



OPTIBAR DP 7060 Technical Datasheet

Differential pressure transmitter for measuring flow, level, differential pressure, density and interface

- High accuracy and measurement stability under all process conditions
- Fast response time
- Modular converter platform for all applications



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1.1 OPTIBAR differential pressure transmitter

The member of the KROHNE OPTIBAR family is unparalleled when it comes to versatility and robustness. The completely newly developed piezoresistive differential pressure measuring device provides not only the exact differential pressure under any operating conditions but also simultaneously measures the static pressure in the process line.

The extremely compact measuring cell has a robust and precise response to temperature changes and with step response times of just 125 ms, it provides enough measurements for reliable and stable process control.



Total 3D linearisation

For a robust and accurate differential pressure measurement, even under changing process conditions, each OPTIBAR DP 7060 differential pressure transmitter is linearised in 3 dimensions during calibration: differential pressure, ambient temperature and static pressure are taken into account in combination. Since the full specified operating range is covered, an outmost stable and accurate measurement under all process conditions is guaranteed.

Highlights

- Outstanding temperature stability even under harsh conditions.
- Very good repeatability and long-term stability of the measuring signal.
- Extremely quick step response times < 125 ms.
- Combined DP, SP and T measurements for maximum process reliability.
- Measuring ranges up to 10 mbar / 0.145 psi even without electronic spreading.
- Turn down up to 100:1, higher on request.
- Universal modularity of the entire OPTIBAR process series.
- Quick start-up for all applications.
- Extensive diagnostic and parameterization functions on the display module or the user-friendly and free DTM.

Industries

- General process technology
- Power generation
- Chemical
- Petrochemicals
- Environmental technology
- Water and wastewater

Applications

- Pressure monitoring of filters and pumps with overload protection of up to 400 bar / 5800 psi.
- Level measurement of liquids in open and pressurised vessels
- Flow measurement of gases, vapours and liquids with differential pressure transmitters.
- Measurement of density and interface of liquids in tanks.

1.2 Options

The OPTIBAR process pressure series allows free choice of pressure sensors, process connections, electronics and housings - so that each device is perfectly adapted to each measuring task.



① The optional display and adjustment module make it possible to start-up the converter entirely on site. With double chamber housings it can be installed on the side or on the top.



② The converter can be configured using the optional display and adjustment module as well as by way of PACTware™ via HART® or the optionally available USB module. Regardless of the selected option, user guidance and navigation are absolutely identical.



③ There are a variety of converters available and they can be used regardless of the housing or sensor selected. In addition to the standard configuration with 2-wire 4...20 mA and superimposed HART® (version 7) signal, Foundation Fieldbus and Profibus PA can be selected depending on the application.



④ Note that not all approvals are available with all housings.



⑤ The OPTIBAR process pressure series comprises relative and absolute pressure sensors with metallic and ceramic measuring cells as well as a differential pressure measuring cell with metallic diaphragm for any application in industrial process measuring technology.



Figure 1-1: Plastic housing

- ① Single chamber
- ② Double chamber

The plastic housing is cost-effective and features a low net weight and high chemical resistance in corrosive environments.



Figure 1-2: Aluminium housing

- ① Single chamber
- ② Double chamber

The standard housing for all pressure transmitters – it is perfectly equipped for industrial use and can be used in hazardous areas for all protection types.

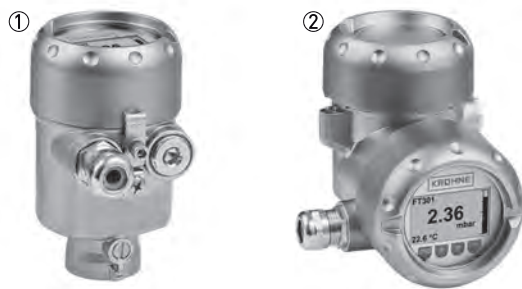


Figure 1-3: Stainless steel housing (precision casting)

- ① Single chamber
- ② Double chamber

For applications that place particular demands on the mechanical robustness of the converter. These housings can be used with all protection types for hazardous areas.

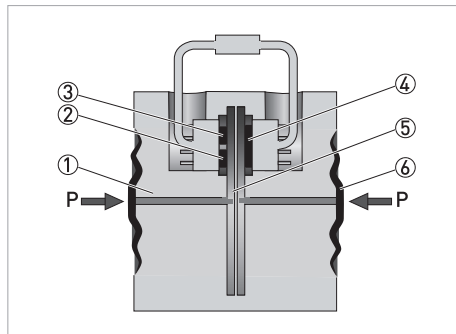


Figure 1-4: Stainless steel housing (electro-polished)

- ① Single chamber

Recommended for applications requiring the corrosion resistance of stainless steel but not the mechanical robustness of a stainless steel precision casting housing. Also suitable for hygienic applications that require an IP69K protection class for steam jet cleanings. Converters can only be used in hazardous areas in intrinsically safe operation.

1.3 Measuring principle



- ① Fill fluid
- ② Temperature sensor
- ③ Absolute pressure sensor
- ④ Differential pressure sensor
- ⑤ Overload system
- ⑥ Separating diaphragm

The process pressure is transferred via the separating metallic diaphragms ⑥ of the high and low pressure side and the fill fluid ① to the piezoresistive silicon sensor. Through the prevailing pressure differential, the silicon diaphragm of the differential pressure sensor ④ is deflected and changes the resistance value of the four piezoresistive elements in the bridge circuit. The change in resistance of the bridge circuit is proportional to the differential pressure. Additionally, the measured cell temperature ② and the prevailing static pressure ③ on the low pressure side is measured and then made available to the signal converter for further processing. If the measurement limit is exceeded, the overload system ⑤ restricts the prevailing process pressure at the differential pressure sensor and protects it from damage.

2.1 Technical data

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).

Measuring system

Measuring principle	Piezoresistive differential pressure cell	
Application range	<ul style="list-style-type: none">• Flow measurement (volume or mass flow) with corresponding differential pressure transmitter in gases, vapours and liquids• Differential pressure measurement• Interface and density measurement• Level, volume and mass measurement of liquids	
Measuring range	10 mbar, 30 mbar, 100 mbar, 500 mbar, 3 bar, 16 bar / 0.14 psi, 0.43 psi, 1.45 psi, 7.25 psi, 43.51 psi, 232 psi	
Display and User interface		
Display on signal converter	<ul style="list-style-type: none">• Dot-matrix display 45 x 27 mm / 1.77 x 1.06", illuminated• Display turnable in 90° steps• Digit size 13 x 7 mm / 0.51 x 0.27"• Ambient temperatures below -20°C / -4°F may affect the readability of the display	
Display values	Number of digits	5
	Digit size	WxH = 7x13 mm
Display function	<ul style="list-style-type: none">• Display of measured value or derived measured value such as filling height, density, interface position, volume or mass flow and total counter• Warning and diagnostic information• All parameters are accessible via the operating menu	
Operating and display languages	German, English, French, Spanish, Portuguese, Italian, Dutch, Russian, Turkish, Polish, Czech, Japanese and Chinese	
Operating	Local operation via 4 push buttons on the display and adjustment module	
Remote control	<ul style="list-style-type: none">• PACTware™, incl. Device Type Manager (DTM)• HART® Hand Held Communicator from Emerson Process• AMS® from Emerson Process• PDM® from Siemens	
Integrated clock		
Date format	Day / Month / Year	
Time format	12 hours / 24 hours	
Time zone	CET (Factory setting)	
Rate deviation	Maximum 10.5 minutes / year	

Measuring accuracy

Differential pressure					
Reference conditions acc. to IEC 60770-1	<ul style="list-style-type: none">Ambient temperature (constant): +18...+30°C / +64...+86°FRelative humidity (constant): 45...75%Ambient pressure (constant): 860...1060 mbar / 12.5...15.4 psiMounting position: verticalRising characteristicsMeasurement start at 0.00 bar / psiProcess diaphragm: 316L / 1.4404Fill fluid: silicone oilMaterial of process flanges: 316L / 1.4404Power supply: 24 VDC ±3 VDCLoad for HART®: 250 Ω				
Reference accuracy acc. to DIN EN 61298	Includes the linearity, hysteresis and non-repeatability under reference conditions. Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4...20 mA current output. [% of the set span]				
		TD < 5:1	TD > 5:1	TD < 10:1	TD > 10:1
	10 mbar / 0.145 psi	<± 0.10%	<± 0.02% x TD		
	30 mbar / 0.44 psi				
	100 mbar / 1.5 psi			<± 0.065%	<±-0.035% + 0.01% x TD
	500 mbar / 7.3 psi				<± 0.015% + 0.005% x TD
	3 bar / 43.51 psi				
	16 bar / 232.1 psi				<±-0.035% + 0.01% x TD
Effect of ambient temperature	Ambient temperature effect on zero and span in relation to the set measuring span. Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4...20 mA current output. [% of the set span]				
		-10...+60°C / +14...+140°F		-40...+85°C / -40...+185°F	
	10 mbar / 0.145 psi	<± 0.15% + 0.20% x TD		<± 0.4% + 0.3% x TD	
	30 mbar / 0.44 psi	<± 0.15% + 0.10% x TD		<± 0.2% + 0.15% x TD	
	100 mbar / 1.5 psi	<± 0.15% + 0.15% x TD		<± 0.15% + 0.20% x TD	
	500 mbar / 7.3 psi	<± 0.15% + 0.05% x TD		<± 0.2% + 0.06% x TD	
	3 bar / 43.51 psi				
	16 bar / 232.1 psi	<± 0.15% + 0.15% x TD		<± 0.15% + 0.20% x TD	
Effect of system pressure	Ambient temperature effect on zero and span in relation to the set measuring span. Zero-point offsets can be calibrated out under operating pressure. Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4...20 mA current output. [% of the set span]				
		up to nominal pressure	on zero		on span
	10 mbar / 0.145 psi	40 bar / 580 psi	<± 0.10% x TD		<± 0.10%
	30 mbar / 0.44 psi				
	100 mbar / 1.5 psi	160 bar / 2320 psi or 400 bar / 5800 psi	160 bar / 2320 psi: <± 0.10% x TD 400 bar / 5800 psi: ≤0.25% x TD	160 bar / 2320 psi: <± 0.10% 400 bar / 5800 psi: ≤0.25%	
	500 mbar / 7.3 psi				
	3 bar / 43.51 psi				
	16 bar / 232.1 psi				
Effect of mounting position	A position-dependent zero offset can be corrected.				
	≤0.35 mbar per 10° inclination around the transverse axis				

Long-term stability acc. to DIN 16086 and IEC 60770-1	Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4...20 mA current output. [% of the set span]			
	<0.1% x TD (Turn Down) over a period of 5 years			
Total performance in accordance with DIN 16086	At a temperature change of -10...+60°C / +14...+140°F, up to the indicated nominal pressure. [% of the set span]			
		up to TD	Nominal pressure	-10...+60°C / +14...+140°F
	10 mbar / 0.145 psi	1:1	40 bar / 580 psi	<± 0.42%
	30 mbar / 0.44 psi			<± 0.29%
	100 mbar / 1.5 psi		160 bar / 2320 psi	<± 0.32%
	500 mbar / 7.3 psi			<± 0.18%
	3 bar / 43.51 psi			
	16 bar / 232.1 psi			<± 0.32%
	The details of total performance comprise the reference accuracy, the effect of the ambient temperature on the zero signal and the measuring span as well as the effect of the static pressure on the measuring span.			
	$E_{\text{perf}} = \sqrt{((E_{\Delta\text{TZ}} + E_{\Delta\text{TS}})^2 + E_{\Delta\text{PS}}^2 + E_{\text{lin}}^2)}$ E _{ΔTZ} = Effect of ambient temperature on the zero signal E _{ΔTS} = Effect of ambient temperature on the measuring span E _{ΔPS} = Effect of the static pressure on the measuring span E _{lin} = Reference accuracy			
Dynamic output behaviour	These parameters depend on the fill fluid, temperature and, if applicable, the diaphragm seal. For further information refer to <i>Dynamic behaviour of the current output</i> on page 30			
Damping	63% of the input variable 0...999 seconds, adjustable in 0.1 second steps.			
Temperature				
The evaluation is made using the HART® output signal.				
Resolution	1°C / 1.8°F			
Accuracy	± 1°K			
System pressure				
Reference conditions acc. to IEC 60770-1	<ul style="list-style-type: none">Ambient temperature (constant): +18...+30°C / +64...+86°FRelative humidity (constant): 45...75%Ambient pressure (constant): 860...1060 mbar / 12.5...15.4 psiMounting position: vertical			
Reference accuracy acc. to DIN EN 61298	Includes the non-linearity, hysteresis and repeatability under reference conditions. Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4...20 mA current output. [% of URL]			
		up to nominal pressure acc. to URL absolute pressure	TD 1:1	
	10 mbar / 0.145 psi	40 bar / 580 psi	<± 0.10%	
	30 mbar / 0.44 psi			
	100 mbar / 1.5 psi	160 bar / 2320 psi or 400 bar / 5800 psi		
	500 mbar / 7.3 psi			
	3 bar / 43.51 psi			
	16 bar / 232.1 psi			

Effect of ambient temperature	Ambient temperature effect on zero and span. [% of URL]			
		up to nominal pressure acc. to URL absolute pressure	-10...+60°C / +14...140°F	-40...+80°C / -40...+176°F
	10 mbar / 0.145 psi	40 bar / 580 psi	<± 0.5%	<± 0.5%
	30 mbar / 0.44 psi			
	100 mbar / 1.5 psi	160 bar / 2320 psi or 400 bar / 5800 psi		
	500 mbar / 7.3 psi			
	3 bar / 43.51 psi			
	16 bar / 232.1 psi			
Long-term stability acc. to DIN EN 61298-1	<± 0.1% of URL over a period of 5 years			

Operating conditions

Temperature	
Operating temperature / nominal temperature range	-40...+85°C / -40...+176°F
Ambient temperature	-40...+80°C / -40...+176°F
Storage temperature	-40...+80°C / -40...+176°F
Climate category	4K 4H (air temperature: -20...+55°C, humidity: 4...100% according to DIN EN 60721-3-4)

Further operating conditions

Ingress protection according to IEC 60529			
Plastic (PBT)	Single chamber	IP66 / IP67	NEMA 6P
	Double chamber	IP66 / IP67	NEMA 6P
Aluminium	Single chamber	IP66 / IP67	NEMA 6P
		IP68 (1 bar / 14.5 psi)	-
	Double chamber	IP66 / IP67	NEMA 6P
Stainless steel (electro-polished)	Single chamber	IP66 / IP67 / IP69K optional	NEMA 6P
Stainless steel (precision casting)	Single chamber	IP66 / IP67	NEMA 6P
		IP68 (1 bar / 14.5 psi)	-
	Double chamber	IP66 / IP67	NEMA 6P
Stainless steel	Sensor for version with external housing	IP68 (25 bar / 362.6 psi)	-

Vibration	
Reference conditions	<ul style="list-style-type: none"> Without mounting bracket Process flanges 316L / 1.4404 PN 160 Single chamber housing, aluminium
Vibration resistance acc. to IEC 60770-1	10...58 Hz, 0.35 mm 58...1000 Hz, 20 m/s ² 1 octave per minute, 10 cycles per axis
Shock resistant according to IEC 60770-1	500 m/s ² , 6 ms 100 shocks per axis
Noise according to IEC 60770-1	10...200 Hz, 1 (m/s ²) ² /Hz 200...500 Hz, 0.3 (m/s ²) ² /Hz 4 hours per axis

Materials

Gaskets	
EPDM	-40...+85°C / -40...+185°F
Copper	
FKM	-20...+85°C / -4...+185°F
Filling oil	
Silicone oil	-40...+85°C / -40...+185°F
Halocarbon oil	
Wetted parts	
Process connection, screwed flange	316L / 1.4404, NACE MR0175 / MR0103, Hastelloy® C-276
Separating diaphragm	316L / 1.4404, NACE MR0175 / MR0103, Hastelloy® C-276
Vent and lock screws	316L / 1.4404, NACE MR0175 / MR0103, Hastelloy® C-276
Internal transmission fluid	Silicone oil, halocarbon oil
Non-wetted parts	
Electronics housing	Plastic PBT (Polyester), powder coated polyester die-cast aluminium, 316L / 1.4404
Housing cover sealing ring	Silicone (Si 850,R), NBR (silicone-free version)
Inspection window in housing cover (display, adjustment module)	Polycarbonate (UL746-C listed), in case of Ex d version: glass
Screws and bolts for the side flanges	up to PN160: hexagon screw DIN 931 M8 x 85 A2-70, hexagon nut DIN 934 M8 A2-70 PN400: hexagon screw DIN 931 M8 x 85 A2-70, hexagon nut DIN 934 M8 A2-70
Grounding flange	316Ti, 316L / 1.4404

Process connection

Process	1/4-18 NPT (Female), IEC 61518 A
Mounting	7/16 UNF, M10 (up to PN160)

Electrical connections

Mechanical		
Cable gland	M20 x 1.5 mm	
cable diameter	5...9 mm / 0.20...0.35" 6...12 mm / 0.24...0.47" 10...14 mm / 0.39...0.55"	
Cable entry 1/2 NPT	Blind plug: M20 x 1.5 mm, 1/2-14 NPT	
	Closing cap: M20 x 1.5 mm, 1/2-14 NPT	
	Connector option: M12 x 1, Harting HAN 7D,8D, 7/8 FF	
Wire cross-section	Solid wire with cords: 0.2 mm...2.5 mm ² / AWG 24...14	
	Cord with wire end sleeve: 0.2 mm...1.5 mm ² / AWG 24...16	
Electrical		
Operating voltage	non-illuminated indication	illuminated indication
	Non-Ex device: 11...35 VDC	Non-Ex device: 16...35 VDC
	Ex ia device: 11...30 VDC	Ex ia device: 16...30 VDC
	Ex d device: 11...35 VDC	Ex d device: 16...35 VDC
	Ex ia d device: 15...35 VDC	No Backlight
Reverse polarity protection	Integrated	
Permissible residual ripple	Non-Ex devices,	for U _n 12 VDC (11 < UB < 14 VDC) ≤ 0.7 V _{eff} (16...400 Hz)
	Ex ia devices, Ex ia d devices	for U _n 24 VDC (18 < UB < 35 VDC) ≤ 1.0 V _{eff} (16...400 Hz)
Load	R _{L,max} =(UB-11) / 22 mA	
Potential connection in device	Electronics: not electrically isolated	
	Ground terminal: galvanically connected with process connection	
Overvoltage category	III	
Protection class	II	

Inputs and outputs

Output signal	
Output signal	4...20 mA / HART® version 7.3 3.8...20.5 mA (factory setting acc. to NAMUR recommendation)
Signal resolution	0.3 μ A
Error signal of current output (adjustable)	High alarm ≥ 21 mA Low alarm ≤ 3.6 mA, last valid measurement
Max. output current	21.5 mA
Boot-up current	≤ 10 mA for 5 ms after switching on, then ≤ 3.6 mA
Damping	0...999 seconds, adjustable
Activation phase	
Boot-up time with operating voltage U_B	≥ 12 VDC: ≤ 9 s
	< 12 VDC ≤ 22 s

Approvals and certificates

CE	The device complies with the legal requirements of the EU directive. The manufacturer confirms compliance with these regulations by affixing the CE marking.
Electromagnetic compatibility (EMC)	EN 61326-1:2013 EN 61326-2-3:2013
NAMUR	NE 21 - Electromagnetic compatibility of equipment NE 43 - Signal level for the failure information of digital transmitters NE 53 - Compatibility of field devices and display/adjustment components NE 107 - Self-monitoring and diagnosis of field devices
Classification according to Pressure Equipment Directive (PED 2014/68/EU)	PN160 (2320 psi), PN400 (5800 psi) - For gases of fluid group 1 and liquids of fluid group 1, the requirements are fulfilled according to article 3, paragraph 3 (sound engineering practice).

2.2 Dimensions and weight

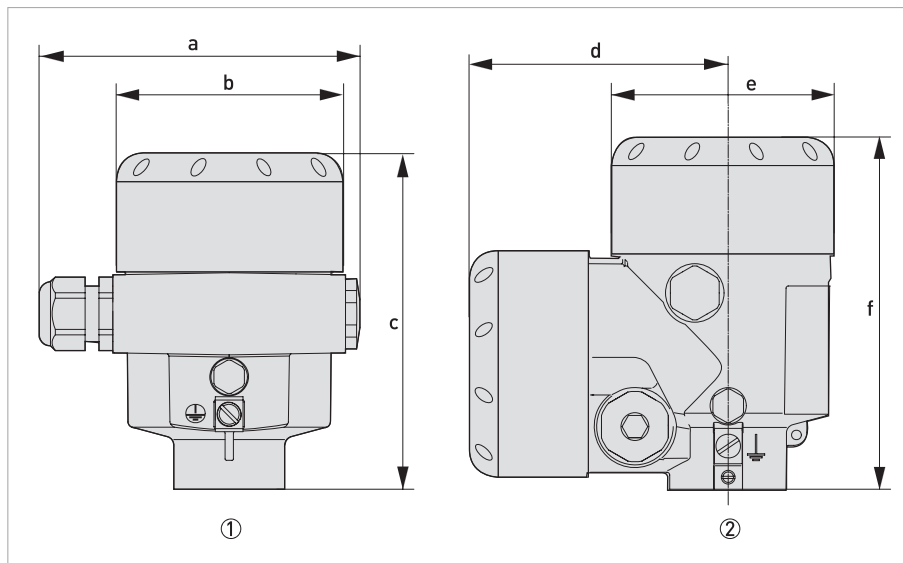


Figure 2-1: Aluminium housing

- ① Single chamber
- ② Double chamber

	Dimension [mm]	Dimension [inch]
a	116	4.57
b	86	3.39
c	116	4.57
d	87	3.43
e	86	3.39
f	120	4.72

With integrated display and adjustment module the height of the housing increases by 9 mm / 0.35 inch.

Housing version	Weight [kg]	Weight [lb]
Single chamber, aluminium	0.83	1.84
Double chamber, aluminium	1.24	2.73

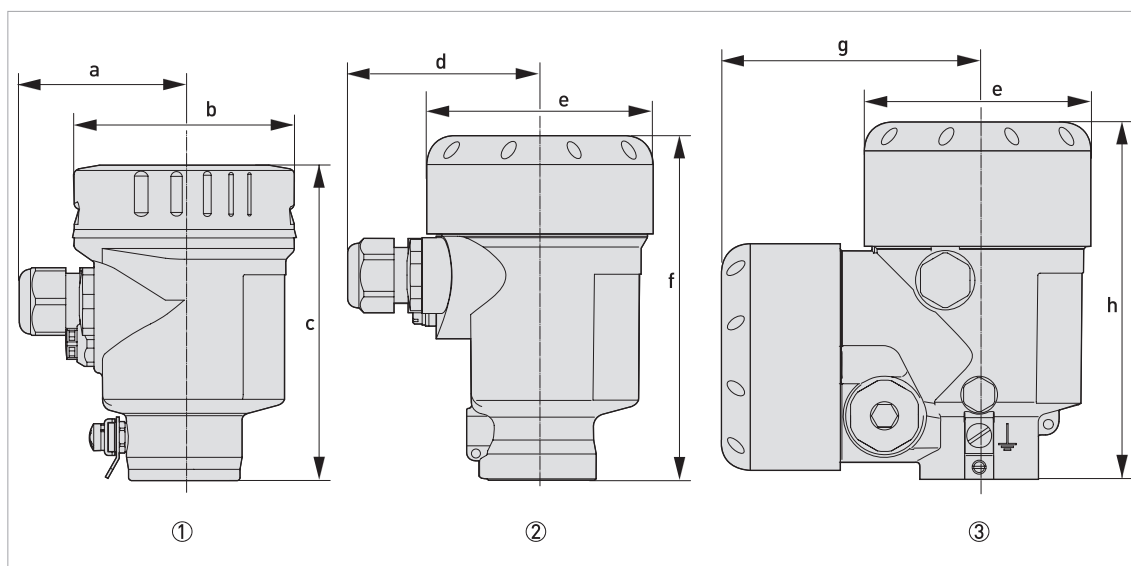


Figure 2-2: Stainless steel housing

- ① Single chamber, stainless steel (electro-polished)
- ② Single chamber, precision casting
- ③ Double chamber, precision casting

	Dimension [mm]	Dimension [inch]
a	59	2.32
b	80	3.15
c	112	4.41
d	69	2.72
e	79	3.11
f	117	4.61
g	87	3.42
h	79	3.11
i	120	4.72

With integrated display and adjustment module the height of the housing increases by 9 mm / 0.35 inch.

Housing version	Weight [kg]	Weight [lb]
Single chamber, stainless steel (electro-polished)	0.73	1.61
Single chamber, precision casting	1.31	2.89
Double chamber, precision casting	2.86	6.31

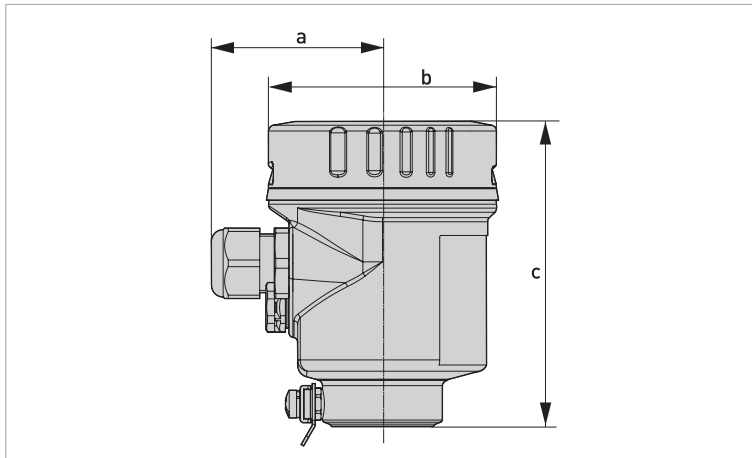


Figure 2-3: Stainless steel (electro-polished) in IP69K version

	Dimension [mm]	Dimension [inch]
a	59	2.32
b	80	3.15
c	104	4.10

With integrated display and adjustment module the height of the housing increases by 9 mm / 0.35 inch.

Housing version	Weight [kg]	Weight [lb]
Single chamber, stainless steel (electro-polished)	0.73	1.61

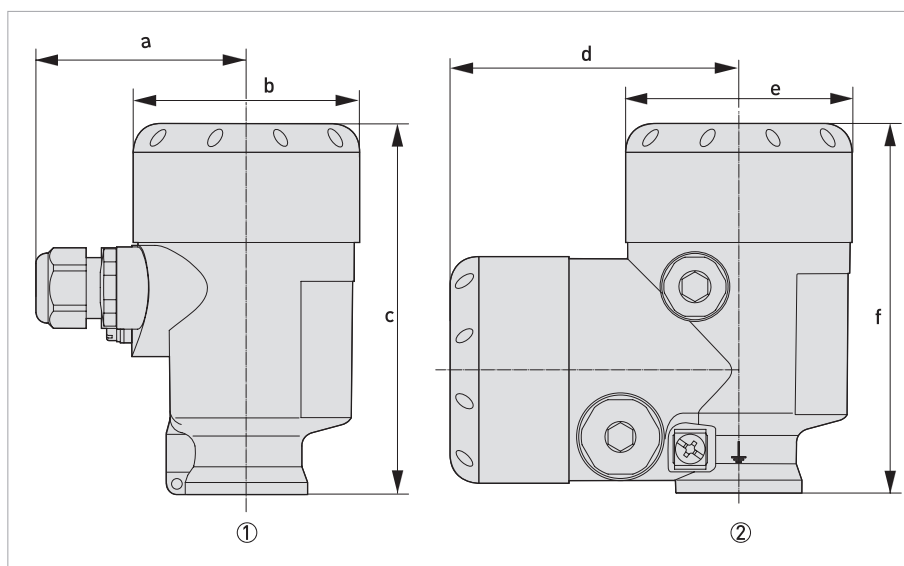


Figure 2-4: Plastic housing

- ① Single chamber
② Double chamber

	Dimension [mm]	Dimension [inch]
a	69	2.72
b	79	3.11
c	112	4.41
d	84	3.31
e	79	3.11
f	112	4.41

With integrated display and adjustment module the height of the housing increases by 9 mm / 0.35 inch.

Housing version	Weight [kg]	Weight [lb]
Single chamber, plastic	0.40	0.88
Double chamber, plastic	0.51	1.13

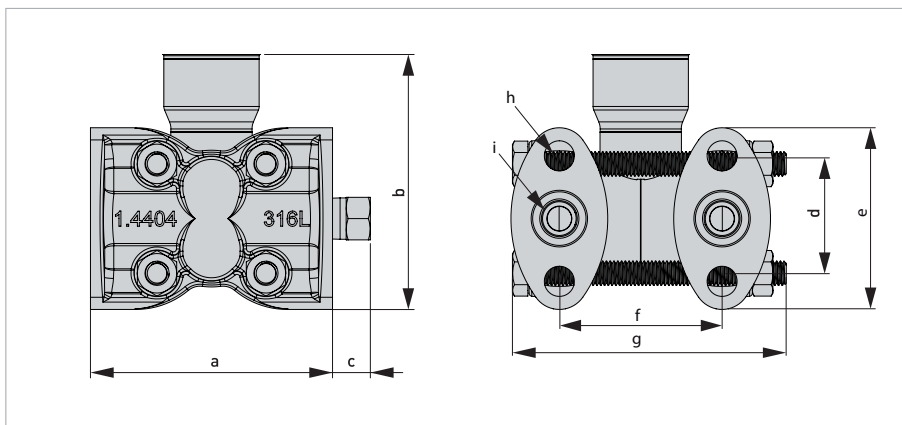


Figure 2-5: 1/4-18 NPT Process connection without venting (S0)

	Dimension [mm]	Dimension [inch]
a	80	3.15
b	83.9	3.3
c	12.5	0.49
d	41.3	1.63
e	60	2.36
f	54	2.13
g	91	3.58
h	7/16 UNF or M10	
i	1/4-18 NPT	

	Weight [kg]	Weight [lb]
Process connection	1.48	3.26

Overall height of the differential pressure transmitter = b (process connection) + overall height of the respective housing

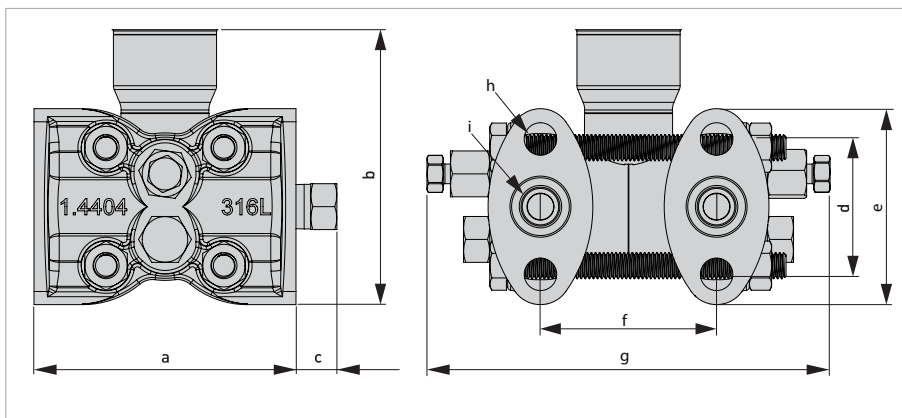


Figure 2-6: 1/2 NPT with side vent (SD)

	Dimension [mm]	Dimension [inch]
a	80	3.15
b	83.9	3.3
c	12.5	0.49
d	41.3	1.63
e	60	2.36
f	54	2.13
g	125	4.92
h	7/16 UNF	
i	1/4-18 NPT according to IEC 61518 A	

	Weight [kg]	Weight [lb]
Process connection, side vent	0.734	1.62

Overall height of the differential pressure transmitter = b (process connection) + overall height of the respective housing

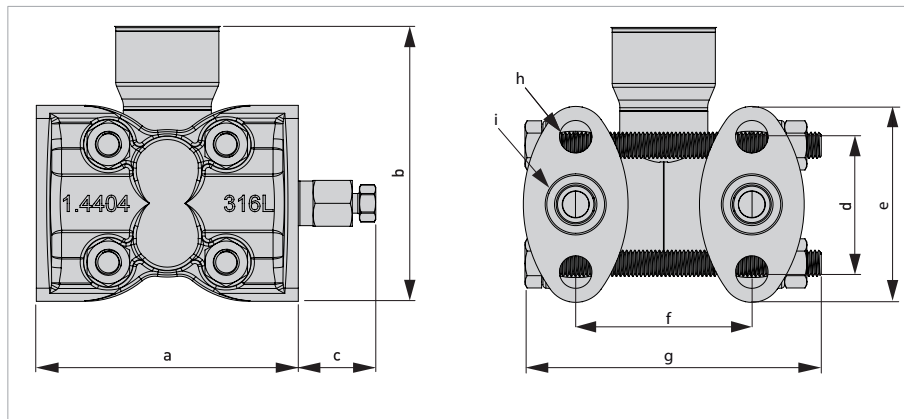


Figure 2-7: 1/4 NPT venting on the process axis (SR)

	Dimension [mm]	Dimension [inch]
a	80	3.15
b	83.9	3.3
c	12.5	0.49
d	41.3	1.63
e	60	2.36
f	54	2.13
g	125	4.92
h	7/16 UNF	
i	1/4-18 NPT according to IEC 61518 A	

	Weight [kg]	Weight [lb]
Process connection, side vent	1.5	3.31

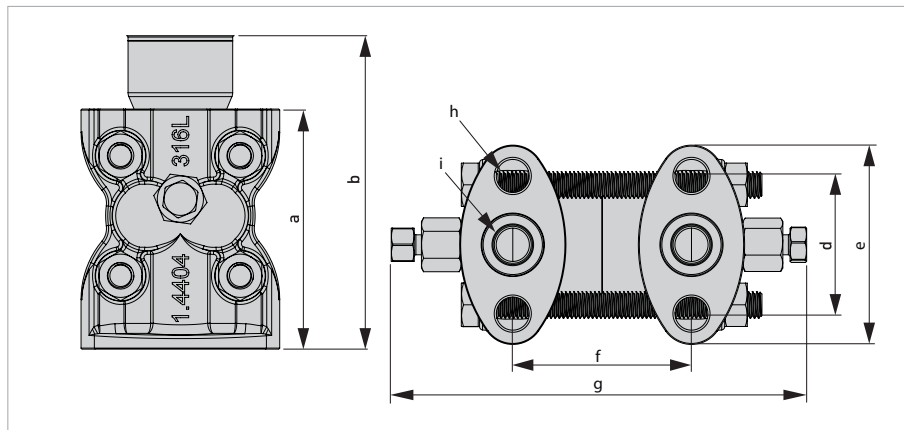


Figure 2-8: 90° vertical 1/4-18 Process connection, side vent (VD)

	Dimension [mm]	Dimension [inch]
a	72	2.83
b	94	3.7
d	41.3	1.63
e	60	2.36
f	54	2.13
g	125	4.92
h	7/16 UNF	
i	1/4-18 NPT according to IEC 61518 A	

	Weight [kg]	Weight [lb]
Process connection, side vent	0.629	1.39

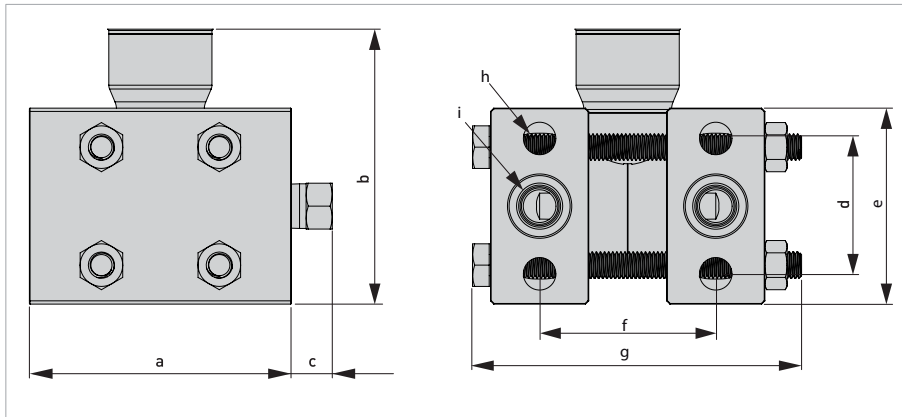


Figure 2-9: 1/4 NPT without venting, Process connection in Hastelloy® C-276 (H0)

	Dimension [mm]	Dimension [inch]
a	80	3.15
b	83.9	3.3
c	12.5	0.49
d	41.3	1.63
e	59.4	2.34
f	54	2.13
g	100.5	3.96
h	7/16 UNF	
i	1/4-18 NPT according to IEC 61518 A	

	Weight [kg]	Weight [lb]
Process connection in Hastelloy® C-276	2.29	5.05

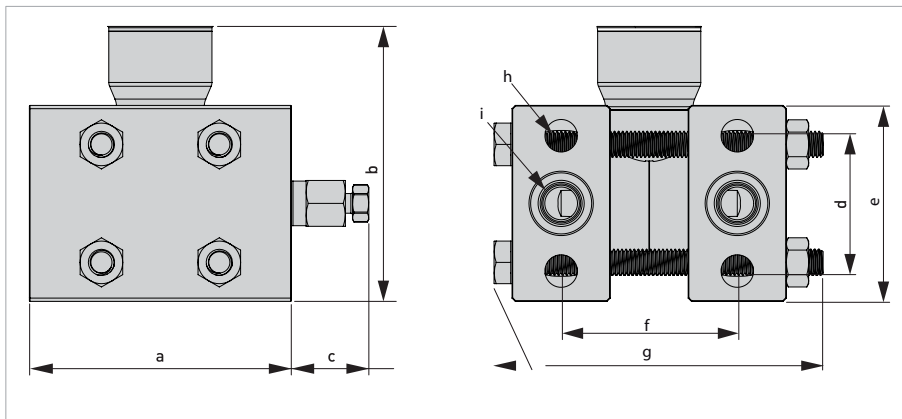


Figure 2-10: 1/4 NPT Process connection in Hastelloy C-276 with venting on the process axis (HR)

	Dimension [mm]	Dimension [inch]
a	80	3.15
b	83.9	3.3
c	25	0.98
d	41.3	1.63
e	59.8	2.35
f	54	2.13
g	100.5	3.96
h	7/16 UNF	
i	1/4-18 NPT according to IEC 61518 A	

	Weight [kg]	Weight [lb]
Process connection in Hastelloy, side vent	2.31	5.1

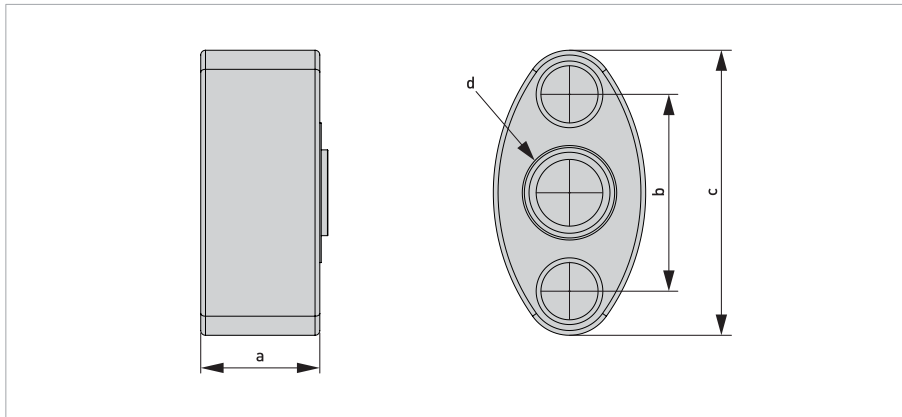


Figure 2-11: Oval flange adapter (Ax)

	Dimension [mm]	Dimension [inch]
a	25.3	0.996
b	41.3	1.63
c	60	2.36
d	1/2 NPT	

	Weight [kg]	Weight [lb]
Mounting bracket	0.196	0.43

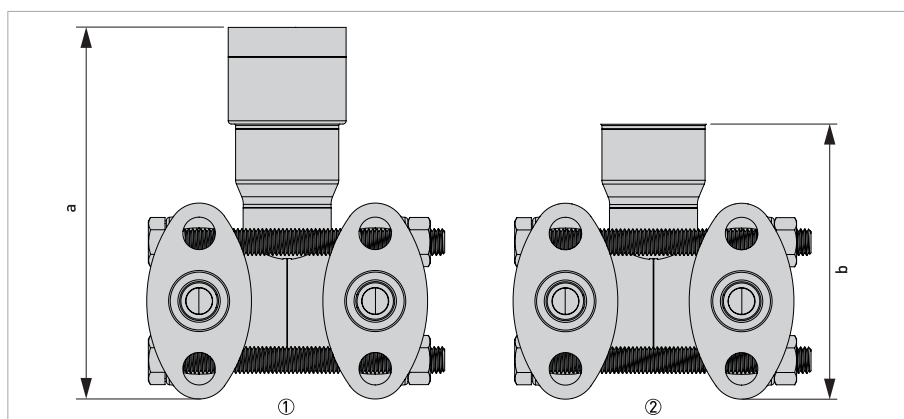


Figure 2-12: Adapter collar version

- ① Adapter collar for versions with protection type "flameproof enclosure" Ex d
 ② Adapter collar for all versions with the exception of "flameproof enclosure" Ex d

	Dimension [mm]	Dimension [inch]
a	113.4	4.46
b	83.9	3.30

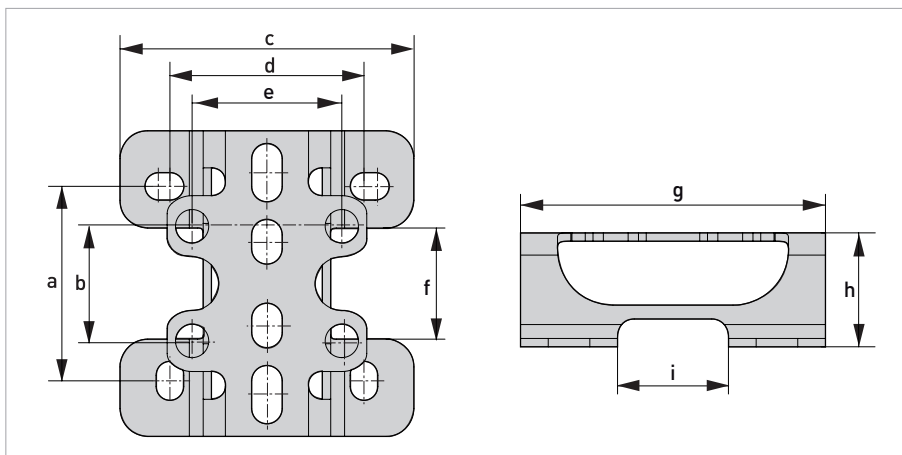


Figure 2-13: Mounting bracket for pipe and wall mounting 2" / 50.8 mm

	Dimension [mm]	Dimension [inch]
a	70	2.76
b	41.3	1.63
c	106	4.17
d	70	2.76
e	54	2.13
f	40	1.57
g	110	4.33
h	41	1.61
i	40	1.57

	Weight [kg]	Weight [lb]
Mounting bracket	0.33	0.73

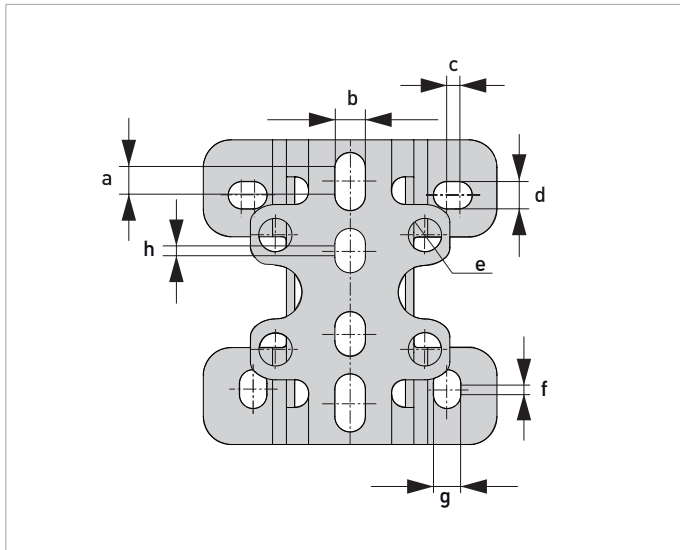


Figure 2-14: Drilling diameter for mounting bracket

	Dimension [mm]	Dimension [inch]
a	10	0.39
b	11	0.43
c	4	0.16
d	10	0.39
e	4x Ø12	4x Ø0.47
f	4	0.16
g	10	0.39
h	5	0.2

2.3 Pressure ranges

Min. / Max. adjustment:

Percent value: -10...+110%

Pressure value: -20...+120%

Zero/Span adjustment

Zero: -95...+95%

Span: -120...+120%

Difference between zero and span: max. = 120% of the nominal range.

Maximum allowed turn down = unlimited (recommended 20:1)

Nominal range	10 mbar	30 mbar	100 mbar	500 mbar	3 bar	16 bar
Limit URL (upper)	10 mbar	30 mbar	100 mbar	500 mbar	3 bar	16 bar
Limit LRL (lower)	-10 mbar	-30 mbar	-100 mbar	-500 mbar	-3 bar	-16 bar
Smallest adjustable measuring span	0.5 mbar	1 mbar	1 mbar	5 mbar	30 mbar	160 mbar
Turn down	20:1	30:1	100:1	100:1	100:1	100:1
MWP (maximum system pressure) ①	40 bar	40 bar	160 bar / 400 bar	160 bar / 400 bar	160 bar / 400 bar	160 bar / 400 bar
Minimum system pressure	1 mbar abs (under reference conditions)					

① MWP corresponds to the PS designation in the PED (maximum system pressure)

Nominal range	0.15 psi	0.44 psi	1.50 psi	7.30 psi	43.51 psi	232.1 psi
Limit URL (upper)	0.15 psi	0.44 psi	1.50 psi	7.30 psi	43.51 psi	232.1 psi
Limit LRL (lower)	-0.15 psi	-0.44 psi	-1.45 psi	-7.25 psi	-43.51 psi	-232.1 psi
Smallest adjustable measuring span	0.007 psi	0.015 psi	0.015 psi	0.073 psi	0.44 psi	2.32 psi
Turn down	20:1	30:1	100:1	100:1	100:1	100:1
MWP (maximum system pressure) ①	580 psi	580 psi	2320 psi / 5800 psi	2320 psi / 5800 psi	2320 psi / 5800 psi	2320 psi / 5800 psi
Minimum system pressure	0.014 psi abs (under reference conditions)					

① MWP corresponds to the PS designation in the PED (maximum system pressure)

2.4 Dynamic behaviour of the current output

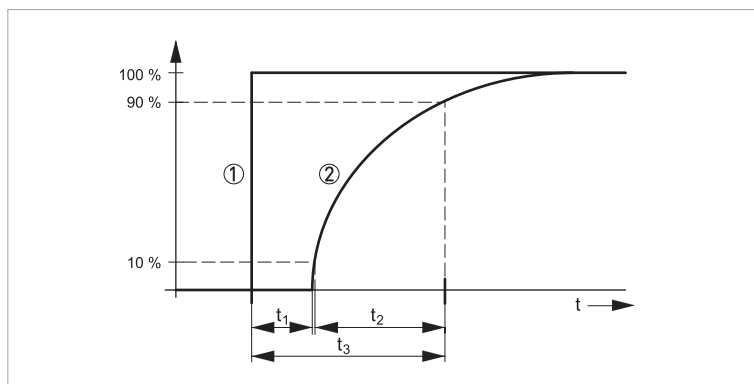


Figure 2-15: Behaviour at an abrupt change in the process variable.
 t_1 - dead time; t_2 - rise time; t_3 - step response time

- ① Process variable
- ② Output signal

These parameters depend on the fill fluid, temperature and, if applicable, the diaphragm seal

	Dead time (t_1) [ms]	T90% (t_2) [ms]	Step response time (t_3) [ms] ①
10 mbar / 0.15 psi	145	745	890
30 mbar / 0.44 psi	145	115	260
100 mbar / 1.50 psi	125	95	220
500 mbar / 7.3 psi		75	200
3 bar / 43.51 psi	115	60	175
16 bar / 232.1 psi			

- ① Step response time is the sum of dead time and T90%

3.1 Intended use

For devices used in hazardous areas, additional safety notes apply.

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

This device is a Group 1, Class A device as specified within CISPR11:2009. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

The OPTIBAR DP 7060 is a differential pressure transmitter suitable for measuring flow, level, differential pressure, density and interface of gases, vapours and liquids. The available measurement ranges and the respective permissible overloads are indicated on the nameplate. To observe the intended use, adhere to the following points:

- Observe the instructions in this document.
- Comply with the technical specifications (for further information refer to *Technical data* on page 8).
- Only suitably qualified personnel may install and operate the device.
- Observe the generally accepted standards of good practice.

3.2 Installation specifications

Observe the relevant directives, ordinances, standards and accident prevention regulations (e.g. VDE/VDI 3512, DIN 19210, VBG, Elex V, etc.).

The accuracy of the measurement is only guaranteed if the transmitter and accompanying impulse line(s), if any, have been correctly installed. In addition, extreme ambient conditions including large fluctuations in temperature, vibrations and shocks should be kept as far away as possible from the measuring equipment.

3.3 Mounting bracket

Scope of delivery

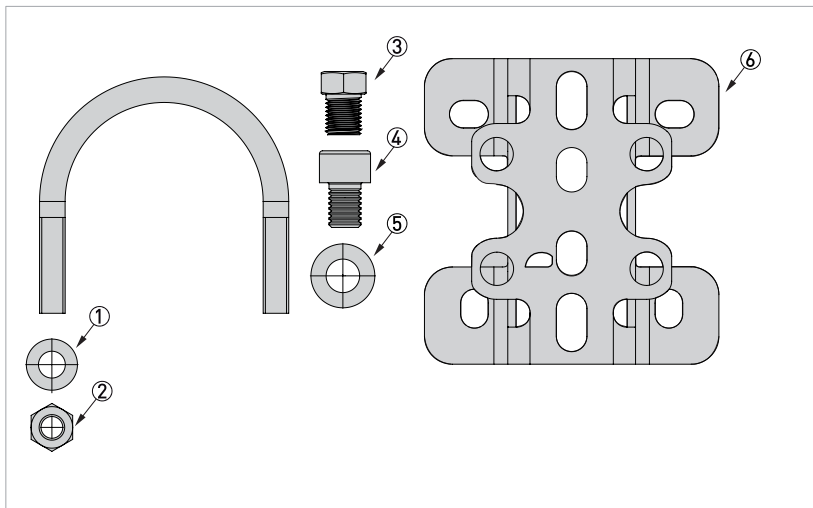


Figure 3-1: Scope of delivery

- ① Washer ISO 7089-8-200 HV
- ② Hexagonal nut ISO 4032-M8-42-70
- ③ Hexagonal head screw 7/16-20 UNF x 1/2 Grade5
- ④ Cylinder head screw ISO 4762-M10-14-A4-50
- ⑤ Washer ISO 7089-10-200-HV
- ⑥ Mounting bracket

Mounting bracket for easy pipe or wall mounting.

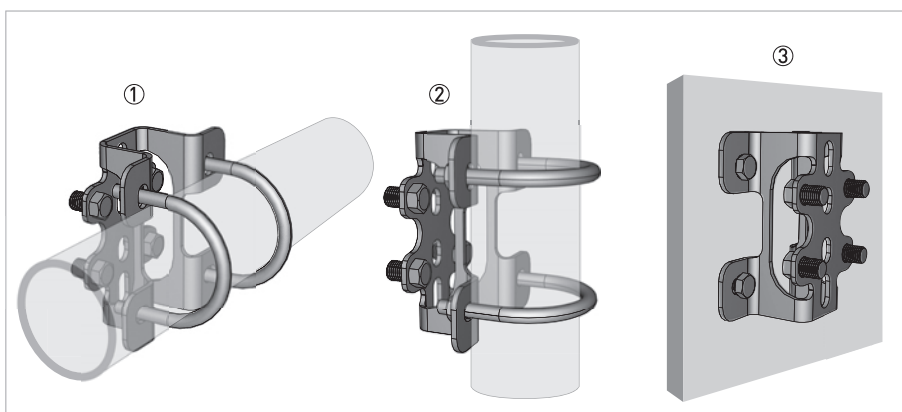


Figure 3-2: Mounting bracket

- ① Horizontal 2" pipe mounting
- ② Vertical 2" pipe mounting
- ③ Wall mount

Mounting bracket for easy valve and pressure transmitter mounting.

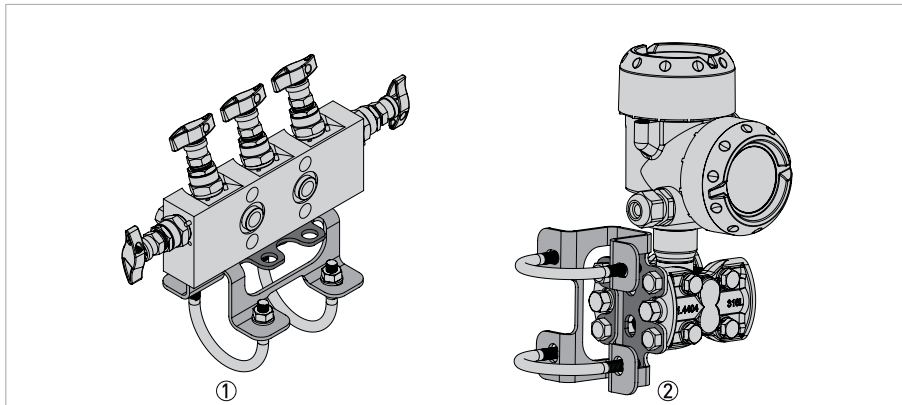


Figure 3-3: Mounting bracket

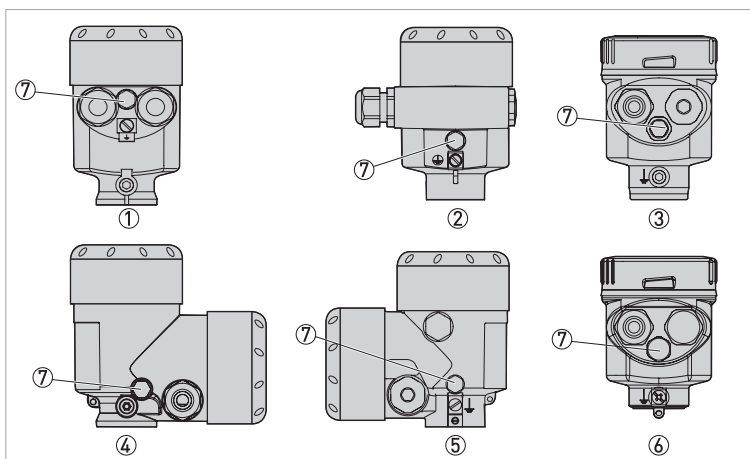
- ① Mounting bracket on a valve
- ② Mounting bracket on a pressure transmitter

3.4 Venting

The ventilation for the electronics housing is assured via a filter element in the vicinity of the cable glands, which is permeable to air but moisture-blocking.

In order to ensure effective ventilation, the filter element must be always free of deposits.

Do not use a high-pressure cleaner to clean the housing. The filter element may become damaged and as a result moisture can penetrate into the housing. The exception to this is the IP69K single chamber housing.



- ① Single chamber housing, plastic, stainless steel precision casting
- ② Single chamber housing, aluminium
- ③ Single chamber housing, stainless steel electro-polished
- ④ Double chamber housing, plastic
- ⑤ Double chamber housing, aluminium
- ⑥ Single chamber housing IP69k
- ⑦ Filter element

3.5 Measurement setup for flow measurement

3.5.1 In gases and liquids with solids content

- Include the pressure tapping points above or to the side on the process line.
- The device must be mounted above the chosen tapping point.

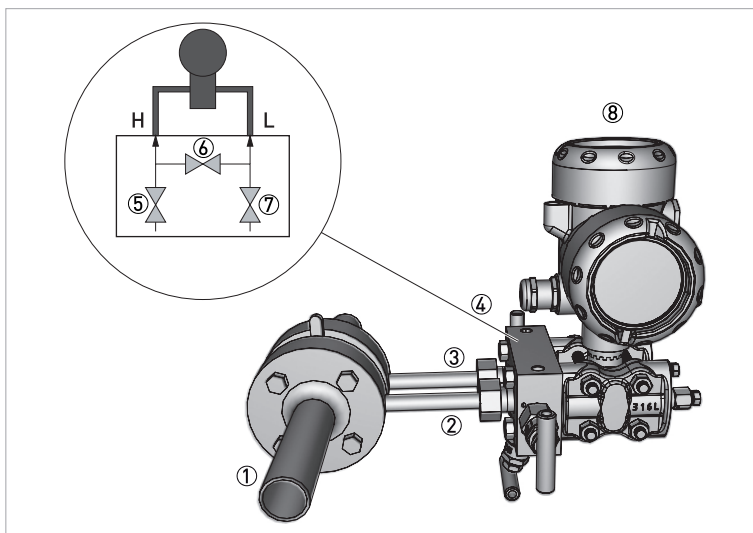


Figure 3-4: Application example

- ① Pipeline with primary element
- ② Low-pressure line (L)
- ③ High-pressure line (H)
- ④ 3-valve manifold
- ⑤ Shut-off valve
- ⑥ Equalizing valve
- ⑦ Shut-off valve
- ⑧ Pressure transmitter

3.5.2 In vapours and pure liquids

- Include the pressure tapping points to the side on the process line.
- The device must be mounted at the same height or underneath the tapping points.
- In steam applications, fill the impulse lines and and/or condensate vessels with an appropriate liquid.

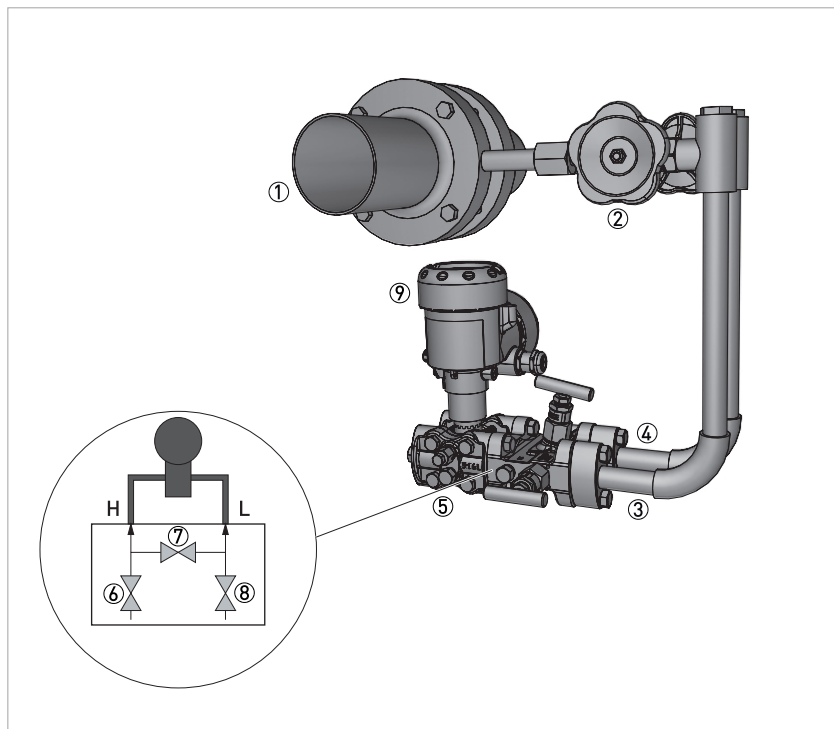


Figure 3-5: Application example

- ① Pipeline with primary element
- ② Primary shut-off valve
- ③ Low-pressure line (L)
- ④ High-pressure line (H)
- ⑤ 3-valve manifold
- ⑥ Shut-off valve
- ⑦ Equalizing valve
- ⑧ Shut-off valve
- ⑨ Pressure transmitter

3.6 Measurement setup for level measurement

3.6.1 In open vessels with impulse line

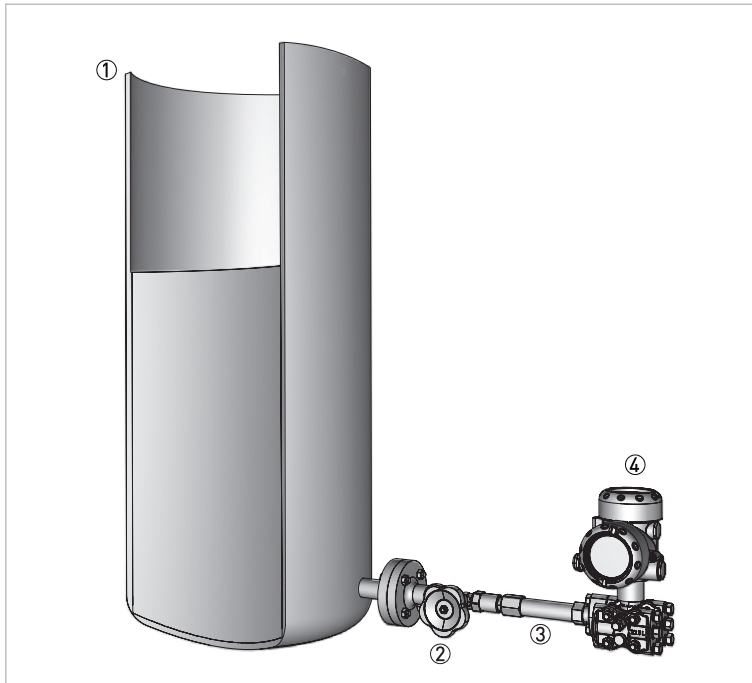


Figure 3-6: Application example

- ① Tank
- ② Shut-off valve
- ③ Impulse line
- ④ Differential pressure transmitter

The following points should be observed in this application:

- Mount the differential pressure transmitter below the lower process connection so that the impulse lines are always filled with liquid.
- The low-pressure side (L) is open to atmospheric pressure.
- For measurements of fluids with solid content, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

3.6.2 In closed vessels with gas-filled impulse lines

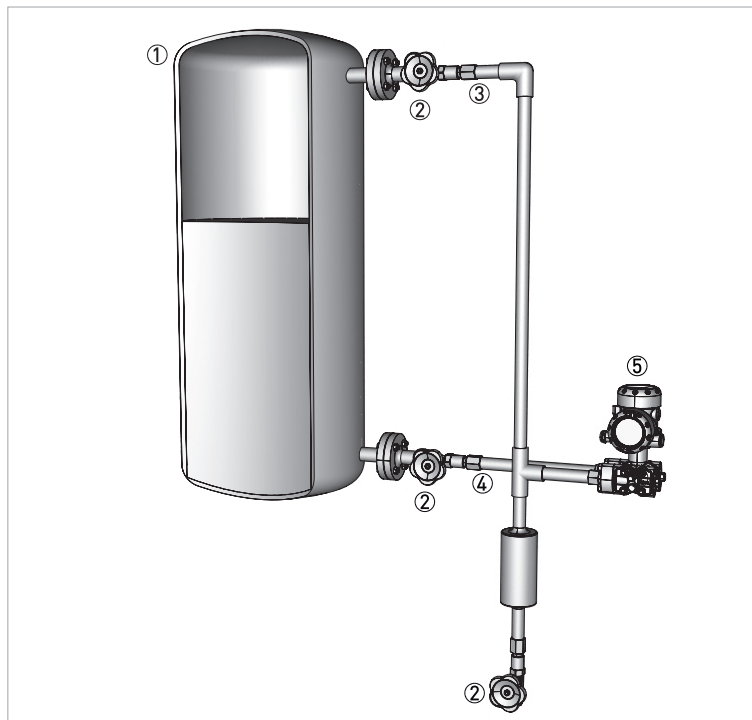


Figure 3-7: Application example

- ① Tank
- ② Shut-off valve
- ③ Low-pressure line (L)
- ④ High-pressure line (H)
- ⑤ Differential pressure transmitter

The following points should be observed in this application:

- Mount the differential pressure transmitter below the lower process connection so that the impulse line is always filled with liquid.
- The low-pressure side (L) must always be connected above the maximum level.
- For measurements of fluids with solid content, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

3.6.3 In closed vessels with liquid / condensate filled impulse lines



Figure 3-8: Application example

- ① Tank
- ② Shut-off valve
- ③ Low-pressure line (L)
- ④ High-pressure line (H)
- ⑤ Differential pressure transmitter

The following points should be observed in this application:

- Mount the differential pressure transmitter below the lower process connection so that the impulse lines are always filled with liquid.
- The low-pressure side (L) must always be connected above the maximum level.
- For measurements of fluids with solid content, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

4.1 Safety instructions

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Observe the national regulations for electrical installations!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Notes for electrical cables

The device must be grounded to a spot in accordance with regulations in order to protect personnel against electric shocks.

Cables may only be connected when the power is switched off! Since the transmitter has no switch-off elements, overcurrent protection devices, lightning protection and/or energy isolating devices need to be provided by the customer.

Metric thread M20 x 1.5 mm

The cable glands with metric threads are screwed in by the factory. They are sealed using plastic plugs to protect them during transport. Remove these plugs prior to establishing an electrical connection.

4.2.1 Requirements for signal cables supplied by the customer

If the signal cable was not ordered, it is to be provided by the customer. The following requirements regarding the electrical values of the signal cable must be observed:

Specifications for standard signal cables

- Test voltage: ≥ 500 VAC RMS (750 VDC)
- Temperature range: $-40...+105^{\circ}\text{C}$ / $-40...+221^{\circ}\text{F}$
- Capacity: ≤ 200 pF/m / 61 pF/ft
- Inductance: ≤ 0.7 $\mu\text{H}/\text{m}$ / 0.2 $\mu\text{H}/\text{ft}$
- Use cable with round cross section.
- A cable outer diameter of 5...9 mm / 0.2...0.35" ensures the seal effect of the cable gland. If you are using cable with a different diameter or cross-section, exchange the seal or use a suitable cable gland.
- We generally recommend the use of a shielded cable for HART® multidrop mode.

4.2.2 Laying electrical cables correctly

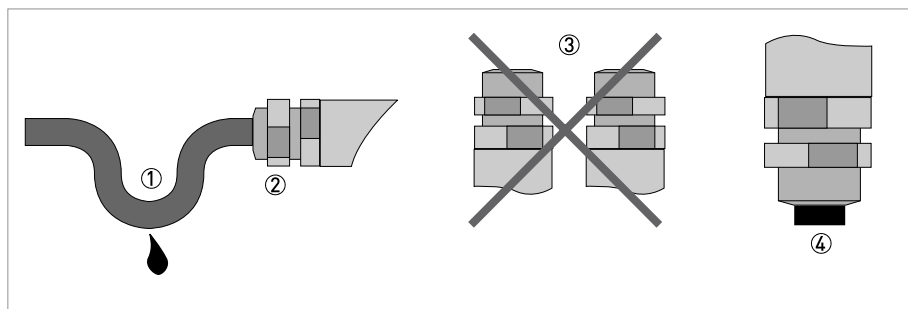


Figure 4-1: Protect housing from dust and water

- ① Lay the cable in a loop just before the housing.
- ② Tighten the screw connections of the cable entry.
- ③ Never mount the housing with the cable entries facing upwards.
- ④ Seal cable entries that are not needed with a plug.

4.2.3 Cable preparation

The device is connected with standard two-wire cable without shielding. If electromagnetic interference is expected which is above the test values of EN 61326-1 for industrial areas, a shielded cable should be used.

Check which outer diameter is suitable for the cable gland in order to ensure the sealing effect according to the specified IP protection class.

- 5...9 mm / 0.20...0.35" (standard)
- 6...12 mm / 0.24...0.47" (optional)
- 10...14 mm / 0.40...0.55" (optional)

The terminals in the terminal compartment are designed for wire cross-sections of up to 1.5 mm². To ensure a proper connection, you should strip the cable 40...50 mm / 1.6...2".

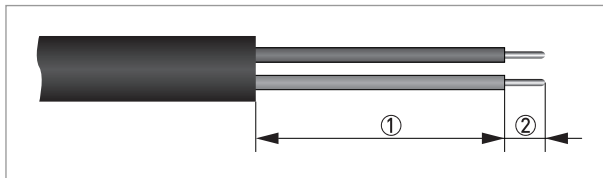


Figure 4-2: Stripping the cable

- ① 40...50 mm / 1.6...2"
- ② 5 mm / 0.2"

4.2.4 Cable entry 1/2-14 NPT (female)

With plastic housings, the NPT cable gland or the conduit steel tube must be screwed without grease into the thread.

4.2.5 Connector pin assignment

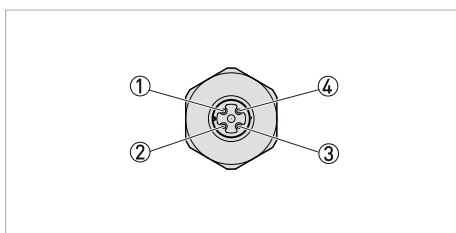


Figure 4-3: Connector M12 x 1, 4-pin, A-coding

- ① VS+
- ② Not Connected
- ③ Not Connected
- ④ VS-

Contact pin	Colour of cable	Electronic insert for terminal
Pin ①	Brown	1
Pin ④	Blue	2

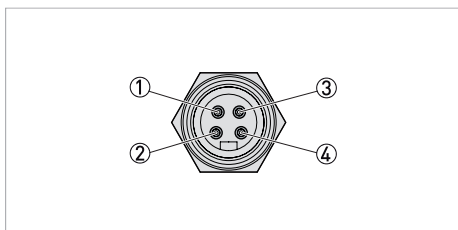


Figure 4-4: 7/8 connector, Foundation Fieldbus (FF)

- ① VS-
- ② VS+
- ③ Not connected
- ④ Cable shield

Contact pin	Colour of cable	Electronic insert for terminal
Pin ①	Blue	1
Pin ②	Brown	2
Pin ④	Green / yellow	Grounding

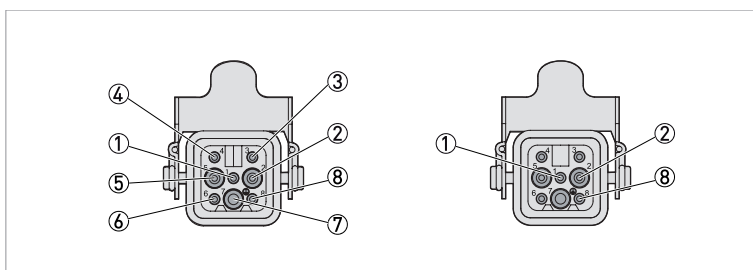


Figure 4-5: Connector, Harting HAN 8D (left) and Harting HAN 7D (right)

- ① VS-
- ② VS+

Contact pin	Colour of cable	Electronic insert for terminal
Pin ①	Black	1
Pin ②	Blue	2
Pin ⑧	Green / yellow	Grounding

4.2.6 Connection to the power supply

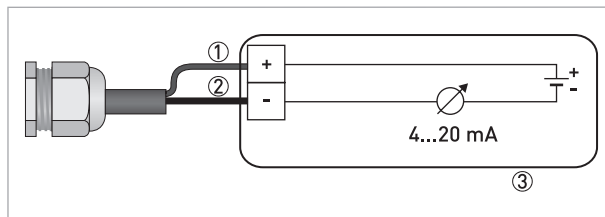


Figure 4-6: Connection to the power supply

- ① Red
- ② Black
- ③ Power supply with load

4.2.7 Cable shield and grounding

If a shielded cable is necessary, connect the cable shield on both ends to the grounding potential.

In the device, the cable shield must be connected directly to the internal ground terminal.

The ground terminal outside on the housing must be connected to the grounding potential with low impedance.

In hazardous areas, the grounding is carried out according to the installation instructions.

Significant potential differences exist inside galvanization plants as well as on vessels with cathodic corrosion protection. A two-sided shield grounding can cause unacceptably high shield currents as a result.

The metallic and wetted parts (process connection, cap flange, measuring cell and separating diaphragm etc.) are conductive connected with the inner and outer ground terminal on the housing.

4.3 Electrical connection

The power supply and signal output are connected via screw terminals in the housing. The display and adjustment module is connected to the interface adapter via contact pins.

4.3.1 Connection in the terminal compartment

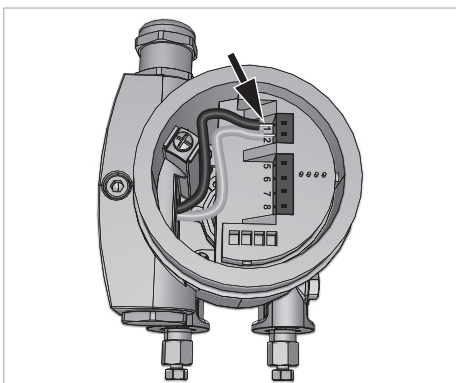


Figure 4-7: Terminal compartment from above

Procedure

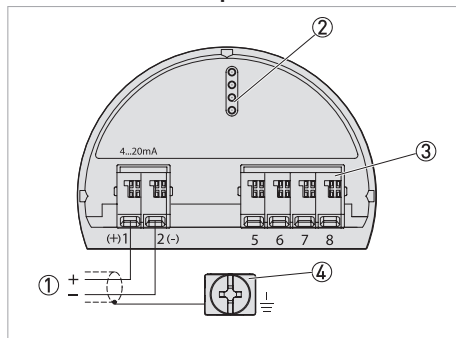
- Unscrew the housing cover.
- If present, remove the display and adjustment module by turning it to the left.
- Loosen union nut of the cable gland.
- For preparation of connection cable refer to *Cable preparation* on page 41.
- Push the cable through the cable gland into the terminal compartment.
- Insert the wire ends into the open terminal connection according to the wiring plan. Flexible cores with wire end sleeves as well as solid cores can be inserted directly into the terminal openings. In case of flexible cores, press the spring terminal with a small screwdriver to open the terminal opening.
- Check the proper hold of the wires in the terminals by lightly pulling on them.
- Connect the cable shield to the internal ground terminal, connect the outer ground terminal to the customer/plant equipotential bonding.
- Tighten the union nut of the cable gland. The sealing ring must completely enclose the cable.
- Screw the housing cover back on.

4.3.2 Single chamber housing

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

The following illustration applies to both the non-Ex as well as the the Ex ia, and the Ex d version.

Electronics compartment



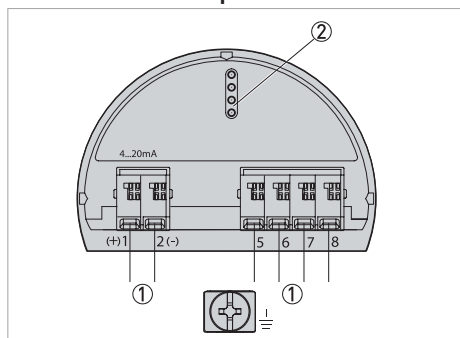
- ① Power supply / signal output
- ② Interface adapter for the display and adjustment module
- ③ Digital interface
- ④ Ground terminal for connection of the cable shield

4.3.3 Double chamber housing

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

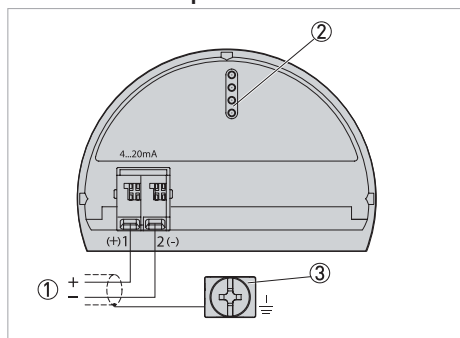
The following illustration applies to both the non-Ex as well as the Ex ia, and the Ex d version.

Electronics compartment



- ① Internal connection to terminal compartment
- ② Interface adapter for the display and adjustment module

Terminal compartment



- ① Power supply / signal output
- ② Interface adapter for the display and adjustment module
- ③ Ground terminal for connection of the cable shield

5.1 Order code

The characters of the order code highlighted in light grey describe the standard.

OPTIBAR DP 7060

VGK7	4	Approval
	AX	Ex-free zone Europe
	AC	ATEX II 1G, 1/2G, 2G Ex ia IIC T6
	AE	ATEX II 1/2G, 2G Ex d IIC T6
	AR	ATEX II 1D, 1/2D, 1/3D, 2D Ex t IIC T* ①
	AH	ATEX II 1G, 1/2G 2G Ex ia IIC + II 1D, 1/2D, 1/3D, 2D IP66
	A7	ATEX II 1/2G, 2G Ex d IIC + II 1D, 1/2D, 1/3D, 2D IP66
	WX	Ex-free zone International
	WC	IEC Ex ia IIC T6 Ga, Ga/Gb, Gb
	WE	IEC Ex d IIC T6 Ga/Gb, Gb
	WR	IEC Ex t IIIC T* ①
	WH	IEC Ex ia IIC T6 + IEC Ex t IIIC T... IP66
	W7	IEC Ex d IIC T6 + IEC Ex t IIIC T... IP66
		Material; Process connection / Material; Venting
	S0	316L; 1/4-18 NPT IEC A; UNF 7/16 / 316L; without
	SR	316L; 1/4-18 NPT IEC A; UNF 7/16 / 316L; on process axis
	SD	316L; 1/4-18 NPT IEC A; UNF 7/16 / 316L; at side
	A0	316L; Adpt. 1/2-14 NPT; UNF 7/16 / 316L; without
	AR	316L; Adpt. 1/2-14 NPT UNF 7/16 / 316L; on process axis
	AD	316L; Adpt. 1/2-14 NPT UNF 7/16 / 316L; at side
	M0	316L; 1/4-18 NPT IEC A; M10 / 316L; without
	MR	316L; 1/4-18 NPT IEC A; M10 / 316L; on process axis
	VD	316L; 90°-vertical 1/4-18 NPT IEC A; UNF 7/16 / 316L; at side
	H0	C-276; 1/4-18 NPT IEC A; UNF 7/16 / C-276; without
	HR	C-276; 1/4-18 NPT IEC A; UNF 7/16 / C-276; on process axis
	D1	316L; diaphragm seal; H-side: capillary; L-side: open 1/4"-18NPT
	DS	316L; diaphragm seal; H-side: direct attachment; L-side: open 1/4"-18NPT
	D2	316L; diaphragm seal; H-side: capillary; L-side: capillary
	DT	316L; diaphragm seal; H-side: direct attachment; L-side: capillary
		Diaphragm / Filling oil
	S	316L (1.4404); Silicone oil
	R	316L (1.4404); Halocarbon oil
	H	Hastelloy C-276; silicone oil

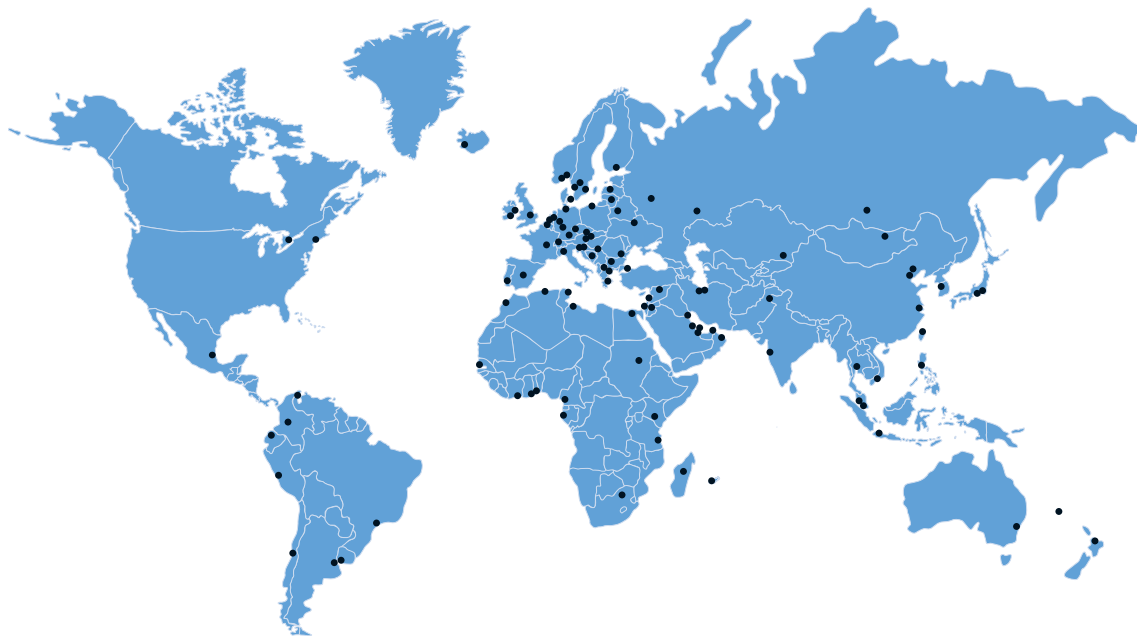
				Gasket / Temperature			
				E	EPDM; -40...+85°F / -40...+185°F		
				F	FKM; -20...+85°C / +5...+185°F		
				C	Copper; -40...+85°C / -40...+185°F		
					Measuring range	PN	Accuracy class
				1	10 mbar; 1 kPa; 0.14 PSI	40 bar / 580 psi	0.1%
				2	30 mbar; 3 kPa; 0.44 psi	40 bar / 580 psi	0.1%
				3	100 mbar; 10 kPa; 1.45 psi	160 bar / 2321 psi	0.065%
				4	500 mbar; 50 kPa; 7.25 psi;	160 bar / 2321 psi	0.065%
				5	3 bar; 300 kPa; 43.5 psi	160 bar / 2321 psi	0.065%
				6	16 bar; 1.6 MPa; 232 psi	160 bar / 2321 psi	0.065%
				D	500 mbar; 50 kPa; 7.25 psi;	400 bar / 5800 psi	0.065%
				E	3 bar; 300 kPa; 43.5 psi	400 bar / 5800 psi	0.065%
				F	16 bar; 1.6 MPa; 232 psi	400 bar / 5800 psi	0.065%
				Adjustment (customer specific measuring range)			
				0	Nominal range %		
				1	Nominal range mbar		
				2	Nominal range bar		
				3	Nominal range psi		
				4	Nominal range Pa		
				5	Nominal range kPa		
				6	Nominal range Mpa		
				7	Nominal range mmH2O		
				8	Nominal range inH2O		
				A	Nominal range mmHG		
				B	Nominal range inHG		
				C	Nominal range mm (density 1)		
				D	Nominal range cm (density 1)		
				E	Nominal range m (density 1)		
				F	Nominal range in (density 1)		
				G	Nominal range ft (density 1)		
				L	Customer specific adjustment for level measurement		
				S	Customer specific adjustment for flow measurement		
				Y	Customer specific adjustment for pressure		

[illegible]

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																Display / Adjustment module	
																X	without
																A	mounted (top)
																B	mounted (side)
																F	without, lid with sight window
																Language - Display	
																D	DE - German
																U	TR - Turkish
																E	EN - English
																L	PL - Polish
																F	FR - French
																Z	CZ - Czech
																N	NL - Dutch
																1	JP - Japanese
																P	PT - Portuguese
																C	CN - Chinese
																S	ES - Spanish
																R	RU - Russian
																T	IT - Italian
																Language – Manual	
																D	DE - German
																Z	CZ - Czech
																E	EN - English
																L	PL - Polish
																F	FR - French
																R	RU - Russian
																E	ES - Spanish
																Additional process barrier	
																0	without
																Identification tag	
																0	without
																F	Foil (40 x 20 mm)
																S	Stainless steel (40 x 20 mm)
																Device settings	
																0	without
																Further certificates	
																X	without
																M	Observe VZPA / B code
																Accessories	
																X	without
																M	Mounting bracket; 316L
VGK7	4																

① depends on the equipment category



KROHNE – Process instrumentation and measurement solutions

- Flow
- Level
- Temperature
- Pressure
- Process Analysis
- Services

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