

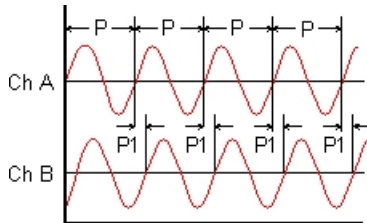


## Standard Features

- Ethernet Serial Data I/O, Modbus TCP or Laurel ASCII protocol
- 4-20 mA or 0-10V transmitter output, 16 bits, jumper selectable, isolated
- Dual 120 mA solid state relays for alarm or control, isolated
- 5V, 10V or 24V dc transducer excitation output, isolated
- Transmits phase angle between two AC wave shapes of similar period
- Transmits power factor from 1.000 to 0.000 with sinusoidal signals
- For frequencies from 0.005 Hz to 10 kHz, voltages from 10 mV to 250 Vac
- Phase angle resolution of 1°, 0.1° or 0.01°, accuracy of 0.03% at AC line frequency
- Analog output resolution 0.0015% of span (16 bits), accuracy ±0.02% of span
- Universal AC power, 85-264 Vac, or low voltage power, 10-48 Vdc or 12-32 Vac
- Power over Ethernet (PoE) jumper selectable with 10-48 Vdc supply

## Description

### Phase Angle Measurement



**Phase angle in degrees** indicates the phase lead or lag between two periodic signals of the same period, as determined from their zero crossings. These two signals will typically be the voltage and current applied to a load. As illustrated, the phase angle in degrees is  $+360 \cdot P1/P$ .

The Laureate 4-20 mA phase angle transmitter transmits the lead or lag in degrees from 0° to 360° between two periodic signals of the same period. In the illustration, phase angle is  $360 \cdot P1/P$ . The signals are applied to the Channel A and B inputs of the Laureate dual-channel pulse input signal conditioner board. 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.

### Power Factor Measurement

**The power factor** of an AC power system is the ratio of real power in watts (W) divided by apparent power in volt-amperes (VA). For sinusoidal signals, power factor is the cosine of phase angle.

The Laureate 4-20 mA power factor transmitter computes power factor as the cosine of phase angle. Power factor readings can range from 1.000 to 0.000 with three decimal places and an accuracy of 0.1% for sinusoidal signals at 50/60 Hz power line frequency. While power factor is always positive, the meter assigns a minus sign to power factor for negative phase angles, and it sets power factor to 0 for phase angles greater than 90°.

**Phase angle and power factor** are determined by timing crystal clock pulses over a specified gate time which is selectable from

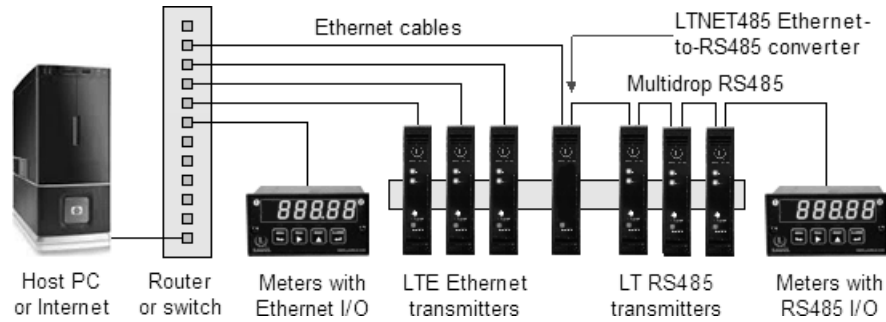
10 ms to 199.99 s. By selecting the minimum gate time of 10 ms, the update rate can be up to 20/s for 50/60 Hz AC line frequency. Improved accuracy is obtained by making the gate time long enough so that multiple cycles can be averaged.

### Standard features of Laureate LTE transmitters include:

- **Ethernet I/O, isolated.** Supported protocols are Modbus RTU and ASCII (tunneled via Modbus TCP) and Laurel ASCII. The latter is simpler than the Modbus protocol and is recommended when all devices are Laureates. Note that RS232 or RS485 data I/O in lieu of Ethernet is provided by our LT Series transmitters.
- **4-20 mA, 0-20 mA or 0-10V analog transmitter output,** isolated, jumper-selectable and user scalable. All selections provide 16-bit (0.0015%) resolution of output span and 0.02% output accuracy of a reading from -99,999 to +99,999 counts that is also transmitted digitally. Output isolation from signal and power grounds eliminates potential ground loop problems. The supply can drive 20 mA into a 500 ohm (or lower) load for 10V compliance, or 10V into a 5K ohm (or higher) load for 2 mA compliance.
- **Dual solid state relays,** isolated. Available for local alarm or control. Rated 120 mA at 130 Vac or 180 Vdc.
- **Transducer excitation output,** isolated. User selectable 5V@100 mA, 10V@120 mA or 24V@50 mA.
- **Universal 85-264 Vac power.** Low-voltage 10-48 Vdc or 12-32 Vac power is optional.

**Discovery and configuration** of Laureate Ethernet Nodes is easily achieved with Laurel's Node Manager Software, and the discovered transmitters can then be programmed using Laurel's Instrument Setup Software. Both softwares run on a PC under MS Windows and can be downloaded at no charge.



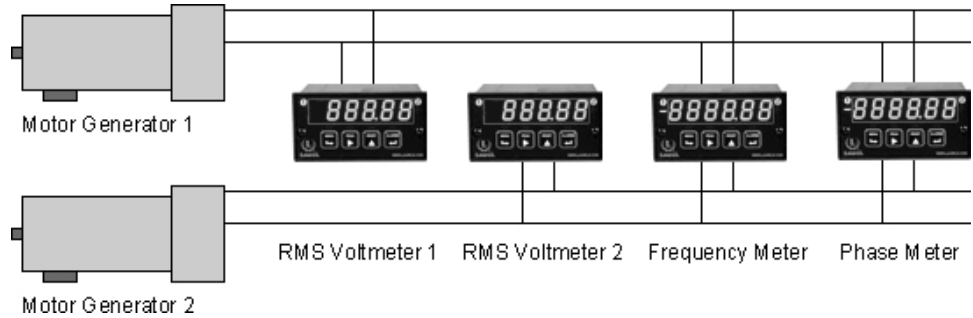


## Specifications

| Phase Angle Mode                    |   |
|-------------------------------------|---|
| Item Transmitted                    | Phase angle difference between two waves of same period |
| Transmitted Units                   | 1°, 0.1°, 0.01°   |
| Frequency Range                     | 0.005 Hz to 10 kHz                                      |
| Resolution                          | 0.01°, 0.005 Hz to 100 Hz, 0.1° at 1 kHz, 1° at 10 kHz  |
| Accuracy                            | 0.03° at 50 or 60 Hz                                    |
| Maximum Timing Interval             | 200 s   |
| Power Factor Mode                   |   |
| Item Transmitted                    | Power factor between two sine waves of same period      |
| Transmitted Units                   | 1.000 to 0.000, 1.00 to 0.00, or 1.0 to 1.0             |
| Polarity                            | Negative sign indicates negative phase angle            |
| Frequency Range                     | 0.005 Hz to 10 kHz                                      |
| Accuracy                            | 0.1% at power line frequencies                          |
| Inputs                              |   |
| Signal Types                        | Sinusoidal AC and square waves                          |
| Signal Ranges                       | 10 mV to 250 Vac  |
| Signal Ground                       | Common ground for channels A & B                        |
| Noise Filter                        | 1 MHz, 30 kHz, 250 Hz (selectable)                      |
| Update Rate                         |   |
| Conversion Interval                 | Gate time + 30 ms + 0-2 signal periods                  |
| Gate Time                           | Selectable 10 ms to 199.99 s                            |
| Time Before Zero Output             | Selectable 10 ms to 199.99 s                            |
| Analog Output (standard)            |   |
| Output Levels                       | 0-20 mA or 0-10 Vdc (selectable)                        |
| Compliance, 4-20 mA                 | 10V (0-500Ω load)                                       |
| Compliance, 0-10V                   | 2 mA (5 kΩ load)  |
| Output Resolution                   | 16 bits (65,536 steps)                                  |
| Output Accuracy                     | 0.02% of output span plus conversion accuracy           |
| Output Isolation                    | 250V rms working, 2.3 kV rms per 1 minute test          |
| Serial Communications (standard)    |   |
| Type                                | 10/100Base-T Ethernet per IEEE 802.3                    |
| Data Rates                          | 300, 600, 1200, 2400, 4800, 9600, 19200 baud            |
| Output Isolation                    | 250V rms working, 2.3 kV rms per 1 min test             |
| Serial Protocols                    | Modbus TCP, Modbus RTU, Modbus ASCII, Laurel ASCII      |
| Modbus Compliance                   | Modbus over Serial Line Specification V1.0 (2002)       |
| Digital Addresses                   | 247 for Modbus, 31 for Laurel ASCII                     |
| Dual Relay Output (standard)        |   |
| Relay Type                          | Two solid state relays, SPST, normally open, Form A     |
| Load Rating                         | 120 mA at 140 Vac or 180 Vdc                            |
| Sensor Excitation Output (standard) |   |
| Output Levels                       | 5V@100 mA, 10V@120 mA, 24V@50 mA (jumper selectable)    |

|                        |  |
|------------------------|--|
| Output Isolation       | 50V from signal ground   |
| <b>Power Input</b>     |  |
| Standard Power         | 85-264 Vac or 90-300 Vdc   |
| Low Power Option       | 10-48 Vdc or 12-32 Vac   |
| Power Frequency        | DC or 47-63 Hz   |
| Power Isolation        | 250V rms working, 2.3 kV rms per 1 min test  |
| Power Consumption      | 2W typical, 3W with max excitation output  |
| <b>Mechanical</b>      |  |
| Dimensions             | 129 x 104 x 22.5 mm case   |
| Mounting               | 35 mm rail per DIN EN 50022  |
| Electrical Connections | Plug-in screw-clamp connectors   |
| <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  |
| Cooling Required       | Mount transmitters with ventilation holes at top and bottom.<br>Leave 6 mm (1/4") between transmitters, or force air with a fan. |

### Application Example

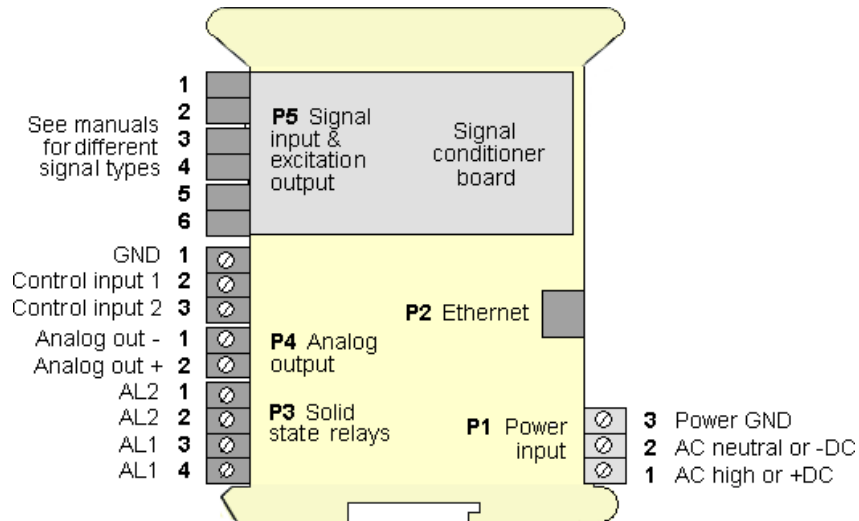


### Using Laureate Meters, Counters or Transmitters to Synchronize Motor Generators

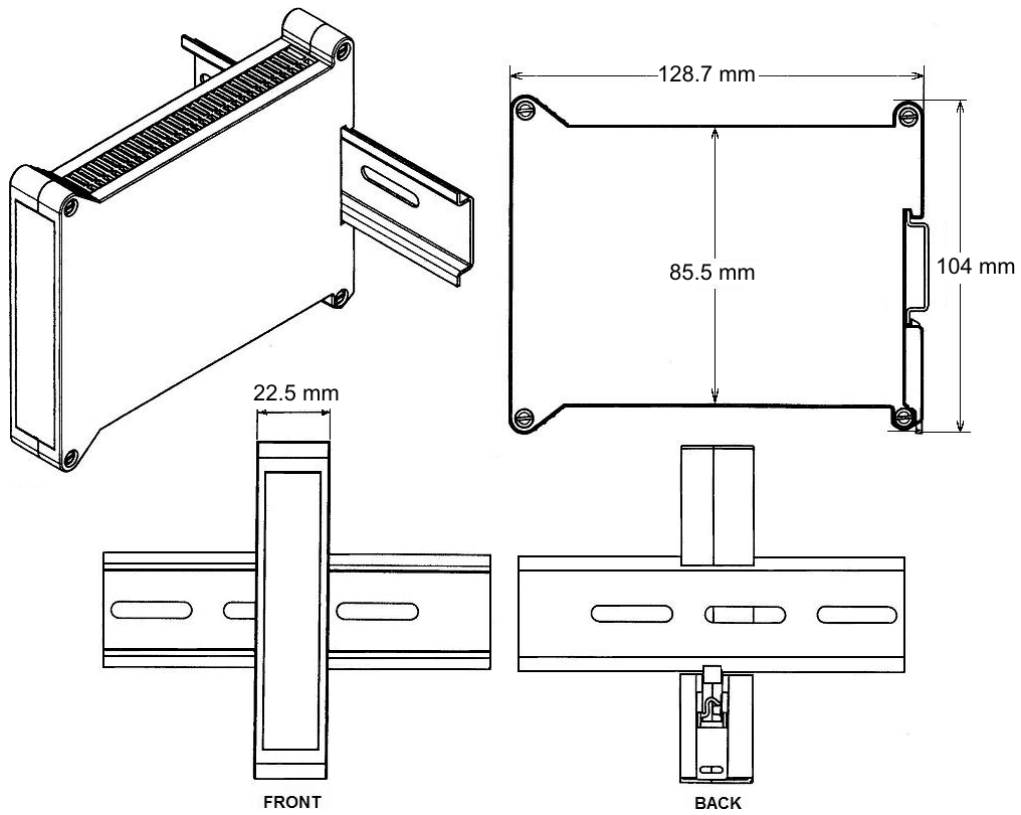
Synchronization of two motor generators requires that the two frequencies be identical, that the lines be in phase, and that the line voltages be close to each other. In this illustration, a single Laureate dual channel counter (or frequency transmitter) measures both frequencies to six-figure accuracy in a few line cycles.

Another Laureate dual channel counter (or phase transmitter) measures phase angle to 0.1° resolution. Two Laureate AC RMS Voltmeters, which offer ranges of 200.00 V and 600.0 V, are used to display the two RMS voltage to 0.1% accuracy.

### Pinout



## Mechanical



## Ordering Guide

Create a model a model number in this format: **LTE60FR**

|                         |  |
|-------------------------|--|
| <b>Transmitter Type</b> | <b>LTE</b> Laureate 4-20 mA & Ethernet Transmitter                                     |
| <b>Main Board</b>       | <b>8</b> Extended Main Board   |
| <b>Power</b>            | <b>0</b> Isolated 85-264 Vac or 90-300 Vdc<br><b>1</b> Isolated 12-32 Vac or 10-48 Vdc |
| <b>Input Type</b>       | <b>FR</b> Dual-Channel Frequency   |