Universal Counter HM8122

- **Frequency Range 0 - 1.6GHz; 3 Inputs**
- **9 Measuring Functions; Ext. Gate and Arming**
- **Up to 9-digit Resolution at 1s Gate Time**
- **100MHz Time Base with ±0.5ppm Stability**
- **Optional IEEE-488 Bus or RS-232 Interface**

... 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 pre selectable 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 measurements of channel A gated by B. An integrated **adjustment 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 **100mV**. Channel A & B have selectable low pass filter, switchable input coupling, two 20dB attenuators per channel, and switchable trigger slope. This enhances trouble free operation with nearly all input signals. **Automatic triggering** can be turned off for complex signal measurements.
Any function of the Counter is controlled 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 **±5x10^{-7}**. The option **HO85** with stability of **±5x10^{-9}** is available for higher stability requirements.

230403

Specifications HM8122

(Ref. temp.: 23°C±2°C)

Input Characteristics (Input A / Input B)

Frequency Range: 0 to 150 MHz (DC coupled), 10 Hz to 150 MHz (AC coupled)
Sensitivity: (normal triggering)
20 mV RMS (sine wave) DC to 80MHz. 80mV$_{pp}$ (Pulse)
60 mV RMS (sine wave) 80 MHz to 150 MHz
50 mV RMS (sine wave) 20 Hz to 80 MHz (Auto trigger)
Min. Pulse Duration: 5 ns
Rise Time: approx. 3 ns
Input Noise: 100 µV (typical)
Coupling: AC or DC (switch selectable)
Impedance: 1 MΩ||40 pF (0.5 MΩ || 80pF when Com. A/B is active)
Attenuation: x1, x10, x100 (switch selectable)
Trigger Level Range: 0 V to ± 100 V
Auto Trigger: (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 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 to 1.6 GHz
Sensitivity (RMS): (20mV typ.) 30 mV to 1.3GHz
(100mV typ.) 100 mV to 1.6GHz
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. 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, C

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 *1)
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)

Totalize A

	Manual mode	Gated by external signal
Range:	DC to 150 MHz	DC to 150 MHz
Min. Pulse Duration:	10 ns	10 ns
LSD :	1 Count	1 Count
Resolution:	LSD	LSD
Accuracy:	(resolution ±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: N = Measuring time x repetition rate

N = 1 to 25	LSD = 10 ns
N = 26 to 2500	LSD = 1 ns
N = 2501 to 250.000	LSD = 100 ps
N = 250.001 to 2.500.000	LSD = 10 ps
N = > 2.500.000	LSD = 1 ps

RPM (Revolutions Per Minute)

NPR *2) **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

Covers the whole measurement range.
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)
2 ms - 10 sec (Input C)
(cannot be shorter than 1 period)
External Gate Time: min. 20 µs
Actual Measuring Time: Gate time + start synchronization time + stop synchronization time + calculation time (approx. 10 ms)
(synchronization times depend 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 ±1°C

General

Display: 9 digits LEDs (10.9mm), sign and exponent sign for negative offset
Power Requirements: 115/230V ±10%; 45-60 Hz, 40 VA
Operating Conditions: +10°C to +40°C
Max. Rel. Humidity: 10%-90%, no condensation
Dimensions: 285x75x365mm (WxHxD)
Weight: approx. 4 kg
Safety: Class I, According to IEC 1010-1

***1)** When the resolution exceeds the display range, the displayed result is shifted to the right.
***2)** NPR = Number of pulses per revolution

Optional Accessories:

HZ33, HZ34: 50Ω Coaxial cable BNC-BNC; **HZ24:** BNC 50Ω attenuators (3 / 6 / 10 / 20 dB)
HZ42: 19" rack mount kit; **HZ72-S/L:** Double shielded IEEE-488-Bus cable, 1m/1.5m.
HO85: OCXO, stability ± 5x10^{-9}/day; **HO88-2:** IEEE-488 Interface; **HO89-2:** RS-232 Interface.

230403