TI01567D/06/EN/02.24-00
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2024-05-15

Technical Information
Proline Prosonic Flow I 400

Ultrasonic time-of-flight flowmeter



Insertion meter with Heartbeat Technology and web server for the water and wastewater industry

Application

- The measuring principle is independent of density and conductivity
- Bidirectional flow measurement of water and wastewater

Device properties

- Supports two parallel measurement paths
- For large diameters: DN 200 to 4000 (8 to 160")
- Medium temperatur: −40 to +80 °C (−40 to +176 °F)
- Transmitter housing made of durable polycarbonate or aluminium
- Remote version for wall mounting
- Integrated data logger: measured values monitoring

Your benefits

- Low procurement costs - high cost efficiency with increasing nominal pipe diameter (up to DN 4000/160")
- Long-term stable signal - maintenance-free direct installation of the sensor into the medium
- Process transparency – diagnostic capability
- Safe operation – no need to open the device thanks to display with touch control, background lighting
- Full remote access – web server
- Integrated diagnostics, verification and monitoring – Heartbeat Technology

Endress+Hauser
People for Process Automation

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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.
	**Potential equalization connection (PE: protective earth)** Ground terminals that must be connected to ground prior to establishing any other connections. The ground terminals are located on the interior and exterior of the device: ▪ Interior ground terminal: potential equalization is connected to the supply network. ▪ Exterior ground terminal: device is connected to the plant grounding system.

Communication-specific symbols

Symbol	Meaning
	**Wireless Local Area Network (WLAN)** Communication via a wireless, local network.
	Bluetooth Wireless data transmission between devices over a short distance.
	**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

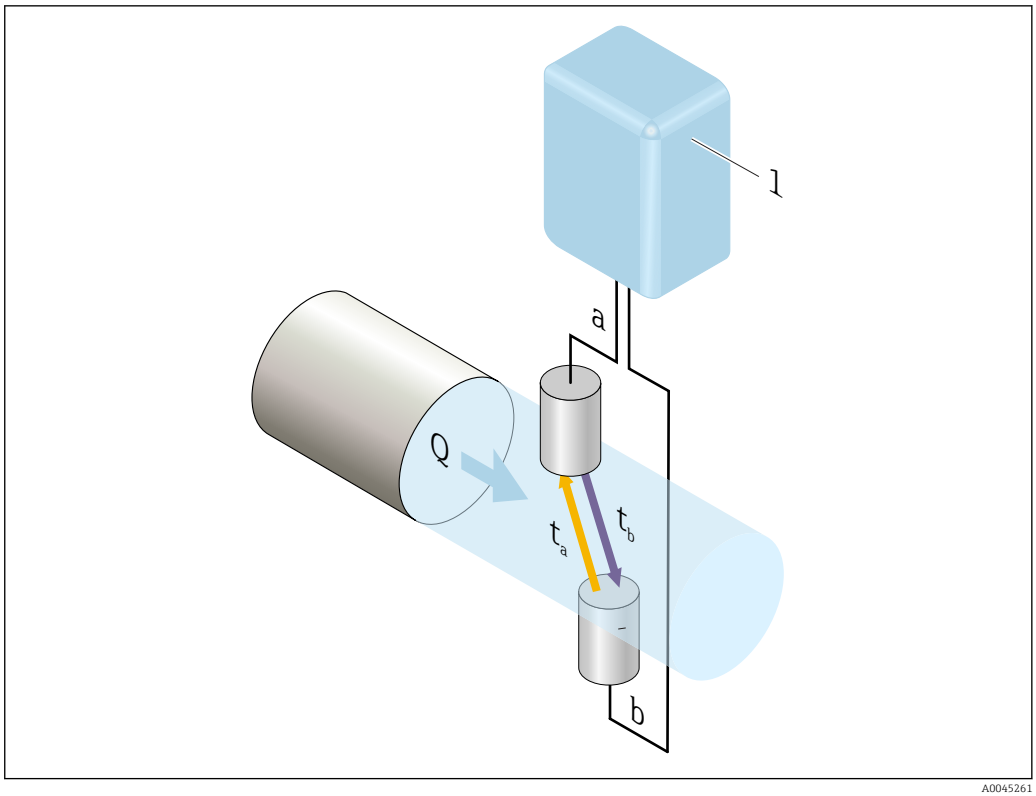
Function and system design

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.



A0045261

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

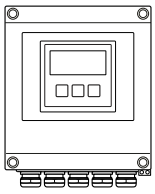
Measuring system

The measuring system consists of a transmitter and one or two 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. The sensors in a sensor pair are always arranged opposite one another and send/receive the ultrasonic signals directly (1-traverse positioning) → 7.

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

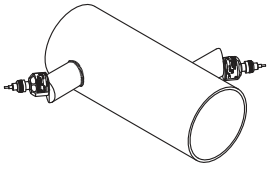
Proline 400  A0045222	Device versions and materials: Remote version: wall-mount housing ▪ Polycarbonate plastic ▪ Aluminum, AlSi10Mg, coated Configuration: ▪ External operation via four-line, illuminated local display with touch control and guided menus ("Make-it-run" wizards) for applications ▪ Via operating tools (e.g. FieldCare) ▪ Via Web browser (e.g. Microsoft Internet Explorer)

Sensor cables

Sensor cables can be ordered in different lengths → 54

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

Sensor

Prosonic Flow I
DN 200 to 4000 (8 to 160")

A0009697
	▪ Measurement of:
	  ▪ Pure liquids or slightly contaminated liquids
	  ▪ Water, e.g. drinking water, industrial water, saltwater, de-ionized water and cooling and heating water
	▪ Nominal diameter range: DN 200 to 4000 (8 to 160")
	▪ Materials:
	  ▪ Sensor holder:
	  Stainless steel 1.4308 (CF-8)
	  ▪ Sensor housing:
	  Stainless steel 1.4301 (304)

Accessories for mounting

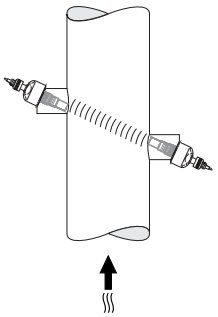
The required installation distances must be determined for the sensors. Information about the medium, material used and the exact pipe dimensions is necessary to determine these values. The values for the sound velocity of the following media are saved in the transmitter.

Medium
▪ Water ▪ Seawater ▪ Distilled water

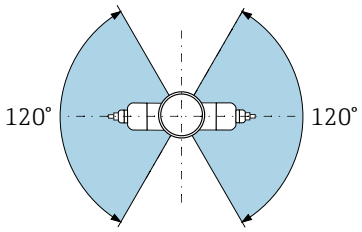
Sensor set selection and arrangement

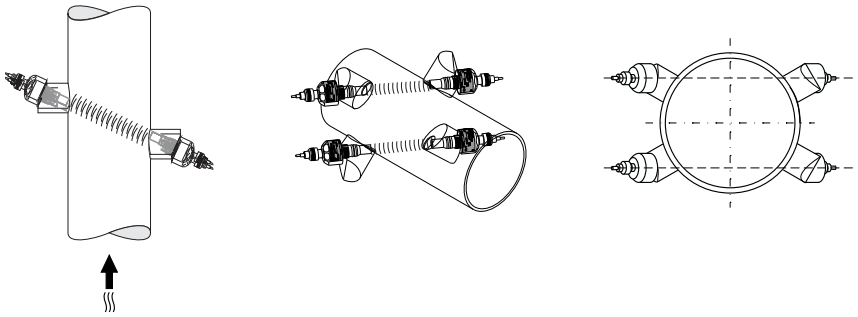
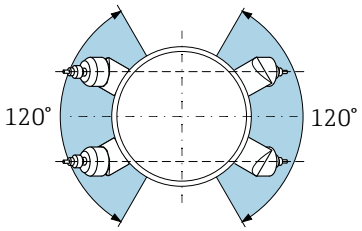
If mounting horizontally, always mount the sensor set so that it is offset at an angle of ±30° to the top of the measuring pipe to avoid incorrect measurements caused by gas pockets or bubbles at the top of the pipe.

The sensors can be arranged in different ways:
- Mounting arrangement for measurement with one sensor set (one measuring path):
  The sensors are located on opposite sides of the measuring pipe (offset by 180°)
- Mounting for measurement with two sensor sets [1] (two measuring paths):
  One sensor of each sensor set is located at the opposite side of the measuring pipe

Single-path measurement (1 sensor set)
Vertical mounting
 A0044939

1) Do not swap the sensors of the two sensor sets, as this can affect the measurement performance.

Single-path measurement (1 sensor set)
Horizontal mounting
 A0044304

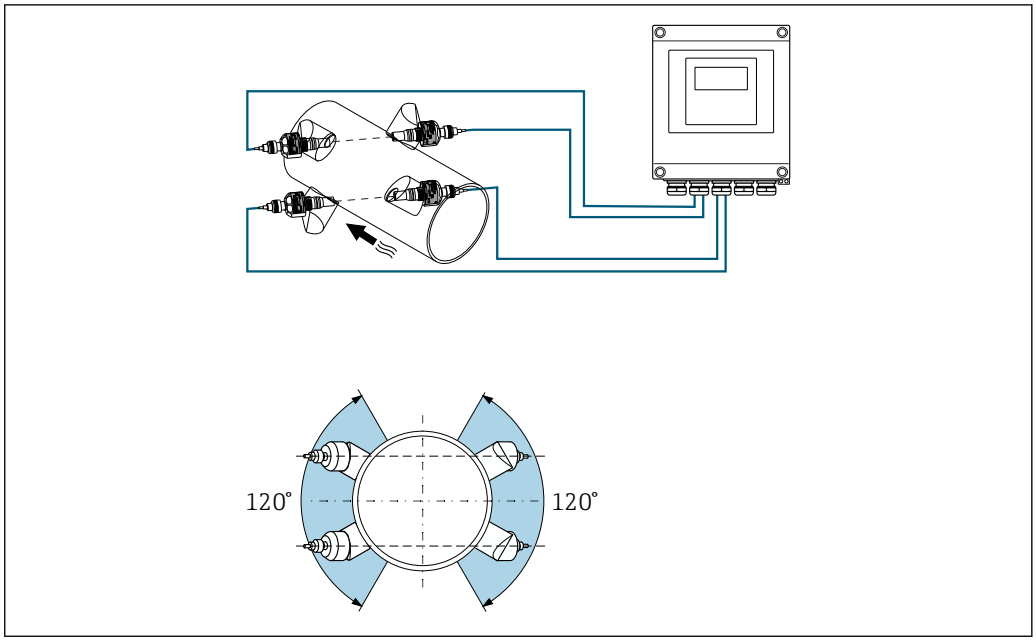
Two-path measurement (2 sensor sets)
Vertical mounting
 A0044940
Horizontal mounting
 A0044942

Measuring mode

Single-path measurement

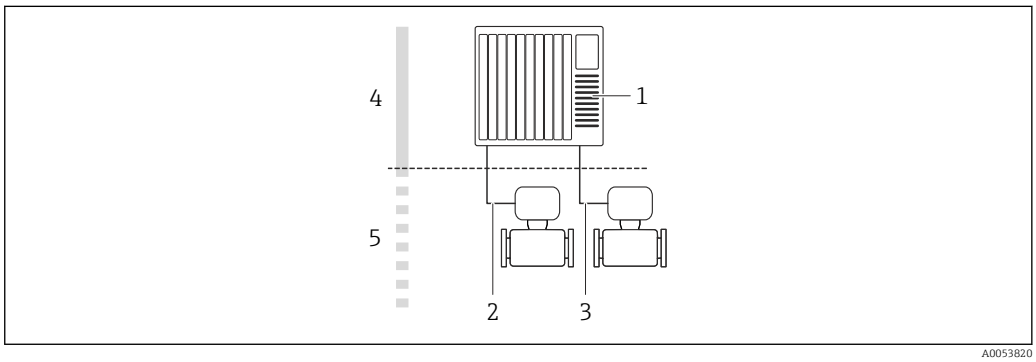
→ 12, 26

Two-path measurement



1 *Two-path measurement: example of horizontal arrangement of the sensor sets at a measuring point*

Device architecture



2 *Possibilities for integrating measuring devices into a system*

1 *Automation system (e.g. PLC)*
2 *4 to 20 mA HART, pulse/frequency/switch output*
3 *Modbus RS485*
4 *Non-hazardous area*
5 *Non-hazardous area and Zone 2/Div. 2*

Dependability

IT security

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

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

Device-specific IT security

The device 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. The following list provides an overview of the most important functions:

Function/interface	Factory setting	Recommendation
Write protection via hardware write protection switch → 🖹 10	Not enabled	On an individual basis following risk assessment
Access code (also applies to web server login or FieldCare connection) → 🖹 10	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) → 🖹 10	Serial number	Assign an individual WLAN passphrase during commissioning
WLAN mode	Access point	On an individual basis following risk assessment
Web server → 🖹 11	Enabled	On an individual basis following risk assessment
CDI-RJ45 service interface→ 🖹 11	–	On an individual basis following risk assessment

Protecting access via hardware write protection

Write access to the parameters of the device via the local display or operating tool (e.g. FieldCare, DeviceCare) can be disabled via a write protection switch (DIP switch on the main electronics module). 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.

User-specific access code

Write access to the device parameters via the local display 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.

General notes on the use of passwords

- The access code and network key supplied with the device should be changed during commissioning for safety reasons.
- Follow the general rules for generating a secure password when defining and managing the access code and 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 established 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 via the **Web server functionality** parameter if necessary (e.g., after commissioning).

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

Detailed information on the device parameters:
"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.

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)

To calculate the measuring range, use the *Applicator* sizing tool → 56

Operable flow range

Over 150 : 1

Input signal

External measured values

The measuring device has an optional interface via which an externally measured variable (temperature) can be transmitted to the measuring device: digital input (via HART input or Modbus)

Various pressure transmitters can be ordered from Endress+Hauser: see "Accessories" section → 57

HART protocol

The measured values are written from the automation system to the measuring device via the HART protocol. The temperature and density measuring device must support the following protocol-specific functions:
- HART protocol
- Burst mode

Status input

Maximum input values	▪ DC 30 V ▪ 6 mA
Response time	Configurable: 5 to 200 ms

Input signal level	▪ Low signal (low): DC −3 to +5 V ▪ High signal (high): DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset totalizers 1-3 separately ▪ Reset all totalizers ▪ Flow override

Output

Output signal

Current output

Current output	Can be set as: ▪ 4 to 20 mA NAMUR ▪ 4 to 20 mA US ▪ 4 to 20 mA HART ▪ 0 to 20 mA
Maximum output values	▪ DC 24 V (when idle) ▪ 22.5 mA
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0 to 999.9 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature The range of options increases if the measuring device has one or more application packages.

Pulse/frequency/switch output

Function	▪ With the order code for "Output; Input", option **H**: output 2 can be set as a pulse or frequency output ▪ With the order code for "Output; Input", option **I**: output 2 and 3 can be set as a pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	▪ DC 30 V ▪ 250 mA
Voltage drop	At 25 mA: ≤ DC 2 V
Pulse output	
Pulse width	Configurable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Configurable
Assignable measured variables	▪ Volume flow ▪ Mass flow
Frequency output	
Output frequency	Configurable: 0 to 12 500 Hz
Damping	Configurable: 0 to 999 s
Pulse/pause ratio	1:1

Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Configurable: 0 to 100 s
Number of switching cycles	Unlimited

Assignable functions	▪ Off
	▪ On
	▪ Diagnostic behavior
	▪ Limit value
	  ▪ Volume flow
	  ▪ Mass flow
	  ▪ Sound velocity
	  ▪ Flow velocity
	  ▪ Totalizer 1-3
	  ▪ Electronics temperature
	▪ Flow direction monitoring
	▪ Status
	  Low flow cut off

Modbus RS485

Physical interface	In accordance with EIA/TIA-485-A standard
Terminating resistor	Integrated, can be activated via DIP switch on the transmitter electronics module

Signal on alarm

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

Current output 4 to 20 mA

4 to 20 mA

Failure mode	Choose from: ▪ 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 ▪ Definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Max. alarm: 22 mA ▪ Definable value between: 0 to 22.5 mA

HART current output

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

Pulse/frequency/switch output

Pulse output	
Fault mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Fault mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Definable value between: 0 to 12 500 Hz
Switch output	
Fault mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Modbus RS485

Failure mode	Choose from: ▪ NaN value instead of current value ▪ Last valid value

Local display

Plain text display	With information on cause and remedial measures
Backlight	Red lighting 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 → 47

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: ▪ Supply voltage active ▪ Data transmission active ▪ Device alarm/error has occurred

Low flow cut off

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

Galvanic isolation

The following connections are galvanically isolated from each other:
- Inputs
- Outputs
- Power supply

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x5B
HART protocol revision	7
Device description files (DTM, DD)	Information and files available at: www.endress.com
HART load	Min. 250 Ω
Dynamic variables	Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ▪ Off ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Mass flow ▪ Sound velocity ▪ Flow velocity ▪ Electronics temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3
Device variables	Read out the device variables: HART command 9 The device variables are permanently assigned. A maximum of 8 device variables can be transmitted: ▪ 0 = volume flow ▪ 1 = mass flow ▪ 2 = sound velocity ▪ 3 = flow velocity ▪ 4 = electronic temperature ▪ 5 = totalizer 1 ▪ 6 = totalizer 2 ▪ 7 = totalizer 3

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
Response times	▪ 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	▪ 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: ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	▪ 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 transmission mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information
System integration	Information regarding system integration: Operating Instructions . ▪ Modbus RS485 information ▪ Function codes ▪ Register information ▪ Response time ▪ Modbus data map

Power supply

Terminal assignment

Transmitter: 0 to 20 mA/4 to 20 mA HART

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	**Power supply**	
Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option **L** (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	–15 to +10%	50/60 Hz, ±4 Hz

Signal transmission current output 0 to 20 mA/4 to 20 mA HART and additional outputs and inputs

Order code for "Output" and "Input"	Terminal numbers							
	Output 1		Output 2		Output 3		Input	
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option **H**	Current output ▪ 4 to 20 mA HART (active) ▪ 0 to 20 mA (active)		Pulse/frequency output (passive)		Switch output (passive)		-	
Option **I**	Current output ▪ 4 to 20 mA HART (active) ▪ 0 to 20 mA (active)		Pulse/frequency/ switch output (passive)		Pulse/frequency/ switch output (passive)		Status input	

Transmitter: Modbus RS485

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"

Supply voltage

Order code "Power supply"	Terminal numbers	terminal voltage		Frequency range
Option **L** (wide range power unit)	1 (L+/L), 2 (L-/N)	DC 24 V	±25%	–
		AC 24 V	±25%	50/60 Hz, ±4 Hz
		AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

Signal transmission Modbus RS485 and additional outputs

Order code for "Output" and "Input"	Terminal numbers							
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option **M**	Modbus		-		-		-	
	B	A						
Option **O**	Current output 4 to 20 mA (active)		Pulse/frequency/ switch output (passive)		Pulse/frequency/ switch output (passive)		Modbus	
							B	A

Supply voltage

Transmitter

Order code for "Power supply"	terminal voltage		Frequency range
Option **L**	DC 24 V	±25%	–
	AC 24 V	±25%	50/60 Hz, ±4 Hz
	AC 100 to 240 V	−15 to +10%	50/60 Hz, ±4 Hz

Power consumption

Order code for "Output"	Maximum power consumption
Option **H**: 4-20mA HART, pulse/frequency output, switch output	30 VA/8 W
Option **I**: 4-20mA HART, 2 x pulse/frequency/switch output, status input	30 VA/8 W
Option **M**: Modbus RS485	30 VA/8 W
Option **O**: Modbus RS485, 4-20mA, 2 x pulse/ frequency/switch output	30 VA/8 W

Current consumption

Transmitter

Order code for "Power supply"	Maximum Current consumption	Maximum switch-on current
Option **L**: AC 100 to 240 V	145 mA	25 A (< 5 ms)
Option **L**: AC/DC 24 V	350 mA	27 A (< 5 ms)

Device fuse

Fine-wire fuse (slow-blow):
- DC 24 V: T1A
- AC 100 to 240 V: T1A

Power supply failure

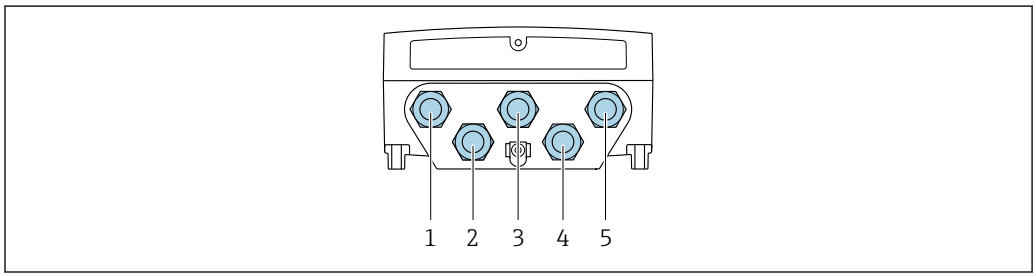
- Totalizers stop at the last value measured.
- Depending on the device version, the configuration is retained in the device memory or in the pluggable data memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Overcurrent protection element

The device must be operated with a dedicated circuit breaker, as it does not have an ON/OFF switch of its own.
- The circuit breaker must be easy to reach and labeled accordingly.
- Permitted nominal current of the circuit breaker: 2 A up to maximum 10 A.

Electrical connection

Terminal connection for transmitter



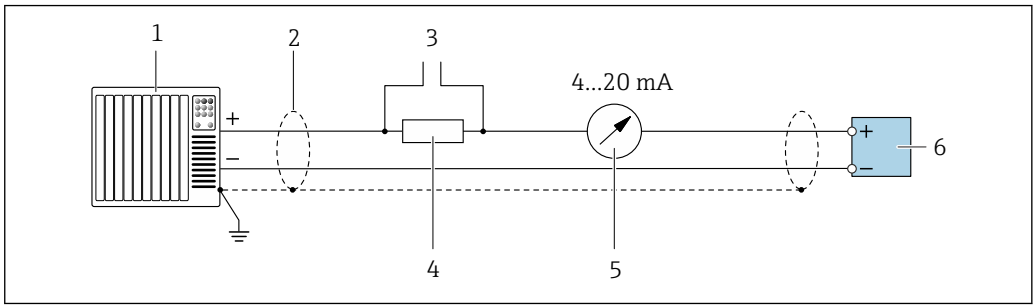
A0044948

3 Wall-mount housing, remote version: connection of supply voltage and signal transmission

1 Cable entry for supply voltage
2 Cable entry for sensor cable
3 Cable entry for sensor cable
4 Cable entry for signal transmission
5 Cable entry for signal transmission

Connection examples

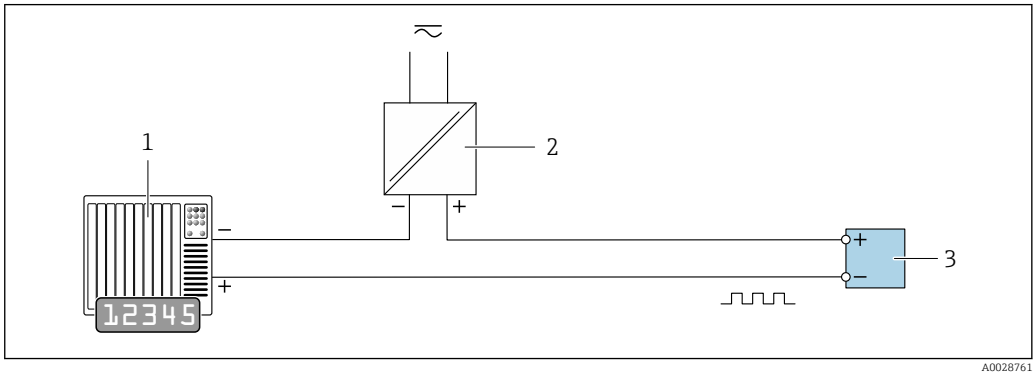
Current output 4 to 20 mA HART



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

1 Automation system with current input (e.g. PLC)
2 Ground cable shield at one end. The cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
3 Connection for HART operating devices → 47
4 Resistor for HART communication (≥ 250 Ω): observe maximum load → 12
5 Analog display unit: observe maximum load → 12
6 Transmitter

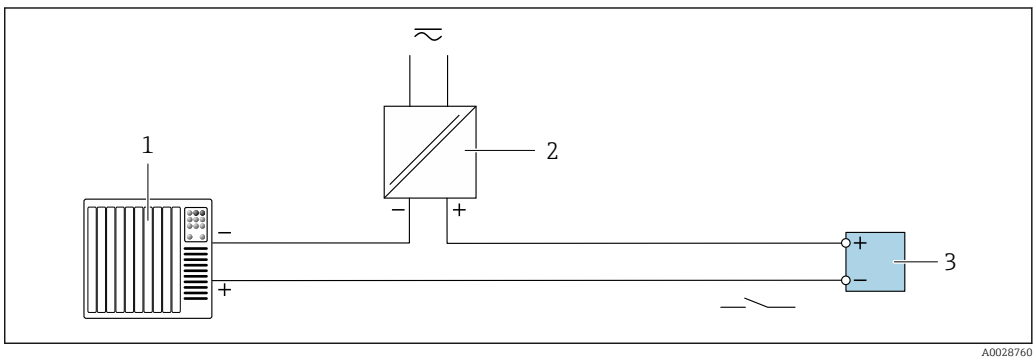
Pulse/frequency output



5 Connection example for pulse/frequency output (passive)

1 Automation system with pulse/frequency input (e.g. PLC with 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 12

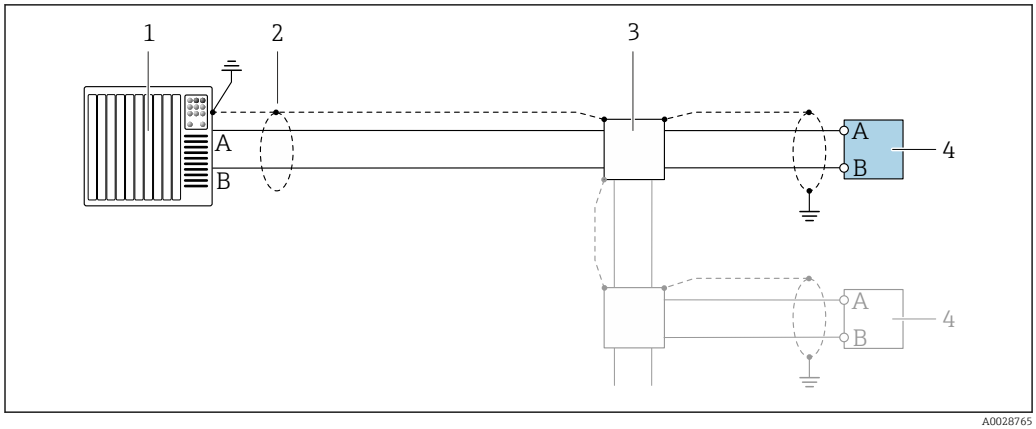
Switch output



6 Connection example for switch output (passive)

1 Automation system with switch input (e.g. PLC with a 10 kΩ pull-up or pull-down resistor)
2 Power supply
3 Transmitter: observe input values → 12

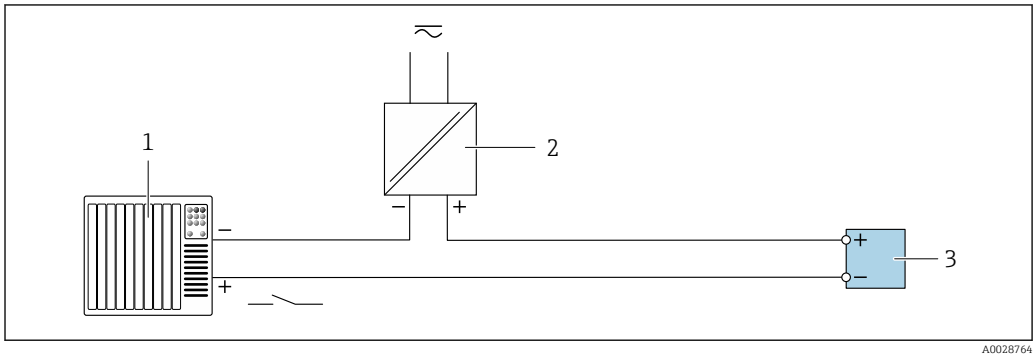
Modbus RS485



7 Connection example for Modbus RS485, non-hazardous area and Zone 2/Div. 2

1 *Control system (e.g. PLC)*
2 *Ground cable shield 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*

Status input



8 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 sensor and transmitter to the same electric potential [2)]
- Use a ground cable with a minimum cross-section of 6 mm² (10 AWG) and a cable lug for potential equalization connections

Terminals

Transmitter

Supply voltage cable: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries

Cable entry thread
- M20 x 1.5
- Via adapter:
  - NPT ½"
  - G ½"

2)

Cable gland
M20 × 1.5 with cable Φ 6 to 12 mm (0.24 to 0.47 in)

If metal cable entries are used, use a grounding plate.

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.

Signal cable

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

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

Pulse /frequency /switch output

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

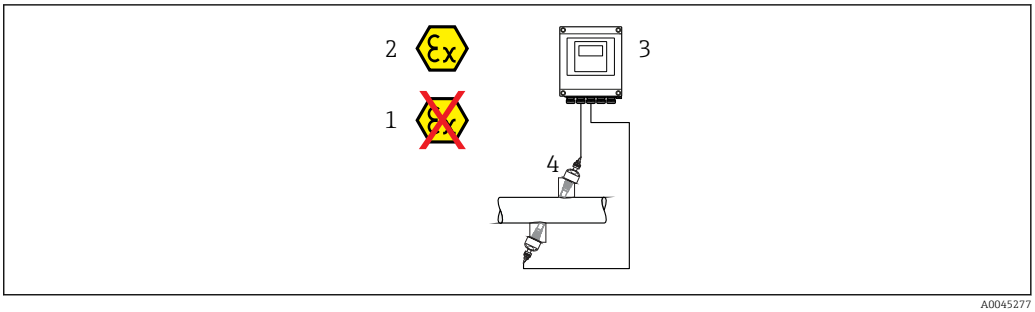
Modbus RS485

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 mm² (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.

Connecting cable between the transmitter and sensor

Sensor cable for sensor - transmitter



A0045277

Standard cable	TPE halogen-free: -40 to +80 °C (-40 to +176 °F)
Cable length (max.)	30 m (90 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (30 ft), 15 m (45 ft), 30 m (90 ft)
Operating temperature	Depends on the device version and how the cable is installed: Standard version: ▪ Cable - fixed installation [1]: minimum −40 °C (−40 °F) ▪ Cable - movable installation: minimum −25 °C (−13 °F)

1) Compare details under the row "Standard cable"

Overvoltage protection

Mains voltage fluctuations	→ 17
Overvoltage category	Overvoltage category II
Short-term, temporary overvoltage	Between cable and ground up to 1200 V, for max. 5 s
Long-term, temporary overvoltage	Between cable and ground up to 500 V

Performance characteristics

Reference operating conditions

- Maximum permissible error according to ISO/DIN 11631
- Specifications as per measurement report
- Accuracy information is based on accredited calibration rigs that are traced to ISO 17025.

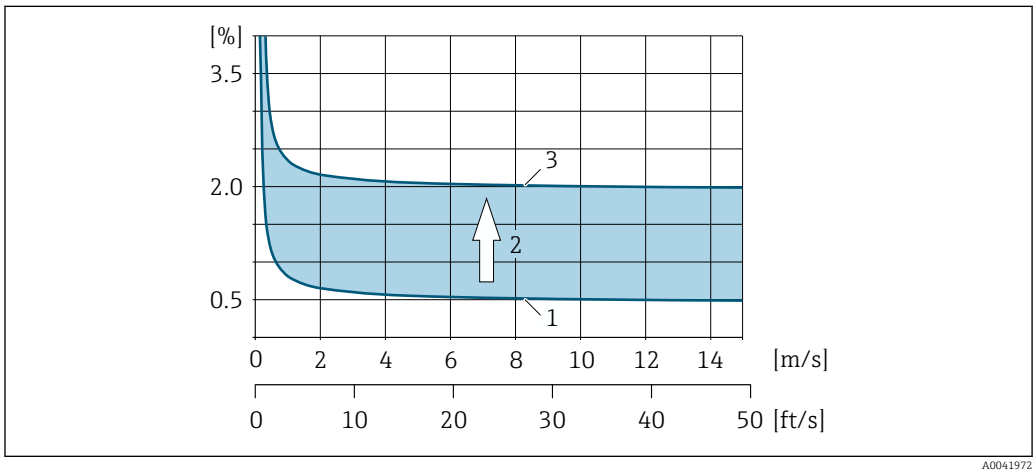
To obtain measured errors, use the *Applicator* sizing tool → 56

Maximum measurement error

o.r. = of reading

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

The installation-specific measurement error depends on the installation conditions on site, such as the nominal diameter, accuracy of sensor mounting (sensor holder welding), real pipe geometry or medium. The sum of the two measurement errors is the measurement error at the measuring point.



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

1 Measurement error of measuring device: 0.5% o.r. ± 3 mm/s (0.12 in/s)
2 Measurement error due to installation conditions: typically 1.5% o.r.
3 Measurement 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)

Measurement error at the measuring point

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

Nominal diameter	Maximum permissible errors for device	+	Installation-specific maximum permissible errors (typical)	→	Maximum permissible errors at the measuring point (typical)	Field calibration [1]
≥ 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 value with correction values written back to the transmitter

Measurement report

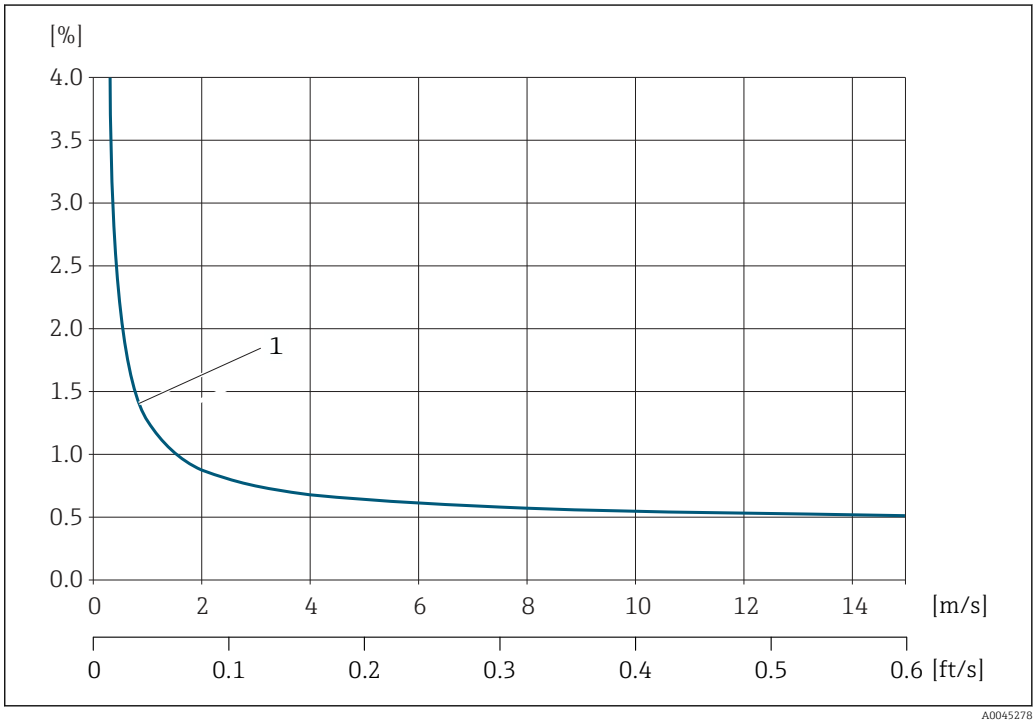
If required, the device can be supplied with a factory measurement report. A measurement is performed under reference conditions to verify the performance of the device. Here, the sensors are mounted on a pipe with a nominal diameter of DN 250 (10") or 400 (16").

With a flow velocity of > 0.3 m/s (1 ft/s) and a Reynolds number > 10 000, the following error limits are guaranteed with the measurement report:

Nominal diameter	Maximum permissible errors for device
250 (10"); single-path	±0.5% o.r. ± 3 mm/s (0.12 in/s)
400 (16"); dual-path	±0.5% o.r. ± 3 mm/s (0.12 in/s)

The specification applies to Reynolds numbers Re ≥ 10 000. Larger measurement errors may occur for Reynolds numbers Re < 10 000.

Example of max. measurement error (volume flow)



10 Example of max. measurement error (volume flow) in % o.r.

1 Pipe diameter ≥ 250 (10")

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	Max. ±5 µA

Pulse/frequency output

o.r. = of reading

Accuracy	Max. ±50 ppm o.r. (over the entire ambient temperature range)

Repeatability

o.r. = of reading

±0.3% for flow velocities >0.3 m/s (1 ft/s)

Influence of ambient temperature

Current output

o.r. = of reading

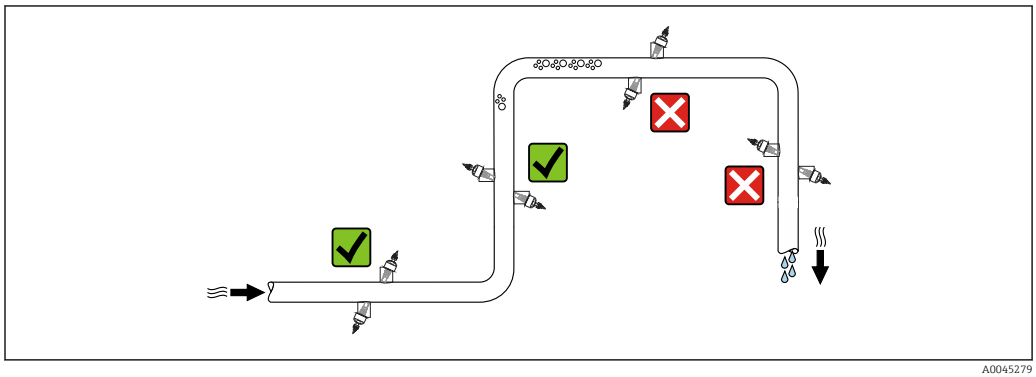
Temperature coefficient	Max. ±0.005 % o.r./°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

Mounting procedure

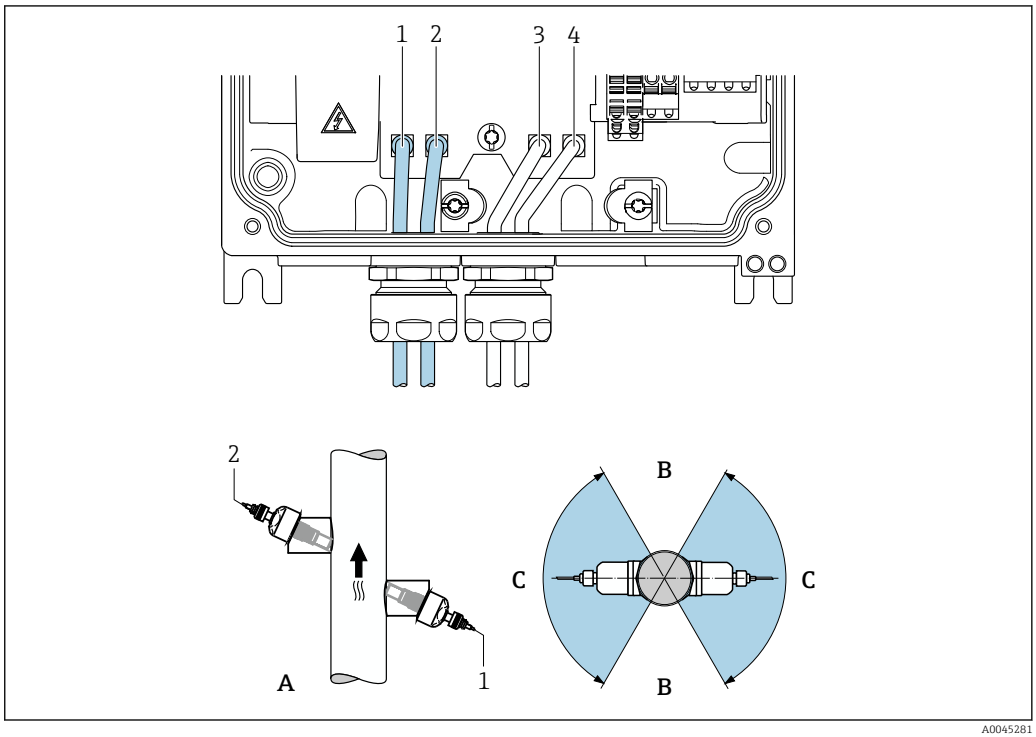
Mounting location



A0045279

To prevent measuring errors arising from accumulation of gas bubbles in the measuring pipe, avoid the following mounting locations in the piping:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Orientation



11 *Orientation views*

1 Channel 1 upstream
2 Channel 1 downstream
3 Channel 2 upstream
4 Channel 2 downstream
A Recommended orientation with upward flow direction
B Non-recommended installation range with horizontal orientation (60°)
C Recommended installation range max. 120°

Vertical

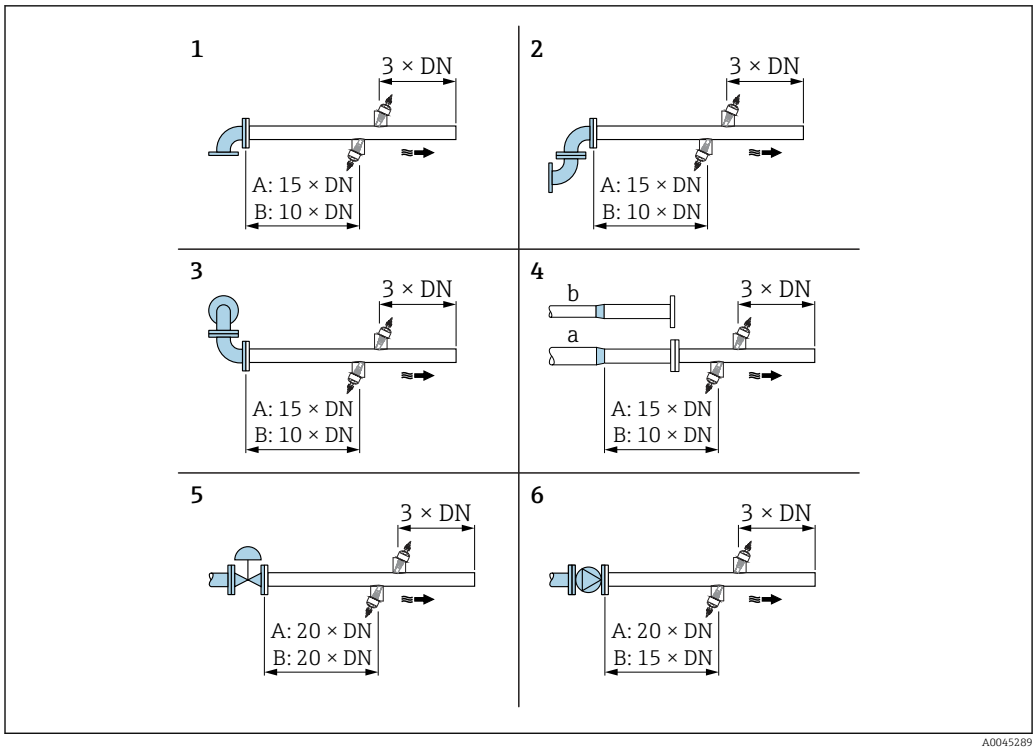
Recommended orientation with upward flow direction (view A) With this orientation, entrained solids sink and gases rise away from the sensor area when the medium is not flowing. In addition, the pipe can be completely drained and protected against the buildup of deposits.

Horizontal

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

Inlet and outlet runs

If possible, install the sensors upstream of assemblies such as valves, T-pieces, elbows, and pumps. If this is not possible, the specified measurement accuracy of the measuring device is achieved by observing the specified minimum inlet and outlet runs with optimum sensor configuration. If there are several flow obstructions, the longest specified inlet run must be taken into account.



12 Minimum inlet and outlet runs with different flow obstructions (A: single-path measurement, B: two-path measurement)

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

Mounting the sensor

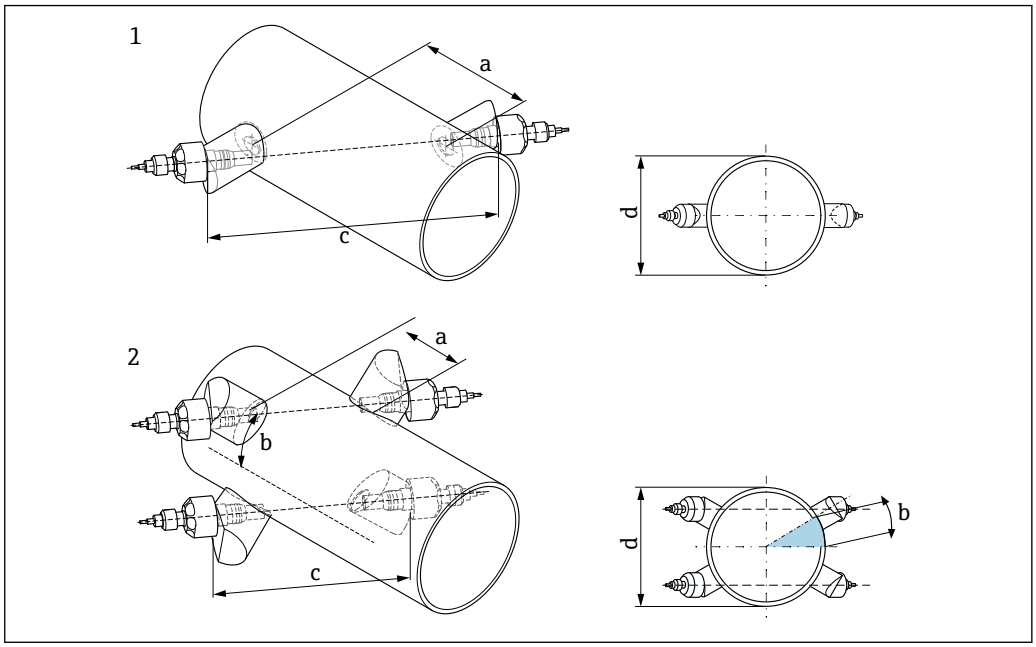
Sensor configuration and settings

DN 200 to 4000 (8 to 160")	
Single-path version [mm (in)]	**Two-path version [mm (in)]**
Sensor distance [1]	Sensor distance [1]
Path length → 13, 27	Path length → 13, 27 Arc length → 13, 27

1) Depends on the conditions at the measuring point (e.g. measuring pipe). The mounting position of the sensor can be determined via FieldCare or Applicator. See also **Result Sensor Type / Sensor Distance** parameter in **Measuring point** submenu

Determining the mounting positions of the sensor

Description of installation



13 *Terminology Description of installation*

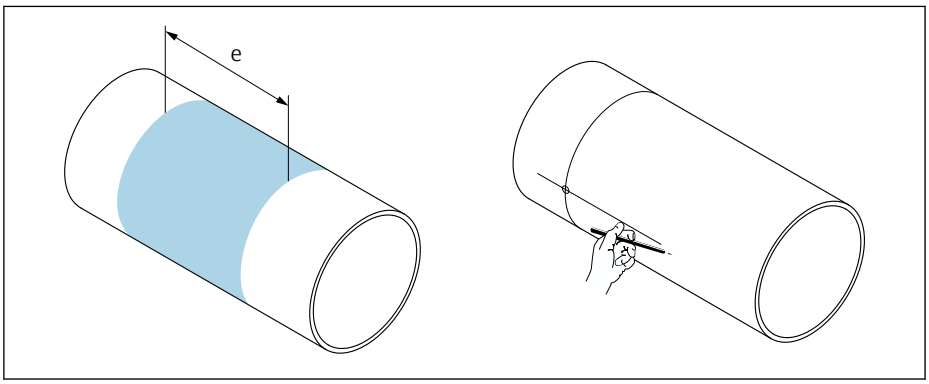
1 Single-path version
2 Two-path version
a Sensor distance
b Arc length
c Path length
d External diameter of measuring pipe

Detailed information:

Sensor holder for single-path version

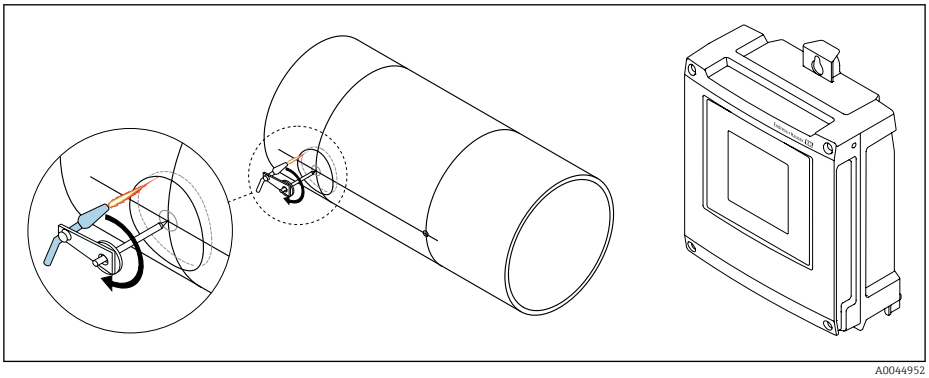
Procedure:

1. Determine mounting area (e) on measuring pipe section (space required at measuring point approx. 1x diameter of measuring pipe).
2. Mark the center line on the measuring pipe at the mounting location and mark the first the drill hole (drill hole diameter: 65 mm (2.56 in)). The center line marking should extend beyond the hole to be drilled.



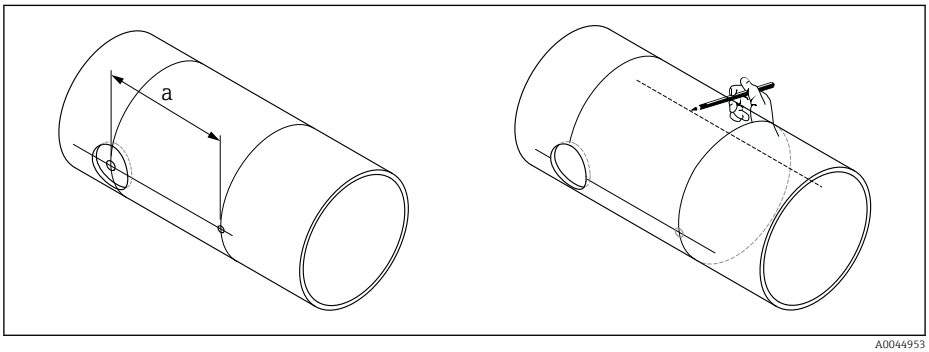
A0044951

3. Cut the first drill hole using a plasma cutter, for example. Measure the wall thickness of the measuring pipe, if not already known.
4. Determine the sensor distance → 26.



A0044952

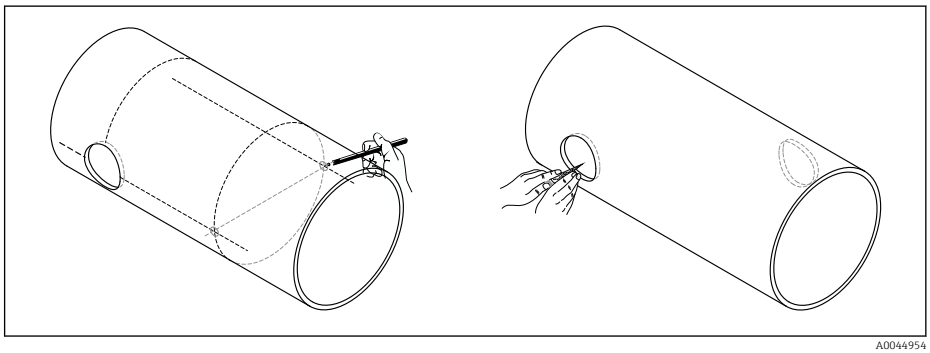
5. Mark the sensor distance (a) starting from the center line of the first drill hole.
6. Project and draw the center line onto the rear of the measuring pipe.



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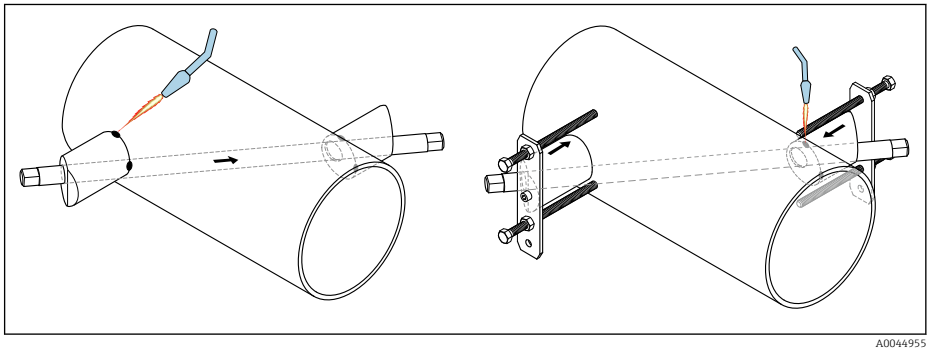
7. Mark the drill hole on the rear center line.

8. Cut out the second drill hole and prepare holes for welding in the sensor holders (deburr, clean).



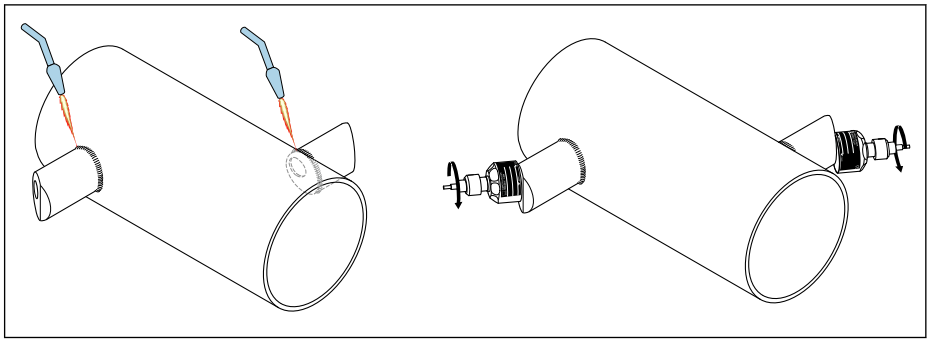
A0044954

9. Insert sensor holders into both drill holes. To adjust the welding depth, both sensor holders can be secured with the special tool for regulating the insertion depth and then aligned using the path rod. The senor holder must be flush with the inside of the measuring pipe.
10. Spot-weld both sensor holders. To align the path rod, screw both guide bushes into the sensor holders.



A0044955

11. Weld in both sensor holders.
12. Check the distances between the drill holes again and determine the path length → 26.
13. Manually screw the sensors into the sensor holders. If using a tool, tighten with max. 30 Nm.
14. Insert the sensor cable plugs into the openings provided and manually tighten the plugs as far as they will go.



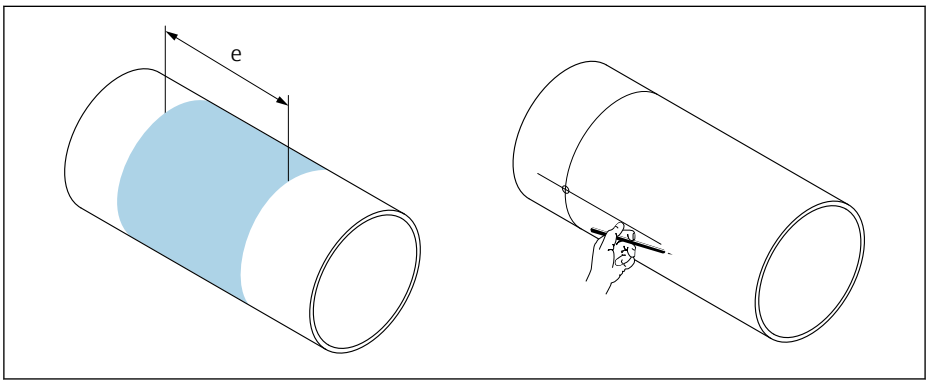
A0044956

Sensor holder for two-path version

Procedure:

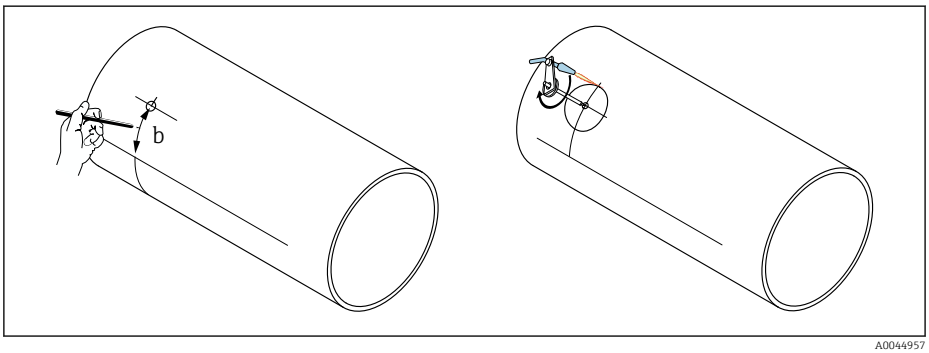
1. Determine mounting area (e) on measuring pipe section (space required at measuring point approx. 1x diameter of measuring pipe).

2. Mark the center line on the measuring pipe at the mounting location.



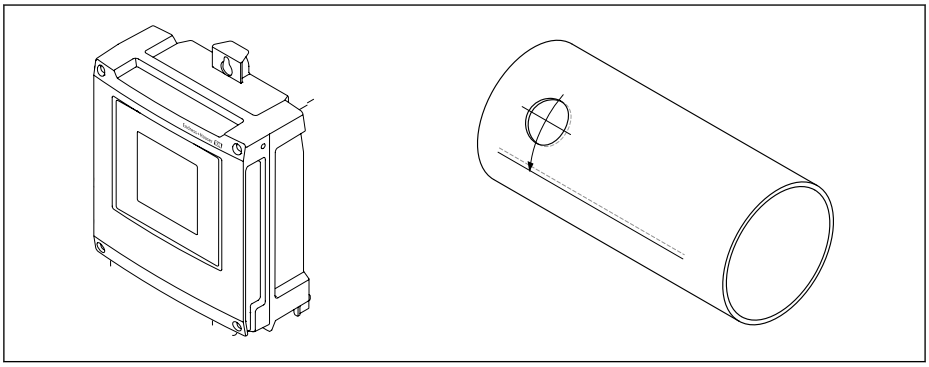
A0044951

3. Draw the length of the arc (b) at the mounting position of the sensor holder from the center line out to one side. Base the arc length on approx. 1/12 of the circumference of the measuring pipe. Mark the first drill hole (drill hole diameter: 81 to 82 mm (3.19 to 3.23 in)). Extend the center line beyond the hole to be drilled.
4. Cut the first drill hole using a plasma cutter, for example. Measure the wall thickness of the measuring pipe, if not already known.



A0044957

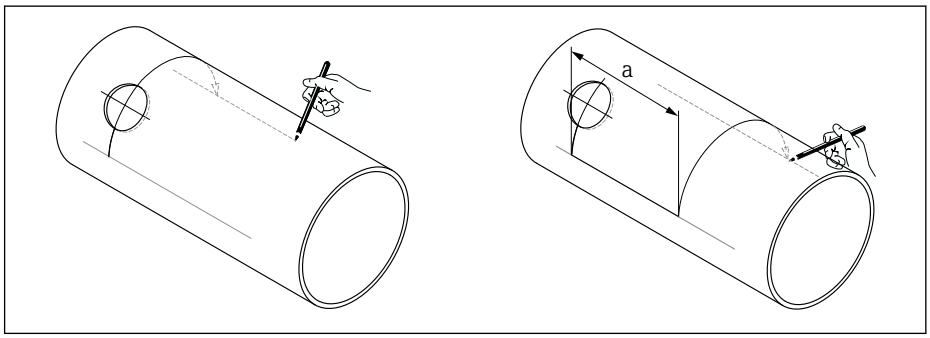
5. Determine the sensor distance and arc length → 26.
6. Use the arc length that was determined to correct the center line.



A0044958

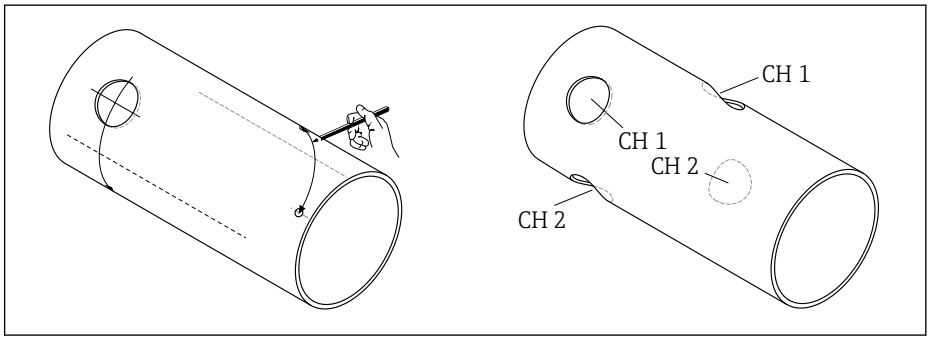
7. Project and draw the corrected center line onto the opposite side of the measuring pipe (half of measuring pipe circumference).

8. Mark the sensor distance on the center line and project it onto the center line on the rear of the pipe.



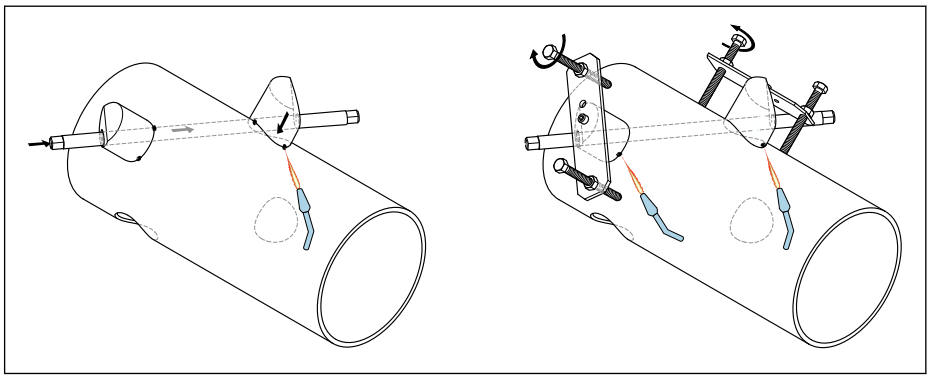
A0044959

9. Draw the length of the arc from the center line out to both sides and mark the drill holes.
10. Create drill holes and prepare them for welding in the sensor holders (deburr, clean). Drill holes for the sensor holders are paired together (CH 1 - CH 1 and CH 2 - CH 2).



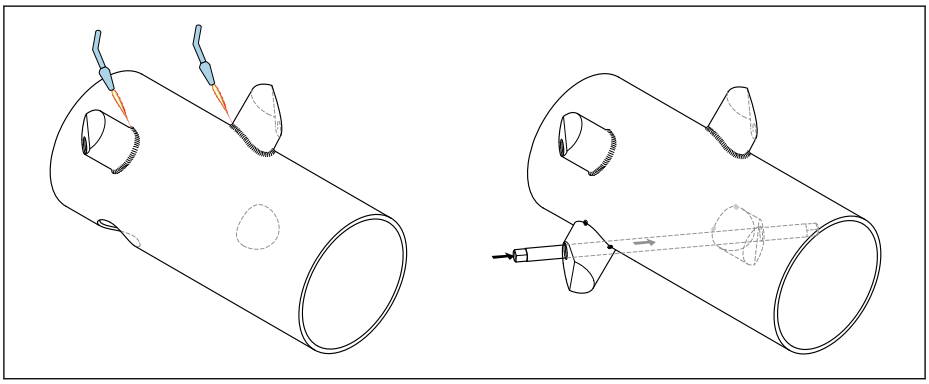
A0044960

11. Insert the sensor holders into the first two drill holes and align them using the path rod (alignment tool). Spot-weld with the welding device and then weld both sensor holders together. To align the path rod, screw both guide bushes into the sensor holders.

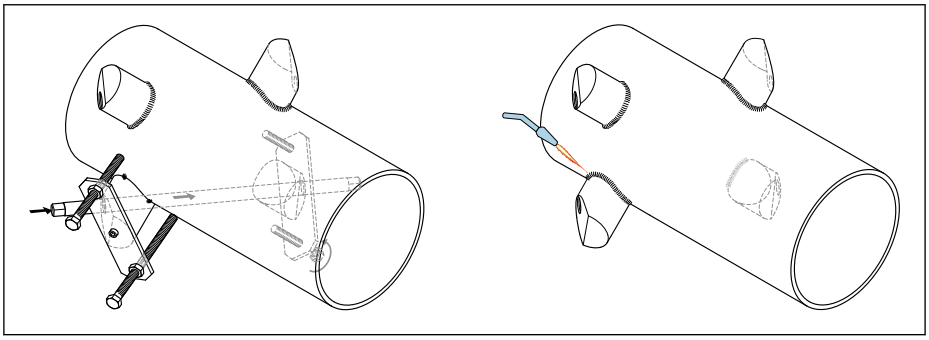

A0044961

12. Weld in both sensor holders.
13. Check the path length, sensor distances and arc lengths again. Deviations can be entered as calibration factors later on when commissioning the measuring point.

14. Insert second pair of sensor holders into the two remaining drill holes as per step 11, and then weld in place.

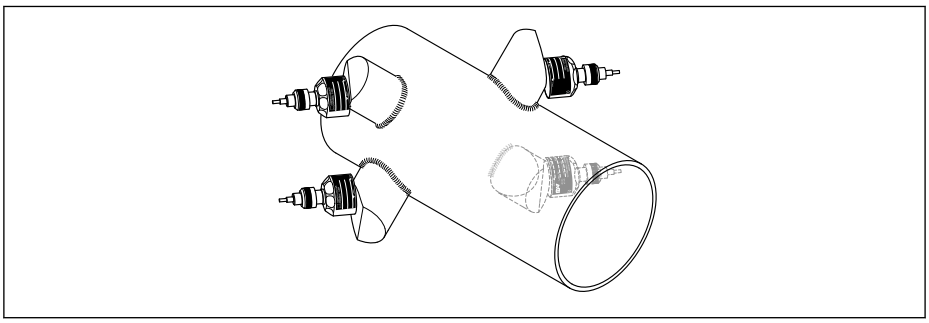


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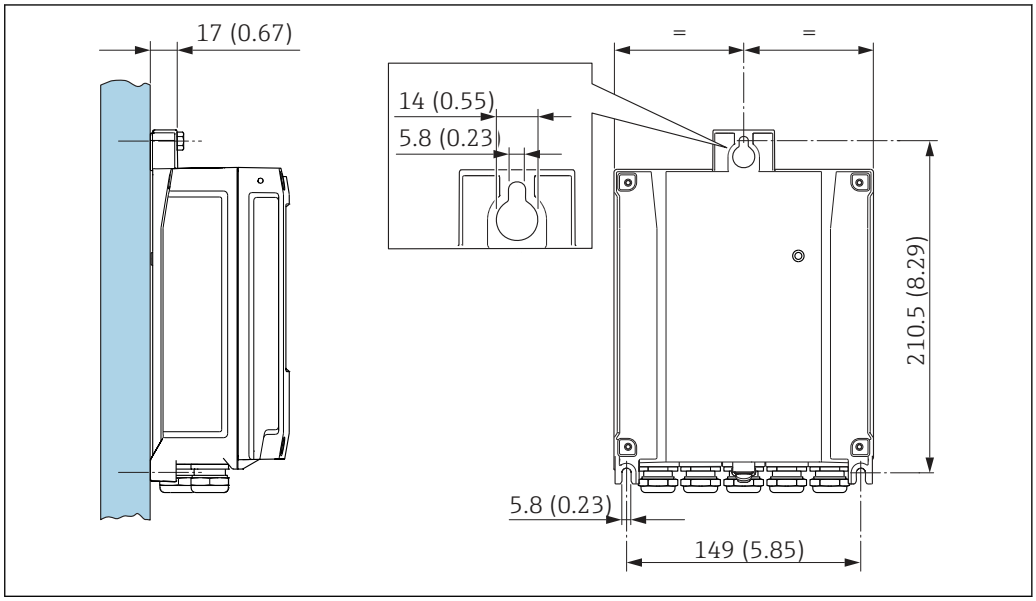
15. Manually screw the sensors into the sensor holders. If using a tool, tighten with max. 30 Nm.
16. Insert the sensor cable plugs into the openings provided and manually tighten the plugs as far as they will go.



A0044964

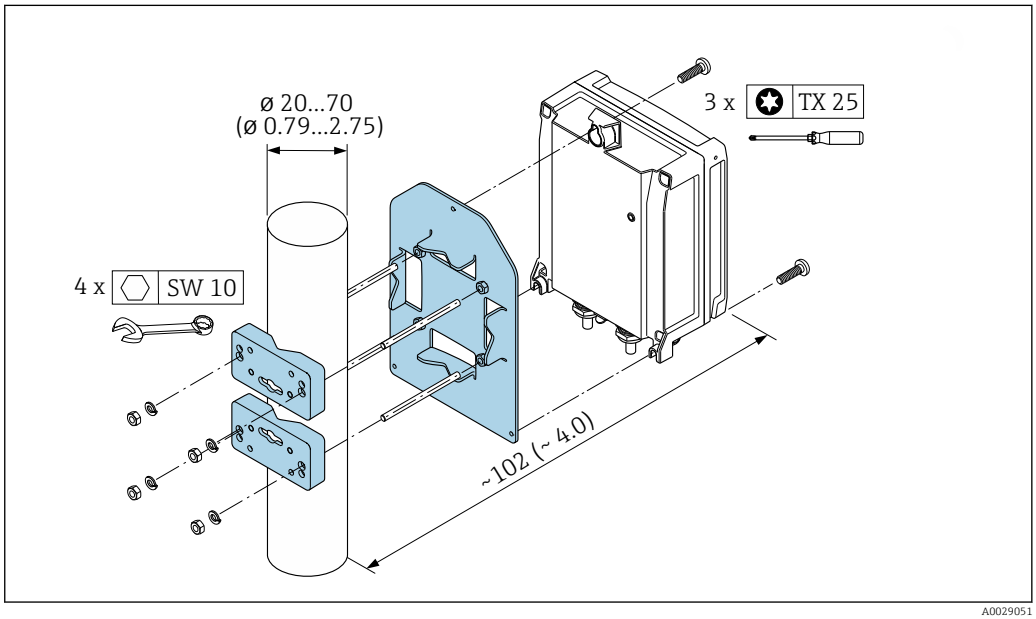
Mounting the transmitter housing

Wall mounting



14 *Unit mm (in)*

Post mounting



15 *Unit mm (in)*

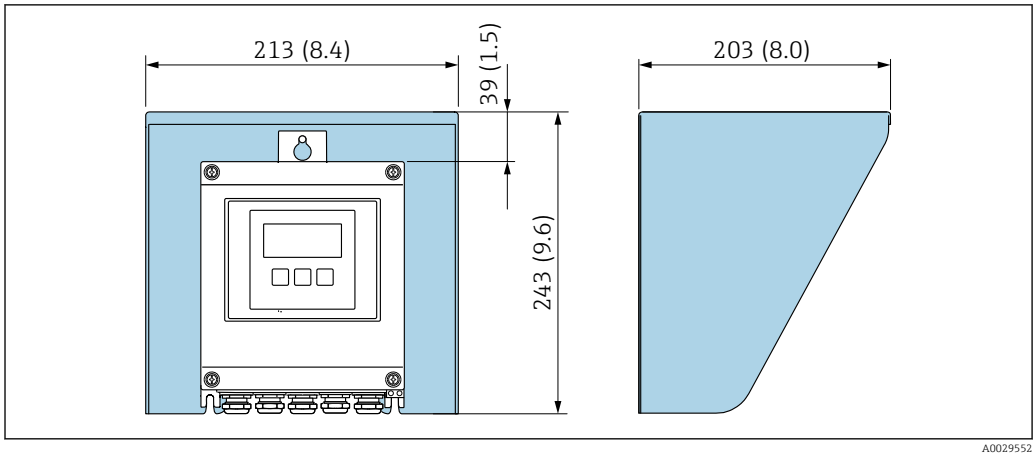
Special mounting instructions

Display guard

To ensure that the display guard can be easily opened, maintain the following minimum head clearance: 350 mm (13.8 in)

Display guard available as an accessory → 54.

Weather protection cover



16 *Weather protection cover; engineering unit mm (in)*

Environment

Ambient temperature range

Transmitter	−40 to +60 °C (−40 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	Standard: −40 to +80 °C (−40 to +176 °F)
Sensor cable (connection between transmitter and sensor)	Standard: TPE halogen-free: −40 to +80 °C (−40 to +176 °F)

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.

Storage temperature

The storage temperature for all components (except display modules and order code for "Sensor version", options AG, AH) corresponds to the ambient temperature range→ 34.

Display modules

−40 to +60 °C (−40 to +140 °F)

Relative humidity

The device is suitable for use outdoors and indoors with a relative humidity of 5 to 95 %.

Operating height

According to EN 61010-1
- ≤ 2 000 m (6 562 ft)
- > 2 000 m (6 562 ft) with additional overvoltage protection (e.g. Endress+Hauser HAW Series)

Degree of protection

Transmitter

- IP66/67, type 4X enclosure, suitable for pollution degree 4
- When the housing is open: IP20, type 1 enclosure, suitable for pollution degree 2
- Display module: IP20, type 1 enclosure, suitable for pollution degree 2

Sensor

- Standard: IP66/67, type 4X enclosure, suitable for pollution degree 4
- Optionally available: IP68, type 6P enclosure, suitable for pollution degree 4

External WLAN antenna

IP67

Shock and vibration resistance

Vibration sinusoidal, in accordance with IEC 60068-2-6

- 2 to 8.4 Hz, 7.5 mm peak
- 8.4 to 2 000 Hz, 2 g peak

Vibration broad-band random, according to IEC 60068-2-64

- 10 to 200 Hz, 0.01 g^2/Hz
- 200 to 2 000 Hz, 0.003 g^2/Hz
- Total: 2.70 g rms

Shock half-sine, according to IEC 60068-2-27

6 ms 50 g

Rough handling shocks according to IEC 60068-2-31

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- As per IEC/EN 61000-6-2 and IEC/EN 61000-6-4
- Complies with emission limits for industry as per EN 55011 (Class A)

Details are provided in the Declaration of Conformity.

This unit is not intended for use in residential environments and cannot guarantee adequate protection of the radio reception in such environments.

Process

Medium temperature range

Sensor version	Frequency	Temperature
I-100-A	1 MHz	−40 to +80 °C (−40 to +176 °F)

Sound velocity range

600 to 3 000 m/s (1 969 to 9 843 ft/s)

Medium pressure range

Maximum nominal pressure PN 16 (16 bar (232 psi))

Flow limit

For an overview of the full scale values for the measuring range, see the "Measuring range" section

- The minimum recommended full scale value is approx. 1/20 of the maximum full scale value.
- In most applications, 10 to 50 % of the maximum full scale value can be considered ideal.

Pressure loss

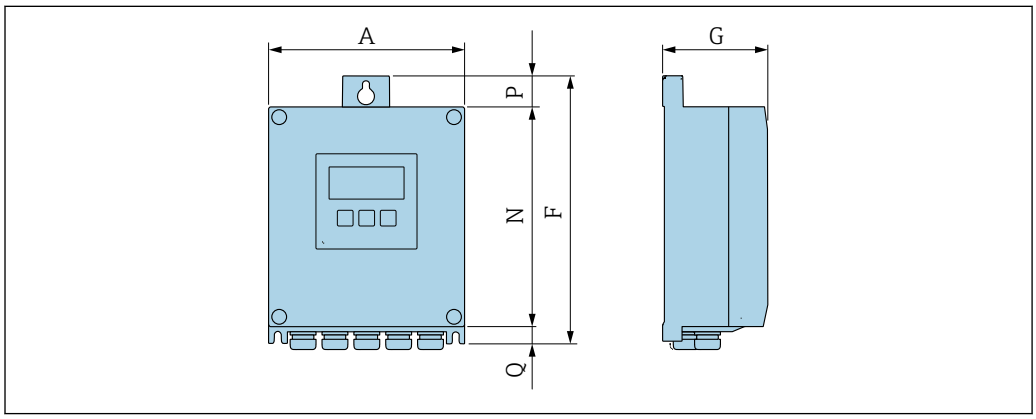
There is no pressure loss.

Mechanical construction

Dimensions in SI units

Transmitter remote version

Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"



A0033789

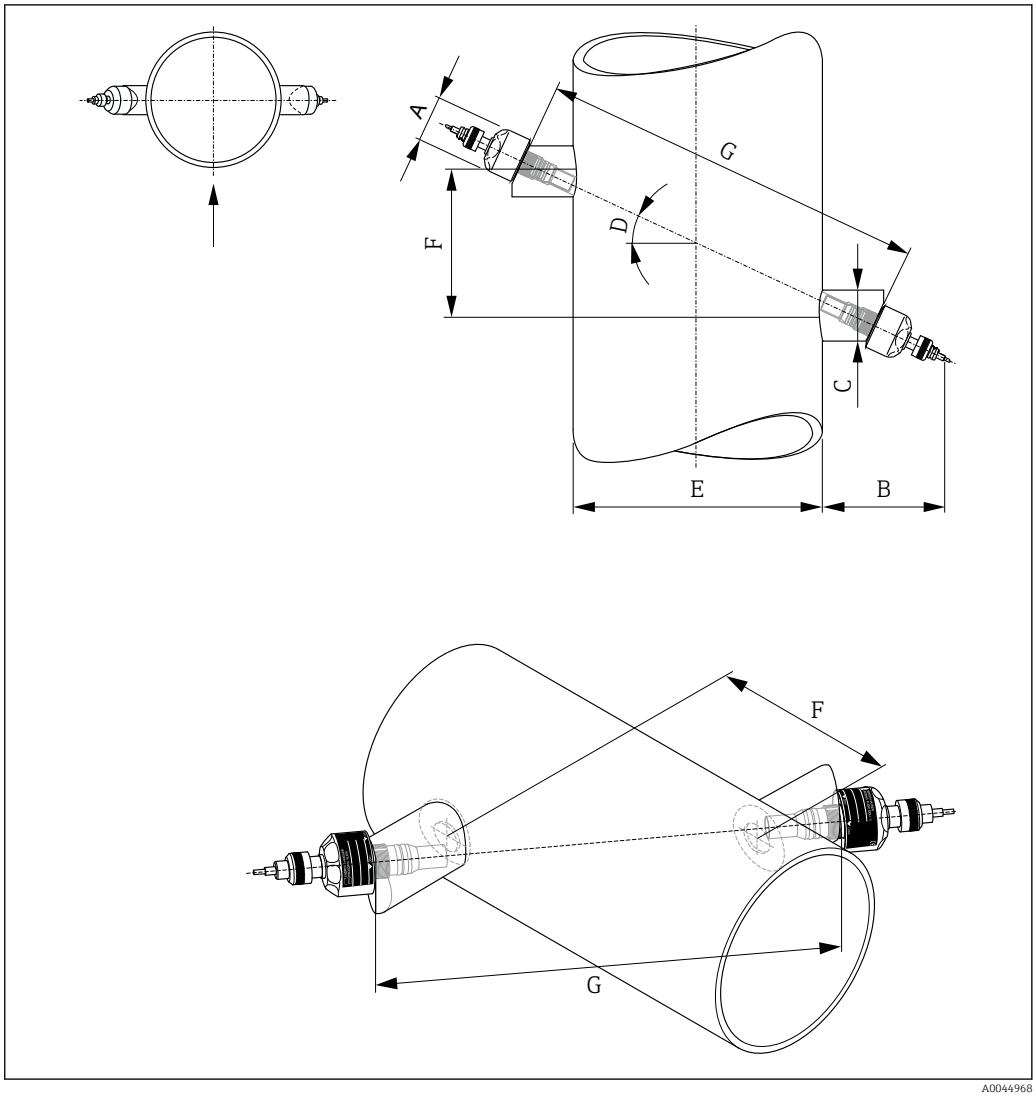
Order code for "Transmitter housing", option P "Remote, aluminum, coated"

A [mm]	F [mm]	G [mm]	N [mm]	P [mm]	Q [mm]
167	232	80	187	24	21

Order code for "Transmitter housing", option N "Remote, polycarbonate"

A [mm]	F [mm]	G [mm]	N [mm]	P [mm]	Q [mm]
177	234	90	197	17	22

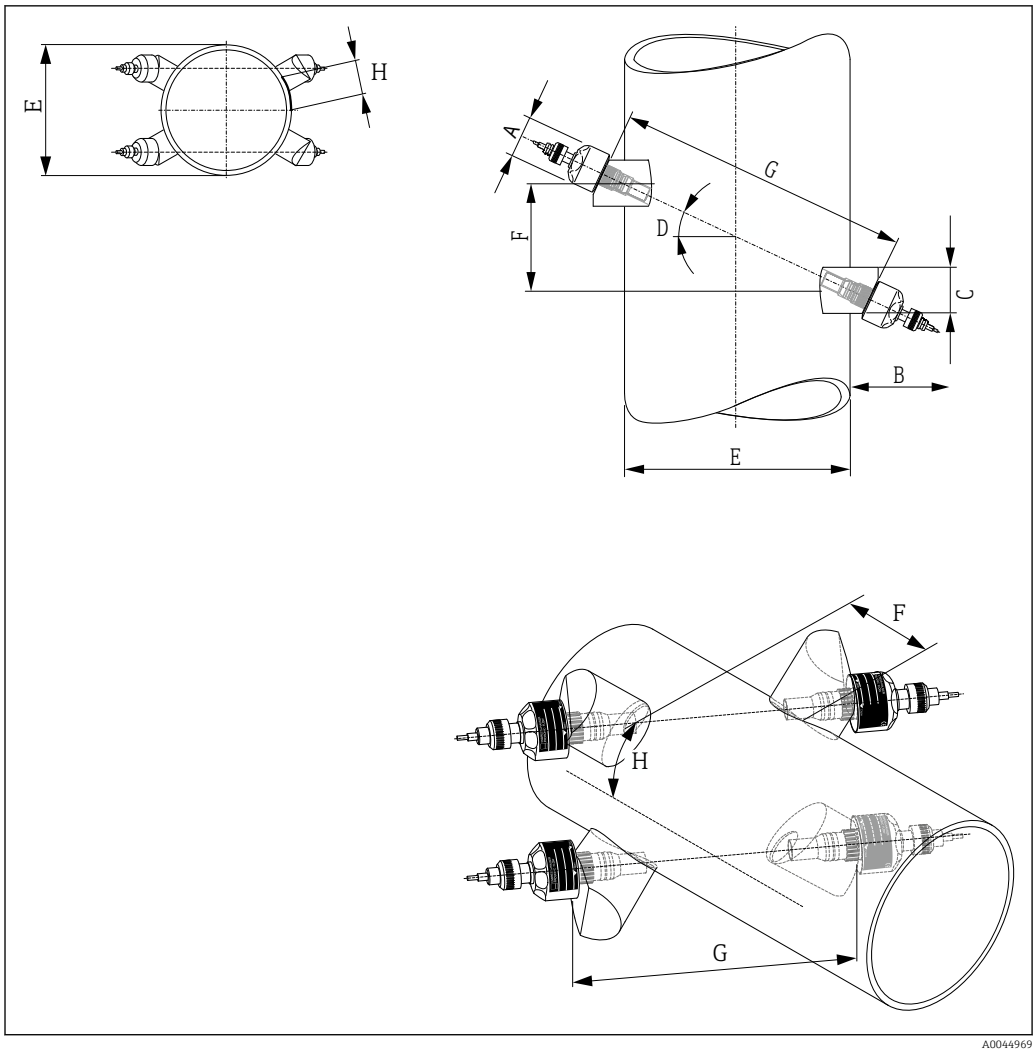
Sensor remote version



17 Single-path installation version

A [mm]	B [mm]	C [mm]	D [°]	E [mm]	F [1] [mm]	G [1] [mm]
ø 58	150	65	25	Measuring pipe outer diameter	Sensor distance	Path length

1) Can be determined via Applicator or FieldCare



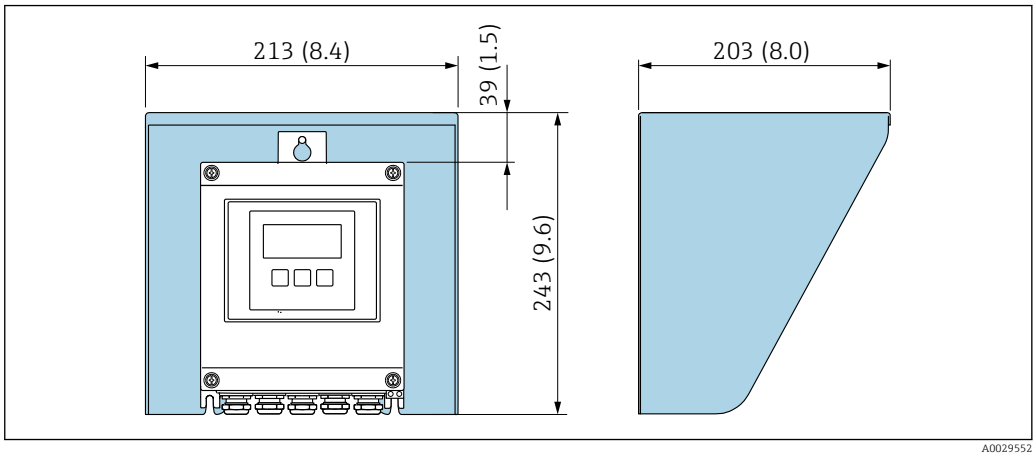
18 Two-path installation version

A [mm]	B [mm]	C [mm]	D [°]	E [mm]	F 1) [mm]	G 1) [mm]	H 1) [mm]
ø 58	150	80	25	Measuring pipe outer diameter	Sensor distance	Path length	Arc length

1) Can be determined via Applicator or FieldCare

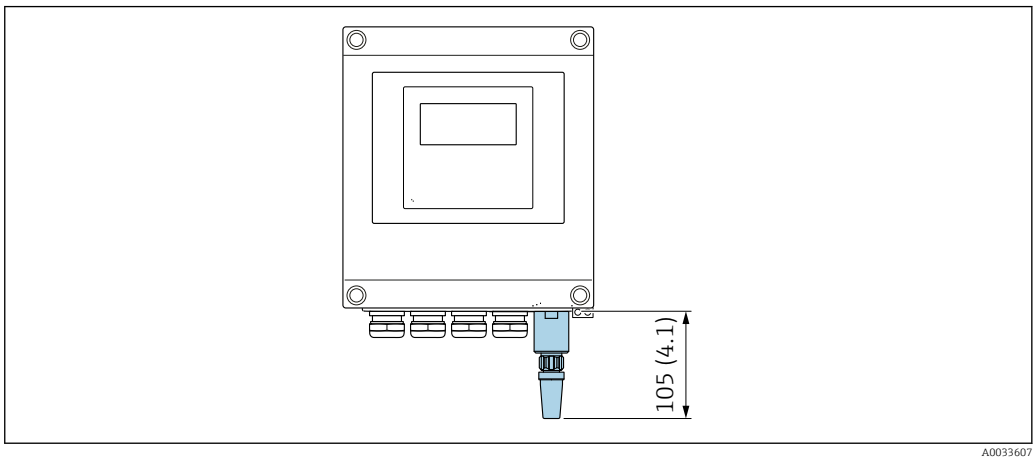
Accessories

Weather protection cover



19 *Weather protection cover; engineering unit mm (in)*

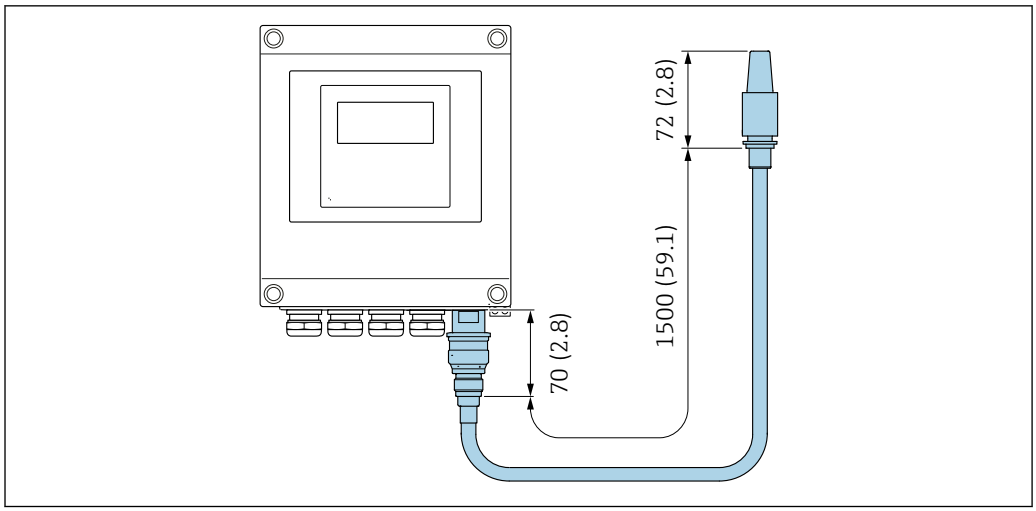
External WLAN antenna mounted on device



20 *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.

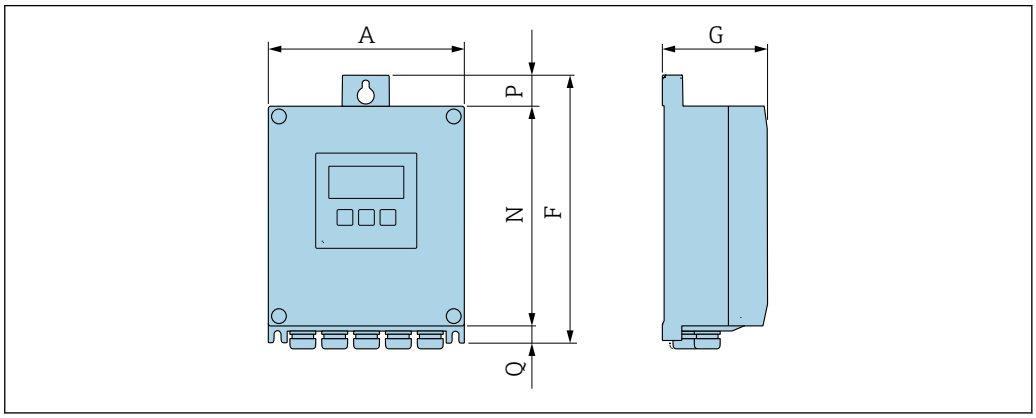


21 Engineering unit mm (in)

Dimensions in US units

Transmitter remote version

Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"



A0033789

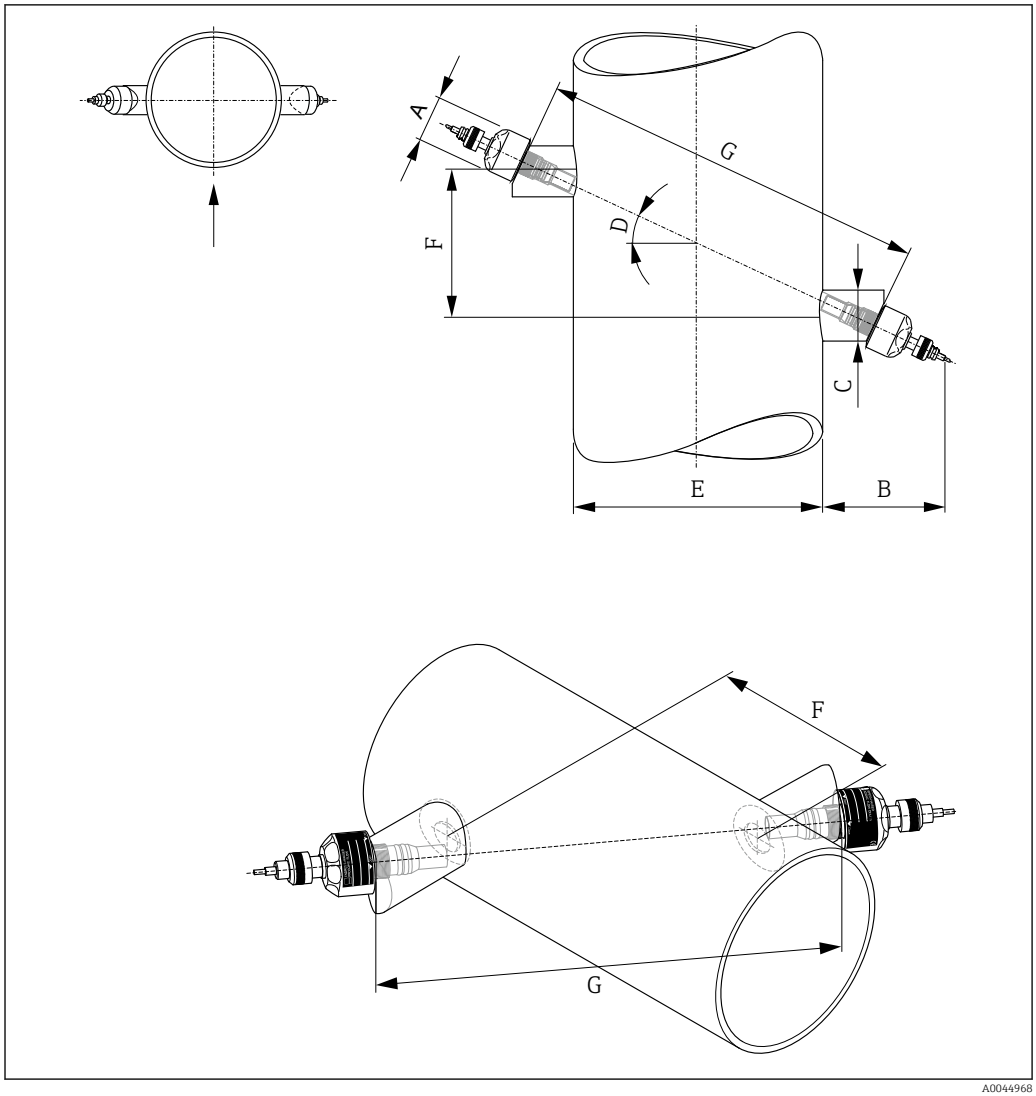
Order code for "Transmitter housing", option P "Remote, aluminum, coated"

A [in]	F [in]	G [in]	N [in]	P [in]	Q [in]
6.57	9.13	3.15	7.36	0.94	0.83

Order code for "Transmitter housing", option N "Remote, polycarbonate"

A [in]	F [in]	G [in]	N [in]	P [in]	Q [in]
6.97	9.21	3.54	7.76	0.67	0.87

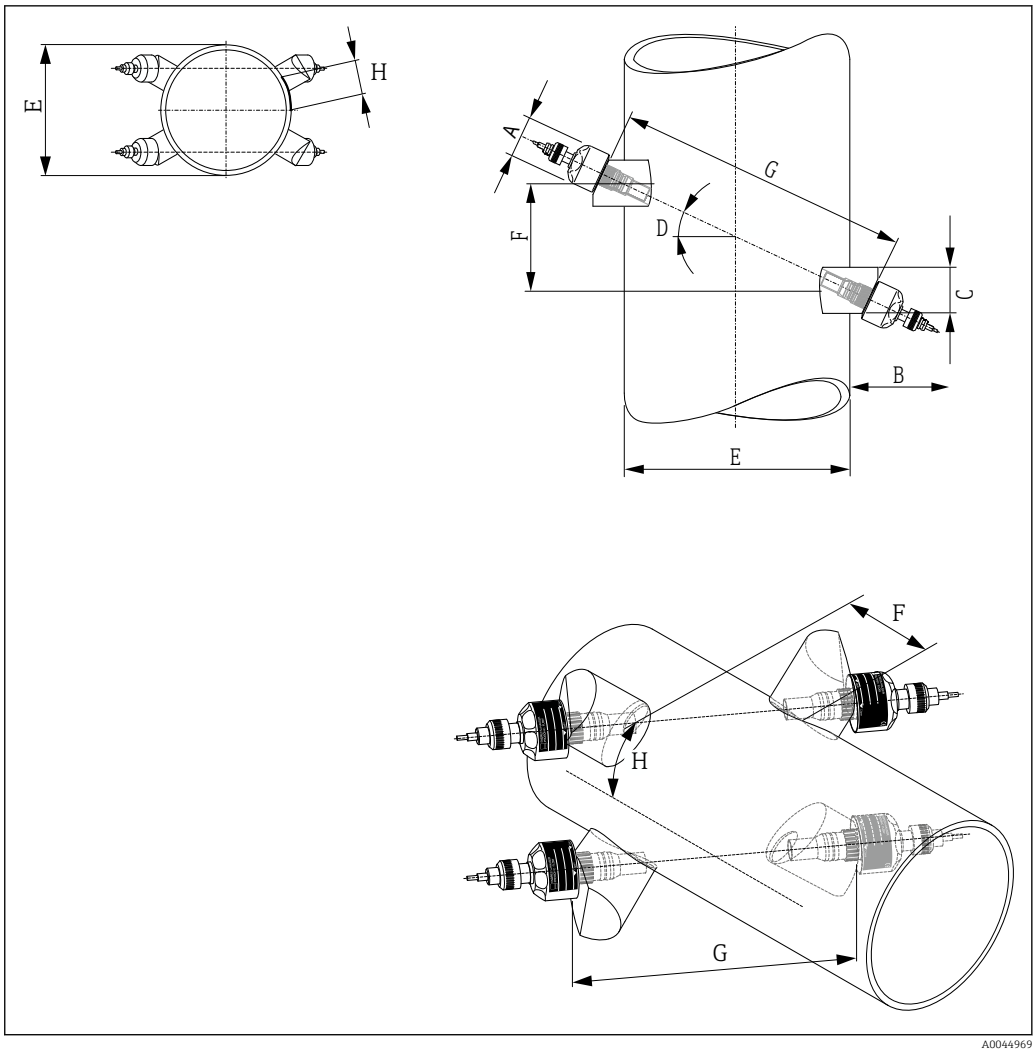
Sensor remote version



22 *Single-path installation version*

A [in]	B [in]	C [in]	D [°]	E [in]	F [1] [in]	G [1] [in]
ø 2.28	5.91	2.56	25	Measuring pipe outer diameter	Sensor distance	Path length

1) Can be determined via Applicator or FieldCare



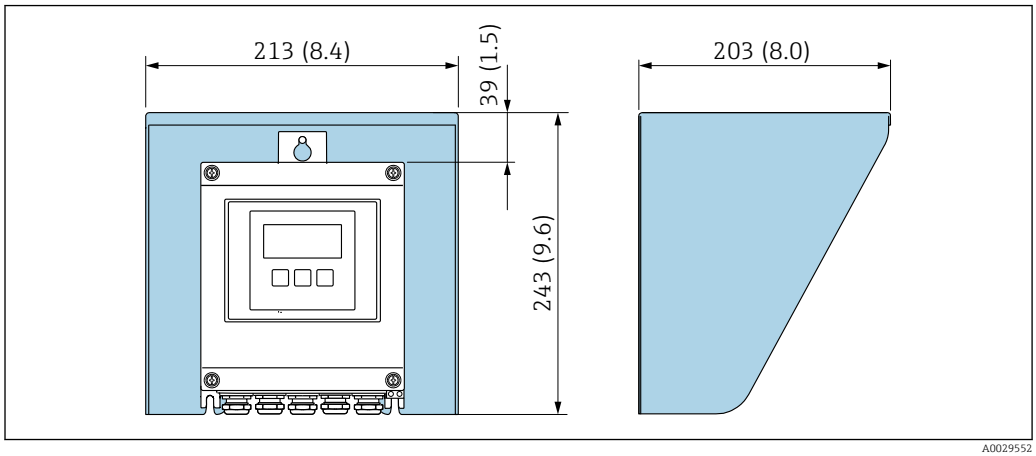
23 Two-path installation version

A [in]	B [in]	C [in]	D [°]	E [in]	F 1) [in]	G 1) [in]	H 1) [in]
ø 2.28	5.91	3.15	25	Measuring pipe outer diameter	Sensor distance	Path length	Arc length

1) Can be determined via Applicator or FieldCare

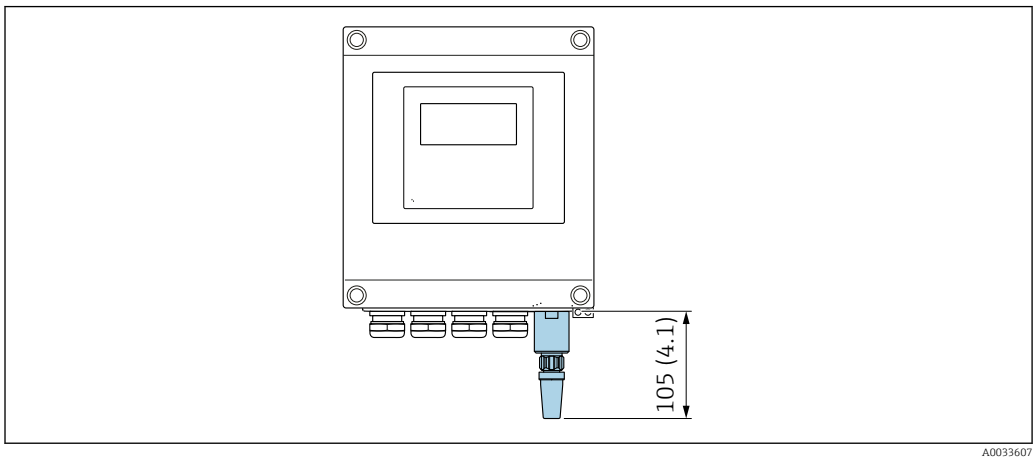
Accessories

Weather protection cover



24 Weather protection cover; engineering unit mm (in)

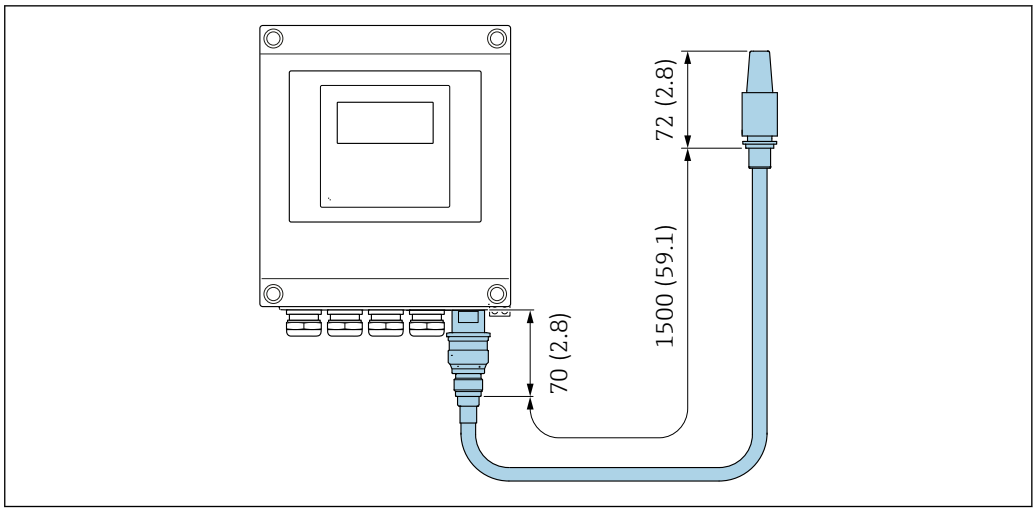
External WLAN antenna mounted on device



25 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.



26 Engineering unit mm (in)

Weight

Weight specifications exclusive of packaging material.

Transmitter

- Proline 400 polycarbonate plastic: 1.2 kg (2.65 lb)
- Proline 400 aluminum, coated: 6.0 kg (13.2 lb)

Sensor

Including mounting material

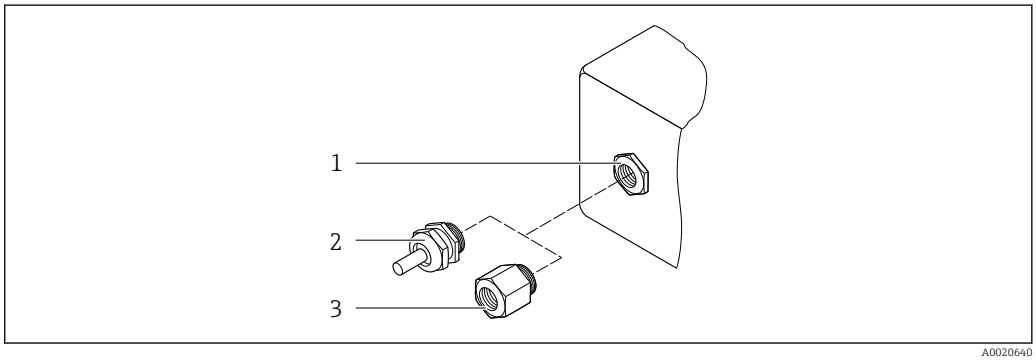
- Single path installation version: 4.5 kg (9.92 lb)
- Two path installation version: 9 kg (19.9 lb)

Materials

Remote version (wall-mount housing)

- Order code for "Housing", option **P** "Remote, alu, coated": Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **N**: polycarbonate plastic
- Window material:
  - For order code for "Housing", option **P**: glass
  - For order code for "Housing", option **N**: plastic

Cable entries/cable glands



27 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"

remote version

Cable entry/cable gland	Material
Cable gland M20 × 1.5	▪ Plastic ▪ Nickel-plated brass
Cable gland of sensor cable	Nickel-plated brass
Power cable gland	Plastic
Adapter for cable entry with female thread G ½" or NPT ½"	Nickel-plated brass

Sensor - transmitter cable

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

Sensor cable, TPE halogen-free
- Cable sheath: TPE halogen-free
- Cable plug: nickel-plated brass

Ultrasonic transducer

- Holder: stainless steel 1.4301 (304), 1.4404 (316L)
- Housing: stainless steel 1.4301 (304), 1.4404 (316L)

Accessories

External WLAN antenna

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

Display and user interface

Operation concept

Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnosis
- Expert level

Quick 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 reliability
- 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

Languages

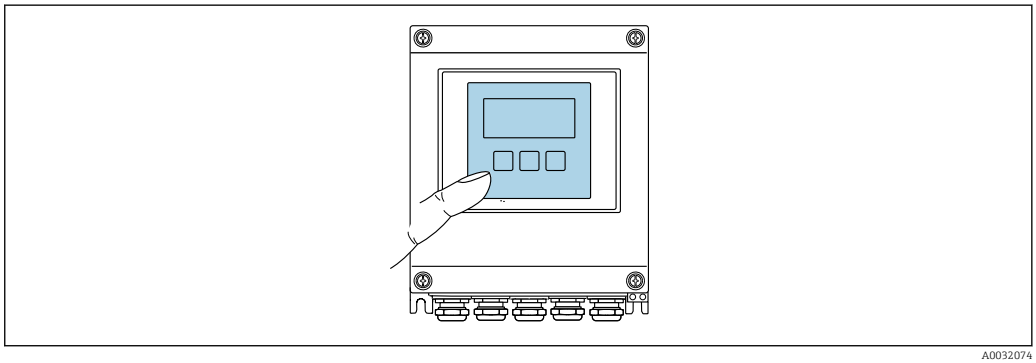
Can be operated in the following languages:
- Via local operation:
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool:
  English, German, French, Spanish, Italian, Chinese, Japanese
- Via Web browser (only available for device versions with HART, PROFIBUS DP and EtherNet/IP):
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish

Onsite operation

Via display module

Features:
- Standard features 4-line, illuminated, graphic display; touch control
- Order code for "Display; operation", option G "4-line, illuminated; touch control +WLAN" offers standard equipment features in addition to access via web browser

Information about WLAN interface → 49



A0032074

28 Operation with touch control

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

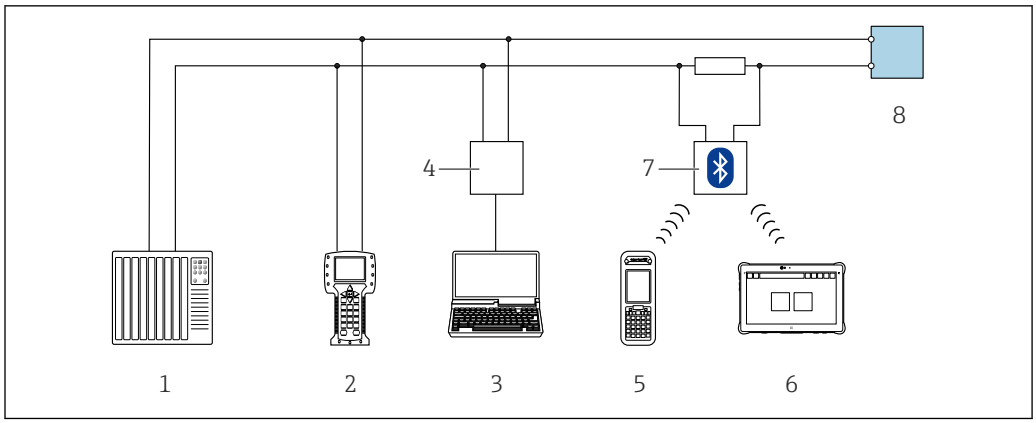
Operating elements

- 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.

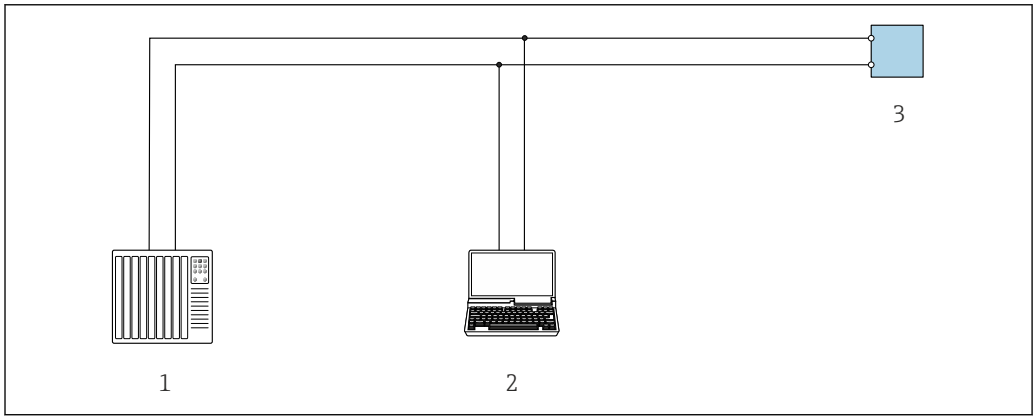


29 Options for remote operation via HART protocol

1 *Control system (e.g. PLC)*
2 *Field Communicator 475*
3 *Computer with operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
4 *Commubox FXA195 (USB)*
5 *Field Xpert SFX350 or SFX370*
6 *Field Xpert SMT70*
7 *VIATOR Bluetooth modem with connecting cable*
8 *Transmitter*

Via Modbus RS485 protocol

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



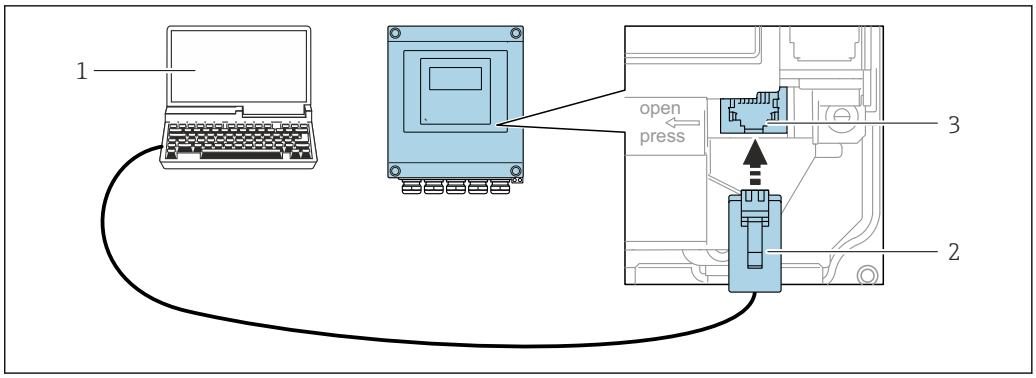
30 Options for remote operation via Modbus RS485 protocol (active)

1 *Control system (e.g. PLC)*
2 *Computer with web browser (e.g. Microsoft Edge) to access 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)

This communication interface is present in the following device version:
- Order code for "Output", option **H**: 4 to 20 mA HART, pulse/frequency output, switch output
- Order code for "Output", option **I**: 4 to 20 mA HART, 2 x pulse/frequency/switch output, status input
- Order code for "Output", option **M**: Modbus RS485
- Order code for "Output", option **O**: Modbus RS485, 4 to 20 mA, 2 x pulse/frequency/switch output

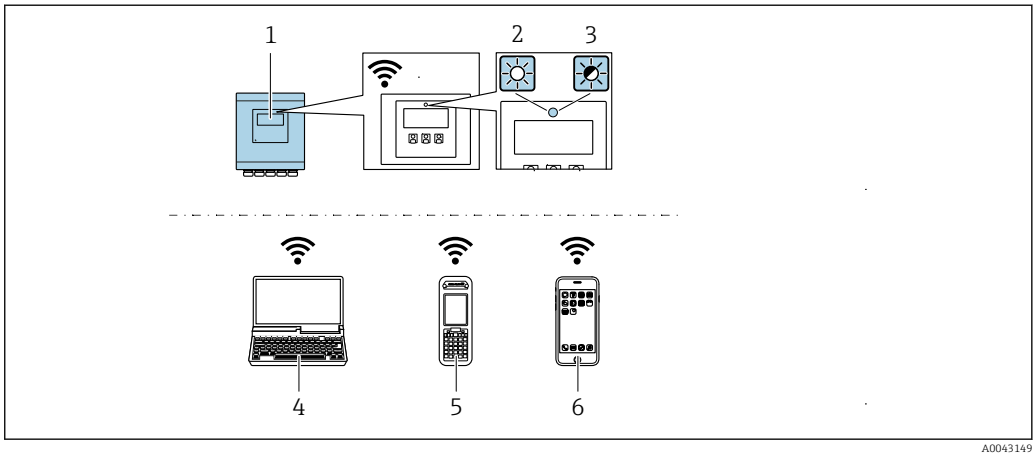


31 Connection via service interface (CDI-RJ45)

1 Computer with web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device web server or with operating tool "FieldCare", "DeviceCare" with COM DTM "CDI Communication TCP/IP" or Modbus DTM
2 Standard Ethernet connecting cable with RJ45 plug
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"



1 Transmitter with integrated WLAN antenna
2 LED lit constantly: WLAN reception is enabled on measuring device
3 LED flashing: WLAN connection established between operating unit and measuring device
4 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)
5 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)
6 Smart phone or tablet (e.g. Field Xpert SMT70)

Function	WLAN: IEEE 802.11 b/g (2.4 GHz) ▪ Access Point with DHCP server (factory setting) ▪ Network
Encryption	WPA2-PSK AES-128 (in accordance with IEEE 802.11i)
Configurable WLAN channels	1 to 11
Degree of protection	IP67
Available antenna	Internal antenna
Range	Typically 10 m (32 ft)

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	▪ CDI-RJ45 service interface ▪ WLAN interface	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 📄 56
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 📄 56
Field Xpert	SMT70/77/50	▪ All Fieldbus protocols ▪ WLAN interface ▪ Bluetooth ▪ CDI-RJ45 service interface	Operating Instructions BA01202S Device description files: Use update function of handheld terminal
SmartBlue app	Smart phone or tablet with iOs or Android	WLAN	→ 📄 56

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.process.honeywell.com
- FieldMate from Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

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

Web server

With the integrated web server, the device can be operated and configured via a web browser service interface (CDI-RJ45) or WLAN interface. The structure of the operating menu is the same as for the local display. In addition to the measured values, status information on the device is displayed and can be used to monitor device health. 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", 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 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 report (PDF file, only available with the **Heartbeat Verification** → 📄 53 application package)
- Flash firmware version for device firmware upgrade, for example
- Download driver for system integration
- Visualize up to 1000 saved measured values (only available with the **Extended HistoROM** application package→ 📄 53)

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.

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	▪ Event logbook, e.g. diagnostic events ▪ Device firmware package	▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Indicator (minimum/maximum values) ▪ Totalizer value	▪ Sensor data: e.g. ▪ Serial number ▪ Device configuration (e.g. SW options, fixed I/O or multi I/O)
Storage location	Fixed on the user interface PC board in the connection compartment	Can be plugged into the user interface PC board in the connection compartment	Fixed on the sensor connection board

Data backup

Automatically
- 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 goes into operation immediately, without any errors.
- If the sensor is replaced: Once the S-DAT has been replaced with new device data, the measuring device goes into operation immediately, without any errors.

Data transmission

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:
- Recording of 1 to 4 channels of up to 1 000 measured values (up to 250 measured values per channel)
- User configurable recording interval
- Export the measured value log via a variety of interfaces and operating tools e.g. FieldCare, DeviceCare or web server

Certificates and approvals

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

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

3. Select **Downloads**.

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.

UKCA marking

The device meets the legal requirements of the applicable UK regulations (Statutory Instruments). These are listed in the UKCA Declaration of Conformity along with the designated standards. By selecting the order option for UKCA marking, Endress+Hauser confirms a successful evaluation and testing of the device by affixing the UKCA mark.

Contact address Endress+Hauser UK:
Endress+Hauser Ltd.
Floats Road
Manchester M23 9NF
United Kingdom
www.uk.endress.com

RCM marking

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

Ex-approval

The devices are certified for use in hazardous areas and the relevant safety instructions are provided in the separate "Control Drawing" document. This is referenced on the nameplate.

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)

Modbus RS485 certification

The measuring device meets all the requirements of the MODBUS RS485 conformity test and has the "MODBUS RS485 Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out.

Radio approval

The measuring device has radio approval.

For detailed information on the radio approval, see the Special Documentation → 57

External standards and guidelines

- EN 60529
  Degrees of protection provided by enclosure (IP code)
- EN 61010-1
  Safety requirements for electrical equipment for measurement, control and laboratory use - general requirements
- IEC/EN 61326-2-3
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements).
- ANSI/ISA-61010-1 (82.02.01)
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- CAN/CSA-C22.2 No. 61010-1-12
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General 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
- ETSI EN 300 328
  Guidelines for 2.4 GHz radio components.
- EN 301489
  Electromagnetic compatibility and radio spectrum matters (ERM).

Ordering information

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

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

Product Configurator - the tool for individual product configuration
- Up-to-the-minute configuration data
- Depending on the device: Direct input of 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 → 57

Diagnostic functionality

Order code for "Application package", option EA "Extended HistoROM"

Comprises extended functions concerning the event log and the activation of the measured value memory.

Event log:
Memory volume is extended from 20 message entries (standard version) to up to 100 entries.

Data logging (line recorder):
- 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.

For detailed information, see the Operating Instructions for the device.

Heartbeat Technology

Order code for "Application package", option EB "Heartbeat Verification + Monitoring"

Heartbeat Verification
Meets the requirement for traceable verification to DIN ISO 9001:2008 Chapter 7.6 a) "Control of monitoring and measuring equipment".
- 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.

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:
- 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 .

For detailed information, see the Special Documentation for the device.

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 Prosonic Flow 400	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output / input ▪ Display/operation ▪ Housing ▪ Software For details, see Installation Instructions EA00104D
Post mounting kit	Post mounting kit for transmitter.
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Order number: 71343504 Installation Instructions EA01191D

External WLAN antenna	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". ▪ The external WLAN antenna is not suitable for use in hygienic applications. ▪ Additional information regarding the WLAN interface → 🖹 49. Order number: 71351317 Installation Instructions EA01238D
Sensor cable Proline 400 Sensor – transmitter	The sensor cable can be ordered directly with the measuring device (order code for "Cable") or as an accessory (order number DK9017). The following cable lengths are available: Temperature: –40 to +80 °C (–40 to +176 °F) ▪ Option AA: 5 m (15 ft) ▪ Option AB: 10 m (30 ft) ▪ Option AC: 15 m (45 ft) ▪ Option AD: 30 m (90 ft) Possible cable length for a Proline 400 sensor cable: max. 30 m (90 ft)

For the sensor

Accessories	Description
Sensor set (DK9018)	Sensor set 1 MHz (I-100)
Sensor holder set (DK9014)	Sensor holder set 1 MHz
Installation set (DK9016)	▪ Installation set, DN200-DN1800, 8"-72" ▪ Installation set, DN1800-DN4000, 72"-160"
Conduit adapter set (DK9003)	▪ Conduit adapter M20x1.5 + sensor cable gland ▪ Conduit adapter NPT1/2" + sensor cable gland ▪ Conduit adapter G1/2" + sensor cable gland

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB port Technical Information TI00404F
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop. Technical Information TI405C/07
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. ▪ Technical Information TI00429F ▪ Operating Instructions BA00371F
Wireless HART adapter SWA70	Is used for the wireless connection of field devices. The WirelessHART adapter can be easily integrated into field devices and existing infrastructures, offers data protection and transmission safety and can be operated in parallel with other wireless networks with minimum cabling complexity. Operating Instructions BA00061S
Fieldgate FXA42	Transmission of the measured values of connected 4 to 20 mA analog measuring devices, as well as digital measuring devices ▪ Technical Information TI01297S ▪ Operating Instructions BA01778S ▪ Product page: www.endress.com/fxa42

Field Xpert SMT50	The Field Xpert SMT50 table PC for device configuration enables mobile plant asset management. It is suitable for commissioning and maintenance staff to manage field instruments with a digital communication interface and to record progress. 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. ▪ Technical Information TI01555S ▪ Operating Instructions BA02053S ▪ Product page: www.endress.com/smt50
Field Xpert SMT70	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. 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. ▪ Technical Information TI01342S ▪ Operating Instructions BA01709S ▪ Product page: www.endress.com/smt70
Field Xpert SMT77	The Field Xpert SMT77 tablet PC for device configuration enables mobile plant asset management in areas categorized as Ex Zone 1. ▪ Technical Information TI01418S ▪ Operating Instructions BA01923S ▪ Product page: www.endress.com/smt77

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ 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. Applicator is available: ▪ Via the Internet: https://portal.endress.com/webapp/applicator ▪ As a downloadable DVD for local PC installation.
Netilion	IIoT ecosystem: Unlock knowledge Endress+Hauser 's Netilion IIoT ecosystem enables you to optimize your plant performance, digitize workflows, share knowledge and improve collaboration. Based on decades of experience in process automation, Endress+Hauser offers the process industry an IIoT ecosystem that enables you to gain useful insights from data. This knowledge can be used to optimize processes, leading to higher plant availability, efficiency and reliability, and ultimately to a more profitable plant. www.netilion.endress.com
FieldCare	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. Operating Instructions BA00027S and BA00059S
DeviceCare	Tool to connect and configure Endress+Hauser field devices. Innovation brochure IN01047S
Commubox FXA291	Connects Endress+Hauser field devices with a CDI interface (= Endress +Hauser Common Data Interface) and the USB port of a computer or laptop. Technical Information TI00405C

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. ▪ Technical Information TI00133R ▪ Operating Instructions BA00247R

Supplemental documentation

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

Standard documentation

Supplementary information on the semi-standard options is available in the relevant Special Documentation in the TSP database.

Brief operating instructions

Brief Operating Instructions for the sensor

Measuring device	Documentation code
Proline Prosonic Flow I	KA01511D

Brief operating instructions for transmitter

Measuring device	Documentation code	
	HART	Modbus RS485
Proline 400	KA01510D	KA01660D

Operating instructions

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow I 400	BA02085D	BA02303D

Description of device parameters

Measuring device	Documentation code	
	HART	Modbus RS485
Prosonic Flow I 400	GP01166D	GP01208D

Device-dependent additional documentation

Special documentation

Content	Documentation code	
	HART	Modbus RS485
Radio approvals for WLAN interface for A309/A310 display module	SD01793D	
Heartbeat Technology	SD02712D	SD03132D

Installation instructions

Contents	Note
Installation instructions for spare part sets and accessories	Documentation code: specified for each individual accessory → 54.

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