LAUREL ELECTRONICS, INC.

4-20 mA & Serial Data Output Transmitter for Pt100, Cu10 and Ni120 RTD Input

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**
- **Factory calibrated for 100Ω platinum, 10Ω copper and 120Ω nickel RTDs**
- **2, 3 or 4-wire RTD connection with lead resistance compensation**
- **User selectable input span from entire RTD range down to 15.0°**
- **Analog output resolution 0.0015% of span (16 bits), accuracy ±0.02% of span**
- **Universal 85-264 Vac / 90-300 Vdc or 10-48 Vdc / 12-32 Vac power**
- **DIN rail mount housing only 22.5 mm wide, detachable screw-clamp connectors**

Description

The Laureate RTD temperature transmitter provides a linearized, highly accurate, stable and repeatable transmitter output for 100 ohm platinum, 10 ohm copper and 120 ohm nickel RTDs. Pt 100 platinum RTDs can have a DIN alpha of 0.00385 or ANSI alpha of 0.00392. The RTD type and temperature range, specified in °C or °F, are user-selectable. The temperature range can be as wide as the entire span of the RTD type or as narrow as 150 counts (such as 15.0°), limited only by considerations of electrical noise and digital filtering time constants.

Digital calibration of all RTD ranges is performed the factory, with calibration data stored in EEPROM on the signal conditioner board. This allows signal conditioner boards and ranges to be changed in the field with no need for recalibration.

RTD connections can be via 2, 3 or 4wires. With 3- and 4-wire connections, the transmitter automatically compensates for lead resistance of the sensor.

Fast read rate at up to 50 or 60 conversions per second while integrating the signal over a full power line cycle is provided by Concurrent Slope (Pat 5,262,780) analog-to-digital conversion. High read rate is ideal for peak or valley capture and for real-time computer interface and control.

Open sensor indication is standard and may be set up to indicate either upscale or downscale. RTD excitation is provided by the transmitter.

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.

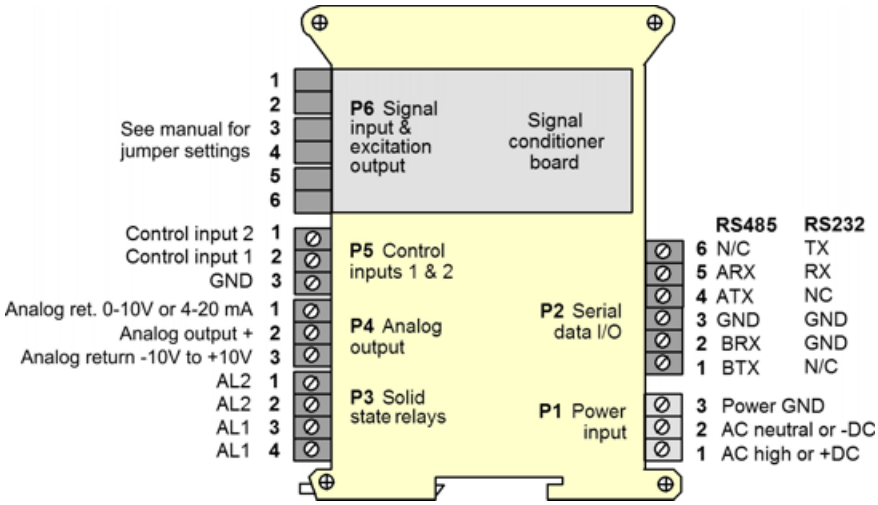
Easy Transmitter programming is via Laurel's Instrument Setup Software, which runs on a PC under MS Windows. This software can be downloaded from our website at no charge. The required transmitter-to-PC interface cable is available from Laurel (P/N CBL04).

Specifications

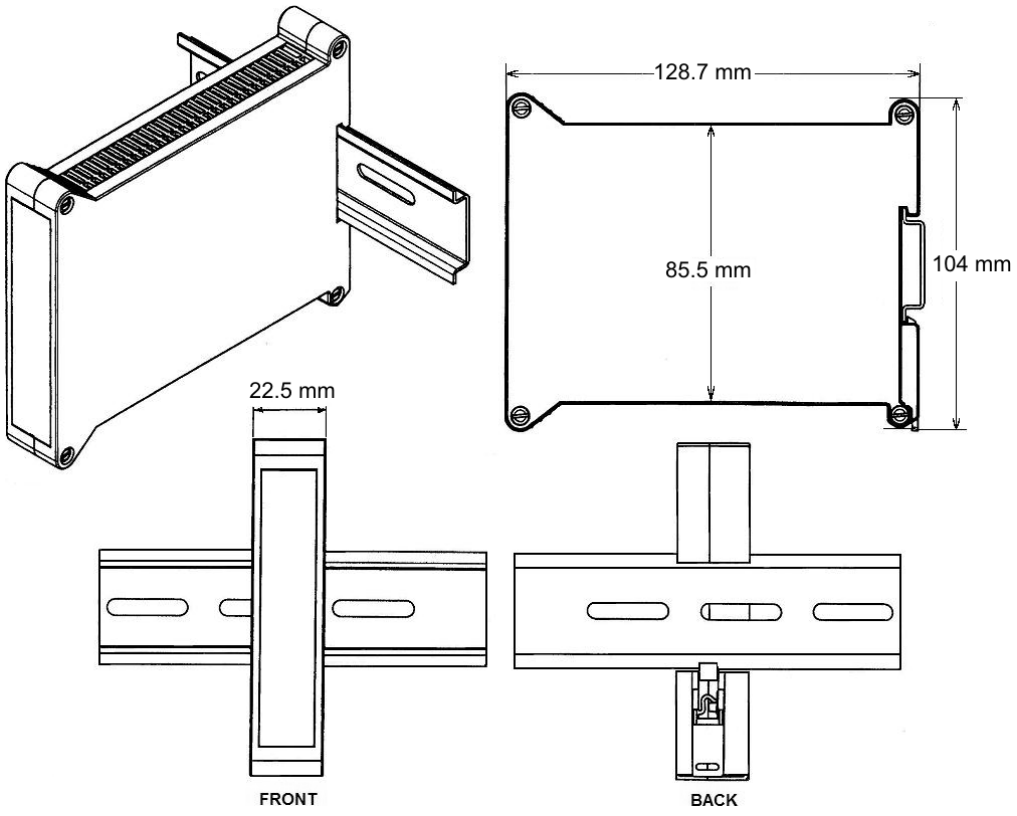
RTD Metal	Alpha	R at 0°C	R at top of range	Excitation Current	Range	Conformity Error
Platinum	0.003850 (DIN)	100Ω	390.48Ω at 850°C	196 µA	-200°C to +850°C -328°F to +1562°F	±0.03°C ±0.05°F
Platinum	0.003902 (ANSI)	100Ω	394.36Ω at 850°C	196 µA	-200°C to +850°C -328°F to +1168°F	±0.04°C ±0.07°F
Nickel	0.00672	120Ω	380.31Ω at 260°C	196 µA	-80°C to +260°C -112°F to +500°F	±0.05°C ±0.09°F
Copper	0.00427	9.035Ω	19.116Ω at 260°C	5.0 mA	-97°C to +260°C -143°F to +500°F	±0.05°C ±0.09°F

RTD Input	
Calibration, Pt 100 DIN	Per IEC 751 (ITS-90)
Calibration, Pt 100 ANSI	NIST Monograph 126
Calibration, Ni 120	DIN 43760
Max error at 25°C, Pt100	± 0.04°C (±0.07°F) ± 0.01% of reading
Span tempco	± 0.003% of reading/°C
Zero tempco	± 0.03 deg/deg
Provision for calibration	Multiplier of RTD resistance plus offset in degrees
Connection	2, 3 or 4-wire
Overvoltage protection	125 Vac
Open sensor indication	0 mA or > 20mA output, user selectable
Sensor lead resistance	2-wire, 10 mdeg/Ω/deg up to 10Ω
Tempco per conductor	3 & 4-wire, 10 mdeg/Ω/deg up to 100Ω
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 m load)
Compliance, 0-10V	2 mA (5 kΩ load)
Output Resolution	16 bits (65,536 steps)
Output Accuracy	±0.02% of output span
Output Isolation	250V rms working, 2.3 kV rms per 1 minute test
Step Response Time	50 ms
Serial Communications (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 Modes	RTU or ASCII
Modbus Compliance	Modbus over Serial Line Specification V1.0 (2002)
Digital Addresses	247 with Modbus. Up to 31 devices on an RS485 line w/o a repeater.
Dual Relay Output (standard)	
Relay Type	Two solid state relays, SPST, normally open, Form A
Load Rating	120 mA at 140 Vac or 180 Vdc
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



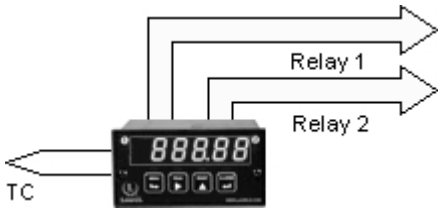
Mechanical



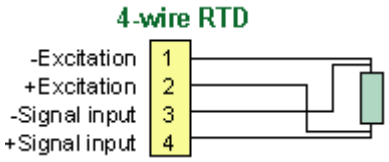
Operation as a Fast ON/OFF Controller or Supervisory Monitor

With the optional dual solid state relay output option, which has a typical response time of only 17 ms, Laureate temperature meters and transmitters can serve as extremely fast and accurate ON/OFF controllers for closed-loop temperature control. They can also serve as supervisory process monitors and provide alarms or shutoffs when processes exceed normal limits.

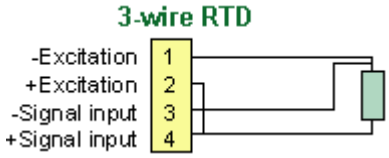
Multiple setpoint operating modes are individually selectable for each relay. Relay duty cycles and chatter can be minimized with programmable hysteresis and time delays. A band deviation operating mode can be selected for each relay, where an alarm is generated whenever the reading is a selected number of counts above or below the setpoint. The relay modes are non-latching.



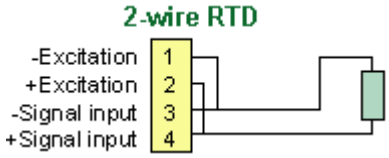
RTD Hookup



In 4-wire hookup, different pairs of leads are used to apply the excitation current and sense the voltage drop across the RTD, so that the IR drop across the excitation leads is not a factor.



In 3-wire hookup, the transmitter senses the combined voltage drop across the RTD plus two excitation leads. It also senses the voltage drop across one excitation lead, and then subtracts twice this voltage from the combined total. This technique effectively subtracts all lead resistance and compensates for ambient temperature changes if the two excitation leads are identical.



In 2-wire hookup, the transmitter senses the combined voltage drop across the RTD and both lead wires. The voltage drop across the lead wires can be measured by shorting out the RTD during transmitter setup, and this voltage is then automatically subtracted from the combined total. However, changing resistance of the lead wires due to ambient temperature changes will not be compensated.

Ordering Guide

Create a model a model number in this format: **LT20P385C**

Transmitter Type	**LT** Laureate 4-20 mA & RS232/RS485 Transmitter
Main Board	**2** Standard Main Board
Power	**0** Isolated 85-264 Vac or 90-300 Vdc **1** Isolated 10-48 Vdc or 12-32 Vac
RTD Input	**P385C** Pt100 DIN RTD, -202°C to 850°C **P385F** Pt100 DIN RTD, -331°F to 1562°F **P392C** Pt100 ANSI RTD, -202°C to 631°C **P392F** Pt100 ANSI RTD, -331°F to 1168°F **N672C** Ni120 RTD, -100°C to +260°C **N672F** Ni120 RTD, -148°F to +500°F **C427C** Cu10 RTD, -100°C to +260°C **C427F** Cu10 RTD, -148°F to +500°F
	Note: The same signal conditioner board can be user configured for all RTD types listed and °C or °F, as well as for resistance measurement.
Accessories	**CBL04** RS232 cable, 7ft. Connects RS232 screw terminals of LT transmitter to DB9 port of PC. **CBL02** USB to RS232 adapter cable. Combination of CBL02 and CBL04 connects transmitter RS232 terminals to PC USB port.