Multivariable Vortex Flowmeter

Heinrichs
KOBOLD Group

measuring
•
monitoring
•
analyzing

DVH

- Measuring Ranges (at 0 PSIG):
  0.9...22 to 142...4270 GPM Water
  1.8...18 to 2071...203,000 SCFM Air
  6.5...52 to 6014...380,148 Lb/Hr Steam
- Accuracy:
  ±0.7 % of Reading (Liquids)
  ±1 % of Reading (Gases and Steam)
- Maximum Pressure: 1450 PSIA
- Maximum Temperature: 750 °F
- Connection: ½" ... 8" ANSI Flange
- Wetted Material: Stainless Steel
- Output: 4 - 20 mA, HART® Protocol. Modbus
- Integrated Temperature and Pressure Measurement
- Measurement of Mass and Density Possible
- ATEX, IECEx
- Energy Consumption (Monitoring)

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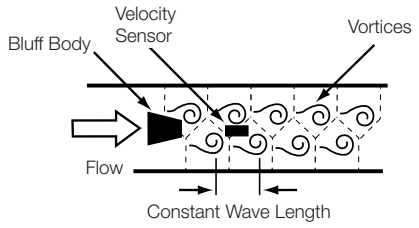
Description

The Heinrichs DVH Series Vortex Flowmeter utilizes three primary sensing elements: a vortex shedding velocity sensor, a 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 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 DVH multi-variable flow meter measures all of these parameters in a single location, it delivers a more accurate process measurement. Integrating multi-variable output capability with a single line penetration also simplifies system complexity and helps reduce initial equipment cost, installation cost and maintenance costs.

Measuring Principle

The measuring principle is based on the Karmann vortex theory. A specially shaped, bluff body is located directly in the flow path. With specific flow velocities, vortices are generated by the bluff body. These small vortices generate small pressure differences, which are sensed via a piezoelectric sensor located directly behind the bluff body. The number of vortices detected by the sensor are directly proportional to the flow velocity.



Advantages of the DVH Vortex Flow Meter

- DVH-V: Provides a Cost Effective Volumetric Flow Monitoring Solution for Most Liquids
- DVH-T: Incorporates Temperature Sensing to Provide a Compensated Mass Flow Reading for Saturated Steam
- DVH-P: Multi-variable Meter Delivers Mass Flow, Temperature, Pressure and Density Readings
- Connections: ½"...8" ANSI
- Easy to Install
- Field-Configurable Ranges, Outputs and Displays
- HART® Protocol, Modbus
- IECEx / ATEX Approvals
- Energy Consumption (Monitoring)

Model DVH-V

The DVH-V delivers a direct reading of volumetric flow rate, and is generally the most cost effective solution for liquid flow monitoring in water and water-based solutions.

Model DVH-T

The DVH-T integrates a precision, 1000Ω platinum RTD temperature sensor that can be used to calculate and output a compensated mass reading. It is typically used to measure flow rates of saturated steam.

Model DVH-P

The DVH-P offers flow computer functionality in a compact field device. This multi-variable instrument incorporates temperature and pressure sensors to provide an instantaneous reading of 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 and density.

Model DVH-E

The DVH-E energy monitoring option permits real-time calculation of energy consumption for a facility or process. The meter can be programmed to measure steam, hot water or chilled water. It monitors one side of the process, either sent or return, and uses the input from a second separate temperature sensor on the opposite side of the process to calculate the change in energy. (It is not approved for custody transfer applications.) Selectable energy units include: BTU, joules, calories, watt-hours, megawatt-hours and horsepower-hours. The local or remote electronics indicate: temperature, delta T, mass total and energy total.

Technical Data

Mass Flow Rate Accuracy: for Gas and Steam Based on 50-100 % of Pressure Range

Model DVH Accuracy:

Process Variables	Liquids	Gas/Steam
Volumetric Flow Rate	± 0.7 % of Rate	± 1 % of Rate
Mass Flow Rate	± 1 % of Rate	± 1.5 % of Rate
Temperature	± 2 °F	± 2 °F
Pressure	± 0.3 % of Full Scale	± 0.3 % of Full Scale
Density	± 0.3 % of Reading	± 0.5 % of Reading

Repeatability

Mass Flow Rate:	± 0.2 % of Rate
Volumetric Flow Rate:	± 0.1 % of Rate
Temperature:	± 0.2 °F
Pressure:	± 0.5 % of Full Scale
Density:	± 0.1 % of Reading

No responsibility taken for errors;
subject to change without prior notice.

Technical Data (Continued)

Stability over 12 Months

Mass Flow Rate:	± 0.2 % of Rate
Volumetric Flow Rate:	Negligible
Temperature:	± 0.9 °F
Pressure:	± 0.1 % of Full Scale
Density:	± 0.1 % of Reading
Response Time:	Adjustable from 1...100 s

Process and Ambient Temperature

Standard:	-330...500 °F
High Temperature:	-40...750 °F
Ambient Temperature:	-40...140 °F
Storage Temperature:	-40...150 °F

Max. Operating Pressure	Max. Overload Pressure
psia	psia
30	60
100	200
300	600
500	100
1500	2500

Power Requirements:

Model DVH-V:	12 - 36 V_{DC}, Loop Powered
Model DVH-P, DC Option:	12 - 36 V_{DC}, 100 mA Max.
Model DVH-P, AC Option:	85 - 240 V_{AC}, 50/60 Hz, 2 Watt
Display:	Alphanumeric, 2-line (16 Characters), Digital LCD Display, Rotatable in 90 ° Steps
Buttons:	Six Buttons for Full Field Configuration The Pushbuttons can be Operated with the Magnetic Wand without Removal of the Enclosure Covers.

Output Signals

Analog:	4 - 20 mA, Loop Powered for Volumetric Meters
Alarm:	Solid State Relay, 40 V_{DC}
Totalizer Pulse:	50 ms, 40 V_{DC}
Volumetric:	1x Analog, 1x Totalizer Pulse, HART®
Multi-variable:	Up to 3 Analog Signals 3 Alarms, 1 Totalizer Pulse, HART®
Option:	Modbus Process Monitoring

Wetted Materials

Body:	316L Stainless Steel
Models with Pressure Transducer:	PTFE Based Thread Sealant

Temperature Version

Standard Temp:	PTFE Packing
High Temp:	Graphite Based Packing

Minimum Straight Run Requirements

Conditions	Pipe Diameters D	
	Upstream	Downstream
One 90° Elbow before Meter	10 D	5 D
Two 90° Elbows before Meter	15 D	5 D
Two 90° Elbows before Meter (Out of Plane)	25 D	5 D
Reduction before Meter	10 D	5 D
Expansion before Meter	20 D	5 D
Partially Open Valve	25 D	5 D

Velocity Range

Liquids

Maximum Velocity:	9 m/s (30 ft/s)
Minimum Velocity:	0.3 m/s (1 ft/s)

Gas/Steam

Maximum Velocity:	90 m/s (300 ft/s)
Minimum Velocity:	$\frac{6{,}1}{\sqrt{\text{Density}\ (\frac{kg}{m^3})}}$ $\frac{5}{\sqrt{\text{Density}\ (\frac{Lb}{ft^3})}}$

Water Minimum and Maximum Flow Rates

	Nominal Pipe Size (in)								
Inch	½	¾	1	1 ½	2	3	4	6	8
GPM min.	0.9	1.4	2.2	5.5	9.2	21	36	81	142
GPM max.	22	40	67	166	276	618	1,076	2,437	4,270

Approvals

ATEX:	II 2 G Ex d IIB + H_2 T6 II 2 D Ex tD A21 IP66 T85 °C Ta =-40 °C ... +60 °C
IECEx:	Ex d IIB + H2 T6 Ex tD A21 IP 66 T85 °C, Ta = -40 °C ... +60 °C

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Turndown (Continued)**:** Turndown is Application Dependent, can exceed 100:1

Typical Air Minimum and Maximum Flow Rates (70 °F) Unit: (SCFM)										
		Nominal Pipe Size (in)								
Pressure		0.5	0.75	1	1.5	2	3	4	6	8
0 psig	min.	1.8	3	5	13	22	50	87	198	247
	max.	18	41	90	221	369	826	1,437	3,256	5,708
100 psig	min.	5	9	15	38	63	141	245	555	972
	max.	138	325	704	1,730	2,890	6,466	11,254	25,515	44,698
200 psig	min.	7	13	21	52	86	193	335	761	1,332
	max.	258	609	1,322	3,248	5,427	12,140	21,131	47,911	83,931
300 psig	min.	8	15	25	63	104	234	407	922	1,615
	max.	380	896	1,944	4,775	7,978	17,847	31,064	70,431	123,375
400 psig	min.	10	18	29	72	120	269	467	467	1,857
	max.	502	1,183	2,568	6,309	10,542	23,580	41,043	41,043	163,000
500 psig	min.	11	20	33	80	134	300	521	1,182	2,071
	max.	624	1,472	3,195	7,849	13,115	28,034	51,063	11,575	203,000

Typical Saturated Steam Minimum and Maximum Flow Rates Unit: (lb/h)										
		Nominal Pipe Size (in)								
Pressure		0.5	0.75	1	1.5	2	3	4	6	8
5 psig	min.	6.5	12	20	49	82	183	318	722	1,264
	max.	52	122	265	650	1,087	2,431	4,231	9,594	16,806
100 psig	min.	15	27	46	112	187	419	728	1,652	2,893
	max.	271	639	1,386	3,405	5,690	12,729	22,156	50,233	87,998
200 psig	min.	20	37	62	151	253	565	983	2,229	3,905
	max.	493	1,163	2,525	6,203	10,365	23,184	40,354	91,494	160,279
300 psig	min.	24	45	74	182	304	680	1,184	2,685	4,704
	max.	716	1,688	3,664	9,000	15,040	33,642	58,556	132,763	232,575
400 psig	min.	28	51	85	209	349	780	1,358	3,079	5,393
	max.	941	2,220	4,816	11,831	19,770	44,222	76,971	174,516	305,717
500 psig	min.	31	57	95	233	389	870	1,514	3,433	6,014
	max.	1,170	2,760	5,988	14,711	24,582	54,987	95,710	217,001	380,148

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***Additional Information Required for Order:**

To ensure proper operation, this product requires a completed application guide form to be submitted with any order. Please refer to the end of this datasheet in order to obtain the correct form. You can also contact your KOBOLD representative for this form.

Order Details (Example: **DVH- V 15 1 S L L 2 S 0H**)

Model	Version	Flange Size	Flange Rating	Material Measuring Tube/ Flow Sensor	Electronic Mounting
DVH-..	**..V..** = Measures Volume of Liquids, Gas or Steam **..T..** = Flow Velocity with Temperature Sensor **..P..** = Flow Velocity with Temperature and Pressure Sensor **..E..** = Energy Consumption Measurement with Temperature Sensor **..M..** = Energy Consumption Measurement with Temperature and Pressure Sensor	**..15..** = ½" ANSI **..20..** = ¾" ANSI **..25..** = 1" ANSI **..40..** = 1-½" ANSI **..50..** = 2" ANSI **..80..** = 3" ANSI **..1H..** = 4" ANSI **..H5..** = 6" ANSI **..2H..** = 8" ANSI	**..1..** = ANSI 150 lbs **..2**..= ANSI 300 lbs **..3..** = ANSI 600 lbs	**..S..** = 316L SS	**..L..** = Compact, with LCD Display **..R[5]..** = Remote, IP66, with LCD Display (Standard Cable Lentgh 5 m)
		..W1.. = Wafer DN 15 EN / 1/2" ANSI **..W2..** = Wafer DN 20 EN / 3/4" ANSI **..W3..** = Wafer DN 25 EN / 1" ANSI **..W4..** = Wafer DN 40 EN / 1-1/2" ANSI **..W5..** = Wafer DN 50 EN / 2" ANSI **..W6..** = Wafer DN 80 EN / 3" ANSI **..W7..** = Wafer DN 100 EN / 4" ANSI	**..2**..= ANSI 300 lbs **..3..** = ANSI 600 lbs		

Power Supply	Output Options	Process Temperature	Pressure Sensor
..L[1].. = 12 - 36 V_{DC}, Loop Powered **..D[2]..** = 12 - 36 V_{DC}, 4-wire **..A[2]..** = 85 - 240 V_{AC}, 50/60 Hz, 12 W	**..2..** = Loop Powered, 1 x 4-20 mA, HART®, 1 x Pulse **..H..** = 1 x 4-20 mA, HART®, 1 x Alarm, 1 x Pulse **..M..** = 1 x 4-20 mA,Modbus 1 x Alarm, 1 x Pulse **..3..** = 3 x 4-20 mA, HART®, 3 x Alarm, 1 x Pulse **..4..** = 3 x 4-20 mA, Modbus 3 x Alarm, 1 x Pulse	**..S..** = Standard -40 ... 500 °F **..H..** = High Temperature -40 ... 750 °F	**..0H[3]** = without **..1H[4]** = with Sensor, Max. 30 psia **..2H[4]** = with Sensor, Max. 100 psia **..3H[4]** = with Sensor, Max. 300 psia **..4H[4]** = with Sensor, Max. 500 psia **..5H[4]** = with Sensor, Max. 1,500 psia

[1] Only for Output Option '2'
[2] Only for Output Options: 'H', 'M', '3' or '4'
[3] Only for Versions: DVH-V.., DVH-T.., DVH-E..
[4] Only for Versions: DVH-P.., DVH-M..
[5] Max. possible cable length 15 m. Please specify cable length in clear text.

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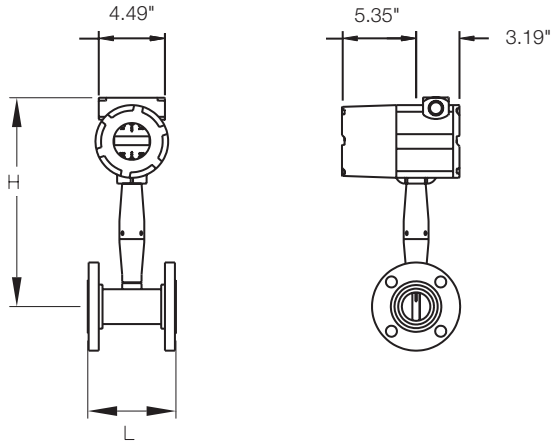
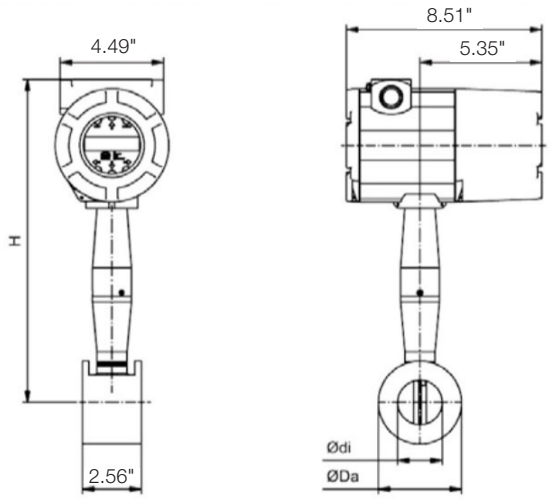
Dimensions: Compact Electronics Option L



Nominal Size	L	H	Weight*		
			ANSI 150 (lbs)	ANSI 300 (lbs)	ANSI 600 (lbs)
½"	approx. 7.87"	approx. 14.8"	12.1	12.6	13.0
¾"	approx. 7.87"	approx. 15"	13.0	14.1	14.6
1"	approx. 7.87"	approx. 15"	13.4	16.3	16.3
1-½"	approx. 7.87"	approx. 15"	14.6	22.7	24.7
2"	approx. 7.87"	approx. 15.3"	19.4	26.9	33.3
3"	approx. 7.87	approx. 15.8"	27.6	39.5	56.2
4"	approx. 9.84"	approx. 16.2"	43.4	66.4	96.1
6"	approx. 11.8"	approx. 17.3"	48.5	96.1	178.1
8"	approx. 11.8"	approx. 18.2"	71.0	148.6	299.9

* For Remote Electronics add 11 lbs

Dimensions: Wafer Style with Integral Mount Transmitter



Size	Ø di	Ø Da	H	Weight (lbs)	ASME B16.5
W1	0.55"	1.38"	13.43"	10.6	1/2"
W2	0.74"	1.69"	13.50"	11.0	3/4"
W3	0.96"	2.00"	13.62"	11.5	1"
W4	1.50"	2.88"	13.90"	13.0	1-1/2"
W5	1.94"	3.62"	14.10"	14.8	2"
W6	2.90"	5.00"	14.76"	19.8	3"
W7	3.83"	6.19"	15.24"	24.3	4"

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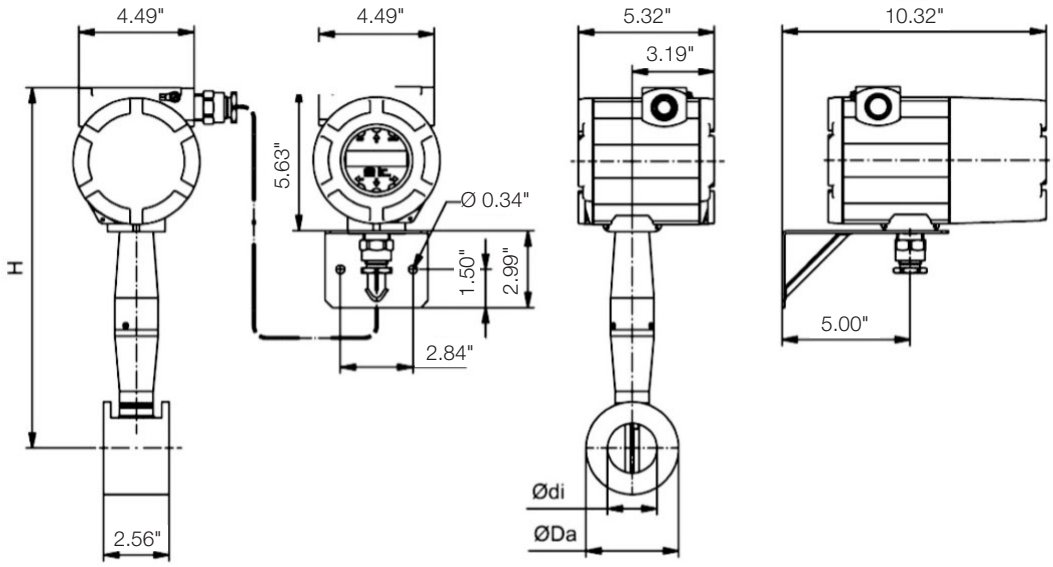
Dimensions: Wafer Style with Remote Mount Transmitter



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W1	0.55"	1.38"	13.43"	8.6	1/2"
W2	0.74"	1.69"	13.50"	9.0	3/4"
W3	0.96"	2.00"	13.62"	9.3	1"
W4	1.50"	2.88"	13.90"	10.8	1-1/2"
W5	1.94"	3.62"	14.10"	12.6	2"
W6	2.90"	5.00"	14.76"	17.4	3"
W7	3.83"	6.19"	15.24"	22.1	4"

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DVH Application Guide

Rev 09/10/18

General Information

Contact Name:_____

Company Name:_____

Phone:_____

Email:_____

Quote Number (if already quoted):_____

Date:_____

Part Number:_____

Number of Pieces Required:_____

☐ **This has not been quoted yet and pricing is required.**

Design Conditions

Accurate design pressure and temperature are essential to ensure the flowmeter will be built to operate without damage. Please fill out accurately and completely.

1. Name/Type of Liquid: _____

2. Name/Type of Gas: _____

Pipe Properties:

Pipe OD:_____ Pipe ID:_____ Schedule Pipe:_____

Flow Profile Conditions:

	Minimum	Nominal	Maximum
Flow Rate			
Temperature			
Pressure			
Density			
Viscosity			

Version Type:

☐ Volume ☐ Velocity/Temperature ☐ Velocity/Temperature/Pressure ☐ Energy Consumption/Temperature

☐ Energy Consumption/Temperature/Pressure

ANSI Flange Size:

☐ 1/2" ☐ 3/4" ☐ 1" ☐ 1-1/2" ☐ 2" ☐ 3" ☐ 4" ☐ 6" ☐ 8"

Flange Rating:

☐ 150lb ☐ 300lb ☐ 600lb

Power Supply:

☐ 12 - 36 V_{DC} Loop ☐ 12 - 36 V_{DC} 4 wire ☐ 85 - 240 V_{AC}

Output Options:

☐ 1x 4 -20 mA Hart® Loop with 1 Pulse

☐ 1x 4 - 20mA Hart® with 1 Pulse and 1 Switch

☐ 1x 4-20mA with 1 Switch and 1 Pulse, Modbus®

☐ 3x 4 - 20mA Hart® with 1 Pulse and 1 Switch

☐ 3x 4-20mA , 3 Switches, and 1 Pulse, Modbus®

Other Options / Custom Configurations / Special Requirements:

**Once completed, please save and email this form to your KOBOLD contact or info@koboldusa.com, or fax to 412-788-4890.*