

# Laureate™ Frequency, Rate & Period Meters

With dual, independently field-scalable channels



## Features

### Standard Counter

- Two independently field-scalable channels selected by front panel pushbutton.
- Frequency from 0.005 Hz to 1 MHz.
- Inputs from NPN or PNP proximity switches, contact closures, digital logic, magnetic pickups down to 12 mV, or AC inputs up to 250 Vac.
- 6-digit resolution at update rates up to 25/s.
- Line frequency measurement to 60.0000 in a few line cycles.
- Selectable "count by" of 10 or 100 with rounding.
- Square root extraction.
- Isolated 5, 10 or 24 Vdc excitation supply to power sensors.
- Green or red LED display.
- Choice of isolated plug-in options for control and computer interface:  
[dual relays](#), [4-20 mA & 0-10 V analog output](#), [RS-232/485 I/O](#), [parallel BCD output](#), [low voltage AC & DC power](#).
- [NEMA 4X, 1/8 DIN case](#).
- Certified to UL 3101-1, CAN/CSA-C22.2, EN 61010-1 (CE Mark)

### Extended Counter

All capabilities of the Standard Counter, plus:

- Rate and total simultaneously.
  - Custom curve linearization.
  - Arithmetic functions A+B, A-B, A\*B, A/B, A/B-1 (draw).
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# Description



The Laureate dual-channel frequency, rate and period meter is a basic operating mode of the Laureate counter with the FR signal conditioner board. It can display frequency from 0.005 Hz to 1 MHz, rate in engineering units, and period (inverse of frequency). The normal displayed value can range up to 999,999 counts. Above that level, the display will flash and go into four-digit XXXXEX scientific notation. Square root extraction is standard. Each channel (A or B) may be independently scaled for frequency, rate or period. The displayed channel is selected via a front panel pushbutton.

Examples of applications are the accurate display of AC line frequency, RPM, speed from proximity switch inputs, and flow from turbine flowmeter inputs.

## Fast, High Resolution Measurement

The Laureate counter determines frequency by timing an integral number of periods over a specified gate time, and then taking the inverse of period. Rate is obtained by multiplying the input by a scale factor. The inverse period approach allows greater accuracy and faster update times than conventional meters which count signal pulses over a specified time interval. AC line frequency may be accurately measured to 50.0000 or 60.0000 Hz in a few line cycles. 1000 Hz signals may be measured to 0.01 Hz resolution at up to 25 readings per second. Fast response is ideal for alarm and control applications.

To reduce the effects of signal noise, a count by 10 or 100 feature with rounding is selectable. Variations in the displayed reading can also be reduced by selecting a longer gate time. An adaptive filter can reduce variations due to noise while rapidly responding to actual changes in the signal.

## Extended Counter Capabilities

An Extended counter version provides capabilities beyond those of the standard counter:

- **Rate and total simultaneously.** One channel can display total while the other displays rate. The selection for either channel is via a front panel pushbutton. This mode is ideal for flow applications when the same signal is applied to both channels.
- **Custom curve linearization.** Exceptionally accurate custom curve linearization allows linearization of the low end of turbine flowmeters. For setup, up to 240 data points can be input into a spreadsheet or text file by the user. The computer then calculates nonlinear segments, which are downloaded into the meter via RS-232. The Extended version allows linearized rates to be totalized.
- **Arithmetic functions.** The Extended counter makes arithmetic functions available, namely A+B, A-B, A\*B, A/B and A/B-1 (draw). For example, A+B allows two input flows to be summed for total flow, while A-B allows outflow to be subtracted from inflow for net flow. If transducers with a frequency output are used, A\*B allows horsepower to be displayed based measured torque and RPM, or based on force and velocity. A/B can be used for the proper mixing of ingredients, while A/B-1 (draw) is used to compare rates for stretching or tensioning.

## Universal Signal Conditioner

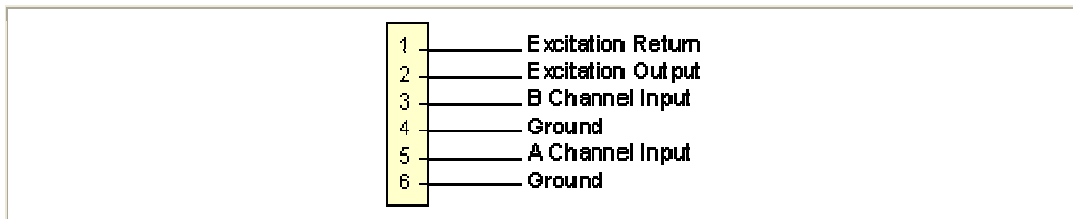
The dual-channel signal conditioner accepts inputs from proximity switches with PNP or NPN output, TTL or CMOS logic, magnetic pickups, contact closures, low-level outputs from turbine flow meters down to 12 mV, and high-level AC line inputs up to 250 Vac.

A built-in isolated 5, 10, or 24 Vdc excitation supply can power proximity switches and other sensors, thus eliminating the need for an external power supply.



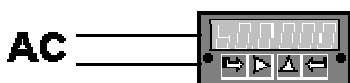
# Specifications

Display	
Readout	6 digits, 7-segment, 14.2 mm (.56")
Color	Red or green LED
Range	-999999 to +999999, XXXXEX scientific notation beyond 999999
Indicators	Four LED lamps
Inputs	
Types	AC, pulses from NPN, PNP transistors, contact closures, magnetic pickups.
Grounding	Common ground for channels A & B
Channel A Frequency	0.005 Hz to 1 MHz
Channel B Frequency	0.005 Hz to 250 kHz
Selectable Hysteresis	-12 to +12 mV, +30 to +60 mV, -30 to -20 mV, -150 to +150 mV, +350 to +600 mV, -600 to -350 mV, -1.15 to +1.15 V, +1.25 to +2.1 V, -2.1 to -1.25 V
Rolloff Filter	Selectable: 1 MHz, 30 kHz, 250 Hz
Debounce Time	Selectable: 0, 3, 50 ms
Conversion	
Frequency Technique	Inverse period
Conversion Time	Gate time + 30 ms+ 0-2 signal periods
Gate Time	Selectable 10 ms to 199.99 s
Timeout	Selectable 10 ms to 199.99 s
Output & Display Updates	Same as conversion time
Accuracy	
Time Base	Crystal calibrated to $\pm 2$ ppm
Span Tempco	$\pm 1$ ppm/ $^{\circ}$ C (typ)
Long-term Drift	$\pm 5$ ppm/year
Power	
Voltage, std.	85-264 Vac and 90-370 Vdc
Voltage, opt.	8-28 Vac and 9-37 Vdc
Frequency	DC or 49-440 Hz
Power isolation	Safety-rated to 250 Vac, meter ground to earth ground, DC to 60 Hz, 4.2 kVp per High Voltage Test
Excitation Output	
5 Vdc	5 Vdc $\pm 5\%$ , 100 mA max
10 Vdc	10 Vdc $\pm 5\%$ , 120 mA max
24 Vdc	24 Vdc $\pm 5\%$ , 50 mA max
Output isolation	50 Vdc to meter ground
Environmental	
Operating Temperature	0 $^{\circ}$ C to 55 $^{\circ}$ C
Storage Temperature	-40 $^{\circ}$ C to 85 $^{\circ}$ C
Relative Humidity	95% at 40 $^{\circ}$ C, non-condensing
Protection	NEMA-4X (IP-65) when panel mounted
Electrical Connections	



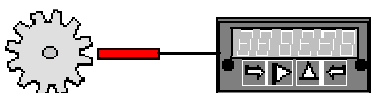
## Typical Applications

### AC Line Frequency



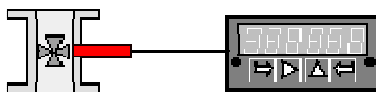
The Laureate will accept line voltages up to 250 Vac and display line frequency to 6-digit accuracy (50.0000 or 60.0000) in a few line cycles. Fast low frequency response is achieved by timing the period and taking its inverse.

### RPM and Speed



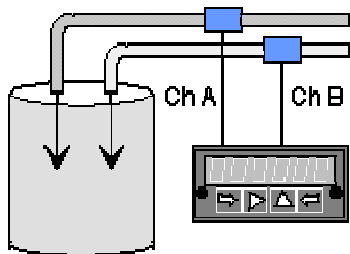
The Laureate can sense the low-level signals from magnetic pickups or the NPN or PNP transistor output of active sensors. These can be powered directly by the meter. Display in RPM or units of speed is achieved by mathematically scaling the meter.

### Flow Rate and Simultaneous Total



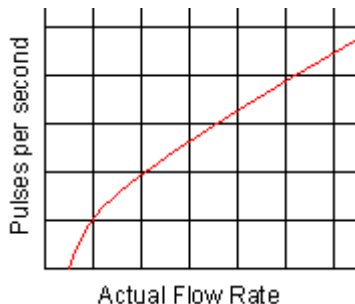
The Laureate is compatible with all flow meters which generate pulses at a frequency proportional to flow rate. The Extended version can display scaled rate or total for the same input at the push of a button, and alarm from both the rate and total. The Extended version can also linearize flow transducers so as to extend their dynamic range.

### Combining Two Rates



The Extended Laureate offers A+B, A-B and A/B arithmetic functions. A+B allows two input flows to be summed for total flow, while A-B allows outflow to be subtracted from inflow for net flow. Flow ratios aid in the proper mixing of ingredients

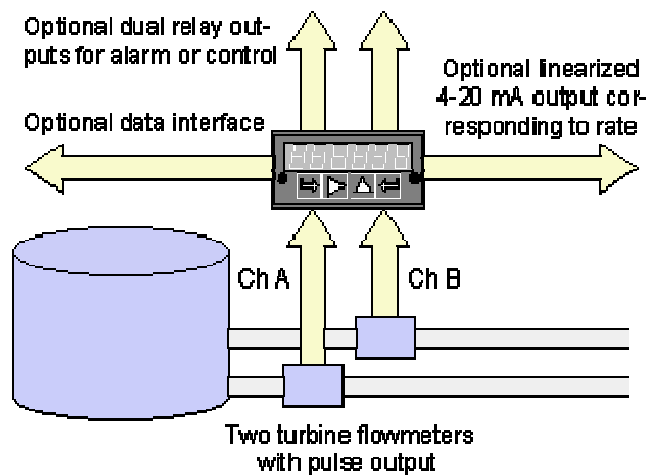
### Custom Curve Linearization



The Extended Laureate can linearize the output turbine flow meters, which tend to be nonlinear on the low end. Linearizing improves the dynamic range and accuracy of turbine flow meters.

### System-level Capabilities

The Laureate dual channel rate meter can independently scale, display and alarm two pulse input channels. All signal or alarm data can further be transmitted via RS-232 or RS-485, including peak readings and arithmetic combinations of the two rates. The displayed rates can also be transmitted as isolated parallel BCD and isolated 4-20 mA analog output.



## Ordering Guide

### Laureate™ Frequency, Rate & Period Meters

Create a model number in this format: **L80101FR**. This example calls out a Laureate counter with an extended main board with red LEDs, 85-264 Vac & 90-370 Vdc power, dual 10 A contact relays, no second output, RS-232 serial output, and a dual-channel frequency signal conditioner. Includes plug-in screw terminals.

<b>Main Board</b>	<input type="checkbox"/>	<b>L5</b> Standard Main Board, Green LEDs.	
	<input checked="" type="checkbox"/>	<b>L6</b> Standard Main Board, Red LEDs.	\$220
	<input type="checkbox"/>	<b>L7</b> Extended Main Board, Green LEDs.	\$260
	<input type="checkbox"/>	<b>L8</b> Extended Main Board, Red LEDs.	\$260
<i>With Standard Main Board:</i> Scalable to ±999,999 for frequency, rate, square root of rate, up or down total, period, A-to-B time interval.			
<i>With Extended Main Board:</i> Above, plus rate and total simultaneously, ratio (A/B), draw (A/B-1), other arithmetic functions (AxB, A+B, A-B), phase angle, stopwatch, up/down counting, batching operation, custom curve linearization.			
<b>Power</b>	<input checked="" type="checkbox"/>	<b>0</b> Isolated 85-264 Vac & 90-370 Vdc	NC
	<input type="checkbox"/>	<b>1</b> Isolated 8-28 Vac & 9-37 Vdc.	\$30
<b>Setpoint Output</b>	<input checked="" type="checkbox"/>	<b>0</b> None.	NC
	<input type="checkbox"/>	<b>1</b> Dual 10A Contact Relays.	\$80
	<input type="checkbox"/>	<b>2</b> Isolated Dual Solid State Relays.	\$55
<b>Second Output</b>	<input checked="" type="checkbox"/>	<b>0</b> None.	NC
	<input type="checkbox"/>	<b>1</b> Isolated 0-20 mA & 0-10 V.	\$90
	<input type="checkbox"/>	<b>2</b> Batch Relay. Only used with pulse-input batching operation.	\$50
<b>Digital Interface</b>	<input checked="" type="checkbox"/>	<b>0</b> None.	NC
	<input type="checkbox"/>	<b>1</b> Isolated RS-232.	\$60
	<input type="checkbox"/>	<b>2</b> Isolated RS-485.	\$80
	<input type="checkbox"/>	<b>3</b> Isolated Parallel BCD Output.	\$105

<b>Input Type</b>	<input checked="" type="checkbox"/> <b>FR</b> Dual-Channel Pulse Input Signal Conditioner		NC
<b>Add-on Options</b>	<input type="checkbox"/> <b>EB</b> Extra Bright Red LED Display.	<input type="checkbox"/> Unselected.	\$30
	<input type="checkbox"/> <b>BL</b> Blank Lens without Button Pads.	<input type="checkbox"/> Unselected.	NC