B&K PRECISION
SETTING NEW STANDARDS IN PERFORMANCE & VALUE

MODEL 4070

Function & Arbitrary Waveform Generator

Data Sheet

The B&K Model 4070 represents the finest single source for signal generation to date. Combining the latest DSP and DSS technologies, the 4070 offers a number of operating modes, providing a versatile, cost-effective signal source. You will find the 4070 is the best value and most capable instrument on the bench.

Arbitrary Waveform Generator, Sweep Function Generator, Pulse, VCO, AM, FM, Ø Modulation, FSK and Burst Modes are all accessed quickly and easily from the front panel keypad. Being a true 12 bit arbitrary generator, the 4070 is stable, accurate and drift free. Unlike competitive models, the 4070 generates every data point independently of the repetition rate instead of a simple look-up table. Custom design waveforms on a PC, or download from a number of sources, spread sheet, oscilloscope or application program - the 4070 will perform like no other signal source.

- **Arbitrary Waveform Generation**
  Design custom waveforms on your PC and download for generation 40 MSamples/sec max update rate 12 bit resolution, 32K buffer.

- **Function Generator**
  Generate Triangle, Ramp, Sinewave and others.

- **Pulse Generator**
  Digital waveforms with an adjustable duty cycle.

- **High Stability Timebase**
  Guarantee ±5 ppm frequency over 0 to 40°C range.

- **Modes**
  - Basic Sine/Square Wave
  - Linear/Log Sweep (Free Run or Triggered)
  - Internal/ External AM
  - Internal/ External FM
  - Internal/ External PM
  - Internal/ External SSB
  - Internal/ External BPSK
  - Internal/ External FSK (Ext FSK to 3 MHz)
  - Burst (Int/Ext trigger)
  - DTMF Generation
  - DTMF Detection
  - Power Measurement
  - Dualtone Generation
  - Arbitrary Waveform
  - Function Generator
  - Pulse Generator

- **Loop n' Link Virtual Memory**
  Nearly infinite memory capabilities for unbelievable flexibility (downloadable upgrade available May '99)

The B&K Precision 4070 represents a major breakthrough in signal generation and analysis. This versatile instrument has capabilities that allow the engineer to use only one instrument in a broad range of applications that include communications, radio, telephony, analog/digital circuit design and test.

The 4070 is much more than a signal generator. Never before has so much versatility, capability and performance been packed into a single low-cost instrument. Its architecture is based on the latest advances in DSP and DDS technology which not only ensures calibrated and drift-free performance, but also gives the engineer signal analysis functions such as DTMF Detection and Power Level Measurement. The capabilities of the 4070 can continually be enhanced and expanded by downloading software upgrades to internal Flash memory.

The 4070 delivers clean, fully synthesized, DC to 21.5 MHz modulated or unmodulated waveforms with .01 Hz frequency resolution. User-friendly features include a large, easy-to-read illuminated LCD display which allows the user to see all modulation parameters simultaneously and a full numeric keypad and encoder which provide direct editing of each parameter. No confusing submenus!

Arbitrary Waveform Generator
The Arbitrary Waveform Generator allows you to design custom waveforms on your personal computer and download them to the 4070 which generates them in real-time. The Arbitrary Waveform Generator system is also used to generate pulse waveforms with an adjustable duty cycle and a suite of pre-stored Function Generator waveforms. Arbitrary waveforms may either be designed with a graphical Windows-based design tool or be generated point-by-point in a variety of data formats from your own application software. A floppy diskette with a data generator program, example waveforms, and a downloader utility are included with this option.

It is important to note that many competing signal generators with Arbitrary Waveform capability simply replace the sinewave lookup table used in the DDS system with the arbitrary waveform data points. The disadvantage of this technique is that waveform points will actually be skipped over as the waveform repetition rate is increased! Unlike these models, the B&K Precision Model 4070 is a true Arbitrary Waveform generator with a highly accurate synthesized clock which will generate every point, every time, regardless of the repetition rate.

A digital TTL/CMOS SYNC output can be independently controlled point-by-point which lets you create a pattern of logic pulses along with your analog waveform. This output swings 0V to +5V and can directly drive digital logic. It is useful for designing arbitrary digital waveforms or generating triggering or synchronizing pulses along with the analog waveform.

The arbitrary waveform generator has been designed to be very easy to use. The 4070 will accept waveform data in a multitude of formats. No confusing protocols or headers are required, and the data may be separated by any non digit character (carriage returns, commas, tabs, spaces, etc.), which makes it easy to download data from a variety of application programs, spreadsheets, and sampling oscilloscopes.

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MODEL 4070

Function & Arbitrary Waveform Generator

■ **Standard Features**
- DC offset capability
- TTL/CMOS sync output available in all modes
- RS232 remote control (Easy to use) Code examples included.
- External logic input for gating or output signal and triggering.
- Easy software updates via Flash memory.
- Configuration save/restore: 10 complete front panel setups.

■ **Main Output**
- Frequency: DC to 21.5000000 MHz, .01 Hz steps
- Level: 2 mVp-p to 5.000 Vp-p, 1mV steps (into 50 W) or -50.0 dBm to +18.0 dBm, .1 dBm steps (into 50 W)
- Level Accuracy: ±1%
- Flatness: ± . 2 dB (DC-21.5 MHz)
- DC offset: 0V to ±4.0 V, 1 mV steps (into 50 Ω)
- Output impedance: 50 Ω
- Freq. accuracy: ±10 ppm (.001%), ±5 ppm optional
- Phase Noise: < -55 dBc in a 30 KHz band
- Spectral Purity:
  - DC to 100 KHz: > -50 dBc
  - 100 KHz to 1 MHz: > -45 dBc
  - 1 MHz to 12 MHz: > -40 dBc
  - 12 MHz to 21.5 MHz: > -35 dBc

■ **Sync Output**
- Amplitude: 0V to +5V (TTL/CMOS comp.)
- Fall Time: 3 nS.
- Rise Time: < 8 nS. 10% to 90%
- Output current: ±24 mA.

■ **RS232 Port**
- Asynchronous, no parity, 1 start bit, 1 stop bit.
- Baud rate: Adjustable, 300 bps to 115,200 bps.
- Remote operation from a terminal or host computer.

■ **External Modulation Input**
- Maximum full scale input: ±5 V (10 Vp-p)
- Input Impedance: 30 KΩ

■ **Ext. Trigger/Gating/FSK/BPSK Input**
- Input impedance: 80 KΩ
- Max. input level: ±10V
- Max. gating freq: 3 MHz

■ **Ext. ARB CLOCK Input**
- Input level: TTL/CMOS
- Max. clock freq: 40 MHz

■ **General**
- Power: 100-240 VAC 47-63 Hz, 30W, 3 prong IEC conn.
- Display: 2 line by 40 character, LCD, backlit.
- Weight: Approx. 3.5 lbs. (1.6 kg)
- Dimensions: (H x W x L) 5.1" x 9.3" x 10.2" (129 x 236 x 259mm)
- Operating Temperature: 32° to 104°F (0° to 40°C) ambient.
- Stored instrument setups: 10, including 1 power-up state

■ **Operating Modes**
- The carrier frequency for all modulation modes is 0 Hz to 21.5000000 MHz, .01 Hz steps.
- All internal modulation frequencies are synthesized and are accurate to .01%.

■ **Basic Sinewave (CW) Mode**
- Output frequency: 0 Hz to 21.500 MHz, .01 Hz steps

■ **Frequency Modulation (FM) Mode**
- Int. modulation freq: 0 Hz to 10 KHz, 1 Hz steps
- Ext. modulation freq: DC to 35 KHz
- Peak frequency deviation: 0 Hz to ±5.0 MHz, 1 Hz steps

■ **Phase Modulation (PM) Mode**
- Int. modulation freq: 0 Hz to 10 KHz, 1 Hz steps
- Ext. modulation freq: DC to 35 KHz
- Peak phase deviation: 0 to ±180°, 1° steps

■ **Sweep Mode**
- Start/Stop freq: 0 Hz to 21.500 MHz, .01 Hz steps
- Linear or Log sweep. Up or Down sweep direction
- Continuous or Int/Ext Triggered sweep
- Sweep time: 1 mS to 60 Sec. 1 mS steps.

■ **Voltage Controlled Oscillator Mode**
- Endpoint frequencies: 0 Hz to 21.500 MHz, .01 Hz steps
- Control input range: -5.0V to +5.0V
- Control signal bandwidth: DC to 35 KHz

■ **Burst Mode**
- Continuous or Triggered from Front Panel, RS232, or Ext. TTL
- On Time: 1 mS to 99.999 Sec, 1 mS steps
- Off Time: 0 mS to 99.999 Sec, 1 mS steps

■ **Dual Tone Multi Frequency (DTMF) Generate Mode**
- Dialing digits generated: 0 to 9, #, W, A, B, C, D
- Duration: 1 mS to 10.000 Sec, 1 mS steps
- Delay: 0 mS to 10.000 Sec, 1 mS steps

■ **Custom Dual Tone Generate Mode**
- Tone 1, Tone 2 Frequency: DC to 10.000 KHz, 1 Hz steps
- Phase Offset: 0 deg. to 359 deg., 1 deg. steps
- Output ON time: Cont. or 1 mS to 10.000 Sec, 1 mS steps
- Output OFF time: 0 mS to 10.000 Sec, 1 mS step.

■ **Amplitude Modulation (AM) Mode**
- Int. modulation freq: 0 Hz to 10 KHz, 1 Hz steps
- Ext. modulation freq: DC to 35 KHz
- Percentage modulation: Variable 0% to 100%, 1% steps

■ **Single Sideband (SSB) Mode**
- Int. modulation freq: 0 Hz to 5.0 MHz, 1 Hz steps
- Ext. modulation freq: DC to 8500 Hz
- Upper or Lower Sideband selectable

■ **Frequency Shift Keying (FSK) Mode**
- Int. modulation freq: 0 Hz to 130 KHz, 1 Hz steps
- Ext. modulation freq: 0 Hz to 3 MHz
- Mark/Space freqs: 0 Hz to 21.5 MHz, .01 Hz steps

■ **Data modulation mode**
- Baud Rate: 0 Hz to 130 KHz, 1 Hz steps
- Message length: 1 to 960 bits. Nonvolatile storage: 10 locs.
- Mark/Space frequencies: 0 Hz to 21.5 MHz, .01 Hz steps

■ **Power & Voltage Measurement Mode**
- Input signal range: ±5 V
- Input signal bandwidth: DC to 50 KHz
- Power calc. impedance: Variable from 1 to 999 ohms

■ **Binary Phase Shift Keying (BPSK) Mode**
- Int. modulation freq: 0 Hz to 130 KHz, 1 Hz steps
- Ext. modulation freq: 0 Hz to 10 KHz

■ **Dual Tone Multi Frequency (DTMF) Detect Mode**
- DTMF digits detected: 0 to 9, #, ✷, A, B, C, D
- Detection range: 10 Vp-p max., 20 mVp-p min.
- Detection time: 100 mS

■ **Other Modes**

New modes are constantly being added. They can be obtained via www, email, or floppy disk and downloaded to the 4070. Please check website periodically for availability.

■ **Arbitrary Waveform Generator Mode**
- Vertical Resolution: 12 bits
- Sample Rate: Variable from 0Hz to 40 Msamples/Sec. in .1 Hz steps
- Sample Buffer Depth: 32,768 data points
- Data Formats Supported: Floating Point, Decimal, Hexadecimal, Integer, Binary, Digital, CSV and PRN formats
- Nonvolatile waveform storage: 1 location, 32,768 points

■ **Function Generator Mode**
- Waveforms: Pos. Ramp, Neg. Ramp, Triangle, Pos. Exponential, Inverted Pos. Exponential, Neg. Exponential, Inverted Neg. Exponential, Random (noise), Sinewave
- Repetition Rate: 0 Hz to 2 MHz in 1 Hz steps, all functions
- Run Mode: Continuous or Internal/External Triggered

■ **Pulse Generator Mode**
- Frequency: 0 Hz to 2 MHz in 1 Hz steps
- Duty Cycle: Variable 0% to 100% in 1% steps
- Run mode: Continuous or Intl/Ext Triggered
- Output: Variable in amplitude and offset, A TTL/CMOS output is simultaneously provided.

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Competitive Review - 20MHz Arbitrary Waveform Generators

	B&K Precision 4070	Pragmatic 1404A	Stanford Research DS 340	Stanford Research DS345	HP 33120A	Wavetek Model 39	Tektronix AFG310
List Price	**$1495**	$1,295	$1,195	$1,595	$1,725	$1,695	$1,895
Bandwidth	**DC – 20.1 MHz**	100 mHz-20 MHz	1 µHZ-15.1 MHz	30.2 MHz	100 µHz-15 MHz	100 µHz-10 MHz	10 mHz-16 MHz
Freq. Resolution	**.01 Hz**	.01 Hz	1 µHZ	1 µHZ	10 µHZ	.1 mHz	1 Hz
Waveforms							
Sine	✔	✔	✔	✔	✔	✔	✔
Square	✔	✔	✔	✔	✔	✔	✔
Pulse	✔					✔	✔
Ramp	✔ **2 MHz**		✔ 100 KHz	✔ 100 KHz	✔ 100 KHz	✔ 100 KHz	✔ 100 KHz
Triangle	✔ **2 MHz**		✔ 100 KHz	✔ 100 KHz	✔ 100 KHz	✔ 100 KHz	✔ 100 KHz
Random (noise)	✔ **10 MHz**		✔ 10 MHz	✔ 10 MHz	✔ 10 MHz		✔ 8 MHz
Arbitrary Waveform	✔ 32K points 40 Msamples/Sec	N/A 16K points 40 Msamples/Sec	$495 option 16K points 40 Msamples/Sec	$495 option 16K points 40 Msamples/Sec	✔ 64K points 30 Msamples/Sec	✔ 16K points 16 Msamples/Sec	✔
Multi Unit Arblock	✔			✔	$395 option	✔	
True Arb Generation *	✔						
Field Software Upgrades	✔						
Modulation							
AM	**Int/Ext**	Int		Int/Ext	Int/Ext	Ext	Ext
FM	**Int/Ext**	Int/Ext		Int	Int		Int
PM	**Int/Ext**			Int			
SSB	**Int/Ext**						
FSK	**Int. / 3 MHz Ext.**	Int. / 1 MHz Ext.	Int. / 1 MHz Ext.		Int. / 1 MHz Ext.		Int
BPSK	**Int/Ext**						
Sweep	**Linear/Log**	Linear/Log	Linear/Log	Linear/Log	Linear/Log	Linear/Log	Linear/Log
Other Functions							
Burst	✔			✔	✔	✔	✔
DTMF Generate	✔						
DTMF Detect	✔						
Dualtone	✔						
VCO	✔						
Volts & Pwr Meas.	✔						
Data Modulation	✔						
Remote Control							
RS232	✔	✔	w/ $495 option	w/ $495 option	✔	✔	
IEEE 488		✔	w/ $495 option	w/ $495 option	✔	✔	✔
Stored Instrument Presets	**10**	1	10	10	10	9	20
Output Level, 50Ω	**4 mV - 10 Vpp**	1 mV - 10 Vpp	50 mV - 10 Vpp	50 mV - 10 Vpp	50 mV - 10 Vpp	2.5 mV - 10 Vpp	10 mV - 10 Vpp
Warranty	**1 Year**	1 Year	1 Year	1 Year	1 Year	1 Year	3 Years

* True Arb Generation: The arb clock is fully synthesized, as opposed to a clock generated by a DDS phase accumulator which can result in phase jitter and missed points.

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