

# Models 4084, 4085, 4086 & 4087

Programmable DDS Function Generator Series

## **Data Sheet**

## Programmable DDS Function Generator Series

Models 4084, 4085, 4086 & 4087

The B+K Precision® models 4084, 4085, 4086 and 4087 are high performance laboratory grade synthesized function generators with a wide frequency range of up to 120 MHz. Direct digital synthesis (DDS) techniques are used to create stable, accurate output signals for all 27 built-in standard and complex (arbitrary) waveforms. The generators produce high purity, low distortion sine waves, square waves up to 40 MHz and provide a stable output of very small signals down to the 1mV - 10mV range. The instrument also provides a built-in 100 MHz Universal Counter with frequency measurement and totalize function.

The versatility and capabilities of this series make it an ideal tool for many general-purpose test and bench applications or for use in Training and Education.

Versatile modulation and trigger capabilities

The generators provide extensive modulation capabilities including AM, FM, FSK, PSK, pulse modulation and linear/logarithmic sweep. Internal and external modulation sources, as well as internal, external and gated trigger sources are supported. Modulation parameters can be set precisely and are

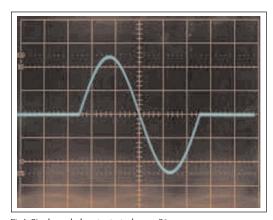


Fig I Single cycle burst, start phase= $0^{\circ}$ 



adjustable over a wide range. For instance burst count is programmable in 1 burst increments up to 10000 bursts and burst phase is adjustable in  $0.1^{\circ}$  increments.

### Convenient user interface and operation

You can adjust parameters via knob or numeric keypad. Enter amplitude values directly in Vpp, mVpp, Vrms, mVrms or dBm and display the correct voltage by entering the actual output configuration used (terminated with 50 Ohm or open circuit). You can enter frequency in terms of frequency or seconds using time values s, ms, Hz, kHz or MHz. Submenus are used for modulation modes and other complex functions. The generators are fully programmable via the standard RS232 interface, using SCPI commands. The instrument also provides 10 memories to store and recall instrument settings. Additionally the current state is saved at power off and can be restored at power up.



				models
	4084	4085	4086	4087
requency Characteristics				l
Sine		$1\mu$ Hz ~ 40MHz		
Square	$\mu$ Hz ~ 20MHz	$1\mu$ Hz ~ 40MHz	·	$\mu$ Hz ~40MHz
All Other waveforms	1μHz ~ 100kHz			
Frequency Stability	±1x10 <sup>-6</sup> (22°C ±5°C)			
Resolution	IμHz			
Accuracy	≤ ± 5x10 <sup>-6</sup> (22°C ±5°C)			
Data entry Units		s, m	s, Hz, kHz, MHz	
Vaveform Characteristics				
Main Waveforms (Sine, Square)				
Amplitude resolution			12 bits	
Sample Rate		200MSa/s		300MSa/s
Sine				
Harmonic Distortion	≤ - 50dBc (frequency ≤ 5MHz)			
of Sine Wave*	≤ - 45dBc (frequency ≤ 10MHz)			
	≤ - 40dBc (frequency ≤ 20MHz)			
			(frequency $\leq 40$	
			(frequency > 40	
THD *	0.1% (20Hz ~ 100kHz)			
Square	(2012 100012)			
Rise and fall time*			≤ 15ns	
* = Note: Test conditions for	harmonic distortio	n, sine distortion.		
rise/fall time Output Ampl			ture: 25°C±5°C	
Others built-in waveforms	11.	1		
27 build-in standard and	S	ne, Square, Triang	le, Positive Ramp	Falling Ramp.
complex waveforms		- 0		0 1
	Noise, Pulse, Positive Pulse, Negative Pulse, Positive DC, Negative DC, Stair wave, Coded Pulse, Full wave rectified, Half-wave rectified, Sine transverse cut, Sin			
	vertical cut, Sine phase modulation, Logarithmi			
	E			
	Exponential, Half-round, Sinx/x, Square root, Tangent, Cardiac, Earthquake, Combination			
Wayeform Langth		aruiac, EarthQuake		
Waveform Length			4096 dots	
Amplitude Resolution			10 bits	
Pulse		0.101	0.00/4.1	11-7
Duty Cycle	0.1% ~ 99.9% (below 10kHz),			
· · ·			% (10kHz ~ 100	
Rise/Fall Time		≤ 100n	s (Duty Cycle 20	%)
DC signal characteristics				
DC range			· 10V (high imped	
DC Accuracy		≤ ±5% of setting	ng +10mV (high i	impedance)
Arbitrary				
Non volatile memory			8 waveforms	
Waveform length		8~	-16000 points	
Amplitude resolution			10 bits	
Frequency range		1,1	µHz∼100kHz	
Sample rate		,	200MSa/s	
implitude Characteristics				
Amplitude Range				
For all models	Freo ≤ 40MHz:	2mV ~ 20Vpp (op	en circuit) . ImV	~ 10Vpp (50Ω)
4084, 4085, 4086		$2mV \sim 4Vp-p$ (or		
4087		$0.1 \text{mV} \sim 3 \text{Vpp}$ (S		11 (2022)
Resolution			n circuit), IµVpp	(50Ω)
Accuracy			(sine wave relative	
/ ICCUIACY			SILL MANC ICIALIVE	
			1 5 % /3 hours	
Stability		±(	0.5 % /3 hours	, , , , , , , , , , , , , , , , , , , ,
Stability Flatness				
Stability Flatness For amplitude ≤ 2Vpp		3% (freo≤ 5MHz)	±10% (5MHz<	freq≤ 40MHz)
Stability Flatness		3% (freo≤ 5MHz) 5% (freo≤ 5MHz)	±10% (5MHz< ±10% (5MHz<	freq≤ 40MHz) freq≤ 20MHz)
Stability Flatness For amplitude ≤ 2Vpp		3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% (	±10% (5MHz < ±10% (5MHz < frequency > 20MH	freo≤ 40MHz) freo≤ 20MHz) Hz)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:		3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% (	. ±10% (5MHz < . ±10% (5MHz < frequency > 20MH (frequency > 40M	freq≤ 40MHz) freq≤ 20MHz) Hz)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance		3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm	. ±10% (SMHz< . ±10% (SMHz< frequency>20MH (frequency>40M 50Ω	freqs 40MHz) freqs 20MHz) Hz) Hz)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units		3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm	. ±10% (5MHz < . ±10% (5MHz < frequency > 20MH (frequency > 40M	freqs 40MHz) freqs 20MHz) Hz) Hz)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units	±	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm	±10% (5MHz< ±10% (5MHz< frequency>20MH (frequency>40M 50Ω p, Vrms, mVrms,	freqs 40MHz) freqs 20MHz) Hz) Hz)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units	±	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm	±10% (5MHz< ±10% (5MHz< frequency>20MH (frequency>40M 50Ω p, Vrms, mVrms,	freqs 40MHz) freqs 20MHz) Hz) Hz)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics	± Freq≤ 40MH:	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm	±10% (5MHz< ±10% (5MHz< frequency>20MH (frequency>40M 50Ω p, Vrms, mVrms, c (Offset ≤ 2 x pl	freqs 40MHz) freqs 20MHz) Hz) Hz) dBm
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics	± Freq≤ 40MH:	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp, mVp  2): ±10Vpk ac+d (z): ±2Vpk ac+de	±10% (5MHz< ±10% (5MHz< frequency>20MH (frequency>40M 50Ω p, Vrms, mVrms, c (Offset ≤ 2 x pl	freq≤ 40MHz) freq≤ 20MHz) Hz) Hz) dBm  - pk amplitude) - pk amplitude)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics Offset Range (open circuit)	± Freq ≤ 40MH; Freq > 40MH	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp, mVp  2): ±10Vpk ac+d (z): ±2Vpk ac+de	$\pm 10\%$ (5MHz < $\pm 10\%$ (5MHz < frequency > 20MH (frequency > 40M	freqs 40MHz) freqs 20MHz) Hz) Hz) dBm  - pk amplitude) - pk amplitude)
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units Offset Characteristics Offset Range (open circuit)  Offset Resolution	± Freq ≤ 40MH Freq > 40MH ±5% of se	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp. mVp  2): ±10Vpk ac+d z): ±2Vpk ac+de 2µV (ope etting +10mV (Am	. ±10% (5MHz < . ±10% (5MHz < frequency > 20MH (frequency > 40MHs	freqs 40MHz) freqs 20MHz) freqs 40MHz) freqs 20MHz) freq
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units Offset Characteristics Offset Range (open circuit)  Offset Resolution Offset Error	± Freq ≤ 40MH Freq > 40MH ±5% of se	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp, mVp  t): ±10Vpk ac+d (z): ±2Vpk ac+de 2µV (ope	. ±10% (5MHz < . ±10% (5MHz < frequency > 20MH (frequency > 40MHs	freq≤ 40MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 40MHz) freq≤ 20MHz) freq≤ 20MHz freq< 20MHz freq≤ 20MHz freq< 20MHz f
Stability Flatness  For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics Offset Range (open circuit)  Offset Error  Modulation	± Freq ≤ 40MH Freq > 40MH ±5% of se	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp. mVp  2): ±10Vpk ac+d z): ±2Vpk ac+de 2µV (ope etting +10mV (Am	. ±10% (5MHz < . ±10% (5MHz < frequency > 20MH (frequency > 40MHs	freq≤ 40MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 40MHz) freq≤ 20MHz) freq≤ 20MHz freq< 20MHz freq≤ 20MHz freq< 20MHz f
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics Offset Range (open circuit)  Offset Error  Modulation AM Characteristics	± Freq ≤ 40MH Freq > 40MH ±5% of se	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp, mVp  2): ±10Vpk ac+de 2µV (ope etting +10mV (Ame etting +20mV (Ame	. ±10% (5MHz < . ±10% (5MHz < frequency>20MH (frequency>40M	freq≤ 40MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 20MHz) freq≤ 40MHz) freq≤ 20MHz) freq≤ 20MHz freq< 20MHz freq≤ 20MHz freq< 20MHz f
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics Offset Range (open circuit)  Offset Resolution Offset Error  And Characteristics Carrier Waveforms	± Freq ≤ 40MH Freq > 40MH ±5% of se	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp, mVp 2): ±10Vpk ac+dd z): ±2Vpk ac+dd 2µV (ope etting +10mV (Am etting +20mV (Am	. ±10% (5MHz < . ±10% (5MHz < frequency>20MH (frequency>40M   50Ω p, Vrms, mVrms, c (Offset ≤ 2 x pk   n circuit), 1μV (5 pl. ≤ 2Vpp into compl. > 2Vpp into compl. > 2Vpp into compl. > 2Vpp into complex co	freq≤ 40MHz) freq≤ 20MHz) dz) Hz) dBm
Stability Flatness For amplitude ≤ 2Vpp For amplitude > 2Vpp:  Output Impedance Output Units OC Offset Characteristics Offset Range (open circuit)  Offset Error  Modulation AM Characteristics	± 5% of s ± 5% of s	3% (freq≤ 5MHz) 5% (freq≤ 5MHz) ±20% ( ±1dBm  Vpp, mVp  2): ±10Vpk ac+dc 2/IV (ope etting +10mV (Am etting +20mV (An  S  Inte	. ±10% (5MHz < . ±10% (5MHz < frequency>20MH (frequency>40M	freq≤ 40MHz) freq≤ 20MHz) Hz) Hz) dBm  (- pk amplitude) - pk amplitude) open circuit) open circuit)

Specifications (Cont.)	Models 4084, 4085, 4086 & 4087
<u> </u>	
Distortion  Modulation Depth	≤ 2%  1% ~ 120%, 1% ~ 80% (frequency>40MHz,
Modulation Error	Ampl > 2Vpp into open circuit) $\pm 5\% + 0.2\% (100\mu Hz < frequency \le 10kHz)$
May Amplitude of out input signal	$\pm 10\% + 2\%$ (10kHz < frequency ≤ 20kHz) 3Vp-p (-1.5V~ +1.5V)
Max. Amplitude of ext. input signal FM Characteristics	3vp-p (-1.3v~ +1.3v)
Carrier Waveforms	Sine or Square
Modulation Source	Internal or external
Internal Modulating Waveform	Sine, Square, Triangle, Rising/Falling Ramp
Frequency of modulating signal	100μHz ~ 10kHz
Deviation	Max. 50% of carrier frequency for internal FM Max 100kHz (carrier frequency≥ 5MHz) for external FM, with input signal voltage 3Vp-p (-1.5V~+1.5V)
FSK Characteristics	
Carrier Waveform	Sine or Square
Control Model	Internal or external trigger (external: TTL level, low level F1, high level F2)
FSK Rate	0.1 ms ~ 800s
PSK Characteristics	6: 6
Carrier Waveform	Sine or Square
PSK Percelution	Phase 1 (P1) and Phase 2 (P2), range: 0.0 ~ 360.0°  0.1°
Resolution PSK rate	0.1° 0.1ms ~ 800s
Control Mode	Internal or external trigger (external: TTL level, low level P1, high level P2)
Burst Characteristics	
Waveform	Sine or Square
Burst Counts	1 ~ 10000 cycles
Time interval between bursts	0.1 ms ~ 800s
Control Mode	Internal, single or external gated trigger
Frequency Sweep Characteristics	
Waveform	Sine or Square
Sweep Time	1ms ~ 800s (linear), 100ms ~ 800s (log)
Sweep Mode Start/ Stop Frequency	Linear or Logarithmic Same as frequency range of Sine & Square
External trigger signal frequency	DC ~ 1kHz (linear) DC~10Hz (log)
Control Mode	Internal or external trigger
Inputs/ Outputs	00
Main Output	
Impedance	50Ω
Protection	Short circuit and overload protected
Output MOD OUT	
Frequency	100Hz ~ 20kHz
Waveform	Sine, Square, Triangle, Rising/Falling Ramp
Amplitude	5Vp-p ± 5%
Output Impedance  Modulation IN	600Ω 2Vpp = 100% Modulation
External Input Trig/FSK/Burst	3Vpp = 100% Modulation Level - TTL
Universal Counter, Key Specs*	LCVCI - IIL
Frequency Range	
Frequency Measurement	1Hz ~ 100MHz
Totalize mode	50MHz max
* For the full specification of the counter so	
General	
Power Supply	198~242V or 99~121V, Frequency: 47~ 63Hz
Power Consumption	<35VA
State Storage Memory	
Storage Parameters	frequency, amplitude, waveform, DC offset values, modulation parameters
Storage Capacity	10 user configurable stored states
Dimensions (W x H x D)	10" x 3.93" x 14.56" (255 mm x 100 mm x 370 mm)
Weight Remote Interface	6.6lbs (3 kg)
Remote Interface Safety designed according to	RS232 EN61010
EMC tested according to	EN55022, EN55024, EN61326, EN601000
Accessories Included	One Year Warranty

BNC to alligator cable, BNC to BNC cable, RS232 communication cable, power line cord, Accessories Included test report, spare fuse

NOTE: Specifications and information are subject to change without notice. Please visit www.bkprecision.com for the most current product information.