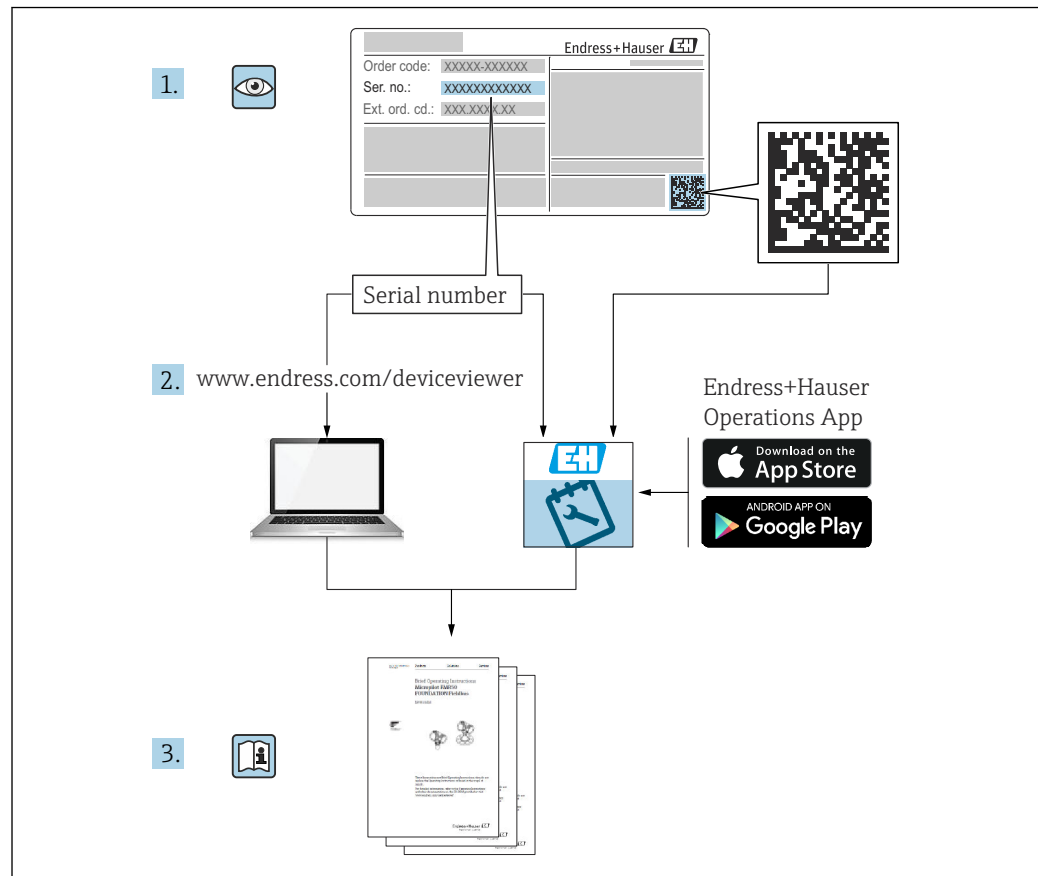


Operating Instructions

Waterpilot FMX11

Hydrostatic level measurement
4 to 20 mA analog





A0023555

- Make sure the document is stored in a safe place such that it is always available when working on or with the device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the document that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

Table of contents

| | | | | | |
|-----------|---|-----------|--------------------|-----------------------------------|-----------|
| 1 | About this document | 4 | 12 | Technical data | 21 |
| 1.1 | Document function | 4 | 12.1 | Input | 21 |
| 1.2 | Symbols | 4 | 12.2 | Output | 22 |
| 1.3 | List of abbreviations | 5 | 12.3 | Performance characteristics | 23 |
| 1.4 | Documentation | 6 | 12.4 | Environment | 24 |
| 2 | Basic safety instructions | 7 | 12.5 | Process | 25 |
| 2.1 | Requirements concerning the staff | 7 | 12.6 | Additional technical data | 25 |
| 2.2 | Designated use | 7 | Index | | 26 |
| 2.3 | Workplace safety | 7 | | | |
| 2.4 | Operational safety | 7 | | | |
| 2.5 | Product safety | 8 | | | |
| 3 | Product description | 9 | | | |
| 3.1 | Product design | 9 | | | |
| 4 | Incoming acceptance and product identification | 9 | | | |
| 4.1 | Incoming acceptance | 9 | | | |
| 4.2 | Product identification | 10 | | | |
| 4.3 | Storage and transport | 10 | | | |
| 5 | Installation | 12 | | | |
| 5.1 | Installation conditions | 12 | | | |
| 5.2 | Mounting the measuring device | 13 | | | |
| 5.3 | Post-installation check | 14 | | | |
| 6 | Electrical connection | 15 | | | |
| 6.1 | Connection conditions | 15 | | | |
| 6.2 | Connecting the measuring device | 15 | | | |
| 6.3 | Post-connection check | 17 | | | |
| 7 | Operation options | 17 | | | |
| 8 | Diagnostics and troubleshooting ... | 17 | | | |
| 8.1 | General troubleshooting | 17 | | | |
| 9 | Maintenance | 18 | | | |
| 9.1 | Maintenance tasks | 18 | | | |
| 10 | Repair | 19 | | | |
| 10.1 | General information | 19 | | | |
| 10.2 | Spare parts | 19 | | | |
| 10.3 | Return | 19 | | | |
| 10.4 | Disposal | 19 | | | |
| 11 | Accessories | 20 | | | |
| 11.1 | Device-specific accessories | 20 | | | |

1 About this document

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

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

Ground connection: 

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

1.2.3 Symbols for certain types of information

Permitted: 

Procedures, processes or actions that are permitted.

Forbidden: 

Procedures, processes or actions that are forbidden.

Additional information: [i](#)

Series of steps: [1](#), [2](#), [3](#)

Result of an individual step: [L](#) ➔

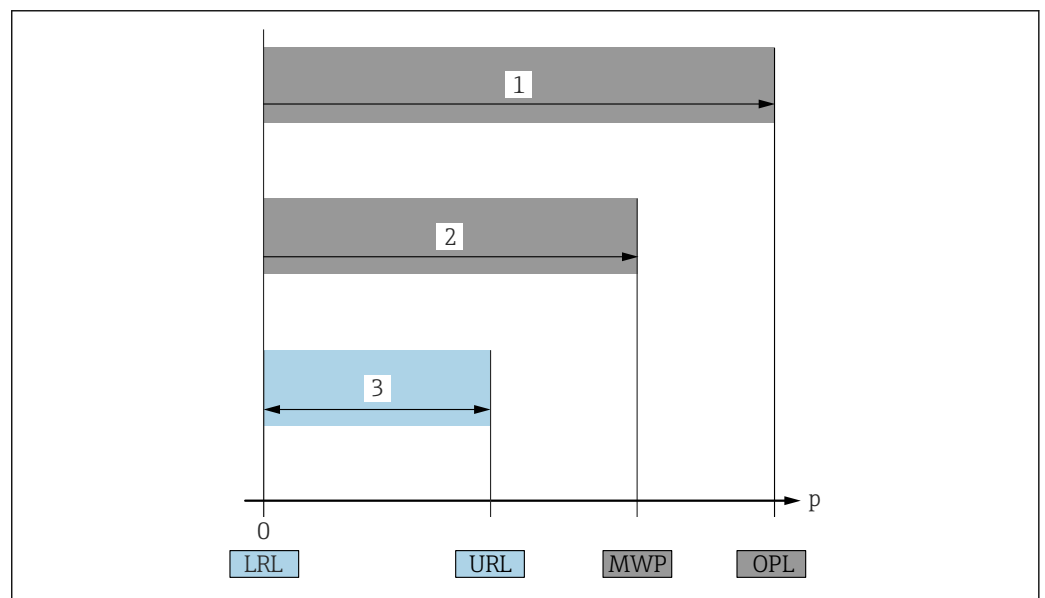
1.2.4 Symbols in graphics

Item numbers: 1, 2, 3 ...

Series of steps: [1](#), [2](#), [3](#)

Views: A, B, C, ...

1.3 List of abbreviations



A0042446

| Item | Term/abbreviation | Explanation |
|------|--|--|
| 1 | OPL | The OPL (over pressure limit = sensor overload 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. |
| 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. The MWP may be applied at the device for an unlimited period. |
| 3 | Maximum sensor measuring range/ calibrated span | Span between LRL and URL This sensor measuring range is equivalent to the maximum calibratable/adjustable span. |
| p | - | Pressure |
| - | LRL | Lower range limit |
| - | URL | Upper range limit |

1.4 Documentation

All available documents can be downloaded using:

- the serial number of the device (see cover page for description) or
- the data matrix code of the device (see cover page for description) or
- "Download" area of web page: www.endress.com

1.4.1 Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.

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

2.2.1 Application and media

The Waterpilot FMX11 is a hydrostatic pressure sensor for level measurement, for example, in the area of untreated water extraction and drinking water storage.

2.2.2 Incorrect use

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

Clarification of 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 protective equipment according to federal or 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

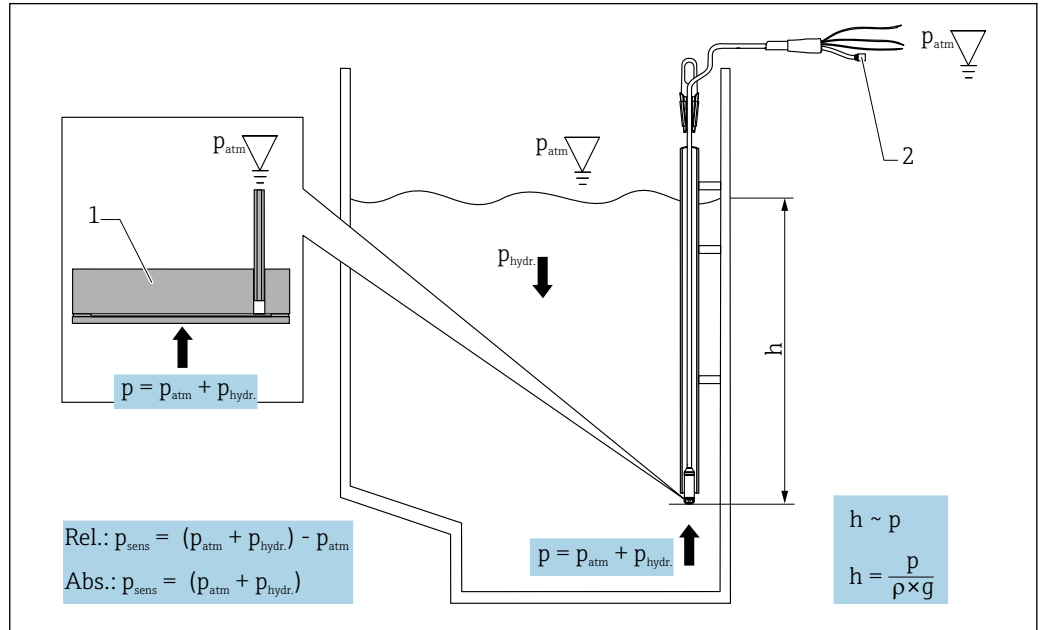
This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

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 Product description

3.1 Product design

The process pressure causes the metal process isolating diaphragm of the sensor to deflect. A filling oil transfers the pressure to a Wheatstone bridge (semiconductor technology). The pressure-dependent change in the bridge output voltage is measured and evaluated.

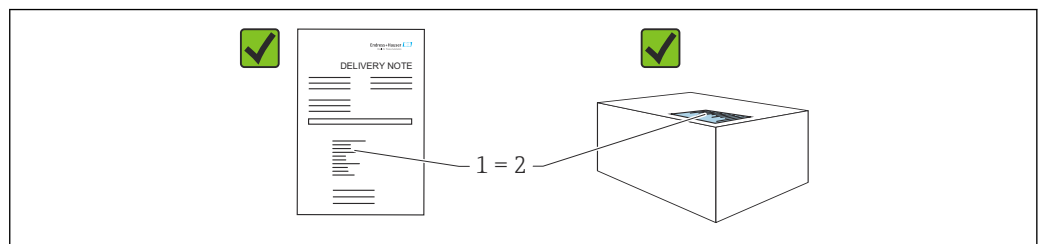


A0019140

- 1 Metal measuring cell
- 2 Pressure compensation tube
- h Level height
- p Total pressure = atmospheric pressure + hydrostatic pressure
- ρ Density of the medium
- g Gravitational acceleration
- $p_{hydr.}$ Hydrostatic pressure
- p_{atm} Atmospheric pressure
- p_{sens} Pressure displayed on the sensor

4 Incoming acceptance and product identification

4.1 Incoming acceptance



A0016870

- Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?
- Do the data on the nameplate correspond to the order specifications and the delivery note?
- Is the documentation provided?
- Are the goods undamaged?

i If one of these conditions is not satisfied, contact the Endress+Hauser Sales Center.

4.2 Product identification

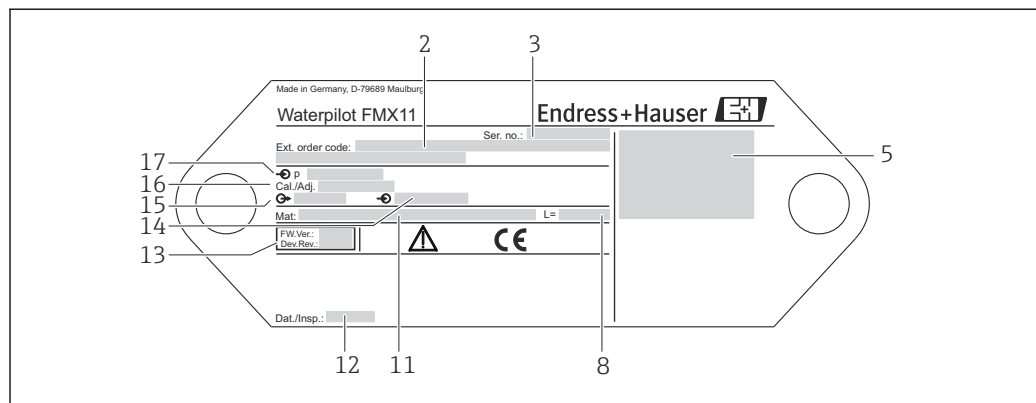
The following options are available for the identification of the measuring device:

- Nameplate specifications
- 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 the information about the measuring device is displayed.

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

4.2.1 Nameplates

Nameplates on extension cable



A0040852

- 2 Extended order number (complete)
- 3 Serial number (for clear identification)
- 5 FMX11 connection diagram
- 8 Length of extension cable
- 11 Materials in contact with process
- 12 Test date (optional)
- 13 Software version/device version
- 14 Supply voltage
- 15 Output signal
- 16 Set measuring range
- 17 Nominal measuring range

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).

Storage temperature range*FMX11*

-10 to +70 °C (+14 to +158 °F)

Terminal box

-40 to +80 °C (-40 to +176 °F)

4.3.2 Transporting the product to the measuring point** WARNING****Incorrect transport!**

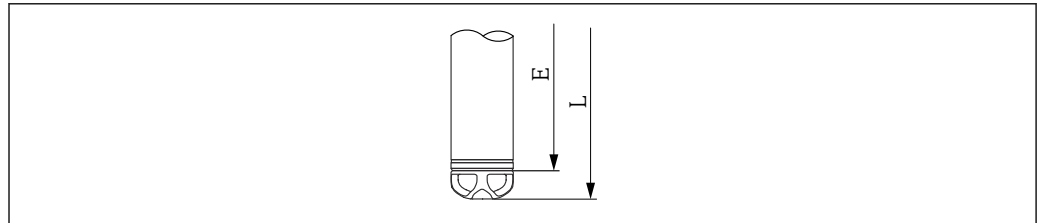
Device or cable may become damaged, and there is a risk of injury!

- ▶ Transport measuring device in the original packaging.

5 Installation

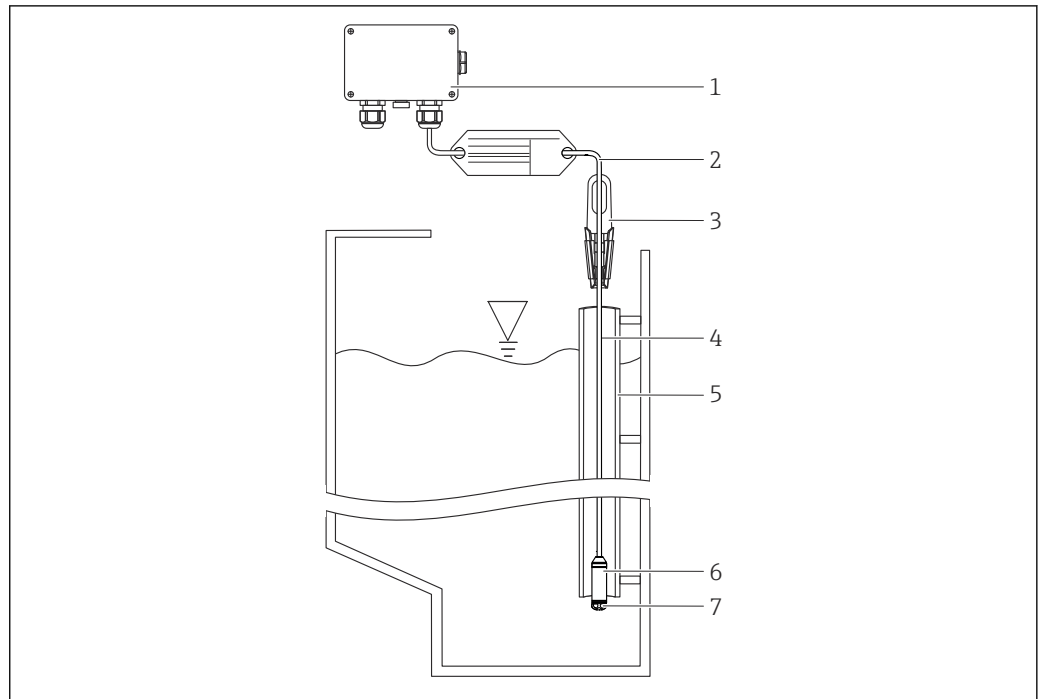
5.1 Installation conditions

- Sideways movement of the level probe can result in measuring errors. Install the probe at a point free from flow and turbulence or use a guiding tube. The internal diameter of the guiding tube should be at least 1 mm (0.04 in) greater than the outer diameter of the FMX11.
- 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.
- Cable length tolerance: $\pm < 50$ mm (1.97 in)
- Endress+Hauser recommends using twisted, shielded cable.
- The length of the extension cable depends on the intended level zero point. The height of the protective 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).



A0043690

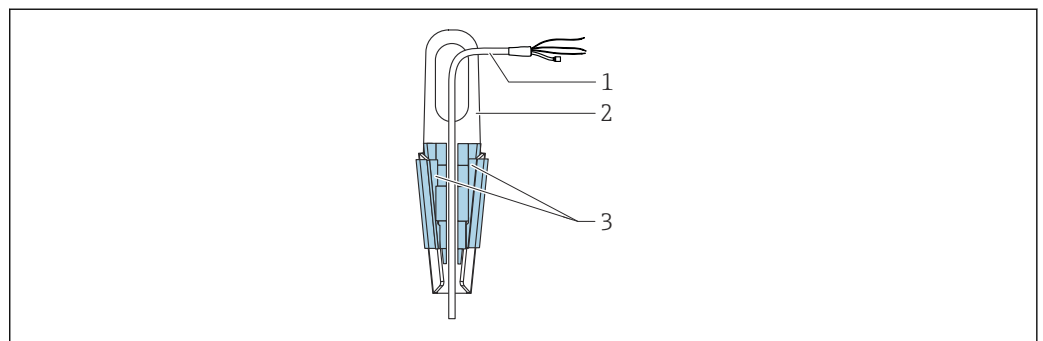
5.2 Mounting the measuring device



A0040853

- 1 Terminal box can be ordered separately
- 2 Bending radius of extension cable
- 3 Suspension clamp can be ordered as an accessory
- 4 Extension cable, cable length
- 5 Guiding tube
- 6 Waterpilot FMX11
- 7 Protection cap

5.2.1 Mounting the Waterpilot with a mounting clamp



A0040921

- 1 Extension cable
- 2 Suspension clamp
- 3 Clamping jaws

Mounting the suspension clamp

1. Mount the suspension clamp (item 2). Take the weight of the extension cable (item 1) into account.
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.

5.2.2 Mounting the terminal box

The optional terminal box is mounted using four screws (M4).

5.3 Post-installation check

- Is the device undamaged (visual inspection)?
- Does the device comply with the measuring point specifications?
 - Process temperature
 - Process pressure
 - Ambient temperature
 - Measuring range
- Check that all screws are firmly seated.

6 Electrical connection

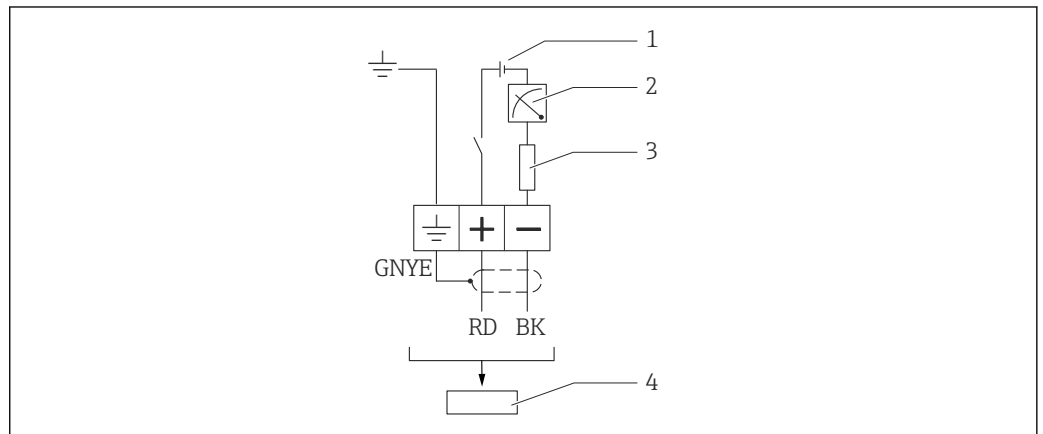
6.1 Connection conditions

⚠ WARNING

Supply voltage might be connected!

Risk of electric shock!

- ▶ Switch off supply voltage.
- The supply voltage must match the supply voltage specified on the nameplate.
- The cable must end in a dry room or a suitable terminal box. The terminal box (IP66/IP67) with GORE-TEX® filter from Endress+Hauser is suitable for outdoor installation. The terminal box can be ordered separately as an accessory (order number: 52006152).
- Connect the device in accordance with the following diagrams. Reverse polarity protection is integrated in the Waterpilot FMX11. Changing the polarities will not result in damage to the device. The device is not operational.
- A suitable circuit breaker should be provided for the device in accordance with IEC/EN 61010.



A0040869

- 1 8 to 28 V_{DC}
- 2 4 to 20 mA
- 3 Resistance (R_I)
- 4 Waterpilot FMX11

6.2 Connecting the measuring device

6.2.1 Supply voltage

8 to 28 V_{DC}

6.2.2 Cable specification


Connecting cable

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

- Commercially available instrument cable
- Terminals, terminal box: 0.08 to 2.5 mm² (28 to 14 AWG)

Extension cable

- Total outer diameter: 6 mm (0.24 in) ±0.2 mm (0.01 in)
- PA pressure compensation tube:
 - Outer diameter 2.5 mm (0.1 in)
 - Internal diameter 1.5 mm (0.06 in)
 - Pressure compensation element outer diameter 6 mm (0.24 in)

 The extension cables are shielded.

Cross-section

2 x 0.22 mm² + pressure compensation tube

Cable resistance

Per wire: ≤0.09 Ω/m

6.2.3 Power consumption

≤ 0.62 W at 28 V_{DC}

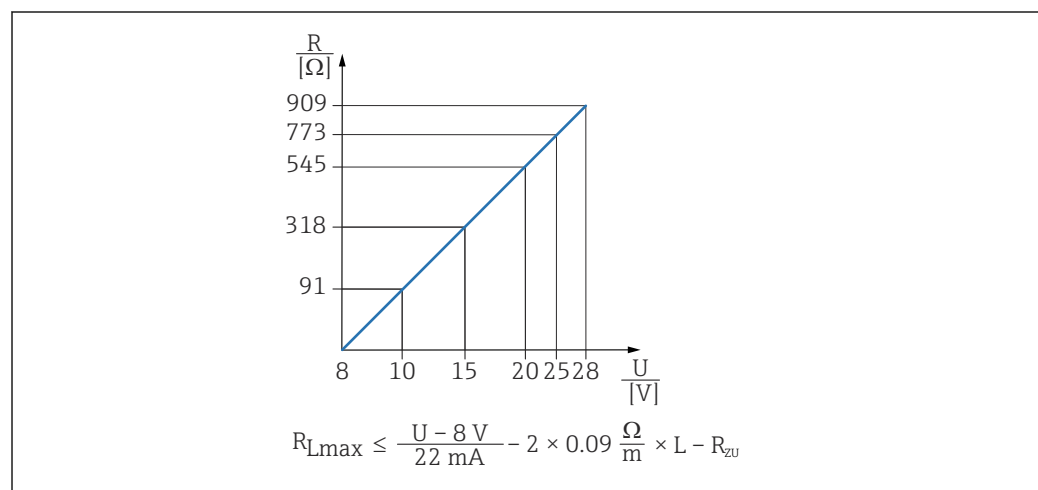
6.2.4 Current consumption

Max. current consumption: ≤ 22 mA

Min. current consumption: ≥ 2 mA

6.2.5 Maximum load

The maximum load resistance depends on the supply voltage (U) and must be determined individually for each current loop, see formula and diagram. The total resistance resulting from the resistances of the connected devices, the connecting cable and, where applicable, the resistance of the extension cable may not exceed the load resistance value. Load diagram for an approximate calculation of the load resistance. Additional resistances, such as the resistance of the extension cable (per wire ≤0.09 Ω/m), have to be subtracted from the value calculated as shown in the equation.



A0043461

R_{Lmax} Max. load resistance [Ω]

R_{add} Additional resistances such as resistance of evaluating device and/or display unit, cable resistance [Ω]

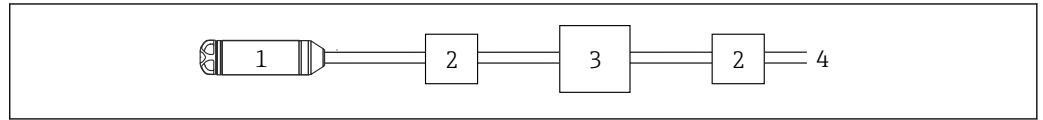
U Supply voltage [V]

L Basic length, extension cable [m]

6.2.6 Overvoltage protection

To protect the Waterpilot from large interference voltage peaks, Endress+Hauser recommends installing overvoltage protection upstream and downstream of the display and/or evaluation unit.

- Integrated overvoltage protection to EN 61000-4-5 (2 kV asymmetrical)
- Install overvoltage protection ≥ 1.0 kV, external if necessary



A0040871


- 1 Waterpilot FMX11
- 2 Overvoltage protection (OVP), e.g., HAW from Endress+Hauser
- 3 Power supply, display and evaluation unit with one input for 4 to 20 mA
- 4 Power supply

6.3 Post-connection check

- Are the device or cables free from damage (visual check)?
- Do the cables comply with the requirements?
- Do the cables have adequate strain relief?
- Are all the cable glands installed, tightened and sealed?
- Does the supply voltage match the information on the nameplate?
- Is the terminal assignment correct?

7 Operation options

Endress+Hauser offers comprehensive measuring point solutions with display and/or evaluation units for the Waterpilot FMX11.

 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

8 Diagnostics and troubleshooting

8.1 General troubleshooting

8.1.1 Device does not respond

- Does the supply voltage match that specified on the nameplate?
Apply correct voltage
- Is the polarity of the supply voltage wrong?
Correct the polarity
- Are the connecting cables in contact with the terminals?
Ensure electrical contact between the cable and the terminal

8.1.2 Output current < 3.6 mA

- Is the signal line wired correctly?
Check wiring
- Is the electronics unit defective?
Replace electronics

9 Maintenance

- Terminal box: Keep the GORE-TEX® filter free from contamination
- FMX11 extension cable: Keep the Teflon filter in the pressure compensation tube free from contamination
- Check the process isolating diaphragm for buildup at suitable intervals.

9.1 Maintenance tasks

9.1.1 Exterior cleaning

Please note the following points when cleaning the device:

- The cleaning agents used should not corrode the surface and the seals.
- Mechanical damage to the process isolating diaphragm, e.g. due to pointed objects, must be avoided.
- Only clean the terminal box with water or with a cloth dampened with very diluted ethanol.

10 Repair


10.1 General information

10.1.1 Repair concept

Repairs are not envisaged for the device.

10.2 Spare parts

All the spare parts for the measuring device, along with the order code, are listed and can be ordered in *W@M Device Viewer* (www.endress.com/deviceviewer). If available, users can also download the associated Installation Instructions.

 Measuring device serial number:
Is located on the nameplate of the device.

10.3 Return

The measuring device must be returned if the wrong device has been ordered or delivered.

As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure swift, safe and professional device returns, please read the return procedures and conditions on the Endress+Hauser website at www.services.endress.com/return-material

- ▶ Select country.
 - ↳ The website of the responsible sales organization opens with all of the relevant information relating to returns.
- 1. If the desired country is not listed:
 - Click on the "Choose your location" link.
 - ↳ An overview of Endress+Hauser sales organizations and representatives opens.
- 2. Contact your Endress+Hauser sales office or representative.

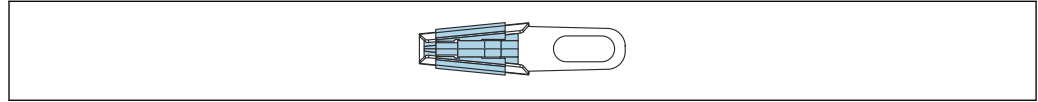
10.4 Disposal

When disposing, separate and recycle the device components based on the materials.

11 Accessories

11.1 Device-specific accessories

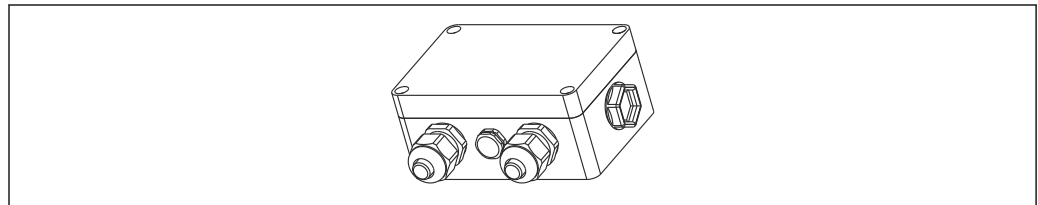
11.1.1 Suspension clamp



A0030950

Order number: 52006151

11.1.2 Terminal box



A0030967

Order number: 52006152

12 Technical data

12.1 Input

12.1.1 Measured variable

Hydrostatic pressure of a liquid

12.1.2 Measuring range

Customer-specific measuring ranges or calibration that has been preset in the factory.

| Input variable absolute pressure | | | | | |
|--|------------|---|-----------|------------|----------|
| Relative nominal pressure [bar (abs.)] | 0.2 (3) | 0.4 (6) | 0.6 (9) | 1.0 (14.5) | 2.0 (29) |
| Level [mH ₂ O] | 2 | 4 | 6 | 10 | 20 |
| Overload OPL [bar (abs.)] | 1 (14.5) | 2 (29) | 5 (72.5) | 5 (72.5) | 10 (145) |
| Burst pressure ≥ [bar (abs.)] | 1.5 (22) | 3 (43.5) | 7.5 (109) | 7.5 (109) | 10 (145) |
| Negative pressure [bar (abs.)] | -0.7 (-11) | -1 (-14.5) (unrestricted vacuum-resistance) | | | |

12.1.3 Input signal

Change in capacitance

12.2 Output

12.2.1 Output signal

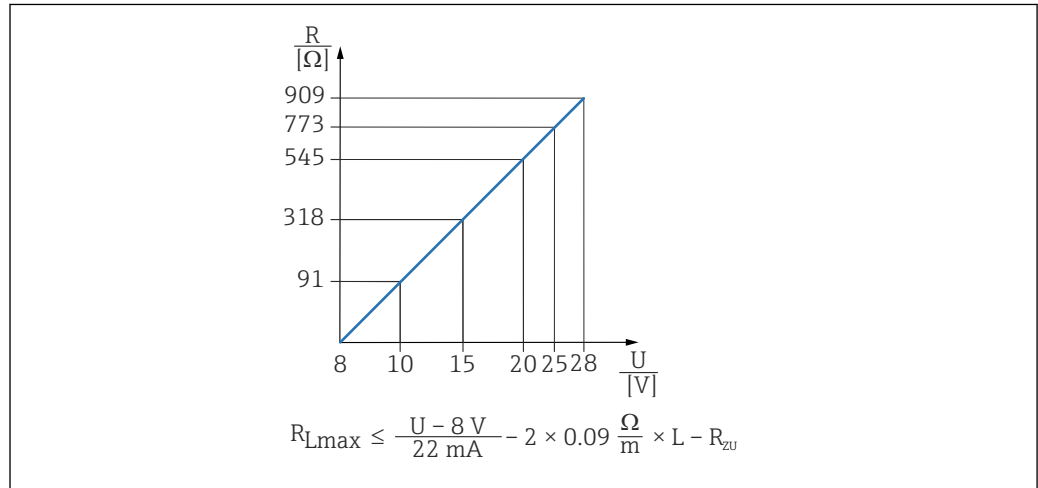
4 to 20 mA analog, 2-wire for hydrostatic pressure measured value.

12.2.2 Signal range

2 to 22 mA

12.2.3 Maximum load

The maximum load resistance depends on the supply voltage (U) and must be determined individually for each current loop, see formula and diagram. The total resistance resulting from the resistances of the connected devices, the connecting cable and, where applicable, the resistance of the extension cable may not exceed the load resistance value. Load diagram for an approximate calculation of the load resistance. Additional resistances, such as the resistance of the extension cable (per wire $\leq 0.09 \Omega/m$), have to be subtracted from the value calculated as shown in the equation.



A0043461

R_{Lmax} Max. load resistance [Ω]

R_{add} Additional resistances such as resistance of evaluating device and/or display unit, cable resistance [Ω]

U Supply voltage [V]

L Basic length, extension cable [m]

12.3 Performance characteristics

12.3.1 Reference operating conditions

- As per IEC 60770
- Ambient temperature T_U = constant, in the range: +21 to +27 °C (+70 to +81 °F)
- Humidity φ = constant, in the range of 20 to 80 % rH
- Ambient pressure p_U = constant, in the range: 860 to 1 060 mbar (12.47 to 15.37 psi)
- Position of measuring cell constant, vertical in the range of $\pm 1^\circ$
- Supply voltage constant: 21 V DC to 27 V DC

12.3.2 Reference accuracy

The reference accuracy comprises the non-linearity after limit point configuration, hysteresis and non-reproducibility in accordance IEC 60770.

- Sensor measuring range ≥ 400 mbar: $\leq \pm 0.35$ %
- Sensor measuring range < 400 mbar: $\leq \pm 0.50$ %

12.3.3 Long-term stability

$\leq \pm 0.1$ % of URL/year at reference operating conditions

12.3.4 Influence of medium temperature

- Thermal change in the zero output and the output span:
-10 to +70 °C (+14 to 158 °F): $< (0.4 + 0.4 \times \text{TD})\%$ of set span
- Temperature coefficient (T_K) of the zero output and the output span
0 to +70 °C (32 to 158 °F): 0.15 %/10 K of URL

12.3.5 Warm-up period

≤ 10 s

12.3.6 Response time

- T90 time: ≤ 15 ms
- T99 time: ≤ 45 ms

12.4 Environment

12.4.1 Ambient temperature range

FMX11

-10 to +70 °C (+14 to +158 °F) (= medium temperature)

Terminal box

-40 to +80 °C (-40 to +176 °F)

12.4.2 Storage temperature range

FMX11

-10 to +70 °C (+14 to +158 °F)

Terminal box

-40 to +80 °C (-40 to +176 °F)

12.4.3 Degree of protection

FMX11

IP68, permanently hermetically sealed at 10 bar (145 psi)

Terminal box (optional)

IP66, IP67

12.4.4 Electromagnetic compatibility (EMC)

- EMC in accordance with all relevant requirements of EN 61326 series. For details, refer to the Declaration of Conformity.
- Maximum deviation: < 0.5 % of span.

12.5 Process

12.5.1 Medium temperature range

0 to +70 °C (+32 to +158 °F)

12.5.2 Medium temperature limit

-10 to +70 °C (+14 to +158 °F)

 The FMX11 may be operated in this temperature range. The specification values, such as accuracy, may be exceeded.

12.5.3 Process pressure range

WARNING

The maximum pressure for the measuring device depends on the lowest-rated element with regard to pressure.

- ▶ The measuring device must be operated only within the specified limits!
- ▶ 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.
- ▶ OPL (Over Pressure Limit = sensor overload limit): The test pressure corresponds to the over pressure limit of the sensor and may only be applied for a limited time period so that no permanent damage develops.

12.6 Additional technical data

See Technical Information.

Index

A

Application 7

C

CE mark (declaration of conformity) 8

Cleaning 18

D

Declaration of Conformity 8

Designated use 7

Device documentation

 Supplementary documentation 6

Document

 Function 4

Document function 4

E

Exterior cleaning 18

M

Maintenance 18

Media 7

N

Nameplate 10

O

Operational safety 7

P

Product safety 8

R

Repair concept 19

S

Safety instructions

 Basic 7

Spare parts 19

 Nameplate 19

Staff

 Requirements 7

T

Troubleshooting 17

U

Use of the measuring device

 see Designated use

Using measuring devices

 Borderline cases 7

 Incorrect use 7

W

W@M Device Viewer 19

Workplace safety 7



www.addresses.endress.com
