LAUREL
ELECTRONICS, INC.

Laureate™ Frequency, Rate & Period Meter

With dual, independently field-scalable channels

MADE IN CALIFORNIA

Features

- **Frequencies from 0.005 Hz to 1 MHz**
- **6-digit resolution at update rates up to 25/s**
- **Selectable "count by" of 10 or 100 with rounding**
- **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 Counter: all capabilities of Standard counter, plus**
  - **Rate and total simultaneously**
  - **Custom curve linearization**
  - **Arithmetic functions A+B, A-B, AxB, A/B, A/B-1 (draw)**

Description

Standard Counter Version:

- **The Laureate dual-channel frequency, rate & 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. Each channel (A or B) may be independently scaled for frequency, rate or period. The displayed channel is selected via a front panel push-button. Examples of applications are the accurate display of AC line frequency, RPM, speed from proximity switch inputs, and flow from turbine flow meter inputs.
- **Fast, high resolution measurements.** 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 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.
- **For noise reduction,** 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 digital filter is selectable to reduce variations due to noise while rapidly responding to actual changes in the signal.

Extended Counter Version:

- **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 180 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, AxB, 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, AxB 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.

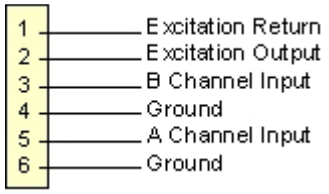
Inputs to the FR dual-channel signal conditioner can be proximity switches with PNP or NPN output, TTL or CMOS logic, magnetic pickups, contact closures, low-level outputs from turbine flow meters down to 12 mV, and high-level AC line inputs up to 250 Vac. A built-in isolated 5, 10, or 24 Vdc excitation supply can power proximity switches and other sensors, thus eliminating the need for an external power supply.

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.

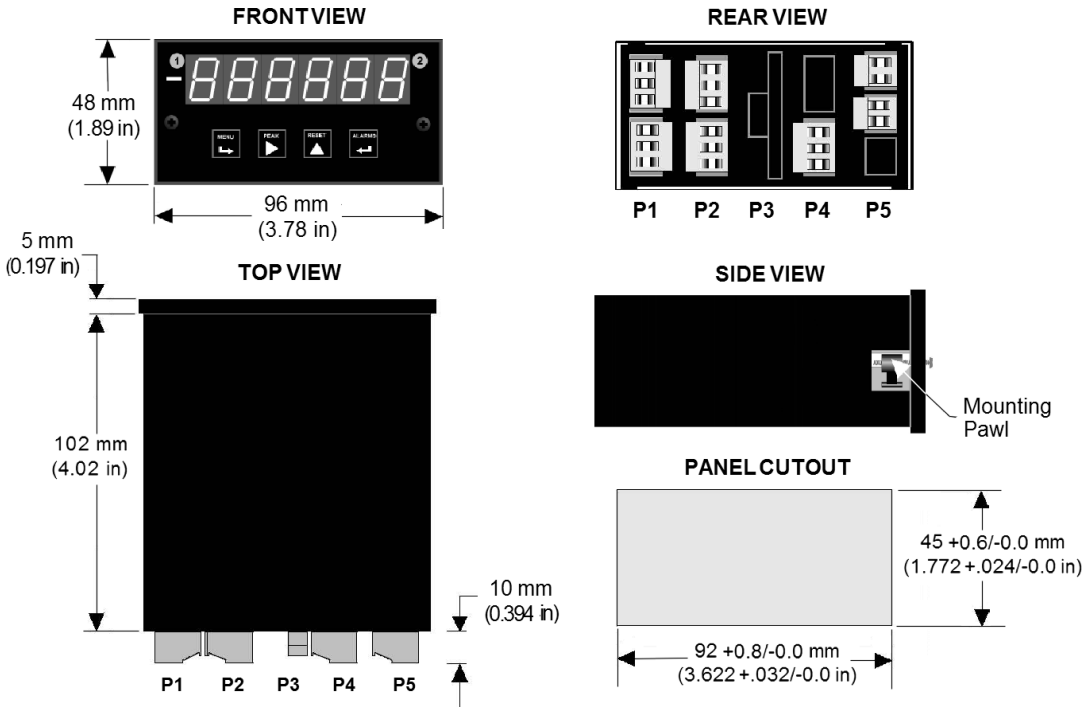
Specifications

Display	
Readout	6 LED digits, 7-segment, 14.2 mm (.56"), red or green.
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)
Update Rate	
Freq. Technique	Inverse period
Conversion Time	Gate time + 30 ms+ 0-2 signal periods
Gate Time	Selectable 10 ms to 199.99 s
Time Before Zero Out	Selectable 10 ms to 199.99 s
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
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

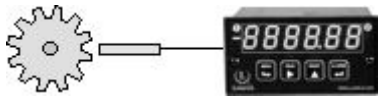
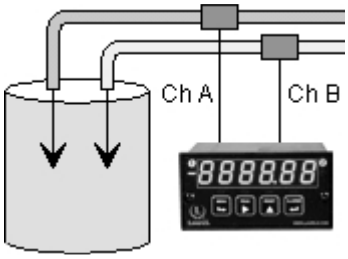
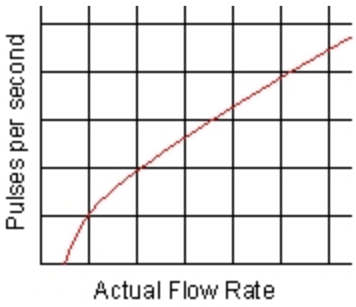
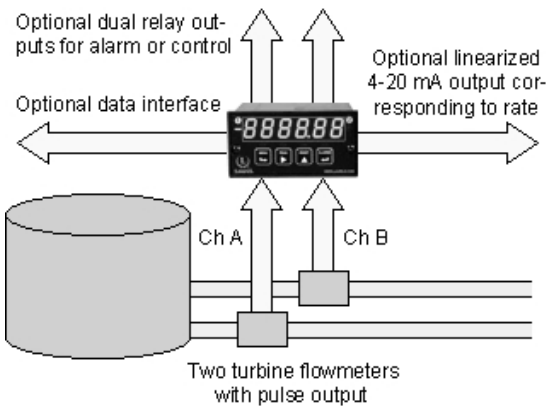
Serial Data I/O (optional)	
Board Selections	Ethernet, Ethernet-to-RS485 server, USB, USB-to-RS485 server, RS485 (dual RJ11), RS485 Modbus (dual RJ45), RS232
Protocols	Modbus RTU, Modbus ASCII, Laurel ASCII protocol
Data Rates	300 to 19200 baud
Digital Addresses	247 (Modbus), 31 (Laurel ASCII).
Isolation	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

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.
AC Line Frequency	
	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 an isolated 4-20 mA or 0-10V analog output.	

Ordering Guide

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

Main Board	**L5** Standard Main Board, Green LEDs **L6** Standard Main Board, Red LEDs **L7** Extended Main Board, Green LEDs **L8** Extended Main Board, Red LEDs
	With Standard Main Board: Scalable to ±999,999 for frequency, rate, square root of rate, up or down total, period, A-to-B time interval. **With Extended Main Board:** 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.
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, 0-10V, -10 to +10V **2** Dual isolated 4-20 mA, 0-20 mA, 0-10V
Digital Interface (isolated)	**0** None **1** RS232 **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