LAUREL ELECTRONICS
MEASUREMENT & CONTROL INSTRUMENTS

Laureate™ Digital Panel Meter for Process and Ratiometric Signals

Features

- **Reads process signals from ±200 mV to ±600V or ±2 mA to ±5A full scale**
- **Ratiometric mode for bridges and potentiometers**
- **Scalable to ±99,999 for display in engineering unit**
- **Error less than 0.01% of full scale for most ranges**
- **Up to 60 readings per second**
- **Peak or valley capture & display**
- **Universal AC power: 85-264 Vac**
- **Built-in isolated excitation supply: 5, 10, 12 or 24 Vdc**
- **Ratiometric compensation for variations in excitation voltage**
- **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

Laureate™ digital process meters are a cost-effective solution for process signals such as 4-20 mA or 0-10V which require zero and span adjustment for monitoring and control applications. Full-scale voltage input ranges from ±200 mV to ±600V and current ranges from ±2 mA to ±5 A are jumper selectable. All ranges are pre-calibrated at the factory, so that recalibration is not needed when changing ranges or signal conditioners. The 200.00 mV and 2.000 V ranges provide a high input impedance of 1 Gohm to minimize the load on the voltage signal.

The meter can be set to a ratio mode (or potentiometer follower mode) by making selections at the connector and in software. In this mode, the meter tracks a ratio of the applied excitation voltage and is unaffected by changes in the excitation voltage. This capability is used for resistive bridge sensors and voltage dividers, such as potentiometers which track wiper position.

Scaling is from -99,999 to +99,999 (five full digits) with any decimal point to display readings in engineering units, such as PSI. Three scaling methods are user selectable: scale and offset, two-point method, and system-level calibration using actual transducer signals.

An isolated 5, 10 or 24 Vdc isolated excitation output is standard to power transducers or two-wire transmitters. Ratiometric operation, which automatically compensates for changes in the applied excitation, is jumper selectable for applications, such as bridges, where the signal to be measured is proportional to the excitation level.

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 automatically captured. These may be displayed via a front panel pushbutton command or a control signal at the rear connector, or be transmitted as serial data.

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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.

Auto-tare allows the display to be zeroed for any input signal by applying a switch closure or logic signal at the rear connector. The tare value is stored in non-volatile memory and is retained when power is removed.

An Extended Laureate computer board can display rate based on successive readings. It also allows exceptionally accurate custom curve linearization, for example to read out liquid volume or rate of flow in a horizontal cylindrical tank based on level reported by a 4-20 mA transmitter. For setup, up to 180 data points can be input into a computer spreadsheet or text file by the user. The computer then calculates spline-fit segments, which are downloaded into the meter.

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, 12, 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

DC Voltage

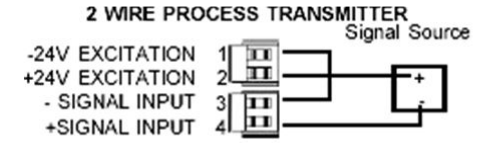
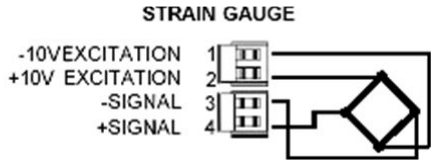
DC Voltage Range	Resolution	Input Resistance	Error at 25°C
±200.00 mV	10 µV	1 GΩ	0.01% FS ± 2 cts
±2.000 V	100 µV	1 GΩ	0.01% FS ± 2 cts
±20.000 V	1 mV	10 MΩ	0.01% FS ± 2 cts
±200.00 V	10 mV	10 MΩ	0.01% FS ± 2 cts
±600.0 V *	100 mV	10 MΩ	± 0.4 V
±300.0 V	100 mV	10 MΩ	± 0.4 V

***** 600.0 V range is ETL certified to 300.0 V.

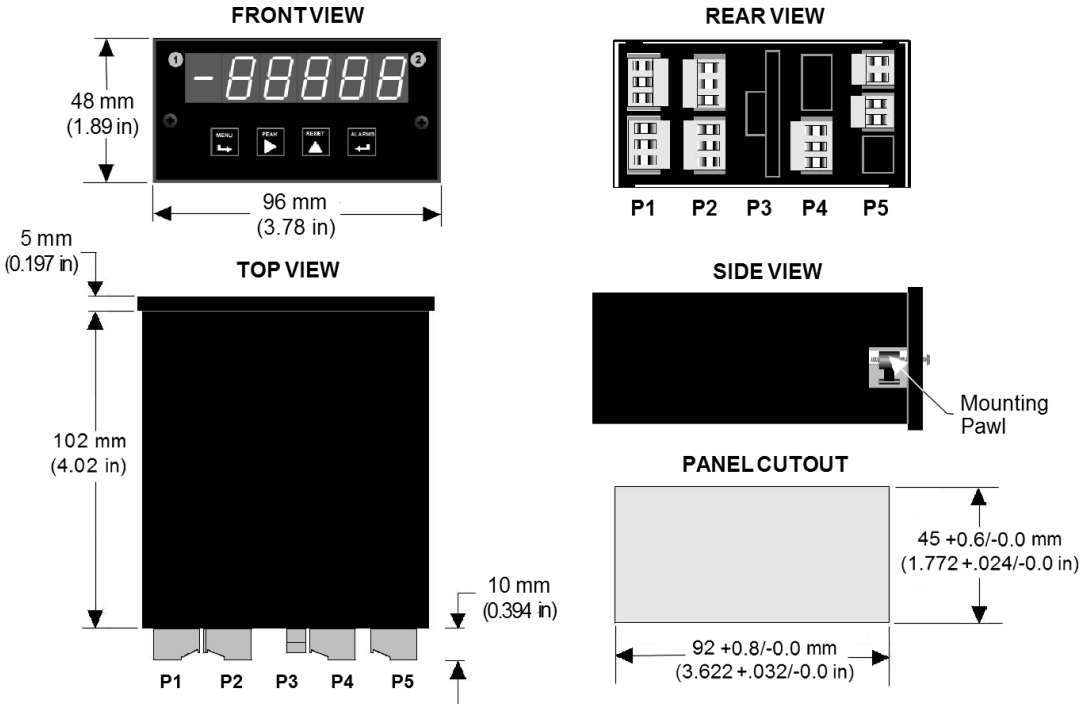
DC Current

DC Current Range	Resolution	Input Resistance	Error at 25°C
±2.0000 mA	0.1 µA	100 Ω	0.01% FS ± 2 cts
±20.000 mA	1.0 µA	10 Ω	0.01% FS ± 2 cts
±200.00 mA	10 µA	1 Ω	0.01% FS ± 2 cts
±5.000 A	1.0 mA	0.01 Ω	± 10 mA

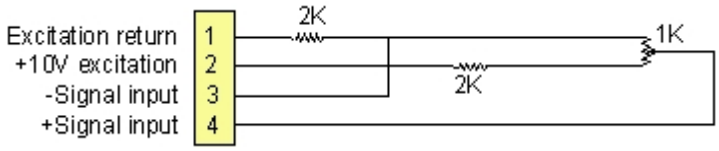
Display	
Readout	5 LED digits, 7-segment, 14.2 mm (.56"), red or green.
Range	-99999 to 99999 or -99990 to 99990 (count by 10)
Indicators	Minus sign, 2 red LED lamps
A-to-D Conversion	
Technique	Concurrent Slope™ (Pat 5,262,780)
A-to-D rate	60/s at 60 Hz, 50/s at 50 Hz
Output update rate	56/s at 60 Hz, 47/s at 50 Hz
Display update rate	3.5/s at 60 Hz, 3/s at 50 Hz
Accuracy	
Error at 25°C	0.01% FS ± 2 counts (except 5A range)
Span tempco	0.003% of reading/°C
Zero tempco	0.1 count/°C
Noise Rejection	
CMR, DC to 60 Hz	130 dB
NMR at 50/60 Hz	90 dB with min filtering
Maximum Signal	
Max applied voltage	600 Vac for 20, 200 and 300 V ranges, 125 Vac for other ranges
Current protection	25x for 2 mA, 8x for 20 mA, 2.5x for 200 mA, 1x for 5 A
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)	
Selectable levels	5 Vdc ± 5%, 100 mA; 10 Vdc ± 5%, 120 mA; 12 Vdc ± 5%, 140 mA; 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 (jumper selectable)
Current compliance	2 mA at 10V (> 5 kΩ load)
Voltage compliance	12V at 20 mA (< 60Ω load)
Scaling	Zero and full scale adjustable from -99999 to +99999

Resolution Isolation	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 (normally open) 2 or 4 Form A, AC/DC solid state relays (normally open) 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
Signal Connections	
	
Environmental	
Operating temperature Storage temperature Relative humidity Protection	-40°C to 70°C -40°C to 85°C 95% at 40°C, non- ondensing NEMA-4X (IP-65) when panel mounted

Mechanical



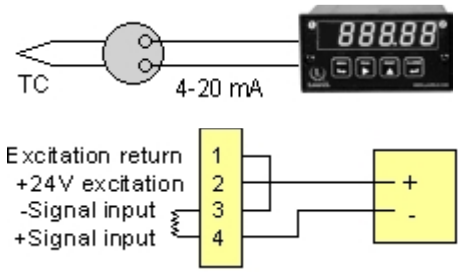
Application Examples



Ratiometric (or potentiometer follower applications

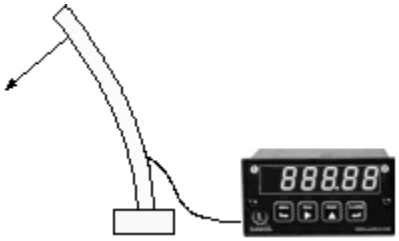
In the application shown, the signal from a sliding contact voltage divider can be converted to engineering units such as position, level or percentage. By operating in a ratiometric mode, the meter will remove any effects caused by variations in the excitation supply.

For use with a 1 kohm potentiometer, the recommended applied excitation voltage is 10 V, and a 2 kohm resistor should be placed in series with the excitation output and excitation return leads. This will allow the meter's 2.0000 V scale with a high input impedance of 1 Gohm to be used.



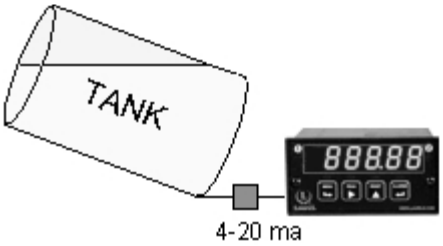
Powering two-wire transmitters

The isolated 24 Vdc, 50 mA excitation output, which is standard with all Laureate meters, is ideal for powering two-wire, 4-20 mA transmitters. The same two wires are used to apply voltage and carry the output current. Inside the meter, the 4-20 mA current is dropped across a 10 ohm resistor and sets up a 40-200 mV voltage, which is then sensed by the meter and scaled to engineering units.



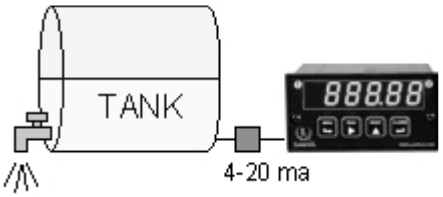
Testing with peak detection

Destructive testing is an ideal application for the Laureate strain meter. Peak readings are automatically captured at rates up to 60 per second, while the display updates at a legible 3.5 readings per second. The peak reading can be recalled at the push of a button or be transmitted via RS232 or RS485. The meter provides isolated 10 Vdc power for up to four (4) the strain gauges and can be scaled to read out directly in engineering units from -99,999 to +99,999.



Custom curve linearization

The Laureate DC meter with the Extended main board option allows exceptionally accurate custom curve linearization. For setup, up to 180 data points can be entered into a spreadsheet. The system then creates multiple non-linear spline-fit segments, which provide much better accuracy than linear segments. Illustrated, is the readout of volume of irregularly shaped tanks based on measured liquid level or pressure. Altimeters and thermistors are further applications.



Rate from successive readings

The Extended computer board allows the display of rate based on successive readings, for instance flow rate based on changes in liquid level or static pressure in a tank. In the above illustration, the meter displays the rate in gallons at which a horizontal tank is being emptied. The input to the meter can be nonlinear, since only the linearized readings are compared for the determination of rate.

Ordering Guide

Create a model number in this format: **L10000P, IPC**

DPM Type	**L** Laureate Digital Panel Meter
Main Board	**1** Standard Main Board, Green LEDs **2** Standard Main Board, Red LEDs **3** Extended Main Board, Green LEDs **4** Extended Main Board, Red LEDs

	Note: Extended capability is required for custom curve linearization or for display of time rate of change, such as flow rate from changing tank level or acceleration from changing speed.
Power (isolated)	**0** 85-264 Vac **1** 12-32 Vac & 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** 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 Modbus (dual RJ45 connectors) **5** USB **6** USB-to-RS485 converter **7** Ethernet **8** Ethernet-to-RS485 converter
Signal Input (isolated)	**Process Signals** (e.g., 4-20 mA, 0-5 V) **P** Field scalable. Default Scaling is 4-20 mA = 0-100.00 **P1** Custom Scaling. In the write-in field of your invoice, specify min input, min reading; max input, max reading.
	Potentiometer Follower Applications (4-wire ratio) **SG** Field Scalable. Default Scaling is 0-200 mV = 0-100.00 **SG1** Custom Scaling. In the write-in field of your invoice, specify min input, min reading; max input, max reading.
	Note: The same DC signal conditioner can be user configured for DC, process, bridge, and potentiometer signals. It is precalibrated in EEPROM for all DC Volt and DC Amp ranges listed for DC meters.
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