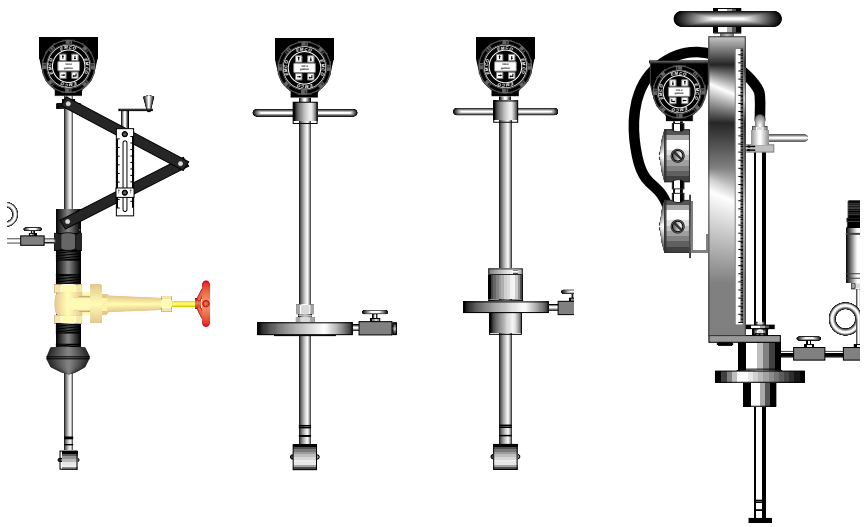
insertion turbine flowmeter

# Model Turbo-Bar™ General Specification

**TMP-600/60S**
**TMP-700**
**TMP-800/80S**
**TMP-910/960**

## Features

- **Fluid types: liquid, gas or steam**
- **Pipe sizes: 3 to 80 in. (80 to 2000 mm)**
- **Rugged construction**
- **Interchangeable rotors for a wide variety of applications**
- **Process pressure up to 5000 psig (345 barg)**
- **Process temperatures up to 750 °F (400 °C)**
- **Industry standard frequency and/or 4 to 20 mA output signals**
- **Optional integral pressure and/or temperature measurement**
- **Optional bidirectional flow rate measurement**
- **Negligible head loss**
- **EZ-Logic™ menu-driven user interface (microprocessor-based)**
- **Linearization with EZ-Logic for enhanced accuracy at low velocities**
- **Local programming via EZ-Logic keypad or magnet wand through explosion-proof enclosure**
- **Compatible with HART® protocol**



EMCO's Turbo-Bar Insertion Turbine flowmeters measure flow rates for a variety of fluids and pipe sizes. Unlike an inline flowmeter, which replaces a section of pipe, an insertion meter is “tapped” into the flow line and can be mounted virtually anywhere.

EMCO's Turbo-Bar insertion flowmeters have three main components: the retractor, the rotor, and the electronics. The retractor positions the rotor within the pipe and houses a pick-up assembly, which detects the rotation of the turbine rotor. The electronics converts the rotational frequency, which is proportional to the velocity of the fluid, to industry standard electrical output signals.

Most Turbo-Bar flowmeters can be installed on an isolation valve, which permits installation and removal without process shutdown. Integral pressure and/or temperature measurement may be combined with the Turbo-Bar and flow processor to provide mass or energy flow measurement from a single pipe tap.

EMCO

**Engineering Measurements Company**
*303.651.0550 • 303.678.7152 Fax*
*sales@emcoflow.com*

ISO 9001 QUALITY SYSTEM CERTIFIED

## Application Guide

| Model | Liquid | Gas | Steam | Hot Tap | Temperature Range | | Maximum Pressure[1] | | Seal Type | Line Sizes | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | °F | °C | psi | bar | | in. | mm |
| **600** | yes | yes | no | yes | –40 to 400 | –40 to 204 | 125 | 8.62 | Viton™ | 3 to 80 | 80 to 2000 |
| **60S** | no | no | yes | yes | –65 to 400 | –54 to 204 | 125 | 8.62 | E/P[3] | 3 to 80 | 80 to 2000 |
| **700** | yes | yes | yes | no[5] | –200 to 600 | –129 to 316 | 5000[4] | 345[4] | Swagelok™ | 3 to 80 | 80 to 2000 |
| **800** | yes | yes | no | yes | –40 to 400 | –40 to 204 | 50 | 3.45 | Viton™ | 3 to 80 | 80 to 2000 |
| **80S** | no | no | yes | yes | –65 to 400 | –54 to 204 | 50 | 3.45 | E/P[3] | 3 to 80 | 80 to 2000 |
| **910** | yes | yes | yes | yes | –200 to 400 | –129 to 204 | flange rating | | Teflon™ | 3 to 80 | 80 to 2000 |
| **960** | yes | yes | yes | yes | –200 to 750 | –129 to 400 | flange rating | | Grafoil™ | 3 to 80 | 80 to 2000 |

1. *Maximum pressure at maximum temperature with appropriate connection.*
2. *In some cases, especially in large pipe sizes, a one or two foot stem extension may be required (See dimensional outlines).*
3. *Ethylene-Propylene elastomer.*
4. *Rating listed is for NPT connection. For flange connections, use ANSI flange rating.*
5. *The TMP-700 is a fixed insertion meter; it cannot be removed or installed under pressure.*

## Operating Specifications

### Measurable Velocity Limits
See Rotor Selection Guide, p. 5, for linear and measurable ranges of available rotors. Continuous operation above the maximum velocity will shorten the life of the rotor and is not recommended.

### Bidirectional Flow
Includes two electromagnetic pick-up assemblies, one for sensing forward flow and one for sensing reverse flow. Specify either the PA2 (frequency) or P2Q2 (current) preamplifier for bidirectional applications. The PA2 provides a relay output indicating flow direction. The P2Q2 provides two 4 to 20 mA signals – one for each direction of flow.
*Note: EZ-Logic electronics not available for bidirectional flow measurement.*

### Process Viscosity
Maximum 5 centipoise

### Ambient Temperature Limit
EZ-Logic Electronics ..... 32 to 140 °F (0 to 60 °C)
All Other Electronics..... –20 to 140 °F (–40 to 60 °C)

### Ambient Humidity Limit
0 to 100% relative humidity non-condensing

### Power Requirements
**EZ-Logic Electronics**
18 to 40 VDC (with totalizer on), 24 VDC nominal
12 to 40 VDC (with totalizer off), 24 VDC nominal

**All Other Electronics**
15 to 40 VDC, 24 V dc nominal

### Output Signals
**EZ-Logic Electronics (LOC-TOT Option)**

**Analog**
4 to 20 mA, 2-wire system, digitally adjusted span

**Frequency**
3-wire system, 1 to 10,000 Hz square wave, 50% duty cycle.
- Low Level: 0 to 1 volts
- High Level: power supply voltage-load

**Pulse**
3-wire system. Output can be scaled so that 1 pulse indicates a specific quantity of fluid passing through the pipe.

**Hart Communications Protocol**

**Display**
2-line by 8-character LCD digital display alternately show flow rate and totalized flow in user-selectable engineering units.

**PA1 Electronics**
Frequency, 3-wire; 10 Vp–p square wave

**PA2 Electronics**
Bidirectional frequency, 3-wire; 10 Vp–p square wave with internal form-C relay (10 VA) for flow direction

**PAQ Electronics**
Current, 2-wire; 4 to 20 mA, 1 second time constant.

**P2Q2 Electronics**
Bidirectional current; two 4 to 20 mA outputs, one for each flow direction.


Engineering Measurements Company
Tel: (303) 651-0550 • FAX: (303) 678-7152 • sales@emcoflow.com
EMCO

## Performance Specifications

**Accuracy (linear ranges)**
L1, G1–G5 rotors ..... ± 1.0% of reading
G6 rotor ..... ± 3.0% of reading

**Repeatability (linear range)**
± 0.25% of reading

**Rotor Velocity Calibration**
Each rotor is factory calibrated in either water or air. Calibration is traceable to NIST.

**Accuracy of the Calibration Standard (linear range)**
Water.....± 0.25% of reading
Air.....± 0.8% of reading

## Physical Specifications

**Materials**

| | |
|---|---|
| Rotor ..... | Blades: 17–4 PH, ten blade, precision machined<br>Housing: 316 stainless steel<br>Pivots: tungsten carbide |
| Rotor Bearing Type: | |
| Liquid ..... | CSJ stellite jewel |
| Gas or Steam ..... | DEV tungsten carbide |
| Wetted Parts ..... | 316L stainless steel stem and housing (bronze & carbon steel housing TMP-600/60S) |
| External Parts ..... | Aluminum, 316 stainless steel,carbon steel (bronze & carbon steel on TMP-600/60S, TMP- 910/960) |
| Electrical Enclosure ..... | 383 Aluminum. Approved for NEMA 4X for watertight and dust tight requirements. |

**Electrical Connection**
Junction box with terminal block for external wiring. 3/4" female NPT connection for conduit.

**Sensor**
Electromagnetic pick–up, 10 mVp–p minimum, 330 Ω nominal resistance.

**Retractor Type**
TMP-600/60S.....Screw thread, rising stem
TMP-700 .....Not retractable
TMP-800/80S.....Manual rising stem
TMP-910/960 .....Acme thread, non-rising stem

**Extended Length Stem (Optional)**
Longer stems are available for large pipe sizes or when the mounting dimensions exceed the insertion capability. Extended stems are not available for the TMP-600/60S.
*Note: Use of the two foot extension is limited to gas applications only.*

**Process Connection**

| | |
|---|---|
| TMP-600/60S..... | 2" NPT |
| TMP-700 ..... | 2" NPT or<br>2" 150#, 300#, 600# or 900# ANSI raised face flange |
| TMP-800/80S..... | 2" NPT or<br>2" 150# ANSI raised face flange |
| TMP-910/960 | 2" 150#, 300#, 600#, 900#, or 1500# ANSI raised face flange |

**Isolation Valve (TMP-600/60S only)**
2" full port bronze gate valve, 125 psi (8.62 bar) maximum. For TMP-800/80S and TMP-910/960, see Accessories.

**Pressure Tap and Bleed Valve**
Standard 1/4" NPT pipe nipple with 1/4" stainless steel bleed valve. Provides connections for mounting optional pressure transmitter (Model PT).

**Model PT Pressure Transmitter (Optional)**
A pressure transmitter can be mounted using the 1/4" NPT connection on the bleed valve supplied with the meter, eliminating the need for a separate pressure tap. A 4 to 20 mA output, scaled to the desired pressure range, is provided. All pressure transmitters include a siphon tube, bleed valve, plug, nipple, and tee. A pressure transmitter is not available with 110/220 VAC power. See the PT General Specifications for complete details.

**Temperature Sensor (RTD Option)**
A 1000 Ω, platinum RTD can be mounted inside the stem of the flowmeter probe, eliminating the need for a separate temperature tap.

**Temperature Transmitter (TXX Option)**
Includes the RTD option with an additional 4 to 20 mA output, scaled to the desired temperature range. A temperature transmitter is not available with 110/220 VAC power and is not CE approved.

**Remote Mount Electronics (RMT Option)**
30 ft (9.1 m) signal cable and U-bolts are provided with remote mount electronics. Cable must be run in conduit (conduit not supplied). Conduit connection is 3/4" NPT.
*Note: Remote mount electronics is only available with EZ-Logic electronics (LOC-TOT Option).*

**FM Approval (FM Option)**
Certified by FM for Class I, Division 2, Groups A, B, C and D; Classes II, III, Division 2, Groups F and G NEMA 4X locations.
*Note: FM not available when used with 4 to 20 mA temperature transmitter or pressure transmitter 0–1000 or special scaled.*

**European CE Mark**
European CE mark when used with EZ-Logic electronics and without a 4 to 20 mA temperature output.

## Accessories

**Gate Valve (Model 2GV)**
**(For use with TMP-800/80S and TMP-910/960 only)**
Installation with a 2" double flanged, raised-face, full port gate valve enables the flow sensor to be inserted and removed from the pipe under full flow conditions. Both the valve and pipe tap must have a minimum 1.875 in. (48 mm) internal diameter clearance.

**Flow Rectifier (Model EFR)**
A flow rectifier (EFR) is recommended when there is insufficient straight pipe run or flow disturbance. When using an EFR, the straight pipe run can be a combination of 5 pipe diameters upstream and 2 pipe diameters downstream, instead of the standard 10 and 5.

**Flow Processors (Models FP-93 and FP-100)**
A microprocessor-based flow processor can be used to significantly increase the accuracy and functionality of any flowmetering application. See the FP-93 or FP-100 General Specifications for complete details.

## Straight Run Piping Requirements

| | Upstream | Downstream |
|---|---|---|
| One 90° elbow before the meter | 10 D | 5 D |
| Two 90° elbows before the meter | 15 D | 5 D |
| Two 90° elbows out of plane before the meter | 30 D | 5 D |
| Reduction before the meter | 10 D | 5 D |
| Regulator or valve partially closed before the meter | 30 D | 5 D |

*D is equal to the internal diameter of the pipe.*
*If there is not sufficient straight run of pipe, a flow rectifier can be used to reduce the above lengths. Consult your local representative or the factory for your application.*

## Other Installation Considerations

**Tap Size**
1.875 in. (47.6 mm) minimum diameter.

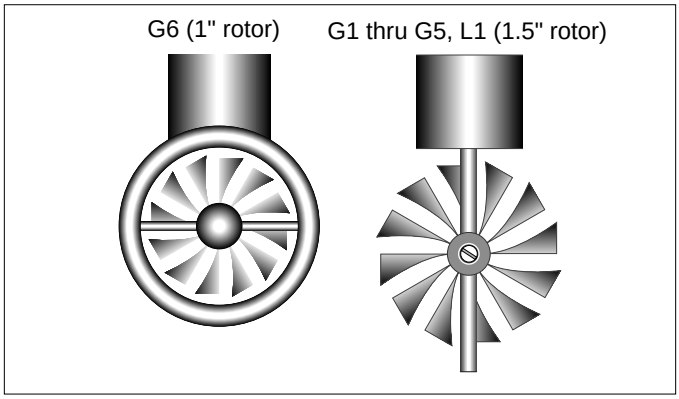
**Mounting Position**
Turbo-Bar probes may be installed in vertical, horizontal, or angled pipe sections. The meter is attached perpendicular to the axis of the pipe and should not be mounted “upside-down” (with its top section hanging below the pipe mount). For liquid service, the fluid must completely fill the pipe.

**Site Selection**
The flow measurement location should be selected to minimize turbulence and swirl. The extent of these flow disturbances depends upon the piping configuration. Valves, elbows, pumps, and other piping components may add disturbances to the flow.

**Hot Tap Comapatibility**
The TMP-600/60S is hot tap compatible, which means that the sensor can be installed and removed under full flow conditions. The TMP-800/80S with flanged connection and TMP-910/960 are hot tap compatible when installed with a 2" double flanged, full port ball or gate valve that adheres to the dimensions of the gate valve on page 7.


Engineering Measurements Company
Tel: (303) 651-0550 • FAX: (303) 678-7152 • sales@emcoflow.com

# Rotor Selection Guide




Selection of the turbine rotor model depends upon the fluid type and operating velocity range of the fluid.

- For *all liquids*, the model L1 rotor, with a maximum velocity of 30 ft/s (9 m/s), must be used.
- For gases and steam, six different rotors are available with maximum velocities ranging from 55 to 175 ft/s (17 to 53 m/s). See Table for maximum velocity limits ($V_{max.}$) for all rotors.

*Note: Rotors have moving parts that require periodic maintenance.*

The turbine rotor typically will respond linearly over the velocity range from $V_{lin}$ to $V_{max}$ – within ± 1.0% (3.0% for G6 rotor). This is defined as the "linear" range of the rotor. The minimum "measurable" velocity ($V_{min}$) can be considered the application minimum. Velocities from $V_{min}$ to $V_{lin}$ are tmeasurable and repeatable, but less accurate.

When determining the fluid velocity limits for a given rotor, the following equations can be used to compute fluid velocity

| Average Fluid Velocity | | |
|---|---|---|
| **Fluid** | **English** | **Metric** |
| **Liquid** | $0.4085 \frac{Q_l}{D^2}$ | $353.7 \frac{Q_l}{D^2}$ |
| **Gas** | $3.056 \frac{Q_g}{D^2}$ | $353.7 \frac{Q_g}{D^2}$ |
| **Steam** | $0.051 \frac{M}{\rho \cdot D^2}$ | $353.7 \frac{M}{\rho \cdot D^2}$ |
| Where: | | |
| V = average fluid velocity | ft/s | m/s |
| D = pipe inside diameter | in. | mm |
| $Q_l$ = liquid volumetric flow | gal/min | $m^3/h$ |
| $Q_g$ = gas actual volumetric flow | $ft^3/min$ | $m^3/h$ |
| M = mass flow rate | lb/h | kg/h |
| ρ = fluid density | $lb/ft^3$ | $kg/m^3$ |

| Liquid Minimum and Maximum Velocity Rates | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Rotor** | **Flow Units** | **All Sizes** | **3–5" (80–125mm)** | | **6" (150mm)** | | **8+" (200+mm)** | |
| | | $V_{max}$ | $V_{lin}$ | $V_{min}$ | $V_{lin}$ | $V_{min}$ | $V_{lin}$ | $V_{min}$ |
| L1 | ft/s | 30 | 1.4 | 0.5 | 1.5 | 0.6 | 1.6 | 0.7 |
| | m/s | 9 | 0.4 | 0.2 | 0.5 | 0.2 | 0.5 | 0.2 |

| Gas or Steam Minimum and Maximum Velocity Rates (ft/s) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Rotor** | **All Sizes** | **3—5 in.** | | **6 in.** | | **8+ in.** | |
| | $V_{max}$ | $V_{lin}$ | $V_{min}$ | $V_{lin}$ | $V_{min}$ | $V_{lin}$ | $V_{min}$ |
| G1 40¡ pitch | 55 | $3.19/\sqrt{\rho}$ | $1.94/\sqrt{\rho}$ | $2.00/\sqrt{\rho}$ | $1.23/\sqrt{\rho}$ | $1.50/\sqrt{\rho}$ | $1.00/\sqrt{\rho}$ |
| G2 30¡ pitch | 70 | $3.98/\sqrt{\rho}$ | $2.26/\sqrt{\rho}$ | $2.27/\sqrt{\rho}$ | $1.63/\sqrt{\rho}$ | $1.90/\sqrt{\rho}$ | $1.31/\sqrt{\rho}$ |
| G3 20¡ pitch | 85 | $4.52/\sqrt{\rho}$ | $2.42/\sqrt{\rho}$ | $2.52/\sqrt{\rho}$ | $1.95/\sqrt{\rho}$ | $2.18/\sqrt{\rho}$ | $1.40/\sqrt{\rho}$ |
| G4 15¡ pitch | 115 | $5.84/\sqrt{\rho}$ | $3.85/\sqrt{\rho}$ | $3.78/\sqrt{\rho}$ | $2.84/\sqrt{\rho}$ | $3.00/\sqrt{\rho}$ | $2.19/\sqrt{\rho}$ |
| G5 10¡ pitch | 145 | $6.91/\sqrt{\rho}$ | $4.57/\sqrt{\rho}$ | $4.78/\sqrt{\rho}$ | $3.47/\sqrt{\rho}$ | $3.54/\sqrt{\rho}$ | $2.81/\sqrt{\rho}$ |
| G6[1] 5¡ pitch | 175 | $6.10/\sqrt{\rho}$ | N/A | $5.53/\sqrt{\rho}$ | N/A | $5.00/\sqrt{\rho}$ | N/A |
| **Gas or Steam Minimum and Maximum Velocity Rates (m/s)** | | | | | | | |
| **Rotor** | **All Sizes** | **80-125 mm** | | **150 mm** | | **200 mm** | |
| | $V_{max}$ | $V_{lin}$ | $V_{min}$ | $V_{lin}$ | $V_{min}$ | $V_{lin}$ | $V_{min}$ |
| G1 40¡ pitch | 17 | $3.89/\sqrt{\rho}$ | $2.37/\sqrt{\rho}$ | $2.44/\sqrt{\rho}$ | $1.50/\sqrt{\rho}$ | $1.83/\sqrt{\rho}$ | $1.22/\sqrt{\rho}$ |
| G2 30¡ pitch | 21 | $4.86/\sqrt{\rho}$ | $2.76/\sqrt{\rho}$ | $2.77/\sqrt{\rho}$ | $2.00/\sqrt{\rho}$ | $2.32/\sqrt{\rho}$ | $1.60/\sqrt{\rho}$ |
| G3 20¡ pitch | 26 | $5.51/\sqrt{\rho}$ | $2.95/\sqrt{\rho}$ | $3.07/\sqrt{\rho}$ | $2.38/\sqrt{\rho}$ | $2.67/\sqrt{\rho}$ | $1.71/\sqrt{\rho}$ |
| G4 15¡ pitch | 35 | $7.12/\sqrt{\rho}$ | $4.70/\sqrt{\rho}$ | $4.61/\sqrt{\rho}$ | $3.46/\sqrt{\rho}$ | $3.66/\sqrt{\rho}$ | $2.67/\sqrt{\rho}$ |
| G5 10¡ pitch | 44 | $8.43/\sqrt{\rho}$ | $5.57/\sqrt{\rho}$ | $5.83/\sqrt{\rho}$ | $4.23/\sqrt{\rho}$ | $4.32/\sqrt{\rho}$ | $3.43/\sqrt{\rho}$ |
| G6[1] 5¡ pitch | 53 | $7.44/\sqrt{\rho}$ | N/A | $6.75/\sqrt{\rho}$ | N/A | $6.10/\sqrt{\rho}$ | N/A |

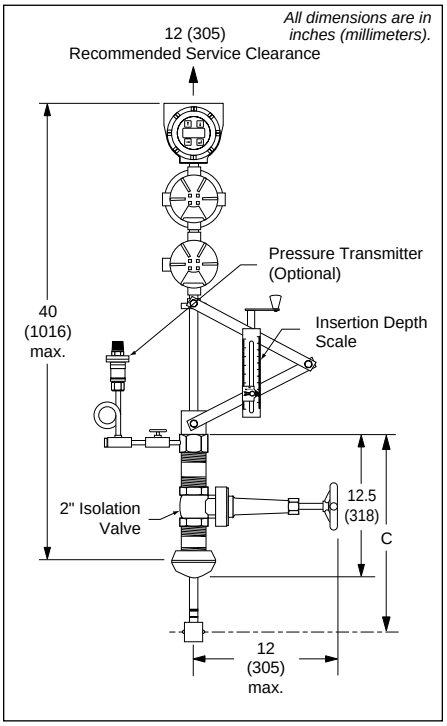
*1. The G6, 1" bidirectional rotor, is not available.*
*2. All values in the above table are approximate and depend on the density of the fluid. Accuracy in both the linear, and nonlinear, ranges may be improved by using the advanced curve fitting techniques present in one of EMCO's flow processors or the EZ-Logic electronics. Consult EMCO if your application falls outside the above limits.*

$V_{max}$ = *maximum velocity of fluid [ft/s (m/s)]*
$V_{lin}$ = *minimum velocity of fluid at which rotor response is linear [ft/s (m/s)]*
$V_{min}$ = *minimum measurable velocity of fluid [ft/s (m/s)]*
ρ = *density of fluid [$lb/ft^3$ ($kg/m^3$)]*
*N/A* = *not applicable*

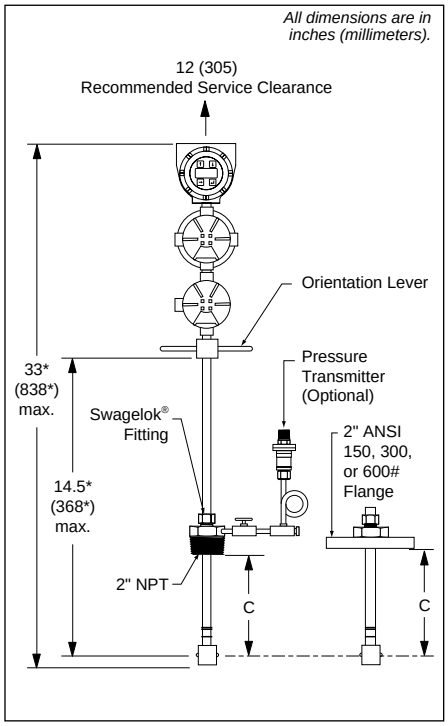
**For EMCO Flowmeter Sizing**
**Download emcosizing program "emcosize" at www.emcoflow.com**

# Dimensions and Weights

## TMP-600/60S




## TMP-700




* Add 12 in. (305 mm) for each additional foot of retractor length.

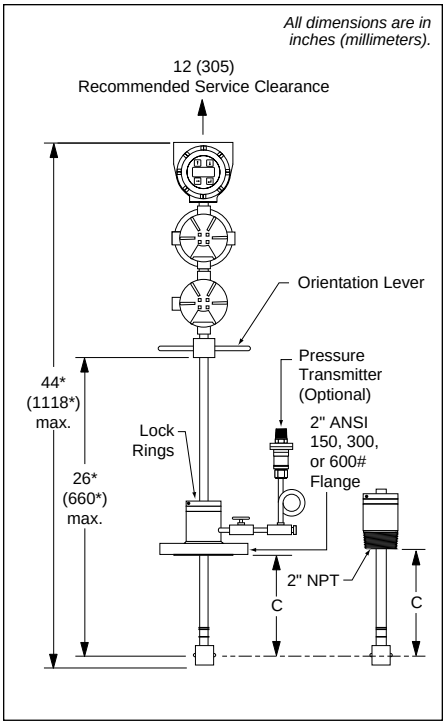
## Dimension Tables

| Model | Connection | C | |
|---|---|---|---|
| | | in. | mm |
| 600/ 60S | 2" NPT | 4.5 min 18 max | 114 min 457 max |
| 700 | 2" NPT | 3 min 10 max | 76 min 254 max |
| | 2" 150# | 3 min 11.5 max | 76 min 292 max |
| | 2" 300# | 3 min 11.25 max | 76 min 285 max |
| | 2" 600# | 3 min 11 max | 76 min 279 max |
| | 2" 900# | 3 min 10.75 max | 76 min 273 max |
| 800/ 80S | 2" NPT & 2" 150# | 2 min 20 max | 51 min 508 max |

| Model | Stem Length | B | | A | |
|---|---|---|---|---|---|
| | | in. | mm | in. | mm |
| 910/ 960 | Standard | 1.5 min 20 max | 38 min 508 max | 30 | 762 |

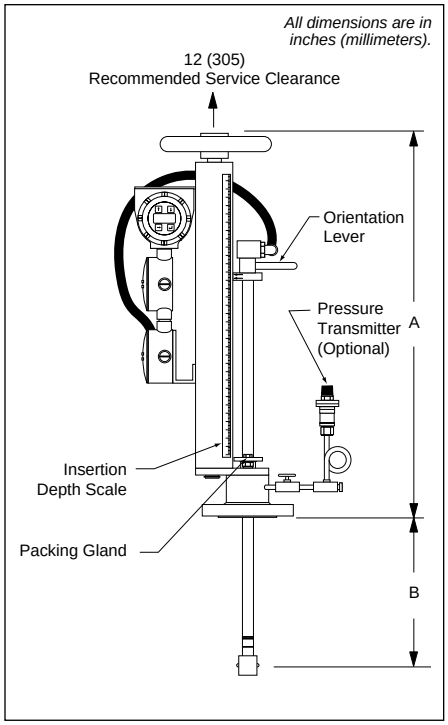
* Add 12 in. (305 mm) for each additional foot of retractor length.

## TMP-800/80S




* Add 12 in. (305 mm) for each additional foot of retractor length.

## TMP-910/960




* Add 12 in. (305 mm) for each additional foot of retractor length.

## Weight

| Model | Connection | Weight | |
|---|---|---|---|
| | | lb | kg |
| 60S | 2" NPT | 28 max. | 12.7 max. |
| 700 | 2" NPT | 9* | 4.1* |
| | 2" 150# | 12* | 5.4* |
| | 2" 300# | 14* | 6.3* |
| | 2" 600# | 16* | 7.2* |
| | 2" 900# | 20* | 9.1* |
| 800/ 80S | 2" NPT | 11* | 5.0* |
| | 2" 150# | 17* | 7.7* |
| 960 | 2" 150# | 30** | 13.6** |
| | 2" 300# | 35** | 15.8** |
| | 2" 600# | 40** | 18.1** |
| | 2" 900# | 47** | 21.3** |

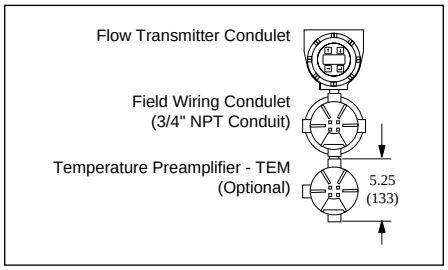
* Add 2.5 lb (1.2 kg) for each additional foot of retractor length.
** Add 5 lb (2.3 kg) for each additional foot of retractor length.


Engineering Measurements Company
Tel: (303) 651-0550 • FAX: (303) 678-7152 • sales@emcoflow.com
EMCO

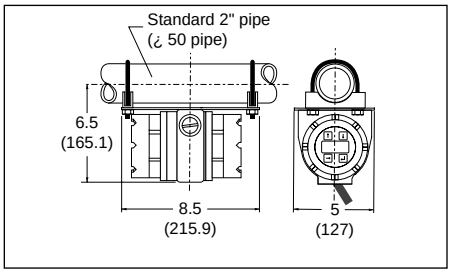
# Dimensions and Weights

*All dimensions are in inches (millimeters).*

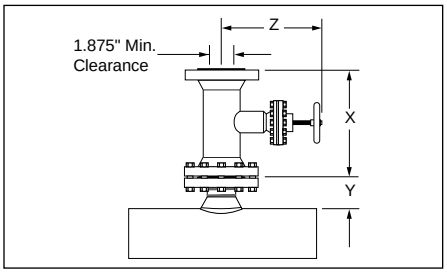
## Integral Electronics




## Pipe Mount Remote Electronics

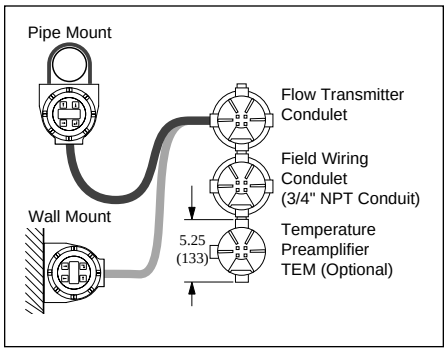



## Gate Valve

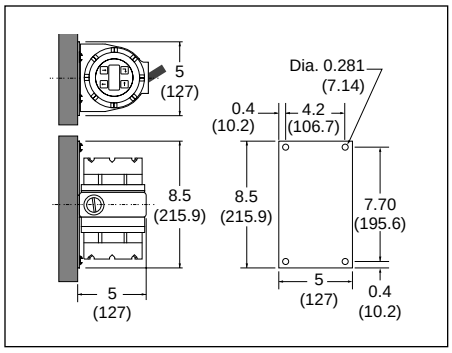



*Gate valve is intended for use with the TMP-800/80S and TMP-910/960 only.*

## Remote Electronics Configuration




## Pipe Mount Remote Electronics




| Type | X | | Y | | Z | |
|---|---|---|---|---|---|---|
| | in. | mm | in. | mm | in. | mm |
| **150#** | 7 | 177.8 | 3.5 | 88.9 | 15.325 | 389.3 |
| **300#** | 8.5 | 215.9 | 3.75 | 95.3 | 16.325 | 414.7 |
| **600#** | 11.5 | 292.1 | 3.75 | 95.3 | 17.875 | 454.0 |

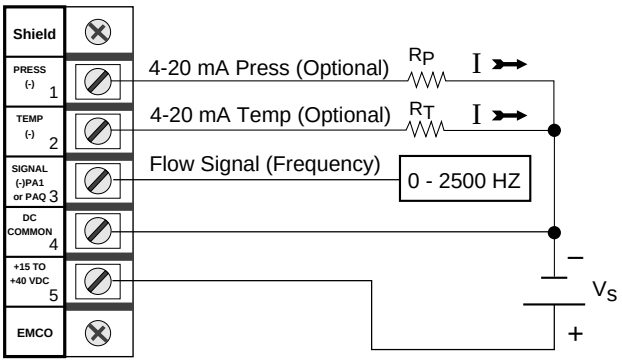
| Type | Weight | |
|---|---|---|
| | lb | kg |
| **2" 150#** | 46 | 20.9 |
| **2" 300#** | 58 | 26.3 |
| **2" 600#** | 84 | 38.1 |

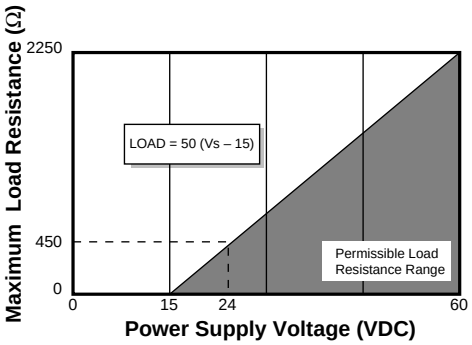
*For flange kit, add 14 pounds (6.4 kilograms) to weight.*

# Wiring Diagrams

## PA1 Electronics

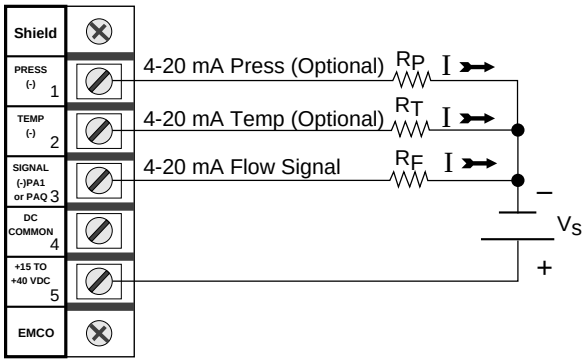
Frequency, 3-wire; 10 Vp–p square wave. $V_s$ = 15–40 VDC. See graph below for permissible $R_{load}$ values.

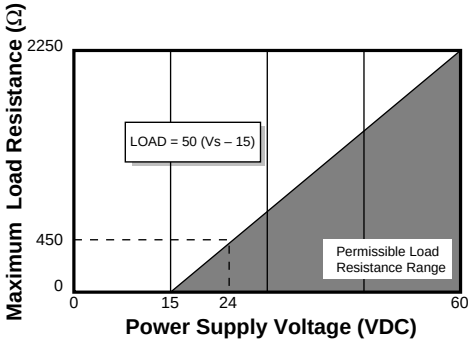



## PAQ Electronics

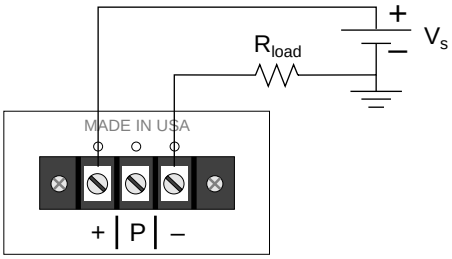
Current, 2-wire; 4 to 20 mA, 1 second time constant. Vs = 15–40 VDC. See graph below for permissible $R_{load}$

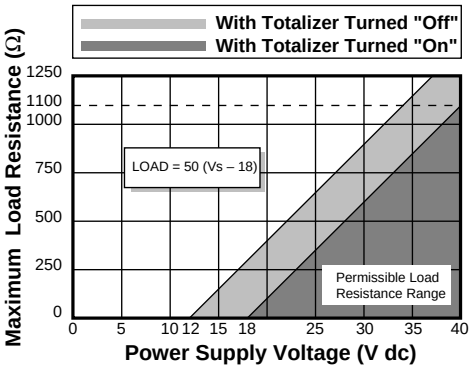



## EZ-Logic Electronics: Analog Output

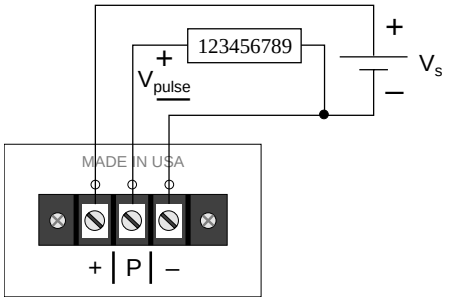
Scalable 4 to 20 mA output, 2-wire principle. Load resistor may be installed on supply or return line. $V_s$ = 18–40 VDC. See graph below for permissible $R_{load}$ values.




## EZ-Logic Electronics: Pulse Output

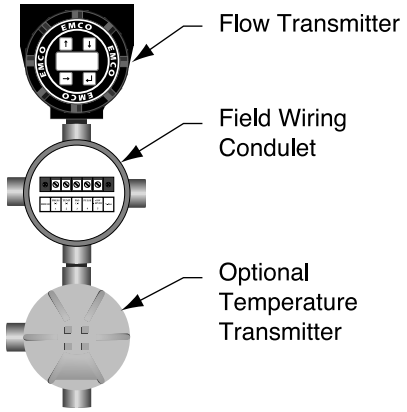
3 wire system. Output can be scaled so that 1 pulse indicates a specific quantity of fluid passing through the pipe. $V_s$ = 18–40 VDC.





Engineering Measurements Company
Tel: (303) 651-0550 • FAX: (303) 678-7152 • sales@emcoflow.com
EMCO

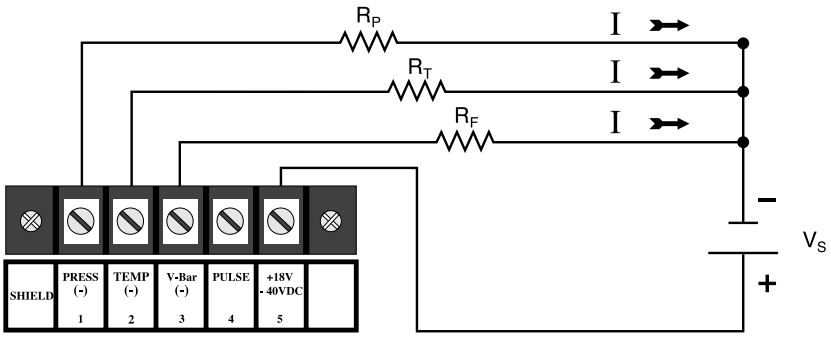
## Pressure and Temperature Transmitter Wiring




Remove the field wiring condulet cap to access the field wiring terminal block for power and signal wiring. Flow, pressure, and temperature output wiring connects to the terminal block. Refer to the previous section on 24 VDC power and signal wiring for appropriate load resistance and power supply values. Pressure and temperature transmitters are scaled to the appropriate ranges at the factory.

*Note: Maximum voltage with optional pressure transmitter is 30 VDC and 110/220 VAC power supply is not available with pressure and/or temperature transmitters.*

**Wiring with analog output:**

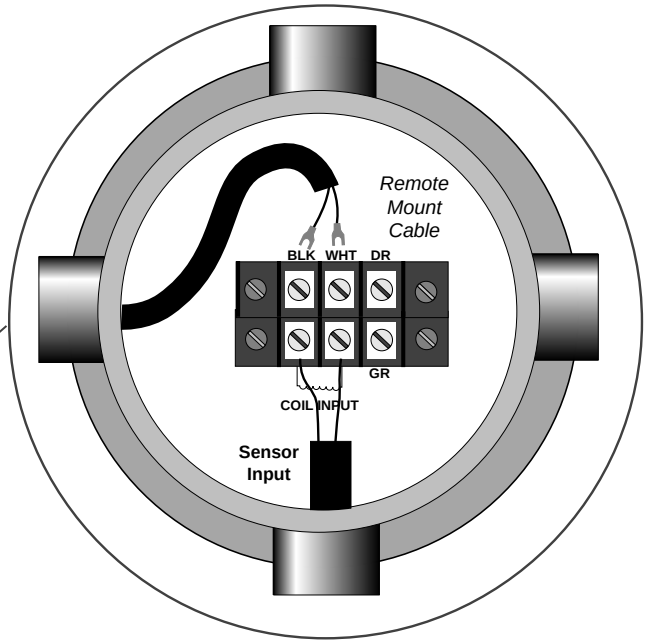


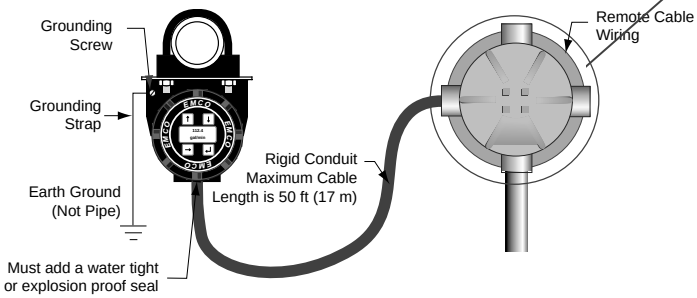

where:
$V_s$ = 18–30 VDC
$R_p$ = Pressure measuring resistance
$R_T$ = Temperature measuring resistance
$R_F$ = Flow rate measuring resistance

## Remote Mount Wiring Diagram (Only available with EZ-Logic Electronics)

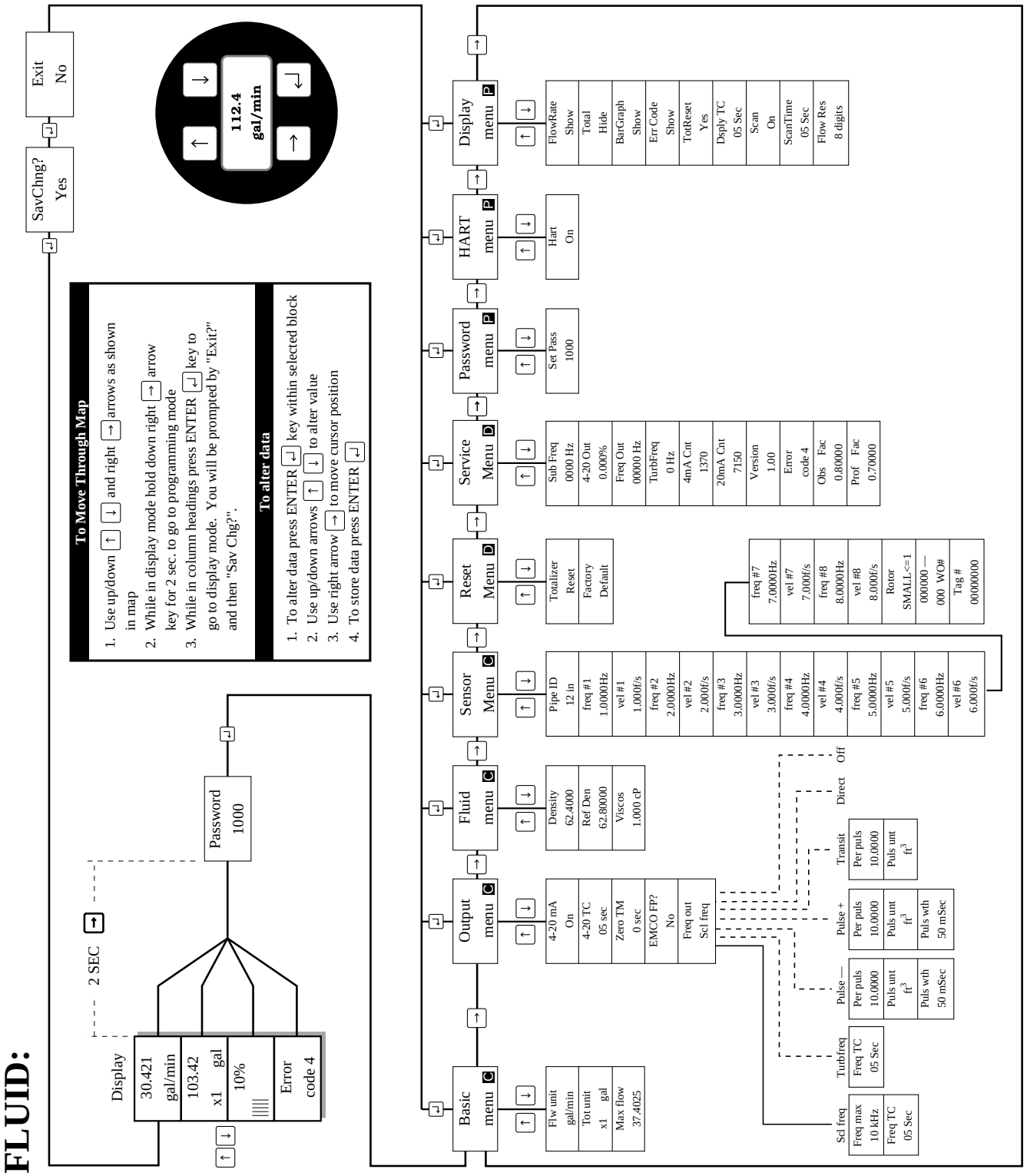
Output wiring from remote electronics is identical to output wiring from integral electronics. Wiring from the remote electronics condulet to the electrical junction box must be performed in the field. Connect the remote cable to the terminal block in the junction box as shown. If nonconductive conduit is used, attach a ground strap from the ground screw on the remote electronics condulet. If the remote cable is cut to a shorter length, insulate shield with tape at electrical junction box.

*Note: If remote mounting is required with a pressure and/or temperature transmitter, two power supplies are required for operation: one for the remote flow transmitter and one for the pressure and/or temperature transmitter.*



# Customer Name




# Work Order #


Engineering Measurements Company
Tel: (303) 651-0550 • FAX: (303) 678-7152 • sales@emcoflow.com

# Model and Suffix Codes

| Category | Description | Suffix Codes | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Model | Liquid or gas service, 400 °F (204 °C) | TMP-600 | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| | Steam service, 400 °F (204 °C) | TMP-60S | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| | Liquid, gas, or steam service, 600 °F (316 °C) | TMP-700 | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| | Liquid or gas service, 400 °F (204 °C) | TMP-800 | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| | Steam service, 400 °F (204 °C) | TMP-80S | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| | Liquid, gas, or steam service, 400 °F (204 °C) | TMP-910 | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| | Liquid, gas, or steam service, 750 °F (400 °C) | TMP-960 | . . . | . . . | . . . | . . . | . . . | . . . | . . . |
| Connection | 2", male NPT (model 700, 800, 80S) | . . . | 2NPT | . . . | . . . | . . . | . . . | . . . | . . . |
| | 2", 150# flange (model 700, 800, 80S, 910, 960) | . . . | 2F150 | . . . | . . . | . . . | . . . | . . . | . . . |
| | 2", 300# flange (model 700, 910, 960) | . . . | 2F300 | . . . | . . . | . . . | . . . | . . . | . . . |
| | 2", 600# flange (model 700, 910, 960) | . . . | 2F600 | . . . | . . . | . . . | . . . | . . . | . . . |
| | 2", 900# flange (model 700, 910, 960) | . . . | 2F900 | . . . | . . . | . . . | . . . | . . . | . . . |
| | 2", 1500# flange (model 910, 960) | . . . | 2F1500 | . . . | . . . | . . . | . . . | . . . | . . . |
| | Thread-o-let, xx = 03-80 inches (models 600, 60S) includes 2" isolation valve | . . . | VXX | . . . | . . . | . . . | . . . | . . . | . . . |
| Rotor | Liquid, 30 ft/s maximum (9 m/s) (40° pitch) | . . . | . . . | L1 | . . . | . . . | . . . | . . . | . . . |
| | Gas or steam, 55 ft/s (17 m/s) maximum (40° pitch) | . . . | . . . | G1 | . . . | . . . | . . . | . . . | . . . |
| | Gas or steam, 70 ft/s (21 m/s) maximum (30° pitch) | . . . | . . . | G2 | . . . | . . . | . . . | . . . | . . . |
| | Gas or steam, 85 ft/s (26 m/s) maximum (20° pitch) | . . . | . . . | G3 | . . . | . . . | . . . | . . . | . . . |
| | Gas or steam, 115 ft/s (35 m/s) maximum (15° pitch) | . . . | . . . | G4 | . . . | . . . | . . . | . . . | . . . |
| | Gas or steam, 145 ft/s (44 m/s) maximum (10° pitch) | . . . | . . . | G5 | . . . | . . . | . . . | . . . | . . . |
| | Gas or steam, 175 ft/s (53 m/s) maximum (5° pitch)[1] | . . . | . . . | G6 | . . . | . . . | . . . | . . . | . . . |
| | For bidirectional rotor | . . . | . . . | XXB | . . . | . . . | . . . | . . . | . . . |
| Electronics | 10 V p-p frequency output[2] | . . . | . . . | . . . | PA1 | . . . | . . . | . . . | . . . |
| | Bidirectional, 10 V p-p frequency output (relay)[2] | . . . | . . . | . . . | PA2 | . . . | . . . | . . . | . . . |
| | 4 to 20 mA current output[2] | . . . | . . . | . . . | PAQ | . . . | . . . | . . . | . . . |
| | Bidirectional, two 4 to 20 mA current outputs[2] | . . . | . . . | . . . | P2Q2 | . . . | . . . | . . . | . . . |
| | EZ-Logic with local rate and total[3] | . . . | . . . | . . . | LOC-TOT | . . . | . . . | . . . | . . . |
| | Remote, only available with LOC-TOT option[4] | . . . | . . . | . . . | RMT | . . . | . . . | . . . | . . . |
| | FM Approval[5] | . . . | . . . | . . . | FM | . . . | . . . | . . . | . . . |
| Pressure Transmitter | No pressure transmitter | . . . | . . . | . . . | . . . | XX | . . . | . . . | . . . |
| | PT for pressure range 0–50 psig (0–3.44 barg) | . . . | . . . | . . . | . . . | 50 | . . . | . . . | . . . |
| | 0–100 psig (0–6.89 barg) (models 600/60S, 700, 910/960) | . . . | . . . | . . . | . . . | 100 | . . . | . . . | . . . |
| | 0–150 psig (0–10.34 barg) (models 600/60S, 700, 910/960) | . . . | . . . | . . . | . . . | 150 | . . . | . . . | . . . |
| | 0–200 psig (0–13.79 barg) (models 600/60S, 700, 910/960) | . . . | . . . | . . . | . . . | 200 | . . . | . . . | . . . |
| | 0–250 psig (0–17.24 barg) (models 700, 910/960) | . . . | . . . | . . . | . . . | 250 | . . . | . . . | . . . |
| | 0–500 psig (0–34.47 barg) (models 700, 910/960) | . . . | . . . | . . . | . . . | 500 | . . . | . . . | . . . |
| | 0–1000 psig (0–68.95 barg) (models 700, 910/960) | . . . | . . . | . . . | . . . | 1000 | . . . | . . . | . . . |
| | Special scaling requests[6] | . . . | . . . | . . . | . . . | PXX | . . . | . . . | . . . |
| Temperature Sensor or Transmitter | No temperature transmitter | . . . | . . . | . . . | . . . | . . . | XXX | . . . | . . . |
| | RTD only | . . . | . . . | . . . | . . . | . . . | RTD | . . . | . . . |
| | Temperature sensor with preamplifier scaled from 32 to 68 °F[2] | . . . | . . . | . . . | . . . | . . . | T09 | . . . | . . . |
| | 0 to 250 °F[2] | . . . | . . . | . . . | . . . | . . . | T10 | . . . | . . . |
| | –40 to 150 °F[2] | . . . | . . . | . . . | . . . | . . . | T11 | . . . | . . . |
| | 212 to 400 °F[2] | . . . | . . . | . . . | . . . | . . . | T12 | . . . | . . . |
| | 212 to 800 °F (models 700, 960)[2] | . . . | . . . | . . . | . . . | . . . | T13 | . . . | . . . |
| | –17.7 to 121.1 °C[2] | . . . | . . . | . . . | . . . | . . . | T20 | . . . | . . . |
| | –40 to 65 °C[2] | . . . | . . . | . . . | . . . | . . . | T21 | . . . | . . . |
| | 100 to 204 °C[2] | . . . | . . . | . . . | . . . | . . . | T22 | . . . | . . . |
| | 100 to 260 °C (models 700, 910/960)[2] | . . . | . . . | . . . | . . . | . . . | T23 | . . . | . . . |
| | Special scaling requests[6,2] | . . . | . . . | . . . | . . . | . . . | TXX | . . . | . . . |
| Extended Stem | None (standard length) | . . . | . . . | . . . | . . . | . . . | . . . | XX | . . . |
| | 1' extension (not available for models 600/60S) | . . . | . . . | . . . | . . . | . . . | . . . | E1 | . . . |
| | 2' extension (gas/steam applications only) (not available for models 600/60S) | . . . | . . . | . . . | . . . | . . . | . . . | E2 | . . . |
| Pick-up Coil Wires | TMP-700 Only: Teflon, –200 to 400 °F (–129 to 204 °C) | . . . | . . . | . . . | . . . | . . . | . . . | . . . | T |
| | TMP-700 Only: Fiberglass, 150 to 600 °F (65 to 316 °C) | . . . | . . . | . . . | . . . | . . . | . . . | . . . | F |

1. *The G6 is the only available 1" shrouded rotor. Not available for use with bidirectional meters.*
2. *Not available with European CE Mark.*
3. *Unidirectional only. Unit has 4 to 20 mA and frequency output.*
4. *Remote mount electronics are required for high process temperatures. The standard remote mount option comes with 30 feet (9.1 meters) of cable.*
5. *Certified by FM for Class I, Div. 2, Groups A, B, C, & D; Class II,III, Div. 2, Groups F & G; NEMA 4X. FM approval with only LOC-TOT and RMT electronics options. If FM is required, use RTD option only for temperature selection. 0–1000 psia and special sealing pressure transmitter not available with FM.*
6. *Special transmitter scaling is available. Please note scaling range below model code with ordering. If no special scaling is indicated, transmitter will be scaled per model code.*

**EXAMPLE: TMP-910-2F900-G3-PA1-0200-T12-E1**
**(for bidirectional meters): TMP-910-2F900-G3B-PA2-0200-T12-E1**

## ORDERING INSTRUCTIONS

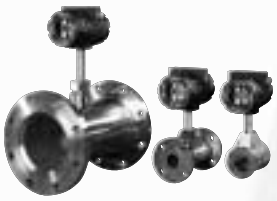
*Please specify the following information with your order:*

- *Fluid type or composition*
- *Maximum, minimum, & normal operating flow rate*
- *Maximum, minimum, & normal operating temperatures*
- *Maximum, minimum, & normal operating pressures*
- *Specific weight & viscosity at normal operating conditions*

# Providing innovative flowmeter products and services for over three decades . . .

Engineering Measurements Company (EMCO) is a long established manufacturer of precision flowmeters for liquid, gas, and steam applications for commerce and industry. Manufactured under an ISO 9001 certified quality system, which includes extensive flow calibration capability, engineering, applications, and service, underpining a world-wide sales and service organization totally focused on providing the best flowmeters and customer service in the industry.

- Manufacturing is housed in a modern plant located in Longmont, Colorado
- Modern clean-room, mechanized assembly equipment, and computer based testing ensure the highest quality product
- Trained professional flow specialists and technicians offer timely customer assistance
- Factory trained and certified field technicians provide product support services



*Vortex PhD™ Inline Vortex*

*V-Bar™ Insertion Vortex*

*Turbo-Bar™ Insertion Turbine*

*MAGFLO® Electromagnetic*

*PDH Helix*

*PDP Piston*

*Sono-Trak™*

EMCO FLOWMETERS

990102 Rev.H
Specifications subject to change without notice

**Engineering Measurements Company**
600 Diagonal Hwy. • Longmont, CO 80501 • (303) 651-0550 • Fax (303) 678-7152 • sales@emcoflow.com