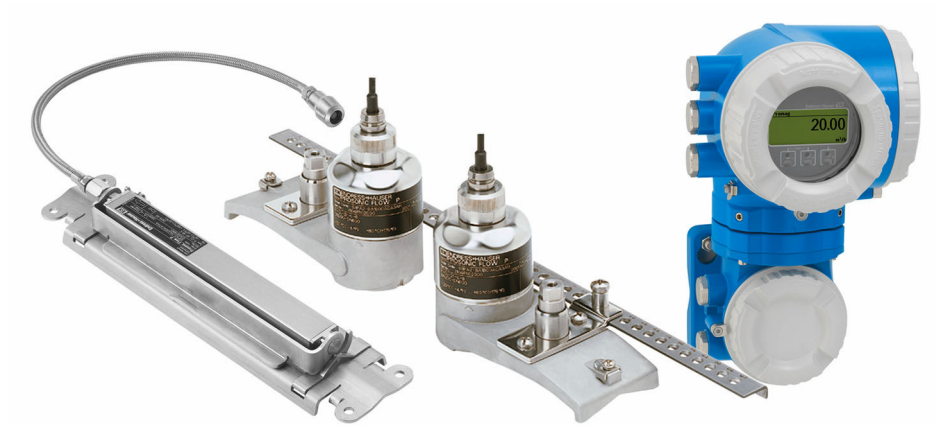


Technical Information

Proline Prosonic Flow P 500

Ultrasonic flowmeter



Clamp-on flowmeter for limited spaces in process industries with up to 3 I/Os

Application

- The measuring principle is non-invasive and independent of pressure, density and conductivity
- Bidirectional measurement of various fluids, e.g. liquid hydrocarbons and chemicals

Device properties

- Mounting without process interruption
- Wide nominal diameter range: DN 15 to 4000 (½ to 160")
- Medium temperature: -40 to +170 °C (-40 to +338 °F)
- Remote version with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Standard cable between sensor and transmitter

Your benefits

- Constant accuracy even when mounted with short inlet run thanks to FlowDC (Flow Disturbance Compensation)
- High safety standards – SIL by design, international hazardous area approvals
- Long-term stable signal – maintenance-free permanent mounting from outside with coupling pads
- Reliable measurement on various pipe materials – sensor for GRP and plastic pipes available
- Full access to process and diagnostic information – numerous, freely combinable I/Os
- Reduced complexity and variety – freely configurable I/O functionality
- Integrated verification – Heartbeat Technology






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About this document

Symbols









Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
	Protective Earth (PE) A terminal which must be connected to ground prior to establishing any other connections. The ground terminals are situated inside and outside the device: <ul style="list-style-type: none"> ▪ Inner ground terminal: Connects the protective earth to the mains supply. ▪ Outer ground terminal: Connects the device to the plant grounding system.




Communication symbols

Symbol	Meaning
	Wireless Local Area Network (WLAN) Communication via a wireless, local network.
	LED Light emitting diode is off.
	LED Light emitting diode is on.
	LED Light emitting diode is flashing.

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.
	Tip Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic
	Visual inspection

Symbols in graphics

Symbol	Meaning
1, 2, 3, ...	Item numbers
1., 2., 3., ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

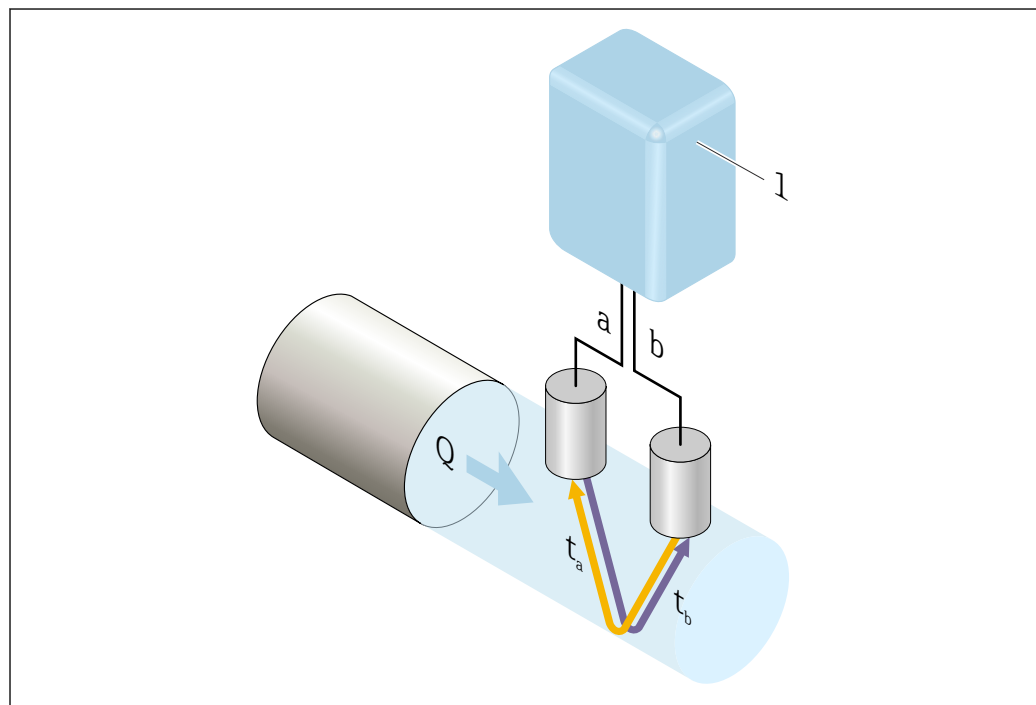
Function and system design

Measuring principle

The measuring system uses a measurement method based on the transit time difference. In this measurement method, acoustic signals (ultrasonic) are transmitted between two sensors. Signal transmission is bidirectional, i.e. the sensor operates as both a sound transmitter and a sound receiver.

As the speed of propagation of the sound waves is slower against the flow direction than in the flow direction, this results in a transit time difference. This transit time difference is directly proportional to the flow velocity.

The measuring system calculates the volume flow of the medium from the measured transit time difference and the pipe cross-sectional area. The sound velocity of the medium is simultaneously measured along with the transit time difference. With this additional measured variable, it is possible to differentiate between different media or monitor the medium quality.



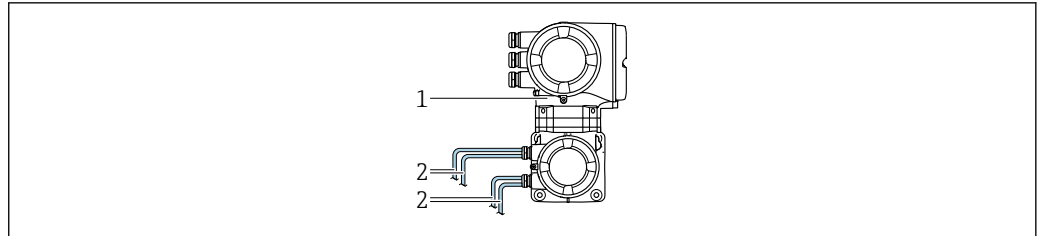
- 1 Transmitter
a Sensor
b Sensor
Q Volume flow
 Δt Transit time difference $\Delta t = t_a - t_b$; flow velocity $v \sim \Delta t$

Measuring system

The measuring system consists of a transmitter and two or one sensor sets. The transmitter and sensor sets are mounted in physically separate locations. They are interconnected by sensor cables.

The sensors function as sound generators and sound receivers. Depending on the application and version, the sensors can be arranged for measurement via 1, 2, 3 or 4 traverses → 6.

The transmitter serves to control the sensor sets, to prepare, process and evaluate the measuring signals, and to convert the signals to the desired output variable.

Transmitter

- 1 Transmitter with integrated ISEM
2 Sensor cable

- Electronics and ISEM (intelligent sensor electronics module) in the transmitter housing.
- Signal transmission: analog
- Order code for "Integrated ISEM electronics", option **B**: transmitter

Sensor cables

Sensor cables can be ordered in various lengths → 73

- Length: max. 30 m (90 ft)
- Cable with a common shield and individual shielded cores

Ex Zone

Use in: Ex Zone 1 and 2; Class 1, Division 2 and Class 1, Division 1

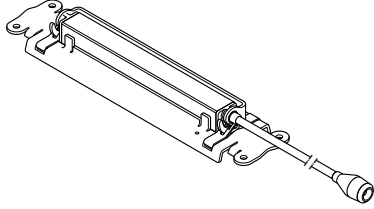
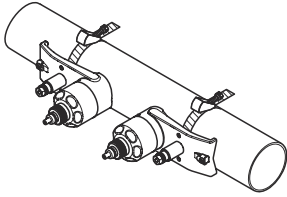
Housing versions and materials

- Transmitter housing
 - Aluminum, coated: aluminum, AlSi10Mg, coated
 - Cast, stainless: cast, stainless steel, 1.4409 (CF3M) corresponds to the properties of 316L
- Window material: glass

Configuration

- External operation via 4-line, backlit, graphic local display with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning.
- Via service interface or WLAN connection:
 - Operating tools (e.g. FieldCare, DeviceCare)
 - Web server (access via Web browser)

Sensor


<p>Prosonic Flow P DN 15 to 65 (½ to 2½")</p>  <p style="text-align: right; font-size: small;">A0011484</p>	<ul style="list-style-type: none"> ■ Measurement of: <ul style="list-style-type: none"> ■ Pure liquids or slightly contaminated liquids ■ Chemicals ■ Solvents ■ Liquid hydrocarbons ■ Acids ■ Alkalis ■ Nominal diameter range: DN 15 to 4000 (½ to 160") ■ Materials: <ul style="list-style-type: none"> ■ Sensor holder: Stainless steel 1.4301 (304), 1.4404 (316L) ■ Sensor housing: Stainless steel 1.4301 (304), 1.4404 (316L) ■ Strapping band/bracket: Stainless steel 1.4301 (304), 1.4404 (316L) ■ Sensor contact surface: Chemically stable plastic
<p>DN 50 to 4000 (2 to 160")</p>  <p style="text-align: right; font-size: small;">A0013475</p> <p>1 Example: 1 sensor set with 2 traverses</p>	

Accessories for mounting

The necessary installation distances must be determined for the sensors. Information about the medium, the pipe material used and the exact pipe dimensions is required to determine these values. The values for the sound velocity of the following media, pipe materials and liner materials are saved in the transmitter:

Medium		Pipe material		Liner
<ul style="list-style-type: none"> ■ Water ■ Seawater ■ Distilled water ■ Ammonia NH3 ■ Benzene ■ Ethanol 	<ul style="list-style-type: none"> ■ Glycol ■ Kerosene ■ Milk ■ Methanol ■ User-specific liquid 	<ul style="list-style-type: none"> ■ Carbon steel ■ Graphite cast iron ■ Stainless steel ■ 1.4301 (UNS S30400) ■ 1.4401 (UNS S31600) ■ 1.4550 (UNS S34700) ■ Hastelloy C ■ PVC ■ PE ■ LDPE 	<ul style="list-style-type: none"> ■ HDPE ■ GFR ■ PVDF ■ PA ■ PP ■ PTFE ■ Pyrex glass ■ Asbestos cement ■ Copper ■ Unknown pipe material 	<ul style="list-style-type: none"> ■ None ■ Cement ■ Rubber ■ Epoxy resin ■ Unknown liner material

Sensor set selection and arrangement

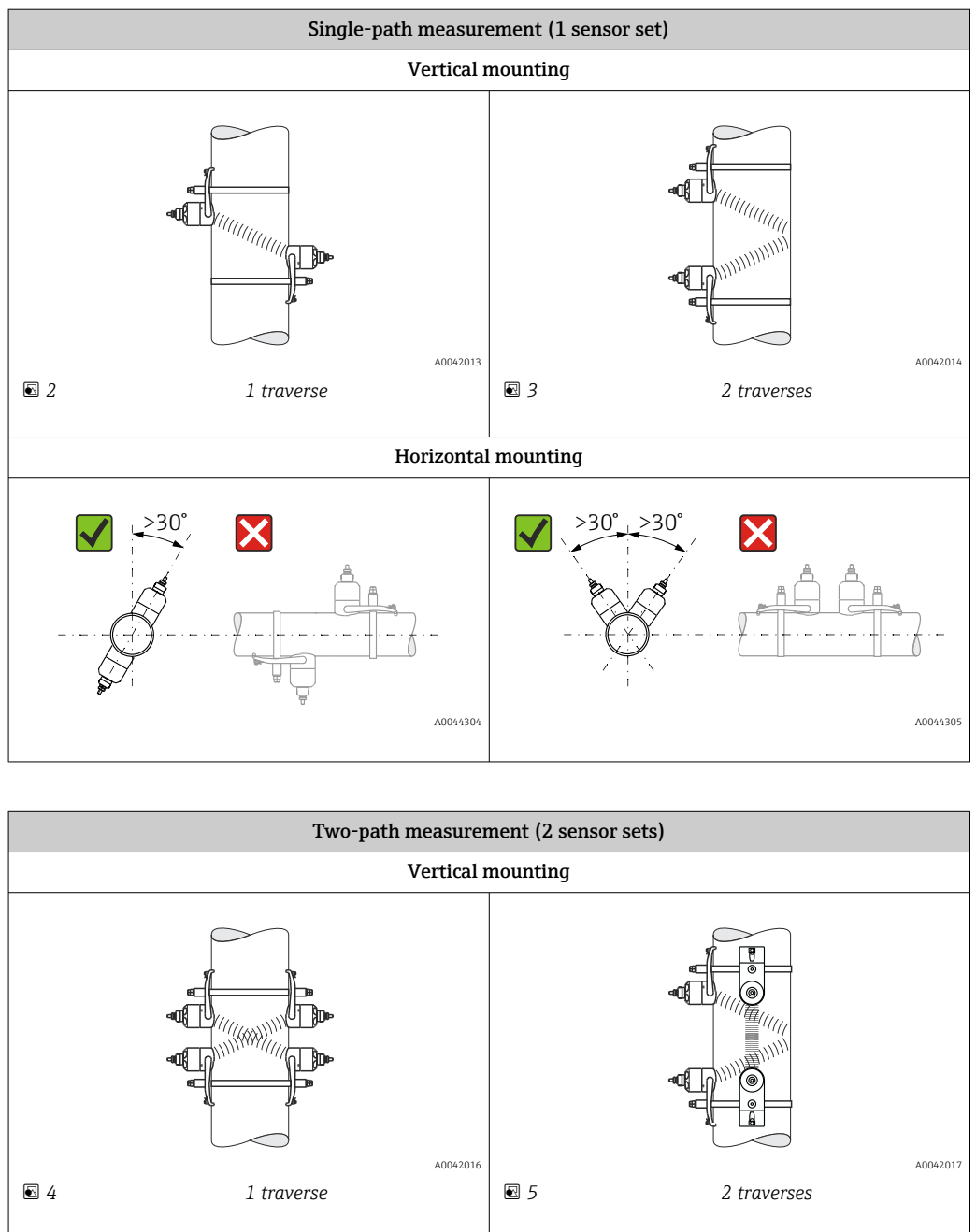
 If mounting horizontally, always mount the sensor set so that it is offset at angle of +30° to the top of the measuring pipe to avoid incorrect measurements caused by empty space at the top of the pipe.

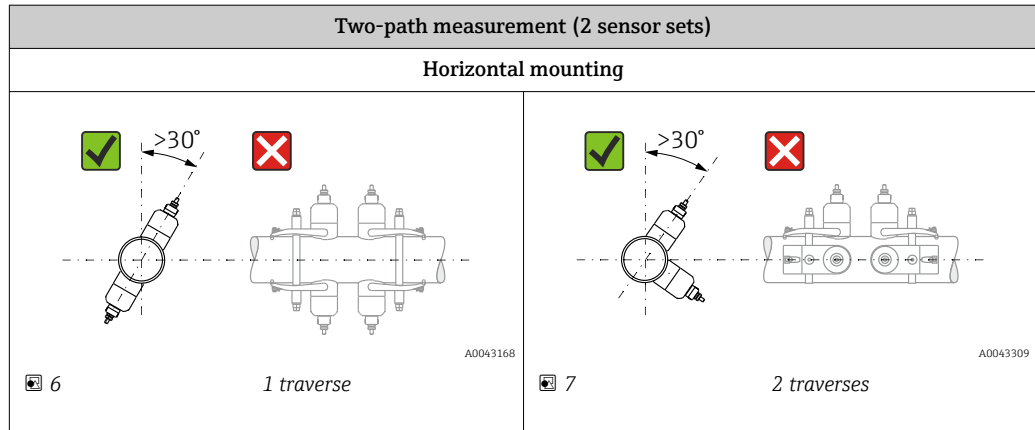
The sensors can be arranged in different ways:

- Mounting arrangement for measurement with 1 sensor set (1 measuring path):
 - The sensors are located on opposite sides of the pipe (offset at 180°): measurement with 1 or 3 traverses
 - The sensors are located on the same side of the pipe: measurement with 2 or 4 traverses
 - Mounting arrangement for measurement with 2 sensor sets (2 measuring paths):
 - 1 sensor of each sensor set is located on the opposite side of the pipe (offset at 180°): measurement with 1 or 3 traverses
 - The sensors are located on the same side of the pipe: measurement with 2 or 4 traverses
- The sensor sets are arranged on the pipe, offset by 90°.

i Using 5 MHz sensors

Here, the rails of the two sensor sets are always arranged at an angle of 180° to one another and connected by cables for all measurements with 1, 2, 3 or 4 traverses. The sensor functions are assigned in the two rails via the transmitter electronics unit depending on the selected number of traverses. It is not necessary to swap the cables in the transmitter between the channels.





Operating frequency selection

The sensors of the measuring device are available with adapted operating frequencies. These frequencies are optimized for different properties of measuring pipes (material, pipe wall thickness) and media (kinematic viscosity) for the resonance behavior of the measuring pipes. If these properties are known, an optimum selection can be made according to the following tables ¹⁾. If these properties are not (completely) known, the sensors can be assigned as follows:

- 5 MHz for DN 15 to 65 (½ to 2½")
- 2 MHz for DN 50 to 300 (2 to 12")
- 1 MHz for DN 100 to 4000 (4 to 160")
- 0.5 MHz for DN 150 to 4000 (6 to 160")
- 0.3 MHz for DN 1000 to 4000 (40 to 160")

Measuring pipe material	Measuring pipe nominal diameter	Recommendation
Steel, cast iron	< DN 65 (2½")	C-500-A
	≥ DN 65 (2½")	See table "Measuring pipe material: steel, cast iron" → 8
Plastic	< DN 50 (2")	C-500-A
	≥ DN 50 (2")	See table "Measuring pipe material: plastic" → 9
Glass-fiber reinforced plastic	< DN 50 (2")	C-500-A (with restrictions)
	≥ DN 50 (2")	See table "Measuring pipe material: glass-fiber reinforced plastic" → 9

Measuring pipe material: steel, cast iron

Pipe wall thickness [mm (in)]	Kinematic viscosity cSt [mm ² /s]		
	0 < ν ≤ 10	10 < ν ≤ 100	100 < ν ≤ 1000
	Transducer frequency (sensor version / number of traverses) ¹⁾		
1.0 to 1.9 (0.04 to 0.07)	2 MHz (C-200 / 2)	2 MHz (C-200 / 1)	2 MHz (C-200 / 1)
1.9 to 2.2 (0.07 to 0.09)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	1 MHz (C-100 / 1)
2.2 to 2.8 (0.09 to 0.11)	2 MHz (C-200 / 2)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)
2.8 to 3.4 (0.11 to 0.13)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	1 MHz (C-100 / 1)
3.4 to 4.2 (0.13 to 0.17)	2 MHz (C-200 / 2)	2 MHz (C-200 / 1)	1 MHz (C-100 / 1)
4.2 to 5.9 (0.17 to 0.23)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 2)

1) Recommendation: product design and sizing in Applicator → 75

Pipe wall thickness [mm (in)]	Kinematic viscosity cSt [mm ² /s]		
	0 < ν ≤ 10	10 < ν ≤ 100	100 < ν ≤ 1000
	Transducer frequency (sensor version / number of traverses) ¹⁾		
5.9 to 10.0 (0.23 to 0.39)	2 MHz (C-200 / 2)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)
>10.0 (0.39)	1 MHz (C-100 / 2)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 1)

1) The table shows a typical selection. In critical situations, the optimum sensor type may differ from these recommendations.

Measuring pipe material: plastic

Nominal diameter [mm (")]	Kinematic viscosity cSt [mm ² /s]		
	0 < ν ≤ 10	10 < ν ≤ 100	100 < ν ≤ 1000
	Transducer frequency (sensor version / number of traverses) ¹⁾		
15 to 50 (½ to 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)
50 to 80 (2 to 3)	2 MHz (C-200 / 2)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)
80 to 150 (3 to 6)	1 MHz (C-100 / 2)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)
150 to 200 (6 to 8)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 2)
200 to 300 (8 to 12)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 2)
300 to 400 (12 to 16)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)
400 to 500 (16 to 20)	1 MHz (C-100 / 1)	0.5 MHz (C-050 / 1)	0.5 MHz (C-050 / 1)
500 to 1000 (20 to 40)	0.5 MHz (C-050 / 1)	0.5 MHz (C-050 / 1)	-
1000 to 4000 (40 to 160)	0.3 MHz (C-030 / 1)	-	-

1) The table shows a typical selection. In critical situations, the optimum sensor type may differ from these recommendations.

Measuring pipe material: glass-fiber reinforced plastic

Nominal diameter [mm (")]	Kinematic viscosity cSt [mm ² /s]		
	0 < ν ≤ 10	10 < ν ≤ 100	100 < ν ≤ 1000
	Transducer frequency (sensor version / number of traverses) ¹⁾		
15 to 50 (½ to 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)	5 MHz (C-500 / 2)
50 to 80 (2 to 3)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)
80 to 150 (3 to 6)	1 MHz (C-100 / 2)	0.5 MHz (C-050 / 1)	0.5 MHz (C-050 / 1)
150 to 200 (6 to 8)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)	-
200 to 300 (8 to 12)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)	-
300 to 400 (12 to 16)	0.5 MHz (C-050 / 2)	0.5 MHz (C-050 / 1)	-
400 to 500 (16 to 20)	0.5 MHz (C-050 / 1)	-	-
500 to 1000 (20 to 40)	0.5 MHz (C-050 / 1)	-	-
1000 to 4000 (40 to 160)	0.3 MHz (C-030 / 1)	-	-

1) The table shows a typical selection. In critical situations, the optimum sensor type may differ from these recommendations.



- If clamp-on sensors are used, a 2 traverse-type installation is recommended. This is the easiest and most convenient type of installation, particularly for measuring devices whose pipe can only be accessed from one side.
- A 1 traverse installation is recommended for the following installation conditions:
 - Certain plastic pipes with a wall thickness >4 mm (0.16 in)
 - Pipes made of composite materials (e.g. glass-fiber reinforced plastic)
 - Lined pipes
 - Applications with media with high acoustic damping

Measuring mode

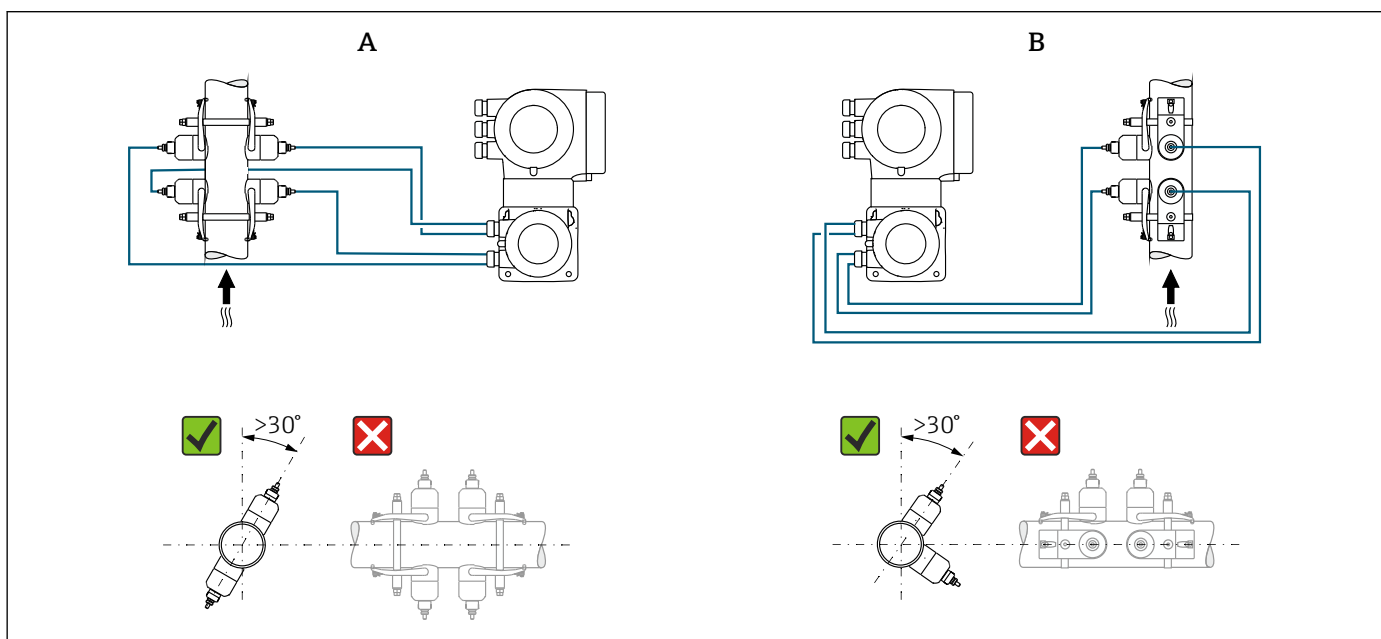
Two-path measurement with FlowDC²⁾ (standard configuration)

In the case of two-path measurement with FlowDC, the flow is measured by two measurements at the measuring point.

For this, the two sensor sets are installed on the measuring pipe, offset at a specific angle to one another (180° for 1 traverse, 90° for 2 traverses). This is independent of the rotation position of the two sensor sets on the measuring pipe.

The measured values of both sensor sets are averaged. Based on this average measurement value, the measured value is compensated depending on the type of disturbance and the distance from the measuring point to the disturbance point. This makes it possible to maintain the specified accuracy and repeatability for measurements in non-ideal conditions (e.g. short inlet runs), with inlet runs up to only 2x DN before and after the measuring point.

The configuration of the two measuring paths is only performed once and is adopted for both measuring paths.



A0041975

8 Two-path measurement: examples for the horizontal arrangement of the sensor sets at a measuring point

A Installation of the sensor sets for measurement via 1 traverse

B Installation of the sensor sets for measurement via 2 traverses

Single-path measurement (alternative configuration)

In the case of single-path measurement, the flow is measured at the measuring point without the option of compensation.

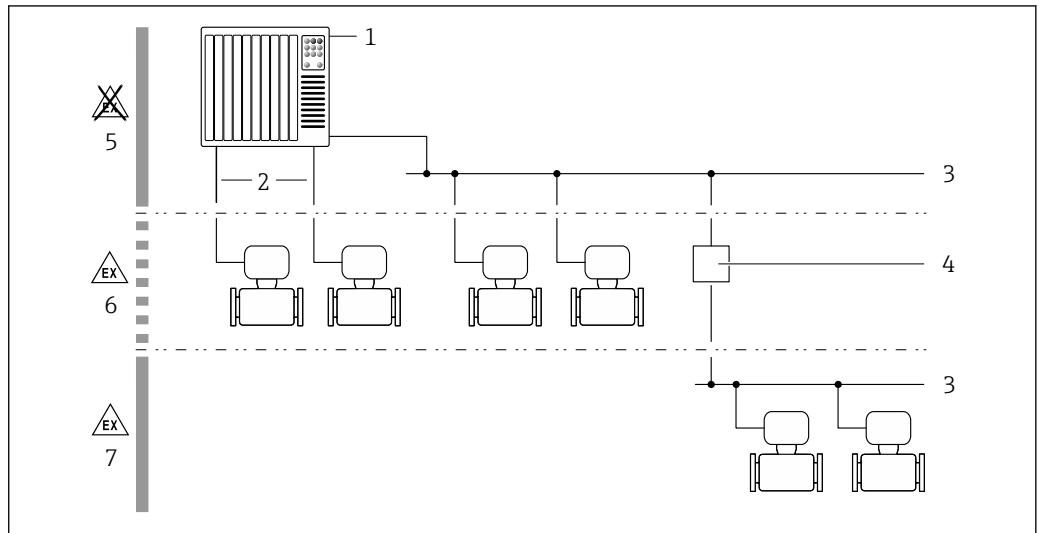
For this, it is necessary to comply strictly with the specified inlet and outlet runs after the disturbance points (e.g. curves, extensions, reductions) in the pipe.

i To ensure the best possible measurement performance and measuring accuracy, the standard configuration with two sensor sets³⁾ with FlowDC is recommended.

2) Flow disturbance compensation

3) Order code for "Mounting type", option A2 "Clamp-on, 2-channel, 2-sensor sets"

Equipment architecture



A0027512

9 Possibilities for integrating measuring devices into a system

- 1 Control system (e.g. PLC)
- 2 Connecting cable (0/4 to 20 mA HART etc.)
- 3 Fieldbus
- 4 Coupler
- 5 Non-hazardous area
- 6 Hazardous area: Zone 2; Class I, Division 2
- 7 Hazardous area: Zone 1; Class I, Division 1

Safety

IT security

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

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

Device-specific IT security

The device offers a range of specific functions to support protective measures on the operator's side. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section.

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 12	Not enabled.	On an individual basis following risk assessment.
Access code (also applies for Web server login or FieldCare connection) → 12	Not enabled (0000).	Assign a customized access code during commissioning.
WLAN (order option in display module)	Enabled.	On an individual basis following risk assessment.
WLAN security mode	Enabled (WPA2-PSK)	Do not change.
WLAN passphrase (Password) → 12	Serial number	Assign an individual WLAN passphrase during commissioning.
WLAN mode	Access Point	On an individual basis following risk assessment.
Web server → 12	Enabled.	On an individual basis following risk assessment.
Service interface CDI-RJ45 → 12	-	On an individual basis following risk assessment.

Protecting access via hardware write protection

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the motherboard). When hardware write protection is enabled, only read access to the parameters is possible.

Hardware write protection is disabled when the device is delivered.

Protecting access via a password

Different passwords are available to protect write access to the device parameters or access to the device via the WLAN interface.

- **User-specific access code**
Protect write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare). Access authorization is clearly regulated through the use of a user-specific access code.
- **WLAN passphrase**
The network key protects a connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface which can be ordered as an option.
- **Infrastructure mode**
When the device is operated in infrastructure mode, the WLAN passphrase corresponds to the WLAN passphrase configured on the operator side.

User-specific access code

Write access to the device parameters via the local display, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code.

WLAN passphrase: Operation as WLAN access point

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface, which can be ordered as an optional extra, is protected by the network key. The WLAN authentication of the network key complies with the IEEE 802.11 standard.

When the device is delivered, the network key is pre-defined depending on the device. It can be changed via the **WLAN settings** submenu in the **WLAN passphrase** parameter.

Infrastructure mode

A connection between the device and WLAN access point is protected by means of an SSID and passphrase on the system side. Please contact the relevant system administrator for access.

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning.
- Follow the general rules for generating a secure password when defining and managing the access code or network key.
- The user is responsible for the management and careful handling of the access code and network key.

Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server. The connection is via the service interface (CDI-RJ45) or the WLAN interface.

The Web server is enabled when the device is delivered. The Web server can be disabled if necessary (e.g. after commissioning) via the **Web server functionality** parameter.

The device and status information can be hidden on the login page. This prevents unauthorized access to the information.



For detailed information on device parameters, see:
The "Description of Device Parameters" document

Access via service interface (CDI-RJ45)

The device can be connected to a network via the service interface (CDI-RJ45). Device-specific functions guarantee the secure operation of the device in a network.

The use of relevant industrial standards and guidelines that have been defined by national and international safety committees, such as IEC/ISA62443 or the IEEE, is recommended. This includes organizational security measures such as the assignment of access authorization as well as technical measures such as network segmentation.



Transmitters with an Ex de approval may not be connected via the service interface (CDI-RJ45)!

Order code for "Approval transmitter + sensor", options (Ex de): BB, C2, GB, MB, NB

Input

Measured variable

Direct measured variables

- Volume flow
- Flow velocity
- Sound velocity

Calculated measured variables

Mass flow

Measuring range

$v = 0$ to 15 m/s (0 to 50 ft/s)



Measuring range depending on the sensor version.



To calculate the measuring range, use the *Applicator* sizing tool → 75

Operable flow range

Over 150 : 1

Input signal

Output and input variants

→ 16

External measured values

The measuring device provides optional interfaces that enable the transmission of externally measured variables (temperature, density) to the measuring device:

- Analog inputs 4-20 mA
- Digital inputs (via HART input or Modbus)



Various temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 76

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The pressure transmitter must support the following protocol-specific functions:

- HART protocol
- Burst mode

Current input

The measured values are written from the automation system to the measuring device via the current input → 14.

Digital communication

The measured values can be written from the automation system to the measuring via: Modbus RS485

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	<ul style="list-style-type: none"> ▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 μ A
Voltage drop	Typically: 0.6 to 2 V for 3.6 to 22 mA (passive)
Maximum input voltage	≤ 30 V (passive)
Open-circuit voltage	≤ 28.8 V (active)
Possible input variables	<ul style="list-style-type: none"> ▪ Temperature ▪ Density

Status input

Maximum input values	<ul style="list-style-type: none"> ▪ DC -3 to 30 V ▪ If status input is active (ON): $R_i > 3 \text{ k}\Omega$
Response time	Configurable: 5 to 200 ms
Input signal level	<ul style="list-style-type: none"> ▪ Low signal: DC -3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	<ul style="list-style-type: none"> ▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override



Output

Output and input variants

Depending on the option selected for output/input 1, different options are available for the other outputs and inputs. Only one option can be selected for each output/input 1 to 3. The following tables must be read vertically (↓).

Example: If the option BA "4–20 mA HART" was selected for output/input 1, one of the options A, B, D, E, F, H, I or J is available for output 2 and one of the options A, B, D, E, F, H, I or J is available for output 3.

Output/input 1 and options for output/input 2

 Options for output/input 3 →  17

Order code for "Output; input 1" (020) →	Possible options			
Current output 4 to 20 mA HART	BA			
Current output 4 to 20 mA HART Ex i passive	↓	CA		
Current output 4 to 20 mA HART Ex i active		↓	CC	
Modbus RS485				MA
Order code for "Output; input 2" (021) →	↓	↓	↓	↓
Not assigned	A	A	A	A
Current output 4 to 20 mA	B			B
Current output 4 to 20 mA Ex i passive		C	C	
User-configurable input/output ¹⁾	D			D
Pulse/frequency/switch output	E			E
Pulse output, phase-shifted ²⁾	F			F
Pulse/frequency/switch output Ex i passive		G	G	
Relay output	H			H
Current input 0/4 to 20 mA	I			I
Status input	J			J

1) A specific input or output can be assigned to a user-configurable input/output →  22.

2) If "pulse output, phase-shifted" (F) is selected for output/input 2 (021), only the "pulse output, phase-shifted" (F) option is available for selection for output/input 3 (022).

Output/input 1 and options for output/input 3




Options for output/input 2 → 16


Order code for "Output; input 1" (020) →	Possible options			
Current output 4 to 20 mA HART	BA			
Current output 4 to 20 mA HART Ex i passive	↓	CA		
Current output 4 to 20 mA HART Ex i active		↓	CC	
Modbus RS485				MA
Order code for "output; input 3" (022) → →	↓	↓	↓	↓
Not assigned	A	A	A	A
Current output 4 to 20 mA	B			B
Current output 4 to 20 mA Ex i passive		C	C	
User-configurable input/output	D			D
Pulse/frequency/switch output	E			E
Pulse output, phase-shifted	F			F
Pulse/frequency/switch output Ex i passive		G	G	
Relay output	H			H
Current input 0/4 to 20 mA	I			I
Status input	J			J

Output signal

Current output 4 to 20 mA HART

Order code	"Output; input 1" (20): Option BA: current output 4 to 20 mA HART
Signal mode	Can be set to: <ul style="list-style-type: none"> ■ Active ■ Passive
Current range	Can be set to: <ul style="list-style-type: none"> ■ 4 to 20 mA NAMUR ■ 4 to 20 mA US ■ 4 to 20 mA ■ 0 to 20 mA (only if the signal mode is active) ■ Fixed current
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 μ A
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Sound velocity ■ Flow velocity ■ Electronics temperature <p> The range of options increases if the measuring device has one or more application packages.</p>


Current output 4 to 20 mA HART Ex i

Order code	"Output; input 1" (20) choose from: <ul style="list-style-type: none"> ■ Option CA: current output 4 to 20 mA HART Ex i passive ■ Option CC: current output 4 to 20 mA HART Ex i active
Signal mode	Depends on the selected order version.
Current range	Can be set to: <ul style="list-style-type: none"> ■ 4 to 20 mA NAMUR ■ 4 to 20 mA US ■ 4 to 20 mA ■ 0 to 20 mA (only if the signal mode is active) ■ Fixed current
Open-circuit voltage	DC 21.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	<ul style="list-style-type: none"> ■ 250 to 400 Ω (active) ■ 250 to 700 Ω (passive)
Resolution	0.38 μ A
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Sound velocity ■ Flow velocity ■ Electronics temperature <p> The range of options increases if the measuring device has one or more application packages.</p>


Modbus RS485

Physical interface	RS485 in accordance with EIA/TIA-485 standard
Terminating resistor	Integrated, can be activated via DIP switches


Current output 4 to 20 mA


Order code	"Output; input 2" (21) or "Output; input 3" (022): Option B: current output 4 to 20 mA
Signal mode	Can be set to: <ul style="list-style-type: none"> ■ Active ■ Passive
Current span	Can be set to: <ul style="list-style-type: none"> ■ 4 to 20 mA NAMUR ■ 4 to 20 mA US ■ 4 to 20 mA ■ 0 to 20 mA (only if the signal mode is active) ■ Fixed current
Maximum output values	22.5 mA
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	0 to 700 Ω
Resolution	0.38 μA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Sound velocity ■ Flow velocity ■ Electronics temperature <p> The range of options increases if the measuring device has one or more application packages.</p>

Current output 4 to 20 mA Ex i passive


Order code	"Output; input 2" (21), "Output; input 3" (022): Option C: current output 4 to 20 mA Ex i passive
Signal mode	Passive
Current span	Can be set to: <ul style="list-style-type: none"> ■ 4 to 20 mA NAMUR ■ 4 to 20 mA US ■ 4 to 20 mA ■ Fixed current
Maximum output values	22.5 mA
Maximum input voltage	DC 30 V
Load	0 to 700 Ω
Resolution	0.38 μA
Damping	Configurable: 0 to 999 s
Assignable measured variables	<ul style="list-style-type: none"> ■ Volume flow ■ Mass flow ■ Sound velocity ■ Flow velocity ■ Electronics temperature <p> The range of options increases if the measuring device has one or more application packages.</p>

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: <ul style="list-style-type: none"> ▪ Active ▪ Passive
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Pulse output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Pulse width	Configurable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow
Frequency output	
Maximum input values	DC 30 V, 250 mA (passive)
Maximum output current	22.5 mA (active)
Open-circuit voltage	DC 28.8 V (active)
Output frequency	Adjustable: end value frequency 2 to 10 000 Hz ($f_{\max} = 12\,500$ Hz)
Damping	Configurable: 0 to 999.9 s
Pulse/pause ratio	1:1
Assignable measured variables	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature <p> The range of options increases if the measuring device has one or more application packages.</p>
Switch output	
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s


Number of switching cycles	Unlimited
Assignable functions	<ul style="list-style-type: none"> ▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Electronics temperature ▪ Sound velocity ▪ Totalizer 1-3 ▪ Flow direction monitoring ▪ Status <ul style="list-style-type: none"> Low flow cut off <p> The range of options increases if the measuring device has one or more application packages.</p>

Pulse output, phase-shifted

Function	Pulse output, phase-shifted
Version	Open collector Can be set to: <ul style="list-style-type: none"> ▪ Active ▪ Passive ▪ Passive NAMUR
Maximum input values	DC 30 V, 250 mA (passive)
Open-circuit voltage	DC 28.8 V (active)
Voltage drop	For 22.5 mA: ≤ DC 2 V
Output frequency	Configurable: 0 to 1 000 Hz
Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow <p> The range of options increases if the measuring device has one or more application packages.</p>

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: <ul style="list-style-type: none"> ▪ NO (normally open), factory setting ▪ NC (normally closed)

Maximum switching capacity (passive)	<ul style="list-style-type: none"> ▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A
Assignable functions	<ul style="list-style-type: none"> ▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Electronics temperature ▪ Sound velocity ▪ Totalizer 1-3 ▪ Flow direction monitoring ▪ Status <ul style="list-style-type: none"> Low flow cut off <p> The range of options increases if the measuring device has one or more application packages.</p>

User-configurable input/output

One specific input or output is assigned to a user-configurable input/output (configurable I/O) during device commissioning.

The following inputs and outputs are available for assignment:

- Choice of current output: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Pulse/frequency/switch output
- Choice of current input: 4 to 20 mA (active), 0/4 to 20 mA (passive)
- Status input

The technical values correspond to those of the inputs and outputs described in this section.

Signal on alarm

Depending on the interface, failure information is displayed as follows:

HART current output

Device diagnostics	Device condition can be read out via HART Command 48
---------------------------	--

Modbus RS485

Failure mode	Choose from: <ul style="list-style-type: none"> ▪ NaN value instead of current value ▪ Last valid value
---------------------	---

Current output 0/4 to 20 mA

4 to 20 mA

Failure mode	Choose from: <ul style="list-style-type: none"> ▪ 4 to 20 mA in accordance with NAMUR recommendation NE 43 ▪ 4 to 20 mA in accordance with US ▪ Min. value: 3.59 mA ▪ Max. value: 22.5 mA ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value
---------------------	--

0 to 20 mA

Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA
---------------------	---

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Actual value ▪ 0 Hz ▪ Defined value ($f_{max} 2$ to 12 500 Hz)
Switch output	
Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Current status ▪ Open ▪ Closed
--------------	---

Local display



Plain text display	With information on cause and remedial measures
Backlight	Red backlighting indicates a device error.

 Status signal as per NAMUR recommendation NE 107

Interface/protocol

- Via digital communication:
 - HART protocol
 - Modbus RS485
- Via service interface
 - CDI-RJ45 service interface
 - WLAN interface

Plain text display	With information on cause and remedial measures
--------------------	---

 Additional information on remote operation →  64

Web browser

Plain text display	With information on cause and remedial measures
--------------------	---

Light emitting diodes (LED)

Status information	Status indicated by various light emitting diodes The following information is displayed depending on the device version: <ul style="list-style-type: none"> ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred
--------------------	---

Load Output signal → 18

Ex connection data

Safety-related values

Order code for "Output; input 1"	Output type	Safety-related values "Output; input 1"	
		26 (+)	27 (-)
Option BA	Current output 4 to 20 mA HART	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$	
Option MA	Modbus RS485	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$	

Order code for "Output; input 2"; "Output; input 3"	Output type	Safety-related values			
		Output; input 2		Output; input 3	
		24 (+)	25 (-)	22 (+)	23 (-)
Option B	Current output 4 to 20 mA	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$			
Option D	User-configurable input/ output	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$			
Option E	Pulse/frequency/switch output	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$			
Option F	Pulse output, phase- shifted	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$			
Option H	Relay output	$U_N = 30 V_{DC}$ $I_N = 100 mA_{DC}/500 mA_{AC}$ $U_M = 250 V_{AC}$			
Option I	Current input 4 to 20 mA	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$			
Option J	Status input	$U_N = 30 V_{DC}$ $U_M = 250 V_{AC}$			

Intrinsically safe values

Order code for "Output; input 1"	Output type	Intrinsically safe values "Output; input 1"	
		26 (+)	27 (-)
Option CA	Current output 4 to 20 mA HART Ex i passive	$U_i = 30 V$ $I_i = 100 mA$ $P_i = 1.25 W$ $L_i = 0 \mu H$ $C_i = 6 nF$	
Option CC	Current output 4 to 20 mA HART Ex i active	Ex ia ¹⁾ $U_0 = 21.8 V$ $I_0 = 90 mA$ $P_0 = 491 mW$ $L_0 = 4.1 mH (IIC)/15 mH$ (IIB) $C_0 = 160 nF (IIC)/$ $1 160 nF (IIB)$ $U_i = 30 V$ $I_i = 10 mA$ $P_i = 0.3 W$ $L_i = 5 \mu H$ $C_i = 6 nF$	

1) Only available for the Zone 1; Class I, Division 1 version

Order code for "Output; input 2"; "Output; input 3"	Output type	Intrinsically safe values or NIFW values			
		Output; input 2		Output; input 3	
		24 (+)	25 (-)	22 (+)	23 (-)
Option C	Current output 4 to 20 mA Ex i passive	$U_i = 30\text{ V}$ $I_i = 100\text{ mA}$ $P_i = 1.25\text{ W}$ $L_i = 0$ $C_i = 0$			
Option G	Pulse/frequency/switch output Ex i passive	$U_i = 30\text{ V}$ $I_i = 100\text{ mA}$ $P_i = 1.25\text{ W}$ $L_i = 0$ $C_i = 0$			

Low flow cut off The switch points for low flow cut off are user-selectable.

Galvanic isolation The outputs are galvanically isolated from one another and from earth (PE).
The clamp-on sensors can also be mounted on cathodically protected pipes ⁴⁾.

Protocol-specific data


HART

Manufacturer ID	0x11
Device type ID	0x5D (93)
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
System integration	Information on system integration: Operating Instructions → 76. <ul style="list-style-type: none"> ▪ Measured variables via HART protocol ▪ Burst Mode functionality

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Response times	<ul style="list-style-type: none"> ▪ Direct data access: typically 25 to 50 ms ▪ Auto-scan buffer (data range): typically 3 to 5 ms
Device type	Slave
Slave address range	1 to 247
Broadcast address range	0
Function codes	<ul style="list-style-type: none"> ▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: <ul style="list-style-type: none"> ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers

4) Only DN 50 to 4000 (2 to 160") and non-Ex

Supported baud rate	<ul style="list-style-type: none"> ▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transfer mode	<ul style="list-style-type: none"> ▪ ASCII ▪ RTU
Data access	<p>Each device parameter can be accessed via Modbus RS485.</p> <p> For Modbus register information</p>
System integration	<p>Information on system integration: Operating Instructions .</p> <ul style="list-style-type: none"> ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

Power supply

Terminal assignment

Transmitter: supply voltage, input/outputs

HART

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (-)	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)
Device-specific terminal assignment: adhesive label in terminal cover..							


Modbus RS485

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (-)	26 (B)	27 (A)	24 (+)	25 (-)	22 (+)	23 (-)
Device-specific terminal assignment: adhesive label in terminal cover..							

Transmitter and sensor connection housing: connecting cable

The sensor and transmitter, which are mounted in separate locations, are interconnected by a connecting cable. The cable is connected via the sensor connection housing and the transmitter housing.

Terminal assignment and connection of the connecting cable:

Proline 500 →  27


Device plugs available



Device plugs may not be used in hazardous areas!

Device plug for connecting to the service interface:

Order code for "Accessory mounted"

option **NB**, adapter RJ45 M12 (service interface) →  27

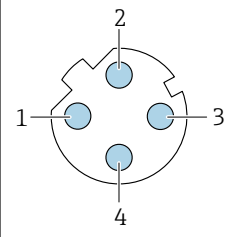
Order code for "Accessory mounted", option NB "Adapter RJ45 M12 (service interface)"

Order code "Accessory mounted"	Cable entry/coupling → 28	
	Cable entry 2	Cable entry 3
NB	Plug M12 × 1	-

Pin assignment, device plug

Service interface

Order code for "Accessories mounted", option NB: Adapter RJ45 M12 (service interface)

 A0032047	Pin	Assignment	
	1	+	Tx
2	+	Rx	
3	-	Tx	
4	-	Rx	
Coding		Plug/socket	
D		Socket	



Recommended plug:

- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q

Supply voltage

Order code for "Power supply"	Terminal voltage		Frequency range
Option D	DC 24 V	±20%	-
Option E	AC 100 to 240 V	-15 to +10%	50/60 Hz, ±4 Hz
Option I	DC 24 V	±20%	-
	AC 100 to 240 V	-15 to +10%	<ul style="list-style-type: none"> ▪ 50/60 Hz ▪ 50/60 Hz, ±4 Hz

Power consumption

Transmitter

Max. 10 W (active power)

switch-on current	Max. 36 A (<5 ms) as per NAMUR Recommendation NE 21
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Current consumption

Transmitter

- Max. 400 mA (24 V)
- Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)

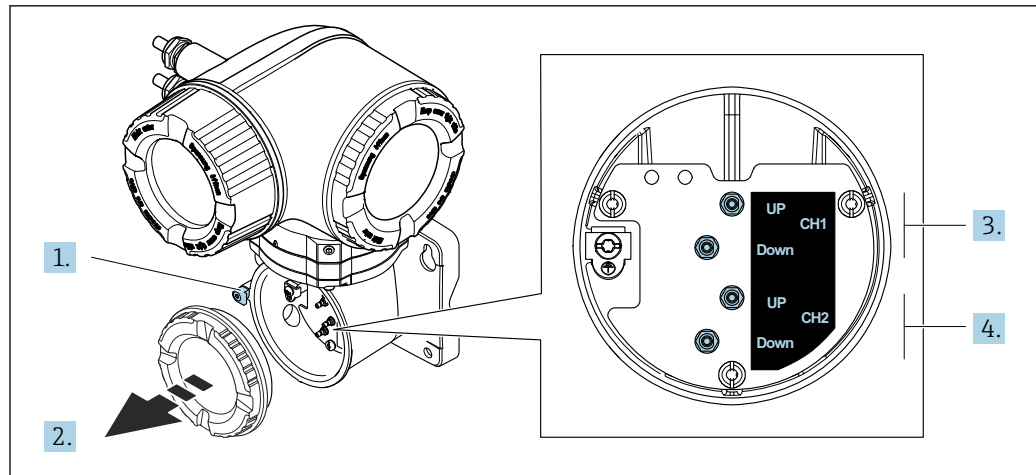
Power supply failure

- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memory or in the pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connection of the connecting cable: Proline 500

The connecting cable is connected via terminals.



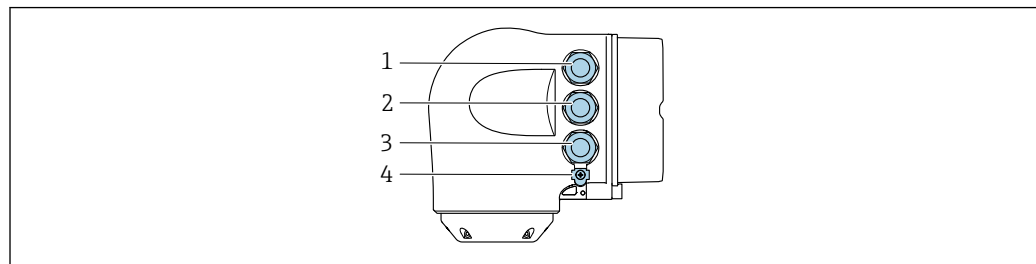
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- 1 Securing clamp
- 2 Connection compartment cover: sensor cable connection
- 3 Channel 1 upstream / downstream
- 4 Channel 2 upstream / downstream

Connecting the transmitter

- i** Terminal assignment → 26
- Device plug pin assignment → 27

Connecting the Proline 500 transmitter



A0026781

- 1 Terminal connection for supply voltage
- 2 Terminal connection for signal transmission, input/output
- 3 Terminal connection for signal transmission, input/output or terminal for network connection (DHCP client) via service interface (CDI-RJ45; non-Ex); optional: terminal connection for external WLAN antenna
- 4 Protective ground (PE)

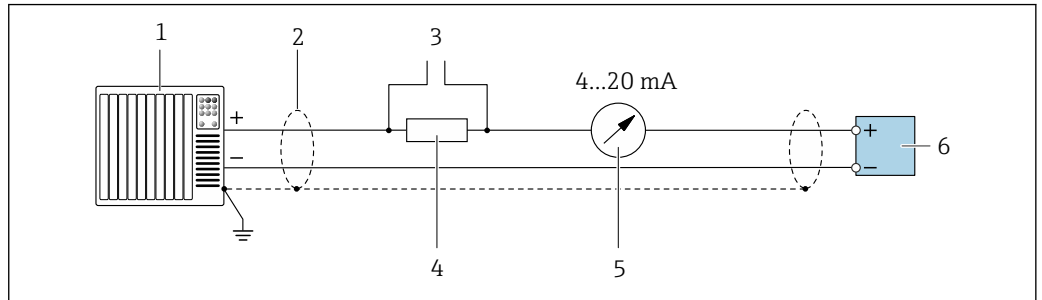
- i** An adapter for RJ45 and the M12 connector is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45; non-Ex) to an M12 connector mounted in the cable entry. Therefore the connection to the service interface can be established via an M12 connector without opening the device.

- i** Network connection (DHCP client) via service interface (CDI-RJ45) → 66

Connection examples

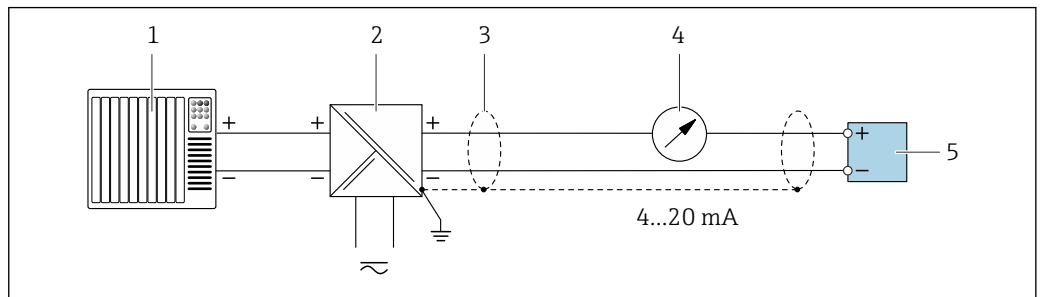
Current output 4 to 20 mA HART



A0029055

10 Connection example for 4 to 20 mA HART current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 34
- 3 Connection for HART operating devices → 64
- 4 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load → 18
- 5 Analog display unit: observe maximum load → 18
- 6 Transmitter

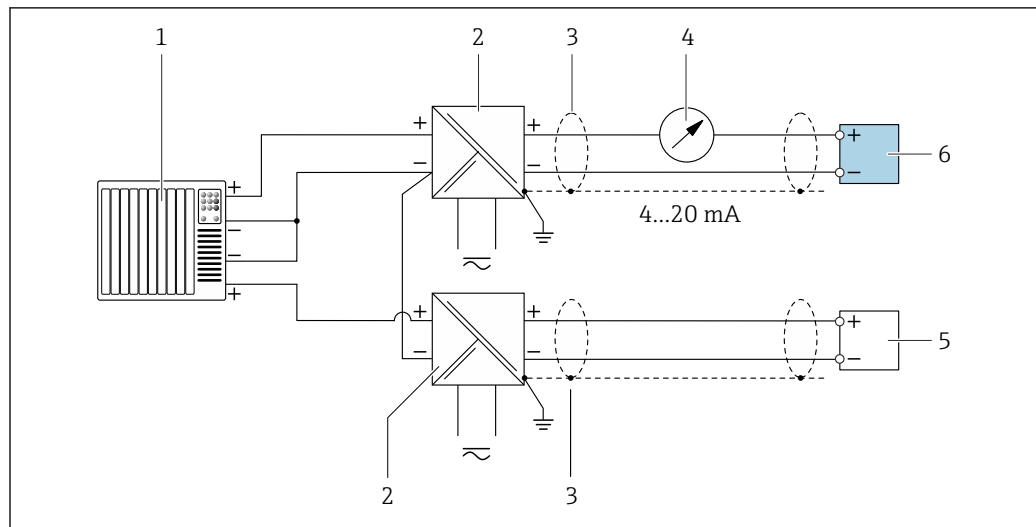


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11 Connection example for 4 to 20 mA HART current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Power supply
- 3 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 34
- 4 Analog display unit: observe maximum load → 18
- 5 Transmitter

HART input

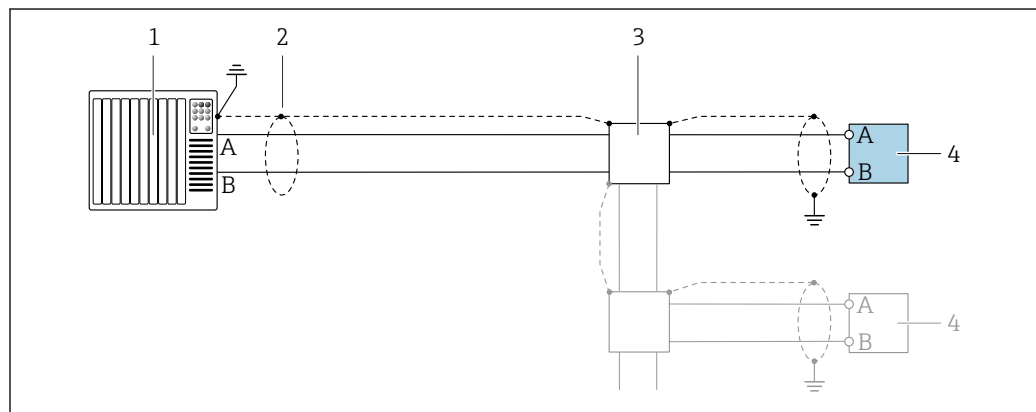


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12 Connection example for HART input with a common negative (passive)

- 1 Automation system with HART output (e.g. PLC)
- 2 Active barrier for power supply (e.g. RN221N)
- 3 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 4 Analog display unit: observe maximum load → 18
- 5 Pressure measuring device (e.g. Cerabar M, Cerabar S): see requirements
- 6 Transmitter

Modbus RS485

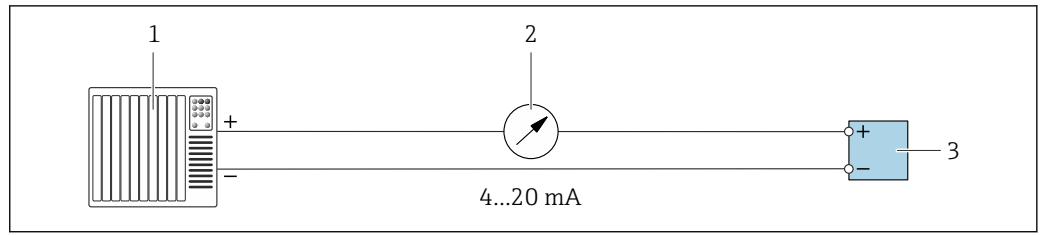


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13 Connection example for Modbus RS485, non-hazardous area and Zone 2; Class I, Division 2

- 1 Control system (e.g. PLC)
- 2 Cable shield provided at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
- 3 Distribution box
- 4 Transmitter

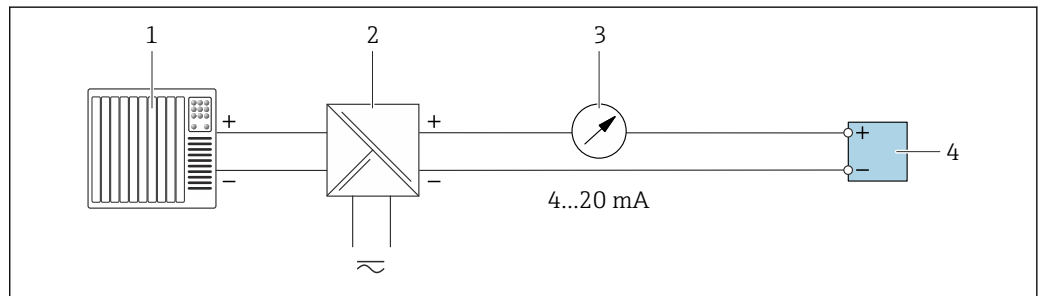
Current output 4-20 mA



A0028758

14 Connection example for 4-20 mA current output (active)

- 1 Automation system with current input (e.g. PLC)
- 2 Analog display unit: observe maximum load → 18
- 3 Transmitter

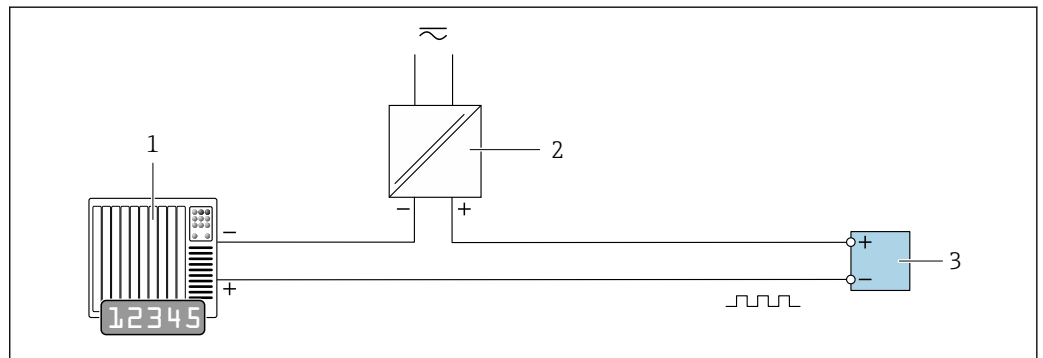


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15 Connection example for 4-20 mA current output (passive)

- 1 Automation system with current input (e.g. PLC)
- 2 Active barrier for power supply (e.g. RN221N)
- 3 Analog display unit: observe maximum load → 18
- 4 Transmitter

Pulse/frequency output

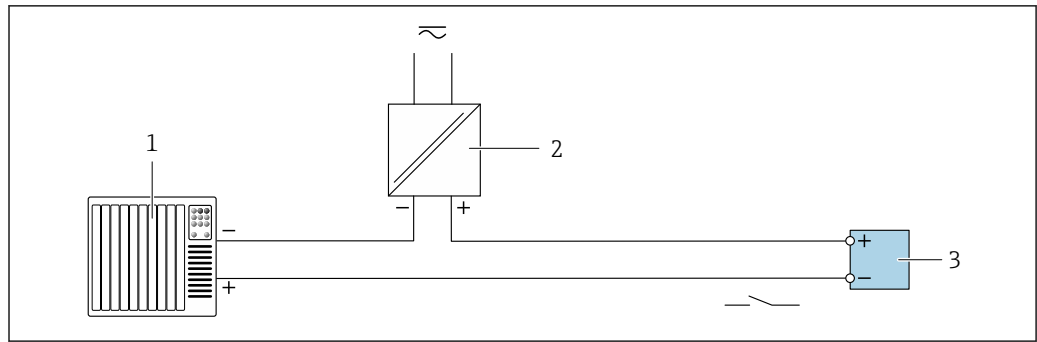


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16 Connection example for pulse/frequency output (passive)

- 1 Automation system with pulse/frequency input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 20

Switch output

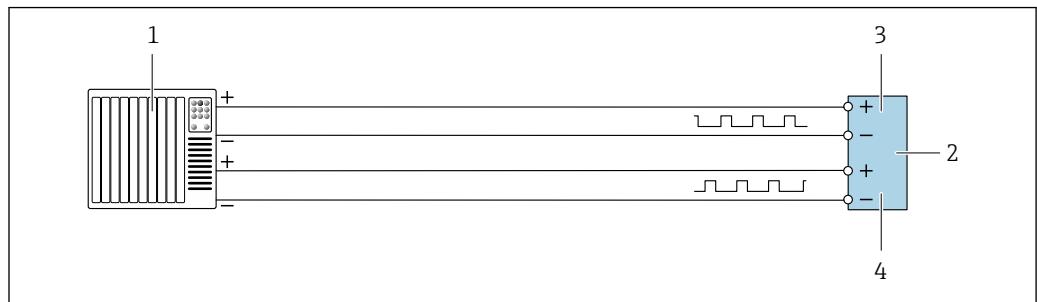


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17 Connection example for switch output (passive)

- 1 Automation system with switch input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 20

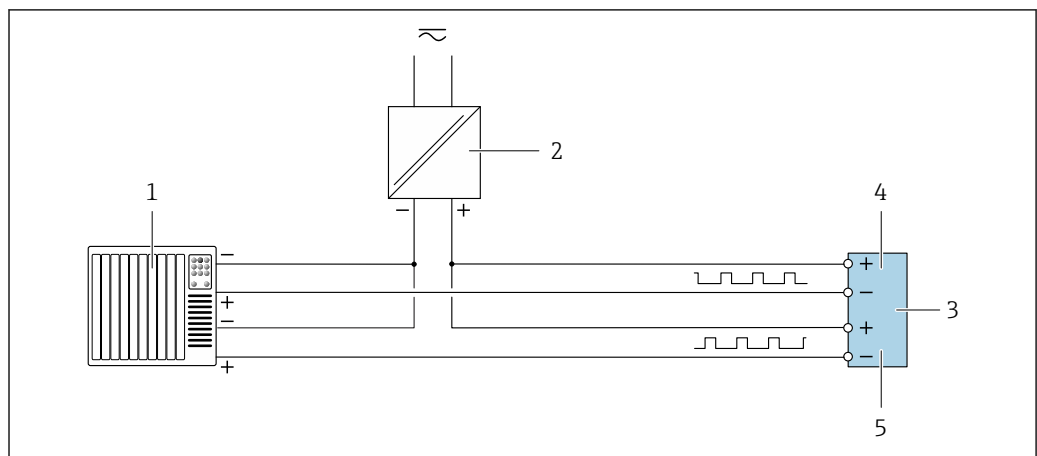
Pulse output, phase-shifted



A0029280

18 Connection example for pulse output, phase-shifted (active)

- 1 Automation system with pulse input, phase-shifted (e.g. PLC)
- 2 Transmitter: Observe input values → 21
- 3 Pulse output
- 4 Pulse output (slave), phase-shifted

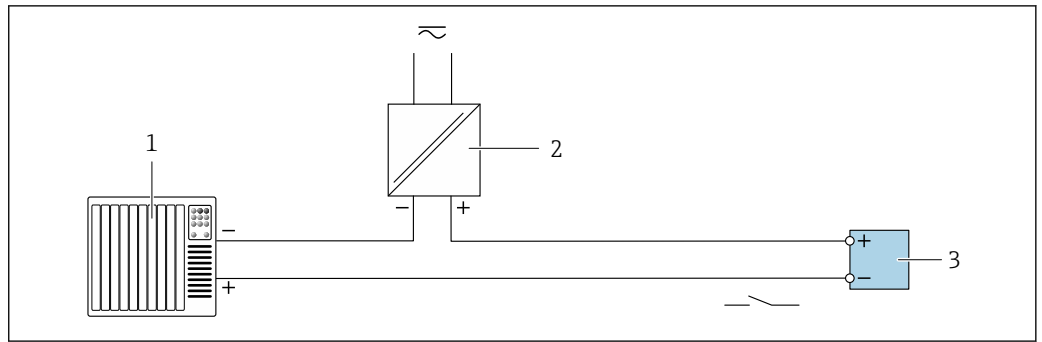


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19 Connection example for pulse output, phase-shifted (passive)

- 1 Automation system with pulse output, phase-shifted (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 21
- 4 Pulse output
- 5 Pulse output (slave), phase-shifted

Relay output

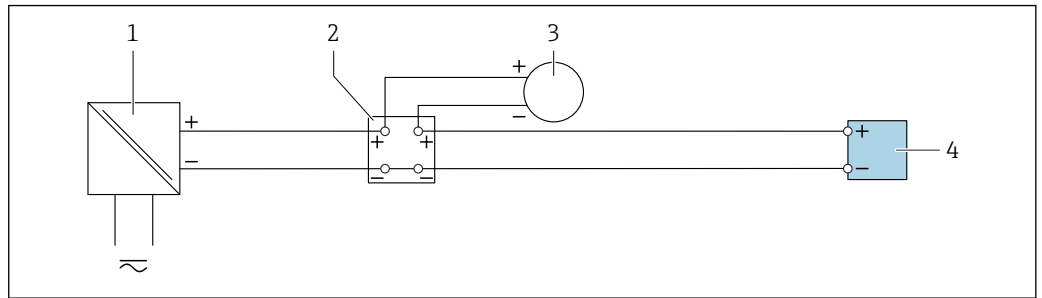


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20 Connection example for relay output (passive)

- 1 Automation system with relay input (e.g. PLC)
- 2 Power supply
- 3 Transmitter: Observe input values → 21

Current input

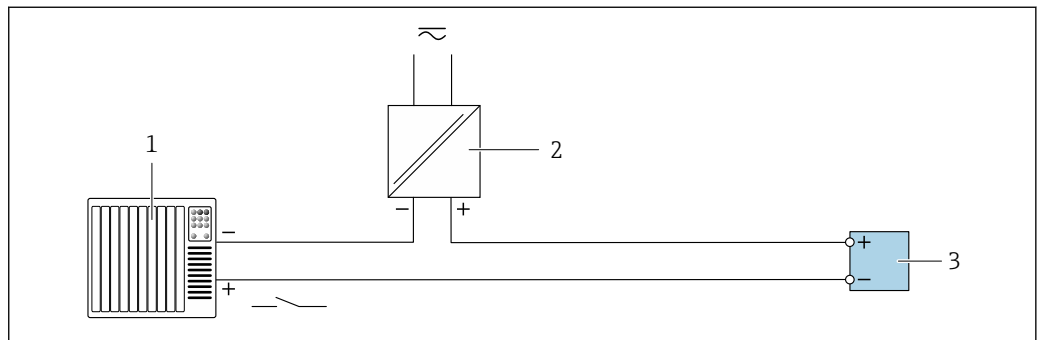


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21 Connection example for 4 to 20 mA current input

- 1 Power supply
- 2 Terminal box
- 3 External measuring device (to read in pressure or temperature, for instance)
- 4 Transmitter

Status input



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22 Connection example for status input

- 1 Automation system with status output (e.g. PLC)
- 2 Power supply
- 3 Transmitter

Potential equalization**Requirements**

For potential equalization:

- Pay attention to in-house grounding concepts
- Take account of operating conditions like the pipe material and grounding
- Connect the medium, sensor and transmitter to the same electrical potential
- Use a ground cable with a minimum cross-section of 6 mm² (0.0093 in²) for potential matching connections



For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

Abbreviations used

- PE: Protective Earth
- P_{FL}: Potential Flanges
- P_M: Potential Medium

Terminals

Spring-loaded terminals: Suitable for strands and strands with ferrules.
Conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG).

Cable entries

- Cable gland: M20 × 1.5 with cable \varnothing 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
 - NPT 1/2"
 - G 1/2"
 - M20
- Device plug for digital communication: M12
Only available for certain device versions → 26.

Cable specification**Permitted temperature range**

- The installation guidelines that apply in the country of installation must be observed.
- The cables must be suitable for the minimum and maximum temperatures to be expected.

Power supply cable (incl. conductor for the inner ground terminal)

Standard installation cable is sufficient.

Protective grounding cable for the outer ground terminal

Conductor cross-section ≤ 2.08 mm² (14 AWG)

Grounding impedance must be less than 2 Ω .

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe grounding concept of the plant.

Modbus RS485

The EIA/TIA-485 standard specifies two types of cable (A and B) for the bus line which can be used for every transmission rate. Cable type A is recommended.

Cable type	A
Characteristic impedance	135 to 165 Ω at a measuring frequency of 3 to 20 MHz
Cable capacitance	< 30 pF/m
Wire cross-section	> 0.34 mm ² (22 AWG)
Cable type	Twisted pairs
Loop resistance	≤ 110 Ω /km
Signal damping	Max. 9 dB over the entire length of the cable cross-section
Shield	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Pulse output, phase-shifted

Standard installation cable is sufficient.

Relay output

Standard installation cable is sufficient.

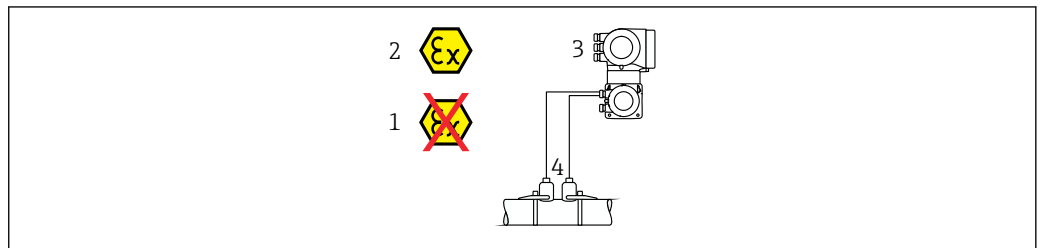
Current input 0/4 to 20 mA

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

Connecting cable between the transmitter and sensor



A0041974

- 1 Non-hazardous area
- 2 Hazardous area: Zone 1; Class I, Division 1 or Zone 2; Class I, Division 2
- 3 Proline 500 transmitter
- 4 sensor set with sensor cable to transmitter 500 → 35
 Transmitter and sensor installed in the hazardous area: Zone 1; Class I, Division 1 oder Zone 2; Class I, Division 2

Sensor cable for sensor - Proline 500 transmitter



Standard cable	<ul style="list-style-type: none"> ■ TPE: -40 to +80 °C (-40 to +176 °F) ■ TPE armored: -40 to +80 °C (-40 to +176 °F) ■ TPE halogen-free: -40 to +80 °C (-40 to +176 °F) ■ PTFE: -50 to +170 °C (-58 to +338 °F) ■ PTFE armored: -50 to +170 °C (-58 to +338 °F)
Cable length (max.)	30 m (100 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (32 ft), 15 m (50 ft), 30 m (100 ft)
Operating temperature	Depends on the device version and how the cable is installed: Standard version: <ul style="list-style-type: none"> ■ Cable - fixed installation ¹⁾: minimum -40 °C (-40 °F) or -50 °C (-58 °F) ■ Cable - movable: minimum -25 °C (-13 °F)

1) Compare details under the "Standard cable" row

Performance characteristics

Reference operating conditions

- Error limits following ISO/DIS 11631
- Specifications as per measurement report
- Accuracy information is based on accredited calibration rigs that are traced to ISO 17025.

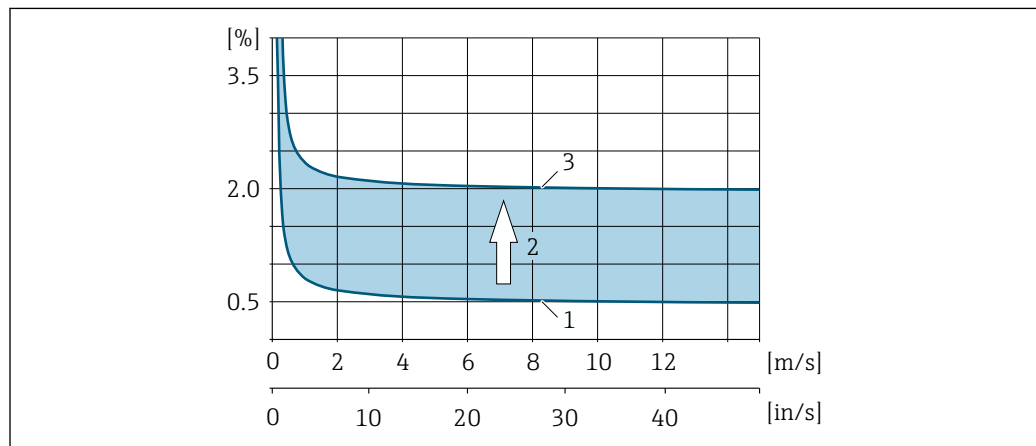
 To obtain measured errors, use the *Applicator* sizing tool →  75

Maximum measured error


o.r. = of reading

The measured error depends on a number of factors. A distinction is made between the measured error of the device (0.5% o.r.) and an additional installation-specific measured error (typically 1.5% o.r.) that is independent of the device.

The installation-specific measured error depends on the installation conditions on site, such as the nominal diameter, wall thickness, real pipe geometry or medium. The sum of the two measured errors is the measured error at the measuring point.



A0041972

 23 Example of the measured error in a pipe with a nominal diameter DN > 200 (8")

- 1 Measured error of the device: 0.5% o.r. ± 3 mm/s (0.12 in/s)
- 2 Measured error due to installation conditions: typically 1.5% o.r.
- 3 Measured error at the measuring point: 0.5% o.r. ± 3 mm/s (0.12 in/s) + 1.5% o.r. = 2% o.r. ± 3 mm/s (0.12 in/s)

Measured error at the measuring point

The measured error at the measuring point is made up of the measured error of the device (0.5% o.r.) and the measured error resulting from the installation conditions on site. Given a flow velocity of > 0.3 m/s (1 ft/s) and a Reynolds number > 10 000 the following are typical error limits:

Nominal diameter	Device error limits	+	Installation-specific error limits (typical)	→	Error limits at the measuring point (typical)	Field calibration ¹⁾
DN 15 (½")	±0.5% o.r. ± 5 mm/s (0.20 in/s)	+	±2.5% o.r.	→	±3% o.r. ± 5 mm/s (0.20 in/s)	±0.5% o.r. ± 5 mm/s (0.20 in/s)
DN 25 to 200 (1 to 8")	±0.5% o.r. ± 7.5 mm/s (0.30 in/s)	+	±1.5% o.r.	→	±2% o.r. ± 7.5 mm/s (0.30 in/s)	±0.5% o.r. ± 7.5 mm/s (0.30 in/s)
> DN 200 (8")	±0.5% o.r. ± 3 mm/s (0.12 in/s)	+	±1.5% o.r.	→	±2% o.r. ± 3 mm/s (0.12 in/s)	±0.5% o.r. ± 3 mm/s (0.12 in/s)

1) Adjustment in relation to a reference with correction values written back to the transmitter


Measurement report

If required, the device can be supplied with a factory measurement report. A measurement is performed under reference conditions to verify the performance of the device. Here, the sensors are

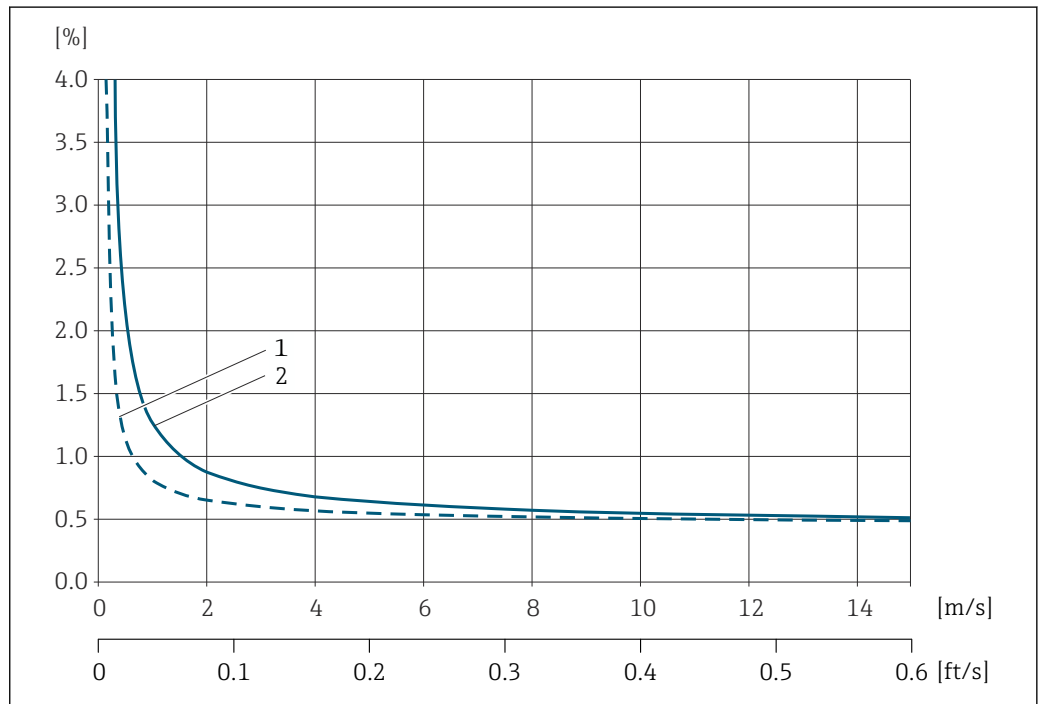
mounted on a pipe with a nominal diameter of DN 15 (½"), 25 (1"), 40 (1½"), 50 (2") or 100 (4"), respectively.


The measurement report guarantees the following error limits at a flow velocity of > 0.3 m/s (1 ft/s) and a Reynolds number > 10 000:

Nominal diameter	Device error limits
DN 15 (½"), 25 (1"), 40 (1½"), 50 (2")	±0.5% o.r. ± 5 mm/s (0.20 in/s)
100 (4")	±0.5% o.r. ± 7.5 mm/s (0.30 in/s)

 The specification applies for Reynolds numbers $Re \geq 10\,000$. Larger measured errors can occur for Reynolds numbers $Re < 10\,000$.

Example for max. measured error (volume flow)



 24 Example for max. measured error (volume flow) in % o.r.

- 1 Pipe diameter < DN 100 (4")
- 2 Pipe diameter = DN 100 (4")

Repeatability o.r. = of reading
 ±0.3% for flow velocities >0.3 m/s (1 ft/s)

Influence of ambient temperature

Current output

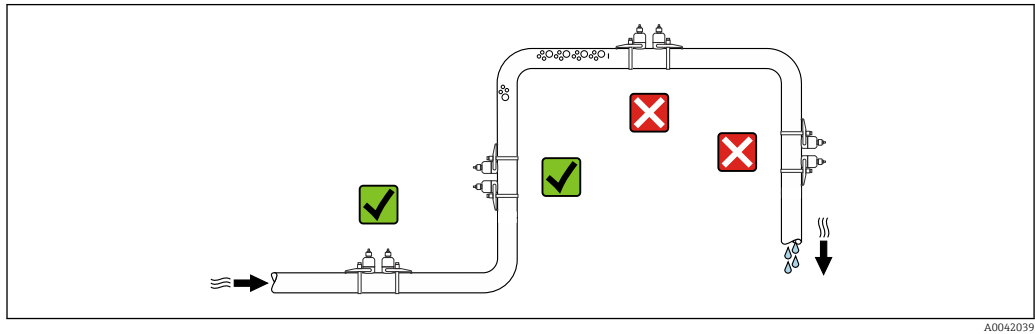
Temperature coefficient	Max. 1 µA/°C
-------------------------	--------------

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.
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Installation

Mounting location

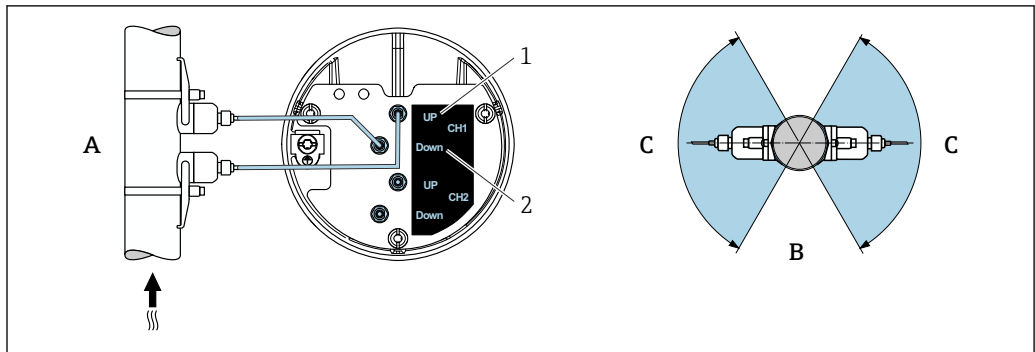


A0042039

To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:

- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Orientation



A0041970

25 Orientation views

- 1 Channel 1 upstream
- 2 Channel 1 downstream
- A Recommended orientation with upward direction of flow
- B Non-recommended installation range with horizontal orientation (30°)
- C Recommended installation range max. 120°

Vertical

Recommended orientation with upward direction of flow (View A). With this orientation, entrained solids will sink and gases will rise away from the sensor area when the medium is not flowing. Furthermore, the pipe can be completely drained and protected against the buildup of deposits.

Horizontal

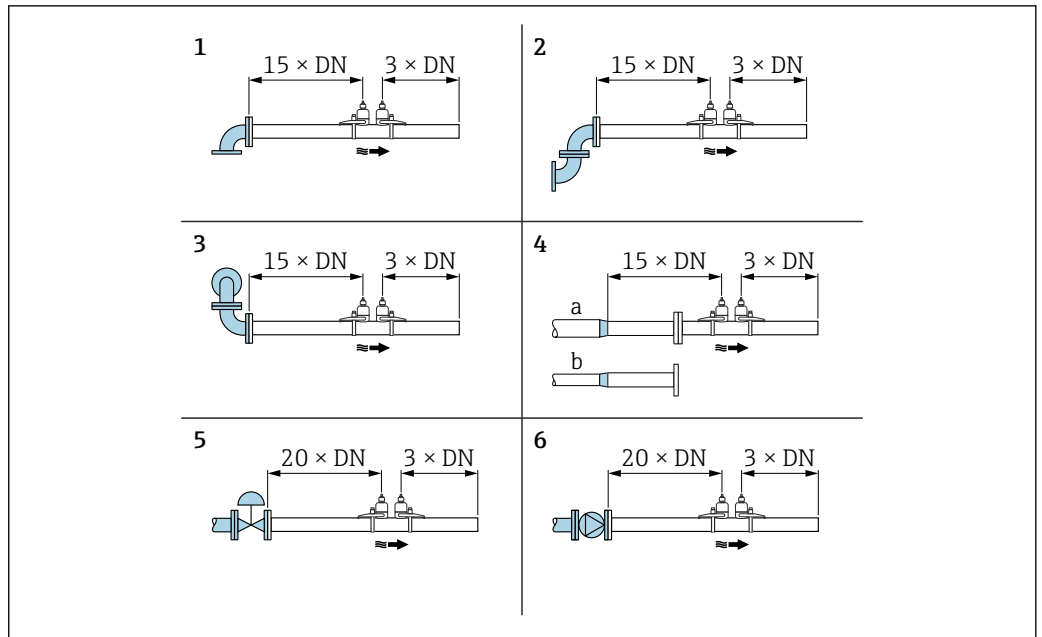
In the recommended installation range with a horizontal orientation (View B), gas and air accumulations at the top of the pipe and interference from deposit buildup at the bottom of the pipe can influence the measurement to a lesser degree.

Inlet and outlet runs

If possible, the sensor should be installed upstream from valves, T-sections, pumps etc. If this is not possible, the inlet and outlet runs indicated below must be maintained at the very minimum in order to attain the specified level of accuracy of the measuring device. If there are several flow disturbances present, the longest specified inlet run must be maintained.

- i** Shorter inlet and outlet runs are possible with the following device versions:
Two-path measurement with 2 sensor sets⁵⁾ and FlowDC²⁾ (for item numbers 1 to 4b):
Up to minimum 2 × DN for inlet run, 2 × DN for outlet run

5) Order code for "Mounting type", option A2 "Clamp-on, 2-channel, 2-sensor sets"



A0042041

26 Minimum inlet and outlet runs with various flow obstructions

- 1 Pipe bend
- 2 Two pipe bends (on one plane)
- 3 Two pipe bends (on two planes)
- 4a reduction
- 4b Expansion
- 5 Control valve (2/3 open)
- 6 Pump

Mounting the sensor



Risk of injury when mounting the sensors and strapping bands!

► Due to the increased risk of cuts, wear suitable gloves and protective goggles.

Sensor configuration and settings

DN 15 to 65 (½ to 2½")	DN 50 to 4000 (2 to 160")			
	Strapping band	Strapping band		Welded bolt
2 traverses [mm (in)]	1 traverse [mm (in)]	2 traverses [mm (in)]	1 traverse [mm (in)]	2 traverses [mm (in)]
Sensor distance ¹⁾	Sensor distance ¹⁾	Sensor distance ¹⁾	Sensor distance ¹⁾	Sensor distance ¹⁾
-	Wire length → 47	Measuring rail ^{1) 2)}	Wire length	Measuring rail ^{1) 2)}

- 1) Depends on the conditions at the measuring point (measuring pipe, medium etc.). The dimension can be determined via FieldCare or Applicator. See also the **Result sensor distance / measuring aid** parameter in the **Measuring point** submenu
- 2) Only up to DN 600 (24")

Mounting types

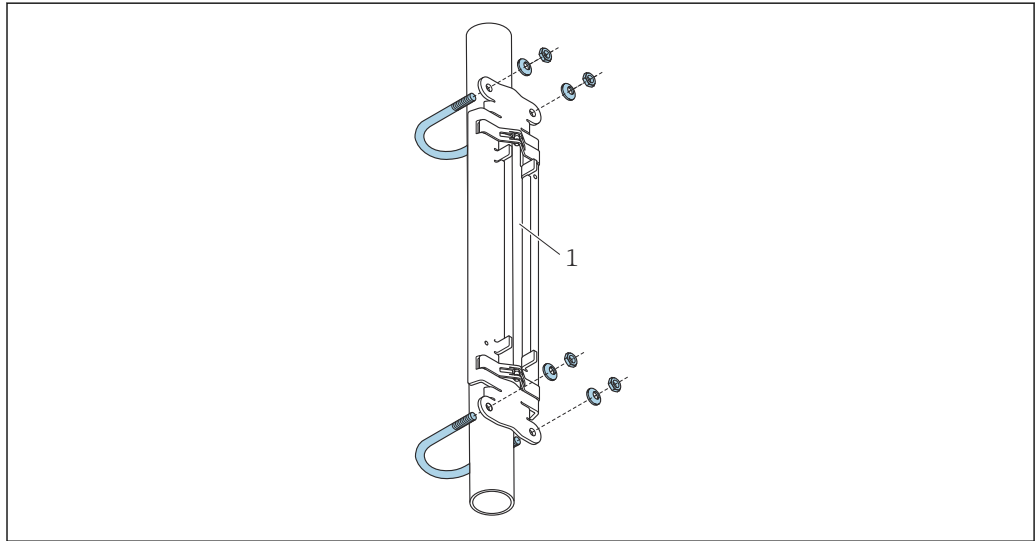
Sensor holder with U-shaped screws

- Can be used for
 - Measuring devices with measuring range DN 15 to 65 (½ to 2½")
 - Mounting on pipes DN 15 to 32 (½ to 1¼")

Procedure:

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the measuring pipe.
3. Fit the U-shaped screws through the sensor holder and lightly grease the thread.

4. Screw the nuts onto the U-shaped screws.
5. Position the sensor holder correctly and tighten the nuts uniformly.



A0043369

27 Holder with U-shaped screws

1 Sensor holder

CAUTION

Risk of damaging plastic or glass pipes if the nuts on the U-shaped screws are tightened too much!

- ▶ The use of a metal half-shell (on the opposite side of the sensor) is recommended for plastic or glass pipes.

i The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.

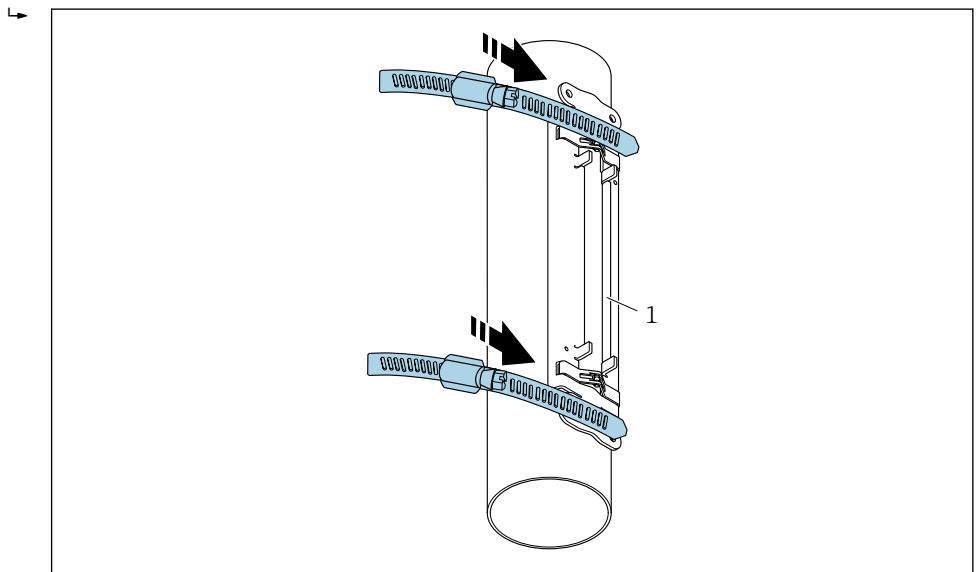
Sensor holder with strapping bands (small nominal diameters)

- i** Can be used for
- Measuring devices with measuring range DN 15 to 65 ($\frac{1}{2}$ to $2\frac{1}{2}$ ")
 - Mounting on pipes DN > 32 ($1\frac{1}{4}$ ")

Procedure:

1. Disconnect the sensor from the sensor holder.
2. Position the sensor holder on the measuring pipe.

3. Wrap the strapping bands around the sensor holder and measuring pipe without twisting them.

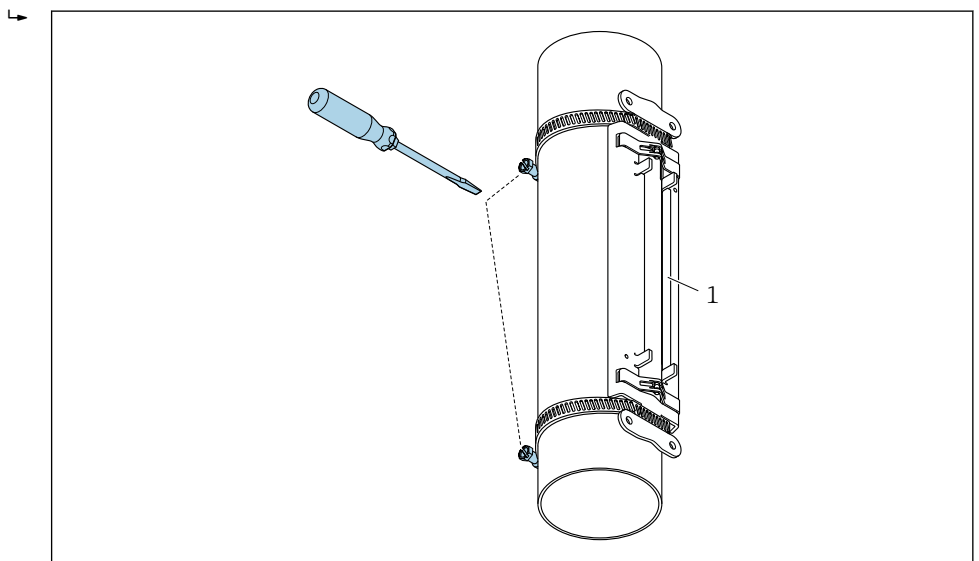


A0043371

28 Positioning the sensor holder and mounting the strapping bands

1 Sensor holder

4. Guide the strapping bands through the strapping band locks.
5. Tighten the strapping bands as tightly as possible by hand.
6. Set the sensor holder to the desired position.
7. Push down the tensioning screw and tighten the strapping bands so they cannot slip.



A0043372

29 Tightening the tensioning screws of the strapping bands

1 Sensor holder

8. If necessary, shorten the strapping bands and trim the cut edges.

⚠ WARNING

Risk of injury!

- ▶ To avoid sharp edges, trim the cut edges after shortening the strapping bands. Wear suitable gloves and protective goggles.

- i** The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.

Sensor holder with strapping bands (medium nominal diameters)

- i** Can be used for
 - Measuring devices with measuring range DN 50 to 4000 (2 to 160")
 - Mounting on pipes DN ≤ 600 (24")

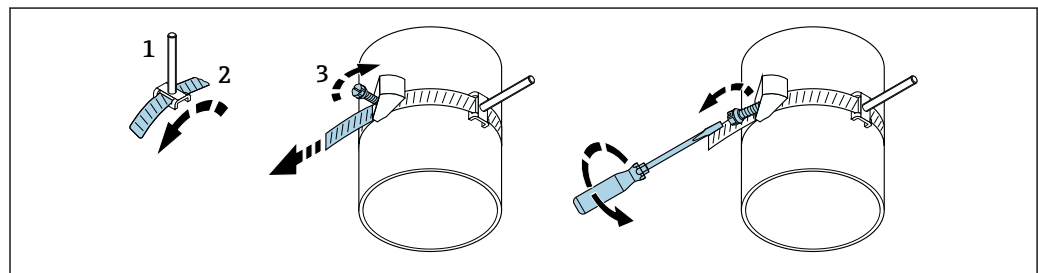
Procedure:

1. Fit the mounting bolt over strapping band 1.
2. Position strapping band 1 as perpendicular as possible to the measuring pipe axis without twisting it.
3. Guide the end of strapping band 1 through the strapping band lock.
4. Tighten strapping band 1 as tightly as possible by hand.
5. Set strapping band 1 to the desired position.
6. Push down the tensioning screw and tighten strapping band 1 so it cannot slip.
7. Strapping band 2: proceed as for strapping band 1 (steps 1 to 6).
8. Only slightly tighten strapping band 2 for final mounting. It must be possible to move strapping band 2 for final alignment.
9. If necessary, shorten both strapping bands and trim the cut edges.

⚠ WARNING

Risk of injury!

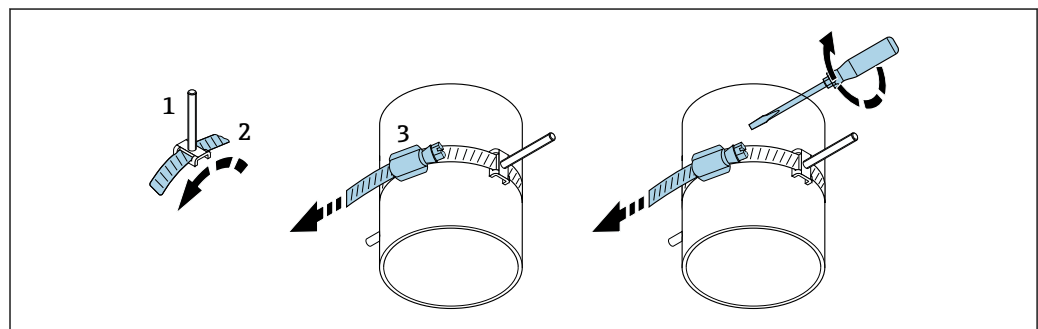
- ▶ To avoid sharp edges, trim the cut edges after shortening the strapping bands. Wear suitable gloves and protective goggles.



A0043373

30 Holder with strapping bands (medium nominal diameters), with hinged screw

- 1 Mounting bolts
- 2 Strapping band
- 3 Tensioning screw



A0044350

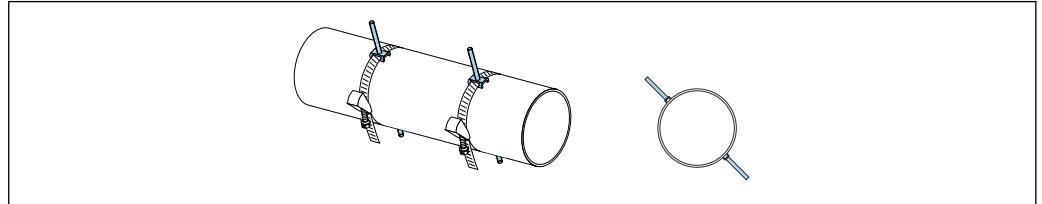
31 Holder with strapping bands (medium nominal diameters), without hinged screw

- 1 Mounting bolts
- 2 Strapping band
- 3 Tensioning screw

Sensor holder with strapping bands (large nominal diameters)

Can be used for

- Measuring devices with measuring range DN 50 to 4000 (2 to 160")
- Mounting on pipes DN > 600 (24")
- 1-traverse mounting or 2-traverse mounting with 180° arrangement
- 2-traverse mounting with two-path measurement and 90° arrangement (instead of 180°)



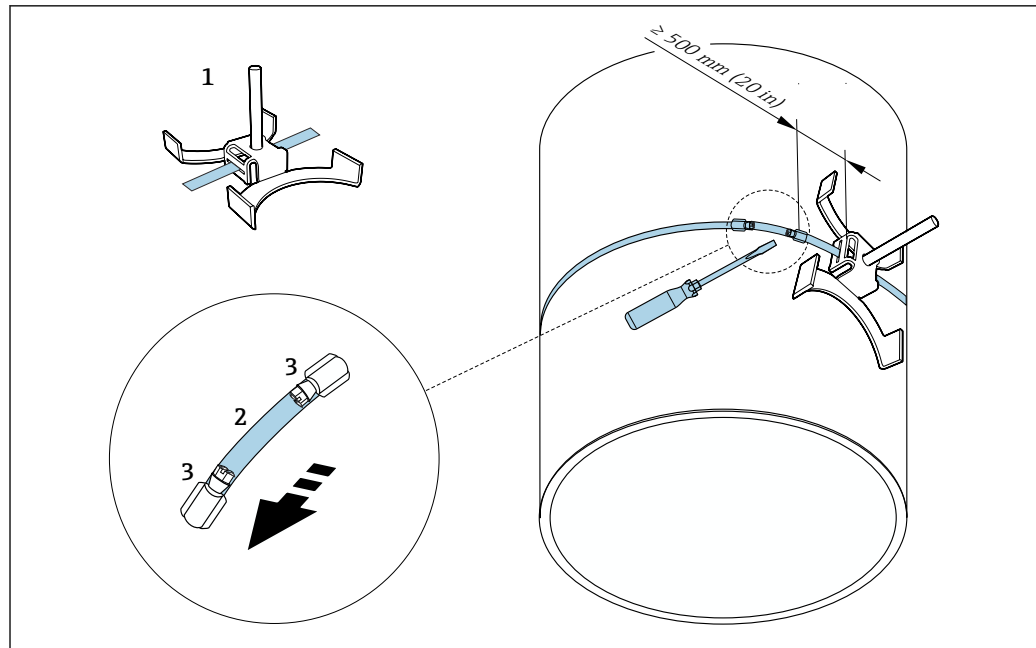
A0044648

Procedure:

1. Measure the pipe circumference. Note down the full/half or quarter circumference.
2. Shorten the strapping bands to the required length (= pipe circumference) and trim the cut edges.
3. Select the mounting location of the sensors with the given sensor distance and optimum inlet run conditions, while ensuring there is nothing impeding sensor mounting over the entire circumference of the measuring pipe.
4. Fit two strap bolts over strapping band 1 and guide approx. 50 mm (2 in) of one of the strapping band ends through one of the two strapping band locks and into the buckle. Then guide the protective flap over this strapping band end and lock in place.
5. Position strapping band 1 as perpendicular as possible to the measuring pipe axis without twisting it.
6. Guide the second strapping band end through the strapping band lock that is still free and proceed in the same way as for the first strapping band end. Guide the protective flap over the second strapping band end and lock in place.
7. Tighten strapping band 1 as tightly as possible by hand.
8. Set strapping band 1 to the desired position, ensuring that it is as perpendicular as possible to the measuring pipe axis.
9. Position the two strap bolts on strapping band 1, arranging them at a half circumference in relation to one another (180° arrangement, e.g. 10 o'clock and 4 o'clock) or quarter circumference (90° arrangement, e.g. 10 o'clock and 7 o'clock).
10. Tighten strapping band 1 so that it cannot slip.
11. Strapping band 2: proceed as for strapping band 1 (steps 4 to 8).
12. Only slightly tighten strapping band 2 for final mounting so that it can still be adjusted. The distance/offset from the center of strapping band 2 to the center of strapping band 1 is indicated by the sensor distance of the device.
13. Align strapping band 2 so that it is perpendicular to the measuring pipe axis and parallel to strapping band 1.
14. Position the two strap bolts on tensioning strap 2 on the measuring pipe so they are parallel to one another and offset at the same height/clock position (e.g. 10 and 4 o'clock) in relation to the two strap bolts on tensioning strap 1. A line drawn on the measuring pipe wall that is parallel to the measuring pipe axis can be helpful here. Now set the distance between the center of the strap bolts at the same level so that it exactly matches the sensor distance. An alternative method is to use the wire length → 47.
15. Tighten strapping band 2 so that it cannot slip.

⚠ WARNING**Risk of injury!**

- ▶ To avoid sharp edges, trim the cut edges after shortening the strapping bands. Wear suitable gloves and protective goggles.



A0043374

32 Holder with strapping bands (large nominal diameters)

- 1 Strap bolt with guide*
- 2 Strapping band*
- 3 Tensioning screw

*The distance between the strap bolt and strapping band lock must be at least 500 mm (20 in).

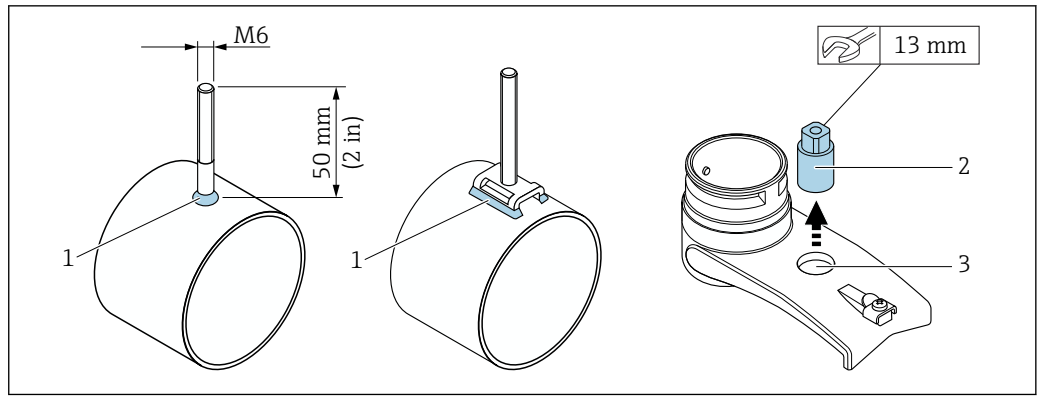
- For 1-traverse mounting with 180° (opposite) → 7 (single-path measurement, A0044304), → 6, 8 (two-path measurement, A0043168)
 - For 2-traverse mounting → 7 (single-path measurement, A0044305), → 7, 8 (two-path measurement, A0043309)
 - Electrical connection → 8, 10

Sensor holder with welded bolts

- Can be used for
 - Measuring devices with measuring range DN 50 to 4000 (2 to 160")
 - Mounting on pipes DN 50 to 4000 (2 to 160")

Procedure:

- The welded bolts must be fixed at the same installation distances as the mounting bolts with strapping bands. The following sections explain how to align the mounting bolts, depending on the mounting method and measurement method:
 - Installation for measurement via 1 traverse → 47
 - Installation for measurement via 2 traverses → 49
 - The sensor holder is secured as standard with a locking nut with a metric M6 ISO thread. If another thread should be used for fastening purposes, a sensor holder with a detachable locking nut must be used.



A0043375

33 Holder with welded bolts

- 1 Welding seam
- 2 Locking nut
- 3 Hole diameter max. 8.7 mm (0.34 in)

Sensor installation – small nominal diameters DN 15 to 65 (½ to 2½")

Requirements

- The installation distance is known → 39
- The sensor holder is pre-assembled

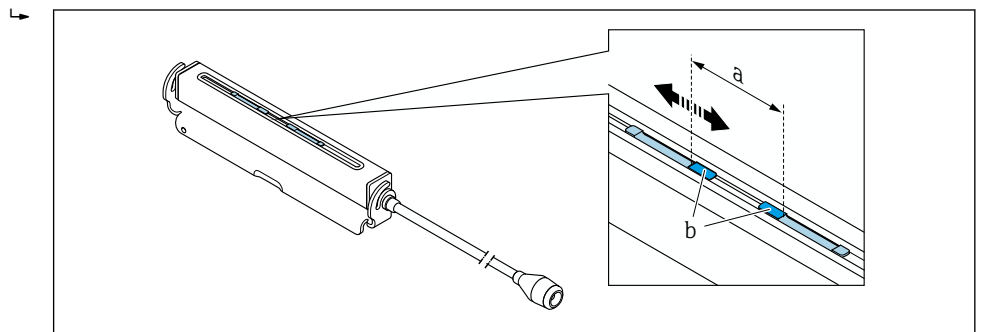
Material

The following material is required for mounting:

- Sensor incl. adapter cable
- Sensor cable for connecting to the transmitter
- Coupling medium (coupling pad or coupling gel) for an acoustic connection between the sensor and pipe

Procedure:

1. Set the distance between the sensors to the value determined for the sensor distance. Press the movable sensor down slightly to move it.



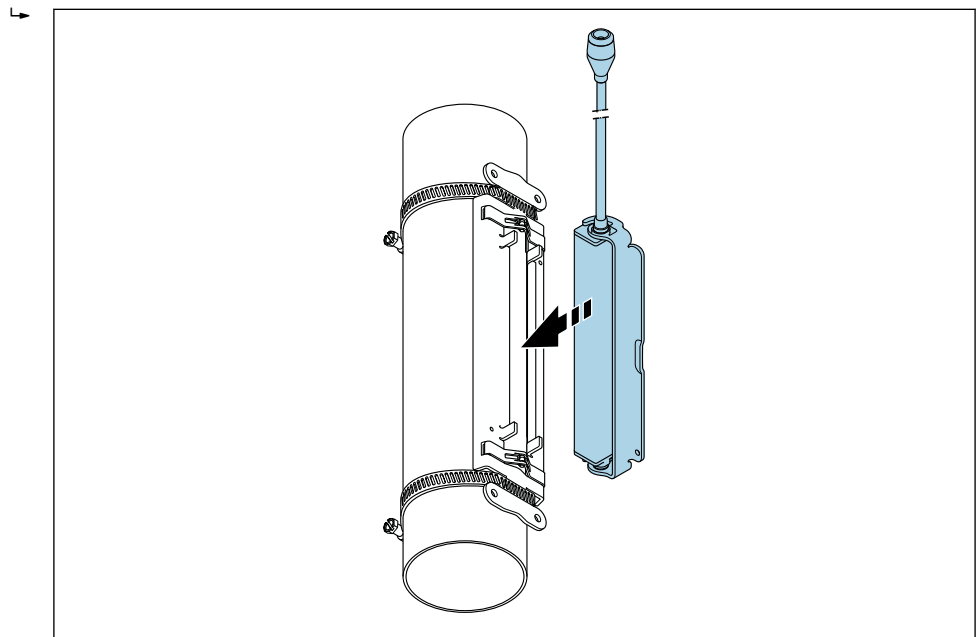
A0043376

34 Distance between sensors as per the installation distance → 39

- a Sensor distance (back of sensor must touch the surface)
- b Sensor contact surfaces

2. Stick the coupling pad under the sensor to the measuring pipe or coat the contact surfaces of the sensor (b) with an even layer of coupling gel (approx. 0.5 to 1 mm (0.02 to 0.04 in)).

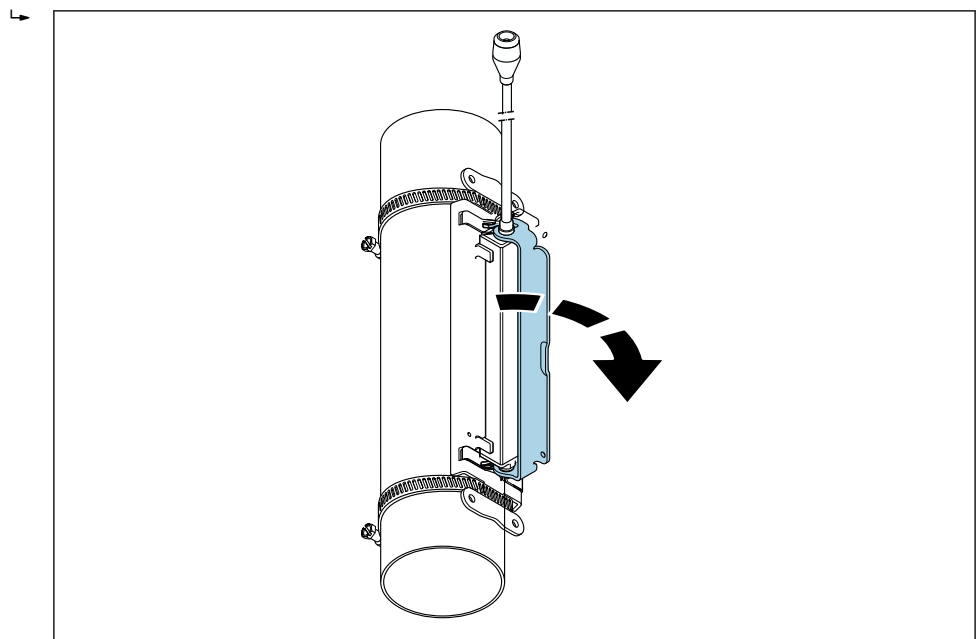
3. Fit the sensor housing on the sensor holder.



A0043377

35 Fitting the sensor housing

4. Lock the bracket in place to fix the sensor housing on the sensor holder.



A0043378

36 Fixing the sensor housing

5. Connect the sensor cable to the adapter cable.

↳ This completes the mounting procedure. The sensors can now be connected to the transmitter via the connecting cables.

- i** The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.
- If necessary, the holder and sensor housing can be secured with a screw/nut or a lead seal (not supplied).
- The bracket can only be released using an auxiliary tool (e.g. screwdriver).

Sensor installation – medium/large nominal diameters DN 50 to 4000 (2 to 160")

Installation for measurement via 1 traverse

Requirements

- The installation distance and wire length are known → 39
- Strapping bands are pre-assembled

Material

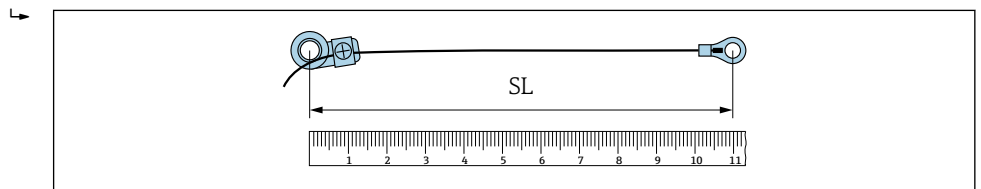
The following material is required for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already pre-assembled → 42, → 43)
- Two measuring wires, each with a cable lug and a fixer to fix the strapping bands
- Two sensor holders
- Coupling medium (coupling pad or coupling gel) for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables

i Installation is unproblematic up to DN 400 (16"), as of DN 400 (16") check the distance and angle (180°) diagonally with the wire length.

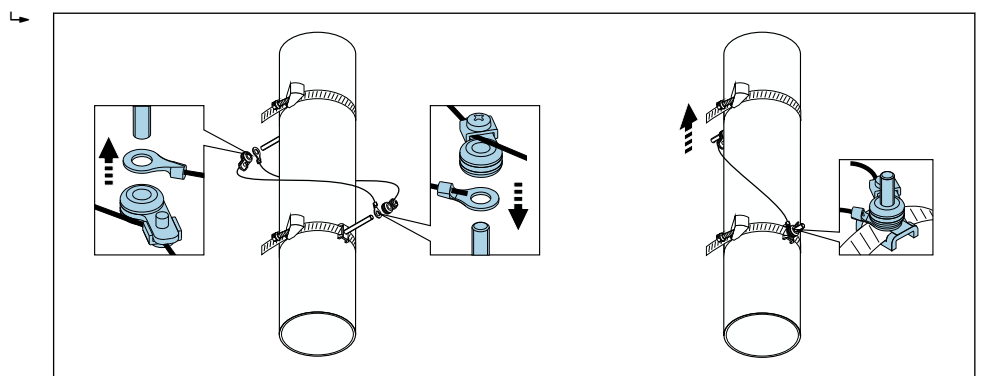
Procedure:

1. Prepare the two measuring wires: arrange the cable lugs and fixer such that the distance they are apart corresponds to the wire length (SL). Screw the fixer onto the measuring wire.



37 Fixer and cable lugs at a distance that corresponds to the wire length (SL)

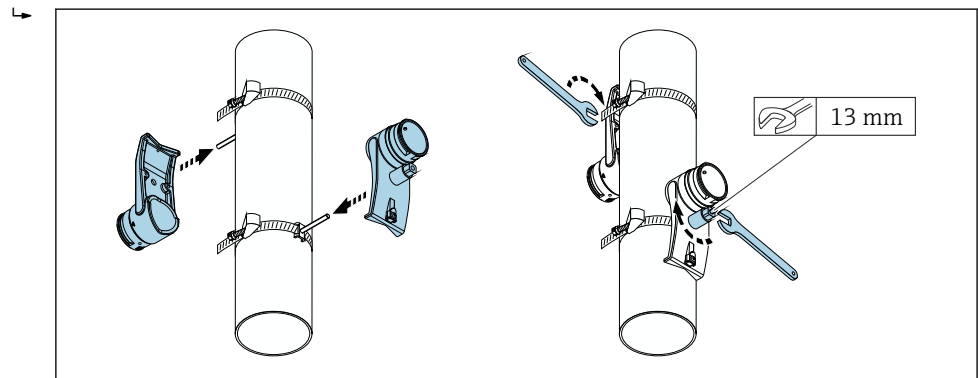
2. With measuring wire 1: fit the fixer over the mounting bolt of strapping band 1 that is already securely mounted. Run measuring wire 1 clockwise around the measuring pipe. Fit the cable lug over the mounting bolt of strapping band 2 that can still be moved.
3. With measuring wire 2: fit the cable lug over the mounting bolt of strapping band 1 that is already securely mounted. Run measuring wire 2 counterclockwise around the measuring pipe. Fit the fixer over the mounting bolt of strapping band 2 that can still be moved.
4. Take the still movable strapping band 2, incl. the mounting bolt, and move it until both measuring wires are evenly tensioned and then tighten strapping band 2 so that it cannot slip. Then check the sensor distance from the center of the strapping bands. If the distance is too small, release strapping band 2 again and position it better. Both strapping bands should be as perpendicular as possible to the measuring pipe axis and parallel to one another.



38 Positioning the strapping bands (steps 2 to 4)

5. Loosen the screws of the fixers on the measuring wires and remove the measuring wires from the mounting bolt.

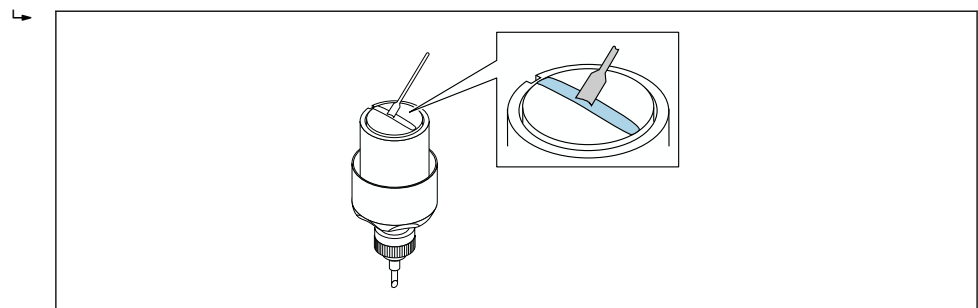
6. Fit the sensor holders over the individual mounting bolts and tighten securely with the locking nut.



A0043381

39 Mounting the sensor holders

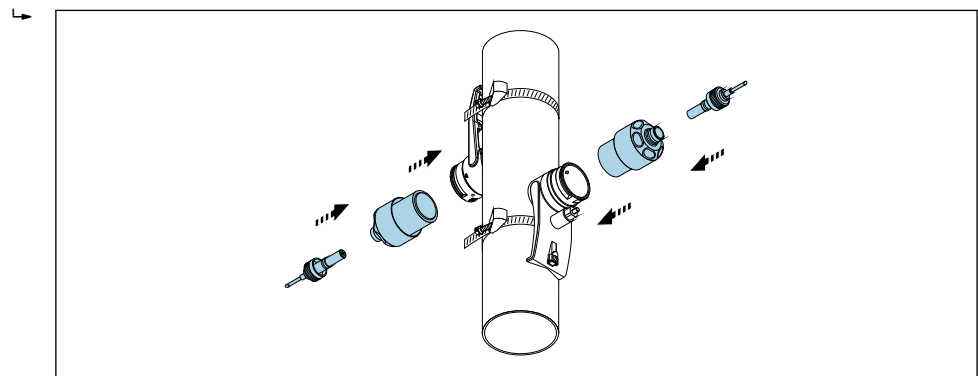
7. Attach the coupling pad with the adhesive side facing down on the sensors (-> 77). Alternatively coat the contact surfaces with an even layer of coupling gel (approx. 1 mm (0.04 in)), going from the groove through the center to the opposite edge.



A0043382

40 Coating the contact surfaces of the sensor with coupling gel (if there is no coupling pad)

8. Insert the sensor into the sensor holder.
 9. Fit the sensor cover on the sensor holder and turn until the sensor cover engages with a click and the arrows (▲ / ▼ "close") are pointing towards one another.
 10. Insert the sensor cable into the sensor until the end stop.




A0043383

41 Mounting the sensor and connecting the sensor cable

The sensors can now be connected to the transmitter via the sensor cables and the error message can be checked in the sensor check function. This completes the mounting procedure.



- i**
- The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.
 - If the sensor is removed from the measuring pipe, it must be cleaned and new coupling gel applied (if there is no coupling pad).
 - On rough measuring pipe surfaces, the gaps in the rough surface must be filled with sufficient amounts of coupling gel if the use of the coupling pad does not suffice (installation quality check).

*Installation for measurement via 2 traverses***Requirements**

- The installation distance is known →  39
- Strapping bands are pre-assembled

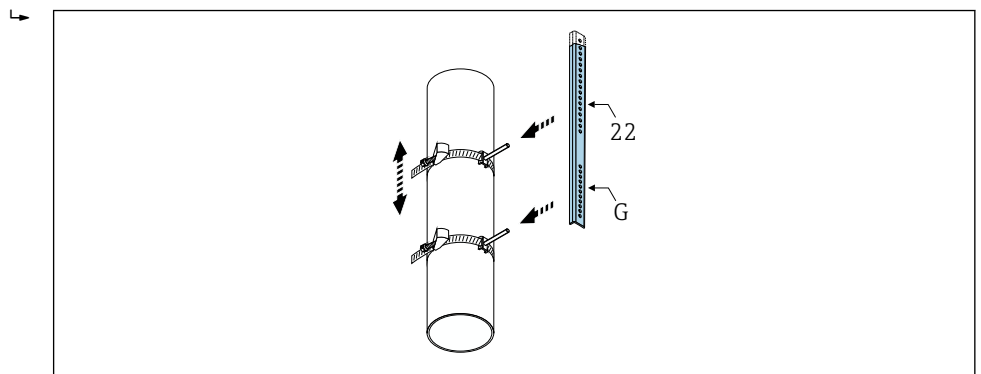
Material

The following material is required for mounting:

- Two strapping bands incl. mounting bolts and centering plates where necessary (already pre-assembled →  42, →  43)
- A mounting rail to position the strapping bands:
 - Short rail up to DN 200 (8")
 - Long rail up to DN 600 (24")
 - No rail > DN 600 (24"), as distance measured by sensor distance between the mounting bolts
- Two mounting rail holders
- Two sensor holders
- Coupling medium (coupling pad or coupling gel) for an acoustic connection between the sensor and pipe
- Two sensors incl. connecting cables
- Open-ended wrench (13 mm)
- Screwdriver

Procedure:

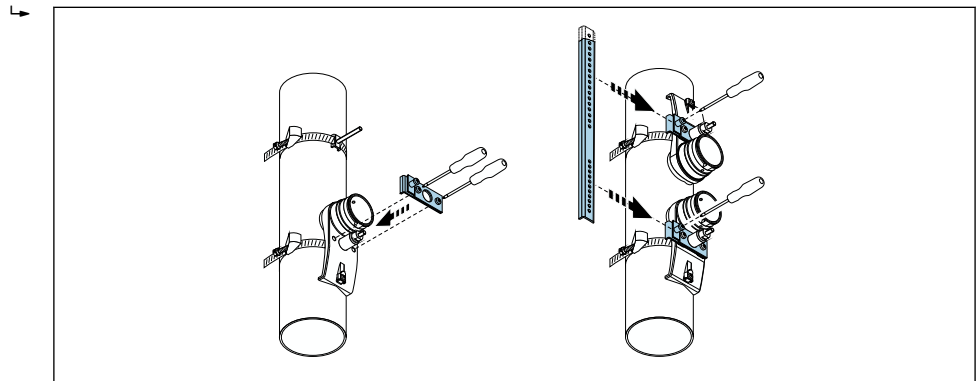
1. Position the strapping bands using the mounting rail [only DN50 to 600 (2 to 24"), for larger nominal diameters, measure the distance between the center of the strap bolts directly]: Fit the mounting rail with the bore identified by the letter (from the **Result sensor distance / measuring aid** parameter) over the mounting bolt of strapping band 1 that is fixed in place. Position the adjustable strapping band 2 and fit the mounting rail with the bore identified by the numerical value over the mounting bolt.



 42 Determining the distance according to the mounting rail (e.g. G22)

2. Tighten strapping band 2 so that it cannot slip.
3. Remove the mounting rail from the mounting bolt.
4. Fit the sensor holders over the individual mounting bolts and tighten securely with the locking nut.
5. Screw the mounting rail holders onto the sensor holder.

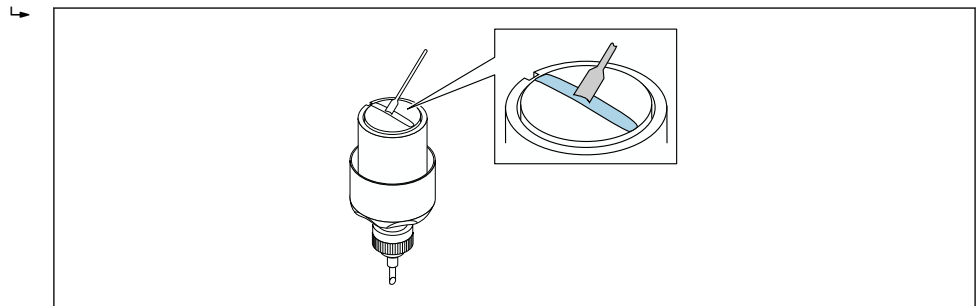
6. Screw the mounting rail onto the sensor holders.



A0043385

43 Mounting the sensor holders and mounting rail

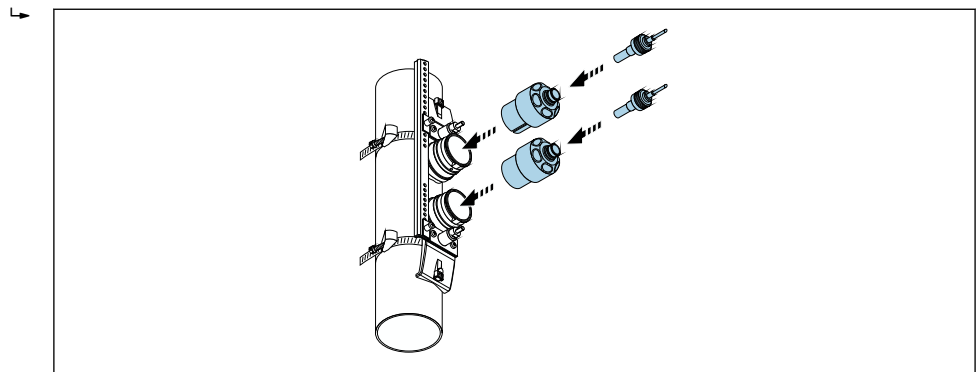
7. Attach the coupling pad with the adhesive side facing down on the sensors (→ 77). Alternatively coat the contact surfaces with an even layer of coupling gel (approx. 1 mm (0.04 in)), going from the groove through the center to the opposite edge.



A0043382

44 Coating the contact surfaces of the sensor with coupling gel (if there is no coupling pad)

8. Insert the sensor into the sensor holder.
9. Fit the sensor cover on the sensor holder and turn until the sensor cover engages with a click and the arrows (▲ / ▼ "close") are pointing towards one another.
10. Insert the sensor cable into the sensor until the end stop.



A0043386

45 Mounting the sensor and connecting the sensor cable

The sensors can now be connected to the transmitter via the sensor cables and the error message can be checked in the sensor check function. This completes the mounting procedure.

- i**
- The visible measuring pipe surface must be clean (free from flaking paint and/or rust) to ensure good acoustic contact.
 - If the sensor is removed from the measuring pipe, it must be cleaned and new coupling gel applied (if there is no coupling pad).
 - On rough measuring pipe surfaces, the gaps in the rough surface must be filled with sufficient amounts of coupling gel if the use of the coupling pad does not suffice (installation quality check).

Mounting the transmitter housing

Proline 500 transmitter

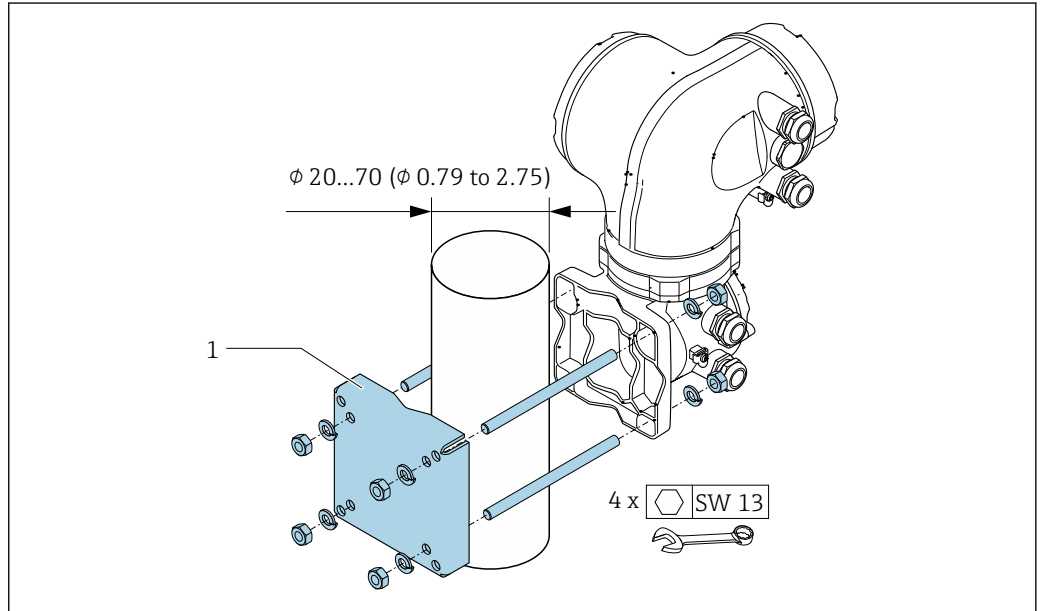
Post mounting

⚠ WARNING

Order code for "Transmitter housing", option L "Cast, stainless": cast transmitters are very heavy.

They are unstable if they are not mounted on a secure, fixed post.

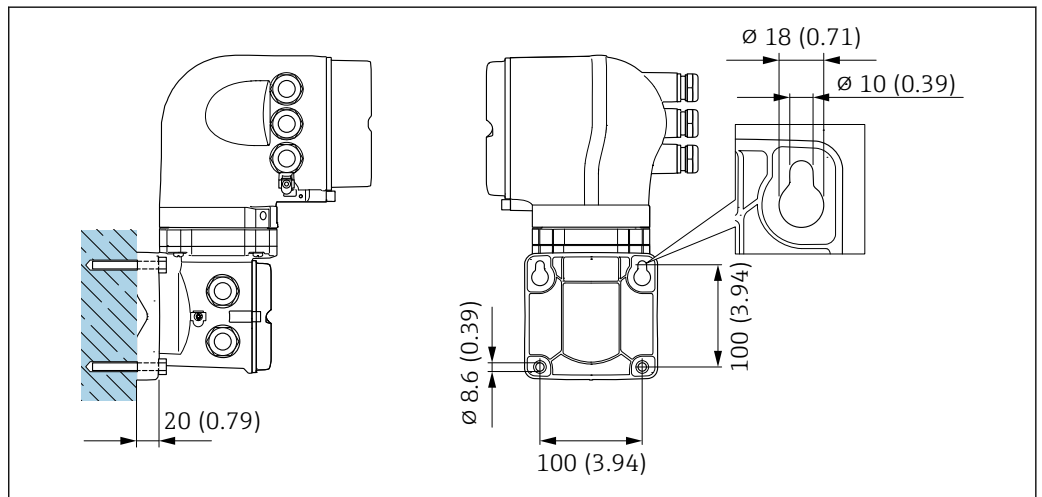
- ▶ Only mount the transmitter on a secure, fixed post on a stable surface.



A0029057

46 Engineering unit mm (in)

Wall mounting

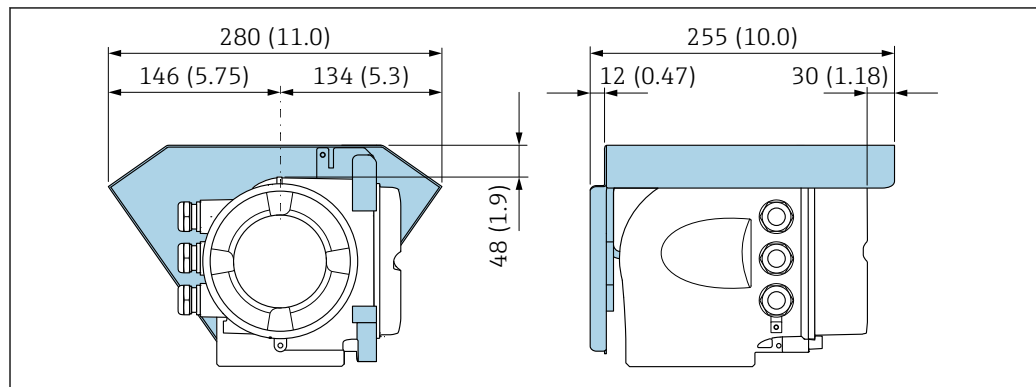


A0029068

47 Engineering unit mm (in)

Special mounting instructions

Protective cover



48 Protective cover for Proline 500; engineering unit mm (in)

A0029553

Environment

Ambient temperature range

Transmitter	<ul style="list-style-type: none"> ■ Standard: -40 to +60 °C (-40 to +140 °F) ■ Optional order code for "Test, certificate", option JN: -50 to +60 °C (-58 to +140 °F)
Readability of the local display	-20 to +60 °C (-4 to +140 °F) The readability of the display may be impaired at temperatures outside the temperature range.
Sensor	DN 15 to 65 (½ to 2½") -40 to +150 °C (-40 to +302 °F) DN 50 to 4000 (2 to 160") <ul style="list-style-type: none"> ■ Standard: -40 to +80 °C (-40 to +176 °F) ■ Optional: 0 to +170 °C (+32 to +338 °F)
Sensor cable (connection between transmitter and sensor)	DN 15 to 65 (½ to 2½") Standard (TPE ¹⁾): -40 to +80 °C (-40 to +176 °F) DN 50 to 4000 (2 to 160") <ul style="list-style-type: none"> ■ Standard (TPE halogen-free): -40 to +80 °C (-40 to +176 °F) ■ Optional (PTFE ¹⁾): -50 to +170 °C (-58 to +338 °F)

1) Armored version also available for order

i In principle, it is permitted to insulate the sensors mounted on the pipe. In the case of insulated sensors, make sure that the process temperature does not exceed or drop below the specified cable temperature.

► If operating outdoors:
Avoid direct sunlight, particularly in warm climatic regions.

i You can order a weather protection cover from Endress+Hauser. → 73.

Storage temperature


The storage temperature for all components (except the display modules) corresponds to the ambient temperature range → 52.

Display modules

-40 to +80 °C (-40 to +176 °F)

Degree of protection	<p>Transmitter</p> <ul style="list-style-type: none"> ■ As standard: IP66/67, type 4X enclosure ■ When housing is open: IP20, type 1 enclosure ■ Display module: IP20, type 1 enclosure <p>Sensor IP68, type 6P enclosure</p> <p>External WLAN antenna IP67</p>
-----------------------------	---

Vibration- and shock-resistance	<p>Vibration sinusoidal, in accordance with IEC 60068-2-6</p> <ul style="list-style-type: none"> ■ 2 to 8.4 Hz, 3.5 mm peak ■ 8.4 to 2 000 Hz, 1 g peak <p>Vibration broad-band random, according to IEC 60068-2-64</p> <ul style="list-style-type: none"> ■ 10 to 200 Hz, 0.003 g²/Hz ■ 200 to 2 000 Hz, 0.001 g²/Hz ■ Total: 1.54 g rms <p>Shock half-sine, according to IEC 60068-2-27 6 ms 30 g</p> <p>Rough handling shocks according to IEC 60068-2-31</p>
--	---

Electromagnetic compatibility (EMC)	<p>As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) and 43 (NE43)</p> <p> Details are provided in the Declaration of Conformity.</p>
--	---

Process

Medium temperature range	Sensor version	Frequency	Temperature
	C-030-A	0.3 MHz	-40 to +100 °C (-40 to +212 °F)
	C-050-A	0.5 MHz	-20 to +80 °C (-4 to +176 °F)
	C-100-A	1 MHz	-20 to +80 °C (-4 to +176 °F)
	C-200-A	2 MHz	-20 to +80 °C (-4 to +176 °F)
	C-500-A	5 MHz	-40 to +150 °C (-40 to +302 °F)
	C-100-B	1 MHz	-40 to +80 °C (-40 to +176 °F)
	C-200-B	2 MHz	-40 to +80 °C (-40 to +176 °F)
	C-100-C	1 MHz	0 to +170 °C (+32 to +338 °F)
	C-200-C	2 MHz	0 to +170 °C (+32 to +338 °F)

Sound velocity range	600 to 2 100 m/s (1 969 to 6 890 ft/s)
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Medium pressure range	No pressure limitation. Nevertheless, for correct measurement, the static pressure of the medium must be higher than the vapor pressure.
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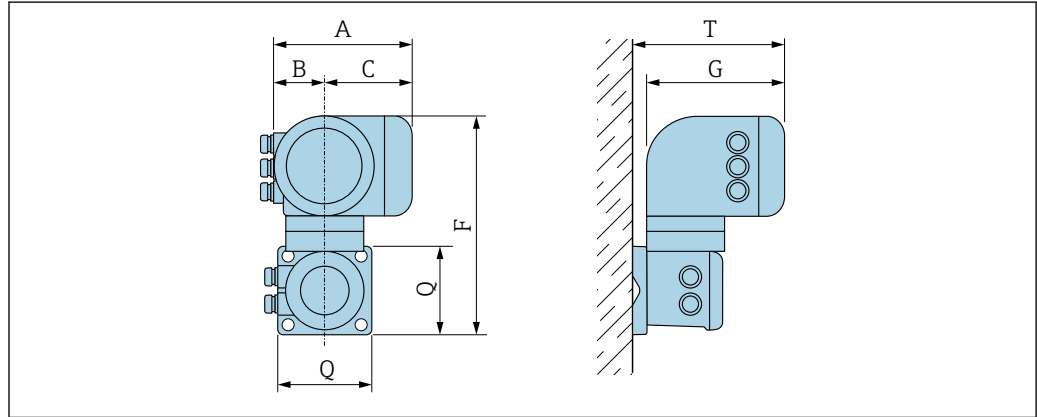
Pressure loss	There is no pressure loss.
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Mechanical construction

Dimensions in SI units

Housing of Proline 500 transmitter

Non-hazardous area or hazardous area: Zone 2; Class I, Division 2 or Zone 1; Class I, Division 1



A0033788

Order code for "Transmitter housing", option A "Aluminum, coated" and order code for "Integrated ISEM electronics", option B "Transmitter"

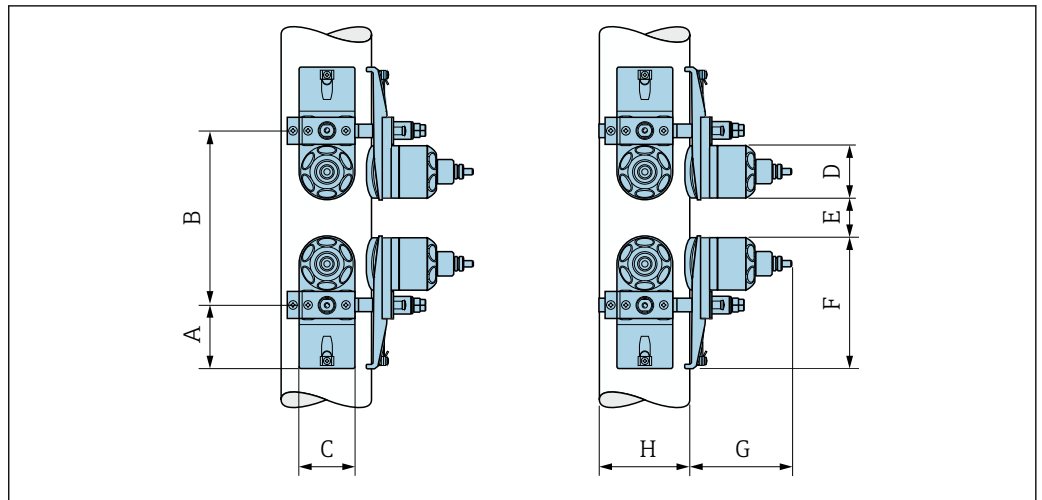
A [mm]	B [mm]	C [mm]	F ¹⁾ [mm]	G ²⁾ [mm]	Q [mm]	T ²⁾ [mm]
188	85	103	318	217	130	239

- 1) Non-hazardous area: values - 38 mm
- 2) Non-hazardous area: values - 10 mm

Order code for "Transmitter housing", option L "Cast, stainless" and order code for "Integrated ISEM electronics", option B "Transmitter"

A [mm]	B [mm]	C [mm]	F [mm]	G [mm]	Q [mm]	T [mm]
188	85	103	295	217	130	239

Sensor remote version

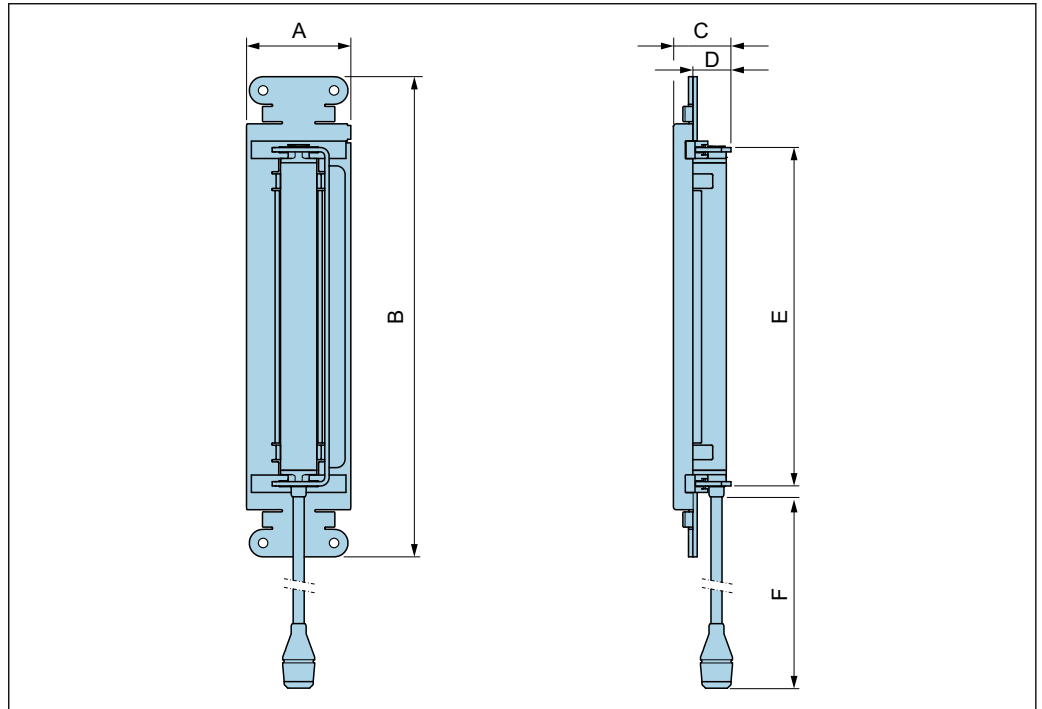


A0041969

49 DN 50 to 4000: measurement with 2 sensor sets

A [mm]	B [mm]	C [mm]	D [mm]	E _{min} [mm]	F [mm]	G [mm]	H [mm]
56	* 1)	62	∅ 58	0.5	145	111	Measuring pipe outer diameter

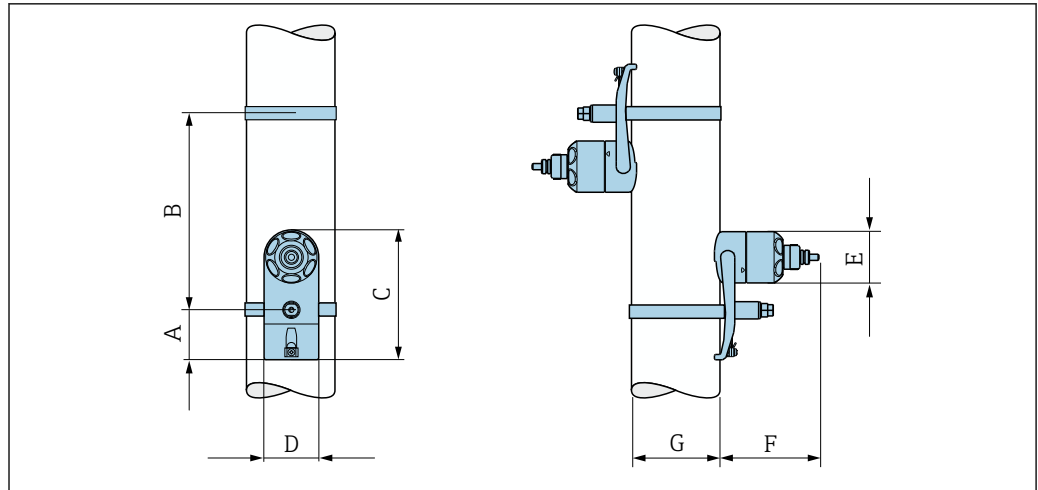
- 1) Depends on the conditions at the measuring point (measuring pipe, medium etc.). The dimension can be determined via FieldCare or Applicator.



A0041968

50 DN 15 to 65

A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
72	331	39	28	233	450



A0041967

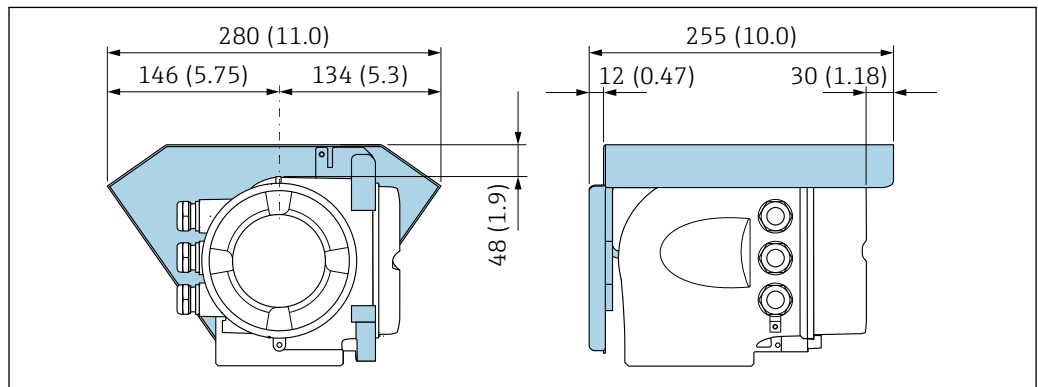
51 DN 50 to 4000: measurement with 1 sensor set

A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]
56	* 1)	145	62	∅ 58	111	Measuring pipe outer diameter

- 1) Depends on the conditions at the measuring point (measuring pipe, medium etc.). The dimension can be determined via FieldCare or Applicator.

Accessories

Protective cover



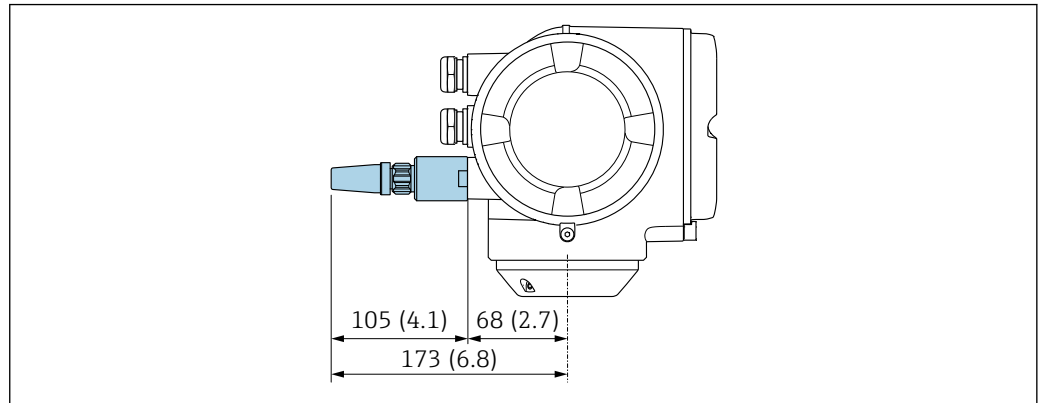
A0029553

52 Protective cover for Proline 500; engineering unit mm (in)

External WLAN antenna

Proline 500

External WLAN antenna mounted on device

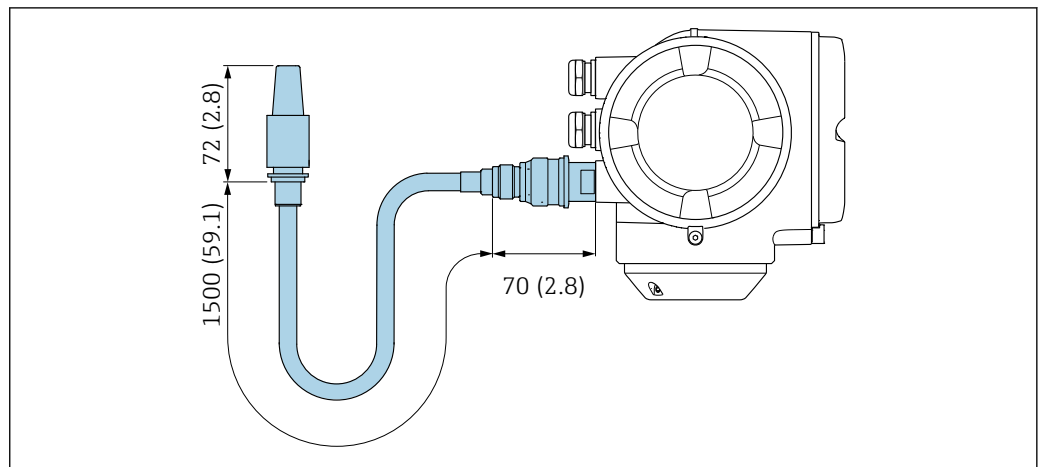


A0028923

53 Engineering unit mm (in)

External WLAN antenna mounted with cable

The external WLAN antenna can be mounted separately from the transmitter if the transmission/reception conditions at the transmitter mounting location are poor.



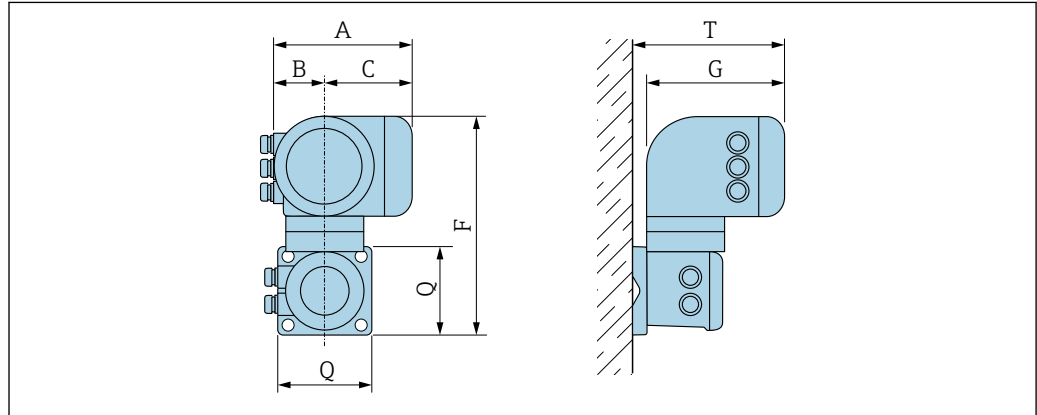
A0033597

54 Engineering unit mm (in)

Dimensions in US units

Housing of Proline 500 transmitter

Non-hazardous area or hazardous area: Zone 2; Class I, Division 2 or Zone 1; Class I, Division 1



A0033788

Order code for "Transmitter housing", option A "Aluminum, coated" and order code for "Integrated ISEM electronics", option B "Transmitter"

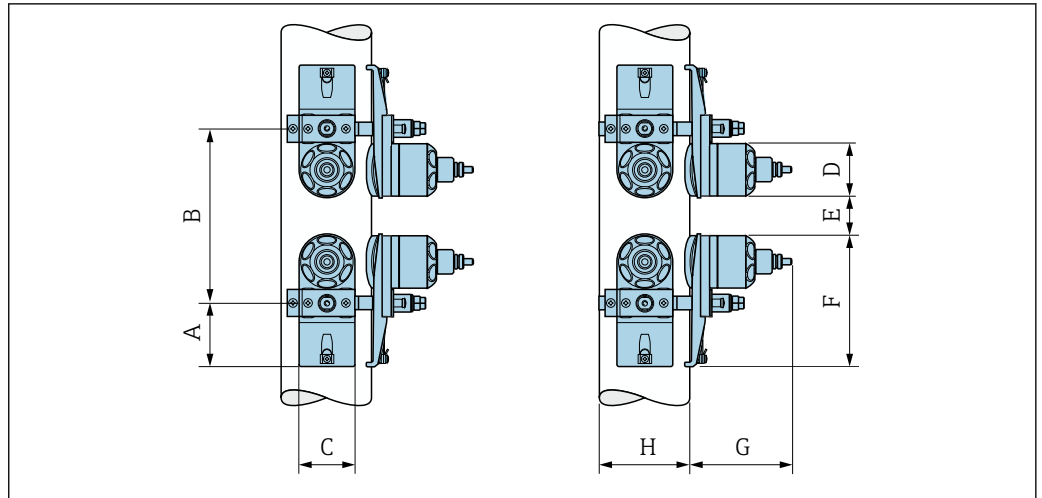
A [in]	B [in]	C [in]	F ¹⁾ [in]	G ²⁾ [in]	Q [in]	T ²⁾ [in]
7.40	3.35	4.06	12.5	8.54	5.12	9.41

- 1) Non-hazardous area: values - 1.5 in
- 2) Non-hazardous area: values - 0.39 in

Order code for "Transmitter housing", option L "Cast, stainless" and order code for "Integrated ISEM electronics", option B "Transmitter"

A [in]	B [in]	C [in]	F [in]	G [in]	Q [in]	T [in]
7.40	3.35	4.06	11.6	8.54	5.12	9.41

Sensor remote version

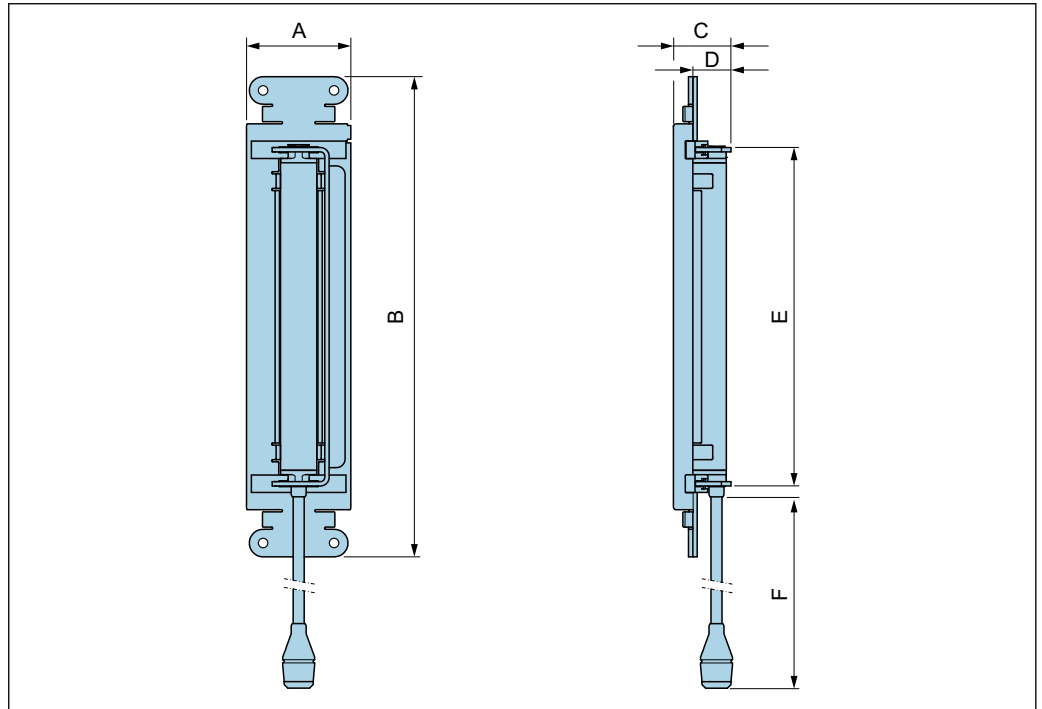


A0041969

55 DN 2 to 160": measurement with 2 sensor sets

A	B	C	D	E _{min}	F	G	H
[in]	[in]	[in]	[in]	[in]	[in]	[in]	[in]
2.20	* 1)	2.44	∅ 2.28	0.20	5.71	4.37	Measuring pipe outer diameter

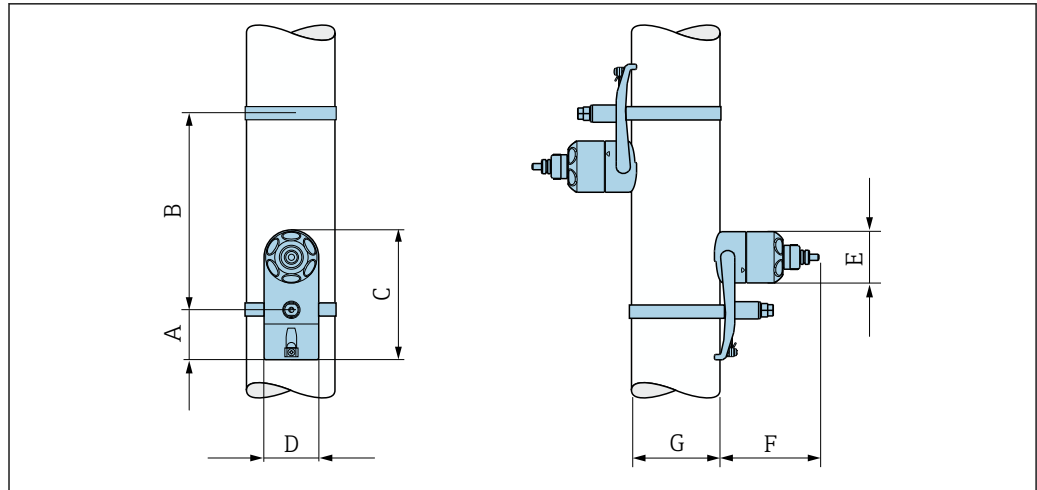
- 1) Depends on the conditions at the measuring point (measuring pipe, medium etc.). The dimension can be determined via FieldCare or Applicator.



A0041968

56 DN ½ to 2½"

A	B	C	D	E	F
[in]	[in]	[in]	[in]	[in]	[in]
2.83	13.0	1.54	1.10	9.17	17.7



A0041967

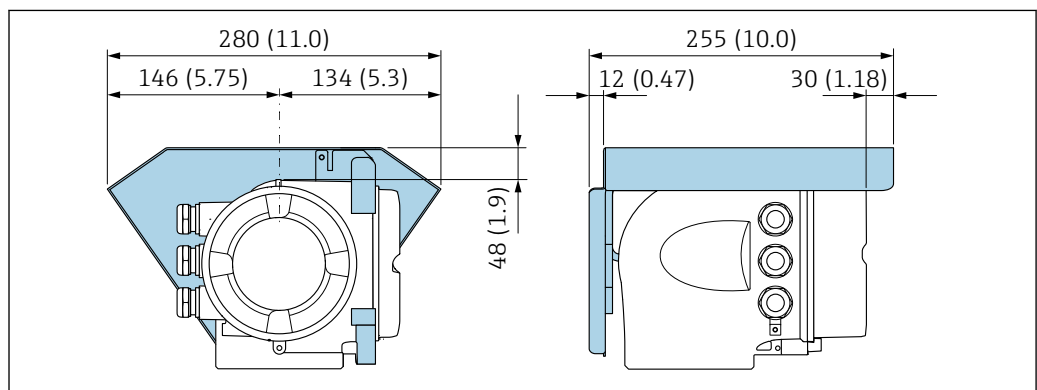
57 DN 2 to 160": measurement with 1 sensor set

A	B	C	D	E	F	G
[in]	[in]	[in]	[in]	[in]	[in]	[in]
2.20	* 1)	5.71	2.44	∅ 2.28	4.37	Measuring pipe outer diameter

- 1) Depends on the conditions at the measuring point (measuring pipe, medium etc.). The dimension can be determined via FieldCare or Applicator.

Accessories

Protective cover



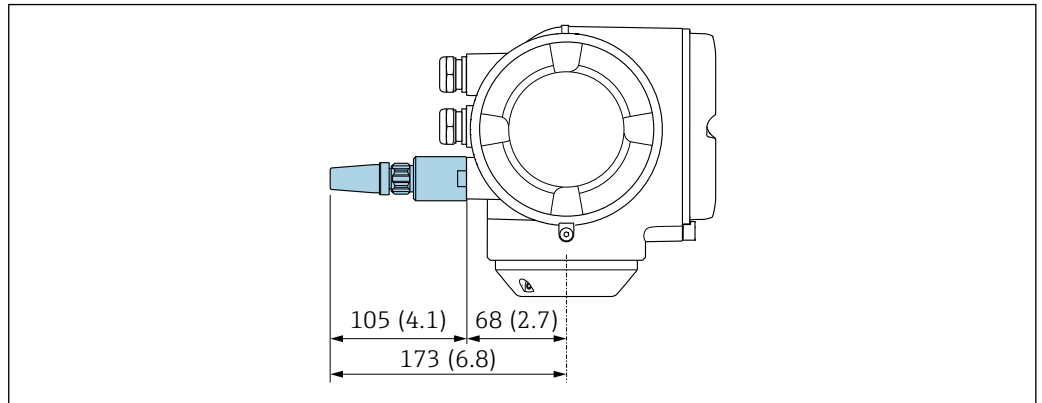
A0029553

58 Protective cover for Proline 500; engineering unit mm (in)

External WLAN antenna

Proline 500

External WLAN antenna mounted on device

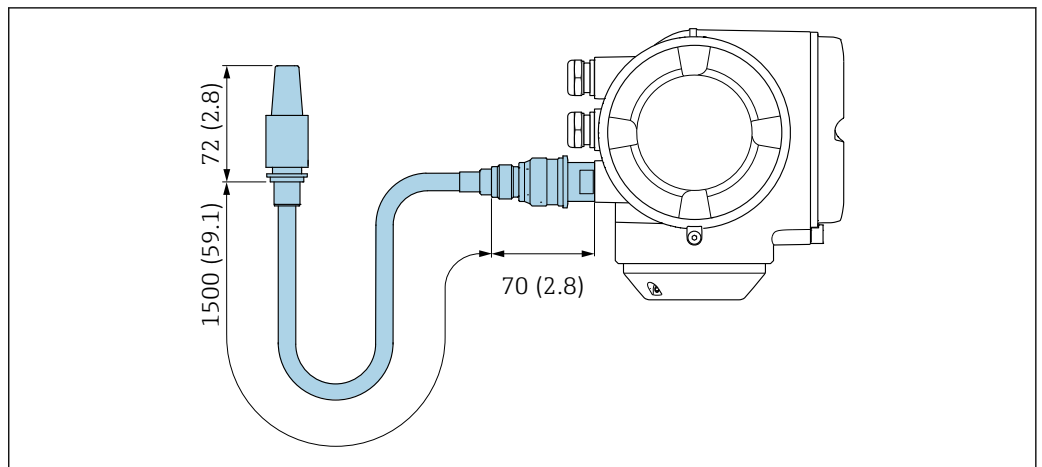


A0028923

59 Engineering unit mm (in)

External WLAN antenna mounted with cable

The external WLAN antenna can be mounted separately from the transmitter if the transmission/reception conditions at the transmitter mounting location are poor.



A0033597

60 Engineering unit mm (in)

Weight

Weight specifications excluding packaging material.

Transmitter

- Proline 500 aluminum: 6.5 kg (14.3 lbs)
- Proline 500 cast, stainless: 15.6 kg (34.4 lbs)

Sensor

Incl. Mounting material

- DN 15 to 65 (½ to 2½"): 1.2 kg (2.65 lb)
- DN 50 to 4000 (2 to 160"): 2.8 kg (6.17 lb)

Materials

Transmitter housing

Housing of Proline 500 transmitter

Order code for "Transmitter housing":

- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **L** "Cast, stainless": cast, stainless steel, 1.4409 (CF3M) corresponds to the properties of 316L

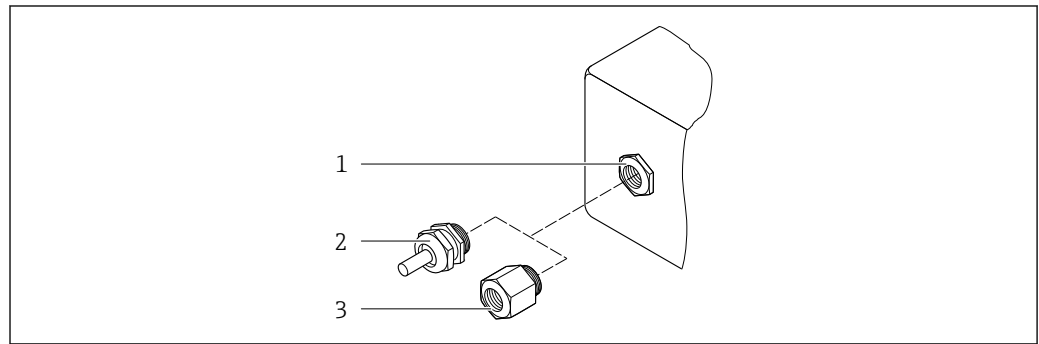
Window material

Order code for "Transmitter housing":


- Option **A** "Aluminum, coated": glass
- Option **L** "Cast, stainless": glass

Fastening components for mounting on a post



- Screws, threaded bolts, washers, nuts: stainless A2 (chrome-nickel steel)
- Metal plates: stainless steel, 1.4301 (304)

Cable entries/cable glands

A0020640

 **61** Possible cable entries/cable glands

- 1 Female thread M20 × 1.5
 2 Cable gland M20 × 1.5
 3 Adapter for cable entry with female thread G ½" or NPT ½"

Cable entries and adapters	Material
Cable gland of sensor cable	Brass or stainless steel 1.4404
Power cable gland	Plastic
<ul style="list-style-type: none"> ▪ Adapter for cable entry with female thread G ½" ▪ Adapter for cable entry with female thread NPT ½" <p> Only available for certain device versions: Order code for "Transmitter housing": Option A "Aluminum, coated"</p>	Nickel-plated brass
<ul style="list-style-type: none"> ▪ Adapter for cable entry with female thread G ½" ▪ Adapter for cable entry with female thread NPT ½" <p> Only available for certain device versions: Order code for "Transmitter housing": Option L "Cast, stainless"</p>	Stainless steel, 1.4404 (316L)

Sensor cable

 UV rays can impair the cable outer sheath. Protect the cable from exposure to sun as much as possible.

Sensor cable for sensor - Proline 500 transmitter

DN 15 to 65 (½ to 2½"):

Sensor cable: TPE⁶⁾

- Cable sheath: TPE
- Cable plug: stainless steel 1.4301 (304), 1.4404 (316L), nickel-plated brass

6) Also available in optional armored version (316L)

DN 50 to 4000 (2 to 160"):

- Sensor cable, TPE halogen-free
 - Cable sheath: TPE halogen-free
 - Cable connector: nickel-plated brass
- PTFE sensor cable⁶⁾
 - Cable sheath: PTFE
 - Cable plug: stainless steel 1.4301 (304), 1.4404 (316L)

Ultrasonic transducer

- Holder: stainless steel 1.4301 (304), 1.4404 (316L)
- Housing: stainless steel 1.4301 (304), 1.4404 (316L)
- Strapping bands/bracket: stainless steel 1.4301 (304), 1.4404 (316L)
- Contact surfaces: chemically stable plastic

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

- Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter: Stainless steel and nickel-plated brass
- Cable: Polyethylene
- Plug: Nickel-plated brass
- Angle bracket: Stainless steel

Human interface

Operating concept

Operator-oriented menu structure for user-specific tasks

- Commissioning
- Operation
- Diagnostics
- Expert level

Fast and safe commissioning

- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief descriptions of the individual parameter functions
- Access to the device via Web server
- WLAN access to the device via mobile handheld terminal, tablet or smart phone

Reliable operation

- Operation in local language
- Uniform operating philosophy applied to device and operating tools
- If replacing electronic modules, transfer the device configuration via the integrated memory (HistoROM backup) which contains the process and measuring device data and the event logbook. No need to reconfigure.

Efficient diagnostics increase measurement availability

- Troubleshooting measures can be called up via the device and in the operating tools
- Diverse simulation options, logbook for events that occur and optional line recorder functions

Installation quality

To optimize the sensor mounting positions, real-time display of:

- Installation status (good, bad, acceptable)
- Signal strength
- Signal to noise ratio
- Sound velocity

Languages

Can be operated in the following languages:

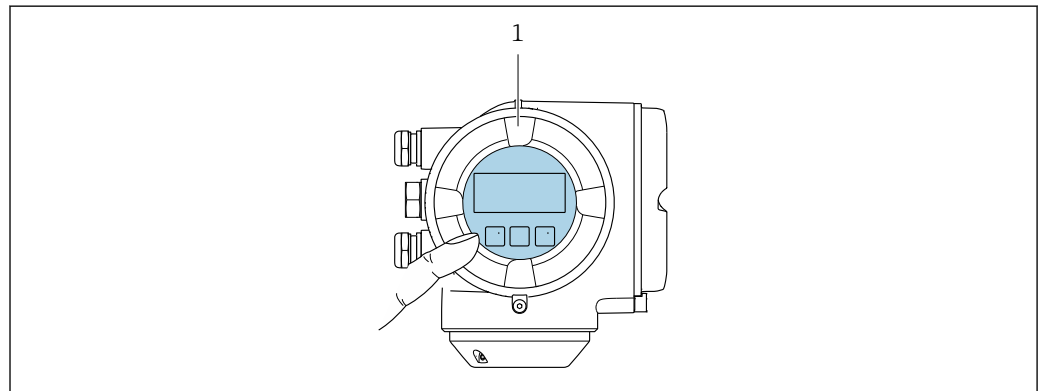
- Via local operation
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via Web browser
English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation**Via display module**


Equipment:

- Order code for "Display; operation", option F "4-line, illuminated, graphic display; touch control"
- Order code for "Display; operation", option G "4-line, illuminated, graphic display; touch control + WLAN"

 Information about WLAN interface →  66



A0041326




 62 *Operation with touch control*

1 *Proline 500*

Display elements

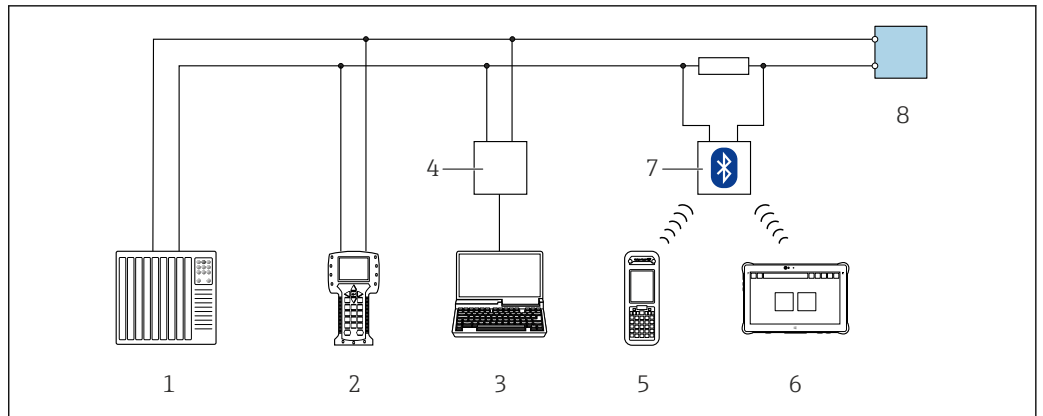
- 4-line, illuminated, graphic display
- White background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for the display: -20 to +60 °C (-4 to +140 °F)
The readability of the display may be impaired at temperatures outside the temperature range.

Operating elements

- External operation via touch control (3 optical keys) without opening the housing: , , 
- Operating elements also accessible in the various zones of the hazardous area

Remote operation**Via HART protocol**

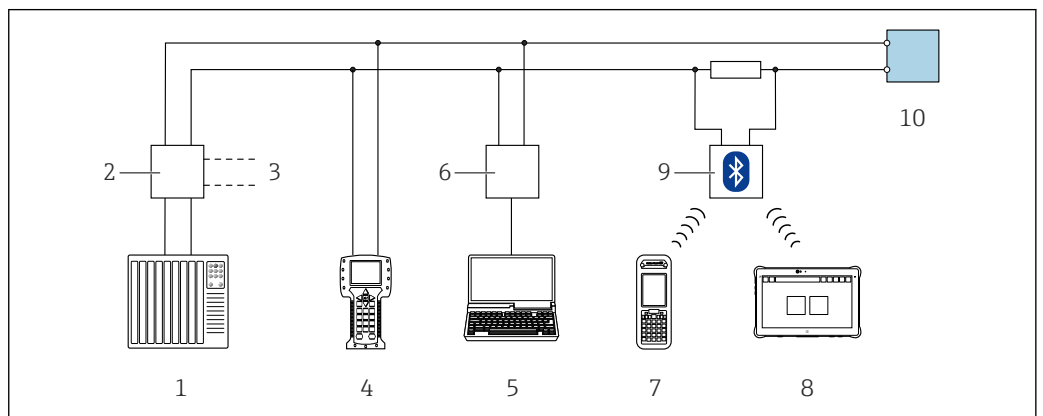
This communication interface is available in device versions with a HART output.



A0028747

63 Options for remote operation via HART protocol (active)

- 1 Control system (e.g. PLC)
- 2 Field Communicator 475
- 3 Computer with Web browser (e.g. Internet Explorer) for access to the integrated device Web server or computer with an operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 4 Commubox FXA195 (USB)
- 5 Field Xpert SFX350 or SFX370
- 6 Field Xpert SMT70
- 7 VIATOR Bluetooth modem with connecting cable
- 8 Transmitter



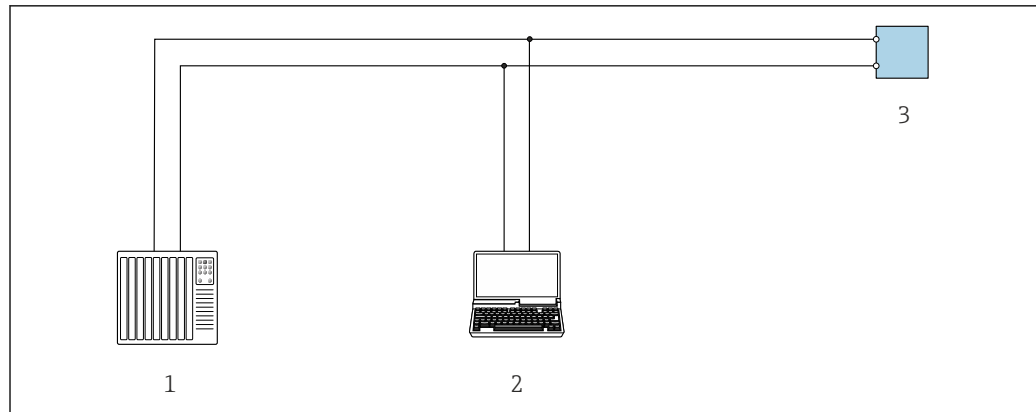
A0028746

64 Options for remote operation via HART protocol (passive)

- 1 Control system (e.g. PLC)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA195 and Field Communicator 475
- 4 Field Communicator 475
- 5 Computer with Web browser (e.g. Internet Explorer) for access to the integrated device Web server or computer with an operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"
- 6 Commubox FXA195 (USB)
- 7 Field Xpert SFX350 or SFX370
- 8 Field Xpert SMT70
- 9 VIATOR Bluetooth modem with connecting cable
- 10 Transmitter

Via Modbus RS485 protocol

This communication interface is available in device versions with a Modbus-RS485 output.



A0029437

65 Options for remote operation via Modbus-RS485 protocol (active)

- 1 Control system (e.g. PLC)
- 2 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP" or Modbus DTM
- 3 Transmitter

Service interface

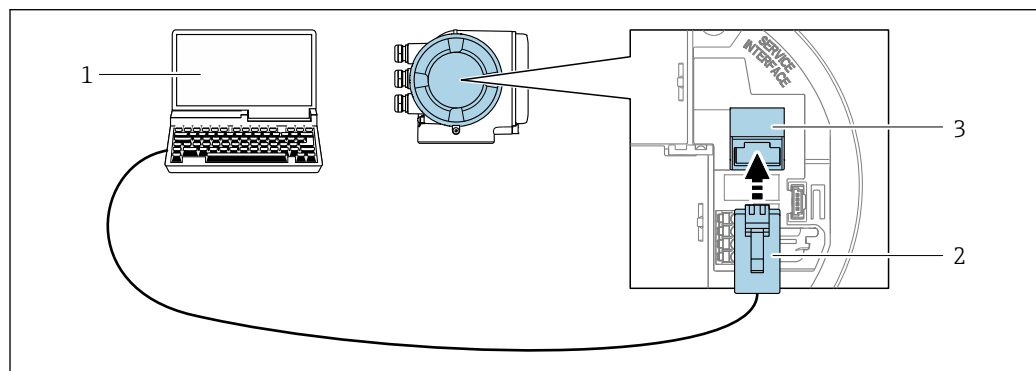
Via service interface (CDI-RJ45)

A point-to-point connection can be established to configure the device onsite. With the housing open, the connection is established directly via the service interface (CDI-RJ45) of the device.

i An adapter for RJ45 and the M12 connector is optionally available:
Order code for "Accessories", option **NB**: "Adapter RJ45 M12 (service interface)"

The adapter connects the service interface (CDI-RJ45) to an M12 connector mounted in the cable entry. Therefore the connection to the service interface can be established via an M12 connector without opening the device.

Proline 500 transmitter



A0027563

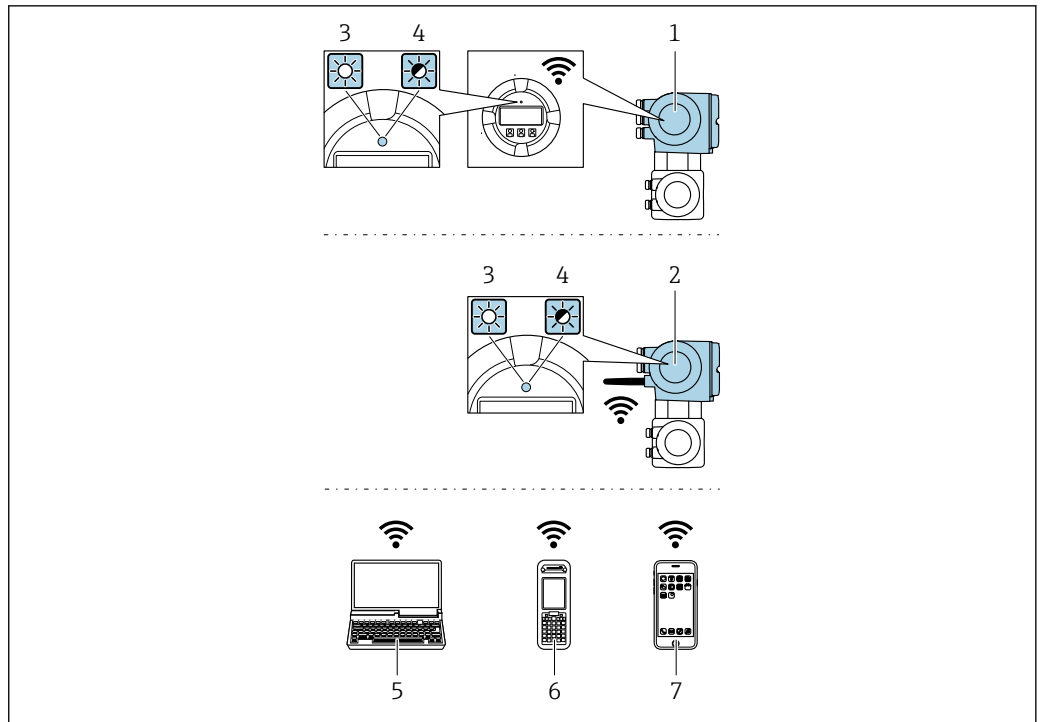
66 Connection via service interface (CDI-RJ45)

- 1 Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP" or Modbus DTM
- 2 Standard Ethernet connecting cable with RJ45 connector
- 3 Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server

Via WLAN interface


The optional WLAN interface is available on the following device version:

Order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN"





A0041325


- 1 Transmitter with integrated WLAN antenna
- 2 Transmitter with external WLAN antenna
- 3 LED lit constantly: WLAN reception is enabled on measuring device
- 4 LED flashing: WLAN connection established between operating unit and measuring device
- 5 Computer with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with operating tool (e.g. FieldCare, DeviceCare)
- 6 Mobile handheld terminal with WLAN interface and Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or operating tool (e.g. FieldCare, DeviceCare)
- 7 Smart phone or tablet (e.g. Field Xpert SMT70)

Function	WLAN: IEEE 802.11 b/g (2.4 GHz) <ul style="list-style-type: none"> ▪ Access point with DHCP server (default setting) ▪ Network
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antennas	<ul style="list-style-type: none"> ▪ Internal antenna ▪ External antenna (optional) In the event of poor transmission/reception conditions at the place of installation. Available as an accessory .  Only one antenna active in each case!
Range	<ul style="list-style-type: none"> ▪ Internal antenna: typically 10 m (32 ft) ▪ External antenna: typically 50 m (164 ft)
Materials (external antenna)	<ul style="list-style-type: none"> ▪ Antenna: ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass ▪ Adapter: Stainless steel and nickel-plated brass ▪ Cable: Polyethylene ▪ Connector: Nickel-plated brass ▪ Angle bracket: Stainless steel

Supported operating tools

Different operating tools can be used for local or remote access to the measuring device. Depending on the operating tool used, access is possible with different operating units and via a variety of interfaces.

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with Web browser	<ul style="list-style-type: none"> ■ CDI-RJ45 service interface ■ WLAN interface 	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> ■ CDI-RJ45 service interface ■ WLAN interface ■ Fieldbus protocol 	→  75
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> ■ CDI-RJ45 service interface ■ WLAN interface ■ Fieldbus protocol 	→  75
Device Xpert	Field Xpert SFX 100/350/370	HART fieldbus protocol	Operating Instructions BA01202S Device description files: Use update function of handheld terminal

 Other operating tools based on FDT technology with a device driver such as DTM/iDTM or DD/EDD can be used for device operation. These operating tools are available from the individual manufacturers. Integration into the following operating tools, among others, is supported:

- FactoryTalk AssetCentre (FTAC) from Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) from Siemens → www.siemens.com
- Asset Management Solutions (AMS) from Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 from Emerson → www.emersonprocess.com
- Field Device Manager (FDM) from Honeywell → www.honeywellprocess.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The related device description files are available: www.endress.com → Downloads


Web server

Thanks to the integrated Web server, the device can be operated and configured via a Web browser and via a service interface (CDI-RJ45) or via a 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 also displayed and allows the user to monitor the status of the device. Furthermore the device data can be managed and the network parameters can be configured.

A device that has a WLAN interface (can be ordered as an option) is required for the WLAN connection: order code for "Display; operation", option G "4-line, illuminated; touch control + WLAN". The device acts as an Access Point and enables communication by computer or a mobile handheld terminal.

Supported functions


Data exchange between the operating unit (such as a notebook for example) and the measuring device:

- Upload the configuration from the measuring device (XML format, configuration backup)
- Save the configuration to the measuring device (XML format, restore configuration)
- Export event list (.csv file)
- Export parameter settings (.csv file or PDF file, document the measuring point configuration)
- Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package)
- Flash firmware version for device firmware upgrade, for instance
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package →  72)



Web server special documentation →  77

HistoROM data management The measuring device features HistoROM data management. HistoROM data management comprises both the storage and import/export of key device and process data, making operation and servicing far more reliable, secure and efficient.

 When the device is delivered, the factory settings of the configuration data are stored as a backup in the device memory. This memory can be overwritten with an updated data record, for example after commissioning.

Additional information on the data storage concept

There are different types of data storage units in which device data are stored and used by the device:

	HistoROM backup	T-DAT	S-DAT
Available data	<ul style="list-style-type: none"> ▪ Event logbook such as diagnostic events for example ▪ Parameter data record backup ▪ Device firmware package 	<ul style="list-style-type: none"> ▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Peakhold indicator (min/max values) ▪ Totalizer values 	<ul style="list-style-type: none"> ▪ Sensor data: measuring point configuration etc. ▪ Serial number ▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface board in the connection compartment	Attachable to the user interface board in the connection compartment	In the sensor plug in the transmitter neck part

Data backup

Automatic

- The most important device data (sensor and transmitter) are automatically saved in the DAT modules
- If the transmitter or measuring device is replaced: once the T-DAT containing the previous device data has been exchanged, the new measuring device is ready for operation again immediately without any errors
- If the sensor is replaced: once the sensor has been replaced, new sensor data are transferred from the S-DAT in the measuring device and the measuring device is ready for operation again immediately without any errors
- If exchanging the electronics module (e.g. I/O electronics module): Once the electronics module has been replaced, the software of the module is compared against the current device firmware. The module software is upgraded or downgraded where necessary. The electronics module is available for use immediately afterwards and no compatibility problems occur.

Manual

Additional parameter data record (complete parameter settings) in the integrated device memory HistoROM backup for:

- Data backup function
Backup and subsequent restoration of a device configuration in the device memory HistoROM backup
- Data comparison function
Comparison of the current device configuration with the device configuration saved in the device memory HistoROM backup

Data transfer

Manual

Transfer of a device configuration to another device using the export function of the specific operating tool, e.g. with FieldCare, DeviceCare or Web server: to duplicate the configuration or to store in an archive (e.g. for backup purposes)

Event list

Automatic

- Chronological display of up to 20 event messages in the events list
- If the **Extended HistoROM** application package (order option) is enabled: up to 100 event messages are displayed in the events list along with a time stamp, plain text description and remedial measures
- The events list can be exported and displayed via a variety of interfaces and operating tools e.g. DeviceCare, FieldCare or Web server

Data logging**Manual**

If the **Extended HistoROM** application package (order option) is enabled:

- Record up to 1 000 measured values via 1 to 4 channels
- User configurable recording interval
- Record up to 250 measured values via each of the 4 memory channels
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

Certificates and approvals

Currently available certificates and approvals can be called up via the product configurator.

CE mark	The device meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
RCM-tick symbol	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	The measuring device is certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Safety Instructions" (XA) document. Reference is made to this document on the nameplate. The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.

Proline 500*ATEX/IECEX*

Currently, the following versions for use in hazardous areas are available:

Ex db ia

Transmitter		Sensor	
Category	Type of protection	Category	Type of protection
–	–	II2G	Ex db ia IIC T6...T1 Gb
II3G	Ex ec nC IIC T5...T4 Gc	II2G	Ex db ia IIC T6...T1 Gb

Ex ec

Transmitter		Sensor	
Category	Type of protection	Category	Type of protection
–	–	II3G	Ex ec ic IIC
II3G	Ex ec nC IIC T5...T4 Gc	II3G	Ex ec ic IIC

Ex tb

Transmitter		Sensor	
Category	Type of protection	Category	Type of protection
–	–	II2D	Ex ia tb IIIC T** °C Db

cCSA_{US}

Currently, the following versions for use in hazardous areas are available:

IS

Transmitter	Sensor
Class I Division 2 Groups A - D	Class I, II, III Division 1 Groups A-G

NI

Transmitter	Sensor
Class I Division 2 Groups A - D	Class I Division 2 Groups A - D

Ex i

Transmitter	Sensor
Class I Zone 2, AEx/Ex nA nC IIC T5...T4 Gc	Class I Zone 1, AEx/Ex d ia IIC T6...T1 Gb

Ex nA

Transmitter	Sensor
Class I Zone 2, AEx/Ex nA nC IIC T5...T4 Gc	Class I Zone 2, AEx/Ex nA ic IIC T6...T1 Gc


Ex tb

Transmitter	Sensor
-	Zone 21, AEx/Ex ia tb IIC T** °C Db

Functional safety

The measuring device can be used for flow monitoring systems (min., max., range) up to SIL 2 (single-channel architecture; order code for "Additional approval", option LA) and SIL 3 (multi-channel architecture with homogeneous redundancy) and is independently evaluated and certified in accordance with IEC 61508.

The following types of monitoring in safety equipment are possible:
Volume flow

 Functional Safety Manual with information on the SIL device

HART certification

HART interface

The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:

- Certified according to HART 7
- The device can also be operated with certified devices of other manufacturers (interoperability)

Radio approval

The measuring device has radio approval.

 For detailed information regarding radio approval, see the Special Documentation →  76

Additional certification

Tests and certificates

- EN10204-3.1 material certificate, parts and sensor housing in contact with medium
- Ambient temperature -50 °C (-58 °F) (order code for "Test, certificate", option JN)
- EN10204-2.1 confirmation of compliance with the order and EN10204-2.2 test report

Other standards and guidelines

- EN 60529
Degrees of protection provided by enclosures (IP code)
- EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326
Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).

- NAMUR NE 21
Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment
- NAMUR NE 32
Data retention in the event of a power failure in field and control instruments with microprocessors
- NAMUR NE 43
Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.
- NAMUR NE 53
Software of field devices and signal-processing devices with digital electronics
- NAMUR NE 105
Specifications for integrating fieldbus devices in engineering tools for field devices
- NAMUR NE 107
Self-monitoring and diagnosis of field devices
- NAMUR NE 131
Requirements for field devices for standard applications

Ordering information

Detailed ordering information is available as follows:

- In the Product Configurator on the Endress+Hauser website: www.endress.com -> Click "Corporate" -> Select your country -> Click "Products" -> Select the product using the filters and search field -> Open product page -> The "Configure" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as 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

Application packages

Many different application packages are available to enhance the functionality of the device. Such packages might be needed to address safety aspects or specific application requirements.

The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.



Detailed information on the application packages:
Special Documentation for the device → 77

Diagnosics functions

Package	Description
Extended HistoROM	<p>Comprises extended functions concerning the event log and the activation of the measured value memory.</p> <p>Event log: Memory volume is extended from 20 message entries (standard version) to up to 100 entries.</p> <p>Data logging (line recorder):</p> <ul style="list-style-type: none"> ■ Memory capacity for up to 1000 measured values is activated. ■ 250 measured values can be output via each of the 4 memory channels. The recording interval can be defined and configured by the user. ■ Measured value logs can be accessed via the local display or operating tool e.g. FieldCare, DeviceCare or Web server.

Heartbeat Technology










Package	Description
Heartbeat Verification +Monitoring	<p>Heartbeat Verification Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".</p> <ul style="list-style-type: none"> ▪ Functional testing in the installed state without interrupting the process. ▪ Traceable verification results on request, including a report. ▪ Simple testing process via local operation or other operating interfaces. ▪ Clear measuring point assessment (pass/fail) with high test coverage within the framework of manufacturer specifications. ▪ Extension of calibration intervals according to operator's risk assessment. <p>Heartbeat Monitoring Continuously supplies data, which are characteristic of the measuring principle, to an external condition monitoring system for the purpose of preventive maintenance or process analysis. These data enable the operator to:</p> <ul style="list-style-type: none"> ▪ Draw conclusions - using these data and other information - about the impact the measuring application has on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets.




Accessories

Various accessories, which can be ordered with the device or subsequently from Endress+Hauser, are available for the device. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: www.endress.com.

Device-specific accessories

For the transmitter


Accessories	Description
Transmitter Proline 500	<p>Transmitter for replacement or storage. Use the order code to define the following specifications:</p> <ul style="list-style-type: none"> ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software <p> Proline 500 transmitter: Order number: 9X5BXX-*****B</p> <p> Proline 500 transmitter for replacement: It is essential to specify the serial number of the current transmitter when ordering. Based on the serial number, the device-specific data of the replacement device can be used for the new transmitter.</p> <p> Proline 500 transmitter: Installation Instructions EA01152D</p>
External WLAN antenna	<p>External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Accessory enclosed", option P8 "Wireless antenna wide area".</p> <p> ▪ The external WLAN antenna is not suitable for use in hygienic applications. ▪ Further information on the WLAN interface →  66.</p> <p> Order number: 71351317</p> <p> Installation Instructions EA01238D</p>
Pipe mounting set	<p>Pipe mounting set for transmitter.</p> <p> Installation Instructions EA01195D</p> <p> Proline 500 transmitter Order number: 71346428</p>












Protective cover Transmitter Proline 500	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight.  Proline 500 transmitter Order number: 71343505  Installation Instructions EA01191D
Sensor cable Proline 500 Sensor – Transmitter	The sensor cable can be ordered directly with the measuring device (order code for "Cable") or as an accessory (order number DK9012). The following cable lengths are available: <ul style="list-style-type: none"> ■ Temperature: -40 to +80 °C (-40 to +176 °F) <ul style="list-style-type: none"> ■ Option AA: 5 m (15 ft) ■ Option AB: 10 m (30 ft) ■ Option AC: 15 m (45 ft) ■ Option AD: 30 m (90 ft) ■ Temperature: -50 to +170 °C (-58 to +338 °F) <ul style="list-style-type: none"> ■ Option BA: 5 m (15 ft) ■ Option BB: 10 m (30 ft) ■ Option BC: 15 m (45 ft) ■ Option BD: 30 m (90 ft) ■ Armored; temperature: -40 to +80 °C (-40 to +176 °F) <ul style="list-style-type: none"> ■ Option CA: 5 m (15 ft) ■ Option CB: 10 m (30 ft) ■ Option CC: 15 m (45 ft) ■ Option CD: 30 m (90 ft) ■ Armored; temperature: -50 to +170 °C (-58 to +338 °F) <ul style="list-style-type: none"> ■ Option DA: 5 m (15 ft) ■ Option DB: 10 m (30 ft) ■ Option DC: 15 m (45 ft) ■ Option DD: 30 m (90 ft)  Possible cable length for a Proline 500 sensor cable: max. 30 m (100 ft)

For the sensor









Accessories	Description
Sensor set (DK9013)	<ul style="list-style-type: none"> ■ Sensor set 0.3 MHz (C-030) ■ Sensor set 0.5 MHz (C-050) ■ Sensor set 1 MHz (C-100) ■ Sensor set 2 MHz (C-200) ■ Sensor set 5 MHz (C-500)
Sensor holder set (DK9014)	<ul style="list-style-type: none"> ■ Sensor holder set 0.3 to 2 MHz ■ Sensor holder set 5 MHz
Installation set (DK9015)	<ul style="list-style-type: none"> ■ Installation set, DN15-DN32, 1/2-1 1/4" ■ Installation set, DN32-DN65, 1 1/2-2 1/2" ■ Installation set, DN50-DN150, 2"-6" ■ Installation set, DN150-DN200, 6"-8" ■ Installation set, DN200-DN600, 8"-24" ■ Installation set, DN600-DN2000, 24"-80" ■ Installation set, DN2000-DN4000, 80"-160"
Conduit adapter set (DK9003)	<ul style="list-style-type: none"> ■ Without conduit adapter + sensor cable gland ■ Conduit adapter M20x1.5 + sensor cable gland ■ Conduit adapter NPT1/2" + sensor cable gland ■ Conduit adapter G1/2" + sensor cable gland
Coupling medium (DK9CM)	<ul style="list-style-type: none"> ■ Permanent coupling pad ■ Coupling gel

Communication-specific accessories



Accessories	Description
Commbox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface.  Technical Information TI00404F

HART Loop Converter HMX50	<p>Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values.</p> <ul style="list-style-type: none">  Technical Information TI00429F  Operating Instructions BA00371F
Fieldgate FXA42	<p>Is used to transmit the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices</p> <ul style="list-style-type: none">  Technical Information TI01297S  Operating Instructions BA01778S  Product page: www.endress.com/fxa42
Field Xpert SMT70	<p>The Field Xpert SMT70 tablet PC for device configuration enables mobile plant asset management in hazardous and non-hazardous areas. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress.</p> <p>This tablet PC is designed as an all-in-one solution with a preinstalled driver library and is an easy-to-use, touch-sensitive tool which can be used to manage field instruments throughout their entire life cycle.</p> <ul style="list-style-type: none">  Technical Information TI01342S  Operating Instructions BA01709S  Product page: www.endress.com/smt70
Field Xpert SMT77	<p>The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1.</p> <ul style="list-style-type: none">  Technical Information TI01418S  Operating Instructions BA01923S  Product page: www.endress.com/smt77


Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none">  Choice of measuring devices for industrial requirements  Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy.  Graphic illustration of the calculation results  Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. <p>Applicator is available:</p> <ul style="list-style-type: none">  Via the Internet: https://portal.endress.com/webapp/applicator  As a downloadable DVD for local PC installation.
W@M	<p>W@M Life Cycle Management</p> <p>Improved productivity with information at your fingertips. Data relevant to a plant and its components is generated from the first stages of planning and during the asset's complete life cycle.</p> <p>W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime.</p> <p>Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, see: www.endress.com/lifecyclemanagement</p>
FieldCare	<p>FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.</p> <ul style="list-style-type: none">  Operating Instructions BA00027S and BA00059S
DeviceCare	<p>Tool to connect and configure Endress+Hauser field devices.</p> <ul style="list-style-type: none">  Innovation brochure IN01047S

System components

Accessories	Description
Memograph M graphic data manager	The Memograph M graphic data manager provides information on all the relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.  <ul style="list-style-type: none"> ▪ Technical Information TI00133R ▪ Operating Instructions BA00247R
iTEMP	The temperature transmitters can be used in all applications and are suitable for the measurement of gases, steam and liquids. They can be used to read in the medium temperature.  "Fields of Activity" document FA00006T

Supplementary documentation

-  For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
 - *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Standard documentation

Brief Operating Instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Prosonic Flow P	KA01474D

Brief Operating Instructions for transmitter

Measuring device	Documentation code	
	HART	Modbus RS485
Proline 500	KA01475D	KA01476D

Operating Instructions

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow P 500	BA02025D	BA02026D

Description of Device Parameters

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow P 500	GP01147D	GP01148D

Device-dependent additional documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEX Ex ia	XA02091D
ATEX/IECEX Ex ec	XA02092D

Contents	Documentation code
cCSAus Ex ia	XA02093D
cCSAus Ex ec	XA02094D
cCSAus XP	XA02095D

Functional Safety Manual

Contents	Documentation code
Proline Prosonic Flow P 500	FY02647D

Special documentation

Contents	Documentation code	
	HART	Modbus RS485
Radio approvals for WLAN interface for A309/A310 display module	SD01793D	
FlowDC	SD02660D	SD02674D
Heartbeat Technology	SD02593D	SD02594D
Web server	SD02603D	SD02604D

Installation Instructions

Contents	Comment
Installation instructions for spare part sets and accessories	Documentation code: specified for each individual accessory → 73.

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, USA

Modbus®

Registered trademark of SCHNEIDER AUTOMATION, INC.



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www.addresses.endress.com
