



**LAUREL**  
ELECTRONICS, INC.

## Laureate™ Digital Panel Meter for DC Voltage or Current



### Features

- Selectable  $\pm 0.2$ ,  $\pm 2$ ,  $\pm 20$ ,  $\pm 200$ ,  $\pm 300$  &  $\pm 600$  Vdc voltage ranges
- Selectable  $\pm 2$ ,  $\pm 20$ ,  $\pm 200$  mA and  $\pm 5$  A dc current ranges
- All ranges factory calibrated
- 99.99% full scale accuracy
- Scalable to  $\pm 99,999$  for use with external current shunts
- Up to 60 conversions per second
- Peak or valley capture & display
- Selectable adaptive digital filter
- Universal AC power: 85-264 Vac
- Built-in isolated excitation supply: 5, 10 or 24 Vdc
- 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™ DC voltage and current panel meters with a DC signal conditioner board combine high accuracy with high read rate and a wide range of isolated output options for computer interface and control. Accuracy is 99.99% of full scale  $\pm 2$  counts.

- **DC voltmeter operation** (selected by jumpers) provides six full-scale voltage ranges from  $\pm 200.00$  mV with 10 mV resolution to  $\pm 600.0$  V with 100 mV resolution. The 200.00 mV and 2.0000V ranges provide a 1 Gohm high input impedance.
- **DC ammeter operation** (selected by jumpers) provides four full-scale current ranges from  $\pm 2.0000$  mA with 0.1 mA resolution to  $\pm 5.000$  A with 1 mA resolution. The 5.000A range measures the IR drop across a built-in 10 milliohm current shunt.

**All voltage and current ranges** are factory calibrated, with calibration factors for each range stored in an EEPROM on the signal conditioner board. This allows ranges and signal conditioner boards to be changed in the field without recalibrating the meter.



**External current shunts are fully supported.** Scaling from full-scale millivolts, such as 50 mV or 100 mV, to amperes is easily accomplished from the front panel of the meter. The scalable display is five full digits up to  $\pm 99,999$  counts.

**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.

**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

### 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 not ETL certified.

### 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          |

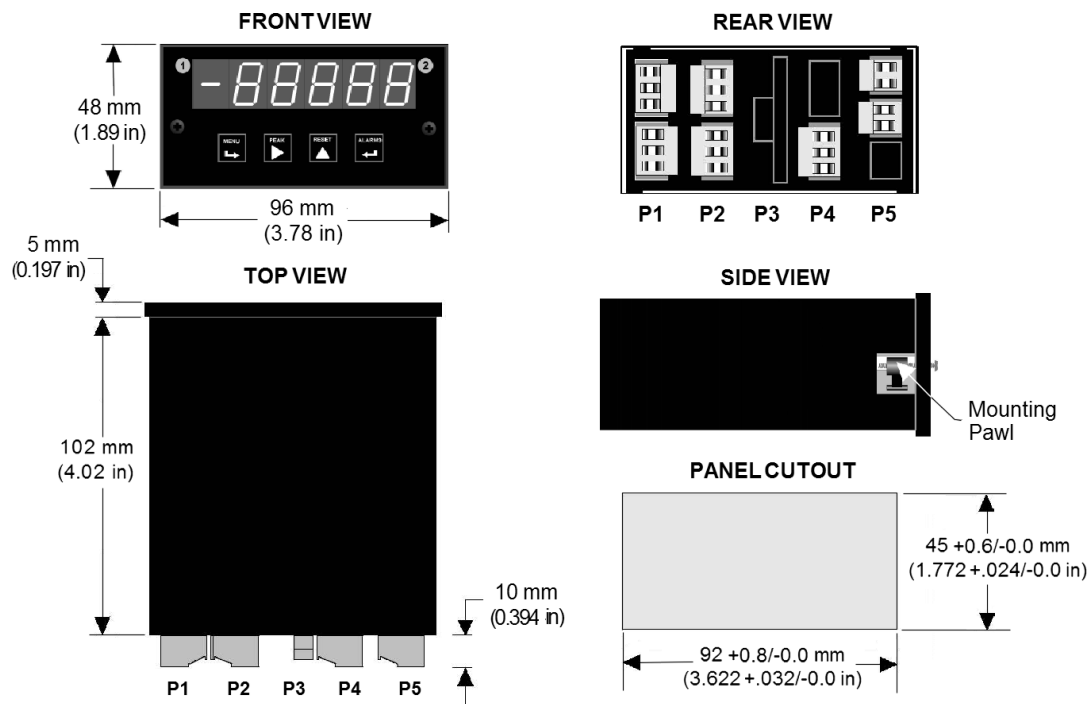
### DC Voltage & Current

| 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            | 1.2W @ 120 Vac, 1.5W @ 240 Vac, 1.3W @ 10 Vdc, 1.4W @ 20 Vdc,  |
| (typical, base meter)        | 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; 24 Vdc ± 5%, 50 mA    |
| Output isolation             | 50 Vdc to meter ground                                         |



|                                   |                                                                                                                      |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Analog Output (optional)</b>   |                                                                                                                      |
| Output levels                     | 4-20 mA, 0-20 mA, 0-10V, -10 to +10V (jumper selectable)                                                             |
| Current compliance                | 2 mA at 10V ( > 5 k $\Omega$ load)                                                                                   |
| Voltage compliance                | 12V at 20 mA (< 60 $\Omega$ 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                                                                          |
| <b>Relay Outputs (optional)</b>   |                                                                                                                      |
| Relay types                       | 2 Form C contact relays or 4 Form A contact relays (NO)<br>2 or 4 Form A, AC/DC solid state relays (NO)              |
| Current ratings                   | 8A at 250 Vac or 24 Vdc for contact relays<br>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                                                                          |
| <b>Serial Data I/O (optional)</b> |                                                                                                                      |
| Board selections                  | Ethernet, Ethernet-to-RS485 server, USB, USB-to-RS485 server,<br>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                                                                          |
| <b>Signal Connections</b>         |                                                                                                                      |
|                                   |                                                                                                                      |
| <b>Environmental</b>              |                                                                                                                      |
| Operating temperature             | 0°C to 55°C                                                                                                          |
| Storage temperature               | -40°C to 85°C                                                                                                        |
| Relative humidity                 | 95% at 40°C, non-condensing                                                                                          |
| Protection                        | NEMA-4X (IP-65) when panel mounted                                                                                   |

## Mechanical



## Ordering Guide

Create a model number in this format: **L10000DCV1, IPC**

|                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>DPM Type</b>                     | <b>L</b> Laureate Digital Panel Meter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Main Board</b>                   | <b>1</b> Standard main board, green LEDs<br><b>2</b> Standard main board, red LEDs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Power</b><br>(isolated)          | <b>0</b> 85-264 Vac<br><b>1</b> 12-32 Vac or 10-48 Vdc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Relay Output</b><br>(isolated)   | <b>0</b> None<br><b>1</b> Two 8A contact relays<br><b>2</b> Two 120 mA AC/DC solid state relays<br><b>3</b> Four 8A contact relays<br><b>4</b> Four 120 mA AC/DC solid state relays                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Analog Output</b><br>(isolated)  | <b>0</b> None<br><b>1</b> Isolated 4-20 mA, 0-20 mA, 0-10 V, -10 to +10V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Data Interface</b><br>(isolated) | <b>0</b> None<br><b>1</b> RS232<br><b>2</b> RS485 (dual RJ11 connectors)<br><b>4</b> RS485 (dual RJ45 connectors)<br><b>5</b> USB<br><b>6</b> USB-to-RS485 converter<br><b>7</b> Ethernet<br><b>8</b> Ethernet-to-RS485 converter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Signal Input</b><br>(isolated)   | <b>DC Volts</b><br><b>DCV1</b> $\pm 200.00$ mV<br><b>DCV2</b> $\pm 2.0000$ V<br><b>DCV3</b> $\pm 20.000$ V<br><b>DCV4</b> $\pm 200.00$ V<br><b>DCV5</b> $\pm 600.0$ V (range not ETL certified)<br><b>DCV6</b> $\pm 300.0$ V (range ETL certified)<br><br><b>DC Amps</b><br><b>DCA1</b> $\pm 2.0000$ mA<br><b>DCA2</b> $\pm 20.000$ mA<br><b>DCA3</b> $\pm 200.00$ mA<br><b>DCA4</b> $\pm 5.000$ A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Add-on Options</b>               | <b>CBL01</b> RJ11-to-DB9 cable. RJ11 to DB9. Connects RS232 ports of meter and PC.<br><b>CBL02</b> USB-to-DB9 adapter cable. Combination of CBL02 and CBL01 connects meter RS232 port to PC USB port.<br><b>CBL03-1</b> 6-wire data cable, RJ11 to RJ11, 1 ft. Used to daisy chain meters via RS485.<br><b>CBL03-7</b> 6-wire data cable, RJ11 to RJ11, 7 ft. Used to daisy chain meters via RS485.<br><b>CBL05</b> USB cable, A-B. Connects USB ports of meter and PC.<br><b>CBL06</b> USB to RS485 adapter cable, half duplex, RJ11 to USB. Connects meter RS485 port to PC USB port.<br><b>CASE1</b> Benchtop laboratory case for one 1/8 DIN meter<br><b>CASE2</b> Benchtop laboratory case for two 1/8 DIN meters<br><b>IPC</b> Splash-proof cover<br><b>BOX1</b> NEMA-4 Enclosure<br><b>BOX2</b> NEMA-4 enclosure plus IPC<br><b>BL</b> Blank Lens without button pads<br><b>NL</b> Meter lens without button pads or Laurel logo |

