# LAUREL
ELECTRONICS, INC.

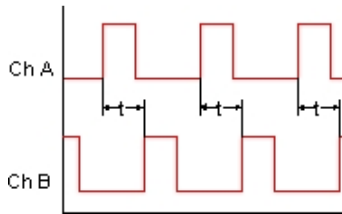# 4-20 mA & Serial Data Output Transmitter for Average Time of Periodic Events

## Features

- **4-20 mA, 0-20 mA, 0-10V or -10V to +10V transmitter output, 16 bits, isolated**
- **RS232 or RS485 serial data output, Modbus or Laurel ASCII protocol, isolated**
- **Dual 120 mA solid state relays for alarm or control, isolated**
- **Transmits average time of periodic events with width from 1 μs to 199.999 s**
- **Resolution to 0.2 μs, rep rated to 250 kHz**
- **Inputs from NPN or PNP proximity switches, contact closures, digital logic, or magnetic pickups down to 12 mV.**
- **Analog output resolution 0.0015% of span (16 bits), accuracy ±0.02% of span**
- **5V, 10V or 24V dc transducer excitation output, isolated**
- **Universal 85-264 Vac / 90-300 Vdc or 10-48 Vdc / 12-32 Vac power**

CE    RoHS    ETL c us 4006497    MADE IN CALIFORNIA

## Description



**The Laureate time interval transmitter** can transmit pulse width or time delay between individual pulses to a resolution of 0.2 μs for periodic events. It can also transmit 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 maximum output rate.

**The dual-channel signal conditioner** used for pulse detection 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 5V, 10V or 24V dc excitation supply can power proximity switches and other sensors, and eliminate the need for an external power supply.

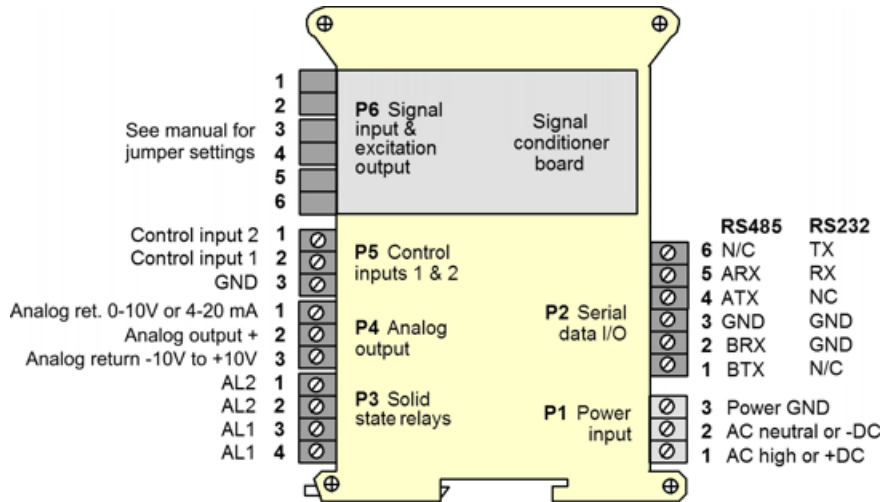**Standard features of Laureate transmitters include:**

- **4-20 mA, 0-10V or -10V to +10V analog transmitter output**, isolated, jumper-selectable and user scalable. All selections provide 16-bit (0.0015%) resolution of output span and 0.02% output accuracy of a reading from -99,999 to +99,999 counts that is also transmitted digitally. Output isolation from signal and power grounds eliminates potential ground loops.

- **Serial communications output,** isolated. User selectable RS232 or RS485, half or full duplex. Three protocols are user selectable: Modbus RTU, Modbus ASCII, or Laurel ASCII. Modbus operation is fully compliant with Modbus Over Serial Line Specification V1.0 (2002). The Laurel ASCII protocol allows up to 31 Laureate devices to be addressed on the same RS485 data line. It is simpler than the Modbus protocol and is recommended when all devices are Laureates.

- **Dual solid state relays,** isolated. Available for local alarm or control. Rated 120 mA at 130 Vac or 170 Vdc.

- **Universal 85-264 Vac power.** Low-voltage 10-48 Vdc or 12-32 Vac power is optional.

**Easy Transmitter programming** is via Laurel's Instrument Setup Software, which runs on a PC under MS Windows. This software can be downloaded from our website at no charge. The required transmitter-to-PC interface cable is available from Laurel (P/N CBL04).
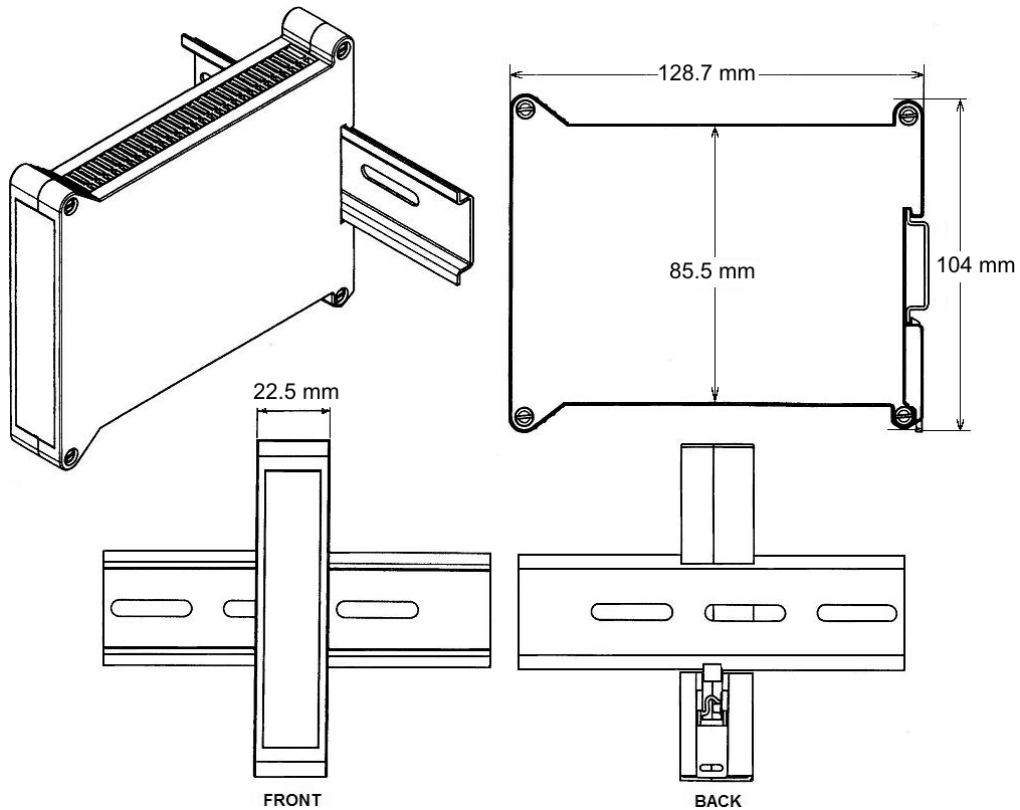
## Specifications

| Pulse Input | |
|---|---|
| Signal Types | AC, pulses from NPN, PNP transistors, contact closures, magnetic pickups |
| Signal Ground | 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 |
| Maximum Frequency | 1 MHz, 30 kHz, 250 Hz (selectable). |
| Contact Debounce | 0, 3, 50 ms (selectable). |
| Time Base Accuracy | Quartz crystal calibrated to ±2 ppm. |
| Span Tempco | ±1 ppm/°C (typ) |
| Long-term Drift | ±5 ppm/year |

| Time Interval Mode | |
|---|---|
| Timing Start | Channel A pulse, + or - edges |
| Timing Stop | Channel B pulse, + or - edges |
| Update Rate | 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 |

| Resolution | |
|---|---|
| 0 - 199.999 s | 1 ms |
| 0 - 99.9999 s | 100 µs |
| 0 - 9.99999 s | 10 µs |
| 0 - .999999 s | 1 µs |
| 0 - .099999 s | 0.2 µs (after averaging) |

| Analog Output (standard) | |
|---|---|
| Output Levels | 4-20 mA, 0-20 mA, 0-10 Vdc, -10 to +10Vdc (user selectable) |
| Compliance, 4-20 mA | 10V ( 0-500Ω load ) |
| Compliance, 0-10V | 2 mA ( 5 kΩ load ) |
| Output Resolution | 16 bits (65,536 steps) |
| Output Accuracy | ±0.02% of output span |
| Output Update Rate | Programmed gate time + 30 ms + 0-2 signal periods |
| Output Isolation | 250V rms working, 2.3 kV rms per 1 minute test |

| Serial Data Output (standard) | |
|---|---|
| Signal Types | RS232 or RS485 (half or full duplex) |
| Data Rates | 300, 600, 1200, 2400, 4800, 9600, 19200 baud |
| Output Isolation | 250V rms working, 2.3 kV rms per 1 min test |
| Serial Protocols | Modbus RTU, Modbus ASCII, Laurel ASCII |
| Modbus Compliance | Modbus over Serial Line Specification V1.0 (2002) |
| Digital Addressing | 247 Modbus addresses. Up to 32 devices on an RS485 line with no repeater |

| Transducer Excitation Output (standard) | |
|---|---|
| Jumper Selection 1 | 10V @ 60 mA, isolated to 50V from signal ground |
| Jumper Selection 2 | 5V @ 50 mA, isolated to 50V from signal ground |
| Jumper Selection 3 | 15V @ 60 mA, non-isolated |

| Power Input | |
|---|---|
| Standard Power | 85-264 Vac or 90-300 Vdc |
| Low Power Option | 10-48 Vdc or 12-32 Vac |
| Power Frequency | DC or 47-63 Hz |
| Power Isolation | 250V rms working, 2.3 kV rms per 1 min test |
| Power Consumption | 2W typical, 3W with max excitation output |

| Mechanical | |
|---|---|
| Dimensions | 129 x 104 x 22.5 mm case |
| Mounting | 35 mm rail per DIN EN 50022 |
| Electrical Connections | Plug-in screw-clamp connectors |

| Environmental | |
|---|---|
| Operating Temperature | 0°C to 55°C |
| Storage Temperature | -40°C to 85°C |
| Relative Humidity | 95% at 40°C, non-condensing |
| Cooling Required | Mount transmitters with ventilation holes at top and bottom. Leave 6 mm (1/4") between transmitters, or force air with a fan. |

# Pinout

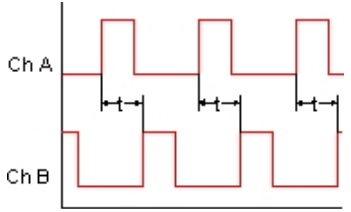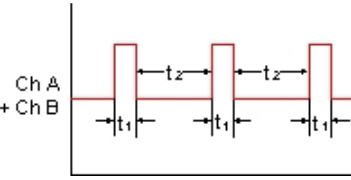**See manual for jumper settings**

1
2
3
4
5
6

**P6** Signal input & excitation output

Signal conditioner board

Control input 2  1 — **P5** Control inputs 1 & 2
Control input 1  2
GND  3

Analog ret. 0-10V or 4-20 mA  1 — **P4** Analog output
Analog output +  2
Analog return -10V to +10V  3

AL2  1 — **P3** Solid state relays
AL2  2
AL1  3
AL1  4

**P2** Serial data I/O

| | RS485 | RS232 |
|---|---|---|
| 6 | N/C | TX |
| 5 | ARX | RX |
| 4 | ATX | NC |
| 3 | GND | GND |
| 2 | BRX | GND |
| 1 | BTX | N/C |

**P1** Power input

| 3 | Power GND |
| 2 | AC neutral or -DC |
| 1 | AC high or +DC |

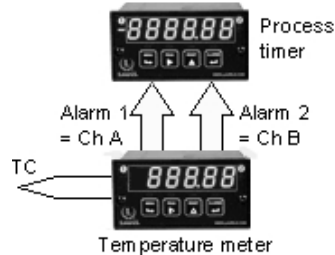# Mechanical

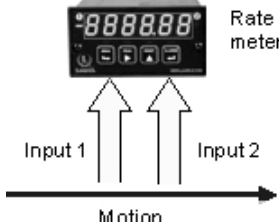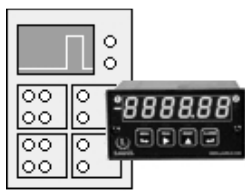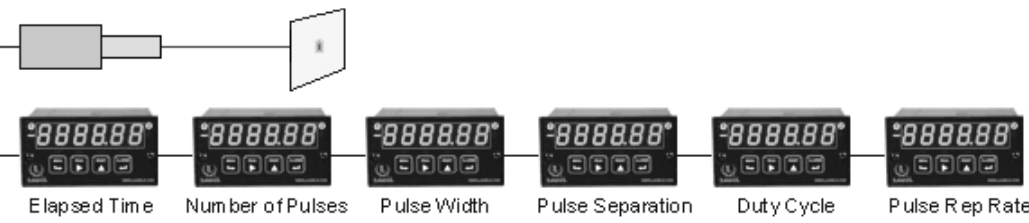128.7 mm

85.5 mm

104 mm

22.5 mm

**FRONT**

**BACK**

# Ordering Guide

Create a model a model number in this format: **LT600FR, CBL04**

| Transmitter Type | **LT** Laureate 4-20 mA & RS485 Transmitter |
|---|---|
| Main Board | **6** Standard Main Board |
| Power | **0** Isolated 85-264 Vac or 90-300 Vdc<br>**1** Isolated 12-32 Vac or 10-48 Vdc |
| Input Type | **FR** Dual-Channel Frequency |
| Accessories | **CBL04** RS232 cable, 7ft. Connects RS232 screw terminals of LT transmitter to DB9 port of PC.<br>**CBL02** USB to RS232 adapter cable. Combination of CBL02 and CBL04 connects transmitter RS232 terminals to PC USB port. |

# Application Examples of Time Averaging Meters and Transmitters

| | |
|---|---|
| **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 or Transmitter** | |
|  | 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. | |