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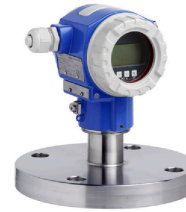
2022-04-05

Brief Operating Instructions
Deltapilot S FMB70

Hydrostatic level measurement

HART COMMUNICATION PROTOCOL



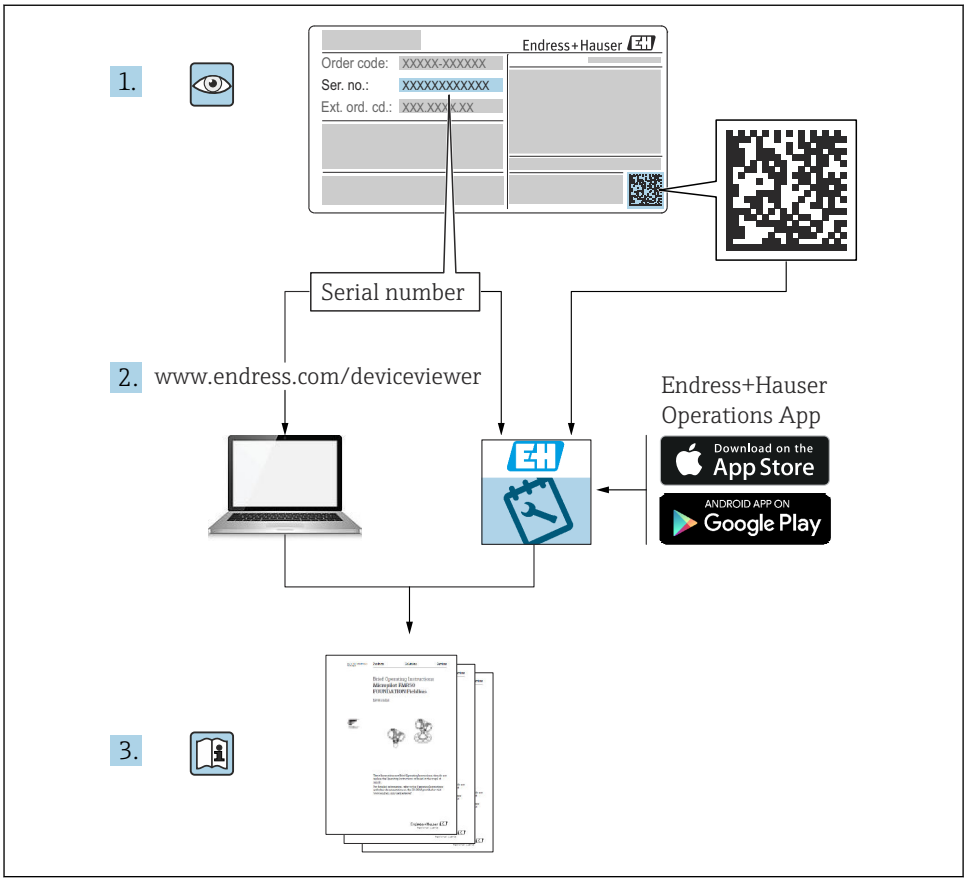
These Brief Operating Instructions are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the additional documentation.

Available for all device versions via
- Internet: www.endress.com/deviceviewer
- Smartphone/tablet: *Endress+Hauser Operations app*

Endress+Hauser
People for Process Automation

1 Associated documentation



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2 About this document

2.1 Document function

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

2.2 Symbols used

2.2.1 Safety symbols

⚠ DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

⚠ WARNING
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

⚠ CAUTION
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

2.2.2 Electrical symbols

⏚

Ground connection

A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

⊜ Protective earth (PE)

Ground terminals that must be connected to ground prior to establishing any other connections.

The ground terminals are located on the interior and exterior of the device:
- Interior ground terminal: protective earth is connected to the mains supply.
- Exterior ground terminal: device is connected to the plant grounding system.

2.2.3 Symbols for certain types of information and graphics

✓ Permitted
Procedures, processes or actions that are permitted

✗ Forbidden
Procedures, processes or actions that are forbidden

ℹ Tip
Indicates additional information

Reference to documentation

Reference to page

Reference to graphic


Visual inspection

▶
Notice or individual step to be observed

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

2.3 Registered trademarks

KALREZ®

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

TRI-CLAMP®

Trademark of Ladish & Co., Inc., Kenosha, USA

HART®

Registered trademark of the FieldComm Group, Austin, USA

GORE-TEX®

Trademark of W.L. Gore & Associates, Inc., USA

3 Basic safety instructions

3.1 Requirements for the personnel

Personnel must meet the following requirements for their tasks:
- ▶ Trained, qualified specialists must be suitably qualified to perform this function and task
- ▶ Are authorized by the plant owner/operator
- ▶ Are familiar with federal/national regulations
- ▶ Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application)
- ▶ Follow instructions and comply with basic conditions

3.2 Intended use

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

3.2.1 Foreseeable incorrect use

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

3.3 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.

3.4 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.

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.

3.5 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.

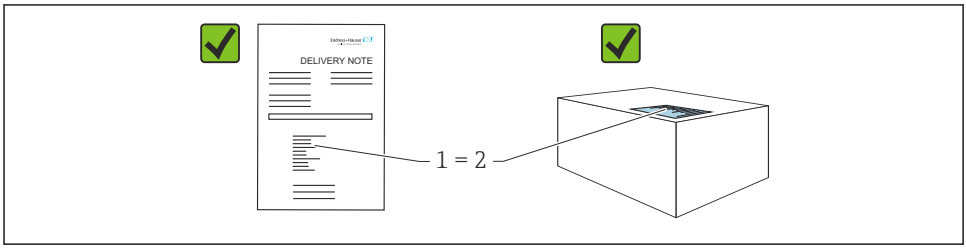
It fulfills general safety requirements and legal requirements. It also conforms to the EC directives listed in the device-specific EC declaration of conformity. Endress+Hauser confirms this fact by applying the CE mark.

3.6 Functional safety SIL3 (optional)

The Functional Safety Manual must be strictly observed for devices that are used in functional safety applications.

4 Incoming acceptance and product identification

4.1 Incoming acceptance



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- Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?
- Are the goods undamaged?
- Do the data on the nameplate correspond to the order specifications and the delivery note?
- Is the documentation available?
- If required (see nameplate): Are the safety instructions (XA) present?

If one of these conditions is not fulfilled, please contact your Endress+Hauser sales office.

4.2 Product identification

The device can be identified in the following ways:
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note

▶ Enter serial number from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer)
  ↳ All of the information on the measuring device and on the scope of the technical documentation pertaining to the device is displayed.

▶ Enter the serial number from the nameplate in the *Endress+Hauser Operations app* or scan the 2-D matrix code on the nameplate with the camera
  ↳ All of the information on the measuring device and on the scope of the technical documentation pertaining to the device is displayed.

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

Store the measuring device in clean and dry conditions and protect from damage caused by shocks (EN 837-2).

5 Mounting

5.1 Mounting requirements

5.1.1

Dimensions → see the Technical Information for Deltapilot S TI00416P, "Mechanical construction" section.

5.1.2 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 membrane, 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. tightening torque:
    20 to 30 Nm (14.75 to 22.13 lbf ft)

5.2 Mounting the device

- Due to the orientation of the Deltapilot S, a zero point shift may occur, i.e. when the vessel is empty, the measured value does not display zero. You can correct this zero point shift either directly on the device via the E button or via remote operation.
- To ensure optimum readability of the local display, it is possible to rotate the housing by up to 380°.
- The local display can be rotated in 90° stages.
- Endress+Hauser offers a mounting bracket for installation on pipes or walls.

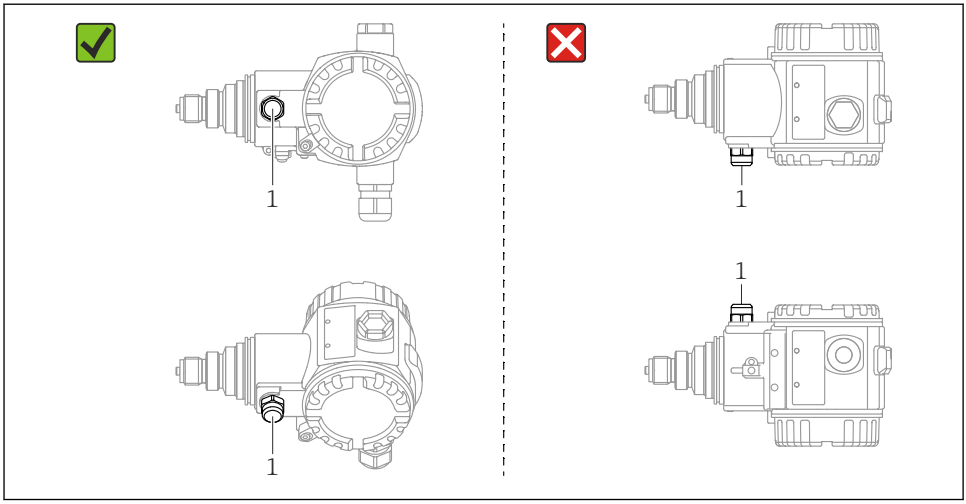
5.2.1 Installation instructions

NOTICE

Damage to the device!

If a heated device is cooled during a cleaning process (e.g. by cold water), a vacuum develops for a short time and, as a result, moisture can enter the sensor through the pressure compensation element (1).

► Mount the device with the pressure compensation element (1) pointing diagonally downwards or to the side as much possible.



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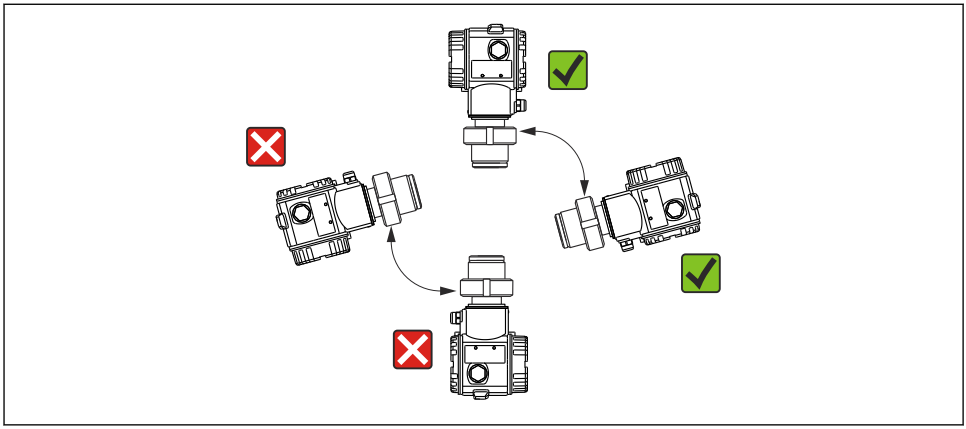
- Keep the pressure compensation and GORE-TEX® filter (1) free from contamination and water.
- Do not clean or touch process membranes with hard or pointed objects.
- The device must be installed as follows in order to comply with the cleanability requirements of the ASME-BPE (Part SD Cleanability):



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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 outlet
  - In the suction area of a pump
  - At a point in the tank which could be affected by pressure pulses from the agitator
- The adjustment and functional test can be carried out more easily if you mount the device downstream from a shutoff device.
- The Deltapilot S must also be insulated in the case of media that can harden when cold.

Pressure measurement in gases

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

Pressure measurement in vapors

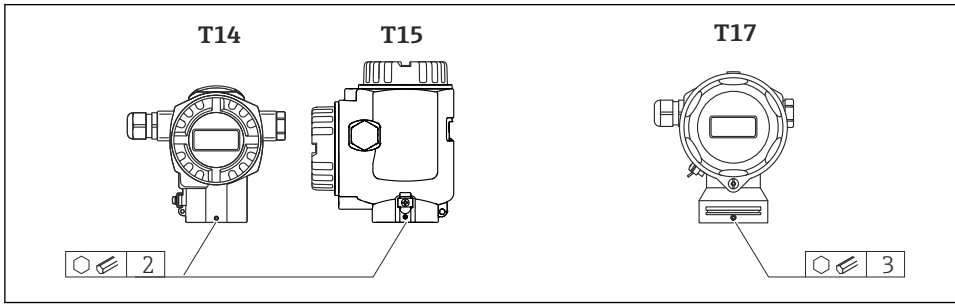
- Mount the Deltapilot S with the water pocket pipe above the tapping point.
- Fill the water pocket pipe with liquid before commissioning. The water pocket pipe reduces the temperature to almost ambient temperature.

Pressure measurement in liquids

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

5.2.2 Turning the housing

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



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1. T14 and T15 housing: loosen the setscrew with a 2 mm (0.08 in) Allen key. T17 housing: loosen the setscrew with a 3 mm (0.12 in) Allen key.
2. Rotate the housing (max. up to 380°).
3. Retighten the setscrew with 1 mm (0.74 lbf ft)1 Nm (0.74 lbf ft).

5.2.3 Closing the housing covers

NOTICE

Devices with EPDM cover seal - leaking transmitter!
Mineral-, animal- or plant-based lubricants cause the EPDM cover seal to swell and the transmitter to leak as a result.
- ▶ It is not necessary to grease the thread due to the coating applied to the thread at the factory.

NOTICE

The housing cover can no longer be closed.
Damaged thread!
- ▶ When closing the housing covers make sure that the threads on the covers and the housing are free from dirt, such as sand. If you encounter resistance when closing the covers, then check the threads again for dirt.

Closing the covers on the hygienic stainless steel housing (T17)

The covers for the terminal compartment and electronics compartment are hooked into the housing and closed with a screw in each case. These screws must be tightened finger-tight (2 Nm (1.48 lbf ft)) to the stop to ensure that the covers are securely seated and leak-tight.

6 Electrical connection

6.1 Connecting the device

⚠ WARNING

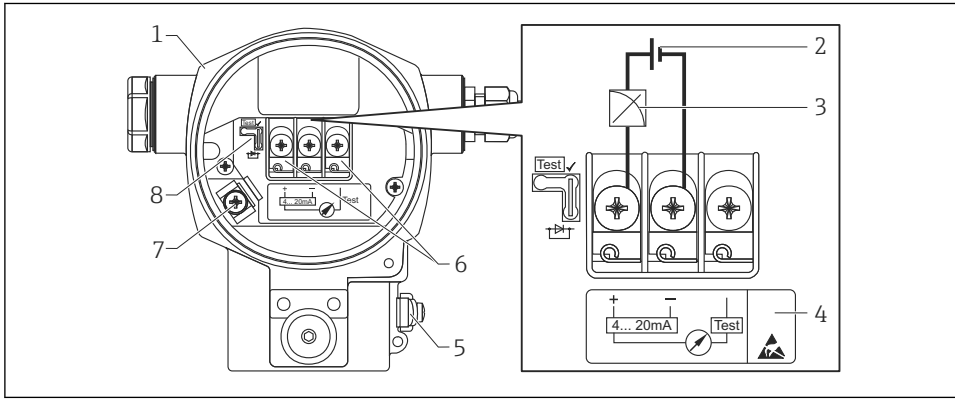
Risk of electric shock!
If the operating voltage is > 35 VDC: Dangerous contact voltage at terminals.
- ▶ In a wet environment, do not open the cover if voltage is present.

⚠ WARNING

An incorrect connection compromises electrical safety!
- ▶

- Risk of electric shock and/or explosion! Switch off the supply voltage before connecting the device.
- When using the measuring device in hazardous areas, installation must also comply with the applicable 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 integrated.
- The supply voltage must match the power supply on the nameplate, see Operating Instructions.
- Switch off the supply voltage before connecting.
- Remove the housing cover of the terminal compartment.

- Guide the cable through the gland. Preferably use a twisted, shielded two-wire cable.
- Connect the device as indicated in the diagram.
- Screw down the housing cover.
- Switch on the supply voltage.



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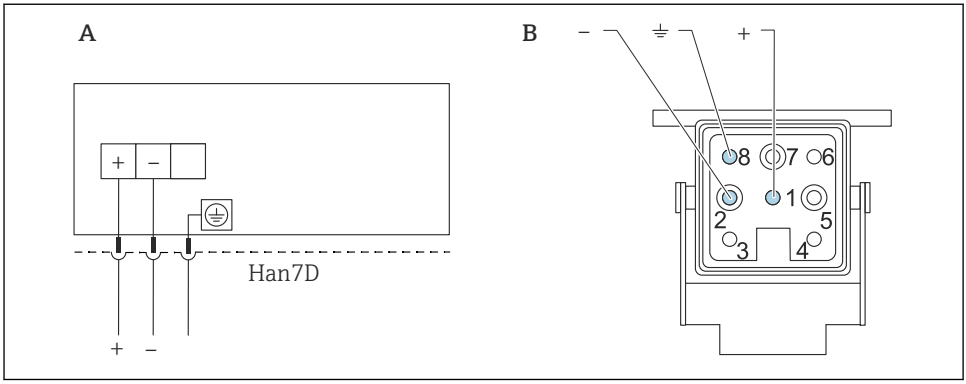
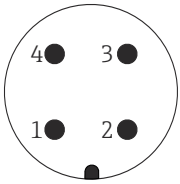
1 Housing
2 Minimum supply voltage = 10.5 V DC, jumper is set as illustrated in the diagram.
2 Minimum supply voltage = 11.5 V DC, jumper is set to the "Test" position.
3 4 to 20 mA
4 Devices with integrated overvoltage protection are labeled "OVP" (overvoltage protection) here.
5 External ground terminal
6 4 to 20 mA test signal between positive and test terminal
7 Internal ground terminal
8 Jumper for 4 to 20 mA test signal

6.1.1 Connection of devices with Harting plug Han7D

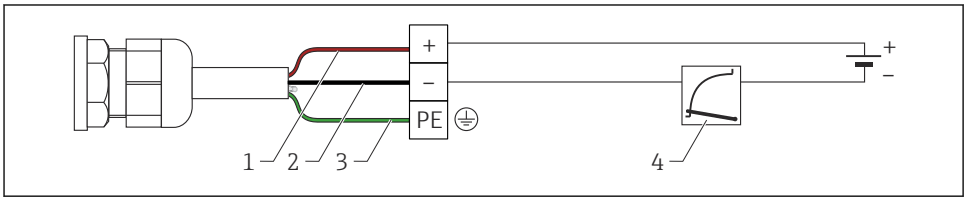


A Electrical connection for devices with Harting plug Han7D
B View of the plug-in connection on the device
- Brown
⏚ Green/yellow
+ Blue

6.1.2 Connection of devices with M12 plug (p. 21)

	PIN	
	1	Signal +
	2	Not assigned
	3	Signal -
	4	Ground

6.1.3 Connection of cable version (p. 21)



1 *rd = red, bk = black, gnye = green/yellow*

6.2 Special connection instructions

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

Electronic version	Jumper for 4 to 20 mA test signal in "Test" position (as-delivered state)	Jumper for 4 to 20 mA test signal in "Non-Test" position
4 to 20 mA HART, version for non-hazardous area	11.5 to 45 V DC	10.5 to 45 V DC

Measuring the 4 to 20 mA test signal

A 4 to 20 mA test signal can be measured via the positive and test terminal without interruption. The minimum supply voltage of the measuring device can be reduced by changing the position of the jumper. As a result, operation with lower supply voltages is also possible.

To keep the measured error below 0.1 %, the ammeter should have an internal resistance of < 0.7 Ω. Observe the position of the jumper according to the following table.

Jumper position for test signal	Description
	▪ Measure 4 to 20 mA test signal via positive and test terminal: possible. (Thus, the output current can be measured without interruption via the diode.) ▪ As-delivered state ▪ Minimum supply voltage: 11.5 V DC
	▪ Measure 4 to 20 mA test signal via positive and test terminal: not possible ▪ Minimum supply voltage: 10.5 V DC

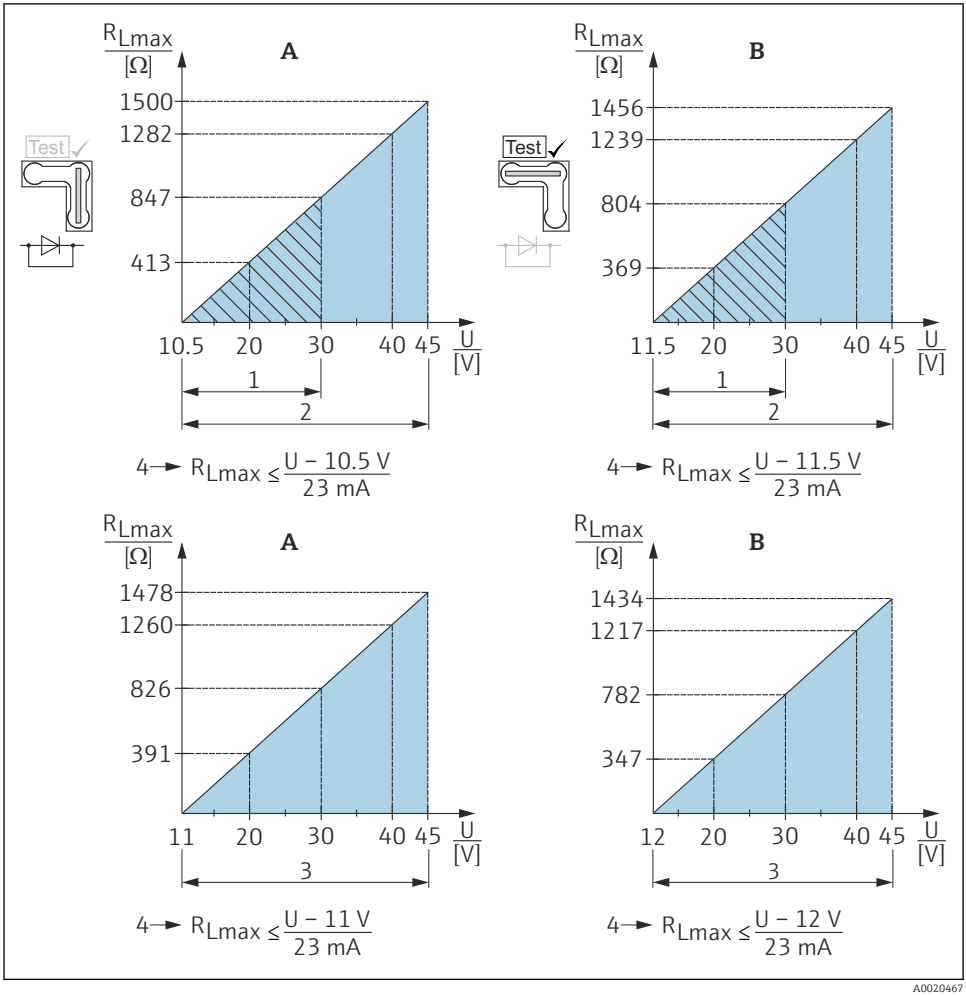
6.2.2 Terminals

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

6.2.3 Cable specification

- Endress+Hauser recommends using twisted, shielded two-wire cables.
- Cable diameter: 5 to 9 mm (0.2 to 0.35 in)

6.2.4 Load



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A Jumper for 4 to 20 mA test signal set to "Non-Test" position
B Jumper for 4 to 20 mA test signal set to "Test" position

When operating using a handheld terminal or a PC with an operating program, a minimum communication resistance of 250 Ω has to be taken into account.

6.2.5 Shielding/potential equalization

- You achieve optimum shielding against disturbances if the shielding is connected on both sides (in the cabinet and on the device). If potential equalization currents are expected in the plant, only ground shielding on one side, preferably at the transmitter (e.g. possibility of hydrogen diffusion).
- When using in hazardous areas, you must observe the applicable regulations. Separate Ex documentation with additional technical data and instructions is included with all Ex systems as standard.

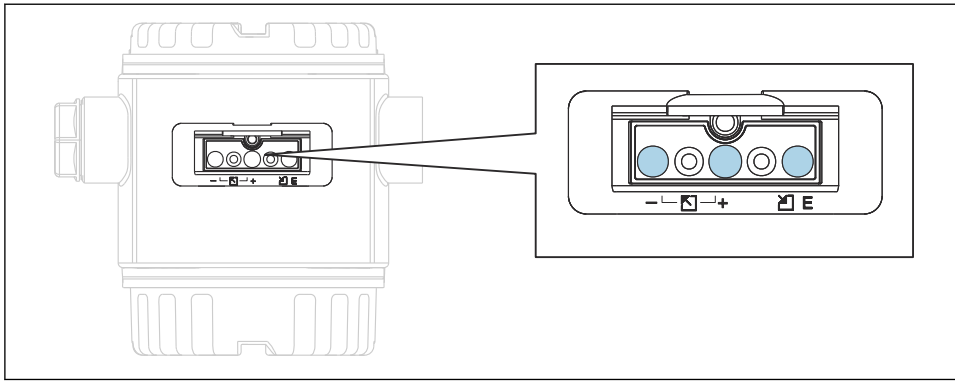
7 Operation options

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

7.1 Structure and function of the operating menu

7.1.1 Position of operating elements

In the case of the aluminum and stainless steel housing (T14), the operating keys are 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 keys are always inside on the electronic insert. In addition, there are operating keys on the optional local display.



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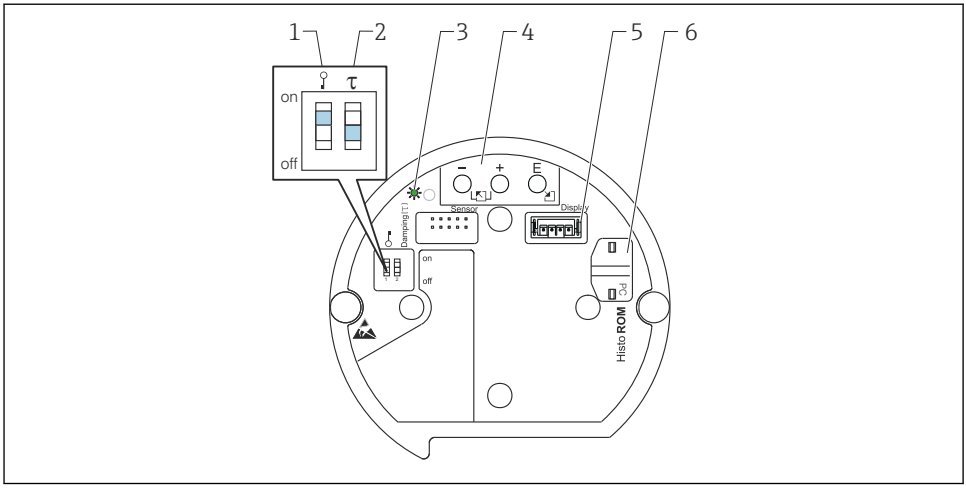
2 Operating keys, outside



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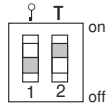
3 Operating keys, inside

1 *DIP switch for locking/unlocking parameters relevant to the measured value*
2 *DIP switch for switching damping on/off*
3 *Green LED to indicate value is accepted*
4 *Operating keys*
5 *Slot for optional display*
6 *Slot for optional HistoROM®/M-DAT*

7.2 Function of the operating elements – local display not connected

To perform the corresponding function, press the key or key combination for at least 3 s. Press the key combination for at least 6 s for a reset.

	Meaning
−	Adopt lower range value. A reference pressure is present at the device. For a detailed description, see also the "Pressure measuring mode" or "Level measuring mode" section.
+	Adopt lower range value. A reference pressure is present at the device. For a detailed description, see also the "Pressure measuring mode" or "Level measuring mode" section.
E	Position adjustment.
+ and − and E	Reset all parameters. The reset via operating keys corresponds to the software reset code 7864.

	Meaning
+ and E	Copy the configuration data from the optional HistoROM®/M-DAT module to the device.
− and E	Copy the configuration data from the device to the optional HistoROM®/M-DAT module.
	▪ DIP switch 1: to lock/unlock parameters relevant to the measured value. Factory setting: off (unlocked) ▪ DIP switch 2: damping on/off, factory setting: on (damping on)

8 Commissioning

8.1 Function check

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 data on the nameplate.

⚠ WARNING

The permitted process pressure is exceeded!

Risk of injury if parts burst! Warnings are displayed if the pressure is too high.

► If a pressure that is greater than the maximum permitted pressure is present at the device, messages "E115 sensor overpressure" and "E727 sensor pressure error - overrange" are output in succession. Only use the device within the sensor range limits!

NOTICE

The permitted process pressure is undershot!

Messages are displayed if the pressure is too low.

► If a pressure that is lower than the minimum permitted pressure is present at the device, messages "E120 sensor low pressure" and "E727 sensor pressure error - overrange" are output in succession. Only use the device within the sensor range limits!

8.2 Switching on the device

The device is switched on by connecting the supply voltage.

8.3 Device configuration

8.3.1 Level measuring mode

If no local display is connected, the following functions are possible via the three keys on the electronic insert or externally on the device:

- Position adjustment (zero point correction)
- Assignment of the lower and upper pressure value to the lower or upper level value
- Device reset
- The ⊟ and ⊞ keys only have a function in the following cases (for other settings, no function is assigned to the keys.):
  - LEVEL SELECTION "Level easy pressure", CALIBRATION MODE "Wet"
  - LEVEL SELECTION "Level standard", LEVEL MODE "Linear", CALIBRATION MODE "Wet"
- The device is configured for the "Level" measuring mode as standard. You can change the measuring mode by means of the MEASURING MODE parameter. See Operating Instructions.
  The following parameters are set to the following values at the factory. These parameters can be changed only via the local display or remote operation, such as FieldCare.
  - LEVEL SELECTION: Level easy pressure
  - CALIBRATION MODE: Wet
  - OUTPUT UNIT or LIN. MEASURAND: %
  - EMPTY CALIB.: 0.0
  - FULL CALIB.: 100.0.
  - SET LRV: 0.0 (corresponds to 4 mA value)
  - SET URV: 100.0 (corresponds to 20 mA value) SET URV: 100.0 (corresponds to 20 mA value)
- Operation must be unlocked.
- The pressure applied must be within the nominal pressure limits of the sensor. See information on the nameplate.
- LEVEL SELECTION, CALIBRATION MODE, LEVEL MODE, EMPTY CALIB., FULL CALIB., SET LRV and SET URV are parameter names that are used for the local display or remote operation, such as FieldCare.

⚠ WARNING

Changing the measuring mode can affect the calibration data!
This can result in product overflow.
▶ Check the calibration data if the measuring mode is changed.

Carrying out position adjustment

1. Make sure that pressure is present at the device. In doing so, pay attention to the nominal pressure limits of the sensor.
2. Press the Ⓔ key for at least 3 s.
   ↳ LED on the electronic insert is lit briefly.
   The applied pressure for position adjustment has been accepted.

Setting the lower range value

1. Make sure the desired pressure for the lower range value is present at the device. In doing so, pay attention to the nominal pressure limits of the sensor.
2. Press the ⊟ key for at least 3 s.
   ↳ LED on the electronic insert is lit briefly.
   The applied pressure for position adjustment has been accepted.

Setting the upper range value

1. Make sure the desired pressure for the upper range value is present at the device. In doing so, pay attention to the nominal pressure limits of the sensor.
2. Press the ⊞ key for at least 3 s.
   ↳ LED on the electronic insert is lit briefly.
   The applied pressure for position adjustment has been accepted.

8.3.2 "Pressure measurement" measuring mode

See Operating Instructions.

- A Quick Setup menu is available for both the "Pressure" and "Level" measuring modes and guides you through the most important basic functions. You specify which Quick Setup menu should be displayed with the setting in the MEASURING MODE parameter.
- For a detailed parameter description, see the Operating Instructions BA00274P "Cerabar S/ Deltabar S/Deltapilot S, Description of Device Functions"
  - Table 6, POSITION ADJUST.
  - Table 7, BASIC SETUP
  - Table 15, EXTENDED SETUP
- For pressure measurement, select the "Pressure" option via the MEASURING MODE parameter. The operating menu is then structured according to the measuring mode that is selected.

⚠ WARNING

Changing the measuring mode can affect the calibration data!
This can result in product overflow.
► Check the calibration data if the measuring mode is changed.

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