

OPTIBAR DP 3050 **Technical Datasheet**

Compact differential pressure transmitter for measuring flow, level and differential pressure

- High accuracy and measurement stability under all process conditions
- Intuitive setup via internal push buttons or LCD display
- Robust stainless steel construction



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1.1 Compact differential pressure transmitter

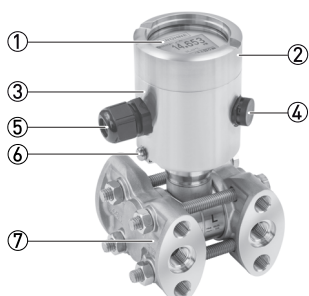


Figure 1-1: OPTIBAR DP 3050

- ① Display and adjustment module (optional)
- ② Stainless steel lid
- ③ Stainless steel housing
- ④ Venting element
- ⑤ Cable gland
- ⑥ Grounding screw
- ⑦ Process connection with differential pressure measuring cell

The OPTIBAR DP 3050 differential pressure transmitter for general purpose differential pressure, flow and level applications with analog 2-wire output and digital HART[®] 7 communication features a compact, fully welded stainless steel housing, easy setup options, superb accuracy and fast response times with outstanding long-term stability as well as optional OPTIBAR DSD series diaphragm seals.

The protection category IP66/67 (NEMA 4X) and IP66/68 (NEMA 6P) depends on the selection of the electrical cable gland. For applications in hazardous areas an optional ATEX/IECEx approval can be selected. Internally located push buttons make it possible to easily set the offset correction, zero point and measuring range for quick start-up. Alternatively, an optional LCD display enables simple and intuitive setup of all configuration parameters via 4 push buttons.

An additional pressure and temperature sensor inside the measuring cell is used for the indication of the absolute pressure and temperature on the display, transmission via the secondary HART[®] value as well as for the following compensation.



Total 3D linearisation

For a robust and accurate differential pressure measurement, even under changing process conditions, each OPTIBAR DP 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.

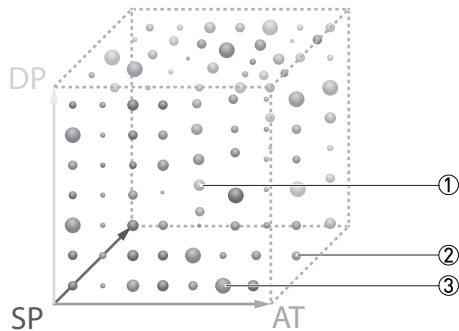


Figure 1-2: DP Differential pressure / SP - Static pressure / AT - Ambient temperature

- ① DP: 250 mbar / 3.6 psi; T: +60°C / +140°F; SP: 50 bar / 725 psi; uncertainty: -0.02%
- ② DP: 100 mbar / 1.4 psi; T: +85°C / +185°F; SP: 100 bar / 1450 psi; uncertainty: -0.04%
- ③ DP: 100 mbar / 1.4psi; T: +60°C / +140°F; SP: 1 bar / 14.5 psi; uncertainty: +0,15%

Highlights

- Reference accuracy $\pm 0.1\%$
- Differential pressure measuring ranges from 100 mbar / 1.45 psi up to 16 bar / 232 psi
- Process temperature -40...105°C / -40...302°F
- Outstanding temperature stability even under harsh conditions
- Excellent repeatability and long-term stability
- Combined DP, SP and T measurements for maximum process reliability
- Suitable for diaphragm seal assembly with OPTIBAR DSD series
- Compact and robust stainless-steel housing (316L / 1.4404)
- 2-wire 4...20 mA output with fully implemented HART 7.5 communication
- Optional display and adjustment module with intuitive user concept
- Internal push buttons for quick parameter set up

Industries

- General process technology
- Environmental technology
- Water and wastewater
- Iron and Steel
- Plant construction and engineering

Applications

- Differential pressure measurement of gases, vapours and liquids
- Pressure monitoring of filters and pumps with overload protection of up to 160 bar / 2321 psi
- Level measurement of liquids in open and pressurised vessels
- Flow measurement of gases, vapours and liquids

1.2 Options

Blind version



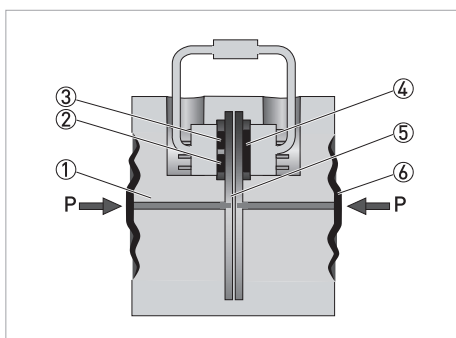
- Extremely robust design
- Commissioning with zero, span and offset correction by internal push button
- Compact dimensions

Version with display and adjustment module



- Easy setup of all configuration parameters via display and adjustment module
- Simple and intuitive handling using 4 push buttons

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 measuring cell
Application range	<ul style="list-style-type: none"> • Flow measurement with square root output in gases, vapours and liquids • Differential pressure measurement • Level measurement of liquids
Measuring range	100 mbar, 500 mbar, 3 bar, 16 bar / 1.45 psi, 7.25 psi, 43.51 psi, 232.06 psi
Display and User interface	
Display on signal converter	<ul style="list-style-type: none"> • Dot-matrix display 32 x 20 mm / 1.26 x 0.79" • Display infinitely rotatable by 350° • Ambient temperatures below -20°C / -4°F may affect the readability of the display
Display function	<ul style="list-style-type: none"> • Display of measured value or derived measured value such as filling height • Warning and diagnostic information • All parameters are accessible via the operating menu
Operating and display languages	German, English, Spanish and French
Operating	Local operation via 4 softkeys on the display and adjustment module
Remote control	<ul style="list-style-type: none"> • PACTware™ via GenericHART® • HART® Hand Held Communicator

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°F • Relative humidity (constant): 45...75% • Ambient pressure (constant): 860...1060 mbar / 12.5...15.4 psi • Mounting position: vertical • Rising characteristics • Measurement start at 0.00 bar / psi • Process diaphragm: 316L / 1.4404 • Fill fluid: silicone oil • Material of process flanges: 316L / 1.4404 • Power supply: 24 VDC ±3 VDC • Load 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®) as well as for the analogue 4...20 mA current output. [% of the set span]		
		TD < 10:1	TD > 10:1
	100 mbar / 1.5 psi	<± 0.1%	<± 0.01% x TD
	500 mbar / 7.3 psi		<± 0.05% + 0.005% x TD
	3 bar / 43.51 psi		
16 bar / 232.1 psi	<± 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®) 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	
	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®) as well as for the analogue 4...20 mA current output. [% of the set span]			
		up to nominal pressure	on zero	on span
	100 mbar / 1.5 psi	160 bar / 2320 psi	160 bar / 2320 psi: <± 0.20% x TD	160 bar / 2320 psi: <± 0.20%
	500 mbar / 7.3 psi		160 bar / 2320 psi: <± 0.10% x TD	160 bar / 2320 psi: <± 0.10%
	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®) 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]			
		Nominal pressure	-10...+60°C / +14...+140°F	
	100 mbar / 1.5 psi	160 bar / 2320 psi	<± 0.37%	
	500 mbar / 7.3 psi		<± 0.24%	
	3 bar / 43.51 psi			
16 bar / 232.1 psi	<± 0.33%			
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.				
$E_{\text{perf}} = \sqrt{((E_{\Delta TZ} + E_{\Delta TS})^2 + E_{\Delta PS}^2 + E_{\text{lin}}^2)}$ <p> $E_{\Delta TZ}$ = Effect of ambient temperature on the zero signal $E_{\Delta TS}$ = Effect of ambient temperature on the measuring span $E_{\Delta PS}$ = Effect of the static pressure on the measuring span E_{lin} = Reference accuracy </p>				
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 14			
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°F Relative humidity (constant): 45...75% Ambient pressure (constant): 860...1060 mbar / 12.5...15.4 psi Mounting 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®) 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	
	100 mbar / 1.5 psi	160 bar / 2320 psi	<± 0.10%	
	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
	100 mbar / 1.5 psi	160 bar / 2320 psi	<± 0.5%	<± 0.5%
	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	
Process temperature	-40...+105°C / -40...+221°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

Protection category according to IEC 529 / EN 60529	Single chamber Housing, IP66/67, NEMA 4X or IP66/68 (0.2 bar) NEMA 6P (depends on electrical connection)
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Vibration	
Reference conditions	<ul style="list-style-type: none"> Without mounting bracket Process flanges 316L / 1.4404 PN 160 Single chamber housing
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...+105°C / -40...+221°F
Copper	
FKM	-20...+105°C / -4...+221°F
Filling oil	
Silicone oil	-40...+105°C / -40...+221°F
Halocarbon oil	
Wetted parts	
Process connection, screwed flange	316L / 1.4404, NACE MR0175 / MR0103
Separating diaphragm	316L / 1.4435, NACE MR0175 / MR0103
Vent and lock screws	316L / 1.4404, NACE MR0175 / MR0103
Non-wetted parts	
Housing	316L / 1.4404
Lid cover sealing ring	EPDM
Housing lid	316L / 1.4404
Sight glass	Makrolon
Grounding screw	316L / 1.4404
Cable gland	Plastic (polyamide) black; nickel-plated brass; 316 / 1.4305

Process connection

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

Electrical connections

Mechanical			
Cable gland	Type	Ingress Protection	Cable diameter
	A - M16 x 1.5 plastic	IP66/67 NEMA 4X	4.5...10 mm / 0.18...0.39"
	E - M16 x 1.5 nickel plated brass	IP66/67 NEMA 4X	4.5...10 mm / 0.18...0.39"
	X - M16 x 1.5 316L	IP66/68 NEMA 6P (0.2 bar)	4...11 mm / 0.16...0.43"
	C - M12 4-pin quick disconnect	IP66/67 NEMA 4X	n/a
Wire cross-section	Solid wire with cords: 0.34...2.5 mm ² / AWG 22...14		
	Cord with wire end sleeve: 0.34...1.5 mm ² / AWG 24...16		
Electrical			
Operating voltage	Non-Ex device: 12...45 VDC		
Reverse polarity protection	Integrated		
Permissible residual ripple	for U_n 12 VDC ($12 < U_B < 14$ VDC) $\leq 0.7 V_{eff}$ (16...400 Hz)		
Load	$R_{L,max} = (U_B - 12) / 22$ 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 7.5 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
Max. output current	24 mA
Boot-up current	≤ 5 mA for 15 ms after switching on, then ≤ 3.6 mA
Damping	0.0 seconds: no damping
	0.5 seconds: with digital filter + PT1 element
	from 1.0 second: 63% of the input measurement from 1...30 seconds can be set in 1 second increments
Boot-up time first measurement value	3.5 seconds

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)	EMC conformity for EN 61326-1:2013 and 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)	For gases of fluid group 1 and liquids of fluid group 1, the requirements are fulfilled according to article 4, paragraph 3 (sound engineering practice).
RoHS	The device complies with the Directive 2011/65/EU of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment.
AD2000	The pressure retaining material 316L (1.4404/1.4435) complies with the AD2000 W2 and W10 guidelines.

2.2 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 = 50:1 (recommended 20:1)

Nominal range	100 mbar	500 mbar	3 bar	16 bar
Limit URL (upper)	100 mbar	500 mbar	3 bar	16 bar
Limit LRL (lower)	-100 mbar	-500 mbar	-3 bar	-16 bar
Smallest adjustable measuring span	1 mbar	5 mbar	30 mbar	160 mbar
Turn down	100:1	100:1	100:1	100:1
MWP (maximum system pressure) ①	160 bar	160 bar	160 bar	160 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	1.45 psi	7.25 psi	43.51 psi	232.06 psi
Limit URL (upper)	1.45 psi	7.25 psi	43.51 psi	232.06 psi
Limit LRL (lower)	-1.45 psi	-7.25 psi	-43.51 psi	-232.06 psi
Smallest adjustable measuring span	0.015 psi	0.073 psi	0.435 psi	2.321 psi
Turn down	100:1	100:1	100:1	100:1
MWP (maximum system pressure) ①	2320 psi	2320 psi	2320 psi	2320 psi
Minimum system pressure	0.015 psi abs (under reference conditions)			

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

2.3 Ambient temperature effect on current output

< 0.05% / 10 K, max. < 0.15%, each case at -40...+80°C / -40...+176°F

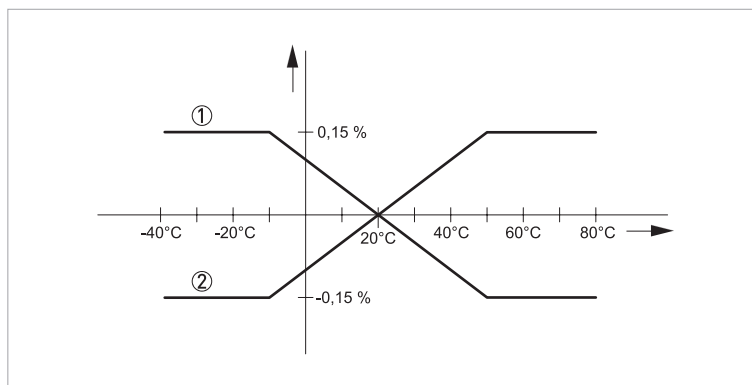


Figure 2-1: Ambient temperature effect on current output

- ① Falling characteristics
- ② Rising characteristics

2.4 Dynamic behaviour of the current output

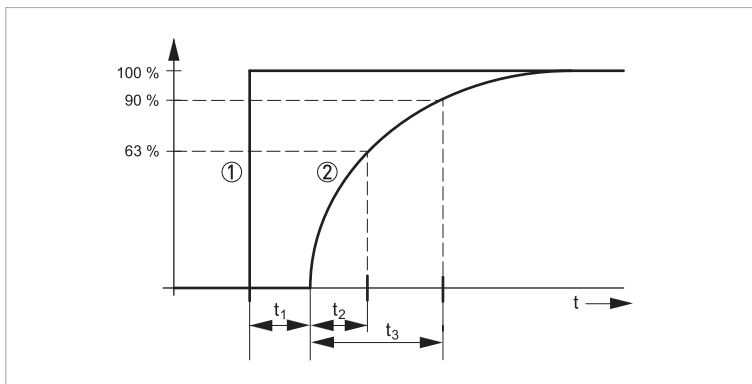


Figure 2-2: Behaviour at an abrupt change in the process variable.
 t₁ - dead time; t₂ - rise time; t₃ - step response time

- 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]	T63% (t ₂) [ms]	T90% (t ₃) [ms] ①
100 mbar / 1.50 psi	50	95	220
500 mbar / 7.3 psi		75	200
3 bar / 43.51 psi		60	175
16 bar / 232.1 psi			

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

2.5 Dimensions and weight

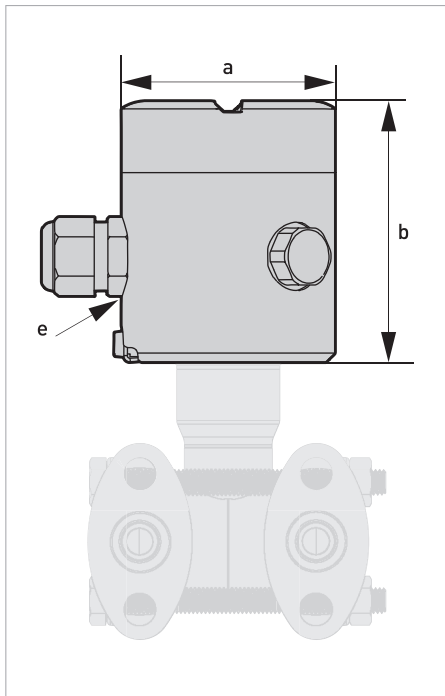


Figure 2-3: Dimension of the enclosure

Dimension	Blind Version		Version with display	
	mm	inch	mm	inch
a	64	2.52	64	2.52
b	65	2.8	73	3.1
e	M16 x 1.5			

Table 2-1: Dimension in mm / inch

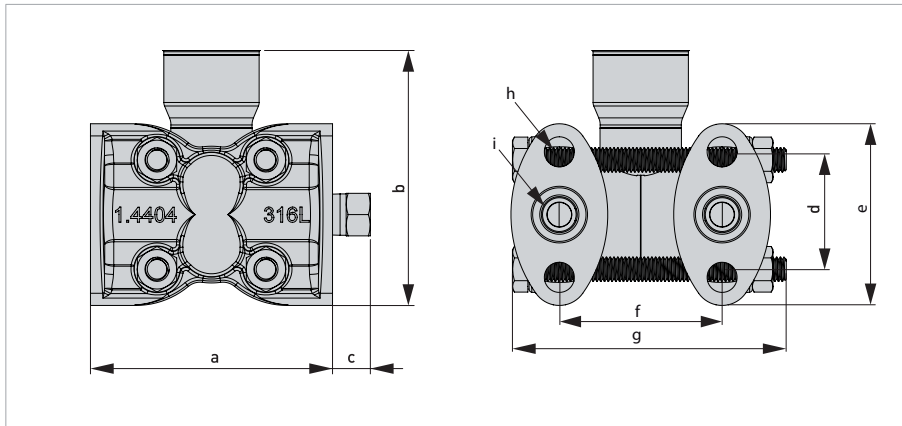


Figure 2-4: 1/4-18 NPT Process connection without venting (S0)

	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

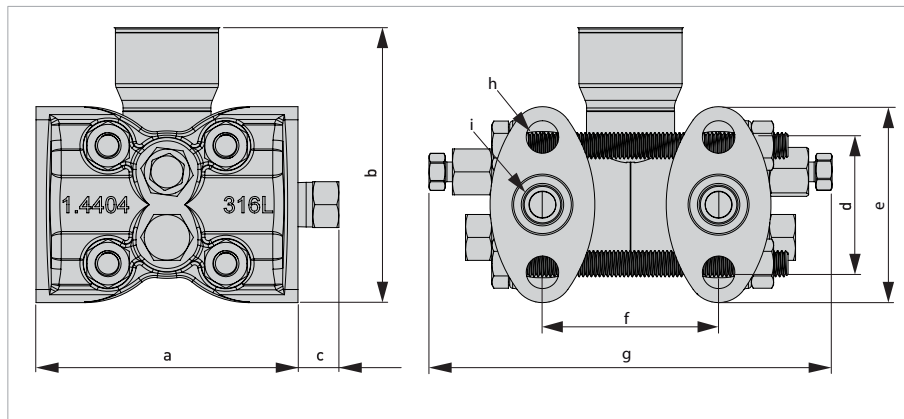


Figure 2-5: 1/2 NPT with side vent (SD)

	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

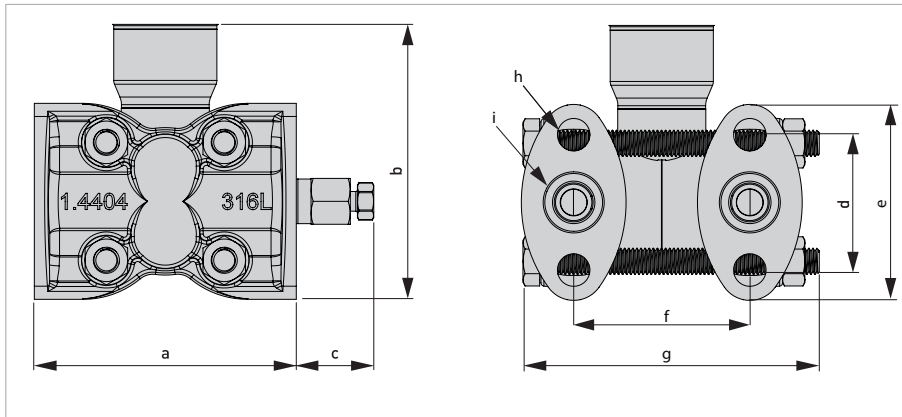


Figure 2-6: 1/4 NPT venting on the process axis (SR)

	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

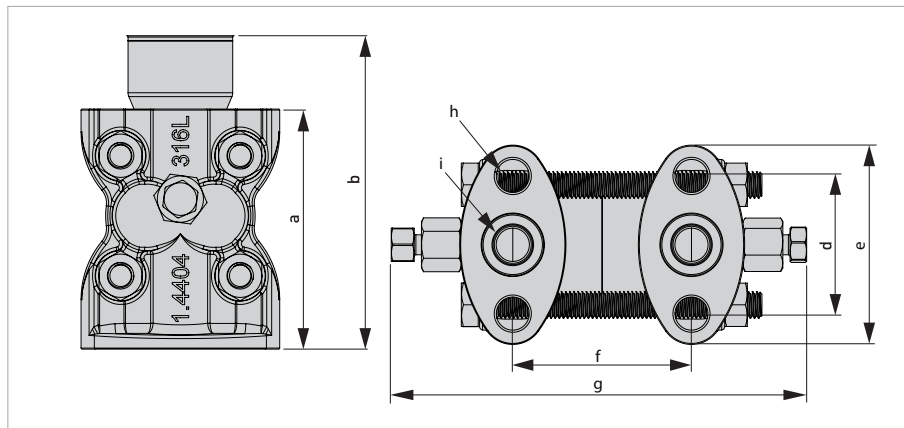


Figure 2-7: 90° vertical 1/4-18 Process connection, side vent (VD)

	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

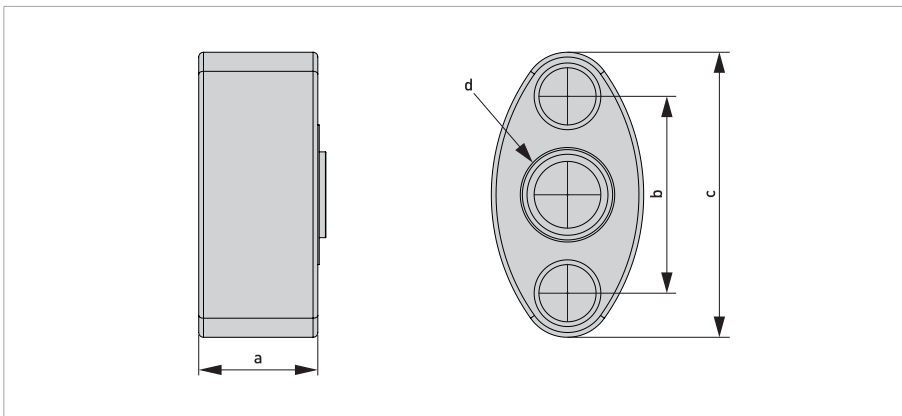


Figure 2-8: Oval flange adapter (Ax)

	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

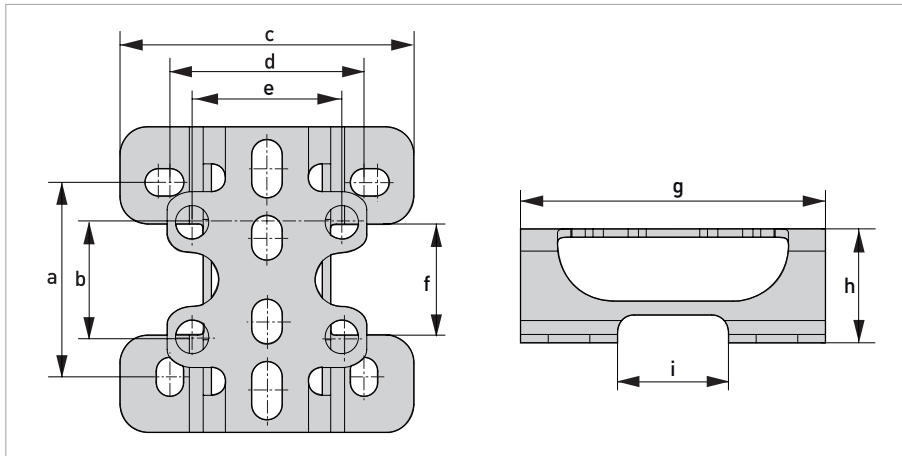


Figure 2-9: Mounting bracket for pipe and wall mounting 2" / 50.8 mm

	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

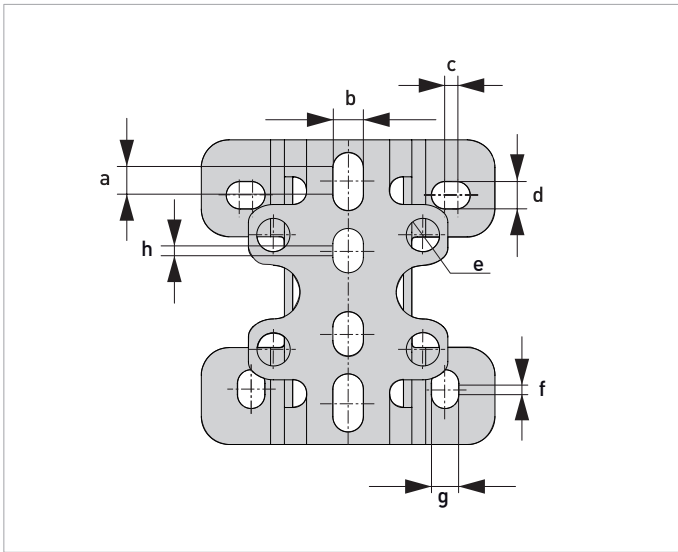


Figure 2-10: Drilling diameter for mounting bracket

	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

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 3050 is a differential pressure transmitter suitable for measuring flow, level and differential pressure. 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 7).
- Only suitably qualified personnel may install and operate the device.
- Observe the generally accepted standards of good practice.

3.2 Technical limits

The device was constructed solely for use within the technical limits indicated on the nameplate and in the technical data. Applications outside of these limits are not permitted and could lead to significant risk of accident. For this reason, observe the following limits:

- Do not exceed the maximum working pressure (MWP).
- Do not exceed the indicated permissible operating temperature range.
- The permissible ambient temperatures given may not be exceeded or undershot.
- Check the materials used for the wetted parts (e.g. gasket, process connection, separating diaphragm etc.) for suitability as regards process compatibility.

3.3 Measured products

The device is designed to measure the pressure of vaporous, gaseous and liquid media. Prior to using any corrosive or abrasive products, the operator must check the resistance of all materials which are in contact with the product.

3.4 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.

3.5 Mounting

- *Prior to installing the transmitter, it is essential to verify whether the version of the device on hand completely fulfils the technical and safety requirements of the measuring point. This applies in particular to the measuring range, overpressure resistance, temperature, explosion protection and operating voltage.*
- *Check the materials used for the wetted parts (e.g. gasket, process connection, separating diaphragm etc.) for suitability as regards process compatibility.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to an electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*

3.5.1 Opening the device, installing and dismantling the graphic display

Check whether the ambient air around the signal converter is explosive. Opening the signal converter in an explosive atmosphere may result in ignition and explosion.

The product may cause the signal converter to become extremely hot. Possible risk of burning. For this reason, promptly shut off the process or isolate the signal converter sufficiently from the product prior to starting work and check that the converter has cooled down to room temperature.

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

Electrically, the graphic display is connected to the device using a plug connector on the connection board with the aid of a flying lead. The display is mechanically fixed by way of a spacer plugged into the connection board. For optimal readability, the display can be rotated on this bracket by 350°, adjusting to any of the pressure transmitter's possible installation positions.

Procedure

- Ensure that the signal converter has been de-energised!
- Remove the housing cover from the signal converter by hand.
If the housing cover is stuck and cannot be moved by hand, use a suitable square material to carefully remove it. Place this tool in the flaring located in the housing cover. Take care not to damage the optionally available window cover! Use a lever action to now carefully apply greater torque to loosen it. As soon as the housing cover opens, put the tool away and turn the cover by hand until it opens.
- Ensure that no moisture gets into the device while it is open (drops, spray, liquid mist, etc. ...).
- If there is a display, it can be removed by pulling it forward gently. Pay attention to the connecting cable between the device and the display. To completely remove the display, the connecting cable must be carefully pulled out of the connector on the board.
- ➡ The connection board is now available for further work.
- To install the display and close the housing, follow the steps in reverse order.
Note that the housing covers for devices with displays and devices without displays are different heights. Never attempt, even on a temporary basis, to install a housing cover for a blind device on a device with an installed display.

Each time a housing cover is opened, the thread should be cleaned and greased. Use only resin-free and acid-free grease.

Ensure that the housing gasket is properly fitted, clean and undamaged.

3.5.2 Process connections

Before installation of the device, please check the correct position of the high (H) and low (L) pressure side. You can see the designations (H / L) underneath the measuring cell acc. to the following figure.

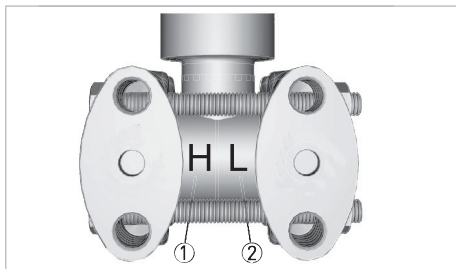


Figure 3-1: Process connection of the differential pressure transmitter

- ① High-pressure side
- ② Low-pressure side

The process connections of the differential pressure transmitter are usually 1/4-18 NPT (female) at a distance of 54 mm / 2.13". Through optional oval flange adapters, the connections 1/2-14 NPT (female) are also selectable.

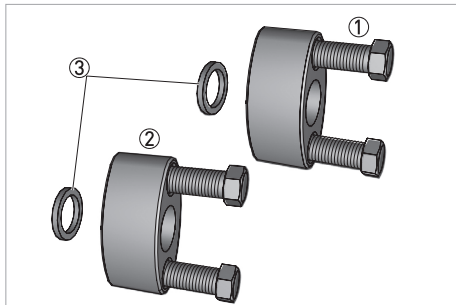


Figure 3-2: Oval flange adapter

- ① 7/16 UNF screws
- ② Oval flange adapter
- ③ Sealing ring

If the adapter is not supplied pre-assembled, proceed as follows:

- Position the adapter with inserted O-ring.
- Use the screws supplied to screw the adapter to the transmitter.
- Tighten the screws to a torque of 25 Nm (stainless steel screws) or 12.5 Nm (stainless steel acc. to NACE).

3.5.3 Mounting bracket

Scope of delivery

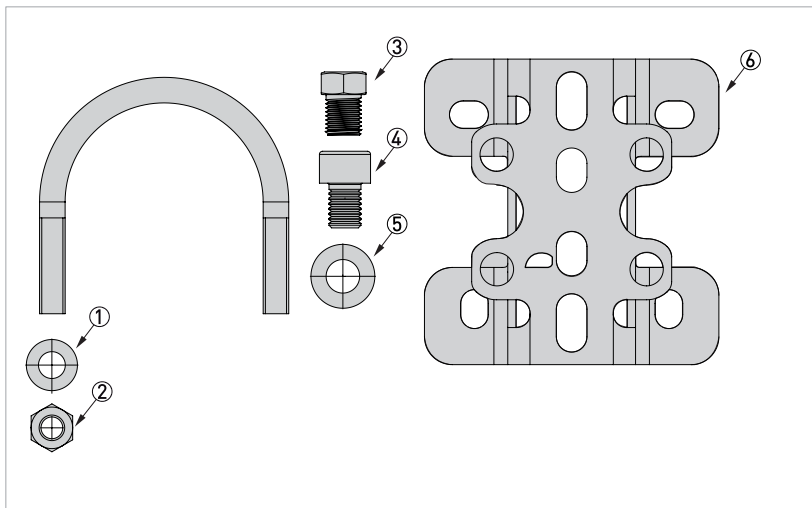


Figure 3-3: Scope of delivery

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

Mounting bracket for easy pipe or wall mounting.

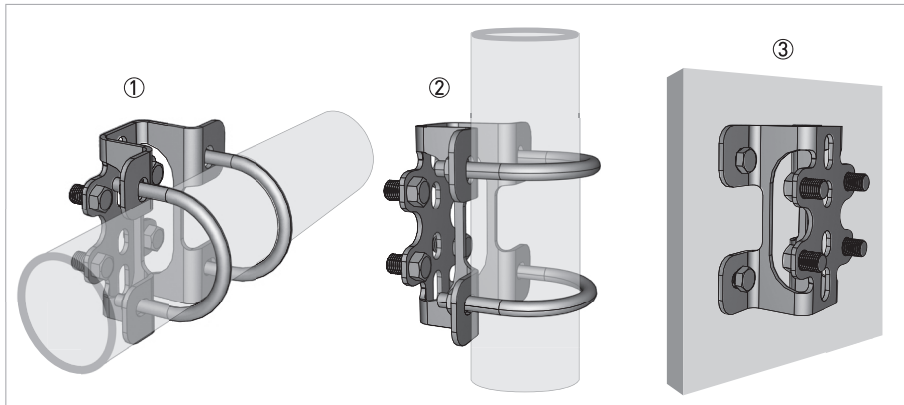


Figure 3-4: Mounting bracket

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

Mounting bracket for easy valve and pressure transmitter mounting.

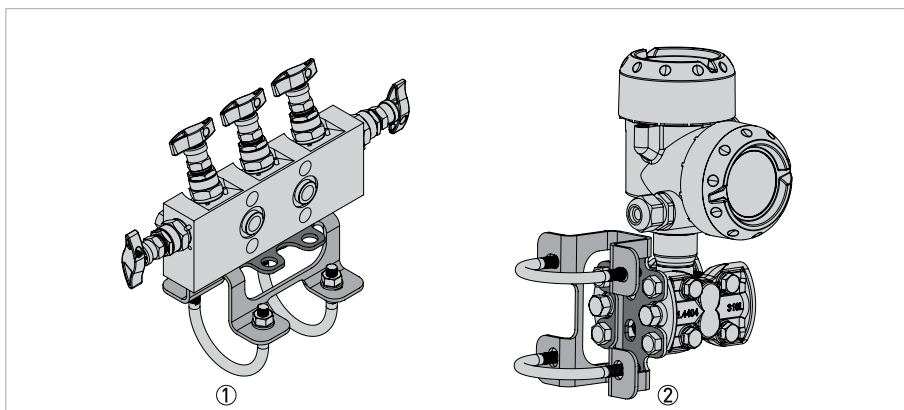


Figure 3-5: Mounting bracket

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

3.5.4 Manifolds

Manifolds allow for easy installation and commissioning of the transmitter. They separate the device from the process side and ensure simple control of the measuring point. They are available as 3-way and 5-way versions. The integrated equalize valve allows pressure equalization between the high (H) and low (L) pressure side during commissioning. With the manifold, it is possible to disassemble the differential pressure transmitter without interrupting the process. This means higher system availability and even simpler commissioning or maintenance purposes. The 3-way manifold with double-sided flange adapters allows a mechanically robust connection between the differential pressure transmitter and, for example, the impulse lines or the flange adapters of a averaging pitot tube. With a 5-way manifold, two additional valves allow to blow out of the impulse lines and the calibration of the differential pressure transmitter in place.

3.5.5 Differential pressure transmitter

Primary elements, such as averaging pitot tubes, orifice plates or venturis are designed for certain line sizes and flow conditions. Therefore, prior to installation, the line size and pressure rating has to be checked and the measuring point number compared. For detailed instructions on installing a primary element refer to DIN EN ISO 5167.

3.5.6 Pressure connection with impulse line

Please review the following information for pressure connection with impulse line:

- Select the shortest impulse line possible and install without sharp bends.
- Avoid material deposits and blockages in the impulse line. Accordingly, install the impulse lines so that such occurrences are impossible. The slope should not fall below approx. 8% in the piping.
- Ensure that the impulse line flows freely before installation and rinse with compressed air or, even better, with the product itself.
- When measuring liquid, the impulse line must be completely purged of air.
- Run the impulse line so that trapped air (when measuring liquids) or condensate (when measuring gas) can flow back into the process.
- Hot steam must not enter the process connection (the over temperature will destroy the device). To avoid this situation, a suitable water trap (such as a syphon filled with water prior to installation) can be installed upstream from the measuring device.
- All connections must be tight and fixed properly.
- The process lines must be installed so that the medium cannot be blown out of the measuring chambers.

3.5.7 Vibrations

In case of strong vibrations at the measuring point, the device should be mounted via impulse lines in a calm place.

3.5.8 Temperature limits

Higher process temperatures often mean also higher ambient temperatures for electronics and connection cables. Make sure that the upper temperature limits for the environment of the electronics housing and connection cable are not exceeded. .

3.6 Instructions for oxygen applications

Oxygen and other gases can be explosive when brought into contact with oils, grease and plastics, so the following measures must also be taken:

- All components of the plant, such as e.g. measuring devices must be cleaned according to the requirements of BAM (DIN 19247).
- Depending on the seal material, certain temperatures and pressures must not be exceeded in oxygen applications, refer to *Technical data* on page 7.

Devices for oxygen applications are sealed in PE foil and a "DEGREASED" label (oil and grease-free) is affixed. Remove this foil just before mounting the device. Once the protection for the process connection has been removed, the label O_2 will be visible on the process connection. No oil, grease or dirt should penetrate. Danger of explosion.

3.7 Measurement setup for flow measurement

3.7.1 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.

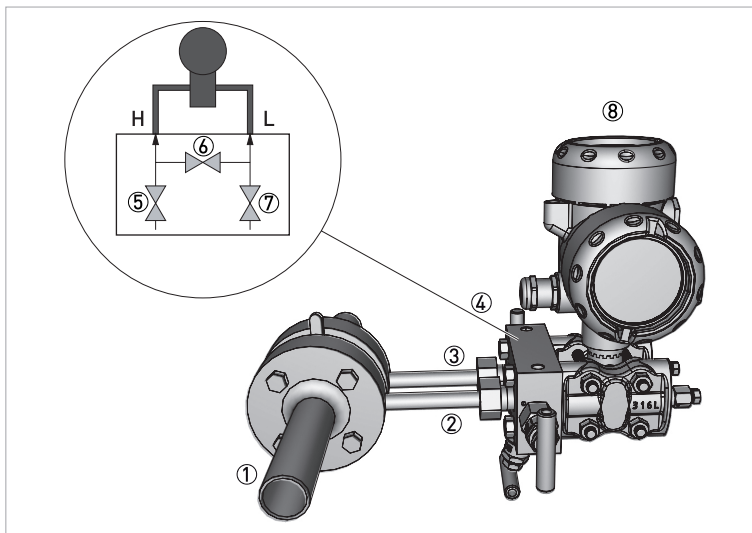


Figure 3-6: Application example

- 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

3.7.2 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.

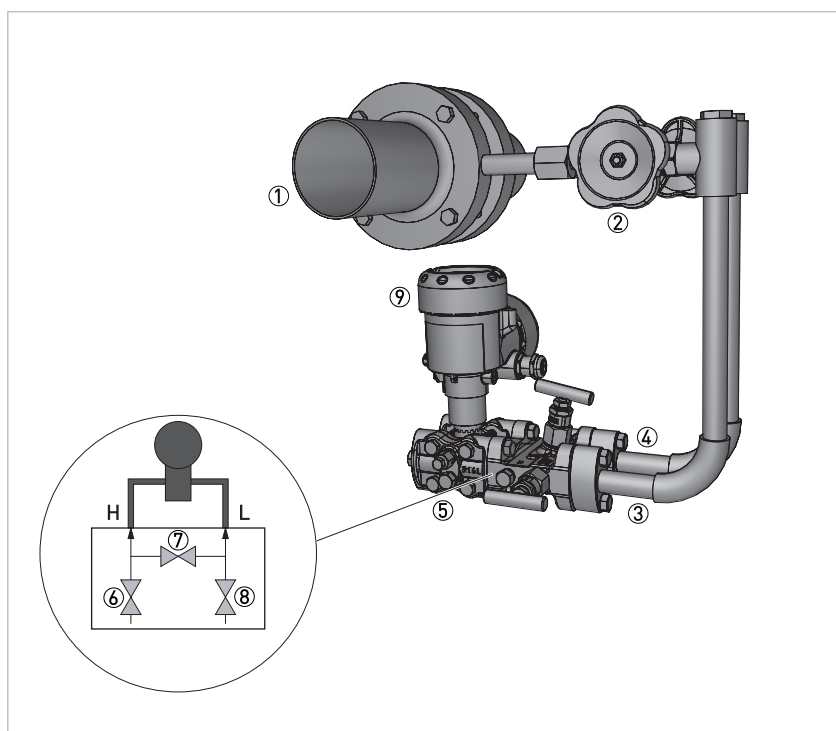


Figure 3-7: Application example

- 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

3.8 Measurement setup for level measurement

3.8.1 In open vessels with impulse line

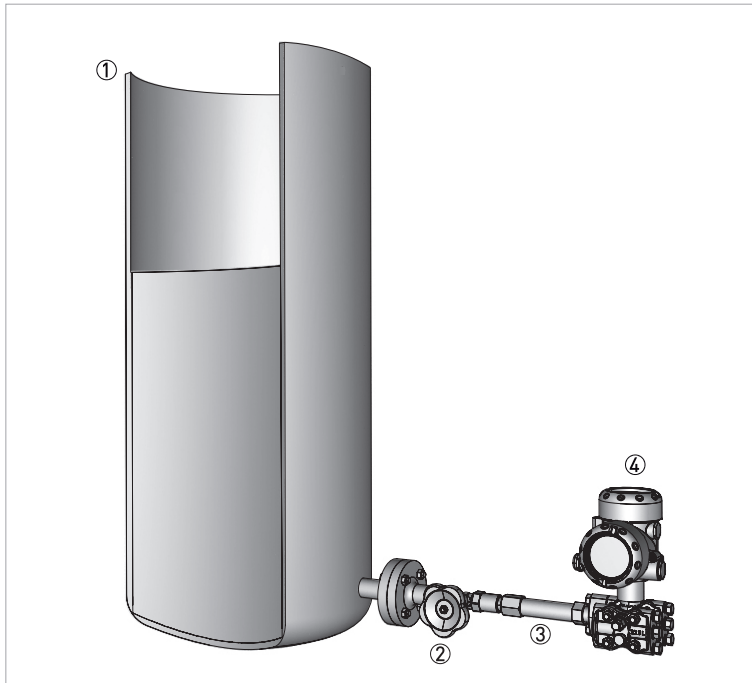


Figure 3-8: Application example

- 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.

3.8.2 In closed vessels with gas-filled impulse lines

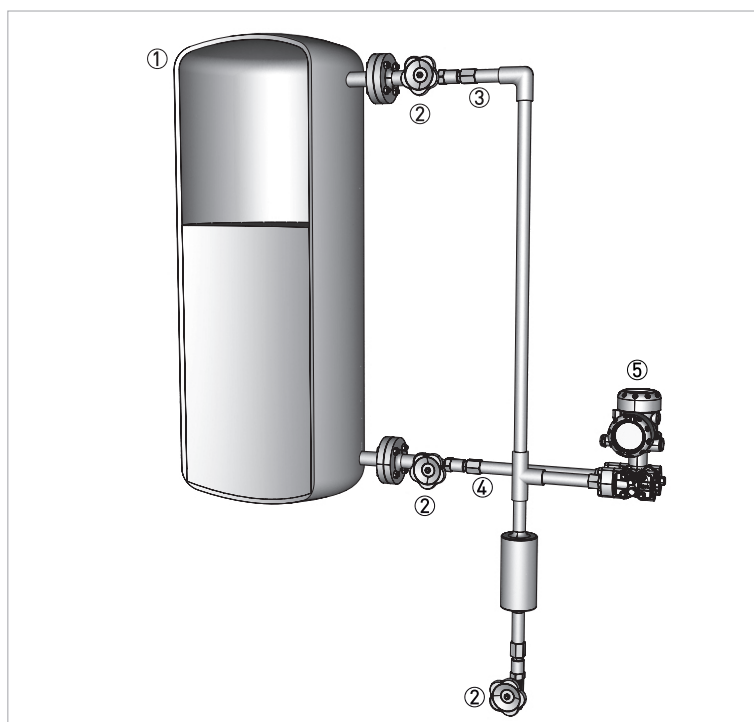


Figure 3-9: Application example

- 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.

3.8.3 In closed vessels with liquid / condensate filled impulse lines



Figure 3-10: 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 M16 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 specifications of the signal cable must be observed:

Specifications for standard signal cables

- Test voltage: ≥ 500 VAC RMS (750 VDC)
- Temperature range: $-40\dots+105^{\circ}\text{C}$ / $-40\dots+221^{\circ}\text{F}$
- 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.
- We generally recommend the use of a shielded cable for HART[®] multidrop mode.

Make sure that the cable used features the required temperature resistance and fire safety for the maximum possible ambient temperature.

4.2.2 Laying electrical cables correctly

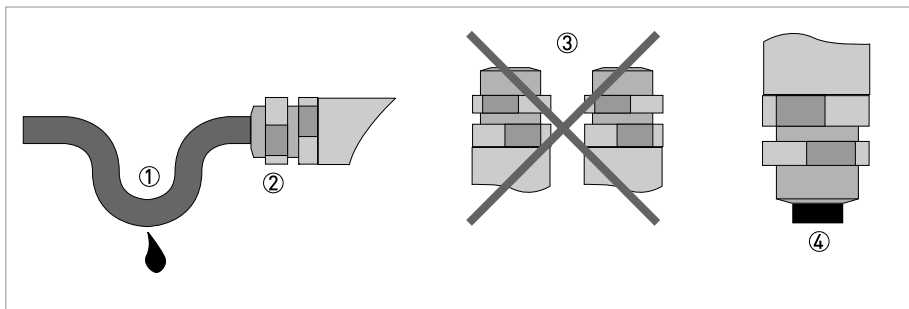


Figure 4-1: Protect housing from dust and water

- 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.

- 4.5...10 mm / 0.18...0.39" (standard)
- 4...11 mm / 0.16...0.43" (optional)

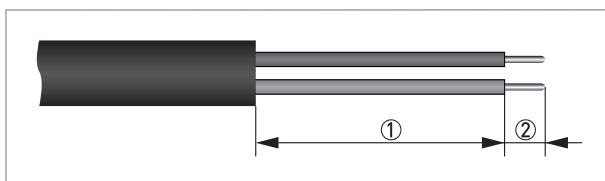


Figure 4-2: Stripping the cable

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

4.2.4 Connection to the power supply

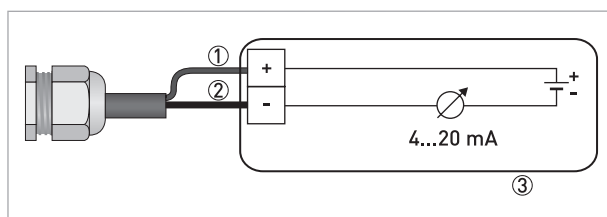


Figure 4-3: Connection to the power supply

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

4.2.5 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

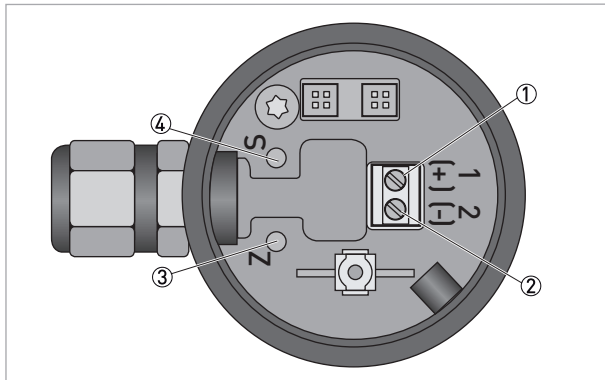


Figure 4-4: Connection in the terminal compartment

- ① (V_{in+}) signal terminals
- ② (V_{in-}) signal terminals
- ③ Push button Zero point (Zero)
- ④ Push button Span point (Span)

4.4 Grounding the measuring device

There should be no difference in potential between the pressure sensor and the housing or protective earth of the transmitter!

- The pressure sensor must be properly grounded.
- Do not use the grounding cable to connect any other electrical devices to ground at the same time.
- The pressure transmitter is connected to ground by means of a functional grounding conductor.
- In hazardous areas, grounding is used at the same time for equipotential bonding.

A ground terminal is provided on the outside of the housing to accommodate wire widths of up to 1.5 mm².

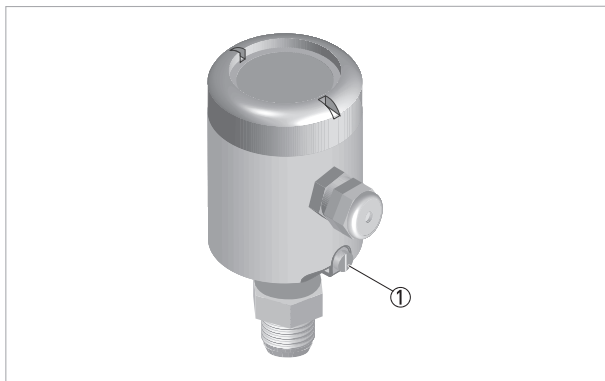


Figure 4-5: Position of the ground terminal on the housing

- ① Ground terminal

4.5 Description of the current output

The current output is a 2-wire 4...20 mA output with a low alarm of 3.6 mA and high alarm of 21 mA set by default. A high frequency HART[®] signal superimposes this signal. For further information on the current output, refer to *Technical data* on page 7.

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

OPTIBAR DP 3050

Sensor	Approval		
VGKN	4	AX	Ex-free Europe
		AC	ATEX II 1G,1/2G,2G Ex ia IIC T6
		AR	ATEX II 1D,1/2D,1/3D,2D Ex ia IIIC TX
		AH	ATEX II 1G,1/2G,2G Ex ia IIC T6 + 1D,1/2D,1/3D,2D Ex ia IIIC TX
		WX	Ex-free International
		WC	IEC Ex ia IIC T6 Ga, Ga/Gb, Gb T6
		WR	IEC Ex ia IIIC TX Da Da/Db Db
		WH	IEC Ex ia IIC T6 Ga, Ga/Gb, Gb T6 + Ex ia IIIC TX Da Da/Db Db
		Process Connection / Material / Venting Plugs	
		S0	316L; 1/4"-18 NPT-F IEC A; UNF7/16; 316L; without
	SR	316L; 1/4"-18 NPT-F IEC A; UNF7/16; 316L; on process axis	
	SD	316L; 1/4"-18 NPT-F IEC A; UNF7/16; 316L; on the side	
	A0	316L; Adapter 1/2"-14 NPT-F; UNF7/16; 316L; without	
	AR	316L; Adapter 1/2"-14 NPT-F; UNF7/16; 316L; on process axis	
	AD	316L; Adapter 1/2"-14 NPT-F; UNF7/16; 316L; on the side	
	M0	316L; 1/4"-18 NPT-F IEC A; M10; 316L; without	
	MR	316L; 1/4"-18 NPT-F IEC A; M10; 316L; on process axis	
	VD	316L; 90 - vertical 1/4"-18 NPT-F IEC A; UNF7/16; 316L; on the side	
	D1	316L; Diaphragm seal; H-side: capillary; L-side: 1/4"-18NPT	(OPTIBAR DSD 3110, Pn = 500 mbar, sealing FKM)
	DS	316L; Diaphragm seal; H-side: direct; L-side: 1/4"-18NPT	(OPTIBAR DSD 3100, Pn = 500 mbar, sealing FKM)
	D2	316L; Diaphragm seal; H-side: capillary; L-side: capillary	(OPTIBAR DSD 3220, Pn = 500 mbar, sealing FKM)
	DT	316L; Diaphragm seal; H-side: direct; L-side: capillary	(OPTIBAR DSD 3210, Pn = 500 mbar, sealing FKM)
	Diaphragm Material / Fill fluid		
	S	316L (1.4435); Silicon oil	(standard for process connection D1...DT)
	R	316L (1.4435); Halocarbon oil	(standard for oxygen applications + VZPA)
	Sealing / Process Temperature		
	E	EPDM; -40...+105°C / -40...+221°F	
F	FKM; -20...+105°C / -4...+221°F		
C	Copper; -40...+105°C / -40...+221°F	(standard for oxygen applications + VZPA)	

Measuring Range		Pressure Rating
3	100 mbar / 10 kPa / 1.45 psi	PN160 / 2321 psi (in preparation)
4	500 mbar / 50 kPa / 7.25 psi	PN160 / 2321 psi
5	3 bar / 300 kPa / 43.5 psi	PN160 / 2321 psi
6	16 bar / 1.6 MPa / 232 psi	PN160 / 2321 psi
Adjustment		
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	
Y	Customer specific adjustment pressure	
S	Customer specific adjustment Flow (square root output)	
Accuracy Class		
M	0.065%	
E	0.1%	
Electronics		
H	2-wire 4...20mA / HART	
Housing		
S	316L; 1-Chamber	
Electrical Connection / Material		
A	M16x1.5; Plastic (PA); black; 4.5-10mm; IP66/67 NEMA 4X	
E	M16x1.5; Brass nickel-plated; 4.5-10mm; IP66/67 NEMA 4X	
X	M16x1.5; 316L; 4-11mm; IP66/68 (0.2 bar) NEMA 6P	
C	M16x1.5; Plug M12x1 A; IP66/67 NEMA 4X	
Display and Adjustment Modul		
X	without, adjustment buttons on electronics	
A	mounted, adjustment buttons on electronics and display	





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