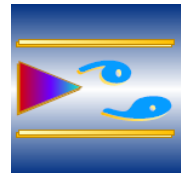


# Multivariable Vortex Flow Meter

## DVH



- **Sensor Design w/o sealing**
- **Fully welded sensor**
- **Integrated temperature and pressure measurement (optional)**
- **Calculation of mass and density possible**
- **High temperature version 400°C**
- **High pressure version up to 100 bar**
- **Energy monitoring ability**
- **Field configurable ranges, outputs and displays**
- **2-wire AND 4-wire power supply available**
- **Up to 3 analog outputs and 3 alarms available**
- **HART protocol**
- **MODBUS communications**



The **Heinrichs** DVH multivariable Vortex meters utilize three primary sensing elements

- a 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 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 multivariable 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.

**DVH-V flow meter provides cost effective volumetric flow monitoring solution for most liquids**

**DVH-T incorporates temperature sensing to provide a compensated mass flow reading of saturated steam**

**DVH-P multivariable meter delivers mass flow, temperature, pressure and density readings from a single installed device.**

**Available pipe sizes DN 15 to DN 200  
1/2" to ANSI 8",**

**Easy to install and commission**

**Field- configurable ranges, outputs and displays**

**HART protocol communications**

**ATEX / IEC EX /**

#### **Model DVH-V**

The Model DVH-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

#### **Model DVH-T**

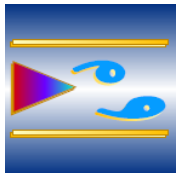
The Model DVH-VT integrates a precision 1000 Ohm platinum RTD temperature sensor that can be used to calculate and output a compensated mass reading. This device is typically used to measure flow rates of saturated steam.

#### **Model DVH-P**

The Model DVH-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 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

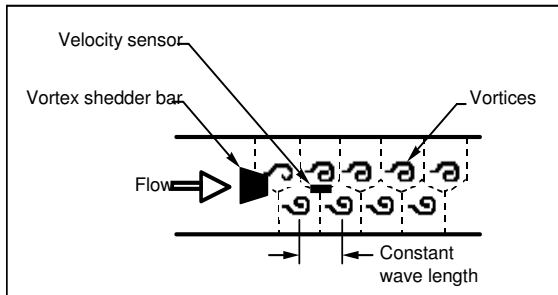
#### **Model DVH-M**

The Model DVH-M 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. The Model DVH-P flow meter monitors one side of the process, either sent or return, and uses the input from a second separate temperature sensor on the opposite leg of the process to calculate the change in energy. Selectable energy units include Btu, joules, calories, Watt-hours, Megawatt-hours and Horsepower-hours. The local or remote electronics indicate two temperatures, delta T, mass total and energy total.  
(Not approved for custody transfer applications)



## Technical Data

### Measuring principle



The measuring principle is based on the Karman Vortice Street. A specially shaped bluff body is located in direction of the flow. From a certain flow velocity on vortices are generated through the bluff body. These small vortices generate small pressure differences which are sensed from a piezoelectric sensor behind. The number of vortices is directly proportional to the flow velocity and will be provided to an evaluating electronic.

### Accuracy

Mass flow rate accuracy for gas and steam based on 50-100% of pressure range

### Model DVH Accuracy Flow Meter

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 (± 1°C)	± 2°F (± 1°C)
Pressure	± 0.3% of Full Scale	± .3% of Full Scale
Density	± 0.3% of Reading	± .5% of Reading

### Repeatability

Mass Flow Rate	±0.2% of rate
Volumetric Flow Rate	±0.1% of rate
Temperature	±0.2°F (± .1°C)
Pressure	±0.05% of full scale
Density	±0.1% of reading

### Stability Over 12 Month

Mass Flow Rate	±0.2% of rate
Volumetric Flow Rate	± negligible
Temperature	±0.9°F (± .5°C)
Pressure	±0.1% of full scale
Density	±0.1% of reading

### Response Time

Adjustable from 1 to 100 seconds

## Operating Specifications

### Process and Ambient Temperature

Process Standard Temperature  
-40 to 260°C (-40 to 500°F)  
Process High Temp: up to 400°C (750°F)  
Ambient Operating: -40 to 60°C (-5 to 140°F)  
Ambient Storage: -40 to 85°C (-40 to 185°F)

### Pressure Ratings

Pressure Sensor			
Full Scale Operating Pressure		Max. Over-Range Pressure	
psia	bar abs	psia	bar abs
30	2	60	4
100	7	200	14
300	20	600	40
500	35	1000	70
1500	100	2500	175

Meter pipe and vortex sensor system:  
Standard PN100 (SCH 80 measuring pipe)  
Other non standard measuring pipes on request  
Pressure rating process connections: acc. pressure specification - see model code

### Power Requirements

Model DVH-V: 12-36 VDC loop powered  
Model DVH-P, DC option: 12-36 VDC, 300 mA max  
Model DVH-P, AC option: 85-240 VAC, 50/60Hz, 5 Watts

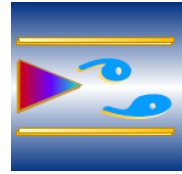
### Display

Alphanumeric 2 line x 16 character LCD digital display  
6 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

### Output signals

Analog: 4-20 mA, loop powered for volumetric meters

Alarm: Solid state relay, 40 VDC  
Totalizer Pulse: 50 millisecond pulse, 40 VDC  
Volumetric: 1 analog, 1 totalizer pulse, HART  
Multivariable: Up to 3 analog signals, 3 alarms, 1 totalizer pulse, HART  
Multivariable option: Modbus process monitoring



## Materials

### Wetted Materials

Housing / bluff body / flanges  
stainless steel 1.4404 (316L)  
Dupont Teflon® based thread sealant on models with pressure transducer.  
Dupont Teflon® packing on standard temperature models with packing gland.  
Graphite based packing on high temperature models with packing gland

### APPROVALS

ATEX: II 2 G Ex d IIB + H2 T6  
II 2 D EX tD A21 IP66 T85 °C  
Ta-40...+60 °C

IEC EX Ex d IIB + H2 T6  
Ex tD A21 IP 66 T 85 °C, Ta=-40...+60 °C

## Sizing Considerations

### Piping Conditions

Condition	Pipe Diameters D	
	Upstream	Downstream
One 90° elbow before meter	<b>10 D</b>	<b>5 D</b>
Two 90° elbow before meter	<b>15 D</b>	<b>5 D</b>
Two 90° elbows before meter, out of plane	<b>25 D</b>	<b>5 D</b>
Reduction before meter	<b>10 D</b>	<b>5 D</b>
Expansion before meter	<b>20 D</b>	<b>5 D</b>
Partially open valve	<b>25 D</b>	<b>5 D</b>

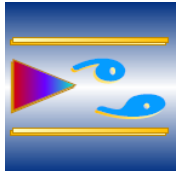
### Velocity Range

Maximum velocity, liquid: 30 feet/sec (9 meters/second)  
Minimum velocity, liquid: 1 foot/sec (.3 meters/second)  
Maximum velocity, gas or steam: 300 feet/sec (90 meters/second)  
Minimum velocity, gas or steam feet/sec (meters/second)

$$v_{min} = \frac{6,1}{\sqrt{\text{density} \left( \frac{\text{kg}}{\text{m}^3} \right)}} \frac{\text{m}}{\text{sec}}; \quad v_{min} = \frac{5}{\sqrt{\text{density} \left( \frac{\text{lb}}{\text{ft}^3} \right)}} \frac{\text{ft}}{\text{sec}}$$

### Water Minimum and Maximum Flow Rates

Rate	Nominal. Pipe Size (in)								
	0,5	0,75	1	1,5	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	1076	2437	4270
Nominal. Pipe Size mm									
	10	20	25	40	50	80	100	150	200
m <sup>3</sup> /h min	0,2	0,3	0,5	1,3	2,1	4,7	8,1	18	32
m <sup>3</sup> /h max	5	9	15	38	63	140	244	554	970



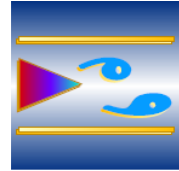
Typical Saturated Steam Minimum and Maximum Flow Rates (kg/hr)									
Nominal Pipe Size (mm)									
Pressure	15	20	25	40	50	80	100	150	200
0 bar rel	3 18	5 42	8 91	19 224	32 375	72 838	126 1459	286 3309	500 5797
5 bar rel	6 95	11 224	18 485	45 1192	75 1992	167 4455	290 7754	658 17581	1153 30799
10 bar rel	8 168	15 397	24 862	59 2118	99 3539	222 7915	387 13777	877 31237	1537 54720
15 bar rel	9 241	17 569	29 1236	71 3036	119 5073	266 11347	463 19750	1050 44779	1840 78444
20 bar rel	11 314	20 742	33 1610	81 3956	136 6611	304 14787	529 25738	1199 58355	2100 102226
30 bar rel	13 463	24 1092	40 2370	99 5822	165 9729	369 21763	642 37880	1455 85884	2548 150451

Typical Air Minimum and Maximum Flow Rates (nm <sup>3</sup> /hr)									
Air at 20 °C									
Nominal Pipe Size (mm)									
Pressure	15	20	25	40	50	80	100	150	200
0 bar rel	3 28	5 66	9 142	21 350	36 584	79 1307	138 2275	313 5157	549 9034
5 bar rel	7 165	13 390	21 847	52 2080	87 3476	194 7775	337 13533	764 30682	1339 53749
10 bar rel	9 304	17 716	29 1554	70 3819	117 6381	262 14273	457 24844	1035 56329	1814 98676
15 bar rel	11 442	21 1044	34 2265	85 5565	142 9299	317 20801	551 36205	1250 82087	2190 143801
20 bar rel	13 582	24 1373	40 2979	97 7318	162 12229	363 27354	632 47612	1434 107949	2511 189105
30 bar rel	16 862	29 2034	48 4414	118 10843	198 18119	442 40529	770 70544	1745 159942	3057 280187

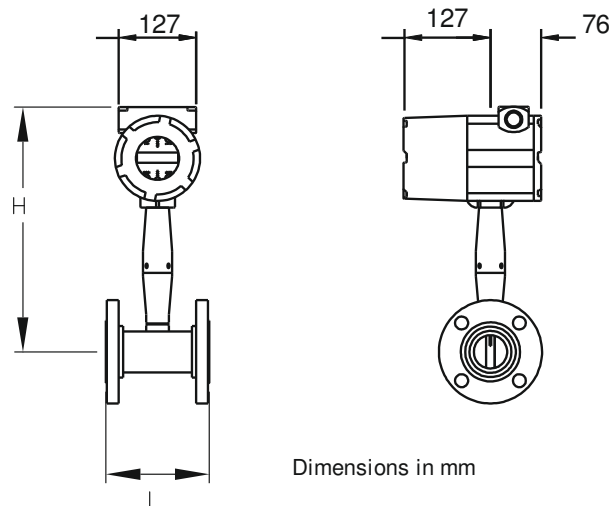
Typical Saturated Steam Minimum and Maximum Flow Rates (lb/hr)									
Nominal Pipe Size (in)									
Pressure	0,5	0,75	1	1,5	2	3	4	6	8
5 psig	6,5 52	12 122	20 265	49 650	82 1087	183 2431	318 4231	722 9594	1264 16806
100 psig	15 271	27 639	46 1386	112 3405	187 5690	419 12729	728 22156	1652 50233	2893 87998
200psig	20 493	37 1163	62 2525	151 6203	253 10365	565 23184	983 40354	2229 91494	3905 160279
300 psig	24 716	45 1688	74 3664	182 9000	304 15040	680 33642	1184 58556	2685 132763	4704 232575
400 psig	28 941	51 2220	85 4816	209 11831	349 19770	780 44222	1358 76971	3079 174516	5393 305717
500 psig	31 1170	57 2760	95 5988	233 14711	389 24582	870 54987	1514 95710	3433 217001	6014 380148

Typical Air Minimum and Maximum Flow Rates (SCFM)									
Air at 70 °F									
Nominal Pipe Size (in)									
Pressure	0,5	0,75	1	1,5	2	3	4	6	8
0psig	1,8 18	3 41	5 90	13 221	22 369	50 826	87 1437	198 3258	347 5708
100 psig	5 138	9 325	15 704	38 1730	63 2890	141 6466	245 11254	555 25515	972 44698
200psig	7 258	13 609	21 1322	52 3248	86 5427	193 12140	335 21131	761 47911	1332 83931
300 psig	8 380	15 896	25 1944	63 4775	104 7978	234 17847	407 31064	922 70431	1615 123375
400 psig	10 502	18 1183	29 2568	72 6309	120 10542	269 23580	467 41043	1060 93057	1857 163000
500 psig	11 624	20 1472	33 3195	80 7849	134 13115	300 28034	521 51063	1182 115775	2071 203000

Turndown is application dependant and can exceed 100:1



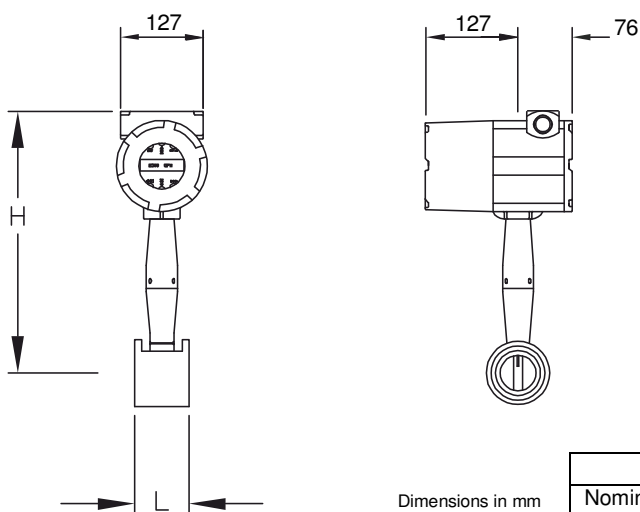
## Dimensional Outline: Inline Flanged Models



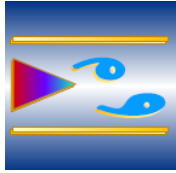
Flow Meter Nominal Size	L	H	Weight		
			ANSI 150 PN16	ANSI 300 PN 40	ANSI 600 PN 64
1/2" – DN15	200 mm	376 mm	5,5 Kg	5,7 Kg	5,9 Kg
3/4" – DN 20	200 mm	381 mm	5,9 Kg	6,4 Kg	6,6 Kg
1" – DN 25	200 mm	381 mm	6,1 Kg	7,4 Kg	7,4 Kg
1 1/2" DN40	200 mm	384 mm	6,6 Kg	10,3 Kg	11,2Kg
2" – DN 50	200 mm	389 mm	8,8 Kg	12,2Kg	15,1Kg
3" – DN80	200 mm	401 mm	12,5 Kg	17,9 Kg	25,5Kg
4" – DN100	250 mm	411 mm	19,7 Kg	27,4 Kg	43,6 Kg
6" – DN150	300 mm	439 mm	22,0 Kg	43,6 Kg	80,8 Kg
8" – DN200	300 mm	462 mm	32,2 Kg	67,4 Kg	136 Kg

## Dimensional Outline: Wafer Models

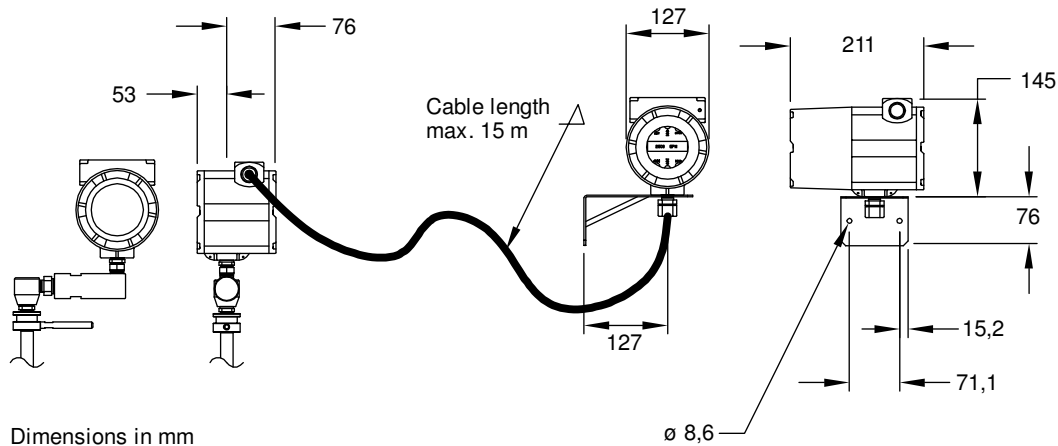
Add 5 Kg for remote electronics



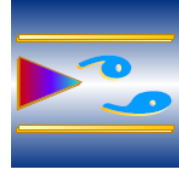
Nominal Size	L	H	Weight
			ASME CL 300 DIN PN 40
1/2" - DN15	65 mm	341 mm	3,9 Kg
3/4" - DN 20	65 mm	343 mm	4,1 Kg
1" – DN 25	65 mm	346 mm	4,2 Kg
1 1/2" – DN 40	65 mm	353 mm	4,9 Kg
2" – DN 50	65 mm	358 mm	5,7 Kg
3" – DN80	65 mm	375 mm	7,9 Kg
4" – DN100	65 mm	387 mm	10 Kg



## Dimensional Outline: Remote Electronic Option R



Model Code / Description			
<b>Model</b>	<b>Base Price</b>		
DVH	-		
<b>Elektronic - Options</b>			
V	Volume Measurement of Liquids, Gases and Steam		
T	Flow Velocity including temperature sensor		
P	Flow Velocity including temperature and pressure sensor		
E	Energy Consumption Measurement including temperature sensor		
M	Energy Consumption Measurement including temperature and pressure sensor		
X	Special (on request)		
<b>Flow Body FLANGE</b>			
15	DN15 DIN EN	1/2 inch ANSI	JIS 15
20	DN20 DIN EN	3/4 inch ANSI	JIS 20
25	DN 25 DIN EN	1 inch ANSI	JIS 25
40	DN 40 DIN EN	1,5 inch ANSI	JIS 40
50	DN 50 DIN EN	2 inch ANSI	JIS 50
80	DN 80 DIN EN	3 inch ANSI	JIS 80
1H	DN 100 DIN EN	4 inch ANSI	JIS 100
H5	DN 150 DIN EN	6 inch ANSI	JIS 150
2H	DN 200 DIN EN	8 inch ANSI	JIS 200
<b>Flow Body WAFER</b>			
W1	Wafer	DN 15 EN / 1/2" ANSI / JIS 15	
W2	Wafer	DN 20 EN / 3/4" ANSI / JIS 20	
W3	Wafer	DN 25 EN / 1" ANSI / JIS 25	
W4	Wafer	DN 40 EN / 1 1/2" ANSI / JIS 40	
W5	Wafer	DN 50 EN / 2" ANSI / JIS 50	
W6	Wafer	DN 80 EN / 3" ANSI / JIS 80	
W7	Wafer	DN 100 EN / 4" ANSI / JIS 100	
XX	Special (on request)		
<b>Process Connection</b>			
1	ANSI 150 lbs	ASME B16.5.2003	(not for wafer)
2	ANSI 300 lbs	ASME B16.5.2003	
3	ANSI 600 lbs	ASME B16.5.2003	
5	DIN PN 40	DIN EN 1092-1	
6	DIN PN 64	DIN EN 1092-1	
7	DIN PN 100	DIN EN 1092-1	(not for wafer)
J	JIS 10 K		
K	JIS 16 K	(not for wafer)	
L	JIS 20 K	(not for wafer)	
X	Special	(on request)	
<b>Material Flow Body</b>			
S	st.st. 1.4404 / 316 L	(standard)	
x	Special	(on request)	



Sensor Configuration / Mounting Option				
	<b>L</b>	Compact	incl. LCD Display	IP 66 / Nema 4
	<b>R</b>	remote	incl. LCD Display	IP 66 / Nema 4 Specify cable length in m (max.17m inclusive)
	<b>X</b>	Special	on request	
Input Power				
	<b>L</b>	12-36 VDC	loop powered	
	<b>D</b>	12-36 VDC	4-wire	requested for output options H / M / 3 / 4
	<b>A</b>	100-240 VAC	50/60 Hz 12 W	requested for output options H / M / 3 / 4
Output Signal				
	<b>2</b>	Loop powered	1x 4-20mA, HART 1 x pulse	only with Input Power L passive
	<b>H</b>	1x 4-20mA HART	1x Alarm, 1x Pulse	only with Input Power D/ A passive
	<b>M</b>	1x 4-20mA	1x Alarm, 1x Pulse	MODBUS only with Input Power D/ A passive
	<b>3</b>	3x 4-20 mA HART	3x Alarm, 1x Pulse	only with Input Power D/ A passive
	<b>4</b>	3x 4-20 mA	3x Alarm, 1x Pulse	MODBUS only with Input Power D/ A passive
	<b>X</b>	Special	(on request)	
Process Temperature				
	<b>S</b>	Standard Temperature	-200...+260 °C	-330...+500 °F
	<b>H</b>	High Temperature	-200...+400 °C	-330 ...+750 °F
	<b>X</b>	Special	(on request)	
Option Pressure Sensor (Electronic versions T/P/E/M)				
	<b>0</b>	w/o Pressure Sensor	Electr.version V / T / E	Max. test pressure
	<b>1</b>	Incl. Pressure Sensor	2 bar abs (30 psia)	Electr.version P / M 4 bar abs.(60 psia)
	<b>2</b>	Incl. Pressure Sensor	7 bar abs (100 psia)	Electr.version P / M 14 bar abs. (200 psia)
	<b>3</b>	Incl. Pressure Sensor	20 bar abs ( 300 psia)	Electr.version P / M 41 bar abs. (600 psia)
	<b>4</b>	Incl. Pressure Sensor	34 bar abs ( 500 psia)	Electr.version P / M 69 bar abs. (1000 psia)
	<b>5</b>	Incl. Pressure Sensor	100 bar abs (1500 psia)	Electr.version P / M 172 bar abs. (2500 psia)
	<b>X</b>	Special	(on request)	

More information : [www.heinrichs.eu](http://www.heinrichs.eu)

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