LAUREL ELECTRONICS
MEASUREMENT & CONTROL INSTRUMENTS

Laureate™ Rate Meter & Totalizer with Functions A+B, A-B, AxB, A/B, A/B-1

Features

- **Arithmetic functions A+B, A-B, AxB, A/B, A/B-1 applied to rate or total for channels A & B**
- **Frequencies from 0.005 Hz to 10 kHz**
- **Independent scaling for each channel**
- **Selectable "count by" of 10 or 100 with rounding**
- **6-digit red or green LED display**
- **Universal AC power Input, 85-264 Vac**
- **Isolated 5, 10, 12 or 24 Vdc excitation output**
- **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**

Description

Arithmetic functions A+B, A-B, AxB, A/B, A/B-1 applied to channels A & B are a capability of Laureates with an Extended counter main board and FR dual-channel signal conditioner board. These functions are applicable to rate or total after scaling to engineering units. The following are application examples:

- Add two flows (A+B) for total flow or total volume.
- Subtract two flows (A-B) for net flow or net volume.
- Take the ratio of two flow rates (A/B) for chemical mixing.
- Take the ratio of RPMs or belt speeds (A/B) to synchronize moving machinery.
- Subtract 1 from ratio (A/B-1) to control elongation of material compressed by rollers (draw).
- Multiply belt speed by weight of material on the belt to for rate or weight of material delivered by the belt. A weight transducer with frequency output is required.

Ratio and draw are similar, except that 1 is subtracted from ratio to obtain draw. The frequency of channels A or B is measured and converted to rate in engineering units by multiplying it by the appropriate scale factor for that channel. Either rate can be displayed. The A/B ratio is taken mathematically by the meter, and 1 is subtracted for draw. The result can be multiplied by a multiple or 10 from 0.0001 to 100000, and the decimal point can be set to display the result with the desired precision up to six digits.

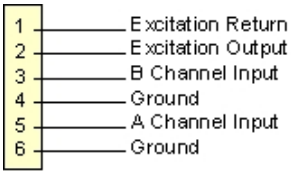
Fast, High Resolution Measurements. Laureate counters determine frequency by timing an integral number of periods over a programmable gate time. The inverse period approach allows greater accuracy and faster update times than conventional meters which count signal pulses over a specified time interval. Channel A accepts pulses from 0.005 Hz to 1 MHz, while Channel B accepts pulses from 0.005 Hz to 250 kHz. At the minimum gate time of 10 ms, update rates can be up to 25/second. Such fast response is ideal for peak capture and for alarm and control applications. Variations in the displayed reading can be reduced by selecting a longer gate time. An adaptive digital filter can further reduce variations due to noise while rapidly responding to actual changes in the signal.

Universal Signal Conditioner. The Laureate dual- hannel signal conditioner accepts inputs from proximity switches with PNP or NPN output, TTL or CMOS logic, magnetic pickups, contact closures, low-level outputs from turbine flow meters down to 12 mV, or high-level AC line inputs 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 or other sensors, and eliminate the need for an external power supply.

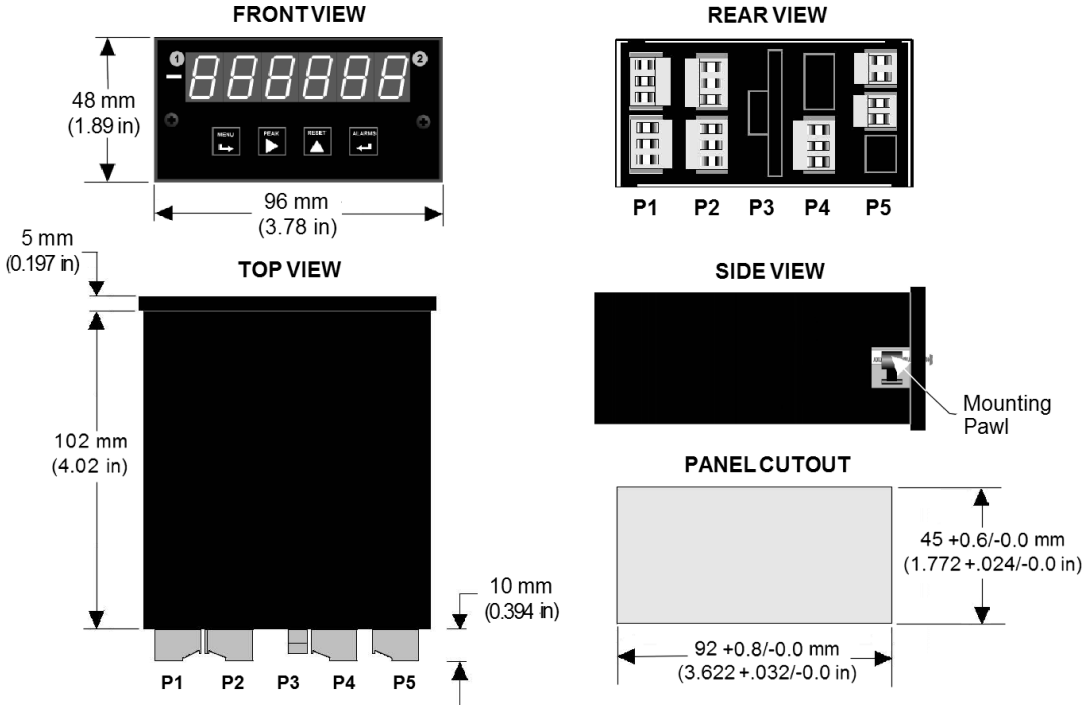
Designed for system use. Optional plug-in boards include Ethernet and other serial communication boards, dual or quad relay boards, and an isolated analog output board. Laureates may be powered from 85-264 Vac or optionally from 12-32 Vac or 10-48 Vdc. The display is available with red or green LEDs. 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, 12, 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

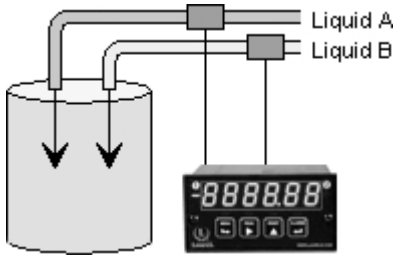
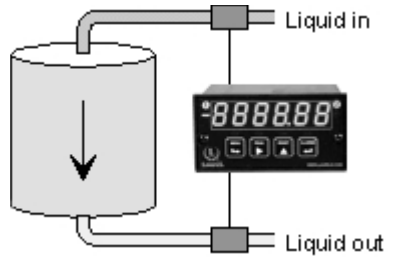
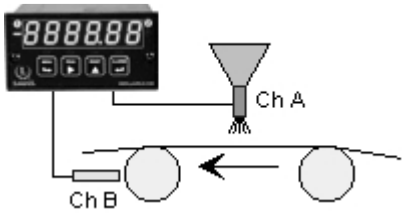
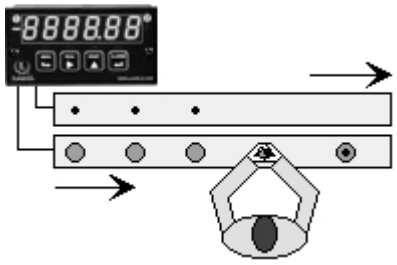
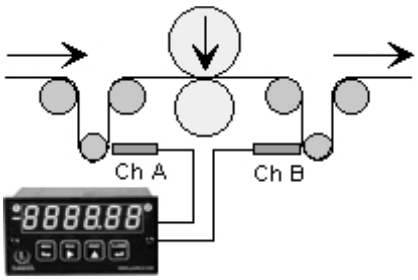
Display	
Readout	6 LED digits, 7-segment, 14.2 mm (.56"), red or green LED
Display Range	-999999 to +999999, XXXXEX notation beyond 999999
Zero Adjust	-999999 to +999999
Span Adjust	0 to 999999
Indicators	Four LED lamps
Inputs	
Types	AC, pulses from NPN, PNP transistors, contact closures, magnetic pickups
Signal Ground	Common ground for channels A & B
Channel A Frequency	0.005 Hz to 1 MHz
Channel B Frequency	0.005 Hz to 250 kHz
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)
Rate Accuracy	
Time Base	Crystal calibrated to ±2 ppm
Span Tempco	±1 ppm/°C (typ)
Long-term Drift	5 ppm/year
Power	
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
Excitation Output (standard)	
5 Vdc	5 Vdc ± 5%, 100 mA
10 Vdc	10 Vdc ± 5%, 120 mA
12 Vdc	12 Vdc ± 5%, 140 mA
24 Vdc	24 Vdc ± 5%, 50 mA
Output Isolation	50 Vdc to meter ground
Analog Output (optional)	
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 kΩ load)
Voltage compliance	12V at 20 mA (< 600Ω 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)
Relay Outputs (optional)	
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	Isolated commons for dual relays or each pair of quad relays
Isolation	250V rms working, 2.3 kV rms per 1 min test
Serial Data I/O (optional)	
Board Selections	Ethernet, Ethernet-to-RS485 converter, USB, USB-to-RS485 converter, 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 Temp. Storage Temp. Relative Humidity Protection	-40°C to 70°C -40°C to 85°C 95% at 40°C, non- ondensing NEMA-4X (IP-65) when panel mounted
Signal Connections	
	

Mechanical



Application Examples

Controlling the Mixing Ratio of Two Fluids	
	Displaying and alarming the input flow rate ratio of two fluids (gas or liquid) allows these to be mixed in a predetermined ratio in continuous processes. The sensing element is normally a turbine flowmeter, which outputs pulses at a frequency proportional to flow rate. The A/B ratio can also be displayed for totalized rate (or delivered volume).
Comparing Fluid Inflow & Outflow	
	The ratio of the inflow and outflow rates of a tank is a measure of the relative filling or emptying rate. The same meter can also be programmed to display the net inflow or outflow rate in flow units, or to display totalized inflow our outflow in volume units. Any of these parameters can be alarmed using the dual relay board and be transmitted via 4-20 mA, RS-232 or RS-485.
Controlling Coating Thickness on a Film	
	In this application, Channel A measures the rate at which a coating material is applied, as measured by a flow meter, while Channel B measures the speed of the film based on pulses from a proximity switch. Displaying and alarming the A/B ratio assures that an even thickness of coating material is applied as the speed of the film is varies.
Synchronizing Two Conveyor Lines	
	The dual-channel Laureate counter can measure the speed of conveyor lines by using the output of proximity switches which sense gear teeth or spokes of rotating drive wheels. Displaying the speed ratio of two lines allows line speeds to be adjusted so that material arrives at work stations when needed.
Measuring Draw for Elongation	
	Draw (Ch A / Ch B - 1) can be used to display the elongation of films compressed between rollers, the shrinkage films, and the RPM difference of rollers whose speed is varied to maintain tension. The six-digit resolution of the Laureate dual channel counter / rate meter is ideal for comparison of rates that are close to each other.

Ordering Guide

Create a model number in this format: **L70000FR, IPC**

Main Board	**L7** Extended Main Board, Green LEDs **L8** Extended Main Board, Red LEDs
	Note: Extended capability is required for arithmetic functions, simultaneous rate and total in the same counter, phase, stopwatch, batching, and custom curve linearization.
Power	**0** Isolated 85-264 Vac **1** Isolated 12-32 Vac or 10-48 Vdc
Relay Output (isolated)	**0** None **1** Two 8A Contact Relays **2** Two 120 mA Solid State Relays **3** Four 8A Contact Relays **4** Four 120 mA Solid State Relays
Analog Output (isolated)	**0** None **1** Single isolated 4-20 mA, 0-20 mA, 0-10 V, -10 to +10V **2** Dual isolated 4-20 mA, 0-20 mA, 0-10V
Digital Interface (isolated)	**0** None **1** RS-232 **2** RS485 (dual RJ11 connectors) **4** RS485 Modbus (dual RJ45 connectors) **5** USB **6** USB-to-RS485 converter **7** Ethernet **8** Ethernet-to-RS485 converter
Input Type	**FR** Dual-Channel Pulse Input Signal Conditioner
Add-on Options	**CBL01** RJ11-to-DB9 cable. RJ11 to DB9. Connects RS232 ports of meter and PC. **CBL02** USB-to-DB9 adapter cable. Combination of CBL02 and CBL01 connects meter RS232 port to PC USB port. **CBL03-1** 6-wire data cable, RJ11 to RJ11, 1 ft. Used to daisy chain meters via RS485. **CBL03-7** 6-wire data cable, RJ11 to RJ11, 7 ft. Used to daisy chain meters via RS485. **CBL05** USB cable, A-B. Connects USB ports of meter and PC. **CBL06** USB to RS485 adapter cable, half duplex, RJ11 to USB. Connects meter RS485 port to PC USB port. **CASE1** Benchtop laboratory case for one 1/8 DIN meter **CASE2** Benchtop laboratory case for two 1/8 DIN meters **IPC** Splash-proof cover **BOX1** NEMA-4 Enclosure **BOX2** NEMA-4 enclosure plus IPC **BL** Blank Lens without button pads **NL** Meter lens without button pads or Laurel logo