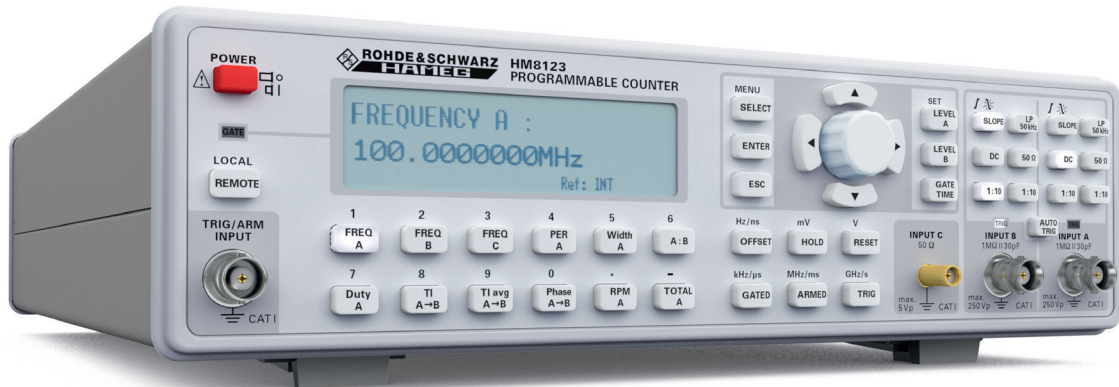


## 3GHz Programmable Counter HM8123 | HM8123-X



HM8123



HZ33, HZ34  
Test Cable BNC/BNC



HZ42  
19" Rackmount Kit 2RU



HZ20 Connector BNC to  
4mm Socket



- Measurement range:** DC to 3GHz  
 Input A/B (BNC): DC to 200MHz  
 Input C (SMA): 100MHz 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/Output (10MHz) via BNC-connector
- HM8123: TCXO (temperature stability:  $\pm 0.5 \times 10^{-6}$ )  
 HM8123-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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All data valid at 23 °C after 30 minutes warm-up.

### Input characteristics (Input A and B)

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

### Input characteristics (Input C)

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

### Input characteristics

|                             | External Reset | Reference             | Gate/Arming  |
|-----------------------------|----------------|-----------------------|--------------|
| <b>Input impedance:</b>     | 5 k $\Omega$   | 500 $\Omega$          | 5 k $\Omega$ |
| <b>Max. input voltage:</b>  | $\pm$ 30V      | $\pm$ 20V             | $\pm$ 30V    |
| <b>Input sensitivity:</b>   | -              | typ. 2V <sub>pp</sub> | -            |
| <b>High level:</b>          | >2V            | -                     | >2V          |
| <b>Low level:</b>           | <0.5V          | -                     | <0.5V        |
| <b>Min. pulse duration:</b> | 200 ns         | -                     | 50 ns        |
| <b>Input frequency:</b>     | -              | 10 MHz                | -            |
| <b>Min. eff. gate time:</b> | -              | -                     | 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)

|                         |   |  |
|-------------------------|---|--|
| <b>Frequency range:</b> | 0 to 200 MHz (3 GHz)  |  |
| <b>LSD:</b>             | (1.25 x 10 <sup>-8</sup> s x frequency)/measurement time  |  |
| <b>Resolution:</b>      | 1 LSD   |  |
| <b>Accuracy:</b>        | $\pm$ (resolution/frequency<br>$\pm$ time inaccuracy<br>$\pm$ trigger error <sup>2</sup> /measurement time) |  |

### Period duration measurement

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

### Totalization A

|                             | (manual control)   | (external control) |
|-----------------------------|--|--------------------|
| <b>Range:</b>               | 0 to 200 MHz   | 0 to 200 MHz       |
| <b>Min. pulse duration:</b> | 10 ns  | 10 ns              |
| <b>LSD:</b>                 | 1 count  | $\pm$ 1 count      |
| <b>Resolution:</b>          | LSD  | LSD                |
| <b>Accuracy:</b>            | (resolution $\pm$ ext. gate time error<br>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 (0,1 ps to 10 ns in 'average' mode)   |              |
| <b>Resolution:</b>                | 1 LSD   |              |
| <b>Accuracy:</b>                  | $\pm$ (resolution + trigger error <sup>2</sup><br>$\pm$ system error)/time interval<br>$\pm$ time base uncertainty<br>(system error: $\leq$ 4 ns) |              |
| <b>Number of average:</b>         | N = 1 to 25   | LSD = 10 ns  |
|                                   | N = 26 to 2,500   | LSD = 1 ns   |
|                                   | N = 2,501 to 250,000  | LSD = 100 ps |
|                                   | N = 250,001 to 25,000,000   | LSD = 10 ps  |
|                                   | N = >25,000,000   | LSD = 0.1 ps |

### RPM measurement

|                                    |   |  |
|------------------------------------|---|--|
| <b>NPR<sup>1</sup> presetting:</b> | 1 to 65,535 pulses per revolution                                 |  |
| <b>Gate time:</b>                  | 330 ms fixed  |  |
| <b>LSD:</b>                        | 7.5 x 10 <sup>-8</sup> x revolution speed                         |  |
| <b>Resolution:</b>                 | 1 LSD   |  |
| <b>Accuracy:</b>                   | $\pm$ (trigger error <sup>2</sup> /0.33)<br>$\pm$ time base 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 to 65 s    |  |
| <b>Resolution:</b>         | 1 ms            |  |
| <b>External gate time:</b> | min. 20 $\mu$ s |  |

### Time base

|  |  |  |
|--|--|--|
| <b>Frequency:</b>                          | 400 MHz clock rate; 10 MHz crystal   |  |
| <b>Temperature stability (0 to 50 °C):</b> | HM8123 (TCXO): $\pm$ 0.5 x 10 <sup>-6</sup><br>HM8123-X (OCXO): $\pm$ 1.0 x 10 <sup>-8</sup> |  |
| <b>Aging HM8123 (TCXO):</b>                | <0.27 x 10 <sup>-6</sup> per month, 0.05 x 10 <sup>-6</sup> per day                          |  |
| <b>HM8123-X (OCXO):</b>                    | $\leq$ 1.0 x 10 <sup>-9</sup> /day   |  |
| <b>External Reference:</b>                 | 10 MHz $\pm$ 20 x 10 <sup>-6</sup>   |  |

### Miscellaneous

|                                |  |  |
|--------------------------------|--|--|
| <b>Interface:</b>              | Dual-Interface USB/RS-232 (H0820),<br>IEEE-488 (GPIB) (optional) |  |
| <b>Safety class:</b>           | Safety Class I [EN61010-1]                                       |  |
| <b>Display:</b>                | LCD display (83 x 21 mm)   |  |
| <b>Power supply:</b>           | 115/230V $\pm$ 10%, 45 to 60 Hz, CAT II                          |  |
| <b>Power consumption:</b>      | approx. 20W  |  |
| <b>Operating temperature:</b>  | +5 to +40 °C   |  |
| <b>Storage temperature:</b>    | -20 to +70 °C  |  |
| <b>Rel. humidity:</b>          | 5 to 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=  $\pm$ noise input (V<sub>pp</sub>)/slew rate of the input signal

**Accessories supplied:** Line cord, printed Operating manual, CD

#### Recommended accessories:

|       |  |
|-------|--|
| H0880 | Interface IEEE-488 (GPIB), galvanically isolated |
| HZ13  | Interface cable (USB) 1.8 m                      |
| HZ14  | Interface cable (serial) 1:1                     |
| HZ20  | Adapter, BNC to 4mm banana                       |
| HZ24  | Attenuators 50 $\Omega$ (3/6/10/20 dB)           |
| HZ33  | Test cable 50 $\Omega$ , BNC/BNC, 0.5 m          |
| HZ34  | Test cable 50 $\Omega$ , BNC/BNC, 1.0 m          |
| HZ42  | 19" Rackmount kit 2RU                            |
| HZ72  | GPIB-Cable 2m                                    |