Operating Instructions

Differential pressure transmitter DPT-10

GB

Metallic measurement diaphragm
Profibus PA



Differential pressure transmitter DPT-10

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Safety instructions for Ex areas

Take note of the Ex specific safety instructions for Ex applications. These instructions are attached as documents to each instrument with Ex approval and are part of the operating instructions.

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1 About this document

1.1 Function

This instruction provides all the information you need for mounting, connection and setup as well as important instructions for maintenance, fault rectification, the exchange of parts and the safety of the user. 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 personnel. The contents of this manual must be made available to the qualified personnel and implemented.

1.3 Symbols used



Information, note, tip: This symbol indicates helpful additional information and tips for successful work.



Note: This symbol indicates notes to prevent failures, malfunctions, damage to devices or plants.



Caution: Non-observance of the information marked with this symbol may result in personal injury.



Warning: Non-observance of the information marked with this symbol may result in serious or fatal personal injury.



Danger: Non-observance of the information marked with this symbol results in serious or fatal personal injury.



Ex applications
This symbol indicates special instructions for Ex applications.

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

1 **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 aquainted 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

DPT10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface.

You can find detailed information about the area of application 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 this product can give rise to application-specific hazards, e.g. vessel overfill through incorrect mounting or adjustment. Damage to property and persons or environmental contamination can result. Also, the protective characteristics of the instrument can be impaired.

2.4 General safety instructions

This is a state-of-the-art instrument complying with all prevailing regulations and directives. The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for the trouble-free operation of the instrument. When measuring aggressive or corrosive media that can cause a dangerous situation if the instrument malfunctions, the operator has to implement suitable measures to make sure the instrument is functioning properly.

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.

The safety instructions in this operating instructions manual, the national installation standards as well as the valid safety regulations and accident prevention rules must be observed by the user.

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. For safety reasons, only the accessory specified by the manufacturer must be used.

To avoid any danger, the safety approval markings and safety tips on the device must also be observed and their meaning read in this operating instructions manual.

2.5 Safety label on the instrument

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

2.6 EU conformity

The device fulfils the legal requirements of the applicable EU directives. By affixing the CE marking, we confirm the conformity of the instrument with these directives.

The EU conformity declaration can be found on our homepage.

2.7 Fulfillment of NAMUR recommendations

The device fulfills the requirements of the applicable NAMUR recommendations.

2.8 Installation and operation in the USA and Canada

This information is only valid for USA and Canada. Hence the following text is only available in the English language.

Installations in the US shall comply with the relevant requirements of the National Electrical Code (ANSI/NFPA 70).

Installations in Canada shall comply with the relevant requirements of the Canadian Electrical Code.

2.9 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 assocations must be noted.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- DPT10 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 "*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 DPT10:

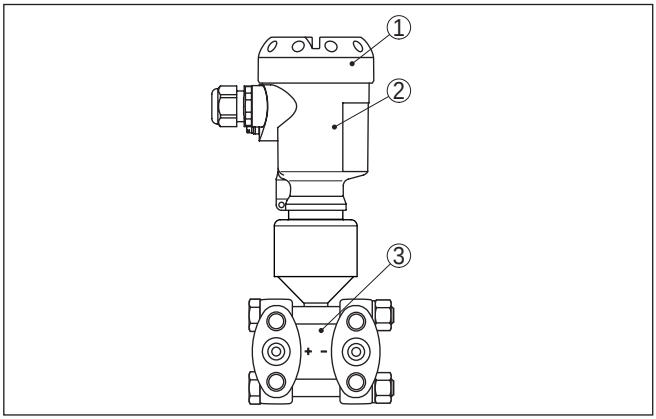


Fig. 1: DPT10 in basic version

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 type label contains the most important data for identification and use of the instrument:

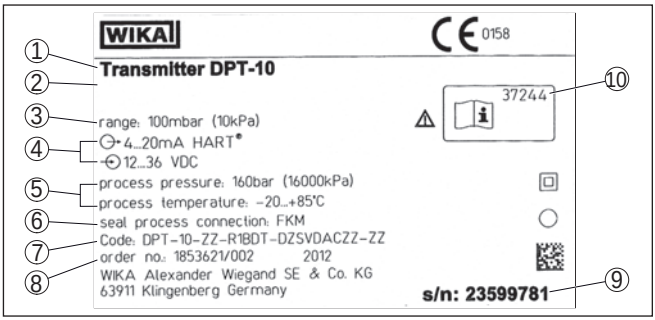


Fig. 2: Layout of the type label (example)

1 Instrument type
2 Place for approvals
3 Measuring range
4 Signal output/Operating 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

DPT10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface. Measured products are gases, vapours and liquids.

Flow measurement

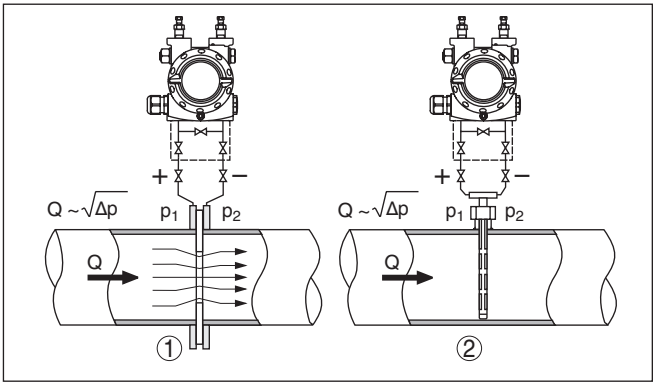


Fig. 3: Flow measurement with DPT10 and DP flow element, Q = flow, Δp = differential pressure, $\Delta p = p_1 - p_2$

1 Orifice
2 Pitot tube

Level measurement

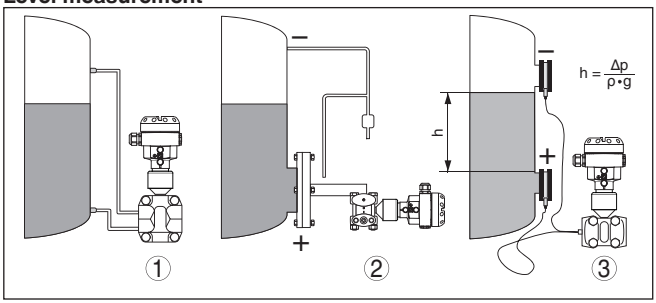


Fig. 4: Level measurement with DPT10. Δp = differential pressure, ρ = density of the medium, g = acceleration of gravity

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

Differential pressure measurement

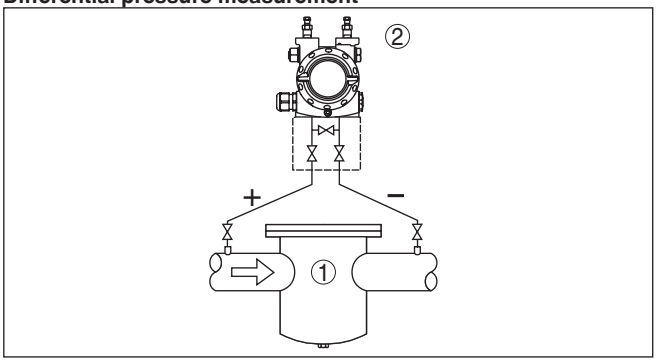


Fig. 5: Differential pressure measurement with DPT10

1 Filter
2 DPT10

Density measurement

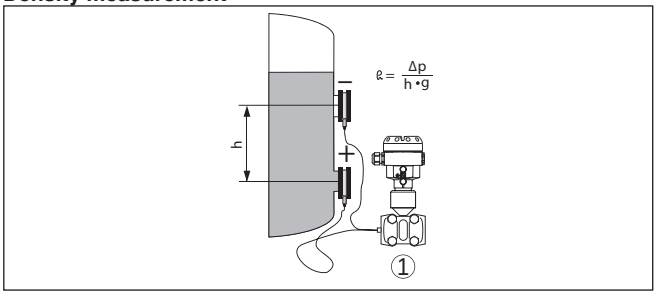


Fig. 6: Density measurement with DPT10, h = defined mounting distance, Δp = differential pressure, ρ = density of the medium, g = acceleration of gravity

1 DPT10

Interface measurement

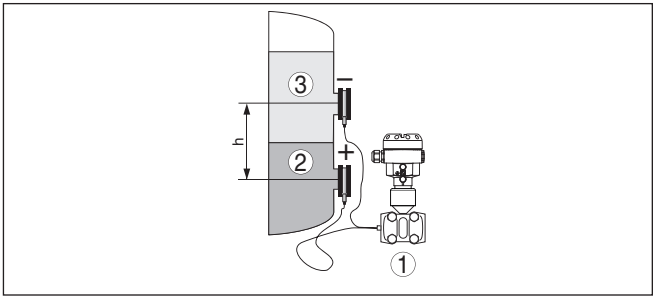


Fig. 7: Interface measurement with DPT10

1 DPT10
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 piezoresistive measuring element (resistance measuring bridge in semi-conductor technology).

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

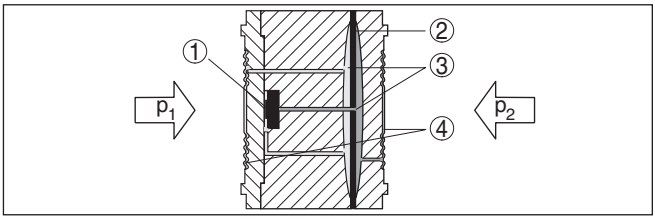


Fig. 8: Configuration metallic measuring cell

1 Measuring element
2 Overload diaphragm/Middle diaphragm
3 Filling oil
4 Separating diaphragms
p_1, p_2 Process pressures

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.

Power supply and bus communication

Power supply via the Profibus DP/PA segment coupler. A two-wire cable according to Profibus specification serves as carrier of both power and digital data transmission for multiple sensors. The instrument profile of DPT10 corresponds to profile specification version 3.0.

GSD/EDD

The GSD (instrument master files) and bitmap files necessary for planning your Profibus DP (PA) communication network are available from the download section on the WIKA homepage www.wika.com under "*Service"*. There you can also find the appropriate certificates. In a PDM environment, an EDD (Electronic Device Description) is also required to enable the full range of sensor functions (also available as a download). A CD with the appropriate files can be ordered via e-mail or by phone from one of the WIKA agencies.

The backlight of the display and adjustment module is powered by the sensor. Prerequisite is a certain level of operating voltage.

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

3.3 Adjustment

The instrument can be adjusted with the following adjustment media:

- With the display and adjustment module
- the Simatic adjustment program PDM

The entered parameters are generally saved in DPT10, optionally also in the indicating/adjustment module.

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

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- 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

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

Lifting and carrying

With instrument weights of more than 18 kg (39.68 lbs) suitable and approved equipment must be used for lifting and carrying.

4 Mounting

4.1 General instructions for use of 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 or references in chapters "*Technical data*", "*Dimensions, versions process component*" and on the nameplate.

Suitability for the ambient conditions

The instrument is suitable for standard and extended ambient conditions acc. to DIN/EN/IEC/ANSI/ISA/UL/CSA 61010-1.

Moisture

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

You can give your instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable gland. 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.

To maintain the housing protection, make sure that the housing lid is closed during operation and locked, if necessary.

Make sure that the degree of contamination specified in chapter "*Technical data*" meets the existing ambient conditions.

Ventilation

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

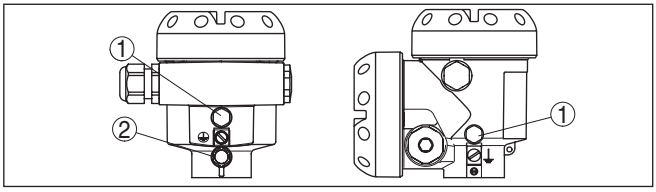


Fig. 9: Position of the filter element with single and double chamber housing

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.

DP flow element

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

When wiring the effective pressure lines outdoors, make sure that you use a suitable antifreeze, e.g. by using a heat tracing. Wire the effective pressure lines with a monotonous gradient of at least 10 %. Effective pressure lines for gases must remain dry, condensate must be avoided. Effective pressure lines for liquids must be completely filled and ventilated.

General recommendations for wiring of effective pressure lines are stated in the corresponding national and international standards.

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.

4.2 Instructions for oxygen applications

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!

4.3 Mounting and connection instructions

Connection plus/minus side

When connecting the DPT10 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.

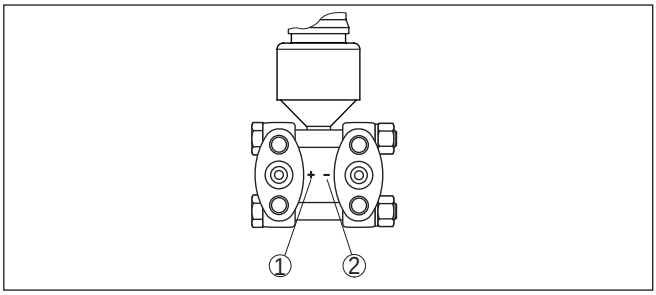


Fig. 10: Marking for plus/minus side on the process component

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.

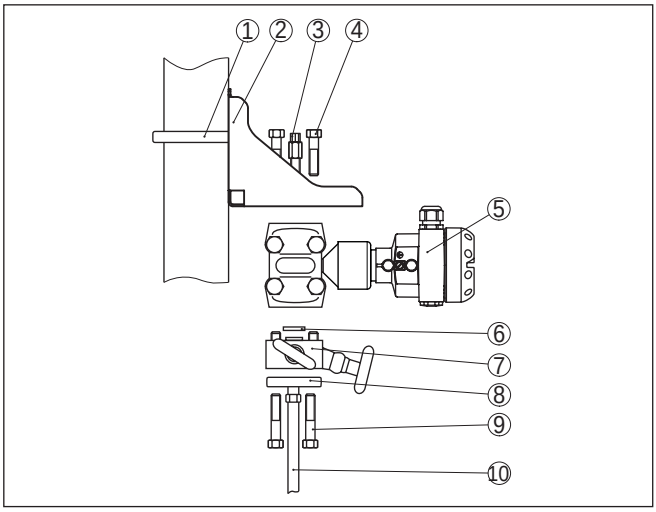


Fig. 11: Mounting arrangement with tube mounting

1 Strap for tube mounting
2 Mounting bracket
3 Ventilation valve
4 Fixing screws
5 DPT10
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 DPT10 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 DPT10 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 DPT10 in installed condition.

3-fold valve block

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

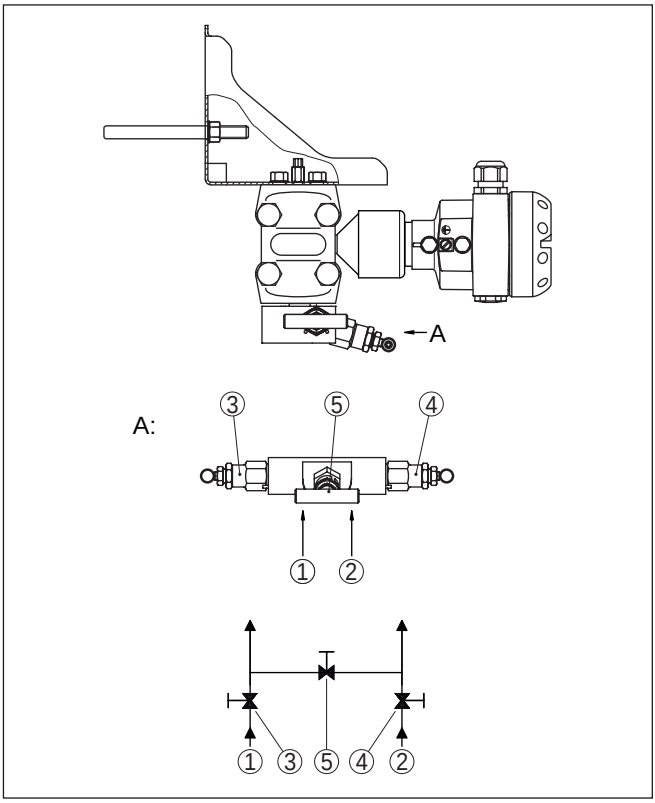


Fig. 12: Connection of a 3-fold valve block

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.

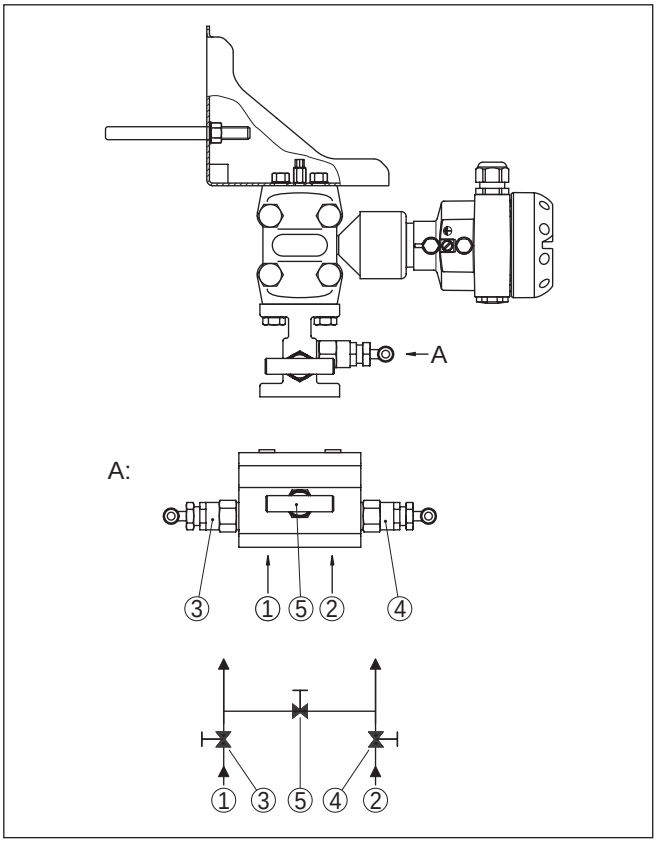


Fig. 13: Connection of a 3-fold valve block, flanging on both sides

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.

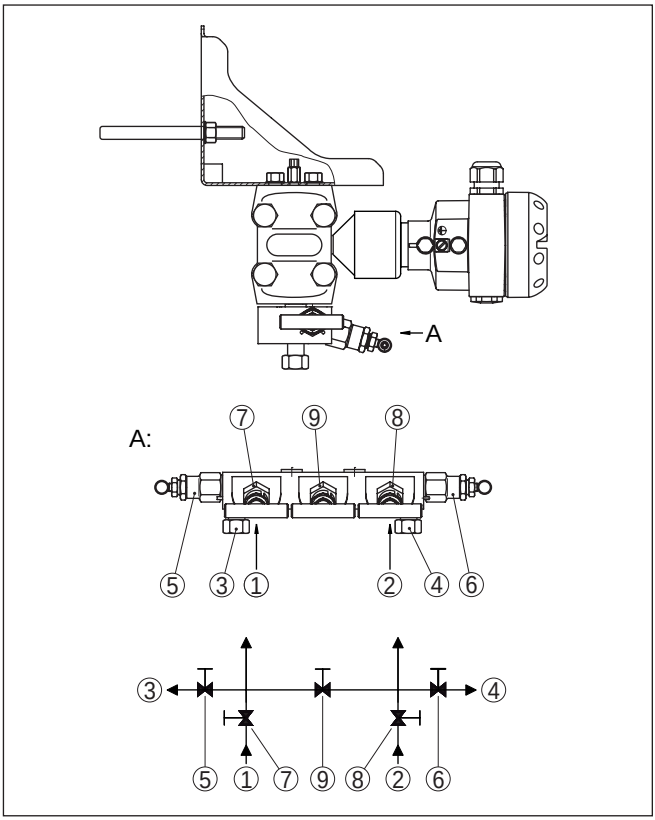


Fig. 14: Connection of a 5-fold valve block

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 DPT10 above the measurement loop so that condensate can drain off in the process cable.

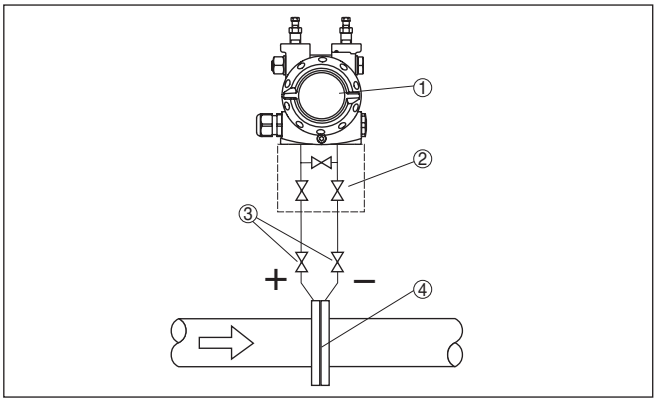


Fig. 15: Measurement setup with flow measurement of gases, connection via 3-fold valve block

1 DPT10
2 3-fold valve block
3 Blocking valves
4 Orifice or impact pressure probe

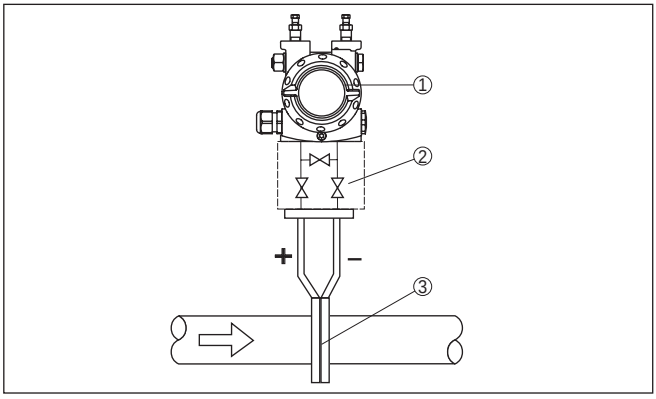


Fig. 16: Measurement setup with flow measurement of gases, connection via 3-fold valve block, flanging on both sides

1 DPT10
2 3-fold valve block, flanging on both sides
3 Orifice or impact pressure probe

In vapours

. Mount DPT10 below the measurement loop

. Mount condensate vessels at the same height with the discharge socket and at the same distance to DPT10

. Fill the effective pressure lines to the height of the condensate vessels before setup

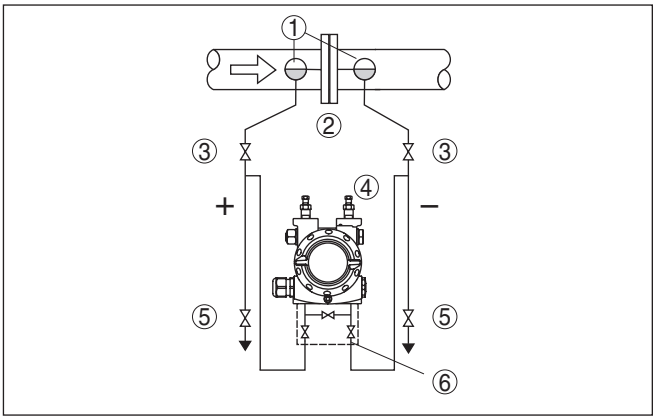


Fig. 17: Measurement setup, flow measurement in vapours

1 Condensate vessels
2 Orifice or impact pressure probe
3 Blocking valves
4 DPT10
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

. Mount DPT10 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

. 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.

. Fill the effective pressure lines to the height of the condensate vessels before setup

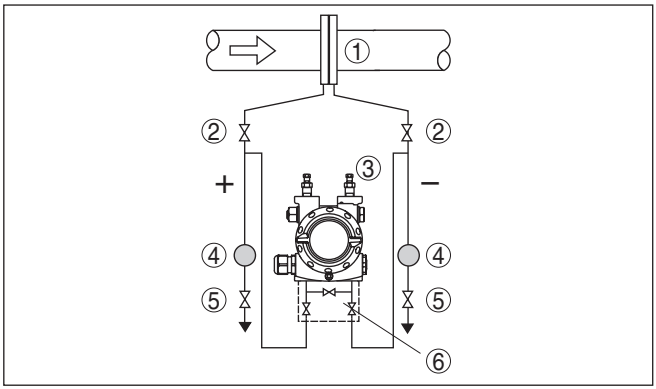


Fig. 18: Measurement setup, flow measurement in liquids

1 Orifice or impact pressure probe
2 Blocking valves
3 DPT10
4 Precipitator
5 Drain valves
6 3-fold valve block

4.5 Measurement setup level

In open vessels with effective pressure line

. Mount DPT10 below the lower measurement connection so that the effective pressure lines are always filled with liquid

. Minus side is open to the atmospheric pressure

. When measuring liquids with solid content, the mounting of separators and drain valves is useful to be able to avoid and remove buildup.

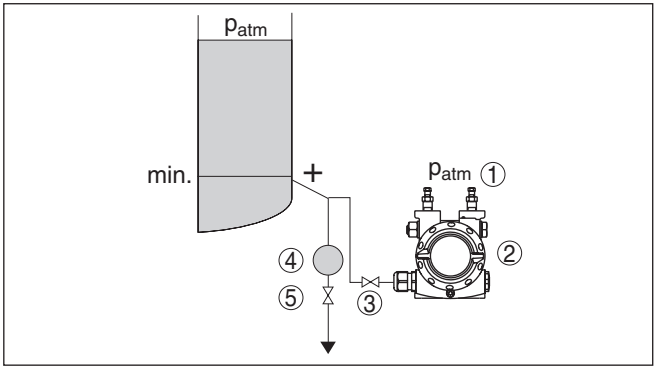


Fig. 19: Measurement setup, level measurement in the open vessel

1 DPT10
2 Minus side is open to the atmospheric pressure
3 Blocking valve
4 Precipitator
5 Drain valve

In open vessels with single chemical seal

. Mount DPT10 directly to the vessel
. Minus side is open to the atmospheric pressure

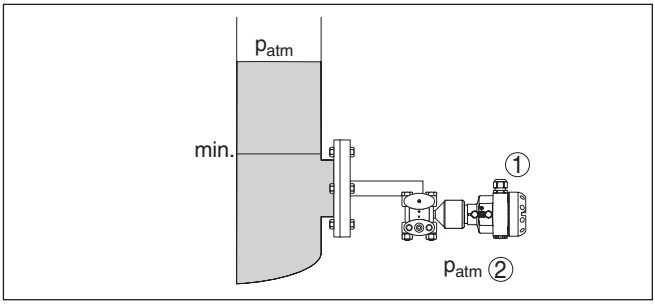


Fig. 20: Measurement setup, level measurement in the open vessel

1 DPT10
2 Minus side is open to the atmospheric pressure

In closed vessels with effective pressure lines

. Mount DPT10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
. Connect minus side always above the max. level
. 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.

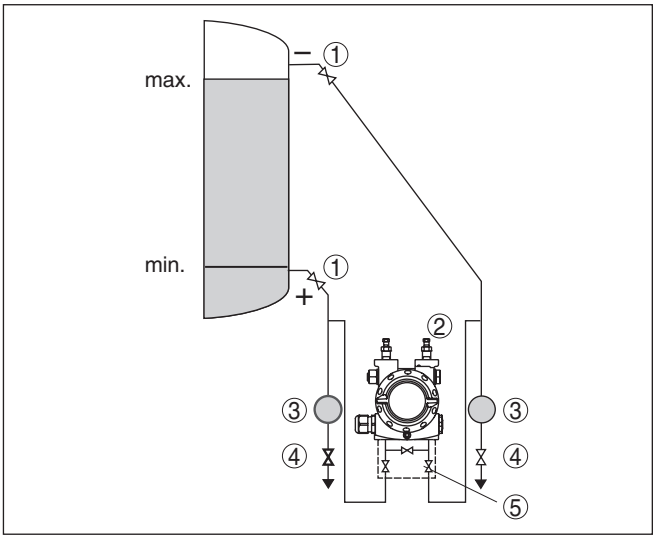


Fig. 21: Measurement setup, level measurement in closed vessel

1 Blocking valves
2 DPT10
3 Precipitator
4 Drain valves
5 3-fold valve block

In closed vessels with single chemical seal

. Mount DPT10 directly to the vessel
. Connect minus side always above the max. level
. 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.

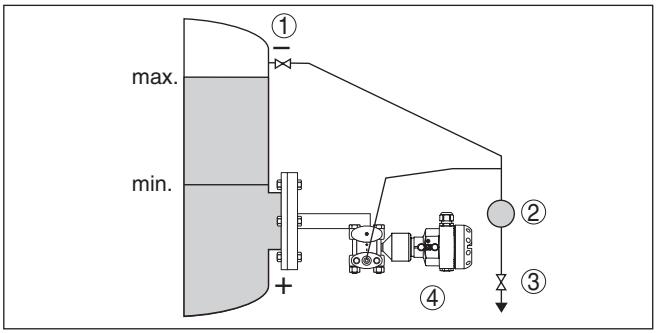


Fig. 22: Measurement setup, level measurement in closed vessel

1 Blocking valve
2 Precipitator
3 Drain valve
4 DPT10

In closed vessels with double chemical seal

. Mount DPT10 below the lower chemical seal
. 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.

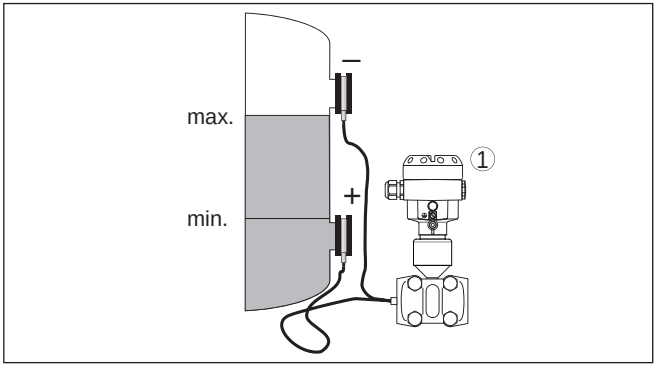


Fig. 23: Measurement setup, level measurement in closed vessel

1 DPT10

In closed vessels with steam layering with effective pressure line

. Mount DPT10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
. Connect minus side always above the max. level

. The condensate vessel ensures a constant pressure on the minus side

. 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.

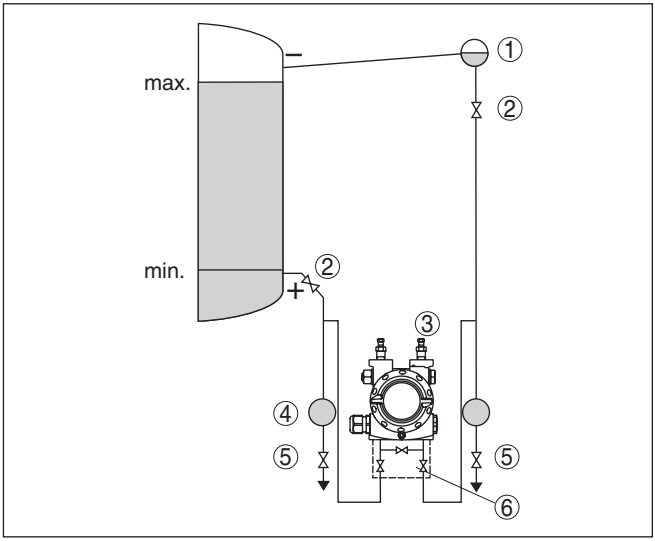


Fig. 24: Measurement setup in closed vessel with superimposed steam

1 Condensate vessel
2 Blocking valves
3 DPT10
4 Precipitator
5 Drain valves
6 3-fold valve block

In closed vessels with superimposed steam with single chemical seal

. Mount DPT10 directly to the vessel

. Connect minus side always above the max. level

. The condensate vessel ensures a constant pressure on the minus side

. 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.

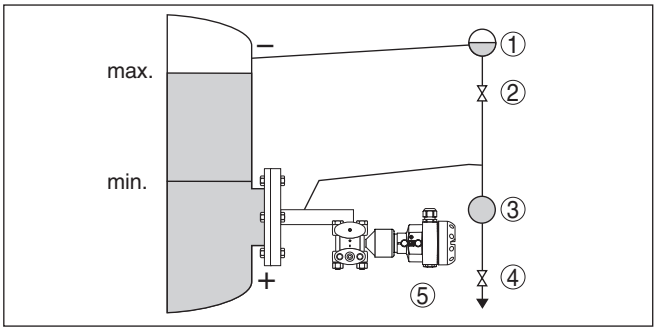


Fig. 25: Measurement setup in closed vessel with superimposed steam

1 Condensate vessel
2 Blocking valve
3 Precipitator
4 Drain valve
5 DPT10

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.

. Mount DPT10 below the lower chemical seal

. 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/m^3

Max. density: 1200 kg/m^3

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

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

$\Delta p = \rho \bullet g \bullet h$

$= 1000\ kg/m^3 \bullet 9.81\ m/s^2 \bullet 0{,}3\ m$

$= 2943\ Pa = 29.43\ mbar$

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

$\Delta p = \rho \bullet g \bullet h$

$= 1200\ kg/m^3 \bullet 9.81\ m/s^2 \bullet 0.3\ m$

$= 3531\ Pa = 35.31\ mbar$

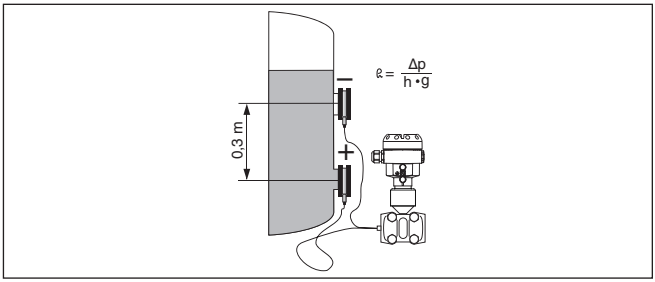


Fig. 26: Measurement setup for density measurement

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/m^3

Max. density: 1000 kg/m^3

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

$\Delta p = \rho \bullet g \bullet h$

$= 800\ kg/m^3 \bullet 9.81\ m/s \bullet 0.3\ m$

$= 2354\ Pa = 23.54\ mbar$

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

$\Delta p = \rho \bullet g \bullet h$

$= 1000\ kg/m^3 \bullet 9.81\ m/s \bullet 0.3\ m$

$= 2943\ Pa = 29.43\ mbar$

. Mount DPT10 below the lower chemical seal

. The ambient temperature should be the same for both capillaries

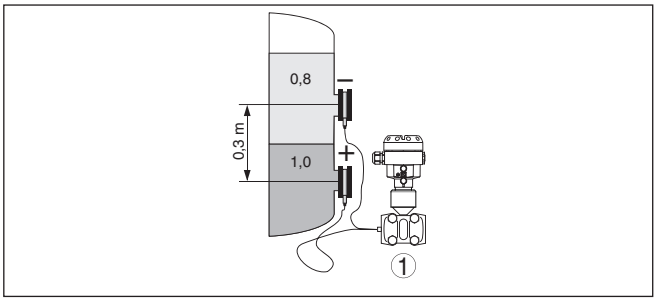


Fig. 27: Measurement setup with interface measurement

4.7 Measurement setup differential pressure

In gases and vapours

→ Mount DPT10 above the measurement loop so that condensate can drain off in the process cable.

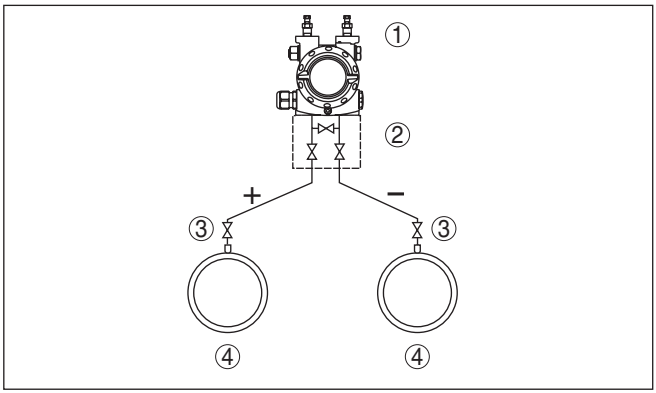


Fig. 28: Measurement setup with differential pressure measurement between two pipelines in gases and vapours

1 DPT10
2 3-fold valve block
3 Blocking valves
4 Pipelines

In vapour and condensate plants

→ Mount DPT10 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.

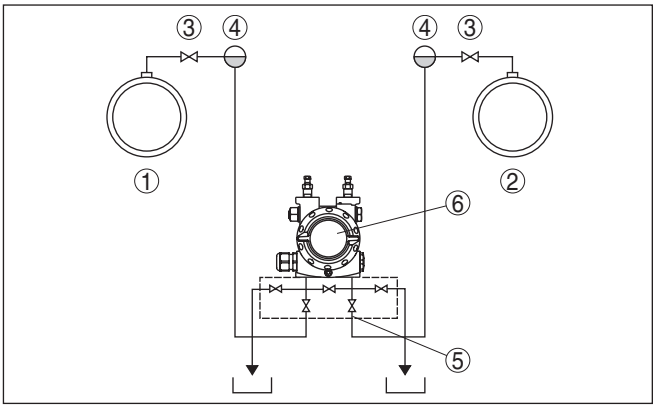


Fig. 29: Measurement setup with differential pressure measurement between a vapour and a condensate cable

1 Vapour cable
2 Condensate cable
3 Blocking valves
4 Condensate vessels
5 5-fold valve block
6 DPT10

In liquids

. Mount DPT10 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

. 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.

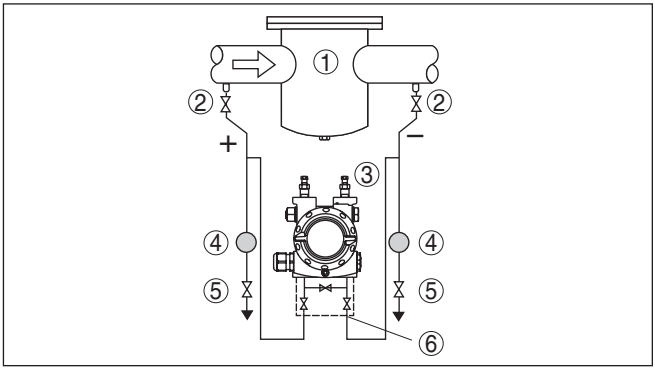


Fig. 30: Measurement setup, flow measurement in liquids

1 E.g. filter
2 Blocking valves
3 DPT10
4 Precipitator
5 Drain valves
6 3-fold valve block

When chemical seal systems are used in all products

. Mount chemical seal with capillaries on top or laterally on the pipeline
. In vacuum applications: Mount DPT10 below the measurement loop
. The ambient temperature should be the same for both capillaries

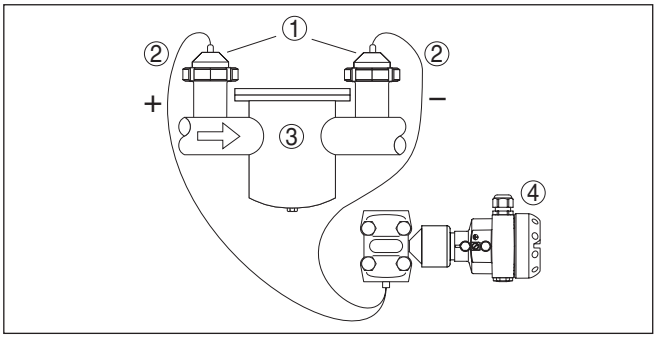


Fig. 31: Measurement setup, differential pressure measurement in gases, vapours and liquids

1 Chemical seal with slotted nut
2 Capillaries
3 E.g. filter
4 DPT10

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

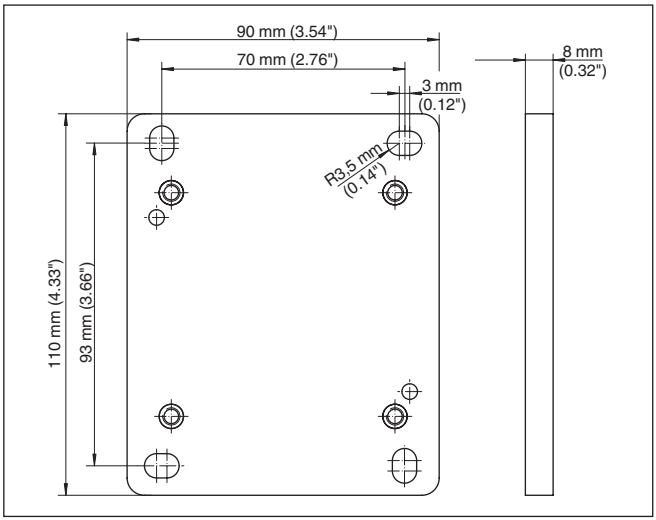


Fig. 32: Drilling template - wall mounting plate

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

Note safety instructions

Always keep in mind the following safety instructions:

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

Take note of safety instructions for Ex applications

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

Select voltage supply

Power is supplied via a Profibus DP/PA segment coupler. The power supply range can differ depending on the instrument version. The exact range is stated in the "*Technical data*".

Select connection cable

DPT10 is connected with screened cable according to the Profibus specification. Power supply and digital bus signal are carried over the same two-wire connection cable.

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.

Please make sure that your installation is carried out according to the Profibus specification. In particular, make sure that the termination of the bus is done with appropriate terminating resistors.

Cable screening and grounding

In systems with potential equalisation, connect the cable screening directly to ground potential at the power supply unit, in the connection box and at the sensor. The screen in the sensor must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the potential equalisation (low impedance).

In systems without potential equalisation, connect the cable screen directly to ground potential at the power supply unit and at the sensor. In the connection box or T-distributor, the screen of the short stub to the sensor must not be connected to ground potential or to another cable screen. The cable screens to the power supply unit and to the next distributor must be connected to each other and also connected to ground potential 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.

The total capacitance of the cable and of all capacitors must not exceed 10 nF in Ex applications.

Select connection cable for Ex applications

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.

5.2 Connection procedure

Single/Double chamber housing

Proceed as follows:

1. Unscrew the housing lid
2. If a display and adjustment module is installed, remove it by turning it to the left
3. Loosen compression nut of the cable gland and remove blind plug
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 external ground terminal to potential equalisation
11. Tighten the compression nut of the cable entry gland. The seal ring must completely encircle the cable
12. Screw the housing lid back on

The electrical connection is finished.

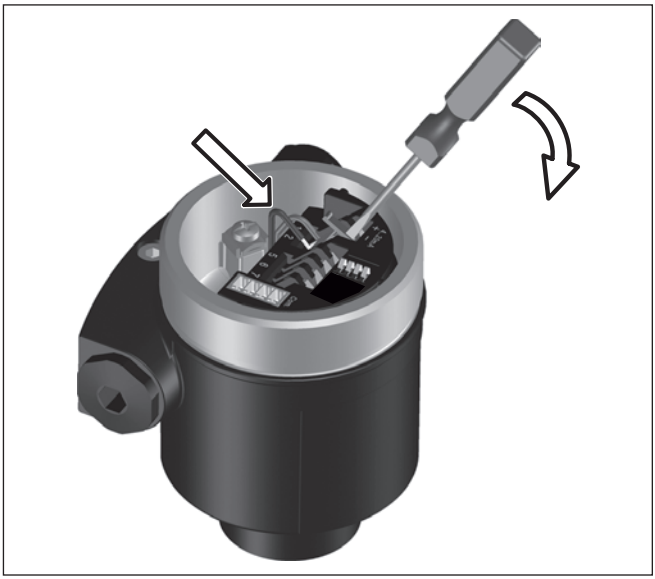
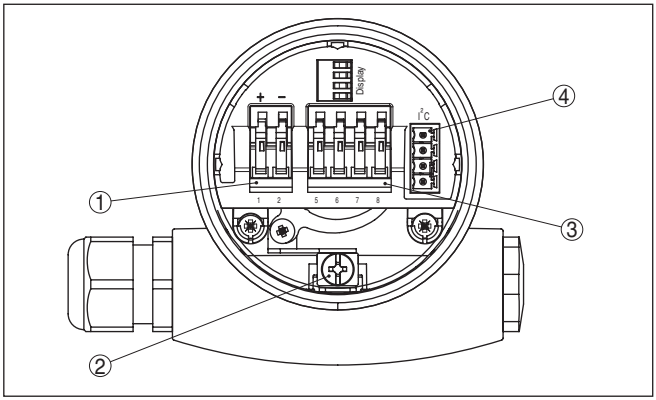


Fig. 33: Connection steps 6 and 7

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 Spring loaded terminals for display and adjustment module
3 Plug connector for service interface
4 Ground terminal for connection of the cable screening

Wiring plan

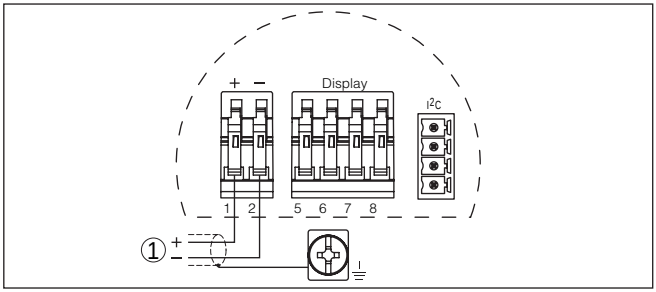


Fig. 34: Wiring plan - single chamber housing

1 Voltage supply, signal output

5.4 Double chamber housing

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

Electronics compartment

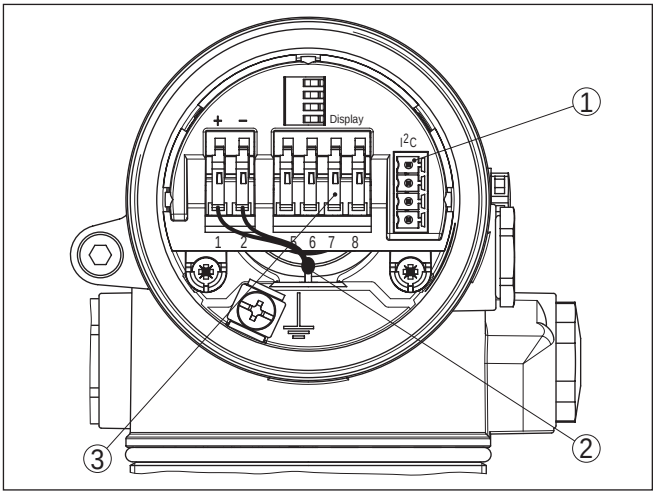


Fig. 35: Electronics compartment - double chamber housing

1 Internal connection cable to the connection compartment
2 Spring loaded terminals for display and adjustment module
3 Plug connector for service interface

Connection compartment

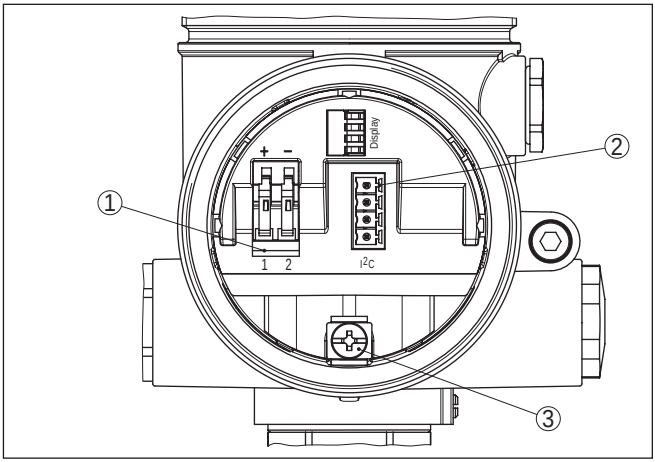


Fig. 36: Connection compartment - double chamber housing

1 Spring-loaded terminals for voltage supply
2 Plug connector for service (I^2C interface)
3 Ground terminal for connection of the cable screening

Wiring plan

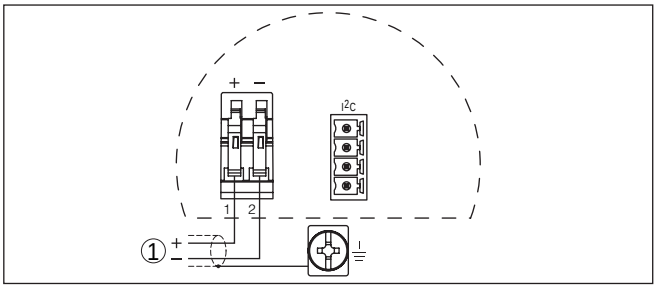


Fig. 37: Wiring plan - double chamber housing

1 Voltage supply, signal output

5.5 Double chamber housing Ex d ia

Electronics compartment

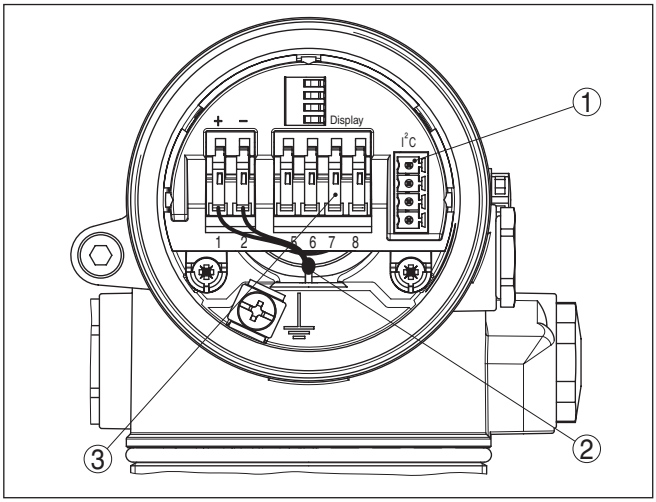


Fig. 38: Electronics compartment, double chamber housing

1 Plug connector for service (I^2C interface)
2 Internal connection cable to the connection compartment
3 Terminals for the external display and adjustment unit

Connection compartment

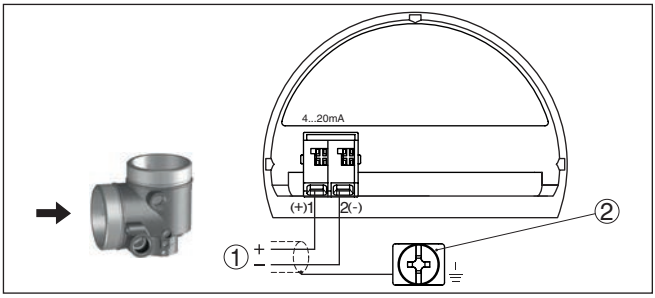


Fig. 39: Connection compartment - Ex-d-ia double chamber housing

1 Voltage supply, signal output
2 Ground terminal for connection of the cable screening

Plug M12 x 1 for external display and adjustment unit

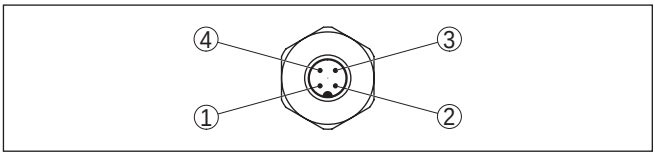


Fig. 40: Top view of the plug connector

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

5.6 Version IP66/IP68, 1 bar

Wire assignment, connection cable

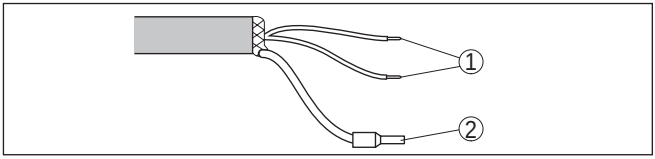


Fig. 41: Wire assignment, connection cable

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

5.7 Switch-on phase

Switch-on phase

After DPT10 is connected to voltage supply or after voltage recurrence, the instrument carries out a self-check for approx. 30 seconds. The following steps are carried out:

- Internal check of the electronics
- Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
- Status byte goes briefly to fault value

Then the current measured value will be displayed and the corresponding digital output signal will be output to the cable.[1)]

[1)] The values correspond to the actual measured level as well as to the settings already carried out, e.g. default 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 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 again at any time. It is not necessary to interrupt the power supply.

For installation, proceed as follows:

1. Unscrew the housing lid
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 lid with inspection window tightly back on

Disassembly is carried out in reverse order.

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



Fig. 42: 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 lid with an inspection glass is required.

6.3 Adjustment system

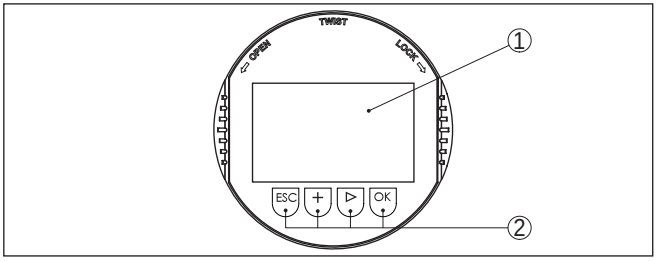


Fig. 43: Display and adjustment elements

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 instrument is operated via the four keys of the display and adjustment module. The individual menu items are shown on the LC display. You can find the function of the individual keys in the previous illustration.

Time functions

When the ***[+]*** and ***[->]*** keys are pressed quickly, the edited value, or the cursor, changes one value or position at a time. If the key is pressed longer than 1 s, the value or position changes continuously.

When the ***[OK]*** and ***[ESC]*** keys are pressed simultaneously for more than 5 s, the display returns to the main menu. The menu language is then switched over to "*English*".

Approx. 60 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

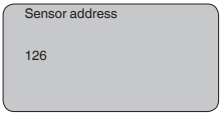
Introduction

This chapter describes the device-specific adjustment parameters.

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]***.

Basic adjustment - Sensor address

Level and pressure sensors operate as slaves on the Profibus PA. To be identified as a bus participant, each sensor must have a unique address. Each instrument is delivered with address 126. With this address, it can at first be connected to an existing bus. However, the address must be changed. This can be done in this menu item.



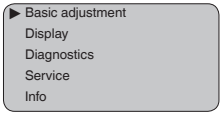
Basic adjustmen - Application

The DPT10 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.

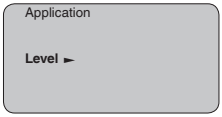
Information:
The applications density and interface measurement are also realized via the application level measurement.

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.



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



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

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

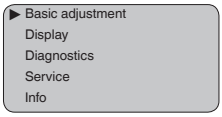
4. Select with ***[->]*** "*OK*" and confirm with ***[OK]***.
5. Select the requested application in the selection list, for example "*Flow*" and confirm with ***[OK]***.

Basic adjustment - Unit

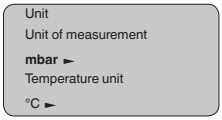
In this menu item you select the adjustment unit as well as the unit for the temperature indication in the display.

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.



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



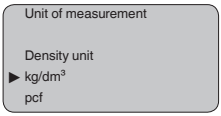
3. Activate the selection with ***[OK]*** and select "***Units of measurement*** with *[->]*.
4. Activate the selection with ***[OK]*** and select the requested unit with ***[->]*** (in the example bar).
5. Confirm with ***[OK]*** and move to position correction with ***[->]***.

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

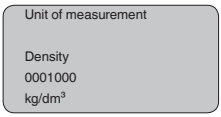
Information:
When switching over to adjustment in a height unit (for example for level measurement), the density also has to be entered.

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:

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

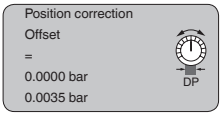
The temperature unit is hence switched over from °C to °F.

Basic adjustment - Position correction

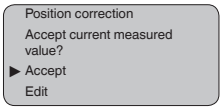
The position correction compensates the influence of the installation position of the instrument on the measured value. In this menu item, the offset value as well as the current measured value are displayed.

Proceed as follows:

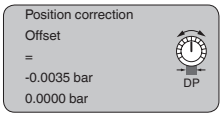
1. Activate in the menu item "*Position correction*" the selection with ***[OK]***.



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.

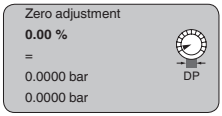
If a known value should be taken over as position correction which is not the current value, then you have to select the function "*Edit*" and enter the requested value.

Basic adjustment - 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.

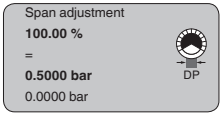
Information:
The Zero adjustment shifts the value of the span adjustment. The span, i.e. the difference between these values, however, remains unchanged.

Basic adjustment - 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]***.

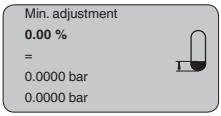
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

The span adjustment is finished.

Basic adjustment - 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 ***[->]***.

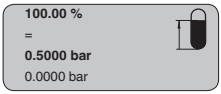
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The min. adjustment is finished.

Basic adjustment - 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.

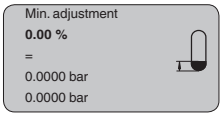
The max. adjustment is finished.

Basic adjustment - 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.
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.

Basic adjustment - 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:

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 100 mbar).

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

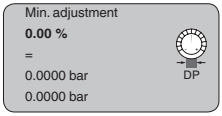
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The max. adjustment is finished.

Basic adjustment - Min. adjustment with flow

Proceed as follows:

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



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

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

Information:
The DPT10 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.

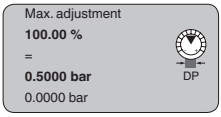
Example: Max. adjustment value **+100 mbar**, as min. adjustment value, **-100 mbar** must hence be entered.

The min. adjustment is finished.

Basic adjustment - 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.

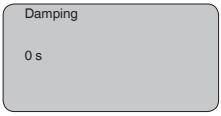
The max. adjustment is finished.

Menu section, basic adjustment

Basic adjustment - Damping

To damp process-dependent measured value fluctuations, set an integration time of 0 … 999 s in this menu item.

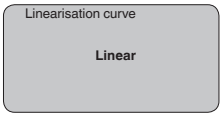
Depending on the sensor type, the factory setting is 0 s or 1 s.



Basic adjustment - 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 DPT10 with corresponding approval is used as part of an overfill protection system according to WHG (Water Resources Act):

If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when setting the switching point on the limit signal transmitter.

Basic adjustment - Linearization curve with flow

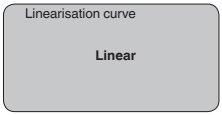
The square of the flow is proportional to the pressure difference at the orifice or the back pressure probe:

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

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

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

The DPT10 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.

Basic adjustment - 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.

Basic adjustment - Sensor TAG

In the menu item "*Sensor-TAG*" you edit a 12-digit measurement loop name. An unambiguous designation can hence be assigned to the

sensor, e.g. the measurement loop name or the tank or product designation. In digital systems and in the documentation of larger plants, a singular designation should be entered for exact identification of individual measuring sites.

The available digits include:

- Letters from A … Z
- Numbers from 0 … 9
- Special characters +, -, /, -

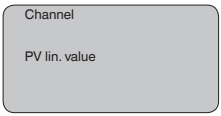
Factory setting is "*Sensor*".



Basic adjustment - Channel

The channel is the input selector switch for function block (FB) of the sensor. Within the function block, additional scalings (Out-Scale) are carried out. In this menu item, the value fir the function block is selected:

- SV1 (Secondary Value 1):
  - Pressure or height
- SV2 (Secondary Value 2):
  - Percent
- PV (Primary Value):
  - Linearised percentage value



Display - Indicated value

In the menu item "*Display*" you can define how the measured value should be presented on the display.

The following indication values are available:

- Height
- Pressure (only with pressure transmitters)
- Current
- Scaled
- Percent
- Lin. percent
- Temperature

The selection "*scaled*" opens the menu items "*Display unit*" and "*Scaling*". In "*Display unit*" there are the following options:

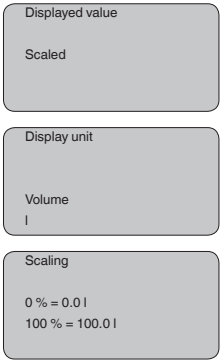
- Height
- Ground
- Flow
- Volume
- Without unit

Depending on selection, the different units are in turn available.

In the menu item "*Scaling*", the requested numerical value with decimal point is entered for 0 % and 100 % of the measured value.

There is the following relationship between the indication value in the menu "*Display*" and the adjustment unit in the menu "*Device settings*":

- With pressure, the displayed value "*Pressure*" or "*Height*" means: presentation of the measured value in the selected adjustment unit, e.g. bar or m.



Display - Backlight

An integrated background lighting can be switched on via the adjustment menu.

The function depends on the height of the operating voltage, see operating instructions of the respective sensor.

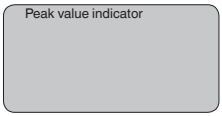
To maintain the function of the device, the lighting is temporarily switched off if the power supply is insufficient.

In the default setting, the lightning is switched on.

Diagnosis - Peak value

The respective min. and max. measured values are saved in the sensor. The values are displayed in the menu item "*Peak values*".

- Min. and max. pressure[2)]
- Min. and max. temperature[3)]

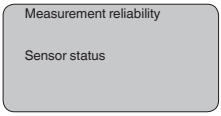


Diagnostics - Device status

The instrument status is displayed in this menu item. If no failure is detected by the sensor, "*OK*" will be displayed. If a failure is detected, there will be a sensor-specific flashing fault signal, for example "*E013*". The failure is also displayed in clear text, for example "*No measured value available*".

2) Pressure: -50 … +150 % of the nominal measuring range.
3) Temperature: -50 … +150 °C.

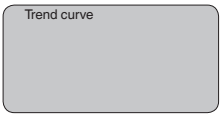
Information:
The fault message as well as the clear text indication are also carried out in the measured value display.



Diagnostics - Trend curve

Available with the trend curve:

- "X-Zoom": Resolution in minutes, hours or days
- "Stop/Start": Interrupt a recording or start a new recording
- "Unzoom": Reset the resolution to minutes

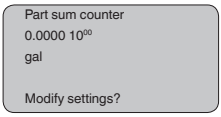


Diagnosis - Total amounts counter and subtotalizer with flow

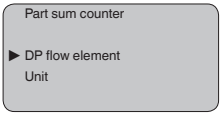
The DPT10 has two internal totalizers. For both you can adjust volume or mass as count function as well as separately the unit.

Proceed as follows:

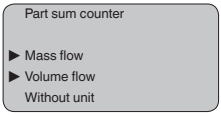
1. Select, for example, menu item "*Part sum counter*".



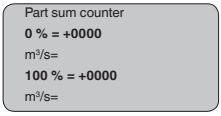
2. Activate the function "*Modify settings?*" with ***[OK]***.



3. Confirm with ***[OK]*** "*DP flow element*".



4. Select the requested variable with ***[->]*** and confirm with ***[OK]***.
5. Select calibration unit of the DP flow element with ***[->]***, for example m^3/s and confirm with ***[OK]***.



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 m^3/s and confirm with ***[OK]***.

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

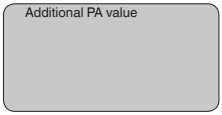
The procedure of the total sum counter is the same.

Service - Additional PA value

Profibus transmits two values cyclically. The first value is determined in the menu item "*Channel*". The additional cyclical value is selected in the menu item "*Additional PA value*".

With pressure transmitters the following values are available:

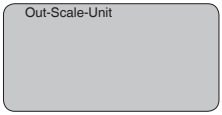
- SV1 (Secondary Value 1): Pressure or height value before adjustment
- SV2 (Secondary Value 2): Percentage value after the adjustment
- PV (Primary Value): Linearised percentage value

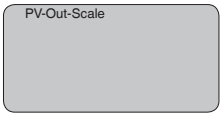


Service - Out-Scale

Here, you determine the unit and scaling for PA-Out. These settings also apply to the values displayed on the display and adjustment module if in the menu item "*Displayed value*" PA-Out was selected.[4)]

In the menu item "*PV-Out-Scale*", the requested numerical value with decimal point is entered for 0 % and 100 % of the measured value.





Menu section, service

Service - Simulation

In this menu item you simulate a user-defined level or pressure value via the current output. This allows you to test the signal path, e.g. through connected indicating instruments or the input card of the control system.

The following simulation variables are available:

- Percent
- Current
- Pressure

[4)] The following display values are available in "Out-Scale-Unit": Pressure, height, mass, flow, volume, others (without unit, %, mA).

With Profibus PA sensors, the selection of the simulated value is made via the "Channel" in the menu "*Basic adjustments*".

How to start the simulation:

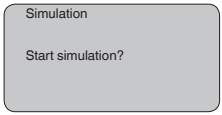
1. Push ***[OK]***
2. Select the requested simulation variable with ***[->]*** and confirm with ***[OK]***.
3. Set the requested numerical value with ***[+]*** and ***[->]***.
4. Push ***[OK]***

The simulation is now running, with 4 … 20 mA/HART a current is output and with Profibus PA or Foundation Fieldbus a digital value.

How to interrupt the simulation:

→ Push ***[ESC]***

Information:
The simulation is automatically terminated 10 minutes after the last pressing of a key.



Service - Reset

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

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
	Linearisation	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

Menu section	Menu item	Reset value
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

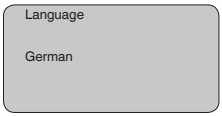
Peak value indicator
The min. and max. temperature or pressure values are each reset to the actual value.

Totalizer
The total and part sum counter are reset to zero.

Service - Language

The sensor is already set to the ordered national language. In this menu item you can change the language. The following languages are available as of software version 3.50:

- Deutsch
- English
- Français
- Espanõl
- Pycckuu
- Italiano
- Netherlands
- Japanese
- Chinese



Copy sensor data

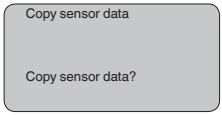
This function enables reading out parameter adjustment data as well as writing parameter adjustment data into the sensor via the display and adjustment module.

The following data are read out or written with this function:

- Measured value presentation
- Application
- Adjustment
- Damping
- Linearisation curve
- Leak flow volume suppression
- Sensor-TAG
- Displayed value
- Scaling unit (Out-Scale unit)
- Positions after the decimal point (scaled)
- Scaling PA/Out-Scale 4 values
- Unit of measurement
- Language

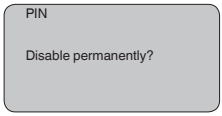
The following safety-relevant data are **not** read out or written:

- Sensor address
- PIN



Service - PIN

In this menu item, the PIN is activated/deactivated permanently. Entering a 4-digit PIN protects the sensor data against unauthorized access and unintentional modifications. If the PIN is activated permanently, it can be deactivated temporarily (i.e. for approx. 60 min.) in any menu item. The instrument is delivered with the PIN set to 0000.



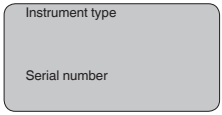
Only the following functions are permitted with activated PIN:

- Select menu items and show data
- Read data from the sensor into the display and adjustment module

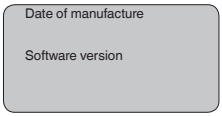
Info

In this menu item the most important sensor information can be displayed:

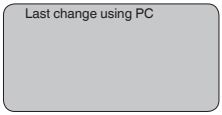
- Instrument type
- Serial number: 8-digit number, e.g. 12345678



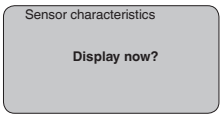
- Date of manufacture: Date of the factory calibration
- Software version: Edition of the sensor software



- Date of last change using PC: Date of the last change of sensor parameters via PC



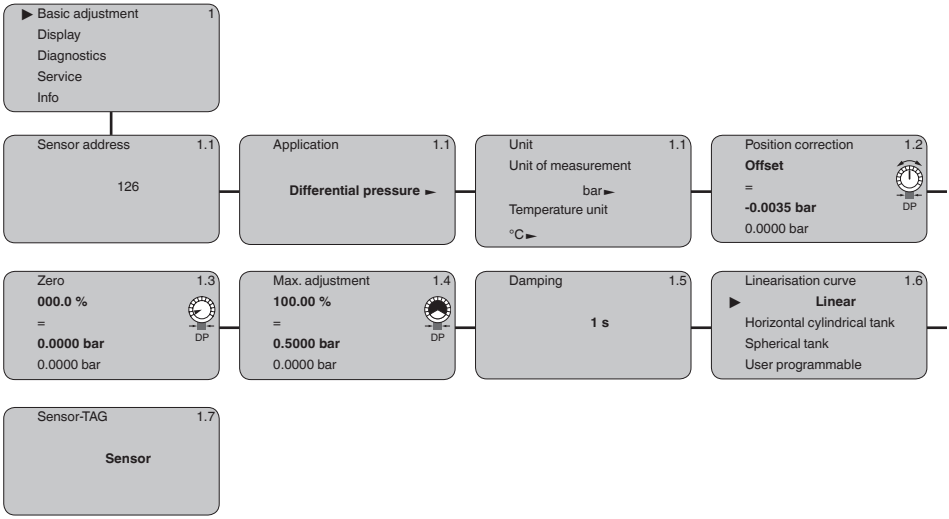
- Sensor details, e.g. approval, process fitting, seal, measuring cell, measuring range, electronics, housing, cable entry, plug, cable length etc.



6.5 Menu schematic

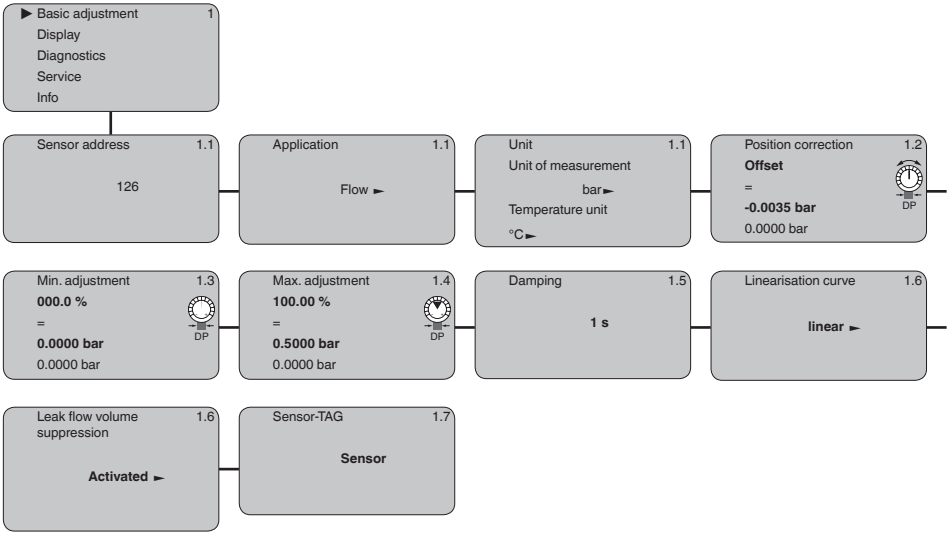
Information:
Depending on the version and application, the highlighted menu windows may not always be available.

Basic adjustment differential pressure

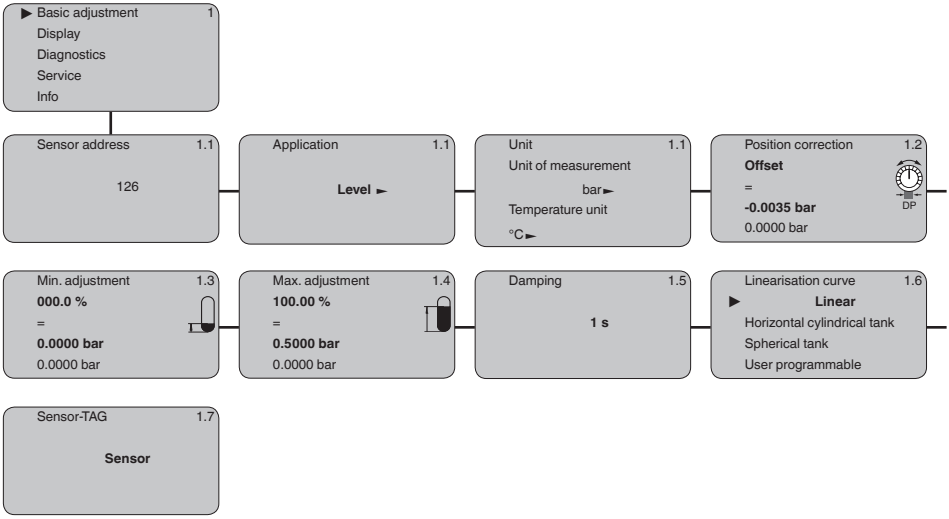


6.6 Menu schematic

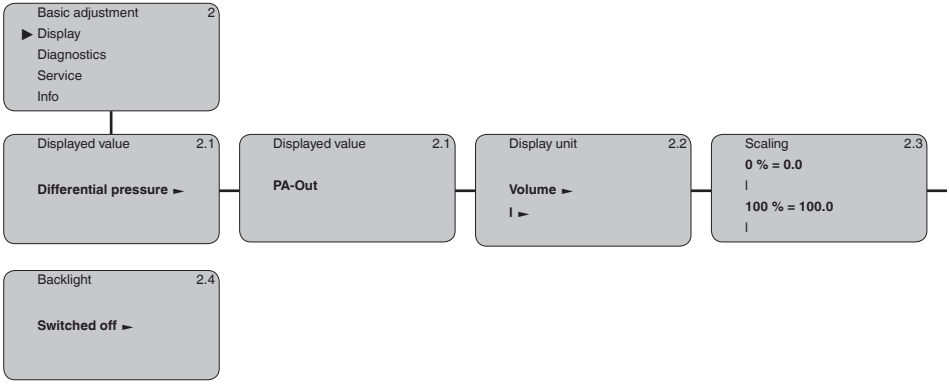
Basic adjustment flow



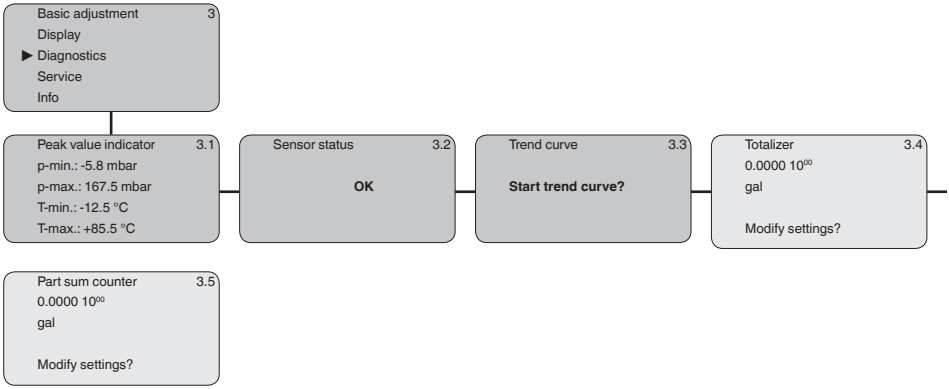
Basic setting level



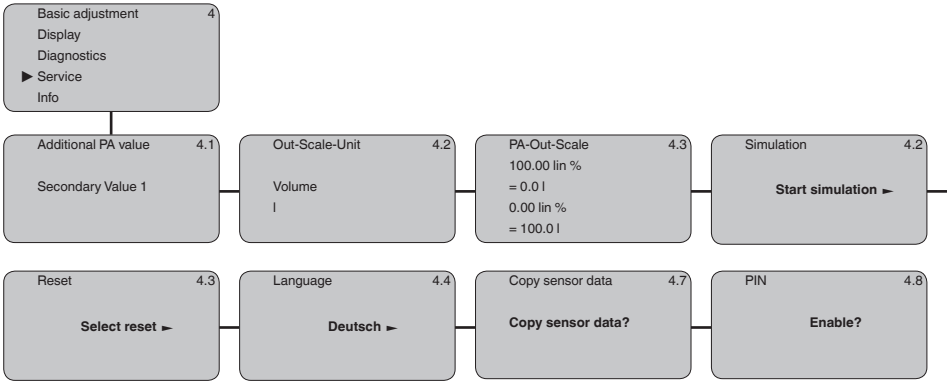
Display



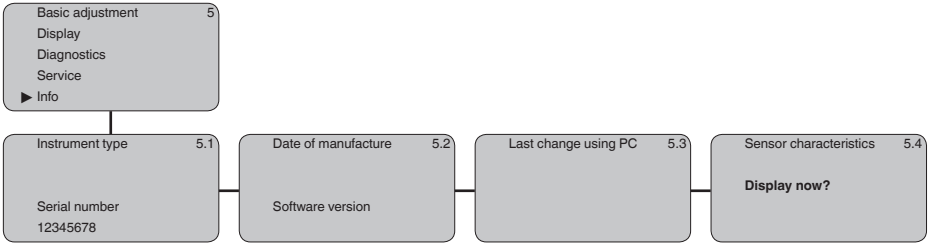
Diagnostics



Service



Info



6.7 Saving the parameterisation data

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

If the DPT10 is equipped with a dsiplay and adjustment module, the most important data can be read from the sensor into the display and adjustment module. The data remain permanently saved there even in case of sensor supply failure.

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 PDM

7.1 Parameter adjustment with PDM

For WIKA sensors, instrument descriptions are also available as EDDs for the adjustment program PDM. The instrument descriptions are already implemented in the current version of PDM. For older versions of PDM, a free-of-charge download is available via Internet.

Go via www.wika.com to the item "*Service*".

8 Setup

8.1 General instructions

Before adjusting DPT10, you have to clean the effective pressure lines and the instrument must be filled with the medium.

DPT10 with double chemical seal is immediately ready for operation.

The DPT10 without chemical seal or with single chemical seal is ready for operation after opening a blocking valve, in case one is present.

8.2 Flow measurement

Gases

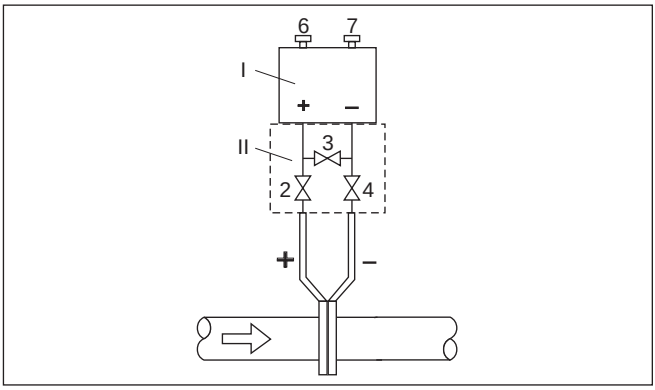


Fig. 44: Prefered measurement setup for gases, connection via 3-fold valve block, flanging on both sides

I DPT10
II 3-fold valve block
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on DPT10

Liquids

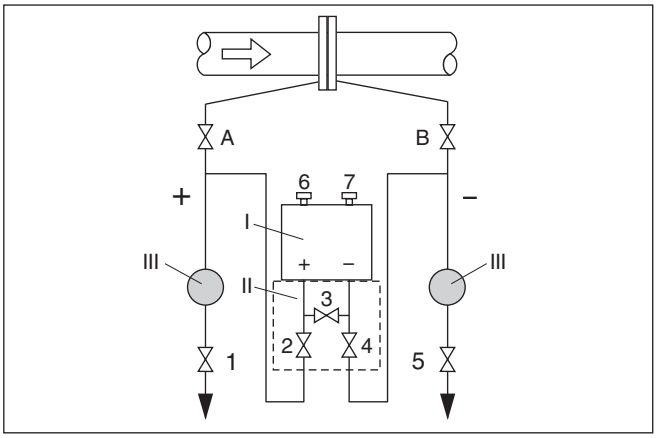


Fig. 45: Preferred measurement setup for liquids

I DPT10
II 3-fold valve block
III Precipitator
1, 5 Drain valves
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on DPT10
A, B Blocking valves

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.[5)]

   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: Low pressure side is closed

   Open valve 3: Equalisation high and low pressure 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:

[5)] Arrangement with 5 valves.

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 high and low pressure side

   Open valve 4: Connect low pressure side

   Now:

   Valves 1, 3, 5, 6 and 7 are closed[6)]

   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.

8.3 Level measurement

Closed vessel

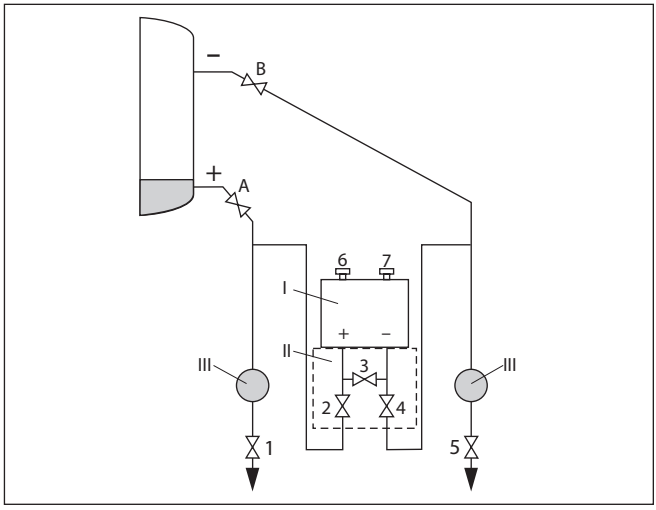


Fig. 46: Preferred measurement setup for closed vessels

I DPT10
II 3-fold valve block
III Precipitator
1, 5 Drain valves
2, 4 Inlet valves
6, 7 Vent valves on DPT10
A, B Blocking valves

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium

   Close valve 3: Separate high/low pressure side

[6)] Valves 1, 3, 5: Configuration with 5 valves.

Open valve A and B: Open block valves

3. Vent high pressure side (probably empty low pressure side)

   Open valve 2 and 4: Discharge medium on the high pressure side

   Briefly open valve 6 and 7, then close again: Fill the high pressure 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

Closed vessel with steam layer

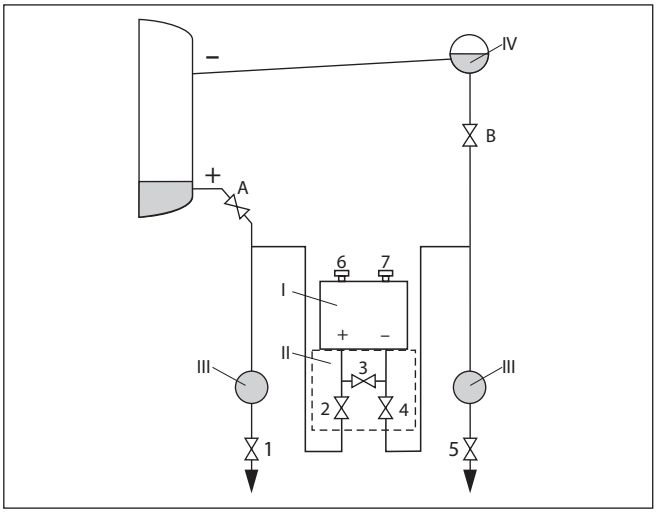


Fig. 47: Preferred measurement setup for closed vessels with steam overlay

I DPT10
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 DPT10
A, B Blocking valves

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 low pressure 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 high and low pressure 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 high and low pressure side

   Open valve 4: Connect low pressure side

   Now:

   Valve 3, 6 and 7 are closed

   Valves 2, 4, A and B are open.

8.4 Density and interface measurement

For density and interface measurements, DPT10 with double chemical seal is used.

DPT10 in this version is immediately ready for operation.

8.5 Differential pressure measurement

Instructions

For differential pressure measurements, DPT10 without chemical seal or with double chemical seal is used.

DPT10 with double chemical seal is immediately ready for operation.

Before adjusting DPT10 without chemical seal, the effective pressure lines must be cleaned and the instrument filled with medium.

9 Maintenance and fault rectification

9.1 Maintenance

Maintenance

If the device 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 malfunction occurs

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

Causes of malfunction

The device 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.

Checking Profibus PA

The following table describes possible errors and helps to remove them:

Error	Cause	Rectification
When an additional instrument is connected, the segment fails.	Max. supply current of the segment coupler exceeded	Measure the current consumption, reduce size of segment
Wrong presentation of the measured value in Simatic S5	Simatic S5 cannot interpret the number format IEEE of the measured value	Insert converting component from Siemens
In Simatic S7 the measured value is always presented as 0	Only four bytes are consistently loaded in the PLC	Use function component SFC 14 to load 5 bytes consistently
Measured value on the display and adjustment module does not correspond to the value in the PLC	The menu item "*Display - Display value*" is not set to "*PA-Out*"	Check values and correct, if necessary
No connection between PLC and PA network	Incorrect adjustment of the bus parameter and the segment coupler-dependent baud rate	Check data and correct, if necessary

Error	Cause	Rectification
Instrument does not appear during connection setup	Profibus DP cable pole-reversed	Check cable and correct, if necessary
	Incorrect termination	Check termination at the beginning and end points of the bus and terminate, if necessary, according to the specification
	Instrument not connected to the segment, double assignment of an address	Check and correct, if necessary



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

Error messages via the display and adjustment module

Error code	Cause	Rectification
E013	no measured value available[7)]	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

[7)] Fault message can also appear if the pressure is higher than the nominal range.

10 Dismount

10.1 Dismounting steps



Warning:
Before dismounting, 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 voltage 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 electronics to be easily separable.

WEEE directive
The instrument does not fall in the scope of the EU WEEE directive. Article 2 of this Directive exempts electrical and electronic equipment from this requirement if it is part of another instrument that does not fall in the scope of the Directive. These include stationary industrial plants.

Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points.

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

Note for approved instruments

The technical data in the respective safety instructions which are included in delivery are valid for approved instruments (e.g. with Ex approval). These data can differ from the data listed herein, for example regarding the process conditions or the voltage supply.

All approval documents can be downloaded from our homepage.

Materials and weights

Material 316L corresponds to stainless steel 1.4404 or 1.4435

Materials, wetted parts	
– Process fitting with lateral flanges	Steel C 22.8 (1.0460), 316L, Alloy C276 (2.4819)
– Separating diaphragm	316L, Alloy C276 (2.4819), Tantalum, Alloy C276 (2.4819) 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 oil[8)]
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 lid 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
– Conductive connection	Between ground terminal and process fitting
– Connection cable with Version IP68 (1 bar)	PE
– Connection between IP68 transmitter and external electronics housing	PUR
– Type label support with IP68 version on cable	PE hard
Max. torque screws mounting strap	30 Nm

[8)] Halocarbon oil generally with oxygen applications, not with vacuum and absolute pressure measuring range < 1 bar_{abs}.

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	digital output signal, format according to IEEE-754
Sensor address	126 (default setting)
Current value	10 mA, ±0.5 mA

Dynamic behaviour output

Run-up time	≤ 20 s

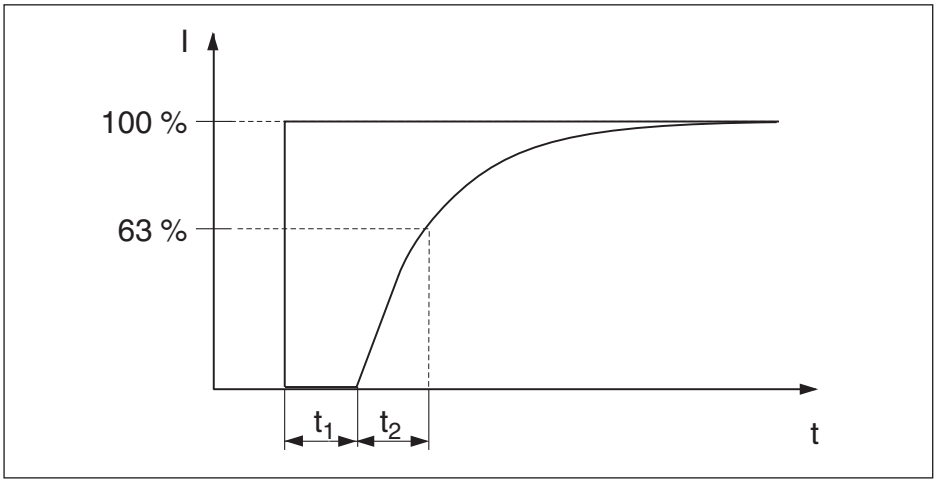


Fig. 48: Presentation of the dead time t_1 and the time constant t_2

Version, nominal measuring range	Dead time t_1	Time constant t_2
Basic version 10 bar and 30 bar	100 ms	450 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

Bus response time with Profibus PA

– cyclically approx.	10 ms
– acyclically approx.	50 ms
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 %)[9]

Adjustment level

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

– Percentage value	-10 … +110 %
– Pressure value	-120 … +120 %[10]

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 %[11]
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 influencing variables (according to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1

– Temperature	+18 … +30 °C (+64 … +86 °F)

[9] Values less than -1 bar cannot be set.
[10] Values less than -1 bar cannot be set.
[11] Values less than -1 bar cannot be set.

– 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 zero point	≤ 4 mbar[12)]

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 (2.4819), gold rhodium plated, Alloy 400 (2.4360)
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 60770[13)]

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.

All versions

The following applies to square root extracted characteristics: The accuracy data of DPT10 are entered with factor 0.5 in the accuracy calculation of the flow.

Basic version

10 mbar, 30 mbar measuring cell	
– Turn down 1 : 1	±0.09 % of the set span
– Turn down > 1 : 1	±0.09 % of the set span x TD
100 mbar measuring cell	
– Turn down 1 : 1 to 4 : 1	±0.075 % of the set span
– Turn down > 4 : 1	±(0.012 x TD + 0.027) % of the set span
Measuring cells ≥ 500 mbar	
– Turn down 1 : 1 to 15 : 1	±0.075 % of the set span
– Turn down > 15 : 1	±(0.0015 x TD + 0.053) % of the set span

Chemical seal versions

100 mbar measuring cell	
– Turn down 1 : 1 to 4 : 1	±0.075 % of the set span + influence of the chemical seal
– Turn down > 4 : 1	±(0.012 x TD + 0.027) % of the set span + influence of the chemical seal

[12)] Max. value with horizontal process component. Specification applies to the basic version without chemical seal. The value doubles with instruments with inert oil.

[13)] Incl. non-linearity, hysteresis and non-repeatability.

Measuring cells ≥ 500 mbar

– Turn down 1 : 1 to 15 : 1	±0.075 % of the set span + influence of the chemical seal
– Turn down > 15 : 1	±(0.0015 % x TD + 0.053 %) of the set span + influence of the chemical seal

Influence of the medium or ambient temperature

Thermal change zero signal and output span

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	
-10 … +60 °C (+14 … +140 °F)	10 mbar, 30 mbar	±(0.30 x TD + 0.06) %
	100 mbar	±(0.18 x TD + 0.02) %
	500 mbar, 3 bar	±(0.08 x TD + 0.05) %
	16 bar	±(0.1 x TD + 0.1) %
	40 bar	±(0.08 x TD + 0.05) %
-40 … +10 °C (-40 … +50 °F) +60 … +85 °C (+140 … +185 °F)	10 mbar, 30 mbar	±(0.45 x TD + 0.1) %
	100 mbar	±(0.3 x TD + 0.15) %
	500 mbar, 3 bar	±(0.12 x TD + 0.1) %
	16 bar	±(0.15 x TD + 0.2) %
	40 bar	±(0.37 x TD + 0.1) %

Thermal change, current output

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

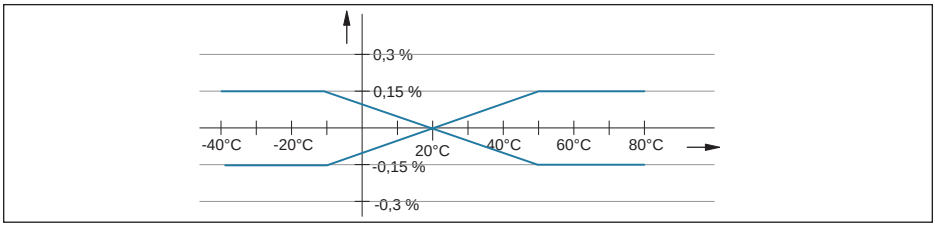


Fig. 49: Thermal change, current output

Influence of the system pressure on the zero point and span

316L, Alloy C276 (2.4819), Alloy 400 (2.4360) diaphragm

Measuring cell	10 mbar	30 mbar	100 mbar	500 mbar
Influence of the system pressure to the zero point	±0.15 % of URL/7 bar	±0.50 % of URL/70 bar	±0.15 % of URL/70 bar	±0.075 % of URL/70 bar

Measuring cell	10 mbar	30 mbar	100 mbar	500 mbar
Influence of the system pressure to the span	±0.035 % of URL/7 bar	±0.14 % of URL/70 bar	±0.14 % 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	±0.075 % of URL/7 bar	±0.075 % of URL/70 bar	±0.075 % 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

Alloy gold rhodium-coated diaphragm

Measuring cell	10 mbar	30 mbar	100 mbar	500 mbar
Influence of the system pressure to the zero point	±0.15 % of URL/7 bar	±0.77 % of URL/70 bar	±0.42 % of URL/70 bar	±0.075 % of URL/70 bar
Influence of the system pressure to the span	±0.035 % of URL/7 bar	±0.14 % 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	±0.075 % of URL/7 bar	±0.075 % of URL/70 bar	±0.075 % 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

Tantalum diaphragm

Measuring cell	10 mbar	30 mbar	100 mbar	500 mbar
Influence of the system pressure to the zero point	±0.32 % of URL/7 bar	±1.60 % of URL/70 bar	±0.42 % of URL/70 bar	±0.14 % of URL/70 bar
Influence of the system pressure to the span	±0.07 % of URL/7 bar	±0.32 % 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 the non-linearity incl. hysteresis and non-repeatability, the thermal change of the zero point and the static pressure influence (p_{st} = 70 bar). All specifications refer to the adjusted span and apply to the temperature range +10 … +60 °C (+50 … +140 °F).

Diaphragm material	Turn Down up to	316L, Alloy	Alloy gold rhodium	Tantalum
Measuring cell				
10 mbar	1 : 1	< ±0.35 %	< ±0.64 %	< ±0.61 %
30 mbar	1 : 1	< ±0.77 %	< ±0.99 %	< ±1.66 %
100 mbar	2 : 1	< ±0.27 %	< ±0.50 %	< ±0.30 %
≥500 mbar	2 : 1	< ±0.15 %	< ±0.15 %	< ±0.30 %

Total Error - basic version

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

Diaphragm material	316L, Alloy	Alloy gold rhodium	Tantalum
Measuring cell			
10 mbar	< ±0.36 %	< ±0.64 %	< ±0.62 %
30 mbar	< ±0.77 %	< ±0.99 %	< ±1.66 %
100 mbar	< ±0.33 %	< ±0.50 %	< ±0.48 %
≥500 mbar	< ±0.20 %	< ±0.20 %	< ±0.35 %

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 range	1 year	5 years	10 years
10 mbar	< ±0.100 %	< ±0.150 %	-
100 mbar	< ±0.180 %	-	-
500 mbar	< ±0.025 %	< ±0.050 %	< ±0.075 %
3 bar	< ±0.038 %	< ±0.075 %	< ±0.150 %
16 bar	< ±0.025 %	< ±0.110 %	< ±0.210 %

Ambient conditions

Ambient, storage and transport temperature

- Standard version -40 … +80 °C (-40 … +176 °F)
- Version for oxygen applications[14)] -40 … +60 °C (-40 … +140 °F)
- Versions IP66/IP68 (1 bar), connection cable PE -20 … +60 °C (-4 … +140 °F)
- Versions IP66/IP68 (1 bar) and IP68, connection cable PUR -20 … +80 °C (-4 … +176 °F)

[14)] Up to 60 °C (140 °F).

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 seal[15)]

- 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 C 22.8 (1.0460) — -40 … +120 °C (-40 … +248 °F)

Specifications apply to suitable chemical seals

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

Process temperature limits according to the seal material

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

Process pressure limits according to measuring range[16)]

[15)] For the version for oxygen application, note chapter "Oxygen applications".
[16)] Reference temperature +20 °C (+68 °F)

Nominal range	Nominal pressure	Overload one-sided	Overload two-sided	Min. system pressure
10 mbar (1 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)	0.1 $mbar_{abs}$ (10 Pa_{abs})
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)	160 bar (16000 kPa)	240 bar (24000 kPa)	
	420 bar (42000 kPa)	420 bar (42000 kPa)	630 bar (63000 kPa)	
3 bar (300 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)	
	420 bar (42000 kPa)	420 bar (42000 kPa)	630 bar (63000 kPa)	
16 bar (1600 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)	
	420 bar (42000 kPa)	420 bar (42000 kPa)	630 bar (63000 kPa)	
40 bar (4000 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)	
	420 bar (42000 kPa)	420 bar (42000 kPa)	630 bar (63000 kPa)	

Process pressure limits according to the seal material[17)]

Seal material	Nominal pressure	Overload one-sided	Overload two-sided	Min. system pressure
FFKM (Kalrez 6375)	100 bar (10000 kPa)	100 bar (10000 kPa)	150 bar (15000 kPa)	0.1 $mbar_{abs}$ (10 Pa_{abs})
FFKM (Kalrez 6375)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)	

Vibration resistance (mechanical vibrations with 5 … 100 Hz), depending on the version as well as the material and series of the electronics housing[18)]

- Plastic single and double chamber housing, Aluminium single chamber housing — 4 g
- Aluminium double chamber housing, stainless steels single chamber housing — 1 g
- Stainless steel double chamber housing — < 1 g

Shock resistance — Acceleration 100 g/6 ms[19)]

Electromechanical data - version IP66/IP67

Cable entry/plug[20)]

- 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:
  - 1 x plug (depending on the version), 1 x blind stopper M20 x 1.5

17) Reference temperature +20 °C (+68 °F)
18) Tested according to the guidelines of German Lloyd, GL directive 2.
19) Tested according to EN 60068-2-27.
20) Depending on the version M12 x 1, according to ISO 4400, Harting, 7/8" FF.

– Double chamber housing	– 1 x cable entry M20 x 1.5 (cable: ø 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 ½ NPT, 1 x blind plug ½ 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)

Electromechanical data - version IP66/IP68 (1 bar)

Cable entry	
– Single chamber housing	– 1 x IP68 cable gland M20 x 1.5; 1 x blind plug M20 x 1.5 or: – 1 x closing cap ½ NPT, 1 x blind plug ½ NPT
Connection cable	
– Configuration	four wires, one suspension wire, one breather capillary, screen braiding, metal foil, mantle
– Wire cross-section	0.5 mm² (AWG 20)
– Wire resistance	< 0.036 Ω/m (0.011 Ω/ft)
– Tensile strength	> 1200 N (270 pounds force)
– Standard length	5 m (16.4 ft)
– Max. length	1000 m (3281 ft)
– Min. bending radius at 25 °C/77 °F	25 mm (0.985 in)
– Diameter approx.	8 mm (0.315 in)
– Colour - Non-Ex version	Black
– Colour - Ex-version	Blue

Electromechanical data - version IP68 with external electronics

Connection cable between IP68 instrument and external housing:

– Configuration	Four wires, screen braiding, inner cover, screen braiding, outer cover
– Wire cross-section	0.5 mm² (AWG 20)
– Standard length	5 m (16.40 ft)
– Max. length	25 m (82.02 ft)
– Min. bending radius at 25 °C/77 °F	25 mm (0.985 in)
– Diameter approx.	8 mm (0.315 in)
– Colour	Blue

Cable entry/plug[21)]	
– External housing	– 2 x cable gland M20 x 1.5 (cable: ø 5 … 9 mm), 1 x blind plug M20 x 1.5 or: – 1 x cable gland M20 x 1.5, 1 x plug (depending on version), 1 x blind plug M20 x 1.5
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	IP20
– Mounted into the sensor without cover	IP40
Ambient temperature - Display and adjustment module	-20 … +70 °C (-4 … +158 °F)
Material	
– Housing	ABS
– Inspection window	Polyester foil

Voltage supply	
Operating voltage	
– Non-Ex instrument	9 … 32 V DC
– Ex-ia instrument	9 … 24 V DC
– Ex-d-ia instrument	16 … 32 V DC
Operating voltage with illuminated display and adjustment module	
– Non-Ex instrument	18 … 32 V DC
– Ex-ia instrument	18 … 24 V DC
– Ex-d-ia instrument	No lighting possible (integrated ia barrier)
Max. number of sensors on the DP/PA segment coupler non-Ex/Ex	32/10

Electrical protective measures	
Protection rating	
– Housing, standard	IP66/IP67
Overvoltage category	For voltage supply via separator through networks of overvoltage category III
Protection class	II

[21)] Depending on the version M12 x 1, according to ISO 4400, Harting, 7/8" FF.

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 Information on Profibus PA

Instrument master file

The instrument master file (GSD) contains the characteristic data of the Profibus PA instrument. These data are, e.g. the permissible transmission rates as well as information on diagnostics values and the format of the measured value output by the PA instrument.

A bitmap file is also provided for the Profibus network planning tool. This file is installed automatically when the GSD file is integrated. The bitmap file is used for symbolic indication of the PA instrument in the configuration tool.

Ident number

Each Profibus instrument gets an unambiguous ident number (ID number) from the Profibus user organisation (PNO). This ID number is also included in the name of the GSD file. For DPT10 the ID number is **0 x 0BFB(hex)** and the GSD file **DF650BFB.GSD**. Optionally to this manufacturer-specific GSD file, PNO provides also a general so-called profile-specific GSD file. For DPT10 you have to use the general GSD file **PA139701.GSD**. If the general GSD file is used, the sensor must be set to the profile-specific ident number via the DTM software. By default, the sensor operates with the manufacturer-specific ID number.

When using the profile-specific GSD file, the PA-OUT value as well as the temperature value are transmitted to the PLC (see block diagram "*Cyclical data traffic*").

Cyclical data traffic

The master class 1 (e.g. PLC) cyclically reads out measured values from the sensor during operation. The below block diagram below shows which data can be accessed by the PLC.

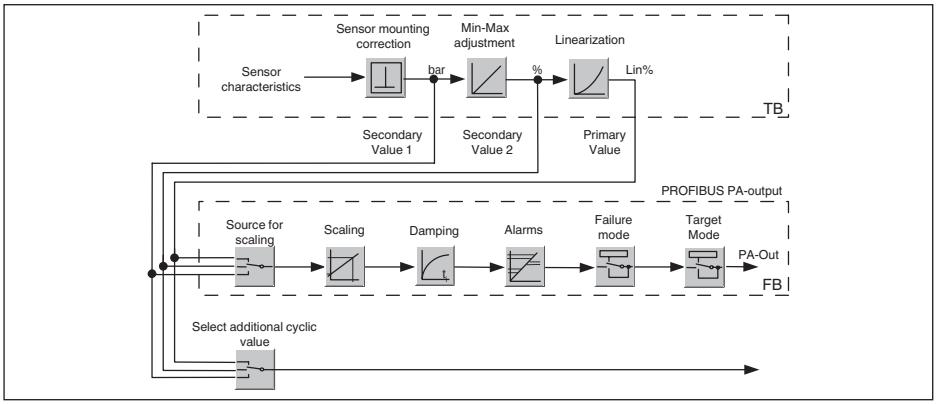


Fig. 50: DPT10: Block diagram with AI (PA-OUT) value and Additional Cyclic Value

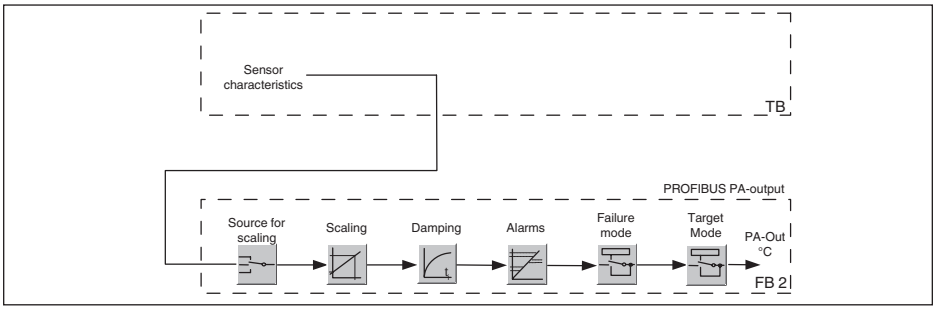


Fig. 51: DPT10: Block diagram with temperature value

Module of the PA sensors

For the cyclic data traffic, DPT10 provides the following modules:

- AI (PA-OUT)
  - PA-OUT value of the FB1 after scaling
- Temperature
  - PA-OUT value of the FB2 after scaling
- Additional Cyclic Value
  - Additional cyclical value (depending on the source)
- Free Place
  - This module must be used if a value should not be used in the data telegram of the cyclical data traffic (e.g. replacement of the temperature and Additional Cyclic Value)

A maximum of three modules can be active. By means of the configuration software of the Profibus master you can determine the configuration of the cyclical data telegram with these modules. The procedure depends on the respective configuration software.

The modules are available in two versions:

- Short for Profibus master supporting only one "Identifier Format" byte, e.g. Allen Bradley
- Long for Profibus master only supporting the "Identifier Format" byte, e.g. Siemens S7-300/400

Examples of telegram configuration

In the following you will see how the modules can be combined and how the appendant data telegram is structured.

Example 1 (standard setting) with pressure value, temperature value and additional cyclical value:

- AI (PA-OUT)
- Temperature
- Additional Cyclic Value

Byte-No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Format	IEEE-754-Floating point value				Status	IEEE-754-Floating point value				Status	IEEE-754-Floating point value				Status
Value	PA-OUT (FB1)				Status (FB1)	Temperature (FB2)				Status (FB2)	Additional Cyclic Value				Status

Fig. 52: Telegram configuration example 1

Example 2 with pressure value and temperature value without additional cyclical value:

- AI (PA-OUT)

- Temperature
- Free Place

Byte-No.	1	2	3	4	5	6	7	8	9	10
Format	IEEE-754-Floating point value				Status	IEEE-754-Floating point value				Status
Value	PA-OUT (FB1)				Status (FB1)	Temperature (FB2)				Status (FB2)

Fig. 53: Telegram configuration example 2

Example 3 with pressure value and additional cyclical value without temperature value:

- AI (PA-OUT)
- Free Place
- Additional Cyclic Value

Byte-No.	1	2	3	4	5	6	7	8	9	10
Format	IEEE-754-Floating point value				Status	IEEE-754-Floating point value				Status
Value	PA-OUT (FB1)				Status (FB1)	Additional Cyclic Value				Status

Fig. 54: Telegram configuration example 3

Data format of the output signal

Byte4	Byte3	Byte2	Byte1	Byte0
Status	Value (IEEE-754)			

Fig. 55: Data format of the output signal

The status byte corresponds to profile 3.0 "Profibus PA Profile for Process Control Devices" coded. The status "Measured value OK" is coded as 80 (hex) (Bit7 = 1, Bit6 … 0 = 0).

The measured value is transferred as a 32 bit floating point number in the IEEE-754 format.

Byte n								Byte n+1								Byte n+2								Byte n+3							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VZ	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
Sign Bit	Exponent							Significant								Significant								Significant							

$$\text{Value} = (-1)^{VZ} \bullet 2^{(\text{Exponent} - 127)} \bullet (1 + \text{Significant})$$

Fig. 56: Data format of the measured value

Coding of the status byte associated with the PA output value

Status code	Description according to Profibus standard	Possible cause
0x00	bad - non-specific	Flash-Update active
0x04	bad - configuration error	● Adjustment error ● Configuration error with PV-Scale (PV-Span too small) ● Unit irregularity ● Error in the linearization table

Status code	Description according to Profibus standard	Possible cause
0x0C	bad - sensor failure	● Hardware error ● Converter error ● Leakage pulse error ● Trigger error
0x10	bad - sensor failure	● Measured value generation error ● Temperature measurement error
0 x 1f	bad - out of service constant	"Out of Service" mode switched on
0 x 44	uncertain - last unstable value	Failsafe replacement value (Failsafe-Mode = "Last value" and already valid measured value since switching on)
0 x 48	uncertain substitute set	● Switch on simulation ● Failsafe replacement value (Failsafe-Mode = "Fsafe value")
0 x 4c	uncertain - initial value	Failsafe replacement value (Failsafe-Mode = "Last valid value" and no valid measured value since switching on)
0 x 51	uncertain - sensor; conversion not accurate - low limited	Sensor value < lower limit
0 x 52	uncertain - sensor; conversion not accurate - high limited	Sensor value > upper limit
0 x 80	good (non-cascade) - OK	OK
0 x 84	good (non-cascade) - active block alarm	Static revision (FB, TB) changed (10 sec. active, after the parameter of the static category has been written)
0 x 89	good (non-cascade) - active advisory alarm - low limited	Lo-Alarm
0 x 8a	good (non-cascade) - active advisory alarm - high limited	Hi-Alarm
0 x 8d	good (non-cascade) - active critical alarm - low limited	Lo-Lo-Alarm
0 x 8e	good (non-cascade) - active critical alarm - high limited	Hi-Hi-Alarm

11.3 Dimensions, versions process component

Plastic housing

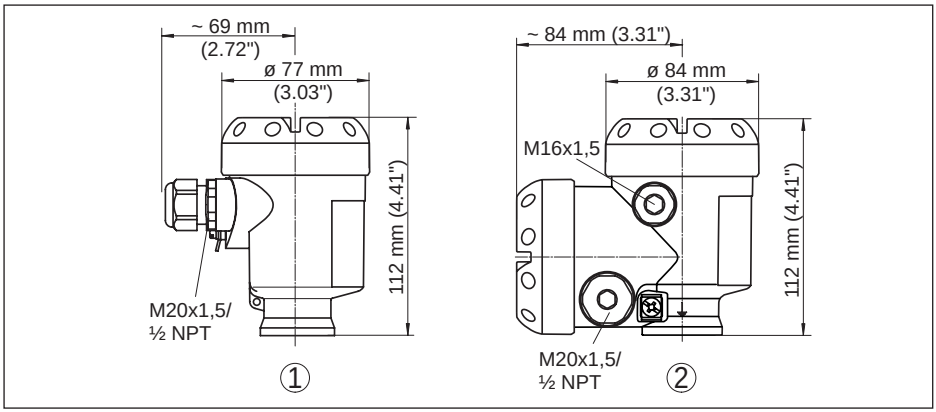


Fig. 57: Housing versions with protection rating IP66/IP68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Plastic single chamber
2 Plastic double chamber

Aluminium housing

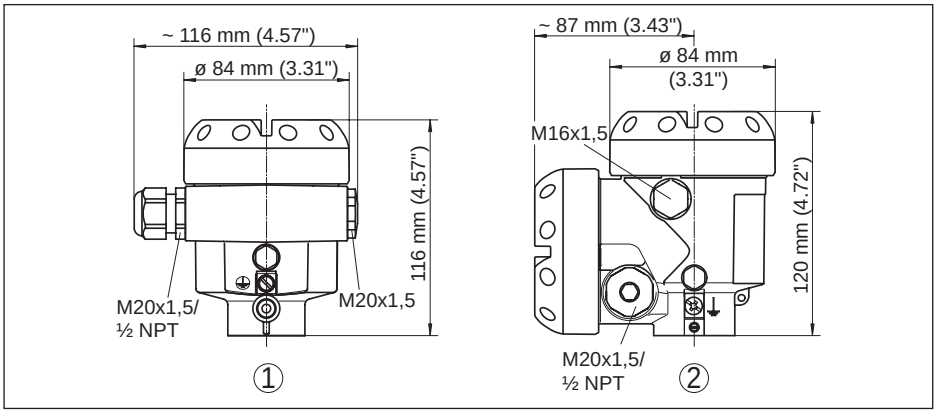


Fig. 58: Housing versions with protection rating IP66/IP68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Aluminium - single chamber
2 Aluminium - double chamber

Aluminium housing with protection rating IP66/IP68 (1 bar)

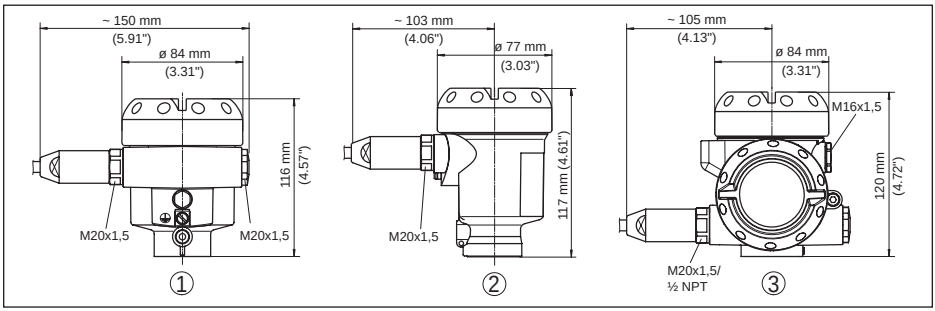


Fig. 59: Housing version with protection rating IP66/IP68 (1 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Aluminium - single chamber
2 Aluminium - double chamber

Stainless steel housing

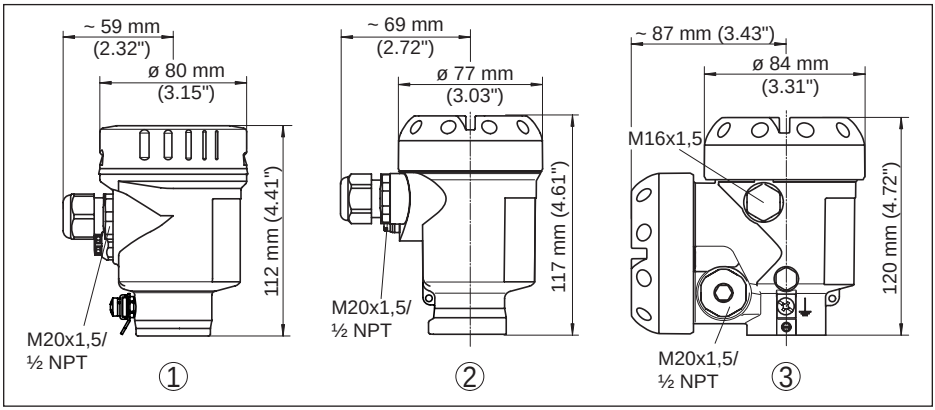


Fig. 60: Housing versions with protection rating IP66/IP68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Stainless steel single chamber (electropolished)
2 Stainless steel single chamber (precision casting)
3 Stainless steel double chamber housing (precision casting)

Oval flange, connection ¼-18 NPT or RC ¼

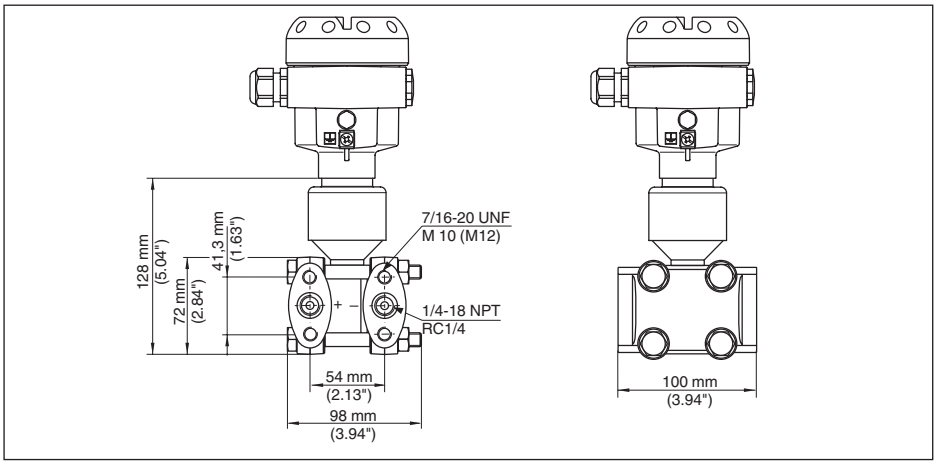


Fig. 61: DPT10, connection ¼-18 NPT or RC ¼

Version	Connection	Fastening	Material	Scope of delivery
B	¼-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8 (1.0460)	incl. 2 vent valves (316L)
D	¼-18 NPT IEC 61518	7/16-20 UNF	AISI 316L (1.4435 or 1.4404)	incl. 2 vent valves (316L)
F	¼-18 NPT IEC 61518	7/16-20 UNF	Alloy C276 (2.4819)	without valves/closing screws
U	RC 1/4	7/16-20 UNF	AISI 316L (1.4435 or 1.4404)	incl. 2 vent valves (316L)
1	¼-18 NPT IEC 61518	PN 160: M10, PN 420: M12	Steel C 22.8 (1.0460)	incl. 2 vent valves (316L)
2	¼-18 NPT IEC 61518	PN 160: M10, PN 420: M12	AISI 316L (1.4435 or 1.4404)	incl. 2 vent valves (316L)
3	¼-18 NPT IEC 61518	PN 160: M10, PN 420: M12	Alloy C276 (2.4819)	without valves/closing screws

The oval flanges of steel C 22.8 (1.0460) are zinc-coated. For applications with water we recommend oval flanges of 316L.

Oval flange, connection ¼-18 NPT or RC ¼, with lateral ventilation

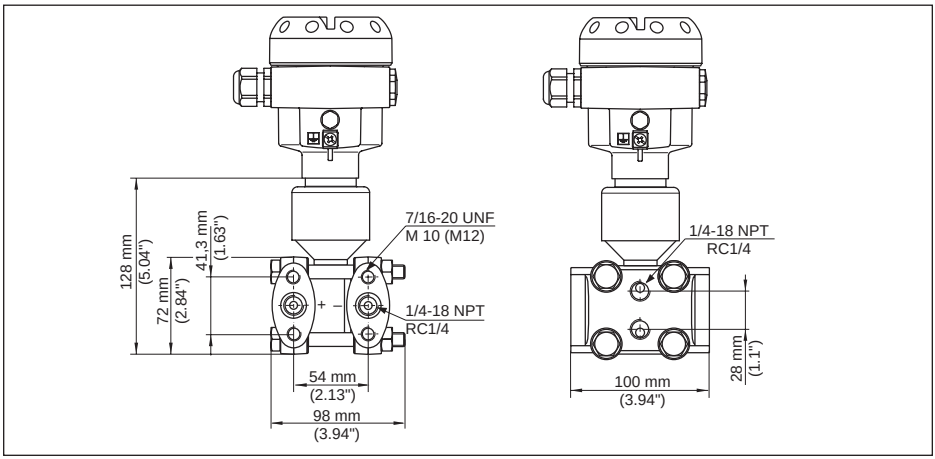


Fig. 62: DPT10, connection ¼-18 NPT or RC ¼, with lateral ventilation

Version	Connection	Fastening	Material	Scope of delivery
C	¼-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8 (1.0460)	incl. 4 closing screws (AISI 316L) and 2 ventilation valves
E	¼-18 NPT IEC 61518	7/16-20 UNF	AISI 316L (1.4435 or 1.4404)	incl. 4 closing screws (AISI 316L) and 2 ventilation valves
H	¼-18 NPT IEC 61518	7/16-20 UNF	Alloy C276 (2.4819)	without valves/closing screws
V	RC 1/4	7/16-20 UNF	AISI 316L	incl. 4 closing screws (AISI 316L) and 2 ventilation valves

The oval flanges of steel C 22.8 (1.0460) are zinc-coated. For applications with water we recommend oval flanges of 316L.

Oval flange, prepared for chemical seal connection

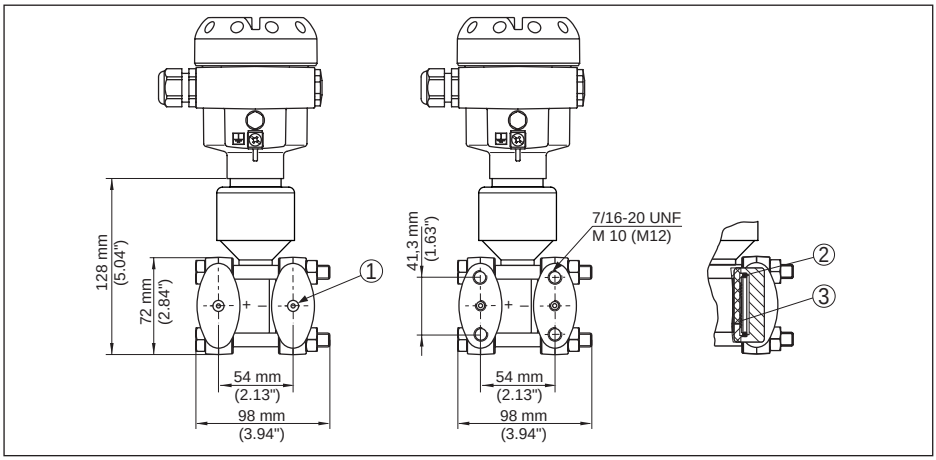


Fig. 63: left: Process fitting DPT10 prepared for chemical seal assembly. right: Position of the copper ring seal

1 Chemical seal connection
2 Copper ring seal
3 Cup diaphragm

11.4 Trademark

All the brands as well as trade and company names used are property of their lawful proprietor/ originator.

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Notes

Notes

Printing date:

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.

WIKA Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
63911 Klingenberg
Germany
Phone (+49) 9372/132-0
Fax (+49) 9372 132-406
E-mail: info@wika.de
www.wika.de

37245-EN-200124