Electronic Counters

Counters Using the Reciprocal Method

TR5821/5822/5823

- **Reciprocal Counting Method**
- **GO–NO GO Decisions, Scaling and Other Operations Can Be Done On Measurement Results (With TR1644)**
- **Models with Various Interfaces Available**
- **Masking Function**
- **Burst Signal Measurement Function**

TR5821/5822/5823
Universal Counters

TR5821/5822/5823 Series is a universal counters capable of measuring frequencies from 1 mHz to 120 MHz (TR5821/5822) or from 1 mHz to 1300 MHz (TR5823). The Series can measure periods from 20 ns to 1000 s and can make time interval measurements from 200 ns to 1000 s. Frequency ratio and totalization measurements can also be done from DC to 50 MHz. For frequencies between 1 mHz and 50 MHz (INPUT B), the Series uses the reciprocal method to find the frequency by measuring the period of the input frequency and then taking the reciprocal with the internal microprocessor to calculate the frequency. From 10 Hz to 120 MHz (INPUT A), the Series uses the direct measurement method. The TR5823 uses the prescale method between 100 MHz and 1300 MHz (INPUT C). Due to these various methods of measurement, accurate measurement of frequencies from low to high can be obtained from a single unit. The Series also features a Masking Function, Autotrigger Function and can perform a self–check. When used with the TR1644, the series can do calculations on the measured results. The TR5822 comes with either built–in GPIB or BCD output or D/A converter and the TR5823 comes with either built–in GPIB or BCD output. These features allow for system upgrading or automatic recording of measured results.

■ Wide Selections Provided By Series

The TR5821/5822/5823 have the following high specifications and functions.

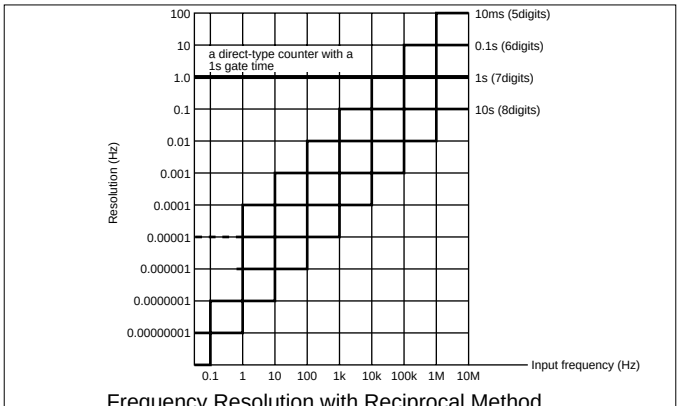
	TR5821/5822/5823		TR5823
Input terminals	INPUT A	INPUT B	INPUT C
Measurement method	Direct counting method	Reciprocal method	Prescale method
Frequency measuring range	10 Hz to 120 MHz	1 mHz to 50 MHz	100 MHz to 1300 MHz
Period measuring range	—	20 ns to 1000 s	—
Time interval measuring range	200 ns to 1000 s		—
Frequency ratio measuring range	DC to 50 MHz		—
Totalization	DC to 50 MHz	—	—

■ Reciprocal Frequency Counting Enables High Resolution Even at Low Counting Frequencies

The low-frequency measurement sections of the TR5820 Series counters measure the frequency of low-frequency signals by directly measuring the period (P) of one or more cycles and taking the reciprocal of this value using the internal processor. This reciprocal technique enables high resolution measurements at low frequencies while preserving fast measurement times. It can therefore be used to accurately measure the number of revolutions of rotators or similar equipment. The time units and resolution for the various ranges are as shown below.

Counting time	TR5821/5822/5823	Direct-type counters
10 ms	5-digit display (10 Hz)	4-digit display (100 Hz)
0.1 s	6-digit display (1 Hz)	5-digit display (10 Hz)
1 s	7-digit display (0.1 Hz)	6-digit display (1 Hz)
10 s	8-digit display (0.01 Hz)	7-digit display (0.1 Hz)

Values in parentheses are for a 100 kHz input signal



Frequency Resolution with Reciprocal Method

TR5821/5822/5823

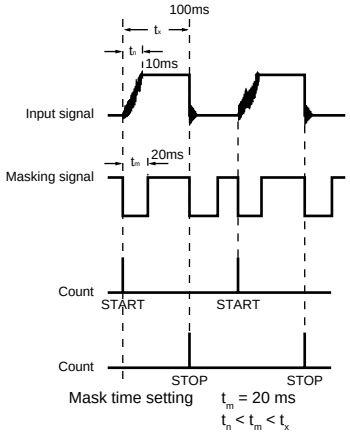
■ GO/NO-GO Testing, % Deviation and Scaling Functions

By using the TR5821/5822/5823 Series counters in conjunction with the TR1644 Calculation Unit, the following types of measurements are possible, making the counters extremely useful in field and laboratory situations.

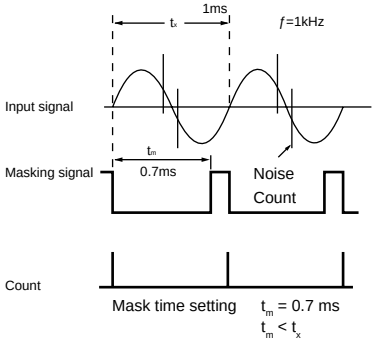
- GO–NO GO decisions of measured values and keyboard set values
- Offset measurements by addition and subtraction of measured values and set values
- Units conversion to number of revolutions, flow or speed by multiplication and division of measured values and set values
- Measurement of changes of difference amounts in deterioration with age or phenomenon changes is possible using the Δ function
- Substances which change linearly can be converted to voltage, resistance, temperature etc. and measured using the scaling function
- % deviation of measured values
- Maximum and minimum values

■ Masking Function Eliminates Chattering and Other Noise

The masking function allows accurate measurements by masking chattering and various types of noise. Only the required signal is extracted regardless of the size of the noise component. So by setting the masking time to an appropriate value, relay switch signals with chattering noise or other signals with large noise components can be measured. This function is possible using the A or B inputs on the TR5821/5822/5823.



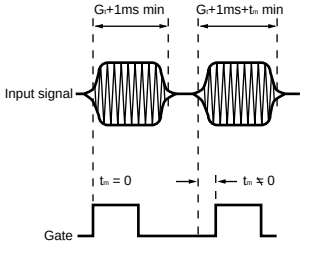
Time interval measurement of signals with chattering noise



Frequency measurement of signals with chattering noise

■ Burst Signal Measurement

By using the sync gate circuit which provides synchronization of an input signal with the counter's gate signal, frequencies of burst signals can be measured in the same way as continuous signals. Because delayed start is also possible, a further enhancement in accuracy is achieved. The delay time is set in the same manner as the mask time. This function is possible using the C input of the TR5823.



Burst signal measurement

■ A Wide Variety of Interface Functions

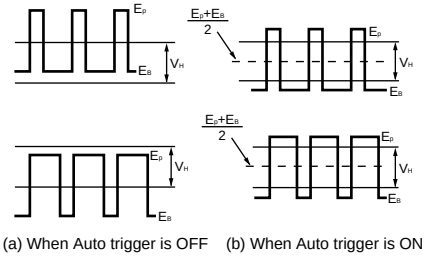
The TR5822 and TR5823 models are available with either built–in GPIB, BCD output or D/A converter (requires the separately sold TR1644 Calculation Unit). These choices allow for the construction of a measurement system to meet your needs.

One type of interface can be built in to either the TR5822 or TR5823 (main unit only)

Model type	Product code	Built–in interface	Remarks
TR5822	5822–GP	GPIB	Only one type can be selected
	5822–BCD	BCD output	
	5822–DA	D/A converter (TR1644 required)	
TR5823	5823		Only one type can be selected
	5823–GP	GPIB	
	5823–BCD	BCD output	

■ Auto trigger Function

The Auto trigger Function always sets the center of the counter's trigger equal to half the value of the input signal width. This allows measurements of triangular, sawtooth and rectangular waveforms to be easily made since the trigger level is set appropriately even when measuring micro pulses or signals where the duty cycle is 100:1.



(a) When Auto trigger is OFF (b) When Auto trigger is ON

Auto trigger level set waveforms

Electronic Counters

120 MHz/1300 MHz Counters Using the Reciprocal Method

TR5821/5822/5823 (Continued From Previous Page)

Specifications

Frequency Measurements (FREQ A)
Measurement range: 10 Hz to 120 MHz (Direct counting method)
Counting time: 10 ms, 0.1 s, 1 s, 10 s
Unit display: Hz, kHz, MHz
Measurement accuracy: ±1 count ± time base accuracy

Frequency Measurements (FREQ B)
Measurement range: 1 mHz to 50 MHz (Reciprocal method)
Counting time:
10 ms (9 ms to 0.1 s) but for frequencies less than 10 Hz counting time is one period of input signal, 5 digits are displayed.
0.1 s (90 ms to 1 s) but for frequencies less than 1 Hz counting time is one period of input signal, 6 digits are displayed.
1 s (0.9 s to 10 s) but for frequencies less than 0.1 Hz counting time is one period of input signal, 7 digits are displayed.
10 s (9 s to 100 s) but for frequencies less than 10 mHz counting time is one period of input signal, 8 digits are displayed.
Unit display: mHz, Hz, kHz, MHz
Measurement accuracy: ±(trigger error/10^n) ± 1 count ± time base accuracy (10^n is the number of periods measured)

Frequency Measurements (FREQ C) (TR58223 only)
Measurement range: 100 MHz to 1300 MHz (using a 1/20 prescaler)
Counting time: 20 ms, 0.2 s, 2 s, 20 s
Unit display: Hz, kHz, MHz, GHz
Measurement accuracy: ±1 count ± time base accuracy

Period Measurements (PERIOD B)
Measuring range: 20 ns to 999.99999 (using multiplier)
Multipliers (10^n): 10^0, 10^1, 10^2, 10^3
Time unit: 100 ns
Unit display: ns, µs, ms, s
Measurement accuracy: ± (trigger error/10^n) ±1 count ± time base accuracy

Time Interval Measurements (T.IA → B)
Measurement range: 200 ns to 999.99999 s (with a resolution of 100 ns, multiplier x 10^0)
Multipliers (10^n): 10^0, 10^1, 10^2, 10^3
Time unit: 100 ns
Unit display: ns, µs, ms, s
Measurement accuracy: ± (trigger error/$\sqrt{10^n}$) ±1 count ± time base accuracy
Dead time: 50 ns

Frequency Ratio (RATIO A/B)
Measurement range: DC to 50 MHz
Multipliers (10^n): 10^0, 10^1, 10^2, 10^3
Unit display: m, k, M
Measurement accuracy: ± (B input trigger error/10^n) ±1 count ±A input accuracy

Totalize (TOT.A)
Counting frequency range: DC to 50 MHz
Counting capacity: 0 to 99999999

Input Specifications
INPUT A/B
Input sensitivity:
25 m Vrms, DC to 100 MHz
55 m Vrms, 100 MHz to 120 MHz
Sensitivity ranges: × 1, × 10, × 100
Input voltage range: 25 m Vrms, to 500 m Vrms. (in × 1 range)
Destructive input voltage:
100 Vrms. (× 1), 150 Vrms (× 10, × 100) (DC to 100 kHz)
5 Vrms. (× 1), 50 Vrms, (× 10, × 100) (100 kHz to 120 MHz)
Input coupling modes: DC, AC, AUTO (AC coupled)
Input impedance: Approx. 1 MΩ/30 pF, COM-A approx. 500 kΩ
Pulse resolution: 10 ns
Trigger level:
Continuously variable approx. ±1 V and AUTO mode in which trigger level is set automatically to half the peak width of the measured signal.
Trigger slope: +, – switchable
Common/separate: Common inputs of A and B in COM and independent inputs in SEP mode.
Masking: Approx. 0.1 ms to 0.1 s monitoring of masking time is possible in CHECK mode.
Noise rejection: 100 kHz lowpass filter

INPUT C (TR5823 only)
Input sensitivity: 20 m Vrms. (–21 dBm)/100 MHz to 1300 MHz
Sensitivity ranges: × 1, × 10
Input voltage range: 20 mVrms to 500 mVrms. (–21 dBm to +7 dBm) (in × 1 range)
Input coupling mode: AC coupled
Input impedance: Approx. 50 Ω
Destructive input voltage: 5 Vrms. (+27 dBm) (with protective fuse)
Burst mode: Measurement of burst signals is possible using the BURST switch.
Superimposed noise suppression:
The auto-noise suppressor (ANS) automatically eliminates noise and is switchable on and off.

Time base
Internal time base frequency: 10 MHz
Frequency stability:

	TR5821/5822/5823
Aging rate	$\pm 5 \times 10^{-7}$/month
Temperature stability (0 to +40°C)	$\pm 5 \times 10^{-6}$

Internal time base output: Frequency; 10 MHz, output voltage; 1 Vp-p to 2 Vp-p, output impedance; approx. 500 Ω
External time base input: Frequency; 10 MHz, input voltage; 1 Vp- p to 2 Vp-p, input impedance; approx. 500 Ω

TR5821/5822/5823 (Continued From Previous Page)

General Specifications

Counting capacity: 8 decimal digits
Display type: 7-segment green LED elements with display memory
Sampling rate: 50 ms or HOLD
Self-check: Counting operation is checked by an internal reference signal.
Operating environment: Temperature, 0 to +40°C; Relative humidity, 85% (max.)
Storage temperature range: –20 to +70°C
Power requirement: Specified at time of ordering

Option No.	Standard	Option 32	Option 42	Option 44
Power supply voltage	90 to 110 V	108 to 132 V	198 to 242 V	216 to 250 V

50 to 400 Hz

Power consumption: Less than 40 VA (TR5821/5822/5823/5823H)
Dimensions: Approx. 240 (W) × 88 (H) × 280 (D) mm
Mass: Less than 3.5 kg (TR5821)
Less than 4 kg (TR5822/5823)

Accessories

Name	Model	Product code	Description
Power supply cable	**A01402**		
Input cable	**MI-02**		BNC to BNC
Input cable	**MI-03**		BNC to alligator clips

Interface Specifications

(one type only can be built in to TR5822/5823)

GPIB Data Output and Remote Control
Standard: IEEE488-1978
Interface functions: SH1, AH1, T5, L4, SR1, R1, PP0, DC1, DT1, C0, E1
Code used: ASCII
Remotely programmable functions: Function, gate time/multiplier, HOLD

BCD Data Output
Data: Digital parallel
No. of digits output: 7 mantissa digits and one exponential digit
Output level: TTL positive logic
Connector: 50–pin (Amphenol 57–40500 or equivalent)

D/A Converter (The separate TR1644 is required.)
Output voltage: 0.999 V fullscale (binding post output terminals)
Conversion accuracy: ±0.2% of f.s. (23°C ± 5°C temperature coefficient 150 ppm/°C)
Converted digits: Any 3 continuous digits
Output impedance: Approx. 1 kΩ

*T.O.T A data can not output

Accessories (Sold separately)

TR16202A Carrying Case
Carrying case for the TR5820 Series. Comes with accessory storage pocket and strap for convenient carrying.


TR16202A

TR1644 Calculation Unit
Calculation modes: ± (addition/subtraction), × (multiplication), – (division), DAC (D/A converter mode), comparator mode, delta, max, min, percent, scaling, calculations performed between set values by "=" key (±, ×, ÷)
Calculation digits: 8 set mantissa digits, 1 set exponent digit, 8 display digits

A02006 Panel Mount Set
A02208 Rack Mount Set (main unit only) JIS standard
A02407 Rack Mount Set (main unit only) EIA standard
A02209 Rack Mount Set (main unit and TR1644) JIS standard
A02408 Rack Mount Set (main unit and TR1644) EIA standard
TR16202A Carrying case