LAUREL
ELECTRONICS, INC.

Laureate™ RTD Temperature Panel Meter / Controller

Features

- **Factory calibrated for 100Ω platinum, 10Ω copper & 120Ω nickel RTDs**
- **2, 3 or 4-wire connection with lead resistance compensation**
- **Highly accurate and repeatable**
- **Selectable 1° or 0.°1, degrees Celsius, Fahrenheit, Kelvin or Rankin**
- **Up to 60 conversions per second**
- **Peak or valley display**
- **Universal AC power, 85-264 Vac**
- **1/8 DIN case sealed to NEMA-4X from front panel**
- **Optional serial I/O: Ethernet, USB, RS232, RS485, Ethernet-to-RS485 converter**
- **Optional relay output: 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**

Description

The Laureate™ RTD meter is factory calibrated for four Resistance Temperature Detector (RTD) types: 100-ohm platinum (Pt100) with DIN alpha of 0.00385, 100-ohm platinum (Pt100) with ANSI alpha of 0.003902, 10-ohm copper with alpha of 0.00427, and 120-ohm nickel with alpha of 0.00672. The entire span of each RTD type is presented in a single range. The RTD type, unit of measure (°C or °F) and resolution (1°, 0.1° or 0.01°) are selectable from the front panel or via the meter's serial interface. Display in Kelvin or Rankin is selected by offsetting the Celsius or Fahrenheit ranges. Typical accuracy is better than ±0.1°C (±0.2°F).

RTD connections can be via 2, 3 or 4 wires. With 3 or 4-wire connections, the meter automatically compensates for changes in lead resistance to the sensor. With 2-wire connection, the meter can measure and then subtract the lead wire resistance.

All ranges for all RTD types are digitally calibrated at the factory, with calibration factors stored in an EEPROM on the signal conditioner board. This allows temperatures sensors and signal conditioner boards to be changed in the field without recalibrating the meter.

High read rates at up to 60 or 50 conversions per second while integrating the signal over a full power cycle are provided by Concurrent Slope (US Pat 5,262,780) analog-to-digital conversion. High read rates are ideal for peak or valley capture, real-time computer interface, and control. Peak and valley values are standard. These may be displayed via a front panel pushbutton command or a control signal at the rear connector, or be transmitted as serial data.

Digital filtering is selectable for electrically noisy environments or resolution to 0.01°, 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 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 for communications and control 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. All power and signal connections are via UL / VDE / CSA rated screw clamp plugs.

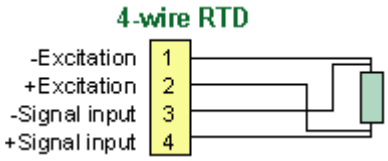
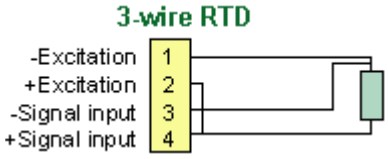
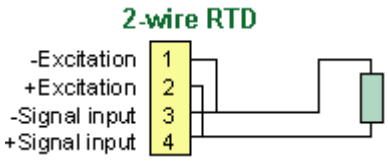
Specifications

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 +1562°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

Display	
Readout Color Indicators	5 digits, 7-segment, 14.2 mm (.56") Red or green LED Minus sign, 2 red LED lamps
Accuracy	
Calibration, Pt 100 DIN Calibration, Pt 100 ANSI Calibration, Ni 120 Max error at 25°C, Pt100 Span tempco Zero tempco Provision for user calibration	Per IEC 751 (ITS-90) NIST Monograph 126 DIN 43760 ± 0.04°C (±0.07°F) ± 0.01% of reading ± 0.003% of reading/°C ± 0.03 deg/deg Multiplier of RTD resistance plus offset in degrees
Electrical	
Connection Overvoltage protection Open sensor indication Sensor lead resistance Tempco per conductor	2, 3 or 4-wire 125 Vac Flashes full-scale 2-wire, 10 mdeg/Ω/deg up to 10Ω 3 & 4-wire, 10 mdeg/Ω/deg up to 100Ω
A-to-D Conversion	
Technique A-to-D Rate Output Update Display Update	Concurrent Slope™ (Pat 5,262,780) 60/s at 60 Hz, 50/s at 50 Hz 56/s at 60 Hz, 47/s at 50 Hz 3.5/s at 60 Hz, 3/s at 50 Hz
Power	
Voltage, standard Voltage, optional Power frequency Power consumption (typical, base meter) Power isolation Ratiometric operation	85-264 Vac or 90-300 Vdc 12-32 Vac or 10-48 Vdc DC or 47-63 Hz 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 250V rms working, 2.3 kV rms per 1 min test Automatically compensates for changes in excitation level
Analog Output (optional)	
Output Levels Current compliance Voltage compliance Scaling Resolution Isolation	4-20 mA, 0-20 mA, 0-10V, -10 to +10V (jumper selectable) 2 mA at 10V (> 5 kΩ load) 12V at 20 mA (< 600Ω load) Zero and full scale adjustable from -99999 to +99999 16 bits (0.0015% of full scale) 250V rms working, 2.3 kV rms per 1 min test
Relay Outputs (optional)	
Relay Types Current Ratings Output common Isolation	2 Form C contact relays or 4 Form A contact relays (NO) 2 or 4 Form A, AC/DC solid state relays (NO) 8A at 250 Vac or 24 Vdc for contact relays 120 mA at 140 Vac or 180 Vdc for solid state relays Isolated commons for dual relays or each pair of quad relays 250V rms working, 2.3 kV rms per 1 min test
Serial Data I/O (optional)	
Board Selections Protocols Data Rates Digital Addresses Isolation	Ethernet, Ethernet-to-RS485 server, USB, USB-to-RS485 server, RS485 (dual RJ11), RS485 Modbus (dual RJ45), RS232. Modbus RTU, Modbus ASCII, Laurel ASCII protocol 300 to 19200 baud 247 (Modbus), 31 (Laurel ASCII), 250V rms working, 2.3 kV rms per 1 min test

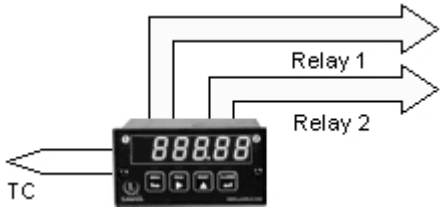
Environmental	
Operating Temp. Storage Temp. Relative Humidity Protection	0°C to 55°C -40°C to 85°C 95% at 40°C, non-condensing NEMA-4X (IP-65) when panel mounted

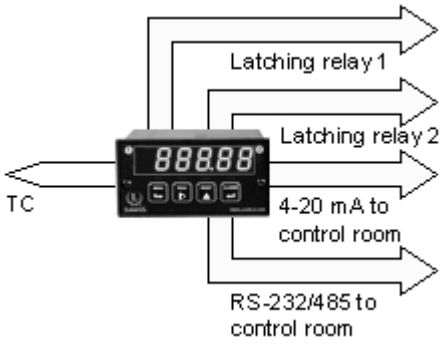
RTD Connections with Excitation & Lead Compensation

	**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 meter 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 meter 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 meter 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.

RTD hookup can be via 2, 3 or 4 wires to the J5 connector. The meter applies an excitation current of 256 µA (Pt100 and Ni120) or 5 mA (Cu10).

Application Examples

	**Operation as a 4-20 mA Transmitter** With the optional analog output board, Laureate temperature meters can serve as superb, isolated 4-20 mA transmitters. The analog output is scaled to the display, which is linearized to °C or °F and is exceptionally accurate. The analog output further tracks the high read rate of the meter, at up to 60 readings per second at 60 Hz power. Fast update rates are beneficial in many closed-loop and PID control applications.
	**Operation as a Fast Controller** With the dual contact relay or dual solid state relay output board options, Laureate temperature meters can serve as extremely fast and accurate ON/OFF controllers for closed-loop temperature control. Multiple setpoint operating modes are individually selectable for each relay, as explained in the dual-setpoint controller section. Relay duty cycles and chatter can be minimized with programmable hysteresis and time delays. High duty cycles and extremely fast response times are possible with the solid state relay, which has a typical response time of only 17 ms.



Operation as a Supervisory Monitor

By using the optional dual contact relay or dual solid state relay output options, Laureate temperature meters can monitor processes and provide alarms or shutoffs when these processes exceed normal limits. 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. Relay operation can be selected as latching or non-latching. When an alarm or shutdown condition is reached, a latched output will remain in the alarm condition until it is reset by a front panel pushbutton, via the serial interface, or via the rear connector.

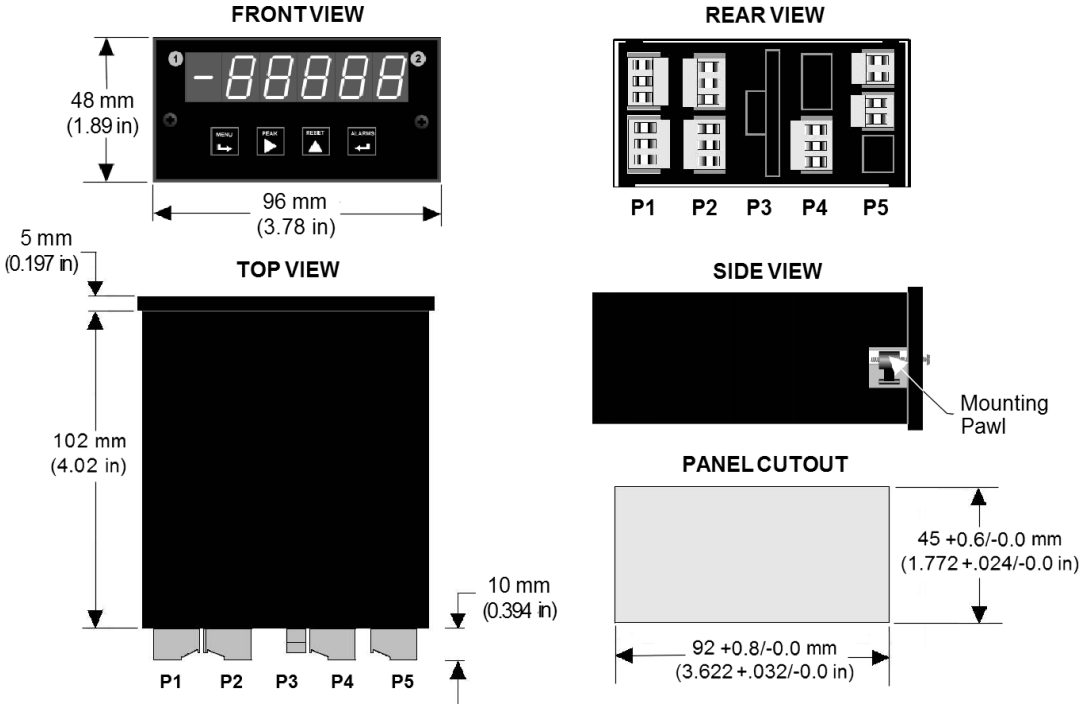
Ordering Guide

Create a model number in this format: **L1110P385C, IPC**

DPM Type	**L** Laureate Digital Panel Meter
Main Board	**1** Standard main board, green LEDs **2** Standard main board, red LEDs
Power (isolated)	**0** 85-264 Vac **1** 12-32 Vac or 10-48 Vdc
Relay Output (isolated)	**0** None **1** Two 8A contact relays **2** Two 120 mA AC/DC solid state relays **3** Four 8A contact relays **4** Four 120 mA AC/DC solid state relays
Analog Output (isolated)	**0** None **1** Isolated 4-20 mA, 0-20 mA, 0-10 V, -10 to +10V
Digital Interface (isolated)	**0** None **1** RS232 **2** RS485 (dual RJ11 connectors) **4** RS485 (dual RJ45 connectors) **5** USB **6** USB-to-RS485 converter **7** Ethernet **8** Ethernet-to-RS485 converter
RTD Signal (isolated)	**P385C** Pt 100 DIN RTD, -202°C to 850°C **P385F** Pt 100 DIN RTD, -331°F to 1562°F **P392C** Pt 100 ANSI RTD, -202°C to 631°C **P392F** Pt 100 ANSI RTD, -331°F to 1168°F **N672C** Ni 120 RTD, -100°C to +260°C **N672F** Ni 120 RTD, -148°F to +500°F **C427C** Cu 10 RTD, -100°C to +260°C **C427F** Cu 10 RTD, -148°F to +500°F
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

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)