



Technology Solutions

TEK-VOR 1300XP

Explosion-Proof Inline Vortex Flow Meter



FLOW



Introduction

Tek-Trol's Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter utilize three primary sensing elements including, vortex shedding velocity sensor, an RTD temperature sensor, and a solid-state pressure transducer to measure the mass flow rate of gases, liquids and steam.

Systems that use external process measurements to calculate mass flow may not provide adequate compensation for the fact that process conditions can change radically between the point of velocity measurement and the point where upstream or downstream pressure and temperature measurements are being made. Because the Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter measures all of these parameters in a single location, it delivers a more accurate process measurement.

Integrating multivariable output capability with a single line penetration also simplifies system complexity and helps reduce initial equipment cost, installation cost and maintenance costs.

The product line is available with a wide range of options and meter configurations to meet your specific application requirements.



Fig 1: Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter

Measuring Principle

Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter measure flows of liquid, gas and steam by detecting the frequency at which vortices are alternately shed from a bluff body. According to proven laws of physics, the frequency at which the vortices are alternately shed is directly proportional to the flow velocity.

As flow passes a bluff body in the flow stream, the vortices create low and high-pressure zones behind the bluff body, or shedder bar. The Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter uses piezoelectric crystal sensor to detect the pressure exerted by the vortices on the velocity sensor. The piezoelectric converts these "pulses" into electrical signals.

The meter uses an all welded sensor design to create a robust sensor and to minimize potential leakages.

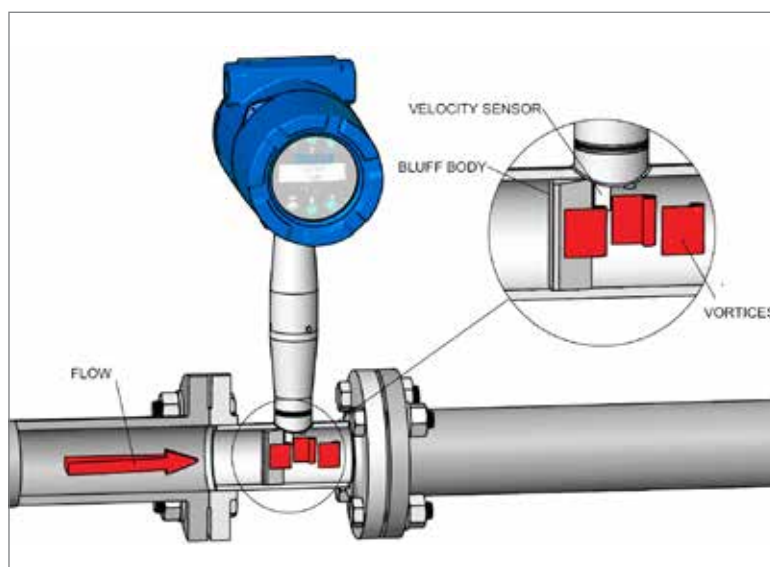


Fig 2: Measuring Principle of Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter

Benefits

- Volumetric or mass flow monitoring of most liquids, gases, and steam.
- Multivariable meter delivers mass flow, temperature, pressure, and density readings from a single installed device and reduces initial cost, installation cost and cost-of ownership over the lifetime of the instrument.
- Mass flow equations - real gas, ideal gas, AGA 8, API 2540.
- Compensated mass flow reading of liquids, gases, and steam.
- Energy Monitoring - ability to compute and output energy use.
- Easy to install and commission.
- Reliable - no moving parts, no fluid to sensor contact.
- High accuracy with rangeability up to 100:1.
- Temperature up to 750°F.
- Pressure up to 1500psig.
- Inline configuration for pipes from 1/2"-12" DN15 to DN 300.
- Field configurable ranges, outputs and displays.
- Remote electronics option available for use in harsh environments or locations with limited access.
- 4-20mA loop-powered Mass Meter design saves on energy costs.
- HART protocol communications - Standard.
- Modbus, BACnet communications available.
- FM, FMC, ATEX, IECEx Approved.

Applications

- Food and Beverages.
- Water and Wastewater Treatment Plants.
- Process Industry.
- Petrochemical.
- Pharmaceutical Industries.

Vortex Flow Meter Types

Tek-Vor 1300XP-V

The Model Tek-Vor 1300XP-V delivers a direct reading of volumetric flow rate, generally the most cost-effective solution for liquid flow monitoring in applications ranging from general water flows to hydrocarbon fuel flow measurement.

Tek-Vor 1300XP-VT

The Model Tek-Vor 1300XP-VT integrates a precision 1000 Ohm platinum RTD temperature sensor that can be used to calculate and output a compensated mass reading. This device is typically used to measure flow rates of saturated steam.

Tek-Vor 1300XP-VTP

The Model Tek-Vor 1300XP-VTP offers you flow computer functionality in a compact field device. This multivariable instrument incorporates temperature and pressure sensors to provide an instantaneous reading of the compensated mass flow rate of gases, liquids and steam. In addition to outputs for totalized mass and alarm settings, the field-configurable electronics deliver up to three analog 4-20 mA outputs of five process measurements, including volumetric flow rate, mass flow rate, pressure, temperature and density.



Fig 3: Tek-Vor 1300XP Explosion-Proof Inline Vortex Flow Meter

Specifications

Accuracy	Volumetric Flow Rate: $\pm 0.7\%$ of rate (for Liquids), $\pm 1\%$ of rate (for Gas or Steam); Mass Flow Rate: $\pm 1\%$ of rate (for Liquids), $\pm 1.5\%$ of rate (for Gas or Steam); Temperature: $\pm 2^{\circ}\text{F}$ ($\pm 1^{\circ}\text{C}$) Pressure: $\pm 0.3\%$ of Full Scale Density: $\pm 0.3\%$ of Reading (for Liquids), $\pm 0.5\%$ of Reading (for Gas or Steam)	
Repeatability	Mass Flow Rate: $\pm 0.2\%$ of rate Volumetric Flow Rate: $\pm 0.1\%$ of rate Temperature: $\pm 0.2^{\circ}\text{F}$ ($\pm 0.1^{\circ}\text{C}$) Pressure: $\pm 0.05\%$ of full scale Density: $\pm 0.1\%$ of reading	
Stability	Mass Flow Rate: $\pm 0.2\%$ of rate Volumetric Flow Rate: negligible Temperature: $\pm 0.9^{\circ}\text{F}$ ($\pm 0.5^{\circ}\text{C}$) Pressure: $\pm 0.1\%$ of full scale Density: $\pm 0.1\%$ of reading	over 12 months
Response Time	Adjustable from 1 to 100 seconds	
Operating Temperature	-40°F to 140°F (-40°C to 60°C)	
Process Temperature	-330°F to 500°F (-200°C to 260°C)	
Storage Temperature	-40°F to 185°F (-40°C to 85°C)	
Pressure Rating	Full Scale Operating Pressure: 30 to 1500psi (2 to 100bar) Maximum Over Range Pressure: 60 to 2750psi (4 to 175bar)	
Output Signal	Analog: 4-20mA Alarm: Solid state relay, 40VDC Totalizer Pulse: 50 millisecond pulse, 40VDC Volumetric or Loop Powered Mass: One Analog, One Totalizer Pulse, HART Multivariable option: Up to Three Analog Signals, Three Alarms, One Totalizer Pulse, HART Multivariable option: Modbus, Ethernet, or BACnet process monitoring	
Power Supply	DCL option: 12-36VDC, 25mA, 1W max, loop powered (single output) DCH option: 12-36VDC, 300mA, 9W max, (multiple outputs) AC option: 100-240VAC, 50/60Hz line power, 5W (multiple outputs)	
Display	Alphanumeric 2 line x 16 character LCD digital display Six pushbuttons for full field configuration Pushbuttons can be operated with magnetic wand without removal of enclosure covers Display can be mounted in 90° intervals for better viewing	
Wetted Material	Standard 316L Stainless Steel, plus • Optional Carbon Steel or Hastelloy C • DuPont Teflon® based thread sealant on models with pressure transducer	
Approvals	FM, FMC, ATEX, IECEx	

Sizing

Piping Conditions		
Condition	Pipe Diameters, D	
	Upstream	Downstream
One 90° elbow before meter	10D	5D
Two 90° elbows before meter	15D	5D
Two 90° elbows before meter, out of plane	30D	10D
Reduction before meter	10D	5D
Expansion before meter	20D	5D
Partially open valve	30D	10D

Velocity Range

Maximum velocity, liquid: 30 feet/sec (9 meters/second)

Minimum velocity, liquid: 1 foot/sec (0.3 meters/second)

Maximum velocity, gas or steam: See Table Below

Minimum velocity, gas or steam feet/sec (meters/second):

$$\frac{5}{\sqrt{\text{density (Lb/ft}^3)}} \quad \frac{6.1}{\sqrt{\text{density (kg/m}^3)}}$$

Pressure Drop Equations

$\Delta P = 0.00024 p l^2$ English Units (ΔP in psi, p in lb/ft³, V in ft/sec)

$\Delta P = 0.000011 p l^2$ Metric Units (ΔP in bar, p in kg/m³, V in m/sec)

Water Minimum and Maximum Flow Rates											
Rate	Nominal Pipe Size in (mm)										
	½" (15)	¾" (20)	1 (25)	1 ½" (40)	2 (50)	3 (80)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)
GPM min	0.9	1.4	2.2	5.5	9.2	21	36	81	142	224	317
GPM max	22	40	67	166	276	618	1076	2437	4270	6715	9501
M ³ /hr min	0.2	0.3	0.5	1.3	2.1	4.7	8.1	18	32	51	72
M ³ /hr Max	5	9	15	38	63	140	244	554	970	1525	2158

Gas or Steam Max Velocity											
Rate	Nominal Pipe Size in (mm)										
	½" (15)	¾" (20)	1 (25)	1 ½" (40)	2 (50)	3 (80)	4 (100)	6 (150)	8 (200)	10 (250)	12 (300)
FT/SEC Max	175	250	250	300	300	300	300	300	300	300	300
M/SEC Max	53	76	76	90	90	90	90	90	90	90	90

Model Chart

Example - Tek-Vor 1300XP	V	50	C	A	1	I	1	S	L	DD	ATEX	Tek-Vor 1300XP-V-50-C-A-1-I-1-S-L-DD-ATEX
Multivariable Options	V VT VTP											Volumetric Flow Meter for liquid, gas and steam Velocity and Temperature Sensors Velocity, Temperature and Pressure Sensors
Size		15 20 25 40 50 80 100 150 200 250 300										Standard 1/2" Nominal Bore (15mm) (Only Available in Standard) 3/4" Nominal Bore (20mm) 1" Nominal Bore (25mm) 1 1/2" Nominal Bore(40mm) 2" Nominal Bore (50mm) 3" Nominal Bore (80mm) 4" Nominal Bore (100mm) 6" Nominal Bore (150mm) 8" Nominal Bore (200mm) 10" Nominal Bore(250mm) 12" Nominal Bore(300mm) Reduced Bore 3/4" by 1/2" Reducing Bore (15mm) 1" by 1/2" Reducing Bore (15mm) 1.5" by 1" Reducing Bore (25mm) 2" by 1.5" Reducing Bore (40mm) 3" by 2" Reducing Bore (50mm) 4"by 3"Reducing Bore (80mm) 6"by 4"Reducing Bore (100mm) 8" by 6" Reducing Bore (150mm) 10" by 8"Reducing Bore (200mm) 12"by 10"Reducing Bore (250mm)
Meter Body			C S H									Carbon Steel (1.5 " and Up) 316 Stainless Steel Hastelloy
Process Connection				A B C D E F G H W								ANSI 150# Flange ANSI 300# Flange ANSI 600# Flange ANSI 900# Flange PN 16 PN 40 PN 64 PN 100 Wafer ANSI 600#
Pressure Rating					00 01 02 03 04 05							No Pressure Sensor Maximum 30 psia (2 bara), Proof 60 psia (4 bara) Maximum 100 psia (7 bara), Proof 200 psia (14 bara) 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)
Temperature Rating						S H						Standard temperature. Process temperature -330° to 500°F (-200° to 260°C) High temperature. Process temperature 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 Power								1 2 3				12-36 VDC, 25mA, 1W max. 12-36 VDC, 300mA, 9W max 100-240 VAC, 50/60 Hz line power, 5W max.
Enclosure									L R			NEMA 4X IP66 Enclosure Remote Electronics NEMA 4X, IP66
Display										DD		Digital Display and Programming Buttons
Approvals											ATEX FM IE	II 2 G Ex d IIB + H2 T6,II 2 D Ex tD A2I IP66 T85°C, Ta = -40 to 60°C CLASS I, DIV. 1, GROUPS B, C, D,CLASS II/III, DIV. 1, GROUPS E, F, G,Type 4X and IP66, T6, Ta = -40 to 60°C Ex d IIB + H2 T6,Ex tD A2I IP66 T85°C, Ta = -40 to 60°C

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