BA02254F/09/EN/01.22-00
71706880
2022-12-29

Operating Instructions
FlexView FMA90

Control unit with color display and touch control for up to two ultrasonic, radar, hydrostatic or universal 4-20 mA/ HART level sensors

HART COMMUNICATION PROTOCOL

Endress+Hauser
People for Process Automation

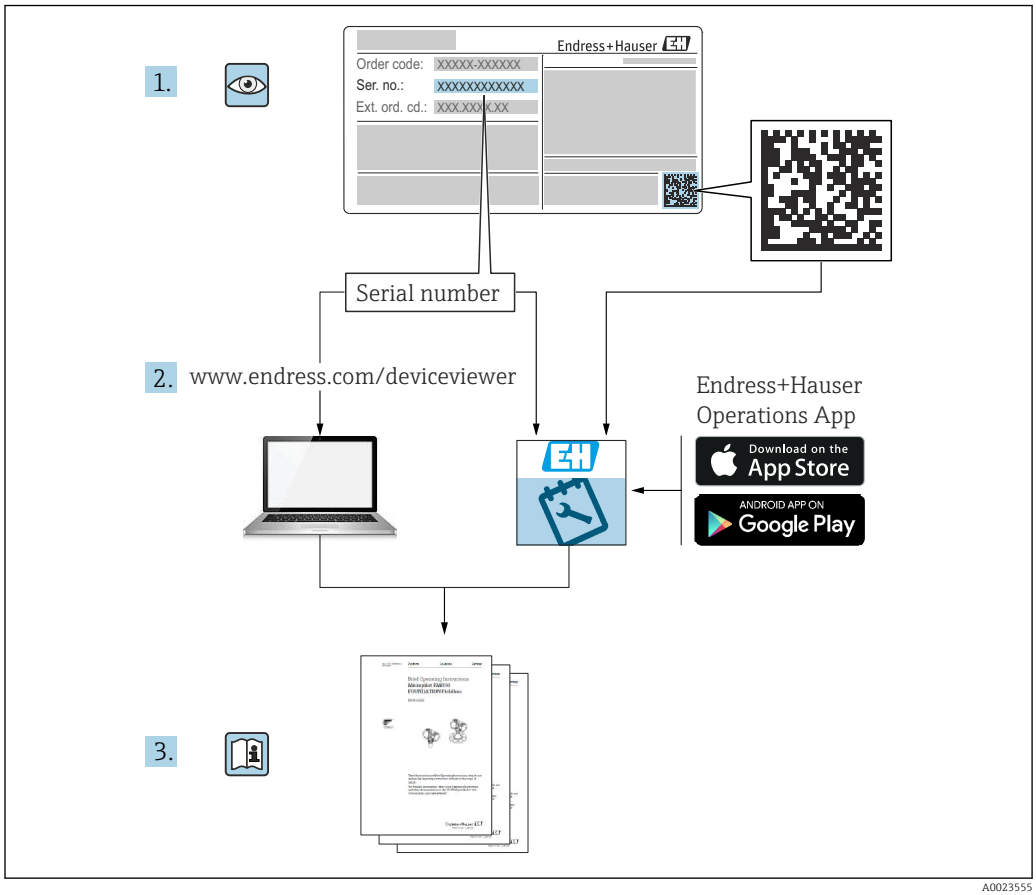
1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX XXX XX
Serial number
2. www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.
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Table of contents

1 About this document

1.1 Symbols

1.1.1 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 potentially dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

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

NOTICE
This symbol alerts you to a potentially harmful situation. Failure to avoid this situation can result in damage to the product or something in its vicinity.

1.1.2 Symbols for certain types of information

Symbol	Meaning
✓	**Permitted** Procedures, processes or actions that are permitted.
✓✓	**Preferred** Procedures, processes or actions that are preferred.
✗	**Forbidden** Procedures, processes or actions that are forbidden.
i	**Tip** Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
▶	Notice or individual step to be observed
1., 2., 3...	Series of steps
↳	Result of a step
?	Help in the event of a problem
	Visual inspection

1.1.3 Electrical symbols

⎓	Direct current	~	Alternating current	≂	Direct and alternating current
⏚	Ground connection	⊕	Protective earth (PE)		

1.1.4 Symbols in graphics

1, 2, 3,...	Item numbers	**A, B, C, ...**	Views

1.1.5 Symbols on the device

	**Warning** Observe the safety instructions contained in the associated Operating Instructions
	Device protected all over by DOUBLE INSULATION or REINFORCED INSULATION

1.2 Documentation

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

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads), depending on the device version:

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** The 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.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is a constituent part of the device documentation.

2 Safety instructions

2.1 Requirements for the personnel

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 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.

The operating personnel must fulfill the following requirements:
- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in this manual.

2.2 Intended use

The device is designed for the water and wastewater industry for the evaluation of measured values and device status, as well as for the configuration of the following Endress+Hauser sensors:
- Radar time-of-flight method: Micropilot FMR10B [1], FMR20B, FMR30B
- Hydrostatic level measurement: Waterpilot FMX11 [1], FMX21

Universal level sensors can also be connected to the 4 to 20 mA/HART inputs.

Typical measuring tasks
- Level measurement and linearization
- Flow measurement at open flumes and weirs
- Pump control
- Rake control

2.2.1 Product liability

The manufacturer does not accept any responsibility for damage that results from non-designated use and from failure to comply with the instructions in this manual.

2.3 Workplace safety

For work on and with the device:
- Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

Risk of injury!
- Operate the device only if it is in proper technical condition, free from errors and faults.
- The operator is responsible for interference-free operation of the device.

1) 4 to 20 mA only, configuration via HART not possible

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:
- If modifications are nevertheless required, consult with the manufacturer.

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 the repair of an electrical device.
- Use only original spare parts and accessories from the manufacturer.

Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):
- Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

2.5 Product safety

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

2.6 IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

2.7 Device-specific IT security

The device was developed in accordance with the requirements of the IEC 62443-4-1 "Secure product development lifecycle management" standard.

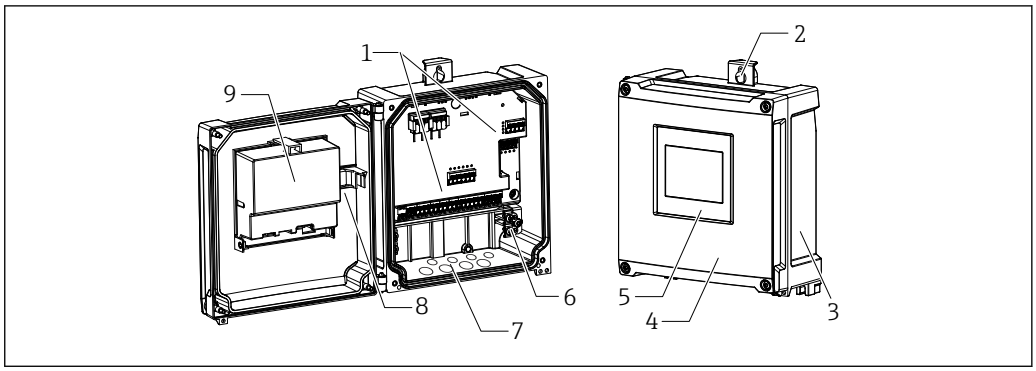
Link to the cybersecurity website: https://www.endress.com/cybersecurity

Further information on cybersecurity: see product-specific security manual (SD).

3 Product description

The following diagrams each show a possible version of the device. Depending on the device version, there may be more or fewer terminals.

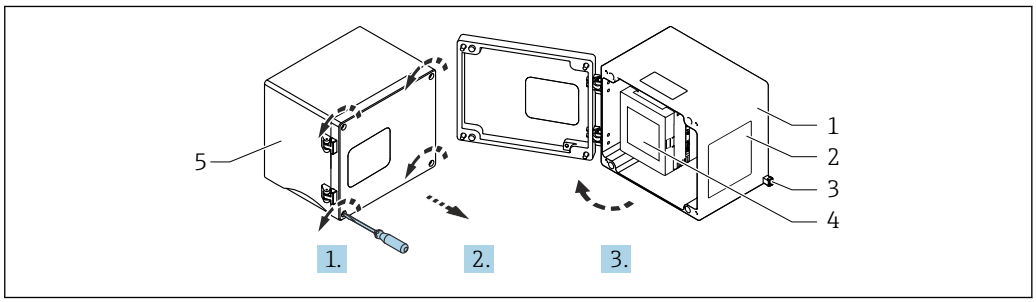
3.1 Product layout: polycarbonate field housing



1 *Structure of polycarbonate field housing*

1 *Terminals*
2 *Housing bracket*
3 *Nameplate*
4 *Cover of terminal compartment*
5 *Display and operating module*
6 *Grounding terminal block*
7 *Precut openings for cable entries*
8 *Display-to-mainboard connecting cable*
9 *Function diagram on CPU cover*

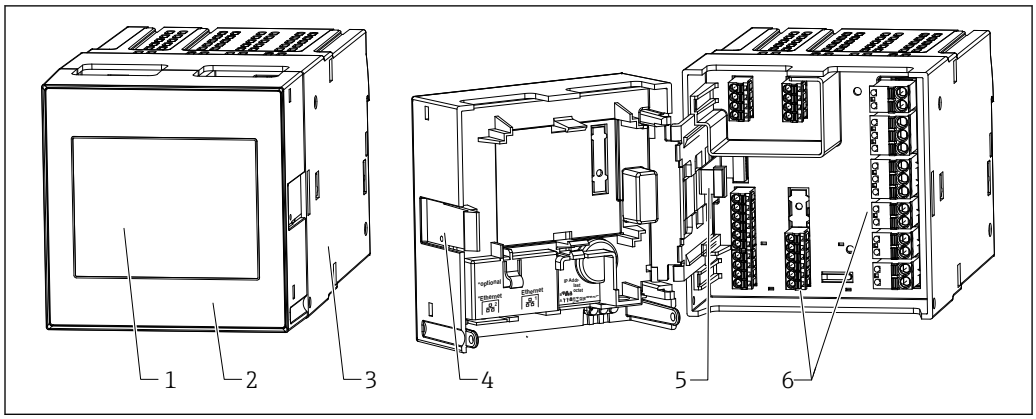
3.2 Product layout: aluminum field housing



2 *Access to terminal compartment in aluminum field housing*

1 *Aluminum field housing, open*
2 *Nameplate*
3 *Terminal for protective ground*
4 *Display and operating module NOHrD FMA90 (DIN rail device)*
5 *Aluminum field housing, closed*

3.3 Product design: DIN rail device



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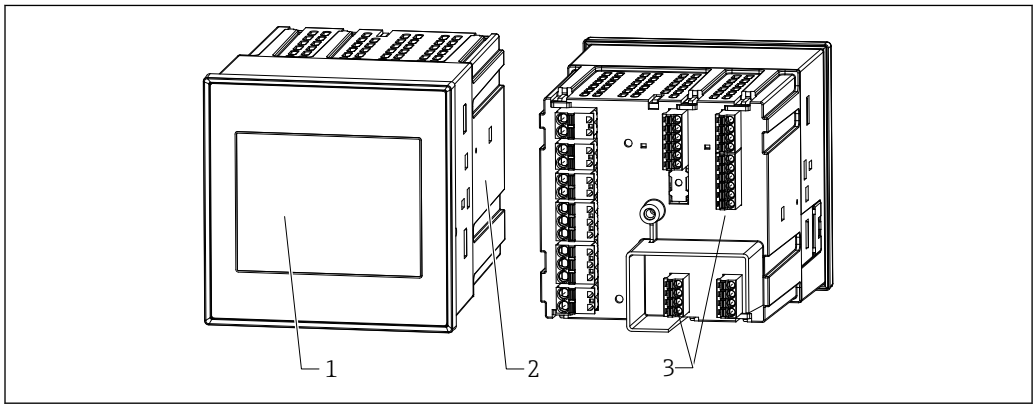
3 Structure of the DIN rail device

1 *Display and operating module (optional)*
2 *Cover of terminal compartment*
3 *Nameplate*
4 *Unlocking mechanism*
5 *Display-to-mainboard connecting cable*
6 *Terminals*

3.4 Product design: panel-mounted device



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4 Structure of the panel-mounted device

1 *Display and operating module*
2 *Nameplate*
3 *Terminals*

4 Incoming acceptance and product identification

4.1 Incoming acceptance

On receipt of the delivery:

1. Check the packaging for damage.
   ↳ Report all damage immediately to the manufacturer.
   Do not install damaged components.
2. Check the scope of delivery using the delivery note.

3. Compare the data on the nameplate with the order specifications on the delivery note.
4. Check the technical documentation and all other necessary documents, e.g. certificates, to ensure they are complete.

If one of the conditions is not satisfied, contact the manufacturer.

4.2 Product identification

The following options are available for identification of the device:
- Nameplate specifications
- Extended order code with breakdown of the measuring instrument features on the delivery note
- Enter the serial number on the nameplate into *Device Viewer* (www.endress.com/deviceviewer): all the information about the device and an overview of the Technical Documentation supplied with the device are displayed.

4.2.1 Nameplate

Do you have the correct device?

The nameplate provides you with the following information on the device:
- Manufacturer identification, device designation
- Order code
- Extended order code
- Serial number
- Tag name (TAG) (optional)
- Technical values, e.g. supply voltage, current consumption, ambient temperature, communication-specific data (optional)
- Degree of protection
- Approvals with symbols
- Reference to Safety Instructions (XA) (optional)

▶ Compare the information on the nameplate with the order.

4.2.2 Name and address of manufacturer

Name of manufacturer:	Endress+Hauser Wetzer GmbH + Co. KG
Address of manufacturer:	Obere Wank 1, D-87484 Nesselwang
Model/type reference:	FMA90

4.3 Storage and transport

Storage temperature: −40 to +80 °C (−40 to +176 °F)

Maximum relative humidity: < 95%

Pack the device for storage and transportation in such a way that it is reliably protected against impact and external influences. The original packaging provides the best protection.

Avoid the following environmental influences during storage:
- Direct sunlight
- Proximity to hot objects
- Mechanical vibration
- Aggressive media

5 Mounting

5.1 Mounting requirements

NOTICE

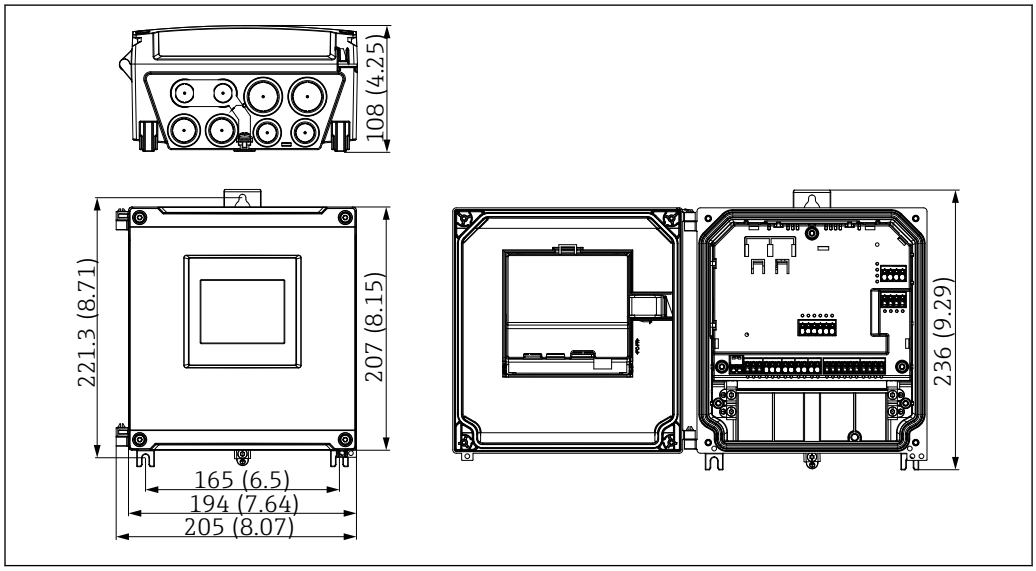
- When using in hazardous areas, the limit values of the certificates and approvals must be observed.

For information on ambient conditions, see the "Technical data" section.

5.2 Mounting the polycarbonate field housing

5.2.1 Mounting requirements

Dimensions of the polycarbonate field housing



5 *Dimensions of the polycarbonate field housing. Unit of measurement mm (in)*

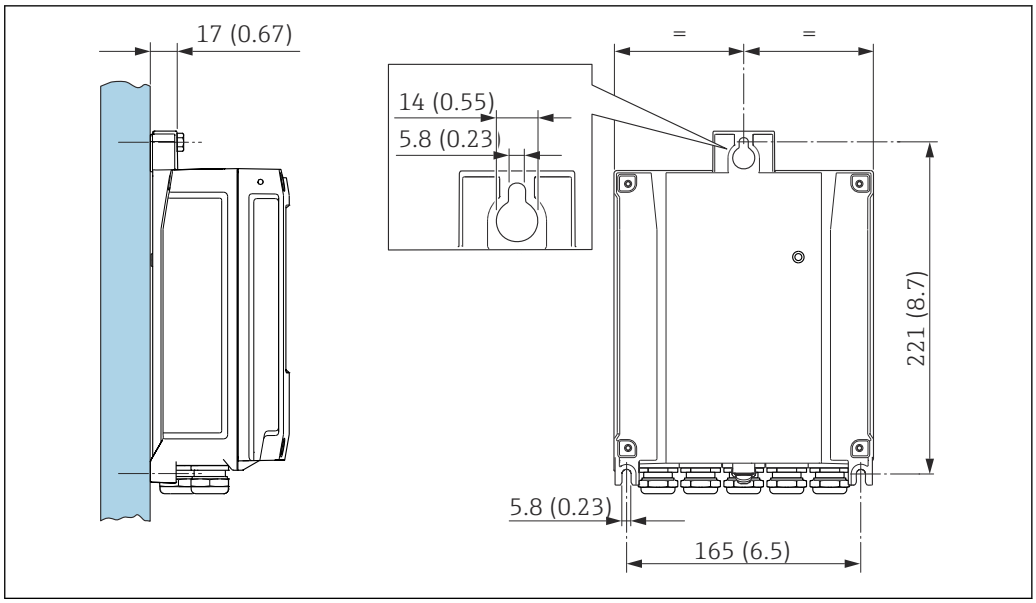
Mounting location

- Protected from direct sunlight. Use a weather protection cover if necessary.
- If mounting outdoors: use a surge arrester.
- Minimum clearance to the left: 55 mm (2.17 in); the housing cover cannot be opened otherwise.
- Orientation: vertical

5.2.2 Mounting the device

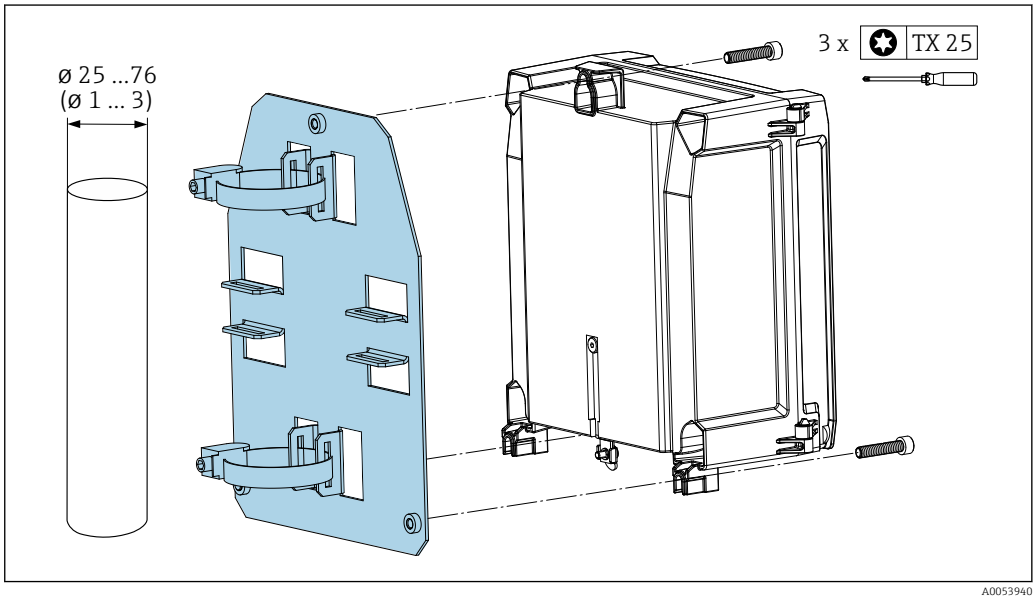
Wall mounting

The polycarbonate field housing is mounted directly on the wall using 3 screws (ϕ 5 mm (0.20 in), L: min. 50 mm (1.97 in); suitable wall plugs are recommended; not included in the scope of delivery).



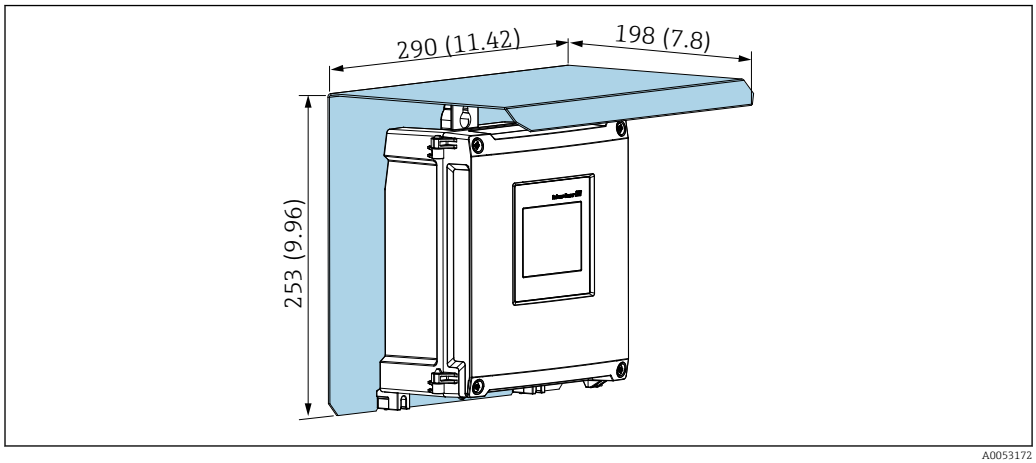
6 *Wall-mounted polycarbonate field housing. Unit of measurement mm (in)*

Pipe mounting (accessories) for polycarbonate field housing



7 *Mounting plate for pipe mounting of polycarbonate field housing. Unit of measurement mm (in)*

Mounting protective cover (accessories) for polycarbonate field housing



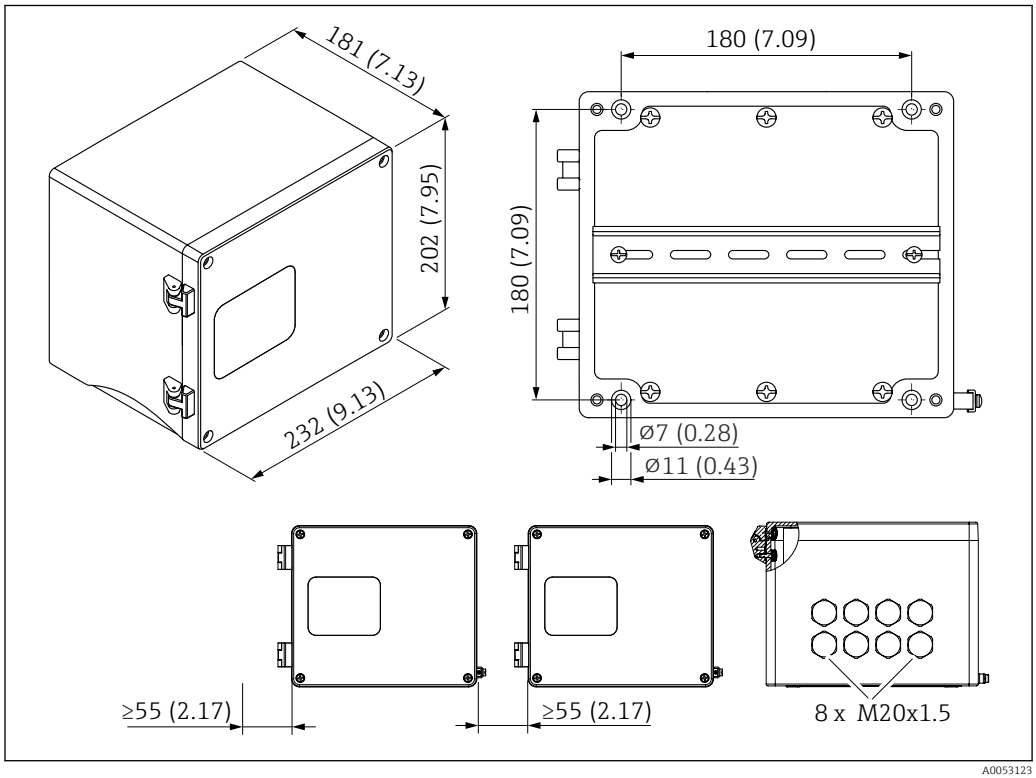
8 Protective cover (accessories) for direct wall mounting or using mounting plate (accessories) for pipe mounting. Unit of measurement mm (in)

5.3 Mounting the aluminum field housing

The DIN rail device can be installed in the aluminum field housing.

5.3.1 Mounting requirements

Dimensions of the aluminum field housing



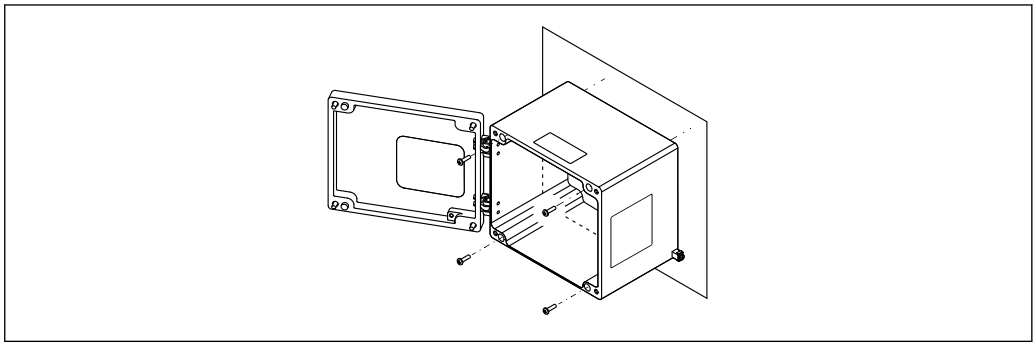
9 Dimensions of the aluminum field housing. Unit of measurement mm (in)

Mounting location

- Protected from direct sunlight
- If mounting outdoors: use a surge arrester
- Minimum clearance to the left: 55 mm (2.17 in), the housing cover cannot be opened otherwise

5.3.2 Mounting the device

The aluminum field housing is mounted directly on the wall using 4 screws (ϕ 7 mm (0.28 in), L: min. 50 mm (1.97 in); not included in the scope of delivery).



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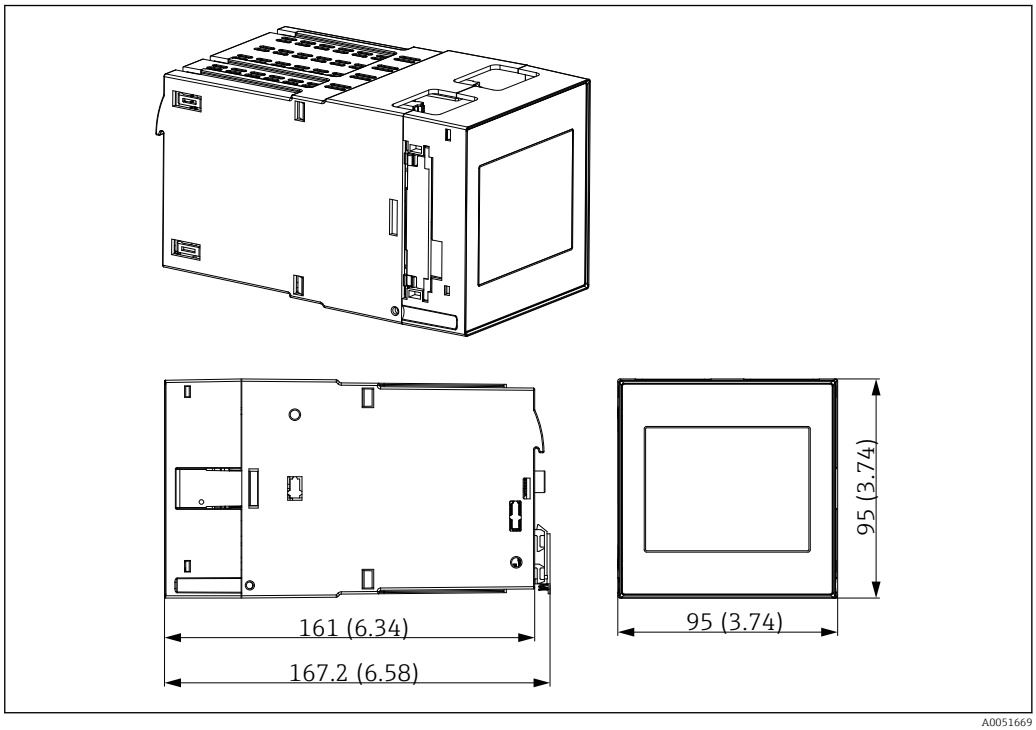
10 Wall-mounted aluminum field housing

5.4 Installing a DIN rail device

The DIN rail device is available with or without a display unit (optional). The installation is the same.

5.4.1 Mounting requirements

Dimensions



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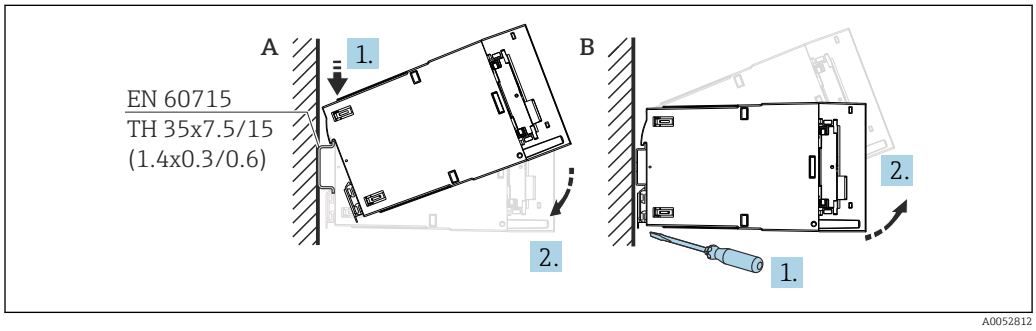
11 Dimensions of the DIN rail device. Unit of measurement mm (in)

Mounting location

- In the cabinet outside hazardous areas
- At a sufficient distance from high-voltage electric cables, motor cables, contactors or frequency converters
- Minimum distance to the left: 20 mm (0.8 in)
  To protect against overheating, keep the vents at the top and bottom free
- Orientation: vertical

5.4.2 Mounting the device



12 *Mounting/disassembling the DIN rail housing. Unit of measurement mm (in)*

A Mounting
B Disassembly (use a suitable tool to release the locking device at the bottom)

5.5 Mounting in a panel

5.5.1 Mounting requirements

Ensure compliance with the permitted ambient conditions during installation and operation. The device must be protected from exposure to heat.

Installation dimensions

Required panel cutout 92 mm (3.62 in) x 92 mm (3.62 in). Installation depth of 160 mm (6.3 in) for device and cable.

Mounting location

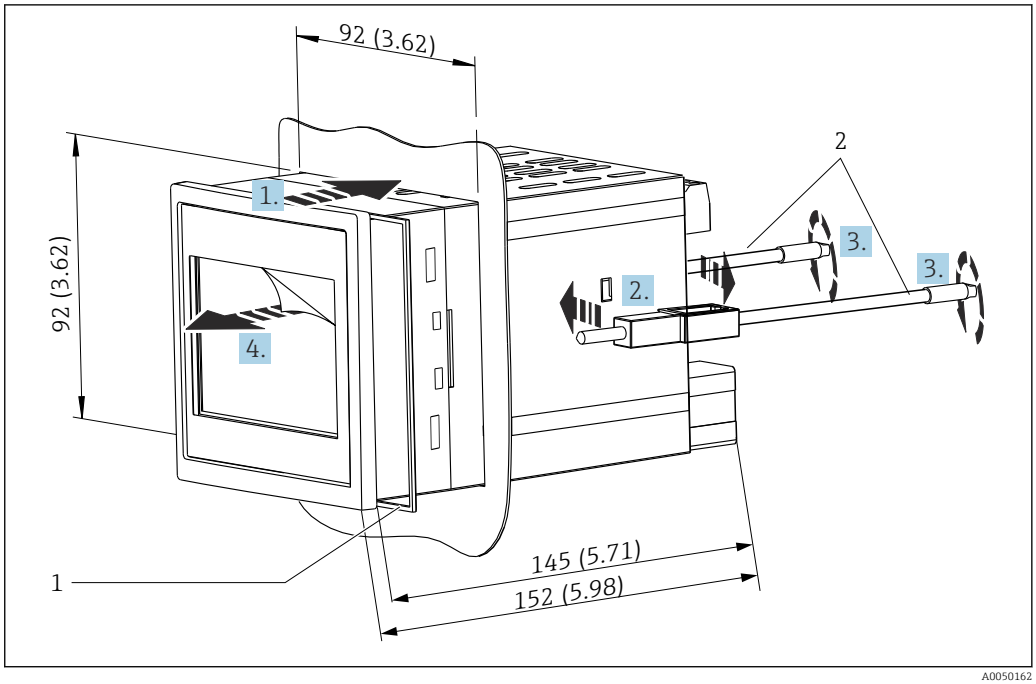
For installation in a panel. The mounting location must be free from vibrations. A suitable electrical, fire-proof and mechanical enclosure must be provided.

Orientation

- Vertical
- Lateral clearance (arranged side-by-side) min. 10 mm (0.4 in)

When connecting Ethernet cables, observe the clearance below.

5.5.2 Mounting the device



13 *Installation in a panel. Unit of measurement mm (in)*

Mounting the device in a panel

1. Push the device with the sealing ring (item 1) through the panel cutout from the front.
2. Hold the device horizontally and clip the fastening clips (item 2) into the openings provided on both sides.
3. Tighten the screws of the fastening clips uniformly using a screwdriver (fastening torque: 0.2 Nm).
4. Remove the protective film of the touch screen.

5.6 Disassembling the device

The device is disassembled by following the installation procedure in the reverse order.

5.7 Post-mounting check

Device condition and specifications	Notes
Is the device undamaged (visual inspection)?	-
Do the ambient conditions match the device specification (e.g. ambient temperature, measuring range etc.)?	See 'Technical data'
If provided: are the measuring point number and labeling correct?	-
Is the device mounted correctly? (Visual inspection)	-
Is the device adequately protected against precipitation and direct sunlight?	See Accessories

6 Electrical connection

6.1 Connecting requirements

⚠ CAUTION

Destruction of parts of the electronics

▶ Switch off power supply before installing or connecting the device.

For information on the connection data, see the "Technical data" section.

For the 85 to 253 V_{AC} version (mains connection), a switch marked as a circuit breaker, as well as an overload protection device (rated power ≤ 10 A) must be fitted in the supply line near the device (easy to reach).

For the 10.5 to 32 V_{DC}version: The device must only be powered by a power unit that operates using an energy-limited electric circuit according to UL/EN/IEC 61010-1, Section 9.4 and the requirements in Table 18.

Apart from the relay and the AC supply voltage, only energy-limited circuits according to IEC/EN 61010-1 shall be connected.

6.1.1 Cable specification

⚠ CAUTION

Unsuitable connection cables may cause overheating and fire hazards, insulation damage, electric shock, power loss, and reduced operating life.

▶ Only use connection cables that comply with the specifications below.

Minimum requirement: Cable temperature range ≥ ambient temperature +20 K

For all connections on the field device and for power and relay connections in the case of the panel-mounted and DIN rail device:
- **Conductor cross-section**: 0.2 to 2.5 mm^2 (26 to 14 AWG)
- **Cross-section with wire end ferrule**: 0.25 to 2.5 mm^2 (24 to 14 AWG)
- **Stripping length**: 10 mm (0.39 in)

For digital input, open collector and analog input/output connections in the case of panel-mounted and DIN rail device:
- **Conductor cross-section**: 0.2 to 1.5 mm^2 (26 to 16 AWG)
- **Cross-section with wire end ferrule (excluding collar/including collar)**: 0.25 to 1 mm^2 (24 to 16 AWG)/ 0.25 to 0.75 mm^2 (24 to 16 AWG)
- **Stripping length**: 10 mm (0.39 in)

6.1.2 Terminals

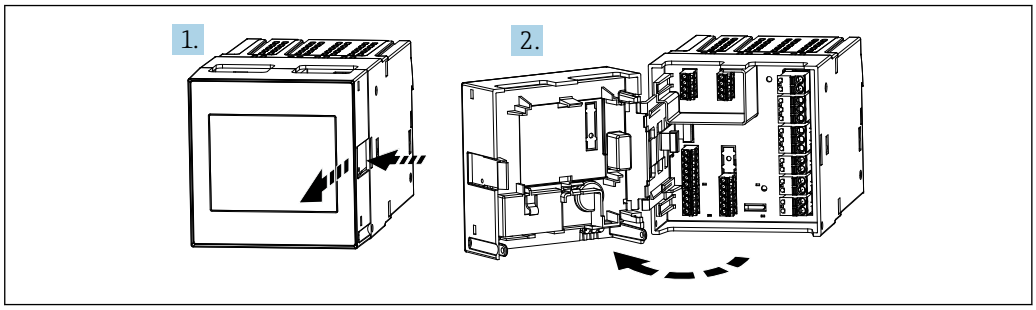
The device is fitted with push-in terminals. Rigid conductors or flexible conductors with ferrules can be inserted directly into the terminal without using the lever, and create a contact automatically.

6.2 Connecting the device

6.2.1 DIN rail device

Device version: Order code 040 (housing); option A (DIN rail mounting)

Access to terminals



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6.2.2 Panel-mounted device

Device version: Order code 040 (housing); option B (panel mounting)

Access to terminals

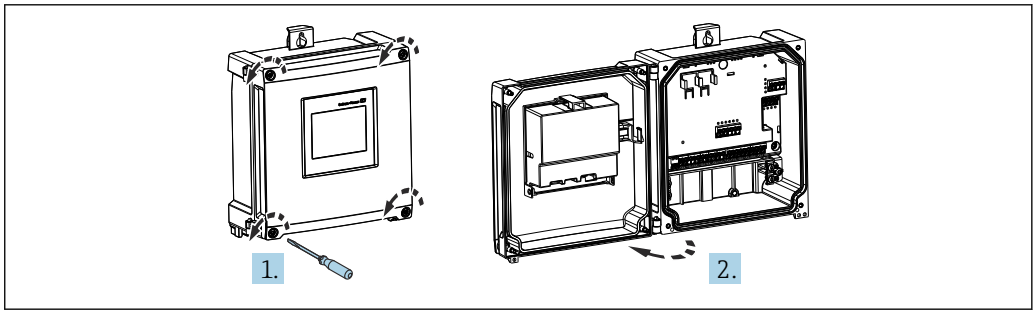
The terminals are freely accessible at the rear of the device.

6.2.3 Terminal compartment of polycarbonate field housing

Device version: Order code 040 (housing); option C (polycarbonate field housing)

Access to terminal compartment

Required tool: Torx T8 or flat-blade screwdriver



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14 *Access to terminal compartment in polycarbonate field housing*

Cable entries of polycarbonate field housing

Precut openings on the bottom of the housing for the following cable entries:
- M16x1.5 (4 openings)
- M20x1.5 (2 openings)
- M25x1.5 (2 openings)

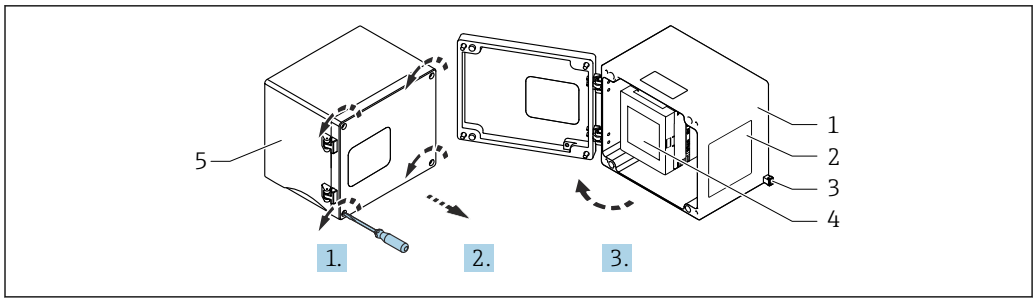
Use a suitable tool to cut out the required openings.

6.2.4 Terminal compartment of aluminum field housing

Device version: Order code 040 (housing); option D (aluminum field housing)

Access to terminal compartment

Required tool: Torx T8 or flat-blade screwdriver



15 *Access to terminal compartment in aluminum field housing*

1 *Aluminum field housing, open*
2 *Nameplate*
3 *Terminal for protective ground*
4 *FMA90 DIN rail device*
5 *Aluminum field housing, closed*

Cable entries for aluminum field housing

- There are eight M20x1.5 openings with blanking covers for cable glands on the bottom of the field housing.
- To establish the electrical connection: remove the blanking covers and replace them with cable glands. Guide the cables through the cable glands into the housing. The device is then connected in the same way as the DIN rail device.

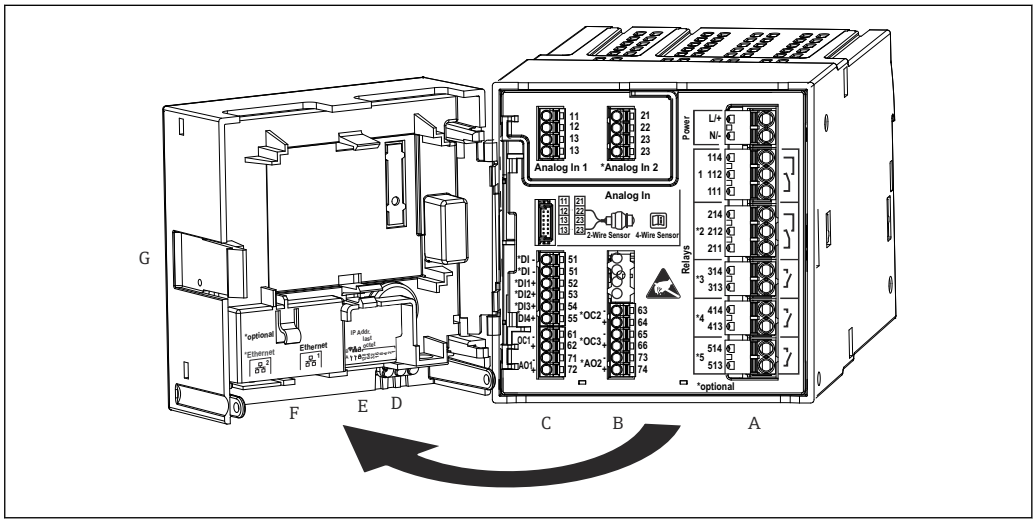
6.2.5 Terminal areas of DIN rail device

Device version

Order code 040 (housing); option A (DIN rail mounting)

The DIN rail device is designed for installation in the optional aluminum field housing.

The DIN rail device is available with or without a display unit (optional). The electrical connection is the same.



16 *Terminals for DIN rail device; terminal design: attachable push-in terminals*

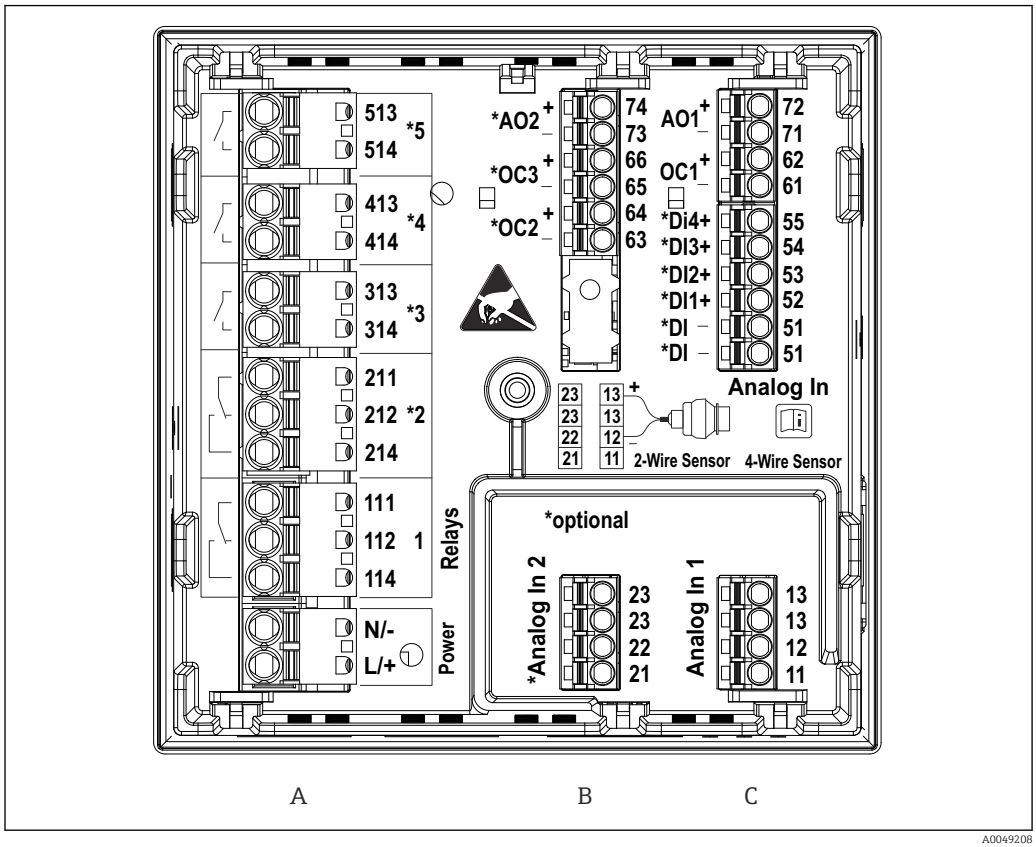
A Power unit with relay 1 (changeover contact). Optional: Relay 2 to 5
B I/O option card with analog input 2 (incl. loop power supply), analog output 2, open collector 2, 3
C Standard I/O card with analog input 1 (incl. loop power supply), analog output 1, open collector 1, optional: digital inputs 1 to 4
D 3 LEDs (only for version without display): DS (device status), NS (network status), WLAN
E DIP switch
F Ethernet connection 1 (standard), Ethernet connection 2 (optional)
G Unlocking device

The switching positions of the relays shown on the terminal area refer to the de-energized (current-free) state.

6.2.6 Terminal areas of panel-mounted device

Device version

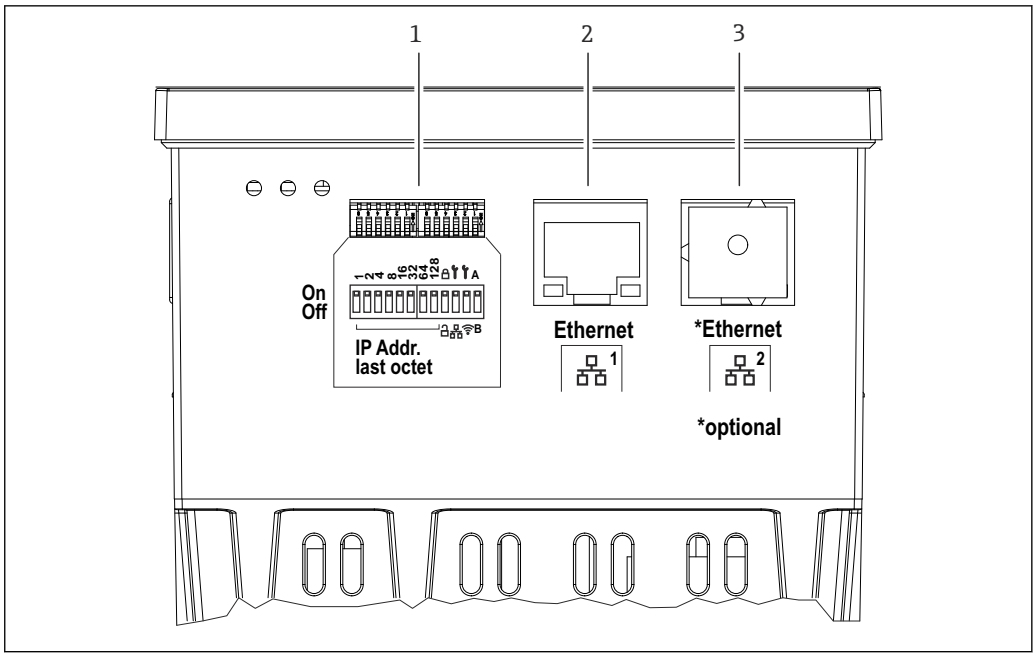
Order code 040 (housing); option B (panel mounting)



17 *Terminals for panel-mounted device (rear of device); terminal design: attachable push-in terminals*

A Power unit with relay 1 (changeover contact). Optional: Relay 2 to 5
B I/O option card with analog input 2 (incl. loop power supply), analog output 2, open collector 2, 3
C Standard I/O card with analog input 1 (incl. loop power supply), analog output 1, open collector 1, optional: digital inputs 1 to 4

The switching positions of the relays shown on the terminal area refer to the de-energized (current-free) state.



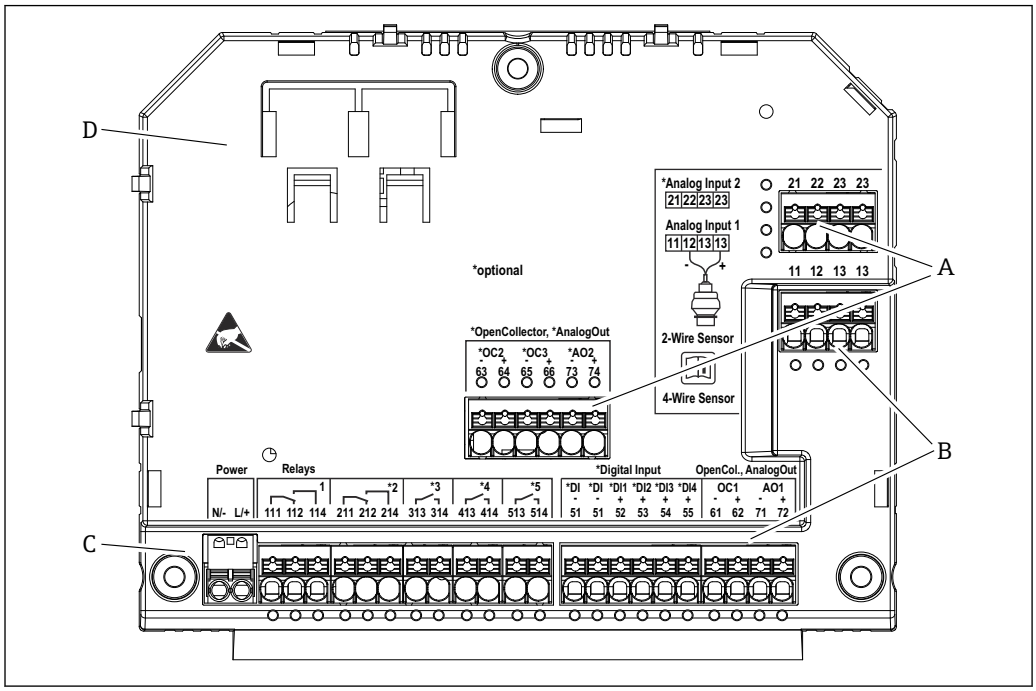
18 *Connections for panel-mounted device (underside of devices)*

1 DIP switch
2 Ethernet connection 1 (standard)
3 Ethernet connection 2 (optional)

6.2.7 Terminal areas of polycarbonate field housing

Device version

Order code 040 (housing); option C (field mounting, polycarbonate)



19 *Terminals in terminal compartment of polycarbonate field housing; terminal design: push-in terminals*

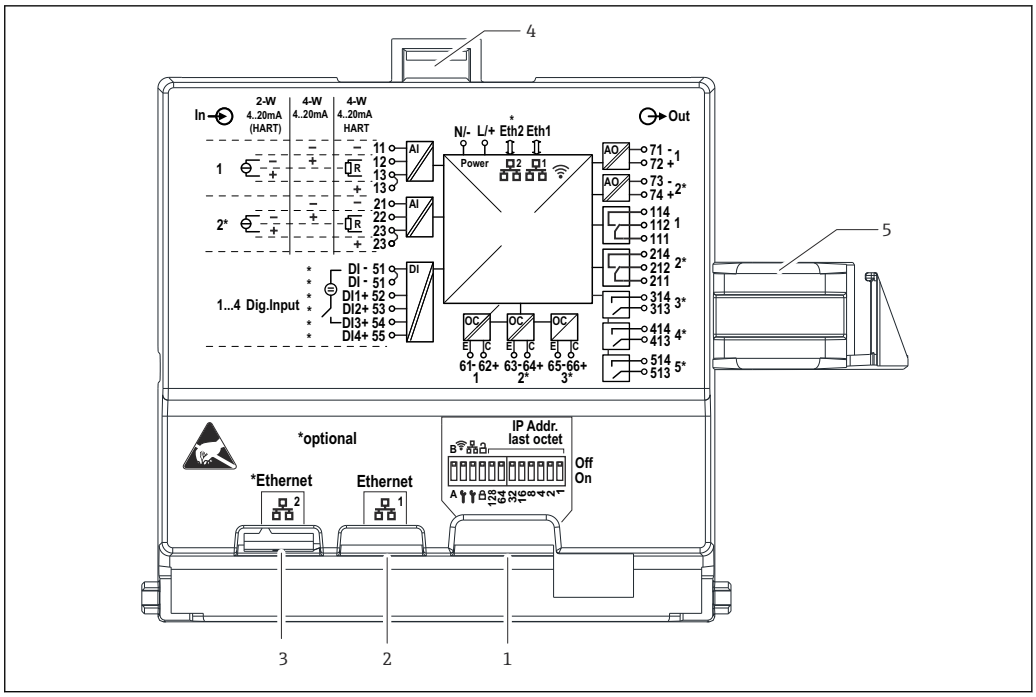
A Terminal area for analog input 2 (incl. loop power supply), analog output 2, open collector 2, 3
B Terminal area for analog input 1 (incl. loop power supply), analog output 1, open collector 1, optional: Digital inputs 1 to 4
C Terminal area for power supply and relay 1 (changeover contact). Optional: Relay 2 to 5
D Holder for commercially available shunting clamps

The switching positions of the relays shown on the terminal area refer to the de-energized (current-free) state.

Terminal areas on rear side of display for the polycarbonate field housing

Device version

Order code 040 (housing); option C (field mounting, polycarbonate)



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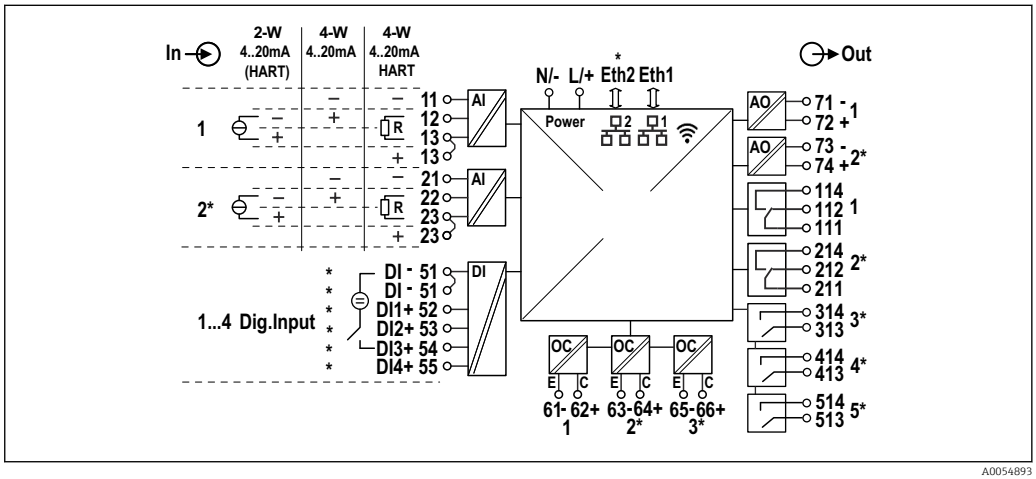
20 *Connections on the rear side of display for the polycarbonate field housing*

1 *DIP switch*
2 *Ethernet connection 1 (standard)*
3 *Ethernet connection 2 (optional)*
4 *Locking device*
5 *Connecting cable to the main board*

Adapters for RJ45 to M12 connectors are available as an option for the field housing (see "Accessories" section in Operating Instructions). The adapters connect the RJ45 Ethernet interfaces with the M12 connectors mounted in the cable entries. Therefore the connection to the Ethernet interface can be established via an M12 connector without opening the device.

6.2.8 Block diagram and terminal table

Function diagram



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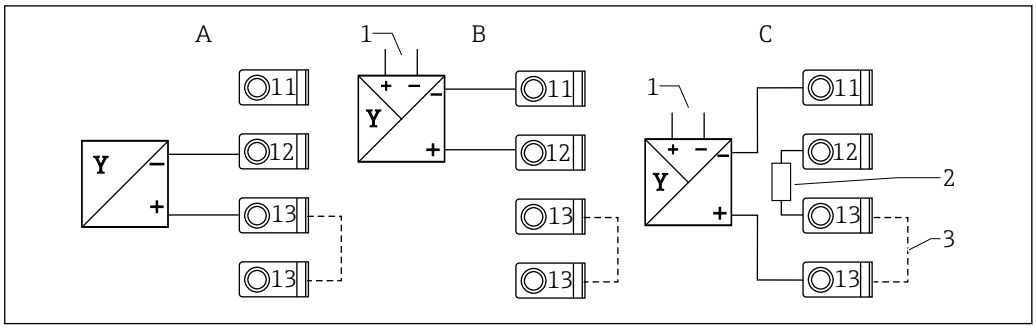
21 *Connection diagram (terminals marked with * depend on options)*

Terminal table

Terminal	Terminal assignment	Description
L/+	L for AC + for DC	Power supply
N/-	N for AC - for DC	
11	Only for 4-wire: - Current measuring input	Analog input 1
12	For 2-wire: - of sensor For 4-wire: + Current measuring input For 4-wire with HART: Communication resistor	
13	For 2-wire: + of sensor For 4-wire with HART: Communication resistor	
13	Only for 4-wire with HART: + of sensor output (LPS must be disabled)	
21	Only for 4-wire: - Current measuring input	Analog input 2 (optional)
22	For 2-wire: - of sensor For 4-wire: + Current measuring input For 4-wire with HART: Communication resistor	
23	For 2-wire: + of sensor For 4-wire with HART: Communication resistor	
23	Only for 4-wire with HART: + of sensor output (LPS must be disabled)	
51 (2x)	- For digital inputs 1 to 4	Digital inputs/switch inputs (optional)
52	+ Digital input 1 (external switch 1)	
53	+ Digital input 2 (external switch 2)	
54	+ Digital input 3 (external switch 3)	
55	+ Digital input 4 (external switch 4)	
61	-	Open Collector 1
62	+	
63	-	Open collector 2 (optional)
64	+	
65	-	Open collector 3 (optional)
66	+	
71	- (0/4 to 20 mA, HART)	Analog output 1
72	+ 0/4 to 20 mA	
73	- (0/4 to 20 mA)	Analog output 2 (optional)
74	+ 0/4 to 20 mA	
111	Normally closed (NC)	Relay 1
112	Common (COM)	
114	Normally open (NO)	
211	Normally closed (NC)	Relay 2 (optional)
212	Common (COM)	
214	Normally open (NO)	
313	Common (COM)	Relay 3 (optional)
314	Normally open (NO)	
413	Common (COM)	Relay 4 (optional)
414	Normally open (NO)	

Terminal	Terminal assignment	Description
513	Common (COM)	Relay 5 (optional)
514	Normally open (NO)	

6.2.9 Sensor connection



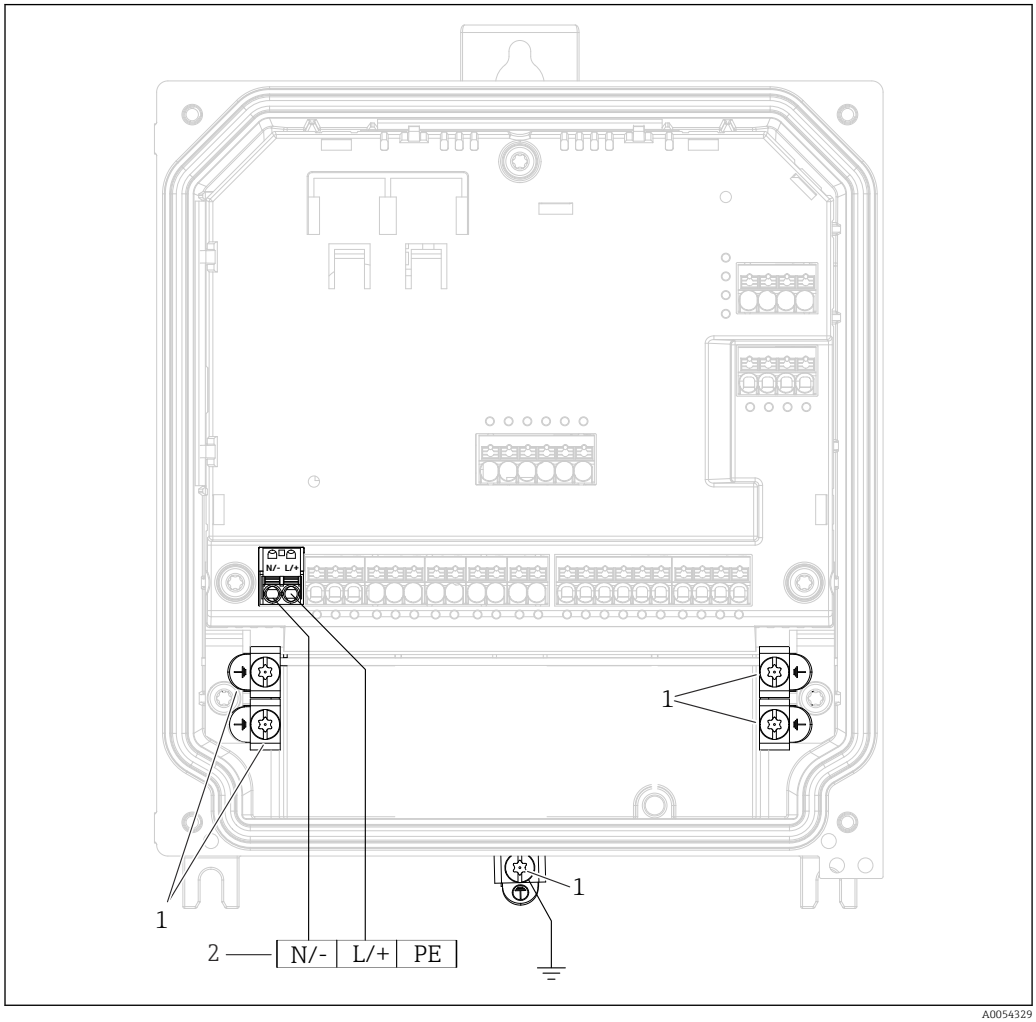
22 *Connection examples: 2-wire and 4-wire sensor on 4 to 20 mA current input or HART*

A Passive 2-wire sensor (LPS switched on), e.g. FMR10B, FMR20B, FMR30B, FMX11, FMX21
B Active 4-wire sensor, 4 to 20 mA
C Active 4-wire sensor, HART (LPS switched off)
1 External power supply
2 External HART communication resistor
3 Terminal 13 and 13 jumpered internally

Observe the relevant Operating Instructions when connecting a sensor.

6.3 Special connection instructions

6.3.1 Connection of the power supply in the polycarbonate field housing



23 *Connection of the power supply in the polycarbonate field housing*

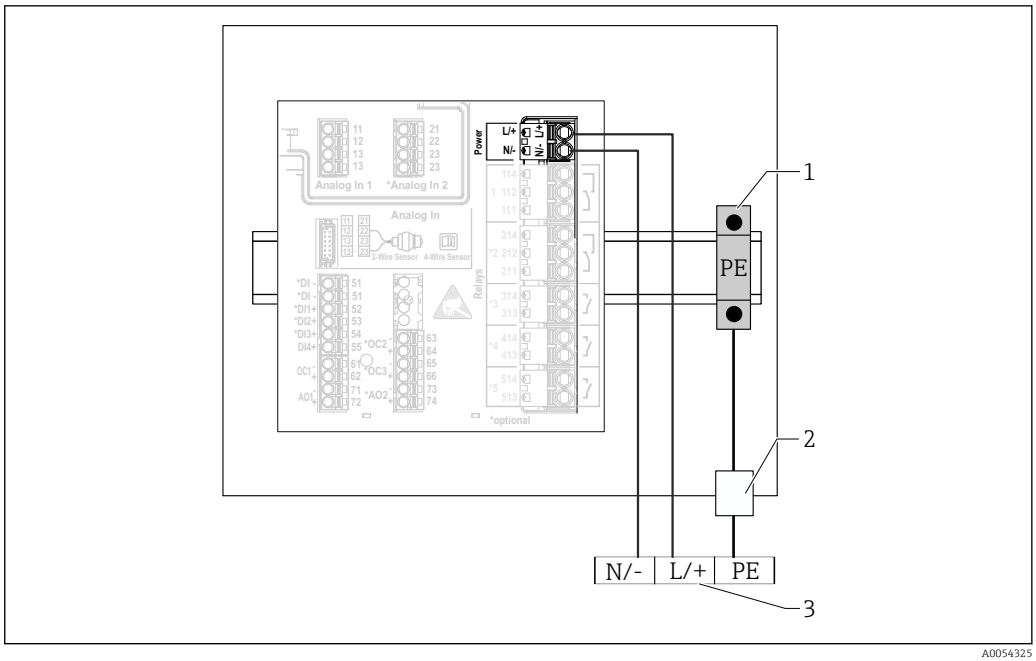
1 *Connection options for functional ground and shielding of signal lines*
2 *Connection of the power supply (see nameplate)*

6.3.2 Connection of the power supply in the aluminum field housing

WARNING

Shock hazard and explosion hazard

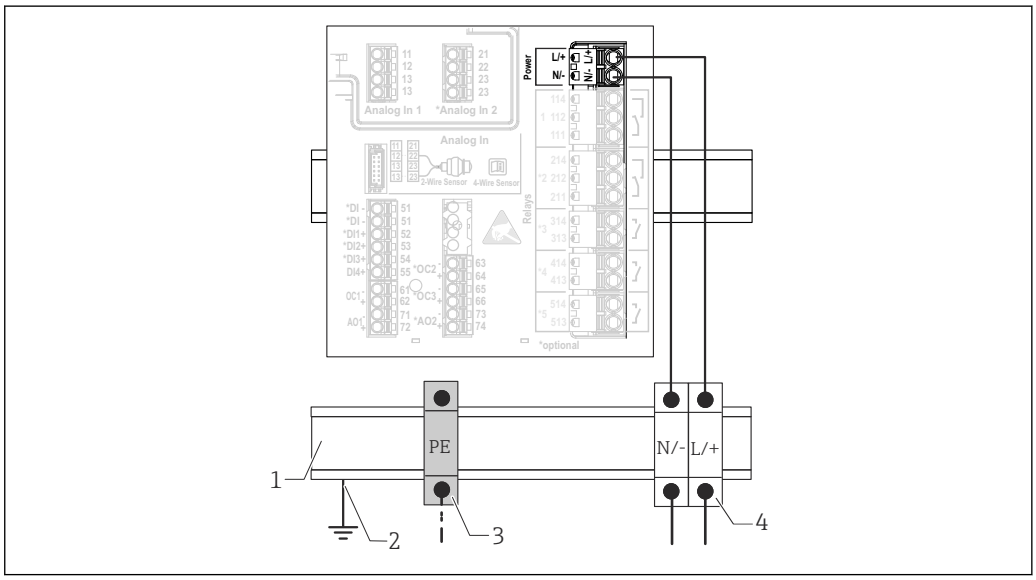
- Connect the aluminum field housing to the potential earth (PE) and/or the local ground potential (PML) via the protective ground terminal.



24 *Connection of the power supply in the aluminum field housing*

1 *Protective ground terminal strip (with contact to DIN rail)*
2 *Protective ground terminal on the outside of the field housing*
3 *Connection of the power supply (see nameplate)*

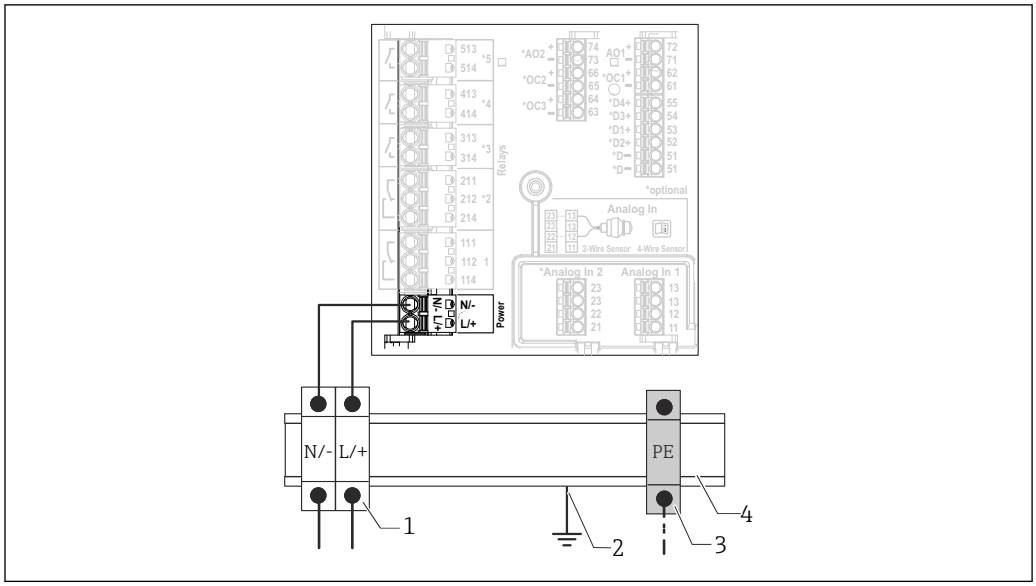
6.3.3 Connection of the power supply on the DIN rail device



25 *Connection of the power supply on the DIN rail device*

1 *Metal DIN rail in cabinet*
2 *Grounding via DIN rail*
3 *Protective ground terminal strip (with contact to DIN rail)*
4 *Terminal blocks (no contact with DIN rail); connection of power supply (see nameplate)*

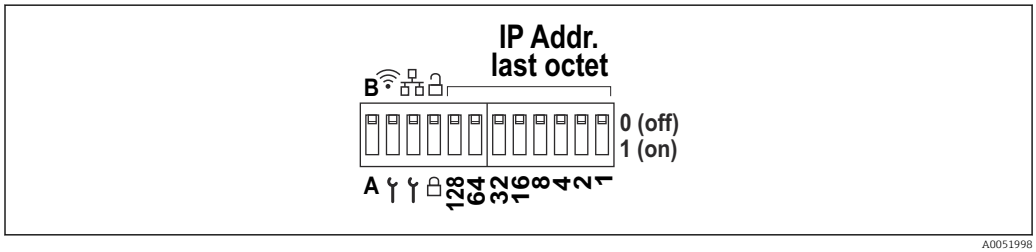
6.3.4 Connection of the power supply on the panel-mounted device



26 *Connection of the power supply on the panel-mounted device*

1 *Terminal blocks (no contact with DIN rail); connection of power supply (see nameplate)*
2 *Grounding via DIN rail*
3 *Protective ground terminal strip (with contact to DIN rail)*
4 *Metal DIN rail in cabinet*

6.4 Hardware settings



27 *DIP switch (drawing shows the delivery settings)*

The following settings are made at the DIP switch (from left to right):
- A/B: Reserve (currently no function)
- Activate/deactivate the WLAN service IP address (192.168.**2**.212)
- Activate/deactivate the LAN service IP address (192.168.**1**.212)
- Write protection switch: locks the device to prevent modifications to the configuration
- 128 to 1: last octet of IP address (192.168.1.xxx) or hardware address for PROFINET

The LAN and WLAN must not be in the same subnet.

6.5 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions, and which are necessary for the required intended use, may be established on the device delivered.

6.5.1 DIN rail device

The device meets all the requirements of IP20 protection.

6.5.2 Panel-mounted device

The device fulfills all the requirements for the IP65/NEMA type 4 (front) and IP20 (rear) degree of protection.

Carry out the following steps after electrical connection to ensure the degree of protection:

1. Check that the housing seal to the panel is clean and fitted correctly. Dry, clean or replace the seal if necessary.
2. Tighten all the fastening clips.

6.5.3 Field housing

The field housing fulfills all the requirements for the IP65/NEMA type 4X degree of protection.

Carry out the following steps after electrical connection to ensure the degree of protection:

1. Aluminum field housing: The device must be mounted and connected on a DIN rail in the field housing as described in this manual.
2. Polycarbonate field housing: Check that the housing seal is not damaged. Dry, clean or replace the seal if necessary.
3. Tighten all housing screws and screw covers. (Tightening torque: 1.3 Nm (1 lbf ft))
4. Firmly tighten the cable glands.
5. To ensure that moisture does not enter the cable entry, route the cable so that it loops down before the cable entry ("water trap").

6.6 Post-connection check

Device condition and specifications	**Notes**
Are the device and cable undamaged (visual inspection)?	-
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	-
Are the power supply and signal cables connected correctly?	-
Are the mounted cables strain-relieved?	-
Are all the connections of the terminals, ground terminals, etc. checked?	-
For field housing: Are the cable glands tightened correctly? Are the cover screws on the connection compartment cover firmly tightened? (Visual inspection)	-

7 Operation options

7.1 Structure and function of the operating menu

7.1.1 Structure of the operating menu

Menu	Typical tasks	Contents/Submenu [1)]
Guidance	Main functions for use: From fast and reliable commissioning to guided support during operation.	▪ **Commissioning ("Maintenance" only)** This wizard guides through the commissioning of the device. ▪ **Certificate management** Import of certificates for the web server or other services, as well as the creation of certificates for reliable communication. ▪ **Import/Export** Option for file import and export viaand web server
Diagnostics	Troubleshooting and preventive maintenance: Device behavior settings for process and device events and help and measures for diagnostic purposes.	Contains all parameters for detecting and analyzing errors: ▪ **Active diagnostics** Shows the current diagnostic message with the highest priority, the last diagnostic message and the operating time of the device ▪ **Diagnostic list** Shows the current diagnostic events pending ▪ **Event logbook** Shows all event messages in chronological order ▪ **Minimum/maximum values** Shows the lowest and highest electronics temperature measured to date, the minimum/maximum level values linearized to date and the minimum/maximum volume flow rate with the respective timestamps. The values can be reset. ▪ **Simulation** Simulation of a process variable, a pulse output or a diagnostic event ▪ **Diagnostic settings** Contains all parameters for configuring error events ▪ **HART master** Diagnostic information for checking the quality of the HART signal and HART communication

Menu	Typical tasks	Contents/Submenu [1]
Application	Targeted optimization for the specific application: Comprehensive device settings from sensor technology to system integration for optimum application adjustment.	Contains all parameters for commissioning an application: ▪ **Measured values** Displays the current measured values and status of the applications ▪ **Operating mode** Use this function to select the operating mode (normal operating mode or configuration mode), as well as the logging interval and the application ▪ **Units** Contains all parameters for configuring the engineering units ▪ **Sensors** Contains all parameters for configuring the sensors ▪ **Level** Contains all parameters for level configuration ▪ **Pump control** Contains all the parameters for configuring pump control ▪ **Flow** Contains all parameters for flow configuration ▪ **Backwater detection** Contains all parameters for configuring backwater detection ▪ **Calculations** Enables average calculations and totalizers for level and flow ▪ **Totalizer** Enables a reset of the totalizer ▪ **Rake control** Contains all parameters for configuring rake control ▪ **Digital inputs** Contains all parameters for configuring the digital inputs ▪ **Limit values** Contains all parameters for configuring the limit values ▪ **Current output** Contains all parameters for configuring the current outputs ▪ **HART output (optional)** Contains all parameters for configuring the HART outputs ▪ **Relay** Contains all parameters for configuring the relays ▪ **Open collector** Contains all parameters for configuring the open collector outputs
System	Comprehensive device management and security settings: Management of system settings and adjustment to the operating requirements.	Contains all higher-level device parameters that are assigned to system, device and user management. ▪ **Device management** Contains all parameters for general device management ▪ **Security** Contains all parameters for device security and user administration ▪ **Connectivity** Contains the parameters for configuring the communication interfaces ▪ **Web server** Contains all parameters for the web server ▪ **Display** Configuration of the on-site display ▪ **Date/time** Configuration and display of date/time ▪ **Geolocation** Configuration of GPS coordinates for the device ▪ **Information** Contains all parameters for unique identification of the device ▪ **Hardware configuration** Overview of the hardware configuration ▪ **Software configuration** Updates, activation and overview of the software
Visualization	Tasks during operation: Create and display groups for the visualization of measured values.	**Group 1 to 6** Configuration, display and visualization of the current measured values in groups
Help	Additional information on the device	Displays QR codes with external links (product page, training videos, etc.)

1) The visibility of the submenus depends on the device configuration and the selected ordering options.

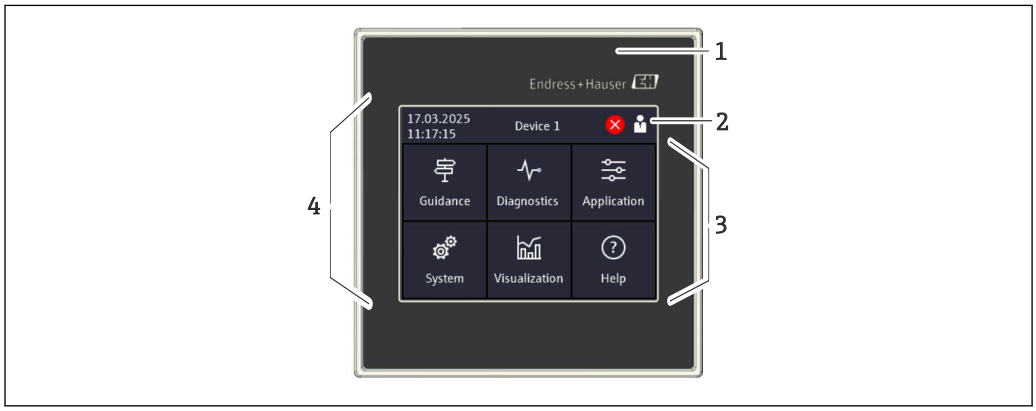
For a detailed overview of all operating parameters, see the associated description of device parameters (GP)

7.2 Access to the operating menu via the local display

The device can be operated intuitively via the 3.5" TFT touch display (order option). Once switched on, the device responds by displaying the start screen. The device is operated using buttons, drop-down lists and input fields. A screen keyboard is available for alphanumeric entries. Drop-down lists and visualization menus (measured value displays) can be operated by swiping vertically/horizontally.

7.2.1 Elements on front of device with touch display

The device version without display features 3 LEDs: DS (device status), NS (network status) and WLAN status at the bottom left instead of the display



1 *Front of device*
2 *Header: date/time, tag name, diagnostic information, quick access menu (logging in/log out, language)*
3 *Function tiles for display and touch operation*
4 *Touch display*

7.2.2 Light emitting diodes (LEDs)

The LEDs are only visible with the DIN rail version without touch display.

DS (device status): LED for operating status

- **Lit green**
  Normal operation; no faults detected.
- **Flashes red**
  Warning is pending. Details are saved in the diagnostic list.
- **Lit red**
  Alarm is pending. Details are saved in the diagnostic list.
- **Off**
  No supply voltage.

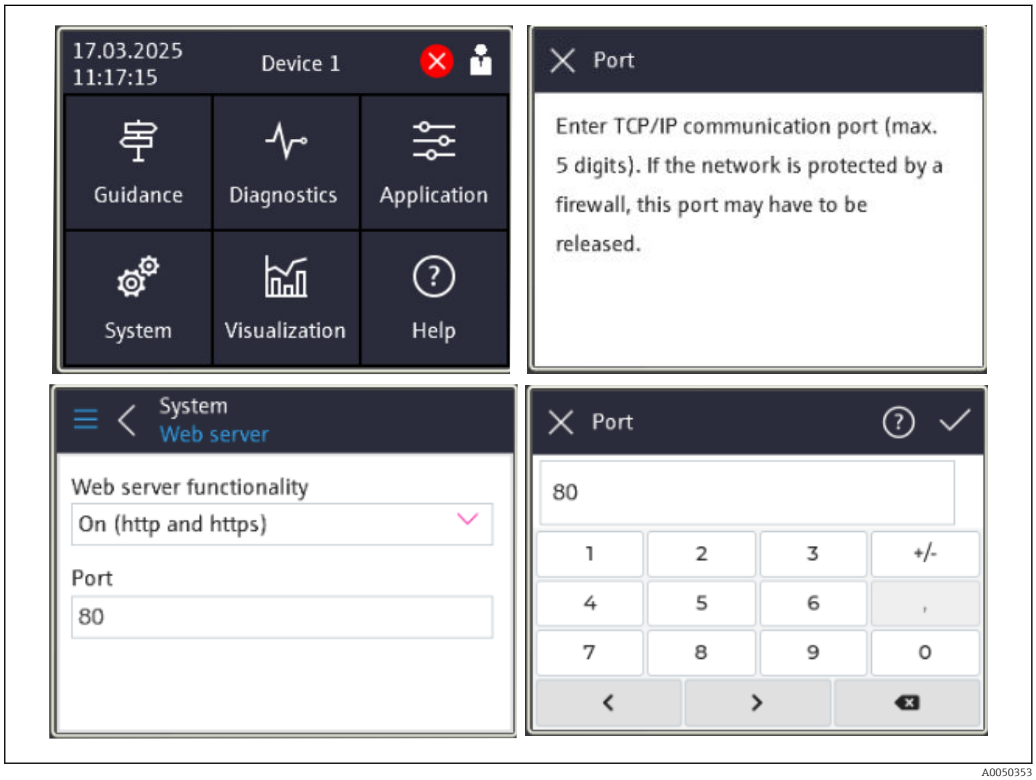
NS (network status): LED for PROFINET or Ethernet/IP

- **Lit red**
  Communication active
- **Lit green**
  Connection established, no active communication
- **Off**
  No connection

WLAN: LED for communication

- **Flashing blue**
  Searching for WLAN access point
- **Lit blue**
  Connection established
- **Off**
  No connection

7.2.3 Operation via touch display



28 *Operating menu on the touch display: Start screen, submenu with input fields, screen keyboard, online help*

The ✔ symbol with the "OK" or "Confirm entry" function appears in the top right of each dialog box.

The value is accepted and the dialog box closes by clicking ✔.

The ☒ symbol with the "Back" or "Cancel" function appears in the top left of each dialog box.

Pressing ☒ closes the dialog box without accepting the value entered.

Help: The ⓘ symbol appears in the top right of each dialog box and can be used to call up the integrated help function.

Pressing ☒ closes help.

7.3 Access to operating menu via web browser

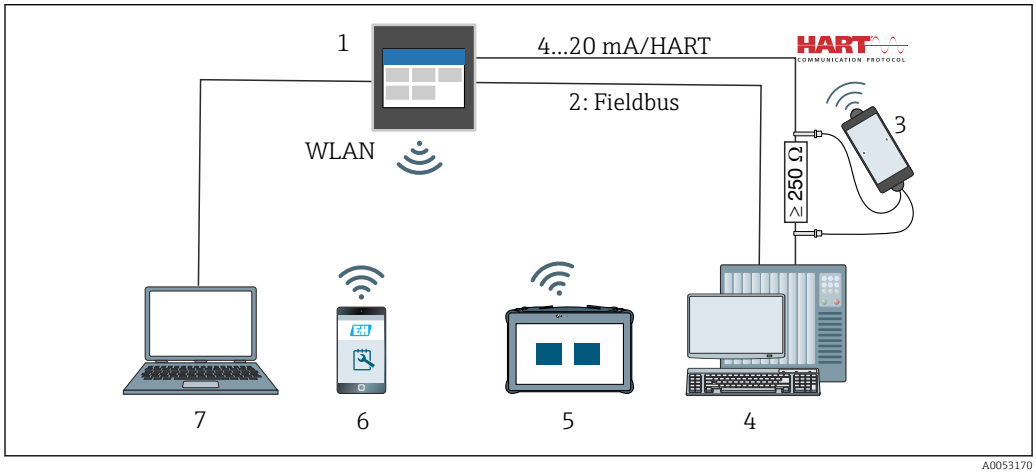
The device can be operated and configured via a web browser with the integrated web server. The web server is enabled when the device is delivered, but can be disabled via an appropriate parameter. Access to the web server always requires entering a PIN. For device versions with Industrial Ethernet communication types, the connection can be established at the signal transmission port via the network.

Function range

Thanks to the integrated web server, the device can be operated and configured using a web browser via the LAN or WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is displayed which can be used to monitor device health. Furthermore the device data can be managed and the network parameters can be configured.

A device which has a WLAN interface (optional) is required for the WLAN connection.

8 System integration



29 *System integration*

1 *FlexView FMA90*
2 *Fieldbus: PROFINET, Modbus TCP, EtherNet/IP to PLC (optional)*
3 *HART modem with connection cable, e.g. Commubox FXA195 or VIATOR Bluetooth (restricted operation)*
4 *PLC via HART protocol (FDI package, restricted operation)*
5 *Field Xpert SMT70 via WLAN and web server*
6 *Operation and configuration via WLAN and web server*
7 *Operation and configuration via Ethernet and web server*

8.1 Overview of device description files

- Manufacturer ID: 17 (0x0011)
- Device type ID: 0x11DD
- HART specification: 7.9
- DD files, information and files can be found at:
  www.endress.com
  www.fieldcommgroup.org

8.2 Measured variables via HART protocol (slave)

It is possible to change the assignment of device variables to process variables in the **Application → HART output → Process variables** menu.

Detailed overview of all device variables: see the corresponding description of Device Parameters (GP)

8.3 Supported HART commands (slave)

The integrated HART slave of the device supports the following commands:

Command No.	Description
Universal commands	
0, Cmd0	Read unique identifier
1, Cmd001	Read primary variable
2, Cmd002	Read loop current and percent of range
3, Cmd003	Read dynamic variables and loop current
6, Cmd006	Write polling address
7, Cmd007	Read loop configuration
8, Cmd008	Read dynamic variable classifications
9, Cmd009	Read device variables with status
11, Cmd011	Read unique identifier associated with TAG
12, Cmd012	Read message
13, Cmd013	Read TAG, descriptor, date
14, Cmd014	Read primary variable transducer information
15, Cmd015	Read device information
16, Cmd016	Read final assembly number
17, Cmd017	Write message
18, Cmd018	Write TAG, descriptor, date
19, Cmd019	Write final assembly number
20, Cmd020	Read long TAG (32-byte TAG)
21, Cmd021	Read unique identifier associated with long TAG
22, Cmd022	Write long TAG (32-byte TAG)
38, Cmd038	Reset configuration changed flag
48, Cmd048	Read additional device status
Common practice commands	
33, Cmd033	Read device variables
35, Cmd035	Write primary variable range values
40, Cmd040	Enter/Exit fixed current mode
44, Cmd044	Write primary variable units
45, Cmd045	Trim loop current zero
46, Cmd046	Trim loop current gain
50, Cmd050	Read dynamic variable assignments
51, Cmd051	Write dynamic variable assignments
54, Cmd054	Read device variable information
59, Cmd059	Write number of response preambles
60, Cmd060	Read analog channel and percent of range
63, Cmd063	Read analog channel information
72, Cmd072	Squawk
95, Cmd095	Read Device Communication Statistics
100, Cmd100	Write Primary Variable Alarm Code

Command No.	Description
226, Cmd226	Firmware version string
227, Cmd227	Serial number string
228, Cmd228	Extended order code string
231, Cmd231	Device status
233, Cmd233	Order code string
234, Cmd234	ENP version string
236, Cmd236	Start-up time
516, Cmd516	Read Device Location
517, Cmd517	Write Device Location
518, Cmd518	Read Location Description
519, Cmd519	Write Location Description
520, Cmd520	Read Process Unit Tag
521, Cmd521	Write Process Unit Tag
523, Cmd523	Read Condensed Status Mapping Array
524, Cmd524	Write Condensed Status Mapping Array
525, Cmd525	Reset Condensed Status Mapping Array
526, Cmd526	Write Simulation Mode
527, Cmd527	Simulate Status Bit
Device Specific Commands	
194, Cmd194	Read Parameter via HART Index
195, Cmd195	Write Parameter via HART Index
226, Cmd226	Firmware version string
227, Cmd227	Serial number string
228, Cmd228	Extended order code string
231, Cmd231	Device status
233, Cmd233	Order code string
234, Cmd234	ENP version string
236, Cmd236	Start-up time

9 Commissioning

9.1 Post-installation check

Make sure that all installation and connection checks have been carried out before putting the device into operation.

NOTICE

- Before commissioning the device, make sure that the supply voltage matches the voltage specifications on the nameplate. Failure to perform these checks may result in damage to the device caused by the incorrect supply voltage.

9.2 Switching on the device

Once the supply voltage has been applied, the display or the status LED indicates that the device is ready for operation.

If you are commissioning the device for the first time, program the setup as described in the following sections.

If you are commissioning a device that is already configured or preset, the device starts measuring immediately as defined in the settings. The values of the channels currently activated are shown on the touch display.

Remove the protective film from the touch display as this will otherwise affect the readability of the display.

9.3 Configuring the operating language at the device

Factory setting: English or local language ordered

(Only relevant for version with touch display)

You can change the language under "Language" using the quick access menu at the top right in the header.

1. Select the required language from the "Language" drop-down list
2. Confirm selection by pressing "✔" in the top right

The operating language has been changed.

9.4 User management and permissions

The access control concept consists of several hierarchical levels for different users. User management reflects the various requirements with specific read and write rights.

Settings are configured in the **System** → **Security** menu.

- **Operator** (logged-out status)
  An **operator** can only change settings that have no effect on the application. The operator is able to read most of the parameters, however.
- **Maintenance (factory setting)**
  A **Maintenance** role is assigned to the device configuration. It is possible to change the most important parameters.
- **Service** (exclusively for the manufacturer's service technicians)
  The **Service** role is primarily intended for diagnostics and troubleshooting. It allows configuration and modification of the relevant parameters.
- **Production**
  Internal account for service cases and repair Deactivated in delivery state, can only be activated by the customer’s maintenance technician.
- **Developer**
  Internal account for service cases and repair Deactivated in delivery state, can only be activated by the customer’s maintenance technician.

Settings in the **System → Security → Device PIN** menu
- Creating, changing or deleting **Maintenance PIN**.
  To restrict access to certain device functions, a PIN can be assigned to the **Maintenance** user. This activates the **Operator** user as the lowest hierarchy level, without a PIN prompt. This PIN can only be changed or deactivated by the **Maintenance** user.
- Creating, changing or deleting the **operator PIN** (required for web server access)

- **As-delivered state**
  The device is delivered with the **Maintenance** user activated. This default state makes it possible to commission the device and make other process adjustments directly on the device without having to enter a password. Access to the web server always requires a PIN.
  - **Initial PIN** for Operator and Maintenance technician: **0000**

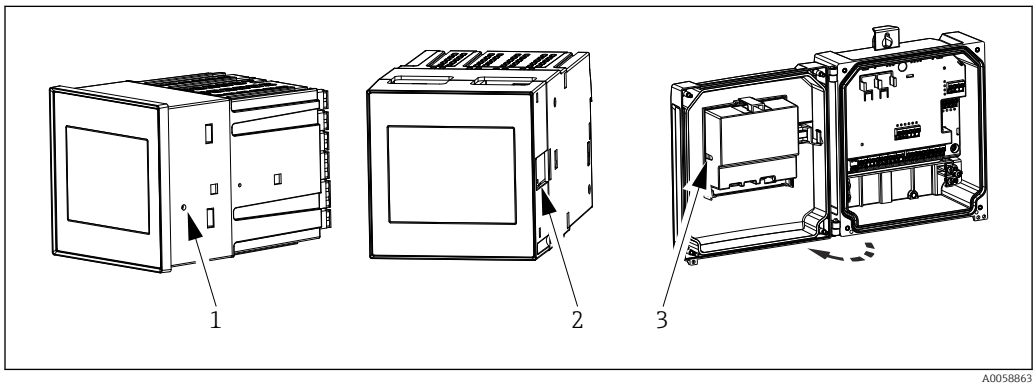
9.4.1 Logging in/out a user

Changes to existing access rights are generally made by selecting the desired user and then entering the corresponding PIN when prompted.

Settings in the quick access menu (top right):
- **Login**
  To log in, select the new user e.g. **Maintenance** and enter the corresponding PIN. The previously logged-in user is automatically logged out.
- **Extended Maintenance mode:** This mode affects the visibility of the displayed parameters. When enabled, all the parameters available for the user in question are displayed. If this mode is not enabled, only the most relevant parameters, which are normally sufficient for normal operation, are displayed.
- **Logout**
  Log out the active user and return to **Operator**. Logging out occurs immediately without entering a PIN.
  Alternatively, automatic logout occurs after inactivity exceeding a timeout of 600 seconds. Irrespective of this, actions that are already in progress (e.g. active upload/ download, data logging, etc.) continue to be executed in the background.

9.4.2 Reset button (RLC button)

The device has a reset button that offers different functions:



30 Position reset button

1 Panel-mounted device
2 DIN rail device
3 Polycarbonate field housing

The reset button is operated using a suitable thin tool.

⚠ CAUTION

Conductive objects such as needles or office clips can cause electrical accidents.

- ▶ Use a non-conductive tool.
- ▶ Do not insert in ventilation slots etc.
- ▶ Only insert the tool into the opening of the reset button.

Functions of the button:

- **Press once briefly (1s): restart device**
  The device is restarted.
- **Press 4 times briefly: Reset User Accounts**
  The PINs for the maintenance and operator roles are deleted; the web server is enabled. A diagnostic message is displayed.
- **Press once and hold down (12s): Decommissioning Reset**
  The device is reset to factory settings. Pins, logbooks, measured values, analyses, counters, RAM and certificates are deleted.

After the reset, the device restarts.

Before returning a device or disposing of it, perform a "Decommissioning Reset" to ensure that stored data cannot be misused.

9.5 Configuring the device

Further configuration of device parameters can be carried out directly via the touch display or the web server.

For a detailed overview of all operating parameters, see the associated description of device parameters (GP)

Flow calculation of customer-specific flumes and weirs: See the associated Special Documentation (SD)

NOTICE

Avoiding incorrect configuration

- ▶ Do not configure the device simultaneously via various interfaces (LAN/WLAN/touch). The device does not restrict this to facilitate (on-site) operation even in emergency situations.
- ▶ If using a device that has already been used and is not brand new from Endress+Hauser Sensors, it is recommended to perform a factory reset before commissioning.

⚠ CAUTION

Undefined switching of outputs and relays

- During configuration, the device may assume undefined states! This may result in the undefined switching of outputs (relays/OC) and the output of a failure current (current outputs).
- To counteract this, configuration mode can be activated in the **Guidance → Commissioning** menu or via **Application → Operating mode → Configuration mode**. This ensures that the current states of the outputs (relays/OC) are retained during configuration.

Configuration via wizard

For quick and easy commissioning, we recommend you carry out device configuration using the integrated wizard. The wizard can be called up directly via the touch display, the web server and all the operating tools (restricted).

Can be called up in **Guidance → Commissioning** menu

The wizard guides you through the commissioning of the device. A suitable value can be entered or the appropriate option selected for each parameter.

The following wizard is stored in the device:
- Device settings
- Application
- Outputs
- Visualization

If multiple applications are to be configured in combination, manual configuration must be selected.

If the wizard is canceled before all the necessary parameters have been configured, any settings already set are saved. For this reason, the device may then be in an undefined state. In such situations, it is advisable to reset the device to the factory default settings.

Certain parameters are preset for the operation of the FMA90 in conjunction with Endress+Hauser sensors and are always defined by the FMA90.

9.5.1 Setup via touch display

Recommendation:

In the **Guidance → Commissioning** menu: As a component in the guided device operation (Wizard)

In the **System** menu: Configure basic device settings such as language, date/time, communication etc.

In the **Application** menu, configure settings for the application in question

9.5.2 Establishing a connection and setup via web server

Establishing a connection via WLAN (option)

The WLAN access data and applicable radio approvals are affixed to the housing on devices with the WLAN option.

For quick and easy connection during initial commissioning, scan the matrix code (QR) located there with a mobile device.

Setting up a connection manually:

Carry out the following steps to connect to the device via WLAN:

1. Network information: The information on the WLAN MAC address, network name (SSID) and network key WLAN password) is located outside the device.

2. Enable WLAN on the device under **System → Connectivity → WLAN → Configuration → WLAN** (= factory setting). Confirm changes with "Apply".
3. Enable WLAN on the mobile device: In the settings of the device to be connected (e.g. laptop, smartphone), activate WLAN.
4. Select network: In the list of available networks, search for the network name (SSID) provided by the device.
5. When prompted, enter the network key (WLAN password) provided on the device (case-sensitive).
6. Connect: Click "Connect" or a similar button to connect to the WLAN network.

If you have problems connecting, check that the password is correct, check the range of the WLAN network for the device and restart the router and the device if necessary.

It is recommended to change the WLAN network key after setting up the device. For security, use a combination of upper and lower case letters, numbers, and symbols. Note: After this change, the matrix code (QR) on the device is no longer valid.

It is also recommended to disable the “Connect automatically” function for this network on the mobile device (e.g. laptop, smartphone), to prevent the terminal from connecting to the device unintentionally instead of to the company network.

Establishing a connection via Ethernet

The device is equipped with one or two (order option) RJ45 Ethernet ports. They can be used to build point-to-point, star or ring topologies. Both RJ45 ports are identical in terms of their functionality.

A crossover cable is not required.

When connecting via LAN to a company network: please contact your system administrator.

The LAN and WLAN must not be in the same subnet.

Device version with touch display

Procedure to establish a direct connection via Ethernet (point-to-point connection):

1. Retrieve the Ethernet settings such as IP address etc. on the device under **System → Connectivity → Ethernet → Information**.
2. Disable DHCP on the device under **System → Connectivity → Ethernet → Configuration**.
3. Connect the PC to the device using a LAN cable.
4. Set the IP address on the PC (network part: octets 1 to 3 must match the device; host part: octet 4 must differ, e.g: 192.168.1.**213**)
5. Set the subnet mask on the PC: 255.255.255.0

Device version without touch display

Procedure to establish a direct connection via Ethernet (point-to-point connection):

Note: The following activation of the LAN Service IP address via DIP switch will interrupt communication to the network!

1. Activate the service IP address 192.168.1.212 using DIP switch 3 on the device.
2. Connect the PC to the device using a LAN cable.
3. Set the IP address on the PC (network part: octets 1 to 3 must match the device; host part: octet 4 must differ, e.g: 192.168.1.**213**)
4. Set the subnet mask on the PC: 255.255.255.0

Setup via web server

The device features an integrated web server, which enables access via Ethernet or WLAN. The web server is used for convenient device commissioning and configuration and to visualize measured values. Access is possible from any access point when the device is connected to an Ethernet network. Suitable IT infrastructure, security measures, etc. must be provided according to system-specific requirements. For service purposes, point-to-point access via web server and Ethernet is particularly suitable.

To activate the web server: go to the menu **System** → **Web server** → **Web server functionality** → **On (http and https)** (factory setting)

The web server port is preset to 80. The port and the language of the web server can be changed directly in this menu. The factory setting of the language is English.

To establish a secure https connection to the web server, a corresponding X.509 certificate must be stored on the device.

Certificate management is available under **Guidance** → **Certificate management**.

For more information on certificate management: refer to the relevant description of the device parameters (GP)

If the network is protected by a firewall, the port may need to be activated.

Authentication as operator is required to configure the device via web server ("Operator" or "Maintenance"). The initial device PIN for both accounts is **0000**.

PIN management is available under **System** → **Security**.

Note: The initial device PIN should be changed during commissioning!

In order to use the full functionality of the Web server, it is recommended that the latest version of the browser is used.

A minimum resolution of 1920x1080 (full HD) is recommended.

It is not possible to access the web server from multiple devices simultaneously via both WLAN and Ethernet.

Establishing a connection to the web server:

1. Connect the PC with the device via Ethernet or WLAN (optional). Pay attention to the DIP switch settings!
2. Start the browser on the PC or on the mobile device
3. Enter the device's IP address in the browser **http://<ip address>** or **https://<ip address>**. Note: Leading zeros in IP addresses must not be entered. **LAN: 192.168.1.212**, **WLAN: 192.168.2.212**
4. Select "Maintenance" (for parameter configuration) or "Operator" user ID, enter the device PIN and confirm with "Login".

The web server responds with the start screen and device operation or parameter configuration can be started.

9.6 Application examples

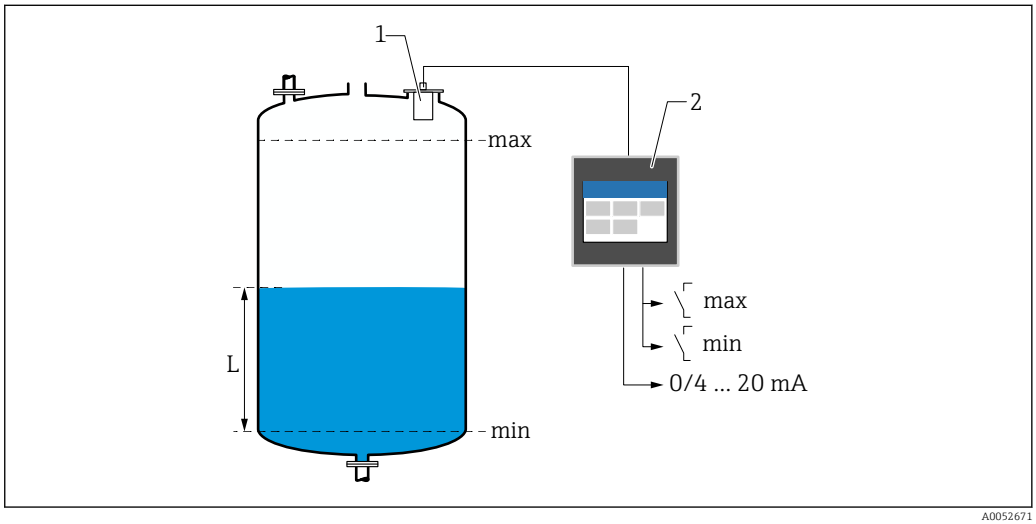
Flow calculation of customer-specific flumes and weirs: See the associated Special Documentation (SD)

For a detailed overview of all operating parameters, see the associated description of device parameters (GP)

9.6.1 Application examples for level measurement

Level measurement and alarm output

The level is recorded with the sensor. Limit values can be used to define minimum and maximum values and switch relays accordingly. Linearization must be set to "on" for the level to be passed on.



31 Level measurement and alarm output

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
L Level

Level linearization

Pre-programmed linearization curves

- None (the sensor value is adopted directly)
- "Linear" cylindrical tank
- Horizontal cylindrical tank
- Spherical tank
- Tank with pyramid bottom
- Tank with conical bottom
- Tank with flat angled bottom

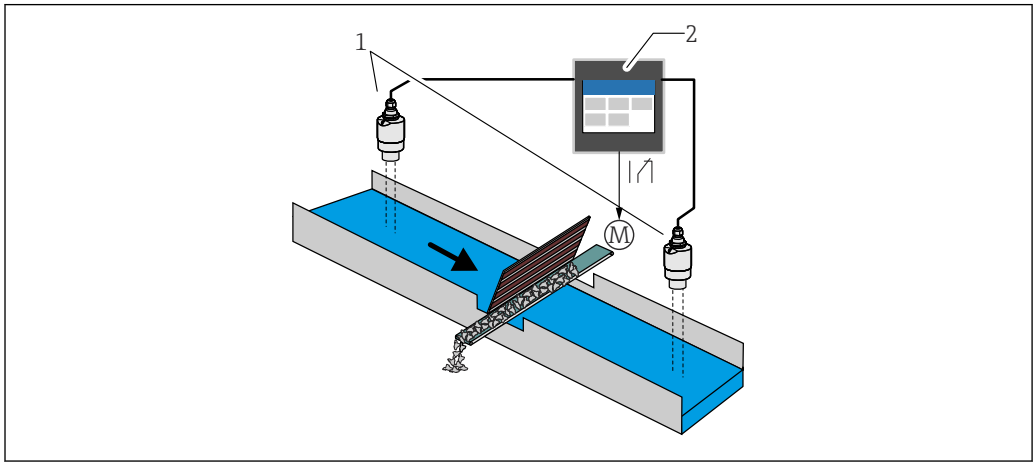
Linearization table

- Manual entry
- Up to 32 linearization points "Level - Volume". A linearization table can be created on the device or via the web server using editors. This table can be imported and exported as a CSV file (backup) in the web server.

Rake control (differential measurement)

Two sensors measure the levels before the rake (= upstream water level) and after the rake (= downstream water level). If the rake is dirty, the difference between the levels increases and the relays can be switched accordingly for rake control.

The rake control can operate in two modes: Difference: upstream water level – downstream water level or Ratio downstream water level / upstream water level



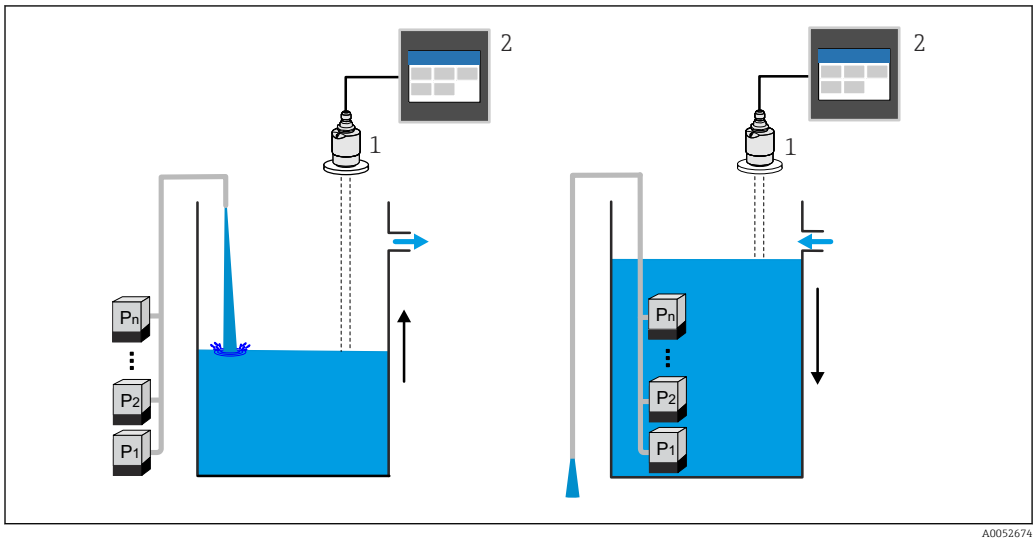
32 *Rake control (differential measurement)*

1 *Level sensors (e.g. Radar or ultrasonic sensor). Left sensor: upstream water level; right sensor: downstream water level*
2 *FlexView FMA90*
M *Motor for rake control*

Pump control

Via the pump control, up to eight pumps can be controlled individually or in groups based on the level, the status of digital inputs and/or the time. Additional functions for pump control are individually configurable. Each pump control can be operated in 2 modes: limit value control or pump rate control.

On 2-channel devices, two individual pump controls can be activated.



33 *Pump control for up to eight pumps. Example on the left: Filling; on the right: Emptying*

1 *Level sensor (e.g. radar or ultrasonic sensor)*
2 *FlexView FMA90*

Individually configurable for each pump:
- Pump switching delay
  E.g. to prevent overload of the power supply system.
- Pump run-on times and intervals
  E.g. for complete emptying of shafts or channels.
- Reduction of buildup on pump chamber walls by fine adjustment of the switch point
  E.g. variably changing level.

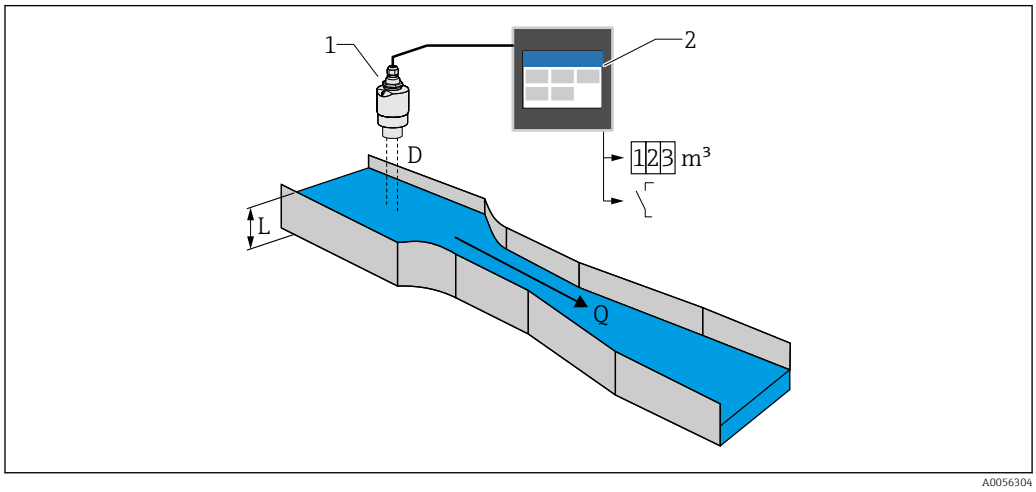
Further functions:
- Alternation in sequence/according to defined load.
  E.g. for protecting individual pumps, or pumps with the same load.
- Limit control
  Individual operation/parallel operation/pump group.
- Pump rate control
  Pumps are switched on automatically one by one until the minimum pump rate or switch-off point is reached.
- Tariff control
  Control of pumps according to electricity tariff.
- Storm function
  The storm function is used to prevent the unnecessary operation of the pumps if the plant is flooded for a short time (e.g. in the event of strong rainfall).
- Flush control
  The flushing function enables a relay to be switched on for a certain number of flush cycles for a specific flushing duration, e.g. to inject water into the container in order to dissolve/prevent sedimentation at the bottom of the container.
- Function test
  Pumps that have been switched off for too long are automatically switched on for a certain amount of time with the function test in order to avoid standing damage.
- Operating data recording
  Display of operating data such as operating hours since the last reset, total operating hours, number of starts since the last reset, starts per operating hour since the last reset, number of run-on starts since the last reset, runtime of the last switch-on (pump is off)/ since switch-on (pump running), downtime (last downtime if pump on/since switch-off if pump off).
- Operating hours alarm
  E.g. alarm goes off if the operating hours of a pump are exceeded.
- Pump feedback
  E.g. for indicating the pump status using a digital input.

9.6.2 Application examples for flow measurement

Flow measurement at flumes or weirs

A level sensor measures the level at the inlet of a flume or weir. The corresponding flow is calculated using pre-programmed or freely selectable linearization curves. If a critical value is exceeded or fallen short of, an alarm can be generated or a relay can be switched.

On 2-channel devices, two individual flow measurements can be activated.



34 *Flow measurement at flumes or weirs*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
D Distance between sensor membrane (reference point) and surface of liquid
L Level
Q Flow

The level L is derived from D. With linearization, the flow Q is derived from L.

Flow linearization

Pre-programmed linearization curves

Pre-programmed open flumes:
- Khafagi-Venturi flume
- ISO Venturi flume
- Parshall flume
- Palmer-Bowlus flume
- Trapezoidal flume according to ISO 4359:2022
- Rectangular flume according to ISO 4359:2022
- Leopold-Lagco flume
- Cutthroat flume
- U-shaped flume according to ISO 4395:2022
- H-flume

Pre-programmed weirs:
- Trapezoidal weir
- Circular-crested horizontal weir according to ISO 4374:1990
- Broad-crested weir according to ISO 3846:2008
- Thin-walled rectangular weir according to ISO 1438:2017
- Thin-walled triangular weir according to ISO 1438:2017

The pre-programmed linearization curves are stored in the device.

Standard formula for flow measurement

$Q = C\ (h^{\alpha} + \gamma h^{\beta})$

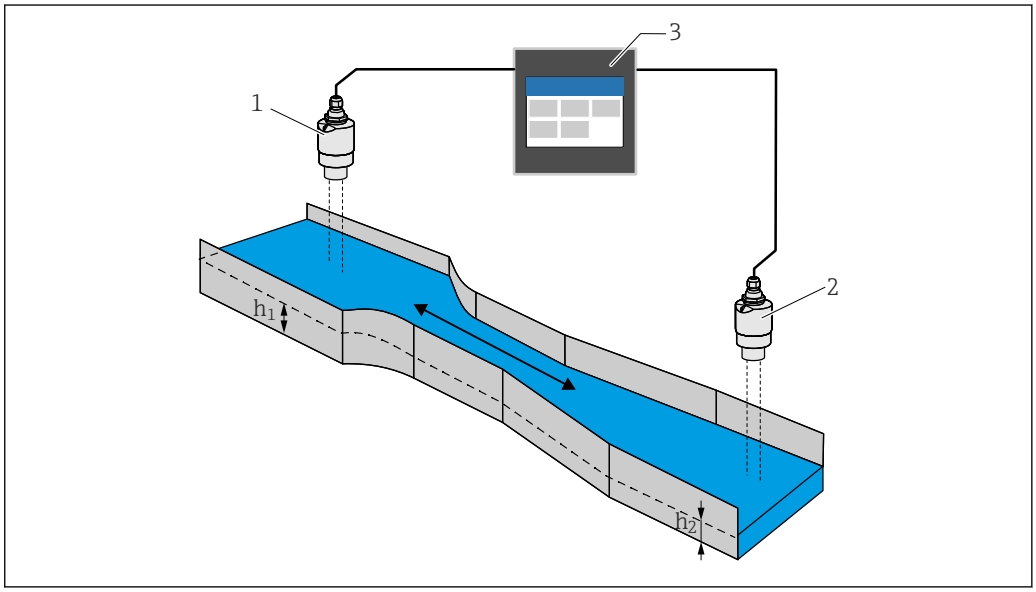
- h: Upstream level
- α, β, γ, C: User-definable parameters

Other supported calculations

- Ratiometric calculation
- Pipe profile (Manning)
- Linearization table with 32 points A linearization table can be created on the device or via the web server using editors. This table can be imported and exported as a CSV file (backup) in the web server.

Backwater detection (differential measurement)

Two level sensors measure the level at the inlet and outlet of a flume or weir. If the "downstream level : upstream level" ratio exceeds a critical value, an alarm is generated.



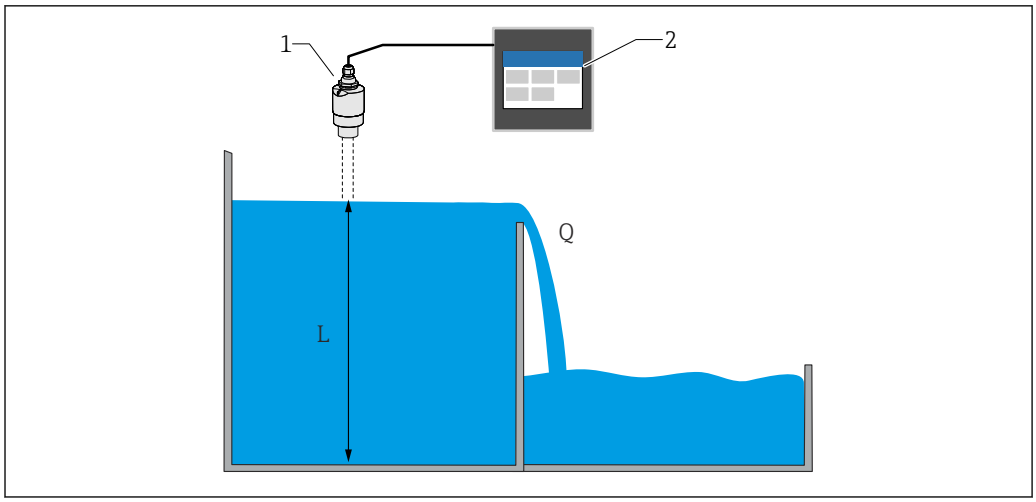
35 *Backwater detection*

1 Upstream sensor (e.g. radar or ultrasonic sensor)
h_1 Upstream level
2 Downstream sensor (e.g. radar or ultrasonic sensor)
h_2 Downstream level
3 FlexView FMA90

Stormwater overflow basin

A level sensor measures the level L. Using the integrated applications for the weirs, the overflow quantity Q can be calculated and stored in a totalizer. If a critical value is exceeded, an alarm can be generated or a relay can be switched.

Low flow cut off can be activated at the device, which sets the output value to 0 when a customer-specific flow value is fallen short of. This prevents downstream totalizers from further integrating the flow.



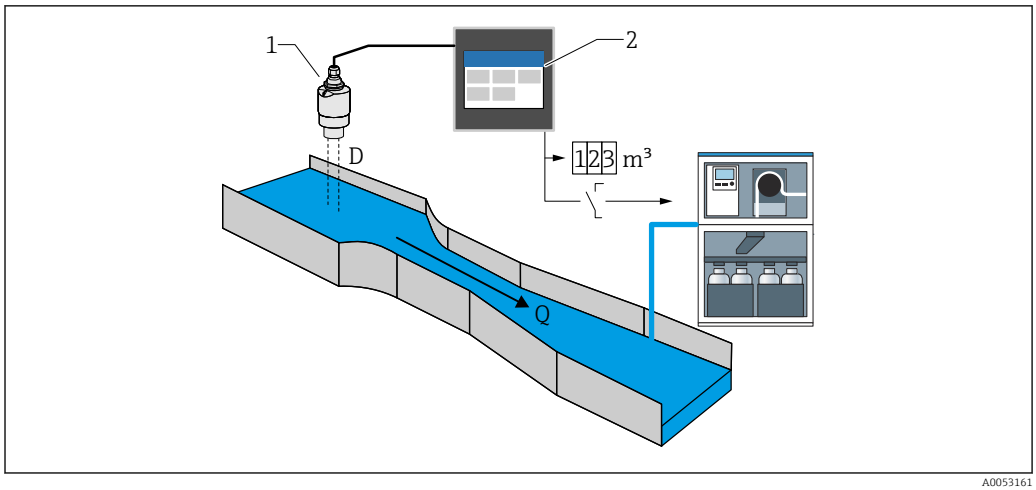
36 *Stormwater overflow basin*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
L Level
Q Overflow quantity

Totalizer + pulses (e.g. for samplers)

A level sensor measures the level at the inlet of a flume or weir. The corresponding flow is calculated using pre-programmed or freely selectable linearization curves. Using a pulse output (relay, open collector), the device can trigger additional systems such as wastewater samplers for example, with the flow-proportional volume signal.

Low flow cut off can be activated at the device, which sets the output value to 0 when a customer-specific flow value is fallen short of. This prevents downstream totalizers from further integrating the flow.



37 *"Totalizer + pulses" function, e.g. for samplers on flumes or weirs*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
D Distance between sensor membrane (reference point) and surface of liquid
Q Flow

9.7 Creating visualization groups

Selection of different layout options for displaying measured values in one group. Up to 6 visualization groups can be created and displayed, each with a maximum of 4 process

values with or without graphics. Preformatted screen displays, such as curve charts, vertical bar graphs or digital displays are possible.

A user must be logged in as "Maintenance".

For a detailed overview of all operating parameters, see the associated description of device parameters (GP)

Creating a visualization group using the commissioning wizard:

1. Navigation: **Guidance → Commissioning → Visualization**
2. Select the desired values using the wizard.

Creating and editing a visualization group manually:

1. Navigation: **Visualization → Group 1 to 6**
2. Select **+ Group**.
3. Customize the group using the pencil icon (description, layout, value 1-4, process variable, color, graphic).

9.8 Simulation

CAUTION

The output corresponds to the simulated value or event.

- During simulation, the device may assume undefined states! This may result in the undefined switching of outputs (relays/open collector) and the output of a failure current (current outputs).

9.8.1 Simulation of sensor inputs

Navigation

- For sensor 1:
  Diagnostics → Simulation → Sensor 1 simulation
- For sensor 2:
  Diagnostics → Simulation → Sensor 2 simulation

Parameters

- **Simulation**
  Select process variable for simulation, which is thereby activated. Selecting 'Off' will deactivate the simulation.
- **Current**
  Enter current value as process variable for simulation.
- **HART value**
  Enter HART value (PV) as process variable for simulation.
- **Level 1 or 2**
  Enter level value as process variable for simulation.
- **Level 1 or 2 linearized**
  Enter linearized level value as process variable for simulation.
- **Flow 1 or 2**
  Enter flow value as process variable for simulation.

9.8.2 Simulation of current output

Navigation

Diagnostics → Simulation → Current output 1 or 2 simulation

Parameters

- **Current output 1 or 2 simulation**
  'On' The current simulation is active. The output current does not correspond to the measured value but to the value defined in the 'Value current output' parameter.
  'Off' The current simulation is not active. The output current corresponds to the measured value.
- **Value current output 1 or 2**
  Defines the value of the simulated output current.
  Note: On activation, the simulation value is initialized with the current output.

9.8.3 Digital output simulation

Navigation
Diagnostics → Simulation → Digital input → Digital output simulation

Parameters

- **Simulation relay 1 to 5**
  Switch simulation relay on and off.
  Additional information: Selection of the switching state to be simulated: 'Switched on' (relay energized) and 'Switched off' (relay de-energized).
  The simulation affects the switching output.
- **Simulation open collector 1 to 3**
  Switch simulation of the open collector on and off.
  Additional information: Selection of the switching state to be simulated: 'Switched on' (the open collector output is conducting = closed) and 'Switched off' (the open collector output is not conducting = open).
  The simulation affects the switching output.

9.8.4 Simulation of digital input

Navigation
Diagnostics → Simulation → Digital input → Digital input simulation 1 to 4

Parameters
Digital input simulation 1 to 4
Switch digital input simulation on and off.
Additional information: Selection of the switching state to be simulated: 'Switched on' (Closed = logical state 1) and 'Switched off' (Open = logical state 0).

9.8.5 Diagnostic event simulation

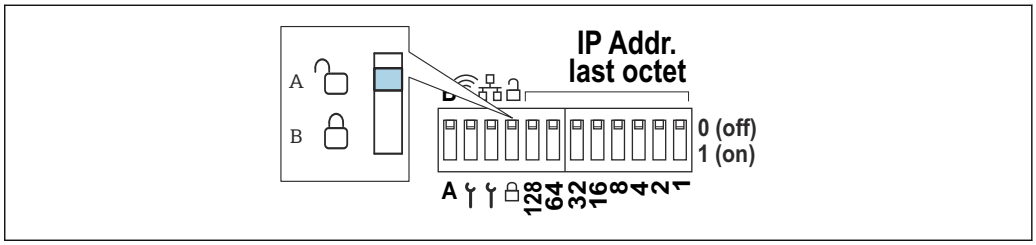
Navigation
Diagnostics → Simulation → Diagnostic event simulation

Parameters

- **Simulation**
  Simulates one or more process variables and/or events.
  Warning: Output will reflect the simulated value or event.
- **Diagnostic event simulation**
  Select the diagnostic event to be simulated.
  Note: To terminate the simulation, select "Off".
- **Channel**
  Assign the corresponding channel to the selected diagnostic event.

9.9 Protecting settings from unauthorized access

9.9.1 Setup lock via hardware locking



38 *Hardware locking via DIP switch*

A Unlocked
B Locked

The device's DIP switch includes a locking switch that can be used to prevent configuration and parameter changes. When locked, a padlock symbol appears on the display and in the web server.

10 Operation

The **Visualization** menu is designed to support the operator's tasks. It contains all the parameters that are needed in ongoing operation. Measured values and analyses can be displayed, and display settings can be configured. However, any settings made here have no effect on the measurement section or the configured device parameters.

The device's simple operating concept and the integrated help function enables you to perform operation for many applications without the need for hardcopy operating instructions.

10.1 Reading the device locking status

10.1.1 Displaying the locking status

Navigation
System → Device management → Locking status
Shows the highest write protection that is currently active.
If none of the following statuses is shown, the device is unlocked and all parameters (except service parameters) can be modified.

Locking status:
- **Hardware locked**
  The device was locked by means of the DIP switch. It can only be unlocked again using this switch.
- **Upload/download active**
  The device is temporarily locked by internal processes (e.g. up/download or reset). Once these processes are complete, the device is automatically unlocked again.
- **Software locked**
  The device is locked by an external software control (e.g. fieldbus). It can only be unlocked again by this software.

10.2 Reading measured values on the touch display

10.2.1 Displaying the visualization group

The "Operator" user rights are sufficient for this.

How to create visualization groups is described in the “Commissioning” section. → 50

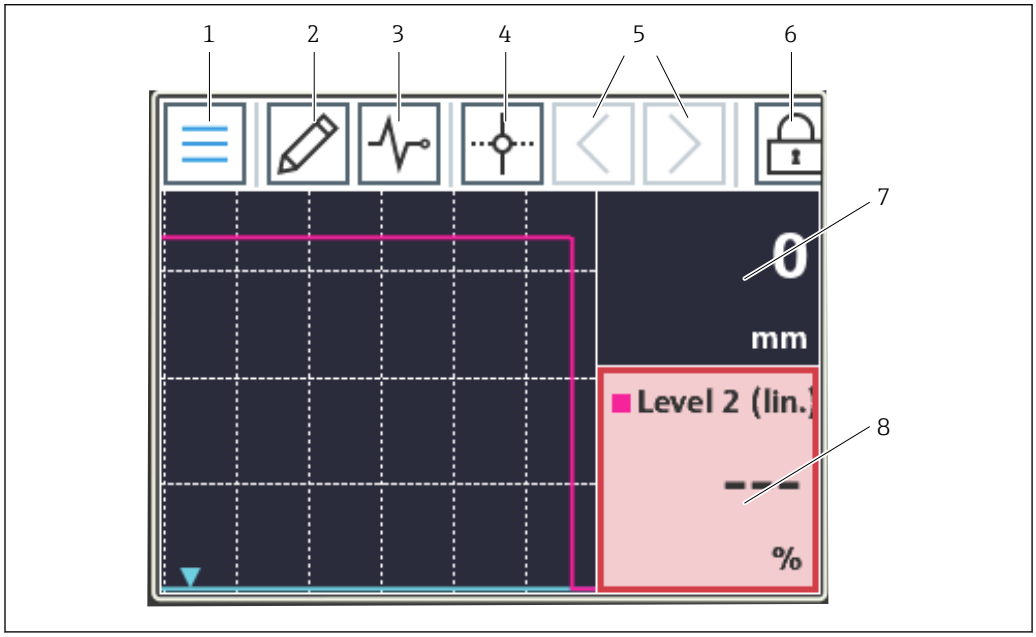
Navigation: **Visualization → Group 1 to 6**

Display functions

You can switch between the configured groups by swiping left or right.

Tapping the screen in the line diagram shows all the values of the group at the time selected.

Swiping from top to bottom displays additional tools:



1 *Return to home screen*
2 *Edit group (s)*
3 *Display diagnostic list*
4 *Show/hide crosshair (cursor; vertical line)*
5 *Move crosshair in the time diagram forward/back*
6 *Activate screen lock*
7 *Show/hide individual measured value curves*
8 *Example of a channel in an invalid measurement status ("bad")*

If a measuring point enters the limit violation range, a symbol is shown at the bottom of the corresponding channel (to quickly identify limit violations). During a limit value violation and device operation, the acquisition of measured values continues uninterrupted.

If a measured value status is invalid ("bad", e.g. cable break, calculation error, device failure, etc), the corresponding tile is displayed in red.

If a measured value status is uncertain ("uncertain", e.g. HART sensor status, application-specific error etc.), the corresponding tile is displayed in yellow.

For details, see the "Diagnostics and troubleshooting" section. → 56

10.3 Reading measured values via the web server

The procedure for establishing a connection to the web server is described in the "Commissioning" section. → 42

If there is no activity, an auto logout is performed. The web server is not intended for continuous display of measured values.

The procedure for creating and displaying visualization groups via the web server is identical to that on the touch display.

11 Diagnostics and troubleshooting

Navigation and display are identical for the local display and the web server.

11.1 General troubleshooting

Always start troubleshooting with the checklists below if faults occur after startup or during operation. The checklists take you directly (via various queries) to the cause of the problem and the appropriate remedial action.

General faults

Fault	Possible cause	Remedial action
Device not functioning, no measured value display, no LED lit	Supply voltage does not match the voltage specified on the nameplate.	Check and correct supply voltage.
	Connection cables not making contact with the terminals.	Check the electrical contact between the cable and terminals and correct if necessary.
	Power unit defective.	Contact the manufacturer's service department or replace the unit.
No measured value display, display is black.	Display is turned off.	Touch the display (without gloves); the display switches on. Adjust settings under **System → Display → Switch off display**.
	Display defective.	Access the device via the web server and check settings under **System → Display**. If accessible and the settings are correct: contact the manufacturer's service department or replace the device.
Display is lit, device does not respond to entries.	Operating lock is active.	Touch the display (without gloves) and the trace the displayed unlock pattern with your finger. Adjust settings under **System → Display → Operating lock**.
Display or LED is lit, device does not respond to entries.	Software problem	Restart device by disconnecting and reconnecting the power supply.

Fault	Possible cause	Remedial action
No access to device web server	Web server on device disabled	Activate web server on device under **System → Web server**.
No WLAN connection to the device possible	Device has no WLAN option?	Check under **System → Hardware configuration → WLAN**.
	Incorrect settings	Check connection settings (e.g. IP address, port, etc.) on the device **System → Connectivity → WLAN** and on the PC.
No Ethernet connection to the device possible	Incorrect settings	Check connection settings (e.g. IP address, port, etc.) on the device **System → Connectivity → Ethernet** and on the PC.
	Ethernet cable defective.	Replace the Ethernet cable.
Diagnostic message is displayed.	For a list of diagnostic messages, see the next section.	

11.2 Active diagnostics

Navigation: Diagnostics → Active diagnostics

Displays the following information:
- **Actual diagnostics**
  Displays the current diagnostic message. If several diagnostic events are pending at the same time, only the diagnostic message with the highest priority is displayed.
- **Timestamp**
  Displays the timestamp for the currently active diagnostic message
- **Last diagnostics**
  Displays the diagnostic message for the last diagnostic event that has ended.
- **Timestamp**
  Displays the timestamp of the diagnostic message for the last diagnostic event that has ended.
- **Operating time**
  Indicates how long the device has been in operation up to this point.
- **Operating time from restart**
  Indicates how long the device has been in operation since the last time the device was restarted
- **Operating hours**
  Indicates the operating hours of the display
- **Sensor diagnostic code**
  Diagnostic code of the connected HART sensor 1 or 2

11.3 Diagnostic list

Navigation: Diagnostics → Diagnostic list

Displays the following information:
Diagnostic list
Displays the currently pending diagnostic events with max. 10 events ordered by priority (highest first) Each entry contains: Status signal as symbol, diagnostic code, description, timestamp, remedial action

Status signals

Letter/symbol [1]	Event category	Meaning
F	Failure Failure	An operating error has occurred.
C	Function check Function check	The device is in service mode (e.g. during a simulation).
S	Out of specification Out of specification	The device is being operated outside its technical specifications (e.g. during startup or cleaning processes).
M	Maintenance required Maintenance required	Maintenance is required.
N -	Not categorized Not categorized	Only the corresponding error number is displayed.

1) As per NAMUR NE107

11.3.1 Overview of all the diagnostic messages

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
041	Sensor 1 to 2 breakage detected	1. Check electrical connection 2. Replace sensor 3. Check configuration of connection type	F	Alarm
046	Sensor limit 1 to 2 exceeded	1. Check sensor 2. Check process conditions	F	Alarm
701	Sensor 1 to 2 PV fixed	1. Check sensor 2. Check process conditions	M	Warning [1]
702	Sensor 1 to 2 PV uncertain	1. Check sensor 2. Check process conditions	M	Warning [1]
703	Sensor 1 to 2 PV bad	1. Check sensor 2. Check process conditions	F	Alarm [1]
710	Sensor 1 to 2 device failure	1. Check sensor 2. Replace sensor	F	Alarm [1]
711	Sensor 1 to 2 check function	1. Check sensor 2. Replace sensor	C	Warning [1]
712	Sensor 1 to 2 out of specification	1. Check sensor 2. Replace sensor	S	Warning [1]
713	Sensor 1 to 2 maintenance required	1. Check sensor 2. Replace sensor	M	Warning [1]
715	Sensor 1 to 2 malfunction	1. Check sensor 2. Replace sensor	F	Alarm [1]
716	Sensor 1 to 2 process value out of limits	1. Check sensor 2. Check process conditions	S	Warning [1]
721	Sensor 1 to 2 echo lost	Check sensor calibration	S	Warning [1]
722	Sensor 1 to 2 buildup detected	Prozessbedingungen prüfen	F	Alarm [1]
723	Sensor 1 to 2 foam detected	Check process conditions	M	Warning [1]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
724	Sensor 1 to 2 in safety distance	1. Check level 2. Check safety distance 3. Reset self holding	S	Warning [1]
725	Sensor 1 to 2 mapping failed	1. Try mapping again 2. Check sensor status	S	Warning
726	Sensor 1 to 2 communication lost	1. Check sensor 2. Check HART address 3. Check HART resistance	F	Alarm
727	Sensor 1 to 2 multi master collision	1. Check bus for second HART master (e.g. hand held) 2. Check HART master configuration (secondary/ primary)	F	Alarm
730	Sensor 1 to 2 configuration mismatch	Read configuration data from sensor or write configuration data to sensor.	F	Alarm
732	Sensor 1 to 2 wrong sensor type detected	1. Check sensor type selection 2. Connect sensor of selected sensor type	F	Alarm
740	Sensor 1 to 2 SV fixed	1. Check sensor 2. Check process conditions	M	Warning [1]
741	Sensor 1 to 2 SV uncertain	1. Check sensor 2. Check process conditions	M	Warning [1]
742	Sensor 1 to 2 SV bad	1. Check sensor 2. Check process conditions	F	Alarm [1]
743	Sensor 1 to 2 TV fixed	1. Check sensor 2. Check process conditions	M	Warning [1]
744	Sensor 1 to 2 TV uncertain	1. Check sensor 2. Check process conditions	M	Warning [1]
745	Sensor 1 to 2 TV bad	1. Check sensor 2. Check process conditions	F	Alarm [1]
746	Sensor 1 to 2 QV fixed	1. Check sensor 2. Check process conditions	M	Warning [1]
747	Sensor 1 to 2 QV uncertain	1. Check sensor 2. Check process conditions	M	Warning [1]
748	Sensor 1 to 2 QV bad	1. Check sensor 2. Check process conditions	F	Alarm [1]
Diagnostic of electronic				
201	Electronics faulty	1. Restart device 2. Replace electronics	F	Alarm
230	Date/time incorrect	1. Replace RTC buffer battery 2. Set date and time	F	Alarm [1]
252	Module incompatible	1. Check electronic module 2. Update firmware 3. Replace I/O or main electronic module	F	Alarm
275	I/O module defective	Replace I/O module	F	Alarm
331	Firmware update failed	1. Update firmware of device 2. Restart device	F	Alarm
332	Restart modules	Please wait	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of configuration				
402	Initialization active	Initialization in progress, please wait	C	Warning
411	Up-/download active	Up-/download active, please wait	F	Alarm
412	Processing download	Download is being processed, please wait.	C	Warning
425	Communication certificate faulty	Replace affected certificate	M	Warning
426	Communication certificate expired	Replace affected certificate	M	Warning [1)]
427	Communication certificate expiring soon	Replace affected certificate	M	Warning [1)]
440	Device not calibrated	Calibrate device	F	Alarm
441	Current output 1 to 2 saturated	1. Check current output settings 2. Check process	S	Warning [1)]
485	Process variable simulation active	Deactivate simulation	C	Warning
486	Current input 1 to 2 simulation active	Deactivate simulation	C	Warning
491	Current output 1 to 2 simulation active	Deactivate simulation	C	Warning
494	Switch output 1 to 5 simulation active	Deactivate switch output simulation	C	Warning
495	Diagnostic event simulation active	Deactivate simulation	S	Warning
496	Status input 1 to 4 simulation active	Deactivate status input simulation	C	Warning
498	Open collector 1 to 3 simulation active	Deactivate simulation	C	Warning
500	Relay 1 to 5 output buffer full	1. Check process value 2. Check "pulse value"	M	Alarm [1)]
501	Open collector 1 to 3 output buffer full	1. Check process value 2. Check "pulse value"	M	Warning [1)]
502	LAN/WLAN - IP address conflict	1. Check network configuration 2. Change IP address of LAN or WLAN to different subnets	M	Warning
538	Calculation 1 to 8 configuration faulty	1. Check configuration 2. Adapt configuration	F	Alarm
550	Pump control 1 to 2 pump direction wrong	Check configuration of pump switching points	F	Alarm
551	Pump control 1 to 2 pump rate not reached	1. Check device configuration 2. Check pumps 3. Check level sensors	C	Warning
552	Pump control 1 to 2 same switch-on points	Check configuration of pump switching points.	S	Warning
553	Pump 1 to 8 pump error	1. Check pump 2. Check pump feedback 3. Reset pump feedback alarm in pump control menu	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
554	Pump control 1 to 2 storm func. on < off	Check configuration of the switching points in the "Storm function" menu.	S	Warning
555	Pump control 1 to 2 pump direction wrong	Check the configuration of the switching points in the "Automatic function test" menu.	S	Warning
556	Pump 1 to 8 max. operating hours reached	1. Check pump 2. Replace pump 3. Reset operating hours	M	Warning
557	Pump control 1 to 2 pump direction wrong	Check the configuration of the switching points in the tariff control.	S	Warning
560	Sensor 1 to 2 write configuration failed	1. Try writing parameter again 2. Unlock connected device 3. Restart connected device 4. Replace connected device	M	Warning
561	Sensor 1 to 2 read configuration failed	1. Try reading parameter again 2. Unlock connected device 3. Restart connected device 4. Replace connected device	M	Warning
570	Rake control switch point configuration	Check configuration rake control switch points.	F	Alarm
577	Sensor 1 to 2 configuration faulty	1. Check configuration 2. Adapt configuration	F	Alarm
578	Pump control 1 to 2 configuration faulty	1. Check configuration 2. Adapt configuration	F	Alarm
579	Level 1 to 2 configuration faulty	1. Check configuration 2. Adapt configuration	F	Alarm
580	Flow 1 to 2 configuration faulty	1. Konfiguration prüfen 2. Konfiguration anpassen	F	Alarm
Diagnostic of process				
816	Hold active	1. "Hold" in progress, please wait. 2. Deactivate "Hold".	C	Warning
879	Sensor input 1 to 2 overloaded	1. Check wiring. 2. Check sensor.	F	Alarm
890	Battery low	Prepare battery replacement	C	Warning
891	Battery empty	Replace battery	M	Warning
950	Backwater detected	1. Check input levels 2. Check parameter "Backwater detected"	S	Warning
955	Level downstream > level upstream	1. Check rake 2. Check sensor level values	M	Warning
956	Rake control calculation error	Check level values of the sensors	F	Alarm
968	Sensor 1 to 2 level limit reached	1. Check sensor level 2. Check settings in the parameters "low/high limit" in the menu "level"	S	Warning
970	Flow 1 to 2 value out of specification	1. Check process value 2. Check application 3. Check sensor	S	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
971	Flow 1 to 2 value above limit	1. Decrease process value 2. Check application 3. Check sensor	S	Warning
972	Level 1 to 2 value out of limits	1. Decrease process value 2. Check application 3. Check sensor	S	Warning

1) Diagnostic behavior can be changed.

11.4 Event logbook

Navigation: Diagnostics → Event logbook

Displays the following information:
Event logbook
Displays the event messages. Event messages are displayed in chronological order. The event history includes diagnostic and information events as well as all configuration changes. The symbol in front of the timestamp indicates whether the event has started or ended.

For every configuration change, a "Direct-ID#" is shown in the event logbook (e.g. "160108-000-000"), which clearly identifies the relevant parameter. With the device-specific "Description of Device Parameters (GP)", you can use this ID to search in the PDF and clearly assign the parameter.

Structure of the "Direct-ID#":

Part 1, e.g. **160108**-000-000 = specific parameter

Part 2, e.g. 160108-**000**-000 = field index (e.g. support point)

Part 3, e.g. 160108-000-**001** = instance (e.g. channel 1, relay 1)

Important: When searching, it is sufficient to search only for the first part of the ID (e.g. "160108") in the "Description of Device Parameters (GP).

11.5 Minimum/maximum values

Navigation: Diagnostics → Minimum/maximum values

Displays the following information:
- **Minimum/maximum electronics temperature**
  Displays the lowest as well as the highest electronics temperature measured to date
- **Reset electronics temperature min max (only possible via "Service")**
  Reset minimum and maximum values for electronics temperature.
- **Level linearized**
  Displays the minimum or the maximum linearized level values measured to date together with the corresponding timestamp The values can be reset together with the associated parameter.
- **Flow**
  Displays the minimum or the maximum flow measured to date together with the corresponding timestamp The values can be reset together with the associated parameter.

The min./max. values are also reset in the following cases:
- The associated application is deactivated (e.g. Operating mode level1 = Off).
- The device is reset.

11.6 Simulation

Navigation: Diagnostics → Simulation

See descriptions in the "Commissioning" section → 51.

11.7 Diagnostic settings

Navigation: Diagnostics → Diagnostic settings

NOTICE

Warning: Changes to the diagnostic settings can affect measured values, measured value status and diagnostic behavior.

▶ Changes to the settings are made at your own risk.

Parameters

- **Properties → Alarm delay**
  Alarm delay: Use this function to set the delay time during which a diagnostics signal is suppressed before it is output.
- **Sensor**
  Settings for the specific failure behavior and status signal
- **Electronics**
  Settings for the specific diagnostic behavior and status signal
- **Configuration**
  Settings for the specific diagnostic behavior and status signal
- **Sensor 1, 2 (FMX21, FMR20B, FMR30B)**
  Configuration of selected diagnostic settings for the connected HART sensor (e.g. echo, min. safety distance, etc.)

Diagnostic behavior

Navigation: Diagnostics → Diagnostic settings → Configuration → Diagnostic behavior	
Off	The diagnostic behavior is completely disabled even if the device is not recording a measured value.
Alarm	Measurement is interrupted (measured value: "bad"). The signal outputs adopt the defined alarm status. A diagnostic message is generated and displayed in the diagnostic list and in the event log. The failure behavior associated with the function block is applied (e.g. **Application → Level → Level 1 linearized → Additional settings → Failure behavior**, Extended Maintenance mode must be enabled)
Warning	The device continues to measure (measured value status: "uncertain"). A diagnostic message is generated and displayed in the diagnostic list and in the event log.
Logbook entry only	The device continues to measure. The event is only saved in the event log.

11.8 HART master

Diagnostic information for checking the quality of the HART signal and the HART communication.

Only relevant if a universal HART sensor has been selected (e.g. FMX21, FMR20B, FMR30B).

Navigation: Diagnostics → HART master

11.9 Device reset

Reset the device configuration - either entirely or in part - to a defined status.

Navigation: System → Device management → Device reset

11.10 Device information

Display of important device information such as serial number, firmware version, order code, etc. for service purposes

Navigation: System → Information

11.11 Enabling software options

Enter the application package code or the code for another subsequently ordered function to enable it.

Navigation: System → Software configuration → Software configuration → Activate SW option

11.12 Firmware history

Overview of the device software history:

Device software Version/date	Software changes	Operating Instructions
V01.00.00 / 07.2025	Original software	BA02254F/09/EN/01.22

11.13 Firmware update

Contact the manufacturer's service department to update the firmware.

The firmware update is only possible if a valid date is set on the device.

Firmware updates can only be performed via the web server <ip-address/swupdate>.

The device supports Secure Boot and Secure Firmware Update, i.e. it verifies the firmware and does not allow invalid firmware updates.

The device continues to operate normally during a firmware update. A restart is only performed if the update is successful.

Navigation: System → Security → Configuration → Firmware update

12 Maintenance

No special maintenance work is required for the device.

12.1 Cleaning

12.1.1 Cleaning of surfaces not in contact with the medium

- Recommendation: Use a lint-free cloth that is either dry or slightly dampened using water.
- Do not use any sharp objects or aggressive cleaning agents that corrode the surfaces (displays, housing, for example) and seals.
- Do not use high-pressure steam.
- Observe the degree of protection of the device.

The cleaning agent used must be compatible with the materials of the device configuration. Do not use cleaning agents with concentrated mineral acids, bases or organic solvents.

13 Repair

13.1 General information

The device has a modular design and repairs can be carried out by the customer's electrotechnical personnel. For more information on service and spare parts, contact the supplier.

13.1.1 Repair of Ex-certified devices

- Only specialist personnel or the manufacturer may undertake repairs on Ex-certified devices.
- The prevailing standards, national hazardous area regulations, safety instructions and certificates must be observed.
- Only use original spare parts from the manufacturer.
- When ordering spare parts, check the device designation on the nameplate. Parts may only be replaced by identical parts.
- Carry out repairs according to the instructions. On completion of the repair, carry out the routine test specified for the device.
- A certified device may only be converted to another certified device version by the manufacturer only.
- Document all repairs and modifications.

13.2 Replacing a sensor

After the sensor has been replaced, the configuration must be written back to the sensor or read from the sensor. Adjust the settings on the device under **Application → Sensors → Sensor x**.

13.3 Spare parts

Product spare parts that are currently available can be found online at:
www.endress.com/onlinetools

13.4 Return

For return shipments in the event of service (repairs), the user account “Production” must be enabled on the device.

The requirements for safe device return can vary depending on the device type and national legislation.

1. Refer to the web page for information:
   https://www.endress.com/support/return-material
   ↳ Select the region.
2. If returning the device, pack the device in such a way that it is reliably protected against impact and external influences. The original packaging provides optimum protection.

13.5 Disposal

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to the manufacturer for disposal under the applicable conditions.

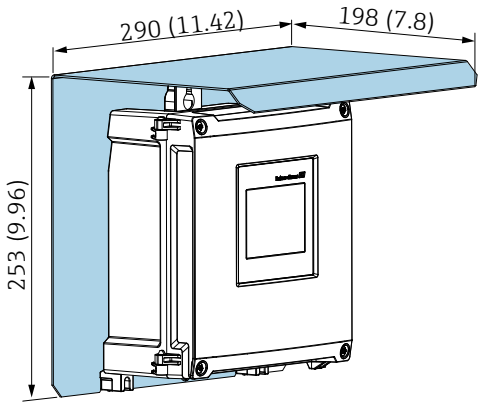
14 Accessories

The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

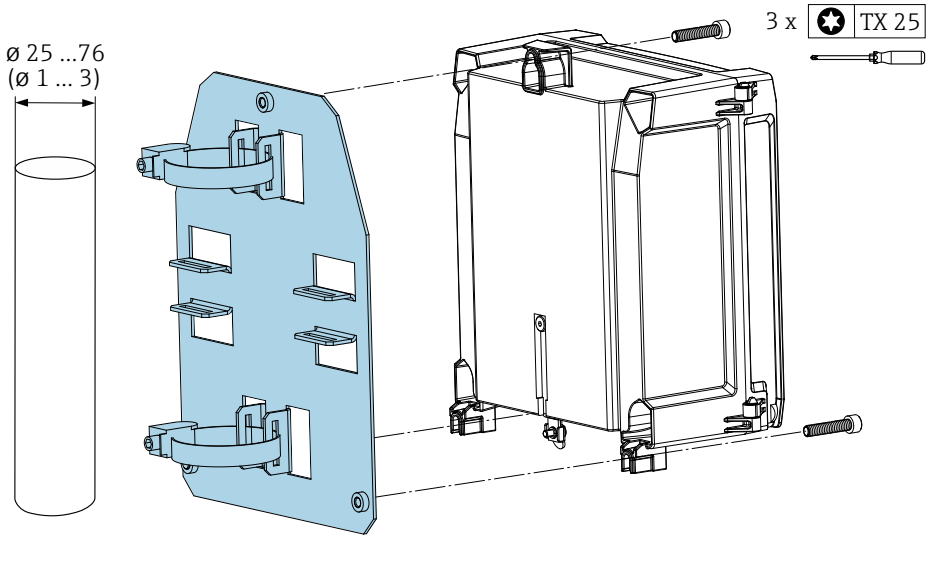
14.1 Device-specific accessories

Type
Stainless steel 316Ti (1.4571) weather protection cover for polycarbonate field housing



39 *Weather protection cover for direct wall mounting or using assembly board for pipe mounting. Unit of measurement mm (in)*

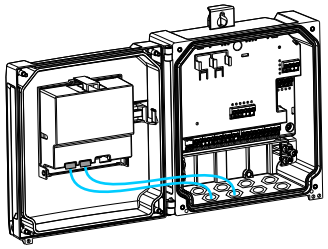
Assembly board for pipe mounting for polycarbonate field housing



40 *Mounting plate for pipe mounting of polycarbonate field housing. Unit of measurement mm (in)*

- Pipe diameter: 25 to 76 mm (1 to 3 in)
- Dimensions: 210 x 110 mm (8.27 x 4.33 in)
- Material: Stainless steel 316L
- Mounting accessories: fastening clips, screws and nuts are supplied.

Cable glands 4x M16x1.5/2x M20x1.5/2x M25x1.5



1x M12 plug, Ethernet/PROFINET (adapter RJ45 on M12 plug; for polycarbonate field housing)
2x M12 plug, Ethernet/PROFINET (adapter RJ45 on M12 plug; for polycarbonate field housing)

14.2 Online tools

Product information over the entire life cycle of the device: www.endress.com/onlinetools

14.3 System components

Surge arrester modules from the HAW product family

Surge arrester modules for DIN rail and field device mounting, for the protection of plants and measuring instruments with power supply and signal/communication lines.

More detailed information: www.endress.com

15 Technical data

15.1 Function and system design

The device is designed for the water and wastewater industry for the evaluation of measured values and device status, as well as for the configuration of the following Endress+Hauser sensors:
- Radar time-of-flight method: Micropilot FMR10B [2], FMR20B, FMR30B
- Hydrostatic level measurement: Waterpilot FMX11 [1], FMX21

Universal level sensors can also be connected to the 4 to 20 mA/HART inputs.

Typical measuring tasks
- Level measurement and linearization
- Flow measurement at open flumes and weirs
- Pump control
- Rake control

15.1.1 Measuring principle

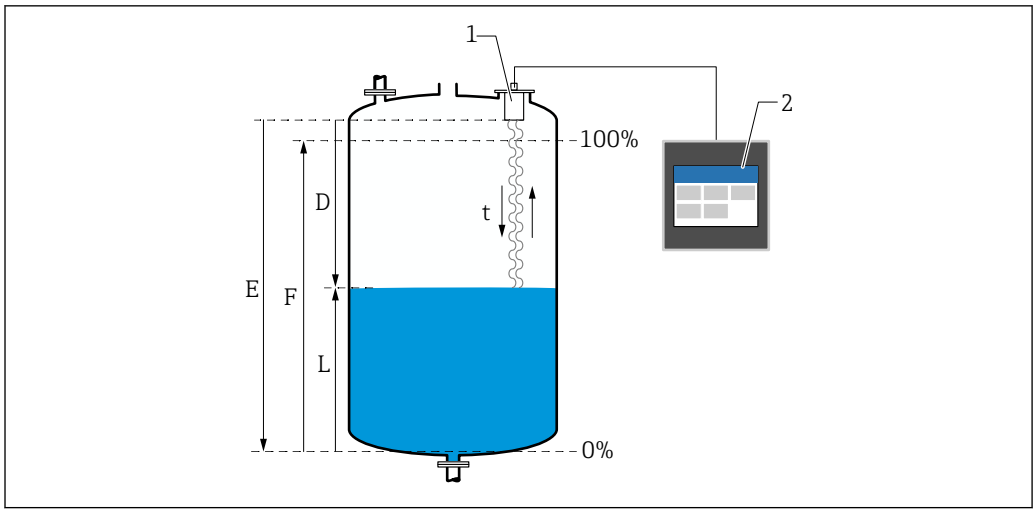
The device receives a 4 to 20 mA signal from connected sensors and scales it to a level value.

Connected HART sensors provide a digital value with a unit that is scaled according to the application.

Level measurement using ultrasonic or radar sensor

The level sensor sends an electromagnetic wave or ultrasonic pulses in the direction of the surface of the medium. These are reflected there, and then received again by the level sensor. The sensor measures the time t between the transmission and reception of a pulse. The distance D between the sensor and the surface of the medium is calculated from this. The level L is derived from D. Schematic representation below; for details regarding the measuring principle, see the Operating Instructions of the connected sensor technology.

2) 4 to 20 mA only, configuration via HART not possible

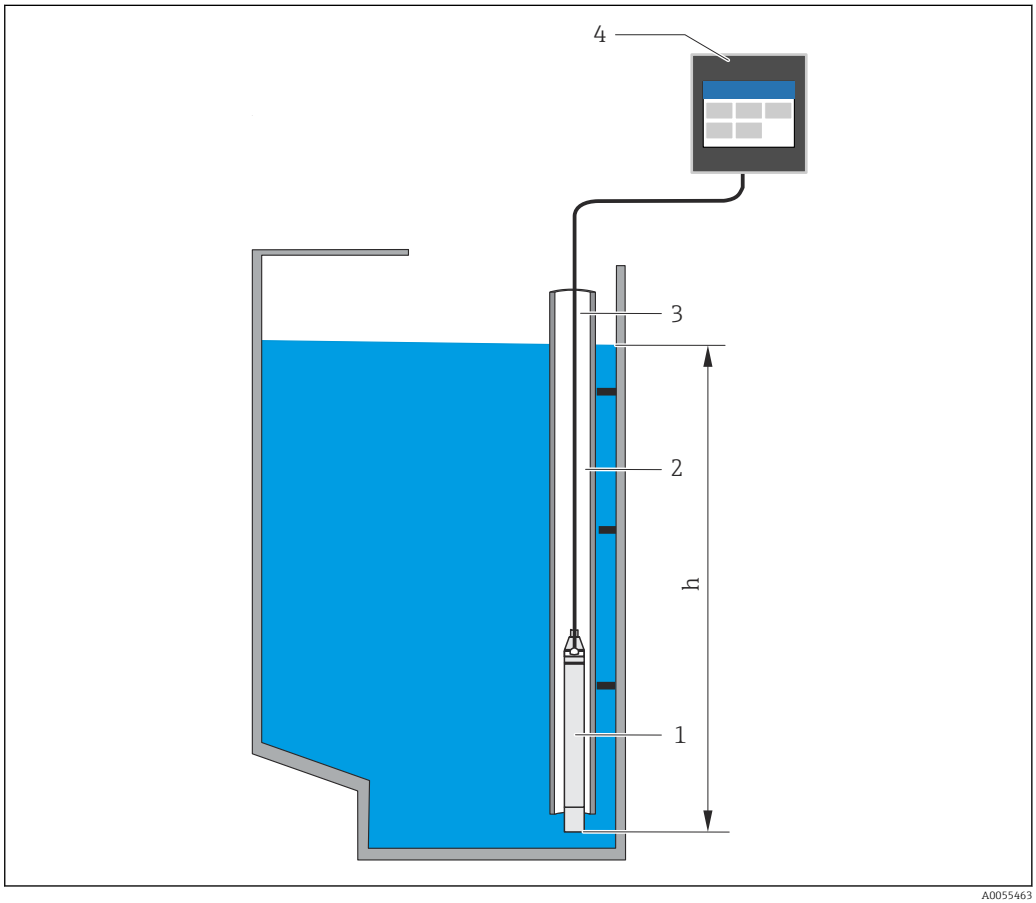


41 *Configuration parameters for level measurement using an ultrasonic or radar sensor*

1 Level sensor
2 FlexView FMA90
D Distance between sensor (reference point) and surface of medium
E Empty calibration (Empty)
F Full calibration (Full)
L Level

Level measurement using the hydrostatic sensor

The ceramic measuring cell is a dry measuring cell, i.e. the pressure acts directly on the robust, ceramic process membrane of the Waterpilot. Changes in atmospheric pressure are guided via a pressure compensation tube through the supporting cable to the rear of the ceramic process membrane and are compensated for. A pressure-dependent change in capacitance, caused by the movement of the process membrane, is measured at the electrodes of the ceramic carrier. The sensor electronics will then convert this to a signal that is proportional to the pressure and linear to the level. At the field housing of the FlexView FMA90, the pressure compensation tube can be inserted directly. Pressure compensation relative to the environment is achieved via an integrated membrane.



1 *Pressure measuring cell (ceramic measuring cell)*
2 *Guiding tube*
3 *Extension cable with pressure compensation tube*
4 *FlexView FMA90*
h *Level height*

15.1.2 Application packages

The basic functions of the device are defined with the optional application packages in order code 030 (application package):

1: Universal (level, pump control, flow measurement, rake control)

Functions of the "Universal" application package

Application examples for level measurement

- Level measurement in containers and tanks using stored curves or free tables
- Alarm output
- Offsetting of both channels, e.g. for determining the mean value
- Rake control
- Pump control

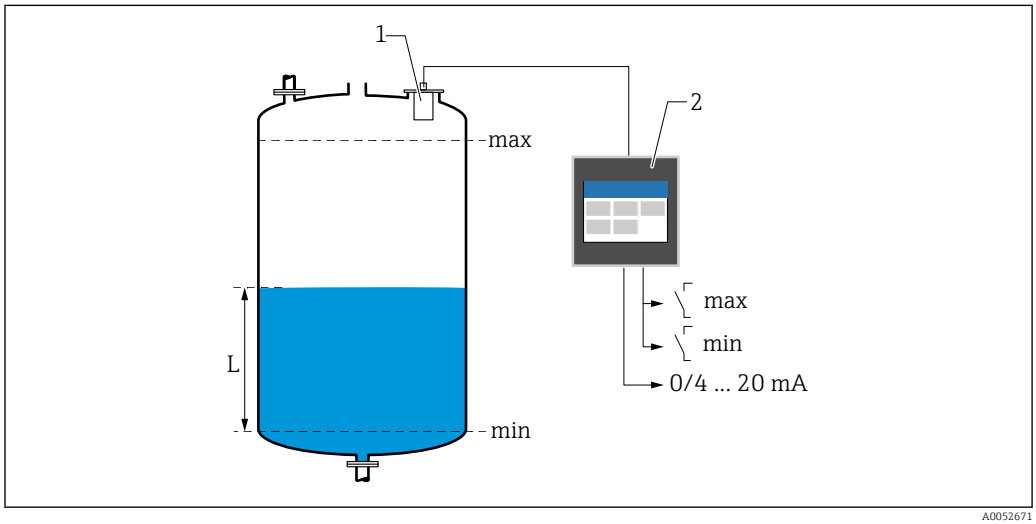
Application examples for flow measurement

- Flow measurement in flumes or weirs using stored curves or free tables
- Offsetting of both channels
- Totalizer + pulses
- Backwater detection
- Storm water overflow tank

Application examples for level measurement

Level measurement and alarm output

The level is recorded with the sensor. Limit values can be used to define minimum and maximum values and switch relays accordingly. Linearization must be set to "on" for the level to be passed on.



42 *Level measurement and alarm output*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
L Level

Level linearization

Pre-programmed linearization curves

- None (the sensor value is adopted directly)
- "Linear" cylindrical tank
- Horizontal cylindrical tank
- Spherical tank
- Tank with pyramid bottom
- Tank with conical bottom
- Tank with flat angled bottom

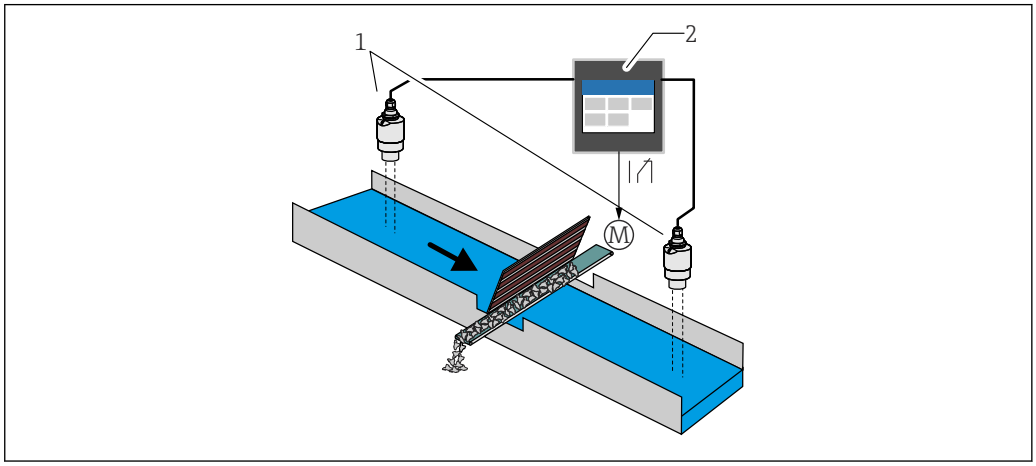
Linearization table

- Manual entry
- Up to 32 linearization points "Level - Volume". A linearization table can be created on the device or via the web server using editors. This table can be imported and exported as a CSV file (backup) in the web server.

Rake control (differential measurement)

Two sensors measure the levels before the rake (= upstream water level) and after the rake (= downstream water level). If the rake is dirty, the difference between the levels increases and the relays can be switched accordingly for rake control.

The rake control can operate in two modes: Difference: upstream water level – downstream water level or Ratio downstream water level / upstream water level



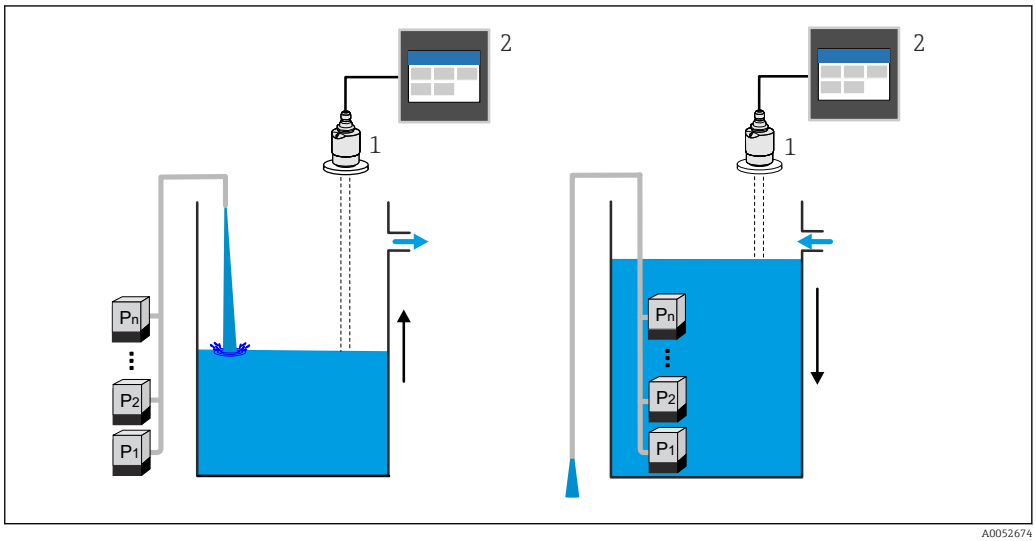
43 *Rake control (differential measurement)*

1 *Level sensors (e.g. Radar or ultrasonic sensor). Left sensor: upstream water level; right sensor: downstream water level*
2 *FlexView FMA90*
M *Motor for rake control*

Pump control

Via the pump control, up to eight pumps can be controlled individually or in groups based on the level, the status of digital inputs and/or the time. Additional functions for pump control are individually configurable. Each pump control can be operated in 2 modes: limit value control or pump rate control.

On 2-channel devices, two individual pump controls can be activated.



44 *Pump control for up to eight pumps. Example on the left: Filling; on the right: Emptying*

1 *Level sensor (e.g. radar or ultrasonic sensor)*
2 *FlexView FMA90*

Individually configurable for each pump:
- Pump switching delay
  E.g. to prevent overload of the power supply system.
- Pump run-on times and intervals
  E.g. for complete emptying of shafts or channels.
- Reduction of buildup on pump chamber walls by fine adjustment of the switch point
  E.g. variably changing level.

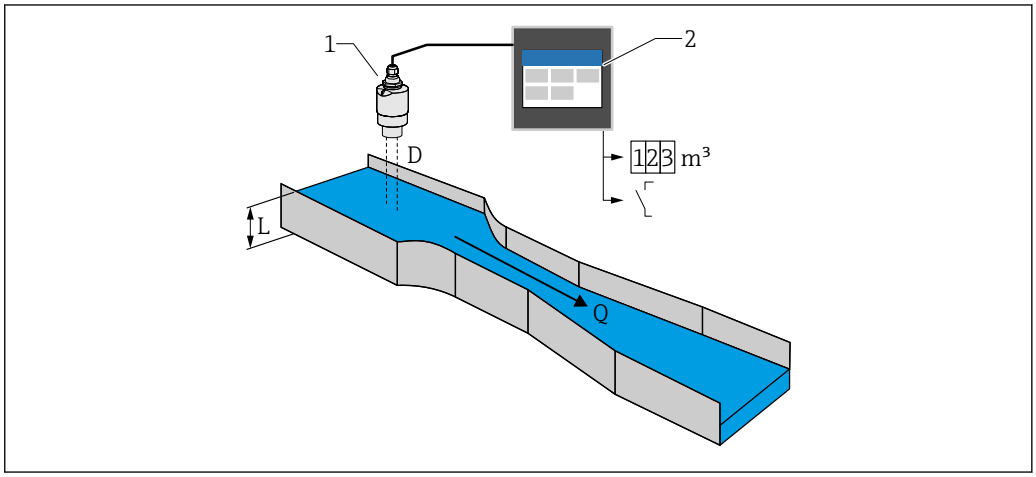
Further functions:
- Alternation in sequence/according to defined load.
  E.g. for protecting individual pumps, or pumps with the same load.
- Limit control
  Individual operation/parallel operation/pump group.
- Pump rate control
  Pumps are switched on automatically one by one until the minimum pump rate or switch-off point is reached.
- Tariff control
  Control of pumps according to electricity tariff.
- Storm function
  The storm function is used to prevent the unnecessary operation of the pumps if the plant is flooded for a short time (e.g. in the event of strong rainfall).
- Flush control
  The flushing function enables a relay to be switched on for a certain number of flush cycles for a specific flushing duration, e.g. to inject water into the container in order to dissolve/prevent sedimentation at the bottom of the container.
- Function test
  Pumps that have been switched off for too long are automatically switched on for a certain amount of time with the function test in order to avoid standing damage.
- Operating data recording
  Display of operating data such as operating hours since the last reset, total operating hours, number of starts since the last reset, starts per operating hour since the last reset, number of run-on starts since the last reset, runtime of the last switch-on (pump is off)/ since switch-on (pump running), downtime (last downtime if pump on/since switch-off if pump off).
- Operating hours alarm
  E.g. alarm goes off if the operating hours of a pump are exceeded.
- Pump feedback
  E.g. for indicating the pump status using a digital input.

Application examples for flow measurement

Flow measurement at flumes or weirs

A level sensor measures the level at the inlet of a flume or weir. The corresponding flow is calculated using pre-programmed or freely selectable linearization curves. If a critical value is exceeded or fallen short of, an alarm can be generated or a relay can be switched.

On 2-channel devices, two individual flow measurements can be activated.



45 *Flow measurement at flumes or weirs*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
D Distance between sensor membrane (reference point) and surface of liquid
L Level
Q Flow

The level L is derived from D. With linearization, the flow Q is derived from L.

Flow linearization

Pre-programmed linearization curves

Pre-programmed open flumes:
- Khafagi-Venturi flume
- ISO Venturi flume
- Parshall flume
- Palmer-Bowlus flume
- Trapezoidal flume according to ISO 4359:2022
- Rectangular flume according to ISO 4359:2022
- Leopold-Lagco flume
- Cutthroat flume
- U-shaped flume according to ISO 4395:2022
- H-flume

Pre-programmed weirs:
- Trapezoidal weir
- Circular-crested horizontal weir according to ISO 4374:1990
- Broad-crested weir according to ISO 3846:2008
- Thin-walled rectangular weir according to ISO 1438:2017
- Thin-walled triangular weir according to ISO 1438:2017

The pre-programmed linearization curves are stored in the device.

Standard formula for flow measurement

$Q = C\ (h^{\alpha} + \gamma h^{\beta})$

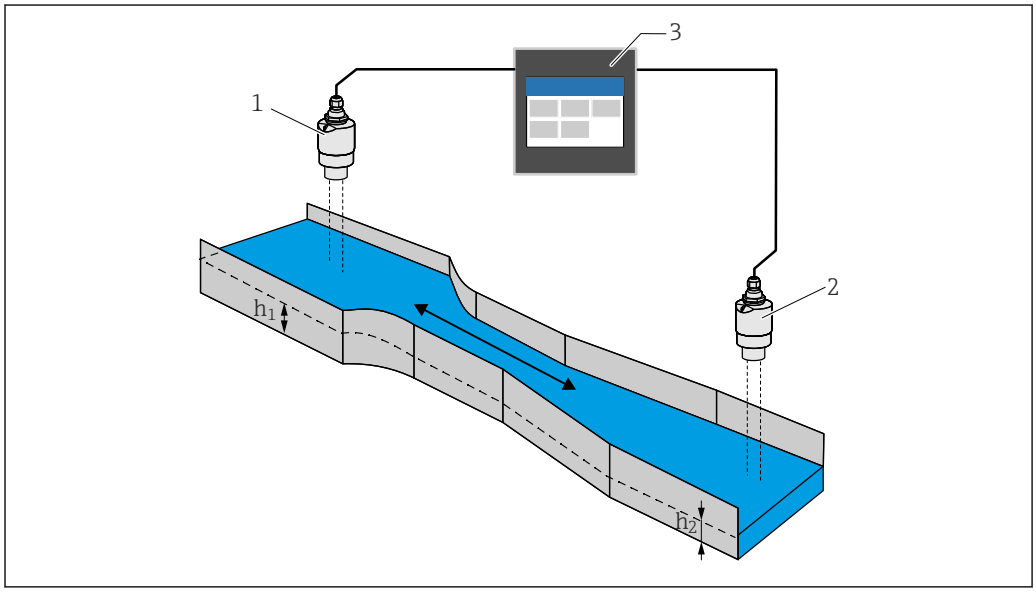
- h: Upstream level
- α, β, γ, C: User-definable parameters

Other supported calculations

- Ratiometric calculation
- Pipe profile (Manning)
- Linearization table with 32 points A linearization table can be created on the device or via the web server using editors. This table can be imported and exported as a CSV file (backup) in the web server.

Backwater detection (differential measurement)

Two level sensors measure the level at the inlet and outlet of a flume or weir. If the "downstream level : upstream level" ratio exceeds a critical value, an alarm is generated.



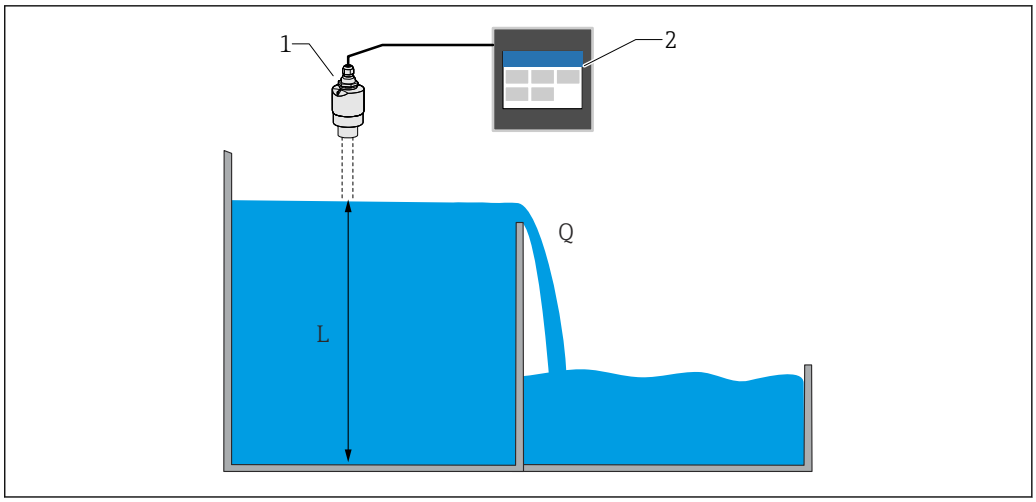
46 *Backwater detection*

1 Upstream sensor (e.g. radar or ultrasonic sensor)
h_1 Upstream level
2 Downstream sensor (e.g. radar or ultrasonic sensor)
h_2 Downstream level
3 FlexView FMA90

Stormwater overflow basin

A level sensor measures the level L. Using the integrated applications for the weirs, the overflow quantity Q can be calculated and stored in a totalizer. If a critical value is exceeded, an alarm can be generated or a relay can be switched.

Low flow cut off can be activated at the device, which sets the output value to 0 when a customer-specific flow value is fallen short of. This prevents downstream totalizers from further integrating the flow.



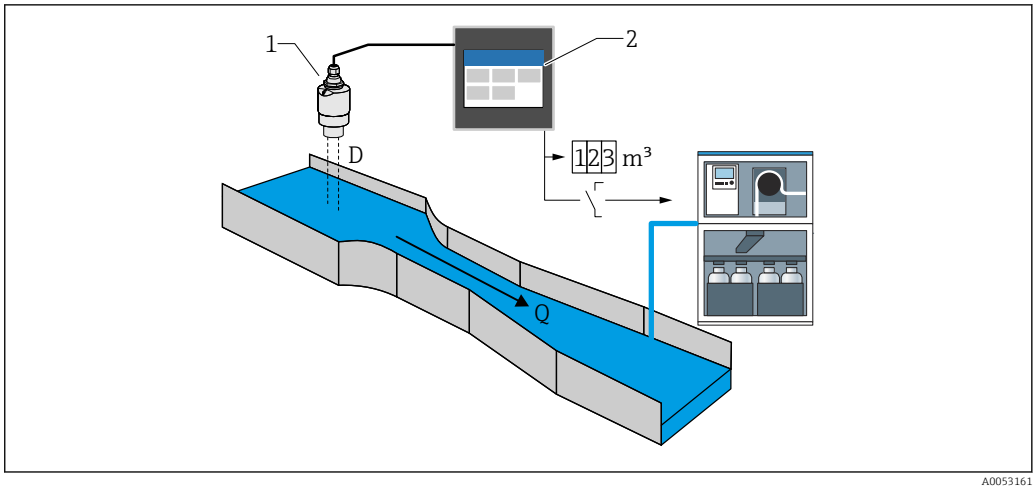
47 *Stormwater overflow basin*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
L Level
Q Overflow quantity

Totalizer + pulses (e.g. for samplers)

A level sensor measures the level at the inlet of a flume or weir. The corresponding flow is calculated using pre-programmed or freely selectable linearization curves. Using a pulse output (relay, open collector), the device can trigger additional systems such as wastewater samplers for example, with the flow-proportional volume signal.

Low flow cut off can be activated at the device, which sets the output value to 0 when a customer-specific flow value is fallen short of. This prevents downstream totalizers from further integrating the flow.



48 *"Totalizer + pulses" function, e.g. for samplers on flumes or weirs*

1 Level sensor (e.g. radar or ultrasonic sensor)
2 FlexView FMA90
D Distance between sensor membrane (reference point) and surface of liquid
Q Flow

15.1.3 Dependability

Security

IT security

The manufacturer warranty is valid only if the product is installed and used as described in the Operating Instructions. The product is equipped with security mechanisms to protect it against any inadvertent changes to the settings.

IT security measures, which provide additional protection for the product and associated data transfer, must be implemented by the operators themselves in line with their security standards.

Device-specific IT security

The device was developed in accordance with the requirements of the IEC 62443-4-1 "Secure product development lifecycle management" standard.

Link to the cybersecurity website: https://www.endress.com/cybersecurity

Further information on cybersecurity: see product-specific security manual (SD).

15.2 Input

15.2.1 Measured variable and measuring range of the sensor inputs

Number of sensor inputs

To be selected in order code 060 (sensor connection; analog output)

1x 4–20 mA/HART input; 1x 4–20 mA output

2x 4–20 mA/HART input; 2x 4–20 mA output

Connectable sensors

1. Connectable Endress+Hauser sensors with automatic sensor detection:
- Micropilot FMR20B, FMR30B
- Waterpilot FMX21

The most important sensor parameters are transmitted to the device via the HART interface and managed there. This makes it possible, for example, to replace the sensor quickly and easily.

2. Connectable Endress+Hauser 4 to 20 mA sensors:
- Micropilot FMR10B
- Waterpilot FMX11

3. Universal level sensors can also be connected to the 4 to 20 mA/HART inputs.

Sensor supply

Supply voltage (LPS): 14 to 27 V (load-dependent)

Input resistor current measurement: 25 Ω typ.

Internal HART communication resistor: 330 Ω typ.

Measurement accuracy

Basic accuracy: < 0.02 mA

Temperature drift: < 2 µA/K

Long-term drift: < 0.02 mA/year

15.2.2 Digital inputs

Number of digital inputs

4; to be selected in order code 080 (digital input; switch output)

Switching possibilities

External limit switch (for safety functions such as overflow or dry-running protection)
- 0: ≤ 5 V
- 1: ≥ 11 V
- Maximum permitted voltage: 30 V

Possible applications

- Pump feedback
- Pump tariff control
- Min/max level detection e.g. using Liquiphant

15.3 Output

15.3.1 Analog output (current output)

Quantity

To be selected in order code 060 (sensor connection; analog output)

1x 4–20 mA/HART input; 1x 4–20 mA output

2x 4–20 mA/HART input; 2x 4–20 mA output

Technical data for analog output

- Version: Active current output
- Load: Max. 600 Ω
- Basic accuracy: < 0.02 mA
- Temperature drift: < 2 µA/K
- Long-term drift: < 0.02 mA/year

Output signal

Configurable:
- 4 to 20 mA with HART
- 0 to 20 mA without HART

The HART signal is superimposed on the first analog output. The second analog output does not have a HART signal.

Response to errors

- For setting 4 to 20 mA, selectable:
  - MIN: 3.5 mA
  - MAX: Adjustable 21.5 to 22.5 mA
- For setting 0 to 20 mA:
  Adjustable 21.5 to 22.5 mA

15.3.2 Relay output

Quantity

To be selected in order code 070 (relay output)

Selection 1 relay: Version as SPDT [3)]

Selection 5 relay: 2xSPDT [3)], 3xSPST [4)];

technical data for relay

- Version: Potential-free contact, can be inverted
- Switching capacity (DC voltage): 4 A at 30 V
- Switching capacity (AC voltage): 4 A, 250 V, 1 000 VA (AC1)
- Mechanical switching cycles (without load): > 10^6
- Mechanical switching cycles (under load): > 10^4

Assignable functions

The functions that can be assigned to a switch output or a relay are identical.

3) "Single Pole, Double Throw" = relay with changeover contact
4) "Single Pole, Single Throw" = relay with make contact

- Alarm:
  Switches as soon as "Alarm" type diagnostics are pending
- Switch output:
  Digital inputs
  Limit values
- Pump control application:
  Pumps
  Flush control
  Alarm feedback
  Alarm operating hours
- Rake control application:
  Switching the rake
- Flow measurement application:
  Backwater alarm
- Pulse output:
  Flow 1 or 2
  Calculated flows
- Time pulse output:
  Switching a pulse after an adjustable duration

15.3.3 Switch output

Quantity

To be selected in order code 080 (digital inputs; switch outputs)

1 or 3 open collector outputs (NPN)

Technical data for switch output

- Max. switching current: 120 mA
- Max. voltage: 30 V
- Max. rate: 1000 pulses/second (at a load resistance ≤ 10 kΩ); adjustable pulse length
- Voltage drop when switched on (live): < 3 V

Assignable functions

The functions that can be assigned to a switch output or a relay are identical.

- Alarm:
  Switches as soon as "Alarm" type diagnostics are pending
- Switch output:
  Digital inputs
  Limit values
- Pump control application:
  Pumps
  Flush control
  Alarm feedback
  Alarm operating hours
- Rake control application:
  Switching the rake
- Flow measurement application:
  Backwater alarm
- Pulse output:
  Flow 1 or 2
  Calculated flows
- Time pulse output:
  Switching a pulse after an adjustable duration

15.3.4 Galvanic isolation

The following connections are galvanically isolated from one another:
- Power supply
- Sensor inputs
- Analog outputs
- Relay outputs
- Digital inputs (isolated from other connections but not from each other)
- Open collector outputs

15.4 Power supply

15.4.1 Connection data (AC voltage)

Device version

Order code 020 (power supply); option 1 (100-230 V AC)

- Supply voltage: 85 to 253 V_{AC} (50/60 Hz)
- Power consumption: Max. 20 VA

15.4.2 Connection data (DC voltage)

Device version

Order code 020 (power supply); option 2 (10.5-32 V DC)

- Supply voltage: 10.5 to 32 V_{DC}
- Power consumption: Max. 15 VA

⚠ CAUTION

- ▶ The device must be powered only by a power unit that operates using a limited-energy circuit in accordance with UL/EN/IEC 61010-1, Section 9.4 and the requirements in Table 18.
- ▶ Apart from the relays and the AC supply voltage, only energy-limited circuits according to IEC/EN 61010-1 may be connected.

15.4.3 Terminal assignment

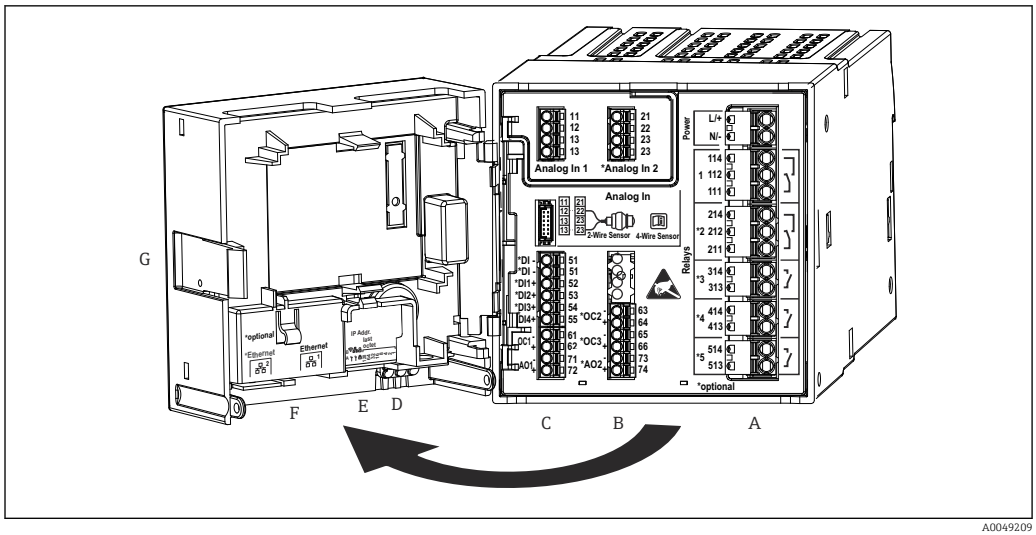
Terminal areas of DIN rail device

Device version

Order code 040 (housing); option A (DIN rail mounting)

The DIN rail device is designed for installation in the optional aluminum field housing.

The DIN rail device is available with or without a display unit (optional). The electrical connection is the same.



49 *Terminals for DIN rail device; terminal design: attachable push-in terminals*

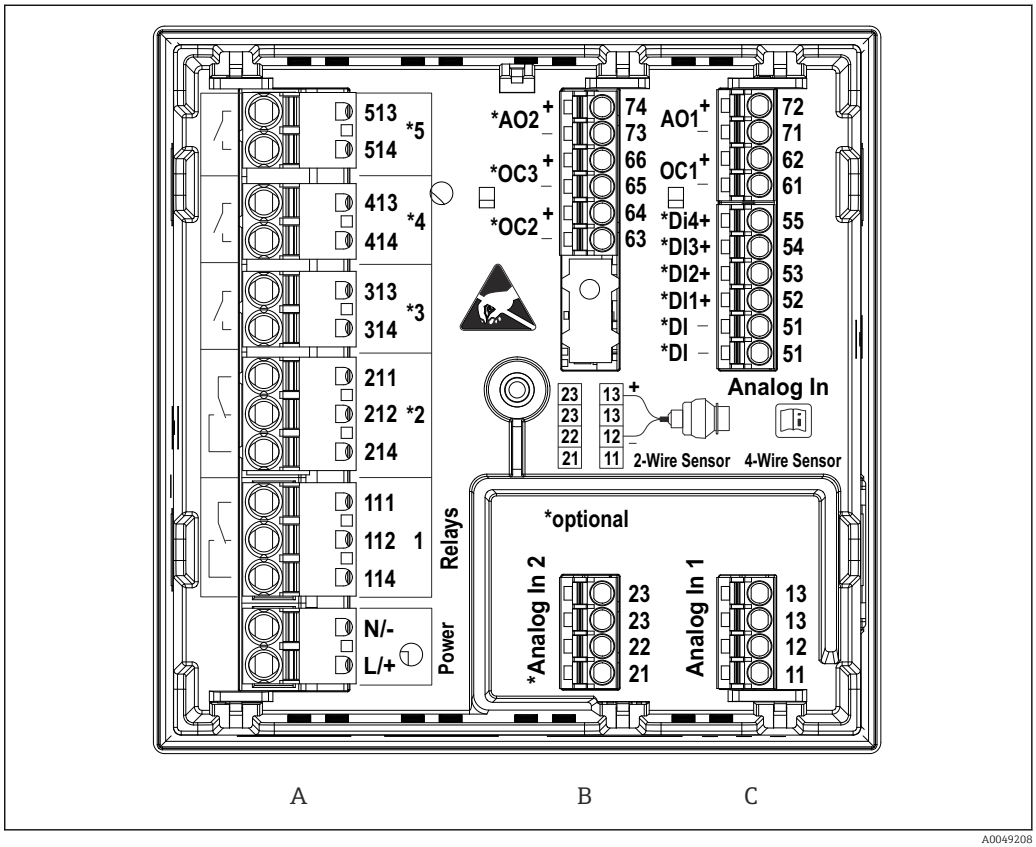
A Power unit with relay 1 (changeover contact). Optional: Relay 2 to 5
B I/O option card with analog input 2 (incl. loop power supply), analog output 2, open collector 2, 3
C Standard I/O card with analog input 1 (incl. loop power supply), analog output 1, open collector 1, optional: digital inputs 1 to 4
D 3 LEDs (only for version without display): DS (device status), NS (network status), WLAN
E DIP switch
F Ethernet connection 1 (standard), Ethernet connection 2 (optional)
G Unlocking device

The switching positions of the relays shown on the terminal area refer to the de-energized (current-free) state.

Terminal areas of panel-mounted device

Device version

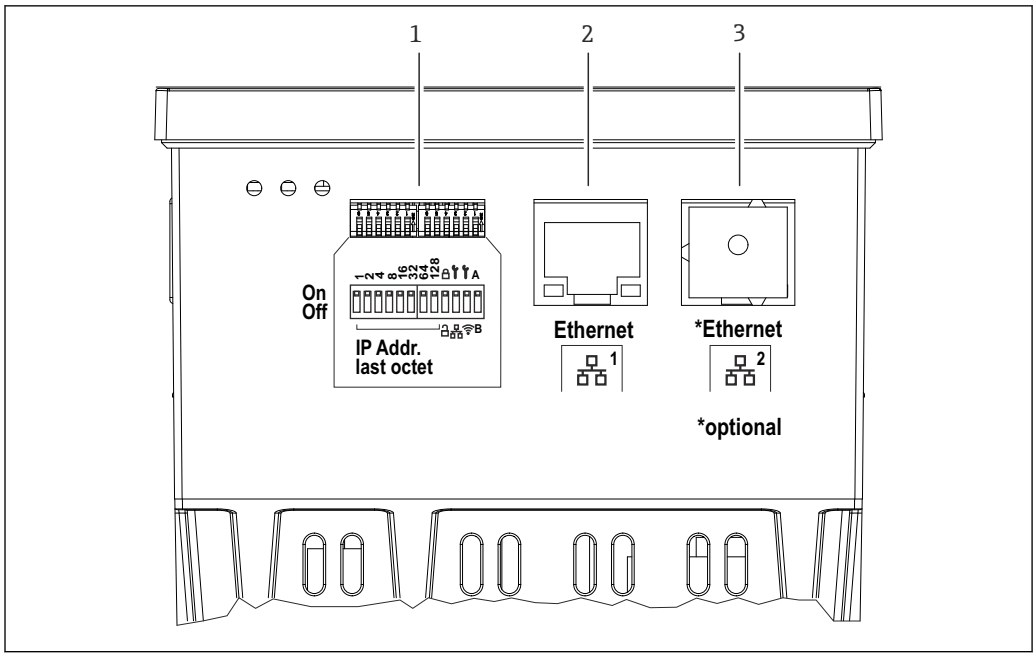
Order code 040 (housing); option B (panel mounting)



50 *Terminals for panel-mounted device (rear of device); terminal design: attachable push-in terminals*

A Power unit with relay 1 (changeover contact). Optional: Relay 2 to 5
B I/O option card with analog input 2 (incl. loop power supply), analog output 2, open collector 2, 3
C Standard I/O card with analog input 1 (incl. loop power supply), analog output 1, open collector 1, optional: digital inputs 1 to 4

The switching positions of the relays shown on the terminal area refer to the de-energized (current-free) state.



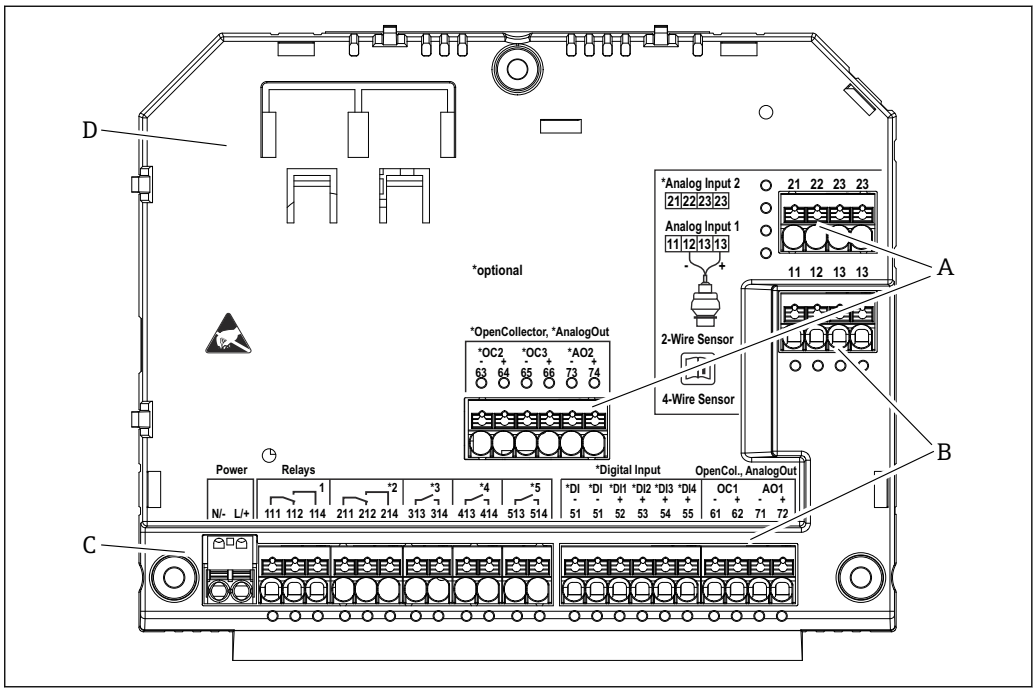
51 Connections for panel-mounted device (underside of devices)

1 DIP switch
2 Ethernet connection 1 (standard)
3 Ethernet connection 2 (optional)

Terminal areas of polycarbonate field housing

Device version

Order code 040 (housing); option C (field mounting, polycarbonate)



52 *Terminals in terminal compartment of polycarbonate field housing; terminal design: push-in terminals*

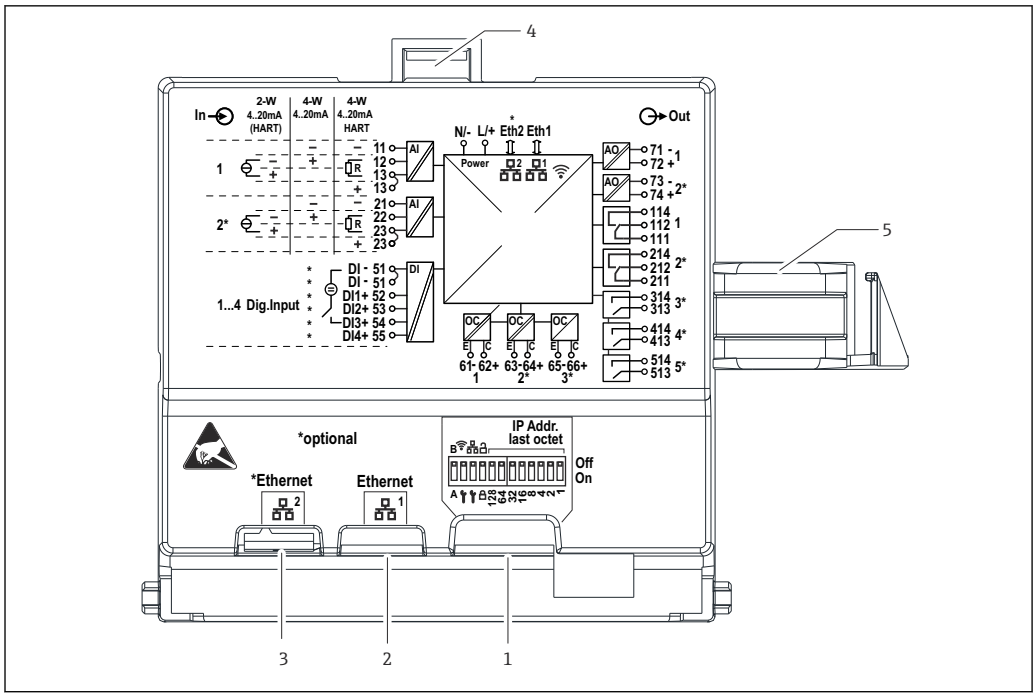
A Terminal area for analog input 2 (incl. loop power supply), analog output 2, open collector 2, 3
B Terminal area for analog input 1 (incl. loop power supply), analog output 1, open collector 1, optional: Digital inputs 1 to 4
C Terminal area for power supply and relay 1 (changeover contact). Optional: Relay 2 to 5
D Holder for commercially available shunting clamps

The switching positions of the relays shown on the terminal area refer to the de-energized (current-free) state.

Terminal areas on rear side of display for the polycarbonate field housing

Device version

Order code 040 (housing); option C (field mounting, polycarbonate)



53 *Connections on the rear side of display for the polycarbonate field housing*

1 *DIP switch*
2 *Ethernet connection 1 (standard)*
3 *Ethernet connection 2 (optional)*
4 *Locking device*
5 *Connecting cable to the main board*

Adapters for RJ45 to M12 connectors are available as an option for the field housing (see "Accessories" section in Operating Instructions). The adapters connect the RJ45 Ethernet interfaces with the M12 connectors mounted in the cable entries. Therefore the connection to the Ethernet interface can be established via an M12 connector without opening the device.

15.4.4 Terminals

The device is fitted with push-in terminals. Rigid conductors or flexible conductors with ferrules can be inserted directly into the terminal without using the lever, and create a contact automatically.

15.4.5 Cable entries

Cable entries of polycarbonate field housing

Precut openings on the bottom of the housing for the following cable entries:
- M16x1.5 (4 openings)
- M20x1.5 (2 openings)
- M25x1.5 (2 openings)

Use a suitable tool to cut out the required openings.

Cable entries for aluminum field housing

- There are eight M20x1.5 openings with blanking covers for cable glands on the bottom of the field housing.
- To establish the electrical connection: remove the blanking covers and replace them with cable glands. Guide the cables through the cable glands into the housing. The device is then connected in the same way as the DIN rail device.

15.4.6 Cable specification

⚠ CAUTION

Unsuitable connection cables may cause overheating and fire hazards, insulation damage, electric shock, power loss, and reduced operating life.

▶ Only use connection cables that comply with the specifications below.

Minimum requirement: Cable temperature range ≥ ambient temperature +20 K

For all connections on the field device and for power and relay connections in the case of the panel-mounted and DIN rail device:

- **Conductor cross-section**: 0.2 to 2.5 mm² (26 to 14 AWG)
- **Cross-section with wire end ferrule**: 0.25 to 2.5 mm² (24 to 14 AWG)
- **Stripping length**: 10 mm (0.39 in)

For digital input, open collector and analog input/output connections in the case of panel-mounted and DIN rail device:

- **Conductor cross-section**: 0.2 to 1.5 mm² (26 to 16 AWG)
- **Cross-section with wire end ferrule (excluding collar/including collar)**: 0.25 to 1 mm² (24 to 16 AWG)/ 0.25 to 0.75 mm² (24 to 16 AWG)
- **Stripping length**: 10 mm (0.39 in)

15.5 Performance characteristics

Only the performance characteristics of the device are mentioned at this point. The sensor-specific performance characteristics can be found in the technical data of the respective sensor.

15.5.1 Reference conditions

- Temperature: +25 °C (+77 °F) ±5 °C (±9 °F)
- Pressure: 960 mbar (14 psi) ±100 mbar (±1.45 psi)
- Humidity: 20 to 60 % r.F.

15.5.2 Maximum measurement error

See the "Sensor inputs" and "Analog output" sections

15.5.3 Response time

The response time is defined from a physical input up to the response at a physical output.

- Response time without HART: < 500 ms
- Response time with HART: < 2 s
- Response time for open circuit: < 5 s

15.5.4 Real time clock (RTC)

- Automatic or manual summer time changeover.
- Battery buffer. Operating life > 5 years if the device is not supplied with energy, > 10 years if the device is supplied with energy.
- Deviation: < 15 min./year
- Time synchronization possible via NTP or via digital input.

15.6 Mounting

Ensure compliance with the permitted ambient conditions during installation and operation. The device must be protected against the effects of heat (see the "Environment" section).

15.6.1 Mounting location

Panel mounting, installation on a DIN rail or installation in the field housing possible. The mounting location must be free from vibrations. A suitable electrical, fire-proof and mechanical enclosure must be provided.

Panel mounting and DIN rail version:
- In the control cabinet outside potentially explosive atmospheres
- At a sufficient distance from high-voltage cables or motor cables as well as contactors or frequency converters
- Minimum distance to the left: Panel-mounted device: 10 mm (0.4 in); DIN rail device: 20 mm (0.8 in)

Field housing:
- Protected from direct sunlight. Use a weather protection cover if necessary (see "Accessories")
- If mounting outdoors: Use overvoltage protection (see "Accessories")
- Minimum clearance to the left: 55 mm (2.17 in); the housing cover cannot be opened otherwise.

15.6.2 Orientation

Vertical

15.6.3 Installation instructions

Special mounting instructions

An optional assembly board is available to mount the field housing, see "Accessories".

Sensor selection and arrangement

Please note the respective Operating Instructions when it comes to installing and mounting the sensor.

15.6.4 Length of connecting cable

See technical data of the respective sensor.

15.6.5 Connecting cable

See technical data of the respective sensor.

15.6.6 Beam angle

See technical data of the respective sensor.

15.7 Environment

15.7.1 Ambient temperature range

−40 to +60 °C (−40 to +140 °F) (Type tested)

−35 to +60 °C (−31 to +140 °F) (approved by CSA)

- The functionality of the LCD display becomes limited at T_A < −20 °C (−4 °F).
- If operating outdoors in strong sunlight: Use a weather protection cover.

15.7.2 Storage temperature

−40 to +80 °C (−40 to +176 °F)

15.7.3 Relative humidity

Maximum 95%

Non-condensing in the case of panel-mounted and DIN rail device.

15.7.4 Operating height

Non-ex version:
Maximum 3 000 m (9 842 ft) above standard elevation zero

Ex version:
Maximum 2 000 m (6 562 ft) above standard elevation zero

15.7.5 Degree of protection

Degree of protection of polycarbonate field housing

IP65/NEMA Type 4x

Degree of protection of aluminum field housing

IP65/NEMA Type 4x

Degree of protection of DIN rail housing

IP20

Degree of protection of panel housing

- IP65/NEMA Type 4 (at front, if mounted in cabinet door)
- IP20 (at rear, if mounted in cabinet door)

15.7.6 Electrical safety

- Electrical safety according to IEC 61010-1:2010/AMD1:2016/COR1:2019
- Class:
  230 V_{AC} version: Class II equipment
  24 V_{DC} version: Class III equipment
- Overvoltage category II
- Pollution level 2
- Upstream overcurrent protection device ≤ 10 A

15.7.7 Mechanical load

Vibration resistance

Field housing: Sinusoidal vibrations according to IEC 60068-2-6
* 2 to 8.4 Hz with 3.5 mm (0.14 in) amplitude (peak)
* 8.4 to 500 Hz with 1g acceleration (peak)

For all housing variants: Noise-induced vibrations according to IEC 60068-2-64
* 10 to 200 Hz with 0.003 g^2/Hz
* 200 to 2 000 Hz with 0.001 g^2/Hz

Shock resistance

Field housing: Half-sine vibrations according to IEC 60068-2-27 (30G, 6 ms)

Note: Deviations from normal operation may occur during the test (e.g. switching of relays).

Impact resistance

Impact resistance and drop test according to IEC 61010-1:2010/AMD1:2016-/COR1:2019

15.7.8 Cleaning

A clean, dry cloth can be used to clean the device.

15.7.9 Electromagnetic compatibility (EMC)

Electromagnetic compatibility in accordance with all the relevant requirements outlined in the EN 61326 series and NAMUR Recommendation EMC (NE 21). For details, refer to the Declaration of Conformity.

Under the influence of interference, the measurement error may be 1% of the full scale value (0.5% for sensor inputs in 4 to 20 mA operation).

Interference immunity according to IEC/EN 61326 series, industrial requirements.

With regard to interference emission, the device meets the requirements of Class A, and is only designed for use in an "industrial environment".

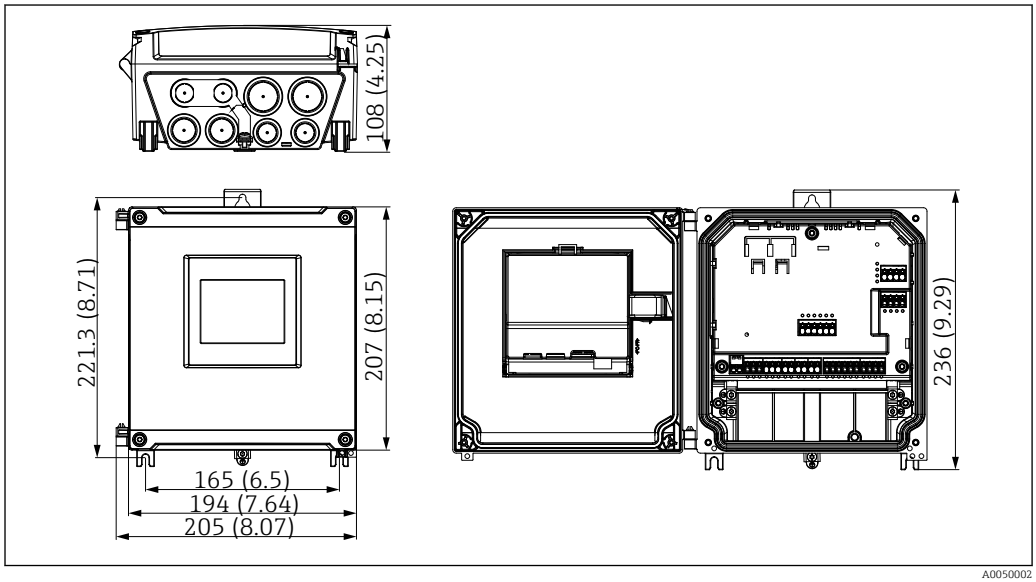
Interference emission according to IEC/EN 61326 series (CISPR 11) Group 1 Class A

This device is not intended for use in living areas. Appropriate protection of the radio reception cannot be ensured in such environments.

15.8 Mechanical construction

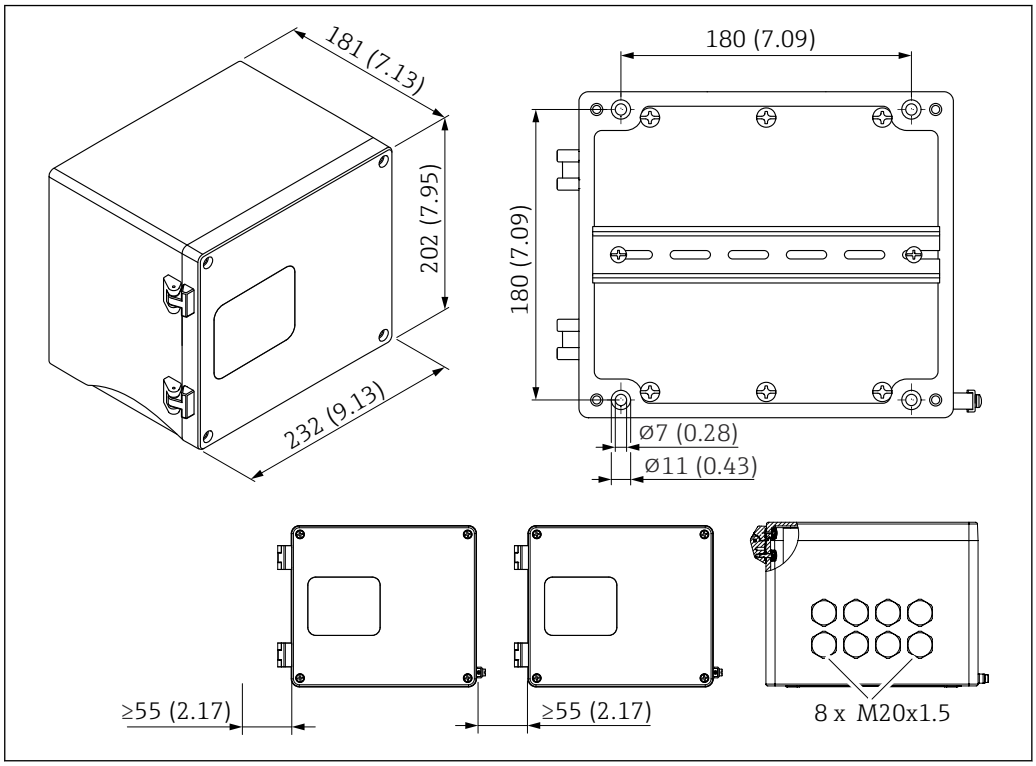
15.8.1 Dimensions

Polycarbonate field housing



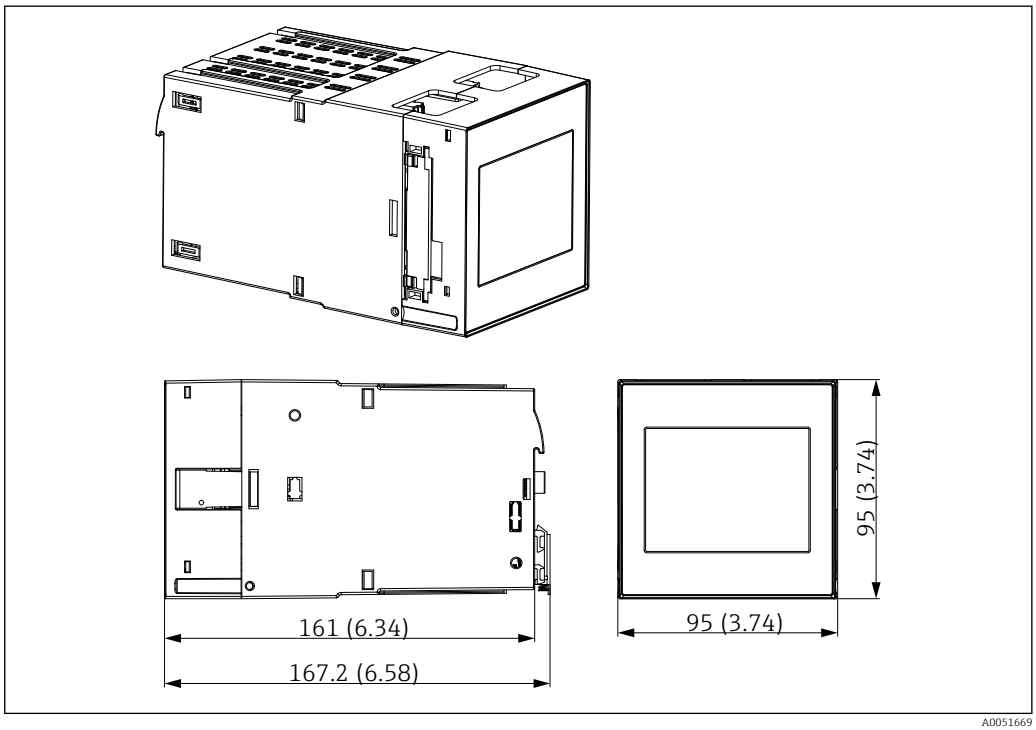
54 *Polycarbonate field housing. Unit of measurement mm (in)*

Aluminum field housing



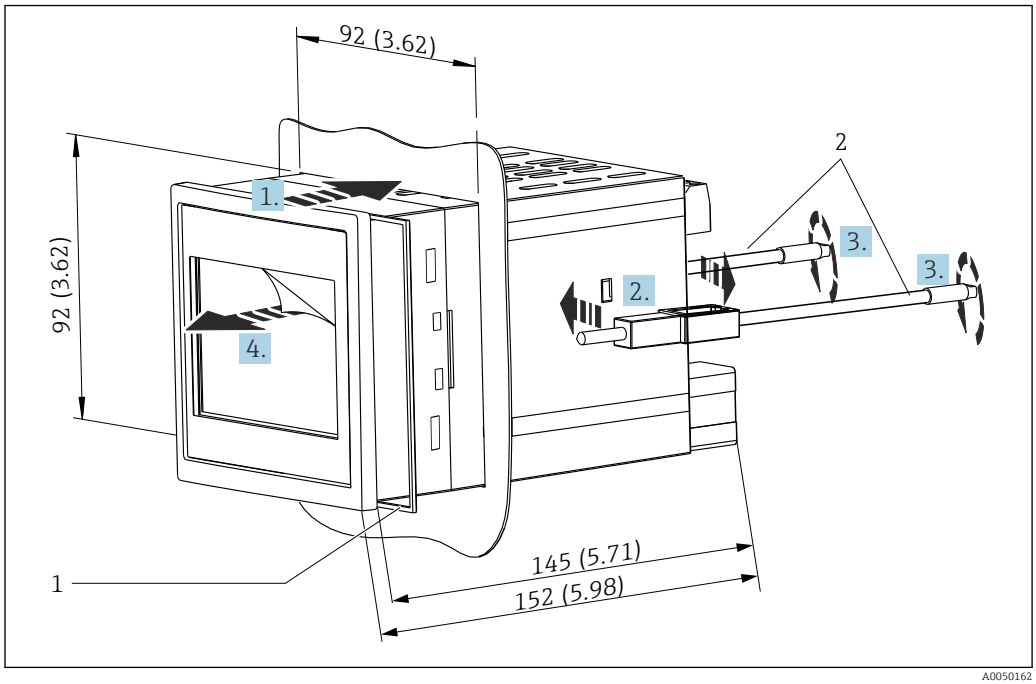
55 *Aluminum field housing (for installing the DIN rail device). The cable entries are located on the bottom. Unit of measurement mm (in)*

DIN rail device



56 *DIN rail housing. Unit of measurement mm (in)*

Panel-mounted device



57 *Panel housing (panel cutout 92 mm (3.62 in) x 92 mm (3.62 in)). Unit of measurement mm (in)*

1 Sealing ring (included in the delivery)
2 Fastening clips (2x included in the delivery)

15.8.2 Weight

Polycarbonate field housing

Approx. 1.6 to 1.8 kg (3.53 to 3.97 lb) depending on device version

Aluminum field housing

Approx. 1.6 to 1.8 kg (3.53 to 3.97 lb) depending on device version

DIN rail device

Approx. 0.7 kg (1.54 lb) depending on device version

Panel-mounted device

Approx. 0.5 kg (1.10 lb)

15.8.3 Materials

Polycarbonate field housing

- Assembly board for pipe mounting: Stainless steel 316L
- Field housing: PC-FR
- Seal: VMQ
- Nameplate: Polyester
- Screws: A4 (1.4578)

Aluminum field housing

- Field housing: Aluminum
- Seal: PUR soft foam
- Nameplate: Polyester
- Screws: A4 (1.4578)

Panel-mounted and DIN rail device

- Housing: PC
- Seal for panel housing: EPDM
- Nameplate: Lasered on

15.9 Display and user interface

The device's display and operating options are defined in order code 050 (display, operation)

- 1: None; RJ45 Ethernet
- 2: None; RJ45 Ethernet + WLAN
- 3: 3.5" TFT touch display; RJ45 Ethernet
- 4: 3.5" TFT touch display; RJ45 Ethernet + WLAN

15.9.1 Onsite operation and display

The device is optionally equipped with a 3.5" TFT touch display for onsite operation.

Size (diagonal screen measurement)

90 mm (3.5 ")

Resolution

QVGA, 76,800 pixels (320 x 240)

Backlight

50,000 h half-life (= half brightness)

Number of colors

24 bit color depth; 16.7 million displayable colors

Maximum character size; number of digits

Digit height max. 50 pixels or 13 mm with max. seven digits

Viewing angle

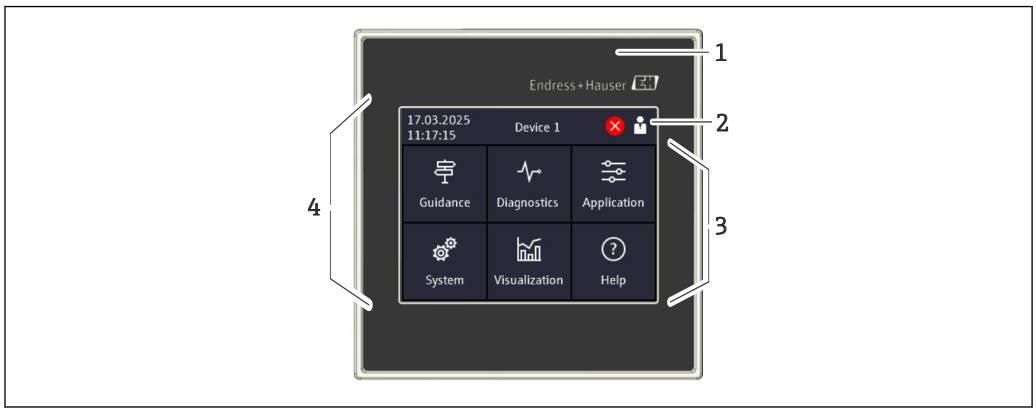
Max. viewing angle range: 85 ° in all directions from the display central axis

Screen displays

- Users can choose between black and white for the background color.
- Active channels can be assigned to up to six groups. For unique identification, each group can be given a descriptive name.
- Linear scales
- Horizontal curve display, bar graph display or digital display

15.9.2 Elements on front of device with touch display

The device version without display features 3 LEDs: DS (device status), NS (network status) and WLAN status at the bottom left instead of the display



1 *Front of device*
2 *Header: date/time, tag name, diagnostic information, quick access menu (logging in/log out, language)*
3 *Function tiles for display and touch operation*
4 *Touch display*

15.9.3 Light emitting diodes (LEDs)

The LEDs are only visible with the DIN rail version without touch display.

DS (device status): LED for operating status

- **Lit green**
  Normal operation; no faults detected.
- **Flashes red**
  Warning is pending. Details are saved in the diagnostic list.
- **Lit red**
  Alarm is pending. Details are saved in the diagnostic list.
- **Off**
  No supply voltage.

NS (network status): LED for PROFINET or Ethernet/IP

- **Lit red**
  Communication active
- **Lit green**
  Connection established, no active communication
- **Off**
  No connection

WLAN: LED for communication

- **Flashing blue**
  Searching for WLAN access point
- **Lit blue**
  Connection established
- **Off**
  No connection

15.9.4 Operation concept

The device can be operated directly on site (option of 3.5" TFT touch display), or through remote configuration via interfaces and operating tools (web server).

Integrated Operating Instructions
Thanks to the device's simple operating concept, it is possible to commission the device for many applications without a hard copy of the Operating Instructions. The device has an integrated help function and displays operating instructions directly on the monitor.

Dynamic operating menu

Only function groups that are relevant for the device version and installation environment are displayed in the menu. The integrated wizard guides the user intuitively through the entire commissioning process.

Locking operation

- Via the lock switch in the terminal compartment
- Via touch display on the operating module
- Automatic operating lock after a set time (configurable)

15.9.5 Languages

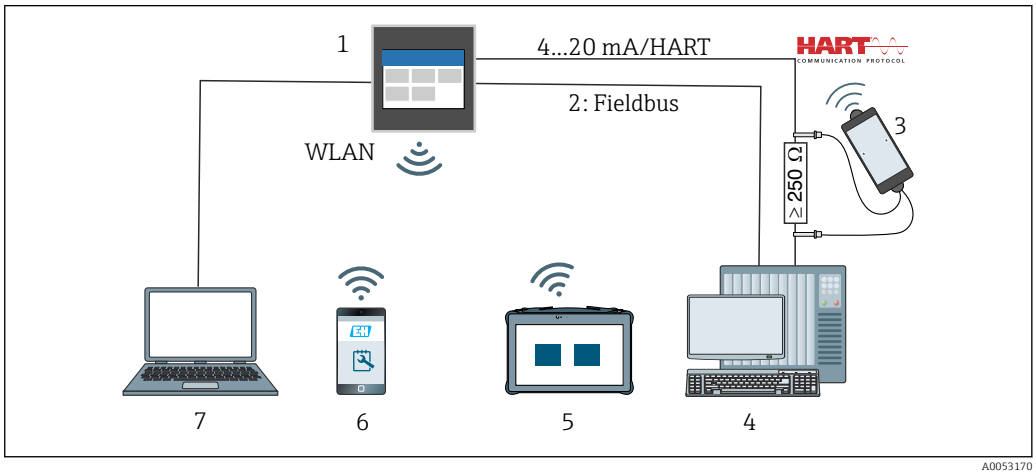
The following languages can be selected in order code 500 (operating language display):

English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese (simplified), Japanese, Korean, Indonesian, Czech, Swedish

15.9.6 Remote operation

The device can be operated independently of the optional touch display using the following operating tools:

Operation options



58 *System integration*

1 *FlexView FMA90*
2 *Fieldbus: PROFINET, Modbus TCP, EtherNet/IP to PLC (optional)*
3 *HART modem with connection cable, e.g. Commubox FXA195 or VIATOR Bluetooth (restricted operation)*
4 *PLC via HART protocol (FDI package, restricted operation)*
5 *Field Xpert SMT70 via WLAN and web server*
6 *Operation and configuration via WLAN and web server*
7 *Operation and configuration via Ethernet and web server*

Device access via WLAN

The device is optionally equipped with WLAN. In addition to Ethernet TCP/IP, device access is therefore also possible via WLAN.

Operation options via web server

A web server is integrated into the device. The web server offers the following range of functions:
- Easy configuration without additional installed software
- Instantaneous value display and diagnostics information
- Display of current measured value curves
- Display of events and logbook entries
- Device firmware update
- Device configuration indicated as PDF

15.9.7 System integration

Communication	Driver technology	Configuration possible	Systems (examples)
HART	EDD	No	EDD hosts (e.g. Emerson AMS, Yokogawa PRM)
HART	EDD (Siemens)	No	Siemens PDM

15.9.8 Supported operating tools

Device configuration and measured value retrieval can also be done via interfaces. The following operating tools are available for this purpose:

Operating tool	Functions	Communication
Web server (integrated into the device; access via browser)	▪ Easy configuration without additional installed software ▪ Display of data and measured value curves via the web browser ▪ Remote access to device and diagnostic information	Ethernet, WLAN

15.10 Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Downloads**.

15.11 Ordering information

Detailed ordering information is available from your nearest sales organization www.addresses.endress.com or in the Product Configurator at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.

3. Select **Configuration**.

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to the measuring point, such as the measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

15.11.1 Scope of delivery

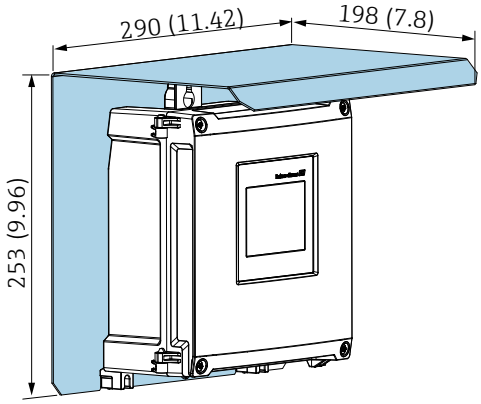
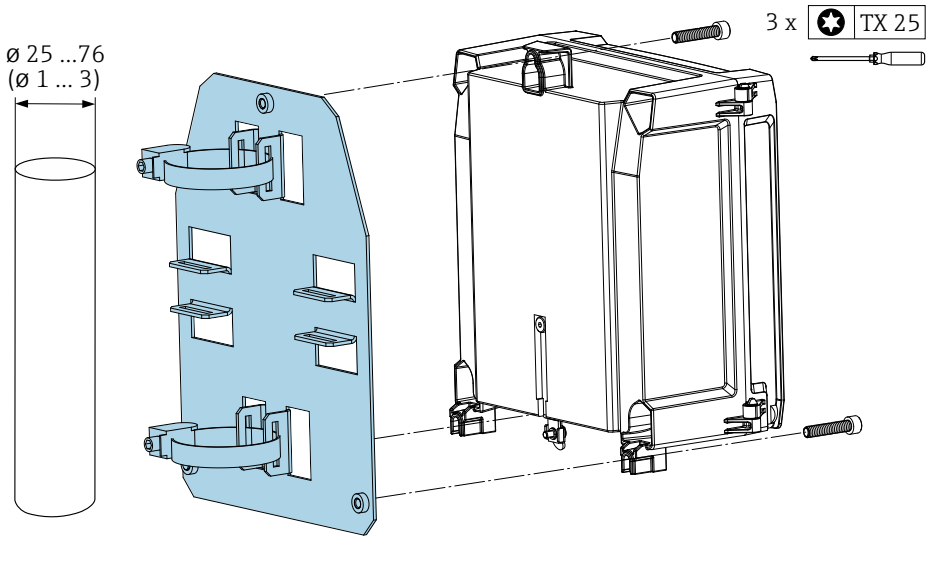
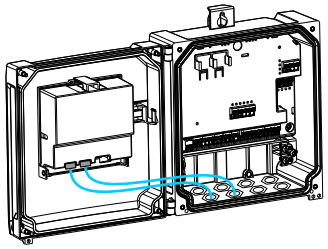
The scope of delivery of the device comprises:
- Device (with terminals, according to order)
- Panel-mounted device: Two screw fastening clips, sealing rubber towards the panel wall
- Delivery note
- Hard copy of Brief Operating Instructions
- Hard copy of Ex Safety Instructions (optional)

15.12 Accessories

The accessories currently available for the product can be selected at www.endress.com:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Spare parts & Accessories**.

15.12.1 Device-specific accessories

Type	
Stainless steel 316Ti (1.4571) weather protection cover for polycarbonate field housing  A0053172 59 *Weather protection cover for direct wall mounting or using assembly board for pipe mounting. Unit of measurement mm (in)*	
Assembly board for pipe mounting for polycarbonate field housing  A0053940 60 *Mounting plate for pipe mounting of polycarbonate field housing. Unit of measurement mm (in)* ▪ Pipe diameter: 25 to 76 mm (1 to 3 in) ▪ Dimensions: 210 x 110 mm (8.27 x 4.33 in) ▪ Material: Stainless steel 316L ▪ Mounting accessories: fastening clips, screws and nuts are supplied.	
Cable glands 4x M16x1.5/2x M20x1.5/2x M25x1.5	
 A0056168	1x M12 plug, Ethernet/PROFINET (adapter RJ45 on M12 plug; for polycarbonate field housing) 2x M12 plug, Ethernet/PROFINET (adapter RJ45 on M12 plug; for polycarbonate field housing)

15.12.2 Online tools

Product information over the entire life cycle of the device: www.endress.com/onlinetools

15.12.3 System components

Surge arrester modules from the HAW product family

Surge arrester modules for DIN rail and field device mounting, for the protection of plants and measuring instruments with power supply and signal/communication lines.

More detailed information: www.endress.com

15.13 Supplementary documentation

The following document types are available in the Downloads area of the Endress+Hauser website (www.endress.com/downloads):

Document type	Purpose and content of the document
Technical Information (TI)	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Brief Operating Instructions (KA)	**Guide that takes you quickly to the 1st measured value** The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	**Your reference document** These Operating Instructions contain all the information that is required in the various life cycle phases of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning, through to troubleshooting, maintenance and disposal.
Description of Device Parameters (GP)	**Reference for your parameters** The document provides a detailed explanation of each individual parameter. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.
Safety Instructions (XA)	Depending on the approval, safety instructions for electrical equipment in hazardous areas are also supplied with the device. These are an integral part of the Operating Instructions. Information on the Safety Instructions (XA) that are relevant for the device is provided on the nameplate.
Supplementary device-dependent documentation (SD/FY)	Always comply strictly with the instructions in the relevant supplementary documentation. The supplementary documentation is an integral part of the device documentation.

www.addresses.endress.com

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