

# 3 GHz Programmable Counter HM8123

HM8123



HZ33, HZ34  
Test cable BNC/BNC



HZ42 19" Rackmount kit 2 RU



HZ20 Connector  
BNC to 4 mm socket



- Measurement range 0Hz...3GHz
- 2 measurement inputs DC...200MHz,  
1 measurement input 100MHz...3GHz
- Input A/B: Input impedance 1 MΩ/50Ω (switchable),  
sensitivity 25mV<sub>rms</sub>
- Input C: Input impedance 50Ω, sensitivity 30mV<sub>rms</sub>
- 400MHz time base with 0.5ppm stability
- 9-digit resolution at 1s gate time
- 9 measurement functions, external gate and arming
- Input for external time base (10MHz)
- Display modes: numeric, histograms or trend plots
- Standard: TCXO (temperature stability:  $\pm 0.5 \times 10^{-6}$ )  
Optional: OCXO (temperature stability:  $\pm 1 \times 10^{-8}$ )
- Intuitive one-pushbutton operation each function directly  
addressable
- Galvanically isolated USB/RS-232 Interface, optional IEEE-488

## 3 GHz Programmable Counter HM8123

All data valid at 23 °C after 30 minute warm-up

### Input characteristics (Input A and B)

<b>Connection:</b>	BNC socket	
<b>Frequency range:</b>		
0...200 MHz	(DC-coupled)	
10 Hz...200 MHz	(1 MΩ, AC-coupled)	
500 kHz...200 MHz	(50 Ω, AC-coupled)	
<b>Input impedance:</b>	1 MΩ    30 pF or 50 Ω (switchable)	
<b>Attenuation:</b>	1:1, 1:10, 1:100 (selectable)	
<b>Sensitivity:</b> (normal triggering)		
0...80 MHz	25 mV <sub>rms</sub> (sine wave), 80 mV <sub>pp</sub> (pulse)	
80 MHz...200 MHz	65 mV <sub>rms</sub> (sine wave)	
20 Hz...80 MHz	50 mV <sub>rms</sub> (sine wave, auto trigger)	
<b>Trigger</b> (programmable via encoder or software)		
<b>Attenuation:</b>	<b>Trigger level:</b>	<b>Resolution:</b>
1:1	0...± 2 V	1 mV
1:10	0...± 20 V	10 mV
1:100	0...± 200 V	100 mV
<b>Max. input voltage:</b>		
<b>Input 1 MΩ:</b>	250 V [DC + AC <sub>peak</sub> ] from 0...440 V decreasing to 8 V <sub>rms</sub> at 1 MHz	
<b>Input 50 Ω:</b>	5 V <sub>rms</sub>	
<b>Minimum pulse duration:</b>	<5 ns for single pulse	
<b>Input noise:</b>	(typ.) 100 μV	
<b>Auto trigger (AC coupling):</b>	trigger point: 50% of peak-to-peak value	
<b>Trigger slope:</b>	Raising or falling	
<b>Filter:</b>	100 kHz low-pass filter (switchable)	

### Input characteristics (Input C)

<b>Connection:</b>	SMA socket	
<b>Frequency range:</b>	100 MHz...3 GHz	
<b>Input sensitivity:</b>	up to 1 GHz: 30 mV <sub>rms</sub> (typ. 20 mV <sub>rms</sub> ) 1 GHz...3 GHz: 100 mV <sub>rms</sub> (typ. 80 mV <sub>rms</sub> )	
<b>Input impedance:</b>	50 Ω nominal	
<b>Max. input voltage:</b>	5 V [DC + AC <sub>peak</sub> ]	

### Input characteristics

	External Reset	Reference	Gate/Arming
<b>Input impedance:</b>	5 kΩ	500 Ω	5 kΩ
<b>Max. input voltage:</b>	± 30 V	± 20 V	± 30 V
<b>Input sensitivity:</b>	-	typ. 2V <sub>pp</sub>	-
<b>High level:</b>	> 2 V	-	> 2 V
<b>Low level:</b>	< 0.5 V	-	< 0.5 V
<b>Min. pulse duration:</b>	200 ns	-	50 ns
<b>Input frequency:</b>	-	10 MHz	-
<b>Min. eff. gate time:</b>	-	-	20 μs

### Measurement functions

Frequency A/B/C; period duration A; width A; totalize A; RPM A; frequency ratio A:B; time interval A:B; time interval A:B (average); phase A to B; Duty cycle A; burst measurements

### Frequency measurement (Inputs A, B, C)

<b>Frequency range:</b>	0...200 MHz (3 GHz)
<b>LSD:</b>	(1.25 x 10 <sup>-8</sup> s x frequency) / measurement time
<b>Resolution:</b>	± 1 or 2 LSD
<b>Accuracy:</b>	± (resolution / frequency ± time inaccuracy ± trigger error <sup>2)</sup> / measurement time

### Period duration measurement

<b>Range:</b>	5 ns...10,000 s
<b>LSD:</b>	(1.25 x 10 <sup>-8</sup> s x period) / measurement time
<b>Resolution:</b>	1 or 2 LSD
<b>Accuracy:</b>	± resolution / period ± (trigger error <sup>2)</sup> B / measurement time

### Totalization A

	(manual control)	(external control)
<b>Range:</b>	0...200 MHz	0...200 MHz
<b>Min. pulse duration:</b>	10 ns	10 ns
<b>LSD:</b>	1 count	± 1 count
<b>Resolution:</b>	LSD	LSD
<b>Accuracy:</b>	(resolution ± ext. gate time error x frequency A)/total	

<b>Pulse resolution:</b>	10 ns	10 ns
<b>Ext. gate error:</b>	-	100 ns

### Time interval / Average time interval

(Input A = start; input B = stop)

<b>LSD:</b>	10 ns (1 ps...10 ns in "average" mode)	
<b>Resolution:</b>	1 LSD (1 or 2 in "average" mode)	
<b>Accuracy:</b>	± (resolution + trigger error <sup>2)</sup> + system error) / time interval ± time basis uncertainty (system error: ≤ 4 ns)	
<b>Number of average:</b>	N = 1...25	LSD = 10 ns
	N = 26...2,500	LSD = 1 ns
	N = 2,501...250,000	LSD = 100 ps
	N = 250,001...25,000,000	LSD = 10 ps
	N = > 25,000,000	LSD = 1 ps

### RPM measurement

<b>NPR<sup>1)</sup> presetting:</b>	1...65,535 pulses per revolution
<b>Gate time:</b>	330 ms fixed
<b>LSD:</b>	7.5 x 10 <sup>-8</sup> revolution speed
<b>Resolution:</b>	1 or 2 LSD
<b>Accuracy:</b>	± (trigger error <sup>2)</sup> / 0.33) ± time basis error

### Offset

<b>Range:</b>	Covers the entire measurement range
<b>Resolution:</b>	Same resolution as in normal measurement. If the gate time is changed in the offset mode, the offset resolution is the reference value resolution or the current reading resolution (whichever is less precise).

### Gate time

<b>Range:</b>	1 ms...65 s
<b>Resolution:</b>	1 ms
<b>External gate time:</b>	min. 20 μs

### Time base

<b>Frequency:</b>	400 MHz clock rate; 10 MHz crystal
<b>Temperature stability</b> (0...50 °C):	TCXO (standard): ± 0.5 x 10 <sup>-6</sup> OCXO (H085): ± 1 x 10 <sup>-8</sup>
<b>Aging</b> TCXO:	< 0.27 ppm per month, 0.05 ppm per day
OCXO:	≤ ± 1 x 10 <sup>-9</sup> / day
<b>External Reference:</b>	10 MHz ± 20 ppm

### Miscellaneous

<b>Interface:</b>	USB/RS-232 (H0820), IEEE-488 (optional)
<b>Safety class:</b>	Safety Class I (EN61010-1)
<b>Display:</b>	LCD display (83 x 21 mm)
<b>Power supply:</b>	115...230 V ± 10%, 45/60 Hz, CAT II
<b>Power consumption:</b>	approx. 20 Watt
<b>Operating temperature:</b>	+5°C...+40°C
<b>Storage temperature:</b>	-20°C...+70°C
<b>Rel. humidity:</b>	5%...80% (non condensing)
<b>Dimensions (W x H x D):</b>	285 x 75 x 365 mm
<b>Weight:</b>	approx. 4 kg

<sup>1)</sup> NPR=number of pulses per revolution

<sup>2)</sup> Trigger error= ± noise input (V<sub>pp</sub>) / slew rate of the input signal

**Accessories supplied:** Operator's Manual and power cable

#### Optional accessories:

HZ42 19" Rackmount kit 2RU  
HZ33/34 Test cable 50 Ω (BNC-BNC)  
HZ24 Attenuators 50 Ω  
HZ20 Adapter plug  
H0880 IEEE-488 (GPIB) Interface (galvanically isolated)  
H085 OCXO (Installation only ex factory)