



OPTIBAR P 3050 C Technical Datasheet

Compact pressure transmitter with internal diaphragm

- Robust design with internal stainless steel diaphragm
- Vacuum and overpressure resistant versions for absolute and gauge pressure
- Very short response times (< 50 ms)

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1.1 Compact pressure transmitter

With its industry standard process connections the **OPTIBAR P 3050 C** is universally used for general purpose pressure applications. The transmitter features superb accuracy over a wide temperature and pressure range, compact stainless steel housing, rapid response times and outstanding reproducibility and long term stability.

These features are made possible by using sensors which are extremely stable across a wide range of temperatures and pressure ranges. Additional digital compensation reduces the temperature dependence on the pressure measurement.

The measuring cell itself is completely isolated from the actual process via a stainless steel (1.4404 / 316L) diaphragm.

The electronics and the optional display are located in a stainless steel housing ventilated through a Gore-Tex® filter. This ensures that the pressure transmitter is resistant to moisture, shocks and vibration.

The protection category IP65 or IP67 depends on the selection of electrical cable glands.

An internally located push button makes it possible to easily adjust the zero point and measuring range for quick start-up.



[Version with LCD display]

- ① LCD display (optional)
- ② Grounding connection (Ground)
- ③ Process connection
- ④ Stainless steel housing

Highlights

- Measuring accuracy $\pm 0.1\%$
- Measuring ranges: 0.5...200 bar abs. / 7...2900 psi abs.; 0.2...200 bar rel. / 3...2900 psi rel.
- 2-wire device (4...20 mA)
- Corrosion-resistant stainless steel housing (316L)
- Internal, fully welded stainless steel diaphragm (316L)
- Easily programmable for a wide range of applications
- A variety of process connections available
- Optional LCD display with intuitive user concept

Industries

- Iron and Steel
- Water & wastewater
- Automation

Applications

- Absolute and gauge pressure measurement of gases, vapours and liquids
- Hydrostatic level measurement in containers

1.2 Options and variants

Blind version



- Extremely robust design
- Start-up using internal push button
- Compact dimensions

Version with LCD display



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

Shut-off valve (optional)



- ½" NPT to ½" NPT
- Separate process and air valve
- High quality stainless steel construction

1.3 Measuring principle

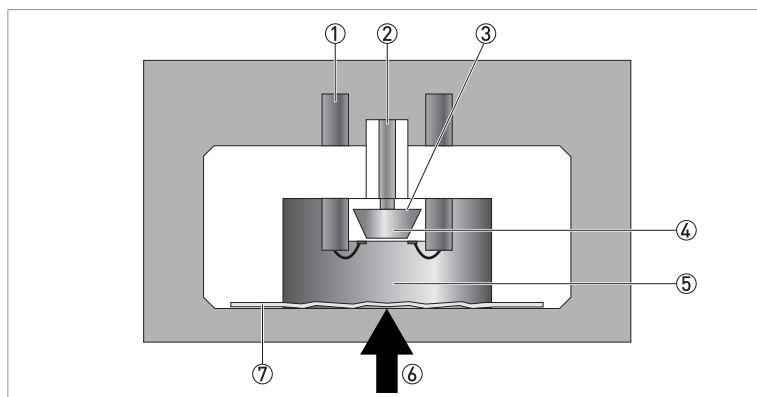


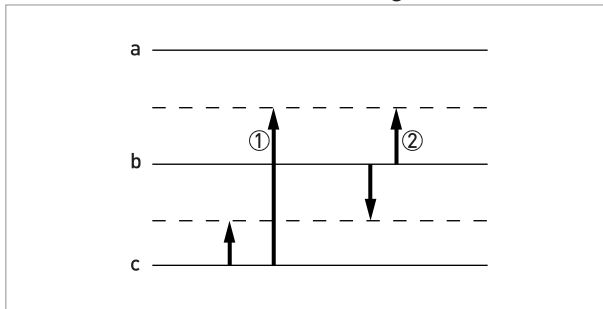
Figure 1-1: Measuring principle for pressure measurement

- ① Signal cables of measuring bridge
- ② Ventilation (only with gauge pressure transmitters)
- ③ Silicone cell
- ④ Silicone diaphragm with piezoresistive elements
- ⑤ Liquid fill
- ⑥ Process pressure "P"
- ⑦ Metal diaphragm

The process pressure is transmitted from the metal diaphragm (⑦) via the liquid fill behind it (⑤) directly to the silicone measuring cell (③). The embedded piezoresistive measuring elements on the silicone diaphragm (④) experience a corresponding strain which is then converted via a Wheatstone Bridge circuit to a voltage proportional to the applied process pressure.

Absolute pressure, gauge pressure and vacuum can be measured using this measuring principle.

Available measurement configurations



a: P_e = Effective pressure [2 bar]

b: P_{amb} = Ambient pressure [1.013 bar]

c: P_0 = Vacuum [0 bar]

① Absolute pressure [1.513 bara]

② Gauge pressure [0.5 barg]

Absolute pressure

During the production process, the sensor is evacuated on the negative side of the measuring cell and then sealed and referenced against a vacuum.

The pressure transmitter now measures the absolute pressure (①) compared to a "zero" pressure in an empty space (vacuum).

Gauge pressure

The back of the sensor is open to the atmosphere via air ventilation. The device is thus automatically referenced to the continuously changing ambient air pressure, indicating the gauge pressure (②) in the process compared to the respective atmospheric pressure.

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 representative.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).*

Measuring system

Measuring principle	Metallic diaphragm with piezoresistive measuring cell
Application range	Measurement of absolute and gauge pressure of gases, vapours and liquids
Measuring ranges	
Absolute pressure	Pressure ranges [bara]: 0...0.5; 0...1; 0...5; 0...10; 0...40; 0...100; 0...200
	Pressure ranges [psia]: 0...7.25; 0...14.5; 0...72.5; 0...145; 0...580; 0...2900
Gauge pressure	Pressure ranges [barg]: 0...0.2; 0...0.5; 0...1; 0...2; 0...5; 0...10; 0...20
	Pressure ranges [psig]: 0...2.9; 0...7.25; 0...14.5; 0...29; 0...72.5; 0...145; 0...290
Design	
Blind version	Position correction, zero and measurement span adjustment of span start (4 mA) and span end (20 mA) with push button on the converter electronics.
Version with display (optional)	LCD graphic display with 4 push buttons.
	Resolution: 128 x 64
	User languages: German, English and French (pending)

Measuring accuracy

Reference conditions acc. to IEC 60770	Ambient temperature (constant): +18...+30°C / +64...+86°F
	Relative humidity (constant): 30...80%
	Ambient pressure (constant): 950...1060 mbar / 14.8...15.4 psi
	Filling: silicone oil
Measuring accuracy	In relation to non-linearity, hysteresis and repeatability
	±0.1% of measuring span
Long-term stability acc. to DIN EN 61298-1	≤±0.1% within 1 year
Response time acc. to IEC 61298-1	T(95%) = 50 ms (incl. dead time)

Operating conditions

Temperature limits	
Operating temperature	Blind version: -40...+85°C / -40...+185°F
	With LCD graphic display: -20...+70°C / -4...+158°F
	Ambient temperatures below -10°C / +14°F may affect the readability of the display.
Process temperature	-40...+85°C / -40...+185°F
Storage temperature	-20...+70°C / -4...+158°F
Other conditions	
Protection category acc. to IEC 529 / EN 60529	Standard: IP65
	Optional: IP67 with internally ventilated cable for gauge pressure sensors

Installation conditions

Installation	Can be installed in any position, zero point or position correction may be required following installation.
	Maximum error through mounting position: <3.5 mbar / <0.05 psi
Dimensions and weights	For detailed information refer to section "Dimensions and weights".

Materials

Wetted parts	Stainless steel W.1.4404 (AISI 316L)
Non-wetted parts	Stainless steel W.1.4404 (AISI 316L)
	Internal housing cover gasket: EPDM
	Version with display: Makrolon®

Process connections

Standard	G½-B acc. to DIN EN 837-1
NPT versions	½"-14 NPT - female
	½"-14 NPT - male
Process connections with flush mounted diaphragm	In preparation

Electrical connection

Supply voltage	12...45 VDC
Output signal	4...20 mA, 2-wire
Damping	0.1 s
Max. load resistance (current output)	$R_{Load} [K\Omega] = (U_B [V] - 12 V) / \text{alarm current max. [mA]}$ with U_B = supply voltage
Initialisation time	10 s
Alarm current	Configurable as high alarm (21 mA) and low alarm (3.6 mA) using optional LCD display
Cable feedthroughs	M16 in plastic, nickel-plated brass or 316L stainless steel

Approvals and certificates

CE	The device fulfils the statutory requirements of the EC directives. The manufacturer certifies that these requirements have been met by applying the CE marking.
Electromagnetic compatibility (EMC)	Electromagnetic influence < 0.5% of measuring span
	EMC conformity for EN 61326-1 (5/2006)
NAMUR	NE 43

2.2 Pressure ranges

Gauge pressure

Order code	Pressure range	Maximum working pressure	Smallest calibratable span	Low pressure resistance $p_{abs.}$
	[bar] / [psi]	[bar]	[bar]	[bar]
1	-0.2...0.2 / -3...3	2.5	0.02	0.05
2	-0.5...0.5 / -7...7	2.5	0.05	0.05
3	-1...1 / -15...15	3	0.1	0.05
4	-1...2 / -15...145	4	0.2	0.05
5	-1...5 / -15...72	7	0.5	0.05
6	-1...10 / -15...145	15	1	0.05
7	-1...20 / -15...290	30	2	0.05

Absolute pressure

Order code	Pressure range	Maximum working pressure	Smallest calibratable span	Low pressure resistance $p_{abs.}$
	[bar] / [psi]	[bar]	[bar]	[bar]
N	0...0.5 / 0...7	2.5	0.05	0.05
P	0...1 / 0...15	3	0.01	0.05
R	0...5 / 0...72	7	0.5	0.05
S	0...10 / 0...145	15	1	0.05
T	0...50 / 0...725	100	5	0.05
U	0...100 / 0...1450	200	10	0.05
V	0...200 / 0...2900	300	20	0.05

2.3 Dimensions and weights

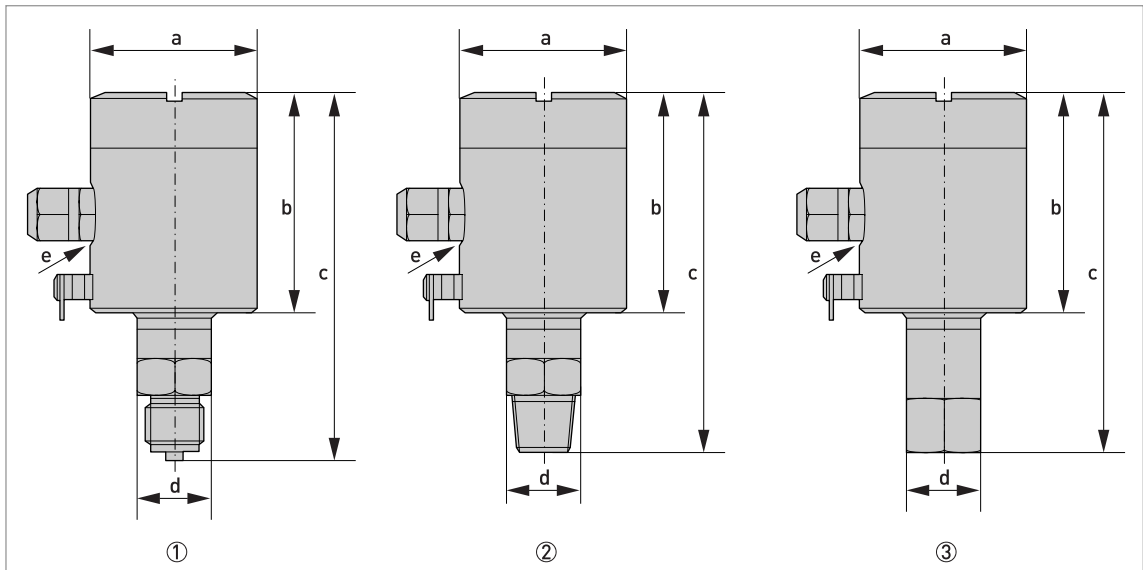


Figure 2-1: Dimensions for available process connection variants

d = WS27
e = M16x1.5

- ① G $\frac{1}{2}$
- ② $\frac{1}{2}$ " NPT - male
- ③ $\frac{1}{2}$ " NPT - female

Version	Dimensions			Weight
	a	b	c	
	[mm / "]			[g / lb]

Process connection G $\frac{1}{2}$

Blind version	60 / 2.4	71 / 2.8	124 / 4.9	734 / 1.60
Version with display	60 / 2.4	79 / 3.1	132 / 5.2	834 / 1.80

Process connection $\frac{1}{2}$ " NPT - male

Blind version	60 / 2.4	71 / 2.8	121 / 4.8	710 / 1.57
Version with display	60 / 2.4	79 / 3.1	129 / 5.1	810 / 1.78

Process connection $\frac{1}{2}$ " NPT - female

Blind version	60 / 2.4	71 / 2.8	118 / 4.6	748 / 1.65
Version with display	60 / 2.4	79 / 3.1	126 / 5.0	834 / 1.80

3.1 Intended use

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.

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

The **OPTIBAR** series pressure transmitters were designed and constructed to measure the absolute pressure and gauge pressure of gases, vapours and liquids. The available measuring ranges and permitted maximum working pressures for each are indicated on the nameplate and described in "Technical Data". To observe the intended use, adhere to the following points:

- Observe the instructions in this document.
- Comply with the technical limit values (for details refer to *Technical limits* on page 12).
- Observe permissible products (for details refer to *Permissible products* on page 12).
- Only suitably qualified personnel may install and operate the device.
- Observe the generally accepted standards of good practice.

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

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 or go below the maximum permissible pressure or vacuum.
- Do not exceed or go below the indicated permissible operating temperature range.
- Do not exceed or go below the indicated permissible ambient temperature.
- Observe the housing protection type during use (IP67 only with internally ventilated cable!).

3.3 Permissible products

The device is designed to measure the pressure of vaporous, gaseous and liquid media. Device variants featuring recessed diaphragms are not suitable for the measurement of products containing solids or viscous and paste-like products. Prior to using any corrosive or abrasive products, the operator must check the resistance of all parts 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 Installation

- *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 product resistance.*

3.5.1 Humidity

Use a suitable cable and tighten the cable gland in accordance with the recommended torque specifications. Protect the transmitter from penetrating moisture by dropping the cable down before the screw connection. Any liquids running along the cable will thus drip off before reaching the screw connection; refer to *Laying electrical cables correctly* on page 15. This is particularly important for unprotected installation outside or in rooms in which moisture is an issue (e.g. as a result of cleaning processes) or on cooled or heated containers.

3.5.2 Pressure connection via impulse line

Bear the following in mind when connecting the pressure connection via an impulse line:

- Select the shortest impulse line possible and lay without sharp bends.
- Avoid deposits and blockages in the impulse line. Accordingly, lay the impulse line so that such occurrences are impossible. Do not exceed a drop or rise of approx. 8% in the pipe.
- Ensure that the impulse line flows freely before the connection 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 line.
- Hot steam must not enter the process connection (the excess temperature will destroy the device). To avoid this situation, a suitable water trap (such as a U-tube filled with water prior to installation) can be installed upstream from the measuring device.
- Ensure that the connection is perfectly sealed!

3.6 Ventilating the pressure sensor

In the case of gauge pressure transmitters, mechanical reasons make it necessary to charge the reference side of the pressure sensor with atmospheric pressure. Ventilation occurs in versions in IP65 via a special aerator fitted with a Gore-Tex[®] filter. Ensure that the ventilation opening is not covered or closed (e.g. covering over with paint not permitted).

For the IP 67 version, a vented cable fitted with a capillary tube must be used. In the process, ensure that the capillary tubes are vented in a dry room protected from moisture and that no dust or moisture can penetrate the capillary tube opening.

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!

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

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 must be provided by the customer.

4.2.1 Requirements for signal cables provided 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

- 2 twisted double wire circuits
- 20 AWG twisted, tinned copper conductors
- Completely tinned copper shielding
- Casing colour: grey
- Colour of wires:
Pair 1: black / red; pair 2: green / white
- 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 $\mu\text{H}/\text{ft}$

4.2.2 Laying electrical cables correctly

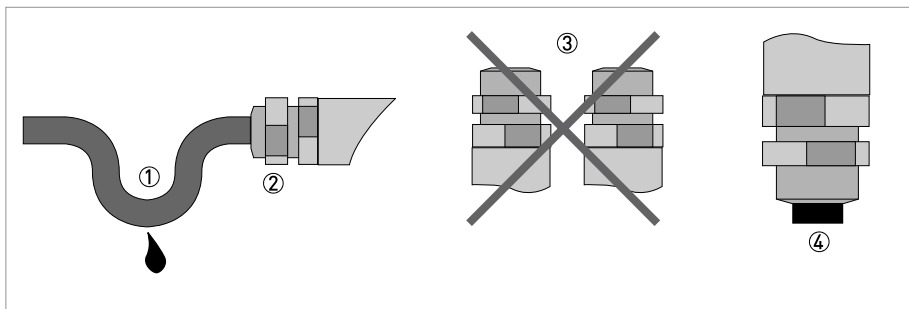


Figure 4-1: Protect housing from dust and water

- ① Lay the cable in a loop just before the housing.
- ② Tighten the screw connection of the cable entry securely.
- 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 Connection to the feed unit

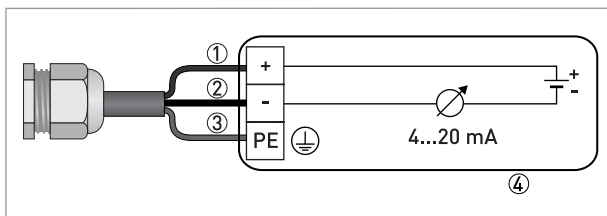


Figure 4-2: Connection to the feed unit

- ① Red
- ② Black
- ③ Green/yellow
- ④ Feed unit with load

4.3 Connection in the terminal compartment

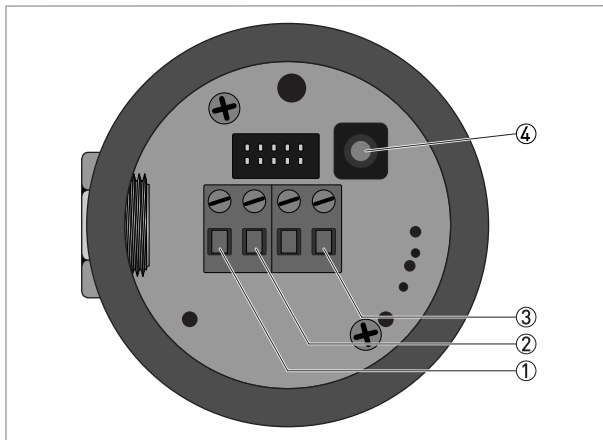


Figure 4-3: Connection in the terminal compartment

- ① (V_{in+}) Signal terminals
- ② (V_{in-}) Signal terminals
- ③ (PE) Grounding terminal or equipotential bonding terminal
- ④ Push button for lower range limit and upper range limit

When using an intrinsically safe or grounded feed unit, do not connect PE!

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.
- When using an intrinsically safe or grounded feed unit, do not connect PE!
- 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.

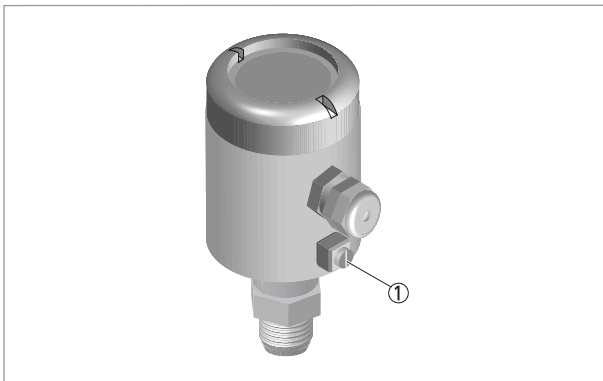
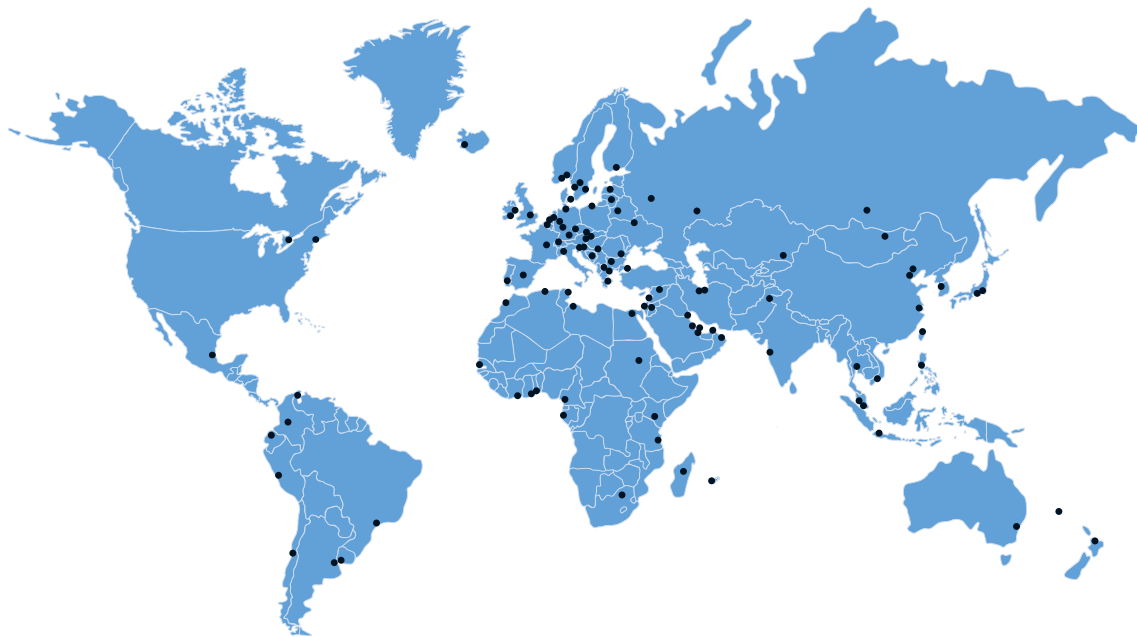


Figure 4-4: Position of the ground terminal on the housing

① Ground terminal

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

Sensor	Version		
VGK3	0	0	Gauge pressure transmitter
		1	Absolute pressure transmitter
			Wetted materials
		S	1.4404 / 316L stainless steel
			Process connection
		0	½" NPT male
		1	½" NPT female
		2	G½ acc. to DIN 837-1 (with appropriate gasket)
			Measuring range
			Gauge pressure [bar] / [psi]
		1	-0.2...0.2 / -3...3
		2	-0.5...0.5 / -7...7
		3	-1...1 / -15...15
		4	-1...2 / -15...145
		5	-1...5 / -15...72
		6	-1...10 / -15...145
		7	-1...20 / -15...290
			Absolute pressure [bar] / [psi]
		N	0...0.5 / 0...7
		P	0...1 / 0...15
		R	0...5 / 0...72
		S	0...10 / 0...145
		T	0...50 / 0...725
		U	0...100 / 0...1450
		V	0...200 / 0...2900
			Shut-off valve
		0	None
		1	Valve block (only available with ½" NPT male thread process connection; pressure transmitter requires ½" NPT female thread process connection)
			Output
		0	2-wire 4...20 mA (24 VDC)
			Ex approvals
		0	Non-Ex
			Housing
		S	316L stainless steel
			Electrical connection
		0	1 x M16 x 1.5 plastic
		1	1 x M16 x 1.5 nickel-plated brass
		2	1 x M16 x 1.5 316L stainless steel



KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Measuring systems for the oil and gas industry
- Measuring systems for sea-going tankers

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