

### Products by Type

Digital Panel Meters  
Electronic Counters  
Programmable Timers  
Transmitters, 4-20 mA  
Transmitters, Modbus  
Large Digit Displays  
Bar Graph Displays  
Meter/Counter Options  
Meter Accessories  
Data Logging Systems  
Serial-to-Analog  
4-20 mA Loop Splitters

### Meters by Application

DC Volts & Amps  
AC Power Monitoring  
Process Meters  
Flow Rate Total Batch  
Weight, Load, Stress  
Frequency, Rate, RPM  
Temperature Control  
Resistance in Ohms  
Pulse & Analog Totals  
Timing Products  
Position Length Speed  
Mixing, Ratio, Sum  
Remote Serial Display

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# True RMS Voltage & Current Meters with 1 Cycle Update at 50/60 Hz

**200 mV - 600 V and 2 mA - 5 A full-scale ranges**



## Standard Features

- True AC RMS measurement with crest factor of 3.0 at FS
- Fast response: reading 0-16.7 ms after completion of each input signal cycle.
- 0.1% accuracy, 0% to 100% of span, 10 Hz to 10 kHz
- Reads AC only or AC plus DC
- 0.2, 2, 20, 200 & 600V voltage ranges with 132% overrange
- 2, 20, 200 mA & 5A current ranges with 132% overrange
- All ranges factory calibrated
- Display flashes at 132% overrange
- Scalable to 5 digits for external current shunts or 5A current transformers
- Selectable peak or valley display
- 85-264 Vac universal AC power
- Green or red display
- NEMA 4X, 1/8 DIN case
- Certified to UL 61010C-1 (UL mark), EN 61010-1 (CE mark)
- RoHS compliant
- Priced competitively with less capable AC meters

### Options:

- Low voltage power: 10-48 Vdc or 12-32 Vac
- 2 or 4 output relays, contact or solid state
- Isolated analog output: 4-20 mA, 0-20 mA, 0-10V, 10 to +10V
- Serial communications: RS232, RS485, Modbus RS485, USB, USB-to-RS485 converter

## Description



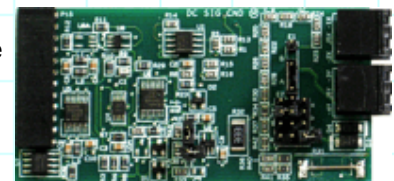
**Laureate™ DC voltage and current panel meters** with a DC signal conditioner board combine high accuracy with high read rate and a wide range of isolated output options for computer interface and control. Accuracy is 99.99% of full scale  $\pm 2$  counts.

- **DC voltmeter operation** (selected by jumpers) provides six full-scale voltage ranges from 200.00 mV with 10 mV resolution to 600.0 V with 100 mV resolution. 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.
- **DC ammeter operation** (selected by jumpers) provides four full-scale current ranges from 2.0000 mA with 0.1 mA resolution to 5.000 A with 1 mA resolution. The 5.000 A 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 readout 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 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.

**An isolated 5, 10 or 24 Vdc isolated excitation output** is standard to power external transducers and transmitters. In many cases, this output can eliminate the need for an external power supply.

**Designed for flexibility.** Optional plug-in boards for communications and control include an analog output board, dual or quad relay boards, and serial communications boards. 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.

# Specifications

## AC Voltage (0 to 100% of full scale range)

AC Voltage FS Range	AC Voltage to Overrange Flash	Resolution	Input Resistance	Error at 25°C
200.00 mV	264.00 mV	10 $\mu$ V	1 M $\Omega$	$\pm$ 0.1% of FS, 0-100% of FS, 10 Hz to 10 kHz (AC coupling) or DC to 10 kHz (DC coupling)
2.0000 V	2.640 V	100 $\mu$ V	1 M $\Omega$	
20.000 V	26.400 V	1 mV	1 M $\Omega$	
200.00 V	264.00 V	10 mV	1 M $\Omega$	
600.0 V *	650 V	100 mV	1 M $\Omega$	$\pm$ 2V

## AC Current (0 to 100% of full scale range)

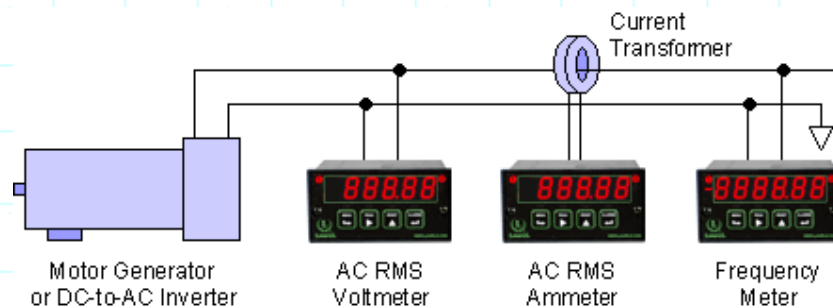
AC Current FS Range	AC Current to Overrange Flash	Resolution	Input Resistance	Error at 25°C
2.0000 mA	2.6400 mA	0.1 $\mu$ A	100 $\Omega$	$\pm$ 0.1% of FS, 0-100% of FS, 10 Hz to 10 kHz (AC coupling) or DC to 10 kHz (DC coupling)
20.000 mA	26.400 mA	1 $\mu$ A	10 $\Omega$	
200.00 mA	264.00 mA	10 $\mu$ A	1 $\Omega$	
5.000 A	5.4 A	1 mA	0.01 $\Omega$	$\pm$ 20 mA

\* The 600V range is UL certified to 264V. For purposes of accuracy calculation, the 600V range is 2000V (20,000 counts), and the 5A range is 20A (20,000 counts).

## Both AC 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)
Display Update Rate	3.75/s at 60 Hz power, 3.1/s at 50 Hz power
Indicators	1 LED lamp per relay setpoint
Crest factor Vp / Vrms	3.00 at full scale range 2.27 at 132% of FS range (display flashes) 1.414 at 212% of FS range (maximum sinusoidal signal)
Output Update Rate	
A-to-D rate	60/s at 60 Hz power, 50/s at 50 Hz power
Signals $\geq$ 50/60 Hz	60/s at 60 Hz power, 50/s at 50 Hz power
Signals 3 Hz to 50/60 Hz	Signal frequency
Signals DC to 3 Hz	3 per second
Maximum Signal	
Max applied voltage	600 Vac for 2, 20, 200, 600V ranges, 50 Vac for 0.2V range
Current protection	25x for 2 mA, 8x for 20 mA, 2.5x for 200 mA, 1x for 5A
Power	
Voltage, standard	85-264 Vac or 90-300 Vdc (DC operation not UL approved)
Voltage, optional	12-32 Vac or 10-48 Vdc
Frequency	DC or 47-63 Hz
Power Isolation	250V rms working, 2.3 kV rms per 1 min test
Analog Output (optional)	
Output Levels	4-20 mA, 0-20 mA, 0-10V, -10 to +10V (jumper selectable)
Current compliance	2 mA at 10V ( $\geq$ 5 kOhm load)
Voltage compliance	12V at 20 mA ( $\leq$ 600 Ohm 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

Relay Outputs (optional)	
Relay Types	2 Form C contact relays or 4 Form A contact relays (NO) 2 or 4 Form A, AC/DC solid state relays (NO)
Current Ratings	8A at 250 Vac or 24 Vdc for contact relays 130 mA at 140 Vac or 180 Vdc for solid state relays
Output common Isolation	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	RS232, RS485, Modbus RS485, USB, USB-to-RS485 converter
Protocols	Modbus RTU, Modbus ASCII, simpler Laurel ASCII
Data Rates	300 to 19200 bps
Digital Addresses	247 (Modbus), 31 (Laurel ASCII),
Isolation	250V rms working, 2.3 kV rms per 1 min test
Signal Connections	
Environmental	
Operating Temperature	0°C to 60°C
Storage Temperature	-40°C to 85°C
Relative Humidity	95% at 40°C, non-condensing
Protection	NEMA-4X (IP-65) when panel mounted



Using Laureate Meters and Counters to Instrument an AC Line

## Why Measure AC Power?

Many AC loads, such as electrical motors, will only operate reliably if the AC line voltage and frequency are within specified tolerances; otherwise permanent damage to expensive plant equipment may occur. Drops in line voltage or frequency may indicate an excessive load and the possibility of equipment damage. Laureate meters and counters are low-cost means to instrument and alarm AC power lines with great accuracy:

- **AC RMS Voltmeter and Ammeter**, as documented in this page. True RMS capability allows the display of RMS voltage for non-sinusoidal waveshapes, such as square waves from a UPS. A built-in 5 A range can be used to display currents up to 5.000 A with 1 mA resolution or accept the output of 5 A current transformers. The 200.00 mV range can be used with external current shunts. With either transformers or shunts, scaling of the input current is easily accomplished via the meter's front panel pushbutton switches.
- **Frequency Meter**. Inverse period is used to determine AC line frequency to six-figure accuracy (60.0000 or 50.0000) in a few line cycles plus 30 ms.
- **Phase Angle & Power Factor Meter**. Two signals with identical periods are applied to Channels A and B. A phase angle resolution of 1°, 0.1° or 0.01° is selectable. Accuracy is .01% up to 100 Hz, .1% at 1 kHz, and 1% at 10 kHz.

## Ordering Guide

### Laureate™ True AC RMS Voltage & Current Panel Meters

Select the buttons to build a model number in this format: **L20000RMV1, IPC**

		Quantity
<b>DPM Type</b>	<input checked="" type="radio"/> <b>L</b> Laureate Digital Panel Meter	1 <input style="width: 20px;" type="text" value="1"/>
<b>Main Board</b>	<input type="radio"/> <b>1</b> Standard Main Board, Green LEDs	NC
	<input type="radio"/> <b>2</b> Standard Main Board, Red LEDs	NC
<b>Power</b>	<input type="radio"/> <b>0</b> Isolated 85-264 Vac	NC
	<input type="radio"/> <b>1</b> Isolated 12-32 Vac or 10-48 Vdc	\$30
<b>Relay Output</b>	<input type="radio"/> <b>0</b> None	NC
	<input type="radio"/> <b>1</b> Two 8A Contact Relays	\$80
	<input type="radio"/> <b>2</b> Two Solid State Relays	\$55
	<input type="radio"/> <b>3</b> Four 8A Contact Relays	\$100
	<input type="radio"/> <b>4</b> Four Solid State Relays	\$75
<b>Analog Output</b>	<input type="radio"/> <b>0</b> None	NC
	<input type="radio"/> <b>1</b> Isolated 4-20 mA, 0-20 mA, 0-10V, or -10 to +10V	\$90
<b>Digital Interface</b>	<input type="radio"/> <b>0</b> None	NC
	<input type="radio"/> <b>1</b> Isolated RS232	\$60
	<input type="radio"/> <b>2</b> Isolated RS485	\$80
	<input type="radio"/> <b>4</b> Isolated Modbus RS485	\$90
	<input type="radio"/> <b>5</b> USB	\$60
	<input type="radio"/> <b>6</b> USB-to-RS485 converter	\$100
<b>Signal Input</b>	<b>True AC RMS Volts</b> <input type="radio"/> <b>RMV1</b> 200.00 mV <input type="radio"/> <b>RMV2</b> 2.0000 V <input type="radio"/> <b>RMV3</b> 20.000 V <input type="radio"/> <b>RMV4</b> 200.00 V <input type="radio"/> <b>RMV5</b> 600.0 V (range UL certified to 250V) <input type="radio"/> <b>RMV6</b> 250.0 V	\$35
	<b>True AC RMS Amps</b> <input type="radio"/> <b>RMA1</b> 2.0000 mA <input type="radio"/> <b>RMA2</b> 20.000 mA <input type="radio"/> <b>RMA3</b> 200.00 mA <input type="radio"/> <b>RMA4</b> 5.000 A	\$35
<b>Note:</b> The same AC RMS signal conditioner can be user configured for AC Volts or AC Amps. It is precalibrated in EEPROM for all AC Volt and AC Amp ranges listed.		
<b>Add-on Options</b>	<input type="checkbox"/> <b>BL</b> Blank Lens without Button Pads	NC
	<input type="checkbox"/> <b>CBL01</b> RJ11-to-DB9 Cable	\$19
	<input type="checkbox"/> <b>CBL02</b> USB-to-DB9 Adapter	\$39
	<input type="checkbox"/> <b>CBL05</b> USB Cable, A to B	\$15
	<input type="checkbox"/> <b>IPC</b> Splash-proof Cover	\$40
	<input type="checkbox"/> <b>BOX1</b> NEMA-4 Enclosure	\$140
	<input type="checkbox"/> <b>BOX2</b> NEMA-4 Enclosure plus IPC	\$180



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