

# Laureate™ Phase Angle Meter

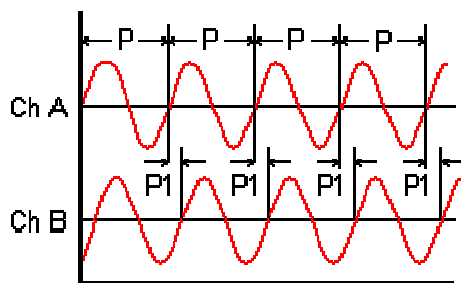
For angular phase offset in degrees



## Features

- Measures phase angle between two waveshapes of similar period
- Resolution of 1°, 0.1° or 0.01°.
- .01% accuracy at AC line frequency
- Inputs from NPN or PNP proximity switches, contact closures, digital logic, magnetic pickups down to 12 mV, or AC inputs up to 250 Vac.
- Trigger on positive or negative pulse edges.
- Frequency from .005 Hz to 10 kHz.
- 6-digit red or green LED display.
- Isolated 5, 10 or 24 Vdc excitation output to power sensors.
- Uses Standard counter main board and FR signal conditioner.
- Choice of isolated plug-in options for control and computer interface:  
[dual relays](#), [4-20 mA & 0-10 V analog output](#), [RS-232/485 I/O](#), [parallel BCD output](#), [low voltage AC & DC power](#).
- [NEMA 4X, 1/8 DIN case](#).
- Certified to UL 3101-1, CAN/CSA-C22.2, EN 61010-1 (CE Mark).

## Description



### Phase Angle Measurement

Phase angle indicates the lead or lag in degrees from 0° to 360° between two periodic signals having the same period. In the illustration to the right, phase angle is  $360^\circ \cdot P1/P$ . The signals are applied to the A and B input channels.

Phase angle measurement is commonly used with AC power from 50 Hz to 400 Hz. Phase angle needs to be set to zero to synchronize AC generators. It also applies to the triggering of SCRs and Triacs for power control. The phase angle between AC current and voltage determines power factor. The Laureate phase angle meter provides exceptionally fast response and high accuracy for low frequencies, such as AC line frequency.

Phase angle measurement with the Laureate™ Phase Meter requires that two signals with identical periods be applied to Channels A and B. A display from -180° to +180° is obtained by timing the rising edge of one channel and the falling edge of the other channel, and programming a 180° offset. A resolution of 1°, 0.1° or 0.01° is selectable. Accuracy is 0.01% up to 100 Hz, 0.1% at 1 kHz, and 1% at 10 kHz.

Phase angle is determined by timing crystal clock pulses over a specified gate time which is selectable from 10 ms to 199.99 s. By selecting the minimum gate time of 10 ms, the update rate can be up to 20/s for 50/60 Hz AC line frequency. Improved accuracy is obtained by making the gate time long enough so that multiple cycles can be

averaged.

## Universal Signal Conditioner

The Laureate Phase Angle Meter uses the FR dual-channel signal conditioner board and Extended counter main board. This board accepts AC signals from 12 mV to 250 Vac as well as inputs from proximity switches with PNP or NPN output, TTL or CMOS logic, magnetic pickups, or contact closures. Jumper selections provide optimum operation for different sensor types and noise conditions.



A built-in isolated 5, 10, or 24 Vdc excitation supply can power active pickups and eliminate the need for an external power supply.

## Other Features & Options

Plug-in [isolated analog output](#), [dual setpoint controller](#), [RS232/485 serial data I/O](#), or [parallel BCD output](#) boards can upgrade the Laureate from a stand-alone monitor to system interface and control. The [1/8 DIN case](#) of Laureate meters and counters meets NEMA 4X (IP-65) standards from the front for high pressure wash-down when panel mounted.

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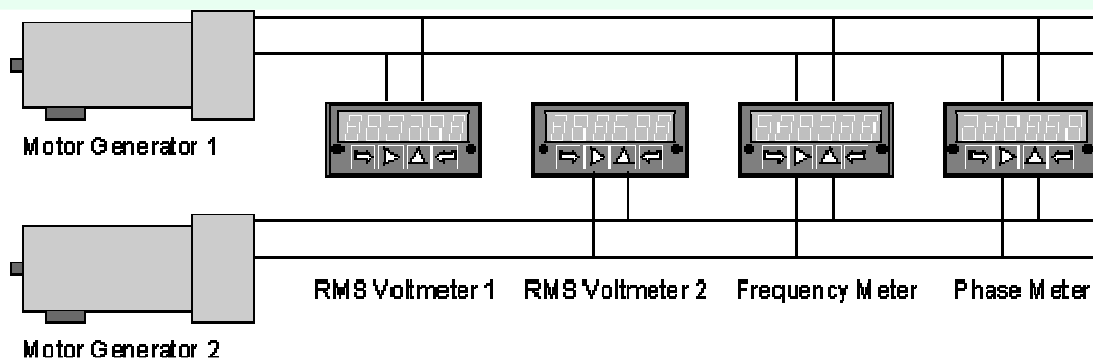
## Specifications

Phase Angle Mode	
Item Displayed	Phase angle difference between two waves of same period
Display Units	1°, 0.1°, 0.01°
Frequency Range	.005 Hz to 10 kHz
Accuracy	.01°, .005 Hz to 100 Hz, .1° at 1 kHz, 1° at 10 kHz
Maximum Timing Interval	200 s
Display	
Readout	6 digits, 7-segment, 14.2 mm (.56")
Color	Red or green LED
Range	-999999 to +999999
Indicators	Four LED lamps
Inputs	
Types	AC, pulses from NPN, PNP transistors, contact closures, magnetic pickups
Signal ground	Common ground for channels A & B
Selectable Hysteresis	-12 to +12 mV, +30 to +60 mV, -30 to -20 mV, -150 mV to +150 mV, +350 mV to +600 mV, -600 to -350 mV, -1.15 to +1.15 V, +1.25 to +2.1 V, -2.1 to -1.25 V
Rolloff Filter	Selectable: 1 MHz, 30 kHz, 250 Hz
Debounce Time	Selectable: 0, 3, 50 ms
Timing Interval	
Periodic Timing Interval	Gate time + 30 ms + 0-2 signal periods
Gate Time	Selectable 10 ms to 199.99 s
Timeout	Selectable 10 ms to 199.99 s
Output & Display Update	Same as period timing interval
Power	

Voltage, std. Voltage, opt. Frequency Power isolation	85-264 Vac and 90-370 Vdc 8-28 Vac and 9-37 Vdc DC or 49-440 Hz Safety-rated to 250 Vac, meter ground to earth ground, DC to 60 Hz, 4.2 kVp per High Voltage Test
<b>Excitation Output</b>	
5 Vdc 10 Vdc 24 Vdc Output isolation	5 Vdc $\pm 5\%$ , 100 mA max 10 Vdc $\pm 5\%$ , 120 mA max 24 Vdc $\pm 5\%$ , 50 mA max 50 Vdc to meter ground
<b>Environmental</b>	
Operating Temperature Storage Temperature 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
<b>Electrical Connections</b>	

## Applications

### Using Laureate Meters and Counters to Synchronize Motor Generators



Synchronization of two motor generators requires that the two frequencies be identical, that the lines be in phase, and that the line voltages be close to each other. In this illustration, a single Laureate dual channel counter measures both frequencies to six-figure accuracy in a few line cycles. Another Laureate dual channel counter measures phase angle to 0.1° resolution. Two Laureate AC RMS Voltmeters, which offer ranges of 200.00 V and 660.0 V, are used to display the two RMS voltage to 0.1% accuracy.

# Ordering Guide

## Laureate™ Phase Meter

Create a model number in this format: **L80101FR**. This example calls out a Laureate counter with an extended main board with red LEDs, 85-264 Vac & 90-370 Vdc power, dual 10 A contact relays, no second output, RS-232 serial output, and a dual-channel frequency signal conditioner. Includes plug-in screw terminals.

<b>Main Board</b>	<input type="checkbox"/> <b>L7</b> Extended Main Board, Green LEDs.		\$260
	<input type="checkbox"/> <b>L8</b> Extended Main Board, Red LEDs.		\$260
<b>Note:</b> Use of the Extended Main Board makes this counter also suitable for A-B time interval, stopwatch, frequency, rate, period, square root of rate, up or down total, arithmetic functions, simultaneous rate and total, duty cycle, batching, and custom curve linearization.			
<b>Power</b>	<input type="checkbox"/> <b>0</b> Isolated 85-264 Vac & 90-370 Vdc		NC
	<input type="checkbox"/> <b>1</b> Isolated 8-28 Vac & 9-37 Vdc.		\$30
<b>Setpoint Output</b>	<input type="checkbox"/> <b>0</b> None.		NC
	<input type="checkbox"/> <b>1</b> Dual 10A Contact Relays.		\$80
	<input type="checkbox"/> <b>2</b> Isolated Dual Solid State Relays.		\$55
<b>Second Output</b>	<input type="checkbox"/> <b>0</b> None.		NC
	<input type="checkbox"/> <b>1</b> Isolated 0-20 mA & 0-10 V.		\$90
	<input type="checkbox"/> <b>2</b> Batch Relay. Only used with pulse-input batching operation.		\$50
<b>Digital Interface</b>	<input type="checkbox"/> <b>0</b> None.		NC
	<input type="checkbox"/> <b>1</b> Isolated RS-232.		\$60
	<input type="checkbox"/> <b>2</b> Isolated RS-485.		\$80
	<input type="checkbox"/> <b>3</b> Isolated Parallel BCD Output.		\$105
<b>Input Type</b>	<input checked="" type="checkbox"/> <b>FR</b> Dual-Channel Pulse Input Signal Conditioner		NC
<b>Add-on Options</b>	<input type="checkbox"/> <b>EB</b> Extra Bright Red LED Display.	<input type="checkbox"/> Unselected.	\$30
	<input type="checkbox"/> <b>BL</b> Blank Lens without Button Pads.	<input type="checkbox"/> Unselected.	NC