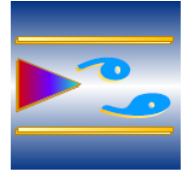


# Multi-Parameter Vortex Flow Meter

## DVE



- **Volumetric or mass flow monitoring of most liquids, gases, and steam**
- **Integrated temperature- and pressure measurement as well as calculation of density (optional)**
- **Energy Monitoring—ability to compute and output energy use**
- **High accuracy with rangeability up to 100:1**
- **High temperature version up to 400°C**
- **High pressure version up to 100 bar**
- **Easy to install and commission by means of field configurable ranges, outputs and displays.**
- **Hot tappable, process shut down not required for installation**
- **HART protocol communications - Standard**
- **Modbus communications available**



**Heinrichs** DVE multi parameter Vortex flow 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 DVE is able to measure all process variables within a single device it provides exceptional accuracy, simplifies system design and reduces installation costs.

To enhance reliability, the DVE insertion flow meters feature a no-moving parts design and rugged, welded construction.

**DVE-V** cost-effective monitoring of most liquids, gases, and steam.

**DVE-T** integrates an RTD temperature sensor that enables to measure the mass flow rate of saturated steam.

**DVE-P** is a multi parameter instrument that delivers volumetric flow rate, mass flow rate, pressure, temperature and density.

**DVE-M** Energy Monitoring option permits real-time calculation of energy consumption for a facility or process

**Field configurable ranges, outputs and displays**

**HART protocol communications**

**ATEX, IEC Ex Approved**

#### **Model DVE-V**

The Model DVE-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 DVE-T**

The Model DVE-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 DVE-P**

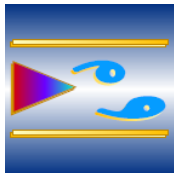
The Model DVE-VTP offers you flow computer functionality in a compact field device. This multivariable instrument incorporates temperature and pressure sensors to provide an instantaneous reading of compensated mass flow rate of gases, liquids and steam. In addition to outputs for totalized mass and 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 DVE-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.

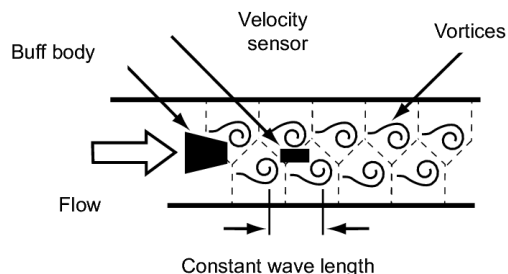
Selectable energy units include Btu, joules, calories, Watt-hours, Megawatt-hours and Horsepower-hours. The local or remote electronics indicate two temperatures, delta T, mass total and energy total.

(Not approved for custody transfer applications)

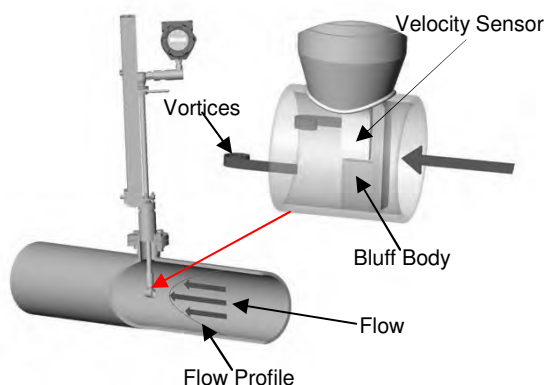


## Technical Data

### Measuring principle



Vortex flow meters 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. Insertion vortex flow meters measure flow by detecting the local velocity at a strategically located position within the pipe. The DVE detects the frequency at which vortices are alternately shed from the bluff body located within the sensor head. The DVE uses the local velocity, along with other parameters, such as fluid type, pipe size and Reynolds number to calculate the average pipe velocity, and consequently, the volumetric flow rate. .



### Accuracy

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

### Modell DVE Multiparameter Flow Meter

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	± 1 °C, (± 2 °F)	± 1 °C, (± 2 °F)
Pressure	±0,3% of Full Scale	±0,3% of Full Scale
Density	±0,3% vom of Reading	±0,5% of Reading

### Repeatability

Mass Flow Rate	±0, 2% of rate
Volumetric Flow Rate	±0, 1% of rate
Temperature	± 0,1 °C, (±0,2 °F)
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	±0,5 °C, (±0,9 °F)
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

Standard:	-200 to 260 °C (-330 to 500 °F)
High Temperature:	to 400 °C, (750 °F)
Ambient Operating:	-40 to 85 °C (-40 to 185 °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

Stem and vortex sensor head: PN100

Compression Fitting: PN 100

Packing gland: PN 64 (600 lbs)

Pressure ratings of process connection acc. specification – see mode code

### Power Requirements

Model DVE-V: 12-36 VDC loop powered

Model DVE-P: DC-Option: 12-36 VDC, 300 mA max.

Model DVE-P: AC-Option: 85-240 VAC, 50/60Hz, 5W

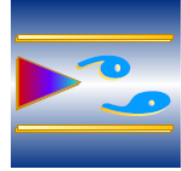
### Display

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 the enclosure covers

Display can be mounted in 90° intervals for better viewing



## Sizing Considerations

### Output Signals

Analog:	4-20 mA
Alarm:	Solid state relay, 40 VDC
Totalizer Pulse:	50 ms pulse, 40 VDC
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 process monitoring

## Physical Specifications

### Wetted Materials

Housing / Bluff Body / Flanges/Sensors: 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 2G Ex d IIB + H2 T6  
II 2D EX tD A21 IP66 T85°C  
Ta=-40...+60°C

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

### Piping Conditions

Condition	Pipe Diameter 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

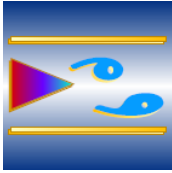
### Velocity Range

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):

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

### Water Minimum and Maximum Flow Rates

Rate	Nominal Pipe Size (inch)					
	3	6	8	12	16	24
GPM min	20,6	81,3	142	317	501	1138
GPM max	618	2437	4270	9501	15043	34144
Rate	Nominal Pipe Size (mm)					
	80	150	200	300	400	600
m³/h min	5,2	20,4	35,4	79,2	125	284
m³/h max	157	614	1062	2337	3753	8537

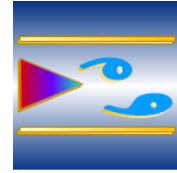


Typical Saturated Steam Minimum and Maximum Flow Rates (kg/hr)						
Nominal Pipe Size (mm)						
Pressure	80	150	200	300	400	600
0 bar g	81 938	316 3667	548 6350	1226 14209	1936 22432	4404 51039
5 bar g	187 4986	729 19486	1263 33742	2826 75495	4461 119189	10151 271187
10 bar g	249 8859	972 34620	1683 33742	3767 134132	5947 211764	13530 481821
15 bar g	298 12700	1164 49629	2016 85939	4510 192283	7120 303570	16200 690705
20 bar g	340 16550	1329 64676	2301 111995	5148 250581	8128 395609	18493 900119
30 bar g	412 24357	1612 95187	2791 164827	6246 368789	9860 582234	22435 1324739

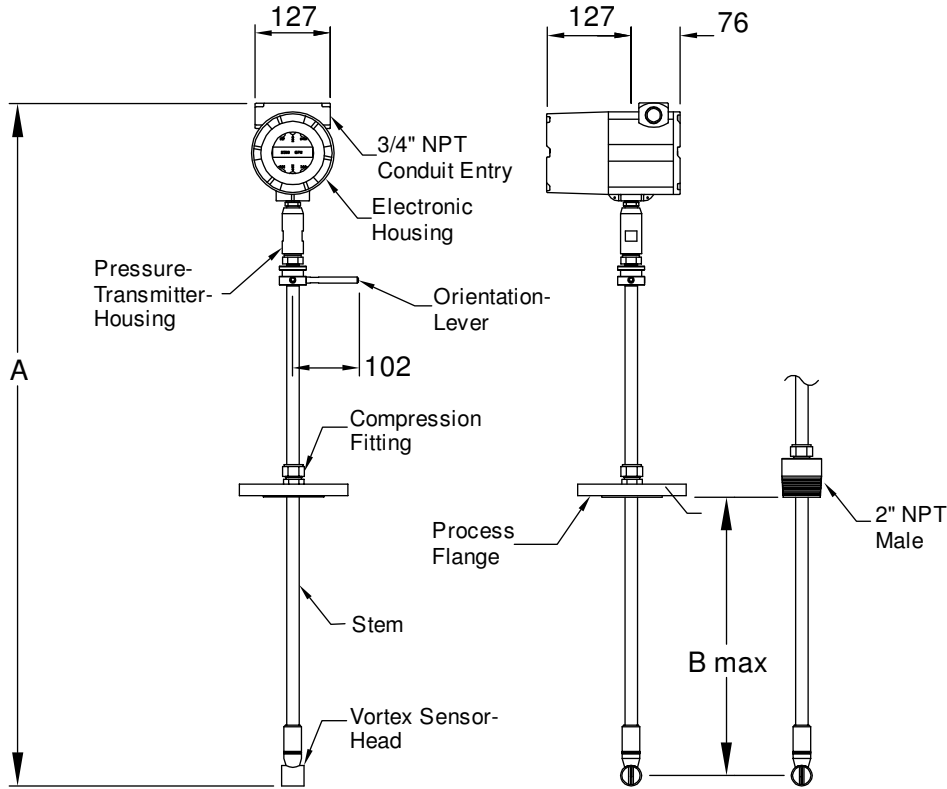
Typical Air Minimum and Maximum Flow Rates (nm3/hr) Air at 20°C						
Nominal Pipe Size (mm)						
Pressure	80	150	200	300	400	600
0 bar g	89 1463	347 5716	601 9897	1345 22145	2124 34962	4833 79547
5 bar g	217 8702	847 34006	1467 58885	3282 131751	5181 208004	11788 473266
10 bar g	294 15975	1148 62430	1987 108105	4446 241878	7020 381870	15972 868857
15 bar g	355 23280	1385 90979	2399 157542	5368 352487	8474 556497	19282 1266182
20 bar g	407 30615	1589 119642	2751 207175	6156 463539	9718 731823	22112 1665095
30 bar g	495 46361	1934 177268	3349 306961	7493 686801	11829 1084302	26915 2467081

Typical Saturated Steam Minimum and Maximum Flow Rates (lb/hr)						
Nominal Pipe Size (in)						
Pressure	3	6	8	12	16	24
5 psig	205 2721	800 10633	1385 18412	3099 41196	4893 65039	11132 147954
100 psig	468 14246	1831 55674	3170 96407	7092 215703	11197 340546	25472 774698
200psig	632 25948	2471 101405	4278 175595	9572 392880	15111 620268	34377 1411029
300 psig	762 37652	2976 147145	5153 254799	11530 570093	18203 900047	41410 2047489
400 psig	873 49494	3412 193420	5908 334930	13219 749382	20870 1183103	47477 2691404
500 psig	974 61543	3805 240507	6588 416468	14741 931816	23272 1471125	52942 3346615

Typical Air Minimum and Maximum Flow Rates (SCFM) Air at 70°F						
Nominal Pipe Size (in)						
Pressure	3	6	8	12	16	24
0psig	56 924	220 3611	381 6253	852 13991	1345 22089	3059 50250
100 psig	157 7236	615 28279	1065 48969	2383 109564	3763 172977	8560 393500
200psig	216 13588	843 53101	1460 91950	3266 205732	5156 324804	11729 738886
300 psig	262 19974	1022 78059	1770 135169	3960 302430	6251 477467	14221 1086176
400 psig	301 26391	1175 103136	2034 178593	4551 399588	7186 630859	16346 1435121
500 psig	335 32834	1310 128314	2269 222191	5077 497136	8015 784865	18233 1785464



### Dimensional Outline: Compression Fitting Models

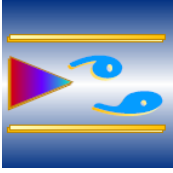


Dimensions in mm

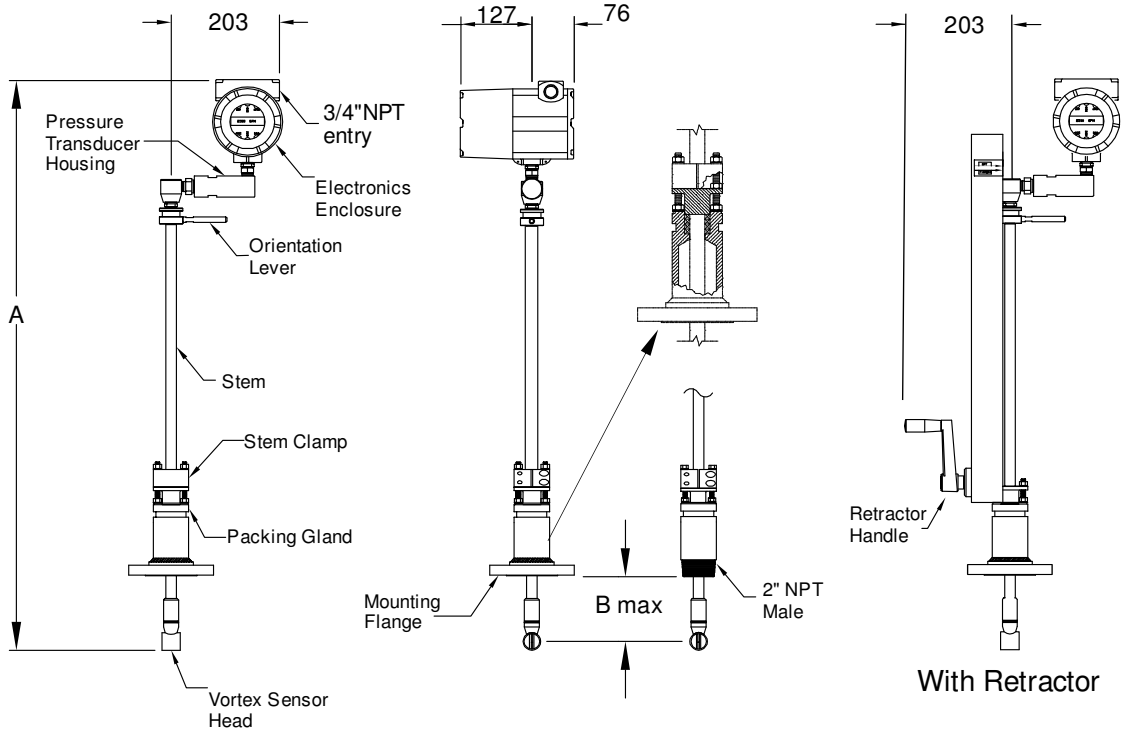
Model DVE-V, T	CL / Compact Length		SL / Standard Length		EL / Extended Length		Weight kg		
	A	B	A	B	A	B	CL	SL	EL
Compression Fitting 2" NPT male	549 mm	249 mm	965 mm	665 mm	1270 mm	970 mm	5,7	6,2	6,7
Compression Fitting 150 lb / PN16 Flange	549 mm	277 mm	965 mm	693 mm	1270 mm	998 mm	6,8	7,3	7,8
Compression Fitting 300 lb / PN40 Flange	549 mm	274 mm	965 mm	691 mm	1270 mm	996 mm	7,8	8,3	8,8
Compression Fitting 600 lb / PN64 Flange	549 mm	264 mm	965 mm	681 mm	1270 mm	986 mm	8,2	8,7	9,2

Model DVE-P	CL / Compact Length		SL / Standard Length		EL / Extended Length		Weight kg		
	A	B	A	B	A	B	CL	SL	EL
Compression Fitting 2" NPT male	625 mm	249 mm	1041 mm	665 mm	1346 mm	970 mm	5,7	6,2	6,7
Compression Fitting 150 lb / PN16 Flange	625 mm	277 mm	1041 mm	693 mm	1346 mm	998 mm	6,8	7,3	7,8
Compression Fitting 300 lb / PN40 Flange	625 mm	274 mm	1041 mm	691 mm	1346 mm	996 mm	7,8	8,3	8,8
Compression Fitting 600 lb / PN64 Flange	625 mm	264 mm	1041 mm	681 mm	1346 mm	986 mm	8,2	8,7	9,2

Add 5 kg for remote electronics



### Dimensional Outline: Packing Gland Models / Retractor Device Models

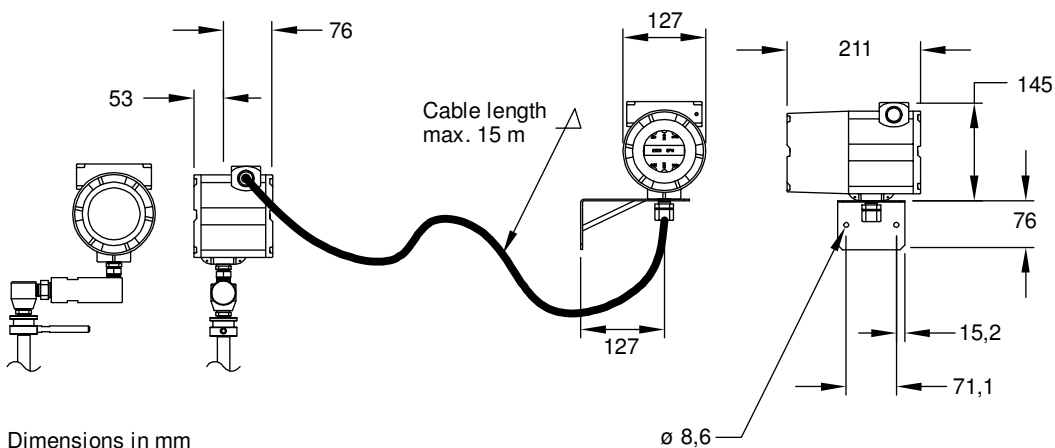


Dimensions in mm

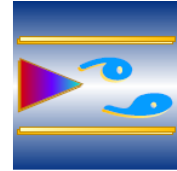
Model DVE with compression fitting / Retractor Device	SL / Standard Length		EL / Extended Length		Weight kg		Weight kg incl. Retractor Device	
	A	B	A	B	SL	EL	SL	EL
Packing Gland NPT male	1029 mm	546 mm	1334 mm	851 mm	7,5	7,8	11,5	14,5
Packing Gland 150 lb / PN16 Flange	1029 mm	536 mm	1334 mm	841 mm	9,5	10	13,7	16,7
Packing Gland 300 lb / PN40 Flange	1029 mm	536 mm	1334 mm	841 mm	11,5	12	15,5	18,5
Packing Gland 600 lb / PN64 Flange	1029 mm	536 mm	1334 mm	841 mm	12,5	15	16	19

Add 5 kg for remote electronics

### Dimensional Outline: Remote Electronics Option



Dimensions in mm



MODEL CODE Insertion Version				
<b>DVE</b>	<b>Electronic - Options</b>			
<b>V</b>	Volume Measurement of Liquids, Gases and Steam			
<b>T</b>	Flow Velocity including temperature sensor			
<b>P</b>	Flow Velocity including temperature and pressure sensor			
<b>E</b>	Energy Consumption Measurement including temperature sensor			
<b>M</b>	Energy Consumption Measurement including temperature and pressure sensor			
<b>X</b>	Special (on request)			
<b>Probe length</b>				
<b>S</b>	Standard length			(Max.Stem Length~ 690 mm)
<b>C</b>	compact length			(Max.Stem Length~ 275 mm)
<b>E</b>	Extended version	Only with Process Connection T/U/V/W/Y/Z/1		(Max.Stem Length~ 995 mm)
<b>X</b>	Special	(on request)		
<b>Sensor Configuration / Mounting Option</b>				
<b>L</b>	Compact	incl. LCD Display	IP 65 / Nema 4	
<b>2</b>	Compact	w/o LCD Display	IP 65 / Nema 4	
<b>R</b>	remote	incl. LCD Display	IP 65 / Nema 4	Specify cable length in m (max.15 m)
<b>3</b>	remote	w/o LCD Display	IP 65 / Nema 4	Specify cable length in m (max.15 m)
<b>x</b>	Special	(on request)		
<b>Input Power</b>				
<b>L</b>	12-36 VDC	loop powered		
<b>D</b>	12-36 VDC	4-Leiter	only with output option H / M / 3 / 4	
<b>A</b>	85-240 VAC	50/60 Hz 12 W	only with output option H / M / 3 / 5	
<b>Output signal</b>				
<b>2</b>	1x 4-20mA, HART, Loop powered	1x 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)		
<b>Process temperature</b>				
<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)		
<b>Option Pressure Sensor (Electronic versions T/P/E/M)</b>				
<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	64 bar abs. (1000 psia)
<b>5</b>	Incl. Pressure Sensor	100 bar abs (1500 psia)	Electr.version P / M	175 bar abs. (2500 psia)
<b>X</b>	Special	(on request)		
<b>Process Connection</b>				
<b>A</b>	2" NPT	Male thread		<b>Sensor Bushing</b> Compression fitting
<b>B</b>	2" 150lbs	Flange		Compression fitting
<b>C</b>	DN 50 PN16	Flange		Compression fitting
<b>D</b>	2" 300 lbs	Flange		Compression fitting
<b>E</b>	DN 50 PN 40	Flange		Compression fitting
<b>F</b>	2" 600 lbs	Flange		Compression fitting
<b>G</b>	DN 50 PN 64	Flange		Compression fitting
<b>H</b>	2" NPT	Male thread		Packing gland
<b>I</b>	2" 150 lbs	Flange		Packing gland
<b>J</b>	DN 50 PN16	Flange		Packing gland
<b>K</b>	2" 300 lbs	Flange		Packing gland
<b>L</b>	DN 50 PN 40	Flange		Packing gland
<b>M</b>	2" NPT	Male Thread	incl. Retraction device	Packing gland
<b>N</b>	2" 150 lbs	Flange	incl. Retraction device	Packing gland
<b>O</b>	DN 50 PN16	Flange	incl. Retraction device	Packing gland
<b>P</b>	2" 300 lbs	Flange	incl. Retraction device	Packing gland
<b>Q</b>	DN 50 PN 40	Flange	incl. Retraction device	Packing gland
<b>R</b>	2" 600 lbs	Flange	incl. Retraction device	Packing gland
<b>S</b>	DN 50 PN 64	Flange	incl. Retraction device	Packing gland
<b>T</b>	2" NPT (only Ext. length)	Male Thread	incl. Retraction device	Packing gland
<b>U</b>	DN 50 PN16 (only Ext.length)	Flange	incl. Retraction device	Packing gland
<b>V</b>	DN 50 PN 40 (only Ext.length)	Flange	incl. Retraction device	Packing gland
<b>W</b>	DN 50 PN 64 (only Ext.length)	Flange	incl. Retraction device	Packing gland
<b>Y</b>	2" 150 lbs (only Ext.length)	Flange	incl. Retraction device	Packing gland
<b>Z</b>	2" 300 lbs (only Ext.length)	Flange	incl. Retraction device	Packing gland
<b>1</b>	2" 600 lbs (only Ext.length)	Flange	incl. Retraction device	Packing gland
<b>X</b>	Special	(on request)		

For more information see: [www.heinrichs.eu](http://www.heinrichs.eu)

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