



Universal Counter HM8122

- Frequency Range 0 - 1600MHz; 3 Inputs
- 9 Measurement Functions; Ext. Gate and Arming
- Up to 8-digit Resolution at 1 second Gate Time
- 100MHz Time Base with 0.5ppm Stability
- IEEE-488 Bus or RS-232 Interface, optional

... when
precision
counts

The **HM8122** is a feature-packed Universal Counter and, like all other instruments in the **8100 Series**, it is prepared for operation in automated test systems as well as for laboratory bench-top measurements. The instrument has three sensitive inputs and provides signal measurement capability from **DC** to **1.6 GHz**.

An impressive **10ns** resolution during single pulse measurement is made possible by using a 100MHz reference oscillator. Resolution as fine as **1ps** is obtained through time interval averaging. The **HM8122** displays **low frequency** measurements with an **8-digit** resolution at a 1s gate time.

Besides its **nine** basic functions, the **HM8122** offers such practical features as a preselectable number of pulses per rotation, offset, display-hold, **single-shot** measurement, **external ports** for gating, arming, gate-view and trigger-view. The rear panel inputs allow for measurements of channel A gated by B. An integrated **calibration routine** and extensive power-up self-test ensure proper and accurate operation of the counter.

Since any counter is only as good as its input circuitry, great care was taken in considering the technique of input signal conditioning.

The **three signal inputs** possess, depending upon frequency range, an input sensitivity of between **20mV** and **60mV**. A selectable low-pass filter, switchable input coupling, two 20dB attenuators per channel, and the switchable trigger slope enhance trouble-free operation with nearly all input signals. **Automatic triggering** can be turned off for complex signal measurements.

Any function of the Counter is programmable via the optional **IEEE-488** or **RS-232** Interface.

Option HO85

The standard version of the **HM8122** already includes a high-stability, oven-controlled oscillator with an accuracy of $\pm 5 \times 10^{-7}$. The option **HO85** with a stability of $\pm 5 \times 10^{-9}$ is available for higher stability requirements. The oscillator is field installable and only an external reference frequency is required for re-calibration.



Specifications HM 8122

(Ref. temp.: 23°C±2°C)

Input Characteristics (Input A / Input B)

Frequency range:
0 - 150 MHz (DC coupled), 10 Hz - 150 MHz (AC coupled)

Sensitivity:
(normal triggering)
20 mV RMS (sinewave) DC to 80MHz. 80mV_{pp} (Pulse)
60 mV RMS (sinewave) 80 MHz to 150 MHz
50 mV RMS (sinewave) 20 Hz to 80 MHz (Autotrigger)

Min. pulse duration: 5 ns

Rise time: 3 ns nominal

Input noise: 100 µV (typical)

Coupling: AC or DC (switch selectable)

Impedance: 1 MΩ||40 pF (0.5 MΩ || 80pF when Com. is active)

Attenuation: x1, x10, x100 (switch selectable)

Trigger level range: 0 V to ± 100 V

Autotrigger: (AC coupling)
trigger point is at the 50% peak to peak value

Max. input voltage: 250 V (DC + AC peak) from 0 to 440 Hz
declining to 8 V RMS at 1 MHz

Trigger slope: Positive or negative (switch selectable)

Filter: 50 KHz low pass filter (20 dB/decade)

Trigger indicators: Tri-state LED indicators

Input Characteristics (Input C)

Frequency range: 100 MHz - 1.6 GHz

Sensitivity: 30 mV to 1.3GHz (typical 20mV)
100 mV to 1.6GHz (typical 80mV)

Coupling: AC

Impedance: 50Ω nominal

Max. input voltage: 5 V (DC + AC_{peak})

Input Characteristics:	External Reset	Reference	Gate/Arming
Input impedance:	4.7 kΩ,	470 Ω,	4.7 kΩ
Max. input voltage:	± 30 V	± 30V	± 30V
Sensitivity:	—	typ. 2 V _{pp}	—
High level:	>2V	—	>2V
Low level:	<0.5V	—	<0.5V
Min. pulse duration:	200 ns	—	50 ns
Input frequency:	—	10 MHz	—
Min. eff. gate time:	—	—	20 µs

Measurement Functions

Frequency A,B,C; Period A; Totalize A; RPM A; Ratio A/B; TI A/B; Pulse width; Totalize A during B; TI AVG A/B

Frequency A, B

LSD: (2.5 x 10⁻⁸ s x FREQ.) / measuring time

Resolution: ± 1 or 2 LSD

Accuracy: ± (Resolution / Frequency + time base uncertainty + trigger error / measurement time)

Period A

Range: 10000 sec - 6.66 ns

LSD: (2.5 x 10⁻⁸ s x period) / measurement time^{*)}

Resolution: 1 or 2 LSD

Accuracy: ± (Resolution / Period + time base uncertainty + trigger error / measuring time)

Ratio A/B

Frequency range: DC to 80 MHz

LSD: (2.5 x ratio) / (FREQ. A x measuring time)

Resolution: ± 1 or 2 LSD

Accuracy: resolution / ratio ± (trigger error B / measuring time)

	(manual mode)	(Gated by external signal)
Range:	DC - 150 MHz	DC - 150 MHz
Min. pulse duration:	10 ns	10 ns
LSD :	1 Count	± 1 Count
Resolution:	LSD	LSD
Accuracy:	(resol. ±ext. gate error x Freq.A)/total	
Pulse pair res.:	10 ns	10 ns
Ext. Gate error:	—	100 ns

Time Interval / Time Interval Average (Input A = start, Input B = stop)

LSD: 10 ns (10 ns to 1 ps when averaged)

Resolution: 1 LSD (1 or 2 when averaged)

Accuracy: ± (Resolution + trigger error + systematic error) / Time interval ±time base uncertainty (systematic error / ≤4ns)

Number of averages:	Measuring time pulse repetition rate	LSD
N = 1 to 25		LSD = 10 ns
N = 26 to 2500		LSD = 1 ns
N = 2501 to 250000		LSD = 100 ps
N = 2500001 to 25000000		LSD = 10 ps
N = > 25000000		LSD = 1 ps

RPM (Revolutions Per Minute)

NPR^{*)} presetting : 1 - 65535 counts / revolution

Gate time: 330 ms fixed

LSD: 7.5 x 10⁻⁸ x revolution speed

Resolution: 1 or 2 LSD

Accuracy (resolution): speed ± (trigger error / 0.33) ± time base error

Offset

Range: same specification as normal measurement

Resolution: same resolution as normal measurement

If the actual gate time is modified, the offset resolution is the resolution of the reference value or the resolution of the current measurement, whichever is smaller.

Gate Time

Range: 1 ms - 10 sec in 199 steps (Input A/B)

Range: 2 ms - 10 sec (Input C)

Range: (cannot be shorter than 1 period)

External gate range: min. 20 µs

Actual measuring time: Gate-Time + start synchronisation time + stop synchronisation time + calculation time (approx. 10 ms) (synchronisation time depends on input signal).

Time base

Frequency: 100 MHz clock rate; 10 MHz crystal

Stability: ± 5 x 10⁻⁷ between 10°C and 40°C

Aging: <2.5 ppm/year

Warm up time: typ. 10 min. to specified accuracy

Option HO85 (OCXO): ±5x10⁻⁸; 10°C to 40°C ±5x10⁻⁹ per day; 23°C ±2°C

General

Display: 9 digits, sign and exponent, 1 leading digit for sign, ST.By, error messages

Power requirements: 110/220V ±15%; 45-60 Hz, 40 VA
-10°C to +70°C (storage), +0°C to +40°C (operation)

Operating conditions: 10%-90%, no condensation, 5%-95% RH

Max. rel. humidity: 10%-90%, no condensation, 5%-95% RH

Dimensions: 285x75x365mm (WxHxD)

Weight: approx. 4 kg

Safety: Class I, According to IEC 348

*1) When the resolution exceeds the display range, the displayed result is shifted to the right.

*2) NPR = Number of pulses per revolution
Subject to change without notice

Optional accessories:

HZ33, HZ34: 50Ω Coaxial cable BNC-BNC; **HZ24:** BNC 50Ω attenuators (3 / 6 / 10 / 20 dB) incl. 1 HZ22;
HZ42: 19" rack mount kit; **HZ72-S/L:** Double shielded IEEE-488-Bus cable, 1m/1.5m.
HO85: OCXO, stability ± 5x10⁻⁹/day; **HO88:** IEEE-488 Interface;
HO89: RS232 Interface.