal fidelity, a variety of modulation schemes, or arbitrary waveform generation capabilities.

Features & Benefits

- 14-bit, 125 MSa/s, 16k point arbitrary waveform generator
- Generate sine waves up to 50 MHz
- Large 3.5-inch LCD color display with waveform preview
- Linear and logarithmic sweep
- AM, DSB-AM, ASK, FM, FSK, PM, and PWM modulation functions
- Variable DC offset
- Adjustable duty cycle
- Two independent channels with individual output ON/OFF buttons
- Internal/external triggering
- Gate and burst mode
- 48 built-in predefined arbitrary waveforms
- Store/recall up to 10 instrument settings and 10 arbitrary waveforms
- Built-in counter
- USB device interface and front panel USB host port
- GPIB connectivity with optional USB-to-GPIB adapter
- SCPI-compliant command set
- Arbitrary waveform editing software provided
- Short circuit protection on output

| Model | 4052 | 4053 | 4054 | 4055 |
|------------------------|--------------------|---------------------|---------------------|---------------------|
| Sine frequency range | 1 μ Hz – 5 MHz | 1 μ Hz – 10 MHz | 1 μ Hz – 25 MHz | 1 μ Hz – 50 MHz |
| Square frequency range | 1 μ Hz – 5 MHz | 1 μ Hz – 10 MHz | 1 μ Hz – 25 MHz | |

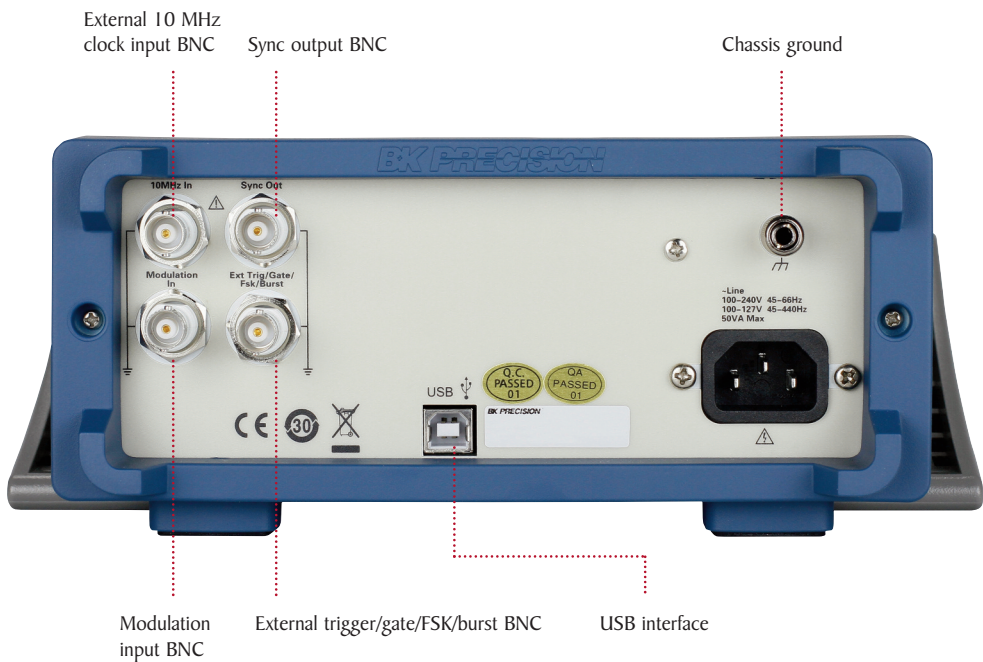
Front panel



Intuitive user interface

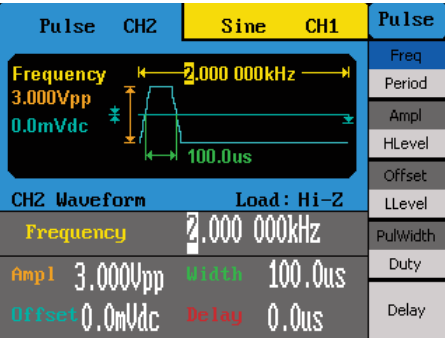
Easily adjust all waveform parameters using the intuitive menu-driven front panel keypad with dedicated waveform keys, numeric keypad, and rotary control knob. Connect your USB flash drive to the USB host port to quickly save and recall instrument settings and waveforms.

Rear panel



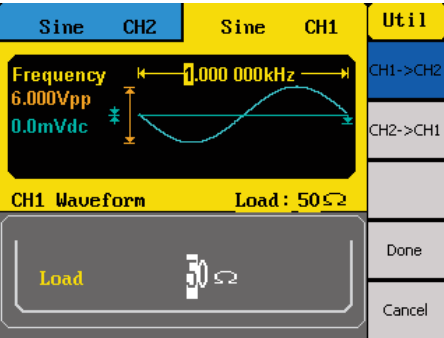
Flexible operation

Color display with waveform preview



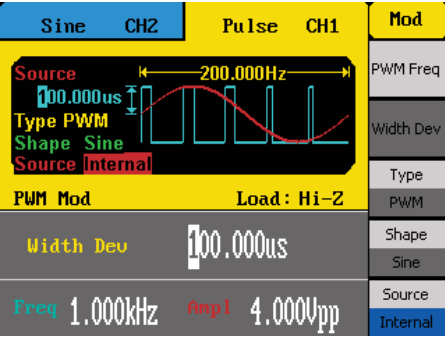
The large 3.5" color display highlights the currently selected channel and shows all relevant parameters with a preview of the waveform being generated.

Duplicate channel parameters



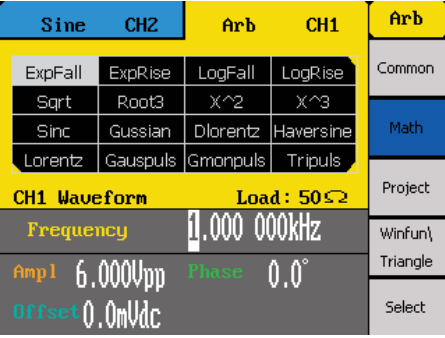
Quickly copy all waveform parameters between channels via the Utility menu. This feature can help you save time when you need to set up two identical output signals.

Wide variety of modulation schemes



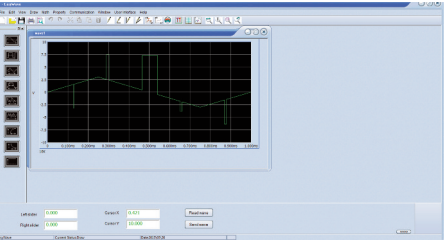
These instruments are capable of many different types of modulation for various applications. Modulate your waveforms with AM, DSB-AM, FM, PM, ASK, FSK, and PWM modulation schemes.

Arbitrary waveform generation



All models in the 4050 series have non-volatile memory to create, store, and recall up to 10 different arbitrary waveforms of up to 16,000 points each. Users can also output any of the 48 built-in predefined arbitrary waveforms.

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. A standard USB interface on the rear panel allows users to easily interface with a PC to load these arbitrary waveforms into the instrument.

Synchronization and external triggering



Use the external 10 MHz clock input to synchronize your signals to a master time base. The Sync output generates a TTL pulse for synchronization to a channel's frequency. An external trigger connector is also available for inputting or outputting trigger signals.

Specifications

| Model | 4052 | 4053 | 4054 | 4055 |
|---|---|---------------------|---------------------|---------------------|
| Channels | 2 | | | |
| Frequency Characteristics | | | | |
| Sine | 1 μ Hz – 5 MHz | 1 μ Hz – 10 MHz | 1 μ Hz – 25 MHz | 1 μ Hz – 50 MHz |
| Square | 1 μ Hz – 5 MHz | 1 μ Hz – 10 MHz | 1 μ Hz – 25 MHz | |
| Triangle, Ramp | 1 μ Hz – 300 kHz | | | |
| Pulse | 500 μ Hz – 5 MHz | | | |
| Gaussian Noise (-3 dB) | > 5 MHz | > 10 MHz | > 25 MHz | > 50 MHz |
| Arbitrary | 1 μ Hz – 5 MHz | | | |
| Accuracy | \pm 50 ppm (90 days) \pm 100 ppm (1 year) | | | |
| Resolution | 1 μ Hz | | | |
| Arbitrary Characteristics | | | | |
| Built-in Waveforms | 48 built-in waveforms (includes DC) | | | |
| Waveform Length | 16,000 points / Ch | | | |
| Vertical Resolution | 14 bits | | | |
| Sampling Rate | 125 MSa/s | | | |
| Minimum Rise/Fall Time | 7 ns (typical) | | | |
| Jitter (pk-pk) | 8 ns (typical) | | | |
| Non-volatile Memory Storage | 10 waveforms | | | |
| Output Characteristics | | | | |
| Amplitude Range | channel 1: 2 mVpp – 10 Vpp into 50 Ω (4 mVpp – 20 Vpp into open circuit), \leq 10 MHz 2 mVpp – 5 Vpp into 50 Ω (4 mVpp – 10 Vpp into open circuit), > 10 MHz | | | |
| | channel 2: 2 mVpp – 3 Vpp into 50 Ω (4 mVpp – 6 Vpp into open circuit) | | | |
| Amplitude Resolution | up to 4 digits | | | |
| Amplitude Accuracy (100 kHz) | \pm (0.3 dB + 1 mVpp of setting value) | | | |
| Amplitude Flatness (relative to 100 kHz, 5 Vpp) | \pm 0.3 dB | | | |
| Cross Talk | < -70 dBc | | | |
| Offset Range (DC) | channel 1: \pm 5 V into 50 Ω (\pm 10 V into open circuit) | | | |
| | channel 2: \pm 1.5 V into 50 Ω (\pm 3 V into open circuit) | | | |
| Offset Resolution | up to 4 digits | | | |
| Offset Accuracy | \pm (offset setting value x 1% + 3 mV) | | | |
| Channel Output Impedance | 50 Ω , high impedance | | | |
| Output Protection | short-circuit protection | | | |
| Sync Out | TTL compatible, 2 MHz maximum frequency > 50 ns width, not adjustable 50 Ω (typical) output impedance | | | |
| Waveform Characteristics | | | | |
| Harmonic Distortion | DC – 1 MHz, < -60 dBc 1 MHz – 5 MHz, < -53 dBc 5 MHz – 25 MHz, < -35 dBc 25 MHz – 50 MHz, < -32 dBc | | | |
| Total Harmonic Distortion | DC – 20 kHz at 1 Vpp, < 0.2 % | | | |
| Spurious (non-harmonic) | DC – 1 MHz, < -70 dBc 1 MHz – 10 MHz, < -70 dBc + 6 dB/spectrum phase | | | |
| Phase Noise | 10 kHz offset, -108 dBc/Hz (typical) | | | |
| Rise/Fall Time (square) | < 12 ns (10 % – 90 %) at full amplitude into 50 Ω | | | |
| Variable Duty Cycle (square) | 20% – 80% to 10 MHz 40% – 60% to 20 MHz 50% > 20 MHz | | | |
| Asymmetry (50% duty cycle) | 1% of period + 20 ns (typical, 1 kHz, 1 Vpp) | | | |
| Jitter (square) | 0.1% of period (typical, 1 kHz, 1 Vpp) | | | |
| Ramp Symmetry | 0% – 100% | | | |
| Linearity (triangle, ramp at 1 kHz, 1 Vpp, 100% symmetry) | < 0.1% of peak output (typical) | | | |

Dual Channel Function/Arbitrary Waveform Generators 4050 Series

| Model | 4052, 4053, 4054 & 4055 |
|---|---|
| Pulse | |
| Pulse Width | 16 ns minimum, 8 ns resolution |
| Rise/Fall Time | 7 ns (typical) at 1 kHz, 1 Vpp from 10% – 90% |
| Duty Cycle | 0.1% resolution |
| Overshoot | < 5% |
| Jitter (pk-pk) | 8 ns |
| Burst | |
| Waveform | sine, square, ramp, pulse, arbitrary (except DC) |
| Type | cycle (1 – 50,000 cycles), infinite, gated |
| Start/Stop Phase | 0° – 360° |
| Internal Period | 1 μ s – 500 s |
| Gated Source | external trigger |
| Trigger Source | internal, external, manual |
| Phase Offset | |
| Range | 0° – 360° |
| Resolution | 0.1° |
| Trigger Characteristics | |
| Trigger Input | |
| Max. Input Voltage | ± 6 V |
| Input Level | TTL compatible |
| Slope | rising or falling, selectable |
| Pulse Width | > 100 ns |
| Input Impedance | > 5 k Ω , DC coupling |
| Maximum Frequency | 1 MHz |
| Input Latency | < 300 ns |
| Trigger Output | |
| Voltage Level | TTL compatible |
| Pulse Width | > 400 ns |
| Output Impedance | 50 Ω |
| Maximum Frequency | 1 MHz |
| AM, FM & PM Modulation Characteristics | |
| Carrier | sine, square, ramp, arbitrary (except DC) |
| Source | internal, external |
| Modulation Waveform | sine, square, ramp, noise, arbitrary (2 mHz – 20 kHz) |
| AM Modulation Depth | 0% – 120%, 0.1% resolution |
| FM Frequency Deviation | 0 – 0.5*bandwidth, 10 μ Hz resolution |
| PM Phase Deviation | 0 – 360°, 0.1° resolution |
| ASK & FSK Modulation Characteristics | |
| Carrier | sine, square, ramp, arbitrary (except DC) |
| Source | internal, external |
| Modulation Waveform | 50% duty cycle square waveform (2 mHz – 50 kHz) |
| DSB-AM Modulation Characteristics | |
| Carrier | sine, square, ramp, arbitrary (except DC) |
| Source | internal, external |
| Modulation Waveform | sine, square, ramp, noise, arbitrary (2 mHz – 1 kHz) |
| PWM Modulation Characteristics | |
| Frequency | 500 μ Hz – 20 kHz |
| Source | internal, external |
| Modulation Waveform | sine, square, ramp, arbitrary (except DC) |
| External Modulation | - 6 V – 6 V (max. width deviation) |
| Duty Cycle Modulating Frequency | 2 mHz – 20 kHz |

| | |
|---|--|
| Sweep Characteristics | |
| Waveforms | sine, square, ramp, pulse, arbitrary (except DC) |
| Sweep Shape | linear or logarithmic, up or down |
| Sweep Time | 1 ms – 500 s |
| Sweep Trigger | internal, external, manual |
| Inputs | |
| Modulation In | ± 6 Vpp for 100% modulation > 5 k Ω input impedance maximum voltage input: ± 6 V |
| Ext Trig/Gate/FSK/Burst | TTL compatible maximum voltage input: ± 6 V |
| External Clock | 10 MHz \pm 100 Hz, TTL compatible for synchronization to external 10 MHz clock or another generator |
| Frequency Counter | |
| Measurement | frequency, period, duty cycle, positive/negative pulse width |
| Measurement Range | single channel: 100 mHz – 200 MHz pulse width/duty cycle: 1 Hz – 10 MHz |
| Frequency Resolution | 6 bits |
| DC Coupling | DC offset range: ± 1.5 VDC 100 mHz – 100 MHz, 50 mVrms – ± 2.5 V 100 MHz – 200 MHz, 100 mVrms – ± 2.5 V |
| AC Coupling | 1 Hz – 100 MHz, 50 mVrms – 5 Vpp 100 MHz – 200 MHz, 100 mVrms – 5 Vpp |
| Pulse Width/Duty Cycle Voltage Range | 50 mVrms – 5 Vpp |
| Input Impedance | 1 M Ω |
| Coupling | AC, DC |
| Trigger Level Range | -3 V – 1.8 V |
| Environmental and Safety | |
| Temperature | operating: 32 °F – 104 °F (0 °C – 40 °C) storage: -4 °F – 140 °F (-20 °C – 60 °C) |
| Humidity | < 95° F (35 °C), \leq 90 % RH 95 °F – 104 °F (35 °C – 40 °C), \leq 60 % RH |
| Altitude | operating: below 9,842 ft (3,000 m) storage: below 49,212 ft (15,000 m) |
| Electromagnetic Compatibility | EMC Directive 2004/108/EC, EN61326:2006, EN61000-3-2:2006+A2:2009, EN61000-3-3:2008 |
| Safety | Low voltage directive 2006/95/EC, EN61010-1:2001, EN61010-031:2002+A1:2008 |
| General | |
| Display | 3.5" TFT-LCD display, 320 x 240 |
| Interfaces | USB/TMC (standard), GPIB (optional), USB host port |
| Storage Memory | 10 instrument settings, 10 arbitrary waveforms |
| Power | 100 – 240 VAC \pm 10%, 50 / 60 Hz \pm 5% 100 – 120 VAC \pm 10%, 45 – 440 Hz |
| Power Consumption | 50 W max. |
| Dimensions (W x H x D) | 8.4" x 3.5" x 11.1" (213 x 89 x 281 mm) |
| Weight | 5.7 lbs (2.6 kg) |
| Three-Year Warranty | |
| Standard Accessories | Getting Started manual, full instruction manual on CD, AC power cord, USB type A-to-type B cable, certificate of calibration |
| Optional Accessories | USB-to-GPIB adapter (model AK40G) |