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Tel: +86-755-8981 8866 Fax: +86-755-8427 6832 Email & Skype: info@chipsmall.com Web: www.chipsmall.com Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



Data Sheet

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. Additionally, the included LabVIEW[™] drivers allow users to conveniently load and save .CSV or text file data directly into the arb memory without having to use waveform editing software. 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.

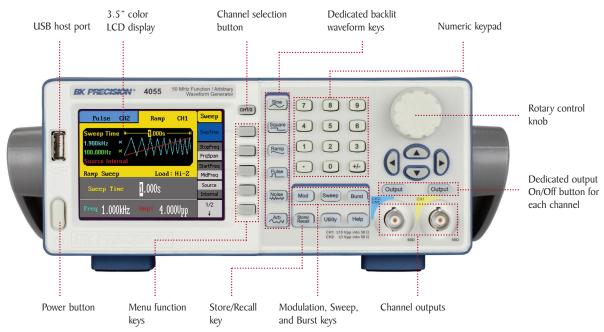
| Model | 4052 | 4053 | 4054 | 4055 |
|------------------------|---------------|----------------|----------------|----------------|
| Sine frequency range | I µHz – 5 MHz | Ι μHz – 10 MHz | Ι μHz – 25 MHz | Ι μHz – 50 MHz |
| Square frequency range | I µHz – 5 MHz | Ι μHz – 10 MHz | I μHz – | 25 MHz |

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 port (USBTMC-compliant) 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
- LabVIEW[™] drivers available



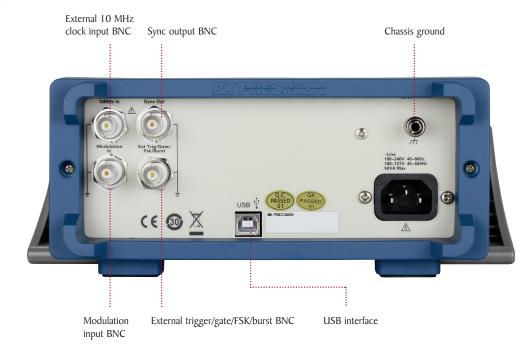
Front panel



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



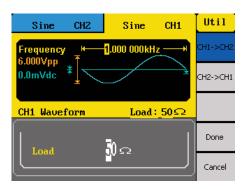
Flexible operation

Pulse Pulse CH2 Sine CH1 2.000 000kHz Frequency Period .000Vpp Ampl ÷ 0.0mVdc HLevel 100.0us Offset Load: Hi-Z CH2 Waveform LLevel 2.000 000kHz PulWidth Duty 100.0us 3.000Vpp Delay 0.0mVdc 0.0us

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

| Sine CH2 | Pulse | CH1 | Mod |
|------------------------|-------------|----------|-----------|
| Source H | -200.000Hz- | - H | PWM Freq |
| Type PWM Shape Sine | | | Width Dev |
| Source Internal | | | Туре |
| PWM Mod | Load : | Hi-Z | PWM |
| Width Dev | 100.000us | | Shape |
| with beo | | | Sine |
| | Ampl 4 MM | <u> </u> | Source |
| Freq 1.000kHz | Amp1 4.000 | vvbb | Internal |

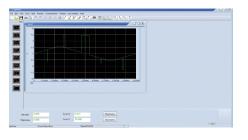
These instruments are capable of many different types of modulation for various applications. Modulate your waveforms with AM, DSB-AM, FM, PM, ASK, FSK, and PWM modulation schemes.

Arbitrary waveform generation

| | Sine | CH2 | Arb | CH1 | Arb |
|--------------|----------------|------------|----------|-----------|----------|
| | ExpFall | ExpRise | LogFall | LogRise | Common |
| | Sqrt | Root3 | X^2 | Х^З | |
| | Sinc | Gussian | Dlorentz | Haversine | Math |
| | Lorentz | Gauspuls | Gmonpuls | Tripuls 🖌 | |
| CH1 Waveform | | Load: 50 🕰 | | Project | |
| Frequency | | 1.000 00 |)0kHz | Winfun\ | |
| I | Amp1 6.000Upp | | Phase | 0.0° | Triangle |
| | offset().OmVdc | | | v.v | Select |

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 USBTMC-compliant USB device port 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 | I µHz – 5 MHz | Ι μHz – 10 MHz | l μHz – 25 MHz | I μHz – 50 MHz |
| Square | I µHz – 5 MHz | 1 μHz – 10 MHz | ι μHz - | - 25 MHz |
| Triangle, Ramp | | Ι μHz - | – 300 kHz | |
| Pulse | 500 µHz – 5 MHz | | | |
| Gaussian Noise (-3 dB) | > 5 MHz | > 10 MHz | > 25 MHz | > 50 MHz |
| Arbitrary | | Ι µHz | – 5 MHz | |
| Accuracy | ± 50 ppm (90 days) ± 100 ppm (1 year) | | | |
| Resolution | | 1 | μHz | |
| Arbitrary Characteristics | | | | |
| Built-in Waveforms | | 48 built-in wavel | forms (includes DC) | |
| Waveform Length | | 16,000 | points / Ch | |
| Vertical Resolution | | | 4 bits | |
| Sampling Rate | | 125 | MSa/s | |
| Minimum Rise/Fall Time | | 7 ns | (typical) | |
| Jitter (pk-pk) | | | (typical) | |
| Non-volatile Memory Storage | | | aveforms | |
| 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 | channer 2. | | 4 digits | |
| Amplitude Accuracy (100 kHz) | | | - | |
| Amplitude Flatness (relative to 100 kHz, 5 Vpp) | $\pm (0.3 \text{ dB} + 1 \text{ mVpp of setting value})$ $\pm 0.3 \text{ dB}$ | | | |
| Cross Talk | | < - | 70 dBc | |
| | (| channel I: \pm 5 V into 50 | Ω (± 10 V into open circu | it) |
| Offset Range (DC) | С | hannel 2: \pm 1.5 V into 50 | $0 \Omega (\pm 3 V into open circu$ | ıit) |
| Offset Resolution | up to 4 digits | | | |
| Offset Accuracy | | · · · · | value x 1% + 3 mV) | |
| Channel Output Impedance | | | h impedance | |
| Output Protection | | | uit protection | |
| Sync Out | TTL compatible, 2 MHz maximum frequency > 50 ns width, not adjustable 50 Ω (typical) output impedance | | | |
| Waveform Characteristics | | 51 | 1 1 | |
| 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 a | at I Vpp, < 0.2 % | |
| Spurious (non-harmonic) | DC - I MHz, $< -70 dBcI MHz - 10 MHz, < -70 dBc + 6 dB/spectrum phase$ | | | |
| 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) | | • | /pical, I kHz, I Vpp) | |
| Ramp Symmetry | 0% - 100% | | | |
| Linearity (triangle, ramp at 1 kHz, | | | | |
| I Vpp, 100% symmetry) | < 0.1% of peak output (typical) | | | |

| InterfaceTotalPulse16 ns minimum, 8 ns resolutionRise/Fall Time7 ns (typical) at 1 kHz, 1 Vpp from 10% – 90%Duty Cycle0.1% resolutionOvershoot $< 55\%$ Jitter (pk-pk)8 nsBurst $= 0.1\%$ resolutionWaveformsine, square, ramp, pulse, arbitrary (except DC)Typecycle (1 – 50,000 cycles), infinite, gatedStart/Stop Phase0° – 360°Internal Period1 μ s – 500 sGated Sourceexternal triggerTrigger Sourceinternal, external, manualPhase Offset0.1°Trigger Input $= 6 V$ Max, Input Voltage $\pm 6 V$ Input LevelTTL compatibleSloperising or falling, selectablePulse Width> 100 nsInput LevelTTL compatibleSlope1 MHzInput Inpedance> 5 kQ, DC couplingMaximum Frequency1 MHzNotlage LevelTTL compatiblePulse Width> 400 nsOutput ImpedanceS 0 ΩMaximum Frequency1 MHzModulation Waveformsine, square, ramp, arbitrary (except DC)Sourceinternal, externalMaximum Frequency1 MHzFrequency Deviation0 – 0.5*bandwidth, 10 µHz resolutionPulse Width> 400 nsOutput Impedance50 ΩSourceinternal, externalMaximum Frequency1 MHzRome5.% square, ramp, arbitrary (except DC)Sourceinternal, external< | Model | 4052, 4053, 4054 & 4055 |
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| Pulse Width> 400 nsOutput Impedance 50Ω Maximum FrequencyI MHzAM, FM & PM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 20 kHz)AM Modulation Depth $0\% - 120\%, 0.1\%$ resolutionFM Frequency Deviation $0 - 0.5*$ bandwidth, 10μ Hz resolutionPM Phase Deviation $0 - 360^{\circ}, 0.1^{\circ}$ resolutionASK & FSK Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsModulation Waveformsine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency 500μ Hz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- 6 V – 6 V (max. width deviation)Duty Cycle2 mHz – 20 kHz | | TTL compatible |
| Maximum Frequency1 MHzAM, FM & PM ModulatiCharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 20 kHz)AM Modulation Depth0% – 120%, 0.1% resolutionFM Frequency Deviation0 – 0.5*bandwidth, 10 µHz resolutionPM Phase Deviation0 – 360 °, 0.1 ° resolutionPM Phase Deviation0 – 360 °, 0.1 ° resolutionSourcesine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 50 kHz)PWM Modulation CharacteristicsFrequencysine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequencyS00 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequencyS00 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (2 mHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (2 mHz – 20 k | | - |
| Maximum Frequency1 MHzAM, FM & PM ModulatiCharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 20 kHz)AM Modulation Depth0% – 120%, 0.1% resolutionFM Frequency Deviation0 – 0.5*bandwidth, 10 µHz resolutionPM Phase Deviation0 – 360 °, 0.1 ° resolutionPM Phase Deviation0 – 360 °, 0.1 ° resolutionSourcesine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 50 kHz)PWM Modulation CharacteristicsFrequencysine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequencyS00 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequencyS00 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (2 mHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (2 mHz – 20 k | Output Impedance | 50 Ω |
| AM, FM & PM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 20 kHz)AM Modulation Depth $0\% - 120\%, 0.1\%$ resolutionFM Frequency Deviation $0 - 0.5*$ bandwidth, 10 μ Hz resolutionPM Phase Deviation $0 - 360^{\circ}, 0.1^{\circ}$ resolutionASK & FSK Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency $500 \ \mu$ Hz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency $500 \ \mu$ Hz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulationch V – 6 V (max. width deviation)Duty Cycle $2 \ m$ Hz – 20 kHz | | I MHz |
| Carriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 20 kHz)AM Modulation Depth $0\% - 120\%, 0.1\%$ resolutionFM Frequency Deviation $0 - 0.5*$ bandwidth, 10μ Hz resolutionPM Phase Deviation $0 - 360^\circ, 0.1^\circ$ resolutionASK & FSK Modulation \Box bracteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform 50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (arbitrary 1 kHz)PWM Modulation CharacteristicsFrequencySource, ramp, noise, arbitrary (2 mHz – 1 kHz)Frequency 500μ Hz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (arcept DC)External Modulation $-6 V - 6 V$ (max. width deviation)Duty Cycle $2 mHz = 20 kHz$ | - | on Characteristics |
| Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 20 kHz)AM Modulation Depth $0\% - 120\%, 0.1\%$ resolutionFM Frequency Deviation $0 - 0.5*$ bandwidth, 10 μ Hz resolutionPM Phase Deviation $0 - 360^\circ, 0.1^\circ$ resolutionASK & FSK Modulation CbaracteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CbaracteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency $500 \ \mu$ Hz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation CharacteristicsFrequency $500 \ \mu$ Hz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- 6 V – 6 V (max. width deviation)Duty Cycle $2 \ m$ Hz – 20 kHz | | |
| AM Modulation Depth $0\% - 120\%$, 0.1% resolutionFM Frequency Deviation $0 - 0.5*$ bandwidth, 10μ Hz resolutionPM Phase Deviation $0 - 360^\circ$, 0.1° resolutionASK & FSK Modulation Characteristics $ASK & FSK Modulation$ Carriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform 50% duty cycle square waveform ($2 \text{ mHz} - 50 \text{ kHz}$)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary ($2 \text{ mHz} - 1 \text{ kHz}$)PWM Modulation CharacteristicsFrequency 500μ Hz - 20 kHz Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)Frequency 500μ Hz - 20 kHz Modulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- $6 V - 6 V$ (max. width deviation)Duty Cycle $2 \text{ mHz} - 20 \text{ kHz}$ | Source | |
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| FM Frequency Deviation $0 - 0.5 * bandwidth, 10 \mu Hz resolution$ PM Phase Deviation $0 - 360 °, 0.1 °$ resolutionASK & FSK Modulation $+ a a cteristics$ Carriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform 50% duty cycle square waveform (2 mHz - 50 kHz)DSB-AM Modulation Ch | AM Modulation Depth | |
| PM Phase Deviation $0 - 360^{\circ}$, 0.1° resolutionASK & FSK Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform 50% duty cycle square waveform (2 mHz - 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz - 1 kHz)PWM Modulation CharacteristicsFrequency 500μ Hz - 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- $6 V - 6 V$ (max. width deviation)Duty Cycle $2 mHz = 20$ kHz | · | 0 – 0.5*bandwidth, 10 μ Hz resolution |
| Carriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequencyFrequency500 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- 6 V – 6 V (max. width deviation)Duty Cycle2 mHz – 20 kHz | PM Phase Deviation | $0 - 360^{\circ}$, 0.1 $^{\circ}$ resolution |
| Sourceinternal, externalModulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency500 μHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- 6 V – 6 V (max. width deviation)Duty Cycle2 mHz – 20 kHz | ASK & FSK Modulation | Characteristics |
| Modulation Waveform50% duty cycle square waveform (2 mHz – 50 kHz)DSB-AM Modulation CharacteristicsCarriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency500 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)Source6 V – 6 V (max. width deviation)Duty Cycle2 mHz – 20 kHz | Carrier | sine, square, ramp, arbitrary (except DC) |
| 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 µHz – 20 kHz Source internal, external Modulation Waveform sine, square, ramp, arbitrary (except DC) External Modulation - 6 V – 6 V (max. width deviation) Duty Cycle 2 mHz – 20 kHz | Source | internal, external |
| Carriersine, square, ramp, arbitrary (except DC)Sourceinternal, externalModulation Waveformsine, square, ramp, noise, arbitrary (2 mHz – 1 kHz)PWM Modulation CharacteristicsFrequency500 µHz – 20 kHzSourceinternal, externalModulation Waveformsine, square, ramp, arbitrary (except DC)External Modulation- 6 V – 6 V (max. width deviation)Duty Cycle2 mHz – 20 kHz | Modulation Waveform | 50% duty cycle square waveform (2 mHz – 50 kHz) |
| Source internal, external Modulation Waveform sine, square, ramp, noise, arbitrary (2 mHz – 1 kHz) PWM Modulation Characteristics Frequency 500 µHz – 20 kHz Source internal, external Modulation Waveform sine, square, ramp, arbitrary (except DC) External Modulation - 6 V – 6 V (max. width deviation) Duty Cycle 2 mHz – 20 kHz | DSB-AM Modulation Ch | aracteristics |
| Modulation Waveform sine, square, ramp, noise, arbitrary (2 mHz – 1 kHz) PWM Modulation Characteristics Frequency 500 µHz – 20 kHz Source internal, external Modulation Waveform sine, square, ramp, arbitrary (except DC) External Modulation - 6 V – 6 V (max. width deviation) Duty Cycle 2 mHz – 20 kHz | Carrier | sine, square, ramp, arbitrary (except DC) |
| PWM Modulation Characteristics Frequency 500 μHz – 20 kHz Source internal, external Modulation Waveform sine, square, ramp, arbitrary (except DC) External Modulation - 6 V – 6 V (max. width deviation) Duty Cycle 2 mHz – 20 kHz | Source | internal, external |
| Frequency 500 μHz – 20 kHz Source internal, external Modulation Waveform sine, square, ramp, arbitrary (except DC) External Modulation - 6 V – 6 V (max. width deviation) Duty Cycle 2 mHz – 20 kHz | Modulation Waveform | sine, square, ramp, noise, arbitrary (2 mHz – 1 kHz) |
| Source internal, external Modulation Waveform sine, souare, ramp, arbitrary (except DC) External Modulation - 6 V - 6 V (max. width deviation) Duty Cycle 2 mHz - 20 kHz | PWM Modulation Chara | cteristics |
| Modulation Waveform sine, square, ramp, arbitrary (except DC) External Modulation - 6 V - 6 V (max. width deviation) Duty Cycle 2 mHz - 20 kHz | Frequency | 500 µHz – 20 kHz |
| External Modulation - 6 V - 6 V (max. width deviation) Duty Cycle 2 mHz - 20 kHz | Source | internal, external |
| Duty Cycle 2 mHz - 20 kHz | Modulation Waveform | sine, square, ramp, arbitrary (except DC) |
| 7 mHz = 70 kHz | External Modulation | - 6 V – 6 V (max. width deviation) |
| Modulating Frequency | Duty Cycle | 2 mHz - 20 bHz |
| | Modulating Frequency | 2 mil = 20 mil |

| Sweep Characteristics | |
|---|---|
| Waveforms | sine, square, ramp, 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 | \pm 6 Vpp for 100% modulation > 5 k Ω input impedance maximum voltage input: \pm 6 V |
| Ext Trig/Gate/FSK/Burst | TTL compatible maximum voltage input: \pm 6 V |
| External Clock | 10 MHz ± 100 Hz, TTL compatible for synchronizatio 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 | ΙΜΩ |
| Coupling | AC, DC |
| Trigger Level Range | -3 V – 1.8 V |
| Environmental and Safe | ty |
| Temperature | operating: 32 °F – 104 °F (0 °C – 40 °C) storage: -4 °F – 140 °F (-20 °C – 60 °C) |
| Humidity | < 95° F (35 °C), ≤ 90 % RH 95 °F – 104 °F (35 °C – 40 °C), ≤ 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 | USBTMC (standard), GPIB (optional), USB host port |
| Storage Memory | 10 instrument settings, 10 arbitrary waveforms |
| Power | 100 - 240 VAC ± 10%, 50 / 60 Hz ± 5% 100 - 120 VAC ± 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 |