

Differential pressure transmitter DPT-10

GB

Metallic measurement diaphragm
4 ... 20 mA/HART



Differential pressure transmitter DPT-10

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Safety instructions for Ex areas



Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used



Information, tip, note

This symbol indicates helpful additional information.



Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.



Ex applications

This symbol indicates special instructions for Ex applications.



List

The dot set in front indicates a list with no implied sequence.



Action

This arrow indicates a single action.



Sequence of actions

Numbers set in front indicate successive steps in a procedure.



Battery disposal

This symbol indicates special information about the disposal of batteries and accumulators.

2 For your safety

2.1 Authorised personnel

Mount and set up the pressure transmitter only if you know the applicable national regulations and have the appropriate qualification. You must be acquainted with the regulations and instructions for hazardous areas, measurement and control technology as well as electrical circuits because the pressure transmitter is "electrical equipment" according to EN 50178. Depending on the application conditions, it is necessary that you have appropriate knowledge, e.g. concerning corrosive products or high pressure.

2.2 Appropriate use

DPT-10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface.

You can find detailed information on the application range in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

2.5 Safety label on the instrument

The safety approval markings and safety tips on the device must be observed.

2.6 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

2.7 Fulfillment of NAMUR recommendations

The device fulfills the requirements of the applicable NAMUR recommendations.

2.8 Safety instructions for oxygen applications

For instruments in oxygen applications the special instructions in chapters "*Storage and transport*", "*Mounting*" as well as "*Technical data*" under "*Process conditions*" must be noted. Furthermore the valid national regulations, implementation instructions and memorandums of the professional associations must be noted.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- DPT-10 differential pressure transmitter
- Depending on the version, ventilation valves and/or screw plugs (details see chapter "*Dimensions*")
- Optional accessory
- Documentation
 - this operating instructions manual
 - Test certificate for pressure transmitters
 - Operating instructions manual "*Display and adjustment module*" (optional)
 - Ex-specific "*Safety instructions*" (with Ex versions)
 - if necessary, further certificates

Constituent parts

The following illustration shows the components of DPT-10:

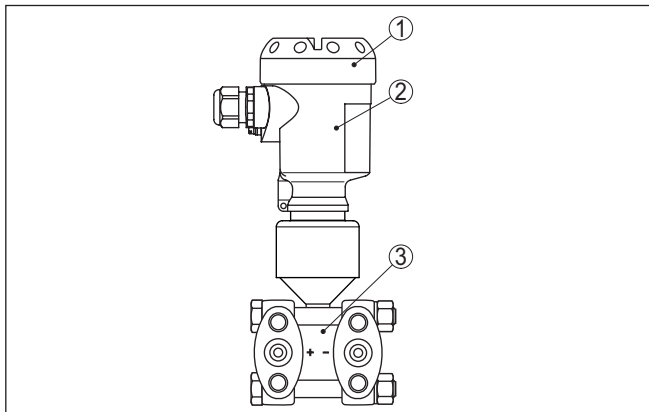


Fig. 1: DPT-10 in basic version

- 1 Housing cover, optionally with integrated display and adjustment module
- 2 Housing with electronics
- 3 Process component with measuring cell

The components are available in different versions.

The nameplate contains the most important data for identification and use of the instrument:

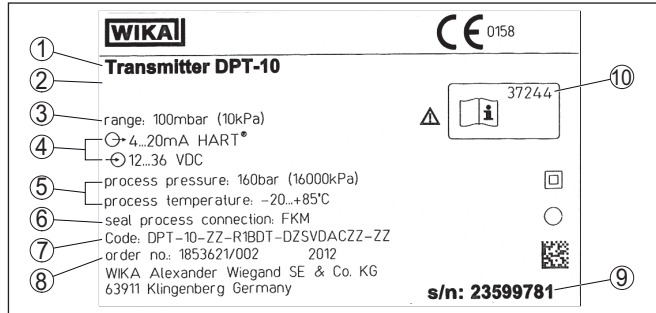


Fig. 2: Layout of the type label (example)

- 1 Instrument type
- 2 Field for approvals
- 3 Measuring range
- 4 Signal output/Supply voltage
- 5 Process pressure - Process temperature
- 6 Seal material
- 7 Product code
- 8 Order number
- 9 Serial number of the instrument
- 10 ID numbers, instrument documentation

3.2 Principle of operation

Application area

DPT-10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface. Measured products are gases, vapours and liquids.

Flow measurement

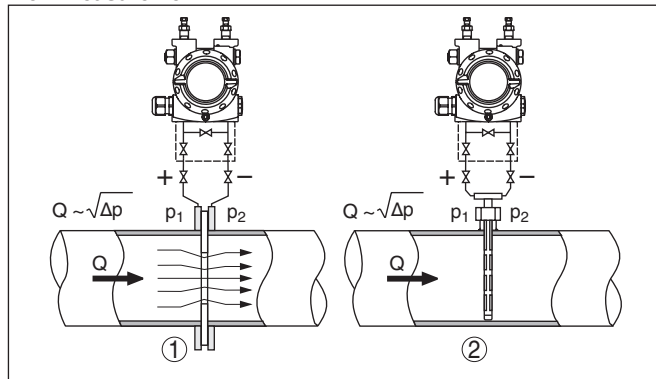


Fig. 3: Flow measurement with DPT-10 and DP flow element, Q = flow, Δp = differential pressure, $\Delta p = p_1 - p_2$

- 1 Orifice
- 2 Pitot tube

Level measurement

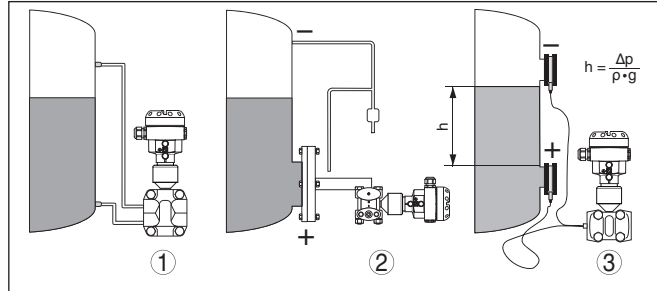


Fig. 4: Level measurement with DPT-10. Δp = differential pressure, ρ = density of the medium, g = acceleration of gravity

- 1 Basic version with effective pressure lines
- 2 Version with flange chemical seal
- 3 Version with capillaries and cell chemical seals

Differential pressure measurement

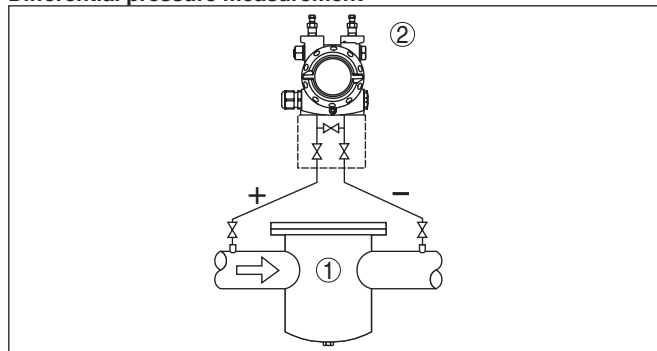


Fig. 5: Differential pressure measurement with DPT-10

- 1 Filter
- 2 DPT-10

Density measurement

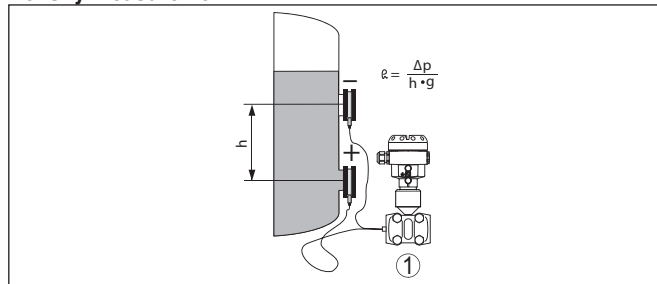


Fig. 6: Density measurement with DPT-10, h = defined mounting distance, Δp = differential pressure, ρ = density of the medium, g = acceleration of gravity

- 1 DPT-10

Interface measurement

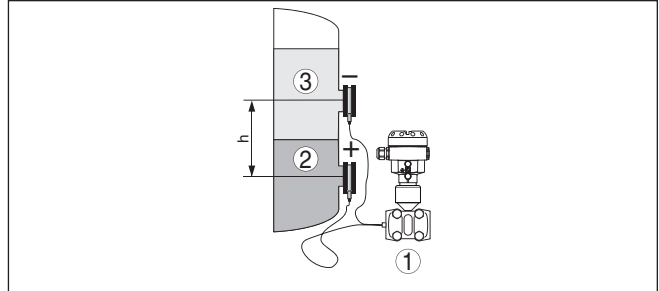


Fig. 7: Interface measurement with DPT-10

- 1 DPT-10
- 2 Liquid with higher density
- 3 Liquid with lower density

Functional principle

A metallic measuring cell is used as sensor element. The process pressures are transmitted via the separating diaphragms and filling oils to a resistance measuring bridge (semi-conductor technology).

The difference between the acting pressures generates a change in the bridge voltage. This change is measured, further processed and converted into a corresponding output signal.

The markings "+" and "-" on the process component in chapter "Mounting and connection instructions" must therefore be noted when connecting to the process. The pressure acting on "+" goes positive, the pressure acting on "-" goes negative into the calculation of the pressure difference.

The configuration of the measuring cells differs depending on the measuring range:

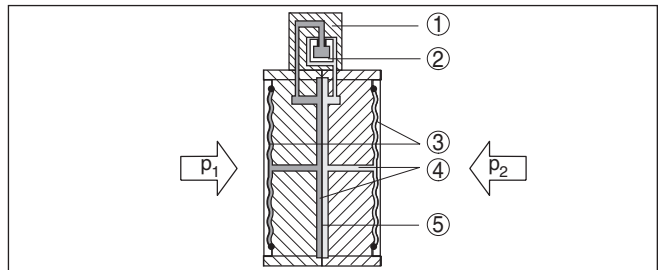


Fig. 8: Metallic measuring cell 10 mbar and 30 mbar - p_1 and p_2 process pressures

- 1 Measuring element
- 2 Silicone diaphragm
- 3 Separating diaphragm
- 4 Filling oil
- 5 Integrated overvoltage arrester

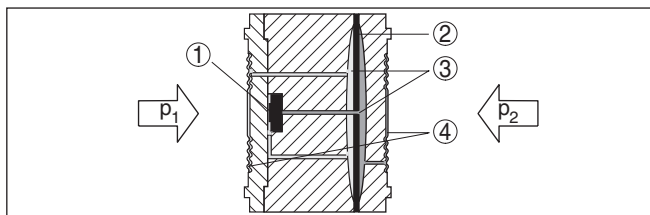


Fig. 9: Metallic measuring cell from 100 mbar - p_1 and p_2 process pressures

- 1 Measuring element
- 2 Overload diaphragm/Middle diaphragm
- 3 Filling oil
- 4 Separating diaphragm

Voltage supply

4 ... 20 mA/HART two-wire electronics for voltage supply and measured value transmission on the same cable.

The supply voltage range can differ depending on the instrument version.

The data for power supply are specified in chapter "Technical data".

The optional background lighting of the display and adjustment module is powered by the sensor. A certain level of operating voltage is required for this. You can find the exact voltage specifications in chapter "Technical data".

3.3 Adjustment

The instrument can be adjusted with the following adjustment media:

- With the display and adjustment module
- the suitable WIKA DTM in conjunction with an adjustment software according to the FDT/DTM standard, e.g. PACTware and PC
- with manufacturer-specific adjustment programs AMS™ or PDM
- With a HART handheld

The entered parameters are generally saved in DPT-10, optionally also in the display and adjustment module or in PACTware.

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.



Caution:

Instruments for oxygen applications are sealed in PE foil and provided with a label "Oxygen! Use no Oil". Remove this foil just before mounting the instrument! See instruction under "Mounting".

| | |
|--|---|
| Transport | Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device. |
| Transport inspection | The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with. |
| Storage | <p>Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.</p> <p>Unless otherwise indicated, the packages must be stored only under the following conditions:</p> <ul style="list-style-type: none">● Not in the open● Dry and dust free● Not exposed to corrosive media● Protected against solar radiation● Avoiding mechanical shock and vibration |
| Storage and transport temperature | <ul style="list-style-type: none">● Storage and transport temperature see chapter "<i>Supplement - Technical data - Ambient conditions</i>"● Relative humidity 20 ... 85 % |

4 Mounting

4.1 General instructions to use the instrument

Suitability for the process conditions

Make sure that all parts of the instrument coming in direct contact with the process, especially the sensor element, process seal and process fitting, are suitable for the existing process conditions, such as process pressure, process temperature as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" and on the nameplate.

Moisture

Use the recommended cables (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give the instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

Ventilation

The ventilation for the electronics housing is realised via a filter element in the vicinity of the cable glands.

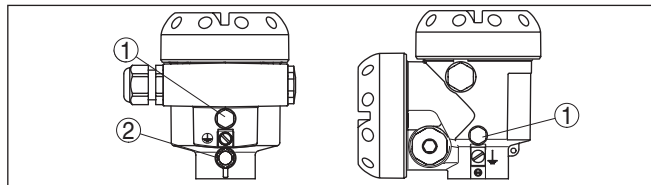


Fig. 10: Position of the filter element with single and double chamber housing

- 1 Filter element for ventilation of the electronics housing
- 2 Blind plug



Information:

Make sure that the filter element is always free of buildup during operation. A high-pressure cleaner may not be used for cleaning.

Effective pressure transmitter

DP flow elements are calculated for certain pipeline and operating data. Therefore, check the pipeline data before installation at the measuring point and compare the measurement loop number.

Detailed instructions for mounting the DP flow element are stated in DIN EN ISO 5167 as well as in the instrument documentation from the respective manufacturer.

Effective pressure lines

You will find general recommendations for the installation of effective pressure lines in the corresponding national or international standards. When installing effective pressure lines outdoors, consider applying suitable anti-freeze protection, e.g. tube heating. Install effective pressure lines with a monotonic downward slope of at least 10 %.

Vibrations

In case of strong vibrations at the application position, the instrument version with external electronics should be used.

Temperature limits

Higher process temperatures often mean also higher ambient temperatures for electronics and connection cable. Make sure that the upper temperature limits stated in chapter "*Technical data*" for the environment of the electronics housing and connection cable are not exceeded.

Oxygen applications

4.2 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 instruments 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, see chapter "*Technical data*"



Danger:

Instruments for oxygen applications must be unpacked just before mounting. After removing the protective cover of the process fitting, the label " O_2 " will be visible on the process fitting. Penetration of oil, grease and dirt should be avoided. Danger of explosion!

Connection plus/minus side

4.3 Mounting and connection instructions

When connecting the DPT-10 to the measurement loop, take note of the plus/minus side of the process component. The plus side is marked with a "+", the minus side with a "-" on the process component next to the oval flanges.

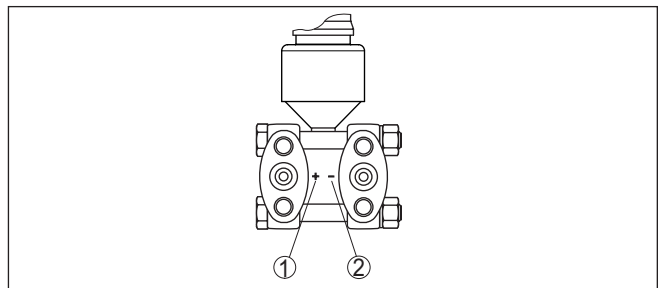


Fig. 11: Marking for plus/minus side on the process component

- 1 Plus side
- 2 Minus side

Mounting arrangement

The following illustration shows the elements for a tube mounting and an example for a mounting arrangement with valve block.

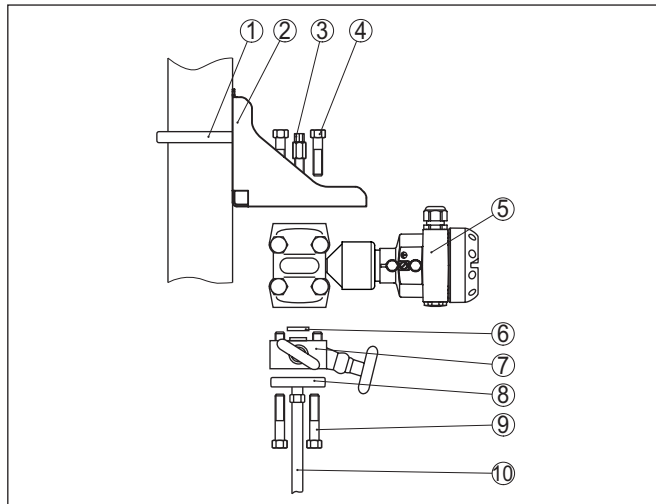


Fig. 12: Mounting arrangement with tube mounting

- 1 Strap for tube mounting
- 2 Mounting bracket
- 3 Ventilation valve
- 4 Fixing screws
- 5 DPT-10
- 6 PTFE seal
- 7 Valve block
- 8 Oval flange adapter
- 9 Fixing screws
- 10 Effective pressure line

Valve blocks

Valve blocks enable the simple installation and setup of the differential pressure transmitter. They separate the pressure transmitter from the process side and enable also a check of the measurement loop. They are available as 3-fold and 5-fold version. The integrated equalization valve enables a pressure compensation between plus and minus side during the setup. Thanks to the valve block it is possible to dismount the DPT-10 without interrupting the process. This means higher plant availability and simpler setup or maintenance.

The 3-fold valve block with flanging on both sides enables a mechanically stable connection between the DPT-10 and e.g. the tapping points or the flange plate of a pitot tube. With the five-fold valve block, two additional valves allow blowing out the process lines or checking the DPT-10 in installed condition.

Connect 3-fold valve block

The following illustration shows the connection of the 3-fold valve block.

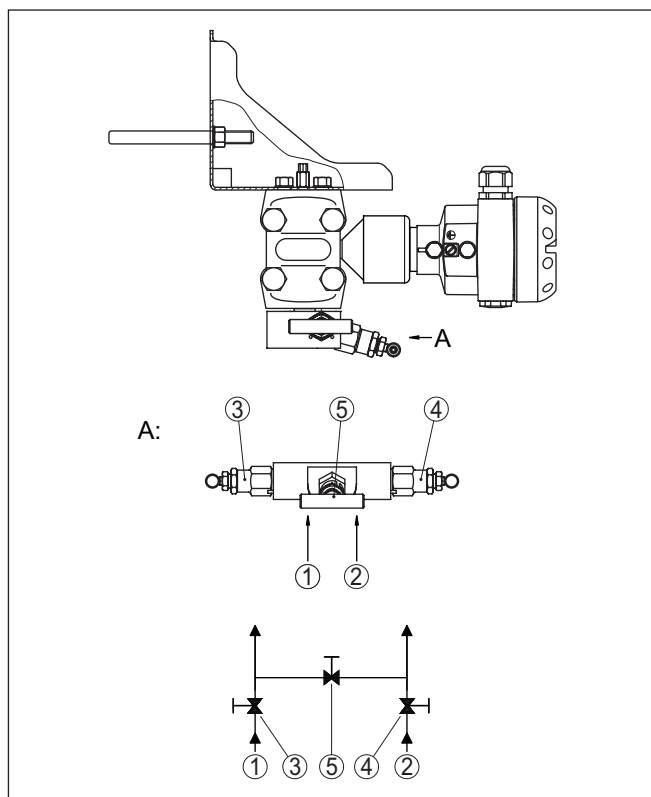


Fig. 13: Connection of a 3-fold valve block

- 1 Process fitting
- 2 Process fitting
- 3 Inlet valve
- 4 Inlet valve
- 5 Breather valve

3-fold valve block, flanging on both sides

The following illustration shows the connection of the 3-fold valve block, flanging on both sides.

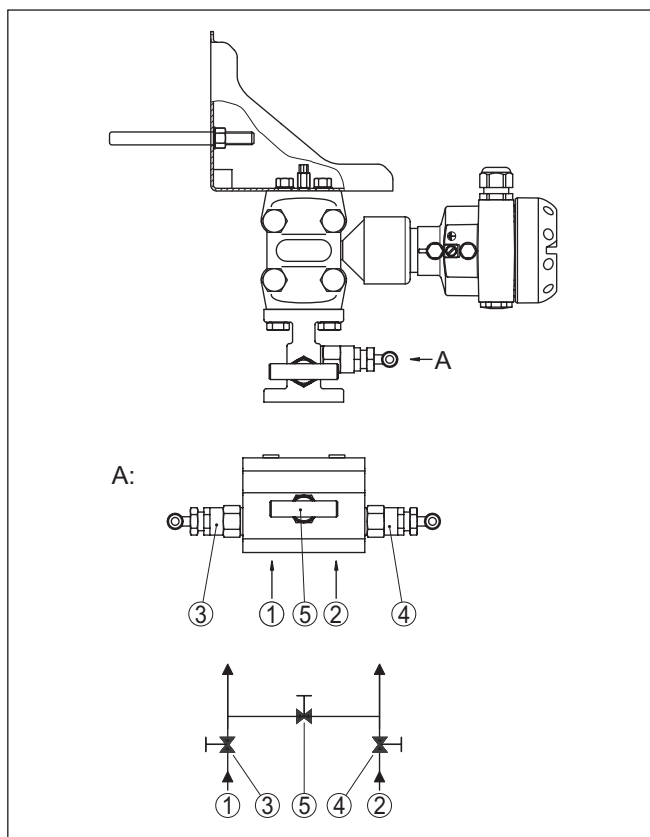


Fig. 14: Connection of a 3-fold valve block, flanging on both sides

- 1 Process fitting
- 2 Process fitting
- 3 Inlet valve
- 4 Inlet valve
- 5 Breather valve

5-fold valve block

The following illustration shows the connection of the 5-fold valve block.

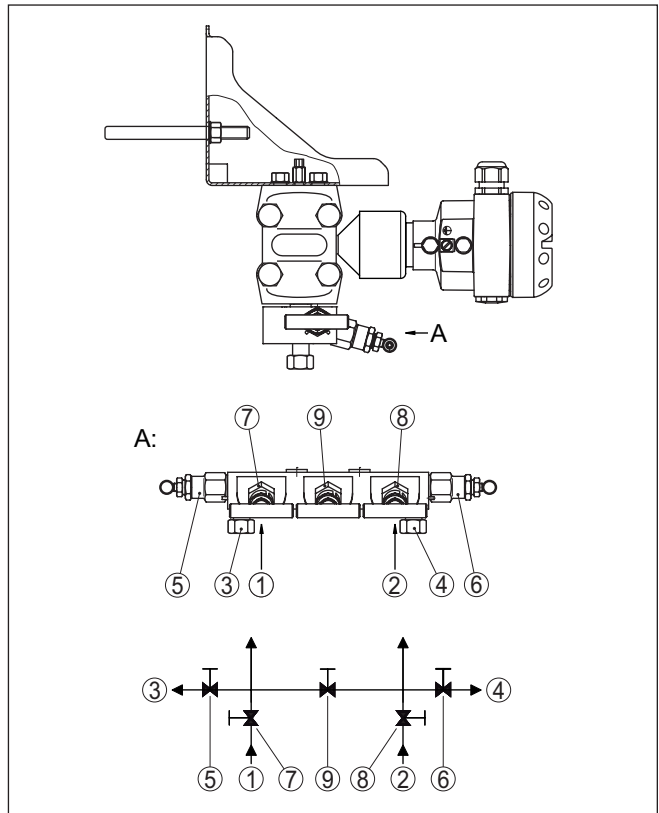


Fig. 15: Connection of a 5-fold valve block

- 1 Process fitting
- 2 Process fitting
- 3 Check/Ventilate
- 4 Check/Ventilate
- 5 Valve for checking/ventilating
- 6 Valve for checking/ventilating
- 7 Inlet valve
- 8 Inlet valve
- 9 Breather valve

4.4 Measurement setup flow

In gases

→ Mount DPT-10 above the measurement loop so that condensate can drain off in the process cable.

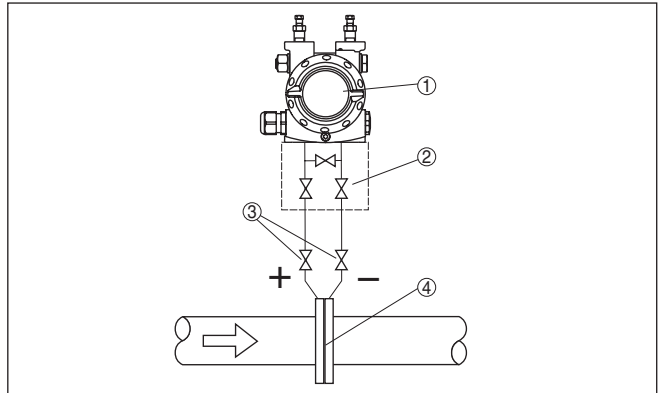


Fig. 16: Measurement setup with flow measurement of gases, connection via 3-fold valve block

- 1 DPT-10
- 2 3-fold valve block
- 3 Blocking valves
- 4 Orifice or impact pressure probe

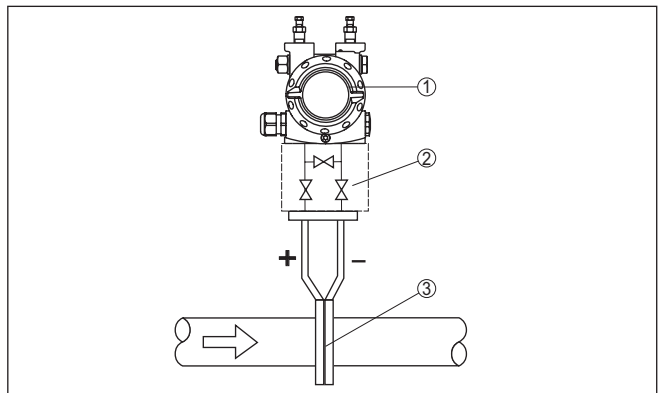


Fig. 17: Measurement setup with flow measurement of gases, connection via 3-fold valve block, flanging on both sides

- 1 DPT-10
- 2 3-fold valve block, flanging on both sides
- 3 Orifice or impact pressure probe

In vapours

1. Mount DPT-10 below the measurement loop
2. Mount condensate vessels at the same height with the discharge socket and at the same distance to DPT-10
3. Fill the effective pressure lines to the height of the condensate vessels before setup

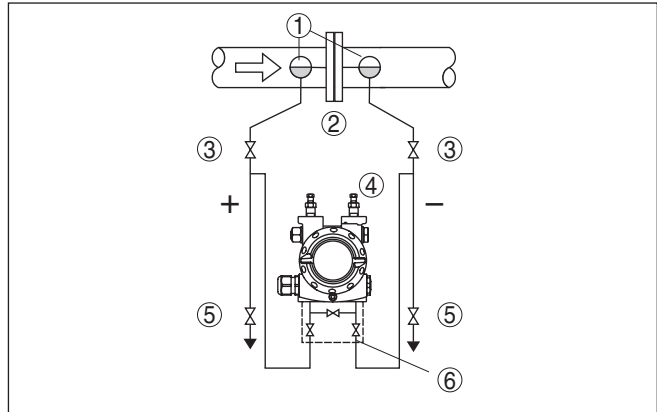


Fig. 18: Measurement setup, flow measurement in vapours

- 1 Condensate vessels
- 2 Orifice or impact pressure probe
- 3 Blocking valves
- 4 DPT-10
- 5 Drain or blow-off valves
- 6 3-fold valve block

When using a 5-fold valve block, the drain or blow-off valves are already integrated.

In liquids

1. Mount DPT-10 below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line
2. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.
3. Fill the effective pressure lines to the height of the condensate vessels before setup

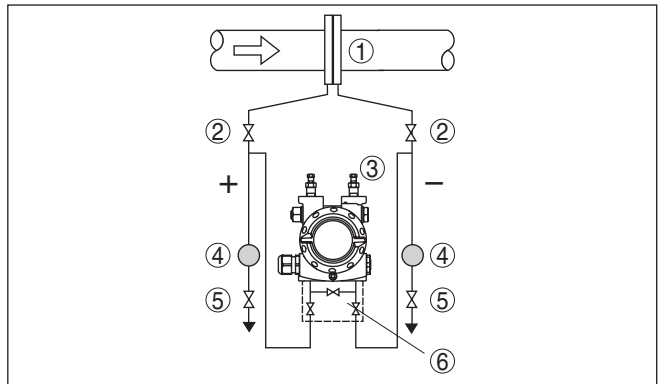


Fig. 19: Measurement setup, flow measurement in liquids

- 1 Orifice or impact pressure probe
- 2 Blocking valves
- 3 DPT-10
- 4 Precipitator
- 5 Drain valves
- 6 3-fold valve block

4.5 Measurement setup level

In open vessels with effective pressure line

1. Mount DPT-10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
2. Minus side is open to the atmospheric pressure
3. When measuring liquids with solid content, the mounting of separators and drain valves is useful to be able to avoid and remove buildup.

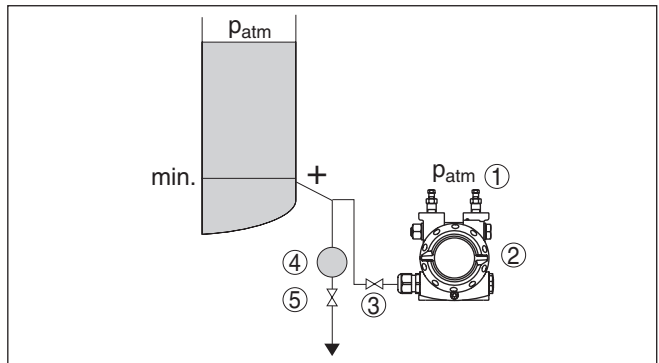


Fig. 20: Measurement setup, level measurement in the open vessel

- 1 DPT-10
- 2 Minus side is open to the atmospheric pressure
- 3 Blocking valve
- 4 Precipitator
- 5 Drain valve

In open vessels with single chemical seal

1. Mount DPT-10 directly to the vessel
2. Minus side is open to the atmospheric pressure

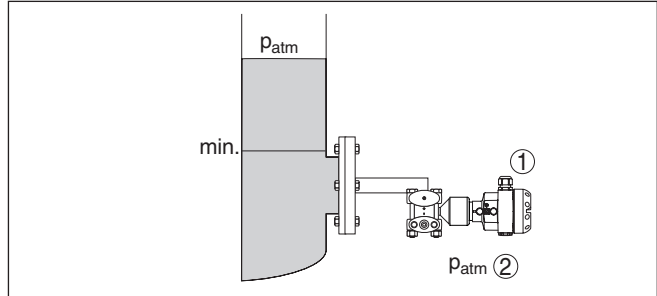


Fig. 21: Measurement setup, level measurement in the open vessel

- 1 DPT-10
- 2 Minus side is open to the atmospheric pressure

In closed vessels with effective pressure lines

1. Mount DPT-10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
2. Connect minus side always above the max. level
3. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

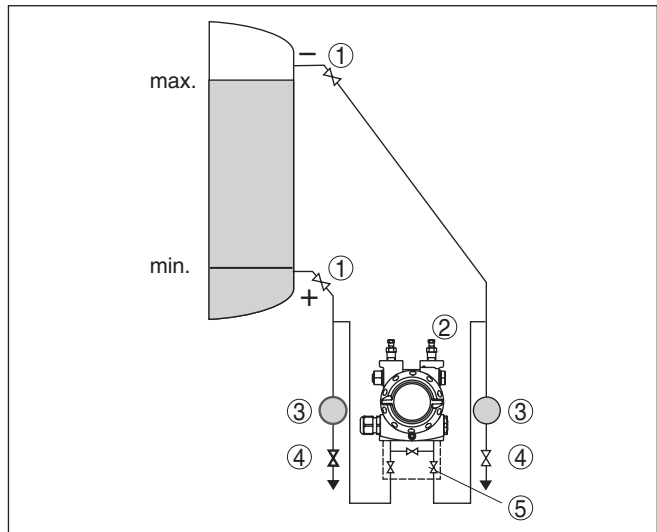


Fig. 22: Measurement setup, level measurement in closed vessel

- 1 Blocking valves
- 2 DPT-10
- 3 Precipitator
- 4 Drain valves
- 5 3-fold valve block

In closed vessels with single chemical seal

1. Mount DPT-10 directly to the vessel
2. Connect minus side always above the max. level
3. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

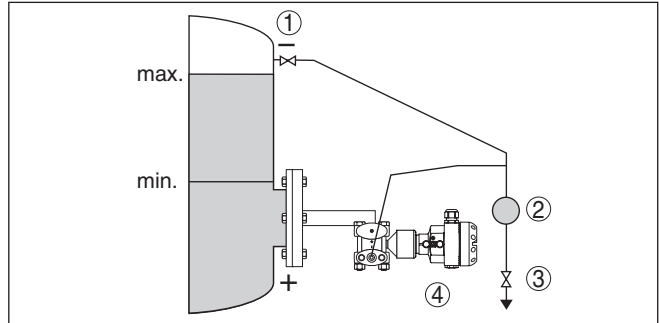


Fig. 23: Measurement setup, level measurement in closed vessel

- 1 Blocking valve
- 2 Precipitator
- 3 Drain valve
- 4 DPT-10

In closed vessels with double chemical seal

1. Mount DPT-10 below the lower chemical seal
2. The ambient temperature should be the same for both capillaries



Information:

Level measurement is only ensured between the upper edge of the lower and the lower edge of the upper chemical seal.

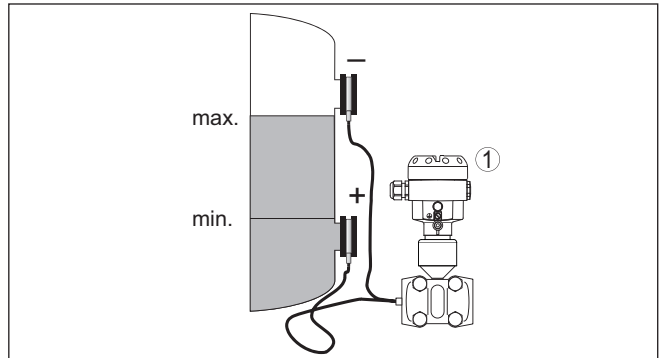


Fig. 24: Measurement setup, level measurement in closed vessel

- 1 DPT-10

In closed vessels with steam layering with effective pressure line

1. Mount DPT-10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
2. Connect minus side always above the max. level

3. The condensate vessel ensures a constant pressure on the minus side
4. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

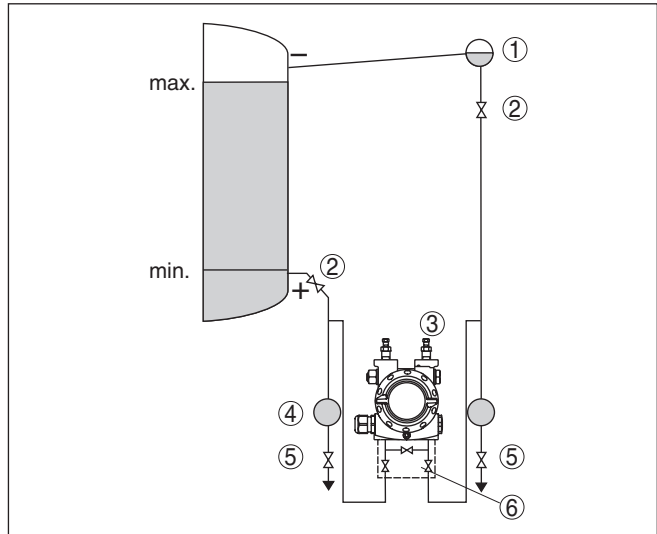


Fig. 25: Measurement setup in closed vessel with superimposed steam

- 1 Condensate vessel
- 2 Blocking valves
- 3 DPT-10
- 4 Precipitator
- 5 Drain valves
- 6 3-fold valve block

In closed vessels with superimposed steam with single chemical seal

1. Mount DPT-10 directly to the vessel
2. Connect minus side always above the max. level
3. The condensate vessel ensures a constant pressure on the minus side
4. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

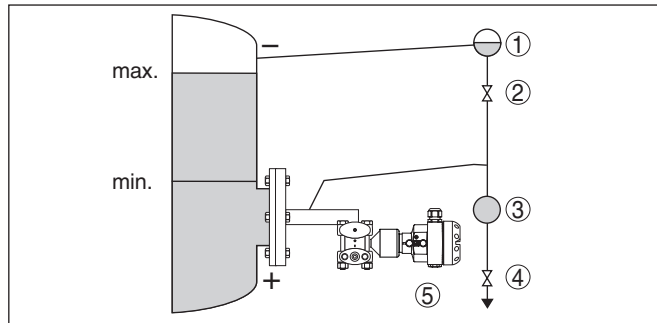


Fig. 26: Measurement setup in closed vessel with superimposed steam

- 1 Condensate vessel
- 2 Blocking valve
- 3 Precipitator
- 4 Drain valve
- 5 DPT-10

4.6 Measurement setup density and interface

Density measurement

In a vessel with varying level and homogeneous density distribution, density measurement with a differential pressure transmitter can be realized. The connection to the vessel is made via a chemical seal on two measuring points. To reach a high accuracy, the distance between these points must be as big as possible. The density measurement is only ensured with a level above the upper measuring point. If the level drops below the upper measuring point, the density measurement is interrupted.

This density measurement functions with open but also with closed vessels. Make sure that small density changes cause only small changes to the measured differential pressure. Select a suitable measuring range.

The density measurement is carried out in the mode level measurement.

1. Mount DPT-10 below the lower chemical seal
2. The ambient temperature should be the same for both capillaries

Example for a density measurement:

Distance between the two measurement points: 0.3 m

Min. density: 1000 kg/m³

Max. density: 1200 kg/m³

Measured differential pressure: $\Delta p = \rho \cdot g \cdot h$

The min. adjustment is carried out for the differential pressure measured at density 1.0:

$$\begin{aligned}\Delta p &= \rho \cdot g \cdot h \\ &= 1000 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0,3 \text{ m} \\ &= 2943 \text{ Pa} = 29.43 \text{ mbar}\end{aligned}$$

The max. adjustment is carried out for the differential pressure measured at density 1.2:

$$\begin{aligned}\Delta p &= \rho \cdot g \cdot h \\ &= 1200 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \\ &= 3531 \text{ Pa} = 35.31 \text{ mbar}\end{aligned}$$

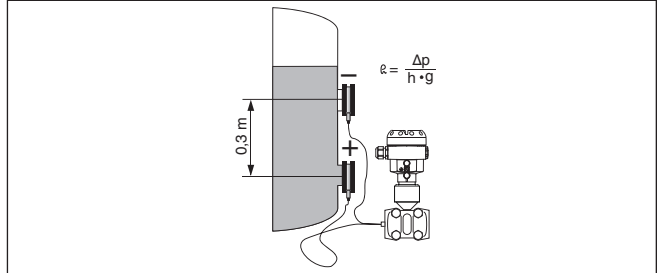


Fig. 27: Measurement setup with density measurement

Interface measurement

In a vessel with varying level, an interface measurement with a differential pressure transmitter can be realized. The connection on the vessel is carried out via a chemical seal on two measuring points. An interface measurement is only possible if the densities of the two products remain the same and the interface is always between the two measuring points. The total level must always be above the upper measuring point.

This density measurement functions with open but also with closed vessel.

Example for an interface measurement:

Distance between the two measurement points: 0.3 m

Min. density: 800 kg/m³

Max. density: 1000 kg/m³

The min. adjustment is carried out for the differential pressure occurring with density 0.8:

$$\begin{aligned}\Delta p &= \rho \cdot g \cdot h \\ &= 800 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \\ &= 2354 \text{ Pa} = 23.54 \text{ mbar}\end{aligned}$$

The max. adjustment is carried out for the differential pressure occurring with density 1.0:

$$\begin{aligned}\Delta p &= \rho \cdot g \cdot h \\ &= 1000 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \\ &= 2943 \text{ Pa} = 29.43 \text{ mbar}\end{aligned}$$

3. Mount DPT-10 below the lower chemical seal
4. The ambient temperature should be the same for both capillaries

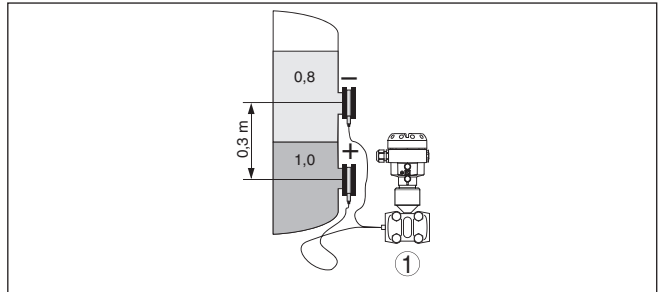


Fig. 28: Measurement setup with interface measurement

4.7 Measurement setup differential pressure

In gases and vapours

→ Mount DPT-10 above the measurement loop so that condensate can drain off in the process cable.

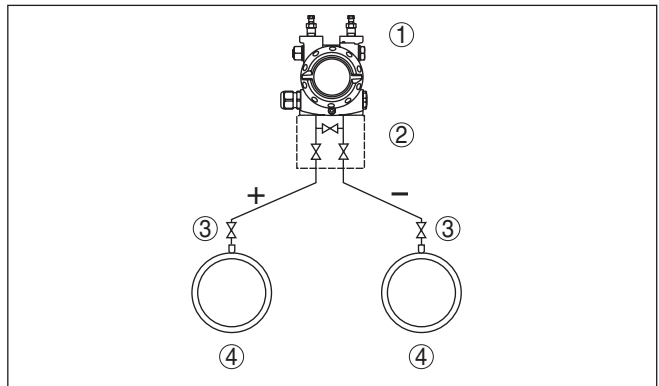


Fig. 29: Measurement setup with differential pressure measurement between two pipelines in gases and vapours

- 1 DPT-10
- 2 3-fold valve block
- 3 Blocking valves
- 4 Pipelines

In vapour and condensate plants

→ Mount DPT-10 below the measurement loop so that some condensate can collect in the effective pressure lines.

The ventilation is carried out via the ventilation valves on the instrument, the 5-fold valve block enables blowing out the cables.

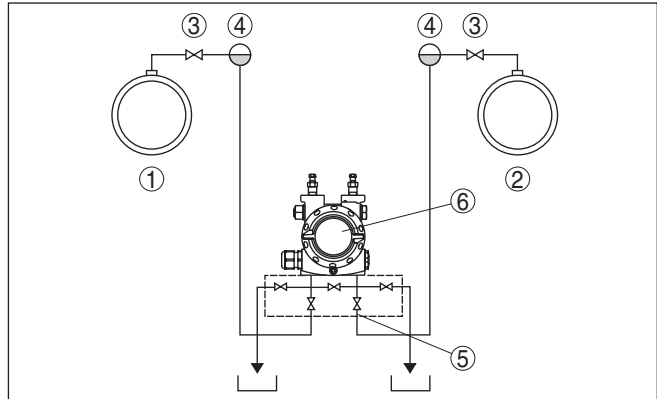


Fig. 30: Measurement setup with differential pressure measurement between a vapour and a condensate cable

- 1 Vapour cable
- 2 Condensate cable
- 3 Blocking valves
- 4 Condensate vessels
- 5 5-fold valve block
- 6 DPT-10

In liquids

1. Mount DPT-10 below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line
2. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

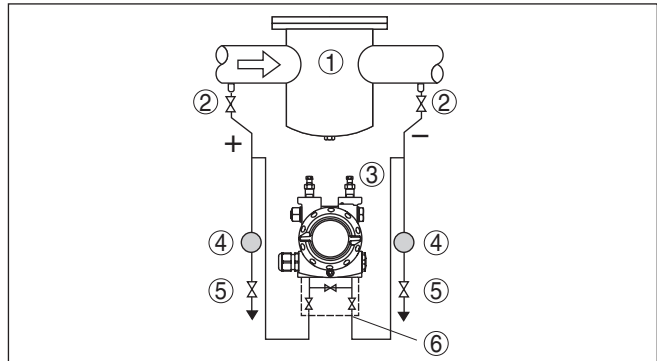


Fig. 31: Measurement setup, flow measurement in liquids

- 1 E.g. filter
- 2 Blocking valves
- 3 DPT-10
- 4 Precipitator
- 5 Drain valves
- 6 3-fold valve block

When chemical seal systems are used in all products

1. Mount chemical seal with capillaries on top or laterally on the pipeline
2. In vacuum applications: Mount DPT-10 below the measurement loop
3. The ambient temperature should be the same for both capillaries

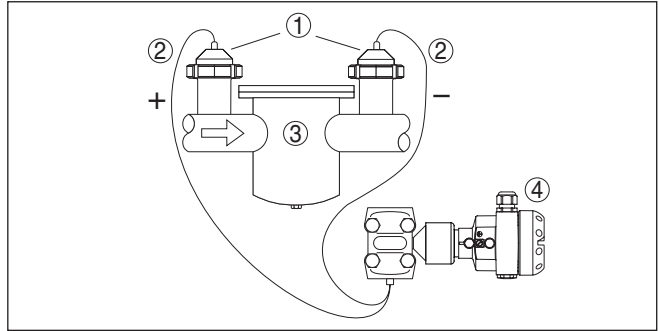


Fig. 32: Measurement setup, differential pressure measurement in gases, vapours and liquids

- 1 Chemical seal with bolting
- 2 Capillaries
- 3 E.g. filter
- 4 DPT-10

4.8 Mounting external housing

1. Mark the holes according to the following drilling template
2. Depending on the mounting surface, fasten the wall mounting plate with 4 screws

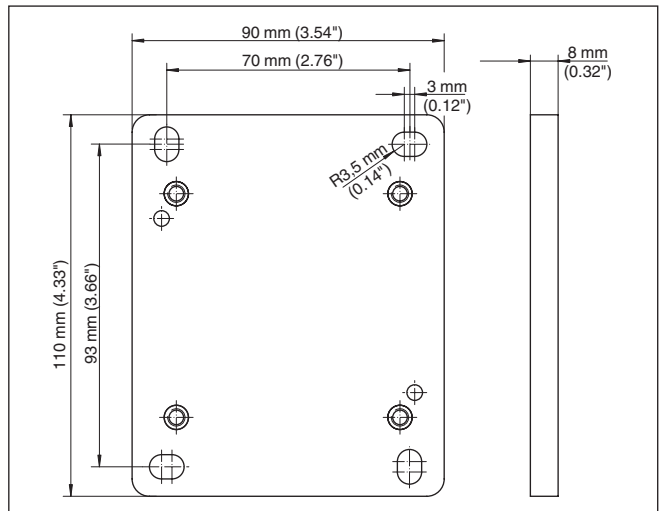


Fig. 33: Drilling template - wall mounting plate

Mount the wall mounting plate so that the cable entry of the socket housing points downward. The socket housing can be displaced by 180° to the wall mounting plate.

4.9 Installation control

Check the following after mounting the instrument:

- Did you tighten all screws?
- Closing screws and ventilation valves closed

5 Connecting to power supply

5.1 Preparing the connection

Safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, overvoltage arresters should be installed



In hazardous areas you must take note of the respective regulations, conformity and type approval certificates of the sensors and power supply units.

Voltage supply

Power supply and current signal are carried on the same two-wire cable. The voltage supply range can differ depending on the instrument version.

The data for power supply are specified in chapter "*Technical data*".

Provide a reliable separation between the supply circuit and the mains circuits according to DIN EN 61140 VDE 0140-1.

Keep in mind the following additional factors that influence the operating voltage:

- Output voltage of the power supply unit can be lower under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault message)
- Influence of additional instruments in the circuit (see load values in chapter "*Technical data*")

Connection cable

The instrument is connected with standard two-wire cable without screen. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used.

Use cable with round cross-section. A cable outer diameter of 5 ... 9 mm (0.2 ... 0.35 in) ensures the seal effect of the cable gland. If you are using cable with a different diameter or cross-section, exchange the seal or use a suitable cable gland.

We generally recommend the use of screened cable for HART multi-drop mode.

Cable gland ½ NPT

On the instrument with cable entry ½ NPT and plastic housing there is a metallic ½" threaded insert moulded into the plastic housing.



Caution:

No grease should be used when screwing the NPT cable gland or steel tube into the threaded insert. Standard grease can contain additives that corrode the connection between threaded insert and housing. This would influence the stability of the connection and the tightness of the housing.

Cable screening and grounding

If screened cable is necessary, connect the cable screen on one or both ends to ground potential depending on the plant installation. In the sensor, the screen must be connected directly to the internal

ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the processing side must be made via a ceramic capacitor (e. g. 1 nF, 1500 V). The low-frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.



Warning:

Considerable potential differences exist inside galvanic plants as well as vessels with cathodic corrosion protection. Very large equalisation currents can flow through the cable screen when the screen is grounded on both ends. To avoid this, the cable screen must be connected to ground potential only on one end (inside the switching cabinet) in such applications. The cable screen must **not** be connected to the internal ground terminal in the sensor and the outer ground terminal on the housing **not** to potential equalisation!



Information:

The metallic parts of the instrument (antenna, transmitter, concentric tube, etc.) are conductively connected with the inner and outer ground terminal on the housing. This connection exists either as a direct metallic contact or via the shielding of the special connection cable on instruments with external electronics. You can find specifications on the potential connections within the instrument in chapter "Technical data".



Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

Single/Double chamber housing

5.2 Connection procedure

Proceed as follows:

1. Unscrew the housing cover
2. If a display and adjustment module is installed, remove it by turning it to the left.
3. Loosen compression nut of the cable entry
4. Remove approx. 10 cm of the cable mantle, strip approx. 1 cm insulation from the individual wires
5. Insert the cable into the sensor through the cable entry
6. Lift the opening levers of the terminals with a screwdriver (see following illustration)
7. Insert the wire ends into the open terminals according to the wiring plan
8. Press down the opening levers of the terminals, you will hear the terminal spring closing
9. Check the hold of the wires in the terminals by lightly pulling on them

10. Connect the screen to the internal ground terminal, connect the outer ground terminal to potential equalisation
 11. Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable
 12. Screw the housing cover back on
- The electrical connection is hence finished.

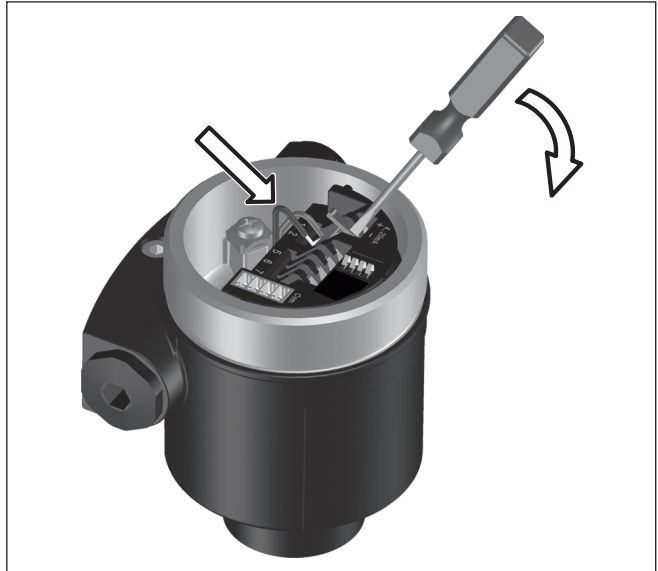


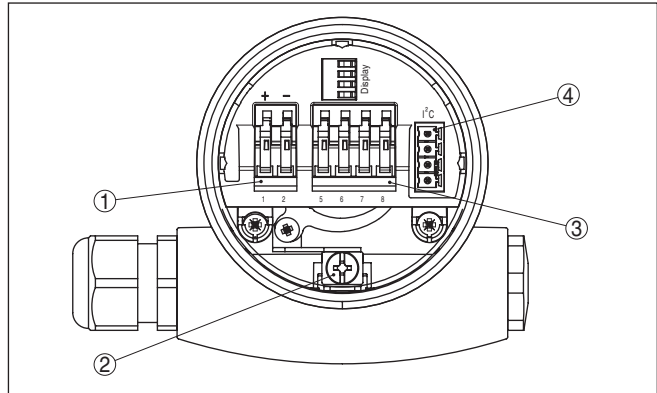
Fig. 34: Connection steps 6 and 7

5.3 Single chamber housing



The following illustrations apply to the non-Ex as well as to the Ex-ia version.

Electronics and connection compartment



- 1 Spring-loaded terminals for voltage supply
- 2 Ground terminal for connection of the cable screen
- 3 Spring-loaded terminals for connection of the external display and adjustment unit
- 4 Plug connector for service interface

Wiring plan

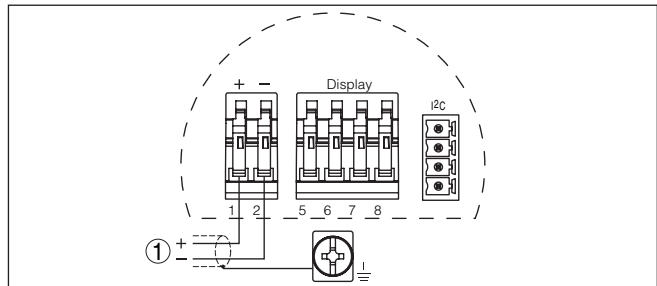


Fig. 36: Wiring plan, single chamber housing

- 1 Voltage supply, signal output

5.4 Double chamber housing



The following illustration apply to non-Ex as well as Ex ia versions. The Exd version is described in the next subchapter.

Electronics compartment

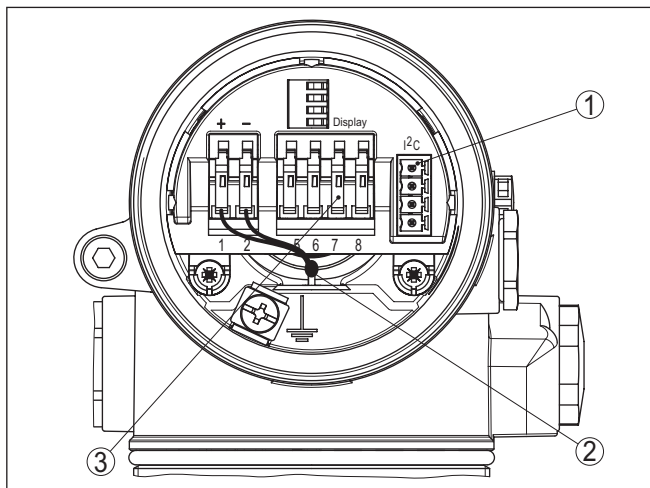


Fig. 37: Electronics compartment, double chamber housing

- 1 Plug connector for service interface
- 2 Internal connection cable to the connection compartment
- 3 Terminals for the external display and adjustment unit

Connection compartment

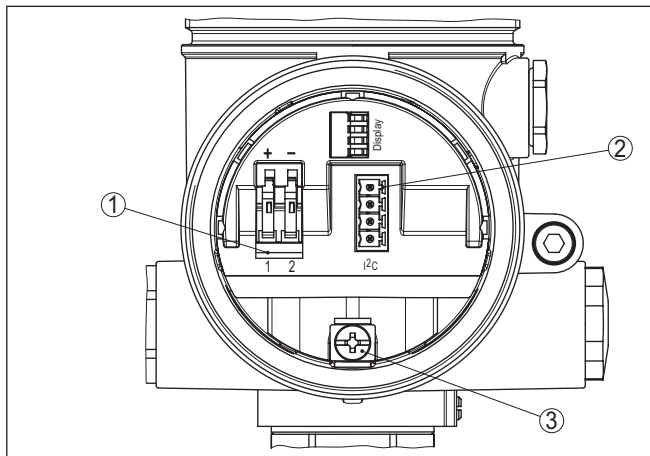


Fig. 38: Connection compartment, double chamber housing

- 1 Spring-loaded terminals for voltage supply
- 2 Plug connector for service interface
- 3 Ground terminal for connection of the cable screen

Wiring plan

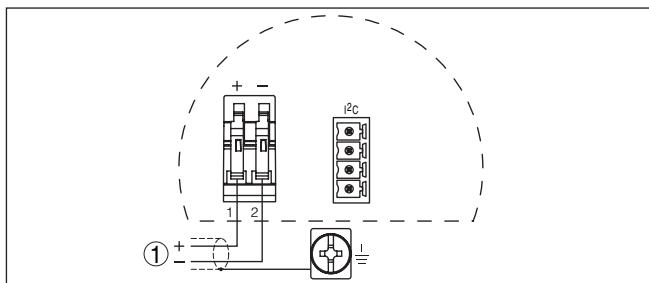


Fig. 39: Wiring plan, double chamber housing

1 Voltage supply, signal output

Plug M12 x 1 for external display and adjustment unit

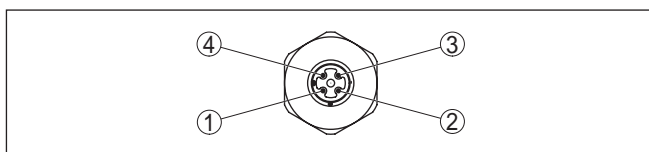


Fig. 40: Top view of the plug connector

- 1 Pin 1
- 2 Pin 2
- 3 Pin 3
- 4 Pin 4

| Contact pin | Colour connection cable in the sensor | Terminal, electronics module |
|-------------|---------------------------------------|------------------------------|
| Pin 1 | Brown | 5 |
| Pin 2 | White | 6 |
| Pin 3 | Blue | 7 |
| Pin 4 | Black | 8 |

5.5 Double chamber housing Ex d

Electronics compartment

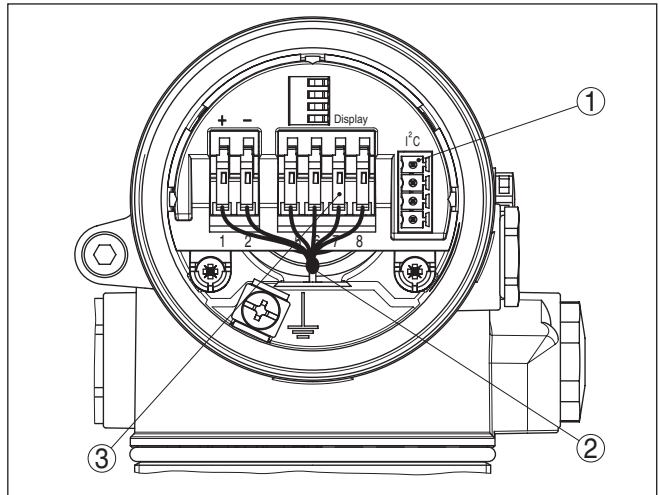


Fig. 41: Electronics compartment, double chamber housing

- 1 Plug connector for service
- 2 Internal connection cable to the connection compartment
- 3 Terminals for the external display and adjustment unit

Connection compartment

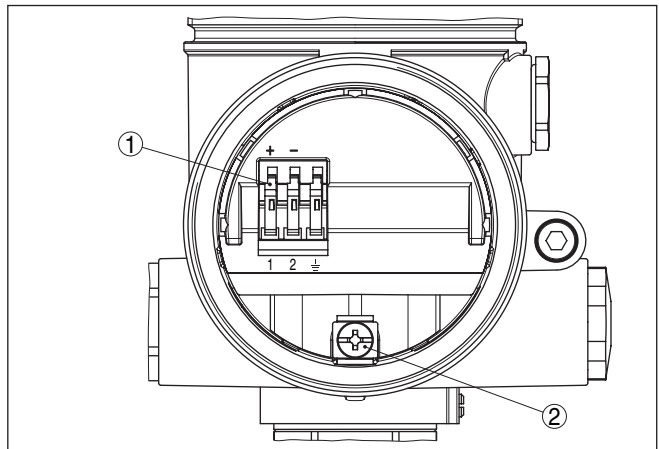


Fig. 42: Connection compartment, Ex-d double chamber housing

- 1 Spring-loaded terminals for power supply and cable screen
- 2 Ground terminal for connection of the cable screen

Wiring plan

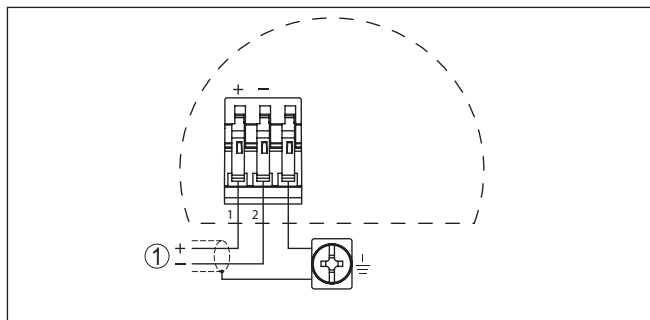


Fig. 43: Wiring plan, Ex-d double chamber housing

1 Voltage supply, signal output

Plug M12 x 1 for external display and adjustment unit

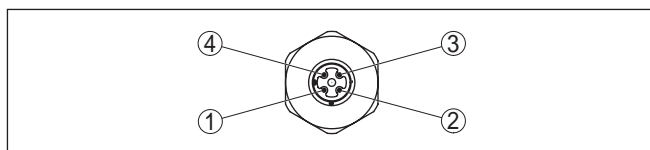


Fig. 44: Top view of the plug connector

- 1 Pin 1
- 2 Pin 2
- 3 Pin 3
- 4 Pin 4

| Contact pin | Colour connection cable in the sensor | Terminal, electronics module |
|-------------|---------------------------------------|------------------------------|
| Pin 1 | Brown | 5 |
| Pin 2 | White | 6 |
| Pin 3 | Blue | 7 |
| Pin 4 | Black | 8 |

5.6 Version IP 66/IP 68, 1 bar

Wire assignment, connection cable

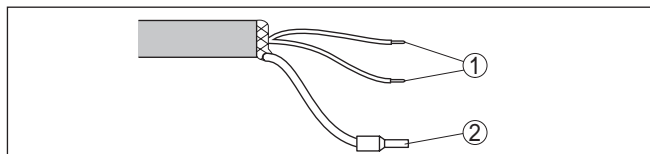


Fig. 45: Wire assignment, connection cable

- 1 brown (+) and blue (-) to power supply or to the processing system
- 2 Shielding

5.7 Switch-on phase

Switch-on phase

After connecting DPT-10 to power supply or after a voltage recurrence, the instrument carries out a self-check for approx. 30 seconds:

- Internal check of the electronics
- Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
- Output signal jumps for approx. 15 seconds to the set fault current

Then the corresponding current is outputted to the cable (the value corresponds to the actual level as well as the settings already carried out, e.g. factory setting).

6 Adjustment with the display and adjustment module

6.1 Short description

Function/Configuration

The display and adjustment module is used for measured value display, adjustment and diagnosis. It can be mounted in the following housing versions and instruments:

- All sensors DPT-10 and IPT-1*, in the single as well as double chamber housing (optionally in the electronics or connection compartment)
- External display and adjustment unit



Note:

You can find detailed information on the adjustment in the operating instructions manual "*Display and adjustment module*".

6.2 Insert display and adjustment module

Mount/Dismount display and adjustment module

The display and adjustment module can be inserted and removed at any time. It is not necessary to interrupt the voltage supply.

For installation, proceed as follows:

1. Unscrew the housing cover
2. Place the display and adjustment module in the desired position on the electronics (you can choose any one of four different positions - each displaced by 90°)
3. Press the display and adjustment module onto the electronics and turn it to the right until it snaps in.
4. Screw housing cover with inspection window tightly back on

Removal is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.



Fig. 46: Insert display and adjustment module



Note:

If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher cover with an inspection glass is required.

6.3 Adjustment system

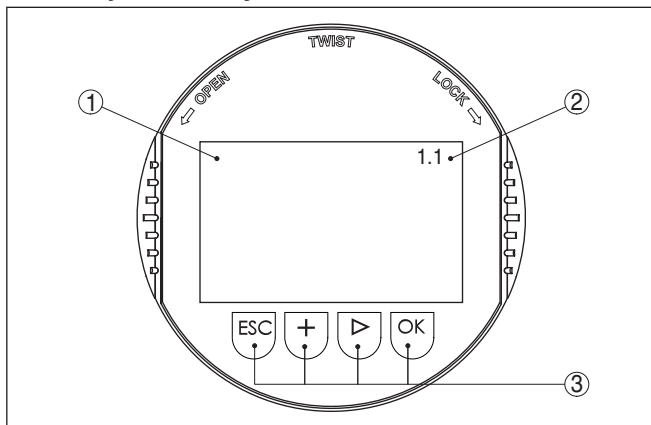


Fig. 47: Display and adjustment elements

- 1 LC display
- 2 Indication of the menu item number
- 3 Adjustment keys

Key functions

- **[OK]** key:
 - Move to the menu overview
 - Confirm selected menu
 - Edit parameter
 - Save value
- **[->]** key to select:
 - Menu change
 - Select list entry
 - Select editing position
- **[+]** key:
 - Change value of the parameter
- **[ESC]** key:
 - Interrupt input
 - Jump to next higher menu

Adjustment system

The sensor is adjusted via the four keys of the display and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. Approx. 10 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with **[OK]** will not be saved.

6.4 Set parameters

Introduction

DPT-10 has general adjustment parameters which are also used for other measuring principles as well as instrument-specific adjustment parameters. The general adjustment parameters are described in the operating instructions manual "*Display and adjustment module*".

The instrument-specific adjustment parameters are described in this chapter.



Information:

If the adjustment limits of the adjustment parameters are exceeded, the message "*Outside parameter limits*" appears. The editing procedure can be aborted with **[ESC]** or the displayed limit value can be accepted with **[OK]**.

Application

The DPT-10 can be used for differential pressure, level, flow as well as density and interface measurement. The selection of the respective application is carried out in the menu item "*Application*". Dependent on the selected application, the adjustment is carried out as zero/span or min./max. adjustment.

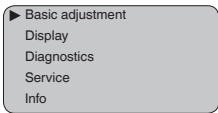


Information:

The applications density and interface measurement are also realized via the application level measurement.

Proceed as follows to switch over to the application differential pressure or flow measurement:

1. Push the **[OK]** button in the measured value display, the menu overview is displayed.



► Basic adjustment
Display
Diagnostics
Service
Info

2. Confirm the menu "*Basic adjustment*" with **[OK]**.



Application

Level ▼

3. Confirm the menu item "*Application*" with **[OK]**.

**Warning:**

Note the warning: "*Output can change*".

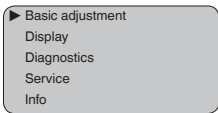
4. Select with **[->]** "*OK*" and confirm with **[OK]**.
5. Select the requested application in the selection list, for example "*Flow*" and confirm with **[OK]**.

Unit of measurement

In this menu item you select the adjustment unit as well as the unit for the temperature indication in the display.

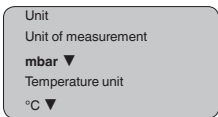
To select the adjustment unit (in the example switching over from mbar to bar), proceed as follows:

1. Push the **[OK]** button in the measured value display, the menu overview is displayed.



► Basic adjustment
Display
Diagnostics
Service
Info

2. Confirm the menu "**Basic adjustment**" with **[OK]**, the menu item "*Unit*" will be displayed.



Unit
Unit of measurement
mbar ▼
Temperature unit
°C ▼

3. Activate the selection with **[OK]** and select "**Units of measurement**" with **[->]**.
4. Activate the selection with **[OK]** and select the requested unit with **[->]** (in the example bar).
5. Confirm with **[OK]** and move to position correction with **[->]**.

The adjustment unit is thus switched over from mbar to bar.

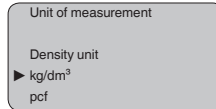
**Information:**

When switching over to adjustment in a height unit (for example for level measurement), the density also has to be entered.

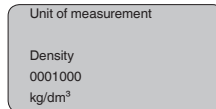
Proceed as follows to enter the density:

1. Push the **[OK]** button in the measured value display, the menu overview is displayed.

2. Confirm the menu "**Basic adjustment**" with [OK], the menu item "**Units of measurement**" will be displayed.
3. Activate the selection with [OK] and select the requested unit with [->] (in the example m).
4. Confirm with [OK], the submenu "**Density unit**" appears.



5. Select the requested unit, e.g. kg/dm³ with [->] and confirm with [OK], the submenu "**Density**" appears.



6. Enter the requested density value with [->] and [+], confirm with [OK] and move to position correction with [->].

The adjustment unit is thus switched over from bar to m.

Proceed as follows to select the temperature unit:

1. Activate the selection with [OK] and select "**Temperature unit**" with [->].
2. Activate the selection with [OK] and select the requested unit with [->] (e.g. °F).
3. Confirm with [OK].

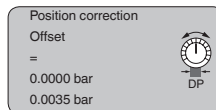
The temperature unit is hence switched over from °C to °F.

Position correction

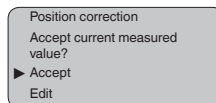
The position correction compensates the influence of the installation position of the instrument on the measured value. In this menu item, the offset value as well as the current measured value are displayed.

Proceed as follows:

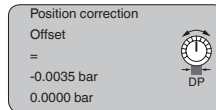
1. Activate in the menu item "**Position correction**" the selection with [OK].



2. Select with [->], e.g. to accept the actual measured value 0.0035 bar.



3. Confirm with [OK].



4. Move to min. (zero) adjustment with **[<->]**.

The current measured value was corrected to 0, the corrective value is available in the display as offset value with sign reversal.

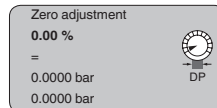
If a known value should be taken over as position correction which is not the current value, then you have to select the function "Edit" and enter the requested value.

Zero adjustment with differential pressure

In this menu item, the min. differential pressure is entered.

Proceed as follows:

1. Edit the bar value in the menu item "zero" with **[OK]**.



2. Set the requested value with **[+]** and **[<->]**.

3. Confirm with **[OK]** and move to span adjustment with **[<->]**.

For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

The zero adjustment is finished.



Information:

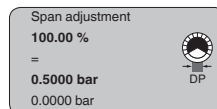
The zero adjustment shifts the value of the span adjustment. The span, i.e. the difference between these values, however, remains unchanged.

Span adjustment with differential pressure

In this menu item, the max. differential pressure is entered.

Proceed as follows:

1. Edit the bar value in the menu item "span" with **[OK]**.



Information:

If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 500 mbar).

2. Set the requested value with **[+]** and **[<->]**.

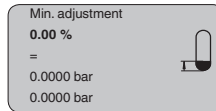
3. Confirm with **[OK]** and move to the menu overview with **[ESC]**.

For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

The span adjustment is finished.

Min. adjustment with level Proceed as follows:

1. Edit the % value in the menu item "Min. adjustment" with **[OK]**.



2. Set the requested value with **[+]** and **[->]**.
3. Confirm with **[OK]** and edit the requested bar value.
4. Set the requested bar value with **[+]** and **[->]**.
5. Confirm with **[OK]** and move to max. adjustment with **[->]**.

For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The min. adjustment is finished.

Max. adjustment with level

Proceed as follows:

1. Edit the % value in the menu item "Max. adjustment" with **[OK]**.



Information:

If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 500 mbar).

2. Set the requested value with **[->]** and **[OK]**.
3. Confirm with **[OK]** and edit the requested mbar value.
4. Set the requested value with **[+]** and **[->]**.
5. Confirm with **[OK]** and move to the menu overview with **[ESC]**.

For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

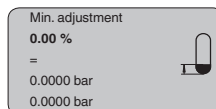
The max. adjustment is finished.

Min. adjustment with density

For the min. adjustment with density, a filling of the vessel is not necessary. The numeric examples are stated in chapter *Mounting, Measurement setup, Density and interface* of this instructions manual.

Proceed as follows:

1. Edit the % value in the menu item "Min. adjustment" with **[OK]**.



2. Set the requested value with **[+]** and **[->]**, for example 100 %.
3. Confirm with **[OK]** and edit the requested bar value.
4. Set the requested bar value with **[+]** and **[->]**, for example 29.4 mbar.

- Confirm with **[OK]** and move to max. adjustment with **[->]**.

For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The min. adjustment is finished.

Max. adjustment with density

For the max. adjustment with density, a filling of the vessel is not necessary. The numeric examples are stated in chapter *Mounting, Measurement setup, Density and interface* of this instructions manual.

Proceed as follows:

- Edit the % value in the menu item "Max. adjustment" with **[OK]**.



Information:

If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 100 mbar).

- Set the requested value with **[->]** and **[OK]**, for example 0.0 %.
- Confirm with **[OK]** and edit the requested mbar value.
- Set the requested value with **[+]** and **[->]**, for example 35.3 mbar.
- Confirm with **[OK]** and move to the menu overview with **[ESC]**.

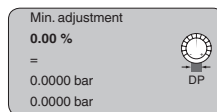
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The max. adjustment is finished.

Min. adjustment with flow

Proceed as follows:

- Edit the bar value in the menu item "Min. adjustment" with **[OK]**.



Information:

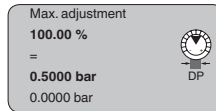
The DPT-10 is also suitable for bidirectional flow measurement (flow in both directions). The selection is carried out in the menu item "Linearization curve". With the bidirectional flow measurement, the min. adjustment value must be equal to the negative max. adjustment value.

Example: Max. adjustment value **+100 mbar**, as min. adjustment value, **-100 mbar** must hence be entered.

The min. adjustment is finished.

Max. adjustment with flow Proceed as follows:

1. Edit the bar value in the menu item "Max. adjustment" with **[OK]**.



Information:

If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 500 mbar).

2. Set the requested mbar value with **[->]** and **[OK]**.
3. Confirm with **[OK]** and move to the menu overview with **[ESC]**.

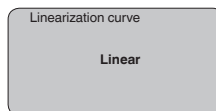
For an adjustment with flow, simply enter the actual measured value indicated at the bottom of the display.

The max. adjustment is finished.

Linearization curve with level

For level measurement, a linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. in a cylindrical or spherical tank - and the indication or output of the volume is requested.

Respective linearisation curves are stored for these vessels. They indicate the relation between the percentage level and the vessel volume. By activating the suitable curve, the percentage vessel volume is displayed correctly.



Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the **[->]** key.



Caution:

Note the following if the DPT-10 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 necessarily linear to the filling height. This must be considered by the user especially when adjusting the switching point on the limit signal transmitter.

Linearization curve with flow

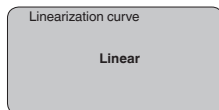
The square of the flow is proportional to the pressure difference at the orifice or the back pressure probe:

$$(Q_n)^2 = c \cdot \Delta p$$

To provide a linear relation between flow and output variable, an extraction by root is necessary:

$$Q_n = \sqrt{(c \cdot \Delta p)}$$

The DPT-10 has a root extraction function. It is selected in the menu item "*Linearization curve*".



Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the **[→]** key.



Information:

When selecting flow bidirectional, the min. adjustment must be entered with negative sign.

Leak flow volume suppression with flow

In some application, small flow quantities should not be detected. With the creeping quantity suppression, the flow value can be suppressed up to a certain % value. The default value is 5 % of the max. flow value, corresponding to 0.25 % of the max. differential pressure value. The limit value is 50 %. This function depends on the selected linearization function and is only available with root extracted characteristics.

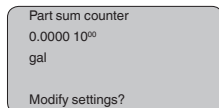
The square root/bidirectional square root characteristics is very steep at the zero point. This means that small changes in the measured differential pressure cause big changes in the output signal. The leak volume suppression stabilises the signal output.

Total amounts counter and subtotalizer with flow

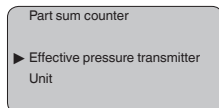
The DPT-10 has two internal totalizers. For both you can adjust volume or mass as count function as well as separately the unit.

Proceed as follows:

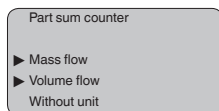
1. Select, for example, menu item "*Part sum counter*".



2. Activate the function "*Modify settings?*" with **[OK]**.



3. Confirm with **[OK]** "*Effective pressure transmitter*".



4. Select the requested variable with **[→]** and confirm with **[OK]**.
5. Select calibration unit of the effective pressure transmitter with **[→]**, for example m³/s and confirm with **[OK]**.

Part sum counter
 0 % = +0000
 m³/s=
 100 % = +0000
 m³/s=

6. Edit with **[OK]** and set the requested values with **[+]** and **[->]**.
7. Confirm with **[OK]** and jump back to the indication of the part sum counter.
8. Select with **[->]** the unit of the sum counter, adjust the requested unit with **[->]**, for example m³/s and confirm with **[OK]**.

The setting of the part sum counter is hence terminated, the counting function is activated.

The procedure of the total sum counter is the same.

Copy sensor data

This function enables uploading parameter adjustment data into the display and adjustment module as well as downloading parameter adjustment data into the sensor. A detailed description of the function is available in the operating instructions manual "*Display and adjustment module*".

The following data are loaded or downloaded with this function:

- Measured value presentation
- Application
- Adjustment
- Damping
- Linearization curve
- Leak flow volume suppression
- Sensor-TAG
- Displayed value
- Display unit
- Scaling
- Current output
- Unit of measurement
- Language

The following safety-relevant data are **not** uploaded or downloaded:

- HART mode
- PIN

Copy sensor data

 Copy sensor data?

Reset

Basic adjustment

The reset "*Basic adjustment*" resets the values of the following menu items to the reset values (see chart):

| Menu section | Menu item | Reset value |
|----------------|----------------------------------|-----------------------------|
| Basic settings | Zero/Min. adjustment | Measuring range begin |
| | Span/Max. adjustment | Measuring range end |
| | Density | 1 kg/l |
| | Density unit | kg/l |
| | Damping | 1 s |
| | Linearization | Linear |
| | Sensor-TAG | Sensor |
| Display | Displayed value | Differential pressure |
| | Display unit | Mass/kg |
| | Scaling | 0.00 to 100.0 |
| | Decimal point indication | 8888.8 |
| Diagnostics | Totalizer | 0.0000 10 ⁰⁰ gal |
| | Part sum counter | 0.0000 10 ⁰⁰ gal |
| Service | Current output - characteristics | 4 ... 20 mA |
| | Current output - failure mode | < 3.6 mA |
| | Current output - min. current | 3.8 mA |
| | Current output - max. current | 20.5 mA |

The values of the following menu items are *not* reset with "**Reset**":

| Menu section | Menu item | Reset value |
|----------------|---------------------|-------------|
| Basic settings | Unit of measurement | bar |
| | Temperature unit | °C |
| | Position correction | No reset |
| Display | Backlight | No reset |
| Service | Language | No reset |
| | HART mode | No reset |
| | Application | No reset |

Peak value

The min. and max. temperature or pressure values are each reset to the actual value.

Totalizer

The total and part sum counter are reset to zero.

Optional settings

Additional adjustment and diagnosis options such as e.g. scaling, simulation or trend curve presentation are shown in the following menu schematic. You will find a detailed description of these menu items in the operating instructions manual "*Display and adjustment module*".

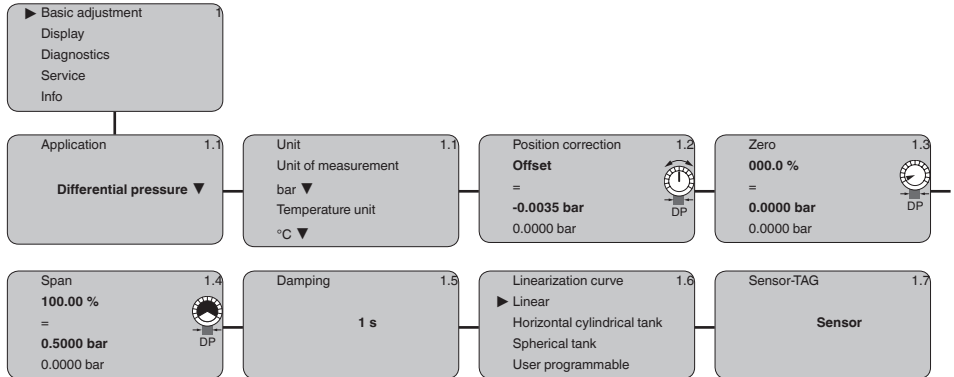
6.5 Menu schematic



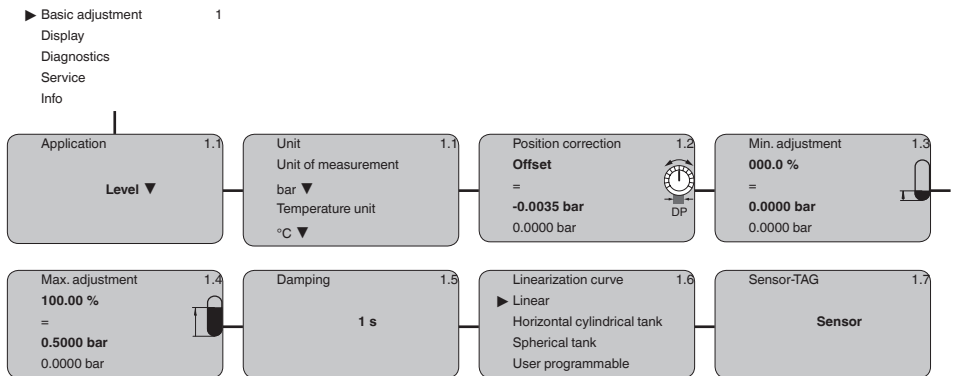
Information:

Depending on the version and application, the highlighted menu windows may not always be available.

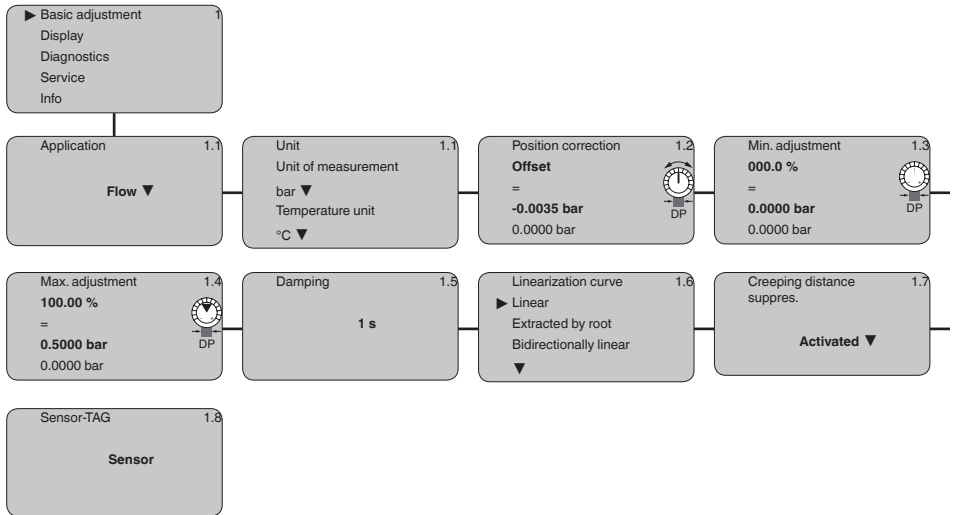
Basic adjustment differential pressure



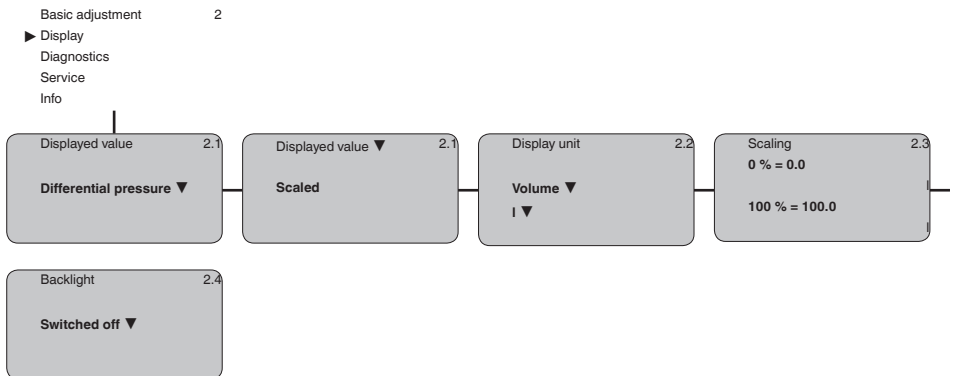
Basic setting level



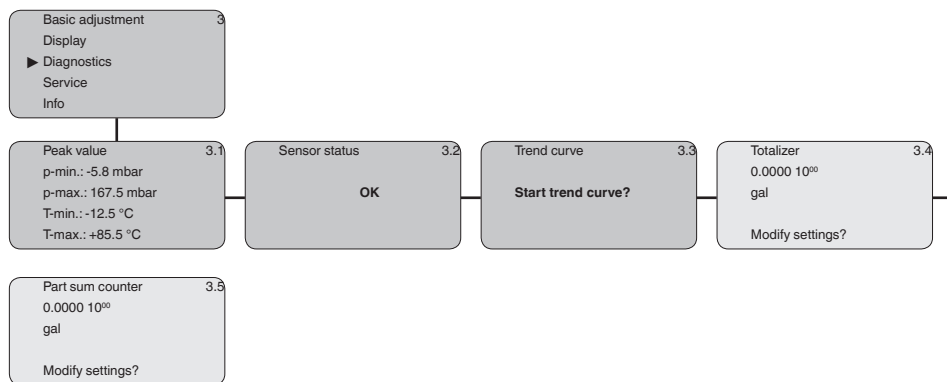
Basic adjustment flow



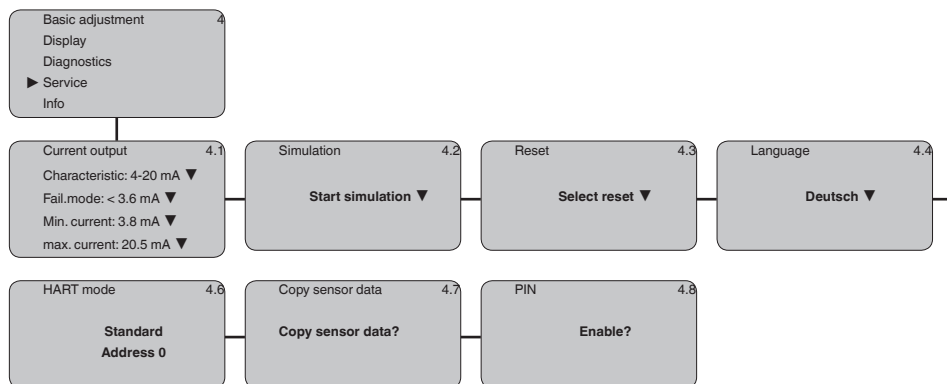
Display



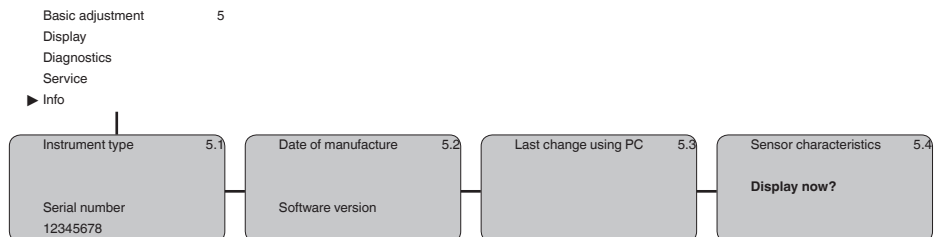
Diagnostics



Service



Info



6.12 Saving the parameter adjustment data

We recommended noting the adjusted data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

If DPT-10 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 procedure is described in the operating instructions manual "*Display and adjustment module*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

If it is necessary to exchange the sensor, the display and adjustment module is inserted into the replacement instrument and the data are written into the sensor under the menu item "*Copy sensor data*".

7 Setup with the adjustment program AMS™

7.1 Parameter adjustment with AMS™

For WIKA sensors, instrument descriptions for the adjustment program AMS™ are available as DD. The instrument descriptions are already implemented in the current version of AMS™. For older versions of AMS™, a free-of-charge download is available via Internet. Go via www.WIKA.com and "Downloads" to the item "Software".

8 Setup

8.1 Select the mode

The following operating modes can be set on DPT-10:

- Flow measurement
- Level measurement
- Differential pressure measurement

8.2 Flow measurement

Instructions

In flow measurement, DPT-10 is normally used without a chemical seal.

Before adjusting DPT-10, you have to clean the effective pressure lines and the instrument must be filled with the medium.

Measurement setup for gases

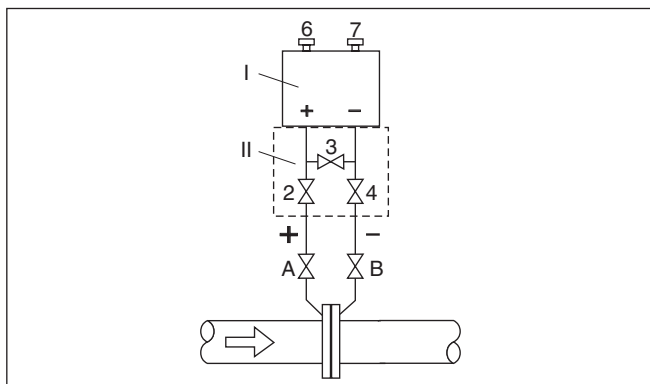


Fig. 48: Preferred measurement setup for gases

- I DPT-10
- II 3-fold valve block
- 2, 4 Inlet valves
- 3 Breather valve
- 6, 7 Vent valves on DPT-10
- A, B Blocking valves

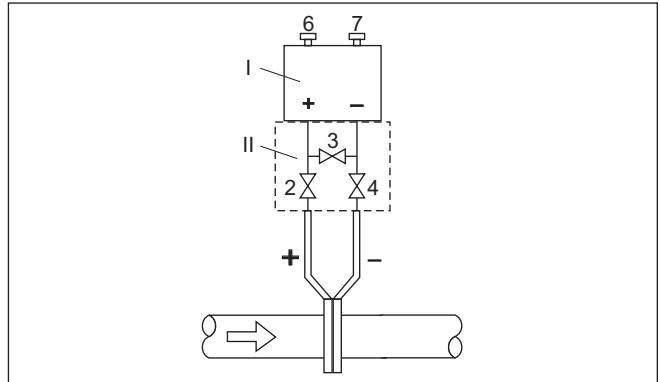


Fig. 49: Preferred measurement setup for gases, connection via 3-fold valve block, flanging on both sides

- I DPT-10
- II 3-fold valve block
- 2.4 Inlet valves
- 3 Breather valve
- 6.7 Vent valves on DPT-10

Measurement setup for liquids

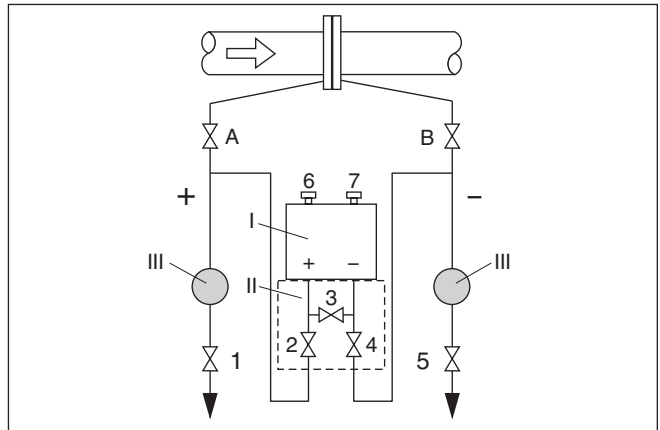


Fig. 50: Preferred measurement setup for liquids

- I DPT-10
- II 3-fold valve block
- III Precipitator
- 1.5 Drain valves
- 2.4 Inlet valves
- 3 Breather valve
- 6.7 Vent valves on DPT-10
- A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Close valve 3

2. Fill measuring system with medium.

For this purpose, open valves A, B (if available) as well as 2, 4:
Medium flows in

If necessary, clean the differential pressure lines: - with gases by blowing out with compressed air - with liquids by rinsing.¹⁾

For this purpose close valve 2 and 4, i.e. block the instrument.

Then open valve 1 and 5 so that the effective pressure lines blow out/rinse.

Close valves 1 and 5 (if available) after cleaning

3. Remove air from instrument:

Open valves 2 and 4: Medium flows in

Close valve 4: Minus side is closed

Open valve 3: Equalisation plus and minus side

Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air

4. Carry out a position correction if the following conditions apply. If the conditions are not fulfilled, then carry out the position correction after step 6.

Conditions:

The process cannot be sealed off.

The pressure extraction points (A and B) are at the same geodesic height.

5. Put measurement loop into operation:

Close valve 3: Separate plus and minus side

Open valve 4: Connect minus side

Now:

Valves 1, 3, 5, 6 and 7 are closed²⁾

Valves 2 and 4 are open

Valves A and B open

6. Carry out position correction, if flow can be blocked. In this case, step 5 is not required.

Then carry out adjustment, see chapter "*Set parameters*".

8.3 Level measurement

For level measurements, all versions of DPT-10 are employed.

DPT-10 with double chemical seal is immediately ready for operation.

The DPT-10 without chemical seal or with single chemical seal is ready for operation after opening a blocking valve, in case one is present.

Before you adjust DPT-10 without chemical seal or with single chemical seal, the effective pressure lines must be cleaned and the instrument filled with the medium.

¹⁾ Arrangement with 5 valves.

²⁾ Valves 1, 3, 5: Configuration with 5 valves.

Instructions

Measurement setup for open vessels

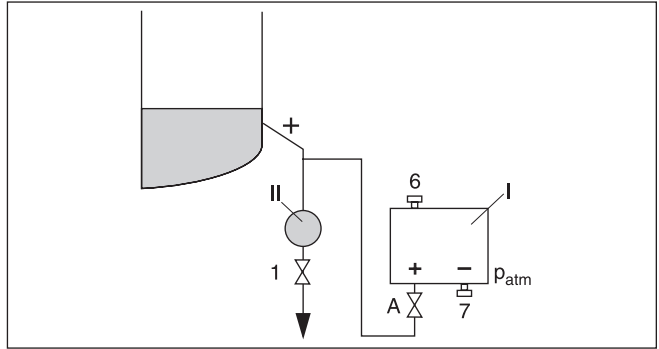


Fig. 51: Preferred measurement setup for open vessels

- I DPT-10
- II Precipitator
- 1 Drain valve
- 6.7 Vent valves on DPT-10
- A Blocking valve

Prepare the adjustment

Proceed as follows:

1. Fill the vessel to just over the lower tap.
2. Fill measuring system with medium.
Open valve A: Medium flows in.
3. Vent instrument
Briefly open valve 6, then close it: Fill the measuring instrument completely with the medium and remove air.
4. Set measurement loop to operation
Now:
Valve A open and valve 6 closed
Then carry out adjustment, see below.

Measurement setup for closed vessels

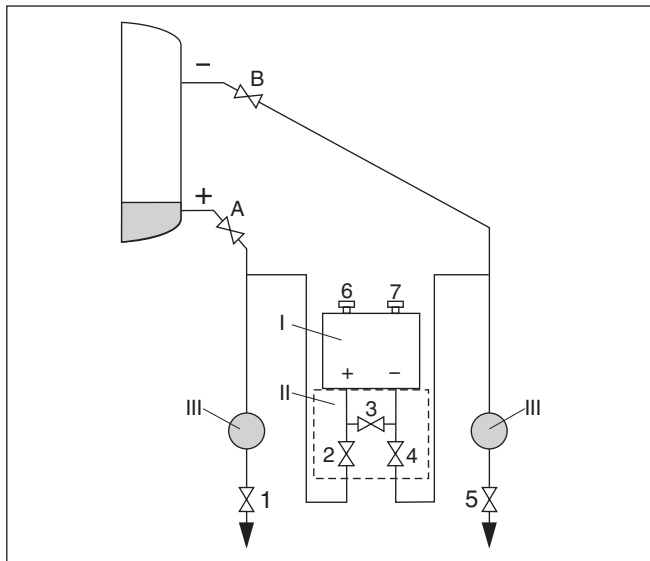


Fig. 52: Preferred measurement setup for closed vessels

- I DPT-10
- II 3-fold valve block
- III Precipitator
- 1, 5 Drain valves
- 2, 4 Inlet valves
- 6, 7 Vent valves on DPT-10
- A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium
Close valve 3: Separate plus and minus side
Open valve A and B: Open block valves
3. Vent plus side (probably empty minus side)
Open valve 2 and 4: Discharge medium on the plus side
Briefly open valve 6 and 7, then close again: Fill the plus side completely with the medium and remove air.

4. Set measurement loop to operation

Now:

Valve 3, 6 and 7 are closed

Valves 2, 4, A and B are open

Then carry out adjustment, see below.

Measurement setup for closed vessels with steam overlay

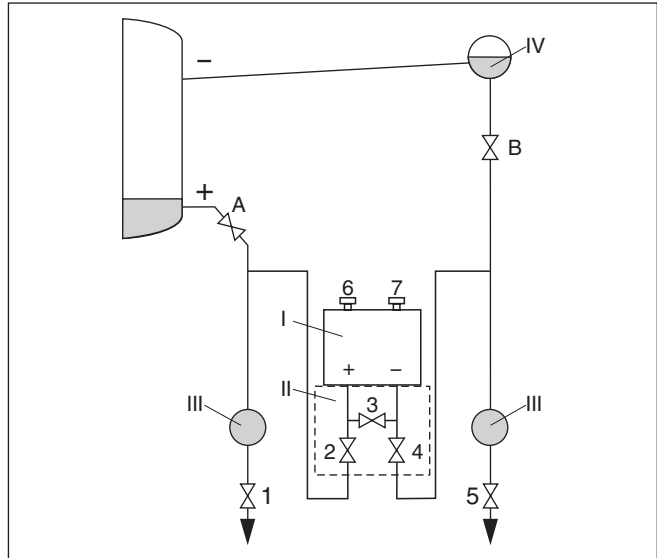


Fig. 53: Preferred measurement setup for closed vessels with steam overlay

- I DPT-10
- II 3-fold valve block
- III Precipitator
- IV Condensate vessel
- 1, 5 Drain valves
- 2, 4 Inlet valves
- 3 Breather valve
- 6, 7 Vent valves on DPT-10
- A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium
Open valve A and B: Open block valves
Fill the minus effective pressure line on the height of the condensation pot
3. Remove air from instrument:
Open valve 2 and 4: Discharge medium
Open valve 3: Equalisation plus and minus side
Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air
4. Put measurement loop into operation:
Close valve 3: Separate plus and minus side
Open valve 4: Connect minus side
Now:
Valve 3, 6 and 7 are closed

Valves 2, 4, A and B are open.

Then carry out adjustment, see chapter "Set parameters".

8.4 Density and interface measurement

For density and interface measurements, DPT-10 with double chemical seal is used.

DPT-10 in this version is immediately ready for operation.

8.5 Differential pressure measurement

For differential pressure measurements, DPT-10 without chemical seal or with double chemical seal is used.

DPT-10 with double chemical seal is immediately ready for operation.

Before adjusting DPT-10 without chemical seal, the effective pressure lines must be cleaned and the instrument filled with medium.

Instructions

Measurement setup for gases

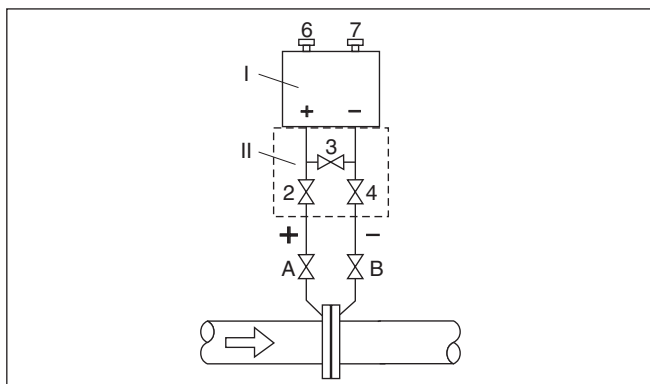


Fig. 54: Preferred measurement setup for gases

- I DPT-10
- II 3-fold valve block
- 2, 4 Inlet valves
- 3 Breather valve
- 6, 7 Vent valves on DPT-10
- A, B Blocking valves

Measurement setup for liquids

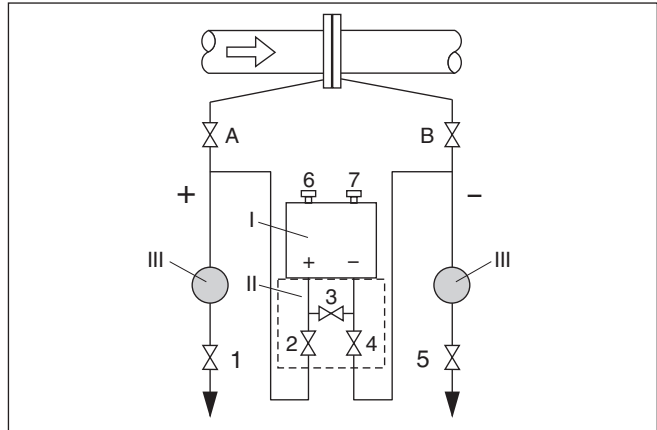


Fig. 55: Preferred measurement setup for liquids

- I DPT-10
- II 3-fold valve block
- III Precipitator
- 1.5 Drain valves
- 2.4 Inlet valves
- 3 Breather valve
- 6, 7 Vent valves on DPT-10
- A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Close valve 3
2. Fill measuring system with medium.
Open valves A, B, 2, 4: Medium flows in.
If necessary, clean the differential pressure lines: - with gases by blowing out with compressed air - with liquids by rinsing.³⁾
Close valve 2 and 4, block the instrument
Open valve 1 and 5
Close valve 1 and 5
3. Remove air from instrument:
Open valves 2 and 4: Medium flows in
Close valve 4: Minus side is closed
Open valve 3: Equalisation plus and minus side
Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air
4. Put measurement loop into operation:
Close valve 3: Separate plus and minus side
Open valve 4: Connect minus side
Now:

³⁾ Arrangement with 5 valves.

Valves 1, 3, 5, 6 and 7 are closed⁴⁾

Valves 2 and 4 are open

Valves A and B open (if present)

Then carry out adjustment, see chapter "*Set parameters*".

⁴⁾ Valves 1, 3, 5: Configuration with 5 valves.

9 Maintenance and fault rectification

9.1 Maintenance

Maintenance

If the instrument is used properly, no special maintenance is required in normal operation.

In some applications, product buildup on the separating diaphragms can influence the measuring result. Depending on the sensor and application, take precautions to ensure that heavy buildup, and especially a hardening thereof, is avoided.

9.2 Rectify faults

Reaction when malfunctions occur

The operator of the system is responsible for taking suitable measures to rectify faults.

Failure reasons

DPT-10 offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Voltage supply
- Signal processing

Fault rectification

The first measures to be taken are to check the output signals as well as to evaluate the error messages via the display and adjustment module. The procedure is described below. Further comprehensive diagnostics can be carried out on a PC with the software PACTware and the suitable DTM. In many cases, the causes can be determined and the faults rectified this way.

Check the 4 ... 20 mA signal

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

| Error code | Cause | Rectification |
|---|---|---|
| 4 ... 20 mA signal not stable | Level fluctuations | – Set the integration time via the display and adjustment module or PACTware |
| 4 ... 20 mA signal missing | Wrong connection to voltage supply | – Check connection according to chapter "Connection steps" and if necessary, correct according to chapter "Wiring plan" |
| | No power supply | – Check cables for breaks; repair if necessary |
| | Operating voltage too low or load resistance too high | – Check, adapt if necessary |
| Current signal greater than 22 mA or less than 3.6 mA | Electronics module or measuring cell defective | – Exchange the instrument or send it in for repair |



Error messages via the display and adjustment module

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

| Error code | Cause | Rectification |
|------------|---|---|
| E013 | no measured value available ¹⁾ | – Exchange the instrument or send it in for repair |
| E017 | Adjustment span too small | – repeat with modified values |
| E036 | no operable sensor software | – Carry out a software update or send instrument for repair |
| E041 | Hardware error | – Exchange the instrument or send it in for repair |

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "Set up" may have to be carried out again.

9.3 Instrument repair

You can find information for a return shipment under "Service" on our local website.

If a repair is necessary, please proceed as follows:

- Complete one form for each instrument
- If necessary, state a contamination
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument

10 Dismounting

10.1 Dismounting steps

**Warning:**

Before dismantling, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

10.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

WEEE directive 2002/96/EG

This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

11 Supplement

11.1 Technical data

General data

| | |
|-------------------------|-----------------------|
| Pressure type | Differential pressure |
| Measuring principle | Piezoresistive |
| Communication interface | I ² C bus |

Materials and weights

Material 316L corresponds to stainless steel 1.4404 or 1.4435

Materials, wetted parts

- Process fitting with lateral flanges C22.8, 316L, Alloy C276
- Separating diaphragm 316L, Alloy C-276, Tantalum, Alloy C-276 gold-rhodium coated
- Seal FKM (Viton), FKM cleaned from oil and grease, FKM for oxygen application, PTFE, PTFE for oxygen application, NBR, copper, copper for oxygen application
- Screw plugs 316L

Internal transmission liquid Synthetic oil, Halocarbon oil¹⁾

Materials, non-wetted parts

- Electronics housing Plastic PBT (polyester), Alu die-casting powder-coated
- External electronics housing plastic PBT (Polyester)
- Socket, wall mounting plate external electronics housing plastic PBT (Polyester)
- Seal between housing socket and wall mounting plate TPE (fixed connected)
- Seal ring, housing cover Silicone
- Inspection window in housing cover for display and adjustment module Polycarbonate (UL-746-C listed)
- Screws and nuts for lateral flange PN 160: hexagon screw ISO 4014-M12 x 90-A4, PN 420: hexagon nut ISO 4032-M12-A4-bs
- Ground terminal 316Ti/316L
- Ohmic contact Between ground terminal and process fitting
- Connection cable with version IP 68 (1 bar) PE
- Connection between IP 68 transmitter and external electronics housing PUR
- Type label support with IP 68 version on cable PE hard

Max. torque screws mounting strap 30 Nm

Max. torque screws socket external housing 5 Nm (3.688 lbf ft)

Weight approx. 4.2 ... 4.5 kg (9.26 ... 9.92 lbs), depending on process fitting

Output variable

| | |
|--|---|
| Output signal | 4 ... 20 mA/HART |
| HART output values | |
| – HART value (Primary Value) | Process pressure |
| – HART value (Secondary Value) | Temperature |
| Signal resolution | 1.6 μ A |
| Failure signal current output (adjustable) | mA-value unchanged 20.5 mA, 22 mA, < 3.6 mA |
| Max. output current | 22 mA |
| Load | see load diagram under Power supply |
| Met NAMUR recommendation | NE 43 |

Dynamic behaviour output

| | |
|-------------|-------------|
| Run-up time | ≤ 20 s |
|-------------|-------------|

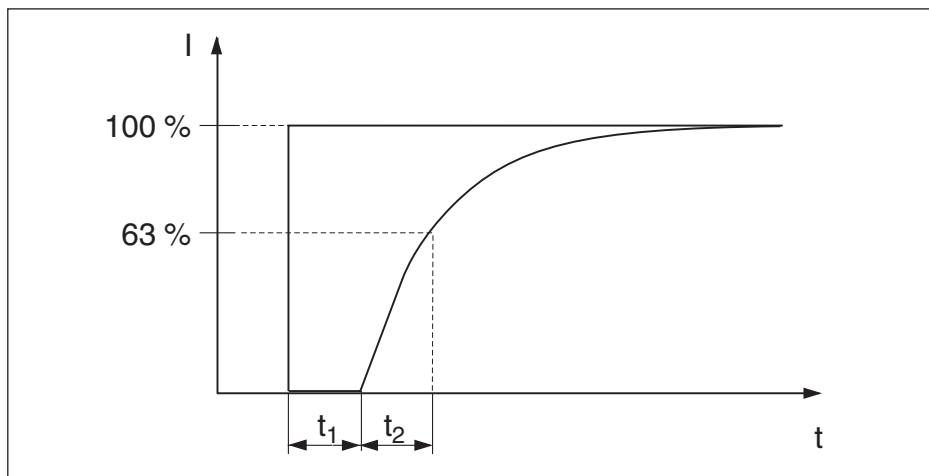


Fig. 56: Presentation of the dead time t_1 and the time constant t_2

The following specified total dead time applies to the 4 ... 20 mA current output:

| Version, nominal measuring range | Dead time t_1 | Time constant t_2 |
|---|--------------------------------|--------------------------------|
| Basic version 10 bar and 30 bar | 100 ms | 250 ms |
| Basic version 100 mbar | 100 ms | 180 ms |
| Basic version 500 mbar | 100 ms | 180 ms |
| Basic version, 3 bar | 100 ms | 180 ms |
| Basic version 16 bar and 40 bar | 100 ms | 180 ms |
| Chemical seal version, all nominal measuring ranges | Dependent on the chemical seal | Dependent on the chemical seal |

Damping (63 % of the input variable) 0 ... 999 s, adjustable

Additional output parameter - temperature

Processing is made via output signal HART multidrop, Profibus PA and Foundation Fieldbus

Range -50 ... +150 °C (-58 ... +302 °F)

Resolution 1 °C (1.8 °F)

Accuracy in the range of 0 ... +100 °C
(+32 ... +212 °F) ±3 K

Accuracy in the range of -50 ... 0 °C
(-58 ... +32 °F) and +100 ... +150 °C
(+212 ... +302 °F) typ. ±3 K

Input variable

Measured variable Differential pressure, flow and level derived from it

Adjustment differential pressure

Adjustment range of the zero/span adjustment relating to the nominal measuring range:

- Pressure value zero -120 ... +120 %
- Pressure value span zero + (-220 ... +220 %)²)

Adjustment level

Adjustment range of the min./max. adjustment relating to the nominal measuring range:

- Percentage value -10 ... +110 %
- Pressure value -120 ... +120 %³)

Adjustment flow

Adjustment range of the zero/span adjustment relating to the nominal measuring range:

- Pressure value zero -120 ... +120 %
- Pressure value span -120 ... +120 %⁴)

Recommended max. turn down 15 : 1 (no limitation)

Nominal measuring ranges, measurement limits and smallest spans to be calibrated

| Nominal range | Lower measurement limit | Upper measuring limit | Smallest adjustable span |
|-------------------|-------------------------|-----------------------|--------------------------|
| 10 mbar (1 kPa) | -10 mbar (-1 kPa) | +10 mbar (+1 kPa) | 0.25 mbar (25 Pa) |
| 30 mbar (3 kPa) | -30 mbar (-3 kPa) | +30 mbar (+3 kPa) | 0.3 mbar (30 Pa) |
| 100 mbar (10 kPa) | -100 mbar (-10 kPa) | +100 mbar (+10 kPa) | 1 mbar (100 Pa) |
| 500 mbar (50 kPa) | -500 mbar (-50 kPa) | +500 mbar (+50 kPa) | 5 mbar (500 Pa) |
| 3 bar (300 kPa) | -3 bar (-300 kPa) | +3 bar (+300 kPa) | 30 mbar (3 kPa) |
| 16 bar (1600 kPa) | -16 bar (-1600 kPa) | +16 bar (+1600 kPa) | 160 mbar (16 kPa) |
| 40 bar (4000 kPa) | -40 bar (-4000 kPa) | +40 bar (+4000 kPa) | 400 mbar (40 kPa) |

Reference conditions and actuating variables (according to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1

- Temperature +18 ... +30 °C (+64 ... +86 °F)
 - Relative humidity 45 ... 75 %
 - Air pressure 860 ... 1060 mbar/86 ... 106 kPa (12.5 ... 15.4 psig)
- Determination of characteristics Limit point adjustment according to IEC 61298-2
- Characteristic curve Linear

Calibration position of the measuring cell Vertical, i.e. upright process component

Influence of the installation position to the $\leq 4 \text{ mbar}^{5)6)}$

zero point

A position-dependent zero-point shift can be corrected (see also chapter "*Adjust parameter*").

Position of the span in the measuring range Based on the zero point

Diaphragm material 316L, Alloy C276, gold rhodium plated, Monel

Filling oil Silicone oil

Material, lateral flanges 316L

A position-dependent zero-point shift can be corrected (see also chapter "*Adjust parameter*").

Deviation determined according to the limit point method according to IEC 60770⁷⁾

Applies to **digital** interfaces (HART, Profibus PA, Foundation Fieldbus) as well as to **analogue** current output 4 ... 20 mA. Specifications refer to the set span. Turn down (TD) is the ratio nominal measuring range/set span.

Deviation - All versions

The following applies to square root extracted characteristics: The accuracy data of DPT-10 are entered with factor 0.5 in the accuracy calculation of the flow.

Deviation - Basic version

10 mbar, 30 mbar measuring cell

- Turn down 1 : 1 $\pm 0.15 \%$ of the set span
- Turn down > 1 : 1 $\pm 0.15 \%$ of the set span x TD

100 mbar measuring cell

- Turn down 1 : 1 to 4 : 1 $\pm 0.075 \%$ of the set span
- Turn down > 4 : 1 $\pm (0.012 \times \text{TD} + 0.027) \%$ of the set span

Measuring cells $\geq 500 \text{ mbar}$

- Turn down 1 : 1 to 15 : 1 $\pm 0.075 \%$ of the set span
- Turn down > 15 : 1 $\pm (0.0015 \times \text{TD} + 0.053) \%$ of the set span

Deviation - Chemical seal versions

100 mbar measuring cell

- Turn down 1 : 1 to 4 : 1 $\pm 0.075 \%$ of the set span + influence of the chemical seal
- Turn down > 4 : 1 $\pm (0.012 \times \text{TD} + 0.027) \%$ of the set span + influence of the chemical seal

Measuring cells $\geq 500 \text{ mbar}$

- Turn down 1 : 1 to 15 : 1 $\pm 0.075 \%$ of the set span + influence of the chemical seal
- Turn down > 15 : 1 $\pm (0.0015 \times \text{TD} + 0.053 \%)$ of the set span + influence of the chemical seal

Influence of the product or ambient temperature

Applies to instruments in basic version with **digital** signal output (HART, Profibus PA, Foundation Fieldbus) as well as to instruments with **analogue** current output 4 ... 20 mA. Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

| Temperature range | Measuring range | Thermal changes of the zero signal and the output span relating to the adjusted span |
|--|------------------|--|
| -10 ... +60 °C (+14 ... +140 °F) | 10 mbar, 30 mbar | $\pm(0.31 \times TD + 0.06) \%$ |
| | 100 mbar | $\pm(0.18 \times TD + 0.02) \%$ |
| | 500 mbar, 3 bar | $\pm(0.08 \times TD + 0.05) \%$ |
| | 16 bar | $\pm(0.1 \times TD + 0.1) \%$ |
| | 16 bar | $\pm(0.08 \times TD + 0.05) \%$ |
| -40 ... +10 °C (-40 ... +50 °F) +60 ... +85 °C (+140 ... +185 °F) | 10 mbar, 30 mbar | $\pm(0.45 \times TD + 0.1) \%$ |
| | 100 mbar | $\pm(0.3 \times TD + 0.15) \%$ |
| | 500 mbar, 3 bar | $\pm(0.12 \times TD + 0.1) \%$ |
| | 16 bar | $\pm(0.15 \times TD + 0.2) \%$ |
| | 40 bar | $\pm(0.37 \times TD + 0.1) \%$ |

Applies also to instruments with **analogue 4 ... 20 mA** current output and refers to the set span.

Thermal change, current output $< 0.05 \%/10 \text{ K}$, max. $< 0.15 \%$, each with $-40 \dots +80 \text{ °C}$ ($-40 \dots +176 \text{ °F}$)

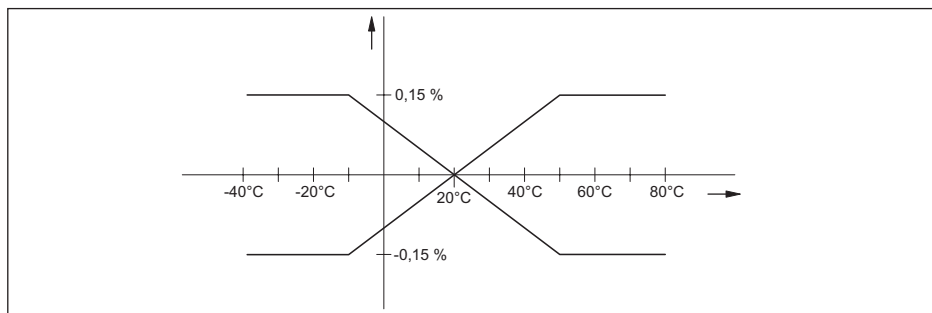


Fig. 57: Thermal change, current output

Influence of the system pressure on the zero point and span

316L, Alloy C276-, Alloy C276 gold-rhodium coated diaphragm

| Measuring cell | 10 mbar | 30 mbar | 100 mbar | 500 mbar |
|--|-----------------------------|-----------------------------|-----------------------------|------------------------------|
| Influence of the system pressure to the zero point | $\pm 0.15 \%$ of URL/7 bar | $\pm 0.35 \%$ of URL/70 bar | $\pm 0.15 \%$ of URL/70 bar | $\pm 0.075 \%$ of URL/70 bar |
| Influence of the system pressure to the span | $\pm 0.035 \%$ of URL/7 bar | $\pm 0.14 \%$ of URL/70 bar | $\pm 0.14 \%$ of URL/70 bar | $\pm 0.14 \%$ of URL/70 bar |

| Measuring cell | 3 bar | 16 bar | 40 bar |
|--|-----------------------------|------------------------------|------------------------------|
| Influence of the system pressure to the zero point | $\pm 0.075 \%$ of URL/7 bar | $\pm 0.075 \%$ of URL/70 bar | $\pm 0.075 \%$ of URL/70 bar |
| Influence of the system pressure to the span | $\pm 0.14 \%$ of URL/7 bar | $\pm 0.14 \%$ of URL/70 bar | $\pm 0.14 \%$ of URL/70 bar |

Tantalum diaphragm

| Measuring cell | 10 mbar | 30 mbar | 100 mbar | 500 mbar |
|--|----------------------|-----------------------|-----------------------|-----------------------|
| Influence of the system pressure to the zero point | ±0.28 % of URL/7 bar | ±0.70 % of URL/70 bar | ±0.42 % of URL/70 bar | ±0.14 % of URL/70 bar |
| Influence of the system pressure to the span | ±0.28 % of URL/7 bar | ±0.70 % of URL/70 bar | ±0.42 % of URL/70 bar | ±0.14 % of URL/70 bar |

| Measuring cell | 3 bar | 16 bar | 40 bar |
|--|----------------------|-----------------------|-----------------------|
| Influence of the system pressure to the zero point | ±0.14 % of URL/7 bar | ±0.14 % of URL/70 bar | ±0.14 % of URL/70 bar |
| Influence of the system pressure to the span | ±0.14 % of URL/7 bar | ±0.14 % of URL/70 bar | ±0.14 % of URL/70 bar |

Total accuracy

Total Performance - Basic version

The specification "*Total Performance*" comprises non-linearity incl. hysteresis and non-repeatability, thermal change of the zero point and static pressure influence ($p_{st} = 70$ bar).

Total Performance

- 316L, Alloy, gold-rhodium diaphragm ±0.15 % of the set span⁸⁾⁹⁾
- Tantalum diaphragm ±0.30 % of the set span¹⁰⁾¹¹⁾

Total Error - basic version

The specification "*Total Error*" comprises the longterm stability and the total performance.

| Diaphragm material | Measuring range | Total Error |
|---------------------------|-----------------|--|
| 316L, Alloy, gold rhodium | < 500 mbar | 0.33 % of the measuring range end value/year |
| | from 500 mbar | 0.20 % of the measuring range final value |
| Tantalum | < 500 mbar | 0.48 % of the measuring range end value/year |
| | from 500 mbar | 0.35 % of the measuring range end value/year |

Heating time - all versions

Warm-up time ≤ 10 s

Long-term stability (according to DIN 16086 and IEC 60770-1)

Applies to **digital** interfaces (HART, Profibus PA, Foundation Fieldbus) as well as to **analogue** current output 4 ... 20 mA. Specifications refer to the measuring range final value.

| Measuring ranges | 1 year | 5 years |
|-------------------------|---------|----------|
| 10 mbar, 100 mbar | ±0.18 % | - |
| 500 mbar, 3 bar, 16 bar | ±0.05 % | ±0.125 % |

Ambient conditions

Ambient, storage and transport temperature

- Standard version -40 ... +80 °C (-40 ... +176 °F)

- Version for oxygen applications¹²⁾ -40 ... +60 °C (-40 ... +140 °F)
- Versions IP 66/IP 68 (1 bar) connection cable PE -20 ... +60 °C (-4 ... +140 °F)
- Versions IP 66/IP 68 (1 bar) and IP 68, -20 ... +80 °C (-4 ... +176 °F) connection cable PUR

Process conditions

The pressure and temperature specifications are used as overview. In general, the max. pressure for the pressure transmitter depends on the weakest (with regard to pressure) link. In detail, the respective specifications of the type label apply.

Process temperature limits

Specifications apply to the basic version as well as to the minus side with version with single chemical seal¹³⁾

- With measuring cells PN 420 Lower temperature limit -10 °C (+14 °F).
- With effective pressure lines longer than 100 mm -40 ... +120 °C (-40 ... +248 °F)
- With effective pressure lines longer than 100 mm, process fitting steel C22.8 -40 ... +120 °C (-40 ... +248 °F)

Specifications apply to suitable chemical seals

- Chemical seal CSS plus side, CSB -40 ... +400 °C (-40 ... +752 °F) both sides

Process temperature limits according to the seal material

| Seal material | Temperature limits |
|--------------------------------|----------------------------------|
| FKM | -20 ... +85 °C (-4 ... +185 °F) |
| FFKM (Kalrez 6375) | -5 ... +85 °C (23 ... +185 °F) |
| EPDM | -40 ... +85 °C (-40 ... +185 °F) |
| PTFE | -40 ... +85 °C (-40 ... +185 °F) |
| NBR | -20 ... +85 °C (-4 ... +185 °F) |
| Copper | -40 ... +85 °C (-40 ... +185 °F) |
| Copper, for oxygen application | -20 ... +60 °C (-4 ... +140 °F) |
| FKM, cleaned | -10 ... +85 °C (+14 ... +185 °F) |
| FKM, for oxygen application | -10 ... +60 °C (-4 ... +140 °F) |
| PTFE, for oxygen application | -20 ... +60 °C (-4 ... +140 °F) |

Process pressure limits according to measuring range

| Nominal range | Nominal pressure | Overload one-sided | Overload two-sided |
|-------------------|--|--|--|
| 10 mbar (1 kPa) | 160 bar (16000 kPa) | 160 bar (16000 kPa) | 240 bar (24000 kPa) |
| 30 mbar (3 kPa) | 160 bar (16000 kPa) | 160 bar (16000 kPa) | 240 bar (24000 kPa) |
| 100 mbar (10 kPa) | 160 bar (16000 kPa) | 160 bar (16000 kPa) | 240 bar (24000 kPa) |
| 500 mbar (50 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | 240 bar (24000 kPa) 630 bar (63000 kPa) |

| Nominal range | Nominal pressure | Overload one-sided | Overload two-sided |
|-------------------|--|--|--|
| 3 bar (300 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | 240 bar (24000 kPa) 630 bar (63000 kPa) |
| 16 bar (1600 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | 240 bar (24000 kPa) 630 bar (63000 kPa) |
| 40 bar (4000 kPa) | 160 bar (16000 kPa) 420 bar (42000 kPa) | Plus side: 160 bar (16000 kPa) 420 bar (42000 kPa) Minus side: 100 bar (10000 kPa) | 240 bar (24000 kPa) 630 bar (63000 kPa) |

Process pressure limits with seal material FFKM (Kalrez 6375)

| Nominal pressure | Overload one-sided | Overload two-sided |
|---------------------|---------------------|---------------------|
| 100 bar (10000 kPa) | 100 bar (10000 kPa) | 150 bar (15000 kPa) |

Min. system pressure with all measuring ranges 0.1 mbar_{abs} (10 Pa_{abs})

Vibration resistance (mechanical vibrations with 5 ... 100 Hz), depending on the version as well as the material and series of the electronics housing¹⁴⁾

- Single and double chamber plastic housing, single chamber Aluminium housing 4 g
- Double chamber Aluminium housing, single chamber stainless steel housing 1 g
- Double chamber stainless steel housing <1 g

Shock resistance Acceleration 100 g/6 ms¹⁵⁾

Electromechanical data - version IP 66/IP 67

Cable entry/plug¹⁶⁾

- Single chamber housing
 - 1 x cable gland M20 x 1.5 (cable: ø 5 ... 9 mm), 1 x blind plug M20 x 1.5
 - or:
 - 1 x closing cap ½ NPT, 1 x blind plug ½ NPT
 - or:
 - 1x plug (depending on the version), 1x blind stopper M20x1.5

- Double chamber housing
 - 1 x cable entry M20 x 1.5 (cable: \varnothing 5 ... 9 mm), 1 x blind plug M20 x 1.5; plug M12 x 1 for the external display and adjustment unit (optional)
 - or:
 - 1 x closing cap $\frac{1}{2}$ NPT, 1 x blind plug $\frac{1}{2}$ NPT, plug M12 x 1 for the external display and adjustment unit (optional)
 - or:
 - 1 x plug (depending on the version), 1 x blind plug M20 x 1.5; plug M12 x 1 for the external display and adjustment unit (optional)

Spring-loaded terminals for wire cross-section up to 2.5 mm² (AWG 14)

Display and adjustment module

| | |
|---|--------------------------|
| Voltage supply and data transmission | through the sensor |
| Indication | LC display in dot matrix |
| Adjustment elements | 4 keys |
| Protection rating | |
| – unassembled | IP 20 |
| – mounted into the sensor without cover | IP 40 |
| Material | |
| – Housing | ABS |
| – Inspection window | Polyester foil |

Voltage supply

| | |
|--|--------------------------|
| Operating voltage | |
| – Non-Ex instrument | 12 ... 36 V DC |
| – Ex-ia instrument | 12 ... 30 V DC |
| – Ex-d instrument | 18 ... 36 V DC |
| Operating voltage with illuminated display and adjustment module | |
| – Non-Ex instrument | 20 ... 36 V DC |
| – Ex-ia instrument | 20 ... 30 V DC |
| – Ex d instrument | 20 ... 36 V DC |
| Permissible residual ripple | |
| – < 100 Hz | $U_{ss} < 1 \text{ V}$ |
| – 100 Hz ... 10 kHz | $U_{ss} < 10 \text{ mV}$ |
| Load | see diagram |

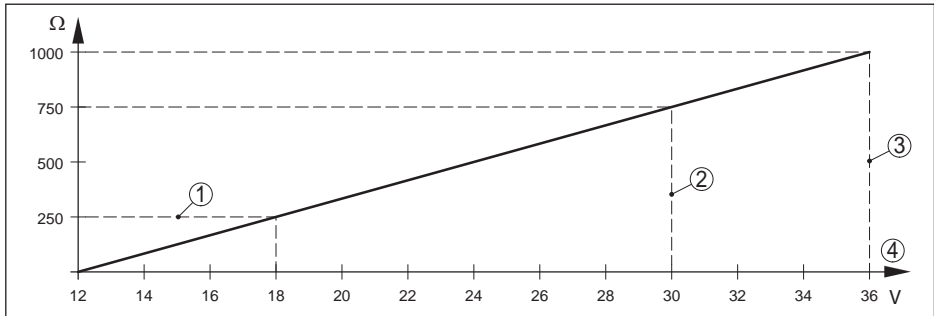


Fig. 58: Voltage diagram

- 1 HART load
- 2 Voltage limit Ex-ia instrument
- 3 Voltage limit non-Ex/Ex-d instrument
- 4 Operating voltage

Electrical protective measures

Protection rating

– Housing, standard IP 66/IP 67

Overtoltage category

III

Protection class

II

Approvals

Depending on the version, instruments with approvals can have different technical data. For these instruments, please note the corresponding approval documents. They are included in the scope of delivery.

11.2 Dimensions

Plastic housing

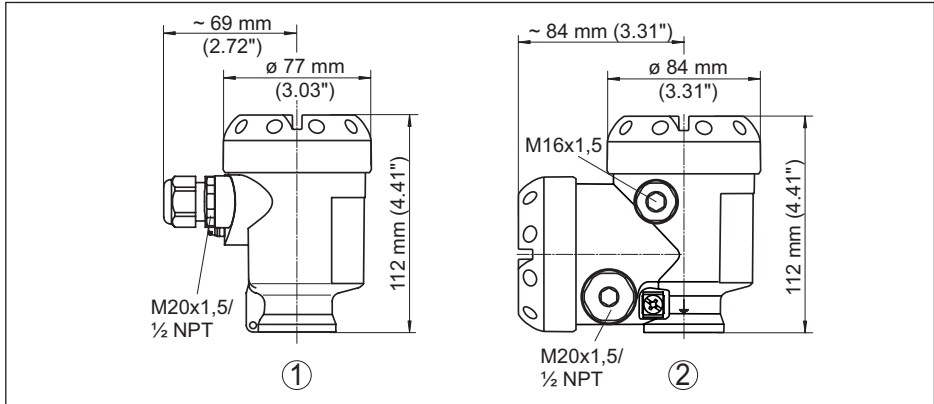


Fig. 59: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

- 1 Single chamber version
- 2 Double chamber version

Aluminium housing

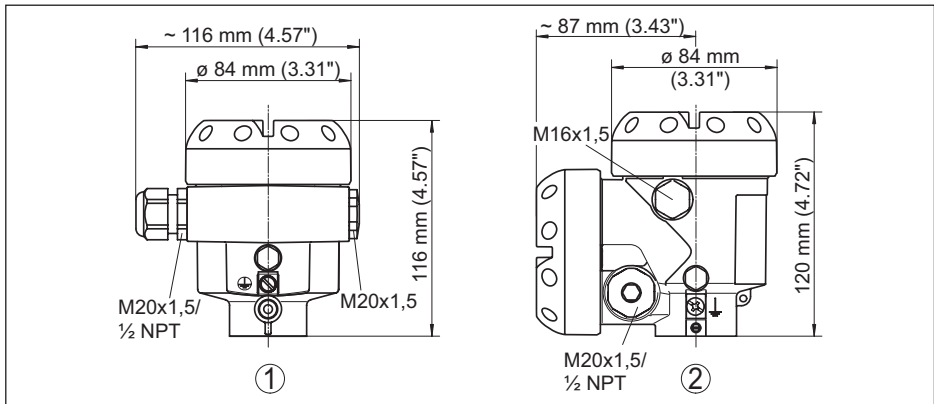


Fig. 60: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

- 1 Single chamber version
- 2 Double chamber version

Aluminium housing in protection rating IP 66/IP 68 (1 bar)

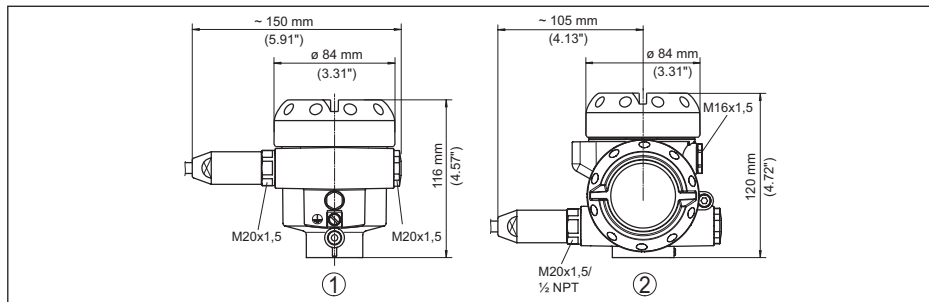


Fig. 61: Housing versions in protection IP 66/IP 68 (1 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

- 1 Single chamber version
- 2 Double chamber version

Stainless steel housing

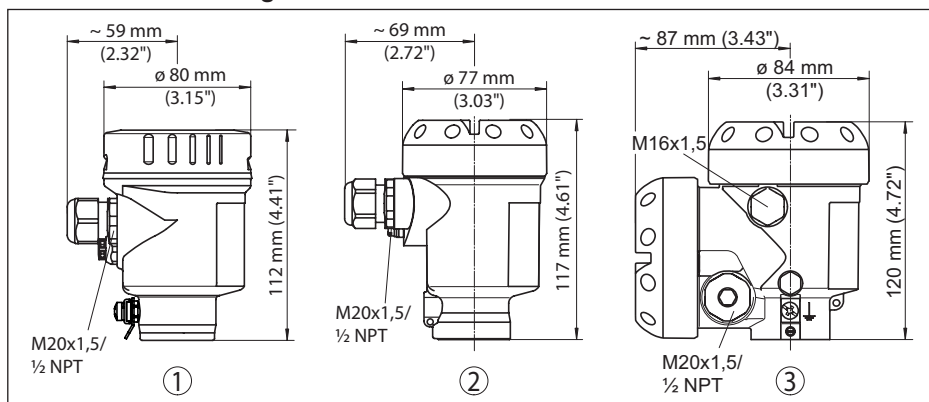


Fig. 62: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

- 1 Single chamber version, electropolished
- 2 Single chamber version, precision casting
- 3 Double chamber version, precision casting

Oval flange, connection 1/4-18 NPT or RC 1/4

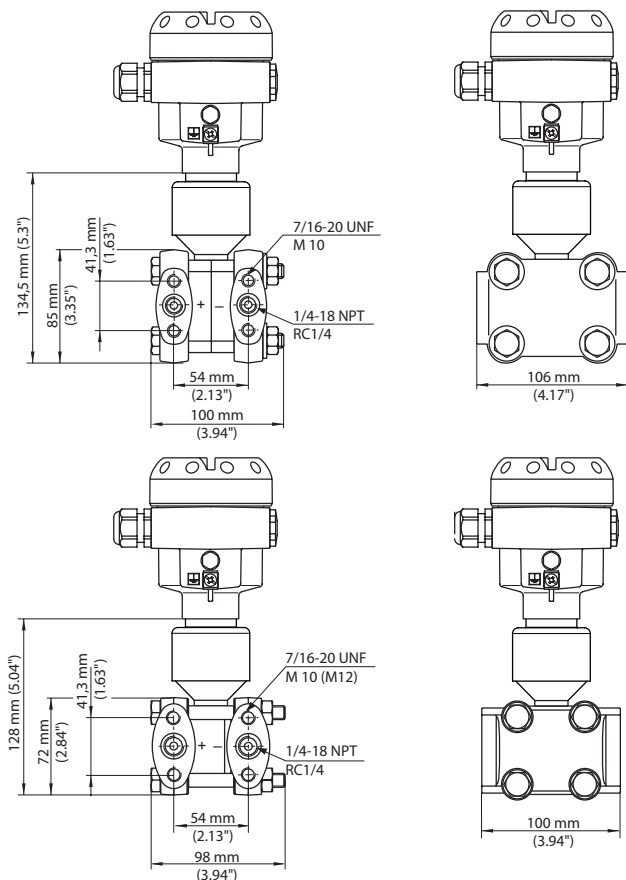


Fig. 63: Top: 10 mbar and 30 mbar measuring cell. Bottom: Measuring cell ≥ 100 mbar

| Version | Connection | Fastening | Material | Scope of delivery |
|---------|-------------------------|-----------------------------|--------------|------------------------------------|
| B | 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Steel C 22.8 | incl. 2 vent valves (316L) |
| D | 1/4-18 NPT IEC 61518 | 7/16-20 UNF | AISI 316L | incl. 2 vent valves (316L) |
| F | 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Alloy C276 | without valves/clos- ing screws |
| U | RC 1/4 | 7/16-20 UNF | AISI 316L | incl. 2 vent valves (316L) |
| 1 | 1/4-18 NPT IEC 61518 | PN 160: M10, PN 420: M12 | Steel C 22.8 | incl. 2 vent valves (316L) |

| Version | Connection | Fastening | Material | Scope of delivery |
|---------|-------------------------|-----------------------------|------------|------------------------------------|
| 2 | 1/4-18 NPT IEC 61518 | PN 160: M10, PN 420: M12 | AISI 316L | incl. 2 vent valves (316L) |
| 3 | 1/4-18 NPT IEC 61518 | PN 160: M10, PN 420: M12 | Alloy C276 | without valves/clos- ing screws |

Oval flange, connection 1/4-18 NPT or RC 1/4, with lateral ventilation

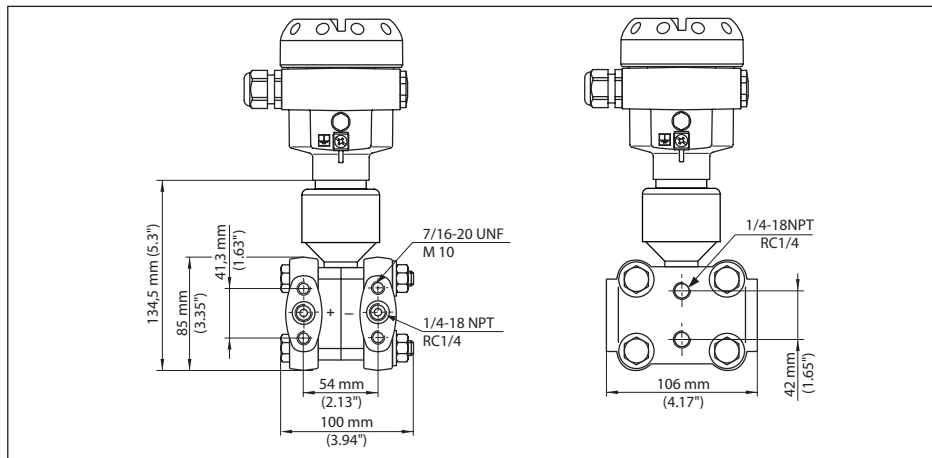


Fig. 64: 10 mbar and 30 mbar measuring cell

| Version | Connection | Fastening | Material | Scope of delivery |
|---------|-------------------------|-------------|--------------|---|
| C | 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Steel C 22.8 | incl. 4 closing screws (AISI 316L) and 2 ventilation valves |
| E | 1/4-18 NPT IEC 61518 | 7/16-20 UNF | AISI 316L | incl. 4 closing screws (AISI 316L) and 2 ventilation valves |
| H | 1/4-18 NPT IEC 61518 | 7/16-20 UNF | Alloy C276 | without valves/clos- ing screws |
| V | RC 1/4 | 7/16-20 UNF | AISI 316L | incl. 4 closing screws (AISI 316L) and 2 ventilation valves |

Oval flange, prepared for chemical seal connection

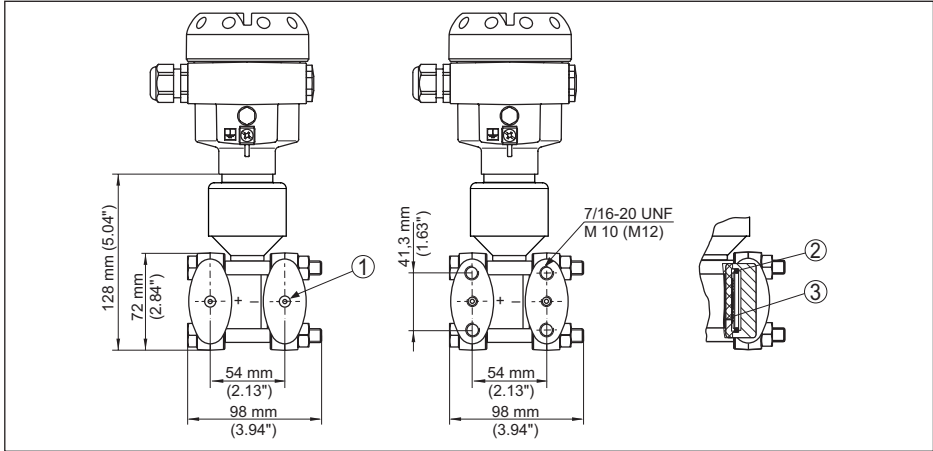


Fig. 65: left: Process fitting DPT-10 prepared for chemical seal assembly. right: Position of the copper ring seal

- 1 Chemical seal connection
- 2 Copper ring seal
- 3 Cup diaphragm

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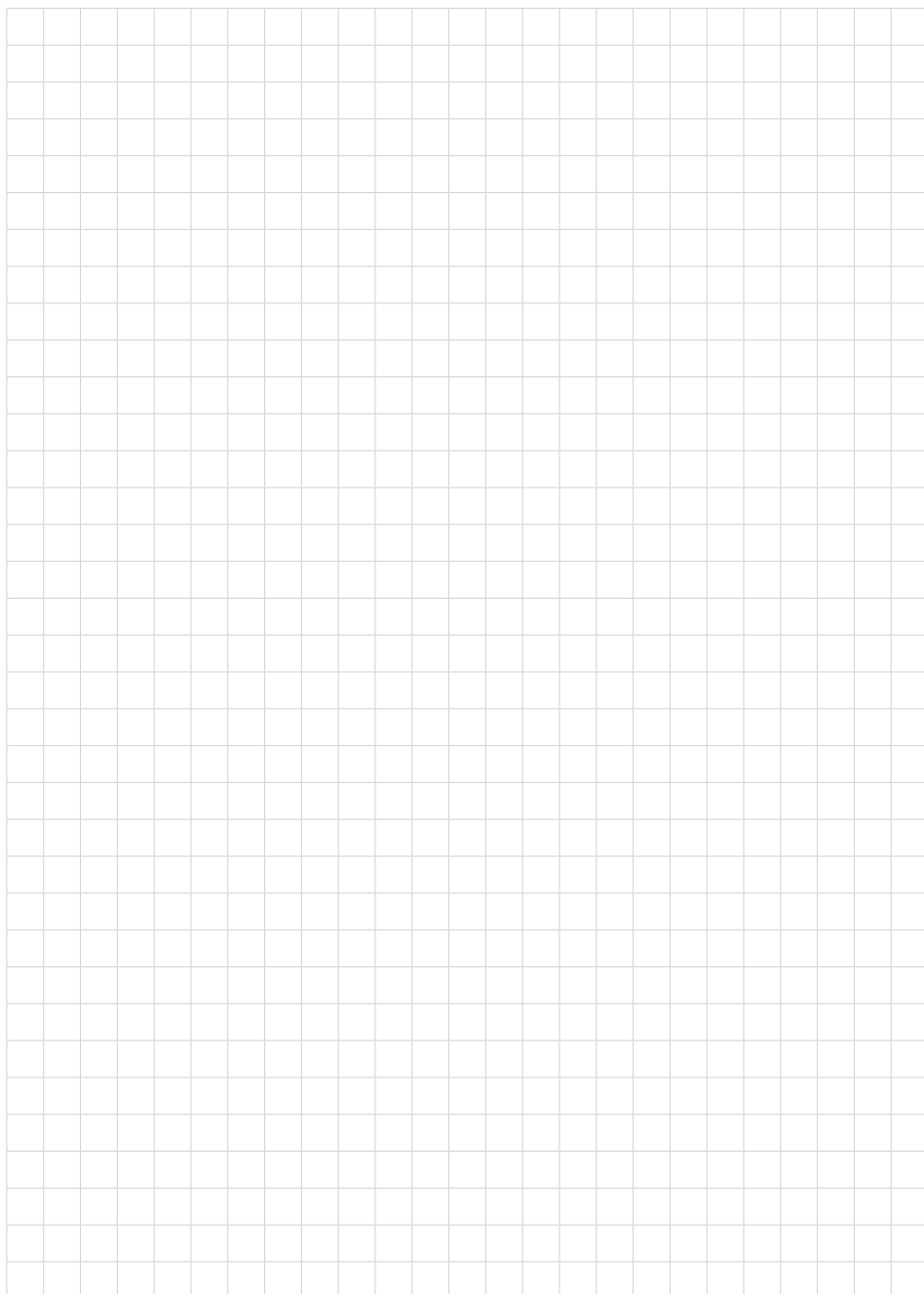
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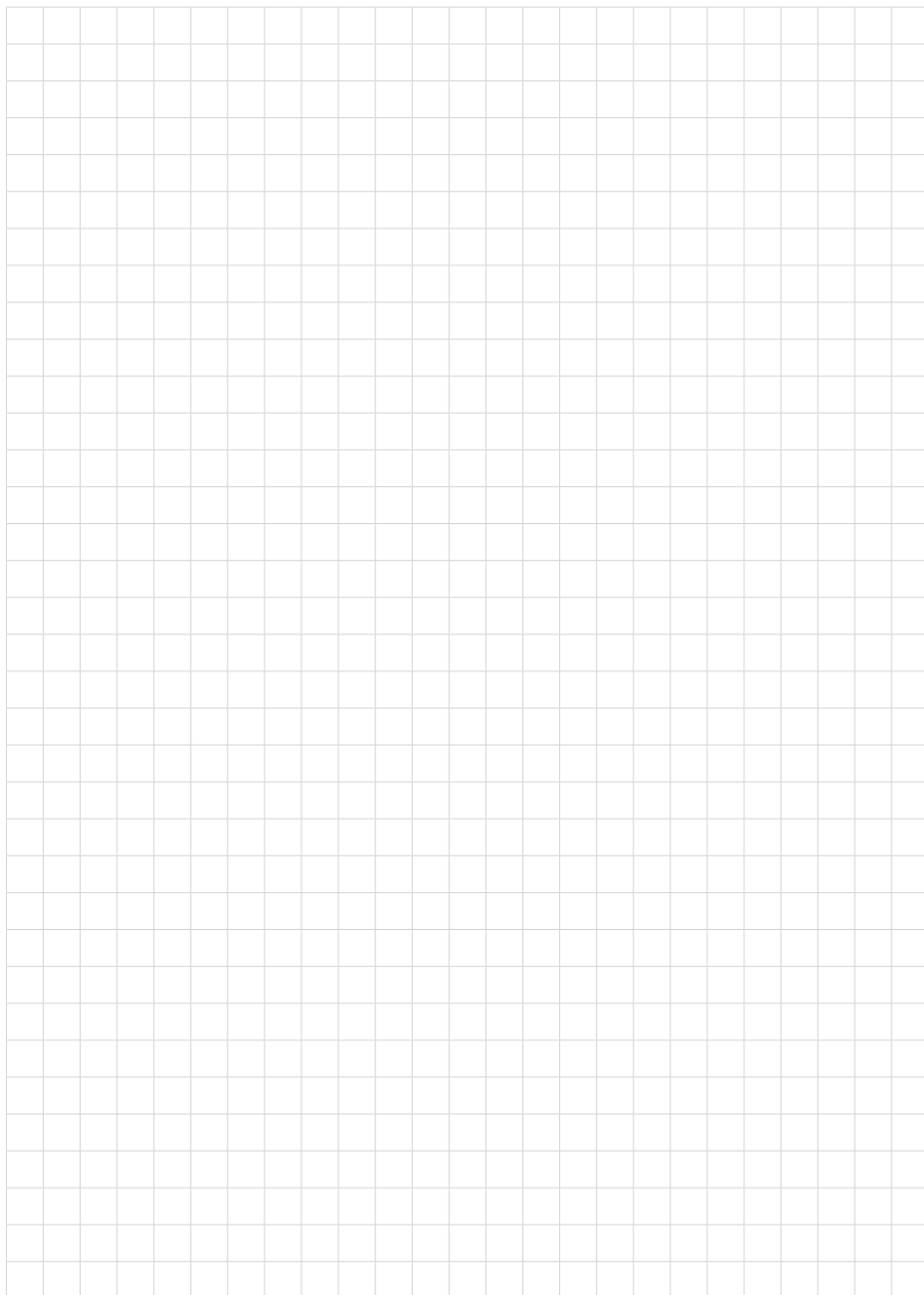
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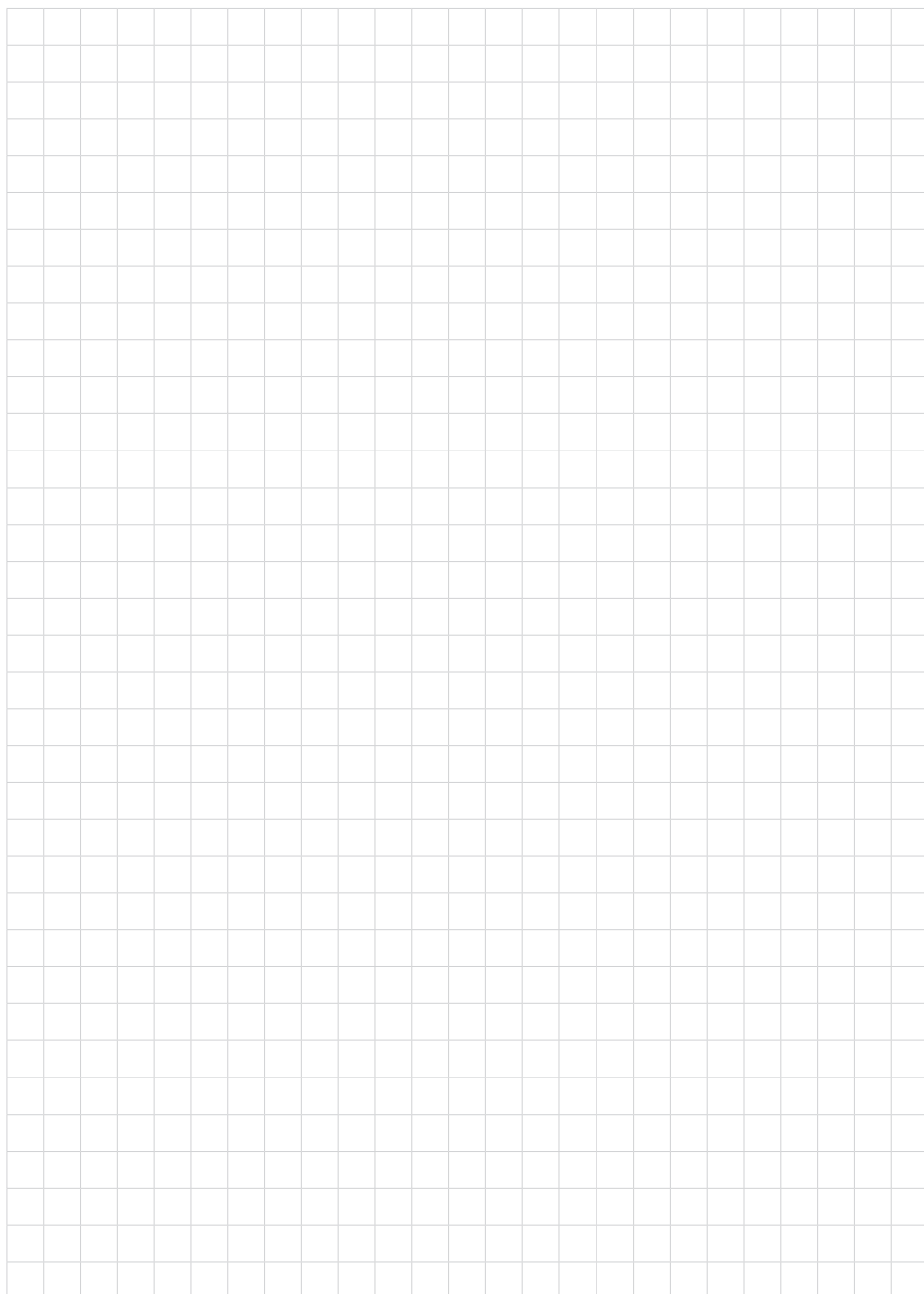
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All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.



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