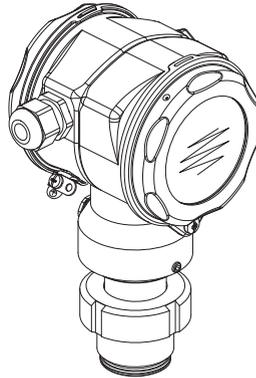


Brief Operating Instructions

Deltapilot S

FMB70

Hydrostatic level measurement

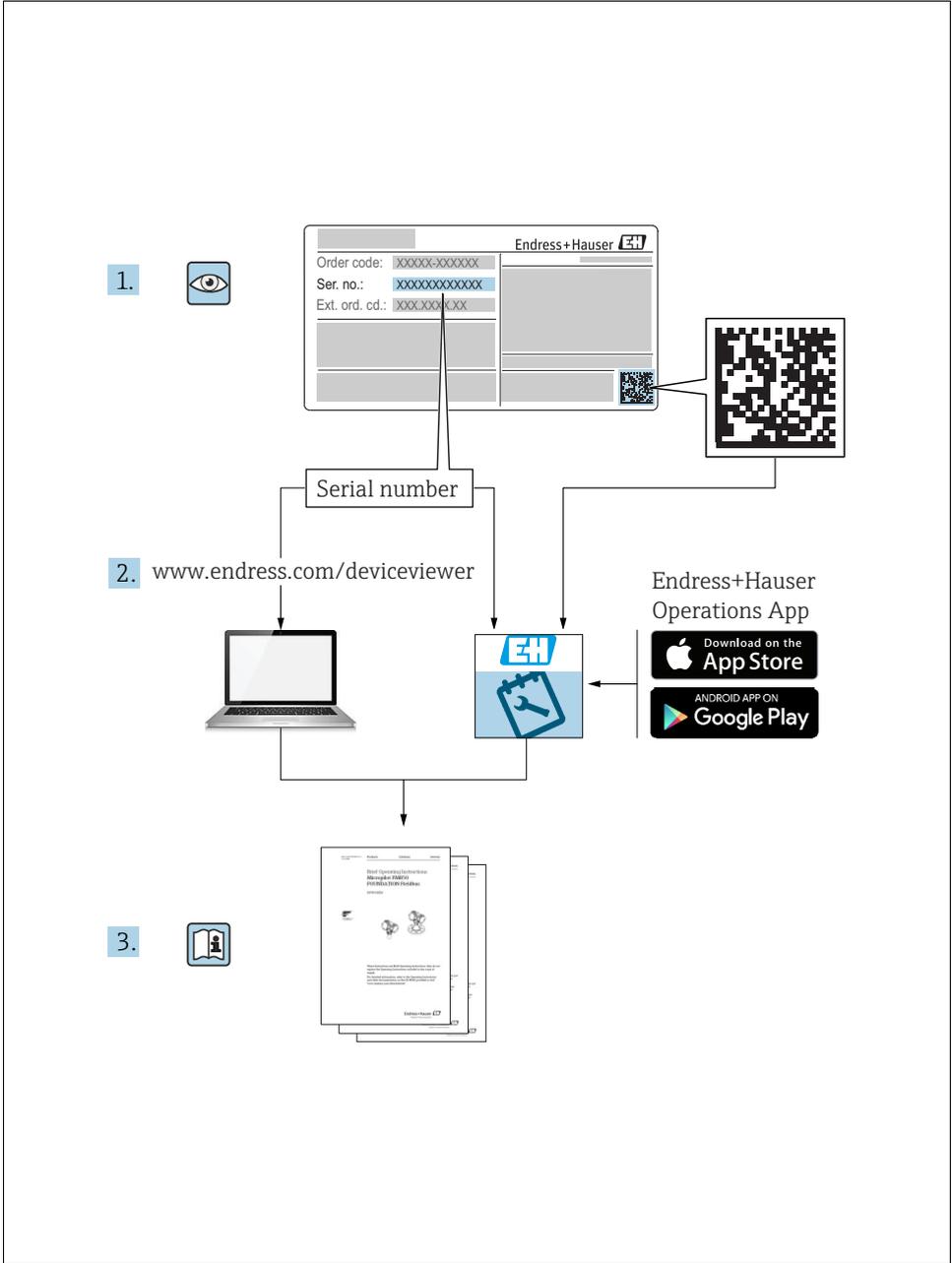


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:

Available for all device versions via:

- Internet: www.endress.com/deviceviewer
- Smart phone/tablet: *Endress+Hauser Operations App*



A0023555

Table of contents

| | | |
|-----|---|----|
| 1 | Document information | 4 |
| 1.1 | Document function | 4 |
| 1.2 | Symbols used | 4 |
| 1.3 | Registered trademarks | 6 |
| 1.4 | Terms and abbreviations | 7 |
| 1.5 | Turn down calculation | 8 |
| 2 | Basic safety instructions | 9 |
| 2.1 | Requirements concerning the staff | 9 |
| 2.2 | Designated use | 9 |
| 2.3 | Workplace safety | 9 |
| 2.4 | Operational safety | 9 |
| 2.5 | Hazardous area | 10 |
| 2.6 | Product safety | 10 |
| 3 | Identification | 10 |
| 3.1 | Product identification | 10 |
| 3.2 | Device designation | 10 |
| 3.3 | Scope of delivery | 11 |
| 3.4 | CE mark, Declaration of Conformity | 11 |
| 4 | Installation | 12 |
| 4.1 | Incoming acceptance and storage | 12 |
| 4.2 | Installation conditions | 12 |
| 4.3 | General installation instructions | 12 |
| 4.4 | Installation instructions | 13 |
| 4.5 | Post-installation check | 16 |
| 5 | Wiring | 17 |
| 5.1 | Connecting the device | 17 |
| 5.2 | Connecting the measuring unit | 18 |
| 5.3 | Overvoltage protection (optional) | 19 |
| 5.4 | Post-connection check | 19 |
| 6 | Operation | 20 |
| 6.1 | Onsite display (optional) | 20 |
| 6.2 | Operating elements | 22 |
| 6.3 | FOUNDATION Fieldbus interface | 25 |
| 6.4 | Local operation – onsite display connected | 26 |
| 6.5 | FieldCare | 30 |
| 6.6 | HistoROM®/M-DAT (optional) | 30 |
| 6.7 | Locking/unlocking operation | 30 |
| 6.8 | Simulation | 30 |
| 6.9 | Factory setting (reset) | 31 |
| 7 | Commissioning | 31 |
| 7.1 | Configuring messages | 31 |
| 7.2 | Function check | 31 |
| 7.3 | Commissioning via an FF configuration program | 32 |
| 7.4 | Selecting the language and measuring mode | 32 |
| 7.5 | Position adjustment | 32 |
| 7.6 | Level measurement | 33 |
| 7.7 | Pressure measurement | 36 |
| 7.8 | Scaling the OUT parameter | 38 |

1 Document information

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

| Symbol | Meaning |
|--|--|
|  <small>A0011189-DE</small> | DANGER! This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury. |
|  <small>A0011190-DE</small> | WARNING! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury. |
|  <small>A0011191-DE</small> | CAUTION! This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury. |
|  <small>A0011192-DE</small> | NOTICE! This symbol contains information on procedures and other facts which do not result in personal injury. |

1.2.2 Electrical symbols

| Symbol | Meaning | Symbol | Meaning |
|--|--|---|--|
|  | Direct current |  | Alternating current |
|  | Direct current and alternating current |  | Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system. |
|  | Protective ground connection A terminal which must be connected to ground prior to establishing any other connections. |  | Equipotential connection A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice. |

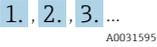
1.2.3 Tool symbols

| Symbol | Meaning |
|---|----------------|
|  A0011221 | Allen key |
|  A0011222 | Hexagon wrench |

1.2.4 Symbols for certain types of information

| Symbol | Meaning |
|---|--|
|  A0011182 | Permitted Indicates procedures, processes or actions that are permitted. |
|  A0011184 | Forbidden Indicates procedures, processes or actions that are forbidden. |
|  A0011193 | Tip Indicates additional information. |
|  A0028658 | Reference to documentation |
|  A0028659 | Reference to page |
|  A0028660 | Reference to graphic |
|  A0031595 | Series of steps |
|  A0018343 | Result of a sequence of actions |
|  A0028673 | Visual inspection |

1.2.5 Symbols in graphics

| Symbol | Meaning |
|--|-----------------|
| 1, 2, 3, 4, ... | Item numbers |
|  | Series of steps |
| A, B, C, D, ... | Views |

1.2.6 Symbols at the device

| Symbol | Meaning |
|--|---|
|  | Safety instructions Observe the safety instructions contained in the associated Operating Instructions. |

1.3 Registered trademarks

KALREZ, VITON, TEFLON

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP

Registered trademark of Ladish & Co., Inc., Kenosha, USA

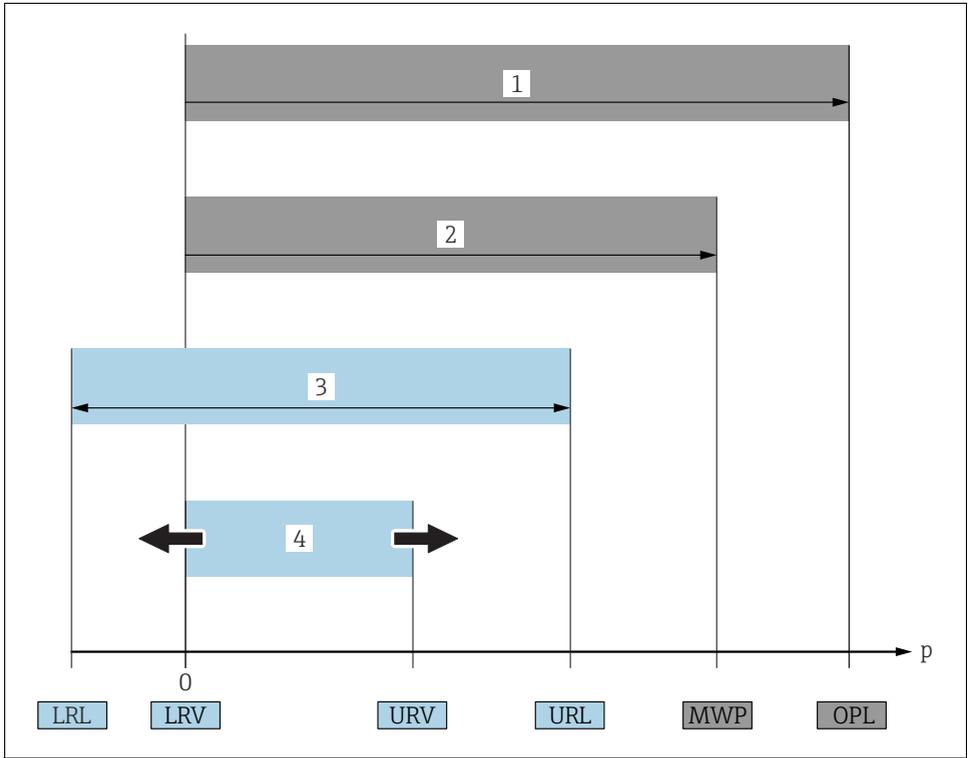
FOUNDATION™ Fieldbus

Registered trademark of the FieldComm Group, Austin, USA

GORE-TEX®

Registered trademarks of W.L. Gore & Associates, Inc., USA

1.4 Terms and abbreviations

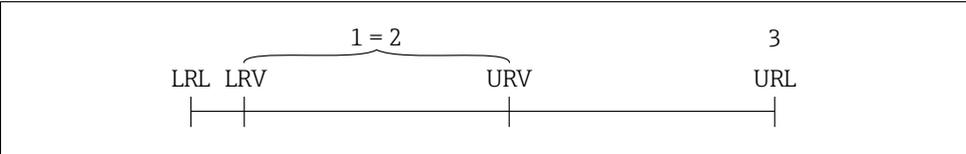


A0029505

| Position | Term/Abbreviation | Explanation |
|----------|--------------------------------|--|
| 1 | OPL | The OPL (over pressure limit = sensor overload limit) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection must be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see technical information. The OPL may be applied for a limited time period. |
| 2 | MWP | The MWP (maximum working pressure) for the sensors depends on the lowest-rated element, with regard to pressure, of the selected components, i.e. the process connection has to be taken into consideration in addition to the measuring cell. Also observe pressure-temperature dependency. For the relevant standards and additional notes, see technical information. The MWP may be applied for an unlimited time. |
| 3 | Maximum sensor measuring range | Range between LRL and URL. This span is the maximum calibratable/adjustable measuring span. |

| Position | Term/Abbreviation | Explanation |
|----------|------------------------------------|--|
| 4 | Calibrated/Adjusted measuring span | Range between LRV and URV Factory setting: 0...URL Other calibrated spans can be ordered with customised settings. |
| p | - | Pressure |
| - | LRL | Lower range limit |
| - | URL | Upper range limit |
| - | LRV | Lower range value |
| - | URV | Upper range value |
| - | TD | Turn down |

1.5 Turn down calculation



A0029545

Fig. 1:

- 1 Calibrated/Adjusted measuring span
- 2 Zero-based span
- 3 Upper range limit

| Example | |
|---|---|
| <ul style="list-style-type: none"> ▪ Sensor: 10 bar (150 psi) ▪ Upper range limit (URL) = 10 bar (150 psi) <p>Turn down (TD):</p> $TD = \frac{URL}{ URV - LRV }$ $TD = \frac{10 \text{ bar (150 psi)}}{ 5 \text{ bar (75 psi)} - 0 \text{ bar (0 psi)} } = 2$ <p>In this example, the TD is thus 2:1. This span is based on the zero point.</p> | <ul style="list-style-type: none"> ▪ Calibrated/Adjusted measuring span: 0...5 bar (0...75 psi) ▪ Lower range value (LRV) = 0 bar ▪ Upper range value (URV) = 5 bar (75 psi) |

2 Basic safety instructions

2.1 Requirements concerning the staff

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists: must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

2.2 Designated use

The Deltapilot S is a hydrostatic pressure transmitter for measuring level and pressure.

2.2.1 Incorrect use

The manufacturer is not liable for damage caused by improper or non-designated use.

Verification for borderline cases:

For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability.

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.
- Switch off the supply voltage before connecting the device.

2.4 Operational safety

Risk of injury!

- ▶ Operate the device in proper technical condition and fail-safe condition only.
- ▶ The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability,

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to repair of an electrical device.
- ▶ Use original spare parts and accessories from Endress+Hauser only.

2.5 Hazardous area

To eliminate a danger for persons or for the facility when the device is used in the hazardous area (e.g. explosion protection, pressure vessel safety):

- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

2.6 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which they are safe to operate. It fulfills general safety requirements and legal requirements. It also conforms to the EC directives listed in the device-specific EC declaration of conformity. Endress+Hauser confirms this fact by applying the CE mark.

3 Identification

3.1 Product identification

The following options are available for identification of the measuring device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in W@M Device Viewer
(www.endress.com/deviceviewer): All information about the measuring device is displayed.

For an overview of the technical documentation provided, enter the serial number from the nameplates in the W@M Device Viewer (www.endress.com/deviceviewer).

3.2 Device designation

3.2.1 Nameplates

- The MWP (maximum working pressure) is specified on the nameplate. This value refers to a reference temperature of +20 °C (68°F) and may be applied to the device for an unlimited time. Observe temperature dependency of the MWP. The pressure values permitted at higher temperatures can be found in the standards EN 1092-1: 2001 Tab. 18 (With regard to their

stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.), ASME B 16.5a – 1998 Tab. 2-2.2 F316, ASME B 16.5a – 1998 Tab. 2.3.8 N10276, JIS B 2220.

- The test pressure corresponds to the over pressure limit (OPL) of the device = MWP x 1.5.
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the measuring device.

3.2.2 Identifying the sensor type

See parameter "Sensor Meas.Type" in Operating Instruction BA00303P.

3.3 Scope of delivery

The scope of delivery comprises:

- Hydrostatic pressure sensor Deltapilot S
- For devices with the "HistoROM/M-DAT" option:
CD-ROM with Endress+Hauser operating program
- Optional accessories

Documentation supplied:

- The Operating Instructions BA00372P and BA00303P are available via the Internet.
→ See: www.endress.com → Download.
- Brief Operating Instructions KA01026P
- Fold-out brochure KA00252P
- Final inspection report
- Additional safety instructions for Ex devices
- Optional: factory calibration form, test certificates

3.4 CE mark, Declaration of Conformity

The devices are designed to meet state-of-the-art safety requirements, have been tested and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations as listed in the EC Declaration of Conformity and thus comply with the statutory requirements of the EC Directives. Endress+Hauser confirms the conformity of the device by affixing to it the CE mark.

4 Installation

4.1 Incoming acceptance and storage

4.1.1 Incoming acceptance

- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

4.1.2 Transport

⚠ WARNING

Incorrect transportation

Housing and diaphragm may become damaged, and there is a risk of injury!

- ▶ Transport the measuring device to the measuring point in its original packaging or by the process connection (with secure transport protection for the diaphragm).
- ▶ Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.6 lbs).

4.1.3 Storage

The device must be stored in a dry, clean area and protected against impact (EN 837-2).

Storage temperature range:

- -40 to +90 °C (-40 to +194°F)
- Onsite display: -40 to +85°C (-40 to +185°F)
- Separate housing: -40 to +60°C (-40 to +140°F)

4.2 Installation conditions

4.2.1 Dimensions

→ For dimensions, please refer to the Technical Information for Deltapilot S TI00416P, "Mechanical construction" section.

4.3 General installation instructions

- Devices with a G 1 1/2 thread:
When screwing the device into the tank, the flat seal has to be positioned on the sealing surface of the process connection. To avoid additional strain on the process isolating diaphragm, the thread should never be sealed with hemp or similar materials.
- Devices with NPT threads:
 - Wrap Teflon tape around the thread to seal it.
 - Tighten the device at the hexagonal bolt only. Do not turn at the housing.
 - Do not overtighten the thread when screwing. Max. torque: 20 to 30 Nm (14.75 to 22.13 lbf ft)

4.4 Installation instructions

- Due to the orientation of the Deltapilot S, there may be a shift in the zero point, i.e. when the container is empty or partially full, the measured value does not display zero. You can correct this zero point shift using the "Zero" key on the electronic insert or externally on the device or via the onsite display. See → [§ 22](#), Section 6.2.1 "Position of the operating elements", → [§ 24](#), Section 6.2.2 "Function of the operating elements – onsite display not connected" and → [§ 32](#), Section 7.5 "Position adjustment".
- To ensure optimal readability of the onsite display, it is possible to rotate the housing up to 380°. See → [§ 15](#), Section 4.4.5 "Rotating the housing".
- Endress+Hauser offers a mounting bracket for installations on pipes or walls. See → [§ 15](#), Section 4.4.3 "Wall and pipe mounting (optional)".

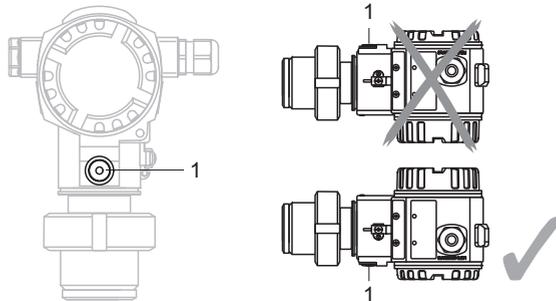
4.4.1 Installation instructions

NOTICE

Damage to the device!

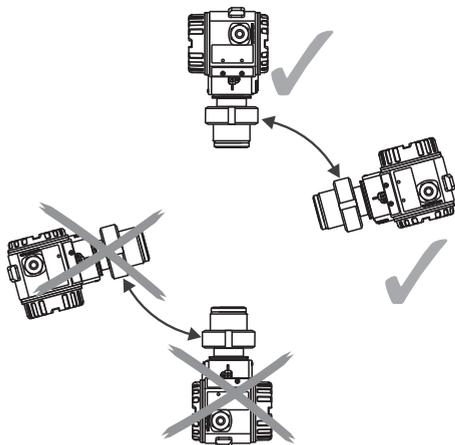
If a heated Deltapilot S is cooled during the cleaning process (e.g. by cold water), a vacuum develops for a short time, whereby moisture can penetrate the sensor through the pressure compensation (1).

- If this is the case, mount the sensor with the pressure compensation (1) pointing downwards.



- Keep the pressure compensation and GORE-TEX® filter (1) free from contamination.
- Do not clean or touch the process isolating diaphragm with hard or pointed objects.

- The device must be installed as follows in order to comply with the cleanability requirements of the ASME-BPE (Part SD Cleanability):



Level measurement

- Always install the device below the lowest measuring point.
- Do not install the device at the following positions:
 - in the filling curtain
 - in the tank outflow
 - in the suction area of a pump
 - or at a point in the tank that can be affected by pressure pulses from the agitator
- The calibration and functional test can be carried out more easily if you mount the device downstream of a shutoff device.
- Deltapilot S must be included in the insulation for media that can harden when cold.

Pressure measurement in gases

- Mount Deltapilot S with shutoff device above the tapping point so that any condensate can flow into the process.

Pressure measurement in steams

- Mount Deltapilot S with siphon above the tapping point.
- Fill the siphon with liquid before commissioning.
The siphon reduces the temperature to almost the ambient temperature.

Pressure measurement in liquids

- Mount Deltapilot S with the shutoff device below or at the same level as the tapping point.

4.4.2 Seal for flange mounting

See operating instructions.

4.4.3 Wall and pipe mounting (optional)

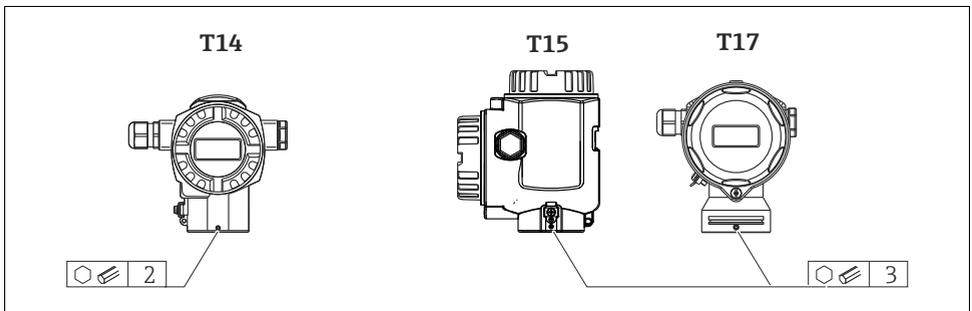
See operating instructions.

4.4.4 Assembling and mounting the "separate housing" version

See operating instructions.

4.4.5 Rotating the housing

The housing can be rotated up to 380° by loosening the Allen screw.



A0019996

1. T14 housing: Loosen setscrew with a 2 mm (0.08 in) Allen key.
T15 and T17 housing: Loosen setscrew with a 3 mm (0.12 in) Allen key.
2. Rotate housing (max. up to 380°).
3. Retighten setscrew with 1 Nm (0,74 lbf ft).

4.4.6 Closing the housing cover

NOTICE

Devices with EPDM cover seal - transmitter leakiness!

Mineral-based, animal-based or vegetable-based lubricants cause the EPDM cover seal to swell and the transmitter to become leaky.

- ▶ The thread is coated at the factory and therefore does not require any lubrication.

NOTICE

The housing cover can no longer be closed.

Damaged thread!

- ▶ When closing the housing cover, please ensure that the thread of the cover and housing are free from dirt, e.g. sand. If you feel any resistance when closing the cover, check the thread on both again to ensure that they are free from dirt.

Close cover on a hygienic stainless steel housing (T17)

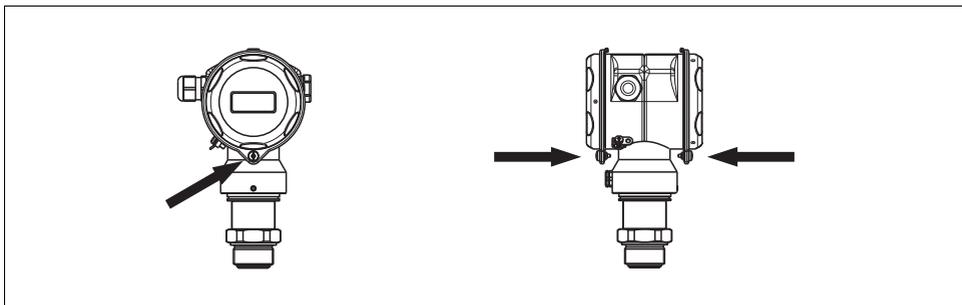


Fig. 2: Close cover

P01-FMB70xxx-17-xx-xx-xx-001

The covers for the terminal and electronics compartment are hooked into the casing and closed with a screw. These screws should be finger-tightened (2 Nm (1.48 lbf ft)) to the stop to ensure that the covers sit tightly.

4.4.7 Mounting of the profile seal for universal process mounting adapter

For details on mounting, see KA00096F/00/A3.

4.5 Post-installation check

After installing the device, carry out the following checks:

- Are all screws firmly tightened?
- Are the housing covers screwed down tight?

5 Wiring

5.1 Connecting the device

⚠ WARNING

Risk of electric shock!

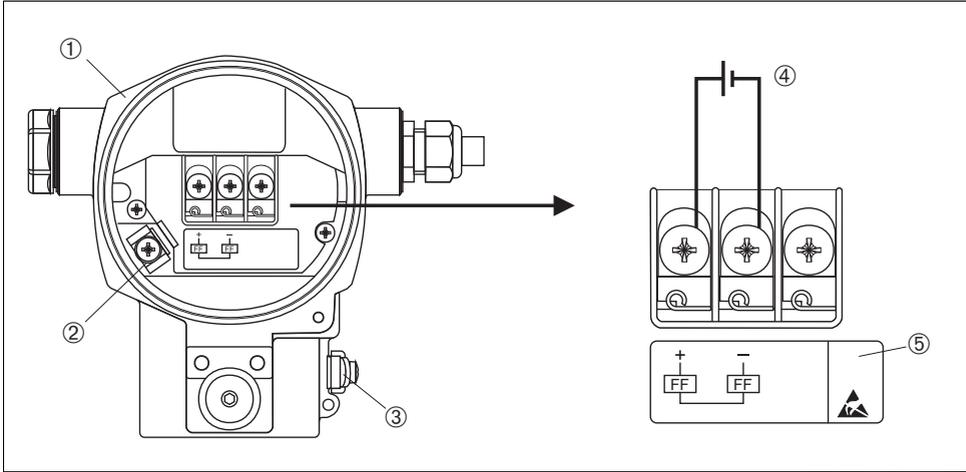
If the operating voltage is > 35 VDC: Dangerous contact voltage at terminals.

- ▶ In a wet environment, do not open the cover if voltage is present.

⚠ WARNING

Limitation of electrical safety due to incorrect connection!

- Risk of electric shock and/or explosion in hazardous areas! In a wet environment, do not open the cover if voltage is present.
- When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- Devices with integrated overvoltage protection must be grounded.
- Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.
- The supply voltage must match the power supply on the nameplate. (See also →  10, Section 3.2.1 "Nameplates".)
- Switch off the supply voltage before connecting the device.
- Remove the housing cover of the terminal compartment.
- Guide the cable through the gland. → For cable specifications, →  19, Section 5.2.4.
- Connect the device in accordance with the following diagram.
- Screw down the housing cover.
- Switch on the supply voltage.



P01-x/Mx/xxxx-04-xx-xx-xx-009

Fig. 3: Electrical connection of FOUNDATION Fieldbus
 → Please refer also to Section 5.2.1 "Supply voltage", → 19.

- 1 Housing
- 2 Internal ground terminal
- 3 External ground terminal
- 4 Supply voltage, for version in non-hazardous area = 9 to 32 V DC
- 5 Devices with integrated overvoltage protection are labeled OVP (overvoltage protection) here.

5.1.1 Connecting devices with 7/8" plug

| PIN assignment for 7/8" connector | PIN | Meaning |
|-----------------------------------|-----|--------------|
| | PIN | Meaning |
| | 1 | Signal - |
| | 2 | Signal + |
| | 3 | Shield |
| | 4 | Not assigned |

A0011176

5.2 Connecting the measuring unit

For further information on the network structure and grounding and for further bus system components such as bus cables, see the relevant documentation, e.g. Operating Instructions BA00013S "FOUNDATION Fieldbus Overview" and the FOUNDATION Fieldbus Guideline.

5.2.1 Supply voltage

⚠ WARNING

Supply voltage might be connected!

Risk of electric shock and/or explosion!

- ▶ When using the measuring device in hazardous areas, installation must comply with the corresponding national standards and regulations and the Safety Instructions or Installation or Control Drawings.
- ▶ All explosion protection data are given in separate documentation which is available upon request. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

Version for non-hazardous area: 9 to 32 V DC

5.2.2 Current consumption

15.5 mA \pm 1 mA, switch-on current corresponds to IEC 61158-2, Clause 21.

5.2.3 Terminals

- Supply voltage and internal ground terminal: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm² (20 to 12 AWG)

5.2.4 Cable specification

- Use a twisted, shielded two-wire cable, preferably cable type A.
- Outer cable diameter: 5 to 9 mm (0.2 to 0.35 in)

For further information on the cable specifications, see Operating Instructions BA00013S "FOUNDATION Fieldbus Overview", FOUNDATION Fieldbus Guideline and IEC 61158-2 (MBP).

5.2.5 Grounding and shielding

Deltapilot S must be grounded, for example by means of the external ground terminal.

Different grounding and shielding installation methods are available for FOUNDATION Fieldbus networks such as:

- Isolated installation (see also IEC 61158-2)
- Installation with multiple grounding
- Capacitive installation

5.3 Overvoltage protection (optional)

See operating instructions.

5.4 Post-connection check

Perform the following checks after completing electrical installation of the device:

- Does the supply voltage match the specifications on the nameplate?

- Is the device connected as per Section 5.1?
- Are all screws firmly tightened?
- Are the housing covers screwed down tight?

As soon as voltage is applied to the device, the green LED on the electronic insert lights up for a few seconds or the connected onsite display lights up.

6 Operation

Feature 20 "Output; operation" in the order code provides you with information on the operating options available to you.

| Versions in the order code | | Operation |
|----------------------------|--|--|
| P | FOUNDATION Fieldbus; external operation, LCD | Via onsite display and 1 key on the exterior of the device |
| Q | FOUNDATION Fieldbus; internal operation, LCD | Via onsite display and 1 key on the inside of the device |
| R | FOUNDATION Fieldbus; internal operation | Without onsite display, 1 key on the inside of the device |

6.1 Onsite display (optional)

A 4-line liquid crystal display (LCD) is used for display and operation. The onsite display shows measured values, fault messages and notice messages.

The display of the device can be turned in 90° steps.

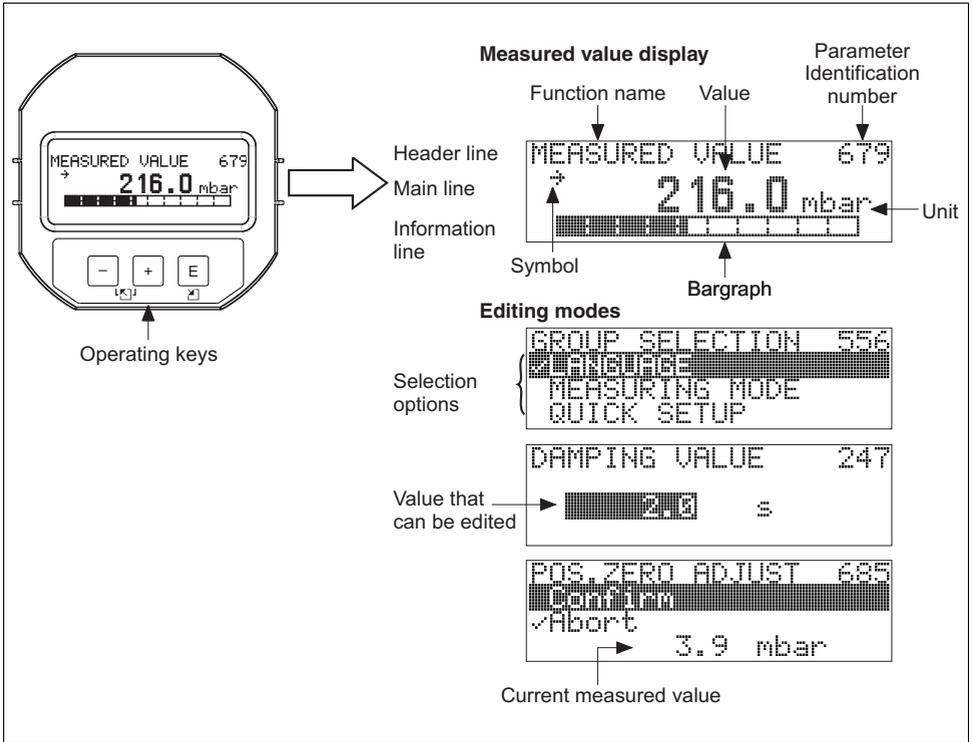
Depending on the orientation of the device, this makes it easy to operate the device and read the measured value.

Functions:

- 8-digit measured value display including sign and decimal point, unit display
- Bar graph as graphic display of the current pressure measured value in relation to the set pressure range in the Pressure Transducer Block. The pressure range is set by means of the SCALE_IN parameter.
- Easy and complete menu guidance by dividing the parameters into several levels and groups
- Menu guidance

The onsite display is available in English. Needless to say, the device can also be operated in 6 languages (de, en, fr, es, jp, ch) via the DTM or EDD. The FieldCare program is an E+H DTM operating tool and can be acquired from endress.com.

- Each parameter has a 3-digit ID to aid navigation
- Option of configuring the display according to individual requirements and preferences, such as language, alternating display, contrast setting, display of other measured values such as sensor temperature
- Comprehensive diagnostic functions (fault and warning message, maximum indicator, etc.)
- Rapid and safe commissioning using Quick Setup menus



P01-xxxxxxx-07-xx-xx-en-011

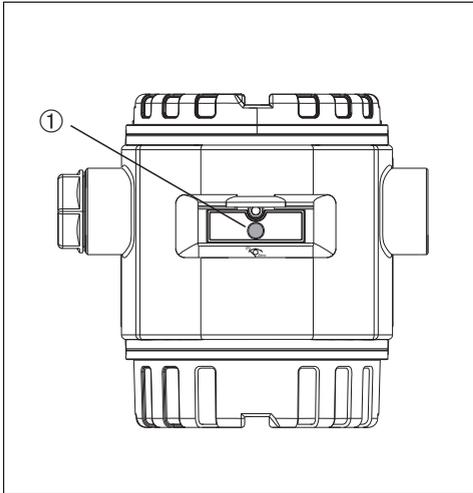
The following table illustrates the symbols that can appear on the onsite display. Four symbols can occur at one time.

| Symbol | Meaning |
|---|---|
|  | Alarm symbol – Symbol flashing: warning, device continues measuring. – Symbol permanently lit: error, device does not continue measuring. <i>Note:</i> The alarm symbol may overlies the tendency symbol. |
|  | Lock symbol The operation of the device is locked. Unlock device, →  30, Section 6.7 "Locking/unlocking operation". |
|  | Communication symbol Data transfer via communication |
|  | Simulation symbol Simulation mode is activated. DIP switch 2 for simulation is set to "On". See also Section 6.2.1 "Position of the operating elements" and →  30, Section 6.8 "Simulation" |
|  | Tendency symbol (increasing) The primary value of the Pressure Transducer Block is increasing. |
|  | Tendency symbol (decreasing) The primary value of the Pressure Transducer Block is decreasing. |
|  | Tendency symbol (constant) The primary value of the Pressure Transducer Block has remained constant over the past few minutes. |

6.2 Operating elements

6.2.1 Position of the operating elements

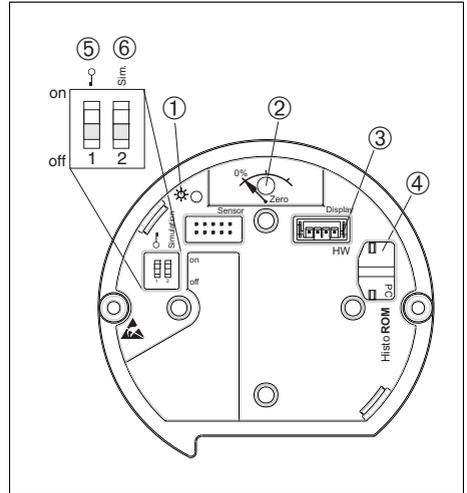
On the aluminum housing (T14/T15), the operating key is located either under the protective flap on the exterior of the device or inside on the electronic insert. In the case of the hygienic stainless steel housing (T17), the operating key is always inside on the electronic insert. In addition, there are three operating keys on the optional onsite display.



P01-PMx7xxxx-19-xx-xx-xx-075

Fig. 4: External operating key, under the protective flap

- 1 Operating key for position adjustment (zero point correction) and total reset

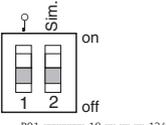


P01-xxxxxxx-19-xx-xx-xx-106

Fig. 5: Operating key and operating elements, internal

- 1 Green LED to indicate value is accepted
- 2 Operating key for position adjustment (zero point correction) and total reset
- 3 Slot for optional display
- 4 Slot for optional HistoROM®/M-DAT
- 5 DIP switch for locking/unlocking parameters relevant to the measured value
- 6 DIP switch for simulation mode

6.2.2 Function of the operating elements – onsite display not connected

| Operating elements | Meaning |
|---|--|
|  | <ul style="list-style-type: none"> - Position adjustment (zero point correction): press key for at least 3 seconds. The LED on the electronic insert lights up briefly if the pressure applied has been accepted for position adjustment. → See also the following section "Performing position adjustment on site". - Total reset: press key for at least 12 seconds. The LED on the electronic insert lights up briefly if a reset is being carried out. |
|  | <ul style="list-style-type: none"> - DIP switch 1: for locking/unlocking parameters relevant to the measured value. Factory setting: off (unlocked) See also → 30, Section 6.7 "Locking/unlocking operation". - DIP switch 2: for simulation mode Factory setting: off (simulation mode off) → See also → 30, Section 6.8 "Simulation" |

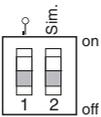
Performing position adjustment on site

- Operation must be unlocked. See → 30, Section 6.7 "Locking/unlocking operation".
- The device is configured for the MEASURING MODE → level and LEVEL SELECTION → level easy pressure as standard.
 - Operation via FF configuration program: In the Pressure Transducer Block, change the measuring mode by means of the PRIMARY_VALUE_TYPE and LINEARIZATION parameters.
 - Operation via digital communication: change the measuring mode by means of the MEASURING MODE parameter.
 - You can change the measuring mode by means of the MEASURING MODE parameter. See → 32, Section 7.4 "Selecting the language and measuring mode".
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.

Perform position adjustment:

1. Pressure is present at device.
2. Press key for at least 3 seconds.
3. If the LED on the electronic insert lights up briefly, the pressure applied has been accepted for position adjustment.
If the LED does not light up, the pressure applied was not accepted. Observe the input limits. For error messages see operating instructions.

6.2.3 Function of the operating elements – onsite display connected

| Key(s) | Meaning |
|---|---|
|  | <ul style="list-style-type: none"> - Navigate upwards in the picklist - Edit numerical values or characters within a function |
|  | <ul style="list-style-type: none"> - Navigate downwards in the picklist - Edit numerical values or characters within a function |
|  | <ul style="list-style-type: none"> - Confirm entry - Go to next item |
|  and  | Contrast setting of onsite display: increase |
|  and  | Contrast setting of onsite display: reduce |
|  and  | <p>ESC functions:</p> <ul style="list-style-type: none"> - Exit the editing mode without saving the altered value - You are in the menu within a function group: the first time you press the keys simultaneously, you go back one parameter in the function group. Every subsequent time you press the keys simultaneously, you go up one level in the menu. - You are in the menu on a selection level: every time you press the keys simultaneously, you go up one level in the menu. <p><i>Note:</i> For the terms function group, level, selection level, →  26, Section 6.4.1</p> |
|  | <ul style="list-style-type: none"> - DIP switch 1: for locking/unlocking parameters relevant to the measured value. Factory setting: off (unlocked) - DIP switch 2: for the simulation mode. Factory setting: off (simulation mode off) |

6.3 FOUNDATION Fieldbus interface

See operating instructions.

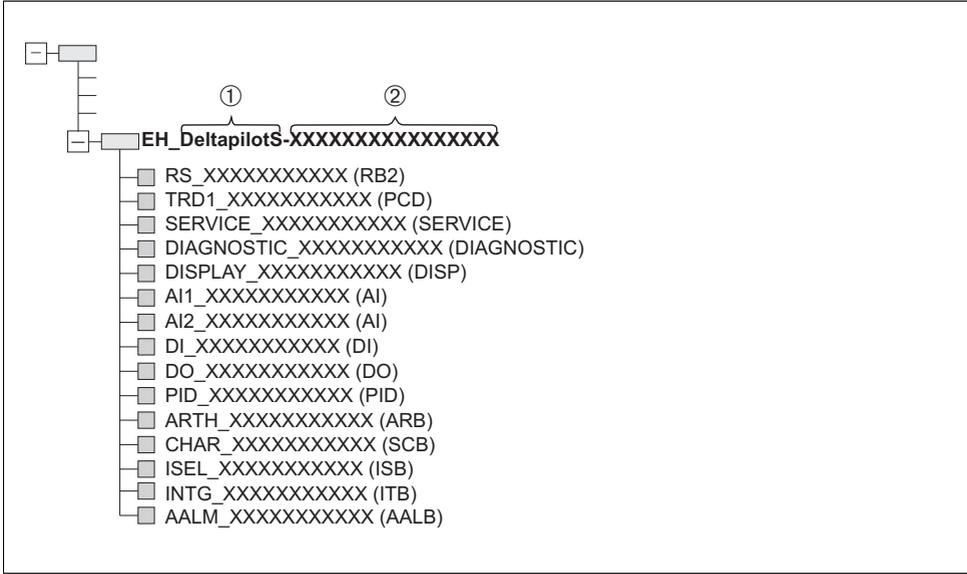
6.3.1 Device identification and addressing

FOUNDATION Fieldbus identifies the device using its ID code and automatically assigns it a suitable field address. The identity code cannot be changed.

The device appears in the network display once you have started the FF configuration program and integrated the device into the network. The blocks available are displayed under the device name.

If the device description has not yet been loaded, the blocks report "Unknown" or "(UNK)".

Deltapilot S reports as follows:



P01-PMx7xxxx-05-xx-xx-xx-017

Fig. 6: Typical Deltapilot S display in a configuration program after the connection has been established.

- 1 Device name
- 2 Serial number

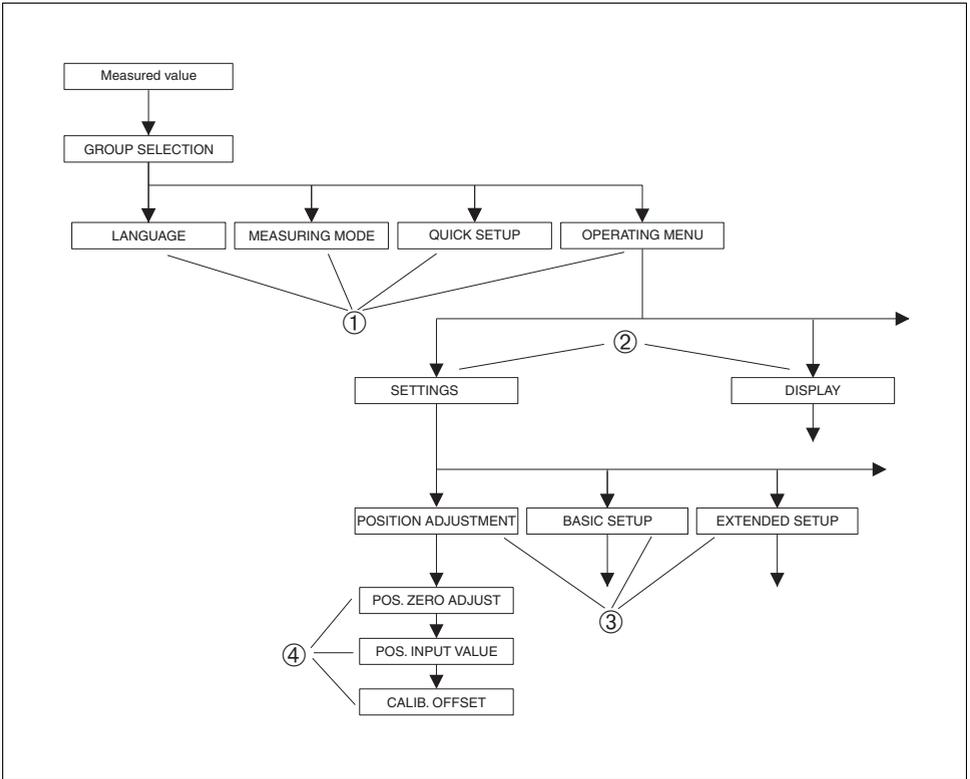
6.4 Local operation – onsite display connected

If the onsite display is connected, the three operating keys are used to navigate through the operating menu, → 25, Section 6.2.3 "Function of the operating elements – onsite display connected".

6.4.1 Menu structure

The menu is split into four levels. The three upper levels are used to navigate while you use the lowest level to enter numerical values, and select and save options.

The structure of the MEASURING MENU depends on the measuring mode selected, e.g. if "Pressure" is selected as the measuring mode, only the functions needed for this measuring mode are displayed.



P01-xxxxxxx-19-xx-xx-en-145

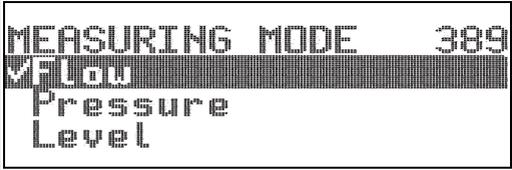
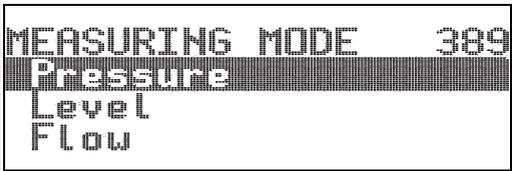
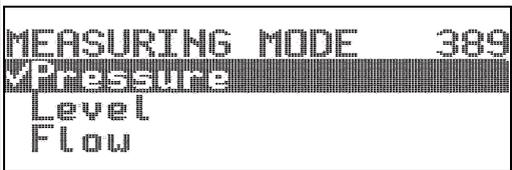
Fig. 7: Menu structure

- 1 1st selection level
- 2 2nd selection level
- 3 Function groups
- 4 Parameters

The MEASURING MODE parameter is only displayed via the onsite display on the 1st selection level. In FieldCare, the LANGUAGE parameter is displayed in the DISPLAY group and the parameters for configuring the measuring mode are displayed in the Measuring Mode menu.

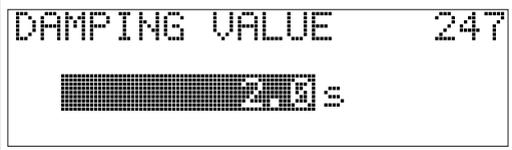
6.4.2 Selecting an option

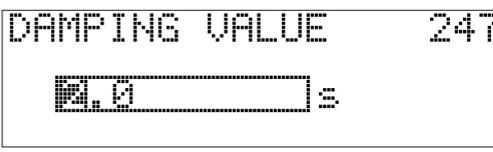
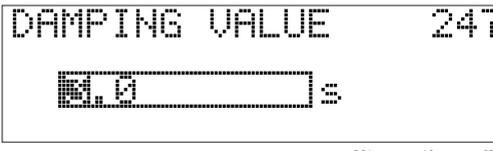
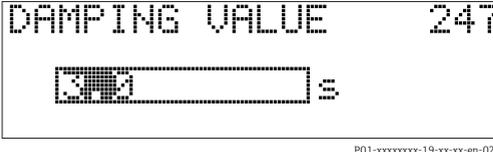
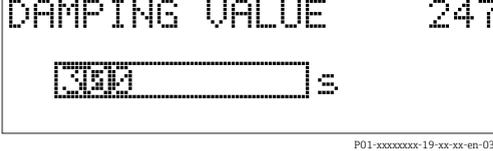
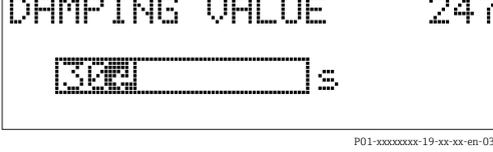
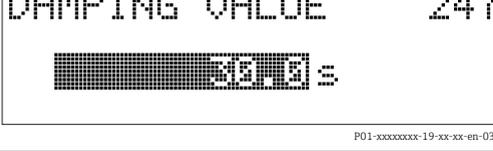
Example: Selecting the "Pressure" measuring mode.

| Onsite display | Operation |
|---|---|
|  <p>MEASURING MODE 389 VALLOW Pressure Level</p> <p style="text-align: right; font-size: small;">MEASURINGMODE_Flow</p> | <p>"Level" has been selected as the measuring mode. The option currently active is indicated by a 3 in front of the menu text.</p> |
|  <p>MEASURING MODE 389 Pressure Level Flow</p> <p style="text-align: right; font-size: small;">MEASURINGMODE_Press</p> | <p>Use "+" or "-" to select "Pressure" as the operating mode.</p> |
|  <p>MEASURING MODE 389 Pressure Level Flow</p> <p style="text-align: right; font-size: small;">MEASURINGMODE_Press-1</p> | <ol style="list-style-type: none"> 1. Press 'E' to confirm your choice. The option currently active is indicated by a 3 in front of the menu text. (The "Pressure" measuring mode is selected.) 2. Go to the next menu item with 'E'. |

6.4.3 Editing a value

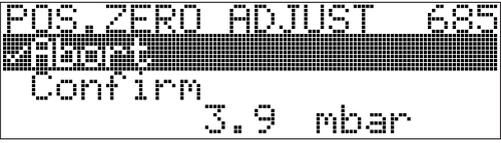
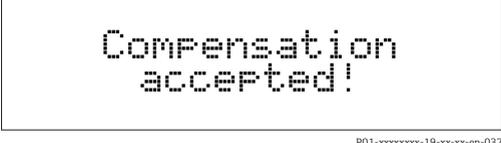
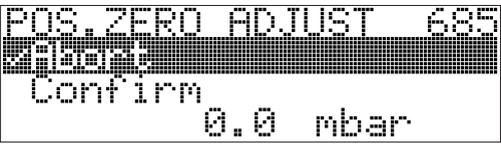
Example: changing the DAMPING VALUE function from 2.0 s to 30.0 s. See also → 25, Section 6.2.3 "Function of the operating elements – onsite display connected".

| Onsite display | Operation |
|--|---|
|  <p>DAMPING VALUE 247 2.0 s</p> <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-en-023</p> | <p>The onsite display indicates the parameter to be modified. The value highlighted in black can be modified. The unit "s" is prespecified and cannot be changed.</p> |

| Onsite display | Operation |
|--|--|
|  <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-en-027</p> | <ol style="list-style-type: none"> 1. Press "+" or "-" to enter the editing mode. 2. The first digit is highlighted in black. |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-en-028</p> | <ol style="list-style-type: none"> 1. Use the "+" key to change the digit "2" to "3". 2. Press the "E" key to confirm "3". The cursor goes to the next position (highlighted in black). |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-en-029</p> | <p>The decimal point is highlighted in black. This means you can now edit this digit.</p> |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-en-030</p> | <ol style="list-style-type: none"> 1. Press "+" or "-" until "0" is displayed. 2. Press the "E" key to confirm "0". The cursor goes to the next position. ␣ is displayed and highlighted in black. → See next graphic. |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-en-031</p> | <p>Press "E" to save the new value and exit the editing mode. → See next graphic.</p> |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxxx-19-xx-xx-en-032</p> | <p>The new value for the damping is 30.0 s.</p> <ul style="list-style-type: none"> - Go to the next parameter with "E". - Press "+" or "-" to go back to the editing mode. |

6.4.4 Accepting pressure present at device as value

Example: performing position adjustment.

| Onsite display | Operation |
|--|---|
|  <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-en-158</p> | <p>The bottom line on the onsite display displays the pressure present, 3.9 mbar in this example.</p> |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-en-159</p> | <p>Use "+" or "-" to switch to the "Confirm" option. The active option is highlighted in black.</p> |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-en-037</p> | <p>Using the "E" key, assign the value (3.9 mbar) to the POS. ZERO ADJUST parameter. The device confirms the adjustment and goes back to the parameter, here POS. ZERO ADJUST (see next graphic).</p> |
|  <p style="text-align: right; font-size: small;">P01-xxxxxxx-19-xx-xx-en-160</p> | <p>Go to the next parameter with "E".</p> |

6.5 FieldCare

See operating instructions.

6.6 HistoROM®/M-DAT (optional)

See operating instructions.

6.7 Locking/unlocking operation

See operating instructions.

6.8 Simulation

See operating instructions.

6.9 Factory setting (reset)

See operating instructions.

7 Commissioning

The device is configured for the level measuring mode as standard. The measuring range and the unit in which the measured value is transmitted correspond to the specifications on the nameplate.

▲ WARNING

Exceeding the maximum allowable working pressure!

Risk of injury due to bursting of parts! Warning messages are generated if pressure is too high.

- ▶ If a pressure greater than the maximum permitted pressure is present at the device, the messages "E115 Sensor overpressure" and "E727 Sensor pressure error - overrange" are output in succession! Use the device only within the sensor range limits

NOTICE

Shortfall of the allowable working pressure!

Output of messages if pressure is too low.

- ▶ If a pressure smaller than the minimum permitted pressure is present at the device, the messages "E120 Sensor low pressure" and "E727 Sensor pressure error - overrange" are output in succession! Use the device only within the sensor range limits

7.1 Configuring messages

- The messages E727, E115 and E120 are "Error"-type messages and can be configured as a "Warning" or an "Alarm". The factory setting for these messages is "Warning". This setting prevents the BAD status from being transmitted in applications (e.g. cascade measurement) where the user is aware of the risk of the sensor range being overshoot.
- We recommend setting messages E727, E115 and E120 to "Alarm" in the following instances:
 - It is not necessary to violate the sensor range for the measuring application.
 - A position adjustment must be carried out that has to correct a large measured error as a result of the orientation of the device.

7.2 Function check

Carry out a post-installation and a post-connection check as per the checklist before commissioning the device.

- "Post-installation check" checklist → see Section 4.5
- "Post-connection check" checklist → see Section 5.4

7.3 Commissioning via an FF configuration program

See operating instructions.

7.4 Selecting the language and measuring mode

7.4.1 Local operation

The MEASURING MODE parameter is on the 1st selection level.
Section 6.4.1 "Menu structure".

The following measuring modes are available:

- Pressure
- Level

7.4.2 Selecting the language and measuring mode by means of the FieldCare operating program

See operating instructions.

7.5 Position adjustment

Due to the orientation of the device, there may be a shift in the measured value, i.e. when the container is empty or partly filled, the measured value parameter does not display zero. There are two options to choose from when performing position adjustment.

- Onsite display menu path: GROUP SELECTION → OPERATING MENU → SETTINGS → POSITION ADJUSTMENT
- FieldCare menu path: OPERATING MENU → SETTINGS → POSITION ADJUSTMENT

7.5.1 Performing position adjustment via the onsite display or FieldCare

The parameters listed in the following table can be found in the POSITION ADJUSTMENT group (menu path: OPERATING MENU → SETTINGS → POSITION ADJUSTMENT).

| Parameter name | Description |
|---------------------------|---|
| POS. ZERO ADJUST Entry | <p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known.</p> <p>Example:</p> <ul style="list-style-type: none"> – MEASURED VALUE = 2.2 mbar (0.032 psi) – Correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option. This means that you are assigning the value 0.0 to the pressure present. – MEASURED VALUE (after pos. zero adjust) = 0.0 mbar <p>The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected.</p> <p>Factory setting: 0.0</p> |

| Parameter name | Description |
|---------------------------|--|
| POS. INPUT VALUE Input | <p>Position adjustment – the pressure difference between zero (set point) and the measured pressure need not be known. To correct the pressure difference, you need a reference measurement value (e. g. from a reference device).</p> <p>Example:</p> <ul style="list-style-type: none"> - MEASURED VALUE = 0.5 mbar (0.0073 psi) - For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE, e.g. 2.0 mbar (0.029 psi). (The following applies: $MEASURED\ VALUE_{new} = POS.\ INPUT\ VALUE$) - MEASURED VALUE (after entry for POS. INPUT VALUE) = 2.0 mbar (0.029 psi) - The CALIB. OFFSET parameter displays the resulting pressure difference (offset) by which the MEASURED VALUE was corrected. The following applies: $CALIB.\ OFFSET = MEASURED\ VALUE_{old} - POS.\ INPUT\ VALUE$, here: $CALIB.\ OFFSET = 0.5\ mbar\ (0.0073\ psi) - 2.0\ mbar\ (0.029\ psi) = -1.5\ mbar\ (0.022\ psi)$) <p>Factory setting: 0.0</p> |
| CALIB. OFFSET Entry | <p>Position adjustment – the pressure difference between zero (set point) and the measured pressure is known. (A reference pressure is not present at the device.)</p> <p>Example:</p> <ul style="list-style-type: none"> - MEASURED VALUE = 2.2 mbar (0.032 psi) - Via the CALIB. OFFSET parameter, enter the value by which the MEASURED VALUE should be corrected. To correct the MEASURED VALUE to 0.0 mbar, you must enter the value 2.2 here. (The following applies: $MEASURED\ VALUE_{new} = MEASURED\ VALUE_{old} - CALIB.\ OFFSET$) - MEASURED VALUE (after entry for calib. offset) = 0.0 mbar <p>Factory setting: 0.0</p> |

7.6 Level measurement

7.6.1 Information on level measurement

- A Quick Setup menu is available for each of the measuring modes Pressure and Level which guides you through the most important basic functions. → For the "Level" Quick Setup menu, see →  34.
- Furthermore, three level modes are available for the level measurement, namely "Level easy pressure", "Level easy height" and "Level standard". For the "Level standard" level mode, you can choose between the "Linear", "Pressure linearized" and "Height linearized" level types. The table in the "Overview of level measurement" section that follows provides you with an overview of the various measuring tasks.
 - With regard to the "Level easy pressure" and "Level easy height" level modes, the values entered are not tested as extensively as in the "Level standard" level mode. In the "Level easy pressure" and "Level easy height" level modes, the values entered for EMPTY CALIBRATION/FULL CALIBRATION, EMPTY PRESSURE/FULL PRESSURE and EMPTY

HEIGHT/FULL HEIGHT have to be at least 1 % apart. If the values are too close together, the value is rejected and the system outputs a message. Other limit values are not checked, i.e. for the device to be able to perform correct measurement, the values entered have to suit the sensor and the measuring task.

- The "Level easy pressure" and "Level easy height" level modes comprise fewer parameters than the "Level standard" mode and are used to quickly and easily configure a level application.
- Customer-specific units of level, volume and mass, or a linearization table, can only be entered in the "Level standard" level mode.
- For a detailed description of the parameters and configuration examples, see Operating Instructions BA00303P "Cerabar S/Deltabar S/Deltapilot S, Description of Device Functions".

⚠ WARNING

Changing the measuring mode affects the span (URV)!

This situation can result in product overflow.

- ▶ If the measuring mode is changed, the span setting (URV) must be verified in the "CALIBRATION" → "BASIC SETUP" operating menu and, if necessary, reconfigured!

7.6.2 Overview of level measurement

See operating instructions.

7.6.3 Quick Setup menu for the Level measuring mode

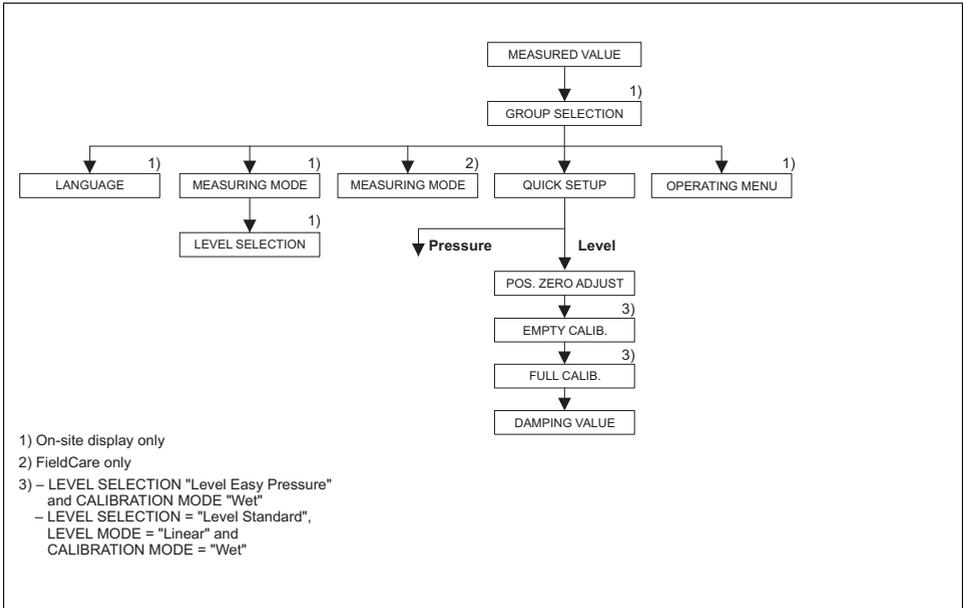
- Some parameters are only displayed if other parameters are appropriately configured. For example, the EMPTY CALIBRATION parameter is only displayed in the following instances:
 - LEVEL SELECTION "Level easy pressure" and CALIBRATION MODE "Wet"
 - LEVEL SELECTION "Level standard", LEVEL MODE "Linear" and CALIBRATION MODE "Wet"
 The LEVEL MODE and CALIBRATION MODE parameters are in the BASIC SETUP function group.
- The following parameters are set to the following values at the factory:
 - LEVEL SELECTION: Level easy pressure
 - CALIBRATION MODE: Wet
 - OUTPUT UNIT or LIN. MEASURAND: %
 - EMPTY CALIBRATION: 0.0
 - FULL CALIBRATION: 100.0
- The Quick Setup is suitable for easy and quick commissioning. If you want to make more complex settings like changing the unit from "%" to "m", the calibration must be performed via the BASIC SETUP group. → See Operating Instructions BA00303P.

⚠ WARNING

Changing the measuring mode affects the span (URV)!

This situation can result in product overflow.

- ▶ If the measuring mode is changed, the span setting (URV) must be verified in the "CALIBRATION" → "BASIC SETUP" operating menu and, if necessary, reconfigured!



P01-FMB70xxx-19-xx-xx-en-015

Fig. 8: Quick Setup menu for the "Level" measuring mode"

| Local operation | FieldCare |
|--|--|
| Measured value display Switch from the measured value display to the GROUP SELECTION with F. | Measured value display Select QUICK SETUP menu. |
| GROUP SELECTION Select the MEASURING MODE. | Measuring Mode Select the Primary Value Type parameter. |
| MEASURING MODE Select "Level". | Primary Value Type Select "Level" option. |
| LEVEL SELECTION Select the level mode. For an overview, see → 34. | Level Selection Select the level mode. For an overview, see → 34. |
| GROUP SELECTION Select QUICK SETUP menu. | |
| POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i.e. you assign the value 0.0 to the pressure present. | POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i.e. you assign the value 0.0 to the pressure present. |

| Local operation | FieldCare |
|---|---|
| <p>EMPTY CALIB. ¹⁾ Enter level value for the lower calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.</p> | <p>EMPTY CALIBRATION ¹ Enter level value for the lower calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.</p> |
| <p>FULL CALIBRATION ¹ Enter level value for the upper calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.</p> | <p>FULL CALIBRATION ¹ Enter level value for the upper calibration point. For this parameter, enter a level value which is assigned to the pressure present at the device.</p> |
| <p>DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT Value of the Analog Input Block react to a change in the pressure.</p> | <p>DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT Value of the Analog Input Block react to a change in the pressure.</p> |

- 1) – LEVEL SELECTION "Level easy pressure" and CALIBRATION MODE "Wet"
– LEVEL SELECTION "Level standard", LEVEL MODE "Linear" and CALIBRATION MODE "Wet"

For onsite operation, see also →  25, Section 6.2.3 "Function of the operating elements – onsite display connected" and →  26, Section 6.4 "Local operation – onsite display connected".

7.7 Pressure measurement

7.7.1 Information on pressure measurement

- A Quick Setup menu is available for each of the measuring modes Pressure and Level which guides you through the most important basic functions. With the setting in the MEASURING MODE parameter, you specify which Quick Setup menu should be displayed. See also Section 7.4 "Selecting the language and measuring mode".
- For a detailed description of the parameters, see Operating Instructions BA00303P "Cerabar S/Deltabar S/Deltapilot S, Description of Device Functions"
 - FF: Table, Pressure Transducer Block
 - FieldCare: Table, POSITION ADJUSTMENT
 - FieldCare: Table, BASIC SETUP
 - FieldCare: Table, EXTENDED SETUP

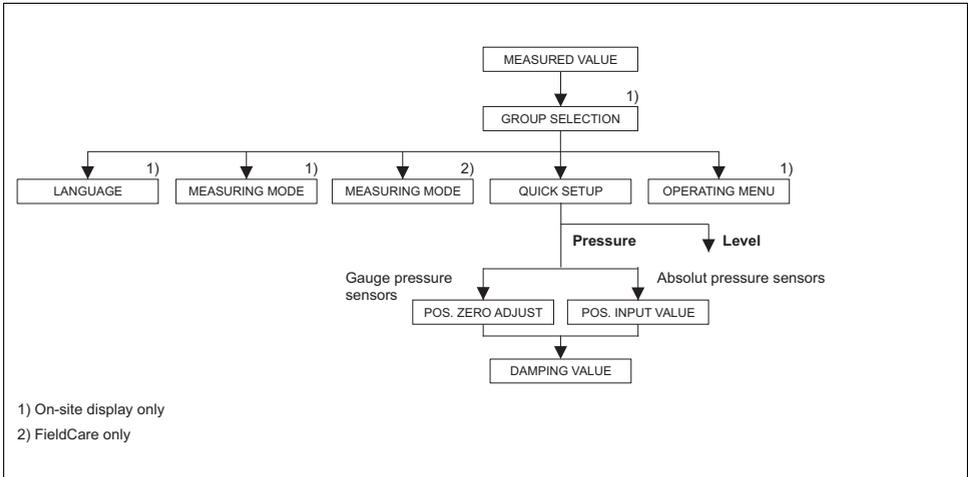
WARNING

Changing the measuring mode affects the span (URV)!

This situation can result in product overflow.

- ▶ If the measuring mode is changed, the span setting (URV) must be verified in the "CALIBRATION" → "BASIC SETUP" operating menu and, if necessary, reconfigured!

7.7.2 Quick Setup menu for the Pressure measuring mode



F01-PMx7xxxx-19-xx-xx-en-078

Fig. 9: Quick Setup menu for the "Pressure" measuring mode

| Local operation | FieldCare |
|--|--|
| Measured value display Switch from the measured value display to the GROUP SELECTION with F. | Measured value display Select QUICK SETUP menu. |
| GROUP SELECTION Select the MEASURING MODE parameter. | Measuring Mode Select the Primary Value Type parameter. |
| MEASURING MODE Select "Pressure". | |
| GROUP SELECTION Select QUICK SETUP menu. | Primary Value Type Select "Pressure" option. |
| POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i.e. you assign the value 0.0 to the pressure present. | POS. ZERO ADJUST Due to orientation of the device, there may be a shift in the measured value. You correct the MEASURED VALUE via the POS. ZERO ADJUST parameter with the "Confirm" option, i.e. you assign the value 0.0 to the pressure present. |
| POS. INPUT VALUE Due to orientation of the device, there may be a shift in the measured value. For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE. | POS. INPUT VALUE Due to orientation of the device, there may be a shift in the measured value. For the POS. INPUT VALUE parameter, specify the desired set point for the MEASURED VALUE. |

| Local operation | FieldCare |
|---|---|
| <p>DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT Value of the Analog Input Block react to a change in the pressure.</p> | <p>DAMPING VALUE Enter damping time (time constant τ). The damping affects the speed at which all subsequent elements, such as the onsite display, measured value and OUT Value of the Analog Input Block react to a change in the pressure.</p> |

For onsite operation, see also →  25, Section 6.2.3 "Function of the operating elements – onsite display connected" and →  26, Section 6.4 "Local operation – onsite display connected".

7.8 Scaling the OUT parameter

See operating instructions.



71336356

www.addresses.endress.com
