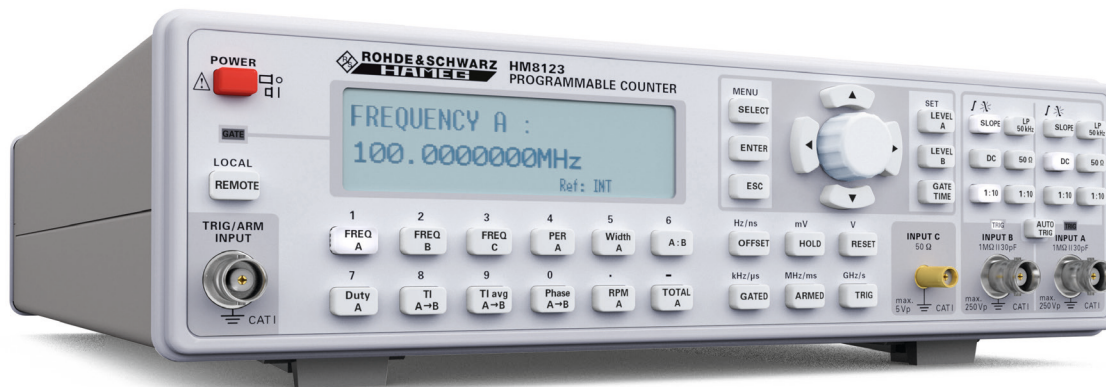


# HM8123, HM8123-X Programmable Counter Technical Data

**HAMEG**<sup>®</sup>  
Instruments  
A Rohde & Schwarz Company



## Key facts

- Measurement range: DC to 3GHz
- Input A/B (BNC): DC to 200MHz
- Input C (SMA): 100 MHz to 3GHz
- Input impedance A/B: 50Ω or 1MΩ (switchable), sensitivity 25mV
- Input impedance C: 50Ω, sensitivity 30mV
- 10-digit resolution (at 10s gate time)
- 9 measurement functions, external GATE and ARMING connectors (BNC)
- External Ref.-Input (10MHz) via BNC-connector
- HM8123: TCXO (temperature stability:  $\pm 0.5 \times 10^{-6}$ )
- M8123-X: OCXO (temperature stability:  $\pm 1.0 \times 10^{-8}$ )
- RS-232/USB dual interface, IEEE-488 (GPIB) optional
- Fanless design

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# Technical Data

## HM8123 3 GHz Programmable Counter

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

### Input characteristics (Input A and B)

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

### Input characteristics (Input C)

Connection	SMA socket	
Frequency range:	100MHz to 3GHz	
Input sensitivity	to 1 GHz: 30 mV <sub>rms</sub> (typ. 20 mV <sub>rms</sub> ) 1 to 2 GHz: 100 mV <sub>rms</sub> (typ. 80 mV <sub>rms</sub> ) 2 to 2.5 GHz: 150 mV <sub>rms</sub> (typ. 100 mV <sub>rms</sub> ) 2.5 to 3 GHz: 200 mV <sub>rms</sub> (typ. 150 mV <sub>rms</sub> )	
Input impedance	50 $\Omega$ nominal	
Max. Input voltage	5V (DC + AC <sub>peak</sub> )	

### Input characteristics

	External Reset	Reference	Gate/Arming
Input impedance	5k $\Omega$	500 $\Omega$	5k $\Omega$
Max. Input voltage	$\pm 30V$	$\pm 20V$	$\pm 30V$
Input sensitivity	-	typ. 2V <sub>pp</sub>	-
High level	>2V	-	>2V
Low level	<0,5V	-	<0,5V
Min. pulse duration	200ns	-	50ns
Input frequency	-	10MHz	-
Min. eff. gate time	-	-	20 $\mu s$

### 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)

Frequency range	0 to 200MHz (3GHz)
LSD	(1,25 x 10 <sup>-8</sup> s x frequency) / measurement time

Resolution	1 LSD
Accuracy	$\pm$ (resolution/frequency $\pm$ time inaccuracy $\pm$ trigger error <sup>2</sup> ) / measurement time)

### Period duration measurement

Range	5ns to 10,000s
LSD	(1.25 x 10 <sup>-8</sup> s x period) / measurement time
Resolution	1 LSD
Accuracy	$\pm$ resolution / period $\pm$ (trigger error <sup>2</sup> ) / measurement time)

### Totalization A

	manual control	external control
Range	0 to 200MHz	0 to 200MHz
Min. pulse duration	10ns	10ns
LSD	1 count	$\pm 1$ count
Resolution	LSD	LSD
Accuracy	(resolution $\pm$ ext. gate time error x frequency A) / total)	
Pulse resolution	10ns	10ns
Ext. gate error	-	100ns

### Time interval/Average time interval

(Input A = start; Input B = stop)		
LSD	10ns (0,1 ps to 10ns im 'average' mode)	
Resolution	1 LSD	
Accuracy	$\pm$ (resolution + trigger error <sup>2</sup> + system error) / time interval $\pm$ time base uncertainty (system error: $\leq 4$ ns)	
Number of average	N = 1 to 25	LSD = 10ns
	N = 26 to 2,500	LSD = 1 ns
	N = 2,501 to 250,000	LSD = 100ps
	N = 250,001 to 25,000,000	LSD = 10ps
	N = >25,000,000	LSD = 0.1 ps

### Rpm measurement

NPR <sup>1</sup> presetting	1 to 65.535 pulses per revolution
Gate time	330ms fixed
LSD	7.5 x 10 <sup>-8</sup> x revolution speed
Resolution	1 LSD
Accuracy	$\pm$ (trigger error <sup>2</sup> ) / 0.33) $\pm$ time base error

### Offset

Range	Covers the entire measurement range
Resolution	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

Range	1 ms to 65 s
Resolution	1 ms
External gate time	min. 20 $\mu s$

### Time base

Frequency	400 MHz clock rate; 10 MHz Quarz	
Temperature stability (0 to 50°C)	TCXO (standard):	$\pm 0,5 \times 10^{-6}$
	OXCXO (HO85):	$\pm 1,0 \times 10^{-8}$
Aging TCXO	<0.27 ppm per month, 0.05 ppm per day	
	OXCXO	$\leq \pm 1 \times 10^{-9}$ /day
External Reference	10MHz $\pm 20$ ppm	

### Miscellaneous

Interface	Dual-Interface USB/RS-232 (HO820), optional HO880 IEEE-488 (GPIB)
Safety class	Safety class I (EN61010-1)
Display	LCD display (83 x 21 mm)

Power Supply	115 to 230V $\pm$ 10%, 45 to 60Hz, CAT II
Power consumption	approx. 20W
Operating temperature	+5 to +40°C
Storage temperature	-20 to +70°C
Rel. humidity	5 to 80% (without condensation)
Dimensions (W x H x D)	285 x 75 x 365mm
Weight	approx. 4kg

1) NPR=number of pulses per revolution

2) Trigger error=  $\pm$ noise input ( $V_{pp}$ )/slew rate of the input signal

#### **Accessories supplied:**

Line cord, Operating manual

#### **Recommended accessories:**

HO880 Interface IEEE-488 (GPIB), galvanically isolated

HZ20 Adapter, BNC to 4mm banana

HZ24 Attenuators 50 $\Omega$  (3/6/10/20dB)

HZ42 19" Rackmount kit 2RU

HZ72 GPIB-Cable 2m