OPTIBAR PC 5060 Handbook

Pressure transmitter for the measurement of process pressure, level, differential pressure, density and interface with ceramic measuring cell

4...20 mA HART®
4...20 mA HART® with SIL-qualification

KROHNE

IMPRINT

1.1 Software history

The "Electronic Revision" (ER) is consulted to document the revision status of the electronics according to NE 53. It is easy to see from the ER whether troubleshooting or larger changes in the electronic equipment have taken place and how that has affected the compatibility.

Changes and effect on compatibility

1	Downwards compatible changes and fault repair with no effect on operation (e.g. spelling mistakes on display)	
2-_	Downwards compatible hardware and/or software change of interfaces:	
	H	HART®
	P	PROFIBUS
	F	Foundation Fieldbus
	M	Modbus
	X	all interfaces
3-_	Downwards compatible hardware and/or software change of inputs and outputs:	
	I	Current output
	F, P	Frequency / pulse output
	S	Status output
	C	Control input
	CI	Current input
	X	All inputs and outputs
4	Downwards compatible changes with new functions	
5	Incompatible changes, i.e. electronic equipment must be changed.	

INFORMATION!
In the table below, "x" is a placeholder for possible multi-digit alphanumeric combinations, depending on the available version.

Release date	Revisions	Changes and compatibility	Documentation
2013-12-01	SW: 1.0.0 HW: 1.0.0	-	MA OPTIBAR PC 5060 R01
2014-08-01	SW: 1.1.0 HW: 1.0.0	1, 2-H, 3-I, 4	MA OPTIBAR PC 5060 R01
2014-10-01	SW: 1.1.1 HW: 1.0.0	1	MA OPTIBAR PC 5060 R01
2014-12-01	SW: 1.1.2 HW: 1.0.1	1	MA OPTIBAR PC 5060 R01
2015-06-01	SW: 1.2.0 HW: 1.0.1	1, 2-H, 4	MA OPTIBAR PC 5060 R02
2015-09-01	SW: 1.2.1 HW: 1.0.1	1	MA OPTIBAR PC 5060 R02
2015-10-01	SW: 1.2.2 HW: 1.0.1	1	MA OPTIBAR PC 5060 R02
2016-11-01	SW: 1.3.0 HW: 1.0.1	1, 2-H, 4	MA OPTIBAR PC 5060 R03
2017-07-01	SW: 1.3.1 HW: 1.0.1	1	MA OPTIBAR PC 5060 R03
2017-12-01	SW: 1.3.2 HW: 1.0.1	1, 2-H, 3-I	MA OPTIBAR PC 5060 R03
2018-09-01	SW: 1.3.3 HW: 1.0.1	1	MA OPTIBAR PC 5060 R04
2020-07-01	SW: 1.3.5 HW: 1.0.1	1	MA OPTIBAR PC 5060 R05

1.2 Intended use

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

CAUTION!
- *Any modification to the device, including drilling, sawing, trimming, welding and soldering of parts, or partially painting over or coating, is prohibited.*
- *Neither is it permitted to use the device as a climbing aid e.g. for installation purposes, as a holder for cables, pipes or other loads.*
- *The mounting or installation of parts is only permitted as described in this document, or insofar as it has been authorised by the manufacturer or a certified service partner.*

CAUTION!
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.

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

The OPTIBAR PC 5060 C process pressure transmitter is suitable for measuring the process pressure and level of gases, vapours and liquids. In combination with a slave sensor, the OPTIBAR PC 5060 C also provides the option of electronic differential pressure measurement of differential pressure, level, density and interface. The available measurering ranges and the respective permissible overloads are indicated on the nameplate. For details refer to *Technical data* on page 82. 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 82).
- Only suitably qualified personnel may install and operate the device.
- Observe the generally accepted standards of good practice.

1.3 SIL-qualification according to IEC 61508

Only for signal converters with SIL-qualification

The Safety Integrity Level (SIL) of an electronic system assesses the reliability of integrated safety functions. To specify safety requirements more accurately, there are several SIL levels according to safety standard IEC 61508. The device complies with the requirements of IEC 61508: 2010 (Edition 2). In single channel operation it is qualified to SIL 2. In multi-channel architecture with HFT 1, the device can be used in homogenous redundancy to SIL 3.

1.4 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.

1.5 Permissible mediums

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.

1.6 Certification

CE marking

The device fulfils the statutory requirements of the following EU directives:

- EMC Directive 2014/30/EU
- EMC specification acc. to EN 61326-1:2013, EN 61326-2-3:2013, EN 61326-2-5:2013, EN 61326-3-2:2008

The manufacturer certifies successful testing of the product by applying the CE marking.

Pressure Equipment Directive PED

Devices with a permissible pressure PS ≤ 200 bar (20 MPa) comply with Pressure equipment directive 2014/68/EU Article 4 Section (3) and are not subject to a conformity assessment. These devices were designed and manufactured in accordance with sound engineering practice (SEP).

The CE marking on the device does not apply to the pressure equipment directive.

Radio licenses for display and adjustment modul with Bluetooth

The radio module used in the instrument for wireless Bluetooth communication is approved for use in countries of the EU and EFTA. It was tested by the manufacturer according to the latest edition of the following standard:

- EN 300 328 – Wideband transmission systems

The radio module used in the instrument for wireless Bluetooth com¦munication has also radio licenses for the USA and Canada applied for by the manufacturer:

- USA - FCC ID: P14BL600
- Canada - IC: 1931B-BL600

1.7 Safety instructions from the manufacturer

1.7.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

We draw your attention to the fact that data transmission over the Internet (e.g. when communicating by e-mail) may involve gaps in security. It is not possible to protect such data completely against access by third parties.

We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.7.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.7.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation or operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.7.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of icons as shown below.

1.7.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.

DANGER!
This warning refers to the immediate danger when working with electricity.

DANGER!
This warning refers to the immediate danger of burns caused by heat or hot surfaces.

DANGER!
This warning refers to the immediate danger when using this device in a hazardous atmosphere.

DANGER!
These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.

WARNING!
Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.

CAUTION!
Disregarding these instructions can result in damage to the device or to parts of the operator's plant.

INFORMATION!
These instructions contain important information for the handling of the device.

LEGAL NOTICE!
This note contains information on statutory directives and standards.

- HANDLING
  This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➲ RESULT
This symbol refers to all important consequences of the previous actions.

1.8 Safety instructions for the operator

WARNING!
In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.

2.1 Scope of delivery

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
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.

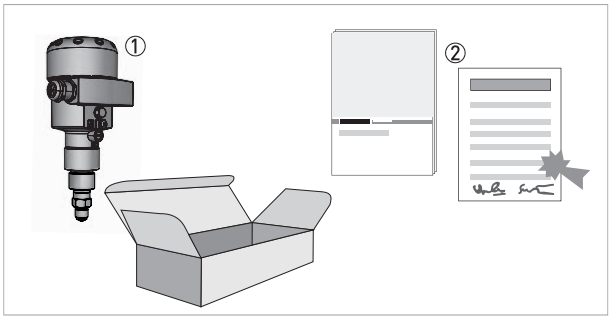


Figure 2-1: Scope of delivery

① Device in the version as ordered
② Documentation (test reports, factory and material certification (if ordered) and product documentation)
For SIL devices only, in addition Safety Manual and device parameters (default and job-related values).

Optional accessories

- Gasket
- Assembled connecting cable (shielded four-wire cable)
- Unassembled cable gland

INFORMATION!
Assembly materials and tools are not part of the delivery. Use the assembly materials and tools in compliance with the applicable occupational health and safety directives.

2.2 Device description

The OPTIBAR PC 5060 C is suited to applications in virtually all areas of industry. It is used to measure the following types of pressure:

- Gauge pressure
- Absolute pressure
- Vacuum

Depending on the version, the OPTIBAR PC 5060 C is also suitable for electronic differential pressure measurement. To do this, the device is combined with a slave sensor. The configuration of the device, as well as the setup of the electronic differential pressure measurement is operated via the display and adjustment module. For further information refer to *Keypad functions* on page 56.

A capacitive ceramic sensor element is used in the measuring cell.

The measuring device is supplied ready for operation. The factory settings for the process data correspond to the order specifications.

For safety reasons do not exceed the measuring range or permissible process pressure. This also applies when, based on the order, a measuring cell is installed with a higher measuring range than the permissible pressure range of the process connection.

Only for signal converter with SIL-qualification

- Nameplate: with SIL logo.
- Scope of delivery: includes Safety Manual and documentation for device parameters.
- Parameterisation: Device status "Function Check" is output during parameterisation, the safety function is disabled.
- Measured value: "Failure" is output for measured values < -20% or > +120% nominal measuring range.
- Current output: Failure mode 20.5 mA cannot be selected
- HART mode: analogue current output is fixed.
- Electronic temperature: "Failure" is output when the temperature values fall outside of the permissible range.
- Diaphragm seals with coatings are partially not permissible.

INFORMATION!
Only for signal converters with SIL-qualification
The necessary measures for use of the device in safety instrumented systems are described in the "Safety Manual". The SIL-functionality may not be disabled by the user or the Service department.

2.2.1 Device design

The following drawing shows the basic components of the pressure transmitter.

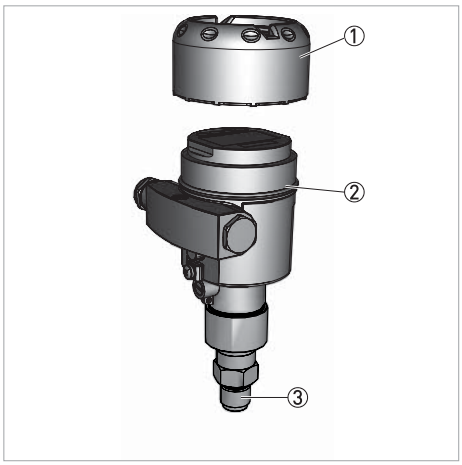


Figure 2-2: Basic components of single chamber pressure transmitter

① Housing cover, optional with display and adjustment module below
② Housing with electronics
③ Process assembly with measuring cell

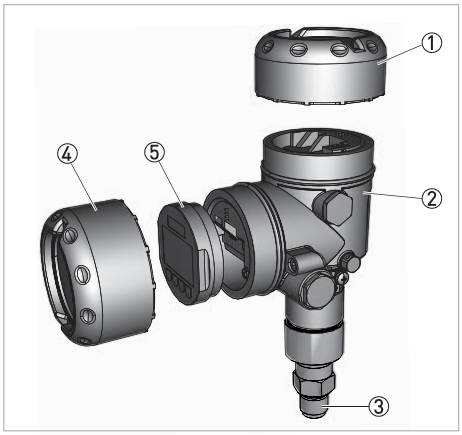


Figure 2-3: Basic components of double chamber pressure transmitter

① Housing cover
② Housing with electronics
③ Process assembly with measuring cell
④ Housing cover, optional with display and adjustment module below
⑤ Operating and display module

2.3 Nameplates

INFORMATION!
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.

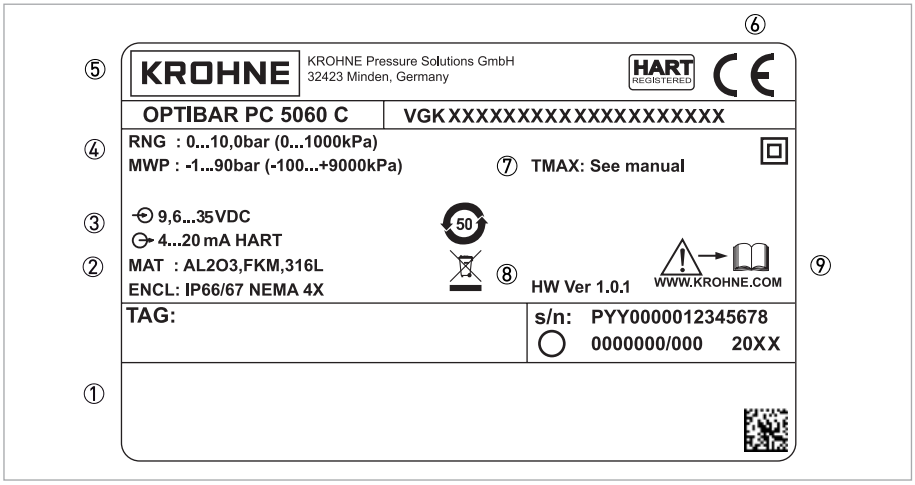


Figure 2-4: Example for a nameplate

① Approvals and approval guidelines
② Ingress protection and material of wetted parts
(Diaphragm, process connection and sealing)
③ Electronics power supply and signal output
④ Nominal range
Permissible process pressure
⑤ Product name and type code
⑥ CE marking and marking of notified body
⑦ Permissible temperature range
⑧ Hardware version
⑨ Observe the installation and operating instructions

2.4 Terms and abbreviations

The following terms and abbreviations are used in this document.

URL Upper Range Limit	Upper measuring range limit. Also called nominal range. The highest value that can be measured by a particular device.
LRL Lower Range Limit	Lower measuring range limit. The lowest value that can be measured by a particular device.
URV Upper Range Value	The calibrated measuring range or the highest adjusted measured value. This value corresponds to the 20 mA signal.
LRV Lower Range Value	The calibrated measuring range or the lowest adjusted measured value. This value corresponds to the 4 mA signal.
SPAN Span	Measuring span or measuring range. SPAN = URL – LRL
CAL SPAN Calibrated Span	Calibrated or adjusted measuring span. CAL SPAN = URV – LRV. Also called "cSPAN". This is the span set to the 4…20 mA output.
TD Turn Down	The ratio from the measuring span to the adjusted measuring span. TD= SPAN/(CAL SPAN) = (+URL)/(CAL SPAN) The following applies: URV ≤ URL, CAL SPAN ≤ SPAN, TD ≥ 1

Example for **TD** Turn Down	
LRL= 0 bar **URL**= 3 bar / 43.5 psi	**SPAN**= 3 bar / 43.5 psi
URV= 2 bar / 29 psi **LRV**= 0.5 bar / 7.25 psi	**CAL SPAN**= 1.5 bar / 21.75 psi **TD**= 2:1

2.5 Sealing concept

2.5.1 Sealing concept for recessed installation

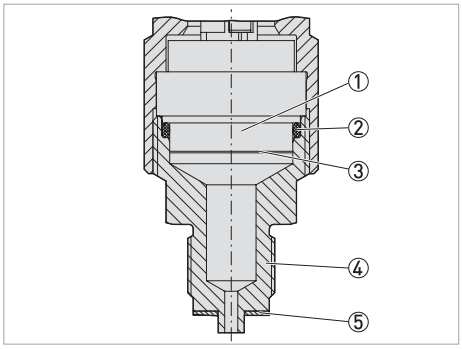


Figure 2-5: Recessed installation of the CERTEC® measuring cell

① Measuring cell
② Measuring cell seal
③ Process diaphragm
④ Process connection
⑤ Seal for the process connection (optional)

2.5.2 Sealing concept for flush-mounted installation with single seal

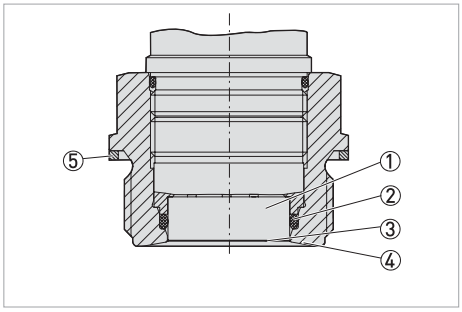


Figure 2-6: Flush mounted installation of the CERTEC® measuring cell

① Measuring cell
② Measuring cell seal
③ Process diaphragm
④ Process connection
⑤ Seal for the process connection (optional)

2.5.3 Sealing concept for flush-mounted installation with double seal

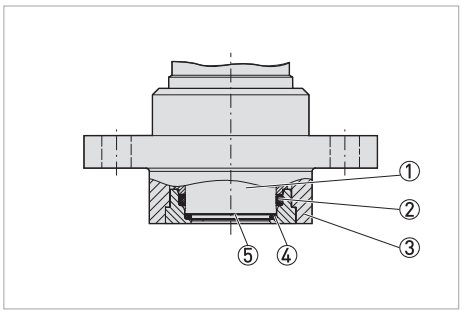


Figure 2-7: Flush mounted installation of the CERTEC® measuring cell with double seal

① Measuring cell
② Measuring cell seal
③ Process connection
④ Additional front measuring cell seal
⑤ Process diaphragm

2.5.4 Sealing concept for installation in hygienic connection

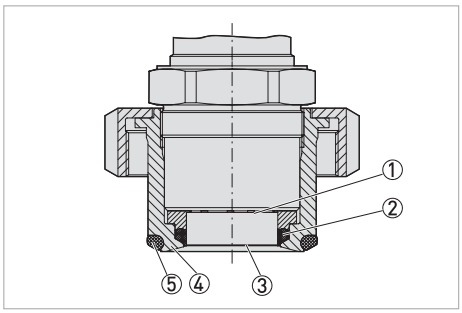


Figure 2-8: Hygienic installation of the CERTEC® measuring cell

① Measuring cell
② Measuring cell moulded seal
③ Process diaphragm
④ Process connection
⑤ Gap-free seal for process connection

2.6 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.

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

CAUTION!
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.

All measuring cells are fully welded and therefore require no additional elastomer seals. Depending on the process connection chosen, additional seals may be necessary.

2.7 Functional Safety (SIL)

2.7.1 Objective

In the event of dangerous failures, process facilities and machines can lead to risks for personnel, the environment and materials. The risk of such failures must be assessed by the plant operator. Depending on that assessment, measures to reduce risk through fault avoidance, fault detection and fault management are to be taken.

The part of plant safety dependent on the correct function of the safety-related components for risk reduction is known as functional safety. Components used in such safety instrumented systems (SIS) must therefore be able to carry out their intended function (safety function) with a defined high degree of probability.

The safety requirements for such components are described in the international standards IEC 61508 and IEC 61511, which set the standard for uniform and comparable assessment of device, plant and machine safety, thus contributing to worldwide legal compliance. Depending on the degree of risk reduction required, one of four safety levels is chosen, from SIL1 for low risk to SIL4 for extremely high risk (SIL = Safety Integrity Level).

2.7.2 SIL-qualification

When developing devices that can be used in safety instrumented systems, special attention is paid to avoiding systematic faults as well as detecting and eliminating accidental faults.

Below are the most important properties and requirements in terms of functional safety according to IEC 61508 (Edition 2):

- Internal monitoring of safety-relevant circuit components
- Advanced standardisation of software development
- In case of error, transition of safety-relevant outputs to a defined safe state
- Determination of the probability of failure of the defined safety function
- Reliable parameterisation with an unsafe operating environment
- Proof tests

SIL-qualification of components is documented in a safety manual. All of the safety-relevant specifications and information that the users and planners need for project planning and for the operation of safety instrumented systems are compiled here. This document is included with each device with SIL-qualification.

2.7.3 Application range

The device can be used, for example, to measure the process pressure and hydrostatic level of liquids in safety instrumented systems (SIS) as per IEC 61508 and IEC 61511. Observe the information in the Safety Manual.

The following inputs/outputs are permitted:

- 4...20 mA current output

2.7.4 Safety concept of configuration

WARNING!
When adjustment is unlocked, the safety function must be classified as unreliable. This applies until configuration has been properly completed. If necessary, you must take other measures to maintain the safety function.

WARNING!
If configuration as described has not been completely and correctly carried out (e.g. premature interruption or power outage), the device remains in an unlocked and thus unsafe state.

WARNING!
Upon resetting to the basic setting, all safety-relevant parameters are reset to factory settings. For this reason, all safety-relevant parameters must be checked or set anew afterwards.

The following equipment is permitted for parameterization of the safety function:

- The integrated display and operating unit for on-site operation
- The DTM suitable for the device in conjunction with frame software according to the FDT/DTM standard, e.g. PACTware

To avoid possible errors during parameter adjustment in unsafe operating environments, a verification procedure is used that allows parameterization errors to be reliably detected. To do this, safety-relevant parameters must be verified after they have been stored in the device. In addition, to protect against unwanted or unauthorised adjustment, the device is locked in normal operating state against any parameter changes. This concept applies both to the operation at the device as well as to PACTware with DTM.

For protection against unwanted or unauthorised adjustment, the set parameters must be protected against unauthorised access. For this reason, the device is shipped in locked condition. The PIN in delivery status is "0000". When shipped with specific parameter settings, the device is accompanied by a list of the values differing from the basic settings.

All safety-relevant parameters must be verified following a change. The parameter settings of the measuring point must be documented. A list of all of the safety-relevant parameters present upon delivery can be found in the "Reset" chapter. on page 66. In addition, a list of the safety-relevant parameters can be saved and printed using PACTware/DTM.

The device must be unlocked using a PIN to make any changes to parameters. The status of the device is indicated in the display with the symbol of a locked or unlocked padlock. The PIN in delivery status is "0000".

Any parameter changes made by the operator are automatically saved for verification in the next step.

Following start-up, you must verify the modified parameters (confirm the correctness of the parameters). To do this you must first enter the PIN. Adjustment is then automatically locked. Then you must compare two strings. You must confirm that both strings are identical. This is to check the string display. Then confirm that the serial number of your device has been saved correctly. This checks for proper device communication. Then all of the modified parameters are listed and each must be confirmed. Upon completion of this procedure, the safety function is once again guaranteed.

3.1 General notes on installation

INFORMATION!
Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

INFORMATION!
Do a check of the packing list to make sure that you have all the elements given in the order.

INFORMATION!
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.

3.2 Ingress protection for housing

The housing of the signal converter fulfills the requirements for ingress protection in accordance with IEC 60529. Housing for protection category IP69K in accordance with ISO 20653 is also available. For further information refer to *Technical data* on page 82.

CAUTION!
The first digit stands for the protection of the inner electronic components against the ingress of foreign bodies including dust. The first digit "6" means that the housing is dust-proof. The second digit designates the protection of the inner electronic components against the ingress of water. The second digit "6" means that the housing is waterproof and also resistant against a strong jet of water. The number "7" means that the housing is waterproof even submersed under water for a given pressure and time. The number "8" means that the housing is permanently waterproof even under water.

3.3 Packaging

CAUTION!
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.

Your device was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test following ISO 22248. The packaging of standard devices consists of environmentally friendly, recyclable cardboard and PE foil. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

3.4 Storage

CAUTION!
Observe the storage information found on the packaging. Labels on the original packaging must always remain legible and may not be damaged.

- Store the device in a dry, dust-free location.
- Avoid extended direct exposure to the sun.
- Store the device in the original packaging supplied.
- Do not expose to aggressive media.
- Avoid mechanical shocks.
- Storage temperature: -40...+80°C / -40...+176°F
- Relative air humidity: 20...85%.

3.5 Transport

- Use original packaging for transport and ensure that the packaging does not get crushed or damaged by sharp objects or other boxes.
- Do not throw or drop the device.
- Avoid temperatures below -40°C / -40°F and above +80°C / +176°F.
- When transporting by ship, use seaworthy outer packing.

3.6 Installation specifications

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

Ensure that all of the parts in the process are suitable for the current process conditions. This includes in particular:

- Parts active in the measurement
- Process connection
- Process seal

Process conditions include in particular:

- Process pressure
- Process temperature
- Chemical properties of the media
- Abrasion and mechanical impact

3.7 Mounting

WARNING!
Do not screw in using the housing! Tightening this way can cause damage to the rotary mechanism on the housing.

For devices with threaded process connections, the hexagon should be tightened with a suitable wrench. For further information refer to *Dimensions and weight* on page 98.

CAUTION!

- *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.*

3.7.1 Rotating the housing

The transmitter housing can be rotated 350° for better readability of the display or access to the wiring. A stop prevents the housing from being rotated too far.

- On all dual chamber housings, the locking screw must be loosened at the neck of the housing.

➲ The housing can then be rotated to the desired position.

- Once the desired position is reached, tightened the locking screw.

3.7.2 Mounting the display and adjustment module

The optional display and adjustment module can be set in any one of four different positions at 90° intervals. The installation of the adjustment module is carried out as per the illustrations below. To do so, unscrew the housing cover and insert the adjustment module clockwise. The display can be installed rotated at 90°. It is not necessary to interrupt the power supply.

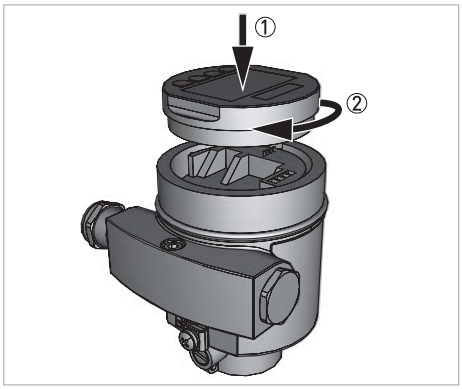


Figure 3-1: Installation in single chamber housing

① Insert the display and adjustment module into the housing
② Turn the display and adjustment module clockwise

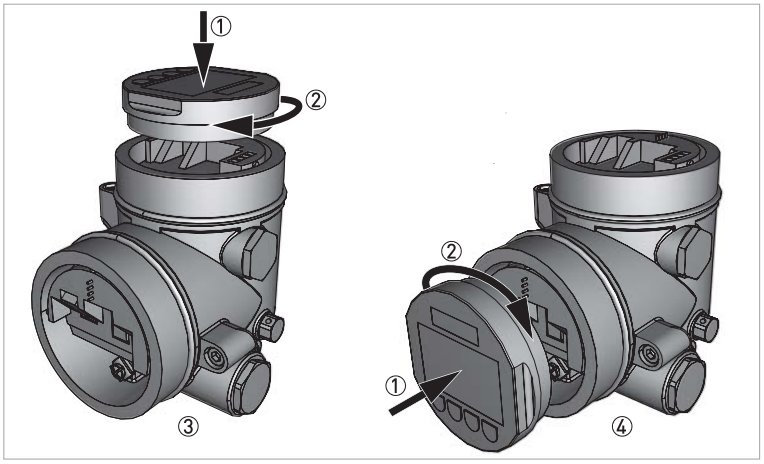


Figure 3-2: Installation in double chamber housing

① Insert the display and adjustment module into the housing
② Turn the display and adjustment module clockwise
③ Mounting on top
④ Mounting at side

3.7.3 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. For further information refer to *Technical data* on page 82.

3.8 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 82.

CAUTION!
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.

3.9 Venting

CAUTION!
The filter element causes a delayed pressure equalisation when the housing cover is opened or closed quickly. During the process the measurement can change by up to 15 mbar for up to 5 seconds.

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

CAUTION!
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.

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.

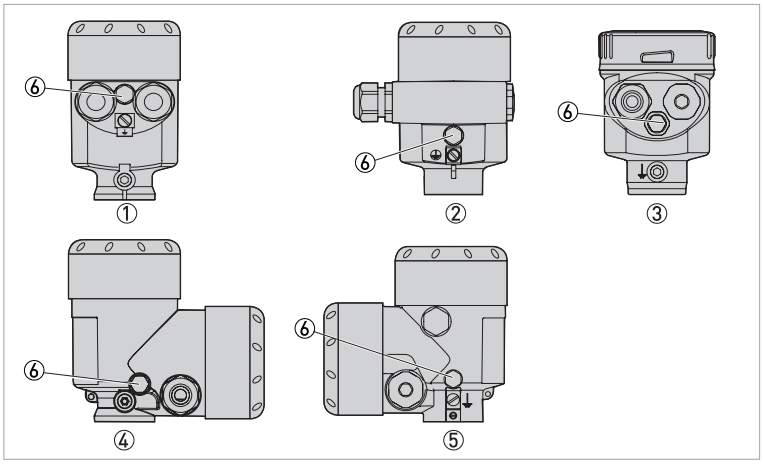


Figure 3-3: Venting in non-Ex, Ex ia and Ex d ia versions

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 Filter element

The following devices feature a dummy plug instead of a filter element:

- Devices in the IP 66 / IP 68 (1bar) protection category - venting via capillary tube in nondetachable cable.
- Devices with absolute pressure

Devices in Ex d version

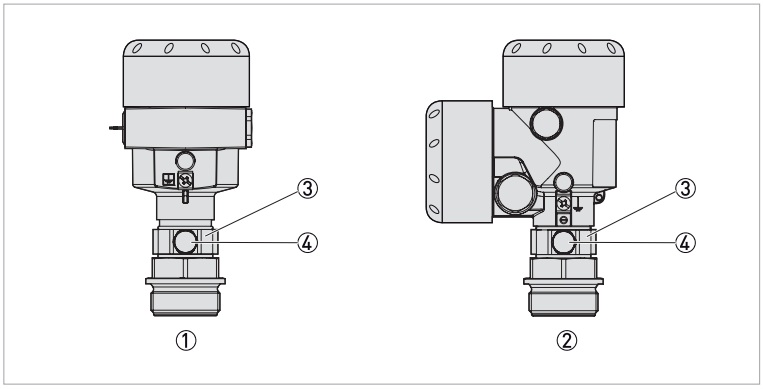


Figure 3-4: Ventilation Ex-housing

① Single chamber housing, aluminium and stainless steel precision casting
② Double chamber housing, aluminium and stainless steel precision casting
③ Rotating metal ring
④ Filter element

The filter element is integrated into the sensor assembly via a rotating metal ring. Align the metal ring downwards to better protect the filter element from deposits. Devices with absolute pressure feature a blind plug instead of a filter element.

Devices with second process barrier

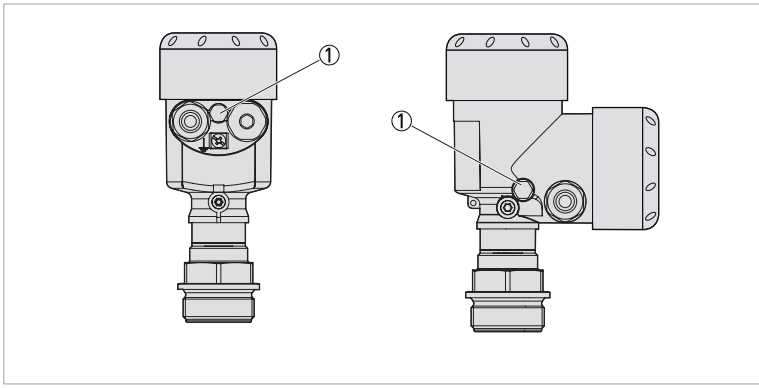


Figure 3-5: Ventilation gas-proof feedthrough

① Filter element

For devices with a secondary process barrier, the sensor assembly is completely encapsulated by an additional, gas-proof feedthrough. Additional venting is not required for absolute pressure sensors. With relative pressure sensors, the ambient pressure is measured and compensated by an additional sensor in the electronics.

Devices in IP69K version

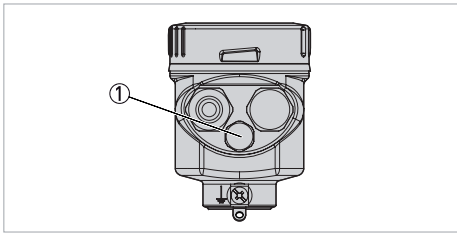


Figure 3-6: Ventilation IP69K

① Filter element

Devices with absolute pressure feature a blind plug instead of a filter element.

3.10 Measurement setup for measuring the process pressure

The following points should be observed in this application:

- The pressure transmitter must be mounted above the measuring point.

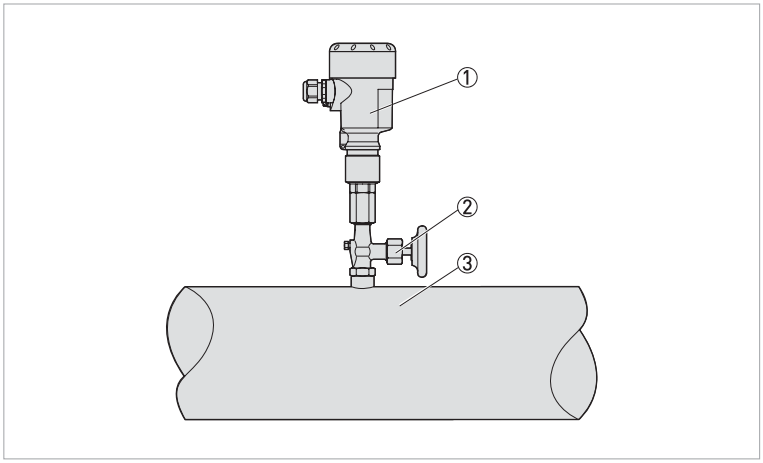


Figure 3-7: Measurement setup for measuring the process pressure of gases

① Pressure transmitter
② Shut-off valve
③ Tapping point

3.11 Measurement setup for measuring steam

The following points should be observed in this application:

- The pressure transmitter should be connected via a syphon to protect the measuring cell from non-permitted high temperatures.
- Siphon to be kept free of insulation.
- When using superheated steam, the siphon must be filled with water prior to start-up.

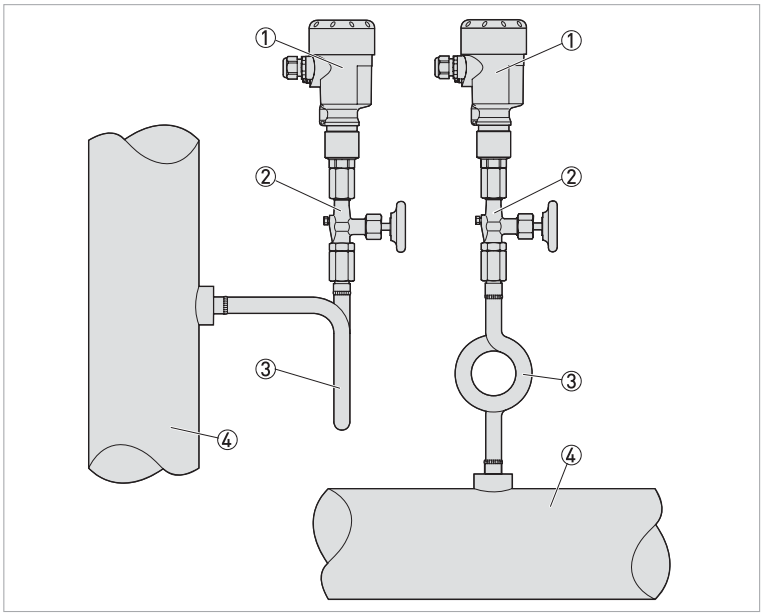


Figure 3-8: Measurement setup for measuring steam

① Pressure transmitter
② Shut-off valve
③ Syphon
④ Tapping point

3.12 Measurement setup for measuring fluids

The following points should be observed in this application:

- The pressure transmitter must be mounted below the measuring point.

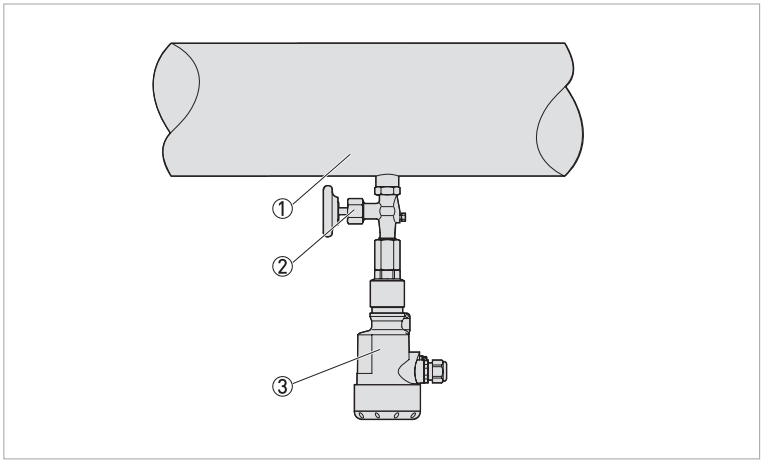


Figure 3-9: Measurement setup for measuring fluids

① Tapping point
② Shut-off valve
③ Pressure transmitter

3.13 Measurement setup for level measurement

The following points should be observed in this application:

- The pressure transmitter should be mounted below the lowest level.
- The pressure transmitter should be protected from filling/emptying current and agitator surges when mounted.

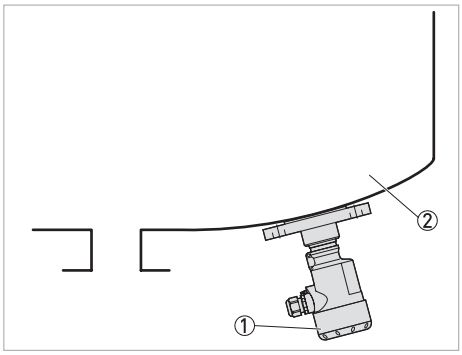


Figure 3-10: Measurement setup for level measurement

① Pressure transmitter
② Tank

3.14 External housing

A mounting plate is available as an option to facilitate the mounting of the external housing. For further information refer to *Technical data* on page 82.

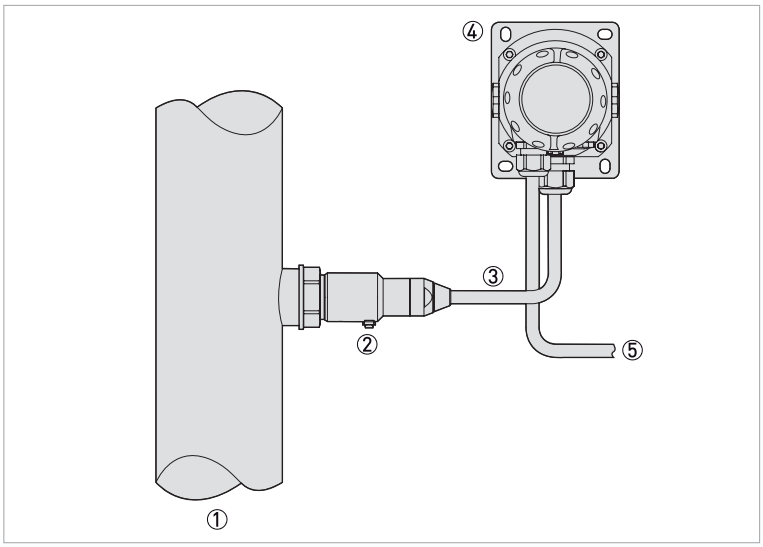


Figure 3-11: Measurement setup with an external housing

① Tapping point
② Sensor assembly
③ Connecting cable
④ External housing
⑤ Signal cable

IP68 version (25 bar)

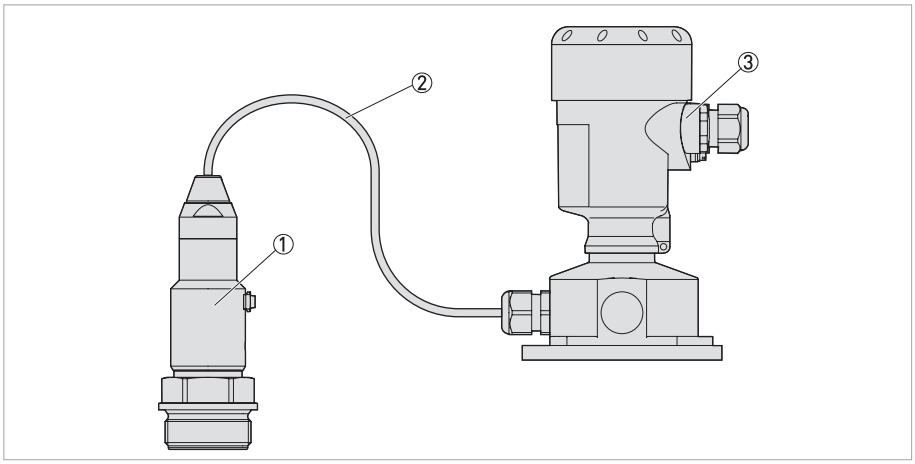


Figure 3-12: Process assembly

① Sensor assembly
② Connection cable
③ External housing

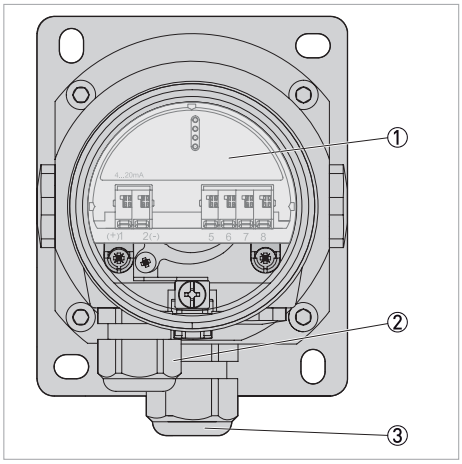


Figure 3-13: External housing (IP68)

① Electronic insert
② Cable gland for the power supply
③ Cable gland for the sensor connection cable

3.15 Electronic differential pressure

The OPTIBAR PC 5060 C slave sensor is combined with a master sensor for an electronic differential pressure measurement. The sensors are connected to each other via a shielded four-wire cable. The measured value of the slave sensor is read in and factored into the calculations. The measurement result (level, differential pressure, density or interface), as well as the measured value of the slave sensor (static pressure or head pressure) are output by the master sensor. Depending on the device version, output takes place as a 4...20 mA signal or digitally via HART, Profibus PA or Foundation Fieldbus with optional SIL-approval. The master sensor also takes care of the power supply and parameter adjustment.

Measurement result = measured value of master sensor (total pressure) - measured value of slave sensor (static pressure)

In principle, all sensor combinations in the OPTIBAR 5060 C device series are permitted, provided that the following requirements are met:

- Configuration of master sensor suitable for electronic differential pressure
- Type of pressure identical for both sensors, i.e. gauge pressure/gauge pressure or absolute pressure/absolute pressure
- The master sensor measures the higher pressure
- Single chamber housing for the master and slave sensor
- Measurement setup as illustrated in the following sections

The measuring range for each sensor is selected in accordance with the application requirements and the measuring ranges of the master and slave sensors do not have to be identical. Observe the maximum recommended turn down. For further information refer to *Pressure ranges* on page 93.

The "climate compensated gauge pressure" version is not suitable for electronic differential pressure measurement.

3.15.1 Measurement setup for level measurement

The master slave combination is suitable for level measurement in pressurised tanks. Note the following information regarding measurement setup.

- Install the master sensor below the minimum level
- Install the master sensor away from the filling stream or emptying area.
- Install the master sensor so that it is protected against pressure shocks from the stirrer.
- Install the slave sensor above the maximum level

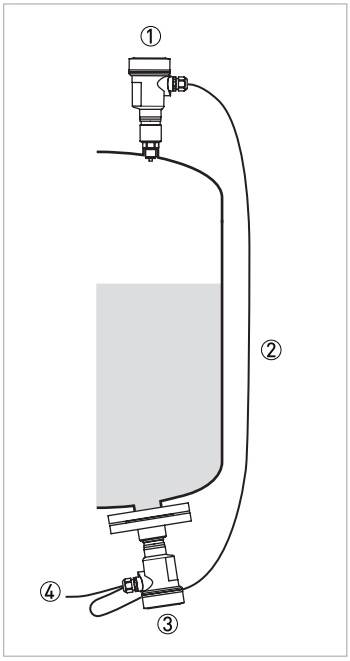


Figure 3-14: Measurement setup for level measurement in pressurised tanks

① Slave sensor
② Shielded four-wire cable
③ Master sensor
④ Power supply

3.15.2 Measurement setup for differential pressure measurement

The master-slave combination is suitable for differential pressure measurement.

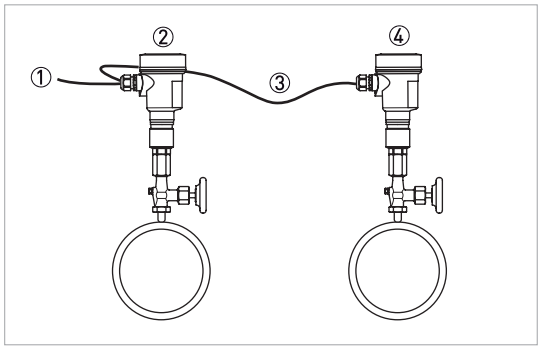


Figure 3-15: Measurement setup for differential pressure measurement of gases in pipelines

① Power supply/signal line
② Master sensor
③ Shielded four-wire cable
④ Slave sensor

3.15.3 Measurement setup for density measurement

The master-slave combination is suitable for density measurement. Requirements for a functioning measurement are:

- Tanks with variable level
- Distance between the measurement points as large as possible
- Level always above the upper measuring point

The mounting distance h of the two sensors should be at least 10%, preferably 20%, of the final value of the sensor measuring range. A greater distance increases the accuracy of the density measurement. Slight density changes cause only slight changes of the measured differential pressure. The measuring range must hence be selected accordingly. The density measurement is possible in open as well as in closed tanks.

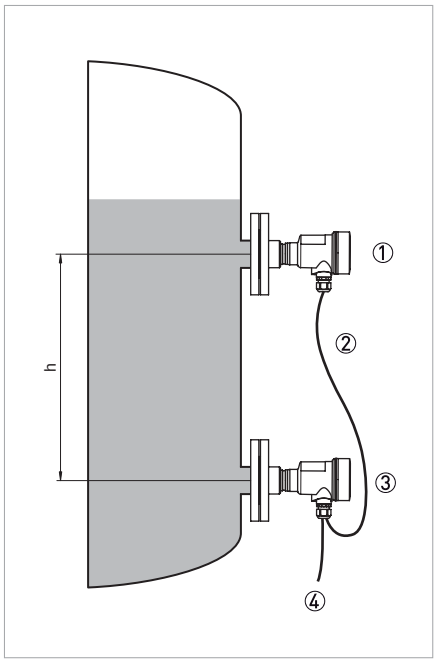


Figure 3-16: Measurement setup for density measurement, h= distance between the two measuring points

① Slave sensor
② Shielded four-wire cable
③ Master sensor
④ Power supply

3.15.4 Measurement setup for interface measurement

The master-slave combination is suitable for interface measurement. Requirements for a functioning measurement are:

- Tanks with variable level
- Media with constant density
- Interface always between the measuring points
- Total level always above the upper measuring point

The mounting distance h of the two sensors should be at least 10%, preferably 20%, of the final value of the sensor measuring range. A greater distance increases the accuracy of the interface measurement. The interface measurement is possible in open as well as in closed tanks.

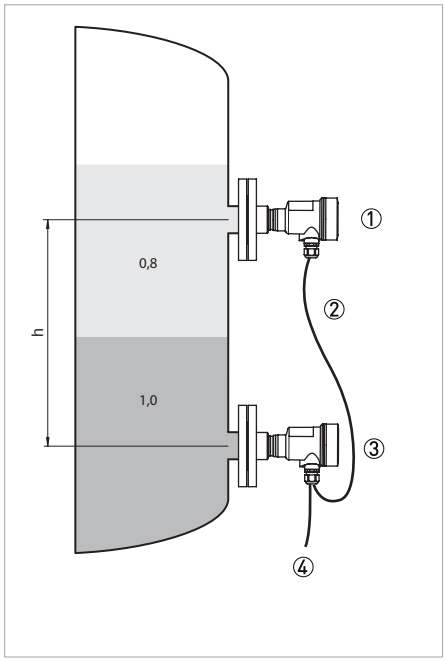


Figure 3-17: Measurement setup for interface measurement, h= distance between the two measuring points

① Slave sensor
② Shielded four-wire cable
③ Master sensor
④ Power supply

3.15.5 Measurement setup for density compensated level measurement

The master-slave combination is suitable for density compensated level measurement. Note the following information regarding measurement setup:

- Install the master sensor below the minimum level
- Install the slave sensor above the master sensor
- Install both sensors away from the filling stream and emptying and protected against pressure shocks from the stirrer.

The mounting distance h of the two sensors should be at least 10%, preferably 20%, of the final value of the sensor measuring range. A greater distance increases the accuracy of the density compensation.

The density compensated level measurement starts with the stored density 1 kg/dm^3. As soon as both sensors are covered, this value will be replaced by the calculated density. Density compensation means that the level value in height units and the adjustment values do not change in case of a fluctuating density.

Density compensated level measurement is only possible when the tank is open, in other words unpressurised.

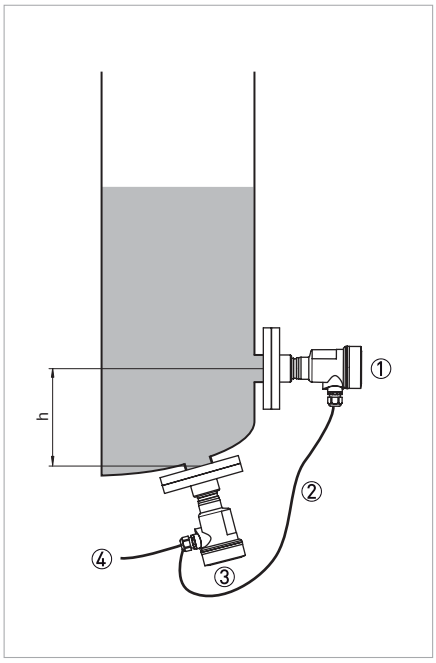


Figure 3-18: Measurement setup for density compensated level measurement, h = distance between the two measuring points

① Slave sensor
② Shielded four-wire cable
③ Master sensor
④ Power supply

4.1 Safety instructions

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

DANGER!
Observe the national regulations for electrical installations!

WARNING!
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.

INFORMATION!
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

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

DANGER!
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...+105°C / -40...+221°F
- Capacity: ≤ 200 pF/m / 61 pF/ft
- Inductance: ≤ 0.7 µH/m / 0.2 µH/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

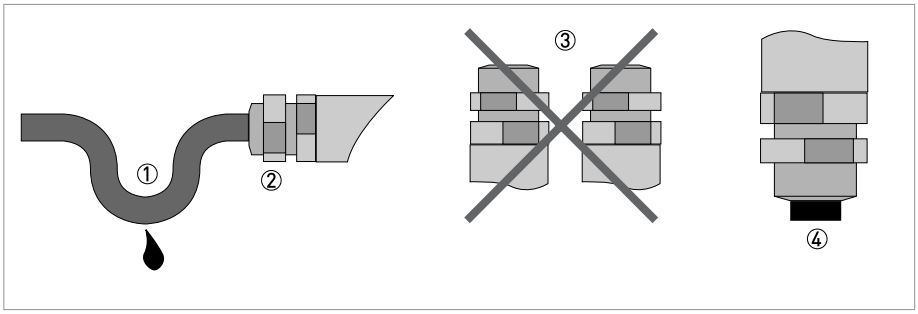


Figure 4-1: Protect housing from dust and water

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)

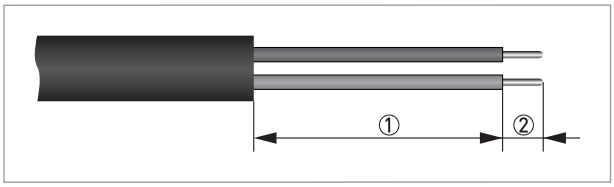


Figure 4-2: Stripping the cable

① 40...50 mm / 1.6...2"
② 5 mm / 0.2"

4.2.4 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

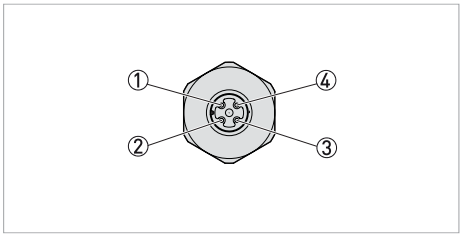


Figure 4-3: Connector M12 x 1, 4-pin, A-coding

① Shield
② Not used
③ VS-
④ VS+

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

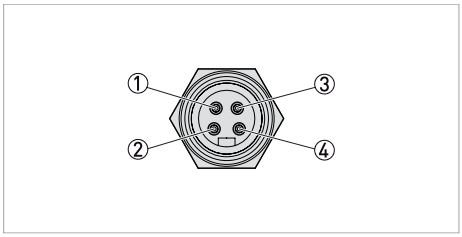


Figure 4-4: 7/8 connector, Foundation Fieldbus (FF)

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

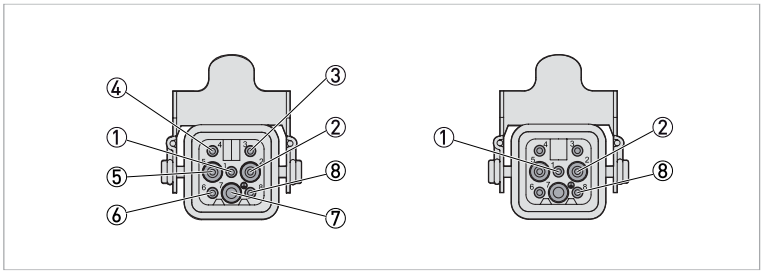


Figure 4-5: Connector, Harting HAN 8D (left) and Harting HAN 7D (right)

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

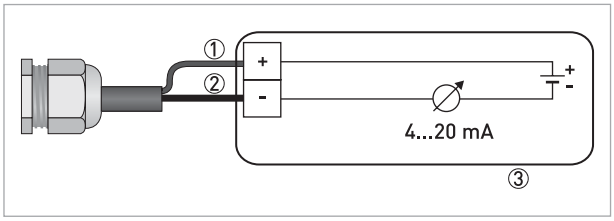


Figure 4-6: Connection to the power supply

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.

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

CAUTION!
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.

CAUTION!
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

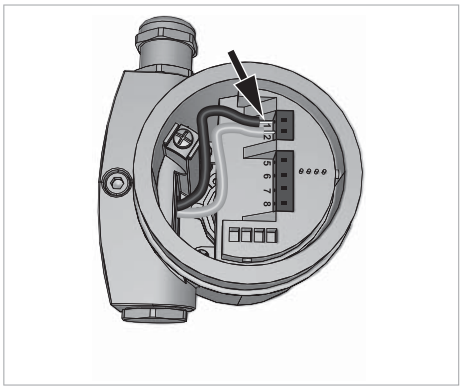


Figure 4-7: Terminal compartment from above

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 43.
- 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 Connection in the housing base (external housing)

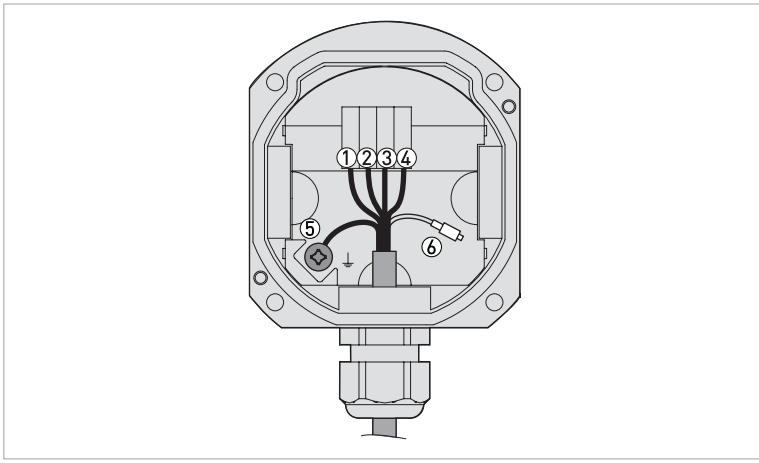


Figure 4-8: Terminal box from front

① Yellow
② White
③ Red
④ Black
⑤ Shielding
⑥ Pressure equalisation capillary

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 43
- Push the cable through the cable gland into the terminal compartment
- Insert the wire ends into the open terminals according to the wiring plan. Solid cores as well as flexible cores with wire end sleeves 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 equipotential bonding
- Tighten the union nut of the cable gland. The sealing ring must completely enclose the cable
- Screw the housing cover back on

4.3.3 Connection of electronic differential pressure

The voltage supply of the slave sensor and the signal transmission are carried out via the shielded, four-wire connecting cable from the master sensor. For this, use the supplied, confectioned cable. Electrical connection is made via spring-loaded terminals in the respective housings. Solid wires as well as flexible wires with cable end sleeves are inserted directly into the terminal openings. In case of flexible cores without end sleeves, press the terminal from above with a small screwdriver, the terminal opening is then free. When the screwdriver is released, the terminal closes again.

1. Unscrew the housing cover
2. Loosen the compression nut on the cable gland and remove the blind plug
3. Remove approx. 10 cm / 4 inch of the cable mantle, strip approx. 1 cm / 0.4 inch insulation from the individual wires or use supplied connection cable
4. Insert the cable through the cable gland into the sensor
5. Insert the wire ends into the terminals according to the wiring plan.
6. Check the hold of the wires in the terminals by lightly pulling on them
7. Connect the screen to the internal ground terminal, connect the external ground terminal to the equipotential bonding
8. Tighten the compression nut of the cable gland. The sealing ring must completely encircle the cable
9. Unscrew the blind plugs from the master sensor, screw in the supplied cable gland
10. Connect cable to the master sensor, see steps 3 to 8
11. Screw on the housing cover. The electrical connection is now finished.

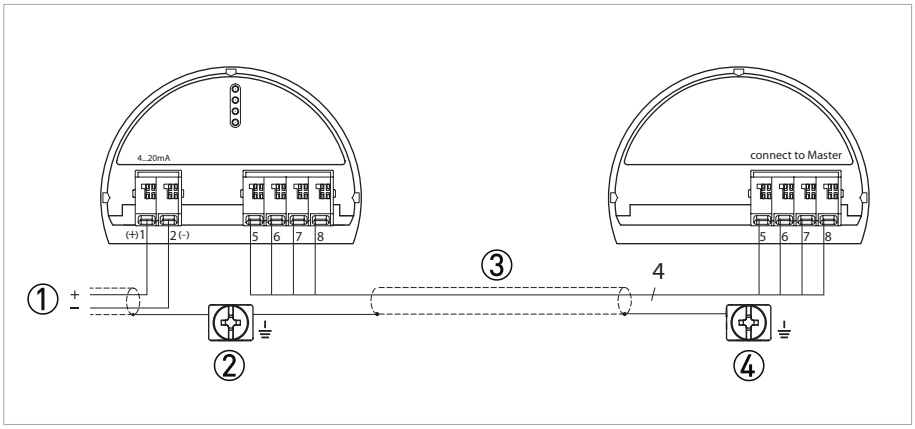


Figure 4-9: Connection example of electronic differential pressure

① Power supply
② Master sensor
③ Shielded four-wire cable
④ Slave sensor

The connection between the master and slave sensors is in accordance with the table:

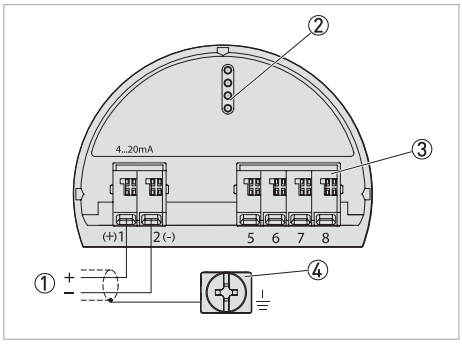
Master sensor	Slave sensor
Terminal 5	Terminal 5
Terminal 6	Terminal 6
Terminal 7	Terminal 7
Terminal 8	Terminal 8

4.3.4 Single chamber housing

DANGER!
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



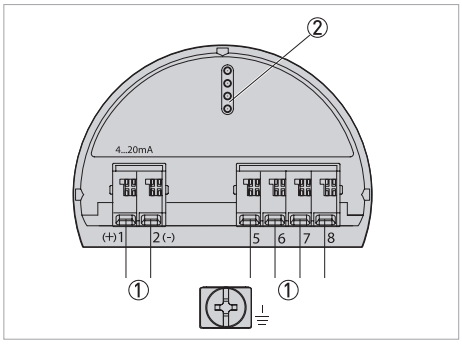
① Power supply / signal output
② Interface adapter for the display and adjustment module
③ Digital interface
④ Ground terminal for connection of the cable shield

4.3.5 Double chamber housing

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

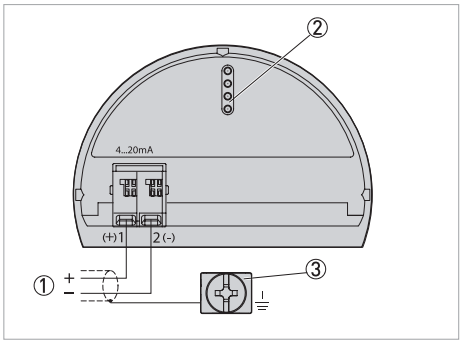
The following illustration applies to both the non-Ex as well as the Ex ia, and the Ex d version.

Electronics compartment



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

Terminal compartment: Standard



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

Terminal compartment: Additional current output

To make a second measured value available for use, you can use the supplementary electronics "Additional current output". Both current outputs are passive and need a power supply.

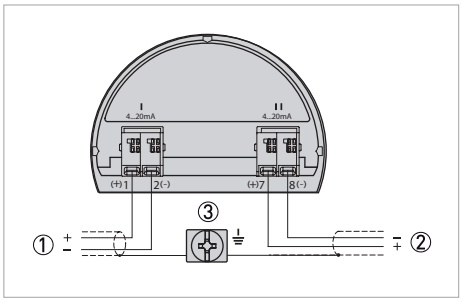


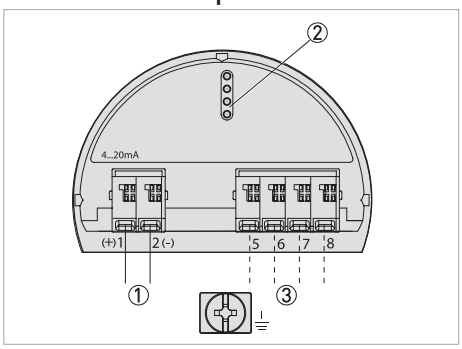
Figure 4-10: Additional current output

① First current output (I) - Voltage supply and signal output, sensor (HART®)
② Additional current output (II) - Voltage supply and signal output (without HART®)
③ Ground terminal for connection of the cable screening

4.3.6 Double chamber housing Ex d ia

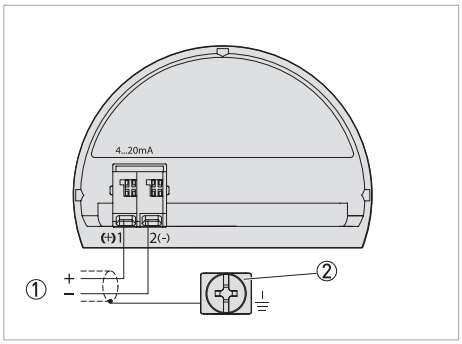
DANGER!
For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

Electronics compartment



① Power supply / signal output
② Interface adapter for the display and adjustment module
③ Digital interface

Terminal compartment



① Power supply / signal output
② Ground terminal for connection of the cable shield

4.4 Grounding the measuring device

WARNING!
Within galvanic plants as well as vessels with cathodic corrosion protection there are considerable potential differences. Considerably equipotential bonding currents can be caused via the cable shield when the shield is grounded on both ends. To avoid this, the cable shield must only be connected to the grounding potential on one side of the control cabinet in such applications. The cable shield must not be connected to the internal ground terminal in the device and the outer ground terminal on the housing not to the equipotential bonding!

CAUTION!
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.

If a shielded cable is necessary, connect the cable shield on both ends to the grounding potential. In the signal converter, the cable shield must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the equipotential bonding with low impedance. If equipotential bonding currents are expected, the evaluation side must be connected with a ceramic capacitor (e.g. 1 nF, 1500 V). The low frequency equipotential bonding currents are thus suppressed, but the protective effect against high frequency interference signals remains.

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 82

5.1 Comissioning

The signal converter may only be started up after it has been completely installed and checked by appropriately qualified personnel. Switch on the operating voltage for start-up.

Prior to applying the operating voltage check that

1. the pressure transmitter is completely installed
2. the process connection fits properly
3. the signal and, if necessary, supply lines are properly connected
4. the impulse lines are completely filled with the process medium

After connecting the signal converter to the power supply or after voltage recovery, the device performs a self test for approximately 5 seconds.

5.2 Operating sequence for SIL devices

Only for signal converters with SIL-qualification

Any change in the parameters of SIL-qualified devices must always take place as follows:

- Unlock adjustment
- Change parameters
- Lock adjustment and verify modified parameters

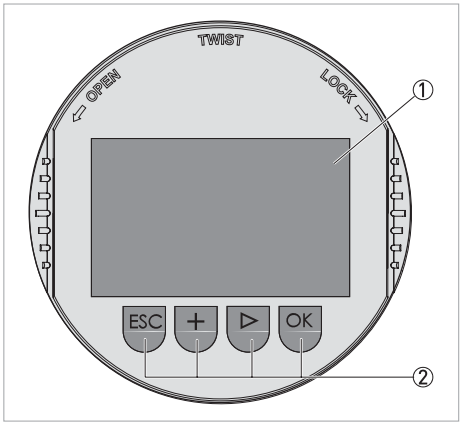
This ensures that all of the parameters modified were done so deliberately.

Unlock adjustment
The device is shipped in locked condition. To protect against unwanted or unauthorised adjustment, the device is locked against any change in parameters in normal operating state. Prior to any change in parameters you must enter the PIN for the device. The PIN in delivery status is "0000".

5.3 Keypad functions

INFORMATION!
The device can be configured either via the relevant fieldbus or the adjustment module.

The display and adjustment module is used for indication of measuring values, adjustment and diagnosis.



① LCD display
② Function buttons

The device is operated via the four keys of the display and adjustment module ②. The LC display ① indicates the individual menu items. Approx. 60 minutes after the last pressing of a key, an automatic reset in the indication of measuring values is triggered. Any values not confirmed with [OK] will not be saved.

[OK]

- Move back to the menu overview
- Confirm selected menu
- Editing the parameters
- Store value

[▷]

- Change measured value
- Select list entry
- Select editing position

[+]

- Change value of the parameter

[ESC]

- Cancel entry
- Jump to next higher menu

5.4 Set up Bluetooth connection with smartphone/tablet

System requirements

Make sure that your smartphone/tablet meets the following system requirements

- Operating system: iOS 8 or higher
- Operating system: Android 5.1 or higher
- Bluetooth Smart 4.0 or higher

Download the OPTICHECK Pressure Mobile application from the "Apple App Store" or "Google Play Store" to your smartphone or tablet.

Activate Bluetooth

- Make sure that the Bluetooth function of the display and adjustment module is activated
- For this, the switch on the bottom side must be set to "On".

Note! Factory setting is "On".

Change sensor PIN

The security concept of Bluetooth operation requires that the default setting of the sensor PIN be changed. This prevents unauthorized access to the sensor. The default setting of the sensor PIN is "0000".

- Change the sensor PIN in the adjustment menu of the respective sensor, e.g. to "1111".

Bluetooth communication functions only if the actual sensor PIN differs from the default setting "0000". After the sensor PIN has been changed, sensor adjustment can be enabled again. For access (authentication) with Bluetooth, the PIN is still effective.

Connecting

- Start the adjustment app and select the function **Setup**. The smartphone/tablet searches automatically for Bluetooth-capable instruments in the area.

➲ The message **Searching...** is displayed.

- All found instruments will be listed in the adjustment window. The search is continued automatically. Select the requested instrument in the device list.

➲ The message **Connecting...** is displayed.

Authenticate

For the first connection, the operating device and the sensor must authenticate each other. After successful authentication, the next connection functions without authentication. For authentication, enter in the next menu window the 4-digit PIN which is used to lock/unlock the sensor (sensor PIN).

If an incorrect sensor PIN is entered, the PIN can only be entered again after a delay time. This time gets longer after each incorrect entry.

Connected

After connection, the sensor adjustment menu appears on the respective operating device. The display of the display and adjustment module shows the Bluetooth symbol and **connected**. Sensor adjustment via the keys of the display and adjustment module itself is not possible in this mode. If the Bluetooth connection is interrupted, e.g. due to a too large distance between the two devices, this is displayed on the operating device. The message disappears when the connection is restored.

Sensor parameter adjustment

The sensor adjustment menu is divided into **Setup** and **Diagnostics**. Enter the requested parameters and confirm via the keyboard or the editing field. The settings are then active in the instrument. Close the app to terminate the connection.

5.5 Quick set-up

To adapt the device quickly and easily to the application, select the menu item "Quick setup". This parameter adjustment essentially involves the selection of the application, position correction and adjustment of the span.

INFORMATION!
Differential pressure, density and interface are only available for electronic differential pressure when the slave sensor is activated

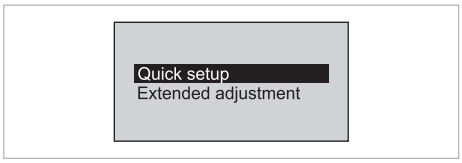


Figure 5-1: Quick set-up

In this chapter, not all settings are displayed graphically but all settings are described.

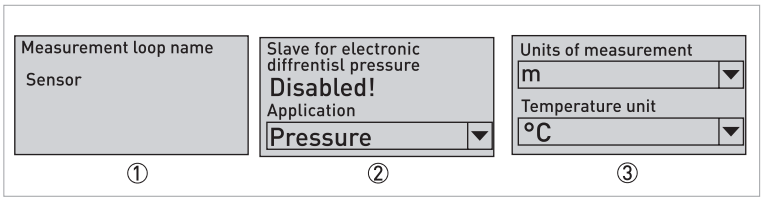


Figure 5-2: Overview Quick setup

① **Measurement loop name**
Assign a suitable measurement loop name

② **Electronic differential pressure**
Activate/deactivate the slave sensor for electronic differential pressure. If you have not connected a slave sensor, confirm this with "deactivate".
Application
Then select the application. The selection includes process pressure, level, differential pressure, density and interface.

③ **Adjustment units**
Determine the adjustment and temperature units of the device.

Adjustment process pressure

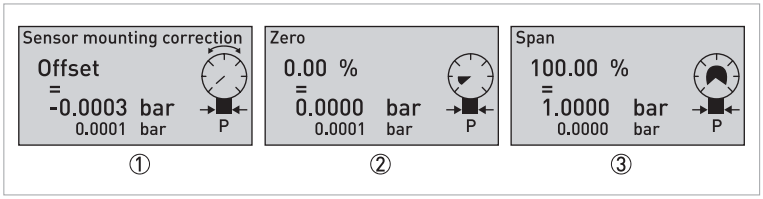


Figure 5-3: Adjustment process pressure

① **Sensor mounting correction**
In this menu item you compensate the influence of the installation position of the device (offset) on the measured value.

② **Zero**
In this menu item you determine the zero point of your measurement (LRV)
This value corresponds to the output signal of 4 mA.

③ **Span**
This value corresponds 100%, or rather an output signal of 20 mA (URV)
If the zero point is actually 0, this value corresponds to the measuring span.

Adjustment level

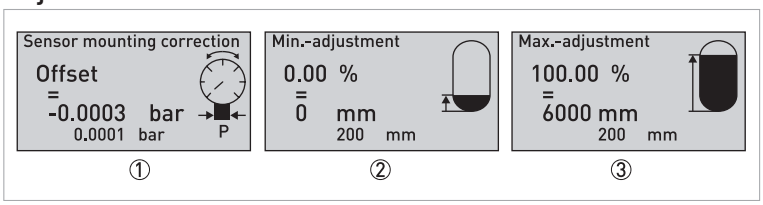


Figure 5-4: Adjustment level

① **Sensor mounting correction**
In this menu item you compensate the influence of the installation position of the device (offset) on the measured value.

② **Min.-adjustment**
Enter the (pressure) value for the min. level.
At 0% this corresponds to the output signal of 4 mA.

③ **Max.-adjustment**
Enter the (pressure) value for the max. level.
At 100% this corresponds to the output signal of 20 mA.

Adjustment differential pressure

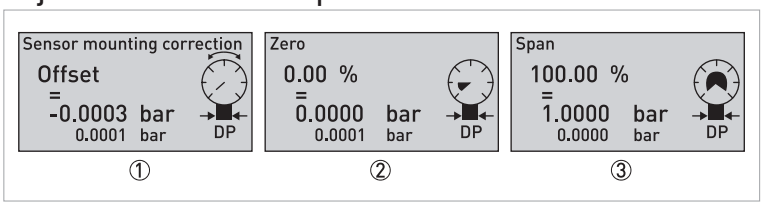


Figure 5-5: Adjustment differential pressure

① **Sensor mounting correction**
In this menu item you compensate the influence of the installation position of the device (offset) on the measured value.

② **Zero**
In this menu item you determine the zero point of your measurement (LRV)
This value corresponds to the output signal of 4 mA.

③ **Span**
This value corresponds 100%, or rather an output signal of 20 mA (URV)
If the zero point is actually 0, this value corresponds to the measuring span.

Adjustment density

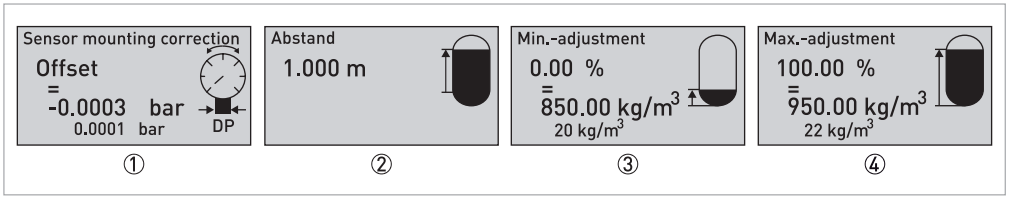


Figure 5-6: Adjustment density

① **Sensor mounting correction**
In this menu item you compensate the influence of the installation position of the device (offset) on the measured value.

② **Distance min. - max.**.
Enter the distance between both measuring points.

③ **Min.-adjustment**
Enter the (pressure) value for the min. density.
This corresponds to the output signal of 4 mA.

④ **Max.-adjustment**
Enter the (pressure) value for the max. density.
At 100% this corresponds to the output signal of 20 mA.

Adjustment interface

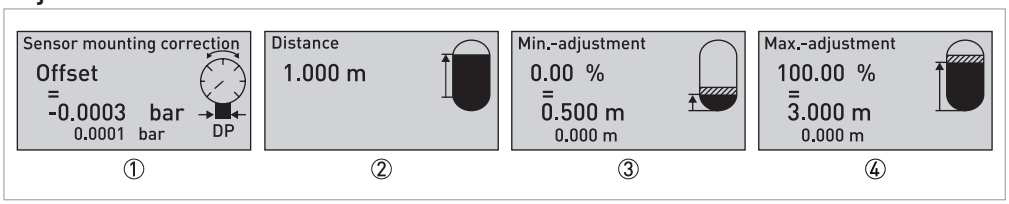


Figure 5-7: Adjustment interface

① **Sensor mounting correction**
In this menu item you compensate the influence of the installation position of the device (offset) on the measured value.

② **Distance max./min.**
Enter the distance between both measuring points.

③ **Min.-adjustment**
Enter the (pressure) value for the min. position of the interface.
This corresponds to the output signal of 4 mA.

④ **Max.-adjustment**
Enter the (pressure) value for the max. position of the interface.
At 100% this corresponds to the output signal of 20 mA.

5.6 Extended adjustment

The main menu is divided into five sections:

- Start-up
- Display
- Diagnosis
- Additional adjustments
- Info

5.6.1 Comissioning

Measurement loop name	Assign a unique device ID. This is useful or even necessary in digital systems and for monitoring large systems.	
Application	Here you select the application: process pressure, level, differential pressure ①, density ① and interface ① are available. The default setting is process pressure and the slave for electronic differential pressure is deactivated.	
Units	In this menu item the adjustment units, as well as the temperature unit are determined. The selection of the adjustment unit determines the unit displayed in the "Min-adjustment" and "Max-adjustment" items. In "Level" mode, it is possible to carry out the adjustment in a height unit (e.g. meters). To do so, the density of the medium must also be specified.	
	Adjustment units	**Process pressure, differential pressure** ① mbar, bar, Pa, kPa, MPa, psi, mmH2O, mmHg, inH2O, inHg and User-defined.
		Level Density input required: mm, cm, m, in and ft
		Density measurement ① kg/dm3 and lb/ft3
		Interface ① mm, cm, m, in and ft with density input/unit of media
	Temperature unit	°C, °F and K
	Static pressure	mbar, bar, Pa, kPa, MPa, psi, mmH2O, mmHg, inH2O and inHg
Sensor mounting correction	The mounting position of the device has a great impact on the measured value (offset), especially with small measuring ranges. The sensor mounting correction compensates for this offset. The sensor mounting correction can automatically take on the current measured value as correction value (auto correct). Or, this correction value can also be entered manually using the "Edit" function. When it comes to electronic differential pressure, the following options are available for the sensor mounting correction: automatic correction for both sensors, manual correction for the master (differential pressure), manual correction for the slave (static pressure). Once the sensor mounting correction is complete, the current measured value is corrected to 0. The sensor mounting correction can compensate for a maximum total of 20% of the nominal measuring range.	
	Offset	Input in adjustment unit, automatic transfer of the current measured value.
Adjustment	Adjustment refers to setting the zero point (zero) and maximum measured value (span). These values correspond to the values of 4 and 20 mA. If the adjustment ranges are exceeded, the message "Outside parameter limits" is displayed.	
	Distance	**Density** ① Distance in m (for kg/cm^3) and ft (for lb/ft^3) **Interface** ① Distance in mm, cm, m, in and ft
	Min.-adjustment / Zero	**Process pressure, differential pressure** ① Zero in X %, pressure **Level (standard 0%)** Min. in X %, pressure or filling height **Density** ① Min. in X %, density **Interface** ① Min. in X %, interface
	Max.-adjustment / Span	**Process pressure, differential pressure** ① Span in %, pressure **Level (standard 100%)** Min. in X %, pressure or filling height **Density** ① Min. in X %, density **Interface** ① Min. in X %, interface

Damping	For the damping of process-dependent measured value fluctuations, you can choose a suitable integration time. The values which can be entered are from 0 … 999 seconds with an increment of 0.1 seconds.		
	Integration time		In 0.1 second increments.
Linearisation	A linearisation is necessary for all vessels in which the volume does not increase linearly with the level height, e.g. in a horizontal cylindrical or spherical tank, and the indication or output of the volume is required. Corresponding linearisation curves are preprogrammed for these vessels. They represent the correlation between the level percentage and vessel volume. By activating the appropriate curve, the volume percentage of the vessel is displayed correctly. Enter the desired parameters using the function buttons and save the entries. Note the following if the pressure transmitter with corresponding approval is used as part of an overfill protection system according to WHG (Water Resources Act): If a linearization curve is selected, the measuring signal is no longer linearly proportional to the level. This must be taken into consideration by the user, particularly when setting the switching point on the limit switch.		
	Type of linearisation		**Level** Linear, Horiz.cylinder, Sphere and User programmable.
Current output	In the current output menu, the saturation region for above or below a threshold is set. Under "Current output min./max." these limit values can be set. The factory setting is 3.8 mA and 20.5 mA. This corresponds to the NAMUR recommendation NE 43.		
	Mode	Output characteristic	0...100% = 4...20 mA or 0...100% = 20...4 mA
		Failure mode	≤ 3.6 mA, ≥ 21 mA, last valid measured value
	Min. and Max.	Min. current	3.8 mA, 4 mA
		Maximum current	20.5 mA, 20 mA
Lock adjustment / Unlock adjustment	In this menu item, a 4-digit PIN can be activated, which protects against undesirable or unintended changes of the settings. With a PIN active, remote access via software or other systems is also no longer possible.		
	Run now		
Only for signal converters with SIL-qualification Lock adjustment / Unlock adjustment	With this menu item you can protect the sensor parameters from unwanted or unintended changes. To avoid possible errors during parameter adjustment in unsafe operating environments, a verification procedure is used that allows parameterization errors to be reliably detected. Safety-relevant parameters must be verified before they are saved to the device. In addition, to protect against unwanted or unauthorised adjustment, the device is locked in normal operating state against any parameter changes.		
	1. Enter PIN Start-up - Lock adjustment - Unlock - The device is shipped in locked condition. The PIN in delivery status is "0000".		

Only for signal converters with SIL-qualification Lock adjustment / Unlock adjustment	2. String comparison Afterwards you must compare the strings. This is to check the string display. Confirm that the two strings are identical. The verification texts are displayed in German and in English with any other menu language.
	3. Serial number confirmation Then confirm that the serial number of your device has been properly transferred. This checks for proper device communication.
	4. Parameter verification **All safety-relevant parameters must be verified following a change:** • SIL parameter 1: Zero adjustment • SIL parameter 2: Slave in/out • Non-SIL parameter 1: Display of measured value • Non-SIL parameter 2: Display value 1, unit of application • Non-SIL parameter 3: Display value 1, unit of application • Non-SIL parameter 4: Backlight Confirm the changed values one after the other If configuration as described has been completely and correctly carried out, the device is locked and ready to operate. Otherwise the device remains unlocked and thus in an unsafe state. As long as the device is supplied with power, the display and adjustment module remain in the momentarily set operating menu. There is no automatic, time-controlled jump back into the display of measured values.

Table 5-1: Comissioning

① Only available for electronic differential pressure when the slave sensor is activated

5.6.2 Display

Menu language	In this menu item you can set the desired language. Factory settings: English	
	German, English, French, Spanish, Portuguese, Italian, Dutch, Russian, Turkish, Polish and Czech.	
Displayed value 1 and 2	In this menu item you can define how the measured value should be presented on the display. The factory setting is "Linear percent".	
	Process pressure	Process pressure, Percent, Scaled, Current output, Linear percent, Meas. cell temp. and Electronics temperature.
	Level	Filling height or Pressure (Adjustment units), Static pressure, Percent, Scaled, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Differential pressure ①	Differential pressure, Static pressure, Percent, Scaled, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Density ①	Density, Differential pressure, Percent, Scaled, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Interface ①	Interface height, Differential pressure, Percent, Scaled, Current output, Linear percent, Meas. cell temp. and Electronics temperature.
Backlight	A backlight on the display is available, which can be turned on or off in this menu. By default, this function is disabled.	
	Off, On	

Table 5-2: Display

① Only available for electronic differential pressure when the slave sensor is activated

5.6.3 Diagnostics

Device status	Status signals	Check function, Out of Specification, Maintenance required, Failure
Peak value	The respective minimum and maximum pressure values are stored in the device. Under "Peak values", these values can be viewed or reset. In addition to the pressure, the minimum and maximum values of the sensor cell and the electronics temperature is stored. These can be viewed or reset here.	
	Peak value Process pressure	Reset peak value
	Peak value Differential pressure ①	Reset peak value
	Peak value Static pressure ①	Reset peak value
	Peak value Meas. cell temp.	Reset peak value
	Peak value Electronic temperature	Reset peak value
Simulation	In menu item "Simulation", measured values can be simulated via the current output. These are issued as both analogue and digital (via HART ®). The simulation is automatically cancelled 60 minutes after the last key stroke.	
	Process pressure	Process pressure, Percent, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Level	Filling height or Process pressure (Adjustment units), Percent, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Differential pressure ①	Differential pressure, Static pressure, Percent, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Density ①	Density, Differential pressure, Percent, Current output, Linear percent, Meas. cell temp. and Electronics temperature
	Interface ①	Interface height, Differential pressure, Percent, Current output, Linear percent, Meas. cell temp. and Electronics temperature

Table 5-3: Diagnostics

① Only available for electronic differential pressure when the slave sensor is activated

5.6.4 Additional adjustments

PIN	In this menu item the PIN can be changed. This option is only available if it has been enabled under "Setup - Lock adjustment". The PIN is "0000" by default factory conditions.	
	0000	Change PIN
Date / Time	Internal clock setting	
	Write date, time, data in device	
Reset	For more information refer to *Reset* on page 66.	
	Delivery status and Basic settings	
Copy instrument settings	For more information refer to *Saving the device settings* on page 68.	
	Copy instrument settings	
Special parameters	Changing these settings is possible only after consultation with a service employee.	
Scaling	In menu item "Scaling variable" you define the scaling variables and the scaling unit for the level mode. In menu item "Scaling format" you define the scaling format on the display and the scaling of the level measurement for 0% and 100%.	
	Scaling variable	Scaling variable
		Scaling unit
	Scaling format	Scaling format
		100% corresponds - user-defined value
		0% corresponds - user-defined value
Current output	In this menu item it is determined which measured variable relates to which current output. Under "Current output - Adjustment", the current output can be assigned a corresponding measured value.	
	Current output variable The selection is limited to linear percent for devices with SIL-qualification.	For applications Process pressure Process pressure, Percent, Linear percent, Meas. cell temp. and Electronics temperature
		For applications Level Filling height or Process pressure (Adjustment units), Percent, Scaled, Linear percent, Meas. cell temp. and Electronics temperature
		For applications Differential pressure ① Differential pressure, Static pressure, Percent, Linear percent, Meas. cell temp. and Electronics temperature
		For applications Density ① Density, Differential pressure, Percent, Scaled, Linear percent, Meas. cell temp. and Electronics temperature
		For applications Interface ① Interface height, Differential pressure, Percent, Scaled, Linear percent, Meas. cell temp. and Electronics temperature
	Current output adjustment	0% = 0% or 100% = 100%
HART®-Mode	The converter offers the HART® modes "Analogue current output" and "Fix current (4 mA)". Under "Fix current (4 mA)", up to 64 sensors can be operated on a two-wire cable in multidrop mode. Each device must be assigned a HART® address between 0 and 63. The analogue signal is fixed at 4 mA. Under "Analogue current output", however, a 4...20 mA signal can also be issued for the assigned HART® address in multidrop mode.	
	HART® address	0...63
	Output mode	Analogue current output with HART® or Fix current (4 mA) with HART®

Table 5-4: Additional adjustments

① Only available for electronic differential pressure when the slave sensor is activated

5.6.5 Info

Device name	Device name
	Serial number
Instrument version	Software version
	Hardware version
Factory calibration	Factory calibration date
	Date of last change
Sensor characteristics	Order-related device characteristics

5.7 Reset

The reset function resets specific user entries. There are 2 reset functions available:

Delivery status
Restore the default values at the time of delivery, including the order-specific settings. A false signal suppression, user programmable linearization curve as well as the measured value memory will be deleted.

Basic settings
Reset the set data, including special parameters to the default values of the manufacturer. A false signal suppression, user programmable linearization curve as well as the measured value memory will be deleted.

The safety-relevant menu items defined as functional safety according to IEC 61508 (Edition 2) are marked with (SIL).

The following menu items are affected during a reset

Menu item	Parameter	Standard value
Measurement loop name		Sensor
Slave for electronic differential pressure	Slave for electronic differential pressure	disabled
Application (SIL)	Application	Level
Unit	Adjustment units	mbar (cell ≤ 400 mbar) bar (cell ≥ 1 bar)
	Temperature unit	°C
Sensor mounting correction (SIL)		0.00 bar
Adjustment (SIL)	Zero / Min.-adjustment	0.00 bar - 0.00%
	Span / Max.-adjustment	+URL in bar - 100%
Damping (SIL)	Integration time	0.0 seconds
Current output (SIL)	Current output mode	Output characteristic 4...20 mA Failure mode ≤ 3.6 mA
	Current output variable	Linear percent - Level
	Current output adjustment	0...100% = 4...20 mA
	Current output min./max.	Min. 3.8 mA Max. 20.5 mA
Lock adjustment (SIL)		Unlock
Simulation		Process pressure

Menu item	Parameter	Standard value
PIN		0000
Scaling	Scaling variable	Volume in l
	Scaling format	0% = 0 L / 100% = 0 L
HART®-Mode		Address 0

Reset - Display

Menu item	Default value
Language	No reset
Displayed value 1	Pressure
Displayed value 2	Ceramic measuring cell: Measuring cell temperature in °C Metallic measuring cell: Electronics temperature in °C
Backlight	Off

Reset - Diagnosis

Menu item	Parameter	Default value
Device status		No reset
Peak value	Pressure	Current measured value
	Temperature	Current temperature values measuring cell, electronics
Simulation	Measured Value	Pressure
	Simulation	Not active
Proof tests		No reset

Reset - Additional settings

Menu item	Parameter	Default value
Date / Time		No reset
Reset		No reset
Copy instrument settings		No reset
Scaling	Scaling variable	Volume in l
	Scaling format	0% corresponds 0 l 100% corresponds 0 l No decimal places
Current output 1 (SIL)	Current output - size	Linear percent - Level
	Current output - adjustment	0...100% corresponds to 4...20 mA
Current output 2	Current output - size	Meas. cell temp.
	Current output - adjustment	0...100% corresponds to 4...20 mA
HART®-Mode		Address 0
Special parameters (SIL)		No reset

5.8 Saving the device settings

We recommended noting the parameters and archiving them afterwards. They are thus available for multiple use or service purposes. If the signal converter is equipped with a display and adjustment module, the most important data can be read out of the sensor into the display and adjustment module. The data remain there permanently even if the sensor power supply fails. If it is necessary to exchange the signal converter, the display and adjustment module is inserted into the replacement device and the data are written into the signal converter under the menu item "Copy device data".

The following data and settings are saved in the adjustment module:

- All data from the "Set-up" and "Display" menus
- Sensor-specific units
- Temperature unit
- Linearisation
- User programmable linearisation curve

5.9 Diagnosis memory

The device has several internal memories which are available for diagnosis purposes. The data remain even with voltage interruption.

Measured value memory
Up to 100,000 measured values can be stored in a ring memory. Each entry contains a time stamp as well as the respective measured value. Storable values are for example:

- Process pressure
- Level
- Differential pressure ①
- Static pressure ①
- Interface ①
- Density ①
- Percent value
- Linear percent
- Scaled values
- Meas. cell temp.
- Electronic temperature

① Only available for electronic differential pressure when the slave sensor is activated

The measured value memory is active with the default settings and stores the pressure value and the measuring cell temperature every 10 seconds as well as the static pressure for electronic differential pressure.

Recording conditions are set via a PC with PACTware™/DTM or the control system with EDD.

Event memory
Up to 500 events are automatically stored with a time stamp in the event memory (permanent). Each entry contains the date/time, event type, event description and value. Event types are for example:

- Modification of a parameter
- Switch on and shut off times
- Status message
- Error message

The data are read out via a PC with PACTware™/DTM or the control system with EDD.

5.10 Failures and diagnostics

The operator of the system is responsible for taking suitable measures to remove interferences. The pressure transmitter offers maximum reliability. Nevertheless, faults can occur during operation. The first measures are to evaluate the error messages, check the output signals as well as the verification of measurement errors.

Asset Management and diagnostics
The device features self-monitoring, diagnostics and VDI/VDE 2650. In addition to the status messages in the following tables there are more detailed error messages available under the menu item "Diagnostics" via the display and adjustment module, PACTware™/DTM and EDD.

Status messages
The status messages are divided into the following categories:

- **Failure**
  Due to a malfunction in the device, a failure message is outputted. This status message is always active. It cannot be deactivated by the user.
- **Check function**
  The device is in operation, the measured value is temporarily invalid. This status message is inactive by default. It can be activated by the user via PACTware™/DTM or EDD.
- **Out of specification**
  The measured value is unstable because the device specification is exceeded. This status message is inactive by default. It can be activated by the user via PACTware™/DTM or EDD.
- **Maintenance required**
  Due to external influences, the device function is limited. The measurement is affected, but the measured value is still valid. Plan in maintenance for the device because a failure is expected in the near future. This status message is inactive by default. It can be activated by the user via PACTware™/DTM or EDD.

5.10.1 Advanced Error codes

Failure

Code Text message	Cause	Action or description	DevSpec State in CMD 48
F013 No measurement value available	No valid measured value available	Check the measuring cell or the overpressure or low pressure conditions.	Bit 0 of byte 0...5
F017 Adjustment span too small	Adjustment not within specification	Change adjustment according to the limit values	Bit 1 of byte 0...5
F025 Error in the linearisation table	Index markers are not continuously rising, for example illogical value pairs	check the linearization table, Delete table/Create new	Bit 2 of byte 0...5
F36 No operable sensor software	Failed or interrupted software update	Repeat software update Check electronics version Exchange the electronics or send device for repair	Bit 3 of byte 0...5
F40 Error in the electronics	Hardware defect	Exchange the electronics or send device for repair	Bit 4 of byte 0...5
F041 Error in the electronics	No connection to sensor electronics	Check connection to sensor electronics (with remote version)	Bit 5 of byte 0...5
F042 Communication error slave	No connection to the slave	Check the connection between the master and slave	
F080	General software error	Disconnect operating voltage briefly	Bit 6 of byte 0...5
F105 Measured value is determined.	Device is still in the energizing phase. The measured value has not yet been determined.	Wait until the energizing phase is complete.	Bit 7 of byte 0...5
F125 Impermissible electronics temperature	Temperature of the electronics in the non-specified section	Check ambient temperature Isolate electronics Use device with higher temperature range	
F260 Error in the calibration	Error in the calibration carried out in the factory Error in EEPROM	Exchange the electronics Send device for repair	Bit 10 of byte 0...5
F261 Error in the configuration	Error during setup Error when carrying out a reset	Repeat setup, Repeat reset	Bit 11 of byte 0...5
F264 Installation / start-up error	Inconsistent settings (e.g. distance, adjustment units in application of process pressure) for selected applications or invalid sensor configuration (e.g. application of electronic differential pressure with a connected differential pressure measuring cell)	Changing settings or changing connected sensor configuration or application	Bit 12 of byte 0...5
F265 Measurement function disturbed	Sensor no longer carries out a measurement	Carry out a reset Disconnect operating voltage briefly	Bit 13 of byte 0...5
F266 Impermissible operating voltage	Operating voltage is below the specified range	Check electrical connection - if necessary, increase operating voltage	

Check function

Code Text message	Cause	Action or description	DevSpec State in CMD 48
C700 Simulation Active	A simulation is active	Finish simulation Wait for automatic end after 60 minutes	"Simulation Active" in "Standardised Status 0"

Out of specification

Code Text message	Cause	Action or description	DevSpec State in CMD 48
S600 Impermissible electronics temperature	Temperature of the electronics in the non-specified section	Check ambient temperature Isolate electronics Use device with higher temperature range	Bit 23-0 of byte 14...24
S603 Impermissible operating voltage	Operating voltage below specified range	Check electrical connection - if necessary, increase operating voltage	Bit 23-1 of byte 14...24
S605 Pressure value out of specification	Measured process pressure below or above the setting range	Check the nominal range of the device If necessary, use a device with a higher measuring range	Bit 23-2 of byte 14...24

Only for signal converter with SIL-qualification
If measured values are outside of the specification and an "Out of Specification" message is triggered, this message results in:

- Status message "Failure"
- Fault signal via the current output

Maintenance required

Code Text message	Cause	Action or description	DevSpec State in CMD 48
M500 Error with the reset delivery status	Saved reset delivery status is incorrect	Send device for repair	Bit 0 of byte 14...24
M501 Error in the non active linearisation table	Index markers are not continuously rising, for example illogical value pairs	check the linearization table, Delete table/Create new	Bit 1 of byte 14...24
M502 Error in the event memory	Hardware error in EEPROM	Exchange the electronics Send device for repair	Bit 2 of byte 14...24
M504 Error on a device interface	Hardware defect	Check connections Exchange the electronics Send device for repair	Bit 3 of byte 14...24
M507 Error in the device settings	Error during setup Error when carrying out a reset	Repeat setup, Repeat reset	Bit 4 of byte 14...24

5.10.2 Check 4...20 mA signal

Connect a multimeter in the suitable measuring range according to the wiring plan.

Error code	Cause	Action or description
4...20 mA signal is missing	Faulty connection to power supply	Check connection and if necessary correct according to wiring plan
	No power supply	Check cable for breaks; repair if necessary
	Operating voltage too low or load-resistance too high	Check, adapt if necessary
Signal is >22 mA or <3.6 mA	Electronic module or sensor defective	Exchange the device or send device for repair
4...20 mA signal not stable	Variation in the measured value	Use the display and adjustment module or PACTware/DTM to set damping, depending on the device

DANGER!
In hazardous area applications, the regulations for the wiring of intrinsically safe circuits must be observed.

5.10.3 Error messages via the display and operating module

Error code	Cause	Action or description
E013	No measurement value available or pressure greater than nominal range	Exchange the device or send device for repair
E017	Adjustment span too small	Repeat with modified values
E036	No executable signal converter software	Carry out software update or send device for repair
E041	Hardware error	Exchange the device or send device for repair

Depending on the reason for the fault and the measures taken, the steps described previously may need to be carried out again.

5.10.4 Change electronic insert

In case of a defect, the electronic insert can be exchanged by the user against an identical type. If no electronic insert is available on site, it can be ordered from the respective local sales representative. To order a replacement, the serial number of the signal converter is required. This is located on the nameplate of the device or on the delivery note.

WARNING!
Installation, assembly, start-up and maintenance may only be performed by personnel trained in ***explosion protection****. Additional regional standards, safety directives and laws must be observed at all times.*

5.10.5 Software update

The device software can be updated in the following ways:

- USB Communicator

The following components are required:

Always needed

- Pressure transmitter
- Power supply
- Software update as a file

Wired instrument connection

- USB Communicator
- USB interface driver
- Computer with PACTware™/DTM

INFORMATION!
The latest version of the signal converter software and the USB interface driver can be found on the manufacturer website (Downloads). Further information is provided in the software update file.

Certain approvals can be subject to a specific software version. Therefore, when carrying out an update, ensure the approval is retained.

Only for signal converters with SIL-qualification
Ensure that you are using the correct software with SIL-qualification. Devices with SIL-qualification can only be updated with the appropriate software. It is impossible to accidentally update it with the wrong software version.

5.11 Adjustment

The pressure transmitter always measures a pressure, regardless of the process variable selected in the menu item "application". To properly output the selected process variable, there must be an allocation of 0 % and 100 % of the output signal (adjustment). In the case of the "level" application the hydrostatic pressure when the vessel is full and empty, for example, could be entered for adjustment. See the following example:

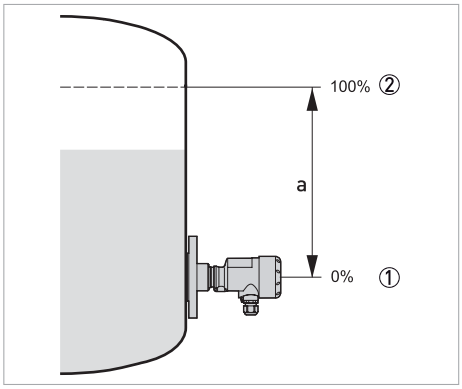


Figure 5-8: Level measurement (a = 5 m / 196,9")

Min. level 0% corresponds to 0 mbar / 0 psi
Max. level 100% corresponds to 490.5 mbar / 7.1 psi

If these values are not known, adjustments can be made with levels of 10 % and 90 % for example. Using these inputs, the actual filling height is then calculated. The current level plays no role in this adjustment, the min/max adjustment is always carried out without changing the product. This means that these settings can be made in advance and the device does not need to be installed.

INFORMATION!
If the adjustment ranges are exceeded, the value entered is not saved. Editing can be cancelled with [ESC] or corrected to a value within the adjustment range. Adjustment is carried out accordingly for the remaining process variables such as process pressure, differential pressure and flow.

6.1 Replacement

DANGER!
Observe the national regulations for electrical installations!

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

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

WARNING!
Installation, assembly, start-up and maintenance may only be performed by personnel trained in ***explosion protection****. Additional regional standards, safety directives and laws must be observed at all times.*

WARNING!
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.

CAUTION!
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.

Change electronic insert
In case of a defect, the electronic insert can be exchanged by the user against an identical type. If no electronic insert is available on site, it can be ordered from the respective local sales representative. To order a replacement, the serial number of the signal converter is required. This is located on the nameplate of the device or on the delivery note.

Only for signal converters with SIL-qualification
Only an appropriate electronic insert with SIL-qualification may be used with SIL-qualified devices. All application specific settings must be entered anew. Therefore, after replacing the electronics you must perform the start-up again. If you saved the configuration data from the initial start-up of the sensor, you can transfer that to the replacement electronics insert. In this case it is no longer necessary to perform the start-up again.

6.2 Maintenance

When used correctly, no maintenance is required in normal operation. In some applications, the measurement can be distorted by adhesive media. In this case, suitable measures should be taken to avoid adhesions and especially hardening on the diaphragm surface and in the pressure connection.

6.3 Spare parts availability

The manufacturer adheres to the basic principle that functionally adequate spare parts for each device or each important accessory part will be kept available for a period of 3 years after delivery of the last production run for the device.

This regulation only applies to spare parts which are subject to wear and tear under normal operating conditions.

6.4 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.

INFORMATION!
For more precise information, please contact your local sales office.

6.5 Repairs

Repairs must be carried out exclusively by the manufacturer or the manufacturer authorised specialist companies.

6.6 Returning the device to the manufacturer

6.6.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.

WARNING!
Should you nevertheless need to return a device for inspection or repair, please pay strict attention to the following points:

- *Due to statutory regulations on environmental protection and safeguarding the health and safety of the personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*

WARNING!
If the device has been operated with toxic, caustic, radioactive, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that it is safe to handle and stating the product used.*

6.6.2 Form (for copying) to accompany a returned device

CAUTION!
To avoid any risk for our service personnel, this form has to be accessible from outside of the packaging with the returned device.

Company:		Address:
Department:		Name:
Telephone number: Fax number:		Email address:
Manufacturer order number or serial number:		
The device has been operated with the following medium:		
This medium is:		radioactive
		water-hazardous
		toxic
		caustic
		flammable
		We checked that all cavities in the device are free from such substances.
		We have flushed out and neutralized all cavities in the device.
We hereby confirm that there is no risk to persons or the environment caused by any residual media contained in this device when it is returned.		
Date:		Signature:
Stamp:		

6.7 Disposal

LEGAL NOTICE!
Disposal must be carried out in accordance with legislation applicable in your country.

Separate collection of WEEE (Waste Electrical and Electronic Equipment) in the European Union:

According to the directive 2012/19/EU, the monitoring and control instruments marked with the WEEE symbol and reaching their end-of-life **must not be disposed of with other waste**.
The user must dispose of the WEEE to a designated collection point for the recycling of WEEE or send them back to our local organisation or authorised representative.

6.8 Exchange process assembly for IP68 (25 bar) version

DANGER!
For devices used in hazardous areas, additional safety instructions apply.

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

In the case of the IP68 (25 bar) version the user can change the process assembly on site. The connection cable and external housing can be retained.

Required tool:

- Size 2 Allen wrench

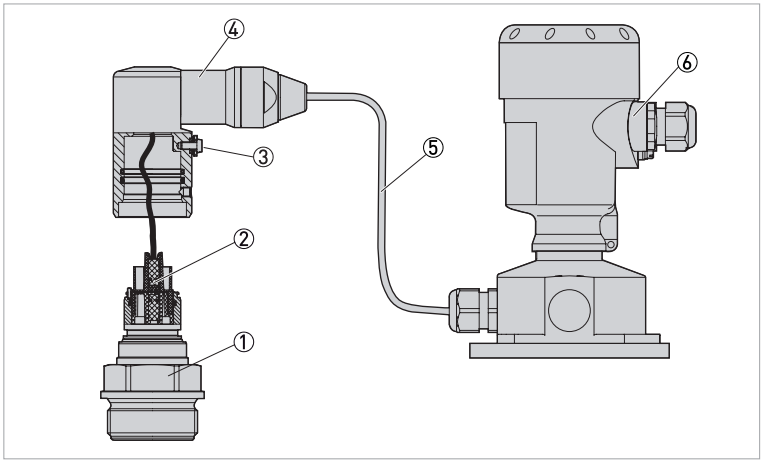


Figure 6-1: IP68 version 25 bar (external housing)

① Process assembly
② Connector
③ Fixing screw
④ Cable assembly
⑤ Connection cable
⑥ External housing

1. Loosen fixing screw with Allen wrench.
2. Carefully remove the cable assembly from the process assembly.
3. Loosen connector.
4. Mount new process assembly on the measuring station.
5. Reassemble connector.
6. Insert cable assembly on process assembly and rotate to desired position.
7. Tighten fixing screw using Allen wrench.

This completes the replacement

6.9 Digital sensor trim

The digital sensor trim is used to readjust pressure deviations and the measuring range according to a pressure reference. The zero trim corrects the pressure deviation of the transmitter at the beginning of the measuring range (LRV), while the span trim corrects the measuring deviation at the end of the measuring range (URV). In order to perform a digital trim, an accurate pressure reference is required.

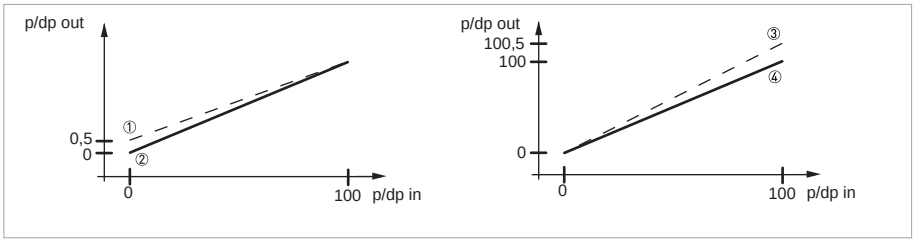


Figure 6-2: Digital sensor trim

① Characteristic curve before zero point trim
② Characteristic curve after zero point trim
③ Characteristic curve before span trim
④ Characteristic curve after span trim

6.9.1 Digital sensor trim via the display and adjustment module

Before the digital sensor trim can be performed, any active offset correction needs to be reset. Therefore, the value of the sensor mounting correction needs to be set to 0 manually via **Extended adjustment -> Setup -> Sensor mounting correction -> Edit**. After the digital sensor trim has been performed, the effect of mounting position can be corrected again via the automatic sensor mounting correction.

To perform the digital sensor trim via the display and adjustment module, navigate through the menu as follows **Extended adjustment -> Additional settings -> Special parameters -> SP02 / SP03 / SP04**

The password for access to the special parameters is: SW

Performing the zero point trim (SP02)

To carry out the zero point trim, special parameter SP02 needs to be selected and confirmed. It needs to be ensured that the system is completely depressurized. The currently applied pressure is set as the new zero point (LRV) and assigned to the current output value of 4 mA. The characteristic curve is adjusted on one side during this procedure, so that the end of the measuring range (URV) remains unaffected.

Performing the span trim (SP03)

To perform the span trim, special parameter SP03 needs to be selected and confirmed. It needs to be ensured that the applied pressure reference corresponds to the desired end of the measuring range (URV). The currently applied pressure is set as new span (URV) and assigned to the current output value of 20 mA. The characteristic curve is adjusted on one side during this procedure, so that the lower range value (LRV) remains unaffected.

Reset of the digital sensor trim (SP04)

Special parameter SP04 resets the zero point and span trim back to factory settings. Attention: If a reset to factory settings is carried out, the previously set trim values are retained! A reset to the basic settings, resets the trim values to the original factory settings.

6.9.2 Digital sensor trim via the KROHNE DTM

The digital sensor trim can be carried out via PACTware$_{TM}$ and the Device Type Manager (DTM). Therefore, the sensor needs to be connected to the terminal instrument via a suitable interface. To get to the appropriate menu items, the following steps needs to be carried out: **Menu -> Parameter -> Parameterisation**.

Before the digital sensor trim can be performed, an active offset correction needs to be reset. Therefore, the value of the sensor mounting corrections needs to be set to 0 manually via: **Setup -> Sensor mounting correction**. Via the **Apply** button the change can be uploaded to the device. After the digital sensor trim has been performed, the effect of mounting position can be corrected again via the automatic sensor mounting correction.

To get access to the special parameters, the service login needs to be activated. Therefore, select the wrench button above the menu and enter the password kps1921 via **Service Login**. The special parameters can be accessed via: **Additional settings -> Special parameters** in the menu.

Performing the zero point trim

To carry out the zero point trim, select **Sensor calibration -> Activate LRV** in the drop down menu of the section (2-4) and confirm the selection with **Execute action**. It needs to be ensured that the system is completely depressurised. The currently applied pressure is set as the new zero point (LRV) and assigned to the current output value of 4 mA. The characteristic curve is adjusted on one side during this procedure, so that the end of the measuring range (URV) remains unaffected. To finally complete the configuration, the parameterisation needs to be written into the instrument using the **Apply** button.

Performing the span trim

To carry out the span trim, select **Sensor calibration -> Activate LRV** in the drop down menu of the section (2-4) and confirm the selection with **Execute action**. It needs to be ensured that the applied pressure reference corresponds to the desired end of the measuring range (URV). The currently applied pressure is set as the new measuring span (URV) and assigned to the current output value of 20 mA. The characteristic curve is adjusted on one side during this procedure so that the lower range value (LRV) remains unaffected. To finally complete the configuration, the parameterisation needs to be written into the instrument using the **Apply** button.

Reset of the digital sensor trim

To reset the zero point and span trim, select **Sensor calibration -> Reset Calibration** in the drop down menu of the section (2-4) and confirm the selection with **Execute action**. To finally complete the configuration, the parameterisation needs to be written to the instrument using the **Apply** button.

7.1 Measuring principle

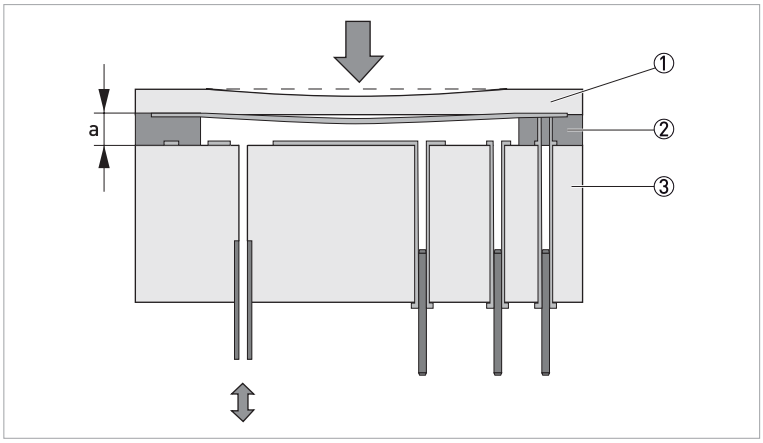


Figure 7-1: Ceramic measuring cell

① Diaphragm
② Glass solder connection
③ Base body

The OPTIBAR PC 5060 C sensor element is the CERTEC® measuring cell with robust ceramic diaphragm. The measuring cell is made up of a ceramic base body welded to the equally ceramic diaphragm via a glass solder connection. The base body and the diaphragm are inside the measuring cell, partially coated with gold and passivated against environmental impacts with an extremely thin glass layer. Pressure acting on the measuring cell diaphragm causes a change in capacitance in the measuring cell. This change is evaluated by the sensor electronics and converted into a corresponding output signal by the converter electronics. A temperature sensor behind the diaphragm allows for the additional output of a temperature measurement.

The ceramic measuring cell is available in two designs:

- Diameter 17.5 mm / 0.69" for small process connections
- Diameter of 28 mm / 1.1" for large process connections

The measuring cells are configured differently depending on the type of pressure selected:

Relative pressure: The measuring cell is open to the atmosphere. The ambient pressure is compensated directly in the measuring cell and thus has no influence on the measurement.

Absolute pressure: The measuring cell is evacuated and enclosed. The process pressure is measured in reference to vacuum. Any change in the ambient pressure changes the measured value.

7.2 Technical data

INFORMATION!

- *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	Capacitive ceramic measuring cell
Application range	• Process pressure measurement • Level of liquids • Differential pressure measurement ① • Density measurement ① • Interface measurement ①
Measuring range	25 mbar...100 bar / 0.73...1450.38 psi
Display and User interface	
Local control	Operation via 4 push buttons on the display and adjustment module
Display and adjustment module	• Indication of measured value or derived measured value such as filling height • Quick start adjustment and extended adjustment of all parameters • Warning and diagnostic information
Remote control	• Bluetooth® via OPTICHECK Pressure Mobile application available in Google Play Store and Apple App Store • PACTware™, incl. Device Type Manager (DTM) • HART® Hand Held Communicator • AMS® from Emerson Process • PDM® from Siemens
Operating and display languages	German, English, French, Spanish, Portuguese, Italian, Dutch, Russian, Turkish, Polish, Czech, Chinese and Japanese
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
① Only available for electronic differential pressure when the slave sensor is activated	

Measuring accuracy

Process pressure				
Reference conditions acc. to DIN 61298-1	• Ambient temperature (constant): +15...+25°C / +59...+77°F • Relative humidity (constant): 45...75% • Ambient pressure (constant): 860...1060 mbar / 86...106 kPa / 12.5...15.4 psi • Measuring accuracy according to IEC 61298-2 (terminal based) • Curve characteristic: linear • Vertical mounting position, measuring diaphragm pointing down • Effect of mounting position < 0.2 mbar / 20 Pa / 0.029 psi (a position-dependent zero offset can be corrected) • Deviation in the current output due to strong, high-frequency electromagnetic fields acc. to EN 61326-1 <± 150 µA			
Reference accuracy acc. to DIN EN 60770 (different availability depending on measuring range and process connection)	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. Turn down (TD) is the relation of nominal range/set measuring span. [% of the set span]			
	Accuracy class	0.05%	0.10%	0.20%
	TD of 1:1 to 5:1	< ±0.05	< ±0.1	< ±0.2
	TD > 5:1	< ±0.01 x TD	< ±0.02 x TD	< ±0.04 x TD
Effect of ambient / process temperature	Ambient temperature effect on zero and span in relation to the set measuring span. Applies to the digital interfaces (HART®, Foundation Fieldbus, Profibus PA) as well as for the analogue 4…20 mA current output. [% of the set span per 28°C / 50°F] All performance characteristics are in conformance with ≥± 3-sigma			
	Accuracy class	-40…0°C / -40…+32°F	0…+100°C / +32…+212°F	+100…+150°C / +212…+302°F
	0.05% 0.1%	0.21 x TD + 0.21	0.105 x TD + 0.105 max. 0.075 x TD + 0.075 ①	0.07 x TD + 0.07
	0.2% 100 mbar abs.	0.41 x TD + 0.41	0.21 x TD + 0.21 max. 0.15 x TD + 0.15 ①	0.14 x TD + 0.14
	0.2% 0.05%, 0.1% with PN=25 mbar	0.63 x TD + 0.63	0.315 x TD + 0.315 max. 0.225 x TD + 0.225 ①	0.21 x TD + 0.21
	① Maximum value apply for the entire temperature intervall.			
Effect of ambient / process temperature for climate compensated measuring cell	Ambient temperature effect on zero and span in relation to the set measuring span. Applies to the digital interfaces (HART®, Foundation Fieldbus, Profibus PA) as well as for the analogue 4…20 mA current output. [% of the set span per 28°C / 50°F] All performance characteristics are in conformance with ≥± 3-sigma			
	Measuring range	-40…0°C / -40…+32°F	0…+100°C / +32…+212°F	+100…+150°C / +212…+302°F
	-1…0 bar, -1…1.5 bar, 10 bar, 25 bar, 60 bar, 100 bar	0.21 x TD + 0.21	0.105 x TD + 0.105 max. 0.075 x TD + 0.075 ①	0.07 x TD + 0.07
	-0.5 bar…0.5 bar, 1 bar, 2.5 bar	0.41 x TD + 0.41	0.21 x TD + 0.21 max. 0.15 x TD + 0.15 ①	0.14 x TD + 0.14
	0.4 bar, -0.2…0.2 bar	0.63 x TD + 0.63	0.315 x TD + 0.315 max. 0.225 x TD + 0.225 ①	0.21 x TD + 0.21
	① Maximum value apply for the entire temperature intervall.			

<table>
<tr><td rowspan="5">Long-term stability acc. to DIN 16086 and IEC 60770-1</td><td colspan="5">Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4…20 mA current output.
[% of set span]</td></tr>
<tr><td>Time period</td><td colspan="2">Measuring cell Ø 28 mm</td><td colspan="2">Measuring cell Ø 17.5 mm</td></tr>
<tr><td></td><td>All measuring ranges</td><td>Measuring range 0…0.025 bar / 0…2.5 kPa</td><td>All process connections</td><td>Process connection G1/2 (ISO228-1)</td></tr>
<tr><td>1 year</td><td><± 0.05 x TD</td><td><± 0.1 x TD</td><td><± 0.1 x TD</td><td><± 0.25 x TD</td></tr>
<tr><td>5 years</td><td><± 0.1 x TD</td><td><± 0.2 x TD</td><td><± 0.2 x TD</td><td><± 0.5 x TD</td></tr>
<tr><td>10 years</td><td><± 0.2 x TD</td><td><± 0.4 x TD</td><td><± 0.4 x TD</td><td><± 1 x TD</td></tr>
<tr><td rowspan="15">Long-term stability acc. to DIN 16086 and IEC 60770-1 for climate compensated measuring cell</td><td colspan="4">Applies to the digital interfaces (HART®, Profibus PA, Foundation Fieldbus) as well as for the analogue 4…20 mA current output.
[% of set span]</td></tr>
<tr><td>Nominal mesuring range in bar / kPa</td><td>Nominal mesuring range in psi</td><td>Measuring cell Ø 28 mm</td><td>Measuring cell Ø 17.5 mm</td></tr>
<tr><td>0…0.4 bar / 0…40 kPa</td><td>0…6 psig</td><td rowspan="2"><± (1 x TD) / year</td><td rowspan="2"><± (1.5 x TD) / year</td></tr>
<tr><td>-0.2…0.2 bar / -20…20 kPa</td><td>-3…3 psig</td></tr>
<tr><td>0…1 bar / 0…100 kPa</td><td>0…15 psig</td><td rowspan="6"><± (0.25 x TD) / year</td><td rowspan="6"><± (0.375 x TD) / year</td></tr>
<tr><td>0…2.5 bar / 0…250 kPa</td><td>0…35 psig</td></tr>
<tr><td>-1…0 bar / -100…0 kPa</td><td>-15…0 psig</td></tr>
<tr><td>-1…1.5 bar / 100…150 kPa</td><td>-15…25 psig</td></tr>
<tr><td>-0.5…0.5 bar / -50…50 kPa</td><td>-7…7 psig</td></tr>
<tr><td>0…10 bar / 0…1000 kPa</td><td>0…150 psig</td><td rowspan="8"><± (0.1 x TD) / year</td><td rowspan="8"><± (0.15 x TD) / year</td></tr>
<tr><td>0…25 bar / 0…2500 kPa</td><td>0…350 psig</td></tr>
<tr><td>0…60 bar / 0…6000 kPa</td><td>0…900 psig</td></tr>
<tr><td>0…100 bar / 0…10000 kPa</td><td>0…1450 psig</td></tr>
<tr><td>-1…10 bar / -100…1000 kPa</td><td>-15…150 psig</td></tr>
<tr><td>-1…25 bar / -100…2500 kPa</td><td>-15…350 psig</td></tr>
<tr><td>-1…60 bar / -100…6000 kPa</td><td>-15…900 psig</td></tr>
</table>

Measuring cell temperature	
The evaluation is made by using the display and adjustment module for indication, the current output and additional current output for analogue signal output and HART®, Profibus PA and Foundation Fieldbus for digital signal output.	
Operating temperature / nominal temperature range	-60...+150°C / -76...+302°F
Resolution	< 0.2 K
Accuracy at 0...+100°C / +32...+212°F	<±2 K
Accuracy at -60...0°C / -76...+32°F	Typ. <± 4 K
Accuracy at +100...+150°C / +212...+302°F	Typ. <± 4 K
Electronics temperature	
The evaluation is made by using the display and adjustment module for indication, the current output and additional current output for analogue signal output and HART®, Profibus PA and Foundation Fieldbus for digital signal output.	
Operating temperature / nominal temperature range	-40...+85°C / -40...+185°F
Resolution	< 0.1 K
Accuracy at -40…+85 °C / -40…+185 °F	<± 3 K

Operating conditions

Temperature		
Version	Ambient temperature	Storage and transport temperature
Standard version	-40...+80°C / -40...+176°F	-60...+80°C / -76...+176°F
IP66 / IP68 version (1 bar / 14.5 psi)	-20...+80°C / -4...+176°F	-20...+80°C / -4...+176°F
IP68 version (25 bar / 362.6 psi), connection cable PUR	-20...+80°C / -4...+176°F	-20...+80°C / -4...+176°F
IP68 version (25 bar / 362.6 psi), connection cable PE	-20...+60°C / -4...+140°F	-20...+60°C / -4...+140°F
Temperature derating		
Version	Process temperature	Ambient temperature
+130°C / +266°F	+100°C / +212°F	+80°C / +176°F
	+130°C / +266°F	+55°C / +131°F
+150°C / +302°F	+100°C / +212°F	+80°C / +176°F
	+150°C / +302°F	+50°C / +122°F
SIP process temperature (SIP = Sterilisation on place)		
Applies to instruments configurations suitable for vapour, i.e. material measuring cell seal EPDM or FFKM (Perlast G75S).		
Vapour stratification up to 2 hours	+150°C / -302°F	

Process temperature (with process connection PVDF, process temperature max. 100°C / 212°F)			
Measuring cell seal		**Sensor version**	
		Standard	**Extended temperature range** Measuring cell ø 28 mm
FKM	VP2/A	-20…+130°C /-4…+266°F	-20…+150°C /-4…+302°F
	A+P 70.16	-40…+130°C /-40…+266°F	-
	Endura V91A	-40…+130°C /-40…+266°F	-40…+150°C /-40…+302°F
	ET 7067	-20…+130°C /-4…+266°F	-
	V70SW	-	-10…+150°C /+14…+302°F
EPDM	A+P 70.10-02	-40…+130°C /-40…+266°F	-40…+150°C /-40…+302°F
	ET 7056	-40…+130°C /-40…+266°F	-
	E70Q	-	-40…+150°C /-40…+302°F
	Fluoraz SD890	-5…+130°C /+23…+266°F	-
FFKM	Kalrez 6375	-20…+130°C /-4…+266°F	-20…+150°C /-4…+302°F
	Perlast G75S	-15…+130°C /+5…+266°F	-15…+150°C /+5…+302°F
	Perlast G75B	-15…+130°C /+5…+266°F	-15…+150°C /+5…+302°F
	Perlast G92E	-15…+130°C /+5…+266°F	-15…+150°C /+5…+302°F
	Chemraz 535	-30…+130°C /-22…+266°F	-

Further operating conditions

Housing material	**Version**	**Protection acc. to IEC 60529**	**Protection acc. to NEMA**
Plastic (PBT)	Single chamber	IP66 / IP67	Type 4X
	Double chamber		
Aluminium	Single chamber	IP66 / IP67	Type 4X
		IP68 (1 bar / 14.5 psi)	-
	Double chamber	IP66 / IP67	Type 4X
Stainless steel (electro-polished)	Single chamber	IP66 / IP67	Type 4X
		IP69K	
Stainless steel (precision casting)	Single chamber	IP66 / IP67	Type 4X
		IP68 (1 bar / 14.5 psi)	-
	Double chamber	IP66 / IP67	Type 4X
Stainless steel	Transmitter, version with external housing	IP68 (25 bar / 363 psi)	-
Connection of the feeding power supply unit	Networks of overvoltage category III		

Altitude above sea level	
by default	up to 2000 m (6562 ft)
with connected overvoltage protection	up to 5000 m (16404 ft)
Pollution degree	2 (when used with fulfilled housing protection)
Protection rating (IEC/EN 61010-1)	II
Mechanical stress (depending on the instrument version)	
Reference conditions	Single chamber housing, aluminium
Vibration resistance acc. to EN 60068-2-6	4 g at 5...200 Hz (vibration with resonance)
Shock resistant acc. to EN 60068-2-27	50 g, 2.3 ms (mechanical shock), 2 g with double chamber housing, stainless steel

Materials

Wetted parts		
Process connection	316L (1.4404), PVDF, Alloy C22 (2.4602), Alloy C276 (2.4819), Duplex (1.4462), Titanium Grade 2	
Diaphragm	Sapphire ceramic ® (>99.9% AL_2O_3 ceramic)	
Joining material diaphragm/base body	Glass (non-wetted for double seal and moulded seal)	
Measuring cell seal	FKM (VP2/A, A+P 70.16, Endura V91A, ET 7067, V70SW), EPDM (A+P 75.5, ET 7056, E70Q, Fluoraz SD890), FFKM (Kalrez® 6375, Perlast® G75S, Perlast® G75B, Perlast® G92E, Chemraz 535)	
Hygienic fitting with compression nut (form seal)	FKM (ET 6067), EPDM (EPDM 7076), FFKM (Chemraz 535), FEPM (Fluoraz SD890)	
Gasket for process connection (included in the scope of delivery)	Thread G1/2 (EN 837)	Klingersil® C-4400
	Thread G1 1/2 (DIN 3852)	Klingersil® C-4400
	M44 x 1.25 (DIN 13)	FKM, FFKM and EPDM
	M30 x 1.5 (DIN 13)	FKM, FFKM and EPDM
	Hygienic connection with compression nut	FKM, EPDM, FFKM, FEPM
Surface quality hygienic connections	Process connection	Typ. R_a< 0.8 µm
	Ceramic diaphragm	Typ. R_a< 0.7 µm
Materials non-wetted parts		
Sensor housing	Plastic PBT (Polyester), Aluminium AlSi10Mg low copper content <0.4% (powder-coated, basis: Polyester), 316L	
Cable gland	PA, stainless steel, brass	
Cable gland: Seal, closure	NBR, PA	
Seal, housing lid	Silicone SI 850 R, NBR silicone-free	
Inspection window housing cover	Polycarbonate (UL-746-C listed), glass with Aluminium and stainless steel precision casting housing	
Ground terminal	316L	
External housing - deviating materials		
Housing and socket	Plastic PBT (Polyester), 316L	
Socket seal	EPDM	

Seal below wall mounting plate (Only for 316L with 3A approval)	EPDM
Inspection window housing cover	Polycarbonate (UL-746-C listed)
Ground terminal	316Ti / 316L
Connection cable with IP 68 (25 bar) between transmitter and external electronics housing	
Cable cover	PE, PUR
Type label support on cable	PE hard
Connection cable with IP 68 (1 bar) fix connected to the sensor.	PE, PUR

Process connection

Thread	from G1/2 and 1/2-14 NPT (female)
Flanges	from DN 25 (DIN / EN) / 1" (ASME)
Flanges with extension	from DN 25 (DIN / EN) / 1" (ASME)
Other connections	ISO 2852 / DIN 32676, DIN 11851, Neumo BioConnect / BioControl, Varivent, DRD, SMS and PMC
Maximum tightening torques for the process connection	
G1/2 and G3/4	30 Nm / 22.13 ft lb
Process connections according to 3A with exchangeable sealing	20 Nm / 14.75 ft lb
Hygienic fitting with compression nut (hexagon)	40 Nm / 29.5 ft lb
G1, M30 x 1.5	50 Nm / 36.88 ft lb
G1 for PASVE	100 Nm / 73.76 ft lb
G1 1/2	200 Nm / 147.5 ft lb
Maximum tightening torques for screws	
PMC1 and PMC1 1/4	2 Nm / 1.5 ft lb
PMC1 1/2	5 Nm / 3.7 ft lb
Maximum tightening torques for NPT cable glands and conduit pipes	
Plastic housing	10 Nm / 7.4 ft lb
Aluminium housing	50 Nm / 37 ft lb
Stainless steel housing	50 Nm / 37 ft lb

Electrical connections

Mechanical - Standard	
Cable entry	M20 x 1.5, 1/2-14 NPT
Cable gland	M20 x 1.5, 1/2-14 NPT
Blind plug	M20 x 1.5, 1/2-14 NPT
Closing cap	M20 x 1.5, 1/2-14 NPT
Connector option	M12 x 1, Harting HAN 7D, 8D, 7/8" FF

Material cable gland / Seal insert	Cable diameter			
	5…9 mm / 0.20…0.35"	6…12 mm / 0.24…0.47"	7…12 mm / 0.27…0.47"	10…14 mm / 0.39…0.55"
PA / NBR	X	X	-	X
Brass, nickel-plated / NBR	X	X	-	-
Stainless steel / NBR	-	-	X	-
Wire cross-section (spring-loaded terminals)				
Massive wire, stranded wire	0.2…2.5 mm² (AWG 24…14)			
Stranded wire with end sleeve	0.2…1.5 mm² (AWG 24…16)			
Mechanical - Display and adjustment module				
Display element	Display with backlight turnable in 90° steps			
Measured value indication	5 digits (13x7 mm / 0.51x0.27")			
Adjustment elements	4 keys [OK], [->], [+], [ESC]			
Bluetooth interface (optional)	Bluetooth LE 4.1			
	Max. participants 1			
	Effective range typ. 25 m / 82 ft (depending on the local conditions)			
	Bluetooth Switch [On], [Off]			
Protection rating	Unassembled IP20			
	Mounted in the housing without lid IP40			
Materials	ABS Housing			
	Polyester foil inspection window			
Functional safety	SIL non-reactive			
Ambient temperatures below -20°C / -4°F may affect the readability of the display				
Mechanical - IP66 / IP68 (1 bar)				
Connection cable				
Structure of connecting cable	Four wires, one pressure compensation capillary, one suspension cable, screen braiding, metal foil and cable jacket			
Wire cross-section	0.5 mm^2 / AWG 20			
Wire resistance	0.037 Ω/m / 0.012 Ω/ft			
Standard length	5 m / 16.40 ft			
Max. length	180 m / 590.5 ft			
Min. bending radius	25 mm / 0.98" at 25°C / 77°F			
Diameter	ca. 8 mm / 0.31"			
Material	PE (black)			
	PUR (blue)			
Mechanical - Electronic differential pressure measurement				
Connection cable between master and slave sensor				
Data transfer	Digital (I²C bus)			
Structure of connecting cable	Four wires, one suspension cable, screen braiding, metal foil, cable jacket			
Wire cross-section	0.34 mm² / AWG 22			
Wire resistance	< 0.05 Ω/m / 0.015 Ω/ft			

Standard length	5 m / 16.40 ft
Max. length	25 m / 82 ft
Min. bending radius	25 mm / 0.98" at 25°C / 77°F
Diameter	ca. 8 mm / 0.31"
Material	PE (black) PUR (blue)
Mechanical - IP68 (25 bar)	
Connecting cable between IP68 device and external housing	
Structure of connecting cable	Four wires, one pressure compensation capillary (not with Ex d version), one suspension cable, screen braiding, metal foil and cable jacket
Wire cross-section	0.5 mm^2 / AWG 20
Wire resistance	0.037 Ω/m / 0.012 Ω/ft
Standard length	5 m / 16.40 ft
Max. length	180 m / 590.5 ft
Min. bending radius	25 mm / 0.98" at 25°C / 77°F
Diameter	ca. 8 mm / 0.31"
Material	PE (black) PUR (blue)
Cable entry / Connector	
External housing	1 x cable gland M20 x 1.5 (cable Ø 5...9 mm), 1 x blind plug M20 x 1.5
	1 x connector (depending on version), 1 x blind plug M20 x 1.5
Spring load terminals for wire cross-section up to	2.5 mm^2 / AWG 14

Electrical		
Operating voltage	Non-Ex device: 9.6...35 VDC	
	Ex ia device: 9.6...30 VDC	
	Ex d device: 9.6...35 VDC	
	Background lighting on display from 16 VDC	
	Electronic differential pressure from 12 VDC	
Reverse polarity protection	Integrated	
Permissible residual ripple	Non-Ex devices	for U_n 12 VDC (9.6 VDC < U_B < 14 VDC) ≤ 0.7 V_{eff} (16...400 Hz) for U_n 24 VDC (18 VDC < U_B < 35 VDC) ≤ 1.0 V_{eff} (16...400 Hz)
	Ex ia d devices and Ex ia devices	for U_n 24 VDC (18 VDC < U_B < 35 VDC) ≤ 1.0 V_{eff} (16...400 Hz)
Load	$R_{L, max}$ = (U_B-9.6) / 22 mA	
Potential connections and electrical separating measures in the instrument	Electronics: Not electrically isolated	
	Reference voltage: 500 V AC (galvanic separation between electronics and metal housing parts)	
	Conductive connection: Between ground terminal and metallic process connection	
Over voltage category	III	
Protection class	II	

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 µA	
Error signal of current output (adjustable)	High alarm ≥ 21 mA Low Alarm ≤ 3.6 mA Last valid measured value (not possible with SIL)	
Max. output current	21.5 mA	
Switch-on phase	Run-up time with operating voltage U_B:	≥ 12 VDC ≤ 9 s
		< 12 VDC ≤ 22 s
	Starting current:	≤ 10 mA for 5 ms after switching on, then ≤ 3.6 mA
Additional current output (optional)		
Output signal	4…20 mA (passive)	
Range of the output signal	3.8…20.5 mA (default setting)	
Signal resolution	0.3 µA	
Error signal of second current output (adjustable)	High alarm ≥ 21 mA Low alarm ≤ 3.6 mA Last valid measured value (not possible with SIL)	
Max. output current	21.5 mA	
Starting current	≤ 10 mA for 5 ms after switching on, ≤ 3.6 mA	
Load	Load resistor, see chapter "Voltage supply"	

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, EN 61326-2-3:2013, EN 61326-2-5:2013, EN 61326-3-2:2008
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).

7.3 Pressure ranges

Adjustment

Data refers to the nominal measuring range, pressure values smaller than -1 bar cannot be set

Adjustment range of min/max adjustment in relation to the nominal range:

- Percent value -10...110%
- Pressure value -20...120%

Adjustment range of the zero / span adjustment in relation to the nominal range

- Zero -20...+95%
- Span: -120...+120%
- Difference between zero and span: max. 120% of the nominal range

Level (min./max. adjustment)

- Percent value -10...110%
- Pressure value -120...120%

Differential pressure ① (zero/span adjustment)

- Zero -95...+95%
- Span: -120...+120%

Density ① (min./max. adjustment)

- Percent value -10...110%
- Density value according to the measuring ranges in kg/dm^3

Interface ① (min./max. adjustment)

- Percent value -10...110%
- Height value according to the measuring ranges in m

① Only available for electronic differential pressure when the slave sensor is activated

Recommended maximum Turn Down (TD): 20:1 (no limit)

Nominal ranges and overload capacity in bar/kPa

This information is provided as an overview and refers to the measuring cell. Limitations due to the material and design of the process connection as well as the type of pressure selected are possible. The information given on the nameplate applies. Data on overload capability apply for reference temperature.

Nominal range	Maximum pressure	Minimum pressure
Gauge pressure		
0…+0.025 bar / 0…+2.5 kPa ①	+5 bar / +500 kPa	-0.05 bar / -5 kPa
0…+0.1 bar / 0…+10 kPa	+15 bar / +1500 kPa	-0.2 bar / -20 kPa
0…+0.4 bar / 0…+40 kPa	+30 bar / +3000 kPa	-0.8 bar / -80 kPa
0…+1 bar / 0…+100 kPa	+35 bar / +3500 kPa	-1 bar / -100 kPa
0…+2.5 bar / 0…+250 kPa	+50 bar / +5000 kPa	-1 bar / -100 kPa
0…+5 bar / 0…+500 kPa	+65 bar / +6500 kPa	-1 bar / -100 kPa
0…+10 bar / 0…+1000 kPa	+90 bar / +9000 kPa	-1 bar / -100 kPa
0…+25 bar / 0…+2500 kPa	+125 bar / +12500 kPa	-1 bar / -100 kPa
0…+60 bar / 0…+6000 kPa	+200 bar / +20000 kPa	-1 bar / -100 kPa
0…+100 bar / 0…+10000 kPa ①	+200 bar / +20000 kPa	-1 bar / -100 kPa
-1…0 bar / -100…0 kPa	+35 bar / +3500 kPa	-1 bar / -100 kPa
-1…+1.5 bar / -100…+150 kPa	+40 bar / +4000 kPa	-1 bar / -100 kPa
-1…+5,0bar / -100…+500kPa	+65 bar / +6500 kPa	-1 bar / -100 kPa
-1…+10 bar / -100…+1000 kPa	+90 bar / +9000 kPa	-1 bar / -100 kPa
-1…+25 bar / -100…+2500 kPa	+125 bar / +12500 kPa	-1 bar / -100 kPa
-1…+60 bar / -100…+6000 kPa	+200 bar / +20000 kPa	-1 bar / -100 kPa
-1…+100 bar / -100…+10000 kPa ①	+200 bar / +20000 kPa	-1 bar / -100 kPa
-0.025…+0.025 bar / -2.5…+2.5 kPa	+5 bar / +500 kPa	-0.05 bar / -5 kPa
-0.05…+0.05 bar / -5…+5 kPa	+15 bar / +1500 kPa	-0.2 bar / -20 kPa
-0.2…+0.2 bar / -20…+20 kPa	+20 bar / +2000 kPa	-0.4 bar / -40 kPa
-0.5…+0.5 bar / -50…+50 kPa	+35 bar / +3500 kPa	-1 bar / -100 kPa

① Only for measuring cell Ø28 mm

Nominal range	Maximum pressure	Minimum pressure
Absolute pressure		
0…+0.1 bar / 0…+10 kPa	+15 bar / +1500 kPa	0 bar abs.
0…+1 bar / 0…+100 kPa	+35 bar / +3500 kPa	0 bar abs.
0…+2.5 bar / 0…+250 kPa	+50 bar / +5000 kPa	0 bar abs.
0…+5 bar / 0…+500 kPa	+65 bar / +6500 kPa	0 bar abs.
0…+10 bar / 0…+1000 kPa	+90 bar / +9000 kPa	0 bar abs.
0…+25 bar / 0…+2500 kPa	+125 bar / +12500 kPa	0 bar abs.
0…+60 bar / 0…+6000 kPa	+200 bar / +20000 kPa	0 bar abs.
0…+100 bar / 0…+10000 kPa ①	+200 bar / +20000 kPa	0 bar abs.

① Only for measuring cell Ø28 mm

Nominal range	Maximum pressure	Minimum pressure
Gauge pressure		
0...+0.4 psi ①	+ 75 psi	-0.7 psi
0...+1.5 psi	+225 psi	-3 psi
0...+5 psi	+375 psi	-11.50 psi
0...+15 psi	+525 psi	-14.51 psi
0...+30 psi	+725 psi	-14.51 psi
0...+75 psi	+975 psi	-14.51 psi
0...+150 psi	+1350 psi	-14.51 psi
0...+300 psi	+1900 psi	-14.51 psi
0...+900 psi	+2900 psi	-14.51 psi
0...+1450 psi ①	+2900 psi	-14.51 psi
-14.5...0 psi	+525 psi	-14.51 psi
-14.5...+20 psi	+600 psi	-14.51 psi
-14.5 ... +75 psi	+975 psi	-14.51 psi
-14.5...+150 psi	+1350 psi	-14.51 psi
-14.5...+300 psi	+1900 psi	-14.51 psi
-14.5...+900 psi	+2900 psi	-14.51 psi
-14.5...+1500 psi ①	+2900 psi	-14.51 psi
-0.7...+0.7 psi	+75 psi	-2.90 psi
-3...+3 psi	+225 psi	-5.80 psi
-7...+7 psi	+525 psi	-14.51 psi

① Only for measuring cell Ø28 mm

Nominal range	Max. working pressure (MWP)	Overload capacity min. pressure
Absolute pressure		
0...1.5 psi	225 psi	0 psi
0...15 psi	525 psi	0 psi
0...30 psi	725 psi	0 psi
0...75 psi	975 psi	0 psi
0...150 psi	1350 psi	0 psi
0...300 psi	1900 psi	0 psi
0...900 psi	2900 psi	0 psi
0...+1450 psi ①	2900 psi	0 psi

① Only for measuring cell Ø28 mm

7.4 Ambient temperature effect on current output

Applies to the analogue 4...20 mA current output and refers to the set span
< 0.05% / 10 K, max. < 0.15%, each case at -40...+80°C / -40...+176°F

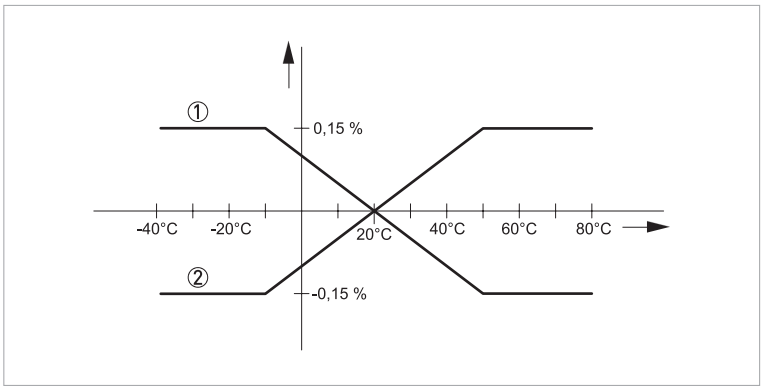


Figure 7-2: Ambient temperature effect on current output

① Falling characteristics
② Rising characteristics

7.5 Dynamic behaviour of the current output

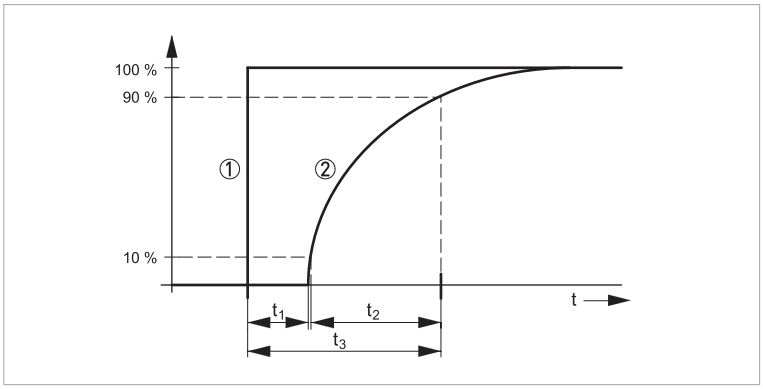


Figure 7-3: Behaviour at an abrupt change in the process variable.
t_1 - dead time; t_2 - rise time; t_3 - step response time

① Process variable
② Output signal

	Standard	IP68 (25 bar)
Dead time (t1)	≤ 25 ms	≤ 50 ms
Rise time 10...90% (t2)	≤ 55 ms	≤ 150 ms
Step response time (t3)	≤ 80 ms (ti: 0 seconds, 10...90%)	≤ 200 ms (ti: 0 seconds, 10...90%)
Damping (63% of input variable)	0...999 seconds, adjustable in 0.1 second steps	

These parameters depend on the temperature.

7.6 Dimensions and weight

INFORMATION!
The following dimensional drawings represent only an extract of the possible versions. Detailed dimensional drawings can be requested individually.

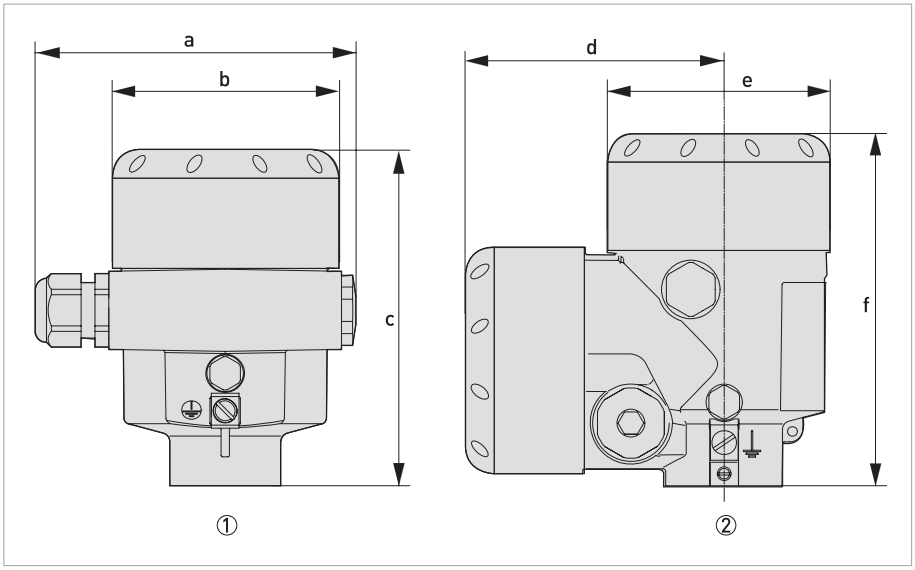


Figure 7-4: Aluminium housing

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

INFORMATION!
With integrated display and adjustment module the height of the housing increases by 18 mm / 0.71 inch.

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

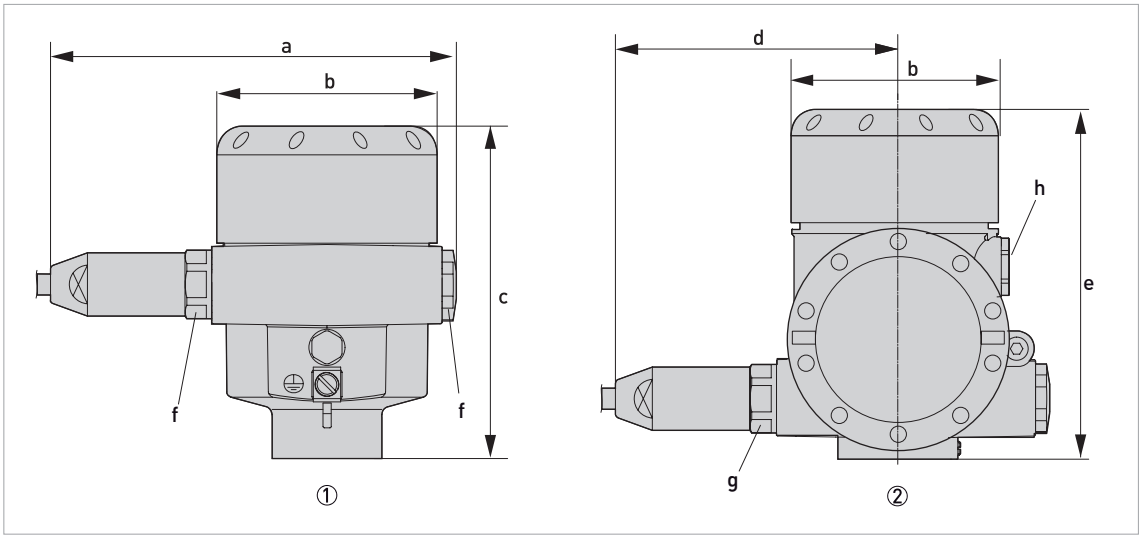


Figure 7-5: Aluminium housing in IP66 / IP68 (1 bar) version

① Single chamber
② Double chamber

	Dimension [mm]	Dimension [inch]
a	150	5.91
b	86	3.39
c	116	4.57
d	105	4.13
e	120	4.72
f	M20 x 1.5	
g	M20 x 1,5 / 1/2-14 NPT	
h	M16 x 1.5	

INFORMATION!
With integrated display and adjustment module the height of the housing increases by 18 mm / 0.71 inch.

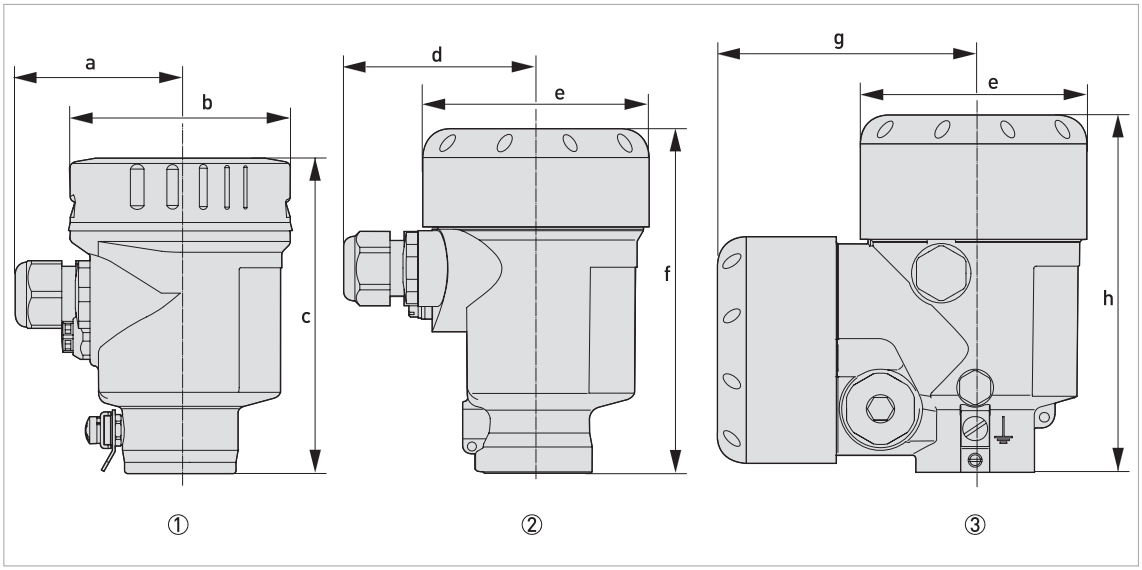


Figure 7-6: Stainless steel housing

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	120	4.72

INFORMATION!
With integrated display and adjustment module the height of the housing increases by 9 mm / 0.35 inch or 18 mm / 0.71 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

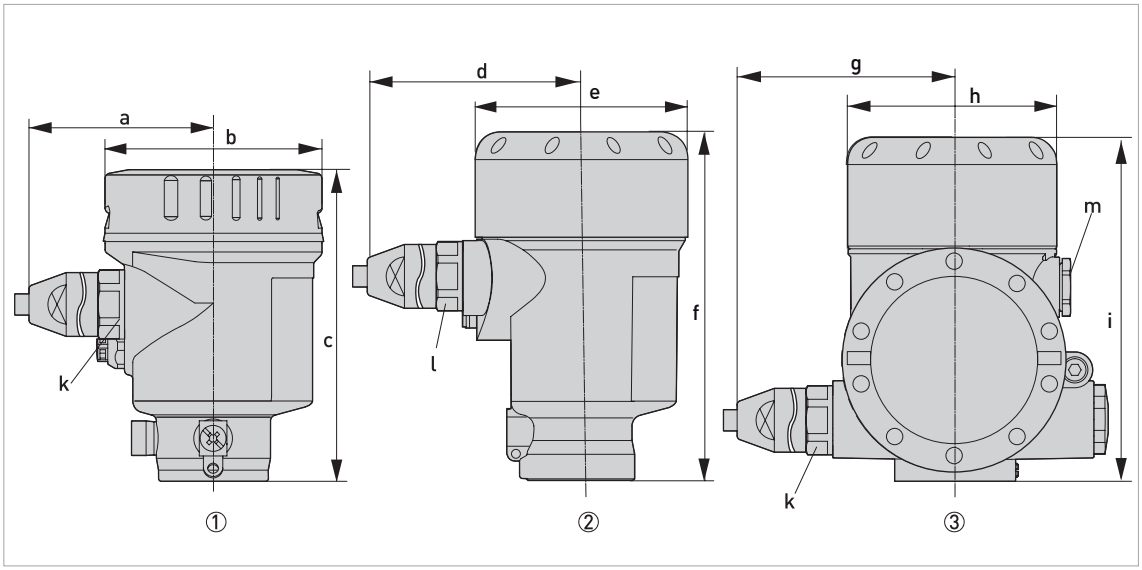


Figure 7-7: Stainless steel housing in IP66 / IP68 (1 bar) version

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

	Dimension [mm]	Dimension [inch]
a	93	3.66
b	80	3.15
c	112	4.41
d	103	4.06
e	79	3.11
f	117	4.61
g	105	4.13
h	86	3.39
i	120	4.72
k	M20 x 1.5 / 1/2-14 NPT	
l	M20 x 1.5	
m	M16 x 1.5	

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

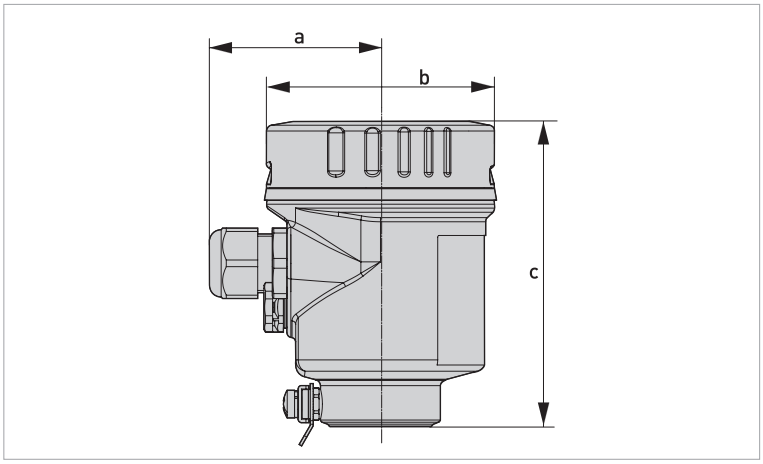


Figure 7-8: Stainless steel (electro-polished) IP69K version

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

INFORMATION!
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

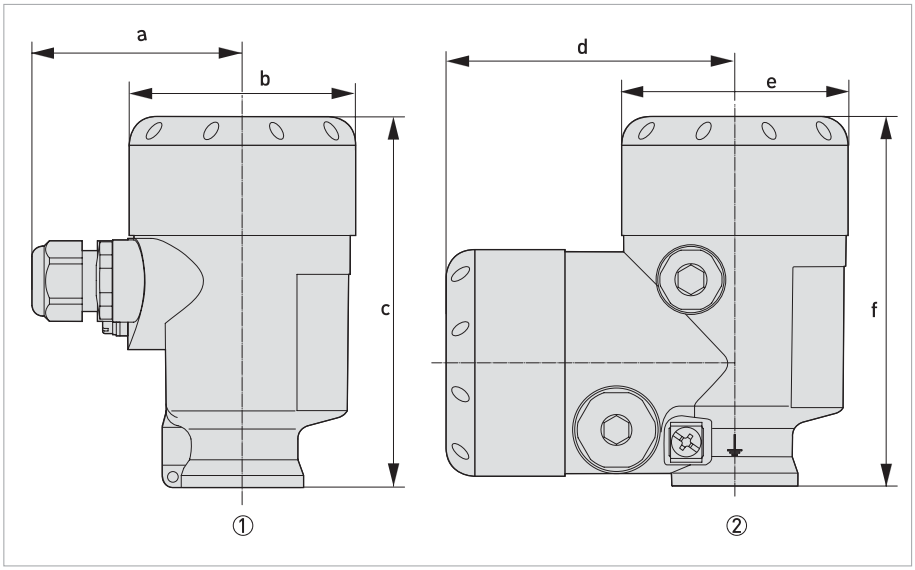


Figure 7-9: Plastic housing

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

INFORMATION!
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

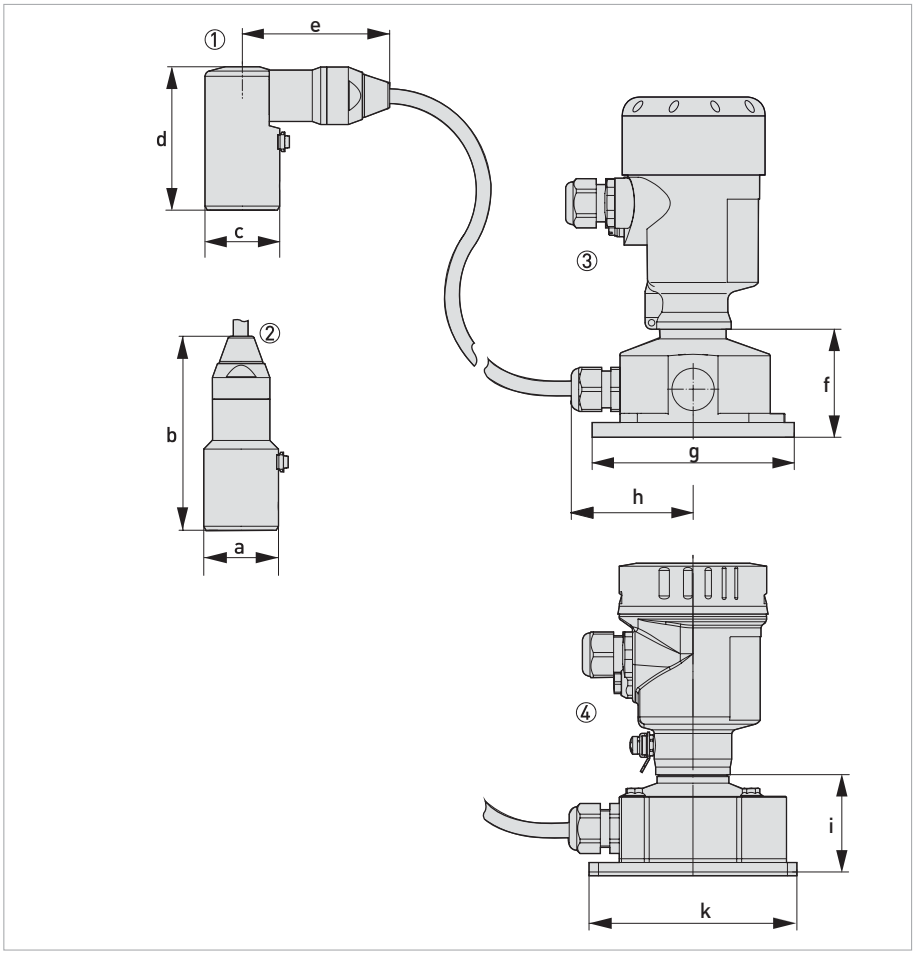


Figure 7-10: External housing

① Cable outlet, lateral
② Cable outlet, axial
③ Plastic single chamber housing (base in plastic)
④ Stainless steel single chamber housing (base in stainless steel)

	Dimension [mm]	Dimension [inch]
a	42	1.65
b	108	4.25
c	42	1.65
d	80	3.15
e	82	3.23
f	59	2.32
g	110 x 90	4.33 x 3.54
h	66	2.60
i	51	2.01
k	110 x 90	4.33 x 3.54

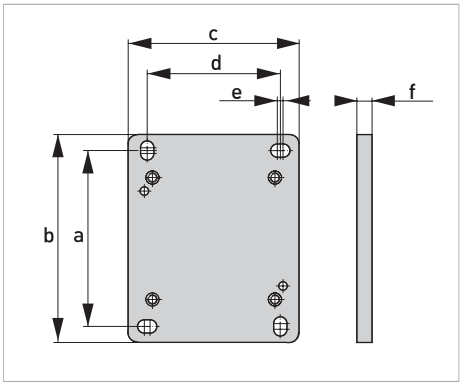


Figure 7-11: Mounting plate

	Dimension [mm]	Dimension [inch]
a	93	3.66
b	110	4.33
c	90	3.54
d	70	2.76
e	3	0.12
f	8	0.31

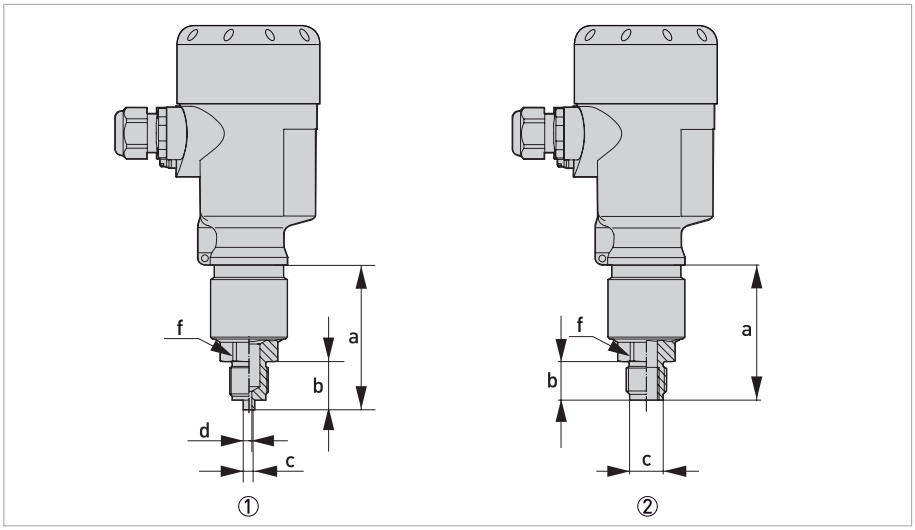


Figure 7-12: Thread recessed

① Thread ISO228 G1/2 EN837-1
② Thread ISO228 G1/2 - G1/4 female DIN3852

Dimension [mm]	a	b	c	d	e	f
①	73	23	6	3	-	WS 27
②	70	20	17.5	-	-	WS 27

Dimension [inch]	a	b	c	d	e	f
①	2.87	0.91	0.24	0.12	-	1.06
②	2.76	0.79	0.69	-	-	1.06

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

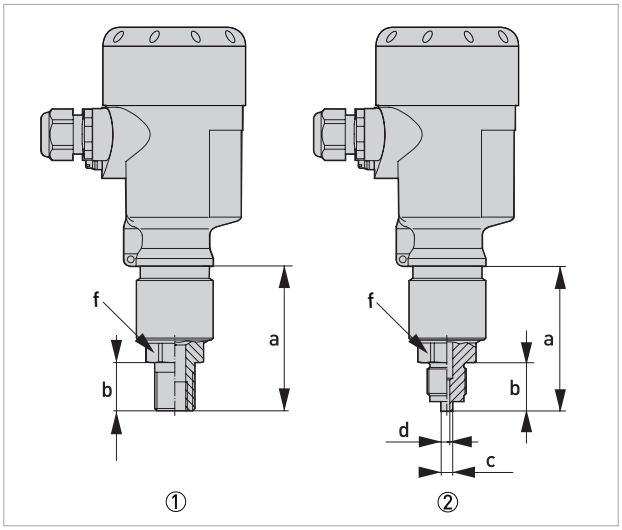


Figure 7-13: Thread recessed

① Thread ANSI 1/2 NPT - 1/4 NPT female
② Thread DIN13 M20 x 1.5 EN837-1

Dimension [mm]	a	b	c	d	e	f
①	75	25	-	-	-	WS 27
②	75	25	6	3	-	WS 27

Dimension [inch]	a	b	c	d	e	f
①	2.95	0.98	-	-	-	1.06
②	2.95	0.98	0.24	0.12	-	1.06

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

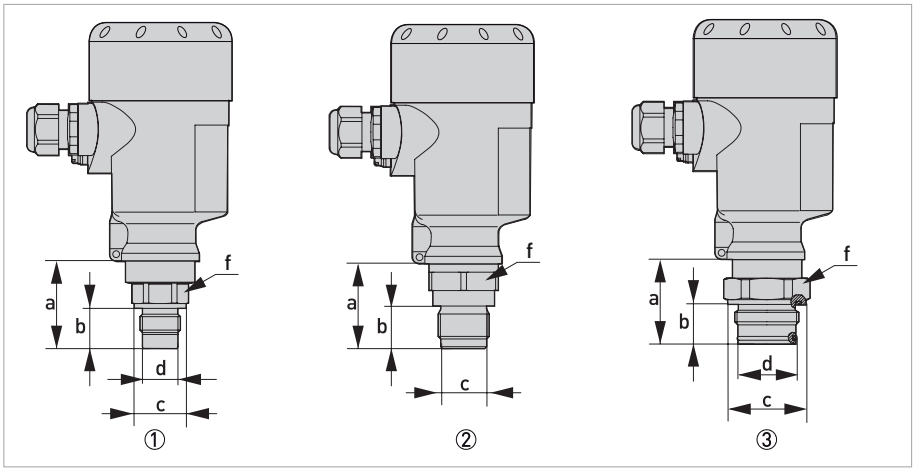


Figure 7-14: Thread front-flush

① Thread ISO228 G1/2 DIN3852
② Thread ISO228 G3/4 DIN3852
③ Thread ISO228 G1 DIN3852

Dimension [mm]	a	b	c	d	e	f
①	45	21	27	18	-	WS 27
②	44	22	24	-	-	WS 36
③	44	21	40	30	-	WS 41

Dimension [inch]	a	b	c	d	e	f
①	1.77	0.83	1.06	0.71	-	1.06
②	1.73	0.87	0.95	-	-	1.42
③	1.73	0.83	1.58	1.18	-	1.61

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

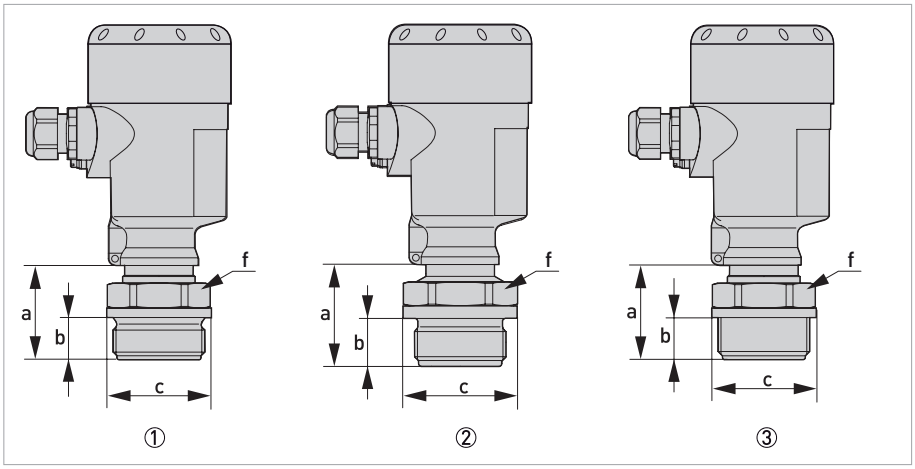


Figure 7-15: Thread front-flush

① Thread ISO228 G1 1/2 DIN3852
② Thread ISO G1 1/2 PVDF DIN 3852
③ Thread ANSI 1 1/2 NPT

Dimension [mm]	a	b	c	d	e	f
①	50	22	55	-	-	WS 46
②	55	25	60	-	-	WS 55
③	55	22	55	-	-	WS 46

Dimension [inch]	a	b	c	d	e	f
①	1.97	0.87	2.17	-	-	1.81
②	2.17	0.98	2.36	-	-	2.17
③	2.17	0.87	2.17	-	-	1.81

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

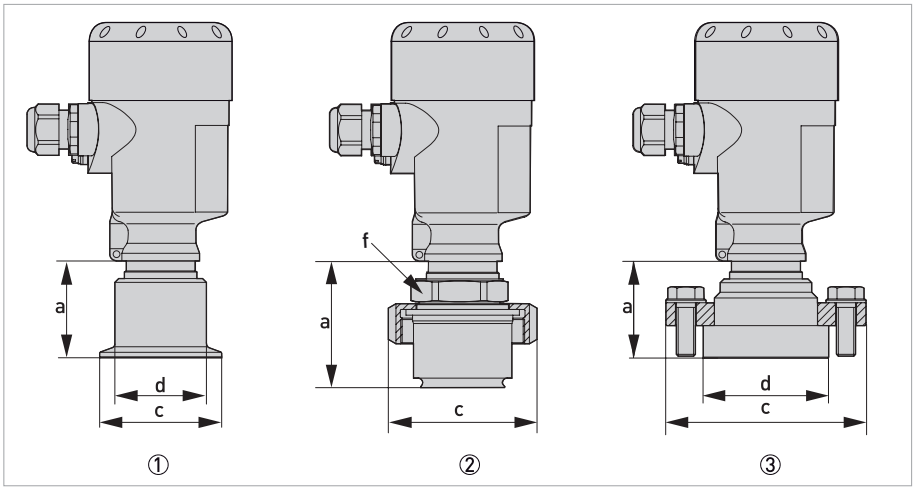


Figure 7-16: Hygienic connection

① Clamp DN50 2" PN16, DIN32676 / ISO2852
② Hygienic fitting with compression nut
③ Flange DRD PN40

Dimension [mm]	a	b	c	d	e	f
①	51	-	48	64	-	-
②	60	-	-	78	-	WS 46
③	55	-	66	105	-	-

Dimension [inch]	a	b	c	d	e	f
①	2.01	-	1.89	2.52	-	-
②	2.36	-	-	3.07	-	1.81
③	2.17	-	2.60	4.13	-	-

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

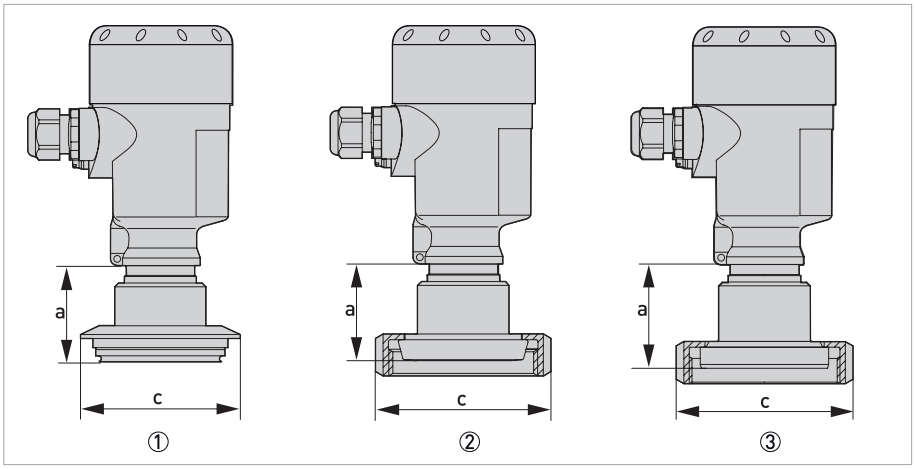


Figure 7-17: Hygienic connection

① Varivent N50-40 PN25
② Collar connection DIN 11851, DN40 PN40
③ Collar connection DIN 11864-1 Form A, DN50 PN 40

Dimension [mm]	a	b	c	d	e	f
①	51	-	84	-	-	-
②	51	-	78	-	-	-
③	50	-	92	-	-	-

Dimension [inch]	a	b	c	d	e	f
①	2.01	-	3.31	-	-	-
②	2.01	-	3.07	-	-	-
③	1.97	-	3.62	-	-	-

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

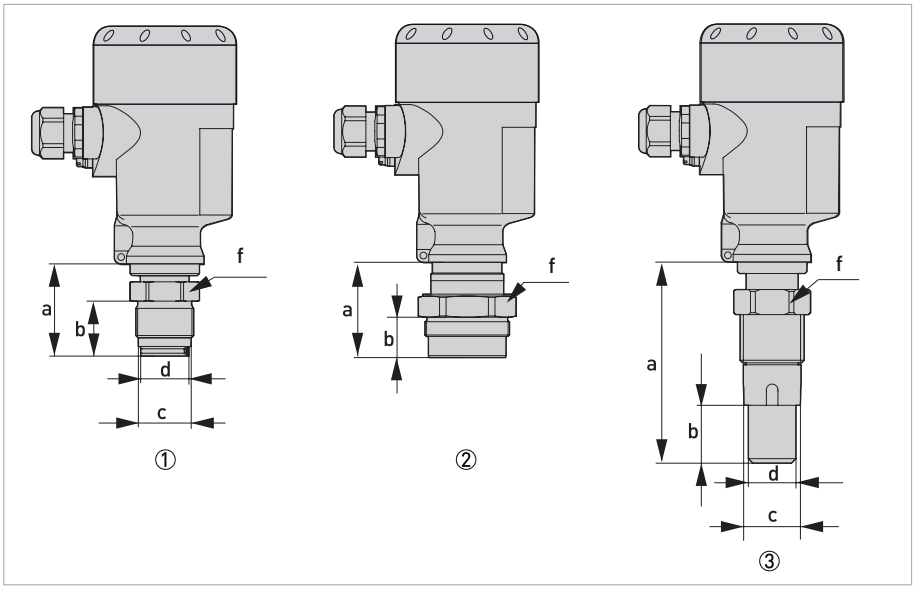


Figure 7-18: Flange with extension

① Thread DIN13 M30x1.5
② Thread DIN13 M44x1.25, pressure screw
③ Thread ISO228 G1, suitable for PASVE

Dimension [mm]	a	b	c	d	e	f
①	48	29	27.4	25	-	WS 32
②	52	21	-	-	-	WS 46
③	106	30	29.9	24.7	-	WS 26

Dimension [inch]	a	b	c	d	e	f
①	1.89	1.14	1.08	0.98	-	1.26
②	2.05	0.83	-	-	-	1.81
③	4.17	1.18	0.97	0.97	-	1.42

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

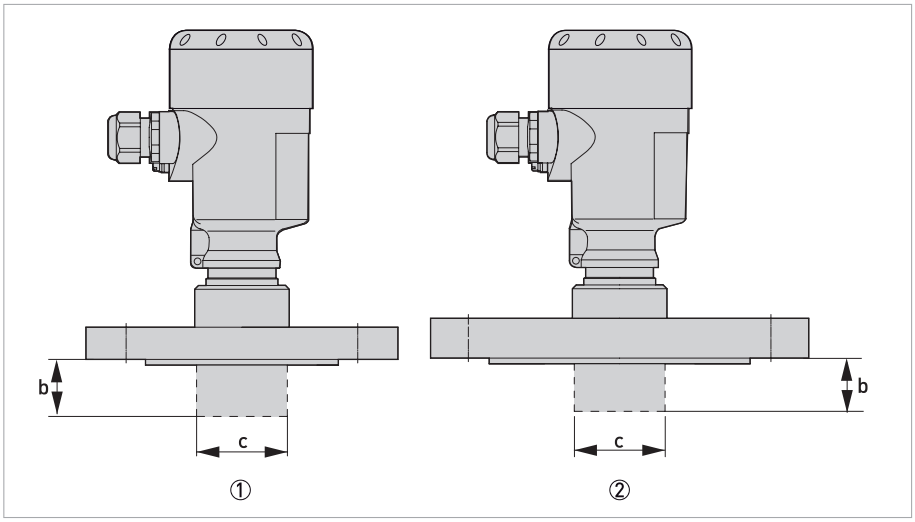


Figure 7-19: Flange with extension

① Flanged connection DN50 PN40 with selectable extension
② Flanged connection DN80 PN40 with selectable extension

Dimension [mm]	a	b	c	d	e	f
①	-	32...300	32...60	-	-	-
②	-	25...300	38...90	-	-	-

Dimension [inch]	a	b	c	d	e	f
①	-	1.26...11.81	1.26...2.36	-	-	-
②	-	0.98...11.81	1.50...3.54	-	-	-

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

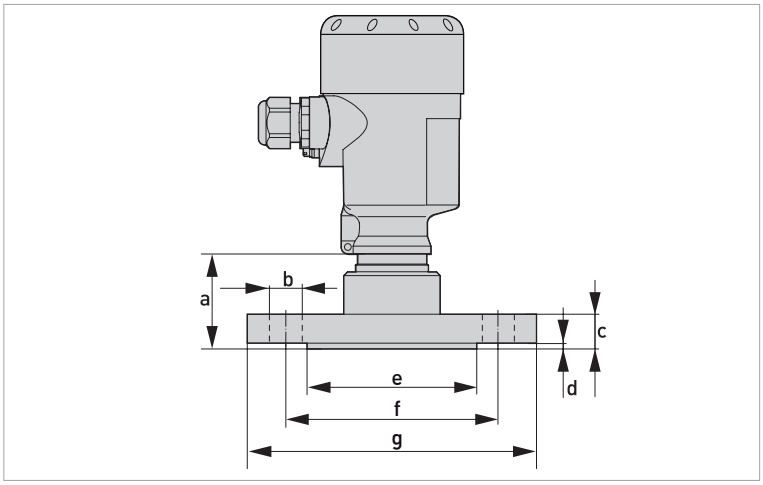


Figure 7-20: Dimensions - Flange

Flange connection acc. to DIN 2501 or ASME B16.5

Dimension [mm]	a	b	c	d	e	f	g
DN40 PN40 Form C	50	4 x Ø 18	18	3	88	110	150
DN50 PN40 Form C	50	4 x Ø 18	20	3	102	125	165
DN80 PN40 Form C	51	8 x Ø 18	24	3	138	160	200
2" Class 150lb RF	51	4 x Ø 19.1	19.1	3.2	91.9	120.7	152.4
3" Class 150lb RF	51	4 x Ø 19.1	23.9	3.2	127	152.4	190.5

Flange connection acc. to DIN 2501 or ASME B16.5

Dimension [inch]	a	b	c	d	e	f	g
DN40 PN40 Form C	1.97	4 x Ø 0.71	0.71	0.12	3.46	4.33	5.91
DN50 PN40 Form C	1.97	4 x Ø 0.71	0.79	0.12	4.02	4.92	6.50
DN80 PN40 Form C	2.01	8 x Ø 0.71	0.95	0.12	5.43	6.30	7.87
2" Class 150lb RF	2.01	4 x Ø 0.75	0.75	0.13	3.62	4.75	6
3" Class 150lb RF	2.01	4 x Ø 0.75	0.94	0.13	5	6	7.50

INFORMATION!
For the version with a temperature range up to 150° C / 302° F the measure of length increases by 28 mm / 1.1".

INFORMATION!
For the version with "secondary process barrier" the measure of length increases by 17 mm / 0.67".

8.1 General description

The open HART® protocol which can be used for free, is integrated into the signal converter for communication.

Devices which support the HART® protocol are classified as either operating devices or field devices. When it comes to operating devices (Master), both manual control units (Secondary Master) and PC-supported workstations (Primary Master) are used in, for example, a control centre.

HART® field devices include measuring sensors, signal converters and actuators. The field devices range from 2-wire to intrinsically safe versions for use in hazardous areas.

The HART® data are superimposed over the analogue 4...20 mA signal via FSK modem. This way, all of the connected devices can communicate digitally with one another via the HART® protocol while simultaneously transmitting the analogue signals.

When it comes to the field devices and secondary masters, the FSK or HART® modem is integrated. If a PC is used, an external modem must be connected to the serial interface (USB interface). There are, however, other connection variants which can be seen in the following connection figures.

The serial number of each device is indicated on the nameplate. For all communication interfaces such DTMs, DDs, etc. the serial number is indicated in its short format.

8.2 Software history

INFORMATION!
In the table below, "x" is a placeholder for possible multi-digit alphanumeric combinations, depending on the available version.

Release date	SW version	HW version	HART®	
			Device Revision	DD Revision
2013-04-01	1.0.x	1.0.x	1	1
2016-07-01	1.2.x	1.0.x	2	2
2019-03-01	1.3.x	1.0.x	3	3

HART® identification codes and revision numbers

Manufacturer ID:	69 (0x45)
Device ID (non-SIL):	196 (0xC4)
Device ID (SIL 2/3):	188 (0xBC)
HART® Universal Revision:	7
FC 475 system SW.Rev.:	≥ 3.7
PDM version:	≥ 8.0
FDT version:	≥ 1.2

8.3 Connection variants

The signal converter is a 2-wire device with a passive 4...20 mA current output and a HART® interface.

- **Point-to-Point is supported**
  In conventional point-to-point operation, the signal converter communicates as a slave with the master.
- **Multidrop mode is supported**
  In a multidrop communication system, more than 2 devices are connected to a common transmission cable.
- **Burst Mode is not supported**
  In the burst operation a slave device transfers cyclic pre-defined response telegrams, to get a higher rate of data transfer.

There are two ways of using the HART® communication:

- as Point-to-Point connection and
- as multidrop connection, with 2-wire connection.

8.3.1 Point-to-Point connection - analogue / digital mode

Point-to-Point connection between the signal converter and the HART® Master.

The current output of the device is passive.

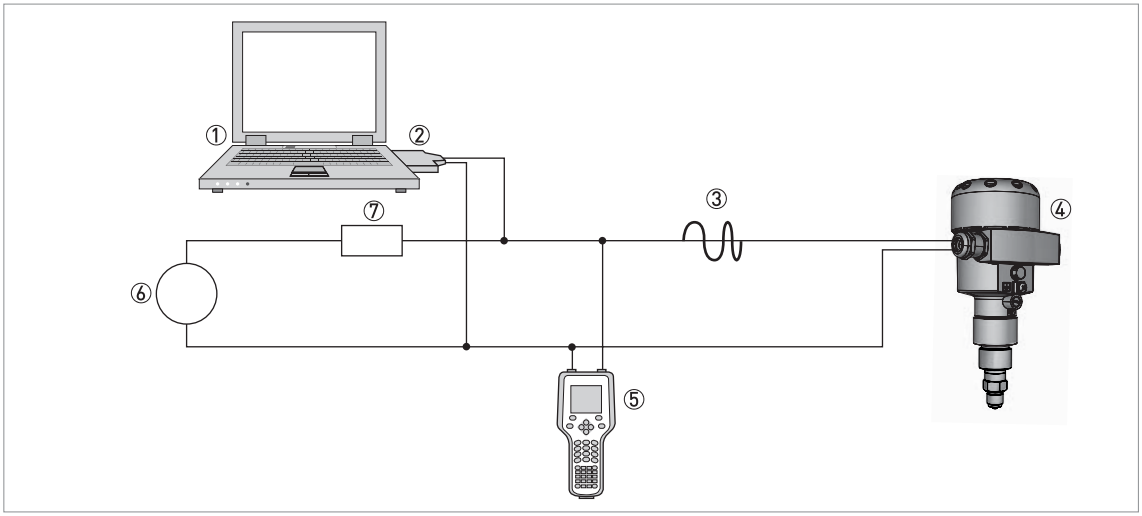


Figure 8-1: Point-to-Point connection

① Primary master with e.g. PACTware™ FDT/DTM
② FSK modem
③ HART® signal
④ OPTIBAR PC 5060 C
⑤ Secondary master with HART® DD
⑥ Power supply for devices (slaves) with passive current output
⑦ Load ≥ 250 Ω

8.4 Inputs / Outputs and HART® dynamic variables and device variables

PV = Primary Variable; SV = Secondary Variable; TV = Third Variable; QV = Quarternary Variable

INFORMATION!
The output values can be assigned individually.

HART® dynamic variable			
PV	SV	TV	QV
Linear percentage value	Measuring cell temperature	Pressure	Electronics temperature

Table 8-1: HART® output values acc. to HART® 7 (factory setting)

8.5 Field Communicator 475 (FC 475)

The Field Communicator is a hand terminal from Emerson Process Management that is designed to configure HART® and Foundation Fieldbus devices. Device Descriptions (DDs) are used to integrate different devices into the Field Communicator.

8.5.1 Installation

The HART® Device Description for the signal converter must be installed on the Field Communicator. Otherwise only the functions of a generic DD are available to the user and the entire device control is not possible. A "Field Communicator Easy Upgrade Programming Utility" is required to install the DDs on the Field Communicator.

The Field Communicator must be equipped with a system card with "Easy Upgrade Option". For details consult the Field Communicator User's Manual.

8.5.2 Operation

Operating the signal converter via the Field Communicator is very similar to manual device control using the keyboard.

8.6 Field Device Tool / Device Type Manager (FDT / DTM)

A Field Device Tool Container (FDT Container) is basically a PC program used to configure a field device via HART®. To adapt to different devices, the FDT container uses a so-called Device Type Manager (DTM).

8.6.1 Installation

If the DTM for the signal converter has not yet been installed on the FDT Container, setup is required and is available for download from the website or on CD-ROM. See the supplied documentation for information on how to install and set up the DTM.

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