Differential pressure transmitter DPT-10

Metallic measurement diaphragm
4 ... 20 mA
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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 acquainted with the regulations and instructions for hazardous areas, measurement and control technology as well as electrical circuits because the pressure transmitter is "electrical equipment" according to EN 50178. Depending on the application conditions, it is necessary that you have appropriate knowledge, e.g. concerning corrosive products or high pressure.

2.2 Appropriate use
DPT-10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface.
You can find detailed information 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 associations must be noted.
3 Product description

3.1 Configuration

Scope of delivery
The scope of delivery encompasses:

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

Constituent parts
The following illustration shows the components of DPT-10:

Fig. 1: DPT-10 in basic version

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

The components are available in different versions. The type label contains the most important data for identification and use of the instrument:
3.2 Principle of operation

Application area

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

Flow measurement

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

1 Orifice
2 Pitot tube
3 Product description

Level measurement

Fig. 4: Level measurement with DPT-10. $\Delta p = \text{differential pressure}$, $\rho = \text{density of the medium}$, $g = \text{acceleration of gravity}$

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

Differential pressure measurement

Fig. 5: Differential pressure measurement with DPT-10

1 Filter
2 DPT-10

Density measurement

Fig. 6: Density measurement with DPT-10. $h = \text{defined mounting distance}$, $\Delta p = \text{differential pressure}$, $\rho = \text{density of the medium}$, $g = \text{acceleration of gravity}$

1 DPT-10
3 Product description

Interface measurement

![Image of interface measurement]

Fig. 7: Interface measurement with DPT-10
1 DPT-10
2 Liquid with higher density
3 Liquid with lower density

Functional principle

A metallic measuring cell is used as sensor element. The process pressures are transmitted via the separating diaphragms and filling oils to a 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.

![Image of metallic measuring cell configuration]

Fig. 8: Configuration metallic measuring cell
1 Measuring element
2 Overload diaphragm/Middle diaphragm
3 Filling oil
4 Separating diaphragms

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.

Voltage supply

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

The supply voltage range can differ depending on the instrument version. The exact range is stated in chapter "Technical data".

The backlight of the display and adjustment module is powered by the sensor. The prerequisite for this is a supply voltage at a certain...
level. The exact voltage specifications are stated in chapter "Technical data".

3.3 Adjustment
The instrument can be adjusted with the following adjustment media:
- With the display and 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](image)

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 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 "O₂" 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

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

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

Valve blocks

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

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

3-fold valve block

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

![Connection of a 3-fold valve block](image)

**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.

![Diagram of 3-fold valve block](image)

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.
**4.4 Measurement setup - Flow**

In gases

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

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

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

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

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

In vapours

- Mount DPT-10 below the measurement loop
- Mount condensate vessels at the same height with the discharge socket and at the same distance to DPT-10
- Fill the effective pressure lines to the height of the condensate vessels before setup
When using a 5-fold valve block, the drain or blow-off valves are already integrated.

**In liquids**

- Mount DPT-10 below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line.
- 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.
4.5  **Measurement setup level**

- Mount DPT-10 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. 18: Measurement setup, flow measurement in liquids**

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

---

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

1. DPT-10
2. Minus side is open to the atmospheric pressure
3. Blocking valve
4. Precipitator
5. Drain valve
In open vessels with single chemical seal

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

![Fig. 20: Measurement setup, level measurement in the open vessel](image)

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

In closed vessels with effective pressure lines

- Mount DPT-10 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](image)

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

In closed vessels with single chemical seal

- Mount DPT-10 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](image)

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

In closed vessels with double chemical seal

- Mount DPT-10 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](image)

1. DPT-10

In closed vessels with steam layering with effective pressure line

- Mount DPT-10 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 DPT-10
4 Precipitator
5 Drain valves
6 3-fold valve block

In closed vessels with superimposed steam with single chemical seal

- Mount DPT-10 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.
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 DPT-10 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/m³
Max. density: 1200 kg/m³

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

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

\[
\Delta p = \rho \cdot g \cdot h \\
= 1000 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \\
= 2943 \text{ Pa} = 29.43 \text{ mbar}
\]
The max. adjustment is carried out for the differential pressure measured at density 1.2:

\[ \Delta p = \rho \cdot g \cdot h \]

\[ = 1200 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \]

\[ = 3531 \text{ Pa} = 35.31 \text{ mbar} \]

**Interface measurement**

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

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

**Example for an interface measurement:**

Distance between the two measurement points: 0.3 m
Min. density: 800 kg/m³
Max. density: 1000 kg/m³

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

\[ \Delta p = \rho \cdot g \cdot h \]

\[ = 800 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \]

\[ = 2354 \text{ Pa} = 23.54 \text{ mbar} \]

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

\[ \Delta p = \rho \cdot g \cdot h \]

\[ = 1000 \text{ kg/m}^3 \cdot 9.81 \text{ m/s}^2 \cdot 0.3 \text{ m} \]

\[ = 2943 \text{ Pa} = 29.43 \text{ mbar} \]

- Mount DPT-10 below the lower chemical seal
- The ambient temperature should be the same for both capillaries
4.7 Measurement setup differential pressure

In gases and vapours

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

In vapour and condensate plants

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

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

- Mount DPT-10 below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line.

- 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.
4 Mounting

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 DPT-10 below the measurement loop
- The ambient temperature should be the same for both capillaries

![Measurement setup, differential pressure measurement in gases, vapours and liquids](image)

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

4.8 Mounting external housing

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

![Drilling template - wall mounting plate](image)
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

Always keep in mind the following safety instructions:

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

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

Power supply and current signal are transmitted via the same two-wire connection cable. The supply voltage range can differ depending on the instrument version. The exact range is stated in the "Technical data" in the "Supplement".

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

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

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

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

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

If screened cable is required, connect the cable screen on both ends to ground potential. In the sensor, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

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

**Warning:**

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

**Information:**
The metallic parts of the instrument such as transmitter and process fitting are conductively connected with the inner and outer ground terminal on the housing. This connection exists either as a direct metallic contact or via the shielding of the special connection cable on instruments with external electronics. You can find specifications on the potential connections within the instrument in chapter "Technical data".

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

### 5.2 Connection procedure

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.
5 Connecting to power supply

5.3 Single chamber housing

Electronics and connection compartment

Fig. 33: Connection steps 6 and 7

Fig. 34: Electronics and connection compartment, single chamber housing

1 Spring-loaded terminals for voltage supply
2 Ground terminal for connection of the cable screening
5 Connecting to power supply

Wiring plan

Fig. 35: Wiring plan - single chamber housing
1 Voltage supply/Signal output

5.4 Double chamber housing

Connection compartment

Fig. 36: Connection compartment - double chamber housing
1 Spring-loaded terminals for voltage supply
2 Plug connector for service (I²C interface)
3 Ground terminal for connection of the cable screening
5 Connecting to power supply

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 (I²C interface)
2 Internal connection cable to the connection compartment
3 Terminals for the external display and adjustment unit
5 Connecting to power supply

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

<table>
<thead>
<tr>
<th>Contact pin</th>
<th>Colour, connection cable in the sensor</th>
<th>Terminal, electronics module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1</td>
<td>Brown</td>
<td>5</td>
</tr>
<tr>
<td>Pin 2</td>
<td>White</td>
<td>6</td>
</tr>
<tr>
<td>Pin 3</td>
<td>Blue</td>
<td>7</td>
</tr>
<tr>
<td>Pin 4</td>
<td>Black</td>
<td>8</td>
</tr>
</tbody>
</table>

Wire assignment, connection cable

Fig. 41: Wire assignment, connection cable
1 Brown (+) and blue (-) to power supply or to the processing system
2 Shielding

5.6 Version IP66/IP68, 1 bar
5 Connecting to power supply

5.7 Switch-on phase

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

- Internal check of the electronics
- Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
- Output signal jumps briefly (approx. 10 seconds) to the set fault current

Then the corresponding current is output to the cable (the value corresponds to the actual level as well as the settings already carried out, e.g. factory setting).
6 Adjustment with the display and adjustment module

6.1 Short description
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
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.
6 Adjustment with the display and adjustment module

![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

![Display and adjustment elements]

**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
6 Adjustment with the display and adjustment module

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

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

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

1. Push the \([OK]\) button in the measured value display, the menu overview is displayed.
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].
6 Adjustment with the display and adjustment module

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].

Zero adjustment
0.00 %
0.0000 bar
0.0000 bar

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].

Span adjustment
100.00 %
0.5000 bar
0.0000 bar

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.
6 Adjustment with the display and adjustment module

Basic adjustment - Min. adjustment with level

Proceed as follows:
1. Edit the % value in the menu item "Min. adjustment" with [OK].

<table>
<thead>
<tr>
<th>Min. adjustment</th>
<th>0.00 %</th>
<th>=</th>
<th>0.0000 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0000 bar</td>
</tr>
</tbody>
</table>

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].

<table>
<thead>
<tr>
<th>100.00 %</th>
<th>=</th>
<th>0.5000 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.0000 bar</td>
</tr>
</tbody>
</table>

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].

<table>
<thead>
<tr>
<th>Min. adjustment</th>
<th>0.00 %</th>
<th>=</th>
<th>0.0000 bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.0000 bar</td>
</tr>
</tbody>
</table>

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].

Information:
The DPT-10 is also suitable for bidirectional flow measurement (flow in both directions). The selection is carried out in the menu item "Linearization curve". With the bidirectional flow measurement, the min. adjustment value must be equal to the negative max. adjustment value.
Example: Max. adjustment value +100 mbar, as min. adjustment value, -100 mbar must hence be entered.
The min. adjustment is finished.
Proceed as follows:

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

![Max. adjustment]

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.

![Damping]

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.

![Linearisation curve]

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

Caution:
Note the following if the DPT-10 with corresponding approval is used as part of an overfill protection system according to WHG (Water Resources Act):
If a linearisation curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the
6 Adjustment with the display and adjustment module

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:

\[(Q_i^2) = c \cdot \Delta p\]

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

\[Q_i = \sqrt{(c \cdot \Delta p)}\]

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

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

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

**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".
**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\(^1\)
- Min. and max. temperature\(^2\)

**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".

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

Proceed as follows:

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

---

\(^1\) Pressure: -50 ... +150 % of the nominal measuring range.

\(^2\) Temperature: -50 ... +150 °C.
6 Adjustment with the display and adjustment module

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 m³/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 m³/s and confirm with [OK].

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

The procedure of the total sum counter is the same.

**Service - Current output**

In the menu item "Current output" you determine the behaviour of the current output during operation and in case of failure. The following options are available:

**Current output**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>4 … 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20 … 4 mA</td>
</tr>
<tr>
<td>Failure mode³)</td>
<td>Hold value</td>
</tr>
<tr>
<td></td>
<td>20.5 mA</td>
</tr>
<tr>
<td></td>
<td>22 mA</td>
</tr>
<tr>
<td></td>
<td>&lt; 3.6 mA</td>
</tr>
</tbody>
</table>

³) Value of the current output in case of failure, e.g. if no valid measured value is delivered.
### Min. current

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 mA</td>
<td></td>
</tr>
<tr>
<td>3.8 mA</td>
<td></td>
</tr>
</tbody>
</table>

### Max. current

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.5 mA</td>
<td></td>
</tr>
<tr>
<td>20 mA</td>
<td></td>
</tr>
</tbody>
</table>

The values in bold font represent the data of the factory setting.

In HART multidrop mode, the current is constantly 4 mA. This value does not change even in case of failure.

#### 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

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.

---

4) This value is not underrun during operation.

5) This value is not exceeded during operation.
Service - Reset

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

<table>
<thead>
<tr>
<th>Menu section</th>
<th>Menu item</th>
<th>Reset value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic settings</td>
<td>Zero/Min. adjustment</td>
<td>Measuring range begin</td>
</tr>
<tr>
<td></td>
<td>Span/Max. adjustment</td>
<td>Measuring range end</td>
</tr>
<tr>
<td></td>
<td>Density</td>
<td>1 kg/l</td>
</tr>
<tr>
<td></td>
<td>Density unit</td>
<td>kg/l</td>
</tr>
<tr>
<td></td>
<td>Damping</td>
<td>1 s</td>
</tr>
<tr>
<td></td>
<td>Linearisation</td>
<td>Linear</td>
</tr>
<tr>
<td></td>
<td>Sensor-TAG</td>
<td>Sensor</td>
</tr>
<tr>
<td>Display</td>
<td>Displayed value</td>
<td>Differential pressure</td>
</tr>
<tr>
<td></td>
<td>Display unit</td>
<td>Mass/kg</td>
</tr>
<tr>
<td></td>
<td>Scaling</td>
<td>0.00 to 100.0</td>
</tr>
<tr>
<td></td>
<td>Decimal point indication</td>
<td>8888.8</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Totalizer</td>
<td>0.0000 10⁰ gal</td>
</tr>
<tr>
<td></td>
<td>Part sum counter</td>
<td>0.0000 10⁰ gal</td>
</tr>
<tr>
<td>Service</td>
<td>Current output - characteristics</td>
<td>4 … 20 mA</td>
</tr>
<tr>
<td></td>
<td>Current output - failure mode</td>
<td>&lt; 3.6 mA</td>
</tr>
<tr>
<td></td>
<td>Current output - min. current</td>
<td>3.8 mA</td>
</tr>
<tr>
<td></td>
<td>Current output - max. current</td>
<td>20.5 mA</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Menu section</th>
<th>Menu item</th>
<th>Reset value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic settings</td>
<td>Unit of measurement</td>
<td>bar</td>
</tr>
<tr>
<td></td>
<td>Temperature unit</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>Position correction</td>
<td>No reset</td>
</tr>
<tr>
<td>Display</td>
<td>Backlight</td>
<td>No reset</td>
</tr>
<tr>
<td>Service</td>
<td>Language</td>
<td>No reset</td>
</tr>
<tr>
<td></td>
<td>HART mode</td>
<td>No reset</td>
</tr>
<tr>
<td></td>
<td>Application</td>
<td>No reset</td>
</tr>
</tbody>
</table>

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
- Español
- Pycckuu
- Italiano
- Netherlands
- Japanese
- Chinese

Service - Copy sensor data

This function enables the upload of parameter adjustment data to the display and adjustment module or the download of parameter adjustment data to the sensor.

The following data are loaded or downloaded with this function:

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

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

- HART mode
- PIN

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.
6 Adjustment with the display and adjustment module

PIN
Disable permanently?

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

Instrument type
Serial number

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

Date of manufacture
Software version

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

Last change using PC

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

Sensor characteristics
Display now?

6.5 Menu schematic

Information:
Depending on the version and application, the highlighted menu windows may not always be available.
6 Adjustment with the display and adjustment module

Basic adjustment differential pressure

- Application 1.1
  - Differential pressure ►
  - Unit: bar ◄
  - Temperature unit: °C ◄

- Span 1.4
  - 100.00 % = 0.5000 bar
  - 0.0000 bar

- Damping 1.5
  - 1 s

- Position correction 1.2
  - Offset:
    - -0.0035 bar
    - 0.0000 bar

- Zero 1.3
  - 000.0 % = 0.0000 bar

- Linearisation curve 1.6
  - Linear
  - Horizontal cylindrical tank
  - Spherical tank
  - User programmable

Sensor-TAG 1.7
- Sensor

Basic adjustment flow

- Application 1.1
  - Flow ◄

- Unit: bar ◄
  - Temperature unit: °C ◄

- Max. adjustment 1.4
  - 100.00 % = 0.5000 bar
  - 0.0000 bar

- Damping 1.5
  - 1 s

- Position correction 1.2
  - Offset:
    - -0.0035 bar
    - 0.0000 bar

- Min. adjustment 1.3
  - 000.0 % = 0.0000 bar

- Linearisation curve 1.6
  - Linear
  - Extracted by root
  - Bidirectionally linear

- Creeping distance suppres. 1.7
  - Activated ◄

Sensor-TAG 1.8
- Sensor
6 Adjustment with the display and adjustment module

Basic setting level

- Basic adjustment
- Display
- Diagnostics
- Service
- Info

1. Application
   - Level

1.1. Unit
   - Unit of measurement
   - bar
   - Temperature unit
   - °C

1.2. Position correction
   - Offset
   - +0.0035 bar
   - 0.0000 bar

1.3. Min. adjustment
   - 000.0 %
   - 0.0000 bar

1.4. Max. adjustment
   - 100.00 %
   - 0.5000 bar
   - 0.0000 bar

1.5. Damping
   - 1 s

1.6. Linearisation curve
   - Linear
   - Horizontal cylindrical tank
   - Spherical tank
   - User programmable

1.7. Sensor-TAG
   - Sensor

Display

- Basic adjustment
- Display
- Diagnostics
- Service
- Info

2. Displayed value
   - Differential pressure

2.1. Displayed value
   - Scaled

2.2. Display unit
   - Volume
   - l

2.3. Scaling
   - 0 % = 0.0
   - 100 % = 100.0

2.4. Backlight
   - Switched off

Diagnostics

- Basic adjustment
- Display
- Diagnostics
- Service
- Info

3. Peak value indicator
   - p-min.: -5.8 mbar
   - p-max.: 167.5 mbar
   - T-min.: -12.5 °C
   - T-max.: +85.5 °C

3.1. Sensor status
   - OK

3.2. Trend curve
   - Start trend curve?

3.3. Totalizer
   - 0.0000 10^9 gal
   - Modify settings?

3.5. Part sum counter
   - 0.0000 10^9 gal
   - Modify settings?
6 Adjustment with the display and adjustment module

Service

- Basic adjustment
- Display
- Diagnostics
- Service
- Info

- Current output
  - Characteristic: 4-20 mA
  - Fail.mode: < 3.6 mA
  - Min. current: 3.8 mA
  - Max. current: 20.5 mA

- Simulation
  - Start simulation
- Reset
  - Select reset
- Language
  - Deutsch

- Copy sensor data
  - Copy sensor data?

Info

- Basic adjustment
- Display
- Diagnostics
- Service
- Info

- Instrument type
- Serial number: 12345678

- Date of manufacture
- Software version

- Last change using PC

- Sensor characteristics
- Display now?

6.6 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 DPT-10 is equipped with a display 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

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

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

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

7.2 Flow measurement

Gases

![Diagram of measurement setup for gases](image)

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

I  DPT-10

II  3-fold valve block

2, 4 Inlet valves

3  Breather valve

6, 7 Vent valves on DPT-10
Liquids

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.
   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:

   \(^{6)}\) 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
   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.

### 7.3 Level measurement

![Diagram of preferred measurement setup for closed vessels]

*Fig. 46: Preferred measurement setup for closed vessels*

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

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

---

7) 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**

![Diagram](image)

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

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

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.

7.4 Density and interface measurement

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

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

7.5 Differential pressure measurement

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

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

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

8.1 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.

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

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

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.

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

<table>
<thead>
<tr>
<th>Error code</th>
<th>Cause</th>
<th>Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ... 20 mA signal not stable</td>
<td>Level fluctuations</td>
<td>Set the integration time via the display and adjustment module or PACTware</td>
</tr>
<tr>
<td>4 ... 20 mA signal missing</td>
<td>Wrong connection to voltage supply</td>
<td>Check connection according to chapter &quot;Connection steps&quot; and if necessary, correct according to chapter &quot;Wiring plan&quot;</td>
</tr>
<tr>
<td></td>
<td>No power supply</td>
<td>Check cables for breaks; repair if necessary</td>
</tr>
<tr>
<td></td>
<td>Operating voltage too low or load resistance too high</td>
<td>Check, adapt if necessary</td>
</tr>
<tr>
<td>Current signal greater than 22 mA or less than 3.6 mA</td>
<td>Electronics module or measuring cell defective</td>
<td>Exchange the instrument or send it in for repair</td>
</tr>
</tbody>
</table>
In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

<table>
<thead>
<tr>
<th>Error code</th>
<th>Cause</th>
<th>Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>E013</td>
<td>no measured value available(^8)</td>
<td>Exchange the instrument or send it in for repair</td>
</tr>
<tr>
<td>E017</td>
<td>Adjustment span too small</td>
<td>repeat with modified values</td>
</tr>
<tr>
<td>E036</td>
<td>no operable sensor software</td>
<td>Carry out a software update or send instrument for repair</td>
</tr>
<tr>
<td>E041</td>
<td>Hardware error</td>
<td>Exchange the instrument or send it in for repair</td>
</tr>
</tbody>
</table>

\(^8\) Fault message can also appear if the pressure is higher than the nominal range.

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.

### 8.3 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
9 Dismount

9.1 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.

9.2 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.
10 Supplement

10.1 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.

Output variable

<table>
<thead>
<tr>
<th>Output signal</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal resolution</td>
<td>1.6 µA</td>
</tr>
<tr>
<td>Fault signal output current</td>
<td>mA value unchanged 20.5 mA, 22 mA, &lt; 3.6 mA (adjustable)</td>
</tr>
<tr>
<td>Max. output current</td>
<td>22 mA</td>
</tr>
<tr>
<td>Load</td>
<td>see load diagram under Power supply</td>
</tr>
<tr>
<td>Met NAMUR recommendation</td>
<td>NE 43</td>
</tr>
</tbody>
</table>

Dynamic behaviour output

| Run-up time | ≤ 20 s |

![Diagram](image)

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

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

<table>
<thead>
<tr>
<th>Version, nominal measuring range</th>
<th>Dead time $t_1$</th>
<th>Time constant $t_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic version 10 bar and 30 bar</td>
<td>100 ms</td>
<td>450 ms</td>
</tr>
<tr>
<td>Basic version 100 mbar</td>
<td>100 ms</td>
<td>180 ms</td>
</tr>
<tr>
<td>Basic version 500 mbar</td>
<td>100 ms</td>
<td>180 ms</td>
</tr>
</tbody>
</table>
### Damping (63 % of the input variable)

0 … 999 s, adjustable

---

### 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 %)

**Adjustment level**

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

- Percentage value
  - 10 … +110 %

- Pressure value
  - 120 … +120 %

**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 %

Recommended max. turn down

15 : 1 (no limitation)

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

<table>
<thead>
<tr>
<th>Nominal range</th>
<th>Lower measurement limit</th>
<th>Upper measuring limit</th>
<th>Smallest adjustable span</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mbar (1 kPa)</td>
<td>-10 mbar (-1 kPa)</td>
<td>+10 mbar (+1 kPa)</td>
<td>0.25 mbar (25 Pa)</td>
</tr>
<tr>
<td>30 mbar (3 kPa)</td>
<td>-30 mbar (-3 kPa)</td>
<td>+30 mbar (+3 kPa)</td>
<td>0.3 mbar (30 Pa)</td>
</tr>
<tr>
<td>100 mbar (10 kPa)</td>
<td>-100 mbar (-10 kPa)</td>
<td>+100 mbar (+10 kPa)</td>
<td>1 mbar (100 Pa)</td>
</tr>
<tr>
<td>500 mbar (50 kPa)</td>
<td>-500 mbar (-50 kPa)</td>
<td>+500 mbar (+50 kPa)</td>
<td>5 mbar (500 Pa)</td>
</tr>
<tr>
<td>3 bar (300 kPa)</td>
<td>-3 bar (-300 kPa)</td>
<td>+3 bar (+300 kPa)</td>
<td>30 mbar (3 kPa)</td>
</tr>
<tr>
<td>16 bar (1600 kPa)</td>
<td>-16 bar (-1600 kPa)</td>
<td>+16 bar (+1600 kPa)</td>
<td>160 mbar (16 kPa)</td>
</tr>
<tr>
<td>40 bar (4000 kPa)</td>
<td>-40 bar (-4000 kPa)</td>
<td>+40 bar (+4000 kPa)</td>
<td>400 mbar (40 kPa)</td>
</tr>
</tbody>
</table>

### 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)

- Relative humidity
  - 45 … 75 %

---

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.
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

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

Applies to digital interfaces (HART, Profield 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 DPT-10 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, ProFieldbus 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.

<table>
<thead>
<tr>
<th>Temperature range</th>
<th>Measuring range</th>
<th>Influence of thermal change zero signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>-10 ... +60 °C (+14 ... +140 °F)</td>
<td>10 mbar, 30 mbar</td>
<td>±(0.30 x TD + 0.06) %</td>
</tr>
<tr>
<td></td>
<td>100 mbar</td>
<td>±(0.18 x TD + 0.02) %</td>
</tr>
<tr>
<td></td>
<td>500 mbar, 3 bar</td>
<td>±(0.08 x TD + 0.05) %</td>
</tr>
<tr>
<td></td>
<td>16 bar</td>
<td>±(0.1 x TD + 0.1) %</td>
</tr>
<tr>
<td></td>
<td>40 bar</td>
<td>±(0.08 x TD + 0.05) %</td>
</tr>
<tr>
<td>-40 ... +10 °C (-40 ... +50 °F)</td>
<td>10 mbar, 30 mbar</td>
<td>±(0.45 x TD + 0.1) %</td>
</tr>
<tr>
<td>+60 ... +85 °C (+140 ... +185 °F)</td>
<td>100 mbar</td>
<td>±(0.3 x TD + 0.15) %</td>
</tr>
<tr>
<td></td>
<td>500 mbar, 3 bar</td>
<td>±(0.12 x TD + 0.1) %</td>
</tr>
<tr>
<td></td>
<td>16 bar</td>
<td>±(0.15 x TD + 0.2) %</td>
</tr>
<tr>
<td></td>
<td>40 bar</td>
<td>±(0.37 x TD + 0.1) %</td>
</tr>
</tbody>
</table>

**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](image)

**Influence of the system pressure on the zero point and span**

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

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>10 mbar</th>
<th>30 mbar</th>
<th>100 mbar</th>
<th>500 mbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of the system pressure to the zero point</td>
<td>±0.15 % of URL/7 bar</td>
<td>±0.50 % of URL/70 bar</td>
<td>±0.15 % of URL/70 bar</td>
<td>±0.075 % of URL/70 bar</td>
</tr>
</tbody>
</table>
### Measuring cell

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>10 mbar</th>
<th>30 mbar</th>
<th>100 mbar</th>
<th>500 mbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of the system pressure to the span</td>
<td>±0.035 % of URL/7 bar</td>
<td>±0.14 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
</tr>
</tbody>
</table>

### Alloy gold rhodium-coated diaphragm

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>10 mbar</th>
<th>30 mbar</th>
<th>100 mbar</th>
<th>500 mbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of the system pressure to the zero point</td>
<td>±0.77 % of URL/7 bar</td>
<td>±0.14 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
</tr>
<tr>
<td>Influence of the system pressure to the span</td>
<td>±0.32 % of URL/7 bar</td>
<td>±0.14 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
</tr>
</tbody>
</table>

### Tantalum diaphragm

<table>
<thead>
<tr>
<th>Measuring cell</th>
<th>10 mbar</th>
<th>30 mbar</th>
<th>100 mbar</th>
<th>500 mbar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influence of the system pressure to the zero point</td>
<td>±0.07 % of URL/7 bar</td>
<td>±0.32 % of URL/70 bar</td>
<td>±0.42 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
</tr>
<tr>
<td>Influence of the system pressure to the span</td>
<td>±0.07 % of URL/7 bar</td>
<td>±0.32 % of URL/70 bar</td>
<td>±0.42 % of URL/70 bar</td>
<td>±0.14 % of URL/70 bar</td>
</tr>
</tbody>
</table>

## 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 \( p_{st} = 70 \text{ bar} \). All specifications refer to the adjusted span and apply to the temperature range +10 ... +60 °C (+50 ... +140 °F).

<table>
<thead>
<tr>
<th>Diaphragm material</th>
<th>Turn Down up to</th>
<th>316L, Alloy</th>
<th>Alloy gold rhodium</th>
<th>Tantalum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring cell</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 mbar</td>
<td>1 : 1</td>
<td>&lt; ±0.35 %</td>
<td>&lt; ±0.64 %</td>
<td>&lt; ±0.61 %</td>
</tr>
<tr>
<td>30 mbar</td>
<td>1 : 1</td>
<td>&lt; ±0.77 %</td>
<td>&lt; ±0.99 %</td>
<td>&lt; ±1.66 %</td>
</tr>
<tr>
<td>100 mbar</td>
<td>2 : 1</td>
<td>&lt; ±0.27 %</td>
<td>&lt; ±0.50 %</td>
<td>&lt; ±0.30 %</td>
</tr>
<tr>
<td>≥500 mbar</td>
<td>2 : 1</td>
<td>&lt; ±0.15 %</td>
<td>&lt; ±0.15 %</td>
<td>&lt; ±0.30 %</td>
</tr>
</tbody>
</table>

**Total Error - basic version**

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

<table>
<thead>
<tr>
<th>Diaphragm material</th>
<th>316L, Alloy</th>
<th>Alloy gold rhodium</th>
<th>Tantalum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring cell</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 mbar</td>
<td>&lt; ±0.36 %</td>
<td>&lt; ±0.64 %</td>
<td>&lt; ±0.62 %</td>
</tr>
<tr>
<td>30 mbar</td>
<td>&lt; ±0.77 %</td>
<td>&lt; ±0.99 %</td>
<td>&lt; ±1.66 %</td>
</tr>
<tr>
<td>100 mbar</td>
<td>&lt; ±0.33 %</td>
<td>&lt; ±0.50 %</td>
<td>&lt; ±0.48 %</td>
</tr>
<tr>
<td>≥500 mbar</td>
<td>&lt; ±0.20 %</td>
<td>&lt; ±0.20 %</td>
<td>&lt; ±0.35 %</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Measuring range</th>
<th>1 year</th>
<th>5 years</th>
<th>10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mbar</td>
<td>&lt; ±0.100 %</td>
<td>&lt; ±0.150 %</td>
<td>-</td>
</tr>
<tr>
<td>100 mbar</td>
<td>&lt; ±0.180 %</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>500 mbar</td>
<td>&lt; ±0.025 %</td>
<td>&lt; ±0.050 %</td>
<td>&lt; ±0.075 %</td>
</tr>
<tr>
<td>3 bar</td>
<td>&lt; ±0.038 %</td>
<td>&lt; ±0.075 %</td>
<td>&lt; ±0.150 %</td>
</tr>
<tr>
<td>16 bar</td>
<td>&lt; ±0.025 %</td>
<td>&lt; ±0.110 %</td>
<td>&lt; ±0.210 %</td>
</tr>
</tbody>
</table>

**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\(^\text{15}\)

- With measuring cells PN 420
- With effective pressure lines longer than 100 mm
- With effective pressure lines longer than 100 mm, process fitting steel C 22.8 (1.0460)

Specifications apply to suitable chemical seals

- Chemical seal CSS plus side, CSB both sides

Process temperature limits according to the seal material

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Version</th>
<th>Temperature limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>FKM</td>
<td>Standard</td>
<td>-20 ... +85 °C (-4 ... +185 °F)</td>
</tr>
<tr>
<td></td>
<td>Cleaned</td>
<td>-10 ... +85 °C (+14 ... +185 °F)</td>
</tr>
<tr>
<td></td>
<td>For oxygen application</td>
<td>-10 ... +60 °C (-4 ... +140 °F)</td>
</tr>
<tr>
<td>FFKM (Kalrez 6375)</td>
<td></td>
<td>-5 ... +85 °C (23 ... +185 °F)</td>
</tr>
<tr>
<td>EPDM</td>
<td></td>
<td>-40 ... +85 °C (-40 ... +185 °F)</td>
</tr>
<tr>
<td>PTFE</td>
<td>Standard</td>
<td>-40 ... +85 °C (-40 ... +185 °F)</td>
</tr>
<tr>
<td></td>
<td>For oxygen application</td>
<td>-20 ... +60 °C (-4 ... +140 °F)</td>
</tr>
<tr>
<td>NBR</td>
<td></td>
<td>-20 ... +85 °C (-4 ... +185 °F)</td>
</tr>
<tr>
<td>Copper</td>
<td>Standard</td>
<td>-40 ... +85 °C (-40 ... +185 °F)</td>
</tr>
<tr>
<td></td>
<td>For oxygen application</td>
<td>-20 ... +60 °C (-4 ... +140 °F)</td>
</tr>
<tr>
<td>PTFE, for oxygen application</td>
<td></td>
<td>-20 ... +60 °C (-4 ... +140 °F)</td>
</tr>
</tbody>
</table>

Process pressure limits according to measuring range\(^\text{16}\)

\(^{15}\) For the version for oxygen application, note chapter "Oxygen applications"

\(^{16}\) Reference temperature +20 °C (+68 °F)
### Nominal pressure

<table>
<thead>
<tr>
<th>Nominal range</th>
<th>Nominal pressure</th>
<th>Overload one-sided</th>
<th>Overload two-sided</th>
<th>Min. system pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mbar (1 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td></td>
</tr>
<tr>
<td>30 mbar (3 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td></td>
</tr>
<tr>
<td>100 mbar (10 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td></td>
</tr>
<tr>
<td>500 mbar (50 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td>630 bar (63000 kPa)</td>
</tr>
<tr>
<td>3 bar (300 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td>630 bar (63000 kPa)</td>
</tr>
<tr>
<td>16 bar (1600 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td>630 bar (63000 kPa)</td>
</tr>
<tr>
<td>40 bar (4000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td>630 bar (63000 kPa)</td>
</tr>
</tbody>
</table>

### Process pressure limits according to the seal material

<table>
<thead>
<tr>
<th>Seal material</th>
<th>Nominal pressure</th>
<th>Overload one-sided</th>
<th>Overload two-sided</th>
<th>Min. system pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>FFKM (Kalrez 6375)</td>
<td>100 bar (10000 kPa)</td>
<td>100 bar (10000 kPa)</td>
<td>150 bar (15000 kPa)</td>
<td>0.1 mbar$<em>{abs}$ (10 Pa$</em>{abs}$)</td>
</tr>
<tr>
<td>FFKM (Kalrez 6375)</td>
<td>160 bar (16000 kPa)</td>
<td>160 bar (16000 kPa)</td>
<td>240 bar (24000 kPa)</td>
<td></td>
</tr>
</tbody>
</table>

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

- 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.

---

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.
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
  or:
  - 2 x blind plug M20 x 1.5

Spring-loaded terminals for wire cross-section
  < 2.5 mm\(^2\) (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 12 ... 36 V DC
- Ex-ia instrument 12 ... 30 V DC
- Ex-d-ia instrument 15 ... 35 V DC

Operating voltage with illuminated display and adjustment module
- Non-Ex instrument 20 ... 36 V DC
- Ex-ia instrument 20 ... 30 V DC
- Ex-d-ia instrument No lighting possible (integrated ia barrier)

Permissible residual ripple
- < 100 Hz \(U_{ss} < 1\) V
- 100 Hz ... 10 kHz \(U_{ss} < 10\) mV

Load resistor
- Calculation \((U_b - U_{min})/0.022\) A

\(^{20}\) Depending on the version M12 x 1, according to ISO 4400, Harting, 7/8” FF.
Example - Non-Ex instrument with $U_B = 24$ V DC

\[(24\ \text{V} - 12\ \text{V})/0.022\ \text{A} = 545\ \Omega\]

**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

**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.

**10.2 Dimensions, versions process component**

**Plastic housing**

![Fig. 50: 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. 51: 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. 52: 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. 53: 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. 54: DPT-10, connection ¼-18 NPT or RC ¼

<table>
<thead>
<tr>
<th>Version</th>
<th>Connection</th>
<th>Fastening</th>
<th>Material</th>
<th>Scope of delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>¼-18 NPT IEC 61518</td>
<td>7/16-20 UNF</td>
<td>Steel C 22.8 (1.0460)</td>
<td>incl. 2 vent valves (316L)</td>
</tr>
<tr>
<td>D</td>
<td>¼-18 NPT IEC 61518</td>
<td>7/16-20 UNF</td>
<td>AISI 316L (1.4435 or 1.4404)</td>
<td>incl. 2 vent valves (316L)</td>
</tr>
<tr>
<td>F</td>
<td>¼-18 NPT IEC 61518</td>
<td>7/16-20 UNF</td>
<td>Alloy C276 (2.4819)</td>
<td>without valves/closing screws</td>
</tr>
</tbody>
</table>
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

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

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

1 Chemical seal connection
2 Copper ring seal
3 Cup diaphragm
10.3 Trademark
All the brands as well as trade and company names used are property of their lawful proprietor/originator.
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