

Brief Operating Instructions

Prosonic S FMU90

PROFIBUS DP

Ultrasonic measuring technology
Flow measurement
1 or 2 sensors

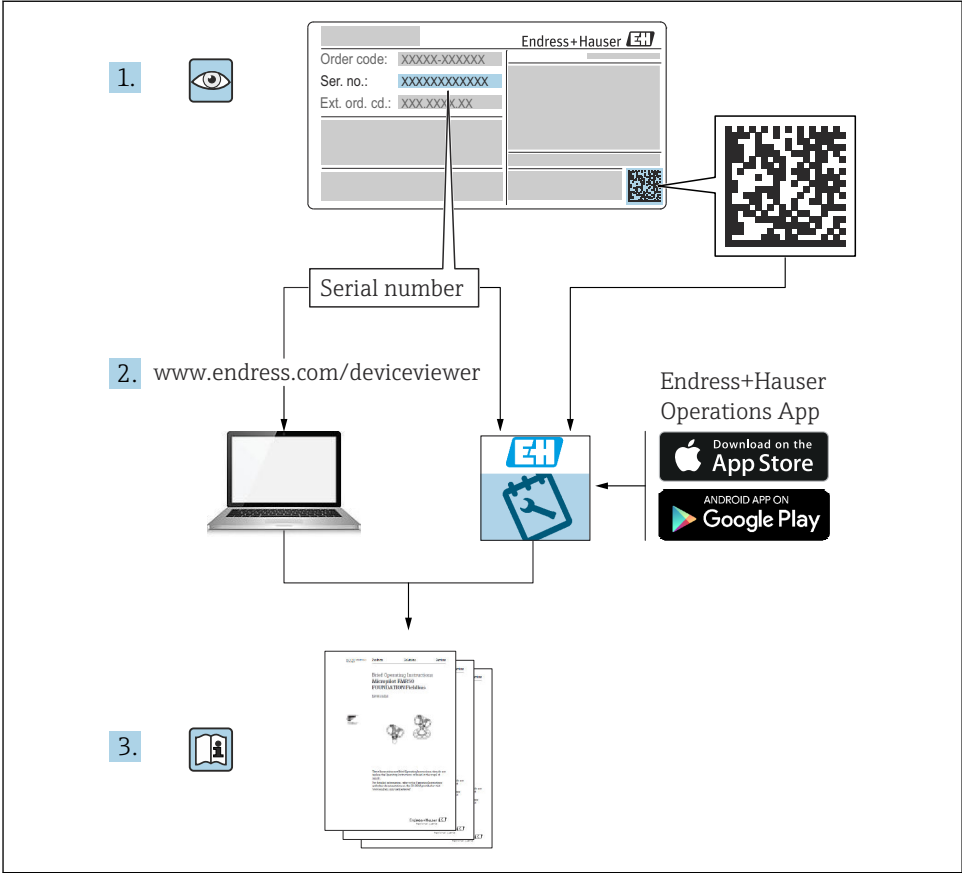


These Instructions are Brief Operating Instructions; they are not a substitute for the Operating Instructions pertaining to the device.

Detailed information about the device can be found in the Operating Instructions and the other documentation:
Available for all device versions via:

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

1 Associated documentation



2 About this document

2.1 Symbols used

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

⚠ CAUTION

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

NOTICE

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

2.1.2 Symbols for certain types of information and graphics

 Tip

Indicates additional information



Reference to documentation



Reference to graphic



Notice or individual step to be observed

1, 2, 3

Series of steps

1, 2, 3, ...

Item numbers

A, B, C, ...

Views

3 Basic safety instructions

3.1 Intended use

Prosonic S FMU90 is a transmitter for ultrasonic sensors FDU90, FDU91, FDU91F, FDU92, FDU93 and FDU95. To support existing installations, the following sensors can also be connected: FDU80, FDU80F, FDU81, FDU81F, FDU82, FDU83, FDU84, FDU85, FDU86, FDU96.

3.2 Installation, commissioning and operation

This device has been safely built with state-of-the-art technology and meets the applicable requirements and EU Directives. However, if it is used improperly or for applications for which it is not intended, application-related hazards may arise, e.g. product overflow due to incorrect installation or configuration. Installation, electrical connection, commissioning, operation and maintenance of the measuring system must therefore be carried out exclusively by trained specialists authorized to perform such work by the system operator. Technical personnel must

have read and understood these Operating Instructions and must adhere to them. Modifications and repairs to the device may only be carried out if they are expressly permitted in the Operating Instructions.

3.3 Operational safety and process safety

Alternative monitoring measures must be taken to ensure operational safety and process safety during configuration, testing and maintenance work on the device.

3.3.1 Hazardous area

When using the measuring system in hazardous areas, the applicable national standards must be observed. The device is accompanied by separate "Ex documentation", which is an integral part of these Operating Instructions. The installation specifications, connection data and safety instructions listed in this supplementary documentation must be observed.

- Ensure that the technical personnel is sufficiently trained.
- Comply with the metrological and safety-related requirements for the measuring point.

The transmitter may only be mounted in suitable areas. Sensors with an approval for hazardous areas may be connected to transmitters that do not have an Ex approval.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during incoming acceptance:

- Are the order codes on the delivery note and the product label identical?
- Are the goods undamaged?
- Do the nameplate data match the ordering information on the delivery note?
- If required (see nameplate): are the Safety Instructions (XA) provided?



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

4.2 Product identification

The measuring device can be identified in the following ways:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter the serial number from the nameplate in *W@M Device Viewer* (www.endress.com/deviceviewer): all the information about the device is displayed.
- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: all the information about the measuring device is displayed.

4.3 Storage and transport

- Pack the device so that it is protected against impact for storage and transportation. The original packaging provides optimum protection.
- Permitted storage temperature: -40 to $+60$ °C (-40 to 140 °F)

5 Mounting

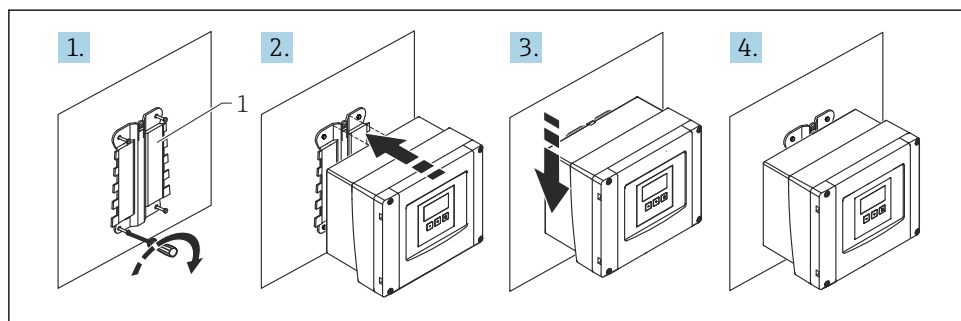
5.1 Mounting the polycarbonate field housing

5.1.1 Mounting location


- Shaded location, protected from direct sunlight. Use a weather protection cover if necessary.
- If mounting outdoors: use a surge arrester.
- Altitude: install at a maximum altitude of 2 000 m (6 560 ft) over MSL
- Minimum clearance to the left: 55 mm (2.17 in); the housing cover cannot be opened otherwise.

5.1.2 Wall mounting

- The housing bracket supplied can also be used as a drilling template.
- Mount the housing bracket on a level surface so that it cannot become warped or bent.

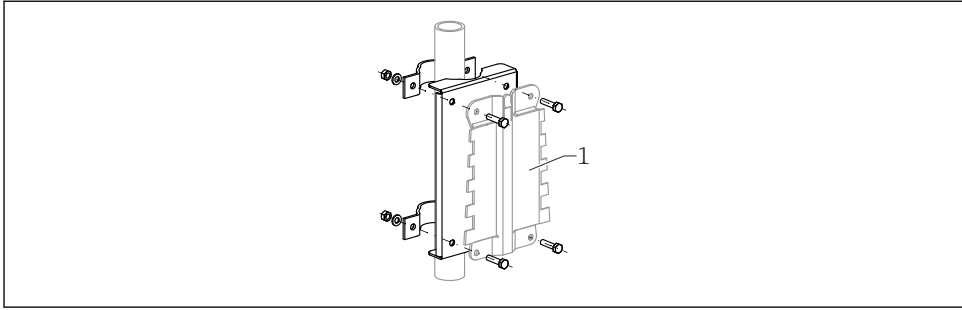


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 1 Wall-mounted polycarbonate field housing

1 Housing bracket (supplied)

5.1.3 Post mounting



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2 Mounting plate for mounting the polycarbonate field housing on a post

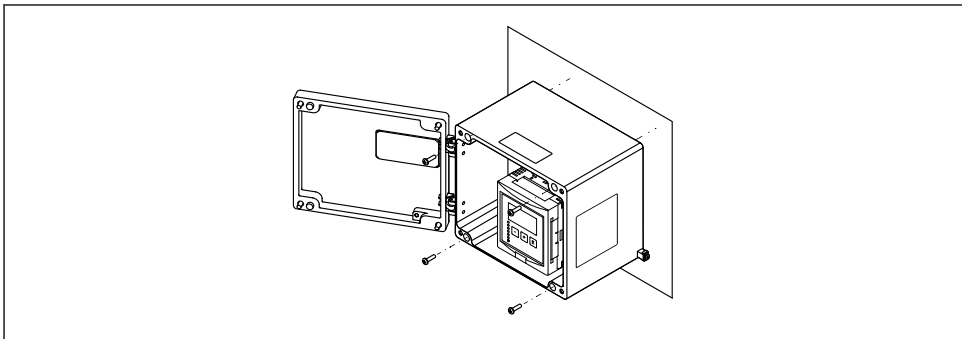
1 Housing bracket (supplied)

5.2 Mounting the aluminum field housing

5.2.1 Mounting location

- Shaded location, protected from direct sunlight
- If mounting outdoors: use a surge arrester
- Altitude: install at a maximum altitude of 2 000 m (6 560 ft) over MSL
- Minimum clearance to the left: 55 mm (2.17 in), the housing cover cannot be opened otherwise

5.2.2 Mounting the device



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3 Wall-mounted aluminum field housing

5.3 Mounting the DIN rail housing

5.3.1 Mounting location

- In cabinet outside hazardous areas
- At a sufficient distance from high-voltage electric cables, motor cables, contactors or frequency converters
- Altitude: install at a maximum altitude of 2 000 m (6 560 ft) over MSL
- Minimum clearance to the left: 10 mm (0.4 in); the housing cover cannot be opened otherwise.

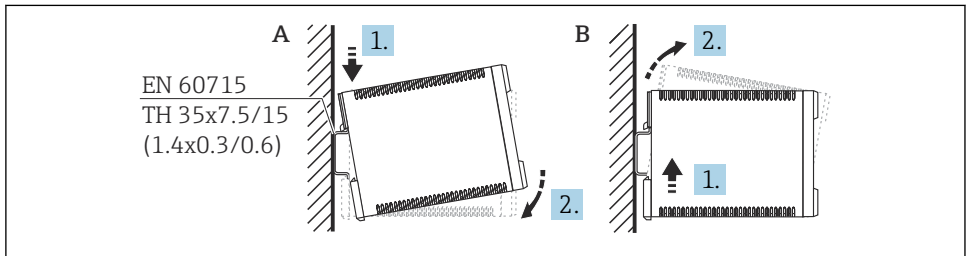
5.3.2 Mounting the device

⚠ WARNING

The DIN rail housing meets protection class IP06.

If the housing is damaged, there is a risk of electric shock at live parts.

- ▶ Install the device in a stable cabinet.



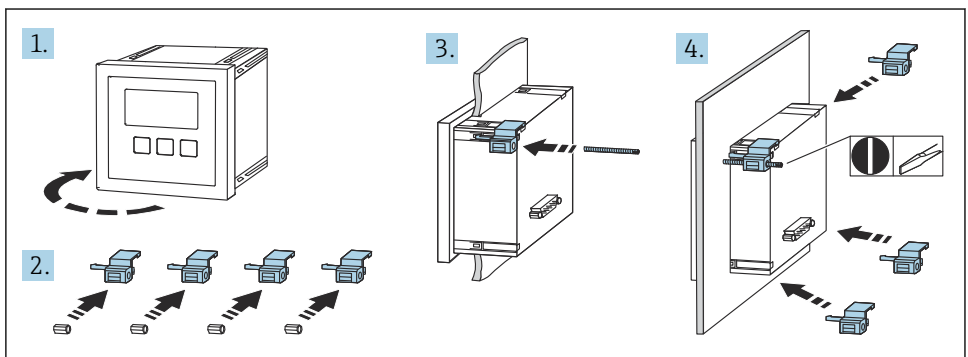
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4 Mounting/disassembling the DIN rail housing. Unit of measurement mm (in)

A Mounting

B Disassembly

5.4 Mounting the remote display and operating module



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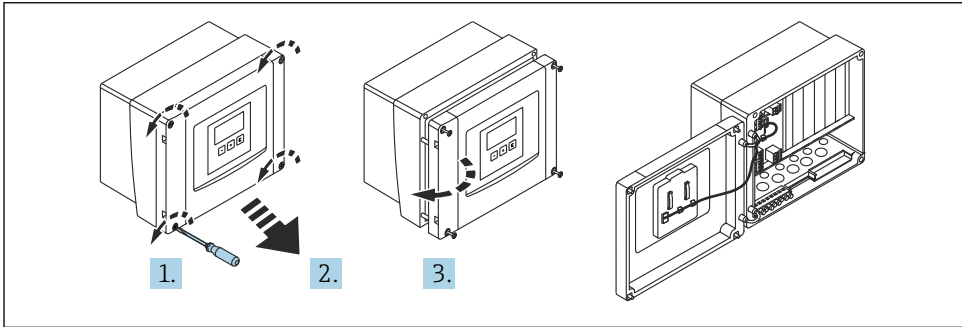
6 Electrical connection

6.1 Connecting requirements


6.1.1 Cable specification

- **Conductor cross-section:** 0.2 to 2.5 mm² (26 to 14 AWG)
- **Wire sleeve cross-section:** 0.25 to 2.5 mm² (24 to 14 AWG)
- **Min. stripping length:** 10 mm (0.39 in)

6.1.2 Terminal compartment of polycarbonate field housing



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 5 Access to terminal compartment in polycarbonate field housing

Cable entries

Precut openings on the bottom of the housing for the following cable entries:

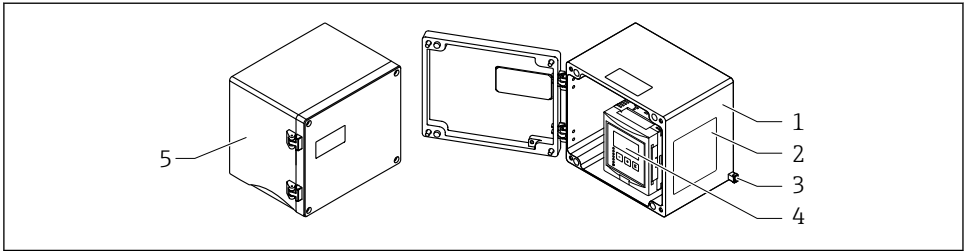
- M20x1.5 (10 openings)
- M16x1.5 (5 openings)
- M25x1.5 (1 opening)

6.1.3 Terminal compartment of aluminum field housing

WARNING

To ensure explosion protection:

- ▶ Ensure that all the terminals are located in the field housing. (Exception: terminal for protective ground on the outside of the field housing).
- ▶ Connect the housing to the local ground potential (PML).
- ▶ To route the cables, only use cable glands that meet the explosion protection requirements at the place of operation.



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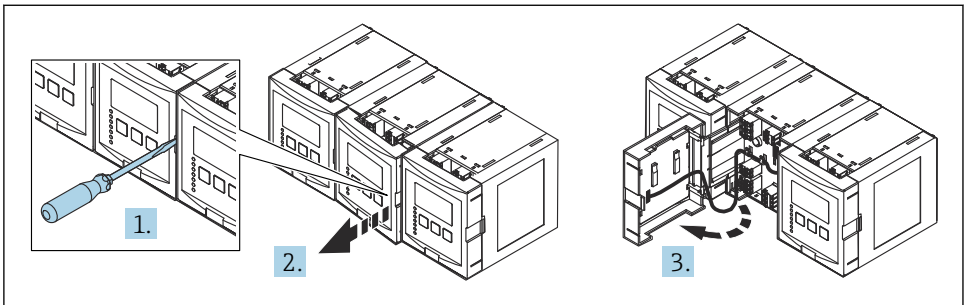
6 Access to terminal compartment in aluminum field housing

- 1 Aluminum field housing, open
- 2 Nameplate
- 3 Terminal for protective ground
- 4 Display and operating module
- 5 Aluminum field housing, closed

Cable entries

- 12 M20x1.5 openings for cable entries are located on the bottom of the field housing.
- To establish the electrical connection: guide the cables through the cable entries and into the housing. The electrical connection is then established in the same way as in the DIN rail housing.

6.1.4 Terminal compartment of DIN rail housing



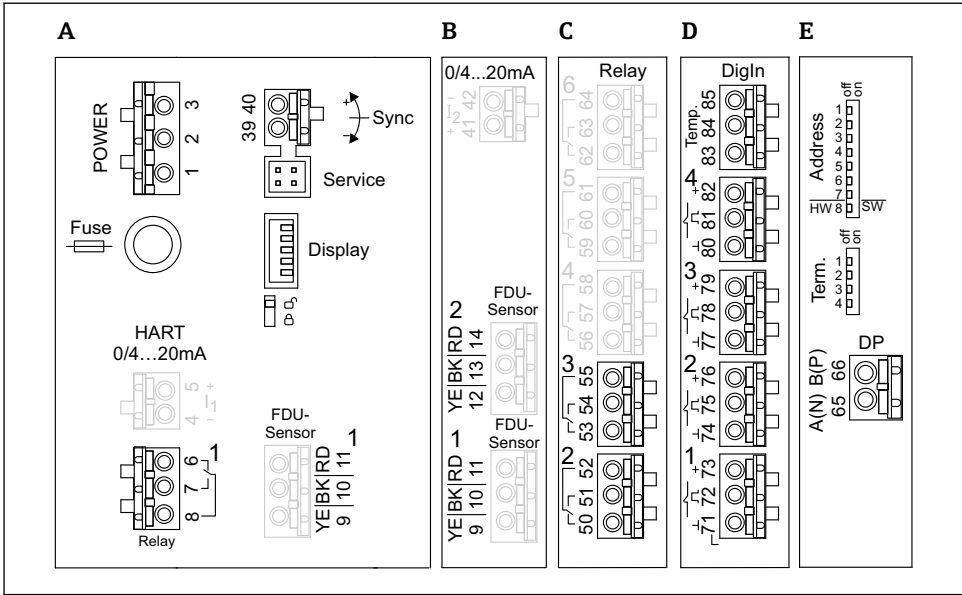
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6.2 Terminal assignment

6.2.1 Terminal type

Prosonic S has plug-in spring terminals. Rigid conductors or flexible conductors with ferrules can be inserted directly into the terminal without using the lever, and create a contact automatically.

6.2.2 Terminal areas



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7 Terminals of Prosonic S (the terminals shown in gray are not available in every device version)

- A Basic terminal area; found in all device versions
- B Optional terminal area for two sensors
- C Optional terminal area for up to five relays
- D Optional terminal area for up to four external switches and one external temperature sensor
- E Optional terminal area for PROFIBUS DP

6.2.3 Terminals for power supply (AC version)

Terminal area A

- Terminal 1: L (90 to 253 V_{AC})
- Terminal 2: N
- Terminal 3: potential equalization
- Fuse: 400 mA T

6.2.4 Terminals for power supply (DC version)

Terminal area A

- Terminal 1: L+ (10.5 to 32 V_{DC})
- Terminal 2: L-
- Terminal 3: potential equalization
- Fuse: 2AT

6.2.5 Terminals for relays

Terminal area A

Terminals 6, 7, 8: relay 1

Terminal area C

- Terminals 50, 51, 52: relay 2
- Terminals 53, 54, 55: relay 3
- Terminals 56, 57, 58: relay 4
- Terminals 59, 60, 61: relay 5
- Terminals 62, 63, 64: relay 6

6.2.6 Terminals for level inputs

Terminal area A

Sensor 1 (for device version with one sensor input)

- Terminal 9: yellow sensor wire
- Terminal 10: black sensor wire (cable shield)
- Terminal 11: red sensor wire

Terminal area B

- Sensor 1 (for device version with two sensor inputs)
 - Terminal 9: yellow sensor wire
 - Terminal 10: black sensor wire (cable shield)
 - Terminal 11: red sensor wire
- Sensor 2 (for device version with two sensor inputs)
 - Terminal 12: yellow sensor wire
 - Terminal 13: black sensor wire (cable shield)
 - Terminal 14: red sensor wire

6.2.7 Terminals for synchronization

Terminal area A

Terminals 39, 40: synchronization of multiple Prosonic S transmitters

6.2.8 Terminals for PROFIBUS DP

Terminal area E

- Terminal 65: PROFIBUS A (RxT/TxD - N)
- Terminal 66: PROFIBUS B (RxT/TxD - P)

6.2.9 Terminals for switch inputs

Terminal area D

- Terminals 71, 72, 73: external switch 1
- Terminals 74, 75, 76: external switch 2
- Terminals 77, 78, 79: external switch 3
- Terminals 80, 81, 82: external switch 4

6.2.10 Terminals for temperature input

Terminal area D

Terminals 83, 84, 85:

- Pt100
- Omnigrad S TR61 (Endress+ Hauser)

6.2.11 Other elements on the terminal areas

Terminal area A

- **Display**

Connection of the display or the remote display and operating module

- **Service**

Service interface; for connection of a PC/notebook via Commubox FXA291

- 

Write protection switch: locks the device to prevent modifications to the configuration.

6.3 Special connection instructions

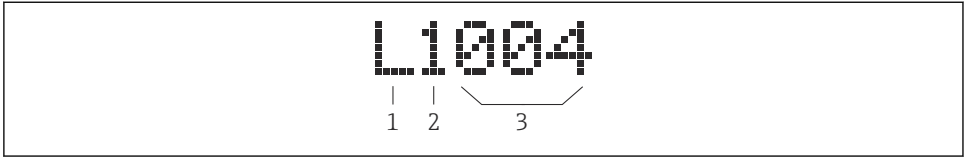
For special connection instructions for the individual terminals, see the Operating Instructions for the device.


7 Operation options

7.1 Structure and function of the operating menu

7.1.1 Submenus and parameter sets

Parameters that belong together are grouped into one parameter set in the operating menu. Each parameter set is identified by a five-digit code.




 8 Identification of the parameter sets:

- 1 Submenu
- 2 Number of the associated input or output (for multi-channel devices)
- 3 Number of the parameter set within the submenu

7.1.2 Types of parameter

Read-only parameters

- Symbol: 
- Cannot be edited.

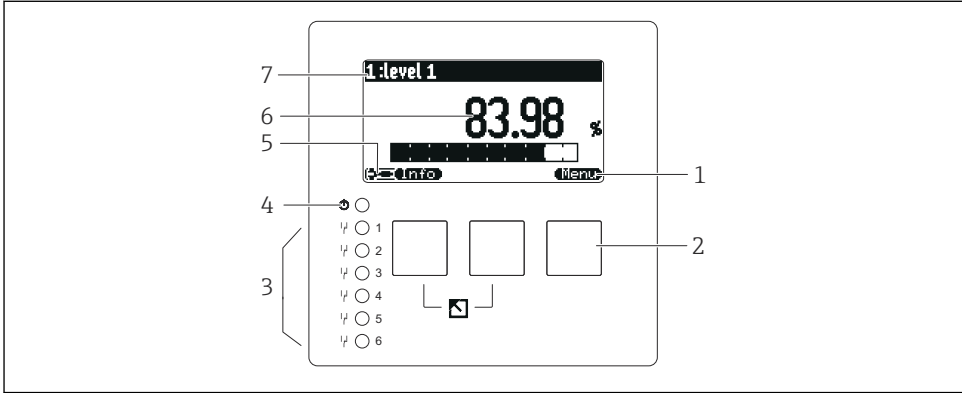
Editable parameters

- Symbol: 
- Can be opened for editing by pressing .

7.2 Access to operating menu via onsite display

7.2.1 Display and operating elements

Elements of the display and operating module








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- 1 Soft key symbols
- 2 Keys
- 3 LEDs to indicate the relay switching states
- 4 LED to indicate the operational state
- 5 Display symbol
- 6 Parameter value with unit (here: primary value)
- 7 Name of displayed parameter

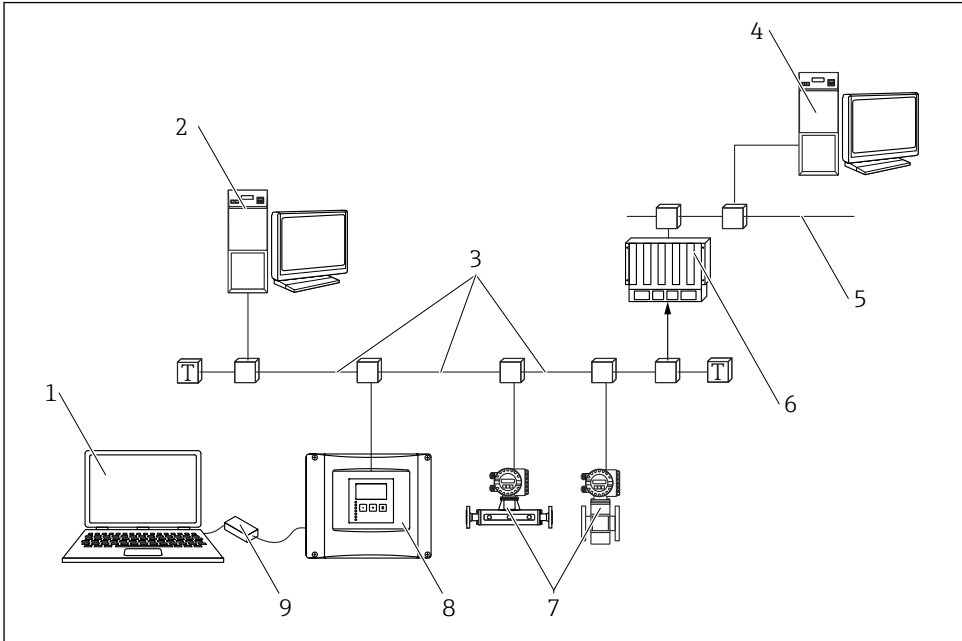
Keys (soft key operation)

The current key function is indicated by soft key symbols above the key.

- Moves the selection bar downwards in a picklist.
- Moves the selection bar upwards in a picklist.
- - Opens the selected submenu, parameter set or parameter.
 - Confirms the edited parameter value.
- Goes to the previous parameter set within the submenu.
- Goes to the next parameter set within the submenu.
- Selects the option in a picklist which is currently marked by the selection bar.
- Increases the selected digit of an alphanumeric parameter.

-  Decreases the selected digit of an alphanumeric parameter.
- 
 - Opens the list of errors which are currently detected.
 - If a warning is present, the symbol flashes.
 - If an alarm is present, the symbol is displayed permanently.
-  Displays the next page of measured values (only available if several pages of measured values have been defined; see the "Display" menu).
-  Opens the "Shortcut" menu, which contains the most important read-only parameters.
-  Opens the main menu from where you can access **all** the device parameters.

7.3 Access to the operating menu via PROFIBUS DP



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9 Operation method, PROFIBUS DP

- 1 Computer with DeviceCare/FieldCare
- 2 Computer with DeviceCare/FieldCare
- 3 PROFIBUS DP
- 4 Computer with DeviceCare/FieldCare
- 5 Ethernet
- 6 PLC
- 7 Field devices
- 8 Prosonic S transmitter
- 9 Commubox FXA291

8 Commissioning

8.1 Switching on the device

Parameters that need to be configured when the device is switched on for the first time

- **Language**
Select the language of the display.
- **Distance unit**
Select the unit of length in which the distance is measured.
- **Temperature unit**
Select the unit for the sensor temperature.
- **Operating mode**
The possible options depend on the device version and installation environment.
- **Controls**
Choose whether pump control or rake control should be configured.

8.2 Device configuration

8.2.1 Navigation to the menu "Basic setup"

Operating mode: "Level+flow" or "Flow"

Flow → Flow → Flow N → Basic setup

Operating mode: "Flow+backwater detection"

Flow → Flow 1 +backwater → Flow → Basic setup

8.2.2 Parameter set "Sensor selection"

Navigation

Basic setup → Sensor selection

Parameter

- **Input**
Assign a sensor to the channel.
- **Sensor selection**
Specify the sensor type.
Select the **Automatic** option for FDU9x sensors.
Select the **Manual** option for FDU8x sensors.
- **Detected**
Only displayed if **Sensor selection** = **Automatic**
Displays the sensor type detected automatically.

8.2.3 Parameter set "Linearization"

Purpose of linearization

To calculate the flow Q from the measured upstream level h.

Navigation

Basic setup → Linearization

Parameter

■ Type

- "Flume/weir" option
Select this option to use a pre-programmed linearization curve.
- "Table" option
Select this option to enter a linearization table of your choice.
- "Formula" option
Select this option to use a flow formula: $Q = C (h^\alpha + \gamma h^\beta)$

■ Flow unit

Specify the unit for the linearized value.

■ Curve

Only displayed if **Type = Flume/weir**.
Specify the shape of the flume or weir in the first step.
Then specify the size of the flume or weir in the next step.

■ Width

Only displayed if **Type = Rectangular weir, NFX or Trapezoidal weir**.
Select the width of the weir.

■ Edit

Only displayed if **Type = Table**.
Opens the **Edit** parameter set to enter the linearization table.

■ Status table

Activates or deactivates the linearization table.

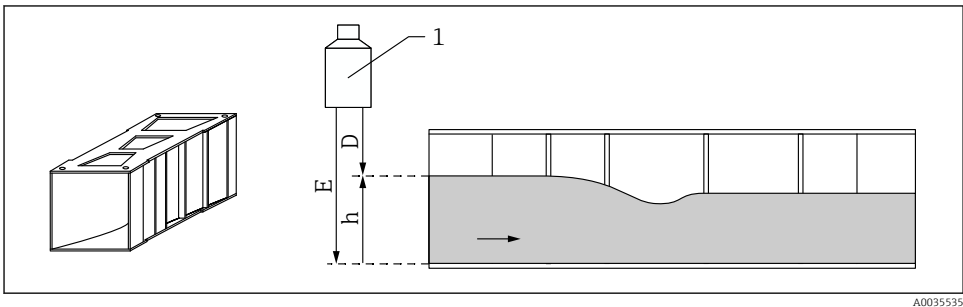
■ alpha, beta, gamma, C

Only displayed if **Type = Formula**.
Assign suitable values to the parameters of the flow formula.

■ Maximum flow

Confirm the value displayed for the maximum flow of the flume or weir or enter a suitable value.

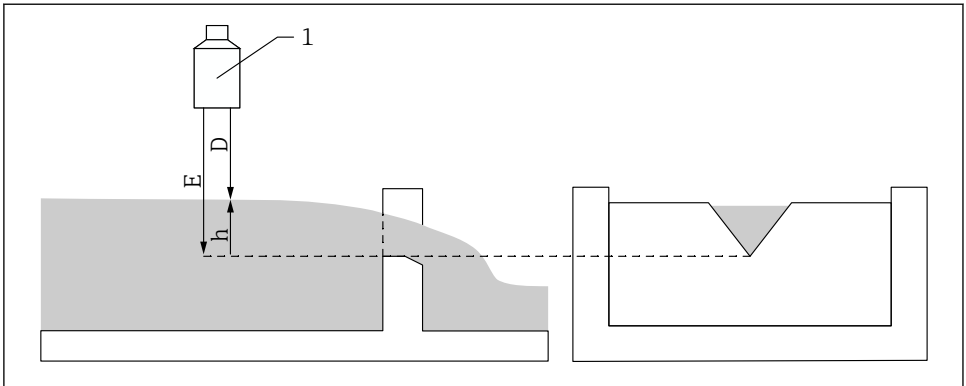
8.2.4 Parameter set "Empty calibration"



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■ 10 Empty calibration for flume

- 1 Ultrasonic sensor
- D Measured distance
- h Upper water level
- E Empty calibration: "Empty E"



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11 Empty calibration for weirs

- 1 Ultrasonic sensor
- D Measured distance
- h Upper water level
- E Empty calibration: "Empty E"

Navigation

Basic setup → Empty calibration

Parameter

■ Empty E

- For flumes: specify the distance between the sensor membrane and the flume floor at the narrowest point.
- For weirs: specify the distance between the sensor membrane and the lowest point of the weir crest.

■ Blocking distance

Indicates the blocking distance BD of the sensor.

8.2.5 Parameter set "Flow N"

Navigation

Basic setup → Flow N

Parameter

■ Flow N

Displays the flow Q currently measured for verification purposes.

■ Level

Displays the level h currently measured for verification purposes.

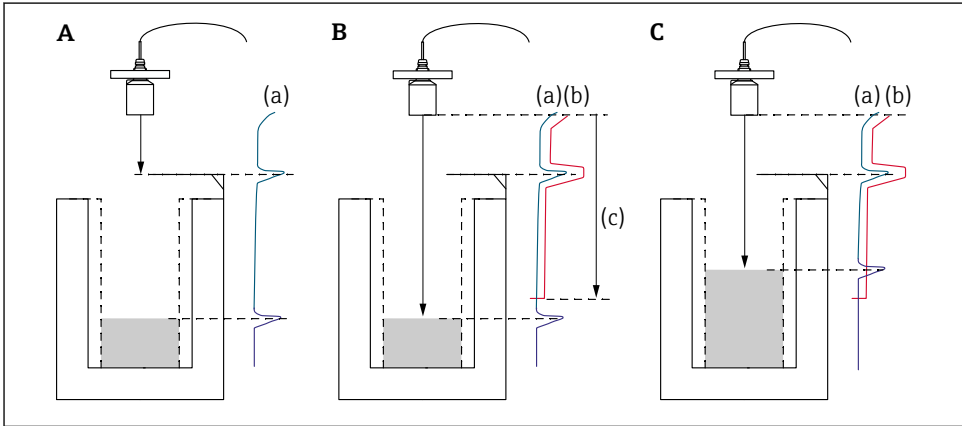
■ Distance

Displays the distance D currently measured for verification purposes.

8.2.6 Parameter set "Check value"



- This parameter set starts interference echo suppression (mapping).
- To record all the interference echoes, perform mapping at the minimum level possible (ideally in an empty channel).
- If it is not possible to empty the channel during commissioning, record preliminary mapping when the channel is partially filled. Repeat mapping when the level reaches approximately 0% for the first time.



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12 Operating principle of the interference echo suppression (mapping) function

- The echo curve (a) contains an interference echo and the level echo. Without mapping, the interference echo might also be evaluated.
- Mapping generates the mapping curve (b). This suppresses all the echoes that are inside the range of mapping (c).
- Afterwards, only echoes that are higher than the mapping curve are evaluated. The interference echo is below the mapping curve and is therefore ignored (not evaluated).

Navigation

Basic setup → Check value

Parameter

■ Distance

Displays the distance D currently measured between the sensor membrane and the surface of the liquid.

■ Check distance

Compare the distance displayed with the actual value and enter the result of the comparison. Based on the entry, the device automatically determines the range of mapping.

■ Distance = ok

The displayed distance and actual distance match.

→ Continue with the parameter set **LVL N dist. map..**

■ Dist. too small

The displayed distance is smaller than the actual distance.

→ Continue with the parameter set **LVL N dist. map..**

■ Dist. too big

The displayed distance is larger than the actual distance.

→ Mapping is not possible.

→ Setup for sensor N ends.

■ Dist. unknown

Actual distance is unknown.

→ Mapping is not possible.

→ Setup for sensor N ends.

■ Manual

The range of mapping is to be defined manually.

→ Continue with the parameter set **LVL N dist. map..**

8.2.7 Parameter set "Distance mapping"

Navigation

Basic setup → Check value → Distance mapping

Parameter

■ **Actual distance**

Displays the distance D currently measured between the sensor membrane and the surface of the liquid.

■ **Range of mapping**

Specifies the range, starting from the sensor membrane, in which mapping is performed.

■ If **Check distance** = **Distance = Ok** or **Dist. too small**:

Confirm the preset value.

■ If **Check distance** = **Manual**:

Enter the desired mapping range.

■ **Start mapping**

Select **Yes** to start recording the mapping curve.

→ The **Flow N status** parameter set appears.

→ If the displayed distance is still too small: keep recording mapping curves until the displayed distance and the actual distance match.

■ **Status**

Specifies the mapping status:

■ **Enable map**

The mapping curve is taken into consideration during signal evaluation.

■ **Disable map**

The mapping curve is not taken into consideration during signal evaluation but remains stored in the device.

■ **Delete map**

The mapping curve is deleted.



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