TEKTROL
Technology Solutions

TEK-VOR 1300I

INSERTION VORTEX FLOW METER

FLOW

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Flow | Level | Temperature | Pressure | Valves | Analyzers | Accessories | TekValSys

Introduction

Multi-Parameter Vortex Mass Flow Meters

The Tek-Vor 1300I Insertion Vortex Flow Meters provide a reliable solution for process flow measurement. From a single-entry point in the pipeline, Tek-Vor 1300I meters offer precise measurements of mass or volumetric flowrates.

Multi-Parameter Mass Flow Meters

Mass flow meters utilize three primary sensing elements: a vortex shedding velocity sensor, an RTD temperature sensor, and a solid-state pressure sensor to measure the mass flow rate of gases, liquids, and steam. Meters are available as loop powered devices or with up to three 4-20 mA analog output signals for monitoring your choice of the five process variables (mass flow, volumetric flow, temperature, pressure and fluid density). The Energy Monitoring option permits real-time calculation of energy consumption for a facility or process.

Volumetric Flow Meters

The primary sensing element of a volumetric flow meter is a vortex shedding velocity sensor. Meters are loop powered. The analog 4-20 mA output signal offers your choice of volumetric or mass flow rate. Mass flow rate is based on a constant value for fluid density stored in the instrument's memory. Both the mass and volumetric flow meters can be ordered with a local keypad/display which provides instantaneous flow rate, total, and process parameters in engineering units. A pulse output signal for remote totalization and MODBUS, HART, or BACnet communications are also available. Tek-Trol digital electronics allows for easy reconfiguration for most gases, liquids and steam. The 1300I Vortex Flow Meters' simple installation combines with an easy-to-use interface that provides quick set up, long term reliability and accurate mass flow measurement over a wide range of flows, pressures and temperatures

Measuring Principle

Karman Vortex Street

This flowmeter operates on the principle of Karman Vortex Street, any medium passing through the pipeline flows around the bluff body and sheds a series of alternating vortices on each side of the body. This phenomenon is referred to as Vortex Shedding. These vortices shed downstream of the bluff body and dissipate as they flow further. This pattern of vortices is called a Karman Vortex Street (also called a Von Karman Vortex Street).

Types

1. **Tek-Vor 1300I-VTP**

   The Tek-Vor 1300I-VTP is a small field device that provides flow computer capabilities. The corrected mass flow rate of gases, liquids, and steam may be instantly read thanks to this multivariable device's integration of temperature and pressure sensors. Together with outputs for alarm settings and totalized mass, the field-configurable electronics can provide up to three analog 4-20 mA outputs of five process measurements: density, temperature, pressure, mass flow rate, and volumetric flow rate.

2. **Tek-Vor 1300I-VT**

   A precise 1000 Ohm platinum RTD temperature sensor is integrated into the Tek-Vor 1300I-VT, which can compute and output a corrected mass measurement. Saturated steam flow rates are commonly measured with this apparatus.

3. **Tek -Vor 1300I-V**

   The Tek-Vor 1300I-V provides a direct reading of volumetric flow rate, which is typically the most economical way to monitor liquid flow in applications ranging from measuring the flow of hydrocarbon fuel to general water flows.

Operations

A Vortex flowmeter primarily consists of a bluff body, a sensor assembly, and a transmitter. A bluff body or a shedder is nothing but a non-streamlined object or a barrier placed perpendicular to the axis of the pipeline, around which the medium flows.

Calculation of the Mass Flow Rate

The frequency of the vortices, i.e. the number of vortices shed per second, is directly proportionate to the velocity of the medium. This Vortex Shedding Frequency is used to calculate the mass flow.

$$f = St * V/d$$

Where:
f = Frequency of Vortex Shedding
St = Strouhal Number
V = Flow Velocity
d = Width of the Bluff Body

Strouhal Number St

The Strouhal Number in the above formula is also called as "reduced frequency". It is a dimensionless parameter that is a measure of the Vortex Shedding Frequency and the velocity of the flow medium. It is calculated using the formula:

$$St = fd/U$$

Where:
f = Frequency of Vortex Shedding
d = Width of the Bluff Body
U = Velocity of the Flow Medium

The Strouhal Number is a function of the Reynold's Number. Reynold's Number is also a dimensionless parameter that is used to determine how the flow pattern of different fluids will change. The Strouhal Number should remain constant when the Reynold's Number ranges from 2×10^4 to 7×10^6.

Calculation of Volume Flow Rate

When the Vortex Shedding Frequency is known, the volumetric flow rate can be calculated using the formula:

$$q = f/k * d$$

Where:
q = Volumetric Flow Rate
f = Vortex Shedding Frequency
k = k Factor, which is a ratio of the pulses transmitted to the unit volume

Benefits

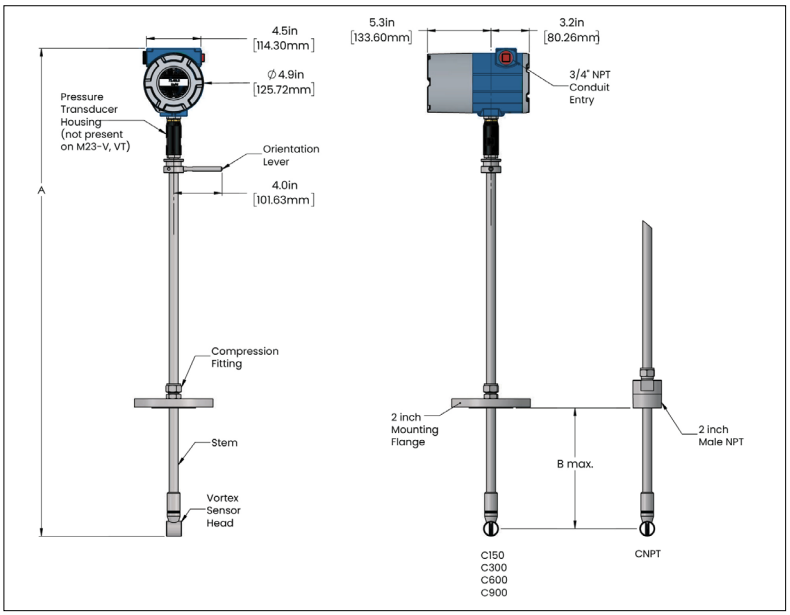
- Monitors volumetric or mass flow for liquids, gases, and steam.
- Combines mass flow, temperature, pressure, and density readings.
- Supports real gas, ideal gas, AGA 8, and API 2540 equations.
- Provides compensated mass flow and energy monitoring, for liquids, gases, and steam.
- Easy installation without process shutdown (hot-tappable).
- Reliable design with no moving parts or fluid contact.
- High accuracy and stability
- Standard HART protocol; Modbus and BACnet optional.
- Approved by FM, FMC, ATEX, and IECEx.

Application

- Food and Beverages
- Water, wastewater
- Process
- Petrochemical

Dimensional Drawing

Size and Dimension for Compression Fitting Models



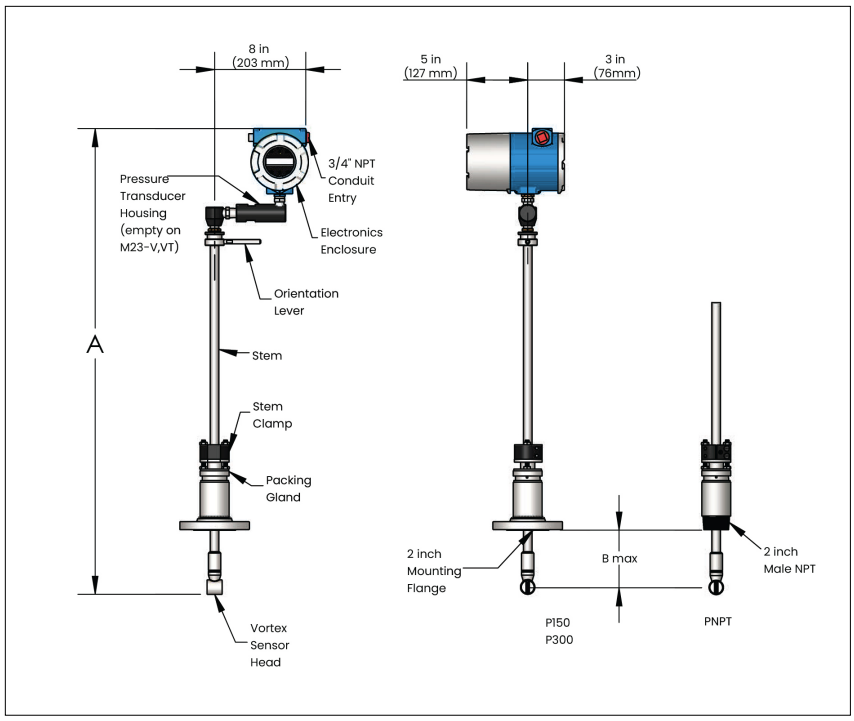
	CL	SL	EL
CNPT	13 (5.7)	14 (6.2)	15 (6.7)
C150	15 (6.8)	16 (7.3)	17 (7.8)
C300	17 (7.8)	18 (8.3)	19 (8.8)
C600	18 (7.8)	19 (8.7)	20 (9.2)
C900	31 (14.1)	32 (14.5)	33 (15)

Add 11LB (5KG) for remote electronics

Tek-Vor 1300I–V, VT, VTEP, VETEP in (mm)	CL/Compact Length		SL/Standard Length		EL/Extended Length	
	A	B	A	B	A	B
CNPT, Compression Fitting, Male NPT	21.6 (549)	9.8 (249)	38 (965)	26.2 (665)	50 (1270)	38.2 (970)
C150, Compression Fitting, 150 lb. Flange	21.6 (549)	10.9 (277)	38 (965)	27.3 (693)	50 (1270)	39.3 (998)
C300, Compression Fitting, 300 lb. Flange	21.6 (549)	10.8 (274)	38 (965)	27.2 (691)	50 (1270)	39.2 (996)
C600, Compression Fitting, 600 lb. Flange	21.6 (549)	10.4 (264)	38 (965)	26.8 (681)	50 (1270)	38.8 (986)
C900, Compression Fitting, 900 lb. Flange	21.6 (549)	9.9 (251)	38 (965)	26.3 (668)	50 (1270)	38.3 (973)

Tek-Vor 1300I–VTP in (mm)	CL/Compact Length		SL/Standard Length		EL/Extended Length	
	A	B	A	B	A	B
CNPT, Compression Fitting, Male NPT	24.6 (625)	9.8 (249)	41 (1041)	26.2 (665)	53 (1348)	38.2 (970)
C150, Compression Fitting, 150 lb. Flange	24.6 (625)	10.9 (277)	41 (1041)	27.3 (693)	53 (1348)	39.3 (998)
C300, Compression Fitting, 300 lb. Flange	24.6 (625)	10.8 (274)	41 (1041)	27.2 (691)	53 (1348)	39.2 (996)
C600, Compression Fitting, 600 lb. Flange	24.6 (625)	10.4 (264)	41 (1041)	26.8 (681)	53 (1348)	38.8 (986)
C900, Compression Fitting, 900 lb. Flange	24.6 (625)	9.9 (251)	41 (1041)	26.3 (668)	53 (1348)	38.3 (973)

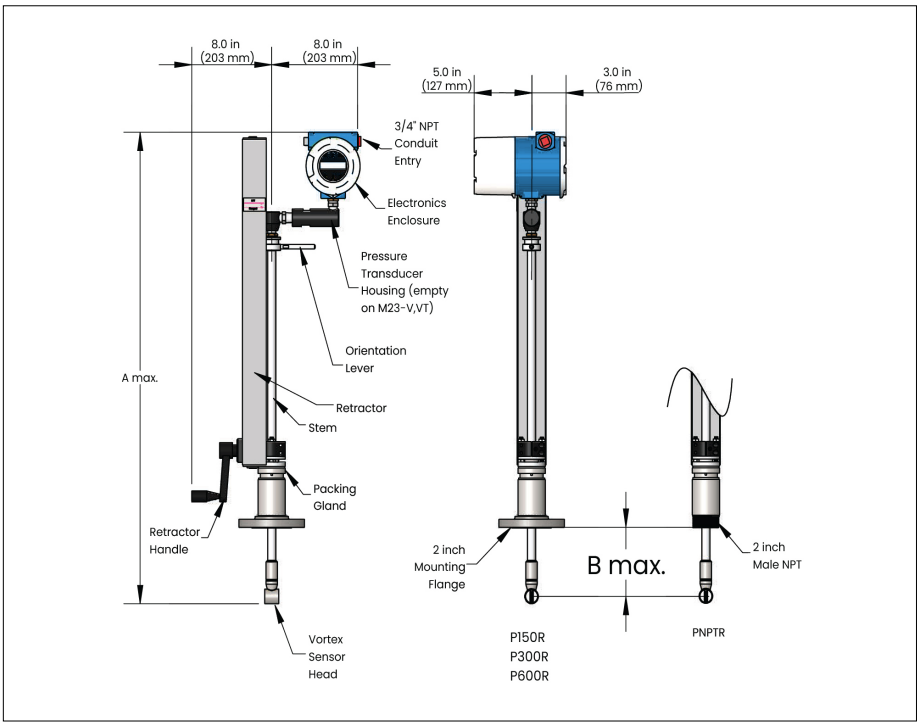
Size and Dimension for Packing Gland Models



APPROXIMATE WEIGHT LB (KG) Add 11 LB (5 KG) for remote electronics	SL	EL
PNPT	16 (7.1)	17 (7.6)
P150	21 (9.4)	22 (9.9)
P300	25 (11.3)	26 (11.8)

Tek-Vor 1300I in (mm)	SL/Standard Length		EL/Extended Length	
	A	B	A	B
PNPT, Packing Gland, Male NPT	40.5 (1029)	21.5 (546)	52.5 (1334)	33.5 (851)
P150, Packing Gland, 150 lb. Flange	40.5 (1029)	21.1 (536)	52.5 (1334)	33.1 (841)
P300, Packing Gland, 300 lb. Flange	40.5 (1029)	21.1 (536)	52.5 (1334)	33.1 (841)

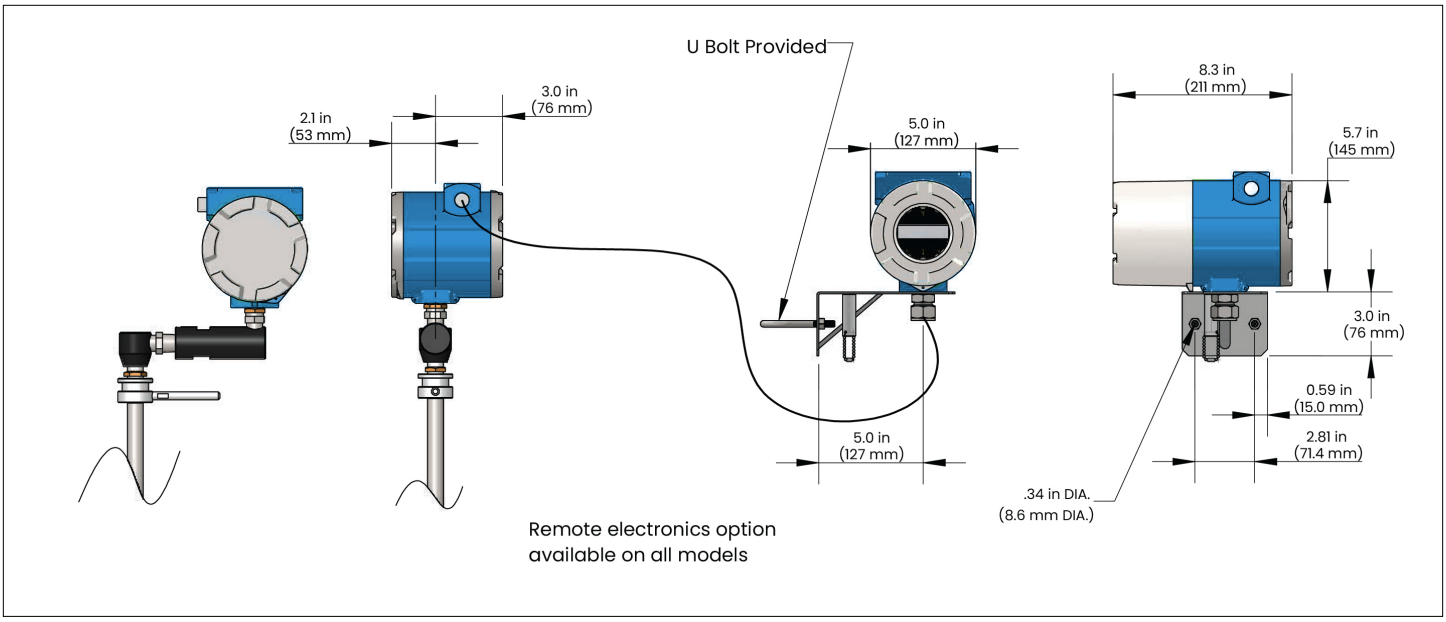
Size and Dimension for Packing Gland Models with Permanent Retractor



	SL	EL
PNPTR	25 (11.5)	32 (14.5)
P150R	30 (13.7)	37 (16.7)
P300R	34 (15.5)	41 (18.5)
P600R	35 (16.0)	42 (19.0)

Add 11LB (5KG) for remote electronics

Size and Dimension for Packing Gland Models with Permanent Retracto



Specifications

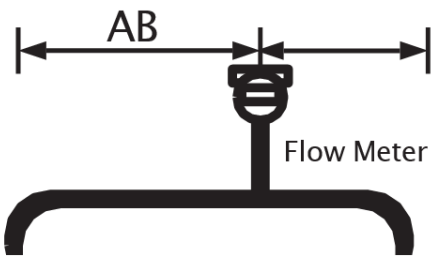
Services	Compatible with liquids, gases, and steam; 316L stainless steel; not for multiphase fluids.		
Accuracy	Process Variables	Liquids	Gas & Steam
	Volumetric Flow Rate	± 1.2% of Rate	± 1.5% of Rate
	Mass Flow Rate	± 1.5% of Rate	± 2.0% of Rate
	Temperature	± 2°F (± 1°C)	± 2°F (± 1°C)
	Pressure	± .3% of Full Scale	± .3% of Full Scale
	Density	± .3% of Reading	± .5% of Reading
Rangeability	100:1		
Temperature Range	• Process Standard Temperature: -330 to 500°F (-200 to 260°C) • Ambient Operating Temperature: -40 to 140°F (-40 to 60°C) • Ambient Storage Temperature: -40 to 140°F (-40 to 60°C		
Pressure Range	Up to 1500 psia		
Wetted Materials	316L, Stainless Steel, PTFE		
Power Supply	DCL option: 12-36 VDC, 25mA, 1W max, loop powered (single output) DCH option: 12-36 VDC, 300mA, 9W max, (multiple outputs) DCHPOE option: 12-28 VDC, or Power over Ethernet, 5W max (multiple outputs) AC option: 100-240 VAC, 50/60Hz line power, 5W (multiple outputs)		
Output Signal	4-20 mA, HART protocol communications – Standard, Modbus, BACnet communications available		
Response Time	Adjustable from 1 to 100 seconds		
Approvals	FM, FMC, ATEX, IECEx		

Installation

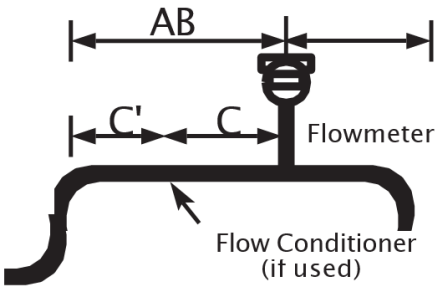
Unobstructed Flow Requirements

Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor.

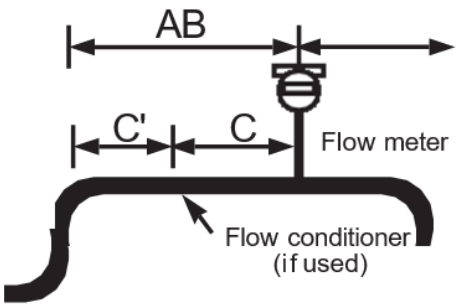
Note: For liquid applications in vertical pipes, avoid installing with flow in the downward direction because the pipe may not be full at all points. Choose to install the meter with flow in the upward direction if possible.



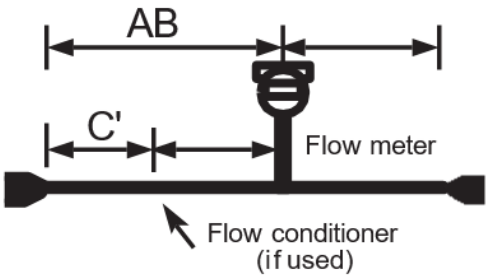
Example 1. One 90O elbow before Meter



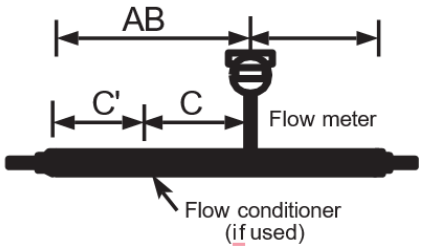
Example 2. Two 90O elbow before Meter in one plane



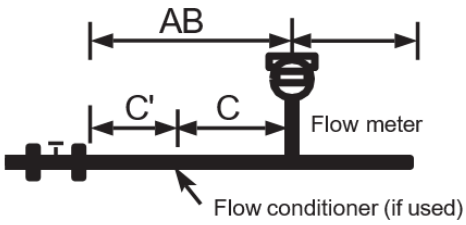
Example 3. Two 90O elbows before meter out of plane (if three 90O bends present, double recommended length)



Example 4. Reduction before meter



Example 5. Expansion before meter



10 D

Example 6. Regulator or valve partially closed before meter (if valve is always wide open, base length requirements on fitting directly preceding it)

Minimum Required Upstream Diameters					Minimum Required Downstream Diameters	
	No Flow Conditioner	With Flow Conditioner			No Flow Conditioner	With Flow Conditioner
Example	A	A	C	C	B	B
1	10 D	N/A	N/A	N/A	5 D	5 D
2	15 D	10 D	5 D	5 D	5 D	5 D
3	30 D	10 D	5 D	5 D	10 D	5 D
4	10 D	10 D	5 D	5 D	5 D	5 D
5	20 D	10 D	5 D	5 D	5 D	5 D
6	30 D	10 D	5 D	5 D	10 D	5 D
D = Internal Diameter of channel N/A = Not applicable						

Model Chart

Example	Tek-Vor 1300I	V	20	S	A	1	S	I	1	D	LCD	1300I-V-20-S-A-1-S-I-1-D-LCD
Series	Tek-Vor 1300I											Inseration Vortex Mass Flow Meter
Type		V VT VTP										Volumetric Flow Meter for liquid, gas and steam Velocity and Temperature Sensors Velocity, Temperature and Pressure Sensors
Size			20 25 40 50 80 100 150 200 250 300									3/4" Nominal Bore 1" Nominal Bore 1 1/2" Nominal Bore 2" Nominal Bore 3" Nominal Bore 4" Nominal Bore 6" Nominal Bore 8" Nominal Bore 10" Nominal Bore 12" Nominal Bore
Probe Length				S C E								Standard Length Compact Length Extended Length
Process Connection					A B C D E F G H I J							Compression, 2 inch NPT Compression, 2 inch 150# Flange Compression, 2 inch 300# Flange Compression, 2 inch 600# Flange Compression, 2 inch 900# Flange Packing Gland, 2 inch 300# Flange Packing Gland, 2 inch NPT, Retractor Packing Gland, 2 inch 150# Flange, Retractor Packing Gland, 2 inch 300# Flange, Retractor Packing Gland, 2 inch 600# Flange, Retractor
Pressure Rating						1 2 3 4 5						Maximum 30 psia (2 bara), Proof 60 psia (4bara) Maximum 100 psia (7 bara), Proof 200 psia (14bara) Maximum 300 psia (20 bara), Proof 600 psia (41 bara) Maximum 500 psia (34 bara), Proof 1000 psia (64 bara) Maximum 1500 psia (100 bara), Proof 2500 psia (175 bara)

Temprature Rating							S H					Standard Process temperature – 330 to 500°F (-200 to 260°C) High Process temperature to 750°F (400°C)
Output								I H R T				4 to 20 mA and Pulse 4 to 20 mA, Pulse and HART 4 to 20 mA, Pulse and RS485 modbus 4 to 20 mA, Pulse , RS485 modbus and TCP/IP
Input									1 2			12-36 VDC, 300mA, 9W max 100-240 VAC, 50/60 Hz line power, 5W max
Electronics Enclosure										D R		NEMA 4X, IP66 Enclosure Remote Electronics NEMA 4X, IP66, Specify cable length in parentheses
Display											LCD B	Digital Display and Programming Buttons No Diplay

Customer Service & Support

TEKTROL

www.tek-trol.com

Tek-Trol LLC

796 Tek Drive Crystal Lake,

IL 60014, USA

+1 847-857-6076 | tektrol@tek-trol.com | www.tek-trol.com

Tek-Trol is a fully owned subsidiary of TEKMATION LLC. We offer our customers a comprehensive range of products and solutions for process, power and oil & gas industries. Tek-Trol provides process measurement and control products for Flow, Level, Temperature & Pressure measurement, Control valves & Analyzer systems. We are present in 15 locations globally and are known for our knowledge, innovative solutions, reliable products and global presence.