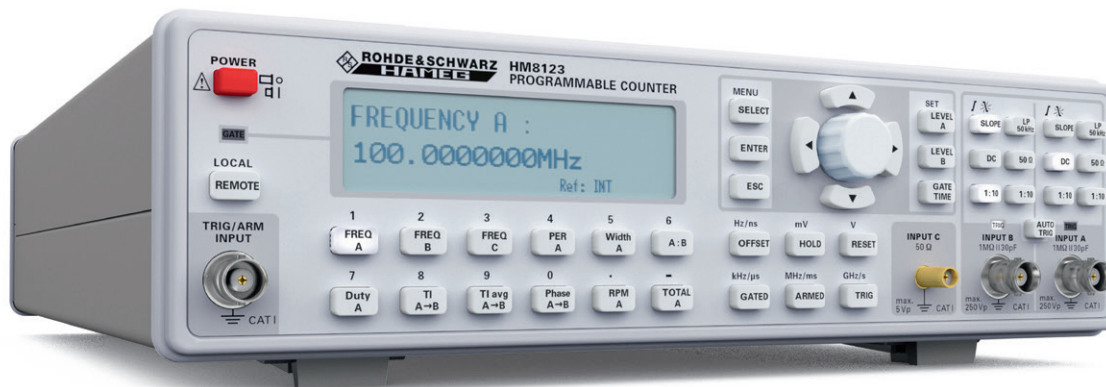


# HM8123, HM8123-X Programmable Counter Technical Data

**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

Test & Measurement

Technical Data

PD 5210.8695.32 - 02.00

# Technical Data

## 3 GHz Programmable Counter HM8123

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                                     | 25mV <sub>rms</sub> (sine wave), 80mV <sub>SS</sub> (pulse)                              |            |
| 80 to 200MHz                                   | 65mV <sub>rms</sub> (sine wave)  |            |
| 20Hz to 80MHz                                  | 50mV <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 1 MHz |            |
| 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 1GHz: 30mV <sub>rms</sub> (typ. 20mV <sub>rms</sub> )<br>1 to 3GHz: 100mV <sub>rms</sub> (typ. 80mV <sub>rms</sub> ) |  |
| Input impedance    | 50 $\Omega$ nominal   |  |
| Max. Input voltage | 5V (DC + AC <sub>peak</sub> )   |  |

### Input characteristics

|                     | External Reset | Reference             | Gate/<br>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<br>$\pm$ time inaccuracy<br>$\pm$ trigger error <sup>2</sup> ) / measurement time)   |   |
| <b>Period duration measurement</b>         |  |   |
| 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<br>$\pm$ (trigger error <sup>2</sup> ) / measurement time)   |   |
| <b>Totalization A</b>                      |  |   |
|  | 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<br>x frequency A) / total   |   |
| Pulse resolution                           | 10ns   | 10ns  |
| Ext. gate error                            | -  | 100ns   |
| <b>Time interval/Average time interval</b> |  |   |
| (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><br>+system error) / time interval<br>$\pm$ time base uncertainty<br>(system error: $\leq 4$ ns)   |   |
| Number of average                          | N = 1 to 25<br>N = 26 to 2.500<br>N = 2.501 to 250.000<br>N = 250.001 to 25.000.000<br>N = >25.000.000   | LSD = 10ns<br>LSD = 1ns<br>LSD = 100ps<br>LSD = 10ps<br>LSD = 0,1ps |
| <b>Drehzahlmessung</b>                     |  |   |
| 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)<br>$\pm$ time base error   |   |
| <b>Offset</b>                              |  |   |
| 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). |   |
| <b>Gate time</b>                           |  |   |
| Range                                      | 1 ms to 65s  |   |
| Resolution                                 | 1 ms   |   |
| External gate time                         | min. 20 $\mu s$  |   |
| <b>Time base</b>                           |  |   |
| Frequency                                  | 400MHz clock rate; 10MHz Quarz   |   |
| Temperature stability (0 to 50°C)          | TCXO (standard): $\pm 0,5 \times 10^{-6}$<br>OCXO (HO85): $\pm 1,0 \times 10^{-8}$   |   |
| Alterung TCXO                              | <0.27ppm per month, 0.05ppm per day  |   |
| OCXO                                       | $\leq \pm 1 \times 10^{-9}$ /day   |   |
| External Reference                         | 10MHz $\pm 20$ ppm   |   |
| <b>Miscellaneous</b>                       |  |   |
| 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)   |   |
| Netzanschluss                              | 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  $\Omega$  (3/6/10/20 dB)

HZ42 19" Rackmount kit 2RU

HZ72 GPIB-Cable 2 m