## Features

- **Times single events or accumulated time from 1 µs to 999,999 hrs**
- **Timing resolution to 0.2 µs**
- **Selectable HH.MM.SS clock format or decimal format**
- **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**
- **External controls for reset, meter hold and decimal points**
- **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 stopwatch meter** is designed to time single events, such as sporting events or processes, which produce start and stop pulses. It can also time the width of a single pulse. Highest resolution is 0.2 µs, since timing is achieved by counting 5.5 MHz clock pulses. For long intervals, the display is updated continuously during timing. Laureate™ stopwatch timers use the FR dual-channel signal conditioner and Standard counter main board.
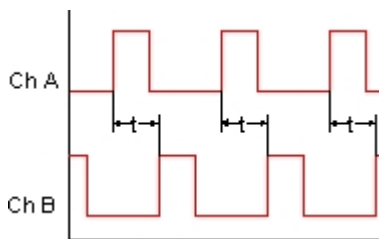


- **A-A Stopwatch Mode.** Time can be measured between a start pulse and a stop pulse, both on Channel A, from either the positive or negative edges.

- **A-B Stopwatch Mode.** Time can also be measured between a start pulse on Channel A (positive or negative edge) and a stop pulse on Channel B (positive or negative edge). This mode allows inputs from different sources. In addition, the A and B inputs can be tied together to start the stopwatch with one polarity and stop it with the other polarity.

- **Rate Based on 1/Time Mode.** Highly accurate rate can be displayed by taking the inverse of time. Extensive arithmetic capabilities allow display in engineering units, such as meter/sec. This mode requires use of an Extended counter.

**Display.** The event time (Item #1) may be displayed H, M or S format with six-digit resolution. The longest single-event timing interval is 999,999 hours. The highest resolution is 0.2 µs. The event time may also be displayed in HH.MM.SS clock format with

1 s resolution. The stopwatch display is updated during timing at a rate controlled by a gate time, up to 25/s. It is reset to zero when the next start pulse occurs. Accumulated time from multiple events (Item #2) is also tracked and may be displayed up to 999,999 hours.

**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.
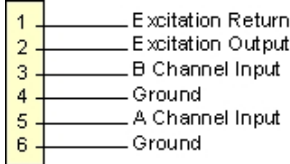
**Digital filtering** is selectable for electrically noisy environments, including a batch averaging filter and an adaptive moving average filter which provides a choice of 8 time constants from 80 ms to 9.6 s. When a significant change in signal level occurs, that filter adapts by briefly switching to the shortest time constant to follow the change, then reverts back to the selected time constant. In a selectable Auto filter mode, the filter time constant is automatically selected based on detected signal noise.

**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.
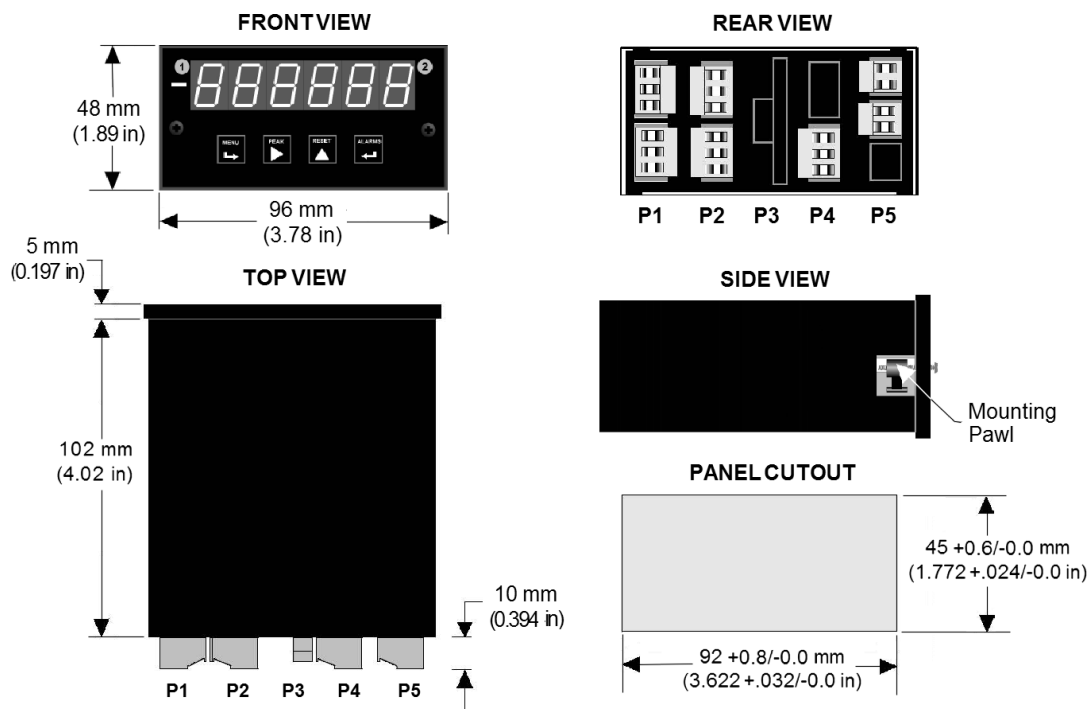
## Specifications

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

| Inputs | |
|---|---|
| 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) |

| Stopwatch Mode | |
|---|---|
| Timing Modes: | |
|   With Ch A only | + to + edge, or - to - edge. |
|   With Ch A tied to Ch B | + to - edge, or - to + edge. |
|   With Ch A and Ch B | + edge of A to + edge of B, + edge of A to - edge of B, |
| | - edge to A to - edge of B, - edge of A to - edge of B |
| Timing Interval | 1 µs to 999,999 hrs |
| Timing Resolution | 0.2 µs to 1 hr |
| Selectable Decimal Time | 999999 H, M or S format with decimal point |
| Selectable Clock Time | HH.MM.SS format |
| Output & Display Update | 30 ms + gate time programmable from 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 (DC operation not UL approved) |
| Voltage, optional | 12-32 Vac or 10-48 Vdc |
| Frequency | DC or 47-63 Hz |
| 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) |

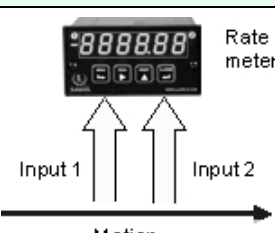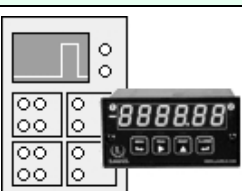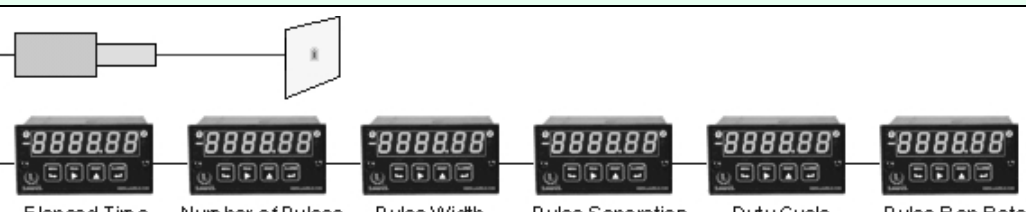| Relay Outputs (optional) | |
|---|---|
| Relay Types | 2 Form C contact relays or 4 Form A contact relays (NO) |
| | 2 or 4 Form A, AC/DC solid state relays (NO) |
| Current Ratings | 8A at 250 Vac or 24 Vdc for contact relays |
| | 120 mA at 140 Vac or 180 Vdc for solid state relays |
| Output common | 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 6°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** | |
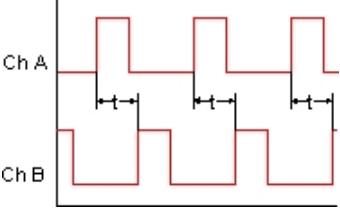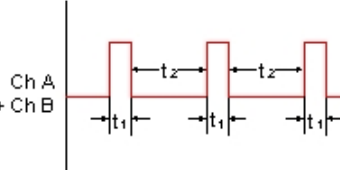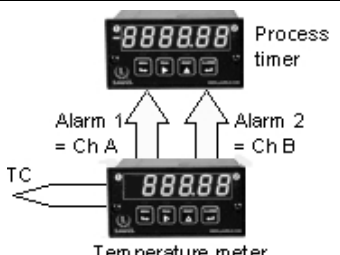
```
1 ── Excitation Return
2 ── Excitation Output
3 ── B Channel Input
4 ── Ground
5 ── A Channel Input
6 ── Ground
```

**Mechanical**

FRONT VIEW

48 mm
(1.89 in)

96 mm
(3.78 in)

REAR VIEW

P1    P2    P3    P4    P5

5 mm
(0.197 in)

TOP VIEW

102 mm
(4.02 in)

10 mm
(0.394 in)

P1    P2    P3    P4    P5

SIDE VIEW

Mounting Pawl

PANEL CUTOUT

45 +0.6/-0.0 mm
(1.772 +.024/-0.0 in)

92 +0.8/-0.0 mm
(3.622 +.032/-0.0 in)

## Application Examples

| | |
|---|---|
| **Time Interval Mode for Time Delay** | |
|  | For periodic pulses applied to A and B channels, time delays can be measured down to 0.2 µs resolution from the rising or falling edge of A to the rising or falling edge of B (selectable). |
| **Time Interval Mode for Time Delay** | |
|  | The width of periodic pulses (t1 or t2) can be measured by tying the A and B channels together. As for time delay, readings are averaged over a user-selectable gate time. |
| **Timing Process Dynamics** | |
|  | 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. |
| **Rate Based on 1 / Time** | |
|  | 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. |
| **Replacing an Oscilloscope with a Laureate Meter** | |
|  | 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 µs is feasible. |
| **Instrumenting a Pulsed Laser System** | |
|  | |
| 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. | |

## Ordering Guide

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

| | |
|---|---|
| **Main Board** | **L5**  Standard Main Board, Green LEDs<br>**L6**  Standard Main Board, Red LEDs<br>**L7**  Extended Main Board, Green LEDs<br>**L8**  Extended Main Board, Red LEDs |
| | **Note:** 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. |
| **Power** | **0**  Isolated 85-264 Vac<br>**1**  Isolated 12-32 Vac or 10-48 Vdc |
| **Relay Output**<br>(isolated) | **0**  None<br>**1**  Two 8A Contact Relays<br>**2**  Two 120 mA Solid State Relays<br>**3**  Four 8A Contact Relays<br>**4**  Four 120 mA Solid State Relays |
| **Analog Output**<br>(isolated) | **0**  None<br>**1**  Single isolated 4-20 mA, 0-20 mA, 0-10V, -10 to +10V<br>**2**  Dual isolated   4-20 mA, 0-20 mA, 0-10V |
| **Digital Interface**<br>(isolated) | **0**  None<br>**1**  RS232<br>**2**  RS485 (dual RJ11 connectors)<br>**4**  RS485 Modbus (dual RJ45 connectors)<br>**5**  USB<br>**6**  USB-to-RS485 converter<br>**7**  Ethernet<br>**8**  Ethernet-to-RS485 converter |
| **Input Type** | **FR**   Dual-Channel Pulse Input Signal Conditioner |
| **Add-on Options** | **BL**        Blank lens without button pads<br>**CBL01**  RJ11-to-DB9 cable<br>**CBL02**  USB-to-DB9 adapter<br>**CBL05**  USB Cable, A to B<br>**IPC**        Clear front panel cover sealed to NEMA 4X / IP65<br>**BOX1**    NEMA-4X wall-mount enclosure<br>**BOX2**    BOX1 plus IPC |