



**Features**

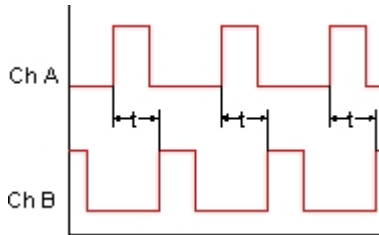


- Times periodic events with width from 1  $\mu$ s to 199.999 s
- Display resolution to 0.2  $\mu$ s
- Rep rates to 250 kHz
- Inputs from NPN or PNP proximity switches, contact closures, digital logic, magnetic pickups down to 12 mV, or AC inputs up to 250 Vac
- Triggers on positive or negative pulse edges
- Universal AC power, 85-264 Vac
- Isolated 5, 10 or 24 Vdc excitation supply to power sensors
- NEMA 4X, 1/8 DIN case
- Optional serial I/O: Ethernet, USB, RS232, RS485, Ethernet-to-RS485 converter
- Optional relay outputs: dual or quad relays, contact or solid state
- Optional isolated analog output: 4-20 mA, 0-20 mA, 0-10V, -10 to +10V
- Optional low voltage power: 10-48 Vdc or 12-32 Vac
- Optional Extended Timer: features of standard timer plus rate based on 1/time



**Description**

The Laureate A-to-B Time Interval Meter can display pulse width or time delay between individual pulses to a resolution of 0.2  $\mu$ s. It can also display average pulse width or average time delay between multiple pulses.



**Time interval is measured** between inputs on channels A and B. Timing starts when a pulse is applied to Channel A (selectable positive or negative edge), and ends when a pulse is applied to Channel B (selectable positive or negative edge). In case of a single pulsed signal, the A and B inputs can be tied together. A positive or negative slope may be selected to start timing, and the opposite slope must be selected to stop timing. Timing is achieved by counting 5.5 MHz clock pulses. Multiple integral time intervals are averaged over a gate time which is selectable from 10 ms to 199.99 s and also controls the display update time.

**Time interval can be displayed** in seconds, milliseconds, or microseconds with 6-digit resolution. In the typical application, time is displayed in milliseconds with 1  $\mu$ s resolution. For times less than 100 ms, display resolution down to 0.2  $\mu$ s can be achieved by applying a multiplier of 10, moving the decimal point by one position, and averaging many time intervals.

**Highly accurate rate** can be displayed by taking the inverse of time. Extensive arithmetic capabilities allow display in engineering units, such as meters/sec. Rate based on time requires use of the Extended counter main board.

The FR dual-channel signal conditioner board accepts inputs from proximity switches with PNP or NPN output, TTL or CMOS logic, magnetic pickups, contact closures, and other signals from 12 mV to 250 Vac. Jumper selections provide optimum operation for different sensor types and noise conditions. A built-in isolated 5, 10, or 24 Vdc excitation supply can power proximity switches and other sensors, and eliminate the need for an external power supply.

**Designed for system use.** Optional plug-in boards include Ethernet and other serial communication boards, dual or quad relay boards, and an isolated analog output board. Laureates may be powered from 85-264 Vac or optionally from 12-32 Vac or 10-48 Vdc. The display is available with red or green LEDs. The 1/8 DIN case meets NEMA 4X (IP65) specifications from the front when panel mounted. Any setup functions and front panel keys can be locked out for simplified usage and security. A built-in isolated 5, 10, or 24 Vdc excitation supply can power transducers and eliminate the need for an external power supply. All power and signal connections are via UL / VDE / CSA rated screw clamp plugs.

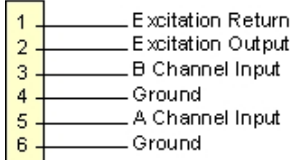
**Specifications**

Display	
Readout	6 LED digits, 7-segment, 14.2 mm (.56"), red or green
Range	-999999 to +999999
Indicators	Four LED lamps

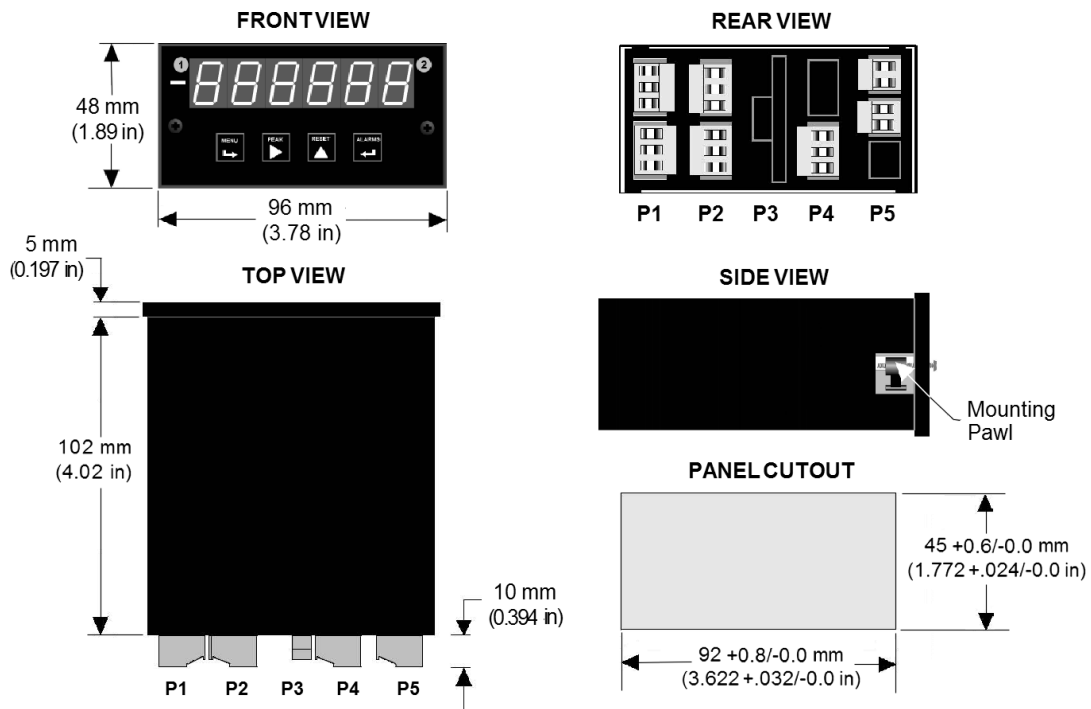


<b>Inputs</b>	
Types	AC, pulses from NPN, PNP transistors, contact closures, magnetic pickups.
Grounding	Common ground for channels A & B
Minimum Signal	Nine ranges from (-12 to +12 mV) to (+1.25 to +2.1V).
Maximum Signal	250 Vac
Noise Filter	1 MHz, 30 kHz, 250 Hz (selectable)
Contact Debounce	0, 3, 50 ms (selectable)
<b>Time Interval Mode</b>	
Timing Start	Channel A pulse, + or - edges
Timing Stop	Channel B pulse, + or - edges
Periodic Timing Interval	Gate time + 30 ms + 0-2 time intervals
Gate Time	Selectable 10 ms to 199.99 s
Time Before Zero Output	Selectable 10 ms to 199.99 s
<b>Resolution</b>	
0 - 199.999 s	1 ms
0 - 99.9999 s	100 $\mu$ s
0 - 9.99999 s	10 $\mu$ s
0 - .999999 s	1 $\mu$ s
0 - .099999 s	0.2 $\mu$ s
<b>Accuracy</b>	
Time Base	Crystal calibrated to $\pm 2$ ppm
Span Tempco	$\pm 1$ ppm/ $^{\circ}$ C (typ)
Long-term Drift	$\pm 5$ ppm/year
<b>Power</b>	
Voltage, standard	85-264 Vac or 90-300 Vdc
Voltage, optional	12-32 Vac or 10-48 Vdc
Power frequency	DC or 47-63 Hz
Power consumption (typical, base meter)	1.2W @ 120 Vac, 1.5W @ 240 Vac, 1.3W @ 10 Vdc, 1.4W @ 20 Vdc, 1.55W @ 30 Vdc, 1.8W @ 40 Vdc, 2.15W @ 48 Vdc
Power isolation	250V rms working, 2.3 kV rms per 1 min test
<b>Excitation Output (standard)</b>	
5 Vdc	5 Vdc $\pm 5\%$ , 100 mA
10 Vdc	10 Vdc $\pm 5\%$ , 120 mA
24 Vdc	24 Vdc $\pm 5\%$ , 50 mA
Output Isolation	50 Vdc to meter ground
<b>Analog Output (optional)</b>	
Output Levels	4-20 mA, 0-20 mA, 0-10V, -10 to +10V (single-output option) 4-20 mA, 0-20 mA, 0-10V (dual-output option)
Current compliance	2 mA at 10V ( > 5 k $\Omega$ load)
Voltage compliance	12V at 20 mA ( < 600 $\Omega$ load)
Scaling	Zero and full scale adjustable from -99999 to +99999
Resolution	16 bits (0.0015% of full scale)
Isolation	250V rms working, 2.3 kV rms per 1 min test (dual analog outputs share the same ground)
<b>Relay Outputs (optional)</b>	
Relay Types	2 Form C contact relays or 4 Form A contact relays (NO) 2 or 4 Form A, AC/DC solid state relays (NO)
Current Ratings	8A at 250 Vac or 24 Vdc for contact relays 120 mA at 140 Vac or 180 Vdc for solid state relays
Output common Isolation	Isolated commons for dual relays or each pair of quad relays 250V rms working, 2.3 kV rms per 1 min test

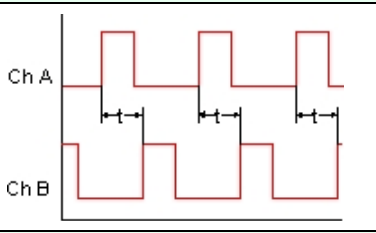
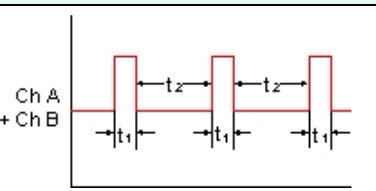
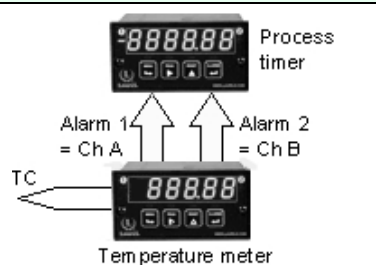
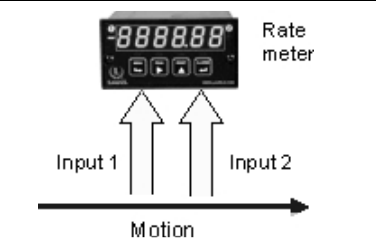
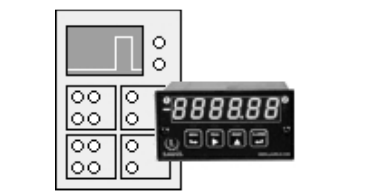
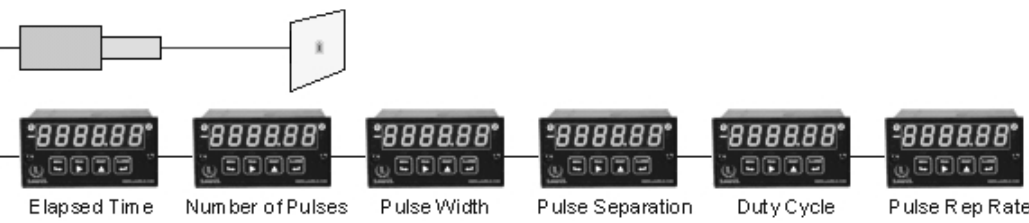


Serial Data I/O (optional)	
Board Selections	Ethernet, Ethernet-to-RS485 server, USB, USB-to-RS485 server, RS485 (dual RJ11), RS485 Modbus (dual RJ45), RS232
Protocols	Modbus RTU, Modbus ASCII, Laurel ASCII protocol
Data Rates	300 to 19200 baud
Digital Addresses	247 (Modbus), 31 (Laurel ASCII),
Isolation	250V rms working, 2.3 kV rms per 1 min test
Environmental	
Operating Temperature	0°C to 55°C
Storage Temperature	-40°C to 85°C
Relative Humidity	95% at 40°C, non-condensing
Protection	NEMA-4X (IP-65) when panel mounted
Electrical Connections	
	

## Mechanical



## Application Examples

<b>Time Interval Mode for Time Delay</b>	
	<p>For periodic pulses applied to A and B channels, time delays can be measured down to 0.2 <math>\mu</math>s resolution from the rising or falling edge of A to the rising or falling edge of B (selectable).</p>
<b>Time Interval Mode for Pulse Width</b>	
	<p>The width of periodic pulses (<math>t_1</math> or <math>t_2</math>) can be measured by tying the A and B channels together. As for time delay, readings are averaged over a user-selectable gate time.</p>
<b>Timing Process Dynamics</b>	
	<p>The start and stop pulses used for timing can be generated by the dual relay board in a Laureate panel meter or digital counter. For instance, the start and stop pulse edges can be created as temperature passes two alarm setpoints, or temperature cycles in a hysteresis control mode.</p>
<b>Rate Based on 1 / Time</b>	
	<p>The start and stop pulses used for timing can be generated by the dual relay board in a Laureate panel meter or digital counter. For instance, the start and stop pulse edges can be created as temperature passes two alarm setpoints, or temperature cycles in a hysteresis control mode.</p>
<b>Replacing an Oscilloscope with a Laureate Time Interval Meter</b>	
	<p>An oscilloscope is great for viewing and timing pulses in a lab. However, in fixed installations where digital timing accuracy and control outputs are required, a low-cost Laureate time interval meter will be the instrument of choice. Resolution to 0.2 <math>\mu</math>s is feasible.</p>
<b>Instrumenting a Pulsed Laser System</b>	
	
<p>Some of the many possibilities in instrumenting a pulsed laser system with Laureate dual-channel counters: elapsed time, number of pulses, pulse width, pulse separation, duty cycle, and pulse rep rate.</p>	

## Ordering Guide

Create a model number in this format: **L50000FR, IPC**

<b>Main Board</b>	<b>L5</b> Standard Main Board, Green LEDs <b>L6</b> Standard Main Board, Red LEDs <b>L7</b> Extended Main Board, Green LEDs <b>L8</b> Extended Main Board, Red LEDs
	<b>Note:</b> Use of the Extended Main Board makes this counter also suitable for A-B time interval, frequency, rate, period, square root of rate, up or down total, arithmetic functions, simultaneous rate and total, phase, duty cycle, batching, and custom curve linearization.
<b>Power</b>	<b>0</b> Isolated 85-264 Vac <b>1</b> Isolated 12-32 Vac or 10-48 Vdc
<b>Relay Output</b> (isolated)	<b>0</b> None <b>1</b> Two 8A Contact Relays <b>2</b> Two 120 mA Solid State Relays <b>3</b> Four 8A Contact Relays <b>4</b> Four 120 mA Solid State Relays
<b>Analog Output</b> (isolated)	<b>0</b> None <b>1</b> Single isolated 4-20 mA, 0-20 mA, 0-10V, -10 to +10V <b>2</b> Dual isolated 4-20 mA, 0-20 mA, 0-10V
<b>Digital Interface</b> (isolated)	<b>0</b> None <b>1</b> RS232 <b>2</b> RS485 (dual RJ11 connectors) <b>4</b> RS485 Modbus (dual RJ45 connectors) <b>5</b> USB <b>6</b> USB-to-RS485 converter <b>7</b> Ethernet <b>8</b> Ethernet-to-RS485 converter
<b>Input Type</b>	<b>FR</b> Dual-Channel Pulse Input Signal Conditioner
<b>Add-on Options</b>	<b>CBL01</b> RJ11-to-DB9 cable. RJ11 to DB9. Connects RS232 ports of meter and PC. <b>CBL02</b> USB-to-DB9 adapter cable. Combination of CBL02 and CBL01 connects meter RS232 port to PC USB port. <b>CBL03-1</b> 6-wire data cable, RJ11 to RJ11, 1 ft. Used to daisy chain meters via RS485. <b>CBL03-7</b> 6-wire data cable, RJ11 to RJ11, 7 ft. Used to daisy chain meters via RS485. <b>CBL05</b> USB cable, A-B. Connects USB ports of meter and PC. <b>CBL06</b> USB to RS485 adapter cable, half duplex, RJ11 to USB. Connects meter RS485 port to PC USB port. <b>CASE1</b> Benchtop laboratory case for one 1/8 DIN meter <b>CASE2</b> Benchtop laboratory case for two 1/8 DIN meters <b>IPC</b> Splash-proof cover <b>BOX1</b> NEMA-4 Enclosure <b>BOX2</b> NEMA-4 enclosure plus IPC <b>BL</b> Blank Lens without button pads <b>NL</b> Meter lens without button pads or Laurel logo