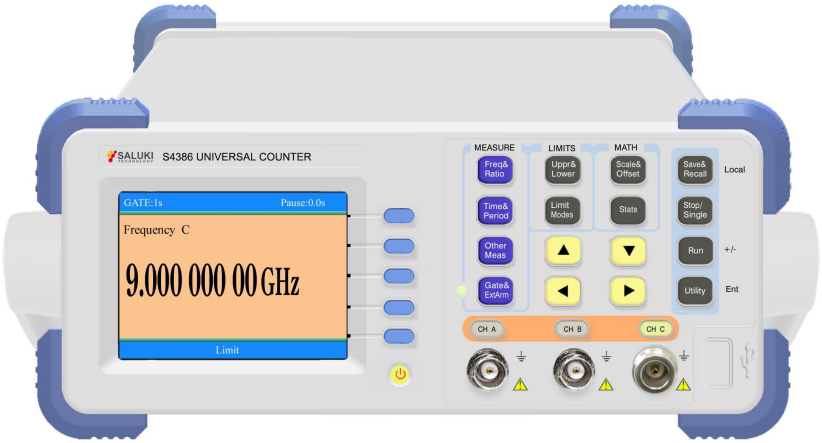
S4386 Series Universal Counter

Datasheet



Saluki Technology Inc.

The document applies to the universal counter of the following models:

- S4386A universal counter (channel A: 0.14mHz-150MHz)
- S4386B universal counter (channel A: 0.14mHz-150MHz, channel C: 100MHz-500MHz)
- S4386C universal counter (channel A: 0.14mHz-150MHz, channel C: 100MHz-1.5GHz)
- S4386D universal counter (channel A: 0.14mHz-150MHz, channel C: 100MHz-2.5GHz)
- S4386E universal counter (channel A: 0.14mHz-150MHz, channel C: 100MHz-3GHz)
- S4386F universal counter (channel A: 0.14mHz-150MHz, channel C: 100MHz-6GHz)
- S4386G universal counter (channel A: 0.14mHz-150MHz, channel BU: 100MHz-1.5GHz, channel C: 1.5GHz-9GHz)

Standard Package of the S4386 series universal counter:

No.	Item	Qty.
1	Universal Counter	1
2	Test Cable (BNC Q9-J5)	2
3	RS232 Cable	1
4	Power Cord	1
5	Fuse Tube BGXP-1-18-1A	2
6	RS232C interface soft panel application installation software	1

Options of the S4386 series universal counter:

Model No.	Item
S4386-01	High-stability and Constant- temperature Crystal Oscillator 5×10^{-9}/day
S4386-02	High-stability and Constant- temperature Crystal Oscillator 3×10^{-9}/day
S4386-03	IEEE488 General Interface
S4386-04	USB general serial interface
S4386-05	Test Cable (Type N)

Preface

Thank you for choosing S4386 series universal counter produced by Saluki Technology Inc.

We devote ourselves to meeting your demands, providing you high-quality measuring instrument and the best after-sales service. We persist with “superior quality and considerate service”, and are committed to offering satisfactory products and service for our clients.

Document No.

S4386-02-01

Version

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Saluki Technology

Document Authorization

Product Quality Assurance

The warranty period of the product is three years from the date of delivery. The instrument manufacturer will repair or replace damaged parts according to the actual situation within the warranty period.

Product Quality Certificate

The product meets the indicator requirements of the document at the time of delivery. Calibration and measurement are completed by the measuring organization with qualifications specified by the state, and relevant data are provided for reference.

Quality/Settings Management

Research, development, manufacturing and testing of the product comply with the requirements of the quality and environmental management system.

Contacts

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Content

1. Overview

S4386 series universal counter is a kind of high-precision instrument for measurement of frequency and time, which is developed by Saluki Technology. Taking the high-performance AVR single chip microcomputer as the core, this instrument is used for function control, measurement time sequence control, data processing and result display. The reciprocal counting technology is employed to achieve the equal precision measurement within the full range. In addition to the functions for measurement of frequency, period, interval of time, frequency width, duty cycle, phase, and counting, it also has the functions for measurement and operation of multiple average, maximum value, minimum value, standard deviation, Allan variance, maximum deviation (Maximum value minus minimum value), single deviation (Minus preset value), and PPM. With the function of external triggering / external gate, it is able to perform the triggering measurement on the rising edge (For measurement of time) and the frequency measurement inside the positive gate (For measurement of frequency). The built-in clock of series universal counter has the frequency of 150MHz.

Due to the characteristics such as stable performance, complete functions, wide range of measurement, high sensitivity, large dynamic range, high precision, small volume, and convenient and reliable operation, S4386 series universal counter is widely used in the fields of industrial production, scientific research, and measurement and metering as the renewal product replacing the traditional electronic counter.

2. Main Characteristics

- The counter uses the clock frequency of 150MHz with the frequency measurement resolution of 9 bits per minute and the time measurement resolution of 7ns.
- The counter has the channel A with the frequency up to 150MHz.
- The channel C can measure the frequency up to 9GHz.
- The instrument has the high reliability due to the high-performance AVR single chip microcomputer, large-scale integrated circuit, and CPLD device.
- Can measure single interval of time and single pulse width.
- Limit operation and arithmetic operation functions.
- This product has the functions of statistical operations such as multiple average, maximum value, minimum value, maximum deviation, single absolute deviation, single relative deviation (PPM), standard deviation, and Allen variance.
- For the counting measurement, this product has the fixed inside-gate counting function and manual operating counting function.
- The current parameters of the counter will be saved automatically and will not be lost when it is shut down.
- The counter may save 9 measuring conditions.
- Standard RS232C universal serial bus and Centronics standard printer port, optional USB DEVICE and IEEE488 universal programmable interface.
- Adopts QVGA color LCD display, which is featured by attractive appearance, small volume, and comfortable operation.

3. Technical Specifications

3. 1. Input Characteristics

Channel A and B:

Frequency range	0.14mHz - 150MHz
Dynamic range	30mVrms to 1.5Vrms sine wave (0.14mHz-100MHz), 50mVrms to 1Vrms sine wave (100MHz-150MHz), 100mVp-p to 4.5Vp-p impulse wave (0.14mHz-100MHz), 150mVp-p to 2Vp-p impulse wave (100MHz-150MHz)
Input impedance	1MΩ‖45pF or 50Ω
Coupling mode	AC or DC (DC coupling for frequency less than 1kHz)
Trigger mode	Rising edge or falling edge
Input attenuation	×1 or ×10
Low-pass filter	Cutoff frequency about 100kHz
Trigger level	-2.5V to +2.5V any setting
Crosstalk interference	Not less than 500mVrms
Damage level	3Vrms

Both channel A and channel B are adaptable to the input signal with the modulation degree ≤30%, and their envelope valley value shall meet the input sensitivity.

In order to prevent the high frequency component in the low frequency signal to be measured. When measuring the low frequency less than 100kHz, it is required to push down the low-pass filter.

When channel A or channel B inputs the signal with the frequency higher than 100MHz and the effective value of amplitude larger than 500mV, it is required to set the input impedance as 50 Ω (Low impedance).

Channel BU:

Model	S4386G
Frequency range	100MHz-1.5GHz
Dynamic range	30mVrms - 1.5Vrms sine wave
Input impedance	50Ω
Coupling mode	AC

Channel C:

Model	S4386B/C/D/E
Frequency range	S4386B: 100MHz-500MHz, S4386C: 100MHz-1.5GHz, S4386D: 100MHz-2.5GHz, S4386E: 100MHz-3GHz
Dynamic range	30mVrms - 1.5Vrms sine wave

Input impedance	50Ω
Coupling mode	AC

Model	S4386F
Frequency range	1GHz-6GHz
Power range and sensitivity	1GHz-6GHz: -25dBm to +13dBm
Damage level	+20dBm
Input impedance	50Ω
Coupling mode	AC

Model	S4386G
Frequency range	1.5GHz-9GHz
Power range and sensitivity	1.5GHz-2GHz: -25dBm to +7dBm, 2GHz-6GHz: -25dBm to +13dBm 6GHz-9GHz: -20dBm to +13dBm
Damage level	+25dBm
Input impedance	50Ω
Coupling mode	AC
Standing wave ratio	< 2.5:1

External trigger input:

Signal input range	TTL level
Pulse width	> 50ns
External gate signal	Positive pulse (measurement of frequency and period)
External triggering signal	Rising edge (measurement of time)

Note: *The input signal shall not exceed the damage level of the channel. Otherwise, the input signal will be damaged, leading to instrument damage!*

3. 2. Time Base

Internal crystal oscillator	Nominal frequency	10MHz
	Daily aging rate	1×10^{-8}/ day (Standard) 5×10^{-9}/day (Option) 3×10^{-9}/ day (Option)
	Accuracy	$\pm1\times10^{-7}$
Time-based input	Frequency	5MHz or 10MHz

	Amplitude	≥ 0.3Vrms
Time-based output	Frequency	10MHz
	Amplitude	≥ 1Vp-p (50Ω)

3. 3. Measurement Indicator

Frequency measurement:

Channel A scope	0.14mHz - 150MHz
Channel BU scope	100MHz - 1.5GMHz (S4386G)
Channel C scope	S4386B: 100MHz - 500MHz, S4386C: 100MHz - 1.5GHz, S4386D: 100MHz - 2.5GHz, S4386E: 100MHz - 3GHz, S4386F: 100MHz - 6GHz, S4386G: 1.5GHz - 9GHz
Display least significant digit LSD	t_{res} × frequency of signal measured / gate time (where, $t_{res}=7\times10^{-9}$s)
Gate time	10μs, 100μs, 1ms, 10ms, 100ms, 300ms, 1s, 10s, 100s, 1000s, external gate optional
Measurement error	± LSD/frequency of signal measured ± triggering error ± time base error

Note: *when the signal-noise ratio of the measured signal is 40dB, trigger error* $= \frac{0.3\% \times Period}{GateTime}$

Periodic measurement:

Channel A scope	7ns - 7000s
Channel BU scope	0.7ns - 10ns (S4386F)
Channel C scope	S4386B: 2ns - 10ns, S4386C: 0.7ns - 10ns, S4386D: 0.4ns - 10ns, S4386E: 0.3ns - 10ns, S4386F: 0.167ns - 1ns, S4386G: 0.11ns - 0.66ns
Display least significant digit LSD	t_{res} × period of signal measured / gate time (where, $t_{res}=7\times10^{-9}$s)
Gate time	10μs, 100μs, 1ms, 10ms, 100ms, 300ms, 1s, 10s, 100s, 1000s, external gate optional
Measurement error	±LSD/period of signal measured ± triggering error ± time base error

Note: *when the signal-noise ratio of the measured signal is 40dB, trigger error* $= \frac{0.3\% \times Period}{GateTime}$

Time interval measurement:

The measured signal is input from Channel A, B (COMMON A: OFF) or through Channel A (COMMON A: ON).

Measurement range	20ns to 7000s
Display least significant digit LSD	7ns
Trigger signal	Internal automatic trigger or external trigger
Measurement error	±LSD ± triggering error ± time base error × time interval
System error	±7ns

Frequency ratio measurement:

When channel A and channel B of product are used for measurement of the frequency ratio, the input frequency of either channel shall not be higher than 100MHz.

Display least significant digit LSD	Channel A/channel B: 1 / frequency of channel B × gate time Channel A/channel BU: 1/ frequency of channel BU × gate time Channel A/channel C: 1/frequency of channel C × gate time Channel B/channel A: frequency of channel B/(frequency of channel A)^2 × gate time Channel BU/channel A: frequency of channel BU/(frequency of channel A)^2 × gate time Channel C/channel A: frequency of channel C/(frequency of channel A)^2 × gate time

Pulse width measurement:

Input of channel A, classified into the measurement of positive pulse width and the measurement of negative pulse width.

Measurement range	≥20ns; period <100s
Display least significant digit LSD	7ns
Trigger signal	Internal automatic trigger or external trigger
Measurement error	±LSD ± triggering error ± time base error × time interval
System error	±7ns

Phase measurement:

The signal measured shall be input through channel A and channel B (COMMON A: OFF). The input impedance of channel A and channel B shall be set as 1MΩ; in order to prevent the high frequency component in the high frequency signal to be measured, 100kHz low-pass filter shall be turned on, and the triggering level shall be set at the center of the signal level.

Input signal frequency range	1Hz - 10kHz
Input signal amplitude	≥2Vp-p

Measurement range	1° - 359°
Display least significant digit LSD	0.1°
Measurement error	±3° ± error arising from signal noise

Duty cycle measurement:

Input of channel A.

Measurement range	1-99% (pulse width ≥20ns, period <100s)
Display least significant digit LSD	t_{res} × frequency of signal measured × [1 + (duty cycle/100)^2] × 100 (where, t_{res}=7×10^{-9} s)
Measurement accuracy	± [(tres2 + 2 × triggering vibrating error2) × (1 + duty cycle2)] × frequency measured × 100% (where, t_{res}=7×10^{-9} s)
Measurement error	±0.01% ±RMS ±(Triggering level error ± time base error × time interval ±1.5ns) × frequency of signal measured × 100%
Triggering level error	(200mV + 0.5% × set triggering level) × 2 / slope of input signal at set triggering level
Triggering vibrating error	Amplitude of signal noise / slope of input signal at set triggering level
Triggering signal	Internal automatic triggering or external triggering

When measuring the duty cycle, the input coupling of channel A shall be set as DC coupling.

Counting measurement:

Measurement range	0 - 1×10^{12}
Resolution	±1 counting
Gate time	AUTO, 10μs, 100μs, 1ms, 10ms, 100ms, 300ms, 1s, 10s, 100s, 1000s, external gate optional

3. 4. Measurement Operation

(Invalid for only counting measurement)

Limit operation:

Limit detection	Conduct after measurement is completed
Display mode	In case of the measurement result falling outside the upper and lower limits, the word "Limit" will be displayed in the special status display area.

Arithmetic operation:

Arithmetic operation	Conduct after measurement is completed
Display mode	Display significant digits unchanged

Statistics operation:

Statistics function	Multiple average, maximum value, minimum value, maximum deviation, single absolute deviation, single relative deviation (PPM), standard deviation, and Allen variance
Display mode	Least significant bit of multiple average, standard deviation, and Allen variance = single/N Least significant bit of single relative deviation (PPM) = single × 10^6/F0, in PPM. For the other functions, the least significant bit is unchanged.
Sampling frequency	2-2000

3. 5. Other Characteristics

Save and recall functions	The measurement conditions of the instrument will be saved automatically to prevent the loss after the shutdown. In addition, the instrument is able to save 9 measurement conditions to the maximum extent for recalling.
Centronics standard printer interface	The Centronics standard printer port is used to connect the printer directly. By switching on the printer, it is possible to print the measurement data.
Remote control interface	RS232C universal serial port, IEEE488 universal port (Option) and USB universal serial port (Option).
Power Supply	Voltage: AC 220V±22V, Frequency: 50Hz±3Hz, Power dissipation: 35VA
Dimension	240mm×380mm×105mm (W×D×H)
Weight	About 2kg

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