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71593282
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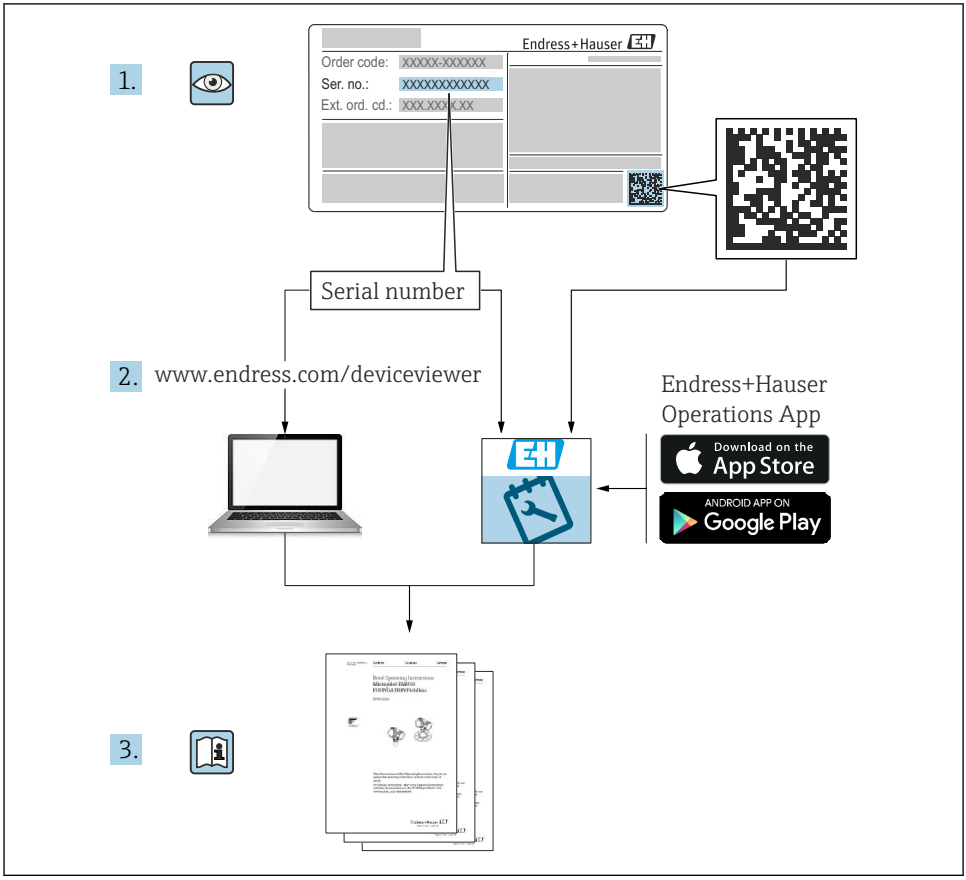
Brief Operating Instructions
Waterpilot FMX21

Hydrostatic level measurement
4 to 20 mA HART

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*

Endress+Hauser
People for Process Automation


1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXXX
Ext. ord. cd.: XXX.XXX-XXX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.

A0023555

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1 About this document

1.1 Document function

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

1.2 Symbols

1.2.1 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.

1.2.2 Electrical symbols

Direct current

Alternating current

Direct and alternating current

Ground connection
Grounded clamp, which is grounded via a grounding system.

Protective earth (PE)
Ground terminals, which must be grounded prior to establishing any other connections. The ground terminals are located on the inside and outside of the device.

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

Flat blade screwdriver

Phillips screwdriver

Allen key

Open-ended wrench

1.2.4 Symbols for certain types of information

Permitted
Procedures, processes or actions that are permitted

Preferred
Procedures, processes or actions that are preferred

Forbidden
Procedures, processes or actions that are forbidden

Tip
Indicates additional information

Reference to documentation

Reference to page

Reference to graphic

1., 2., 3.
Series of steps

Result of a step

Help in the event of a problem

Visual inspection

1.2.5 Symbols in graphics

1, 2, 3, ...
Item numbers

1., 2., 3.
Series of steps

A, B, C, ...
Views

A-A, B-B, C-C etc.
Sections

1.3 Documentation

The following types of documentation are available in the Download Area of the Endress +Hauser website (www.endress.com/downloads):

For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

1.3.1 Operating Instructions (BA)

Your reference guide
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.

1.3.2 Safety Instructions (XA)

Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.

The nameplate indicates the Safety Instructions (XA) that are relevant to the device.

1.4 Registered trademarks

1.4.1 GORE-TEX®

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

1.4.2 TEFLON®

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

1.4.3 HART®

Registered trademark of the FieldComm Group, Austin, USA

1.4.4 FieldCare®

Trademark of Endress+Hauser Process Solutions AG.

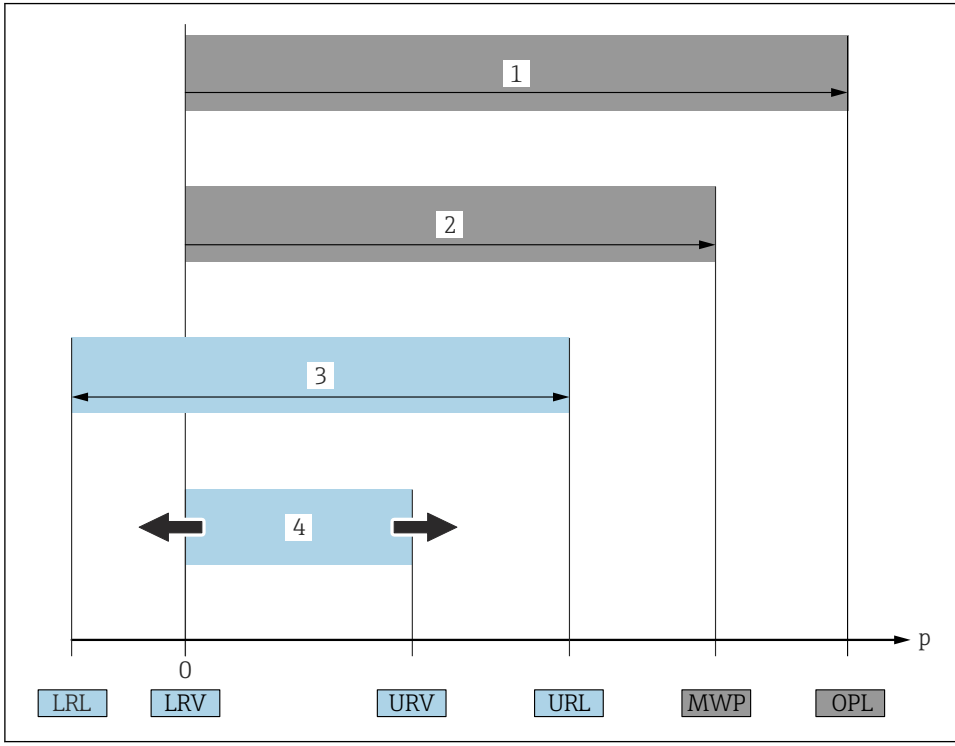
1.4.5 DeviceCare®

Trademark of Endress+Hauser Process Solutions AG.

1.4.6 iTEMP®

Trademark of Endress+Hauser Wetzer GmbH + Co. KG, Nesselwang, D..

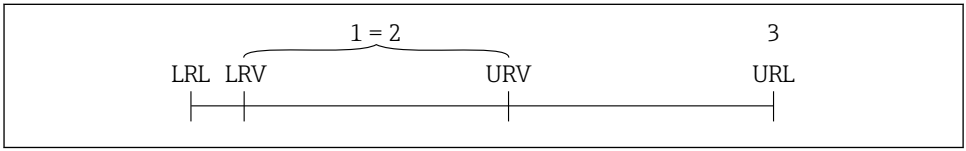
1.5 Terms and abbreviations



- **OPL (1)**
  The OPL (Over Pressure Limit) for the measuring device 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.
  The OPL may only be applied for a limited period of time.
- **MWP (2)**
  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.
  The MWP may be applied at the device for an unlimited period.
  The MWP can also be found on the nameplate.
- **Maximum sensor measuring range (3)**
  Span between LRL and URL. This sensor measuring range is equivalent to the maximum calibratable/adjustable span.

- **Calibrated/adjusted span (4)**
  Span between LRV and URV. Factory setting: 0 to URL
  Other calibrated spans can be ordered as customized spans.
- **p**: Pressure
- **LRL**: Lower range limit
- **URL**: Upper range limit
- **LRV**: Lower range value
- **URV**: Upper range value
- **TD (Turn down)**: Example - see the following section
- **PE**: Polyethylene
- **FEP**: Fluorinated ethylene propylene
- **PUR**: Polyurethane

1.6 Turn down calculation



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1 Calibrated/adjusted span
2 Zero point-based span
3 URL sensor

Example

- Sensor:10 bar (150 psi)
- Upper range value (URL) = 10 bar (150 psi)

Turn down (TD):

$$TD = \frac{URL}{|URV - LRV|}$$

$$TD = \frac{10\ \text{bar (150 psi)}}{|5\ \text{bar (75 psi)} - 0\ \text{bar (0 psi)}|} = 2$$

In this example, the TD is 2:1.
This span is based on the zero point.

- Calibrated/adjusted span: 0 to 5 bar (0 to 75 psi)
- Lower range value (LRV) = 0 bar (0 psi)
- Upper range value (URV) = 5 bar (75 psi)

2 Basic safety instructions

2.1 Requirements for personnel

The personnel must fulfill the following requirements for its tasks:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Personnel must be authorized by the plant owner/operator.
- Personnel must be familiar with federal/national regulations.
- Before starting work: personnel must read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Personnel must follow instructions and comply with general policies.

2.2 Intended use

2.2.1 Application and media

The Waterpilot FMX21 is a hydrostatic pressure sensor for measuring the level of fresh water, wastewater and salt water. The temperature is measured simultaneously in the case of sensor versions with a Pt100 resistance thermometer.

An optional temperature head transmitter converts the Pt100 signal to a 4 to 20 mA signal with superimposed digital communication protocol HART 6.0.

2.2.2 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.

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.

Modifications 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.

Repairs

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 danger to persons or the facility when the device is used in the approval-related area (e.g. explosion protection, pressure vessel safety):
- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the approval-related area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these Instructions.

2.5 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 it is safe to operate.

It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

Check the following during incoming acceptance:

❑ Are the order codes on the delivery note and the product sticker identical?

❑ Are the goods undamaged?

❑ Do the data on the nameplate match the ordering information on the delivery note?

❑ If required (see nameplate): are the Safety Instructions e.g. XA provided?

If one of these conditions is not met, please contact the manufacturer's sales office.

3.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- Enter serial number of nameplates in *W@M Device Viewer* www.endress.com/deviceviewer. All of the information on the measuring device is displayed along with an overview of the scope of technical documentation provided.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations app* or scan the 2-D matrix code on the nameplate with the *Endress+Hauser Operations app*

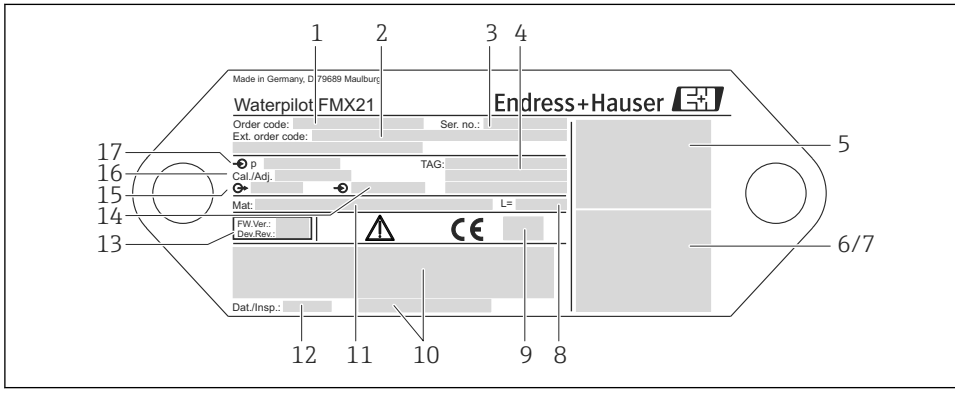
3.2.1 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Address of the manufacturing plant: See nameplate.

3.3 Nameplates

3.3.1 Nameplates on extension cable



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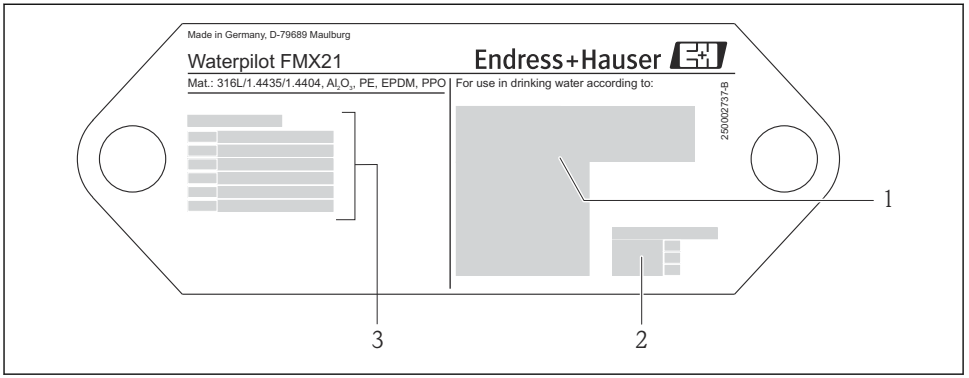
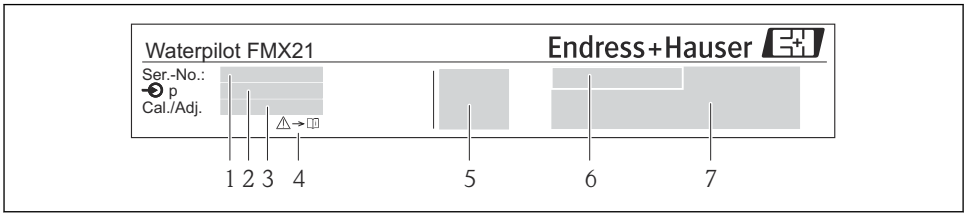
1 Order code (shortened for reordering); The meaning of the individual letters and digits is explained in the order confirmation details.
2 Extended order number (complete)
3 Serial number (for clear identification)
4-17 See the Operating Instructions

Additional nameplate for devices with approvals



1 Approval symbol (drinking water approval)
2 Reference to associated documentation
3 Approval number (marine approval)

3.3.2 Additional nameplate for devices with external diameter 22 mm (0.87 in) and 42 mm (1.65 in)



1 Serial number
2 Nominal measuring range
3 Set measuring range
4 CE mark or approval symbol
5 Certificate number (optional)
6 Text for approval (optional)
7 Reference to documentation

3.4 Identification of sensor type

With gauge pressure or absolute pressure sensors, the "Pos. zero adjust" parameter is displayed in the operating menu. With absolute pressure sensors, the "Calib. offset" parameter is displayed in the operating menu.

3.5 Storage and transport

3.5.1 Storage conditions

Use original packaging.

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

Storage temperature range

Device + Pt100 (optional)

−40 to +80 °C (−40 to +176 °F)

Cable

(when mounted in a fixed position)
- With PE: −30 to +70 °C (−22 to +158 °F)
- With FEP: −30 to +80 °C (−22 to +176 °F)
- With PUR: −40 to +80 °C (−40 to +176 °F)

Terminal box

−40 to +80 °C (−40 to +176 °F)

TMT72 temperature head transmitter (optional)

−40 to +100 °C (−40 to +212 °F)

3.5.2 Transporting the product to the measuring point

⚠ WARNING

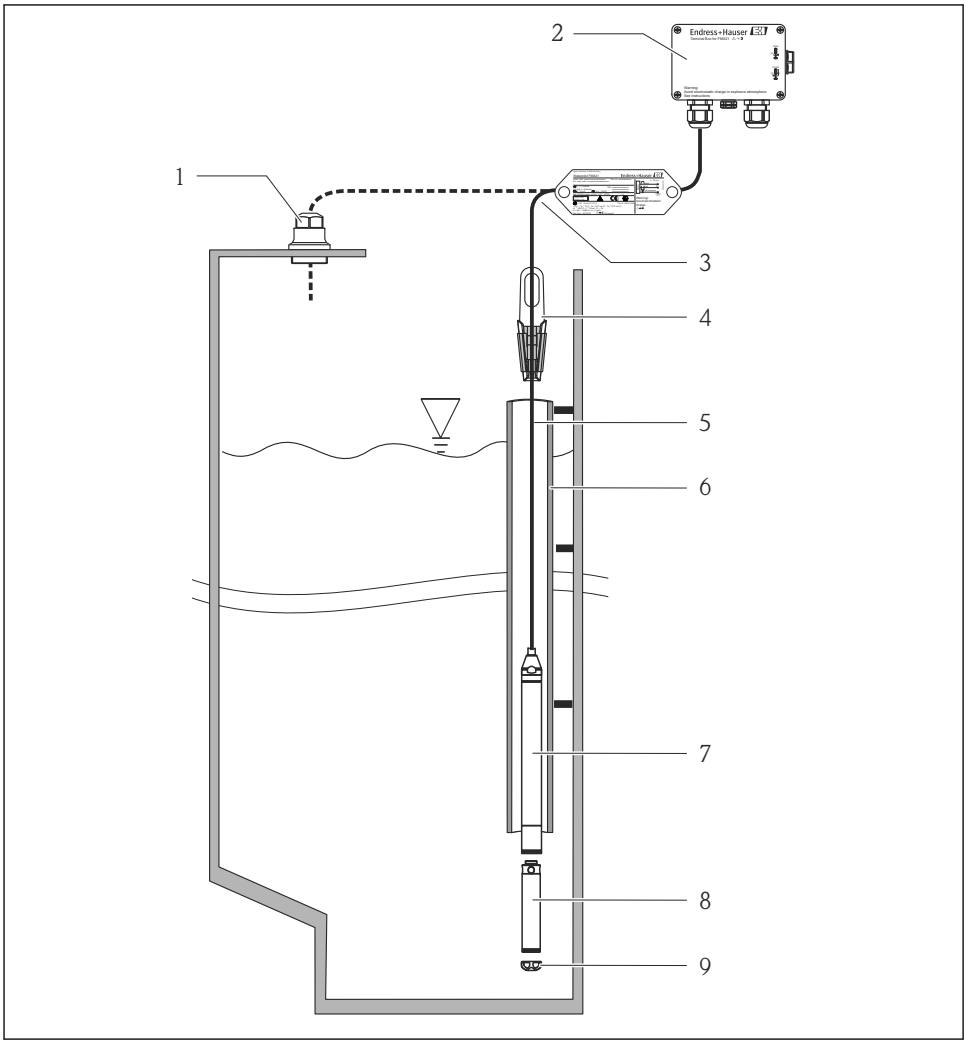
Incorrect transport!

Device or cable may become damaged, and there is a risk of injury!

- ▶ Transport measuring device in the original packaging.
- ▶ Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.6 lbs).

4 Mounting

4.1 Mounting requirements



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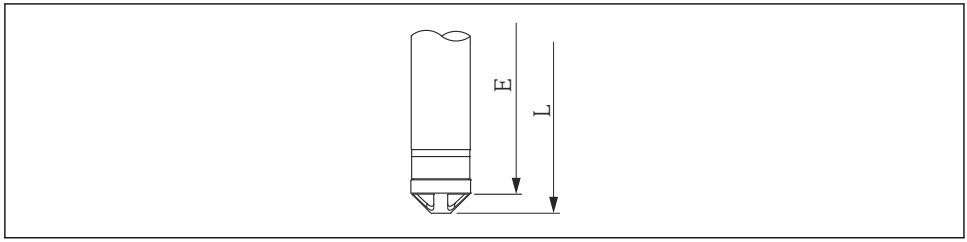
1 *Cable mounting screw (can be ordered as an accessory)*
2 *Terminal box (can be ordered as an accessory)*
3 *Bending radius of extension cable 120 mm (4.72 in)*
4 *Suspension clamp (can be ordered as an accessory)*
5 *Extension cable*
6 *Guide tube*

7 Device
8 Additional weight can be ordered as an accessory for the device with external diameter of 22 mm (0.87 in) and 29 mm (1.14 in)
9 Protective cap

4.2 Additional mounting instructions

- Cable length
  - Customer-specific in meters or feet.
  - Limited cable length when performing installation with freely suspended device with cable mounting screw or mounting clamp, as well as for FM/CSA approval: max. 300 m (984 ft).
- Sideways movement of the level probe can result in measuring errors. For this reason, install the probe at a point free from flow and turbulence, or use a guide tube. The internal diameter of the guide tube should be at least 1 mm (0.04 in) greater than the external diameter of the selected FMX21.
- To avoid mechanical damage to the measuring cell, the device is equipped with a protection cap.
- The cable must end in a dry room or a suitable terminal box. The terminal box from Endress +Hauser provides humidity and climatic protection and is suitable for installation outdoors (see the Operating Instructions for additional information).
- Cable length tolerance: < 5 m (16 ft): ±17.5 mm (0.69 in); > 5 m (16 ft): ±0.2 %
- If the cable is shortened, the filter at the pressure compensation tube must be reattached. Endress+Hauser offers a cable shortening kit for this purpose (see the Operating Instructions for additional information) (documentation SD00552P/00/A6).
- Endress+Hauser recommends using twisted, shielded cable.
- In shipbuilding applications, measures are required to restrict the spread of fire along cable looms.
- The length of the extension cable depends on the intended level zero point. The height of the protection cap must be taken into consideration when designing the layout of the measuring point. The level zero point (E) corresponds to the position of the process isolating diaphragm. Level zero point = E; tip of probe = L (see the following diagram).



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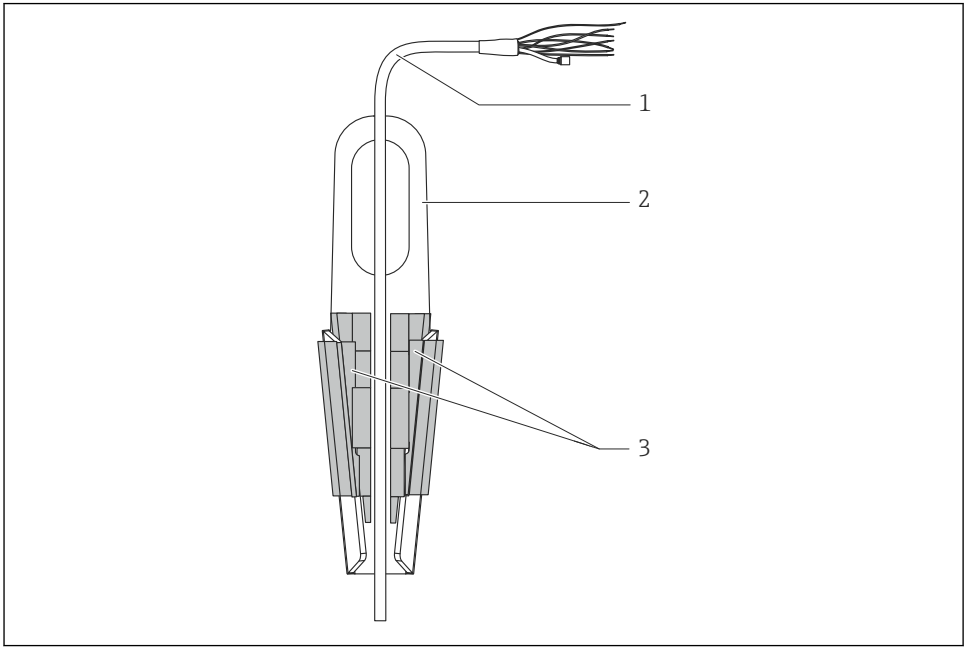
4.3 Mounting the Waterpilot with a suspension clamp



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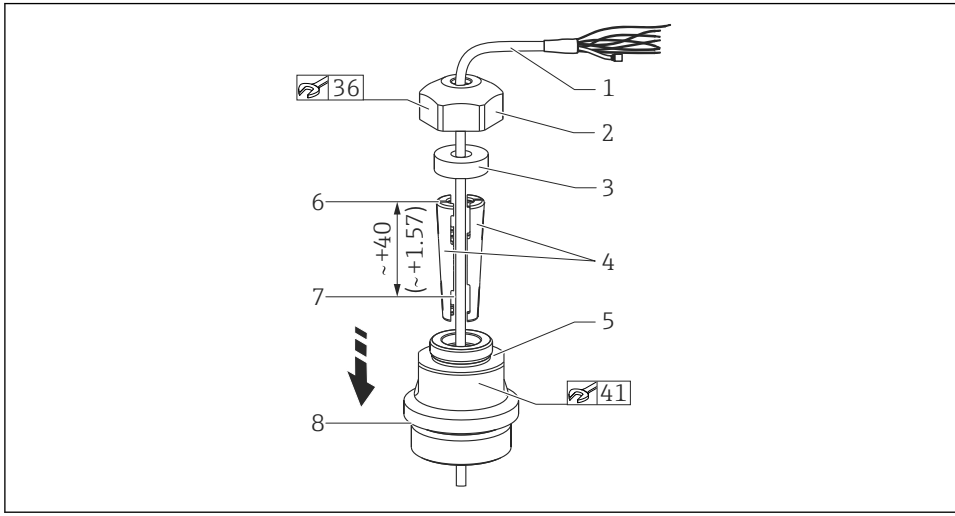
1 Extension cable
2 Suspension clamp
3 Clamping jaws

4.3.1 Mounting the suspension clamp:

1. Mount the suspension clamp (item 2). Take the weight of the extension cable (item 1) and the device into account when selecting the fastening point.
2. Push up the clamping jaws (item 3). Place the extension cable (item 1) between the clamping jaws as shown in the graphic.
3. Hold the extension cable (item 1) in position and push the clamping jaws (item 3) back down. Tap the clamping jaws gently from above to fix them in place.

4.4 Mounting the device with a cable mounting screw



1 *Illustrated with G 1½" thread. Unit of measurement mm (in)*

1 *Extension cable*
2 *Cover for cable mounting screw*
3 *Sealing ring*
4 *Clamping sleeves*
5 *Adapter for cable mounting screw*
6 *Top edge of clamping sleeve*
7 *Desired length of extension cable and Waterpilot probe prior to assembly*
8 *After assembly, item 7 is located next to the mounting screw with G 1½" thread: height of sealing surface of the adapter or NPT 1½" thread height of thread run-out of adapter*

If you want to lower the level probe to a certain depth, position the top edge of the clamping sleeve 40 mm (4.57 in) higher than the required depth. Then push the extension cable and the clamping sleeve into the adapter as described in Step 6 in the following section.

4.4.1 Mounting the cable mounting screw with a G 1½" or NPT 1½" thread:

1. Mark the desired length of extension cable on the extension cable.
2. Insert the probe through the measuring aperture and carefully lower on the extension cable. Fix the extension cable to prevent it from slipping.
3. Slide the adapter (item 5) over the extension cable and screw it tightly into the measuring aperture.
4. Slide the sealing ring (item 3) and cover (item 2) onto the cable from above. Press the sealing ring into the cover.

5. Place the clamping sleeves (item 4) around the extension cable (item 1) at the marked point as illustrated in the graphic.
6. Slide the extension cable with the clamping sleeves (item 4) into the adapter (item 5)
7. Fit the cover (item 2) with the sealing ring (item 3) onto the adapter (item 5) and securely screw together with the adapter.

To remove the cable mounting screw, perform this sequence of steps in reverse.

CAUTION

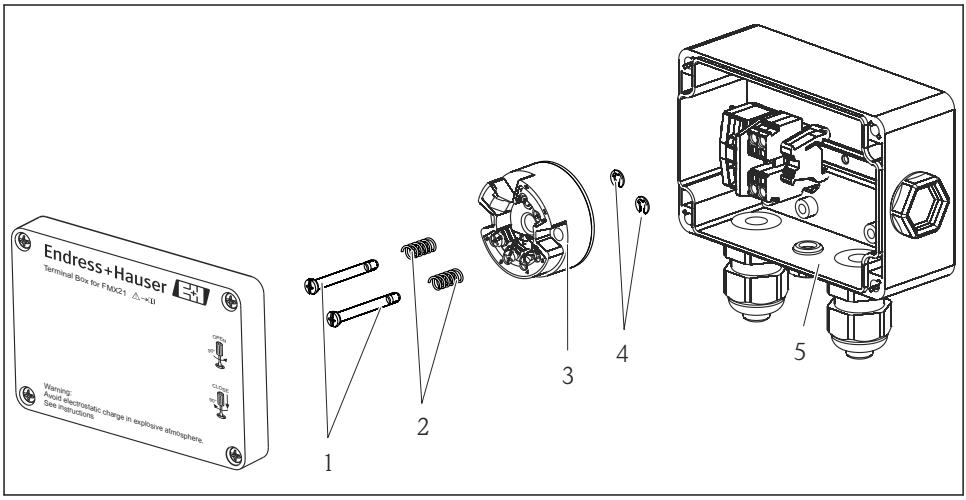
Risk of injury!

- Use only in unpressurized vessels.

4.5 Mounting the terminal box

The optional terminal box is mounted using four screws (M4). For the dimensions of the terminal box, see the Technical Information

4.6 Mounting the TMT72 temperature head transmitter with terminal box



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1 Mounting screws
2 Mounting springs
3 TMT72 temperature head transmitter
4 Circlips
5 Terminal box

Only open the terminal box with a screwdriver.

⚠ WARNING

Explosion Hazard!

▶ The TMT72 is not designed for use in hazardous areas.

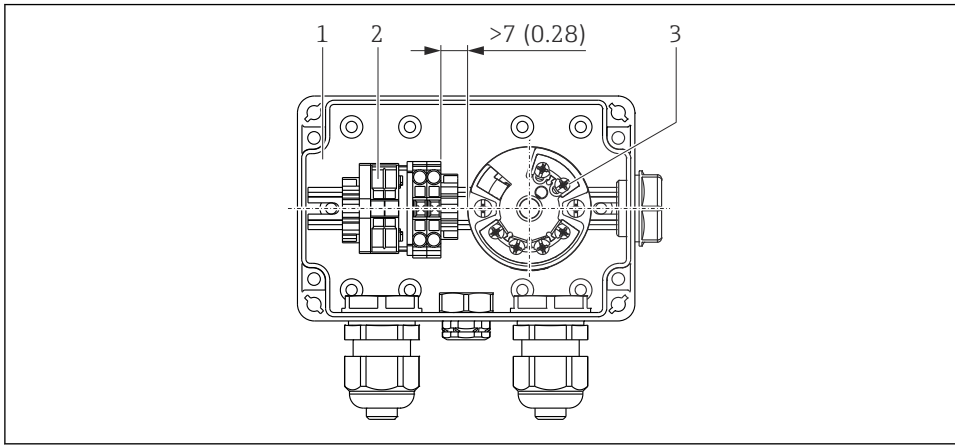
4.6.1 Mounting the temperature head transmitter:

1. Guide the mounting screws (item 1) with the mounting springs (item 2) through the bore of the temperature head transmitter (item 3)
2. Secure the mounting screws with the circlips (item 4). Circlips, mounting screws and springs are included in the scope of delivery for the temperature head transmitter.
3. Screw the temperature head transmitter into the field housing tightly. (Width of screwdriver blade max. 6 mm (0.24 in))

NOTICE

Avoid damage to the temperature head transmitter.

▶ Do not overtighten the mounting screw.



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Unit of measurement mm (in)

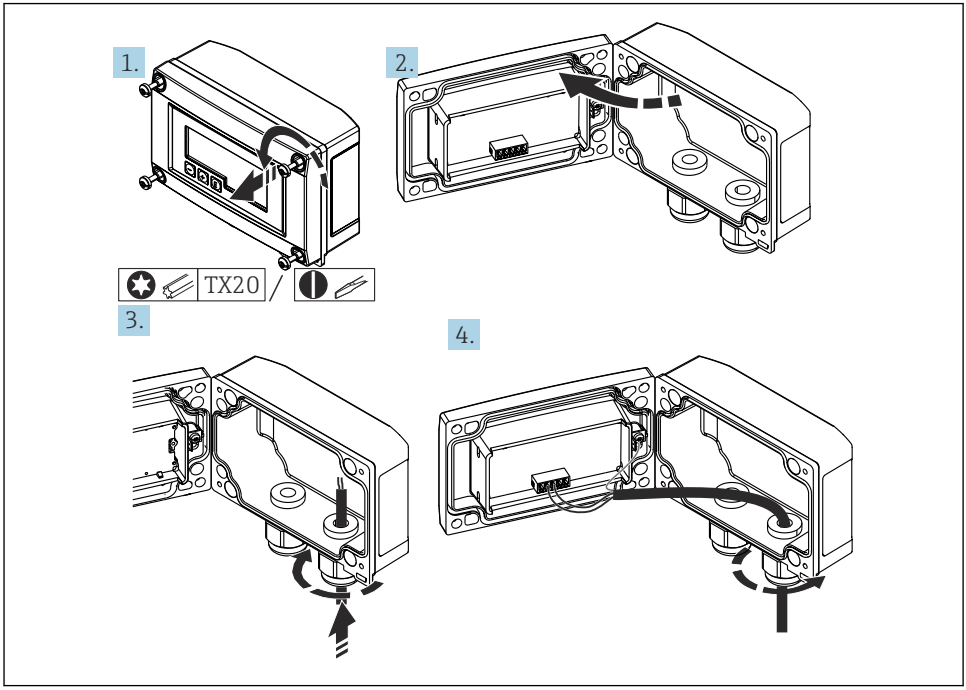
1 Terminal box
2 Terminal strip
3 TMT72 temperature head transmitter

NOTICE

Incorrect connection!

▶ A distance of > 7 mm (28 in) must be maintained between the terminal strip and the TMT72 temperature head transmitter.

4.7 Inserting the cable into the RIA15 field housing



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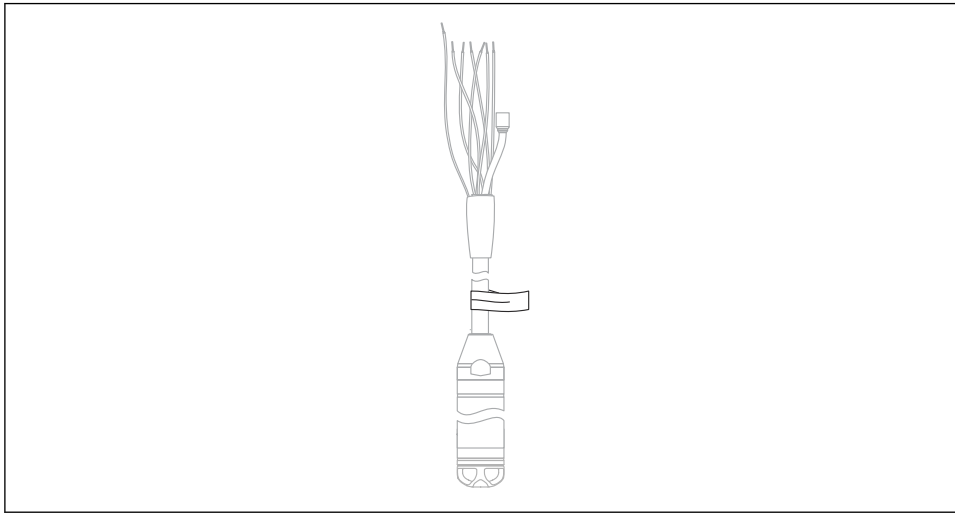
Inserting the cable, field housing, connection without transmitter power supply (example)

1. Release the housing screws
2. Open the housing
3. Open the cable gland (M16) and insert the cable
4. Connect the cable including the functional grounding and close the cable gland

Compensation of the atmospheric pressure must be ensured for the installation. A black, vented cable gland is supplied for this purpose.

If using the communication resistance module in the RIA15, the cable of the device must be inserted into the right gland when connecting the device so that the integrated pressure compensation tube is not pinched.

4.8 Cable marking



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- To make installation easier, Endress+Hauser marks the extension cable if a customer-specific length has been ordered.
- Cable marking tolerance (distance to lower end of level probe):
  Cable length < 5 m (16 ft): ±17.5 mm (0.69 in)
  Cable length > 5 m (16 ft): ±0.2 %
- Material: PET, stick-on label: acrylic
- Immunity to temperature change: −30 to +100 °C (−22 to +212 °F)

NOTICE

The marking is used exclusively for installation purposes.

▶ The mark must be thoroughly removed without trace in the case of devices with drinking water approval. The extension cable must not be damaged in the process.

Not for the use of the device in hazardous areas.

4.9 Post-mounting check

- Is the device undamaged (visual inspection)?
- Does the device conform to the measuring point specifications?
  - Process temperature
  - Process pressure
  - Ambient temperature
  - Measuring range
- Are the measuring point identification and labeling correct (visual inspection)?
- Check that all screws are firmly seated

5 Electrical connection

⚠ WARNING

Electrical safety is compromised by an incorrect connection!

- When using the measuring device in a hazardous area, the relevant national standards and guidelines as well as the Safety Instructions (XAs) or installation or control drawings (ZDs) must be adhered to. All data relating to explosion protection can be found in separate documentation which is available on request. This documentation is supplied with the devices as standard

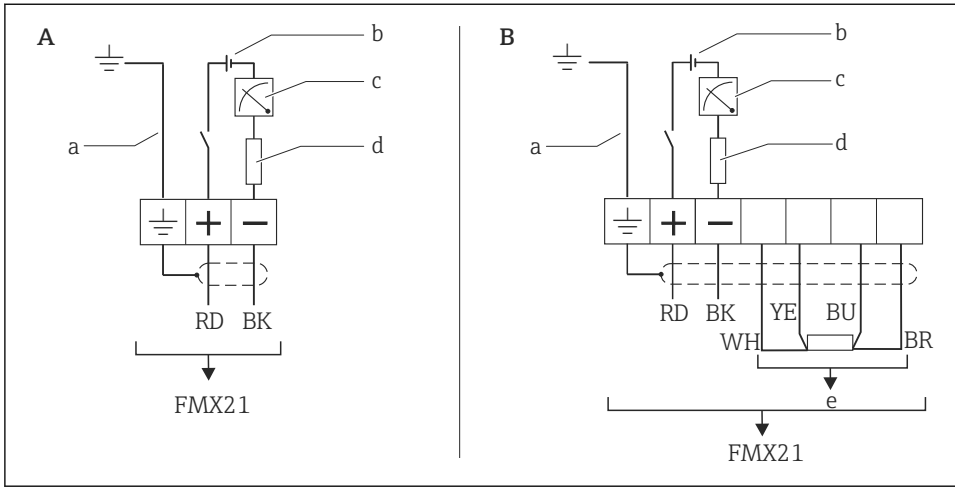
5.1 Connecting the device

⚠ WARNING

Electrical safety is compromised by an incorrect connection!

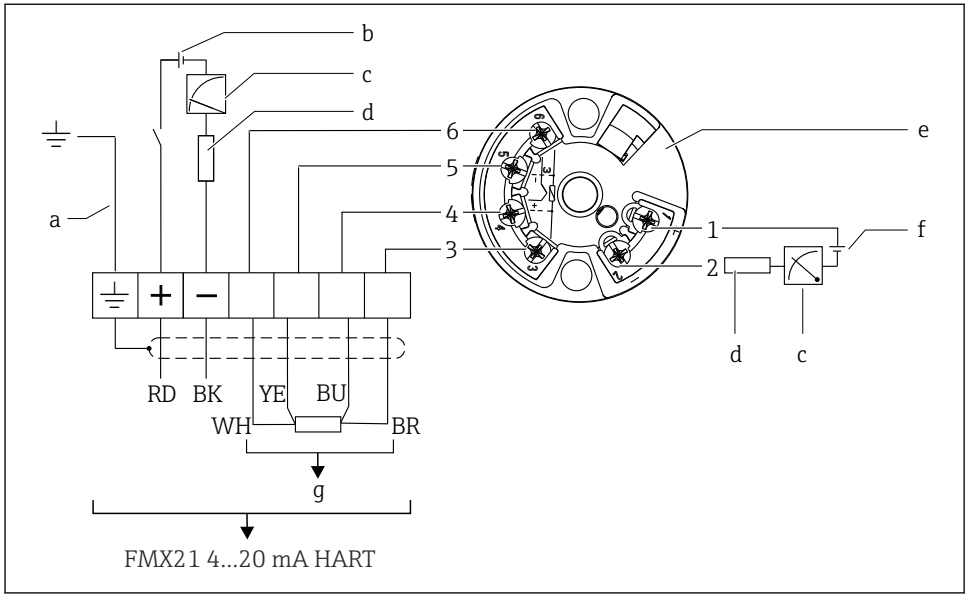
- The supply voltage must match the supply voltage specified on the nameplate
- Switch off the supply voltage before connecting the device.
- The cable must end in a dry room or a suitable terminal box. The IP66/IP67 terminal box with GORE-TEX® filter from Endress+Hauser is suitable for outdoor installation.→ 18
- Connect the device in accordance with the following diagrams. Reverse polarity protection is integrated in the device and the temperature head transmitter. Changing the polarities will not result in the destruction of the devices.
- A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.

5.1.1 Device with Pt100



A Device
B Device with Pt100 (not for use in hazardous areas)
a Not for devices with external diameter of 29 mm (1.14 in)
b 10.5 to 30 V_{DC} (hazardous area), 10.5 to 35 V_{DC}
c 4 to 20 mA
d Resistance (R_L)
e Pt100

5.1.2 Device with Pt100 and TMT72 temperature head transmitter



a Not for devices with external diameter of 29 mm (1.14 in)
b 10.5 to 35 V_{DC}
c 4 to 20 mA
d Resistance (R_L)
e TMT72 temperature head transmitter (4 to 20 mA) (not for use in hazardous areas)
f 11.5 to 35 V_{DC}
g Pt100
1 to 6 Pin assignment

5.1.3 Device with RIA15

The RIA15 remote display (for Ex or non-Ex area) can be ordered together with the device. See the Product Configurator.

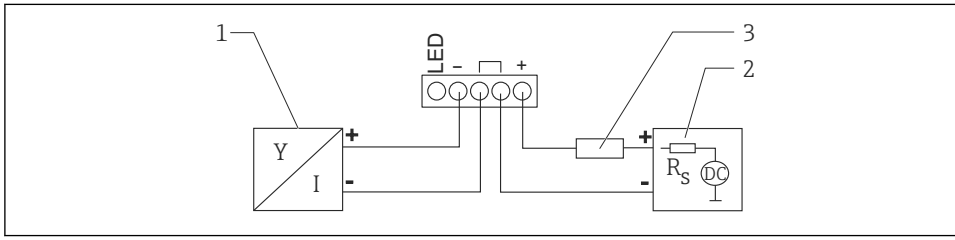
Compensation of the atmospheric pressure must be ensured for the installation. A black, vented cable gland is supplied for this purpose.

The RIA15 process indicator is loop-powered and does not require any external power supply.

The voltage drop to be taken into account is:

- ≤1 V in the standard version with 4 to 20 mA communication
- ≤1.9 V with HART communication
- and an additional 2.9 V if display light is used

Without backlighting



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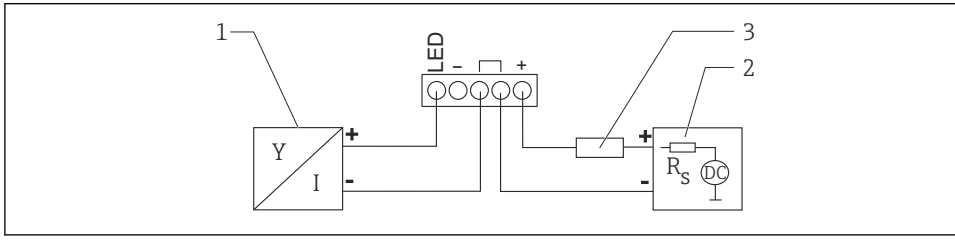
2 Block diagram; connection of the device with HART communication and RIA15 without backlighting

1 Device
2 Power supply
3 HART resistor

With backlighting



A0019568

3 Block diagram; connection of the device with HART communication and RIA15 with backlighting

1 Device
2 Power supply
3 HART resistor

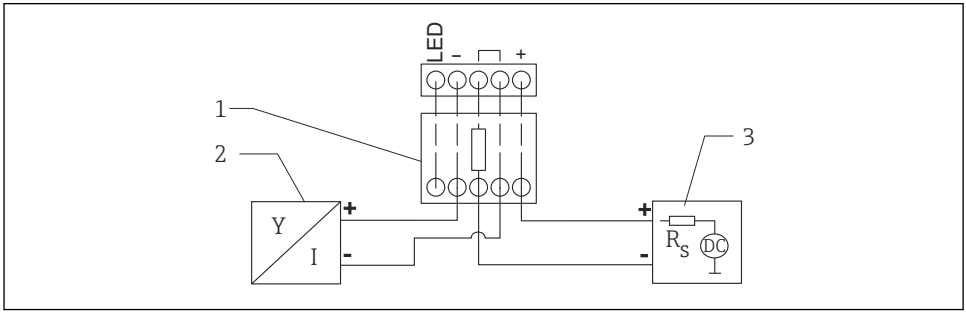
5.1.4 Device, RIA15 with installed HART communication resistor module

The HART communication module for installation in the RIA15 (for Ex or non-Ex areas) can be ordered together with the device.

The **voltage drop** to be taken into account is max. **7 V**

Compensation of the atmospheric pressure must be ensured for the installation. A black, vented cable gland is supplied for this purpose.

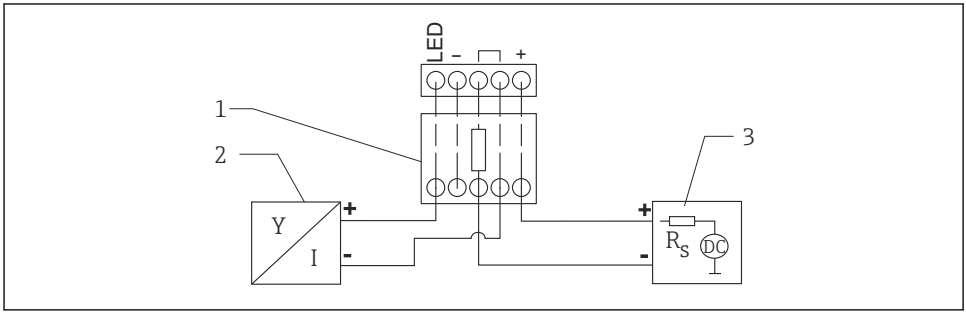
Without backlighting



4 *Block diagram; device connection, RIA15 without light, HART communication resistor*

1 HART communication resistor module
2 Device
3 Power supply

With backlighting



5 *Block diagram; device connection, RIA15 with light, HART communication resistor module*

1 HART communication resistor module
2 Device
3 Power supply

5.1.5 Wire colors

RD = red, BK = black, WH = white, YE = yellow, BU = blue, BR = brown

5.1.6 Connection data

Connection classification as per IEC 61010-1:
- Overvoltage category 1
- Pollution level 1

Connection data in the hazardous area

See relevant XA.

5.2 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 as well as the Safety Instructions.
- ▶ 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.

5.2.1 Device + Pt100 (optional)

- 10.5 to 35 V (non-hazardous area)
- 10.5 to 30 V (hazardous area)

5.2.2 TMT72 temperature head transmitter (optional)

11.5 to 35 V_{DC}

5.3 Cable specifications

Endress+Hauser recommends using shielded, twisted-pair two-wire cables.

The probe cables are shielded for device versions with outer diameters of 22 mm (0.87 in) and 42 mm (1.65 in).

5.3.1 Device + Pt100 (optional)

- Commercially available instrument cable
- Terminals, terminal box: 0.08 to 2.5 mm^2 (28 to 14 AWG)

5.3.2 TMT72 temperature head transmitter (optional)

- Commercially available instrument cable
- Terminals, terminal box: 0.08 to 2.5 mm^2 (28 to 14 AWG)
- Transmitter connection: max. 1.75 mm^2 (15 AWG)

5.4 Power consumption

5.4.1 Device + Pt100 (optional)

- ≤ 0.805 W at 35 V_{DC} (non-hazardous area)
- ≤ 0.690 W at 30 V_{DC} (hazardous area)

5.4.2 TMT72 temperature head transmitter (optional)

≤ 0.805 W at 35 V_{DC}

5.5 Current consumption

5.5.1 Device + Pt100 (optional)

Max. current consumption: ≤ 23 mA
Min. current consumption: ≥ 3.6 mA

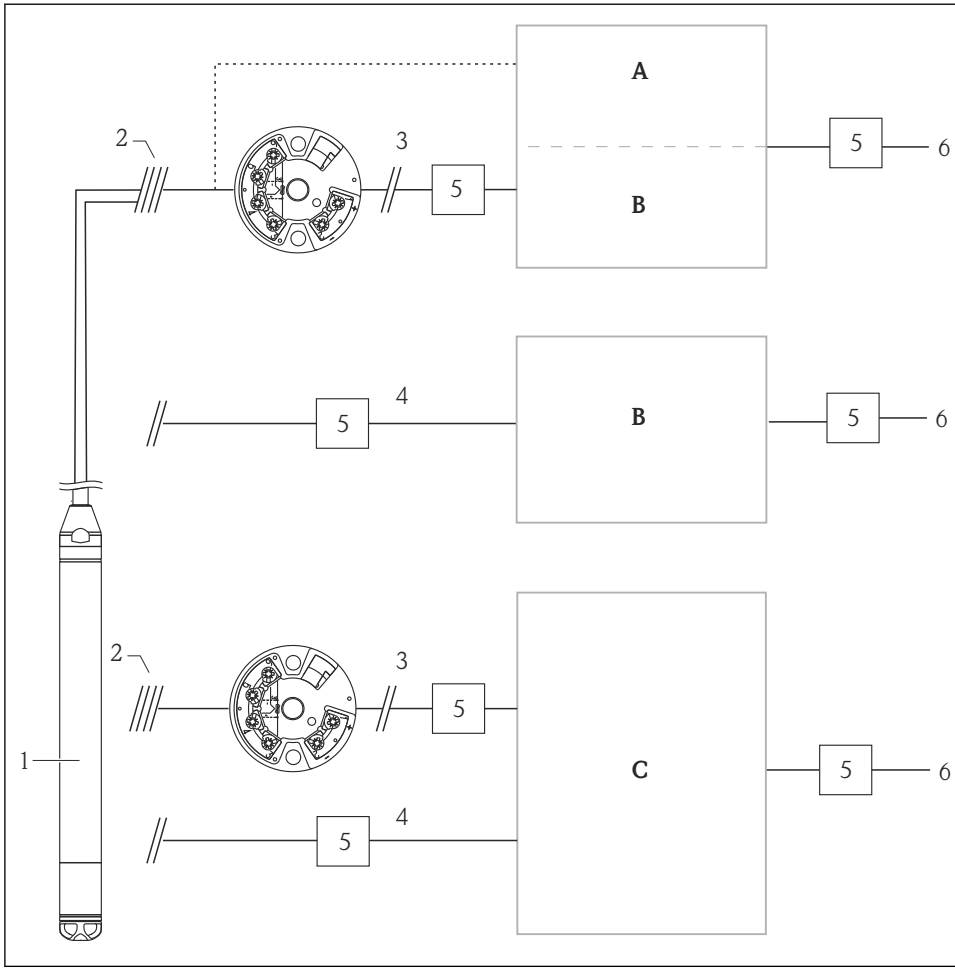
5.5.2 TMT72 temperature head transmitter (optional)

- Max. current consumption: ≤ 23 mA
- Min. current consumption: ≥ 3.5 mA

5.6 Connecting the measuring unit

5.6.1 Overvoltage protection

To protect the Waterpilot and the TMT72 temperature head transmitter from large interference voltage peaks, Endress+Hauser recommends installing overvoltage protection upstream and downstream of the display and/or evaluation unit as shown in the graphic.



A Power supply, display and evaluation unit with one input for Pt100
B Power supply, display and evaluation unit with one input for 4 to 20 mA
C Power supply, display and evaluation unit with two inputs for 4 to 20 mA
1 Device
2 Connection for integrated Pt100 in the FMX21
3 4 to 20 mA HART (temperature)
4 4 to 20 mA HART (level)
5 Overvoltage protection, e.g. HAW from Endress+Hauser (not for use in hazardous areas.)
6 Power supply

Further information on the TMT72 temperature head transmitter for HART applications from Endress+Hauser can be found in the Technical Information TI01392T.

5.7 Post-connection check

- Are the device or cables undamaged (visual check)?
- Do the cables used comply with the requirements?
- Do the mounted cables have adequate strain relief?
- Are all cable glands installed, securely tightened and leak-tight?
- Does the supply voltage match the information on the nameplate?
- Is the terminal assignment correct?

6 Operation options

Endress+Hauser offers comprehensive measuring point solutions with display and/or evaluation units for the Waterpilot FMX21 HART and TMT72 temperature head transmitter.

Your Endress+Hauser service organization would be glad to be of service if you have any other questions. Contact addresses are available at: www.endress.com/worldwide

6.1 Overview of operation options

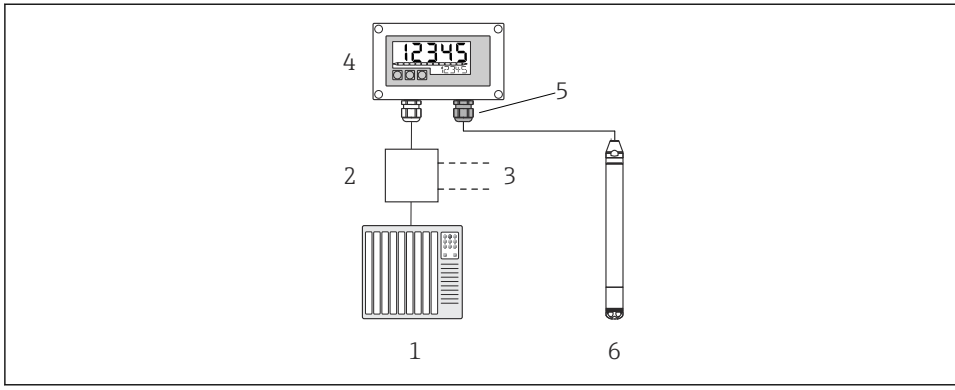
6.1.1 Operation via RIA15

The RIA15 can be used as a local display unit and for the basic configuration of the Waterpilot FMX21 hydrostatic level sensor via HART.

The following parameters can be configured on the FMX21 using the 3 operating keys on the front of the RIA15:

- Pressure engineering unit, level, temperature
- Zero adjustment (only for gauge pressure sensors)
- Empty and full pressure adjustment
- Empty and full level adjustment
- Reset to factory defaults

Further information on the operating parameters → 40



6 Remote operation of the device via the RIA15

1 PLC
2 Transmitter power supply, e.g. RN221N (with communication resistor)
3 Connection for Commubox FXA195 and Field Communicator 375, 475
4 Loop-powered RIA15 process indicator
5 Cable gland M16 with pressure compensation membrane
6 Device

6.2 Operating concept

Operation with an operating menu is based on an operation concept with "user roles" .

- **Operator**
  Operators are responsible for the devices during normal "operation". This is usually limited to the reading of process values. If the work with the devices goes beyond reading, it concerns simple, application-specific functions that are used in operation. Should an error occur, these users simply forward the information on the errors but do not intervene themselves.
- **Maintenance**
  Service engineers usually work with the devices in the phases following device commissioning. They are primarily involved in maintenance and troubleshooting activities for which simple settings have to be made on the device. Technicians work with the devices over the entire life cycle of the product. Thus, commissioning and advanced settings and configurations are some of the tasks they have to carry out.
- **Expert**
  Experts work with the devices over the entire life cycle of the device, but, at times, have high device requirements. Individual parameters/functions from the overall functionality of the devices are required for this purpose time and again. In addition to technical, process-oriented tasks, experts can also perform administrative tasks (e.g. user administration). The "Expert" has access to the entire parameter set.

7 Commissioning

NOTICE

If a pressure smaller than the minimum permitted pressure or greater than the maximum permitted pressure is present at the device, the following messages are output in succession:

- ▶ "S140 Working range P" or "F140 Working range P" (depending on the setting in the "Alarm behav. P" parameter)
- ▶ "S841 Sensor range" or "F841 Sensor range" (depending on the setting in the "Alarm behav. P" parameter)
- ▶ "S971 Adjustment" (depending on setting in "Alarm behav. P" parameter

7.1 Function check

Before commissioning your measuring point, ensure that the post-installation and post-connection checks have been performed:

- "Post-installation check" checklist
- "Post-connection check" checklist

7.2 Unlocking/locking configuration

If the device is locked to prevent configuration, it must first be unlocked.

7.2.1 Locking/unlocking software

If the device is locked via the software (device access code), the key symbol appears in the measured value display. If an attempt is made to write to a parameter, a prompt for the device access code appears. To unlock, enter the user-defined access code.

7.3 Commissioning

Commissioning comprises the following steps:

- Function check
- Selection of the measuring mode and pressure unit
- Position adjustment
- Configuring measurement:
  - Pressure measurement
  - Level measurement

7.4 Selecting the measuring mode

The device is configured for the "Pressure" 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

Changing the measuring mode affects the span (URV)

This situation can result in product overflow.

- ▶ If the measuring mode is changed, the setting for the span (URV) must be checked in the "Setup" operating menu and readjusted if necessary.

Measuring mode

Navigation Setup → Measuring mode

Write permission Operator/Maintenance/Expert

Description Select the measuring mode.
The operating menu is structured differently depending on the measuring mode selected.

Options
- Pressure
- Level

Factory setting Level

7.5 Selecting the pressure engineering unit

Press. eng. unit

Navigation Setup → Press. eng. unit

Write permission Operator/Maintenance/Expert

Description Select the pressure unit. If a new pressure unit is selected, all pressure-specific parameters are converted and displayed with the new unit.

Options
- mbar, bar
- mmH2O, mH2O, inH2O
- ftH2O
- Pa, kPa, MPa
- psi
- mmHg, inHg
- kgf/cm^2

Factory setting mbar or bar depending on the nominal measuring range of the sensor module, or as per order specifications.

7.6 Position adjustment

A pressure shift resulting from the orientation of the device can be corrected by the position adjustment.

Pos. zero adjust (gauge pressure sensor)

Navigation Setup → Pos. zero adjust

Write permission Operator/Maintenance/Expert

Description Pos. zero adjustment – the pressure difference between zero (set point) and the measured pressure need not be known.

Options
- Confirm
- Cancel

Example
- Measured value = 2.2 mbar (0.033 psi)
- You 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
- The current value is also corrected.

Factory setting Cancel

Calib. offset

Write permission Maintenance/Expert

Description Position adjustment – the pressure difference between the set point and the measured pressure must be known.

Example

- Measured value = 982.2 mbar (14.73 psi)
- You correct the measured value with the value entered, e.g. 2.2 mbar (0.033 psi) via the "Calib. offset" parameter. This means that you are assigning the value 980 mbar (14.7 psi) to the pressure present.
- Measured value (after pos. zero adjustment) = 980 mbar (14.7 psi)
- The current value is also corrected.

Factory setting 0.0

7.7 Configuring the damping

The output signal follows measured value changes with the delay time. This can be configured via the operating menu.

Damping

Navigation Setup → Damping

Write permission Operator/Maintenance/Expert
(if the "Damping" DIP switch is set to "on")

Description Enter damping time (time constant τ) ("Damping" DIP switch set to "on")
Display damping time (time constant τ) ("Damping" DIP switch set to "off").
The damping affects the speed at which the measured value reacts to changes in pressure.

Input range 0.0 to 999.0 s

Factory setting 2 s or according to order specifications

7.8 Configuring level measurement

7.8.1 Information on level measurement

You have a choice of two methods for calculating the level: "In pressure" and "In height". The table in the "Overview of level measurement" section that follows provides you with an overview of these two measuring tasks.

- The limit values are not checked, i.e. the values entered must be appropriate for the sensor module and the measuring task for the device to be able to measure correctly.
- Customer-specific units are not possible.
- The values entered for "Empty calib./Full calib.", "Empty pressure/Full pressure", "Empty height/Full height" and "Set LRV/Set URV" must be at least 1 % apart. The value will be rejected, and a message displayed, if the values are too close together.

7.8.2 Overview of level measurement

"In pressure" level selection
Calibration is performed by entering two pressure/level value pairs.
- Via the "Output unit" parameter: select %, level, volume or mass units
- Description:
  - Calibration with reference pressure (wet calibration)
  - Calibration without reference pressure (dry calibration) → 📄 36
- The measured value display and the "Level before lin" parameter display the measured value.

"In height" level selection
Calibration is performed by entering the density and two height/level value pairs.
- Via the "Output unit" parameter: select %, level, volume or mass units
- Description:
  - Calibration with reference pressure (wet calibration)
  - Calibration without reference pressure (dry calibration)
- The measured value display and the "Level before lin" parameter display the measured value.

7.8.3 "In pressure" level selection Calibration without reference pressure (dry calibration)

Example:

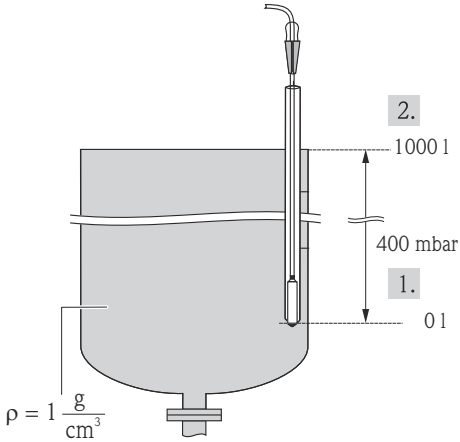
In this example, the volume in a tank should be measured in liters. The maximum volume of 1 000 l (264 gal) corresponds to a pressure of 400 mbar (6 psi).

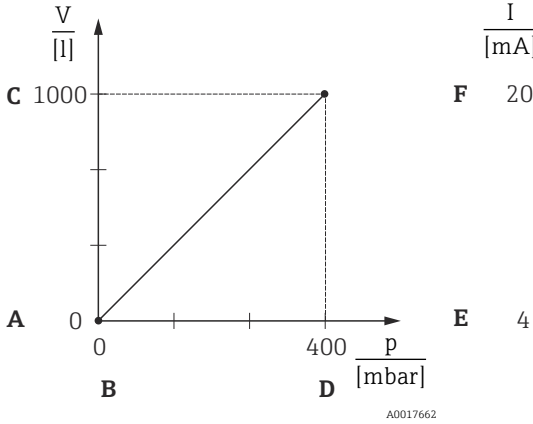
The minimum volume of 0 liters corresponds to a pressure of 0 mbar since the process membrane of the probe is at the start of the level measuring range.

Prerequisite:

- The measured variable is in direct proportion to the pressure.
- This is a theoretical calibration i.e. the pressure and volume values for the lower and upper calibration point must be known.

- The values entered for "Empty calib./Full calib.", "Empty pressure/Full pressure" and "Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message displayed, if the values are too close together. Further limit values are not checked, i.e. the values entered must be appropriate for the sensor module and the measuring task for the device to be able to measure correctly.
- Due to the orientation of the device, there may be pressure shifts in the measured value, i.e. when the vessel is empty or partly filled, the measured value is not zero. For information on how to perform position adjustment, see → 34.





1 *See steps 6 and 7*
2 *See steps 8 and 9*

A See step 6
B See step 7
C See step 8
D See step 9
E See
F See

1. Select the "Level" measuring mode via the "Measuring mode" parameter.
   ↳ Menu path: Setup → Measuring mode

WARNING

Changing the measuring mode affects the span (URV)

This situation can result in product overflow.

▶ If the measuring mode is changed, the setting for the span (URV) must be checked in the "Setup" operating menu and readjusted if necessary.

2. Select a pressure unit via the "Press. eng. unit" parameter, here "mbar" for example.
   ↳ Menu path: Setup → Press. eng. unit

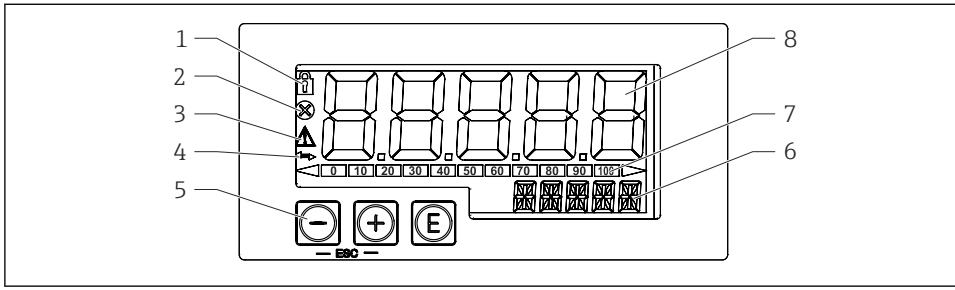
3. Select the "In pressure" level mode via the "Level selection" parameter.
   ↳ Menu path: Setup → Extended setup → Level → Level selection
4. Select a volume unit via the "Output unit" parameter, here "l" (liters) for example.
   ↳ Menu path: Setup → Extended setup → Level → Output unit
5. Select the "Dry" option via the "Calibration mode" parameter.
   ↳ Menu path: Setup → Extended setup → Level → Calibration mode
6. Enter the volume value for the lower calibration point via the "Empty calib." parameter, here 0 liters for example.
   ↳ Menu path: Setup → Extended setup → Level → Empty calib.
7. Enter the pressure value for the lower calibration point via the "Empty pressure" parameter, here "0 mbar" for example.
   ↳ Menu path: Setup → Extended setup → Level → Empty pressure
8. Enter the volume value for the upper calibration point via the "Full calib." parameter, here 1 000 l (264 gal) for example.
   ↳ Menu path: Setup → Extended setup → Level → Full calib.
9. Enter the pressure value for the upper calibration point via the "Full pressure" parameter, here 400 mbar (6 psi) for example.
   ↳ Menu path: Setup → Extended setup → Level → Full pressure
10. "Adjust density" contains the factory setting 1.0 but can be changed if required. The value pairs subsequently entered must correspond to this density
    ↳ Menu path: Setup → Extended setup → Level → Adjust density
11. Set the volume value for the lower current value (4 mA) via the "Set LRV" parameter (0 l).
    ↳ Menu path: Setup → Extended setup → Current output → Set LRV
12. Set the volume value for the upper current value (20 mA) via the "Set URV" parameter (1 000 l (264 gal)).
    ↳ Menu path: Setup → Extended setup → Current output → Set URV
13. If the process uses a medium other than that on which the calibration was based, the new density must be specified in the "Process density" parameter.
    ↳ Menu path: Setup → Extended setup → Level → Density → Process
14. If density correction is required, assign the temperature probe in the "Auto dens. corr." parameter. A density correction is only possible for water. A temperature-density curve that is saved in the device is used. For this reason, the "Adjust density" (step 10) and "Process density" (step 13) parameters are not used here.
    ↳ Menu path: Expert → Application → Auto dens. corr.

The measuring range is configured for 0 to 1 000 l (0 to 264 gal).

For this level mode, the measured variables %, level, volume and mass are available, see "Output unit" in the Operating Instructions .

7.9 Linearization

7.10 Operation and settings via RIA15



7 *Display and operating elements of the process indicator*

1 *Symbol: operating menu disabled*
2 *Symbol: error*
3 *Symbol: warning*
4 *Symbol: HART communication active*
5 *Operating keys "-", "+", "E"*
6 *14-segment display for unit/TAG*
7 *Bar graph with indicators for under range and over range*
8 *5-digit 7-segment display for measured value, digit height 17 mm (0.67 in)*

The device is operated using three operating keys on the front of the housing. The device setup can be disabled with a 4-digit user code. If the setup is disabled, a padlock symbol appears on the display when an operating parameter is selected.

Ⓔ
Enter key; for calling up the operating menu, confirming the selection/configuration of parameters in the operating menu

⊕, ⊖
Selecting and setting/changing values in the operating menu; pressing the '-' and '+' keys simultaneously takes the user back up a menu level. The configured value is not saved.

7.10.1 Operating functions

The operating functions of the process indicator are divided into the following menus. The individual parameters and settings are described in the "Commissioning" section.

If the operating menu is disabled by means of a user code, the individual menus and parameters can be displayed but not changed. To change a parameter, the user code must be entered. As the display unit can only display digits in the 7-segment display and not alphanumeric characters, the procedure for number parameters is different to that for text parameters. If the operating position contains only numbers as parameters, the operating position is displayed in the 14-segment display and the configured parameter is displayed in the 7-segment display. To edit, press the 'E'-button followed by the user code. If the operating position contains text parameters, only the operating position is initially displayed in the 14-segment display. If the 'E' button is pressed again, the configured parameter is displayed in the 14-segment display. To edit, press the '+' button followed by the user code.

- Setup (SETUP)
  Basic device settings
- Diagnostics (DIAG)
  Device information, display of error messages
- Expert (EXPRT)
  Expert settings for device setup. The Expert menu is protected from editing by an access code (default 0000).

7.10.2 Operating modes

The process indicator can be used in two different operating modes:

- 4 to 20 mA mode:
  In this operating mode, the process indicator is incorporated into the 4 to 20 mA current loop and measures the transmitted current. The variable calculated based on the current value and range limits is displayed in digital form on the 5-digit LCD. In addition, the associated unit and a bar graph can be displayed.
- HART mode:
  The indicator is powered via the current loop.
  The device can be adjusted under the "Level" menu (see operating matrix). The measured value displayed corresponds to the measured level.
  HART communication operates according to the master/slave principle.

For additional information, see BA01170K.

7.10.3 Operating matrix

After power-up:

▶ Press the Ⓔ key twice
  ↳ The "Level" menu is then available

Using the following operating matrix, a display in percent can be set. To do this, select "Mode" parameter => 4-20 and "Unit" parameter =>%

The LEVEL menu is only visible if the RIA15 has been ordered with the "Level" option and the indicator is operated in the HART mode (MODE = HART). The basic settings for the device can be made via the RIA15 with this menu.

Menu Setup → Level (LEVEL)
- RIA15 parameter: LEVEL [1)]
- Corresponds to device parameter: Level before linearization
- Visible with "Level" option, MODE = HART, device is connected
- Description:
  This menu contains the parameters for configuring the pressure measuring device for hydrostatic level measurement.
  The basic settings for the device can be made via the RIA15 with this menu.

Once the LEVEL menu item is opened, the following parameters are automatically adjusted in the device for easier operation:
- Measuring mode: Level
- Calibration mode: Dry
- Level selection: In pressure
- Lin mode: Linear

It is possible to reset these parameters to the factory default settings by performing a reset.

Menu Setup → Level (LEVEL) → PUNIT
- RIA15 parameter: PUNIT
- Corresponds to device parameter: Press. eng. unit
- Values (default in bold)
  - **mbar** [2)]
  - **bar** [2)]
  - kPa
  - PSI
- Description: Use this function to select the unit for pressure

Menu Setup → Level (LEVEL) → LUNIT
- RIA15 parameter: LUNIT
- Corresponds to device parameter: Output unit
- Values (default in bold)
  - **%**
  - m
  - inch
  - feet
- Description: Use this function to select the unit for level

1) If the measured value that is read out is too large, it is displayed as "9999.9", for example. To display a valid measured value, the pressure unit (PUNIT) (or level unit (LUNIT)) must be set to suit the measuring range.
2) Default: depends on the sensor nominal range or as per order specifications

Menu Setup → Level (LEVEL) → TUNIT
- RIA15 parameter: TUNIT
- Corresponds to device parameter: Temperature unit
- Values (default in bold)
  - **°C**
  - °F
  - K
- Description: Use this function to select the unit for temperature

Menu Setup → Level (LEVEL) → ZERO
- RIA15 parameter: ZERO
- Corresponds to device parameter: Pos. zero adjust
- Values (default in bold)
  - **NO**
  - YES
- Visible with: gauge pressure sensor
- Description:
  - For performing a position adjustment (gauge pressure sensor).
  - The value 0.0 is assigned to the pressure value present. The current value is also corrected.

Menu Setup → Level (LEVEL) → P_LRV
- RIA15 parameter: P_LRV
- Corresponds to device parameter: Empty pressure
- Values (default in bold)
  - -1999.9 to 9999.9
  - **Gauge pressure sensor: Sensor LRL**
  - Absolute pressure sensor: 0
- Description:
  Pressure empty calibration using keys -, +, E. More in-depth description / valid value range: any value in the range indicated [1) 3)]. Number of decimal places depends on the configured pressure unit.

Menu Setup → Level (LEVEL) → P_URV
- RIA15 parameter: P_URV
- Corresponds to device parameter: Full pressure
- Values (default in bold)
  - -1999.9 to 9999.9
  - **Sensor URL**
- Description:
  Pressure full calibration using keys -, +, E. More in-depth description / valid value range: any value in the range indicated [1) 3)]. Number of decimal places depends on the configured pressure unit.

Menu Setup → Level (LEVEL) → EMPTY
- RIA15 parameter: EMPTY
- Corresponds to device parameter: Empty calibration
- Values (default in bold)
  - -1999.9 to 9999.9
  - **0**
- Description:
  Level empty calibration using keys -, +, E. More in-depth description / valid value range: any value in the range indicated [1) 3)] Number of decimal places depends on the configured level unit.

Menu Setup → Level (LEVEL) → FULL
- RIA15 parameter: FULL
- Corresponds to device parameter: Full calibration
- Values (default in bold)
  - -1999.9 to 9999.9
  - **100**
- Description:
  Level full calibration using keys -, +, E. More in-depth description / valid value range: any value in the range indicated [1) 3)]. Number of decimal places depends on the configured level unit.

Menu Setup → Level (LEVEL) → LEVEL
- RIA15 parameter: LEVEL
- Corresponds to device parameter: Level before linearization
- Values (default in bold)
  Measured value
- Description:
  Displays the measured level. Number of decimal places depends on the configured level unit.

Menu Setup → Level (LEVEL) → RESET
- RIA15 parameter: RESET
- Corresponds to device parameter: Enter reset code
- Values (default in bold)
  - **No**
  - YES
- Description:
  Reset the device to factory settings

Any additional settings such as linearizations must be made using FieldCare or DeviceCare.

Additional information is available in the RIA15 Operating Instructions BA01170K.

3) The values entered for "Empty calib./Full calib.", "Empty pressure/Full pressure" and "Set LRV/Set URV" must be at least 1% apart. The value will be rejected, and a message displayed, if the values are too close together. Further limit values are not checked, i.e. the values entered must be appropriate for the sensor module and the measuring task for the device to be able to measure correctly.

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