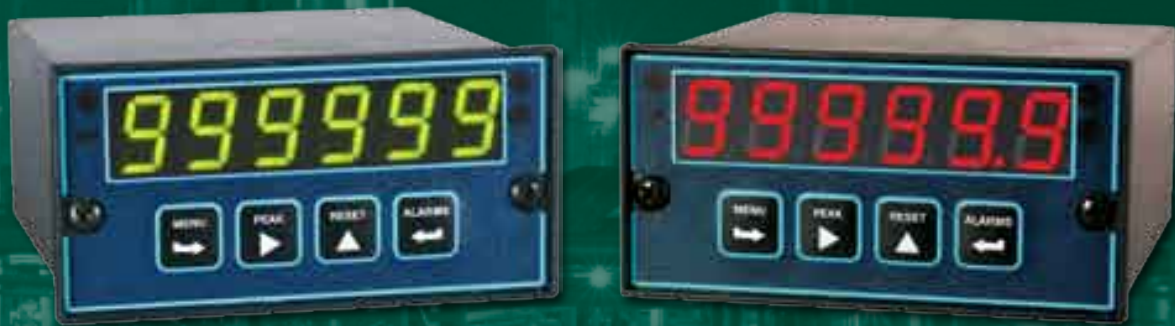




LAUREL[®]

ELECTRONICS INC.

Laureate[™] High-Performance Instruments for Demanding Industrial Applications



Digital Panel Meters

Counters & Timers

Setpoint Controllers

Large Digit Displays

4-20 mA Transmitters

Modbus Transmitters

Serial to 4-20 mA Transmitters

Modbus, RS232, RS485 I/O



LAUREATE™ Panel Meter Series

Available for all popular industrial analog signals. High performance, extensive output options and programmable features to solve application problems at minimum cost.



Basic Features

- 5 LED digits, 14.2 mm (0.56") high
- 1/8 DIN size, NEMA-4X front panel
- Detachable screw-clamp connectors
- Isolated sensor excitation output
- 0.01% FS accuracy for DC signals
- All ranges factory calibrated
- Read rate to 60/sec
- Adaptive input noise filtering
- Peak & valley capture, auto-tare
- Setup via front panel or PC software

Selectable Features

- **Types of main board:**
 - 1) Standard or weight meter
 - 2) Basic or Extended capabilities
 - 3) Red or green display
- **Signal conditioners:**
 - 1) DC voltage & current
 - 2) AC rms voltage & current
 - 3) Load cell & microvolt
 - 4) Temperature (T/C & RTD)
- **Alarm/control outputs:**
 - 1) Dual 8A, 250V contact relays
 - 2) Dual solid state relays
- **Isolated analog output:**
 - 1) 4-20 mA
 - 2) 0-20 mA
 - 3) 0-10V
- **Digital interface:**
 - 1) RS232, point to point
 - 2) RS485, Laurel ASCII protocol
 - 3) RS485, Modbus protocol
- **Power to meter:**
 - 1) Worldwide 95-240V ac $\pm 10\%$
 - 2) Low-voltage 12-30V ac or 10-48V dc



DC Voltmeter & Ammeter

Five voltage ranges and four current ranges, all factory calibrated with calibration factors stored in EEPROM. Built-in 5A current shunt, plus easy scaling from -99,999 to 99,999 for external shunts. Fast read rate to 60 per second with user selectable adaptive input noise filtering.

Process & Strain Meter

User scalable from -99,999 to 99,999 for strain gauge and process signals such as 4-20 mA or 0-10V. Most sensitive range of ± 200 mV. Built-in isolated 5V, 10V or 24V transducer excitation supply. Three scaling methods, including use of signals for known inputs. Ratiometric operation to eliminate excitation variations.

Load Cell & Microvolt Meter

User scalable from -99,999 to 99,999 for load cell and microvolt signals. Most sensitive range of ± 20 mV. Isolated 10V excitation for four 350 ohm load cells in parallel. 4-wire bridge connection to compensate for excitation variation, or 6-wire connection to compensate for excitation variation and lead resistance.

True AC RMS Voltmeter & Ammeter

Five voltage ranges and four current ranges, all factory calibrated, with calibration factors stored in EEPROM. Built-in current shunt plus easy scaling for use with current transformers. Error $< 0.15\%$ FS for AC signals from 10 Hz to 10 kHz. Crest factor (V_p / V_{rms}) of 2.4.

Scale Meter

Meter with DC or load cell signal conditioner, plus special firmware for weighing applications: auto-tare or manual tare, auto-zero, display toggle between gross or net weight, scale calibration using known weights, count by 1, 2, 5, 10, 20, 50 or 100 with rounding, display to 999,990 with dummy zero for large weights.

Universal Temperature Meter / Controller

User selection of seven thermocouple types or two RTD types, display in $^{\circ}\text{C}$ or $^{\circ}\text{F}$, and resolution of 1° or 0.1° . The entire range of each sensor in one scale. An optional dual relay board and programmable setpoint control modes convert the unit from a meter to a temperature controller.

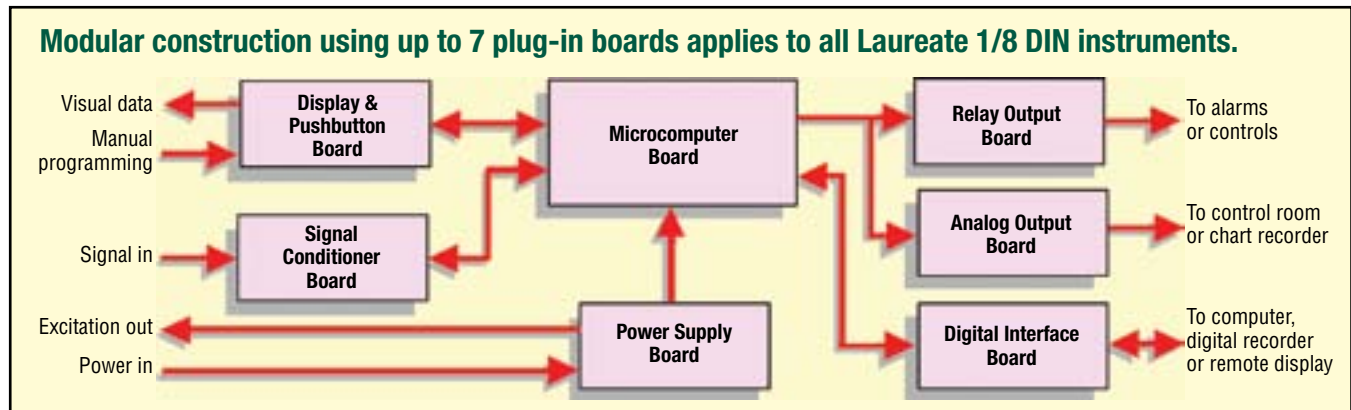
Choice of Options Boards

All meter inputs and outputs are mutually isolated to avoid ground loops.

Relay Output Options: Dual 8A, 250V ac mechanical relays or dual solid state relays for alarm or control. Relay operation includes actuation above or below the setpoint, latching or non-latching, hysteresis mode, and band deviation mode.

Analog Output Option: Scalable 4-20 mA, 0-20 mA or 0-10V transmitter output linearized to the displayed reading.

Digital Interface Options: Choice of RS232 or RS485 serial I/O. Dual RS485 jacks wired in parallel allow daisy chaining with no need for a hub. Direct serial connection to a PC and the Modbus protocol are fully supported.



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LAUREATE™ Panel Meter Specifications

Case

Dimensions 48 x 96 x 102 mm (1/8 DIN)
 Panel cutout 45 x 92 mm (1/8 DIN)
 Connectors Screw clamp plugs

Display

Display 5 digits + 2 LED indicators
 Digit color Red or green
 Digit height 0.56" (14.2 mm)
 Range -99999 to 99999 or -99990 to 99990

A-to-D Conversion

A-to-D rate 60/s at 60 Hz, 50/s at 50 Hz
 Display update 3.5/s at 60 Hz, 3/s at 50 Hz

Noise Rejection

CMR, DC to 60 Hz 130 dB
 NMR at 50/60 Hz 90 dB with no filtering

Max Error at 25°C

DC, strain, load cell 0.01% of FS ±2 counts
 AC rms 0.15% of FS, 10 Hz to 10 kHz
 Thermocouple 0.5°C
 RTD 0.1°C

Temperature Coefficients

Span tempco 0.003% of reading / °C
 Zero tempco 0.1 digit / °C
 TC reference junction 1°C, 10-40°C

Power Input

Voltage 95-240V ac ±10% or 90-300V dc
 Low voltage option 12-30V ac or 10-48V dc
 Power frequency DC or 47-63 Hz
 Isolation 250V rms, 2.3 kV rms for 1 min

Excitation Output (std)

5V dc 100 mA
 10V dc 120 mA
 24V dc 50 mA
 Output isolation 50V

Analog Output (opt)

Output levels 4-20 mA or 0-10V (selectable)
 Output error < 0.05% of full scale
 Compliance at 20 mA 12V (0-600 ohm load)
 Compliance at 10V 2 mA (5 kOhm load)
 Isolation 250V rms, 2.3 kV rms for 1 min

Relay Outputs (opt)

Relay types Dual contact or solid state
 Contact relays 8A at 250V ac or 24V dc
 Solid state relays 120 mA at 130V ac/170V dc
 Update rate 60/s at 60 Hz, 50/s at 50 Hz
 Setpoint setup Via front panel or PC
 Isolation 250V rms, 2.3 kV rms for 1 min

Digital Interface (opt)

Serial signal levels RS232 or RS485
 Serial protocols Modbus or Laurel ASCII
 Baud rates 300 to 19200 baud
 Isolation 250V rms, 2.3 kV rms for 1 min

Environmental

Operating temperature 0°C to 55°C
 Storage temperature -40°C to 85°C
 Protection NEMA-4X when panel mounted

Safety & EM Certifications

USA & Canada UL listed
 Europe CE certified per EN 61010-1:1993

LAUREATE™ Panel Meter Ordering Guide

Create a model number like **L20100DCV1**.

Panel Meter Type

L Laureate panel meter
LW Laureate weight meter
 (LW is not for AC or temperature inputs)

Main Board & Display Color

1 Standard, green LEDs
2 Standard, red LEDs
3 Extended, Green LEDs
4 Extended, Red LEDs
 Extended adds custom curve linearization and rate from successive readings.

Power

0 95-240V ac or 90-300V dc
1 12-30V ac or 10-48V dc

Relay Output

0 None
1 Dual 8A contact relays
2 Dual solid state relays

Analog Output

0 None
1 4-20 mA or 0-10V

Digital Interface

0 None
1 RS232
2 RS485
3 Parallel BCD
4 Modbus RS485

Input Type

DC Input

DCV1 200.00 mV
DCV2 2.0000 V
DCV3 20.000 V
DCV4 200.00 V
DCV5* 600.0 V
DCV6 300.0 V
DCA1 2.0000 mA
DCA2 20.000 mA
DCA3 200.00 mA
DCA4 5.000 A

AC RMS Input

RMV1 200.00 mV
RMV2 2.0000 V
RMV3 20.000 V
RMV4 200.00 V
RMV5* 600.0 V
RMV6 300.0 V
RMA1 2.0000 mA
RMA2 20.000 mA
RMA3 200.00 mA
RMA4 5.000 A

Process Signals (e.g., 4-20 mA)

P 4-20 mA = 0-10000
P1 Custom Scaling

* Range not UL approved.

Strain Gauge (4-wire ratio)

SG 0-200 mV = 0-20000
SG1 Custom Scaling

Load Cells (4 or 6-wire ratio)

WM1 Custom Scaling

Thermocouples

JC -210 to 760°C
JF -347 to 1400°F
KC -244 to 1372°C
KF -408 to 2501°F
TC -257 to 400°C
TF -430 to 752°F
EC -240 to 1000°C
EF -400 to 1830°F
NC -245 to 1300°C
NF -410 to 2370°F
SC -46 to 1768°C
SF -51 to 3214°F
RC -45 to 1768°C
RF -49 to 3213°F

100-Ohm Platinum RTD's

P385C -202 to 850°C
P385F -331 to 1562°F
P392C -202 to 850°C
P392F -331 to 1562°F



LAUREATE™ Counter / Timer Series

Available for frequency, rate, total, time, and quadrature.
Exceptional accuracy at high read rates, plus extensive output options and programmable features to solve tough application problems at minimum cost.

Basic Features

- 6 LED digits, 14.2 mm (0.56") high
- Update rate to 25/s
- Programmable scale factor
- NEMA-4X, 1/8 DIN front panel
- Detachable screw-clamp connectors
- Isolated sensor excitation output
- Crystal accuracy for rate & time
- Inverse period method for rate
- Adaptive digital noise filtering
- Peak & valley capture
- Easy setup via front panel or PC

Selectable Features

- **Display color:** Red or green.
- **Signal conditioners:**
 - 1) Dual channel pulse input
 - 2) Process meter & totalizer
 - 3) Quadrature
- **Alarm/control outputs:**
 - 1) Dual 8A, 250V contact relays
 - 2) Dual solid state relays
- **Isolated analog output:**
 - 1) 4-20 mA
 - 2) 0-20 mA
 - 3) 0-10V (selectable at connector)
- **Digital interface:**
 - 1) RS232, point to point
 - 2) RS485, Laurel ASCII protocol
 - 3) RS485, Modbus protocol
- **Power to meter:**
 - 1) Worldwide 95-240V ac $\pm 10\%$
 - 2) Low-voltage 12-30V ac or 10-48V dc



Frequency, Pulse & Flow Rate Meter

Display two independent pulse or AC channels A and B as a 6-digit frequency from 0 Hz to 1 MHz, or as a scaled rate in engineering units, all with quartz crystal accuracy. Signal sources can be PNP or NPN proximity switches, contact closures, digital logic, magnetic pickups down to 12 mV, or AC lines up to 250 Vac.

Pulse Counter / Totalizer

Independently count up from zero to a preset limit, or count down from a preset value to zero with two independent pulse or AC channels A and B. Readings can be scaled to engineering units, such as gallons. Channel B can also be used to reverse count direction or inhibit counting of Channel A.

Combined Rate & Total

Toggle the display from scaled rate to scaled total by pressing a front panel key or an external switch. Great for flow applications to show either flow in gpm or volume in gallons.

Combination of Two Channels

Combine two pulse input channels A and B after scaling to display and alarm A+B, A-B, AxB, A/B, or A/B-1. Applicable to rate or total. For example, add two flows for total flow, subtract two flows for net flow, or take the ratio of two flows for mixing. Monitor A/B-1 (draw) for elongation of material between rollers.

Pulse Input Batch Controller

Automate repetitive fill operations with our low cost controller. Cycling can be automatic with a programmable delay, or be controlled externally. Press a front panel button to display the current batch total, grand total, number of batches, or flow rate.

Stopwatch & Process Timer

Trigger on the leading or trailing edges of signals applied to channels A and B to time individual or repetitive fast events to 0.2 μ s resolution, or display accumulated time of multiple events to 999,999 hours. The display can be in 6-digit decimal format for hours, minutes or seconds, or in HH.MM.SS format.

Phase Angle or Duty Cycle Meter

Display the phase lead or lag in degrees from -180° to $+180^\circ$ between two signals of the same period applied to channels A and B. Set resolution to 1° , 0.1° or 0.01° . Ideal for AC power phase monitoring with a FS error less than 0.01%. Or display duty cycle by determining On or Off period as a percent of total period with a resolution of 1%, 0.1% or 0.01%.

Process Signal Totalizer

Display scaled rate and total based on 4-20 mA, 0-1 mA or 0-10 V process signals. For example, display rate or volume from a 4-20 mA flow transducer. Square root extraction is standard for use with differential pressure flow sensors.

Quadrature Position & Rate Meter

Display scaled position or rate from the A and B signals of a quadrature encoder. Count transitions at a combined rate to 250 kHz. A great way to measure position or speed accurately in high vibration environments.

Choice of Options Boards

Same modular construction and isolated option boards as for the Laureate Panel Meter Series: dual relays for alarm or control, analog output, and digital interface. Please see the Ordering Guide or website for available options.

Isolated Inputs & Outputs of 1/8 DIN Laureate Instruments

The diagram shows a central Laureate instrument with several red arrows pointing to and from it, representing different I/O options:

- Top:** Two arrows pointing up labeled "Dual relay outputs".
- Top-Right:** Two arrows pointing up labeled "RS232 or RS485 serial I/O".
- Right:** Two arrows pointing right labeled "4-20 mA or 0-10V analog output".
- Bottom:** Two arrows pointing down labeled "Single or dual channel signal inputs".
- Left:** One arrow pointing left labeled "Transducer excitation output".

Isolated transducer excitation rated 120 mA at 10V dc or 50 mA at 24V dc is standard to power transducers or 2-wire transmitters.

Optional dual relays can add alarm or control. Relay operating modes include actuation above or below the setpoint, latching or non-latching, hysteresis mode, and band deviation mode.

An optional analog output can provide a 4-20 mA or 0-10V transmitter output linearized to the display. The output span can be scaled for any portion of the input span.

Serial communication options are RS232 or RS485. The RS232 option allows easy meter setup via a PC. The RS485 option supports the Modbus protocol and allows addressing on a serial data line.



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LAUREATE™ Counter / Timer Specifications

Case

Dimensions..... 48 x 96 x 102 mm (1/8 DIN)
 Panel cutout..... 45 x 92 mm (1/8 DIN)
 Connectors..... Screw clamp plugs

Display

Display 6 LED digits + 4 LED indicators
 Display color Red or green
 Digit height 0.56" (14.2 mm)
 Range..... -999999 to 999999

FR Signal Conditioner (dual pulse inputs)

Inputs..... AC, magnetic pickups, pulses from NPN or PNP transistors, contact closures
 Channel A frequency 0 Hz to 1 MHz
 Channel B frequency 0 Hz to 250 kHz
 Crystal time base accuracy ±2 ppm
 Span tempco..... ±1 ppm/°C (typ)
 Long term drift..... ±5 ppm/year
 Frequency Measurement..... 1/period
 Update time..... Gate time +30 ms +1 period
 Gate time..... 0.01 to 199.99 sec (selectable)
 Scale factor..... ±10⁻¹⁰ to ±10⁶

VF Signal Conditioner (process totalizing)

Inputs..... 4-20 mA, 0-1 mA, 0-10V

Span error..... 0.015% of FS ±1 count
 Span tempco..... 0.003% of reading/°C
 Zero tempco..... 0.001% of FS/°C

QD Signal Conditioner (quadrature inputs)

Input types..... Differential or single-ended
 Transitions monitored..... x1, x2 or x4
 Max transitions /sec..... 250 k
 Error correction..... Zero index (Z-channel)
 Position error..... No error contributed by meter

Power Input

Voltage 95-240V ac ±10% or 90-300V dc
 Low voltage option..... 12-30V ac or 10-48V dc
 Power frequency DC or 47-63 Hz
 Isolation..... 250V rms, 2.3 kV rms for 1 min

Excitation Output (std)

5V dc..... 100 mA
 10V dc..... 120 mA
 24V dc..... 50 mA
 Output isolation..... 50V dc

Analog Output (opt)

Output levels 4-20 mA or 0-10V (selectable)
 Output error < 0.05% of full scale

Compliance at 20 mA..... 12V (0-600 ohm load)
 Compliance at 10V..... 2 mA (5 kOhm load)
 Isolation..... 250V rms, 2.3 kV rms for 1 min

Relay Outputs (opt)

Relay types Dual contact or solid state
 Contact relays 8A at 250V ac or 24V dc
 Solid state relays... 120 mA at 130V ac/170V dc
 Setpoint setup..... Via front panel or PC
 Isolation..... 250V rms, 2.3 kV rms for 1 min

Digital Interface (opt)

Serial signal levels RS232 or RS485
 Serial protocols..... Modbus or Laurel ASCII
 Baud rates..... 300 to 19200 baud
 Isolation..... 250V rms, 2.3 kV rms for 1 min

Environmental

Operating temperature 0°C to 55°C
 Storage temperature -40°C to 85°C
 Protection NEMA-4X when panel mounted

Safety & EM Certifications

USA & Canada UL listed
 Europe CE certified per EN 61010-1:1993

LAUREATE™ Counter / Timer Ordering Guide

Create a model number like **L60100FR**.

- Laureate Main Counter Board**
 L5 Standard, green LEDs
 L6 Standard, red LEDs
 L7 Extended, green LEDs
 L8 Extended, red LEDs
 (See Input Type for Extended capabilities)

- Power**
 0 95-240V ac or 90-300V dc
 1 12-30V ac or 10-48V dc

- Relay Output**
 0 None
 1 Dual 8A contact relays
 2 Dual solid state relays

- Analog Output**
 0 None
 1 4-20 mA or 0-10V

- Digital Interface**
 0 None
 1 RS232
 2 RS485
 4 Modbus RS485

- Input Type**
 FR Frequency
 With Main Boards L5 & L6, scalable to ±999,999 for frequency, rate, total, stop-watch or time interval. Main Boards L7 & L8 add rate and total simultaneously, custom curve linearization, arithmetic functions applied to channels A & B (A+B, A-B, AxB, A/B, A/B-1), phase angle, duty cycle, up/down counting, and batch control.

- VF1** 4-20 mA
VF2 0-1 mA
VF3 0-10 V

With Main Boards L5 & L6, simultaneous scaled rate and total from process signals, with selectable square root extraction. Main Boards L7 & L8 add custom curve linearization, batch control, and 1/rate (time).

- QD** Quadrature
 With Main Boards L5 & L6, scalable to ±999,999 for position from shaft encoders. Main Boards L7 & L8 add scalable rate.

Modular Architecture



Up to seven simultaneous plug-in boards and extensive programmable features are hallmarks of Laurel's 1/8 DIN digital panel meters, counters, timers and serial input displays. This allows cost-effective measurement and control solutions to a wide range of application problems as well as low-cost, display-only instruments. Please phone Laurel to discuss your application.

With many meter suppliers, key I/O options are mutually exclusive. Not with Laurel!



LAUREATE™ TA Series DIN Rail Transmitters

4-20 mA, 0-20 mA or 0-10V Analog Output

4-20 mA, 0-20 mA or 0-10V analog output for all popular industrial analog input signals, plus AC or pulse signals used for frequency, rate, total, time, or position. Exceptional accuracy at high update rates. Optional dual relays for alarm or control.

Basic Features

- Selectable 4-20 mA, 0-20 mA or 0-10V analog output
- 35 mm DIN rail mount
- Only 22.5 mm (0.89") thick
- Detachable screw clamp connectors
- All inputs and outputs mutually isolated
- Isolated sensor excitation output
- Isolated serial port for programming
- Easy setup using Windows software
- Exceptional accuracy
- Adaptive input noise filtering

Selectable Features

- **Power input:**
 - 1) Worldwide 95-240V ac $\pm 10\%$
 - 2) Low voltage 12-30V ac or 10-48V dc
- **Dual relay output**
- **Signal conditioners:**
 - 1) DC (includes process & strain)
 - 2) AC rms
 - 3) Load cell & microvolt
 - 4) Temperature (T/C & RTD)
 - 5) Dual channel pulse input for:
 - Frequency & rate
 - Counter & totalizer
 - Time & stopwatch
 - Phase angle
 - Duty cycle
 - Combinations of two channels (A+B, A-B, AxB, A/B, A/B-1)
 - 6) Process signal totalizer
 - 7) Quadrature (position & rate)

4-20 mA, 0-20 mA or 0-10V Output

Laureate TA Series transmitters provide an isolated current or voltage output, which is selectable at the connector. Either output can be digitally scaled to correspond to the full-scale signal input range, or to a user-selected portion thereof.

An ultra-linear 12-bit digital-to-analog converter provides a resolution of 0.025% of the output span. Output accuracy is $\pm 0.05\%$ of full scale for all DC and pulse inputs, and $\pm 0.15\%$ for AC rms inputs. Output linearity for thermocouples and RTDs is within one degree for the entire temperature range.

Easy Installation

The transmitters snap into a 35 mm DIN rail. All electrical connections are via detachable screw clamp connectors. The units can be powered directly by 120V or 240V ac, or optionally by low voltage AC or DC. An isolated transducer excitation output is standard.

Counterparts to Laureate 1/8 DIN Meters

Laureate TA Series transmitters utilize the same signal conditioner boards as Laureate 1/8 DIN digital panel meters, counters and timers, and they duplicate the input and signal processing capabilities of these instruments. This includes pulse rate meters, pulse totalizers, process signal totalizers, and instruments which combine pulse channels A and B: A+B, A-B, AxB, A/B, A/B-1.

Dual Solid State Relay Option

Optional dual solid state relays add alarm and control capability. Programmable relay operating modes include actuation above or below the setpoint, latching or non-latching, hysteresis mode, and band deviation mode.



Electrical Isolation

All transmitter inputs and outputs are mutually isolated to eliminate ground loops. This includes power, signal in, signal out, transducer excitation, serial I/O, and optional dual relays.

Easy Setup via a PC

TA Series transmitters come with an RS232 port, which is designed to be connected to a PC COM port for programming. Transmitter setup is easily accomplished under Windows using Laurel's graphical Instrument Setup software.


Instrument Setup Software



Laurel's Instrument Setup software is a PC application to set up Laureate digital panel meters, counters, timers and transmitters. It is required for Laureate transmitters, which do not offer front panel keys. It is downloadable from Laurel's website at no charge.

When the PC is connected to a Laureate via RS232, the software can retrieve, edit, save and download the instrument setup file. It recognizes the Laureate main board and user selections, and only brings up the appropriate menu choices. Editing of the setup file is accomplished graphically and easily under Windows.

The software can also be used with 1/8 DIN instruments in lieu of the printed manual to display the keystrokes required for front panel programming.



TLS Triple Loop Splitter

Model TLS Loop Splitter/Retransmitter splits one 4-20 mA input current loop into three independently scalable 4-20 mA output loops. With this unit, if any of the output loads suffers a failure, the signal to the other loads is not affected, as would be the case if all loads were in series on the same loop. The unit is DIN rail mounted and is powered by 120V or 240V ac. It can power 2-wire transmitters at 24V dc and drive 600 ohms per loop at 20 mA.

Ordering Number TLS



LAUREATE™ TA Series Transmitter Specifications

Transmitter Output

Output signals..... 4-20 mA, 0-20 mA, 0-10V
 Compliance, 20 mA..... 10V (0-500 ohm load)
 Compliance, 10V..... 2 mA (5 kOhm load)
 Output resolution 12 bits (1 part in 4096)
 Output accuracy ±0.05% of FS
 (±0.15% of FS for AC rms)
 Isolation 250V rms, 2.3 kV rms for 1 min

Power Input

Standard 95-240V ac ±10% or 90-300V dc
 Low voltage option..... 12-30V ac or 10-48V dc
 Power frequency DC or 47-63 Hz
 Isolation 250V rms, 2.3 kV rms for 1 min

Excitation Output (std)

Isolated 120 mA @ 10V, 50 mA @ 5V
 Non-isolated..... 60 mA @ 15V

Relay Output (opt)

Relay type Dual solid state
 Relay rating 120 mA at 130V ac / 170V dc
 Isolation 250V rms, 2.3 kV rms for 1 min

DC Signal Conditioner (DC, process, strain)

FS ranges 200 mV, 2V, 20V, 200V, 300V
 600V, 2 mA, 20 mA, 200 mA, 5A

AC rms Signal Conditioner

FS ranges 200 mV, 2V, 20V, 200V, 300V
 600V, 2 mA, 20 mA, 200 mA, 5A

Load Cell & Microvolt Signal Conditioner

FS ranges 20, 50 100, 250, 500 mV

Temperature Signal Conditioner

Thermocouple types J, K, T, E, N, R, S
 RTD types Pt 100, DIN or ANSI alpha
 FS ranges Maximum for each sensor type

FR Signal Conditioner (dual pulse inputs)

Inputs..... AC, magnetic pickups, pulses from
 NPN or PNP transistors, contact closures
 Channel A frequency 0 Hz to 1 MHz
 Channel B frequency 0 Hz to 250 kHz
 Crystal time base accuracy ±2 ppm
 Span tempco, typical..... ±1 ppm/°C
 Frequency technique..... 1/period
 Update time..... Gate time +30 ms +1 period
 Gate time..... 0.01 to 199.99 sec (selectable)

VF Signal Conditioner (process totalizing)

Input levels 4-20 mA, 0-1 mA, 0-10V

QD Signal Conditioner (quadrature inputs)

Input types Differential or single-ended
 Transitions monitored x1, x2 or x4
 Max transitions / sec..... 250k
 Error correction..... Zero index (Z-channel)

Case

Dimensions 120 x 101 x 22.5 mm
 Mounting 35 mm rail per DIN EN 50022
 Connectors..... Detachable screw clamp plugs

Environmental

Operating temperature 0°C to 70°C
 Storage temperature -40°C to 85°C

TA Series Inputs & Outputs

Signal Input:

Thermocouple,
 Pt 100 RTD,
 DC, AC rms,
 Strain gauge,
 Load cell,
 Process,

4-20 mA,
 0-20 mA
 or 0-10V
 output

Frequency,
 Pulse rate,
 Pulse total,
 Analog total,
 Stopwatch,
 Time interval
 Quadrature

Dual relay
 output

RS232 port for
 programming

TA Series transmitters are available for a wide range of signal inputs, both analog and pulse. The analog output span can be programmed to correspond to a user selected input span. Optional dual relays can add alarm or control. Programming is easily accomplished by temporarily connecting the transmitter to a PC and using Laurel's Windows based Instrument Setup software.

LAUREATE™ TA Series Transmitter Ordering Guide

Create a model number like **TA200DCV1**.

Transmitter Main Board

TA2 Standard for analog inputs
TA4 Extended for analog inputs
 (DC, RM, P, SG, WM inputs)
TA6 Standard for pulse or VF inputs
TA8 Extended for pulse or VF inputs
 (FR, VF, QD inputs)

Power

0 95-240V ac ±10% or 90-300V dc
1 12-30V ac or 10-48V dc

Setpoint Output

0 None
2 Dual solid state relays

Input Type (TA2 or T4 Main Board)

DC Input

DCV1 200 mV **DCV6** 300 V
DCV2 2 V **DCA1** 2 mA
DCV3 20 V **DCA2** 20 mA
DCV4 200 V **DCA3** 200 mA
DCV5 600 V **DCA4** 5 A

AC RMS Input

RMV1 200 mV **RMV6** 300 V
RMV2 2 V **RMA1** 2 mA
RMV3 20 V **RMA2** 20 mA
RMV4 200 V **RMA3** 200 mA
RMV5 600 V **RMA4** 5 A

Process Signals (e.g., 4-20 mA)

P 4-20 mA in = 4-20 mA out
P1 Custom Scaling

Strain Gauge (4-wire ratio)

SG 0-200 mV in = 4-20 mA out
SG1 Custom Scaling

Load Cells (4 or 6-wire ratio)

WM1 Custom Scaling
 With DC, RM, P, SG or WM inputs, Main Board TA4 adds custom curve linearization and rate from successive readings.

Thermocouples

J Type J **N** Type N
K Type K **S** Type S
T Type T **R** Type R
E Type E

100-Ohm Platinum RTD's

P385 DIN alpha of .00385
P392 ANSI alpha of .003925

Input Type (TA6 or TA8 Main Board)

FR Frequency
 With Main Board TA6, scalable for frequency, rate, totalizing, timing. Main Board TA8 adds rate and total imultaneously, custom curve linearization, arithmetic functions applied to channels A & B (A+B, A-B, AxB, A/B, A/B-1), phase angle, duty cycle, up/down counting.

VF1 4-20 mA
VF2 0-1 mA
VF3 0-10 V

With Main Board TA6, scalable for rate or total from process signals. Includes selectable square root extraction. Main Board TA8 adds custom curve linearization, 1/rate (time).

QD Quadrature
 With Main Board TM6, scalable for position. Main Board TM8 adds scalable rate.



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LAUREATE™ TM Series DIN Rail Transmitters

Serial Output, Modbus or Custom ASCII Protocol

Selectable RS232 or RS485. Available for all popular industrial analog input signals, plus AC or pulse signals used for frequency, rate, total, time, or position. Exceptional accuracy at high update rates. Optional analog output. Optional dual relays for alarm or control.



Basic Features

- Isolated RS232 or RS485 serial port
- Modbus or Custom ASCII protocol
- 35 mm DIN rail mount
- Only 22.5 mm (0.89") thick
- Detachable screw clamp connectors
- All inputs and outputs mutually isolated
- Isolated sensor excitation output
- Easy setup using Windows software
- Exceptional accuracy
- Adaptive input noise filtering

Selectable Features

- **Power input:**
 - 1) Worldwide 95-240V ac $\pm 10\%$
 - 2) Low voltage 10-30V ac or 10-48V dc
- **Dual relay output**
- **Analog output**
 - 1) 4-20 mA
 - 2) 0-20 mA
 - 3) 0-10V
- **Signal conditioners:**
 - 1) DC (includes process & strain)
 - 2) AC rms
 - 3) Load cell & microvolt
 - 4) Temperature (T/C & RTD)
 - 5) Dual channel pulse input for:
 - Frequency & rate
 - Counter & totalizer
 - Time & stopwatch
 - Phase angle
 - Duty cycle
 - Combinations of two channels (A+B, A-B, AxB, A/B, A/B-1)
 - 6) Process signal totalizer
 - 7) Quadrature (position & rate)

Serial Data Output

Laureate TM Series transmitters send data as a serial digital signal. RS485 or RS232 signal levels are jumper selectable and can each be associated with either the Modbus protocol or Laurel's simpler Custom ASCII protocol.

Modbus operation is fully compliant with the MODBUS Over Serial Line Specification V1.0 (2002) for 2-wire, half-duplex connection. This includes RTU or ASCII modes, addressing of up to 32 devices per RS485 line without a repeater, and up to 247 digital addresses. Modbus operation allows devices by different manufacturers to be connected in parallel and be addressed using the same protocol.

Laurel's Custom ASCII protocol allows up to 31 Laureate devices to be addressed on the same RS485 data line. It is simpler than the Modbus protocol and is recommended when all devices are Laureates. It also allows use of Laurel's datalogging software.

Easy Installation

The transmitters snap into a 35 mm DIN rail. All electrical connections are via detachable screw clamp connectors. The units can be powered directly by 120V or 240V ac, or optionally by low voltage AC or DC. An isolated transducer excitation output is standard.

Counterparts to Laureate 1/8 DIN Meters

Laureate TM Series transmitters utilize the same signal conditioner boards as Laureate 1/8 DIN digital panel meters, counters and timers, and they duplicate the input and signal processing capabilities of these instruments. This includes pulse rate meters, pulse totalizers, process signal totalizers, and instruments which combine pulse channels A and B: A+B, A-B, AxB, A/B, A/B-1.

High Accuracy

Laureate TM Series transmitters maintain the full digital accuracy of the signal processing front end. For DC input signals (DC, process, strain, load cell), output accuracy is $\pm 0.01\% \pm 2$ counts of full scale input. For frequency, pulse rate or timing, output accuracy is better than $\pm 0.001\%$, as provided by a calibrated quartz crystal.

Output Options

Optional dual solid state relays can add alarm or control. Relay operating modes include actuation above or below the setpoint, latching or non-latching, hysteresis mode, and band deviation mode.

An isolated 4-20 mA, 0-20 mA or 0-10V analog output can drive an external device.

Electrical Isolation

All transmitter inputs and outputs are mutually isolated to eliminate ground loops. This includes power, signal in, serial I/O, transducer excitation, solid state relays, and analog output.

Easy Setup via a PC

Laureate transmitters are easily programmed via their serial port, which can be jumpered to RS232 and be connected directly to a PC COM port. Laurel's Windows based graphical Instrument Setup software can retrieve, edit, save, and download transmitter setup files. It recognizes Laureate transmitter main boards and only brings up the appropriate menu choices.

Network Operation of Laureate Digital Panel Meters, Counters, Timers, Remote Displays and Transmitters



Serial communications capability allows Laureate panel meters, counters, timers, remote displays and transmitters to be multidropped from an RS485 data line to a computer or PLC.

The Modbus protocol or Laurel's simpler Custom ASCII protocol are user selectable. With Modbus, devices by different manufacturers can be addressed on the same RS485 data line.

All Laureates also offer an optional dual relay output and isolated analog output, which can be scaled to the reading. These outputs can be part of plant-wide distributed processing systems.



LAUREATE™ TM Series Transmitter Specifications

Transmitter Output

Signal levels RS232 or RS485
 Protocols Modbus or Laurel ASCII
 Modbus compliance V1.0 (2002)
 Modbus modes RTU or ASCII, 2-wire
 Baud rates 300 to 19200 baud
 Serial connector 3-position screw clamp
 Output accuracy Same as digital reading
 Isolation 250V rms, 2.3 kV rms for 1 min

Power Input

Standard 95-240V ac $\pm 10\%$ or 90-300V dc
 Low voltage option 12-30V ac or 10-48V dc
 Power frequency DC or 47-63 Hz
 Isolation 250V rms, 2.3 kV rms for 1 min

Excitation Output (std)

Isolated 120 mA @ 10V, 50 mA @ 5V
 Non-isolated 60 mA @ 15V

Relay Outputs (opt)

Relay type Dual solid state
 Relay rating 120 mA at 135V ac / 170V dc
 Isolation 250V rms, 2.3 kV rms for 1 min

Analog Output (opt)

Output signals 4-20 mA, 0-20 mA, 0-10V
 Compliance, 20 mA 10V (0-500 ohm load)

Compliance, 10V 2 mA (5 kOhm load)
 Output resolution 12 bits (1 part in 4096)
 Output accuracy $\pm 0.05\%$ of FS digital reading
 Isolation 250V rms, 2.3 kV rms for 1 min

Case

Dimensions 120 x 101 x 22.5 mm
 Mounting 35 mm rail per DIN EN 50022
 Connectors Detachable screw clamp plugs

Environmental

Operating temperature 0°C to 70°C
 Storage temperature -40°C to 85°C

DC Signal Conditioner (DC, process, strain)

FS ranges 200 mV, 2V, 20V, 200V, 300V
 600V, 2 mA, 20 mA, 200 mA, 5A
 Input accuracy $\pm 0.01\%$ of FS ± 2 counts

AC rms Signal Conditioner

FS ranges 200 mV, 2V, 20V, 200V, 300V
 600V, 2 mA, 20 mA, 200 mA, 5A
 Input accuracy $\pm 0.15\%$ of FS ± 2 counts

Load Cell & Microvolt Signal Conditioner

FS ranges 20, 50 100, 250, 500 mV
 Input accuracy $\pm 0.01\%$ of FS ± 2 counts

Temperature Signal Conditioner

Thermocouple types J, K, T, E, N, R, S
 RTD types Pt 100, DIN or ANSI alpha
 Resolution 1° or 0.1°, °C or °F (0.01° RTD)
 Thermocouple error at 25°C, max 0.5°C
 RTD error at 25°C, max 0.1°C

FR Signal Conditioner (dual pulse inputs)

Inputs AC, magnetic pickups, pulses from
 NPN or PNP transistors, contact closures
 Channel A frequency 0 Hz to 1 MHz
 Channel B frequency 0 Hz to 250 kHz
 Crystal time base accuracy ± 2 ppm
 Span tempco, typical ± 1 ppm/°C
 Frequency technique 1/period
 Update rate Gate time +30 ms +1 period
 Gate time 0 to 199.99 sec (selectable)

VF Signal Conditioner (process totalizing)

Inputs 4-20 mA, 0-1 mA, 0-10V
 Span error 0.015% of FS ± 1 count
 Span tempco 0.003% of reading/°C
 Zero tempco 0.001% of FS/°C

QD Signal Conditioner (quadrature inputs)

Input types Differential or single-ended
 Transitions monitored x1, x2 or x4
 Max transitions / sec 250k
 Error correction Zero index (Z-channel)

LAUREATE™ TM Series Transmitter Ordering Guide

Create a model number like **TA2001DCV1**.

Transmitter Main Board

TM2 Standard for analog inputs
TM4 Extended for analog inputs
 (DC, RM, P, SG, WM inputs)
TM6 Standard for pulse or VF inputs
TM8 Extended for pulse or VF inputs
 (FR, VF, QD inputs)

Power

0 95-240V or 90-300V dc
1 12-30V ac or 10-48V dc

Relay Output

0 None
2 Dual solid state relays

Scalable Analog Output

0 None
1 4-20 mA, 0-20 mA, 0-10V

Input Type

DC Input

DCV1 200.00 mV **DCV6** 300.0 V
DCV2 2.0000 V **DCA1** 2.0000 mA
DCV3 20.000 V **DCA2** 20.000 mA
DCV4 200.00 V **DCA3** 200.00 mA
DCV5 600.0 V **DCA4** 5.000 A

AC RMS Input

RMV1 ... 200.00 mV **RMV6** 300.0 V
RMV2 2.0000 V **RMA1** ... 2.0000 mA
RMV3 20.000 V **RMA2** 20.00 mA
RMV4 200.00 V **RMA3** ... 200.00 mA
RMV5 600/0 V **RMA4** 5.000 A

Process Signals (e.g., 4-20 mA)

P 4-20 mA in = 4-20 mA or 0-100.00
P1 Custom Scaling

Strain Gauge (4-wire ratio)

SG 0-200 mV in = 4-20 mA or 0-100.00
SG1 Custom Scaling

Load Cells (4 or 6-wire ratio)

WM1 Custom Scaling

With DC, RM, P, SG or WM inputs, Main Board TM4 adds custom curve linearization and rate from successive readings.

Thermocouples

JC Type J, °C **JF** Type J, °F
KC Type K, °C **KF** Type K, °F
TC Type T, °C **TF** Type T, °F
EC Type E, °C **EF** Type E, °F
NC Type N, °C **NF** Type N, °F
RC Type R, °C **RF** Type R, °F
SC Type S, °C **SF** Type S, °F

100-Ohm Platinum RTD's

P385 DIN alpha of .00385
P392 ANSI alpha of .003925

Pulse, Process, Quadrature Signals

FR Frequency
 With Main Board TM6, scalable for frequency, rate, totalizing, timing. Main Board TM8 adds rate and total simultaneously, custom curve linearization, arithmetic functions applied to channels A & B (A+B, A-B, Ax/B, A/B, A/B-1), phase angle, duty cycle, up/down counting.

VF1 4-20 mA
VF2 0-1 mA
VF3 0-10 V

With Main Board TM6, scalable for rate or total from process signals. Includes selectable square root extraction. Main Board TM8 adds custom curve linearization, 1/rate (time).

QD Quadrature
 With Main Board 6, scalable for position. Main Board 8 adds scalable rate.



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LAUREATE™ Serial Input Meter

Six-digit remote display with optional relay and analog outputs.

Basic Features

- 6 LED digits, red or green, to display the serial output of a PC, PLC or instrument
- Isolated RS232 or RS485 serial input
- Modbus or Laurel ASCII protocol
- Digitally addressable
- Easy setup using Windows software
- NEMA-4X, 1/8 DIN front panel

Selectable Features

- Dual 8A, 250V ac contact relays, or dual solid state relays
- Isolated 4-20 mA or 0-10V analog output
- Worldwide 95-240V ac $\pm 10\%$ power, or low voltage 12-30V ac or 10-48V dc



Serial Data Input, 6-Digit Readout

The Laureate serial input meter provides a 6-digit display of RS232 or RS485 data extracted from long character strings. With RS485, up to 32 units can be addressed on a single data line without a repeater.

Relay & Analog Output Options

Optional dual relays can provide alarm or control. These can respond to the displayed data or to transmitted control characters.

An optional isolated analog output allows the meter to serve as a serially driven 4-20 mA, 0-20 mA or 0-10V transmitter.

Ordering Guide

Create a model number like **L60001**.

- Laureate Main Counter Board**
L5 Green LEDs
L6 Red LEDs
- Power**
0 95-240V ac $\pm 10\%$ or 90-300V dc
1 12-30V ac or 10-48V dc
- Relay Output**
0 None
1 Dual 8A contact relays
2 Dual solid state relays
- Analog Output**
0 None
1 4-20 mA or 0-10V
- Digital Interface (required)**
1 RS232
2 RS485
4 Modbus RS485

LAUREATE™ TS Serial-to-Analog Converter

Serial input, analog output DIN rail transmitter with optional relay outputs.

Basic Features

- Isolated RS232 or RS485 serial input
- Modbus or Custom ASCII protocol
- 4-20 mA, 0-20 mA or 0-10V analog output
- Programmable analog output span
- Easy setup using Windows software
- All inputs and outputs mutually isolated
- 35 mm DIN rail mount
- Only 22.5 mm (0.89") thick
- Detachable screw clamp connectors

Selectable Features

- **Power input:**
 - 1) Worldwide 95-240V ac $\pm 10\%$
 - 2) Low voltage 12-30V ac or 10-48V dc
- **Dual relay output option**

Serial Data Input, Analog Output

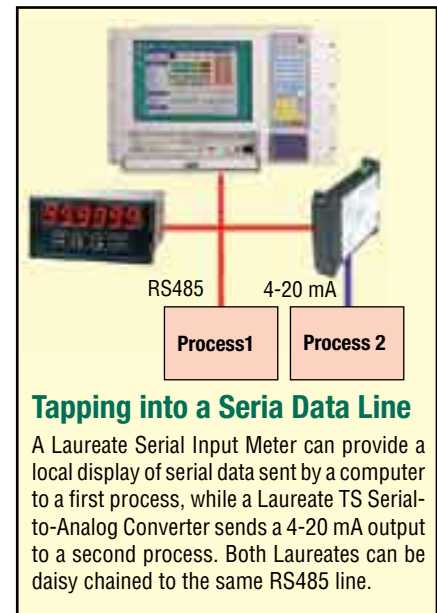
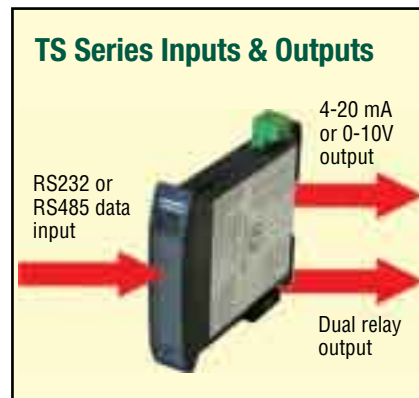
The Laureate TS Serial-to-Analog Converter can extract numeric data from long character strings received via RS232 or RS485, and convert this data to a 4-20 mA, 0-20 mA or 0-10V isolated analog output.

You can select character positions, start and stop ASCII characters, how many characters to skip, and how many characters to convert. You can also program the analog output span so that it corresponds to a specific numerical input span.



The unit supports the Modbus and simpler Laurel ASCII protocols. With RS485, up to 32 units can be addressed on a single data line without a repeater.

Optional dual relays can alarm and control based on the received numeric data or control characters.



Tapping into a Serial Data Line

A Laureate Serial Input Meter can provide a local display of serial data sent by a computer to a first process, while a Laureate TS Serial-to-Analog Converter sends a 4-20 mA output to a second process. Both Laureates can be daisy chained to the same RS485 line.

Ordering Guide

Create a model number like **TS602**.

- TS6**..... Serial input transmitter, 4-20 mA, 0-20 mA, 0-10V analog output
- Power**
0 95-240V ac $\pm 10\%$ or 95-300V dc
1 12-30V ac or 10-48V dc
- Relay Output**
0 None
2 Dual solid state relays



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Grand Series Large Digit Displays



Features

- 2", 4", 6", 8" or 11" high digits for viewing distances up to 440 ft.
- Choice of inputs: process signals (4-20 mA, 0-10V), load cell / weight, frequency, rate, pulse totalizer, serial data, 24-hour clock, elapsed time.
- Choice of mounting methods.
- Choice of 95-240V ac power or low voltage 11-30V dc power.
- Sealed to NEMA-4 (IP65) for 2", 4" & 6" digits, NEMA-12 (IP54) for 8" & 11" digits.
- Extra-bright LEDs and weather cowl available for outdoor installation.
- EM certified (CE Mark).
- Optional RS422 or dual 2A relay outputs.
- Optional remote programming unit.

Large Digits for Long Viewing Distances

Grand Series Large Digit Displays are available in five digit heights for viewing across a plant floor or outdoor yard. A rule of thumb is that viewing distance in feet is 40 times digit height in inches.

Grand Series displays are available for analog, pulsed, or serial data signals. Outdoor versions are available with ultra-bright LEDs and a NEMA-4X (IP65) rated weather cowl, for example to display display truck weight. Suspension mount is standard. Other mounting methods are optional.

Solid LED segments are used for normal brightness and 2.2" or 4.0" digits. Discrete 5 mm LEDs are used for larger and ultra-bright digits.

Grand Model	G02	G04	G06	G08	G11
Digit Height	2.2" (57 mm)	4.0" (102 mm)	5.7" (144 mm)	7.9" (200 mm)	11.0" (280 mm)
Case, W x H 5 digits	11.3" x 4.7" 288 x 120 mm	18.9" x 6.6" 480 x 168 mm	24.6" x 7.6" 624 x 192 mm	32.4" x 9.8" 824 x 248 mm	46.1" x 13.2" 1172 x 336 mm
Case, W x H 7 digits	15.1" x 4.7" 384 x 120 mm	26.4" x 6.6" 672 x 168 mm	34.0" x 7.6" 864 x 192 mm	44.9" x 9.8" 1140 x 248 mm	63.2" x 13.2" 1606 x 336 mm
Case Depth	3.54" (90 mm)	3.54" (90 mm)	3.54" (90 mm)	3.54" (90 mm)	3.54" (90 mm)

Ordering Guide

Create a model number like **G0600P**.

- Digit Height**
 - G02 2" (57 mm)
 - G04 4" (102 mm)
 - G06 6" (144 mm)
 - G08 8" (200 mm)
 - G11 11" (280 mm)
- Display Brightness**
 - 0 Normal indoor brightness
 - 1 Outdoor viewing brightness
- Power**
 - 0 95-265V ac
 - 1 11-30V dc
- Output Options**
 - 0 None
 - 1 Two 2A contact relays
 - 2 RS422 output
- Mounting Options**
 - 0 Panel mount, black case
 - 2 Wall mount, black case
 - 4 Suspension mount, black case
- Input Options**
 - SER5 5-digit serial ASCII input
 - SER7 7-digit serial ASCII input
 - CLK4 4-digit clock, HH:MM
 - CLK6 6-digit clock, HH:MM:SS
 - TIM4 4-digit timer, HH:MM
 - TIM6 6-digit timer, HH:MM:SS
 - P 5-digit process signal, 4-20 mA
 - P1 5-digit process, custom scaling
 - SG 5-digit strain signal, 0-20 mV FS
 - SG1 5-digit strain, custom scaling
 - TOT5 5-digit totalizer
 - TOT7 7-digit totalizer
 - FR 5-digit frequency or rate

Other Process Instrumentation



Bargraph Displays

The 1/8 DIN size BAR bargraph meter provides a 30-segment red or green LED bar display of process signals such as 4-20 mA, 0-20 mA, 1-5V or 0-10V. Transducer excitation is standard. Dual 5A relays are optional. The PRO-BAR is a large-size bargraph display with a 250 mm (10") scale and 50 red LED segments.

Ordering Numbers **BAR or PB**



88-PRO Loop Powered Process Meter

The 88-PRO may be connected directly to a 4-20 mA, 10-50 mA or 1-5 mA current loop, with no need for additional power. The display consists of highly legible 0.5" (12.7 mm) LCD digits. The normal display range of ± 1999 (3-1/2 digits) can be extended to ± 19990 or ± 199900 via jumper-selectable dummy right-hand zeros. 1/8 DIN case, detachable screw terminal connectors.

Ordering Number **88-PRO**



M-35 Microminiature Process Meter

The M-35 is the solution when panel space is limited or portability is desired. The bezel measures only 24 x 48 mm (0.94" x 1.89"), yet the height of the LED digits is a full 10 mm (0.4"). This is a fully scalable 3-1/2 digit process meter for 4-20 mA, 0-10 mA, 0-2 V, 1-5 V, or 0-10V signals. The unit is powered by 10-30V dc, which is isolated from the signal. Detachable screw terminal connectors.

Ordering Number **M-35**



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High-Performance Instrumentation for Industrial Measurement & Control

Applications

- DC Voltage & Current
- AC RMS Voltage & Current
- TC & RTD Temperature
- 4-20 mA & 0-10V Process
- Setpoint Control
- Strain, Load Cell, Microvolt
- Weight, Scale
- Custom Curve Linearization
- Square Root Extraction
- Stopwatch, Time Interval
- Frequency, Rate
- Pulse Signal Totalizing
- Process Signal Totalizing
- Ratio, Sum or Difference
- Phase Angle
- Duty Cycle
- Batch Control
- Quadrature Position & Rate
- Serial Input Display & Control
- PC-Based Data Collection



Device Types

- Digital Panel Meters
- Counters
- Timers
- Setpoint Controllers
- 4-20 mA Transmitters
- Serial I/O Transmitters
- Serial Input Displays
- Large Digit Displays
- Bargraph Meters



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