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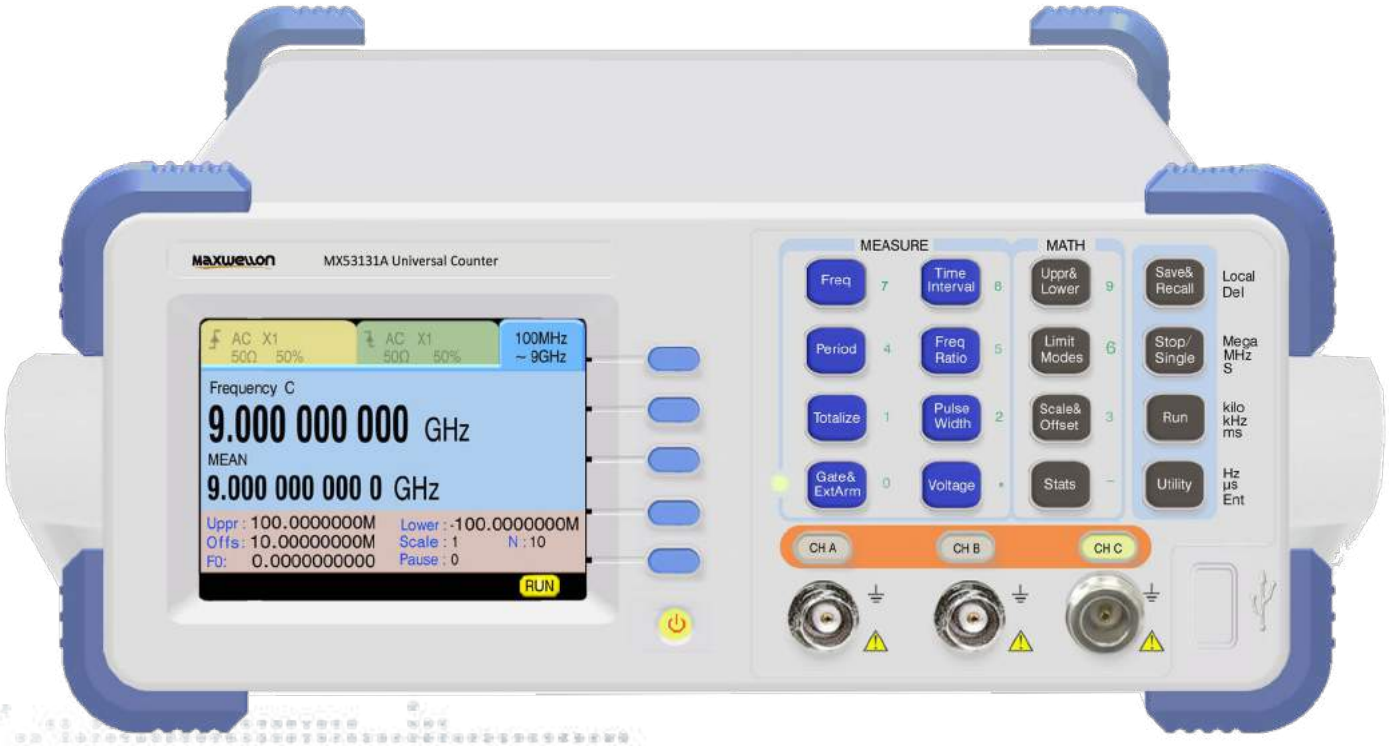

MAXWELLON MX53131A

DC~225MHz/1.5GHz/2.5GHz/3GHz/6GHz/9GHz

High Accurate Universal Counter

2023

Maxwellon

MX53131A high-precision universal counter is a high-precision frequency and time measuring instrument newly developed by Maxwellon. They are based on high-performance AVR microcontrollers for functional control, measurement timing control, data processing, and result display. Using reciprocal counting technology and digital interpolation technology to achieve high-precision measurement across the entire range. In addition to measurement functions such as frequency, period, time interval, pulse width, duty cycle, phase, count, etc., there are also measurement and operation functions for multiple averages, maximum values, minimum values, standard deviation, Allen variance, maximum deviation (maximum minus minimum value), single deviation (minus preset value), and PPM. The instrument has an external trigger/gate function, which can trigger measurement at the rising edge (for time measurement) and measure frequency inside the positive gate (for frequency measurement). The machine has stable performance, complete functions, wide measurement range, high sensitivity, large dynamic range, high accuracy, small size, and convenient and reliable use. It has a wide range of applications in industrial production, scientific research and measurement, and is an ideal replacement product for traditional electronic counters.

Key Feature

Frequency and Timing:

- Operates at 80MHz clock frequency.
- Frequency measurement resolution is 10 digits per second.
- Timing resolution for measurements is 100ps.

Channels A and B:

- Channels A and B support frequencies up to 225MHz.

Instrument Components:

- Utilizes a high-performance AVR microcontroller, large-scale integrated circuits, and Complex Programmable Logic Devices (CPLD) for high reliability.

Channel C:

- Channel C can measure frequencies up to 9GHz.

Measurement Capabilities:

- Capable of measuring single time intervals and single pulse widths.
- Includes extreme value operations.
- Features mathematical operations.

Statistical Operations:

- Supports multiple statistical operations such as multiple averages, maximum, minimum, maximum deviation, single absolute deviation, single relative deviation (PPM), standard deviation, and Allan variance.

Counting Functions:

- Includes fixed gate counting and manual counting functions.
- The counter can store 9 measurement states.

Interfaces:

- Equipped with RS232 universal serial interface and Centronics standard printer interface as standard configurations.
- Optional USB DEVICE interface.
- Optional IEEE488 (GPIB) general-purpose interface bus for remote control.

Display:

- Features a QVGA color LCD display for clear and detailed information.
- Compact design with an aesthetically pleasing appearance.

Instrument Input Characteristics	
Channels A and B	
Frequency Range	DC Coupling: DC to 225MHz
	AC Coupling: 1MHz to 225MHz (50Ω), 30Hz to 225MHz (1MΩ)
Dynamic Range	Sin: 50mVrms to 1.5Vrms
	Pulse: 100mVp-p to 4.5Vp-p
Input Impedance	1MΩ // 45pF or 50Ω
Coupling Modes	AC or DC
Trigger Modes	Rising or falling edge
Input Attenuation	×1 or ×10
Low Pass Filter	Cutoff frequency approximately 100kHz
Trigger Level	-5V to +5V, user-defined
Channel A, B Crosstalk	Not less than 500mVrms

Both channels A and B can adapt to input signals with a modulation level of ≤ 30%, and their envelope valleys should meet the input sensitivity.
To prevent the low-frequency signal being measured from containing high-frequency components, it is necessary to turn on the low-pass filter when conducting low-frequency measurements below 100kHz. When conducting low-frequency measurements below 100Hz, the trigger level needs to be manually set.

Channel C (Options I-IV)	
Frequency Range	Option I: 100MHz to 500MHz
	Option II: 100MHz to 1.5GHz
	Option III: 100MHz to 2.5GHz
	Option IV: 100MHz to 3GHz
Dynamic Range	Sin: 30mVrms to 1.5Vrms
Input Impedance	50Ω
Coupling Mode	AC
Channel BU (Option VI)	
Frequency Range	100MHz to 1.5GHz
Dynamic Range	Sin: 30mVrms to 1.5Vrms
Input Impedance	50Ω
Coupling Mode	AC
Channel C (Options V-VI)	
Option V	
Frequency Range	100MHz to 6GHz
Power Range and Sensitivity	-15dBm to +13dBm (100MHz to 500MHz)
	-25dBm to +13dBm (500MHz to 6GHz)
Damage Level	+20dBm
Input Impedance	50Ω
Coupling Mode	AC
VSWR	<2.5:1
Option VI	
Frequency Range	1.5GHz to 9GHz
Power Range and Sensitivity	-25dBm to +7dBm (1.5GHz to 2GHz)
	-25dBm to +13dBm (2GHz to 6GHz)
	-20dBm to +13dBm (6GHz to 9GHz)
Damage Level	+25dBm
Input Impedance	50Ω
Coupling Mode	AC
VSWR	<2.5:1

Instrument Input Characteristics	
External Trigger Input	
Signal Input Range	TTL Level
Pulse Width	>50ns
Attention: The input signal must not exceed the damaged level of the channel, otherwise it will cause damage to the input channel and cause instrument malfunction!	
Timebase	
Internal Crystal Oscillator	
Nominal Frequency	10MHz
Aging Rate	Standard: 1×10^{-8} / day
	Option VII: 5×10^{-9} / day
	Option VIII: 3×10^{-9} / day
Accuracy	$\pm1\times10^{-7}$
Timebase Input	
Frequency	5MHz or 10MHz
Amplitude	≥0.3Vrms
Timebase Output	
Frequency	10MHz
Amplitude	≥1Vp-p (50Ω)
Measurement Specifications	
Frequency Measurement	
Channel A Range	0.001Hz to 225MHz
Channel B Range	0.001Hz to 225MHz
Channel BU Range (Option VI)	100MHz to 1.5GHz
Channel C Ranges	Option I: 100MHz to 500MHz
	Option II: 100MHz to 1.5GHz
	Option III: 100MHz to 2.5GHz
	Option IV: 100MHz to 3GHz
	Option V: 100MHz to 6GHz
	Option VI: 1.5GHz to 9GHz
Display Least Significant Digit (LSD)	(100ps×Frequency of the measured signal)/Gate Time
Gate Time	1ms to 500s (Selectable)
Measurement Error	±(100ps/Gate Time +Timebase Error+Trigger Error)×Frequency of the measured signal Note: When the signal-to-noise ratio of the measured signal is 40dB, the triggering error is 0.3% × Tested signal period/ gate time
Period Measurement	
Channel A Range	4.44ns to 1000s
Channel B Range	4.44ns to 1000s
Channel BU Range (Option VI)	0.7ns to 10ns
Channel C Ranges	Option I: 2ns to 10ns
	Option II: 0.7ns to 10ns
	Option III: 0.4ns to 10ns
	Option IV: 0.3ns to 10ns
	Option V: 0.167ns to 10ns
	Option VI: 0.11ns to 0.66ns
Display Least Significant Digit (LSD)	(100ps×Frequency of the measured signal)/Gate Time
Gate Time	1ms to 500s (Selectable)
Measurement Error	±(100ps/Gate Time +Timebase Error+Trigger Error)×Frequency of the measured signal Note: When the signal-to-noise ratio of the measured signal is 40dB, the triggering error is 0.3% × Tested signal period/ gate time

Measurement Specifications

Time Interval Measurement	
The measured signal is input from channels A and B (COMMON: OFF) or channel A (COMMON: ON).	
Measurement Range	1ns to 1000s
Display LSD	100ps
Trigger Signal	Internal automatic trigger or external trigger
Measurement Error	±(100ps+Timebase Error×Time Interval+Trigger Error+System Error)
System Error	±1ns
Frequency Ratio Measurement	
Display LSD	Channel A/Channel B: 1/(Channel B frequency × gate time)
	Channel A/Channel BU: 1/(Channel BU frequency × gate time)
	Channel A/Channel C: 1/(Channel C frequency × gate time)
	Channel B/Channel A: Channel B/((Channel A frequency)^2 × gate time)
	Channel BU/Channel A: Channel BU/((Channel A frequency)^2 × gate time)
	Channel C/Channel A: Channel C/((Channel A frequency)^2 × gate time)
Pulse Width Measurement	
Measurement Range	5ns to 1000s
Display LSD	100ps
Trigger Signal	Internal automatic trigger or external trigger
Measurement Error	±(100ps+Timebase Error×Time Interval+Trigger Error+System Error)
System Error	±1ns
Rise/Fall Time Measurement	
Measurement Range	5ns to 1000s
Measurement Error	±(100ps+Timebase Error×Time Interval+Trigger Error+System Error)(Input from Channel A)
Phase Measurement	
Input Signal Frequency Range	<100MHz
Input Signal Amplitude	≥2Vp-p
Measurement Range	0° to 360°
Display LSD	0.1°
Measurement Error	<±(Trigger Error+1.5ns×Frequency×360+0.001)°
Duty Cycle Measurement	
Measurement Range	0% to 99.9%(Pulse width ≥ 5ns, cycle<1000s)
Measurement Error	±0.01%±RMS±(Trigger Level Error±Timebase Error×Time Interval±1.5ns)×Frequency×100%
Count Measurement	
Measurement Range	0 to 1×10^{15}
Resolution	±1 count
Peak Voltage Measurement	
Measures DC voltage for A and B channel inputs. For AC signals, measures peak-to-peak voltage between 100Hz and 30MHz if the signal amplitude is >100mV. Peak voltage measurement for signals with frequency >30MHz is for reference only.	
Measurement Range	-5V to +5V
Resolution	10mV
Measurement Error	25mV+10% of Peak Voltage (when using ×1 attenuation)
	250mV+10% of Peak Voltage (when using ×10 attenuation)

Measurement Operations

Limit Operations	
Limit Check	Conducted after the measurement is completed
Display Method	If the measurement result exceeds the upper or lower limits, "Over the limit" is displayed in the measurement status area.

Measurement Operations	
Mathematical Operations	
Mathematical Operations	Performed after the measurement is completed.
Display	The number of significant figures remains unchanged.
Statistical Operations	
Statistical Functions	multiple averages, maximum value, minimum value, maximum deviation, single absolute deviation, single relative deviation (PPM), standard deviation, Allan variance.
Display	Multiple means, standard deviation, allen variance, least significant bit=single/N Single Relative Deviation (PPM) Least Significant Bit=Single × $10^6/F_0$, in PPM The least significant bit of other functions remains unchanged
Number of Samples	2 to 2000
Others	
Storage and Recall Functionality	
The instrument can store up to 9 measurement states for convenient recall.	
Centronics Standard Printer Interface	
The Centronics standard printer interface allows direct connection to a printer. Simply activate the print switch to print the measurement data.	
Remote Control Interfaces	
RS232 Universal Serial Interface	
IEEE488 (GPIB) Universal Interface (optional)	
USB DEVICE Universal Serial Interface (optional)	
Power Supply	
Voltage	AC 220V ± 22V
Frequency	50Hz ± 3Hz
Power Consumption	35W
Dimensions	
240mm × 380mm × 105mm (Width × Depth × Height)	
Power Supply	
Approximately 2.5kg	

Ordering Information

Standard

No.	Name	Qty.
1	Testing Cables (BNC Q9-J5)	2 pc
2	RS232 Cable	1 pc
3	Power Cord	1 pc
4	Fuse Tube (BGXP-1-18-1A)	2 pc
5	Product User Manual	1 pc
6	Product Certificate of Conformity	1 pc
7	Product Warranty Certificate and User Profile Card	1 pc

Option

No.	Name	Qty.
Input Channels	Option I: 500MHz input channel	1 set
	Option II: 1.5GHz input channel	1 set
	Option III: 2.5GHz input channel	1 set
	Option IV: 3GHz input channel	1 set
	Option V: 6GHz input channel	1 set
	Option VI: 9GHz input channel	1 set
Crystal Oscillators	Option VII: 5×10^{-9}/day Crystal Oscillator	1 unit
	Option VIII: 3×10^{-9}/day Crystal Oscillator	1 unit
Interfaces	Option IX: IEEE488 Universal Interface	1 set
	Option X: USB DEVICE Universal Interface	1 set
Testing Cable	N-type Testing Cable (Option V or VI)	1 pc

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