Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promag P 200

Electromagnetic flow measuring system
The device with genuine two-wire technology and for minimized cost of ownership

Application

- Accurate bidirectional measurement of liquids with a minimum conductivity of ≥ 20 µS/cm for chemical applications.
- The electromagnetic measuring principle is unaffected by pressure and temperature. Additionally the flow profile has a minimal effect on the measurement results.

Device properties
- Medium temperature: max. +150 °C (+302 °F)
- Nominal diameter: DN 15 to 200 (1/2 to 8")
- Application-specific liner (PFA, PTFE)
- Two-wire aluminium transmitter
- Graphical local display with operation from the outside (Touch Control)
- Communication via 4-20 mA HART
- Ex approvals accepted worldwide: ATEX, IECEx cCSAus (intrinsic safety or flameproof enclosure)

Your benefits

Genuine loop-powered technology for seamless 2-wire integration and robustness in standard process applications

Sizing – correct product selection
Applicator– the reliable, easy-to-use tool for selecting and sizing measuring devices for every application

Installation – simple and efficient
- Compact design
- Suitable for installations in the hazardous area
- Reduced wiring effort due to two-wire technology

Commissioning – reliable and intuitive
Guided parameterization – "Make-it-run" wizards

Operation – increased measurement availability
- Measurement of volume flow
- No pressure loss, no moving parts, immune to vibrations
- Diagnostics; Automatic data restore by HistoROM

Cost-effective Life Cycle Management by W@M

TI01062D/06/EN/01.12
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Endress+Hauser
People for Process Automation

Table of contents

Document information

Symbols used

Electrical symbols

Symbol	Meaning
A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
A0017381	**Direct current and alternating current** ■ A terminal to which alternating voltage or DC voltage is applied. ■ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.

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
A0013441	Flow direction

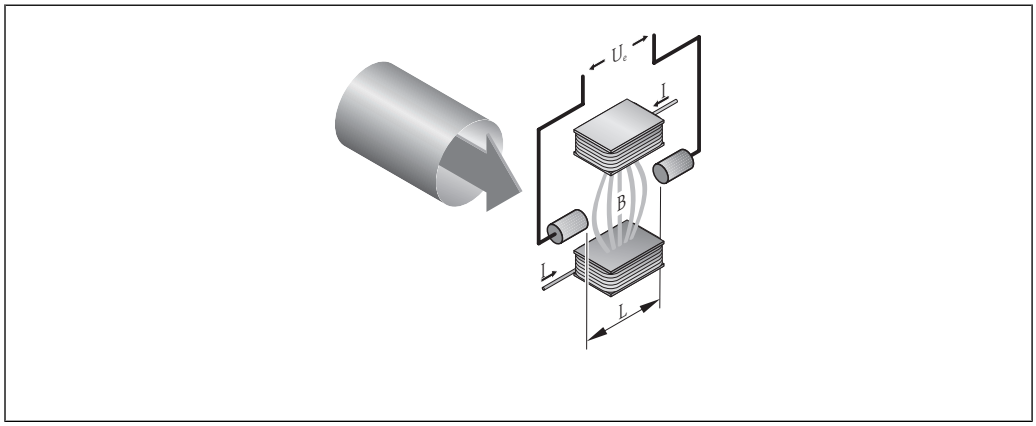
Symbol	Meaning
A0011187	**Hazardous area** Indicates a hazardous area.
A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated via the pipe cross-sectional area. The DC magnetic field is created through a switched direct current of alternating polarity.



A0017035

1 $Ue = B \cdot L \cdot v \quad ; \quad Q = A \cdot v$

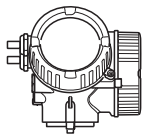
Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
v *Flow velocity*
Q *Volume flow*
A *Piping cross-section*
I *Current*

Measuring system

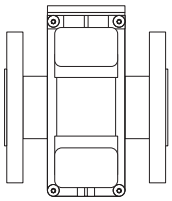
The device consists of a transmitter and a sensor.

One device version is available: compact version, transmitter and sensor form a mechanical unit.

Transmitter

Promag 200  A0013471	Materials: Aluminum coating AlSi10Mg 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)

Sensor

Promag P  A0017703	Nominal diameter range: DN 15 to 200 (½ to 8") Materials: ■ Sensor housing: aluminum coated AlSi10Mg ■ Measuring tubes: stainless steel 1.4301/304, 1.4306/304L ■ Liner: PFA, PTFE ■ Process connections: 1.0425/316L, 1.4571/316L, A105, C22, F316L, FE 410W B, HII, S235JRG2 ■ Electrodes: 1.4435/316L, Alloy C-22, tantalum, platinum ■ Seals: as per DIN EN 1514-1 ■ Ground disks: 1.4435/316L, Alloy C-22, tantalum

Input

Measured variable

Direct measured variables

Volume flow (proportional to induced voltage)

Calculated measured variables

Mass flow

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.310 m/s/	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
32	–	15 to 500	125	1	2
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1 200	10	20
125	–	220 to 7 500	1 850	15	30

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.310 m/s/	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
150	6	20 to 600 m³/h	150 m³/h	0.03 m³	2.5 m³/h
200	8	35 to 1 100 m³/h	300 m³/h	0.05 m³	5 m³/h

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
½	15	1.0 to 27	6	0.05	0.10
1	25	2.5 to 80	18	0.2	0.25
–	32	4 to 130	30	0.2	0.5
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
–	65	16 to 500	130	1	2
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
–	125	60 to 1 950	450	5	7
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1 200	10	15

To calculate the measuring range, use the *Applicator* sizing tool (→ 37)

Recommended measuring range

"Flow limit" section (→ 25)

Operable flow range

Over 1000 : 1

Output

Output signal

Current output

Current output	4-20 mA HART (passive)
Resolution	< 1 µA
Damping	Adjustable:0.0 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	■ DC 35 V ■ 50 mA For information on the Ex connection values (→ 9)
Voltage drop	■ For ≤ 2 mA: 2 V ■ For 10 mA: 8 V
Residual current	≤ 0.05 mA
Pulse output	
Pulse width	Adjustable:5 to 2 000 ms
Maximum pulse rate	100 Impulse/s
Pulse value	Adjustable
Assignable measured variables	■ Volume flow ■ Mass flow
Frequency output	
Output frequency	Adjustable:0 to 1 000 Hz
Damping	Adjustable:0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	■ Volume flow ■ Mass flow
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable:0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	■ Off ■ On ■ Diagnostic behavior ■ Limit value – Volume flow – Mass flow ■ Flow direction monitoring ■ Status – Empty pipe detection – Low flow cut off

Signal on alarm

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

Current output

4-20 mA

Failure mode	Selectable (as per NAMUR recommendation NE 43): ■ Minimum value: 3.6 mA ■ Maximum value: 22 mA ■ Defined value:3.59 to 22.5 mA ■ Actual value ■ Last valid value

HART

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

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ■ Actual value ■ No pulses
Frequency output	
Failure mode	Choose from: ■ Actual value ■ Defined value:0 to 1 250 Hz ■ 0 Hz
Switch output	
Failure mode	Choose from: ■ Current status ■ Open ■ Closed

Local display

Plain text display	With information on cause and remedial measures
Backlight	Additionally for device version with SD03 local display: red lighting indicates a device error.

Status signal as per NAMUR recommendation NE 107

Operating tool

- Via digital communication: HART protocol
- Via service interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation (→ 33)

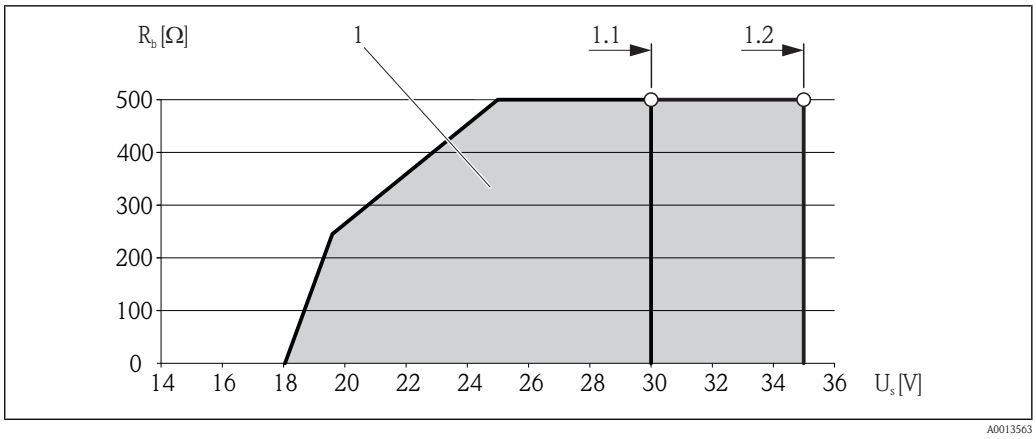
Load

Load for current output: 0 to 500 Ω, depending on the external supply voltage of the power supply unit

Calculation of the maximum load

Depending on the supply voltage of the power supply unit (U_S), the maximum load (R_B) including line resistance must be observed to ensure adequate terminal voltage at the device. In doing so, observe the minimum terminal voltage (→ 11)

- For U_S = 18 to 18.9 V: $R_B \leq (U_S - 18\ V) : 0.0036\ A$
- For U_S = 18.9 to 24.5 V: $R_B \leq (U_S - 13.5\ V) : 0.022\ A$
- For U_S = 24.5 to 30 V: $R_B \leq 500\ \Omega$



1 Operating range
1.1 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with Ex i
1.2 For order code for "Output", option A "4-20 mA HART"/option B "4-20 mA HART, pulse/frequency/switch output" with non-Ex and Ex d

Sample calculation
Supply voltage of the power supply unit: U_S =19 V
Maximum load: $R_B \leq$ (19 V - 13.5 V) : 0.022 A = 250 Ω

Ex connection data

Safety-related values

Ex d type of protection

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20 mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20 mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

1) Internal circuit limited by R_i = 760.5 Ω

Ex nA type of protection

Order code for "Output"	Output type	Safety-related values
Option **A**	4-20 mA HART	U_{nom} = DC 35 V U_{max} = 250 V
Option **B**	4-20 mA HART	U_{nom} = DC 35 V U_{max} = 250 V
	Pulse/frequency/switch output	U_{nom} = DC 35 V U_{max} = 250 V P_{max} = 1 W [1)]

1) Internal circuit limited by R_i = 760.5 Ω

Intrinsically safe values

Type of protection Ex ia

Order code for "Output"	Output type	Intrinsically safe values
Option **A**	4-20 mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF
Option **B**	4-20 mA HART	U_i = DC 30 V I_i = 300 mA P_i =1 W L_i = 0 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF

IS type of protection

Order code for "Output"	Output type	Intrinsically safe values
Option **A**	4-20 mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF
Option **B**	4-20 mA HART	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 5 nF
	Pulse/frequency/switch output	U_i = DC 30 V I_i = 300 mA P_i = 1 W L_i = 0 µH C_i = 6 nF

Low flow cut off

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

Galvanic isolation

All outputs are galvanically isolated from one another.

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x48
HART protocol revision	6.0
Device description files (DTM, DD)	Information and files under: www.endress.com

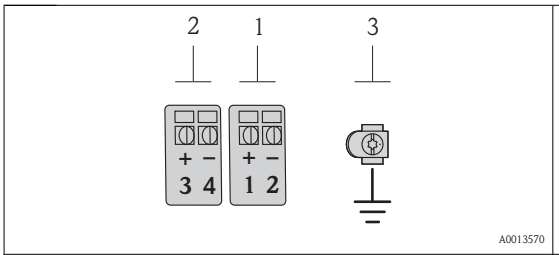
HART load	■ Min. 250 Ω ■ Max.500 Ω
Dynamic variables	The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ■ Volume flow ■ Mass flow **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ■ Volume flow ■ Mass flow ■ Totalizer 1 ■ Totalizer 2 ■ Totalizer 3

Power supply

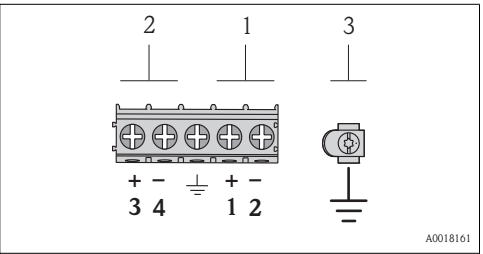
Terminal assignment

Transmitter

4-20 mA HART connection version with additional outputs



Maximum number of terminals, without integrated overvoltage protection



Maximum number of terminals, with integrated overvoltage protection

1 Output 1 (passive): supply voltage and signal transmission
2 Output 2 (passive): supply voltage and signal transmission
3 Ground terminal for cable shield

Order code for "Output"	Terminal numbers			
	Output 1		Output 2	
	1 (+)	2 (-)	3 (+)	4 (-)
Option **A**	4-20 mA HART (passive)		-	
Option **B**[1)]	4-20 mA HART (passive)		Pulse/frequency/switch output (passive)	

1) Output 1 must always be used; output 2 is optional.

Supply voltage

An external power supply is required for each output. The following supply voltage values apply for the 4-20 mA HART current output:

Order code for "Output"	Minimum terminal voltage[1) 2)]	Maximum terminal voltage
■ Option **A**: 4-20 mA HART ■ Option **B**: 4-20 mA HART, pulse/ frequency/switch output	For 4 mA: ≥ DC18 V For 20 mA: ≥ DC14 V	DC 35 V

1) External supply voltage of the power supply unit with load (→ 8)
2) For device versions with local display SD03: The terminal voltage must be increased by DC 2 V if backlighting is used.

For information on the Ex connection values (→ 9)

Various power supply units can be ordered from Endress+Hauser: see "Accessories" section (→ 37)

Power consumption

Transmitter

Order code for "Power supply"	Maximum power consumption
Option **A**: 4-20 mA HART	770 mW
Option **B**: 4-20 mA HART, pulse/frequency/switch output	■ Operation with output 1:770 mW ■ Operation with output 1 and 2:2 770 mW

For information on the Ex connection values (→ 9)

Current consumption

For 4-20 mA or 4-20 mA HART current output: 3.6 to 22.5 mA

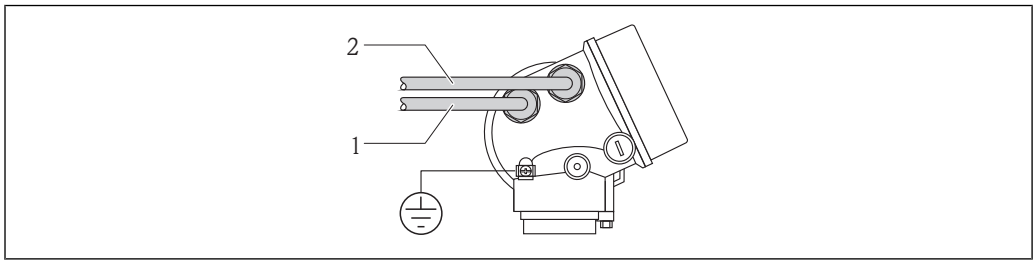
If the option **Defined value** is selected in the **Failure mode** parameter (→ 7): 3.59 to 22.5 mA

Power supply failure

- Totalizers stop at the last value measured.
- Configuration is retained in the device memory (HistoROM).
- Error messages (incl. total operated hours) are stored.

Electrical connection

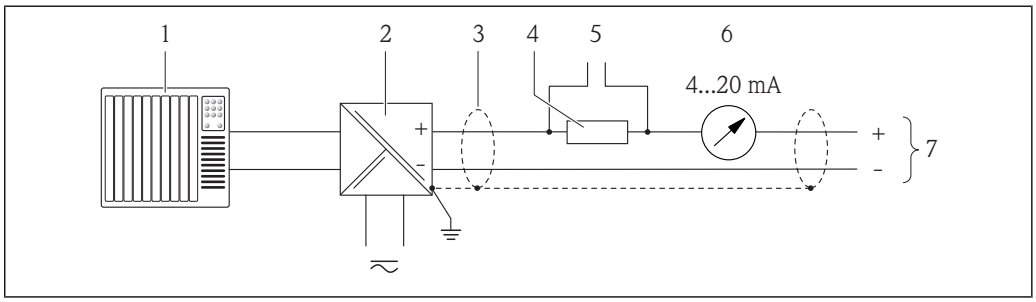
Connecting the transmitter



A0015510

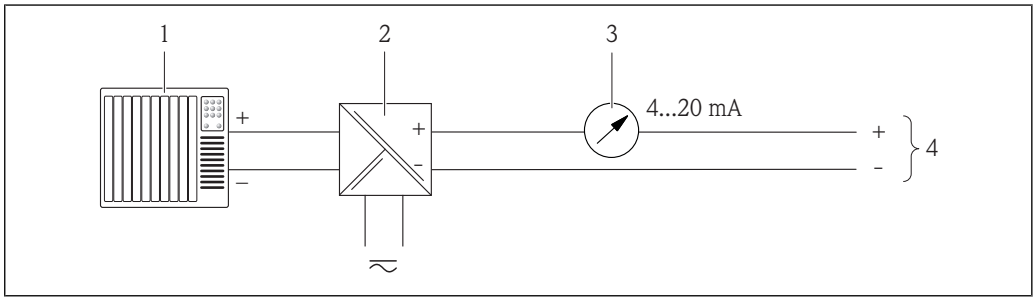
1 Cable entry for output 1
2 Cable entry for output 2

Connection examples



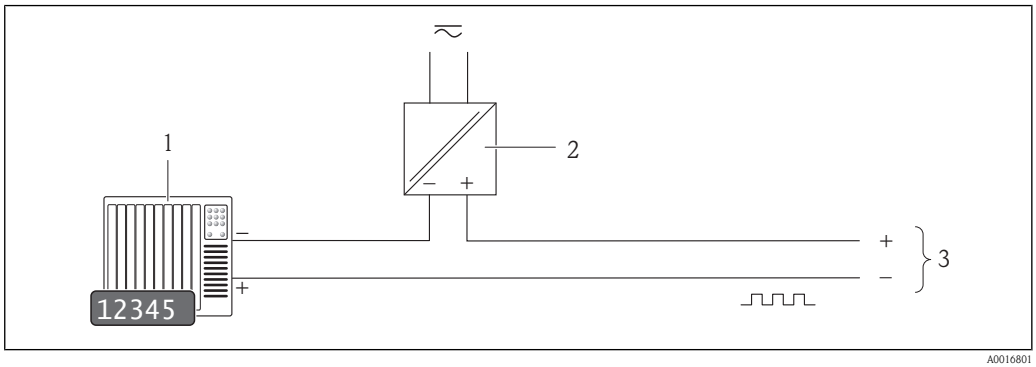
2 Connection example for 4-20 mA HART current output (passive)

1 *Automation system with current input (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N) (→ 16)*
3 *Observe cable specification (→ 16)*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)*
5 *Connection for HART operating devices (→ 33)*
6 *Analog display unit: observe maximum load (→ 8)*
7 *Transmitter*



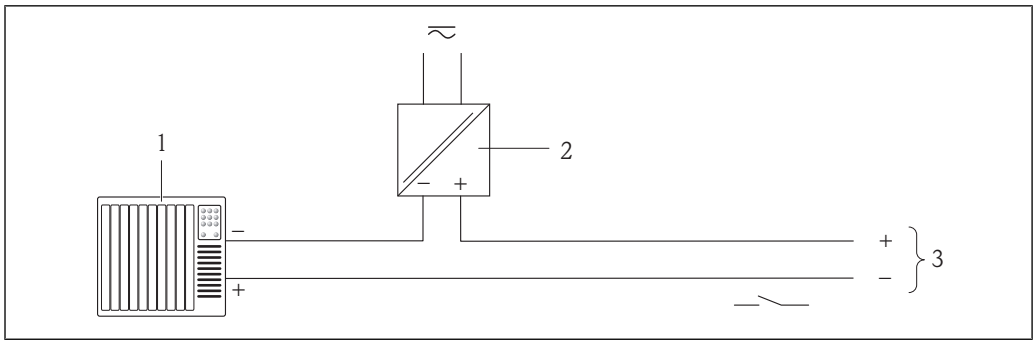
3 Connection example for 4-20 mA current output (passive)

1 *Automation system with current input (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N) (→ 11)*
3 *Analog display unit: observe maximum load (→ 8)*
4 *Transmitter*



4 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 (→ 7)*



5 *Connection example for switch output (passive)*

1 Control system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values (→ 7)

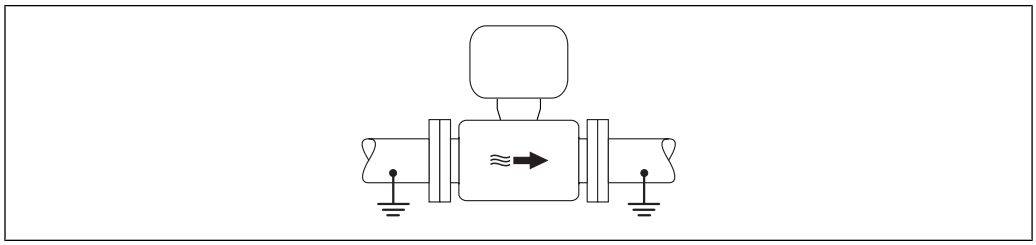
Potential equalization

Requirements

Please consider the following to ensure correct measurement:
- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding

Connection examples for standard situations

Metal, grounded pipe

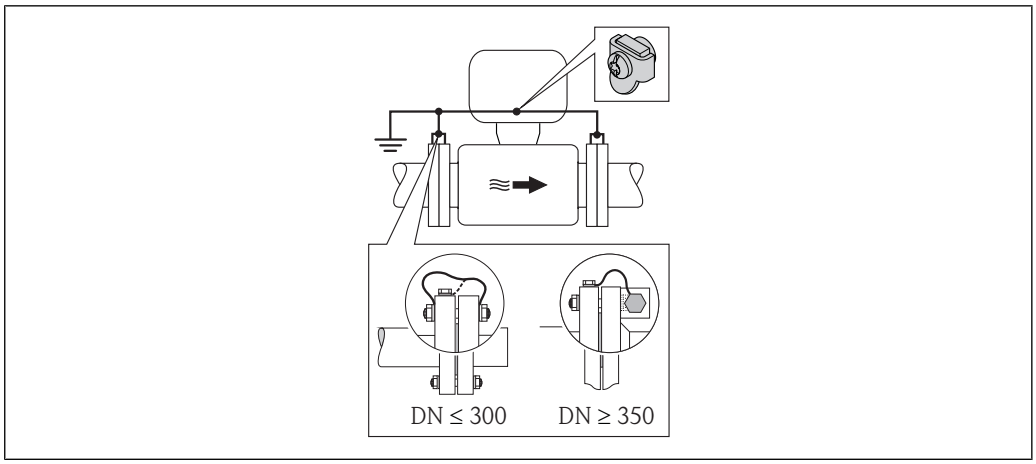


6 *Potential equalization via measuring tube*

Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present



7 *Potential equalization via ground terminal and pipe flanges*

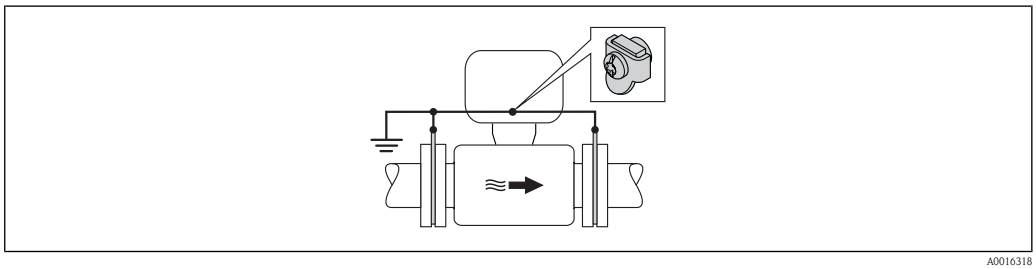
Note the following when installing:
- Connect both sensor flanges to the pipe flange via a ground cable and ground them.
- Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose.To mount the ground cable:
  - If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
  - If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket.

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

The necessary ground cable can be ordered from Endress+Hauser (→ 36).

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present



8 *Potential equalization via ground terminal and ground disks*

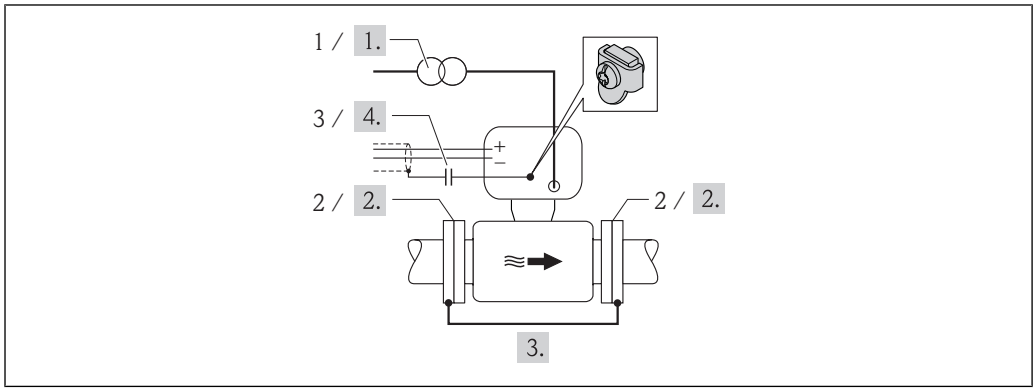
Note the following when installing:
The ground disks must be connected to the ground terminal via the ground cable and be connected to ground potential.

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

The ground cable and ground disks can be ordered from Endress+Hauser (→ 36).

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:
- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment



9 *Potential equalization and cathodic protection*

1 Isolation transformer power supply
2 Electrically isolated from the pipe
3 Capacitor

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

1. Connect the measuring device to the power supply such that it is floating in relation to the protective ground.
2. Install the sensor in the pipe in a way that provides electrical insulation.
3. Connect the two flanges of the pipe to one another via a ground cable.
4. Guide the shield of the signal lines through a capacitor.

The necessary ground cable can be ordered from Endress+Hauser (→ 36).

Terminals

- For device version without integrated overvoltage protection: plug-in spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)
- For device version with integrated overvoltage protection: screw terminals for wire cross-sections 0.2 to 2.5 mm² (24 to 14 AWG)

Cable entries

- Cable gland (not for Ex d): M20 × 1.5 with cable ∅ 6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - For non-Ex and Ex: NPT ½"
  - For non-Ex and Ex (not for CSA Ex d/XP): G ½"
  - For Ex d: M20 × 1.5

Cable specification

Permitted temperature range

- –40 °C (–40 °F)...≥ 80 °C (176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature + 20 K

Signal cable

Current output

- For 4-20 mA: standard installation cable is sufficient.
- For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

Overvoltage protection

The device can be ordered with integrated overvoltage protection for several approvals:
Order code for "Accessory mounted", option **NA** "overvoltage protection"

Input voltage range	Values correspond to supply voltage specifications (→ 11) [1]
Resistance per channel	2 · 0.5 Ω max
DC sparkover voltage	400 to 700 V
Trip surge voltage	< 800 V
Capacitance at 1 MHz	< 1.5 pF
Nominal discharge current (8/20 µs)	10 kA
Temperature range	–40 to +85 °C (–40 to +185 °F)

1) The voltage is reduced by the amount of the internal resistance $I_{min} \cdot R_i$

Depending on the temperature class, restrictions apply to the ambient temperature for device versions with overvoltage protection .

Performance characteristics

Reference operating conditions

To DIN EN 29104
- Fluid temperature: +28 ± 2 °C (+82 ± 4 °F)
- Ambient temperature range: +22 ± 2 °C (+72 ± 4 °F)
- Warm-up period: 30 min

Installation
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

To calculate the measuring range, use the *Applicator* sizing tool (→ 37)

Maximum measured error

Accuracy of outputs

o.r. = of reading; o.f.s. = of full scale value

Current output

Accuracy	±10 µA

Pulse/frequency output

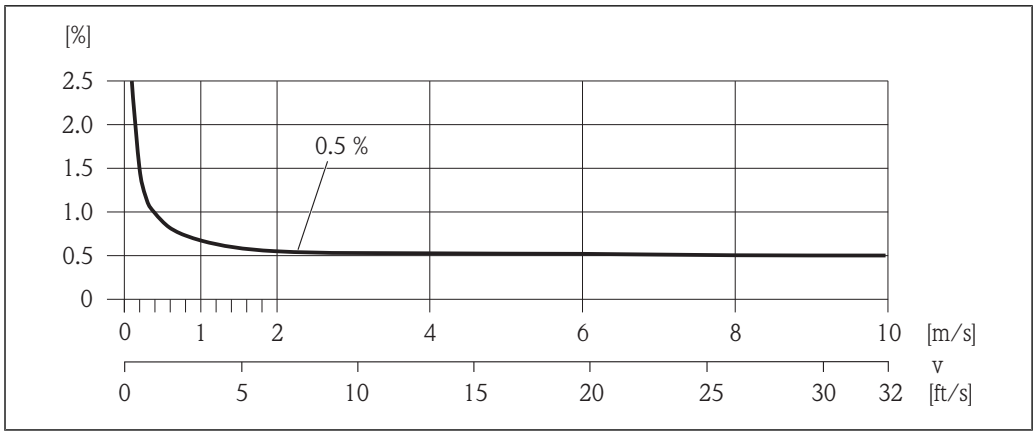
Accuracy	Max. ±100 ppm o.r.

Error limits under reference operating conditions

o.r. = of reading

Pulse output
±0.5 % o.r.±2 mm/s (0.08 in/s)

Fluctuations in the supply voltage do not have any effect within the specified range.



10 Maximum measured error in % o.r.

Repeatability

o.r. = of reading

max. ±0.2 % o.r. ±2 mm/s (0.08 in/s)

Influence of ambient temperature

o.r. = of reading; o.f.s. = of full scale value

Current output

Additional error, in relation to the span of 16 mA:

Temperature coefficient at zero point (4 mA)	0.02 %/10 K, max. 0.35 % over the entire temperature range –40 to +60 °C (–40 to +140 °F)
Temperature coefficient with span (20 mA)	0.05 %/10 K, max. 0.5 % over the entire temperature range –40 to +60 °C (–40 to +140 °F)

Pulse/frequency output

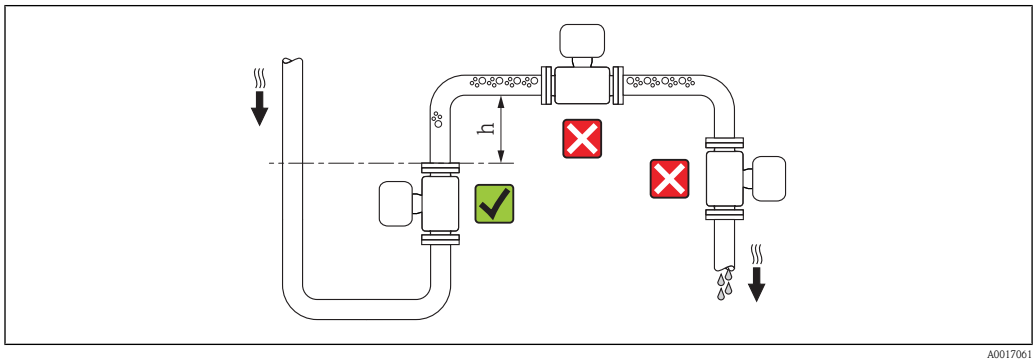
Temperature coefficient	Max. ±100 ppm o.r.

Installation

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

Mounting location

Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h = ≥ 2 × DN

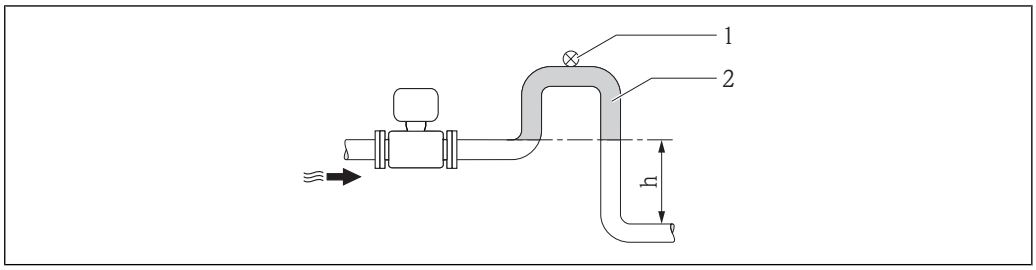


To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime, which could cause air pockets.

For information on the liner's resistance to partial vacuum (→ 25)



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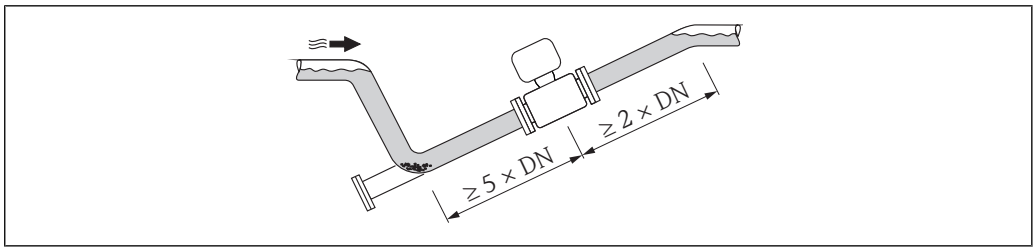
11 Installation in a down pipe

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.

- Do not install the sensor at the lowest point in the drain: risk of solids accumulating.
- It is advisable to install a cleaning valve.



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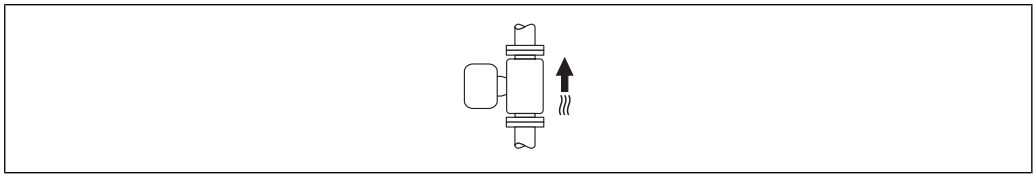
Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).
An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

The measuring device also offers the empty pipe detection function to detect partially empty measuring pipes at outgassing fluids or applications with variable process pressures.

Vertical

This is the optimum orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.

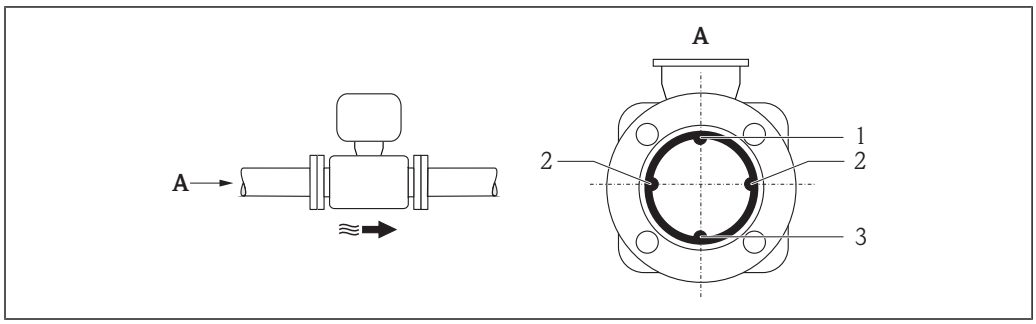


A0015591

Horizontal

The measuring electrode plane must be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

With horizontal orientation, empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.



A0016260

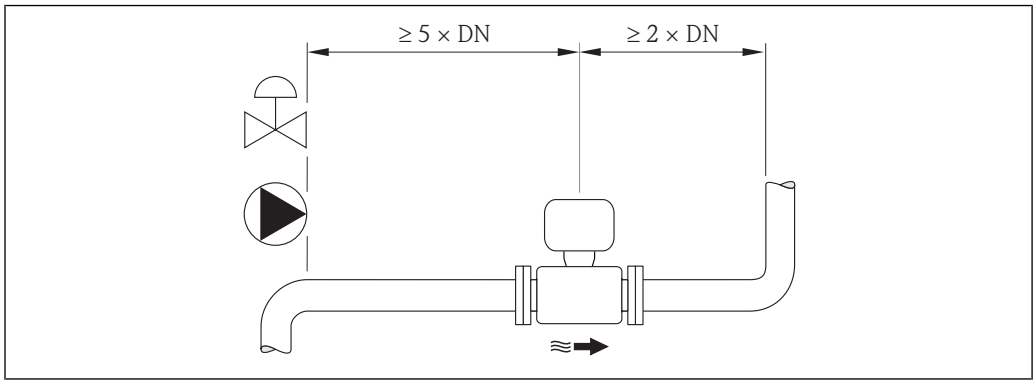
12 Horizontal orientation

1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:
- Inlet run ≥ 5 × DN
- Outlet run ≥ 2 × DN



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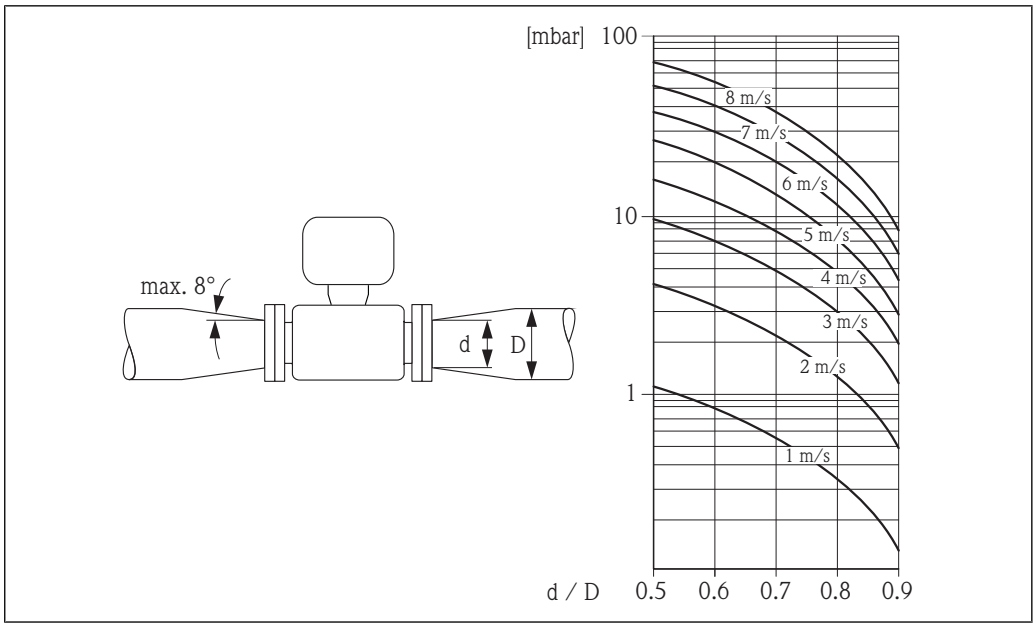
Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids.

The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders:
- Calculate the ratio of the diameters d/D.
- From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

The nomogram only applies to liquids with a viscosity similar to that of water.



Special mounting instructions

Weather protection cover

To ensure that the optional weather protection cover can be easily opened, maintain the following minimum head clearance: 350 mm (13.8 in)

Environment

Ambient temperature range

Transmitter	–40 to +60 °C (–40 to +140 °F)
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	■ Flange material carbon steel: –10 to +60 °C (+14 to +140 °F) ■ Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)
Liner	Do not exceed or fall below the permitted temperature range of the liner (→ 22).

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

Weather protection covers can be ordered from Endress+Hauser: see "Accessories" section (→ 36)

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Degree of protection

Transmitter
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP22, type 1 enclosure

Sensor
IP66/67, type 4X enclosure

Shock resistance

As per IEC/EN 60068-2-31

Vibration resistance

Acceleration up to 2 g following IEC 60068-2-6

Mechanical load

- Protect the transmitter housing against mechanical effects, such as shock or impact.
- Never use the transmitter housing as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

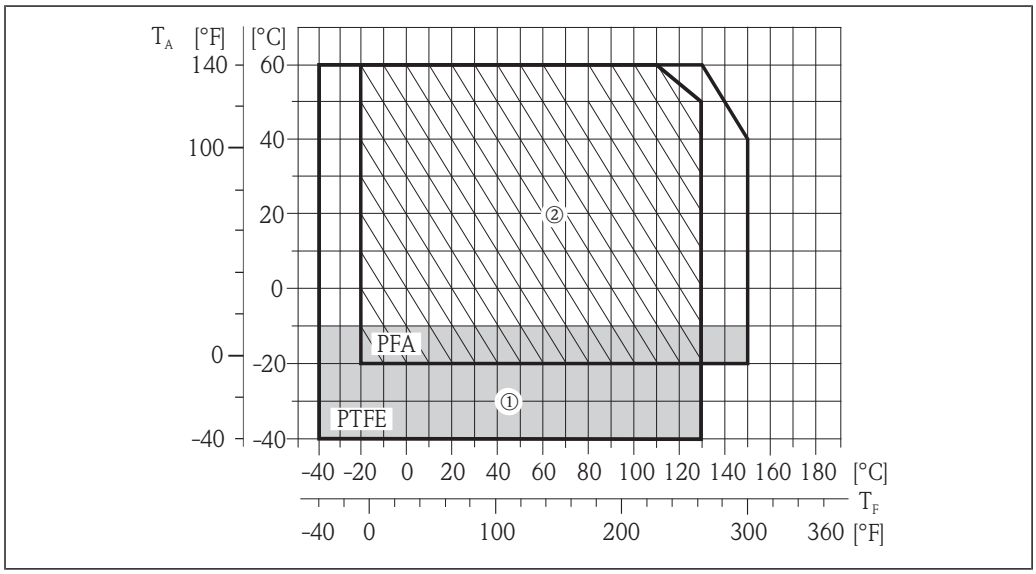
As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)

Details are provided in the Declaration of Conformity.

Process

Medium temperature range

- –20 to +150 °C (–4 to +302 °F) for PFA
- –40 to +130 °C (–40 to +266 °F) for PTFE



T_A Ambient temperature

T_F Medium temperature

① Area shaded in gray: the ambient temperature range of –10 to –40 °C (–14 to –40 °F) applies to stainless flanges only

② Harsh environment and IP68 only to +130 °C (+266 °F)

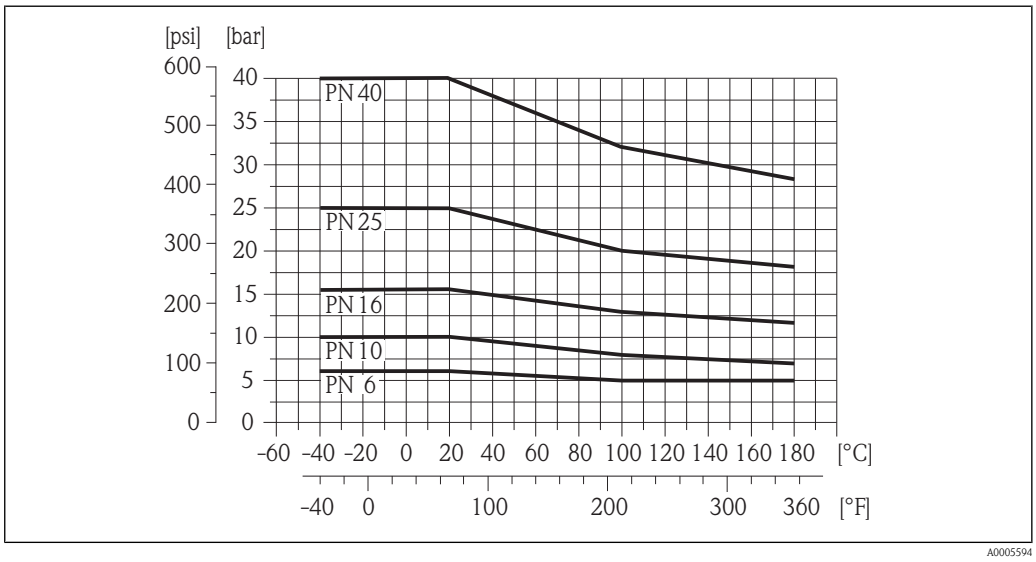
Conductivity

≥ 20 µS/cm for liquids in general

Pressure-temperature ratings

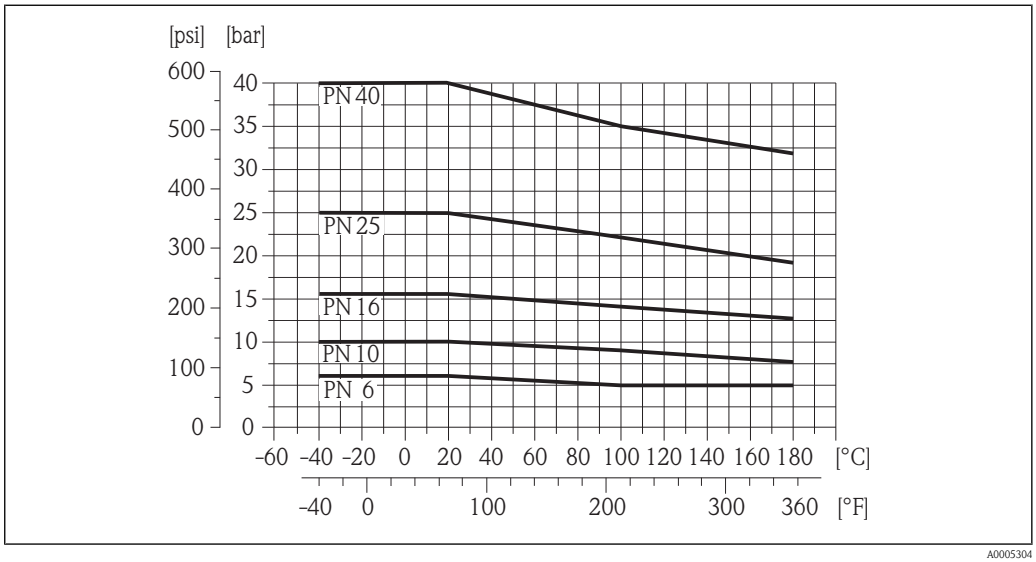
The following material load diagrams refer to the entire device and not just the process connection.

Flange connection according to EN 1092-1 (DIN 2501)



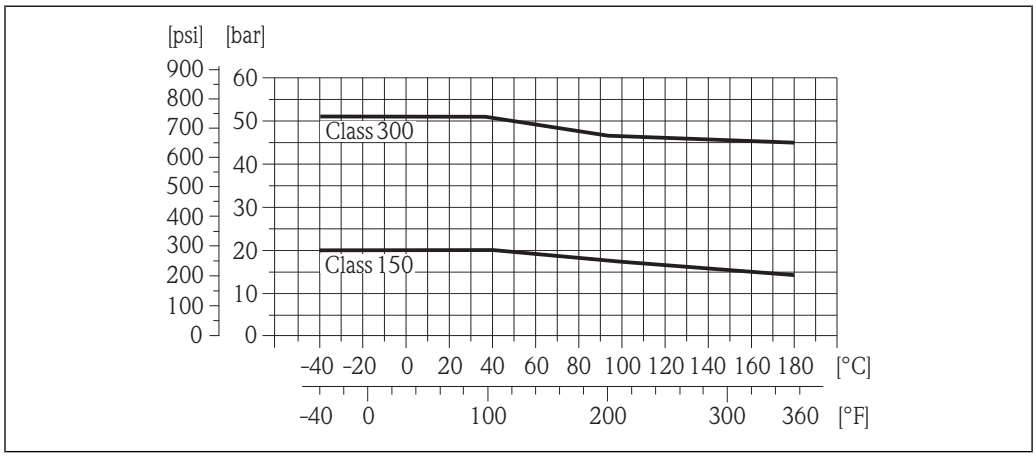
13 Materials C22, FE 410W B and S235JRG2

Flange connection according to EN 1092-1 (DIN 2501)



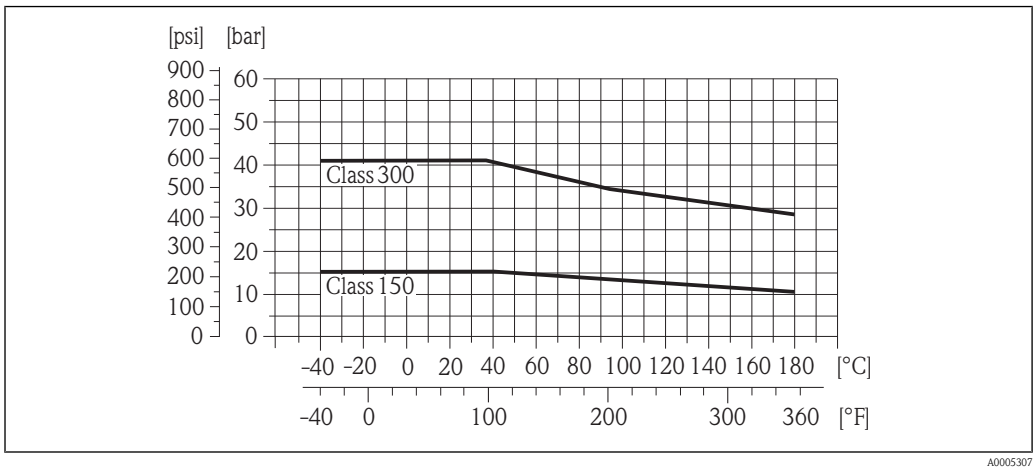
14 Material 1.4571/316L

Flange connection according to ASME B16.5



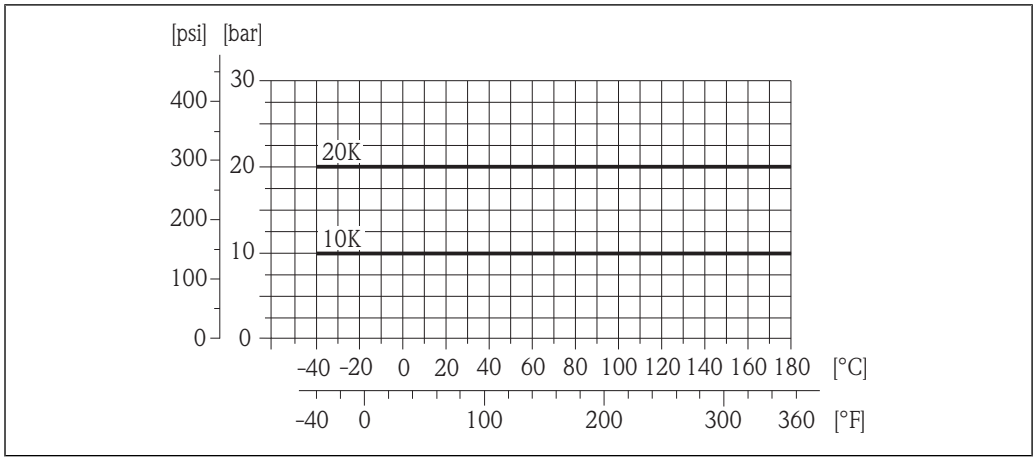
15 Material A105

Flange connection according to ASME B16.5



16 Material F316L

Flange connection according to JIS B2220



17 Materials 1.0425/316L, HII, S235JRG2

Pressure tightness

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 to +180 °C (+212 to +356 °F)
25	1	0 (0)	0 (0)	0 (0)
32	–	0 (0)	0 (0)	0 (0)
40	1 ½	0 (0)	0 (0)	0 (0)
50	2	0 (0)	0 (0)	0 (0)
65	–	0 (0)	– (–)	0 (0)
80	3	0 (0)	– (–)	0 (0)
100	4	0 (0)	– (–)	0 (0)
125	–	0 (0)	– (–)	0 (0)
150	6	0 (0)	– (–)	0 (0)
200	8	0 (0)	– (–)	0 (0)

Liner: PTFE

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
15	½	0 (0)	0 (0)	0 (0)	100 (1.45)
25	1	0 (0)	0 (0)	0 (0)	100 (1.45)
32	–	0 (0)	0 (0)	0 (0)	100 (1.45)
40	1 ½	0 (0)	0 (0)	0 (0)	100 (1.45)
50	2	0 (0)	0 (0)	0 (0)	100 (1.45)
65	–	0 (0)	– (–)	40 (0.58)	130 (1.89)
80	3	0 (0)	– (–)	40 (0.58)	130 (1.89)
100	4	0 (0)	– (–)	135 (1.96)	170 (2.47)
125	–	135 (1.96)	– (–)	240 (3.48)	385 (5.58)
150	6	135 (1.96)	– (–)	240 (3.48)	385 (5.58)
200	8	200 (2.90)	– (–)	290 (4.21)	410 (5.95)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:

- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludges)

For an overview of the measuring range full scale values, see the "Measuring range" section (→ 5)

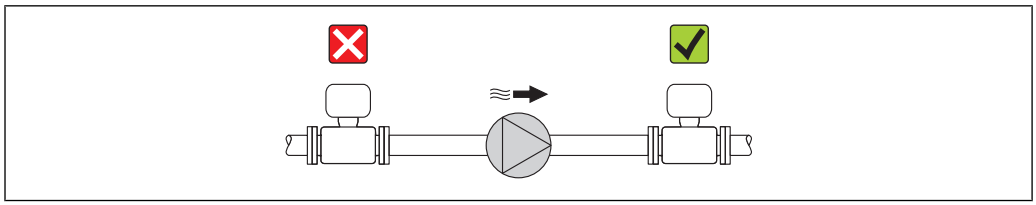
Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 20)

System pressure

- Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.
- Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- For information on the liner's resistance to partial vacuum (→ 25)
- For information on the measuring system's resistance to vibration and shock (→ 22), (→ 22)



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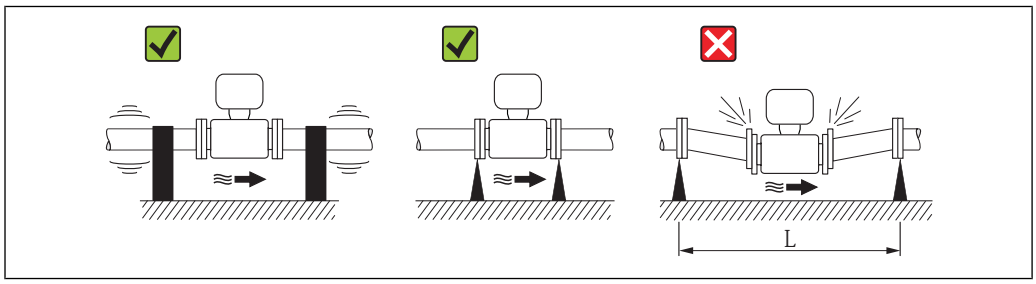
Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

For information on the permitted resistance to vibration and shock (→ 22), (→ 22)



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18 Measures to prevent vibration of the device

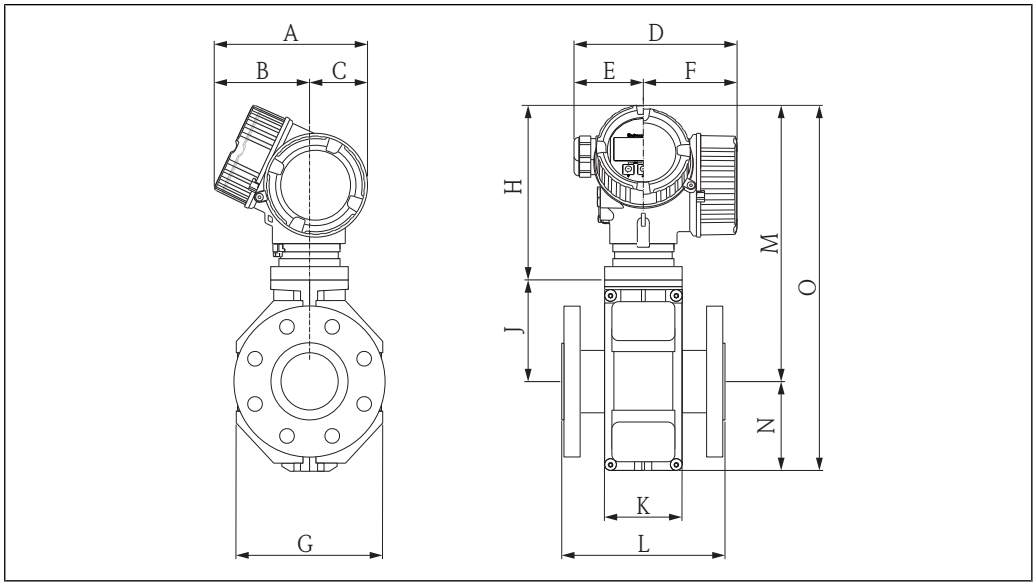
L > 10 m (33 ft)

Mechanical construction

Design, dimensions

Compact version

Order code for "Housing", option C "GT20 two-chamber, aluminium coating" with DN 25 to 200 (1 to 8")



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Dimensions in SI units

DN [mm]	L [1] [mm]	A [mm]	B [2] [mm]	C [mm]	D [3] [mm]	E [mm]	F [3] [mm]	G [mm]	H [mm]	J [mm]	K [mm]	M [4] [mm]	N [mm]	O [4] [mm]
15	200	162	102	60	165	75	90	120	189.5	90	94	280	84	364
25	200	162	102	60	165	75	90	120	189.5	90	94	280	84	364
32	200	162	102	60	165	75	90	120	189.5	90	94	280	84	364
40	200	162	102	60	165	75	90	120	189.5	90	94	280	84	364
50	200	162	102	60	165	75	90	120	189.5	90	94	280	84	364
65	200	162	102	60	165	75	90	180	189.5	115	94	305	109	414
80	200	162	102	60	165	75	90	180	189.5	115	94	305	109	414
100	250	162	102	60	165	75	90	180	189.5	115	94	305	109	414
125	250	162	102	60	165	75	90	260	189.5	155	140	345	150	495
150	300	162	102	60	165	75	90	260	189.5	155	140	345	150	495
200	350	162	102	60	165	75	90	324	189.5	180	156	370	180	550

1) The length (L) is always the same and is not dependent on the selected pressure rating.
2) For version without local display: values - 7 mm
3) For version with overvoltage protection (OVP): values + 8 mm
4) For version without local display: values - 10 mm

Dimensions in US units

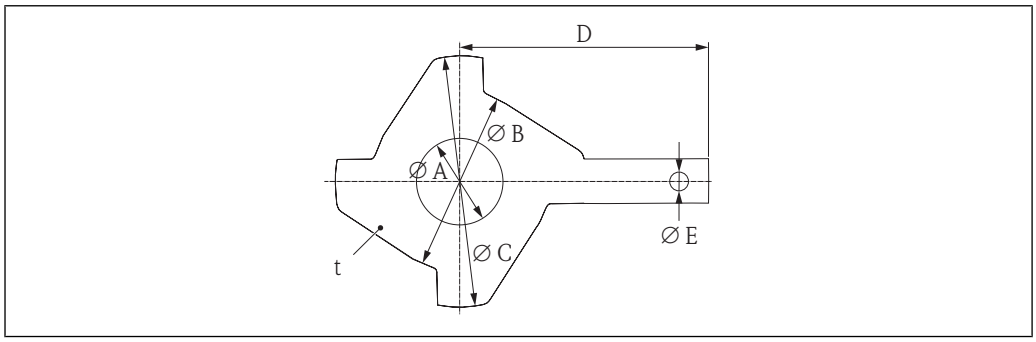
DN [in]	L [1] [in]	A [in]	B [2] [in]	C [in]	D [3] [in]	E [in]	F [3] [in]	G [in]	H [in]	J [in]	K [in]	M [4] [in]	N [in]	O [4] [in]
½	7.87	6.38	4.02	2.36	6.50	2.95	3.54	4.72	7.46	3.54	3.7	11.0	3.31	14.3
1	7.87	6.38	4.02	2.36	6.50	2.95	3.54	4.72	7.46	3.54	3.7	11.0	3.31	14.3

DN [in]	L [1] [in]	A [in]	B [2] [in]	C [in]	D [3] [in]	E [in]	F [3] [in]	G [in]	H [in]	J [in]	K [in]	M [4] [in]	N [in]	O [4] [in]
1 ¼	7.87	6.38	4.02	2.36	6.50	2.95	3.54	4.72	7.46	3.54	3.7	11.0	3.31	14.3
1 ½	7.87	6.38	4.02	2.36	6.50	2.95	3.54	4.72	7.46	3.54	3.7	11.0	3.31	14.3
2	7.87	6.38	4.02	2.36	6.50	2.95	3.54	4.72	7.46	3.54	3.7	11.0	3.31	14.3
2 ½	7.87	6.38	4.02	2.36	6.50	2.95	3.54	7.09	7.46	4.53	3.7	12.0	4.29	16.3
3	7.87	6.38	4.02	2.36	6.50	2.95	3.54	7.09	7.46	4.53	3.7	12.0	4.29	16.3
4	9.84	6.38	4.02	2.36	6.50	2.95	3.54	7.09	7.46	4.53	3.7	12.0	4.29	16.3
5	9.84	6.38	4.02	2.36	6.50	2.95	3.54	10.2	7.46	6.10	5.51	13.6	5.91	19.5
6	11.8	6.38	4.02	2.36	6.50	2.95	3.54	10.2	7.46	6.10	5.51	13.6	5.91	19.5
8	13.8	6.38	4.02	2.36	6.50	2.95	3.54	12.8	7.46	7.09	6.14	14.6	7.09	21.7

1) The length (L) is always the same and does not depend on the selected pressure rating.
2) For version without local display: values - 0.28 in
3) For version with overvoltage protection (OVP): values + 0.31 in
4) For version without local display: values - 0.39 in

Accessories

Ground disk for flange connection



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Dimensions in SI units

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	t [mm]
15	16	43	61.5	73	6.5	2
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5	6.5	2
40	41	82	101	103	6.5	2
50	52	101	115.5	108	6.5	2
65	68	121	131.5	118	6.5	2
80	80	131	154.5	135	6.5	2
100	104	156	186.5	153	6.5	2
125	130	187	206.5	160	6.5	2
150	158	217	256	184	6.5	2
200	206	267	288	205	6.5	2

Dimensions in US units

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	t [in]
½	0.63	1.69	2.42	2.87	0.26	0.08
1	1.02	2.44	3.05	3.44	0.26	0.08
1 ¼	1.38	3.15	3.44	3.72	0.26	0.08
1 ½	1.61	3.23	3.98	4.06	0.26	0.08
2	2.05	3.98	4.55	4.25	0.26	0.08
2 ½	2.68	4.76	5.18	4.65	0.26	0.08
3	3.15	5.16	6.08	5.31	0.26	0.08
4	4.09	6.14	7.34	6.02	0.26	0.08
5	5.12	7.36	8.13	6.30	0.26	0.08
6	6.22	8.54	10.1	7.24	0.26	0.08
8	8.11	10.5	11.3	8.07	0.26	0.08

Weight

Compact version

Weight data:
- Including the transmitter (1.9 kg (4.2 lbs))
- Weight specifications apply to standard pressure ratings and without packaging material.

Weight in SI units

Nominal diameter		EN (DIN), AS [1)]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
15	½	PN 40	5.0	Class 150	5.0	10K	5.0
25	1	PN 40	5.8	Class 150	5.8	10K	5.8
32	1 ¼	PN 40	6.5	Class 150	–	10K	5.8
40	1 ½	PN 40	7.9	Class 150	7.9	10K	6.8
50	2	PN 40	9.1	Class 150	9.1	10K	7.8
65	2 ½	PN 16	10.5	Class 150	–	10K	9.6
80	3	PN 16	12.5	Class 150	12.5	10K	11.0
100	4	PN 16	14.5	Class 150	14.5	10K	13.2
125	5	PN 16	20.0	Class 150	–	10K	19.5
150	6	PN 16	24.0	Class 150	24.0	10K	23.0
200	8	PN 10	43.5	Class 150	43.5	10K	40.4

1) For flanges to AS, only DN 25 and 50 are available.

Weight in US units

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
15	½	Class 150	11.0
25	1	Class 150	12.8
32	1 ¼	Class 150	–
40	1 ½	Class 150	17.4
50	2	Class 150	20.1

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
65	2 ½	Class 150	–
80	3	Class 150	27.6
100	4	Class 150	32.0
125	5	Class 150	–
150	6	Class 150	52.9
200	8	Class 150	95.9

Measuring tube specification

Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
15	½	PN 40	Class 150	–	–	20K	–	–	15	0.59
25	1	PN 40	Class 150	Table E	–	20K	23	0.91	26	1.02
32	–	PN 40	–	–	–	20K	32	1.26	35	1.38
40	1 ½	PN 40	Class 150	–	–	20K	36	1.42	41	1.61
50	2	PN 40	Class 150	Table E	PN 16	10K	48	1.89	52	2.05
65	–	PN 16	–	–	–	10K	63	2.48	67	2.64
80	3	PN 16	Class 150	–	–	10K	75	2.95	80	3.15
100	4	PN 16	Class 150	–	–	10K	101	3.98	104	4.09
125	–	PN 16	–	–	–	10K	126	4.96	129	5.08
150	6	PN 16	Class 150	–	–	10K	154	6.06	156	6.14
200	8	PN 10	Class 150	–	–	10K	201	7.91	202	7.95

Materials

Transmitter housing

- Order code for "Housing", option **C**: aluminum coating AlSi10Mg
- Window material: glass

Transmitter cable entries

Order code for "Housing", option C "GT20 two-chamber, aluminum coating"

Electrical connection	Type of protection	Material
Cable gland M20 × 1.5	■ Non-Ex ■ Ex ia ■ Ex ic	Plastic
	■ Ex nA ■ Ex tb	Nickel-plated brass
Thread G ½" via adapter	For non-Ex and Ex (except for CSA Ex d/XP)	Nickel-plated brass
Thread NPT ½" via adapter	For non-Ex and Ex	

Sensor housing

Aluminum coating AlSi10Mg

Measuring tubes

Stainless steel 1.4301/304 or 1.4306/304L; for flanges made of carbon steel with Al/Zn protective coating

Liner

- PFA
- PTFE

Process connections

EN 1092-1 (DIN 2501)
1.4571/316L, C22, FE 410W B, S235JRG2; with Al/Zn protective varnish

ASME B16.5
A105, F316L; with Al/Zn protective varnish

JIS
S235JRG2, HII, 1.0425/316L; with Al/Zn protective varnish

List of all available process connections (→ 31)

Electrodes

1.4435/316L, Alloy C-22, platinum, tantalum

Seals

In accordance with DIN EN 1514-1

Accessories

Weather protection cover

Stainless steel 1.4301

Ground disks

1.4435/316L, Alloy C-22, tantalum

Fitted electrodes

Measuring electrodes, reference electrodes and electrodes for empty pipe detection:
- Standard: 1.4435/316L, Alloy C-22, platinum, tantalum
- Optional: only measuring electrodes made from platinum

Process connections

- EN 1092-1 (DIN 2501); dimensions as per DIN 2501, DN 65 PN 16 only as per EN 1092-1
- ASME B16.5
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16

For information on the materials of the process connections (→ 31)

Surface roughness

Electrodes with 1.4435/304L, Alloy C-22, platinum, tantalum:
≤ 0.3 to 0.5 µm (11.8 to 19.7 µin)
(All data relate to parts in contact with fluid)

Liner with PFA:
≤ 0.4 µm (15.7 µin)
(All data relate to parts in contact with fluid)

Operability

Operating concept

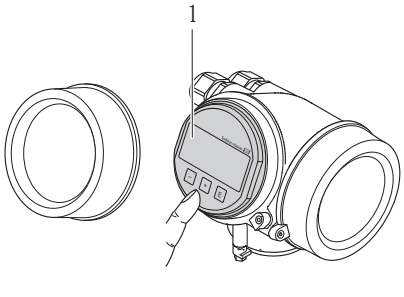
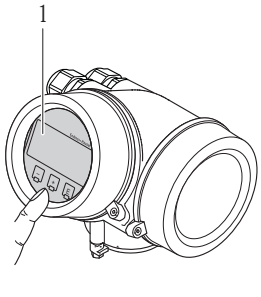
Operator-oriented menu structure for user-specific tasks
- Commissioning
- Operation
- Diagnostics
- Expert level

Quick and safe commissioning
- Guided menus ("Make-it-run" wizards) for applications
- Menu guidance with brief explanations of the individual parameter functions

Reliable operation
- Operation in the following languages:
  - Via local display:
    English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech
  - Via "FieldCare" operating tool:
    English, German, French, Spanish, Italian, Dutch, Japanese
- Uniform operating philosophy applied to device and operating tools
- If replacing the electronic module, transfer the device configuration via the integrated memory (integrated HistoROM) 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

Local operation

Order code for "Display; Operation", option **C** "SD02"	Order code for "Display; Operation", option **E** "SD03"
	
1 Operation with pushbuttons	*1 Operation with touch control*

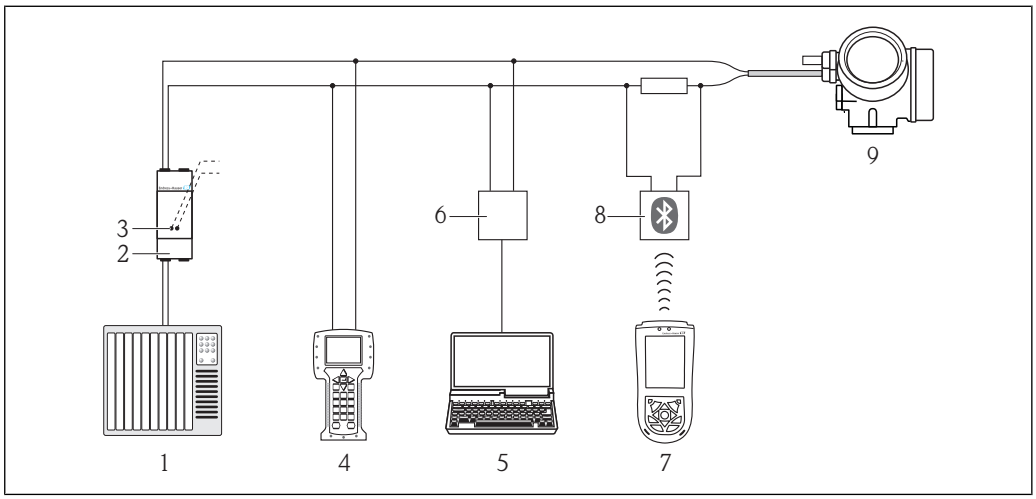
Display elements
- 4-line display
- In the case of order code for "Display; Operation", option **E**: white background lighting; switches to red in event of device errors
- Format for displaying measured variables and status variables can be individually configured
- Permitted ambient temperature for 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
- In the case of order code "Display; Operation", Option **C**: local operation with 3 push buttons (⊕, ⊖, Ⓔ)
- In the case of order code for "Display; Operation", option **E**: external operation via touch control; 3 optical keys: ⊕, ⊖, Ⓔ
- Operating elements also accessible in various hazardous areas

Additional functionality
- Data backup function
  The device configuration can be saved in the display module.
- Data comparison function
  The device configuration saved in the display module can be compared to the current device configuration.
- Data transfer function
  The transmitter configuration can be transmitted to another device using the display module.

Remote operation

Via HART protocol



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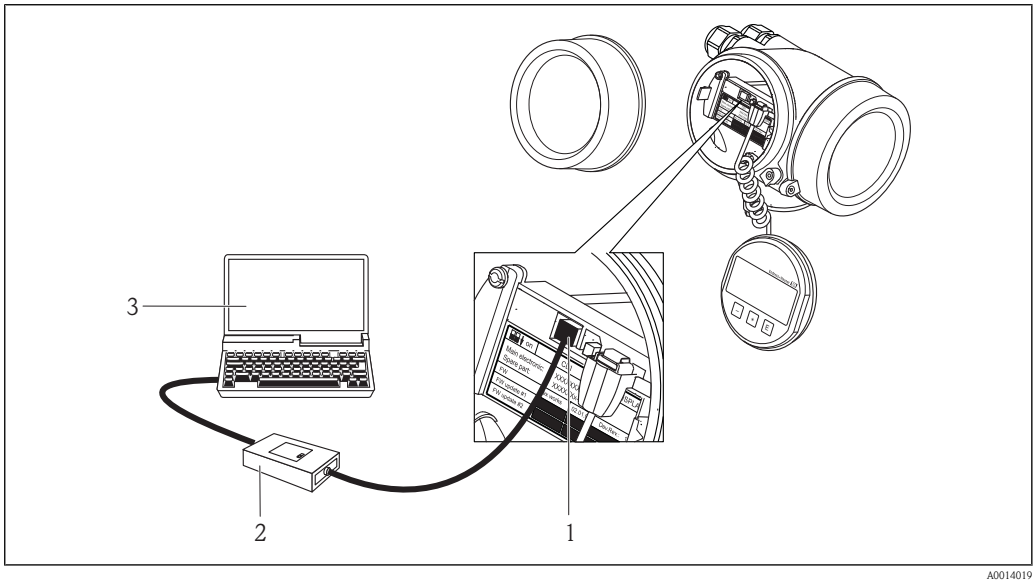
19 *Options for remote operation via HART protocol*

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 operating tool (e.g. FieldCare, AMS Device Manager, SIMATIC PDM)*
6 *Commubox FXA195 (USB)*
7 *Field Xpert SFX100*
8 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

Via service interface (CDI)



A0014019

1 *Service interface (CDI = Endress+Hauser Common Data Interface) of the measuring device*
2 *Commubox FXA291*
3 *Computer with "FieldCare" operating tool with COM DTM "CDI Communication FXA291"*

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-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.

ATEX, IECEx

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

Ex d

Category (ATEX)	Type of protection
II2G	Ex d[ia] IIC T6-T1 Gb
II2D	Ex tb IIIC T** Db

Ex ia

Category (ATEX)	Type of protection
II2G	Ex ia IIC T6-T1 Gb
III2D	Ex tb IIIC T** Db

Ex nA

Category (ATEX)	Type of protection
II3G	Ex nA IIC T6-T1 Gc

Ex ic

Category (ATEX)	Type of protection
II3G	Ex ic IIC T6-T1 Gc

cCSAus

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

XP (Ex d)
Class I/II/III Division 1 Groups ABCDEFG

IS (Ex i)
Class I/II/III Division 1 Groups ABCDEFG

NI (Ex nA, Ex nL)
Class I Division 2 Groups ABCD; NIFW*

*= NIFW parameter as per Control Drawings

Other standards and guidelines

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures
- IEC/EN 61326
  Emission in accordance with Class A requirements. Electromagnetic compatibility (EMC requirements)
- ANSI/ISA-61010-1 (82.02.01): 2004
  Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use - Part 1 General Requirements
- CAN/CSA-C22.2 No. 61010-1-04
  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

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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 from Endress+Hauser either directly with the device or subsequently. 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.

Diagnostics functions

Package	Description

HistoROM extended function	Comprises extended functions concerning the event log and the activation of the measured value memory (data logger). Event log: Memory volume is extended from 20 message entries (basic 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. ■ Data logging is visualized via the local display or FieldCare.

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 for replacement or storage. Use the order code to define the following specifications: ■ Approvals ■ Output ■ Display / operation ■ Housing ■ Software For details, see Installation Instructions EA00104D
Weather protection cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight or extreme cold in winter. For details, see Installation Instructions SD00333F
Ground cable	Set, consisting of two ground cables for potential equalization.

For the sensor

Accessories	Description
Ground disks	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

Communication-specific accessories

Accessories	Description
Commubox FXA191 HART	For intrinsically safe HART communication with FieldCare via the RS232C interface. For details, see "Technical Information" TI00237F
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "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. For details, see "Technical Information" TI00405C

HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
WirelessHART adapter	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. For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ■ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ■ Graphic illustration of the calculation results 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://wapps.endress.com/applicator ■ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: ■ Via the Internet: www.endress.com/lifecyclemanagement ■ On CD-ROM for local PC installation.
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. For details, see Operating Instructions BA00027S and BA00059S

System components

Accessories	Description

Memograph M graphic display recorder	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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R
RN221N	Active barrier with power supply for safe separation of 4-20 mA standard signal circuits. Offers bidirectional HART transmission. For details, see "Technical Information" TI00073R and Operating Instructions BA00202R
RNS221	Supply unit for powering two 2-wire measuring devices solely in the non-Ex area. Bidirectional communication is possible via the HART communication jacks. For details, see "Technical Information" TI00081R and Brief Operating Instructions KA00110R

Documentation

The following document types are available:
- On the CD-ROM supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Standard documentation

Communication	Document type	Documentation code
HART	Operating Instructions	BA01111D
- - - -	Brief Operating Instructions	KA01121D

Supplementary device-dependent documentation

Document type	Approval	Documentation code
Safety Instructions	ATEX/IECEx Ex d[ia], Ex tb	XA01015D
	ATEX/IECEx Ex ia, Ex tb	XA01016D
	ATEX/IECEx Ex nA, Ex ic	XA01017D
	cCSAus XP (Ex d)	XA01018D
	cCSAus IS (Ex i)	XA01019D
Information on the Pressure Equipment Directive		SD01056D
Installation Instructions		Specified for each individual accessory (→ 36)

Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

Applicator®, FieldCare®, Field Xpert™, HistoROM®
Registered or registration-pending trademarks of the Endress+Hauser Group

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Endress+Hauser
People for Process Automation

TI01062D/06/EN/01.12
71185911
EH-COSIMA ProMoDo

Technical Information
Proline Promag H 100

Electromagnetic flowmeter

The flowmeter for smallest flow rates with an ultra-compact transmitter

Application

- The electromagnetic measuring principle is unaffected by pressure, temperature and flow profile
- For the smallest flow rates and demanding hygienic applications

Device properties
- Integrated temperature measurement
- Sensor housing made of stainless steel (3A, EHEDG)
- Wetted materials CIP, SIP cleanable
- Robust, ultra-compact transmitter housing
- High ingress protection: IP69K
- Pre-configured plug connector

Your benefits

- Multivariable measurement for flow, temperature and conductivity
- Flexible installation concept – numerous hygienic process connections
- Energy-saving flow measurement – no pressure loss due to cross-section constriction
- Maintenance-free – no moving parts
- Space-saving transmitter – full functionality on smallest footprint
- Time-saving local operation without additional software and hardware – integrated web server
- Integrated verification – Heartbeat Technology™

Endress+Hauser
People for Process Automation

Table of contents

Document information

Symbols used

Electrical symbols

Symbol	Meaning
A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.

Symbols in graphics

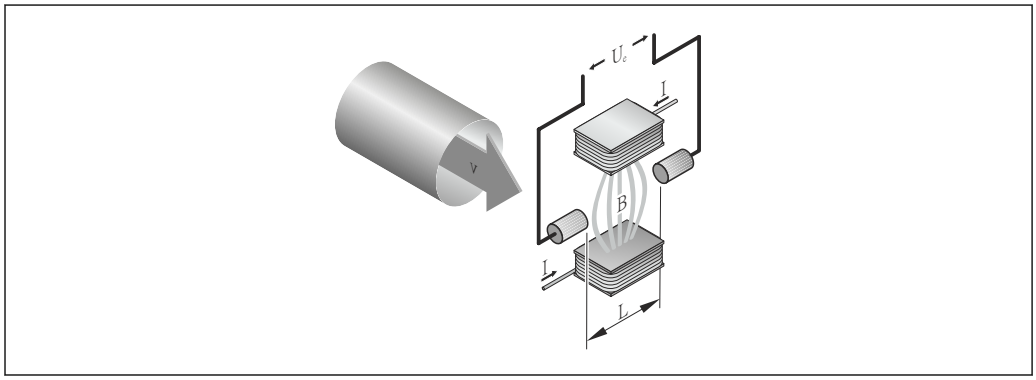
Symbol	Meaning
1, 2, 3,...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
A0013441	Flow direction

Symbol	Meaning
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.



A0017035

Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
I *Current*
v *Flow velocity*

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced (U_e) is proportional to the flow velocity (v) and is supplied to the amplifier by means of two measuring electrodes. The flow volume (Q) is calculated via the pipe cross-section (A). The DC magnetic field is created through a switched direct current of alternating polarity.

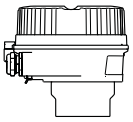
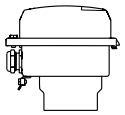
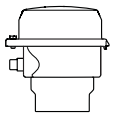
Formulae for calculation

- Induced voltage $U_e = B \cdot L \cdot v$
- Volume flow $Q = A \cdot v$

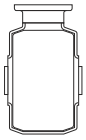
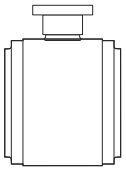
Measuring system

One device version is available: compact version, transmitter and sensor form a mechanical unit.

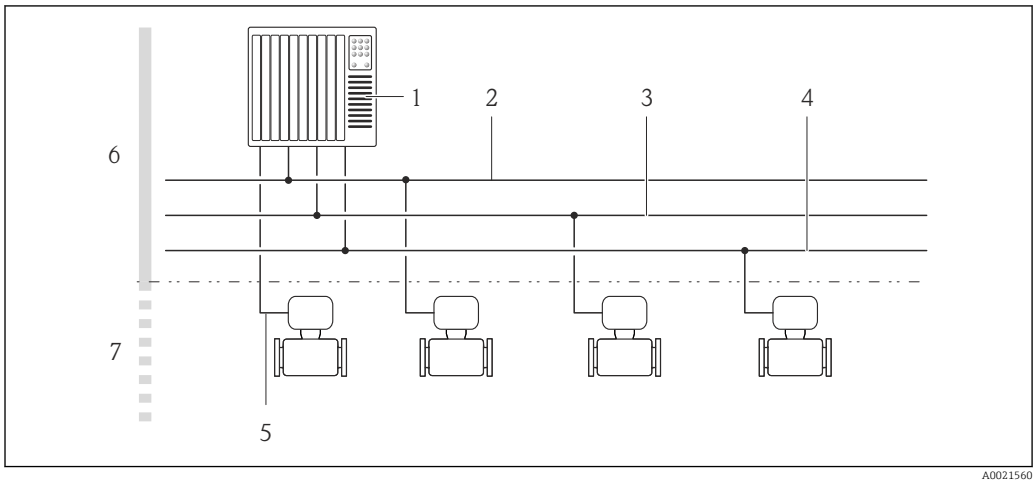
Transmitter

Promag 100  A0016693  A0016694  A0016695	Device versions and materials: ▪ Compact, aluminum coated: Coated aluminum AlSi10Mg ▪ Compact, hygienic, stainless: Hygienic version, stainless steel 1.4301 (304) ▪ Ultra compact, hygienic, stainless: Hygienic version, stainless steel 1.4301 (304) Configuration: ▪ Via operating tools (e.g. FieldCare) ▪ Also for device version with 4-20 mA HART, pulse/frequency/switch output: Via Web browser (e.g. Microsoft Internet Explorer) ▪ Also for device version with EtherNet/IP output: – Via Web browser (e.g. Microsoft Internet Explorer) – Via Add-on Profile Level 3 for automation system from Rockwell Automation – Via Electronic Data Sheet (EDS)

Sensor

Promag H  A0019897  A0019898	Nominal diameter range: DN 2 to 150 (1/12 to 6") Materials: ▪ Sensor housing: stainless steel 1.4301 (304) ▪ Measuring tubes: stainless steel 1.4301 (304) ▪ Liner: PFA ▪ Process connections: stainless steel 1.4404 (316L); PVDF; PVC adhesive sleeve ▪ Electrodes: 1.4435 (316L), Alloy C22, tantalum, platinum (only up to DN 25 (1")) ▪ Seals: – DN 2 to 25 (1/12 to 1"): O-ring seal (EPDM, FKM, Kalrez), aseptic molded seal (EPDM, FKM, silicone) – DN 40 to 150 (1 ½ to 6"): aseptic molded seal (EPDM, FKM, silicone) ▪ Grounding rings: 1.4435 (316L), Alloy C22, tantalum

Device architecture



1 *Possibilities for integrating measuring devices into a system*

1 *Control system (e.g. PLC)*
2 *EtherNet/IP*
3 *PROFIBUS DP*
4 *Modbus RS485*
5 *4-20 mA HART, pulse/frequency/switch output*
6 *Non-hazardous area*
7 *Non-hazardous area and Zone 2/Div. 2*

Safety

IT security

We only provide a warranty 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 device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Endress+Hauser can be contacted to provide support in performing this task.

Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Temperature (DN 15 to 150 (½ to 6"))
- Electrical conductivity

Calculated measured variables

- Mass flow
- Corrected volume flow
- Corrected electrical conductivity

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: 5 to 10 000 µS/cm/cm

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Current output full scale value [1] (v ~ 2.5 m/s)	Pulse value [1] (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
2	1/12	0.06 to 1.8	0.5	0.005	0.01
4	1/8	0.25 to 7	2	0.025	0.05
8	3/8	1 to 30	8	0.1	0.1
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1200	10	20
125	5	220 to 7 500	1850	15	30
150	6	20 to 600 m³/h	150 m³/h	0.03 m³	2.5 m³/h

1) HART only

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Current output full scale value [1] (v ~ 2.5 m/s)	Pulse value [1] (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
1/12	2	0.015 to 0.5	0.1	0.001	0.002
1/8	4	0.07 to 2	0.5	0.005	0.008
3/8	8	0.25 to 8	2	0.02	0.025
½	15	1 to 27	6	0.05	0.1
1	25	2.5 to 80	18	0.2	0.25
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
5	125	60 to 1 950	450	5	7
6	150	90 to 2 650	600	5	12

1) HART only

To calculate the measuring range, use the *Applicator* sizing tool (→ 85)

Recommended measuring range

"Flow limit" section (→ 42)

Operable flow range

Over 1000 : 1

Input signal

Fieldbuses

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device via Modbus RS485, EtherNet/IP or HART input:

- Process pressure or fluid temperature to increase accuracy (e.g. external values from Cerabar M, Cerabar S or iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section (→ 85)

Output

Output signal

Current output

Current output	4-20 mA HART (active)
Maximum output values	▪ DC 24 V (when idle) ▪ 22.5 mA
Load	0 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	▪ DC30 V ▪ 25 mA
Voltage drop	For 25 mA: ≤ DC2 V
Pulse output	
Pulse width	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow
Frequency output	
Output frequency	Adjustable: 0 to 10 000 Hz
Damping	Adjustable: 0 to 999 s

Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronics temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

PROFIBUS DP

Signal encoding	NRZ code
Data transfer	9.6 kBaud...12 MBaud

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

EtherNet/IP

Standards	In accordance with IEEE 802.3

Signal on alarm

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

Current output

4-20 mA

Failure mode	Selectable (as per NAMUR recommendation NE 43): ▪ Minimum value: 3.6 mA ▪ Maximum value: 22 mA ▪ Defined value: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

HART

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

Pulse/frequency/switch output

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

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02

Modbus RS485

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

EtherNet/IP

Device diagnostics	Device condition can be read out in Input Assembly

Operating tool

- Via digital communication:
  - HART protocol
  - PROFIBUS DP
- Via service interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation (→ 78)

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 ▪ EtherNet/IP network available ▪ EtherNet/IP connection established

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:
- Outputs
- Power supply

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x3A
HART protocol revision	6.0
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
Dynamic variables	The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1561
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org

Output values (from measuring device to automation system)	**Analog input 1 to 8** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow ▪ Carrier mass flow ▪ Density ▪ Reference density ▪ Concentration ▪ Dynamic viscosity ▪ Kinematic viscosity ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Carrier pipe temperature ▪ Electronics temperature ▪ Oscillation frequency ▪ Oscillation amplitude ▪ Frequency fluctuation ▪ Oscillation damping ▪ Tube damping fluctuation ▪ Signal asymmetry ▪ Exciter current **Digital input 1 to 2** ▪ Partially filled pipe detection ▪ Low flow cut off **Totalizer 1 to 3** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow
Input values (from automation system to measuring device)	**Analog output 1 to 3 (fixed assignment)** ▪ Pressure ▪ Temperature ▪ Reference density **Digital output 1 to 3 (fixed assignment)** ▪ Digital output 1: switch positive zero return on/off ▪ Digital output 2: perform zero point adjustment ▪ Digital output 3: switch switch output on/off **Totalizer 1 to 3** ▪ Totalize ▪ Reset and hold ▪ Preset and hold ▪ Stop ▪ Operating mode configuration: – Net flow total – Forward flow total – Reverse flow total
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Via operating tools (e.g. FieldCare)

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
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 transfer mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information

EtherNet/IP

Protocol	▪ The CIP Networks Library Volume 1: Common Industrial Protocol ▪ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP
Communication type	▪ 10Base-T ▪ 100Base-TX
Device profile	Generic device (product type: 0x2B)
Manufacturer ID	0x49E
Device type ID	0x103A
Baud rates	Automatic $^{10}/_{100}$ Mbit with half-duplex and full-duplex detection
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported CIP connections	Max. 3 connections
Explicit connections	Max. 6 connections
I/O connections	Max. 6 connections (scanner)
Configuration options for measuring device	▪ DIP switches on the electronics module for IP addressing ▪ Manufacturer-specific software (FieldCare) ▪ Add-on Profile Level 3 for Rockwell Automation control systems ▪ Web browser ▪ Electronic Data Sheet (EDS) integrated in the measuring device
Configuration of the EtherNet interface	▪ Speed: 10 MBit, 100 MBit, auto (factory setting) ▪ Duplex: half-duplex, full-duplex, auto (factory setting)
Configuration of the device address	▪ DIP switches on the electronics module for IP addressing (last octet) ▪ DHCP ▪ Manufacturer-specific software (FieldCare) ▪ Add-on Profile Level 3 for Rockwell Automation control systems ▪ Web browser ▪ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)
Device Level Ring (DLR)	No

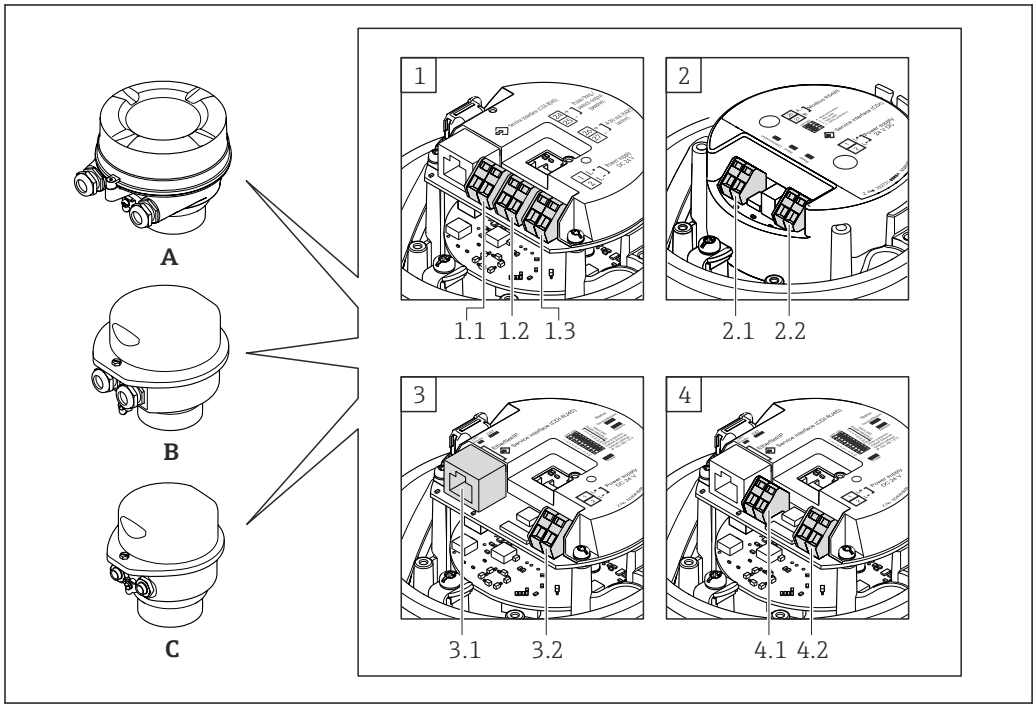
Fix Input			
RPI	5 ms to 10 s (factory setting: 20 ms)		
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0x66	56
	T → O configuration:	0x64	32
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0x66	56
	T → O configuration:	0x64	32
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	32
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	32
Input Assembly	▪ Current device diagnostics ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3		
Configurable Input			
RPI	5 ms to 10 s (factory setting: 20 ms)		
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0x66	56
	T → O configuration:	0x65	88
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0x66	56
	T → O configuration:	0x64	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88

Configurable Input Assembly	▪ Volume flow ▪ Temperature ▪ Corrected volume flow ▪ Mass flow ▪ Totalizer 1 to 3 ▪ Flow velocity ▪ Volume flow unit ▪ Temperature unit ▪ Corrected volume flow unit ▪ Mass flow unit ▪ Unit totalizer 1-3 ▪ Flow velocity unit
Fix Output	
Output Assembly	▪ Activation of reset totalizers 1-3 ▪ Activation of reference density compensation ▪ Activation of temperature compensation ▪ Reset totalizers 1-3 ▪ External density ▪ Density unit ▪ External temperature ▪ Temperature unit
Configuration	
Configuration Assembly	Only the most common configurations are listed below. ▪ Software write protection ▪ Mass flow unit ▪ Mass unit ▪ Volume flow unit ▪ Volume unit ▪ Corrected volume flow unit ▪ Corrected volume unit ▪ Density unit ▪ Reference density unit ▪ Temperature unit ▪ Pressure unit ▪ Length ▪ Totalizer 1-3: – Assignment – Unit – Operating mode – Failure mode ▪ Alarm delay

Power supply

Terminal assignment

Overview: housing version - terminals/device plugs



A0016770

A Housing version: compact, aluminum coated
B Housing version: compact, hygienic, stainless
C Housing version: ultra compact, hygienic, stainless, M12 device plug
1 Connection version: 4-20 mA HART, pulse/frequency/switch output
1.1 Signal transmission: pulse/frequency/switch output
1.2 Signal transmission: 4-20 mA HART
1.3 Supply voltage
2 Connection version: Modbus RS485
2.1 Signal transmission
2.2 Supply voltage
3 Connection version: EtherNet/IP
3.1 Signal transmission
3.2 Supply voltage
4.1 PROFIBUS DP
4.2 Supply voltage

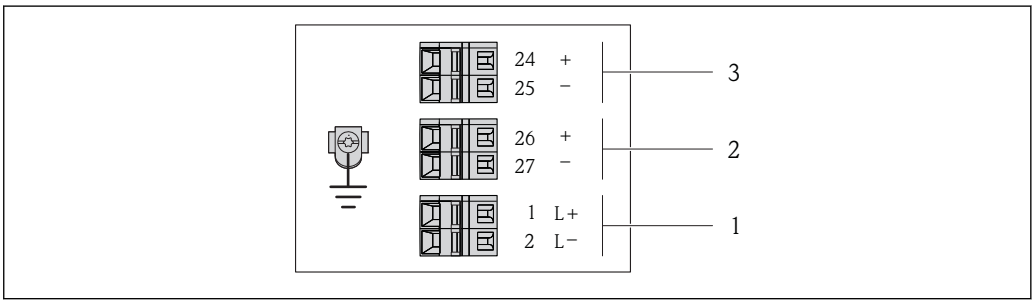
Transmitter

Connection version 4-20 mA HART with pulse/frequency/switch output

Order code for "Output", option **B**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Outputs	Power supply	
Options **A**, **B**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Options **A**, **B**	Device plug (→ 🖹 20)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Options **A**, **B**, **C**	Device plug (→ 🖹 20)	Device plug (→ 🖹 20)	Option **Q**: 2 x plug M12x1
Order code for "Housing": ▪ Option **A**: compact, coated aluminum ▪ Option **B**: compact hygienic, stainless ▪ Option **C**: ultra compact hygienic, stainless, M12 device plug			



2 Terminal assignment 4-20 mA HART with pulse/frequency/switch output

1 Power supply: DC 24 V
2 Output 1: 4-20 mA HART (active)
3 Output 2: pulse/frequency/switch output (passive)

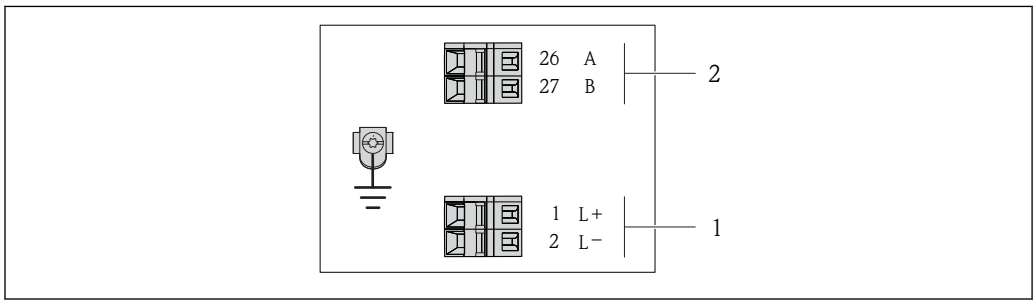
Order code for "Output"	Terminal number					
	Power supply		Output 1		Output 2	
	2 (L-)	1 (L+)	27 (-)	26 (+)	25 (-)	24 (+)
Option **B**	DC 24 V		4-20 mA HART (active)		Pulse/frequency/switch output (passive)	
Order code for "Output": Option **B**: 4-20 mA HART with pulse/frequency/switch output						

PROFIBUS DP connection version for use in non-hazardous areas and Zone 2/Div. 2

Order code for "Output", option **L**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options **A**, **B**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Options **A**, **B**	Device plug (→ 🖹 21)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Options **A**, **B**, **C**	Device plug (→ 🖹 21)	Device plug (→ 🖹 21)	Option **Q**: 2 x plug M12x1
Order code for "Housing": ▪ Option **A**: compact, coated aluminum ▪ Option **B**: compact hygienic, stainless ▪ Option **C**: ultra compact hygienic, stainless, M12 device plug			



3 PROFIBUS DP terminal assignment

1 Power supply: DC 24 V
2 PROFIBUS DP

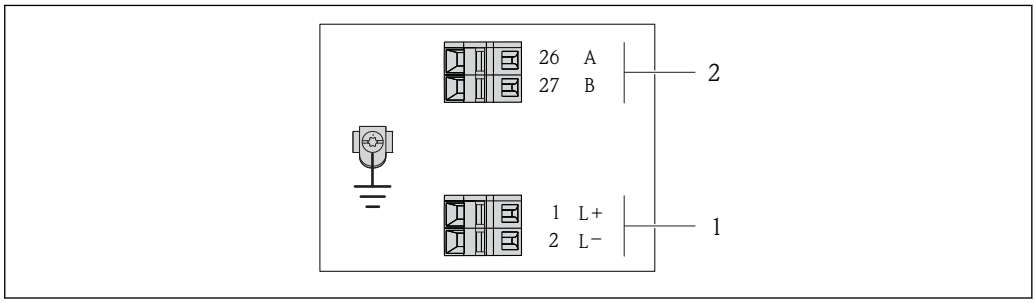
Order code for "Output"	Terminal number			
	Power supply		Output	
	2 (L-)	1 (L+)	27 (B)	26 (A)
Option **L**	DC 24 V		PROFIBUS DP	
Order code for "Output": Option **L**: PROFIBUS DP, for use in non-hazardous areas and Zone 2/div. 2				

Connection version Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2

Order code for "Output", option **M**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options **A**, **B**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Options **A**, **B**	Device plug (→ 🖹 21)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Options **A**, **B**, **C**	Device plug (→ 🖹 21)	Device plug (→ 🖹 21)	Option **Q**: 2 x plug M12x1
Order code for "Housing": ▪ Option **A**: compact, coated aluminum ▪ Option **B**: compact hygienic, stainless ▪ Option **C**: ultra compact hygienic, stainless, M12 device plug			



4 Modbus RS485 terminal assignment

1 Power supply: DC 24 V
2 Modbus RS485

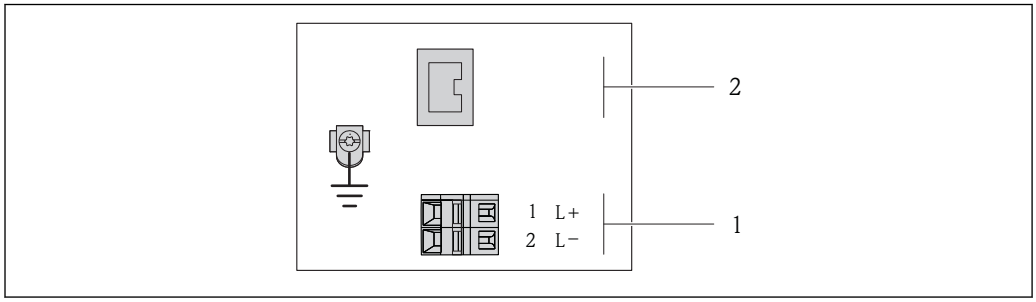
Order code for "Output"	Terminal number			
	Power supply		Output	
	2 (L-)	1 (L+)	27 (B)	26 (A)
Option **M**	DC 24 V		Modbus RS485	
Order code for "Output": Option **M**: Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2				

EtherNet/IP connection version

Order code for "Output", option **N**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Options **A**, **B**	Device plug (→ 🖹 22)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Options **A**, **B**, **C**	Device plug (→ 🖹 22)	Device plug (→ 🖹 22)	Option **Q**: 2 x plug M12x1
Order code for "Housing": ▪ Option **A**: compact, coated aluminum ▪ Option **C**: ultra compact hygienic, stainless, M12 device plug			



5 EtherNet/IP terminal assignment

1 Power supply: DC 24 V
2 EtherNet/IP

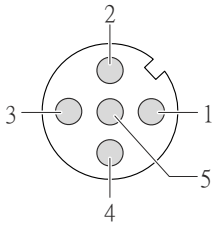
Order code for "Output"	Terminal number		
	Power supply		Output
	2 (L-)	1 (L+)	Device plug M12x1
Option **N**	DC 24 V		EtherNet/IP
Order code for "Output": Option **N**: EtherNet/IP			

Pin assignment, device plug

Order codes for the M12x1 plug, see the "Order code for **electrical connection**" column:
- 4-20 mA HART, pulse/frequency/switch output (→ 🖹 17)
- Modbus RS485 (→ 🖹 19)
- EtherNet/IP (→ 🖹 20)

Supply voltage

Supply voltage for all communication types (on the device side)

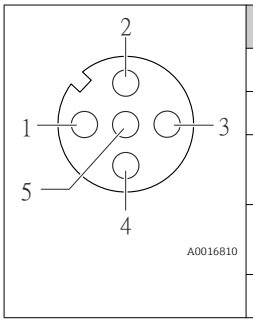


Pin	Assignment		Coding	Plug/socket
1	L+	DC24 V	A	Plug
2				
3				
4	L-	DC24 V		
5		Grounding/shielding		

The following is recommended as a socket:
- Binder, series 763, part no. 79 3440 35 05
- Alternatively: Phoenix part no. 1669767 SAC-5P-M12MS
  - With the order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
  - With the order code for "Output", option **N**: EtherNet/IP
- When using the device in a hazardous location: Use a suitably certified socket.

4-20 mA HART with pulse/frequency/switch output

4-20 mA HART with pulse/frequency/switch output (on the device side)

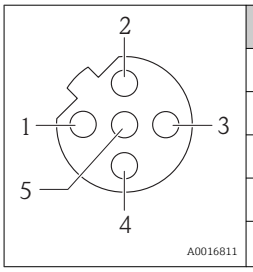


Pin		Assignment	Coding	Plug/socket
1	+	4-20 mA HART (active)	A	Socket
2	-	4-20 mA HART (active)		
3	+	Pulse/frequency/switch output (passive)		
4	-	Pulse/frequency/switch output (passive)		
5		Grounding/shielding		

- Recommended plug: Binder, series 763, part no. 79 3439 12 05
- When using the device in a hazardous location: Use a suitably certified plug.

PROFIBUS DP

PROFIBUS DP, non-hazardous area and Zone 2/Div. 2 (on the device side)

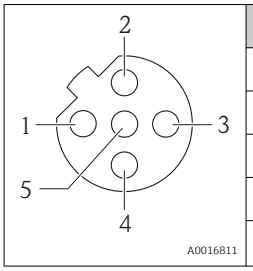


Pin		Assignment	Coding	Plug/socket
1			B	Socket
2	A	PROFIBUS DP		
3				
4	B	PROFIBUS DP		
5		Grounding/shielding		

- Recommended plug: Binder, series 763, part no. 79 4449 20 05
- When using the device in a hazardous location: Use a suitably certified plug.

Modbus RS485

Modbus RS485, non-hazardous area and Zone 2/Div. 2 (on the device side)

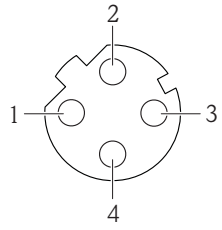


Pin		Assignment	Coding	Plug/socket
1			B	Socket
2	A	Modbus RS485		
3				
4	B	Modbus RS485		
5		Grounding/shielding		

- Recommended plug: Binder, series 763, part no. 79 4449 20 05
- When using the device in a hazardous location: Use a suitably certified plug.

EtherNet/IP

EtherNet/IP (on the device side)



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

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q
- When using the device in a hazardous location: Use a suitably certified plug.

Supply voltage

Transmitter

For device version with all communication types: DC 20 to 30 V

The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

Power consumption

Transmitter

Order code for "Output"	Maximum Power consumption
Option **B**: 4-20mA HART, pulse/frequency/switch output	3.5 W
Option **L**: PROFIBUS DP	3.5 W
Option **M**: Modbus RS485	3.5 W
Option **N**: EtherNet/IP	3.5 W

Current consumption

Transmitter

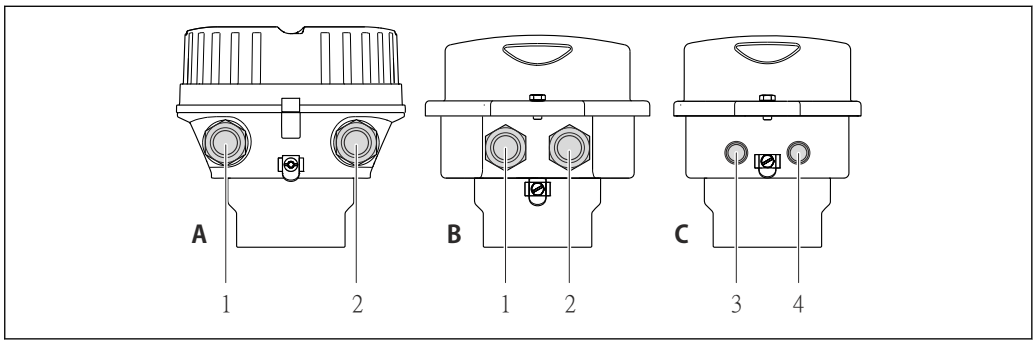
Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option **B**: 4-20mA HART, pul./ freq./switch output	145 mA	18 A (<0.125 ms)
Option **L**: PROFIBUS DP	145 mA	18 A (<0.125 ms)
Option **M**: Modbus RS485	90 mA	10 A (<0.8 ms)
Option **N**: EtherNet/IP	145 mA	18 A (<0.125 ms)

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 plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connecting the transmitter



A0016924

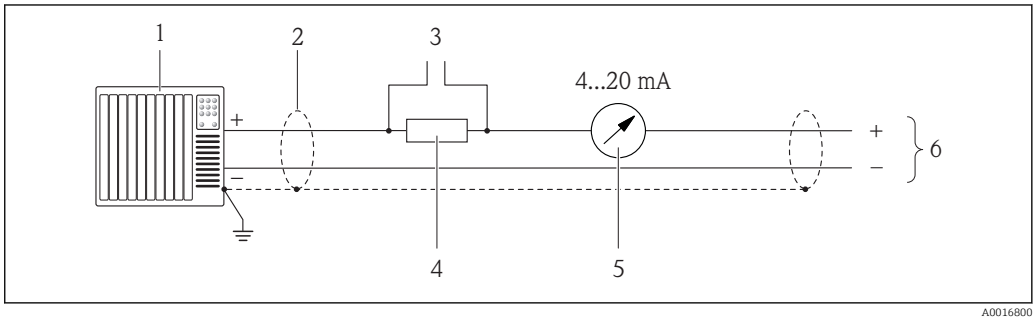
A Housing version: compact, aluminum coated
B Housing version: compact hygienic, stainless
1 Cable entry or device plug for signal transmission
2 Cable entry or device plug for supply voltage
C Housing version: ultra-compact hygienic, stainless, M12 device plug
3 Device plug for signal transmission
4 Device plug for supply voltage

- Terminal assignment (→ 17)
- Pin assignment, device plug (→ 20)

In the case of device versions with a connector, the transmitter housing does not need to be opened to connect the signal cable or power supply cable.

Connection examples

Current output 4-20 mA HART

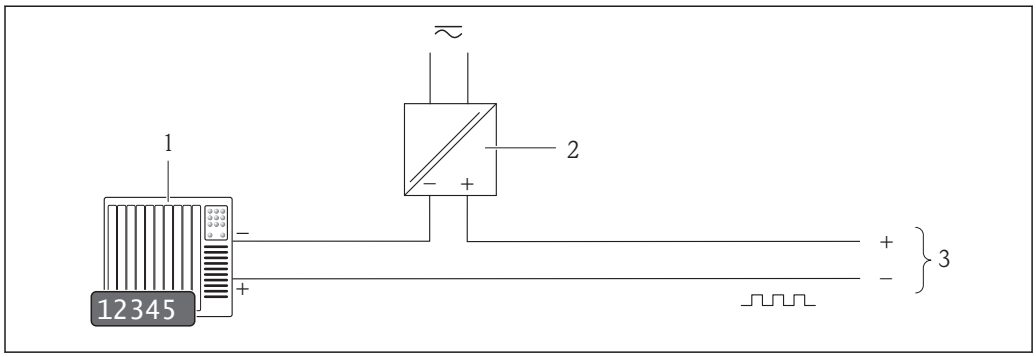


A0016800

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

1 Automation system with current input (e.g. PLC)
2 Cable shield, observe cable specifications (→ 29)
3 Connection for HART operating devices (→ 78)
4 Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)
5 Analog display unit: observe maximum load (→ 8)
6 Transmitter

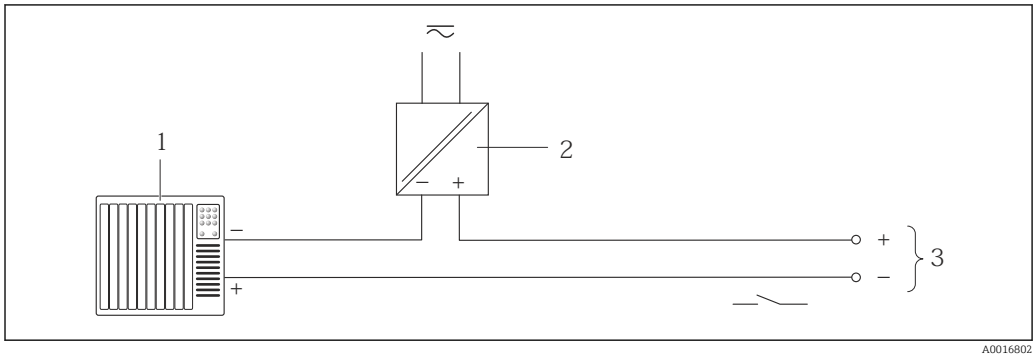
Pulse/frequency output



7 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 (→ 8)

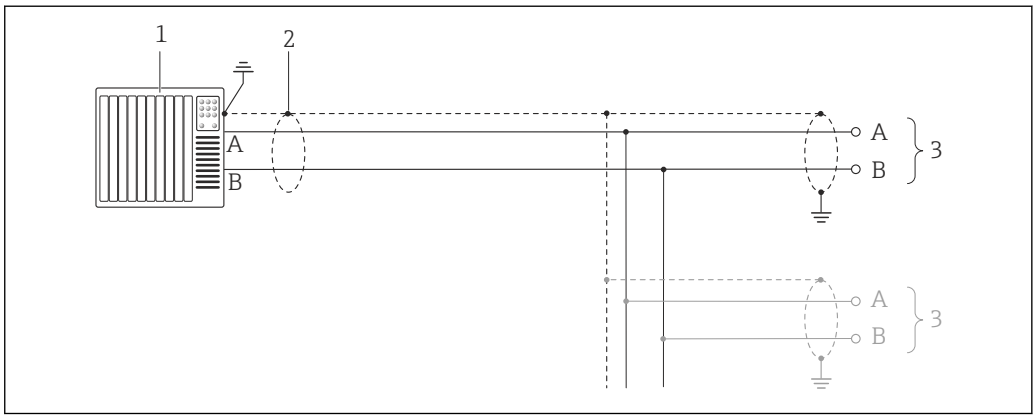
Switch output



8 Connection example for switch output (passive)

1 Automation system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: observe input values (→ 8)

PROFIBUS DP

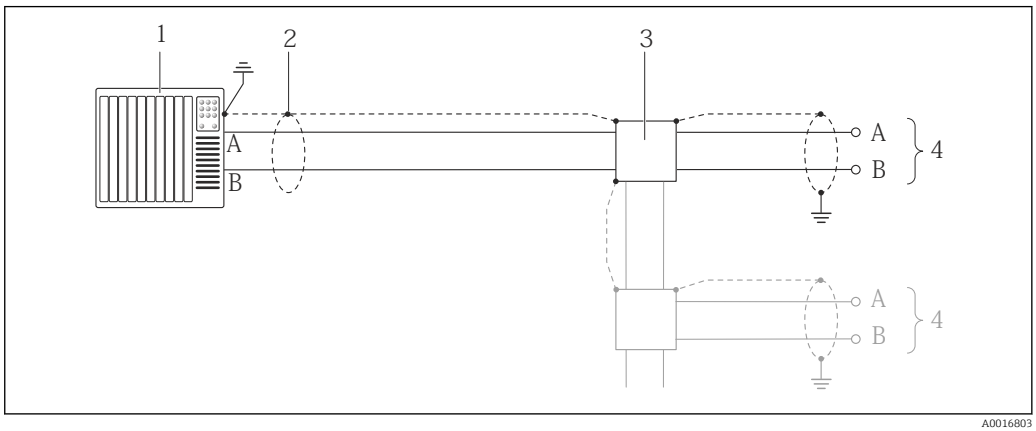


9 Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2

1 Control system (e.g. PLC)
2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications (→ 29)
3 Distribution box
4 Transmitter

If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

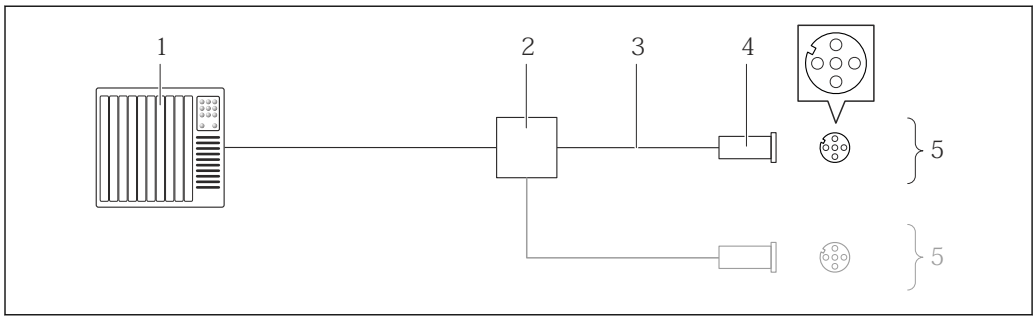
Modbus RS485



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

1 Control system (e.g. PLC)
2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications (→ 29)
3 Distribution box
4 Transmitter

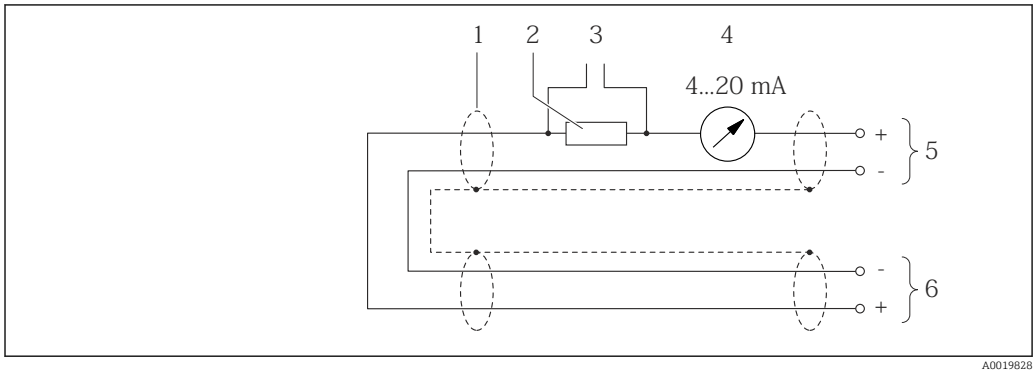
EtherNet/IP



11 Connection example for EtherNet/IP

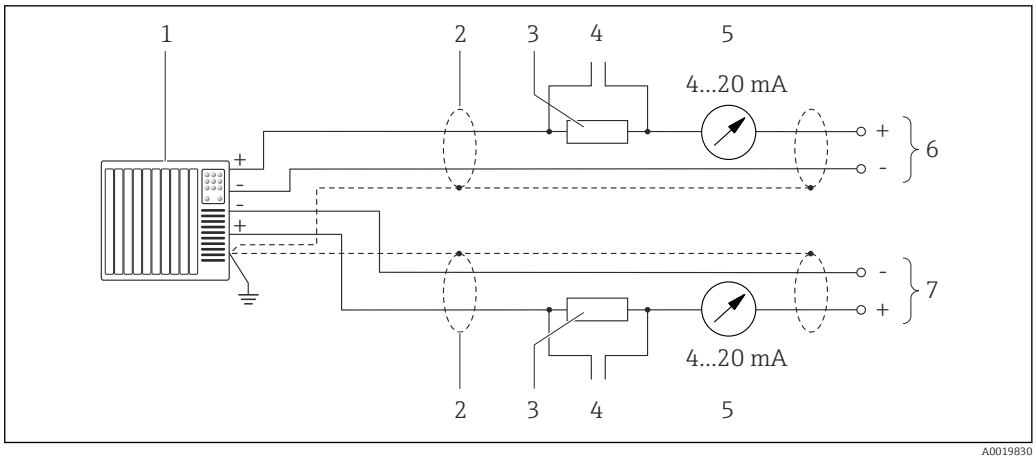
1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications (→ 29)*
4 *Device plug*
5 *Transmitter*

HART input



12 Connection example for HART input (burst mode) via current output (active)

1 *Cable shield, observe cable specifications (→ 29)*
2 *Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)*
3 *Connection for HART operating devices (→ 78)*
4 *Analog display unit*
5 *Transmitter*
6 *Sensor for external measured variable*



13 Connection example for HART input (master mode) via current output (active)

1 *Automation system with current input (e.g. PLC).*
Prerequisite: automation system with HART version 6, HART commands 113 and 114 can be processed.
2 *Cable shield, observe cable specifications (→ 29)*
3 *Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)*
4 *Connection for HART operating devices (→ 78)*
5 *Analog display unit*
6 *Transmitter*
7 *Sensor for external measured variable*

Potential equalization

Requirements

Please consider the following to ensure correct measurement:
- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding

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

Connection examples for standard situations

Metal process connections

Potential matching usually takes place via the metallic process connections in contact with medium which are directly mounted on the measuring transmitter. This usually means that additional potential matching measures are unnecessary.

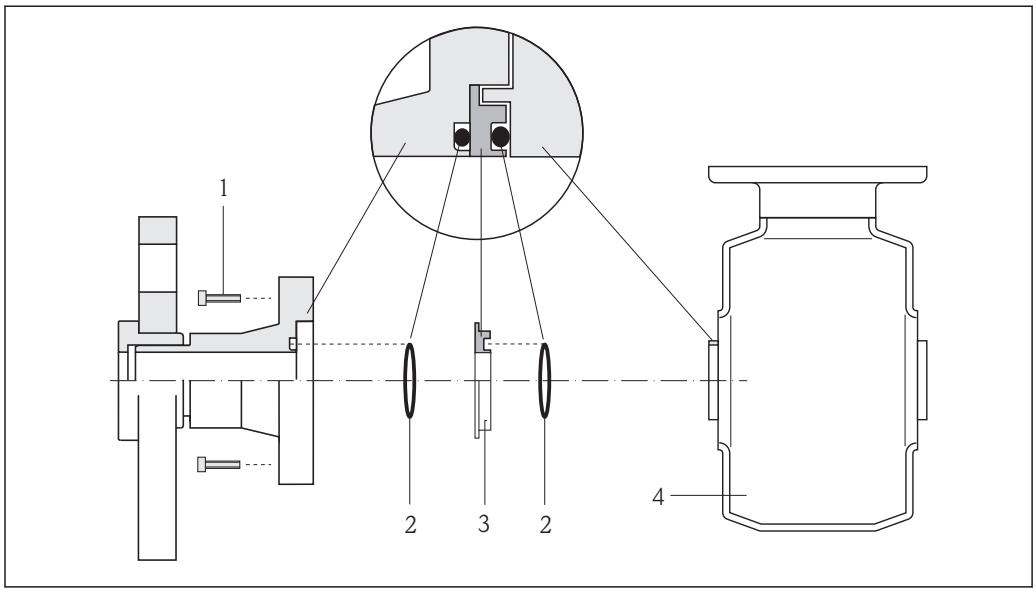
Connection example in special situations

Plastic process connections

If the process connections are made of a synthetic material, additional ground rings or process connections with an integrated ground electrode must be used to ensure the potential between the sensor and fluid is matched. No potential matching can affect the accuracy of the measurements or cause the destruction of the sensor through the electrochemical decomposition of the electrodes.

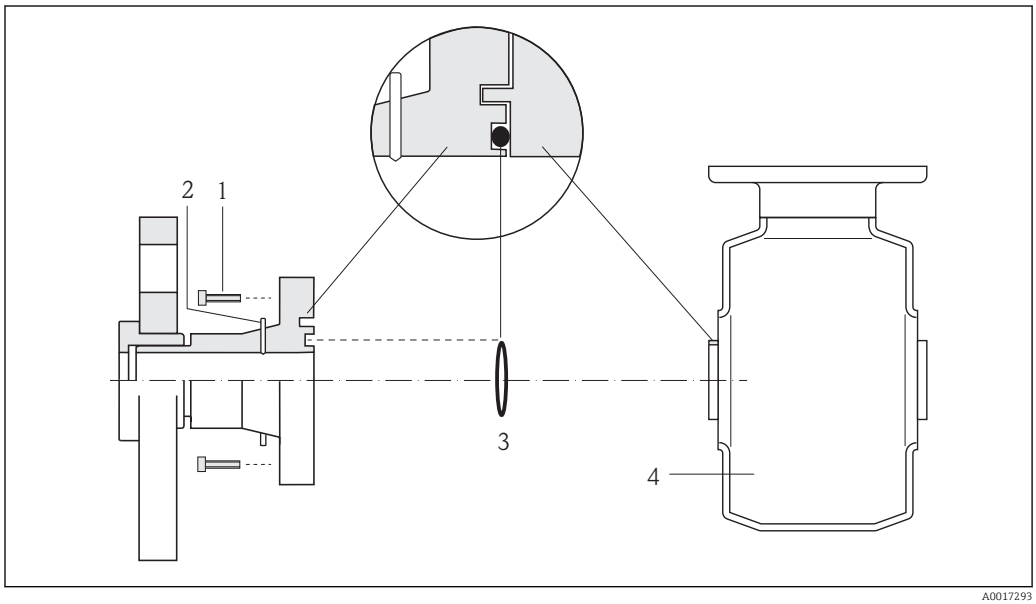
When using ground rings, note the following points:
- Depending on the option ordered, plastic disks may be installed at the process connections instead of ground rings. These plastic disks serve only as spacers and have no potential matching function. In addition, they provide a sealing function at the sensor/process connection interface. For this reason, with process connections without metal ground rings, these plastic disks/seals must not be removed, or must always be installed.
- Ground rings can be ordered separately from Endress+Hauser as accessories. When placing the order, make certain that the ground rings are compatible with the material used for the electrodes. Otherwise, there is a risk that the electrodes may be destroyed by electrochemical corrosion!
- Ground rings, including the seals, are mounted within the process connections. Therefore, the fitting length is not affected.

Potential equalization via additional ground ring



1 Allen screw (process connection)
2 O-ring seals
3 Plastic washer (spacer) or ground ring
4 Sensor

Potential equalization via ground electrodes on process connection



1 Allen screw (process connection)
2 Integrated ground electrodes
3 O-ring seal
4 Sensor

Terminals

Transmitter
Spring terminals for wire cross-sections0.5 to 2.5 mm^2 (20 to 14 AWG)

Cable entries

- Cable gland: M20 × 1.5 with cable Φ6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½"
  - M20

Cable specification

Permitted temperature range

- −40 °C (−40 °F) to +80 °C (+176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output

For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

PROFIBUS DP

The IEC 61158 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 Ωat 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
Shielding	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the 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 Ωat 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
Shielding	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

EtherNet/IP

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of the ODVA Organization.

Performance characteristics

Reference operating conditions

In accordance with DIN EN 29104
- Fluid temperature: +28±2 °C (+82±4 °F)
- Ambient temperature range: +22±2 °C (+72±4 °F)
- Warm-up period:30 min

Installation
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

To calculate the measuring range, use the *Applicator* sizing tool (→ 🖹 85)

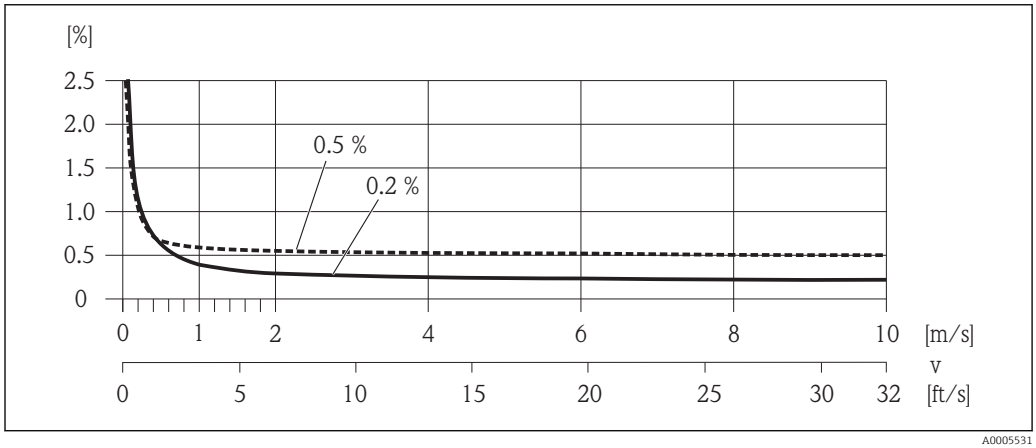
Maximum measured error

Error limits under reference operating conditions

o.r. = of reading

Volume flow
- ±0.5 % o.r. ± 1 mm/s (0.04 in/s)
- Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)

Fluctuations in the supply voltage do not have any effect within the specified range.



14 *Maximum measured error in % o.r.*

Temperature
±3 °C (±5.4 °F)

Electrical conductivity
Max. measured error not specified.

Accuracy of outputs

o.r. = of reading; o.f.s. = of full scale value

The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

Current output

Accuracy	Max. ±0.05 % o.f.s. or ±5 µA

Pulse/frequency output

Accuracy	Max. ±50 ppm o.r.

Repeatability

o.r. = of reading

Volume flow
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Temperature
±0.5 °C (±0.9 °F)

Electrical conductivity
Max. ±5 % o.r.

Temperature measurement response time

T_{90} < 15 s

Influence of ambient temperature

o.r. = of reading; o.f.s. = of full scale value

Current output

Temperature coefficient	Max. ±50 ppm/°C o.f.s. or ±1 µA/°C

Pulse/frequency output

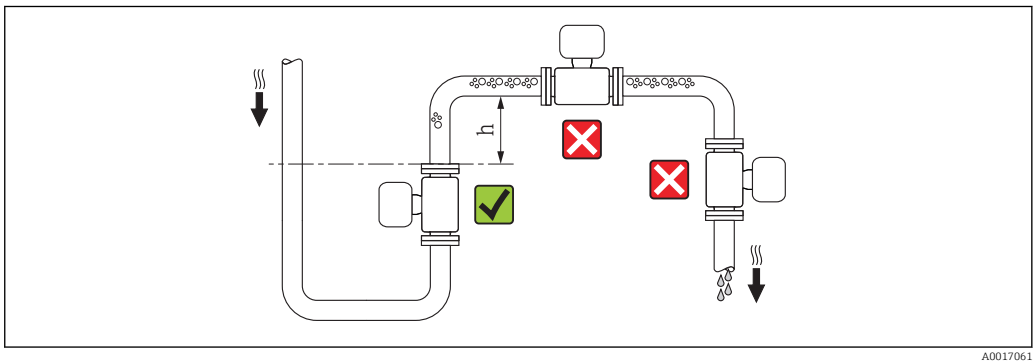
Temperature coefficient	Max. ±50 ppm o.r./100 °C

Installation

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

Mounting location

Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN



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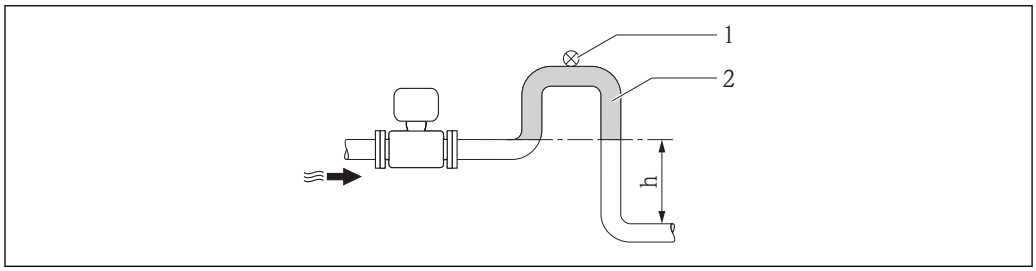
To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime, which could cause air pockets.

For information on the liner's resistance to partial vacuum (→ 42)



A0017064

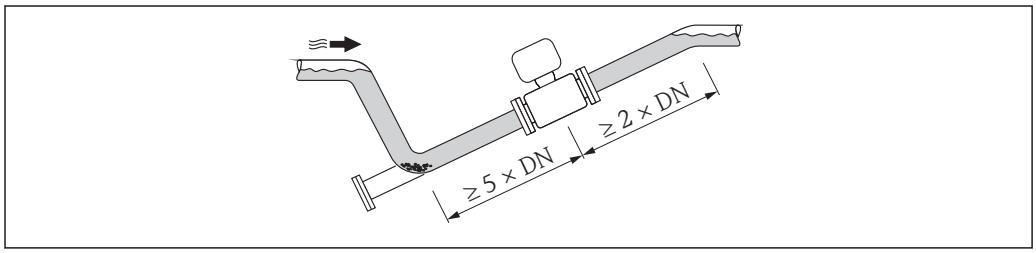
15 *Installation in a down pipe*

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.

- Do not install the sensor at the lowest point in the drain: risk of solids accumulating.
- It is advisable to install a cleaning valve.



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Orientation

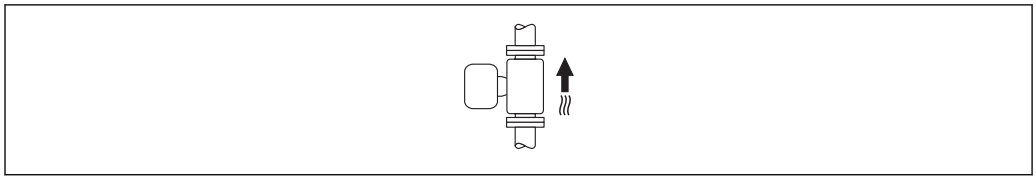
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

The measuring device also offers the empty pipe detection function to detect partially filled measuring pipes in the event of outgassing fluids or variable process pressures.

Vertical

This is the optimum orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.

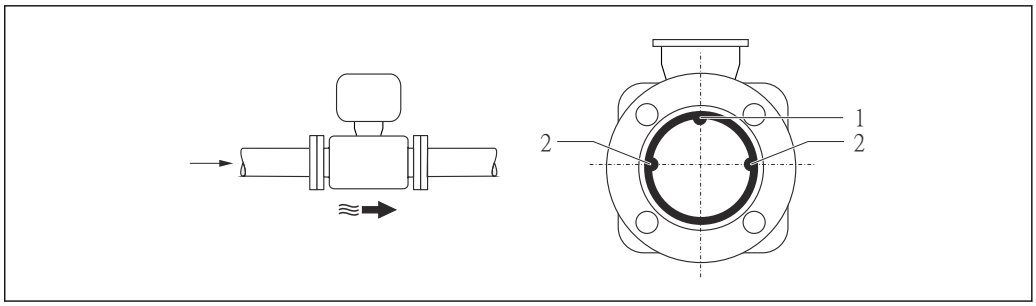


A0015591

Horizontal

The measuring electrode plane must be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

With horizontal orientation, empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.



A0019602

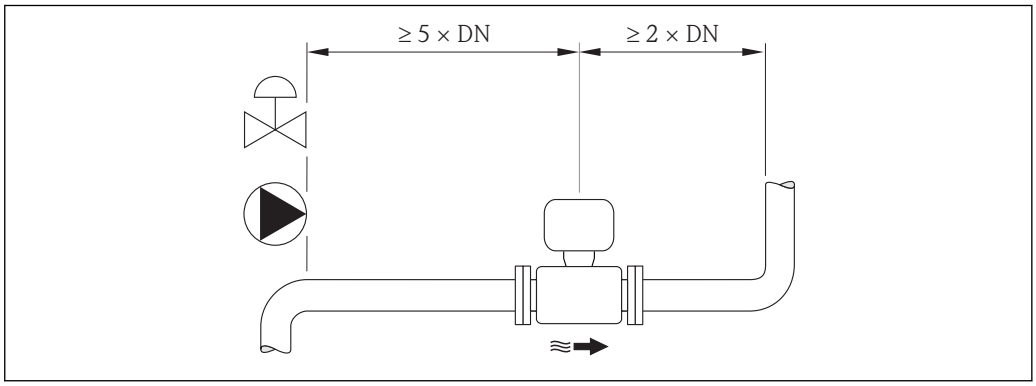
16 *Horizontal orientation*

1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:
- Inlet run ≥ 5 × DN
- Outlet run ≥ 2 × DN



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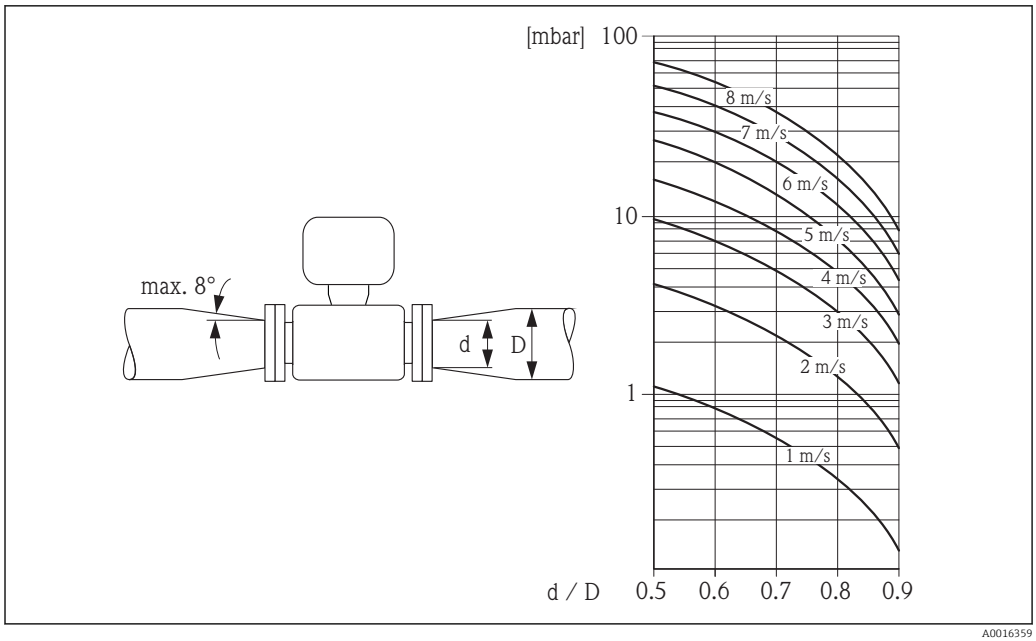
Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids.

The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders:
- Calculate the ratio of the diameters d/D.
- From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

The nomogram only applies to liquids with a viscosity similar to that of water.



Environment

Ambient temperature range

Transmitter	–40 to +60 °C (–40 to +140 °F)
Sensor	–40 to +60 °C (–40 to +140 °F)
Liner	Do not exceed or fall below the permitted temperature range of the liner (→ 35).

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

Temperature tables

The following interdependencies between the permitted ambient and fluid temperatures apply when operating the device in hazardous areas:

Ex nA, $_{C}CSA_{US}$ NI

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
30	50	95	130	150	150	150
50	–	95	130	150	150	150
60	–	95	110	110	110	110

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
86	122	203	266	302	302	302
122	–	203	266	302	302	302
140	–	203	230	230	230	230

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Degree of protection

Transmitter and sensor
- As standard: IP66/67, type 4X enclosure
- With the order code for "Sensor options", option **CM**: IP69K can also be ordered
- When housing is open: IP20, type 1 enclosure

Shock resistance

As per IEC/EN 60068-2-31

Vibration resistance

Acceleration up to 2 g following IEC 60068-2-6

Mechanical load

- Protect the transmitter housing against mechanical effects, such as shock or impact.
- Never use the transmitter housing as a ladder or climbing aid.

Interior cleaning

- Cleaning in place (CIP)
- Sterilization in place (SIP)

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Complies with emission limits for industry as per EN 55011 (Class A)
- Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784

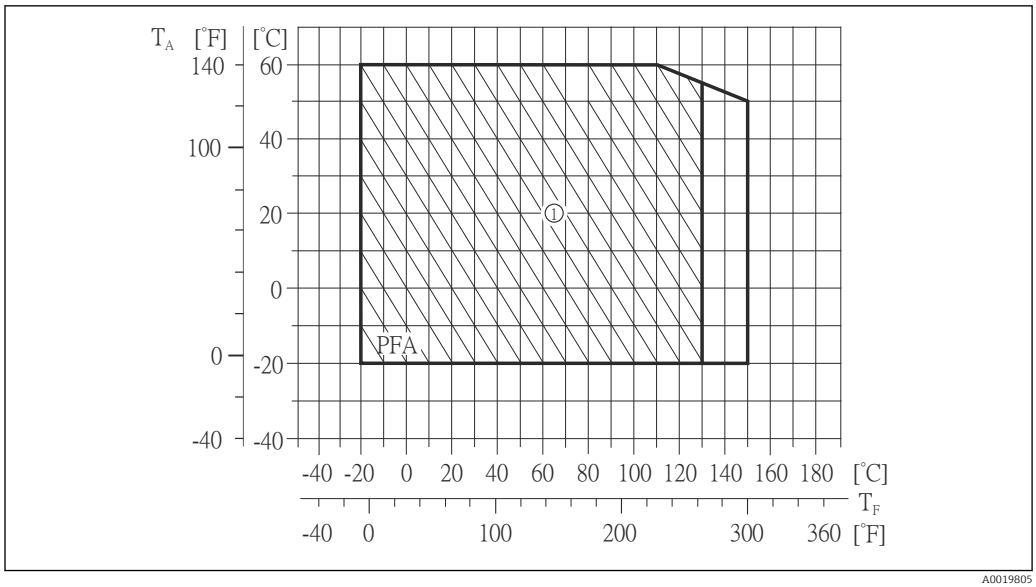
The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Details are provided in the Declaration of Conformity.

Process

Medium temperature range

−20 to +150 °C (−4 to +302 °F)



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T_A Ambient temperature

T_F Medium temperature

1 Harsh environment and IP68 only to +130 °C (+266 °F)

Conductivity

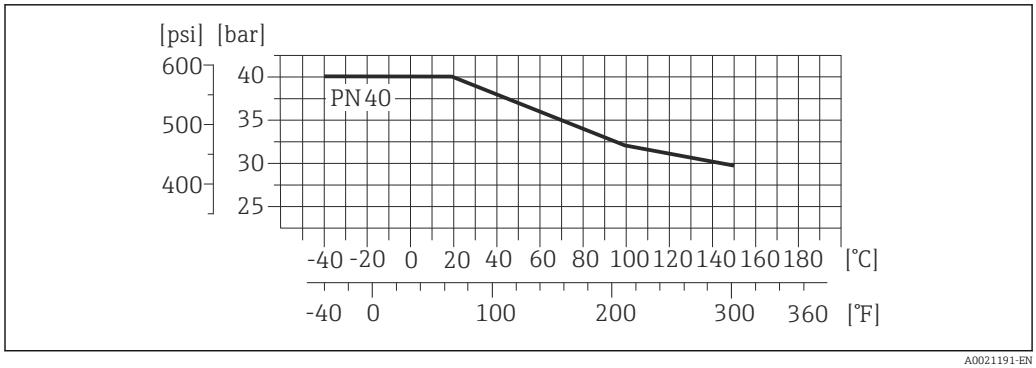
≥ 5 µS/cm for liquids in general

Pressure-temperature ratings

The following graphics contain material load diagrams (reference curves) for different process connections in relation to the medium temperature.

Process connections with O-ring seal, DN 2 to 25 (1/12 to 1")

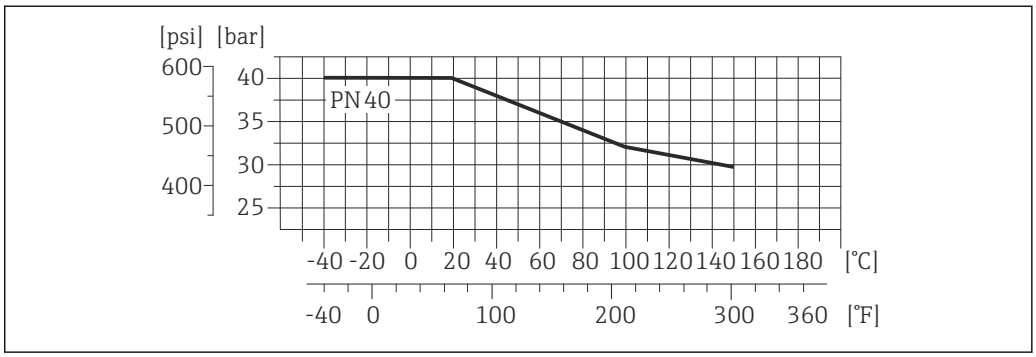
Welded connection as per DIN EN ISO 1127, ODT/SMS, ISO 2037; coupling as per ISO 228 / DIN 2999, NPT



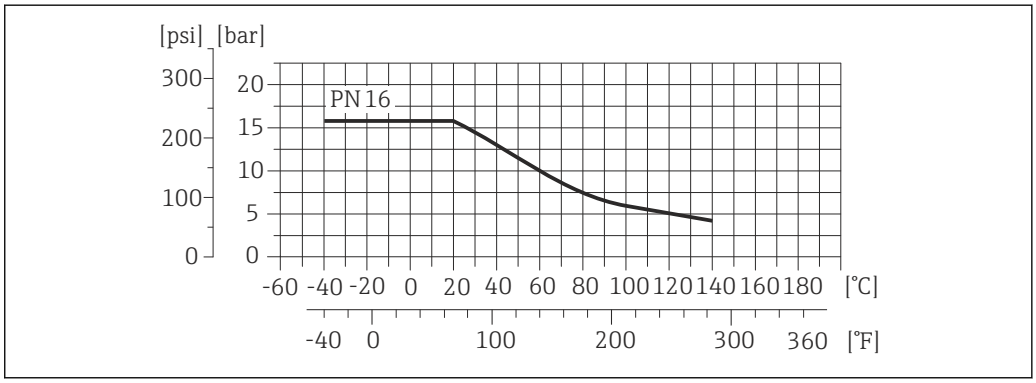
A0021191-EN

17 *Material 1.4404 (316L)*

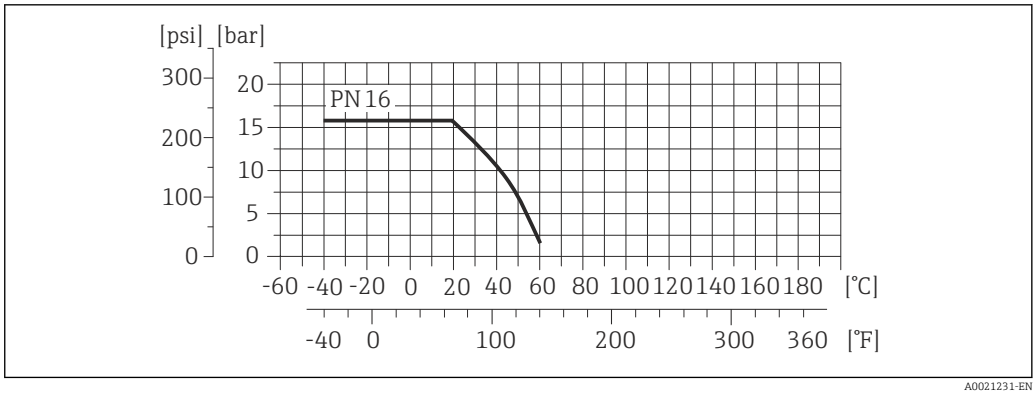
Flange connection as per EN 1092-1 (DIN 2501), adhesive sleeve



18 *Materials 1.4404 (316L)*

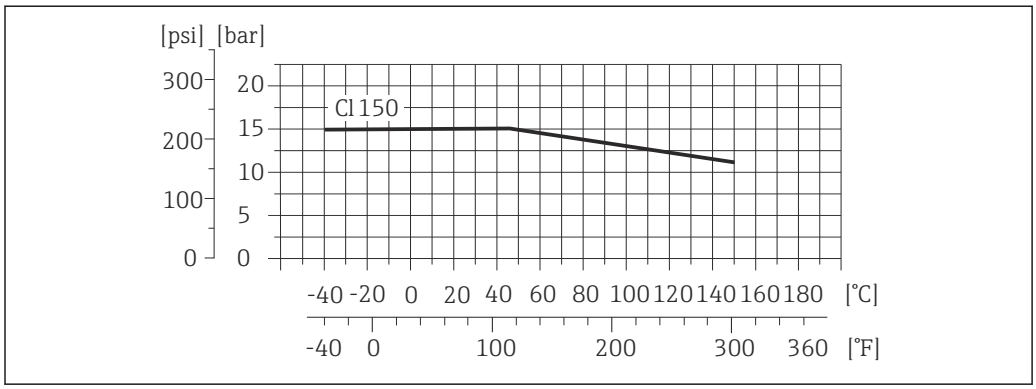


19 *Materials PVDF*

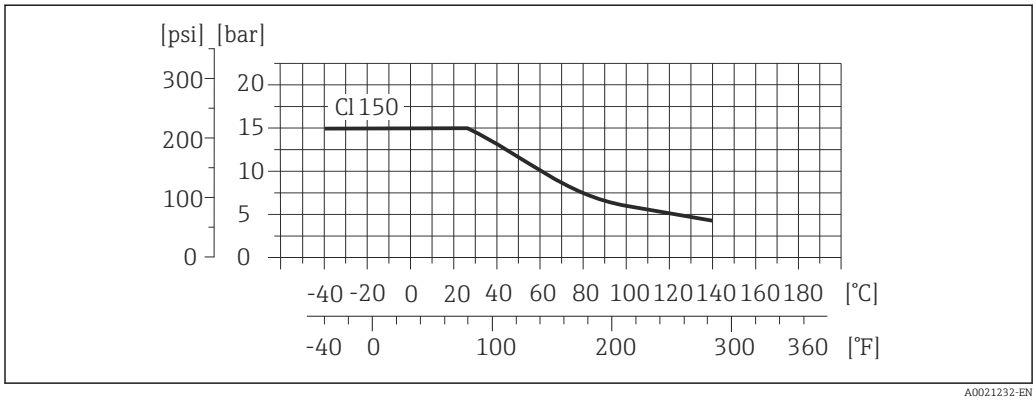


20 *Materials PVC-U*

Flange connection as per ASME B16.5

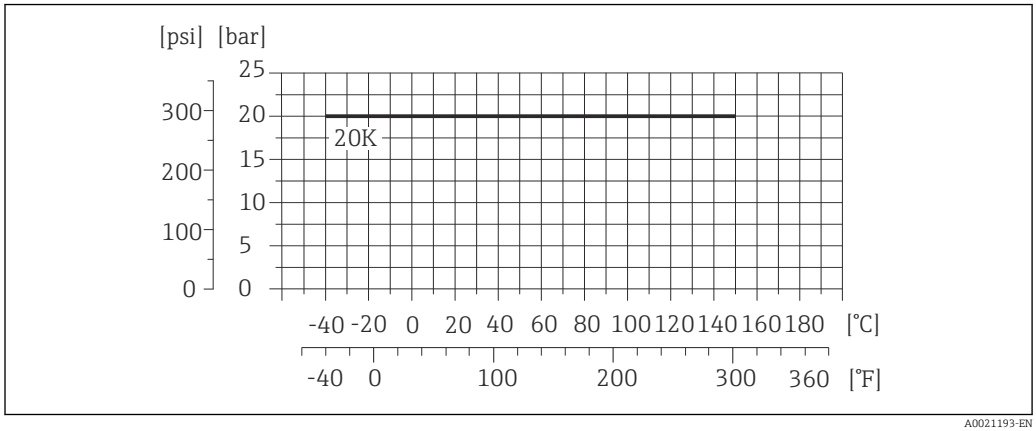


21 Materials 1.4404 (316L)

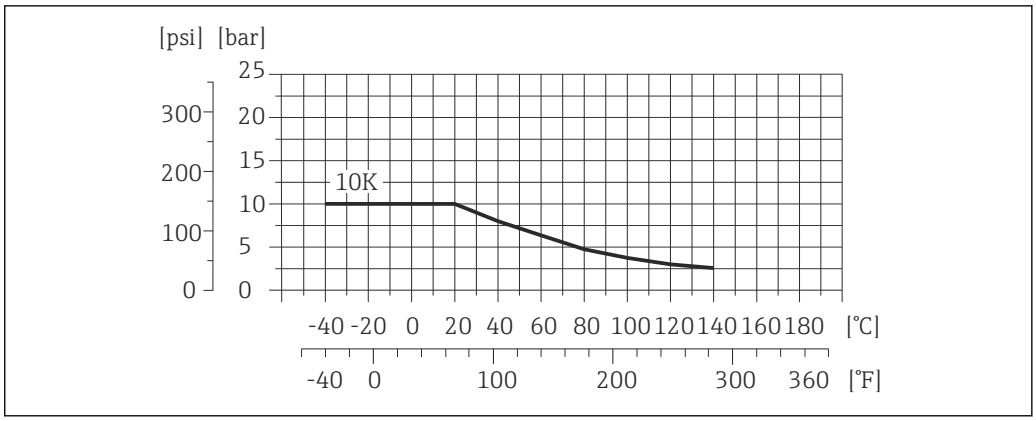


22 Materials PVDF

Flange connection as per JIS B2220



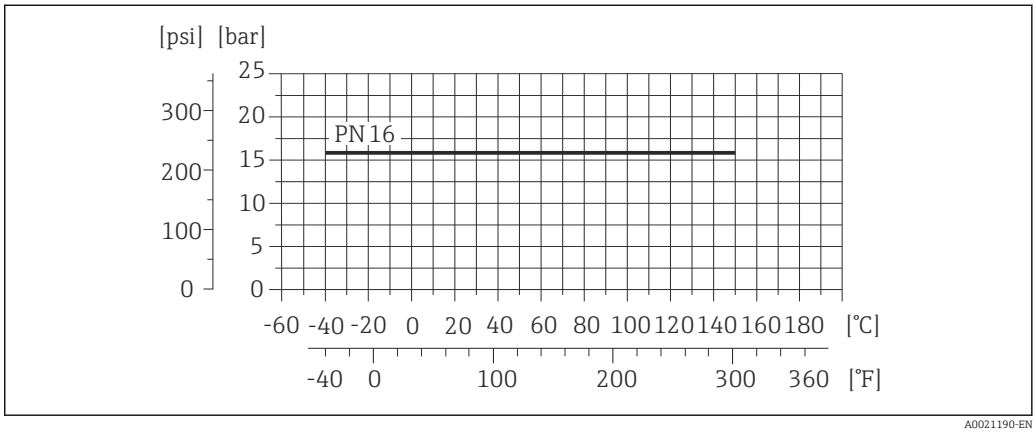
23 Materials 1.4404 (316L)



24 *Materials PVDF*

Process connections with aseptic molded seal, DN 2 to 25 (1/12 to 1")

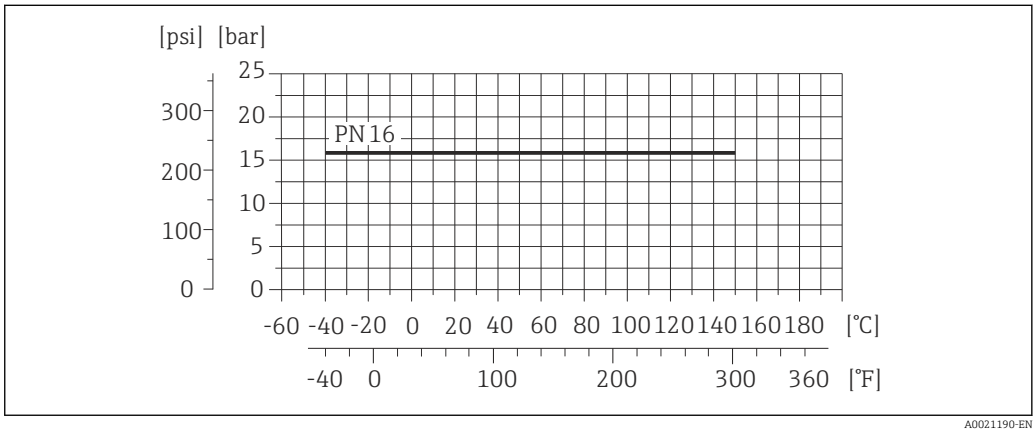
Welded connection as per DIN 11850, ASME BPE, ISO 2037; clamp as per ISO 2852, DIN 32676, L14 AM7; coupling as per SC DIN 11851, DIN 11864-1, SMS 1145; flange as per DIN 11864-2



25 *Material 1.4404 (316L)*

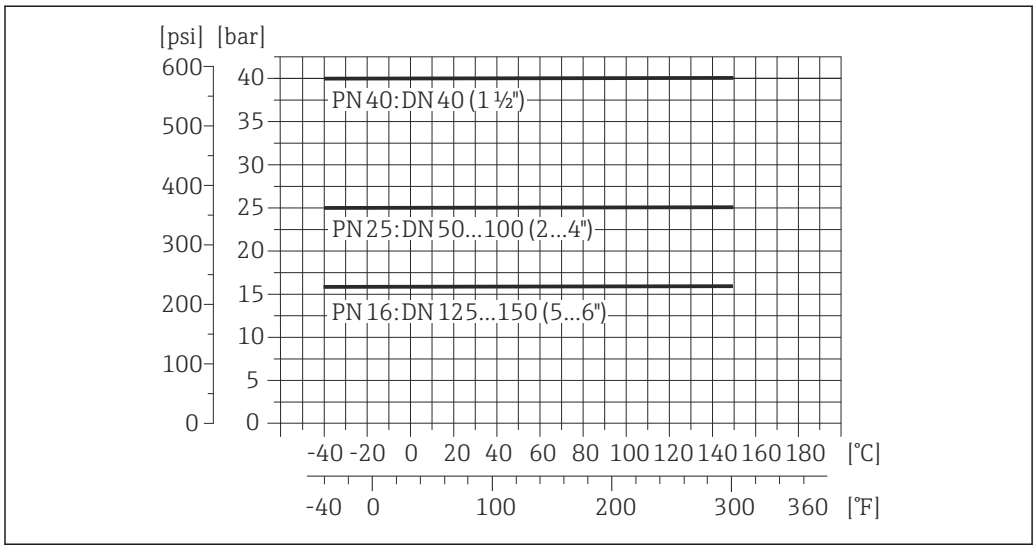
Process connections with aseptic molded seal, DN 40 to 150 (1 ½ to 6")

Coupling as per SMS 1145



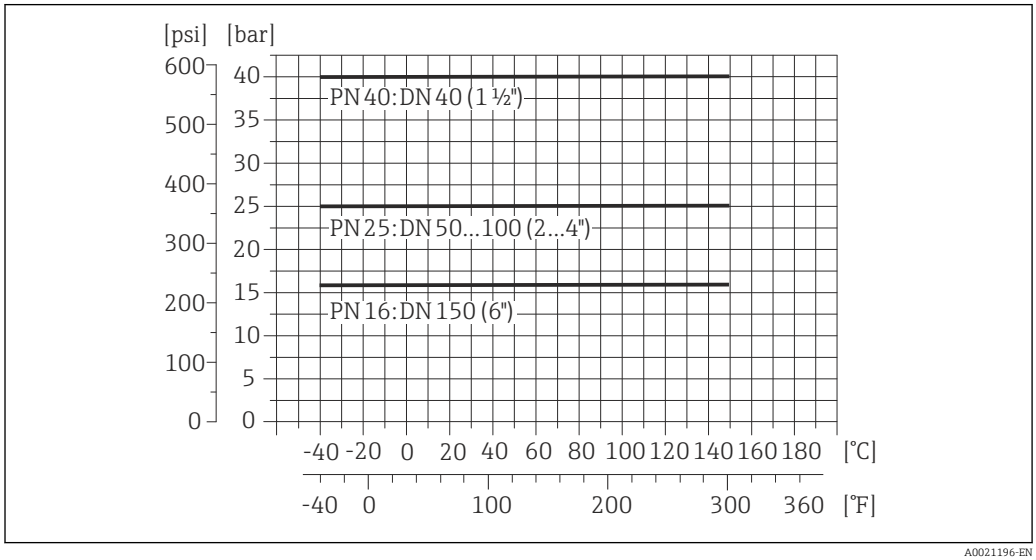
26 *Material 1.4404 (316L)*

Welded connection as per DIN 11850; coupling as per SC DIN 11851

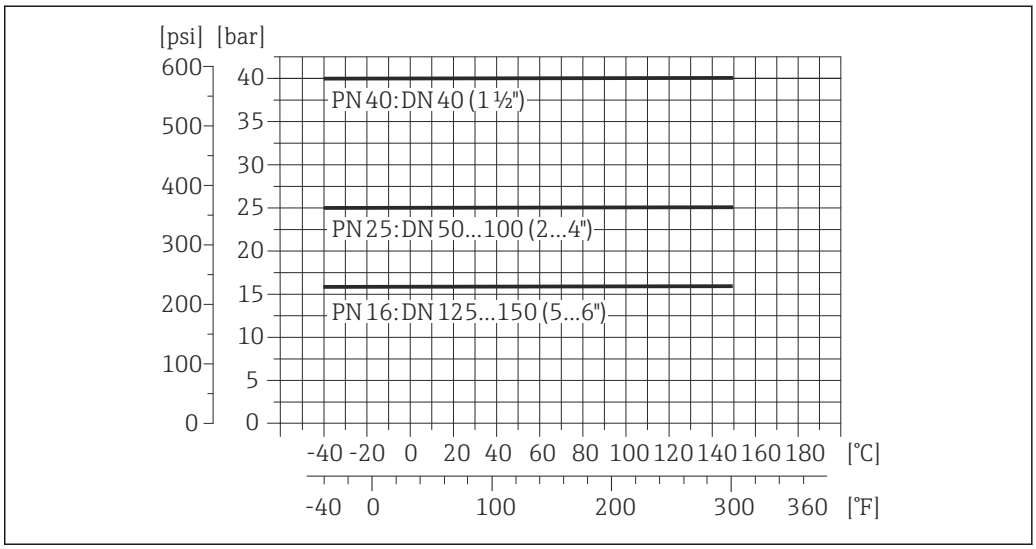


27 *Material 1.4404 (316L)*

Welded connection as per ASME BPE

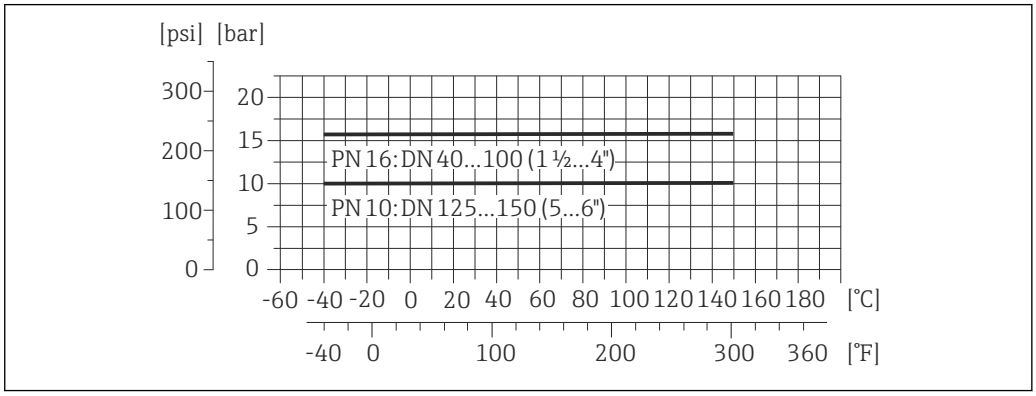


Welded connection as per ISO 2037



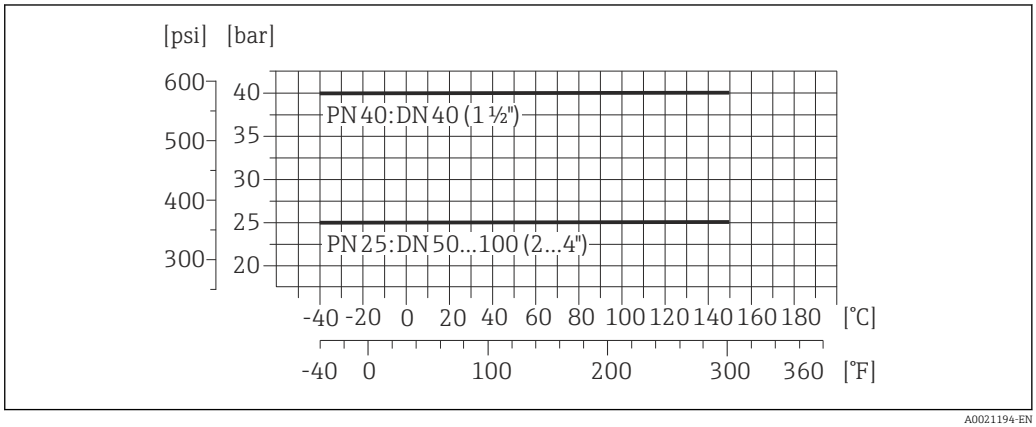
28 *Material 1.4404 (316L)*

Clamp as per ISO 2852, DIN 32676, L14 AM7



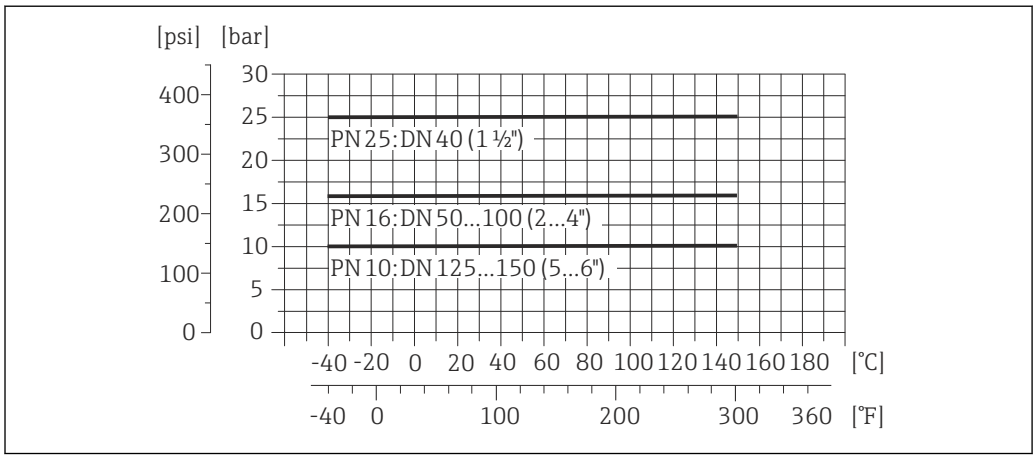
29 *Material 1.4404 (316L)*

Coupling as per DIN 11864-1, ISO 2853



30 *Material 1.4404 (316L)*

Flange connection as per DIN 11864-2



31 *Material 1.4404 (316L)*

Pressure tightness

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:				
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)	+150 °C (+302 °F)
2 to 150	1/12 to 6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum flow velocity is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for low conductivity values
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. milk with a high fat content)

For an overview of the measuring range full scale values, see the "Measuring range" section (→ 6)

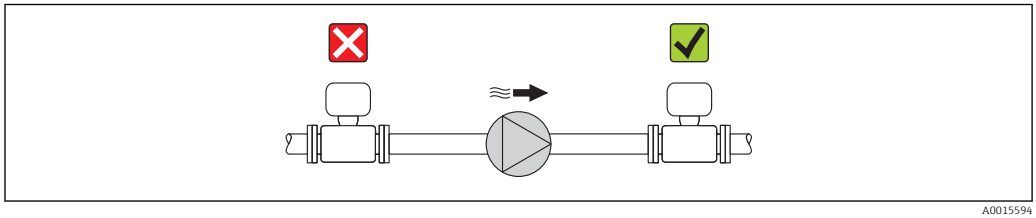
Pressure loss

- No pressure loss occurs as of nominal diameter DN 8 (3/8") if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 33)

System pressure

- Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.
- Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

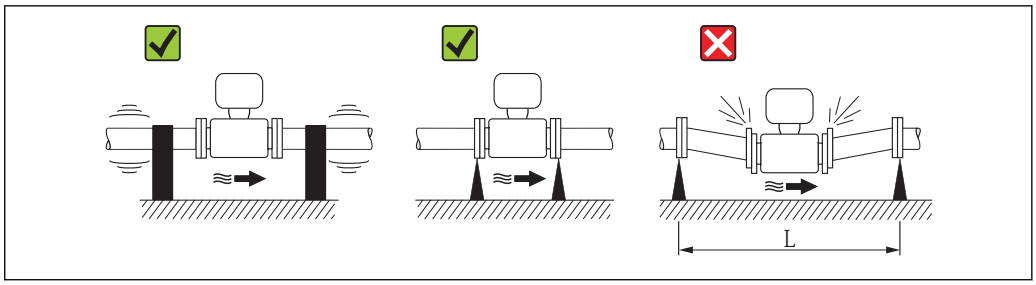
- For information on the liner's resistance to partial vacuum (→ 42)
- For information on the measuring system's resistance to vibration and shock (→ 35), (→ 35)



Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

For information on the permitted resistance to vibration and shock (→ 35), (→ 35)



32 *Measures to prevent vibration of the device*

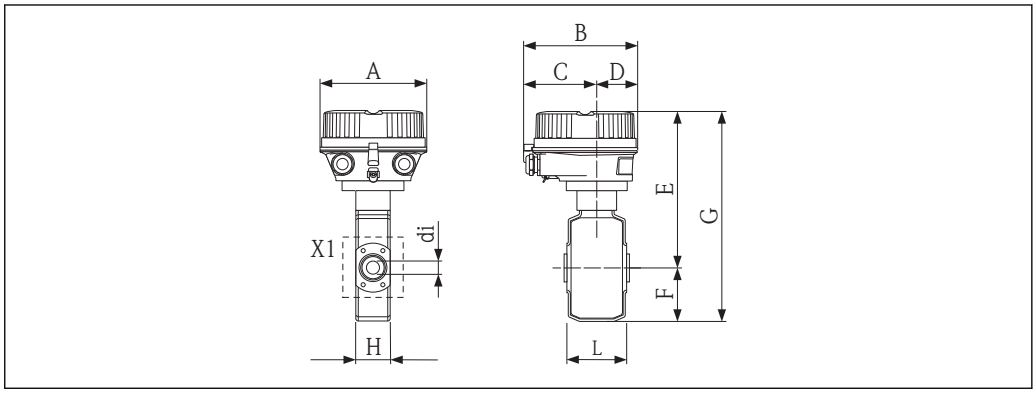
L *> 10 m (33 ft)*

Mechanical construction

Design, dimensions

Compact version

Order code for "Housing", option A "Compact, coated aluminum" with DN 2 to 25 (1/12 to 1")



Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	X1 [mm]	di [mm]
2	86	136	147.5	93.5	54	179	55	234	43	4 × M6	2.25
4	86	136	147.5	93.5	54	179	55	234	43	4 × M6	4.5
8	86	136	147.5	93.5	54	179	55	234	43	4 × M6	9
15	86	136	147.5	93.5	54	179	55	234	43	4 × M6	16
25	86	136	147.5	93.5	54	179	55	234	56	4 × M6	26

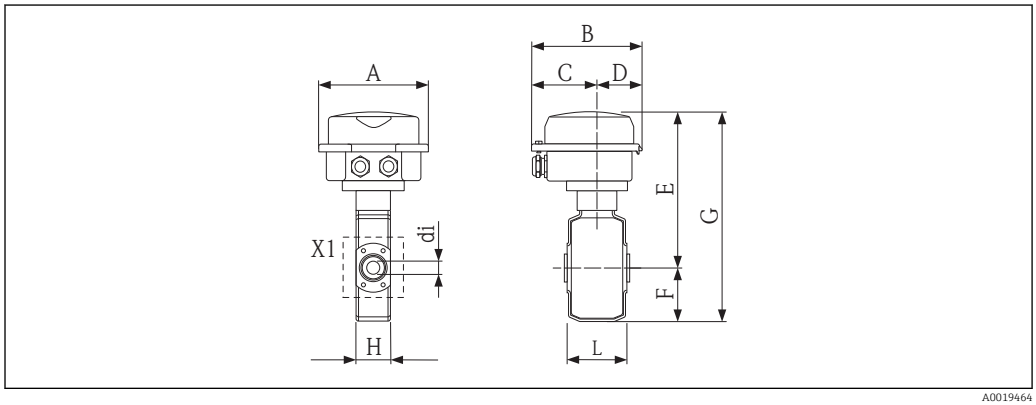
1) Total length (L) depends on the process connections.

Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
1/12	3.39	5.35	5.81	3.68	2.13	7.05	2.17	9.21	1.69	4 × M6	0.09
1/8	3.39	5.35	5.81	3.68	2.13	7.05	2.17	9.21	1.69	4 × M6	0.18
3/8	3.39	5.35	5.81	3.68	2.13	7.05	2.17	9.21	1.69	4 × M6	0.35
½	3.39	5.35	5.81	3.68	2.13	7.05	2.17	9.21	1.69	4 × M6	0.63
1	3.39	5.35	5.81	3.68	2.13	7.05	2.17	9.21	2.20	4 × M6	1.02

1) Total length (L) depends on the process connections.

Order code for "Housing", option B "Compact hygienic, stainless" with DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	X1 [mm]	di [mm]
2	86	133.5	136.8	78	58.8	173	55	228	43	4 × M6	2.25
4	86	133.5	136.8	78	58.8	173	55	228	43	4 × M6	4.5
8	86	133.5	136.8	78	58.8	173	55	228	43	4 × M6	9
15	86	133.5	136.8	78	58.8	173	55	228	43	4 × M6	16
25	86	133.5	136.8	78	58.8	173	55	228	56	4 × M6	26

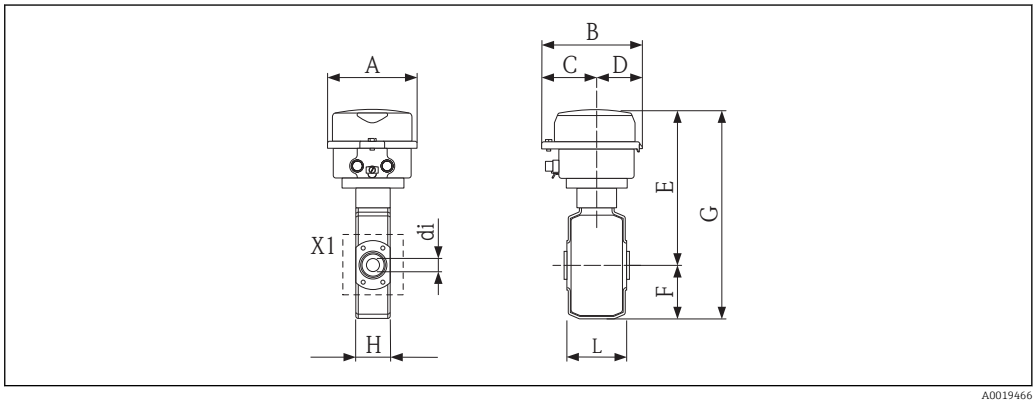
1) Total length (L) depends on the process connections.

Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
1/12	3.39	5.26	5.39	3.07	2.31	6.81	2.17	8.98	1.69	4 × M6	0.09
1/8	3.39	5.26	5.39	3.07	2.31	6.81	2.17	8.98	1.69	4 × M6	0.18
3/8	3.39	5.26	5.39	3.07	2.31	6.81	2.17	8.98	1.69	4 × M6	0.35
½	3.39	5.26	5.39	3.07	2.31	6.81	2.17	8.98	1.69	4 × M6	0.63
1	3.39	5.26	5.39	3.07	2.31	6.81	2.17	8.98	2.20	4 × M6	1.02

1) Total length (L) depends on the process connections.

Order code for "Housing", option C "Ultra compact hygienic, stainless" with DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	X1 [mm]	di [mm]
2	86	111.4	123.6	67.7	55.9	173	55	228	43	4 × M6	2.25
4	86	111.4	123.6	67.7	55.9	173	55	228	43	4 × M6	4.5
8	86	111.4	123.6	67.7	55.9	173	55	228	43	4 × M6	9
15	86	111.4	123.6	67.7	55.9	173	55	228	43	4 × M6	16
25	86	111.4	123.6	67.7	55.9	173	55	228	56	4 × M6	26

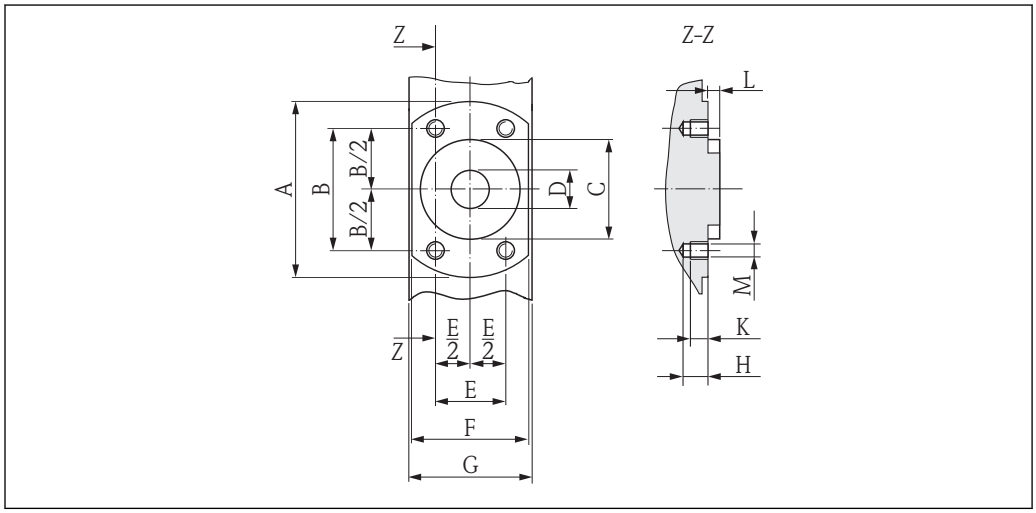
1) Total length (L) depends on the process connections.

Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
1/12	3.39	4.39	4.87	2.67	2.20	6.81	2.17	8.98	1.69	4 × M6	0.09
1/8	3.39	4.39	4.87	2.67	2.20	6.81	2.17	8.98	1.69	4 × M6	0.18
3/8	3.39	4.39	4.87	2.67	2.20	6.81	2.17	8.98	1.69	4 × M6	0.35
½	3.39	4.39	4.87	2.67	2.20	6.81	2.17	8.98	1.69	4 × M6	0.63
1	3.39	4.39	4.87	2.67	2.20	6.81	2.17	8.98	2.20	4 × M6	1.02

1) Total length (L) depends on the process connections.

Detail X1, sensor flange connection DN 2 to 25 (1/12 to 1")



33 *Front view without process connections*

Dimensions in SI units

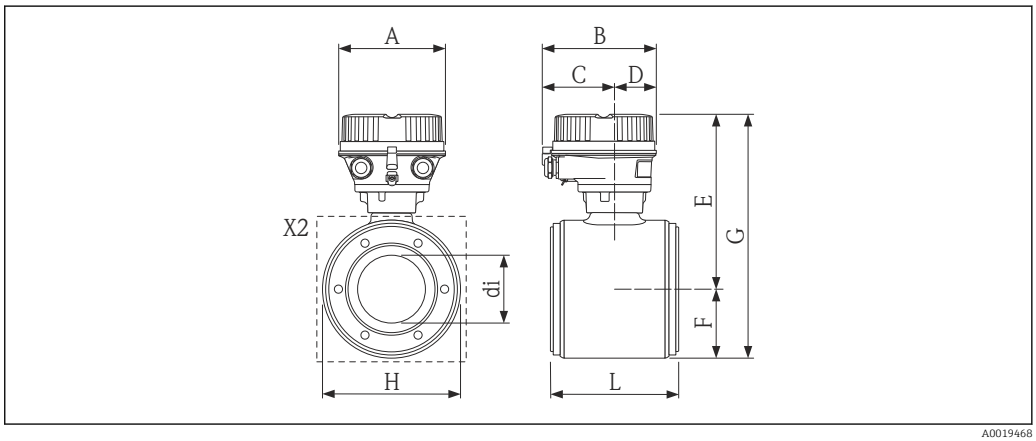
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	K [mm]	L [mm]	M [mm]
2	62	41.6	34	9	24	42	43	8.5	6	4	M6
4	62	41.6	34	9	24	42	43	8.5	6	4	M6
8	62	41.6	34	9	24	42	43	8.5	6	4	M6
15	62	41.6	34	16	24	42	43	8.5	6	4	M6
25	72	50.2	44	26	29	55	56	8.5	6	4	M6

Dimensions in US units

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	K [in]	L [in]	M [mm]
1/12	2.44	1.64	1.34	0.35	0.94	1.65	1.69	0.33	0.24	0.16	M6
1/8	2.44	1.64	1.34	0.35	0.94	1.65	1.69	0.33	0.24	0.16	M6

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	K [in]	L [in]	M [mm]
3/8	2.44	1.64	1.34	0.35	0.94	1.65	1.69	0.33	0.24	0.16	M6
½	2.44	1.64	1.34	0.63	0.94	1.65	1.69	0.33	0.24	0.16	M6
1	2.83	1.98	1.73	0.89	1.14	2.17	2.20	0.33	0.24	0.16	M6

Order code for "Housing", option A "Compact, coated aluminum" with DN 40 to 150 (1 ½ to 6")



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Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	X1 [mm]	di [mm]
40	140	136	147.5	93.5	54	179.3	53.3	232.6	107	4 × M8	34.8
50	140	136	147.5	93.5	54	185.8	59.8	245.6	120	4 × M8	47.5
65	140	136	147.5	93.5	54	195.6	69.6	265.2	135	6 × M8	60.2
80	140	136	147.5	93.5	54	199.8	73.8	273.6	148	6 × M8	72.9
100	140	136	147.5	93.5	54	212.8	86.8	299.6	174	6 × M8	97.4
125	200	136	147.5	93.5	54	228.8	102.8	331.6	206	6 × M10	120.0
150	200	136	147.5	93.5	54	242.8	116.8	359.6	234	6 × M10	146.9

1) Total length (L) depends on the process connections.

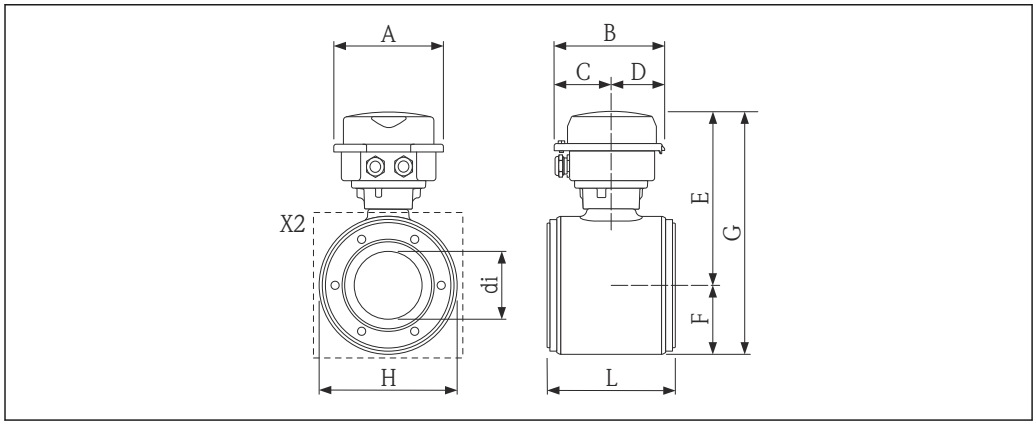
Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
1 ½	5.51	5.35	5.81	3.68	2.13	7.06	2.10	9.16	4.21	4 × M8	1.37
2	5.51	5.35	5.81	3.68	2.13	7.31	2.35	9.67	4.72	4 × M8	1.87
3	5.51	5.35	5.81	3.68	2.13	7.87	2.91	10.8	5.83	6 × M8	2.87

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
4	5.51	5.35	5.81	3.68	2.13	8.38	3.42	11.8	6.85	6 × M8	3.83
5	7.87	5.35	5.81	3.68	2.13	9.01	4.05	13.1	8.11	6 × M10	4.72
6	7.87	5.35	5.81	3.68	2.13	9.56	4.60	14.2	9.21	6 × M10	5.78

1) Total length (L) depends on the process connections.

Order code for "Housing", option B "Compact hygienic, stainless" with DN 40 to 150 (1 ½ to 6")



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Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	X1 [mm]	di [mm]
40	140	133.5	136.8	78	58.8	173.3	53.3	226.6	107	4 × M8	34.8
50	140	133.5	136.8	78	58.8	179.8	59.8	239.6	120	4 × M8	47.5
65	140	133.5	136.8	78	58.8	189.6	69.6	259.2	135	6 × M8	60.2
80	140	133.5	136.8	78	58.8	193.8	73.8	267.6	148	6 × M8	72.9
100	140	133.5	136.8	78	58.8	206.8	86.8	293.6	174	6 × M8	97.4
125	200	133.5	136.8	78	58.8	222.8	102.8	325.6	206	6 × M10	120.0
150	200	133.5	136.8	78	58.8	236.8	116.8	353.6	234	6 × M10	146.9

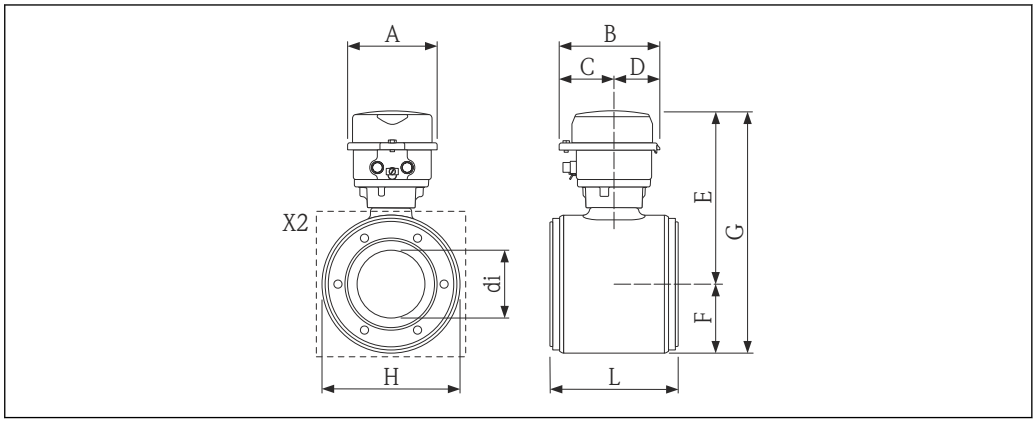
1) Total length (L) depends on the process connections.

Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
1 ½	5.51	5.26	5.39	3.07	2.31	6.82	2.10	8.92	4.21	4 × M8	1.37
2	5.51	5.26	5.39	3.07	2.31	7.08	2.35	9.43	4.72	4 × M8	1.87
3	5.51	5.26	5.39	3.07	2.31	7.63	2.91	10.5	5.83	6 × M8	2.87
4	5.51	5.26	5.39	3.07	2.31	8.14	3.42	11.6	6.85	6 × M8	3.83
5	7.87	5.26	5.39	3.07	2.31	8.77	4.05	12.8	8.11	6 × M10	4.72
6	7.87	5.26	5.39	3.07	2.31	9.32	4.60	13.9	9.21	6 × M10	5.78

1) Total length (L) depends on the process connections.

Order code for "Housing", option C "Ultra compact hygienic, stainless" with DN 40 to 150 (1 ½ to 6")



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Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	X1 [mm]	di [mm]
40	140	111.4	123.6	67.7	55.9	173.3	53.3	226.6	107	4 × M8	34.8
50	140	111.4	123.6	67.7	55.9	179.8	59.8	239.6	120	4 × M8	47.5
65	140	111.4	123.6	67.7	55.9	189.6	69.6	259.2	135	6 × M8	60.2
80	140	111.4	123.6	67.7	55.9	193.8	73.8	267.6	148	6 × M8	72.9
100	140	111.4	123.6	67.7	55.9	206.8	86.8	293.6	174	6 × M8	97.4
125	200	111.4	123.6	67.7	55.9	222.8	102.8	325.6	206	6 × M10	120.0
150	200	111.4	123.6	67.7	55.9	236.8	116.8	353.6	234	6 × M10	146.9

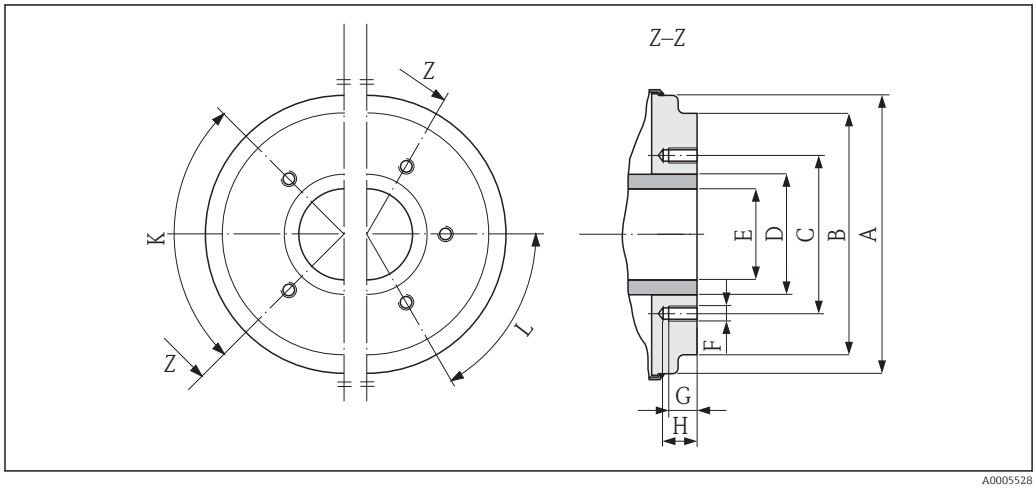
1) Total length (L) depends on the process connections.

Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	X1 [mm]	di [in]
1 ½	5.51	4.39	4.87	2.67	2.20	6.82	2.10	8.92	4.21	4 × M8	1.37
2	5.51	4.39	4.87	2.67	2.20	7.08	2.35	9.43	4.72	4 × M8	1.87
3	5.51	4.39	4.87	2.67	2.20	7.63	2.91	10.5	5.83	6 × M8	2.87
4	5.51	4.39	4.87	2.67	2.20	8.14	3.42	11.6	6.85	6 × M8	3.83
5	7.87	4.39	4.87	2.67	2.20	8.77	4.05	12.8	8.11	6 × M10	4.72
6	7.87	4.39	4.87	2.67	2.20	9.32	4.60	13.9	9.21	6 × M10	5.78

1) Total length (L) depends on the process connections.

Detail X2, sensor flange connection DN 40 to 150 (1 ½ to 6")



34 *Front view without process connections*

Dimensions in SI units

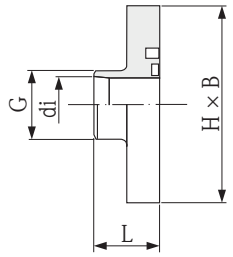
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	K 90° ±0.5° Tapped holes	L 60° ±0.5° Tapped holes
40	99.7	85.8	71.0	48.3	34.8	M8	12	17	4	–
50	112.7	98.8	83.5	60.3	47.5	M8	12	17	4	–
65	127.7	114.8	100.0	76.1	60.2	M8	12	17	–	6
80	140.7	133.5	114.0	88.9	72.9	M8	12	17	–	6
100	166.7	159.5	141.0	114.3	97.4	M8	12	17	–	6
125	198.7	191.5	171.0	139.7	120.0	M10	15	20	–	6
150	226.7	219.5	200.0	168.3	146.9	M10	15	20	–	6

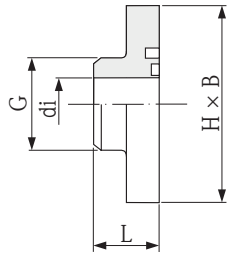
Dimensions in US units

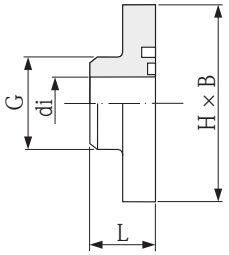
DN	A	B	C	D	E	F	G	H	K	L
									90° ±0.5°	60° ±0.5°
[in]	[in]	[in]	[in]	[in]	[in]	[mm]	[in]	[in]	Tapped holes	
1 ½	3.93	3.38	2.80	1.90	1.37	M8	0.47	0.67	4	–
2	4.44	3.89	3.29	2.37	1.87	M8	0.47	0.67	4	–
3	5.54	5.26	4.49	3.50	2.87	M8	0.47	0.67	–	6
4	6.56	6.28	5.55	4.50	3.83	M8	0.47	0.67	–	6
5	7.82	7.54	6.73	5.50	4.72	M10	0.59	0.79	–	6
6	8.93	8.64	7.87	6.63	5.78	M10	0.59	0.79	–	6

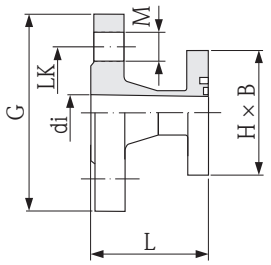
Process connections in SI units

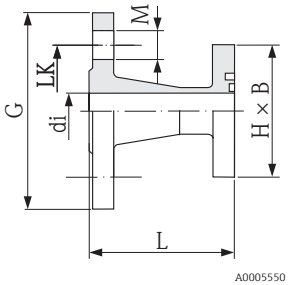
Process connections DN 2 to 25 with O-ring seal

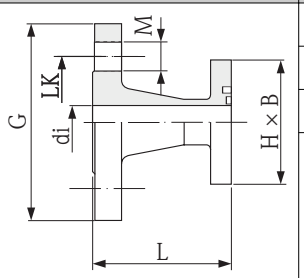
Welded connection DIN EN ISO 1127, 1.4404 (316L)						
Order code for "Process connection", option D1S	DN [mm]	Suitable for pipe DIN EN ISO 1127 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
 A0005547	2 to 8	13.5 × 1.6	10.3	13.5	20.3	62 × 42
	15	21.3 × 1.6	18.1	21.3	20.3	62 × 42
	25 (DIN)	33.7 × 2.0	29.7	33.7	20.3	62 × 52
	Length = (2 × L) + 86 mm					

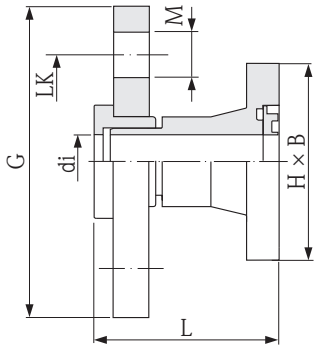
Welded connection ODT/SMS, 1.4404 (316L)						
Order code for "Process connection", option A2S	DN [mm]	Suitable for pipe ODT/SMS [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
 A0005548	2 to 8	13.5 × 2.30	9	13.5	20.3	62 × 42
	15	21.3 × 2.65	16	21.3	20.3	62 × 42
	25 (DIN)	33.7 × 3.25	27.2	33.7	20.3	72 × 55
	Length = (2 × L) + 86 mm					

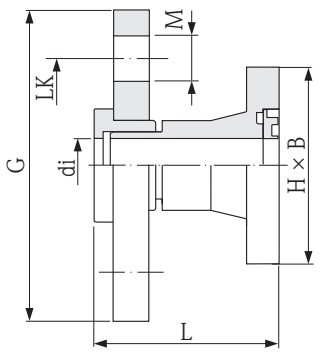
Welded connection ISO 2037, 1.4404 (316L)						
Order code for "Process connection", option I1S	DN [mm]	Suitable for pipe ISO 2037 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	13.5 × 2.3	9	13.5	20.3	62 × 42
	15	21.3 × 2.65	16	21.3	20.3	62 × 42
	25 (DIN)	33.7 × 3.25	27.2	33.7	20.3	72 × 55
	Length = (2 × L) + 86 mm					

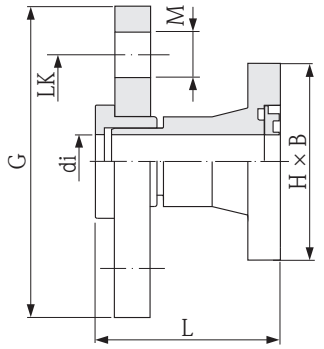
Flange EN 1092-1 (DIN 2501), flat face, 1.4404 (316L), PN 40								
Order code for "Process connection", option D5S	DN [mm]	Suitable for flange EN 1092-1 (DIN 2501) [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	DN 15	17.3	95	56.2	65	14	62 × 42
	15	DN 15	17.3	95	56.2	65	14	62 × 42
	25 (DIN)	DN 25	28.5	115	56.2	85	14	72 × 55
	Length = (2 × L) + 86 mm Length in accordance with DVGW (200 mm)							

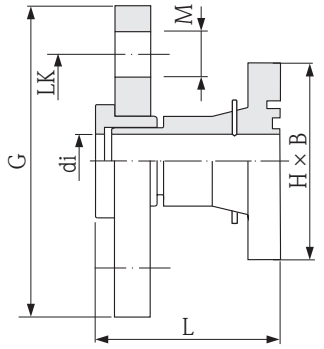
Flange ASME B16.5, 1.4404 (316L), Class 150								
Order code for "Process connection", option A1S	DN [mm]	Suitable for flange ASME B16.5 [in]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	½	15.7	89	66	60.5	15.7	62 × 42
	15	½	16	89	66	60.5	15.7	62 × 42
	25 (1" ASME)	1	26.7	108	71.8	79.2	15.7	72 × 55
	Length = (2 × L) + 86 mm							

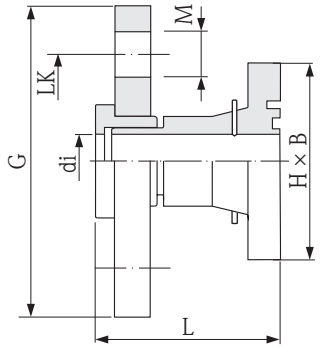
Flange JIS B2220, 1.4404 (316L), 20K								
Order code for "Process connection", option N4S	DN [mm]	Suitable for flange JIS B2220 [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	DN 15	15	95	67	70	15	62 × 42
	15	DN 15	16	95	67	70	15	62 × 42
	25 (DIN)	DN 25	26	125	67	90	19	72 × 55
	Length = (2 × L) + 86 mm							

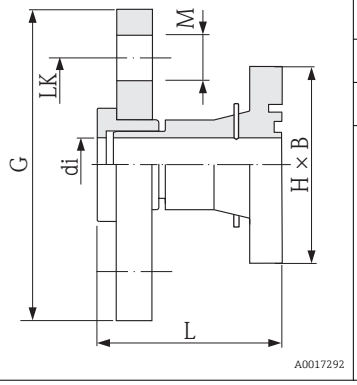
Flange EN 1092-1 (DIN 2501), PVDF, PN16								
Order code for "Process connection", option D3P	DN [mm]	Suitable for flange EN 1092-1 (DIN 2501) [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	DN 15	16	95	57	65	14	62 × 42
	15	DN 15	16	95	57	65	14	62 × 42
	25 (DIN)	DN 25	27.2	115	57	85	14	72 × 55
	Length = (2 × L) + 86 mm Length in accordance with DVGW (200 mm) The required grounding rings can be ordered as accessories (order code: DK5HR-****).							

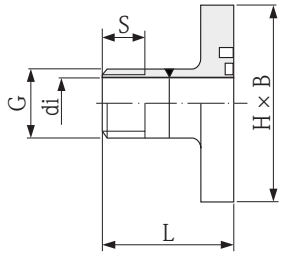
Flange ASME B16.5, PVDF, Class 150								
Order code for "Process connection", option A1P	DN [mm]	Suitable for flange ASME B16.5 [in]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	½	16	95	57	60	16	62 × 42
	15	½	16	95	57	60	16	62 × 42
	25 (DIN)	1	27.2	115	57	79	16	72 × 55
	Length = (2 × L) + 86 mm The required grounding rings can be ordered as accessories (order code: DK5HR-****).							

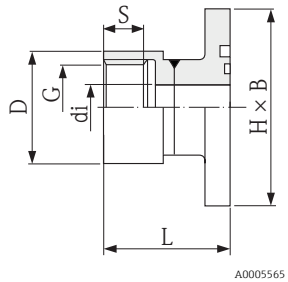
Flange JIS B2220, PVDF, 10K								
Order code for "Process connection", option N3P	DN [mm]	Suitable for flange JIS B2220 [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	DN 15	16	95	57	70	15	62 × 42
	15	DN 15	16	95	57	70	15	62 × 42
	25 (DIN)	DN 25	27.2	125	57	90	19	72 × 55
	Length = (2 × L) + 86 mm The required grounding rings can be ordered as accessories (order code: DK5HR-****).							

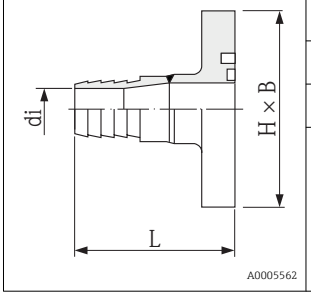
Flange with ground electrode EN 1092-1 (DIN 2501), PVDF, PN 16								
Order code for "Process connection", option D4P	DN [mm]	Suitable for flange EN 1092-1 (DIN 2501) [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	DN 15	16	95	57	65	14	62 × 42
	15	DN 15	16	95	57	65	14	62 × 42
	25 (DIN)	DN 25	27.2	115	57	85	14	72 × 55
	Length = (2 × L) + 86 mm Length in accordance with DVGW (200 mm) Grounding rings are not necessary.							

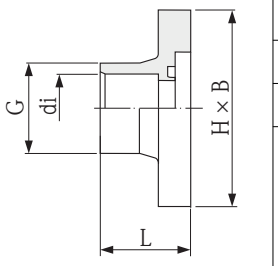
Flange with ground electrode ASME B16.5, PVDF, Class 150								
Order code for "Process connection", option A4P	DN [mm]	Suitable for flange ASME B16.5 [in]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	½	16	95	57	60	16	62 × 42
	15	½	16	95	57	60	16	62 × 42
	25 (DIN)	1	27.2	115	57	79	16	72 × 55
	Length = (2 × L) + 86 mm Grounding rings are not necessary.							

Flange with ground electrode, JIS B2220, PVDF, 10K								
Order code for "Process connection", option N4P	DN [mm]	Suitable for flange JIS B2220 [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	DN 15	16	95	57	70	15	62 × 42
	15	DN 15	16	95	57	70	15	62 × 42
	25 (DIN)	DN 25	27.2	125	57	90	19	72 × 55
	Length = (2 × L) + 86 mm Grounding rings are not necessary.							

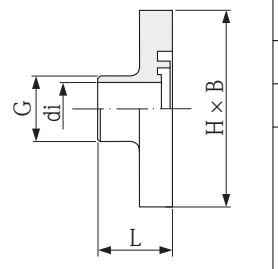
External thread, ISO 228 / DIN 2999, 1.4404 (316L)							
Order code for "Process connection", option I2S	DN [mm]	Suitable for internal thread ISO 228 / DIN 2999 [in]	di [mm]	G [in]	L [mm]	S [mm]	H × B [mm]
	2 to 8	R 3/8	10	3/8	40	10.1	62 × 42
	15	R ½	16	½	40	13.2	62 × 42
	25 (1" ASME)	R 1	25	1	42	16.5	72 × 55
	Length = (2 × L) + 86 mm						

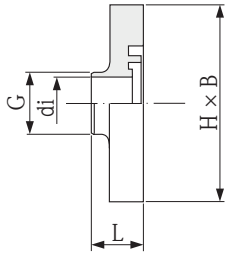
Internal thread, ISO 228 / DIN 2999, 1.4404 (316L)								
Order code for "Process connection", option I3S	DN [mm]	Suitable for external thread ISO 228 / DIN 2999 [in]	di [mm]	G [in]	D [mm]	L [mm]	S [mm]	H × B [mm]
	2 to 8	Rp 3/8	9	3/8	22	45	13	62 × 42
	15	Rp ½	16	½	27	45	14	62 × 42
	25 (1" ASME)	Rp 1	27.2	1	40	51	17	72 × 55
	Length = (2 × L) + 86 mm							

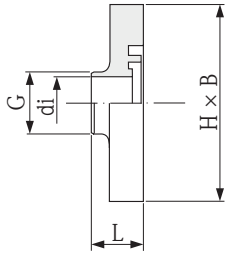
Hose connection 1.4404 (316L)					
Order code for "Process connection", options O1S, O2S, O3S	DN [mm]	Suitable for internal diameter [mm]	di [mm]	L [mm]	H × B [mm]
	2 to 8	13	10	49	62 × 42
	15	16	12.6	49	62 × 42
	15	19	16	49	72 × 55
	Length = (2 × L) + 86 mm				

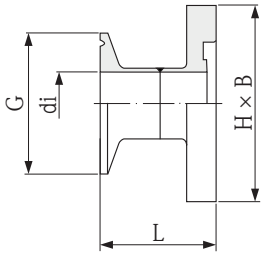
PVC adhesive sleeve						
Order code for "Process connection", options O1V, O2V	DN [mm]	Suitable for pipe [mm] / [in]	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	20 × 2 (DIN 8062)	20.2	27	38.5	62 × 42
	2 to 8	½	21.5	27.3	38.5	62 × 42
	15	20 × 2 (DIN 8062)	20.2	27	28	72 × 55
	Length = (2 × L) + 86 mm The required grounding rings can be ordered as accessories (order code: DK5HR-****).					

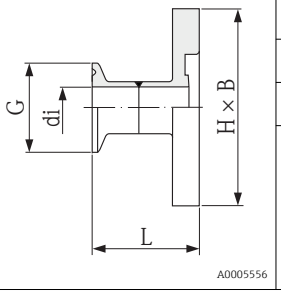
Process connections DN 2 to 25 with aseptic molded seal

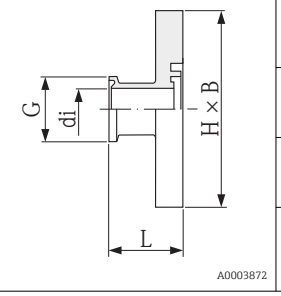
Welded connection DIN 11850, 1.4404 (316L)						
Order code for "Process connection", option DAS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	14 × 2	10	14	23.3	62 × 42
	15	20 × 2	16	20	23.3	62 × 42
	25 (DIN)	30 × 2	26	30	23.3	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

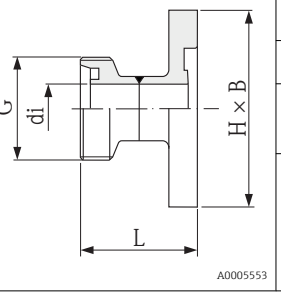
Welded connection ASME BPE, 1.4404 (316L)						
Order code for "Process connection", option AAS	DN [mm]	Suitable for pipe ASME BPE [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
 A0003871	2 to 8	12.7 × 1.65	9	12.7	16.1	62 × 42
	15	19.1 × 1.65	16	19.1	16.1	62 × 42
	25 (1" ASME)	25.4 × 1.65	22.6	25.4	16.1	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

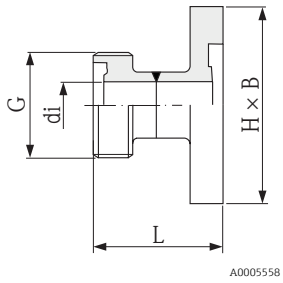
Welded connection ISO 2037, 1.4404 (316L)						
Order code for "Process connection", option IAS	DN [mm]	Suitable for pipe ISO 2037 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
 A0003871	2 to 8	12.7 × 1.65	9	12.7	16.1	62 × 42
	15	19.1 × 1.65	16	19.1	16.1	62 × 42
	25 (1" ASME)	25.4 × 1.65	22.6	25.4	16.1	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

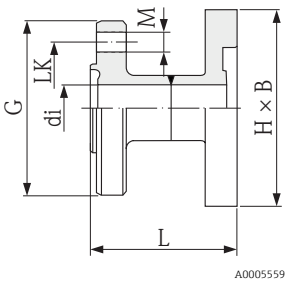
Clamp ISO 2852, Fig. 2, 1.4404 (316L)							
Order code for "Process connection", option IBS	DN [mm]	Suitable for pipe ISO 2037/BS 4825-1 [mm]	DN Clamp ISO 2852 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
 A0005560	25 (1" ASME)	24.5 × 1.65	25	22.6	50.5	44.3	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.						

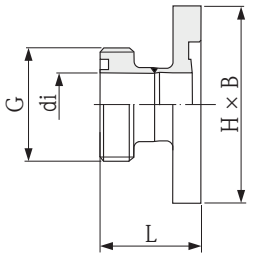
Clamp DIN 32676, 1.4404 (316L)						
Order code for "Process connection", option DBS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	Pipe 14 × 2 (DN 10)	10	34	41	62 × 42
	15	Pipe 20 × 2 (DN 15)	16	34	41	62 × 42
	25 (DIN)	Pipe 30 × 2 (DN 25)	26	50.5	44.5	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

Tri-Clamp for L14 AM7, 1.4404 (316L)						
Order code for "Process connection", option FAS	DN [mm]	Suitable for pipe ODT [mm] ([in])	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	Pipe 12.7 × 1.65 (ODT ½")	9.4	25	28.5	62 × 42
	15	Pipe 19.1 × 1.65 (ODT ¾")	15.8	25	28.5	62 × 42
	25 (1" ASME)	Pipe 25.4 × 1.65 (ODT 1")	22.1	50.4	28.5	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

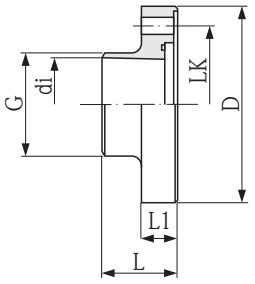
Coupling SC DIN 11851, threaded connection, 1.4404 (316L)						
Order code for "Process connection", option DCS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	Pipe 12 × 1 (DN 10)	10	Rd28 × ⅛	44	62 × 42
	15	Pipe 18 × 1.5 (ODT ¾")	16	Rd34 × ⅛	44	62 × 42
	25 (DIN)	Pipe 28 × 1 or 28×1.5 (DN 25)	26	Rd52 × ⅙	52	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

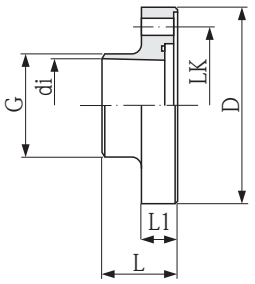
Coupling DIN 11864-1, aseptic threaded connection, form A, 1.4404 (316L)						
Order code for "Process connection", option DDS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
	2 to 8	Pipe 13 × 1.5 (DN 10)	10	Rd28 × ⅛	42	62 × 42
	15	Pipe 19 × 1.5 (DN 15)	16	Rd34 × ⅛	42	62 × 42
	25 (DIN)	Pipe 29 × 1.5 (DN 25)	26	Rd52 × ⅙	49	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

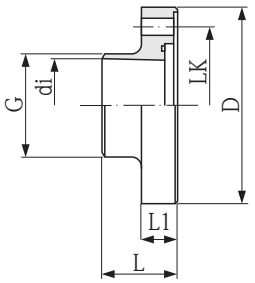
Flange DIN 11864-2, aseptic grooved flange, form A, 1.4404 (316L)								
Order code for "Process connection", option DES	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	L [mm]	LK [mm]	M [mm]	H × B [mm]
	2 to 8	Pipe 13 × 1.5 (DN 10)	10	54	48.5	37	9	62 × 42
	15	Pipe 19 × 1.5 (DN 15)	16	59	48.5	42	9	62 × 42
	25 (DIN)	Pipe 29 × 1.5 (DN 25)	26	70	48.5	53	9	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

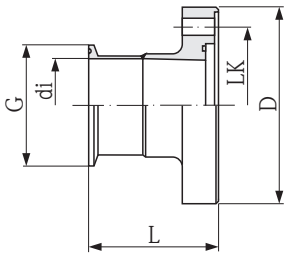
Coupling SMS 1145, threaded connection, 1.4404 (316L)							
Order code for "Process connection", option SAS	DN [mm]	Suitable for pipe OD [in]	DN SMS 1145 [mm]	di [mm]	G [mm]	L [mm]	H × B [mm]
	25 (1" ASME)	1	25	22.6	Rd40 × ⅙	30.8	72 × 55
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.						

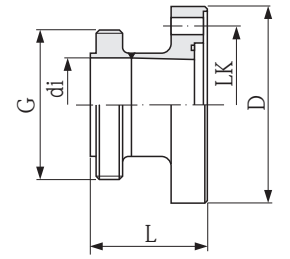
Process connections DN 40 to 150 with aseptic molded seal

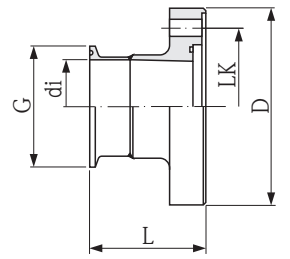
Welded connection DIN 11850, 1.4404 (316L)									
Order code for "Process connection", option DAS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	L1 [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005541	40	41 × 1.5	38	41	99.7	43	18	71	220
	50	53 × 1.5	50	53	112.7	43	18	83.5	220
	65	70 × 2	66	70	127.7	43	18	100	220
	80	85 × 2	81	85	140.7	43	18	114	280
	100	104 × 2	100	104	166.7	43	18	141	280
	125	129 × 2	125	129	198.7	53	25	171	300
	150	154 × 2	150	154	226.7	53	25	200	300
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

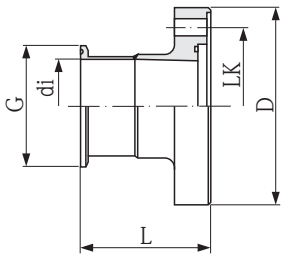
Welded connection ASME BPE, 1.4404 (316L)									
Order code for "Process connection", option AAS	DN [mm]	Suitable for pipe ASME BPE [mm]	di [mm]	G [mm]	D [mm]	L [mm]	L1 [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005541	40	38.1 × 1.65	34.8	38.1	99.7	43	18	71	220
	50	50.8 × 1.65	47.5	50.8	112.7	43	18	83.5	220
	65	63.5 × 1.65	60.2	63.5	127.7	43	18	100	220
	80	76.2 × 1.65	72.9	76.2	140.7	43	18	114	220
	100	101.6 × 1.65	97.4	101.6	166.7	43	18	141	220
	150	152.4 × 2.77	149.9	149.9	226.7	53	25	141	300
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

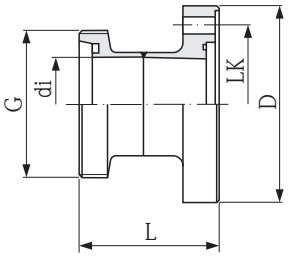
Welded connection ISO 2037, 1.4404 (316L)									
Order code for "Process connection", option IAS	DN [mm]	Suitable for pipe ISO 2037 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	L1 [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005541	40	38 × 1.2	35.6	38	99.7	43	18	71	220
	50	51 × 1.2	48.6	51	112.7	43	18	83.5	220
	65	63.5 × 1.6	60.3	63.5	127.7	43	18	100	220
	80	76.1 × 1.6	72.9	76.1	140.7	43	18	114	220
	100	101.6 × 2	97.6	101.6	166.7	43	18	141	220
	125	139.7 × 2	135.7	139.7	198.7	93	25	171	380
	150	168.3 × 2.6	163.1	168.3	226.7	93	25	200	380
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

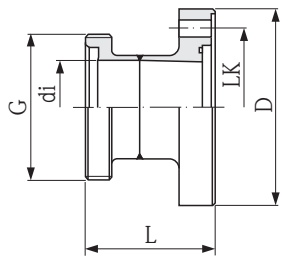
Clamp ISO 2852, Fig. 2, 1.4404 (316L)									
Order code for "Process connection", option IBS	DN [mm]	Suitable for pipe ISO 2037/BS 4825-1 [mm]	DN Clamp ISO 2852 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005544	40	38 × 1.6	38	35.6	50.5	99.7	43	71	220
	50	51 × 1.6	51	48.6	64	112.7	43	83.5	220
	65	63.5 × 1.6	63.5	60.3	77.5	127.7	43	100	220
	80	76.1 × 1.6	76.1	72.9	91	140.7	43	114	220
	100	101.6 × 2	101.6	97.6	119	166.7	43	141	220
	125	139.7 × 2	139.7	135.7	155	198.7	53	171	300
	150	168.3 × 2.6	168.3	163.1	183	226.7	53	200	300
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

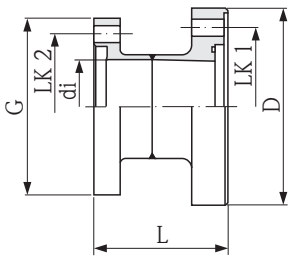
Coupling ISO 2853, threaded connection, 1.4404 (316L)									
Order code for "Process connection", option ICS	DN [mm]	Suitable for pipe ISO 2037/BS 4825-1 [mm]	DN Clamp ISO 2853 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005542	40	38 × 1.6	38	35.6	Tr 50.5 × 3.175	99.7	61	71	256
	50	51 × 1.6	51	48.6	Tr 64 × 3.175	112.7	61	83.5	256
	65	63.5 × 1.6	63.5	60.3	Tr 77.5 × 3.175	127.7	66	100	266
	80	76.1 × 1.6	76.1	72.9	Tr 91 × 3.175	140.7	71	114	276
	100	101.6 × 2	101.6	97.6	Tr 118 × 3.175	166.7	76	141	286
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

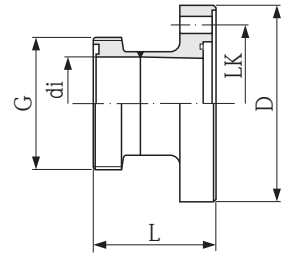
Clamp DIN 32676, 1.4404 (316L)								
Order code for "Process connection", option DBS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005539	40	41 × 1.5	38	50.5	99.7	43	71	220
	50	53 × 1.5	50	64	112.7	43	83.5	220
	65	70 × 2	66	91	127.7	43	100	220
	80	85 × 2	81	106	140.7	43	114	220
	100	104 × 2	100	119	166.7	43	141	220
	125	129 × 2	125	155	198.7	53	171	300
	150	154 × 2	150	183	226.7	53	200	300
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

Tri-Clamp for L14 AM7, 1.4404 (316L)								
Order code for "Process connection", option FAS	DN [mm]	Suitable for pipe ODT/SMS [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
	40	38.1 × 1.65	34.8	50.4	99.7	43	71	220
	50	50.8 × 1.65	47.5	63.9	112.7	43	83.5	220
	65	63.5 × 1.65	60.2	77.4	127.7	43	100	220
	80	76.2 × 1.65	72.9	90.9	140.7	43	114	220
	100	101.6 × 2.11	97.4	118.9	166.7	43	141	220
	150	152.4 × 2.77	146.9	166.9	226.7	53	200	300
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

Coupling SC DIN 11851, threaded connection, 1.4404 (316L)								
Order code for "Process connection", option DCS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
	40	42 × 1.5	38	Rd 65 × 1/6"	99.7	63	71	260
	50	54 × 1.5	50	Rd 78 × 1/6"	112.7	63	83.5	260
	65	70 × 2	66	Rd 95 × 1/6"	127.7	68	100	270
	80	85 × 2	81	Rd 110 × 1/4"	140.7	73	114	280
	100	104 × 2	100	Rd 130 × 1/4"	166.7	78	141	290
	125	129 × 2	125	Rd 160 × 1/4"	198.7	93	171	380
	150	154 × 2	150	Rd 160 × 1/4"	226.7	98	200	390
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

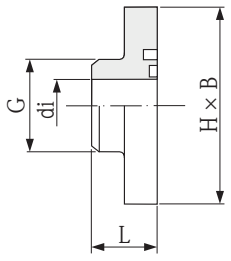
Coupling DIN 11864-1, aseptic threaded connection, form A, 1.4404 (316L)								
Order code for "Process connection", option DDS	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
	40	42 × 1.5	38	Rd 65 × 1/6"	99.7	61	71	256
	50	54 × 1.5	50	Rd 78 × 1/6"	112.7	61	83.5	256
	65	70 × 2	66	Rd 95 × 1/6"	127.7	66	100	266
	80	85 × 2	81	Rd 110 × 1/4"	140.7	71	114	276
	100	104 × 2	100	Rd 130 × 1/4"	166.7	76	141	286
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

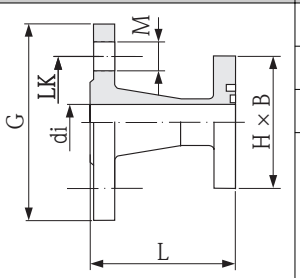
Flange DIN 11864-2, aseptic grooved flange, form A, 1.4404 (316L)									
Order code for "Process connection", option DES	DN [mm]	Suitable for pipe DIN 11850 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK 1 [mm]	LK 2 [mm]	L_{tot} [1] [mm]
 A0005546	40	42 × 1.5	38	82	99.7	56	71	65	246
	50	54 × 1.5	50	94	112.7	56	83.5	77	246
	65	70 × 2	66	113	127.7	56	100	95	246
	80	85 × 2	81	133	140.7	68	114	112	270
	100	104 × 2	100	159	166.7	72	141	137	278
	125	129 × 2	125	190	198.7	84	171	161	362
	150	154 × 2	150	220	226.7	84	200	188	362
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

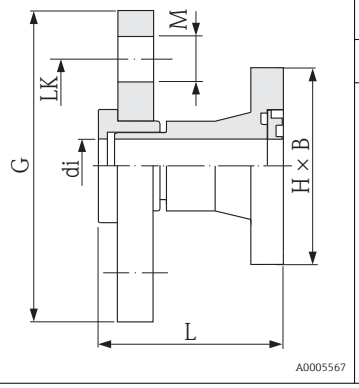
Coupling SMS 1145, threaded connection, 1.4404 (316L)									
Order code for "Process connection", option SAS	DN [mm]	Suitable for pipe ODT [mm]	DN SMS 1145 [mm]	di [mm]	G [mm]	D [mm]	L [mm]	LK [mm]	L_{tot} [1] [mm]
 A0005538	40	38.1 × 1.65	38	34.8	Rd 60 × 1/6"	99.7	61	71	256
	50	50.8 × 1.65	51	47.5	Rd 70 × 1/6"	112.7	61	83.5	256
	65	63.5 × 1.65	63.5	60.2	Rd 85 × 1/6"	127.7	66	100	266
	80	76.2 × 1.65	76	72.6	Rd 98 × 1/6"	140.7	71	114	276
	100	101.6 × 1.65	101.6	97.4	Rd 132 × 1/6"	166.7	76	141	286
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

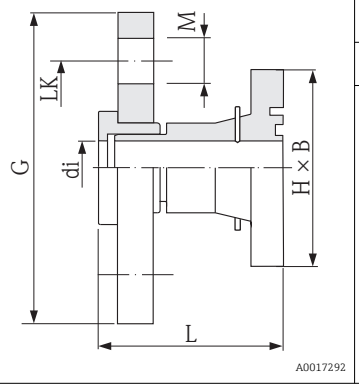
Process connections in US units

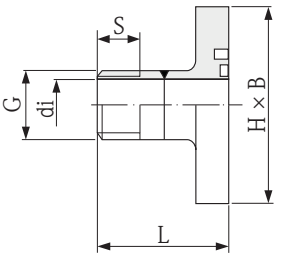
Process connections DN 1/12 to 1" with O-ring seal

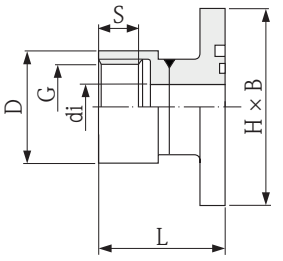
Welded connection ODT/SMS, 1.4404 (316L)						
Order code for "Process connection", option A2S	DN [in]	Suitable for pipe ODT/SMS [in]	di [in]	G [in]	L [in]	H × B [in]
 A0005548	1/12 to 5/16	0.53 × 0.09	0.35	0.53	0.80	2.44 × 1.65
	½	0.84 × 0.10	0.63	0.84	0.80	2.44 × 1.65
	Length = (2 × L) + 3.39 in					

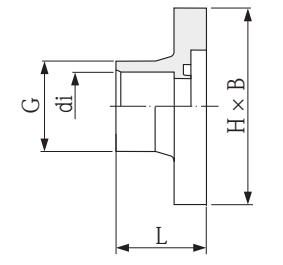
Flange ASME B16.5, 1.4404 (316L), Class 150								
Order code for "Process connection", option A1S	DN [in]	Suitable for flange ASME B16.5 [in]	di [in]	G [in]	L [in]	LK [in]	M [in]	H × B [in]
	1/12 to 5/16	½	0.62	3.50	2.60	2.38	0.62	2.44 × 1.65
	½	½	0.63	3.50	2.60	2.38	0.62	2.44 × 1.65
	1	1	1.05	4.25	2.83	3.12	0.62	2.83 × 2.17
	Length = (2 × L) + 3.39 in							

Flange ASME B16.5, PVDF, Class 150								
Order code for "Process connection", option A1P	DN [in]	Suitable for flange ASME B16.5 [in]	di [in]	G [in]	L [in]	LK [in]	M [in]	H × B [in]
	1/12 to 5/16	½	0.63	3.74	2.24	2.36	0.63	2.44 × 1.65
	½	½	0.63	3.74	2.24	2.36	0.63	2.44 × 1.65
	Length = (2 × L) + 3.39 in The required grounding rings can be ordered as accessories (order code: DK5HR-****).							

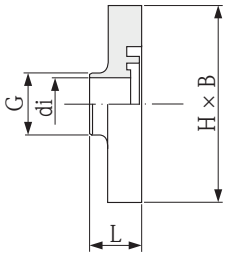
Flange with ground electrode ASME B16.5, PVDF, Class 150								
Order code for "Process connection", option A4P	DN [in]	Suitable for flange ASME B16.5 [in]	di [in]	G [in]	L [in]	LK [in]	M [in]	H × B [in]
	1/12 to 5/16	½	0.63	3.74	2.24	2.36	0.63	2.44 × 1.65
	½	½	0.63	3.74	2.24	2.36	0.63	2.44 × 1.65
	Length = (2 × L) + 3.39 in Grounding rings are not necessary.							

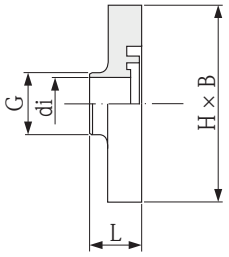
External thread, ISO 228/DIN 2999, 1.4404 (316L)							
Order code for "Process connection", option I2S	DN [in]	Suitable for internal thread ISO 228 / DIN 2999 [in]	di [in]	G [in]	L [in]	S [in]	H × B [in]
	1/12 to 5/16	R 3/8	0.39	3/8	1.57	0.40	2.44 × 1.65
	½	R ½	0.63	½	1.57	0.52	2.44 × 1.65
	1	R 1	0.98	1	1.65	0.655	2.83 × 2.17
	Length = (2 × L) + 3.39 in						

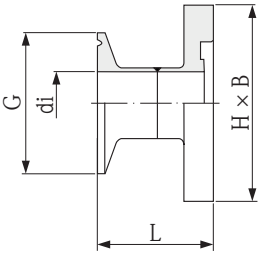
Internal thread, ISO 228/DIN 2999, 1.4404 (316L)							
Order code for "Process connection", option I3S	DN [in]	Suitable for external thread ISO 228 / DIN 2999 [in]	di [in]	G [in]	D [in]	L [in]	S [in]	H × B [in]
	1/12 to 5/16	Rp 3/8	0.35	3/8	0.87	1.77	0.51	2.44 × 1.65
	½	Rp ½	0.63	½	1.06	1.77	0.55	2.44 × 1.65
	1	Rp 1	1.07	1	1.57	2.01	0.67	2.83 × 2.17
	Length = (2 × L) + 3.39 in							

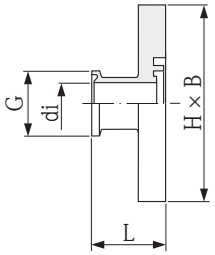
PVC adhesive sleeve						
Order code for "Process connection", options O1V, O2V	DN [in]	Suitable for pipe [in]	di [in]	G [in]	L [in]	H × B [in]
	1/12 to 5/16	½	0.85	1.07	1.52	2.44 × 1.65
	Length = (2 × L) + 3.39 in The required grounding rings can be ordered as accessories (order code: DK5HR-****).					

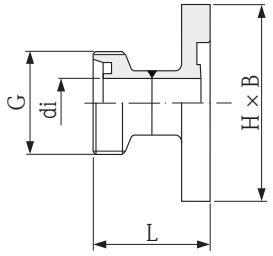
Process connections DN 1/12 to 1" with aseptic molded seal

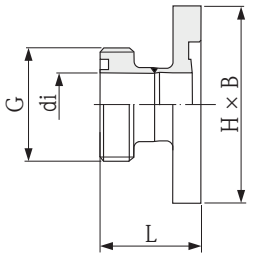
Welded connection ASME BPE, 1.4404 (316L)						
Order code for "Process connection", option AAS	DN [in]	Suitable for pipe ASME BPE [in]	di [in]	G [in]	L [in]	H × B [in]
 A0003871	1/12 to 5/16	0.50 × 0.06	0.35	0.50	0.63	2.44 × 1.65
	½	0.75 × 0.06	0.63	0.75	0.63	2.44 × 1.65
	1	1.00 × 0.06	0.89	1.00	0.63	2.83 × 2.17
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

Welded connection ISO 2037, 1.4404 (316L)						
Order code for "Process connection", option IAS	DN [in]	Suitable for pipe ISO 2037 [in]	di [in]	G [in]	L [in]	H × B [in]
 A0003871	1/12 to 5/16	0.50 × 0.06	0.35	0.50	0.63	2.44 × 1.65
	½	0.75 × 0.06	0.63	0.75	0.63	2.44 × 1.65
	1	1.00 × 0.06	0.89	1.00	0.63	2.83 × 2.17
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

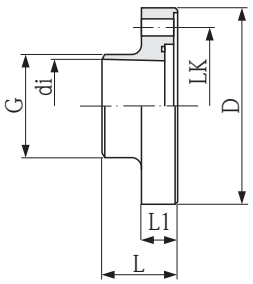
Clamp ISO 2852, Fig. 2, 1.4404 (316L)							
Order code for "Process connection", option IBS	DN [in]	Suitable for pipe ISO 2037/BS 4825-1 [in]	DN Clamp ISO 2852 [in]	di [in]	G [in]	L [in]	H × B [in]
 A0005560	1	0.96 × 0.06	1	0.89	2.00	1.74	2.83 × 2.17
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.						

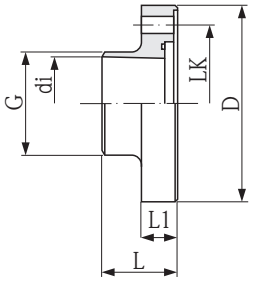
Tri-Clamp L14 AM7, 1.4404 (316L)						
Order code for "Process connection", option FAS	DN [in]	Suitable for pipe OD [in]	di [in]	G [in]	L [in]	H × B [in]
 A0003872	1/12 to 5/16	½	0.37	1	1.12	2.44 × 1.65
	½	¾	0.62	25	1.12	2.44 × 1.65
	1	1	0.87	2	1.12	2.83 × 2.17
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

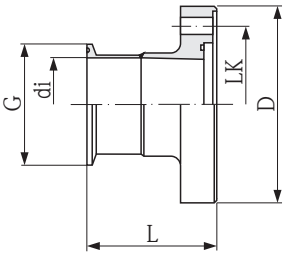
Coupling SC DIN 11851, threaded connection, 1.4404 (316L)						
Order code for "Process connection", option DCS	DN [in]	Suitable for pipe DIN 11850 [in]	di [in]	G [in]	L [in]	H × B [in]
 A0005553	½	Pipe ODT ¾	0.63	Rd0.05 × 0.13	1.73	2.44 × 1.65
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

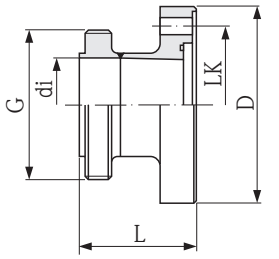
Coupling SMS 1145, threaded connection, 1.4404 (316L)							
Order code for "Process connection", option SAS	DN [in]	Suitable for pipe OD [in]	DN SMS 1145 [in]	di [in]	G [in]	L [in]	H × B [in]
 A0005564	1	1	1	0.89	Rd1.57 × 0.17	1.21	2.83 × 2.17
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.						

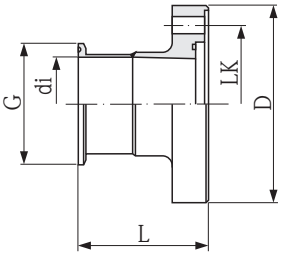
Process connections DN 1 ½ to 6" with aseptic molded seal

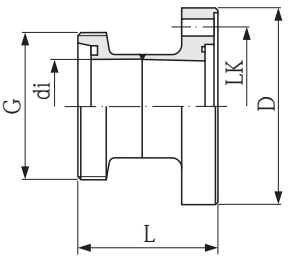
Welded connection ASME BPE, 1.4404 (316L)									
Order code for "Process connection", option AAS	DN [in]	Suitable for pipe ASME BPE [in]	di [in]	G [in]	D [in]	L [in]	L1 [in]	LK [in]	L_{tot} [1] [in]
 A0005541	1 ½	1.50 × 0.06	1.37	1.50	3.93	1.69	0.71	2.80	8.66
	2	2.00 × 0.06	1.87	2.00	4.44	1.69	0.71	3.29	8.66
	3	3.00 × 0.06	2.87	3.00	5.54	1.69	0.71	4.49	8.66
	4	4.00 × 0.08	3.83	4.00	6.56	1.69	0.71	5.55	8.66
	6	6.00 × 0.11	5.90	6.00	8.93	2.09	0.98	7.87	11.8
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

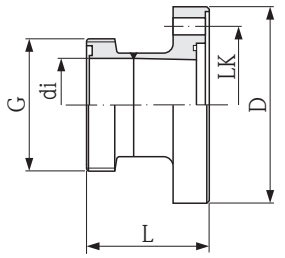
Welded connection ISO 2037, 1.4404 (316L)									
Order code for "Process connection", option IAS	DN [in]	Suitable for pipe ISO 2037 [in]	di [in]	G [in]	D [in]	L [in]	L1 [in]	LK [in]	L_{tot} [1] [in]
 A0005541	1 ½	1.50 × 0.05	1.40	1.50	3.93	1.69	0.71	2.80	8.66
	2	2.00 × 0.05	1.91	2.01	4.44	1.69	0.71	3.29	8.66
	3	3.00 × 0.06	2.87	3.00	5.54	1.69	0.71	4.49	8.66
	4	2.50 × 0.08	3.84	4.00	6.56	1.69	0.71	5.55	8.66
	5	4.00 × 0.08	5.34	5.50	7.82	3.66	0.98	6.73	15.0
	6	6.63 × 0.10	6.42	6.63	8.93	3.66	0.98	7.87	15.0
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

Clamp ISO 2852, Fig. 2, 1.4404 (316L)									
Order code for "Process connection", option IBS	DN [in]	Suitable for pipe ISO 2037/BS 4825-1 [in]	DN Clamp ISO 2852 [in]	di [in]	G [in]	D [in]	L [in]	LK [in]	L_{tot} [1] [in]
 A0005544	1 ½	1.50 × 0.06	1.50	1.40	1.99	3.93	1.69	2.80	8.66
	2	2.00 × 0.06	2.01	1.91	2.52	4.44	1.69	3.29	8.66
	3	3.00 × 0.06	3.00	2.87	3.58	5.54	1.69	4.49	8.66
	4	2.50 × 0.08	4.00	3.84	4.69	6.56	1.69	5.55	8.66
	5	4.00 × 0.08	5.50	5.34	6.10	7.82	2.09	6.73	11.8
	6	6.63 × 0.10	6.63	6.42	7.20	8.93	2.09	7.87	11.8
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

Coupling ISO 2853, threaded connection, 1.4404 (316L)									
Order code for "Process connection", option ICS	DN [in]	Suitable for pipe ISO 2037/BS 4825-1 [in]	DN Clamp ISO 2853 [in]	di [in]	G [in]	D [in]	L [in]	LK [in]	L_{tot} [1] [in]
 A0005542	1 ½	1.50 × 0.06	1.50	1.40	Tr 2.00 × 0.13	3.93	2.40	2.80	10.8
	2	2.00 × 0.06	2.01	1.91	Tr 2.52 × 0.13	4.44	2.40	3.29	10.8
	3	3.00 × 0.06	3.00	2.87	Tr 3.58 × 0.13	5.54	2.80	4.49	10.9
	4	2.50 × 0.08	4.00	3.84	Tr 4.65 × 0.13	6.56	2.99	5.55	11.3
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

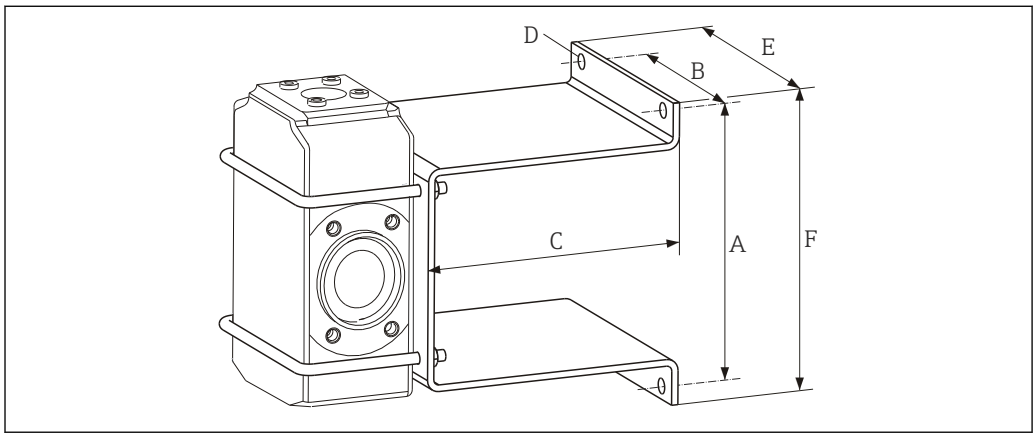
Tri-Clamp for L14 AM7, 1.4404 (316L)								
Order code for "Process connection", option FAS	DN [in]	Suitable for pipe ODT/SMS [in]	di [in]	G [in]	D [in]	L [in]	LK [in]	L_{tot} [1] [in]
 A0005543	1 ½	1.50 × 0.06	1.37	1.98	3.93	1.69	2.80	8.66
	2	2.00 × 0.06	1.87	2.52	4.44	1.69	3.29	8.66
	3	3.00 × 0.06	2.87	3.58	5.54	1.69	4.49	8.66
	4	4.00 × 0.08	3.83	4.68	6.56	1.69	5.55	8.66
	6	6.00 × 0.11	5.90	6.57	8.93	2.09	7.87	11.8
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

Coupling SC DIN 11851, threaded connection, 1.4404 (316L)								
Order code for "Process connection", option DCS	DN [in]	Suitable for pipe DIN 11850 [in]	di [in]	G [in]	D [in]	L [in]	LK [in]	L_{tot} [1] [in]
 A0005540	1 ½	1.65 × 0.06	1.5	Rd 2.56 × 1/6	3.93	2.48	2.80	10.2
	2	2.13 × 0.06	1.97	Rd 3.07 × 1/6	4.44	2.48	3.29	10.2
	3	3.35 × 0.08	3.19	Rd 4.33 × 1/4	5.54	2.87	4.49	11.0
	4	4.09 × 0.08	3.94	Rd 5.12 × 1/4	6.56	3.07	5.55	11.4
	5	5.08 × 0.08	4.92	Rd 6.30 × 1/4	7.82	3.66	6.73	15.0
	6	6.06 × 0.08	5.91	Rd 6.30 × 1/4	8.93	3.86	7.87	15.4
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.							

Coupling SMS 1145, threaded connection, 1.4404 (316L)									
Order code for "Process connection", option SAS	DN [in]	Suitable for pipe ODT [in]	DN SMS 1145 [in]	di [in]	G [in]	D [in]	L [in]	LK [in]	L_{tot} [1] [in]
 A0005538	1 ½	1.50 × 0.06	1.50	1.37	Rd 2.36 × 1/6	3.93	2.40	2.80	10.1
	2	2.00 × 0.06	2.00	1.87	Rd 2.76 × 1/6	4.44	2.40	3.29	10.1
	3	3.00 × 0.06	3.00	2.86	Rd 3.86 × 1/6	5.54	2.80	4.49	10.9
	4	4.00 × 0.08	4.00	3.83	Rd 5.20 × 1/6	6.56	2.99	5.55	11.3
	[1] L_{tot} = length Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.								

Accessories

Wall mounting kit DN 2 to 25 (1/12 to 1")



A0005537

Dimensions in SI units

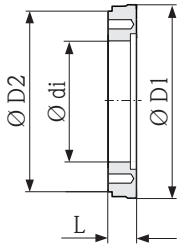
A [mm]	B [mm]	C [mm]	Ø D [mm]	E [mm]	F [mm]
125	88	120	7	110	140

Dimensions in US units

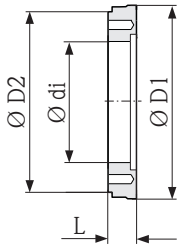
A [in]	B [in]	C [in]	Ø D [in]	E [in]	F [in]
4.92	3.46	4.72	0.28	4.33	5.51

Spacer DN 80 to 100 (3 to 4")

Dimensions in SI units

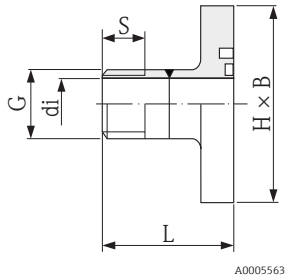
Order code DK5HB-****	DN [mm]	di [mm]	D1 [mm]	D2 [mm]	L [mm]
	80	72.9	140.7	141	33
	100	97.4	166.7	162	33

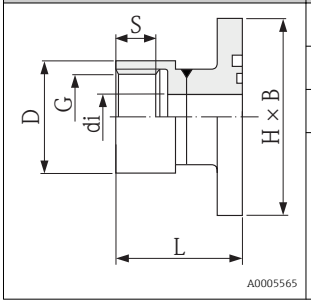
Dimensions in US units

Order code DK5HB-****	DN [in]	di [in]	D1 [in]	D2 [in]	L [in]
	3	2.87	5.54	5.55	1.30
	4	3.83	6.56	6.38	1.30

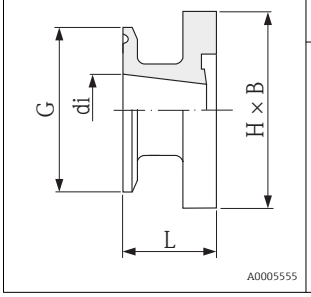
Process connections that can be ordered in SI units

Process connections DN 2 to 25 with O-ring seal

External thread, 1.4404 (316L)							
Order code DKH**-GD**	DN [mm]	Suitable for internal thread NP [in]	di [mm]	G [in]	L [mm]	S [mm]	H × B [mm]
	2 to 8	NPT3/8	10	3/8	50	15.5	62 × 42
	15	NPT ½	16	½	50	20	62 × 42
	25 (1" ASME)	NPT1	25	1	55	25	72 × 55
	Length = (2 × L) + 86 mm						

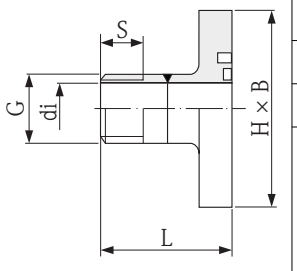
Internal thread, 1.4404 (316L)								
Order code DKH**-GC**	DN [mm]	Suitable for external thread NP [in]	di [mm]	G [in]	D [mm]	L [mm]	S [mm]	H × B [mm]
	2 to 8	NPT3/8	8.9	3/8	22	45	13	62 × 42
	15	NPT ½	16	½	27	45	14	62 × 42
	25 (1" ASME)	NPT1	27.2	1	40	51	17	72 × 55
	Length = (2 × L) + 86 mm							

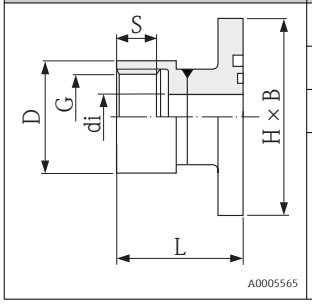
Process connections DN 2 to 25 with aseptic molded seal

Tri-Clamp L14 AM17, 1.4404 (316L)						
Order code DKH**-HF**	DN [mm]	Suitable for pipe OD [mm] ([in])	di [mm]	G [mm]	L [mm]	H × B [mm]
	15	Pipe ODT 1	22.1	50.4	28.5	62 × 42
	Length = (2 × L) + 86 mm Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

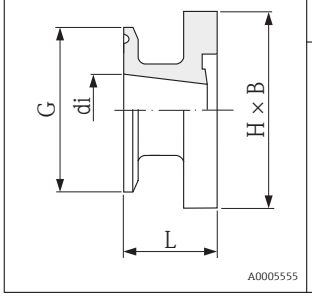
Process connections that can be ordered in US units

Process connections DN 1/12 to 1" with O-ring seal

External thread, 1.4404 (316L)							
Order code DKH**-GD**	DN [in]	Suitable for internal thread NP [in]	di [in]	G [in]	L [in]	S [in]	H × B [in]
	1/12 to 5/16	NPT3/8	0.39	3/8	2	0.61	2.44 × 1.65
	½	NPT ½	0.63	½	2	0.79	2.44 × 1.65
	1	NPT1	1	1	2.17	1	2.83 × 2.17
	Length = (2 × L) + 3.39 in						

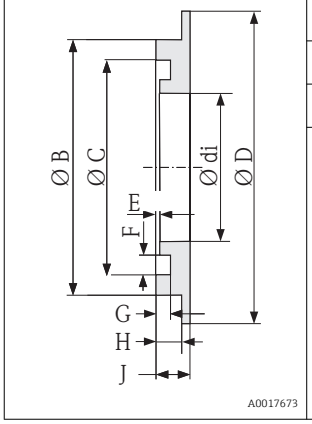
Internal thread, 1.4404 (316L)								
Order code DKH**-GC**	DN [in]	Suitable for external thread NP [in]	di [in]	G [in]	D [in]	L [in]	S [in]	H × B [in]
	1/12 to 5/16	NPT3/8	0.35	3/8	0.87	1.77	0.51	2.44 × 1.65
	½	NPT ½	0.63	½	1.06	1.77	0.55	2.44 × 1.65
	1	NPT1	1.07	1	1.57	2.01	0.67	2.83 × 2.17
	Length = (2 × L) + 3.39 in							

Process connections DN 1/12 to 1" with aseptic molded seal

Tri-Clamp L14 AM17, 1.4404 (316L)						
Order code DKH**-HF**	DN [in]	Suitable for pipe OD [in]	di [in]	G [in]	L [in]	H × B [in]
	½	Pipe ODT 1	0.87	2	1.12	2.44 × 1.65
	Length = (2 × L) + 3.39 in Please note the internal diameters of the measuring tube and process connection (di) when cleaning with pigs.					

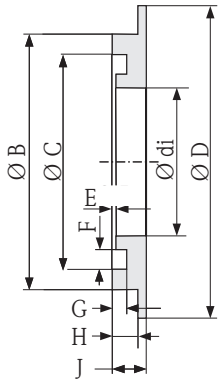
Grounding rings in SI units

For PVDF flanges, PVC adhesive sleeve

Grounding rings 1.4435 (316L), Alloy C22, tantalum										
Order code DK5HR-****	DN [mm]	di [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	J [mm]
	2 to 8	9	22	17.6	33.9	0.5	3.5	1.9	3.4	4.5
	15	16	29	24.6	33.9	0.5	3.5	1.9	3.4	4.5
	25 (DIN)	26	39	34.6	43.9	0.5	3.5	1.9	3.4	4.5

Grounding rings in US units

For PVDF flanges, PVC adhesive sleeve

Grounding rings 1.4435 (316L), Alloy C22, tantalum										
Order code DK5HR-****	DN [in]	di [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	J [in]
	1/12 to 5/16	0.35	0.87	0.69	1.33	0.02	0.14	0.07	0.13	0.18
	½	0.63	1.14	0.97	1.33	0.02	0.14	0.07	0.13	0.18
	1	0.89	1.44	1.23	1.73	0.02	0.14	0.07	0.13	0.18

Weight

Compact version

- Including the transmitter
- Weight specifications apply to standard pressure ratings and without packaging material.

Nominal diameter		Weight	
[mm]	[in]	[kg]	[lbs]
2	1/12	2.00	4.41
4	1/8	2.00	4.41
8	3/8	2.00	4.41
15	½	1.90	4.19
25	1	2.80	6.17
40	1 ½	4.10	9.04
50	2	4.60	10.1
65	–	5.40	11.9
80	3	6.00	13.2
100	4	7.30	16.1
125	5	12.7	28.0
150	6	15.1	33.3

Measuring tube specification

Nominal diameter		Pressure rating [1]	Process connection internal diameter	
		EN (DIN)	PFA	
[mm]	[in]	[bar]	[mm]	[in]
2	1/12	PN 16/40	2.25	0.09
4	1/8	PN 16/40	4.5	0.18
8	3/8	PN 16/40	9.0	0.35
15	½	PN 16/40	16.0	0.63
–	1	PN 16/40	22.6	0.89
25	–	PN 16/40	26.0	1.02
40	1 ½	PN 16/25/40	35.3	1.39

Nominal diameter		Pressure rating [1]	Process connection internal diameter
		EN (DIN)	PFA
[mm]	[in]	[bar]	[mm]	[in]
50	2	PN 16/25	48.1	1.89
65	–	PN 16/25	59.9	2.36
80	3	PN 16/25	72.6	2.86
100	4	PN 16/25	97.5	3.84
125	5	PN 10/16	120.0	4.72
150	6	PN 10/16	146.5	5.77

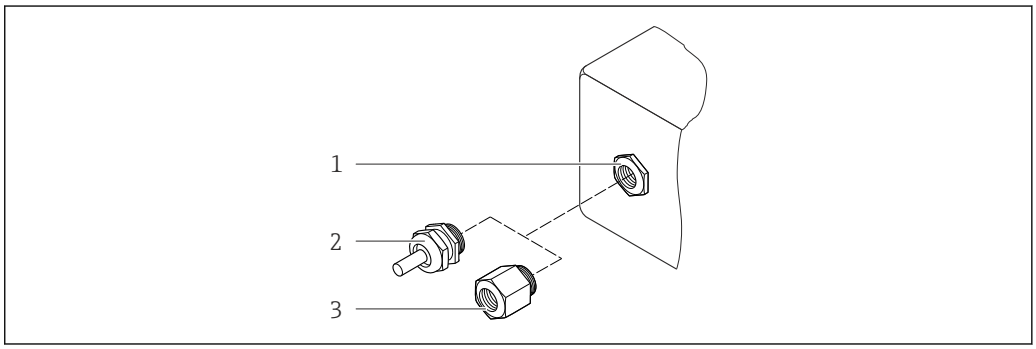
1) Depending on process connection and seals used

Materials

Transmitter housing

- Order code for "Housing", option **A** "Compact, aluminum coated":
  Coated aluminum AlSi10Mg
- Order code for "Housing", option **B** "Compact, hygienic, stainless":
  Hygienic version, stainless steel 1.4301 (304)
- Order code for "Housing", option **C** "Ultra compact hygienic, stainless":
  Hygienic version, stainless steel 1.4301 (304)

Cable entries/cable glands



35 *Possible cable entries/cable glands*

1 *Cable entry in transmitter housing, wall-mount housing or connection housing with internal thread M20 x 1.5*
2 *Cable gland M20 x 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*

Order code for "Housing", option A "Compact, coated aluminum"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Nickel-plated brass
Adapter for cable entry with internal thread G ½"	
Adapter for cable entry with internal thread NPT ½"	

Order code for "Housing", option B "Compact, hygienic, stainless"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Stainless steel 1.4404 (316L)
Adapter for cable entry with internal thread G ½"	
Adapter for cable entry with internal thread NPT ½"	

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Sensor housing

Stainless steel 1.4301 (304)

Measuring tubes

Stainless steel 1.4301 (304)

Liner

PFA (USP Class VI, FDA 21 CFR 177.1550, 3A)

Process connections

- Stainless steel 1.4404 (316L)
- PVDF
- PVC adhesive sleeve

List of all available process connections (→ 77)

Electrodes

- Standard: 1.4435 (316L)
- Optional: Alloy C22, tantalum, platinum (only up to DN 25 (1"))

Seals

- O-ring seal (DN 2 to 25 (1/12 to 1")): EPDM, FKM, Kalrez
- Aseptic molded seal (DN 2 to 150 (1/12 to 6")): EPDM [1], FKM, silicone [1]

Accessories

Grounding rings

- Standard: 1.4435 (316L)
- Optional: Alloy C22, tantalum

Wall mounting kit

Stainless steel 1.4301 (304)

Spacer

1.4435 (316L)

1) USP Class VI, FDA 21 CFR 177.2600, 3A

Fitted electrodes

- 2 measuring electrodes for signal detection
- 1 empty pipe detection electrode for empty pipe detection/temperature measurement (only DN 15 to 150 (½ to 6"))

Process connections

With O-ring seal
- Welded connection (DIN EN ISO 1127, ODT/SMS, ISO 2037)
- Flange (EN (DIN), ASME, JIS)
- Flange from PVDF (EN (DIN), ASME, JIS)
- External thread
- Internal thread
- Hose connection
- PVC adhesive sleeve

With aseptic molded seal:
- Welded connection (DIN 11850, ASME BPE, ISO 2037)
- Clamp (ISO 2852, ISO 2853, DIN 32676, L14 AM7)
- Coupling (DIN 11851, DIN 11864-1, ISO 2853, SMS 1145)
- Flange DIN 11864-2

For information on the materials of the process connections (→ 76)

Surface roughness

Electrodes with 1.4435 (316L), Alloy C22, platinum, tantalum:
≤ 0.3 to 0.5 µm (11.8 to 19.7 in)
(All data relate to parts in contact with fluid)

Liner with PFA:
≤ 0.4 µm (15.7 µin)
(All data relate to parts in contact with fluid)

Stainless steel process connections:
≤ 0.8 µm (31 µin)
Optional: ≤ 0.38 µm (15 µin)
(All data relate to parts in contact with fluid)

Operability

Operating concept

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

Rapid and safe commissioning
- Individual menus for applications
- Menu guidance with brief explanations of the individual parameter functions

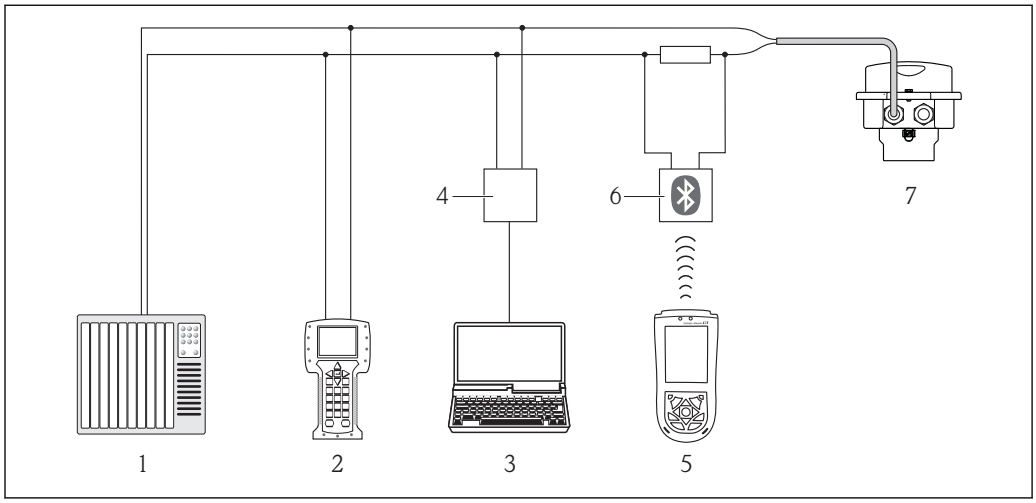
Reliable operation
- Operation in the following languages:
  - Via "FieldCare" operating tool:
    English, German, French, Spanish, Italian, Dutch, Chinese, Japanese
  - Via Web browser:
    English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech
- Uniform operating philosophy applied to operating tools and Web browser
- If replacing the electronic module, transfer the device configuration via the plug-in memory (HistoROM DAT) which contains the process and measuring device data and the event logbook. No need to reconfigure.
  For devices with Modbus RS485, the data recovery function is implemented without the plug-in memory (HistoROM DAT).

Efficient diagnostics increase measurement availability
- Troubleshooting measures can be called up via the operating tools and Web browser
- Diverse simulation options
- Status indicated by several light emitting diodes (LEDs) on the electronic module in the housing compartment

Remote operation

Via HART protocol

This communication interface is present in the following device version:
Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output

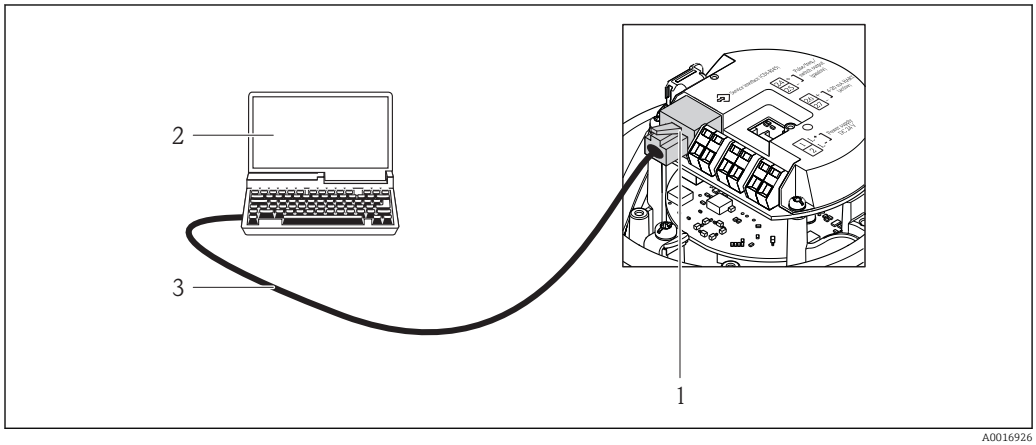


36 Options for remote operation via HART protocol

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 SFX100*
6 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

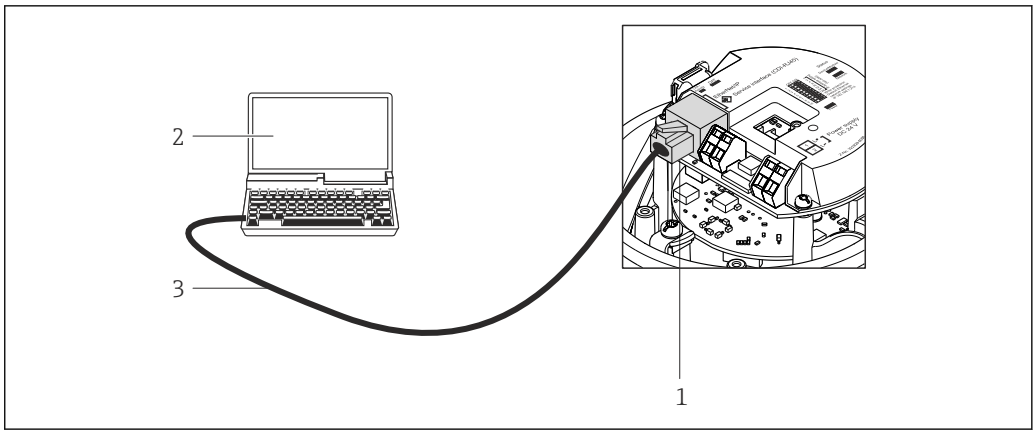
Via service interface (CDI-RJ45)

This communication interface is present in the following device version:
- Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
- Order code for "Output", option **L**: PROFIBUS DP
- Order code for "Output", option **N**: EtherNet/IP



37 Connection for the order code for "Output", option B: 4-20 mA HART, pulse/frequency/switch output

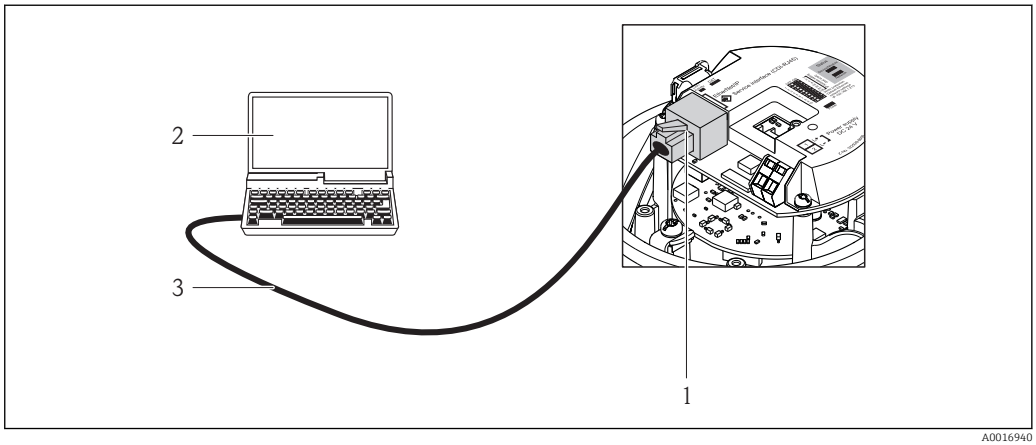
1 *Service interface (CDI -RJ45) of the measuring device with access to the integrated Web server*
2 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"*
3 *Standard Ethernet connecting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



A0021270

38 *Connection for order code for "Output", option L: PROFIBUS DP*

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



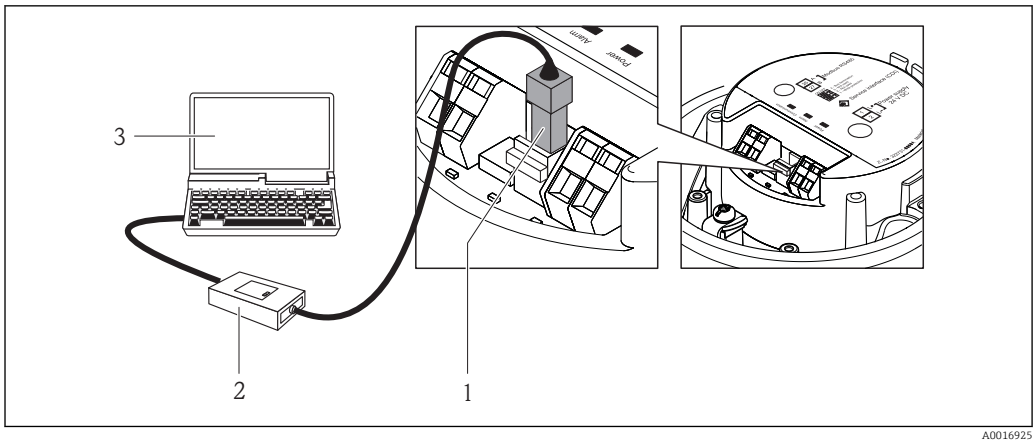
A0016940

39 *Connection for order code for "Output", option N: EtherNet/IP*

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

Via service interface (CDI)

This communication interface is present in the following device version:
Order code for "Output", option **M**: Modbus RS485

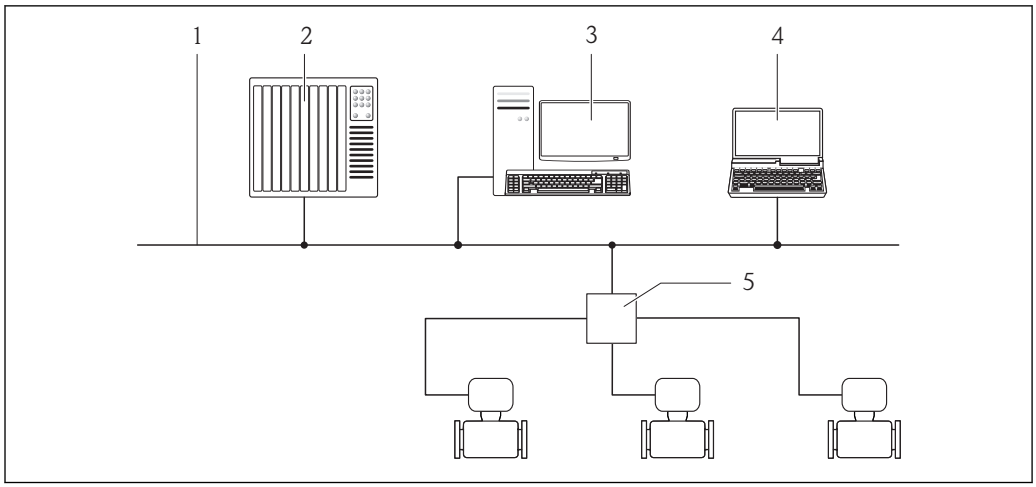


A0016925

1 Service interface (CDI) of the measuring device
2 Commubox FXA291
3 Computer with "FieldCare" operating tool with COM DTM "CDI Communication FXA291"

Via Ethernet network

This communication interface is present in the following device version:
Order code for "Output", option **N**: EtherNet/IP

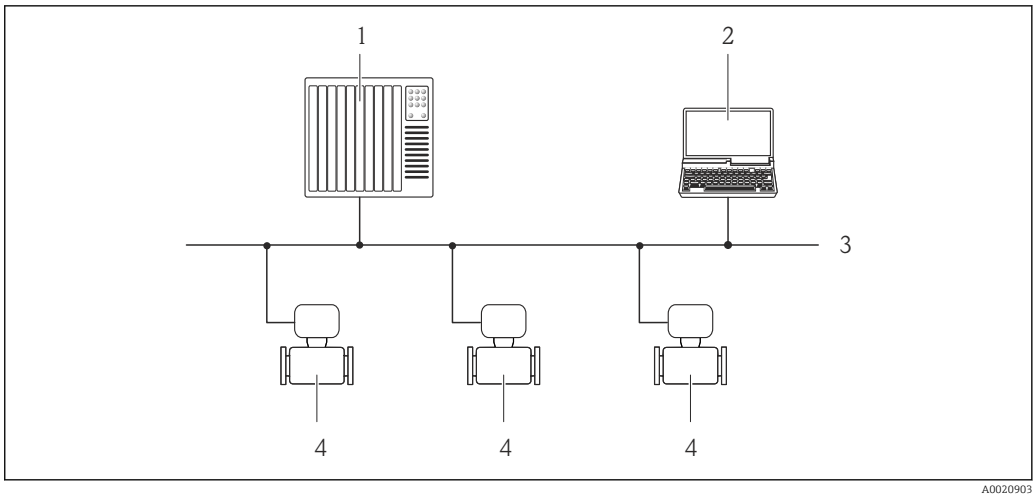


A0016961

1 Ethernet network
2 Automation system, e.g. "RSLogix" (Rockwell Automation)
3 Workstation for measuring device operation: with Add-on Profile Level 3 for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)
4 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"
5 Ethernet switch

Via PROFIBUS DP network

This communication interface is present in the following device version:
Order code for "Output", option **L**: PROFIBUS DP



A0020903

1 *Automation system*
2 *Computer with PROFIBUS network card*
3 *PROFIBUS DP network*
4 *Measuring device*

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-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.

ATEX, IECEx

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

Ex nA

Category	Type of protection
II3G	Ex nA IIC T6-T1 Gc

cCSAus

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

NI

Category	Type of protection
Class I Division 2 Groups ABCD	NI (Non-incendive version), NIFW parameter [1)]

1) Entity and NIFW parameter in accordance with Control Drawings

Sanitary compatibility

- 3A approval and EHEDG-certified
- Seals → conform to FDA (apart from Kalrez seals)

Certification PROFIBUS	**PROFIBUS interface** The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications: ▪ Certified in accordance with PROFIBUS PA Profile 3.02 ▪ 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/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the “MODBUS/TCP Conformance Test Laboratory” of the University of Michigan.
EtherNet/IP certification	The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications: ▪ Certified in accordance with the ODVA Conformance Test ▪ EtherNet/IP Performance Test ▪ EtherNet/IP PlugFest compliance ▪ The device can also be operated with certified devices of other manufacturers (interoperability)
Pressure Equipment Directive	The devices can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary. ▪ With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC. ▪ Devices bearing this marking (PED) are suitable for the following types of medium: Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to0.5 bar (7.3 psi) ▪ Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.
Other standards and guidelines	▪ EN 60529 Degrees of protection by housing (IP code) ▪ EN 61010-1 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ▪ 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 from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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 from Endress+Hauser either directly with the device or subsequently. 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.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**Heartbeat Monitoring:** Continuously supplies monitoring data, which are characteristic of the measuring principle, for an external condition monitoring system. This makes it possible 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 product quality, e.g. gas pockets. **Heartbeat Verification:** Makes it possible to check the device functionality on demand when the device is installed, without having to interrupt the process. ▪ Access via onsite operation or other interfaces (requires no on-site presence). ▪ Ideal solution for recurring device checks (SIL). ▪ End-to-end, traceable documentation of the verification results and verification report. ▪ Extension of calibration intervals.

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
Adapter set	Adapter connections for installing Promag H instead of a Promag 30/33 A or Promag 30/33 H (DN 25) device. Consists of: ▪ 2 process connections ▪ Threaded fasteners ▪ Seals
Seal set	For the regular replacement of seals for the sensor.

Spacer	If replacing a DN 80/100 sensor in an existing installation, a spacer is needed if the new sensor is shorter.
Welding jig	Welded connection as process connection: welding jig for installation in pipe.
Grounding rings	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D
Mounting kit	Consists of: ▪ 2 process connections ▪ Threaded fasteners ▪ Seals
Wall mounting kit	Wall mounting kit for measuring device (only DN 2 to 25 (1/12 to 1"))

For the sensor

Accessories	Description
Adapter set	Adapter connections for installing Promag H instead of a Promag 30/33 A or Promag 30/33 H (DN 25) device. Consists of: ▪ 2 process connections ▪ Threaded fasteners ▪ Seals
Seal set	For the regular replacement of seals for the sensor.
Spacer	If replacing a DN 80/100 sensor in an existing installation, a spacer is needed if the new sensor is shorter.
Welding jig	Welded connection as process connection: welding jig for installation in pipe.
Grounding rings	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D
Mounting kit	Consists of: ▪ 2 process connections ▪ Threaded fasteners ▪ Seals
Wall mounting kit	Wall mounting kit for measuring device (only DN 2 to 25 (1/12 to 1"))

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "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. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and 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. For details, see Operating Instructions BA00061S

Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results 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://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.
W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
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. For details, see Operating Instructions BA00027S and BA00059S

System components

Accessories	Description
Memograph M graphic display recorder	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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

Documentation

The following document types are available:
- On the CD-ROM supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Standard documentation

Communication	Document type	Documentation code
HART	Operating Instructions	BA01171D
EtherNet IP	Operating Instructions	BA01173D
Modbus	Operating Instructions	BA01175D
PROFIBUS DP	Operating Instructions	BA01237D
- - - -	Brief Operating Instructions	KA01142D

Supplementary device-dependent documentation

Document type	Approval	Documentation code
Safety Instructions	ATEX/IECEx Ex nA	XA01090D
Special Documentation	Modbus RS485 Register Information	SD01148D
Special Documentation	Heartbeat Technology	SD01149D
Installation Instructions		Specified for each individual accessory (→ 🖹 83)

Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

EtherNet/IP™
Trademark of ODVA, Inc.

Microsoft®
Registered trademark of the Microsoft Corporation, Redmond, Washington, USA

Applicator®, FieldCare®, Field Xpert™, HistoROM®, Heartbeat Technology™
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روبـروی پالایشگاه نفت پـارس، پلاک ۱۲

www.addresses.endress.com

Endress+Hauser
People for Process Automation

Technical Information
Proline Promag P 100

Electromagnetic flowmeter

The flowmeter for highest medium temperatures with an ultra-compact transmitter

Application

- The electromagnetic measuring principle is unaffected by pressure, temperature and flow profile
- Dedicated for chemical and process applications with corrosive liquids and high medium temperatures

Device properties
- Nominal diameter: max. DN 600 (24")
- All common Ex approvals
- Liner made of PTFE or PFA
- Robust, ultra-compact transmitter housing
- Pre-configured plug connector

Your benefits

- Versatile applications – wide variety of wetted materials
- Energy-saving flow measurement – no pressure loss due to cross-section constriction
- Maintenance-free – no moving parts
- Space-saving transmitter – full functionality on smallest footprint
- Time-saving local operation without additional software and hardware – integrated web server
- Integrated verification – Heartbeat Technology™

Endress+Hauser
People for Process Automation

Table of contents

Document information

Symbols used

Electrical symbols

Symbol	Meaning
A0011197	**Direct current** A terminal to which DC voltage is applied or through which direct current flows.
A0011198	**Alternating current** A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	**Direct current and alternating current** ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	**Ground connection** A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.
 A0011199	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.
 A0011201	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

Symbols for certain types of information

Symbol	Meaning
 A0011182	**Allowed** Indicates procedures, processes or actions that are allowed.
 A0011183	**Preferred** Indicates procedures, processes or actions that are preferred.
 A0011184	**Forbidden** Indicates procedures, processes or actions that are forbidden.
 A0011193	**Tip** Indicates additional information.
 A0011194	**Reference to documentation** Refers to the corresponding device documentation.
 A0011195	**Reference to page** Refers to the corresponding page number.
 A0011196	**Reference to graphic** Refers to the corresponding graphic number and page number.

Symbols in graphics

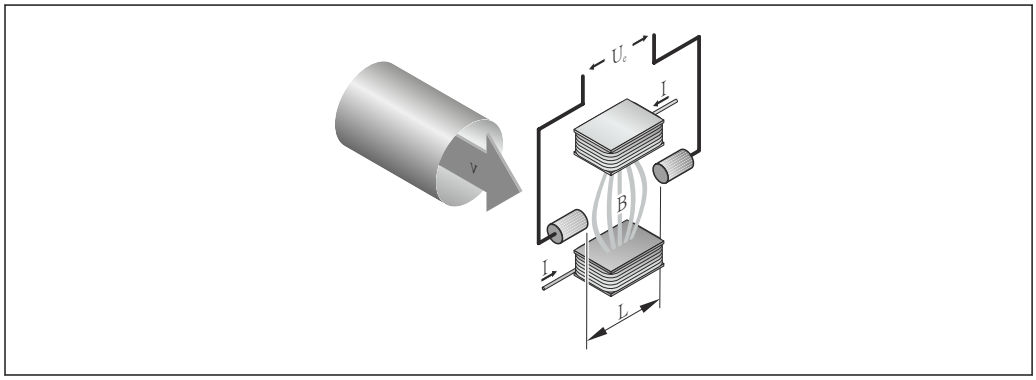
Symbol	Meaning
1, 2, 3,...	Item numbers
1. , 2. , 3. ...	Series of steps
A, B, C, ...	Views
A-A, B-B, C-C, ...	Sections
A0013441	Flow direction

Symbol	Meaning
 A0011187	**Hazardous area** Indicates a hazardous area.
 A0011188	**Safe area (non-hazardous area)** Indicates a non-hazardous area.

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.



A0017035

Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
I *Current*
v *Flow velocity*

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced (U_e) is proportional to the flow velocity (v) and is supplied to the amplifier by means of two measuring electrodes. The flow volume (Q) is calculated via the pipe cross-section (A). The DC magnetic field is created through a switched direct current of alternating polarity.

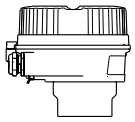
Formulae for calculation

- Induced voltage $U_e = B \cdot L \cdot v$
- Volume flow $Q = A \cdot v$

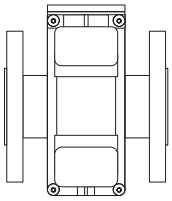
Measuring system

One device version is available: compact version, transmitter and sensor form a mechanical unit.

Transmitter

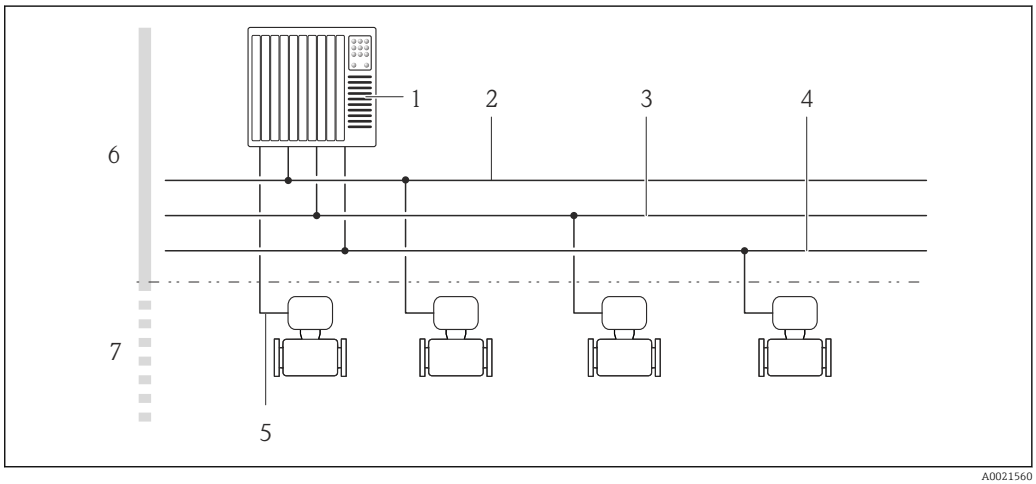
Promag 100  A0016693	Device versions and materials: Compact, aluminum coated: Coated aluminum AlSi10Mg Configuration: ▪ Via operating tools (e.g. FieldCare) ▪ Also for device version with 4-20 mA HART, pulse/frequency/switch output: Via Web browser (e.g. Microsoft Internet Explorer) ▪ Also for device version with EtherNet/IP output: – Via Web browser (e.g. Microsoft Internet Explorer) – Via Add-on Profile Level 3 for automation system from Rockwell Automation – Via Electronic Data Sheet (EDS)

Sensor

Promag P  A0017703	Nominal diameter range: DN 15 to 600 (½ to 24") Materials: ▪ Sensor housing: – DN 15 to 300 (½ to 12"): coated aluminum AlSi10Mg – DN 350 to 600 (14 to 24"): carbon steel with protective varnish ▪ Measuring tubes [1]: stainless steel 1.4301 (304) or 1.4306 (304L) ▪ Liner: PFA, PTFE ▪ Process connections: 1.0425 (316L) [2], 1.4571 (316L), A105, C22, F316L [2], FE 410W B [2], HII, S235JRG2, S275JR ▪ Electrodes: 1.4435 (316L), Alloy C22, platinum, tantalum, titanium ▪ Seals: as per DIN EN 1514-1 ▪ Ground disks: 1.4435 (316L), Alloy C22, tantalum, titanium

1) For flanges made of carbon with Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))
2) With Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))

Device architecture



A0021560

1 *Possibilities for integrating measuring devices into a system*

1 Control system (e.g. PLC)
2 EtherNet/IP
3 PROFIBUS DP
4 Modbus RS485
5 4-20 mA HART, pulse/frequency/switch output
6 Non-hazardous area
7 Non-hazardous area and Zone 2/Div. 2

Safety

IT security

We only provide a warranty 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 device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

Endress+Hauser can be contacted to provide support in performing this task.

Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity

Calculated measured variables

- Mass flow
- Corrected volume flow
- Corrected electrical conductivity

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: 5 to 10 000 µS/cm/cm

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Current output full scale value [1] (v ~ 2.5 m/s)	Pulse value [1] (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
32	–	15 to 500	125	1	2
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1200	10	20
125	–	220 to 7 500	1850	15	30
150	6	20 to 600 m³/h	150 m³/h	0.03 m³	2.5 m³/h
200	8	35 to 1 100 m³/h	300 m³/h	0.05 m³	5 m³/h
250	10	55 to 1 700 m³/h	500 m³/h	0.05 m³	7.5 m³/h
300	12	80 to 2 400 m³/h	750 m³/h	0.1 m³	10 m³/h
350	14	110 to 3 300 m³/h	1 000 m³/h	0.1 m³	15 m³/h
400	16	140 to 4 200 m³/h	1 200 m³/h	0.15 m³	20 m³/h
450	18	180 to 5 400 m³/h	1 500 m³/h	0.25 m³	25 m³/h

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Current output full scale value [1] (v ~ 2.5 m/s)	Pulse value [1] (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
500	20	220 to 6 600 m³/h	2 000 m³/h	0.25 m³	30 m³/h
600	24	310 to 9 600 m³/h	2 500 m³/h	0.3 m³	40 m³/h

1) HART only

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Current output full scale value [1] (v ~ 2.5 m/s)	Pulse value [1] (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
½	15	1.0 to 27	6	0.1	0.15
1	25	2.5 to 80	18	0.2	0.25
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1200	10	15
10	250	250 to 7 500	1500	15	30
12	300	350 to 10 600	2400	25	45
14	350	500 to 15 000	3600	30	60
16	400	600 to 19 000	4800	50	60
18	450	800 to 24 000	6000	50	90
20	500	1 000 to 30 000	7500	75	120
24	600	1 400 to 44 000	10500	100	180

1) HART only

To calculate the measuring range, use the *Applicator* sizing tool (→ 55)

Recommended measuring range

"Flow limit" section (→ 40)

Operable flow range

Over 1000 : 1

Input signal

Fieldbuses

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device via Modbus RS485, EtherNet/IP or HART input:

- Process pressure or fluid temperature to increase accuracy (e.g. external values from Cerabar M, Cerabar S or iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section (→ 56)

Output

Output signal

Current output

Current output	4-20 mA HART (active)
Maximum output values	▪ DC 24 V (when idle) ▪ 22.5 mA
Load	0 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	▪ DC30 V ▪ 25 mA
Voltage drop	For 25 mA: ≤ DC2 V
Pulse output	
Pulse width	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow
Frequency output	
Output frequency	Adjustable: 0 to 10 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s

Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronics temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

PROFIBUS DP

Signal encoding	NRZ code
Data transfer	9.6 kBaud...12 MBaud

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

EtherNet/IP

Standards	In accordance with IEEE 802.3

Signal on alarm

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

Current output

4-20 mA

Failure mode	Selectable (as per NAMUR recommendation NE 43): ▪ Minimum value: 3.6 mA ▪ Maximum value: 22 mA ▪ Defined value: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

HART

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

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses

Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ Defined value: 0 to 12 500 Hz ▪ 0 Hz
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02

Modbus RS485

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

EtherNet/IP

Device diagnostics	Device condition can be read out in Input Assembly

Operating tool

- Via digital communication:
  - HART protocol
  - PROFIBUS DP
- Via service interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation (→ 48)

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 ▪ EtherNet/IP network available ▪ EtherNet/IP connection established

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:
- Outputs
- Power supply

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x3A
HART protocol revision	6.0
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
Dynamic variables	The measured variables can be freely assigned to the dynamic variables. **Measured variables for PV (primary dynamic variable)** ▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity ▪ Temperature ▪ Electronics temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1561
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org

Output values (from measuring device to automation system)	**Analog input 1 to 8** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow ▪ Target mass flow ▪ Carrier mass flow ▪ Density ▪ Reference density ▪ Concentration ▪ Dynamic viscosity ▪ Kinematic viscosity ▪ Temp. compensated dynamic viscosity ▪ Temp. compensated kinematic viscosity ▪ Temperature ▪ Carrier pipe temperature ▪ Electronics temperature ▪ Oscillation frequency ▪ Oscillation amplitude ▪ Frequency fluctuation ▪ Oscillation damping ▪ Tube damping fluctuation ▪ Signal asymmetry ▪ Exciter current **Digital input 1 to 2** ▪ Partially filled pipe detection ▪ Low flow cut off **Totalizer 1 to 3** ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow
Input values (from automation system to measuring device)	**Analog output 1 to 3 (fixed assignment)** ▪ Pressure ▪ Temperature ▪ Reference density **Digital output 1 to 3 (fixed assignment)** ▪ Digital output 1: switch positive zero return on/off ▪ Digital output 2: perform zero point adjustment ▪ Digital output 3: switch switch output on/off **Totalizer 1 to 3** ▪ Totalize ▪ Reset and hold ▪ Preset and hold ▪ Stop ▪ Operating mode configuration: – Net flow total – Forward flow total – Reverse flow total
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Via operating tools (e.g. FieldCare)

Modbus RS485

Protocol	Modbus Applications Protocol Specification V1.1
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 transfer mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information

EtherNet/IP

Protocol	▪ The CIP Networks Library Volume 1: Common Industrial Protocol ▪ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP
Communication type	▪ 10Base-T ▪ 100Base-TX
Device profile	Generic device (product type: 0x2B)
Manufacturer ID	0x49E
Device type ID	0x103A
Baud rates	Automatic $^{10}/_{100}$ Mbit with half-duplex and full-duplex detection
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported CIP connections	Max. 3 connections
Explicit connections	Max. 6 connections
I/O connections	Max. 6 connections (scanner)
Configuration options for measuring device	▪ DIP switches on the electronics module for IP addressing ▪ Manufacturer-specific software (FieldCare) ▪ Add-on Profile Level 3 for Rockwell Automation control systems ▪ Web browser ▪ Electronic Data Sheet (EDS) integrated in the measuring device
Configuration of the EtherNet interface	▪ Speed: 10 MBit, 100 MBit, auto (factory setting) ▪ Duplex: half-duplex, full-duplex, auto (factory setting)
Configuration of the device address	▪ DIP switches on the electronics module for IP addressing (last octet) ▪ DHCP ▪ Manufacturer-specific software (FieldCare) ▪ Add-on Profile Level 3 for Rockwell Automation control systems ▪ Web browser ▪ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)
Device Level Ring (DLR)	No

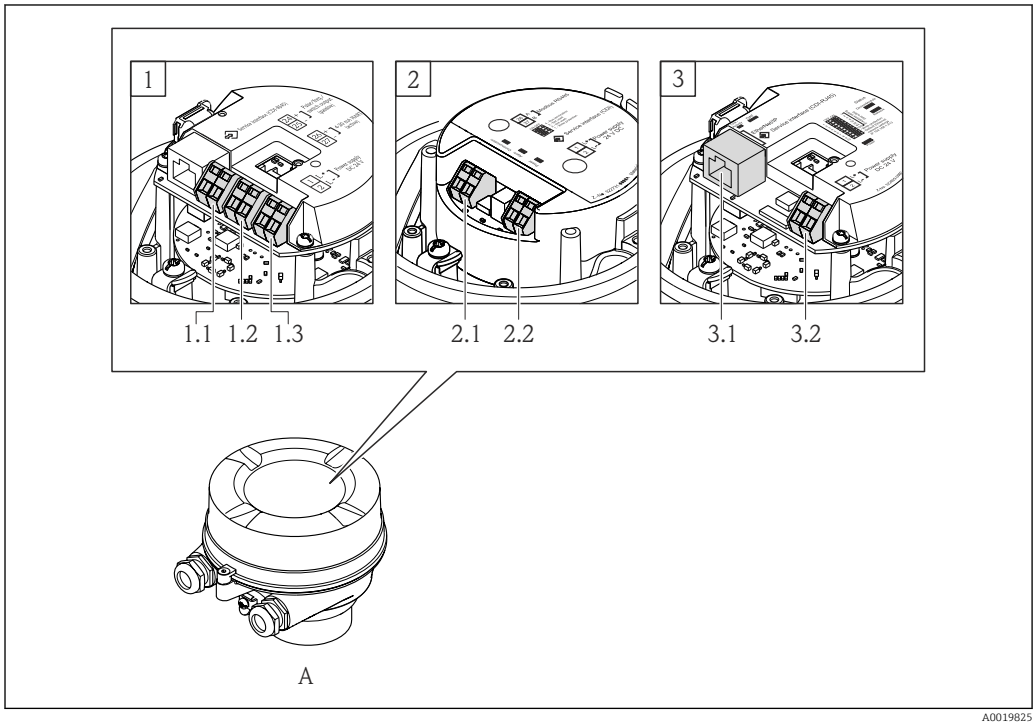
Fix Input			
RPI	5 ms to 10 s (factory setting: 20 ms)		
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0x66	56
	T → O configuration:	0x64	32
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0x66	56
	T → O configuration:	0x64	32
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	32
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	32
Input Assembly	▪ Current device diagnostics ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3		
Configurable Input			
RPI	5 ms to 10 s (factory setting: 20 ms)		
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0x66	56
	T → O configuration:	0x65	88
Exclusive Owner Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0x66	56
	T → O configuration:	0x64	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x64	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88

Configurable Input Assembly	▪ Volume flow ▪ Temperature ▪ Corrected volume flow ▪ Mass flow ▪ Totalizer 1 to 3 ▪ Flow velocity ▪ Volume flow unit ▪ Temperature unit ▪ Corrected volume flow unit ▪ Mass flow unit ▪ Unit totalizer 1-3 ▪ Flow velocity unit
Fix Output	
Output Assembly	▪ Activation of reset totalizers 1-3 ▪ Activation of reference density compensation ▪ Activation of temperature compensation ▪ Reset totalizers 1-3 ▪ External density ▪ Density unit ▪ External temperature ▪ Temperature unit
Configuration	
Configuration Assembly	Only the most common configurations are listed below. ▪ Software write protection ▪ Mass flow unit ▪ Mass unit ▪ Volume flow unit ▪ Volume unit ▪ Corrected volume flow unit ▪ Corrected volume unit ▪ Density unit ▪ Reference density unit ▪ Temperature unit ▪ Pressure unit ▪ Length ▪ Totalizer 1-3: – Assignment – Unit – Operating mode – Failure mode ▪ Alarm delay

Power supply

Terminal assignment

Overview: housing version - terminals/device plugs



A0019825

A Housing version: compact, aluminum coated
1 Connection version: 4-20 mA HART, pulse/frequency/switch output
1.1 Signal transmission: pulse/frequency/switch output
1.2 Signal transmission: 4-20 mA HART
1.3 Supply voltage
2 Connection version: Modbus RS485, PROFIBUS DP
2.1 Signal transmission
2.2 Supply voltage
3 Connection version: EtherNet/IP
3.1 Signal transmission
3.2 Supply voltage

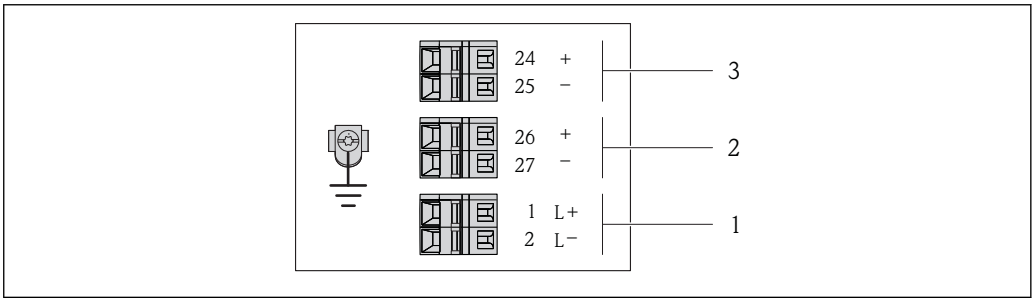
Transmitter

Connection version 4-20 mA HART with pulse/frequency/switch output

Order code for "Output", option **B**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Outputs	Power supply	
Option **A**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Option **A**	Device plug (→ 🖹 20)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Option **A**	Device plug (→ 🖹 20)	Device plug (→ 🖹 20)	Option **Q**: 2 x plug M12x1
Order code for "Housing": Option **A**: compact, coated aluminum			



2 Terminal assignment 4-20 mA HART with pulse/frequency/switch output

1 Power supply: DC 24 V
2 Output 1: 4-20 mA HART (active)
3 Output 2: pulse/frequency/switch output (passive)

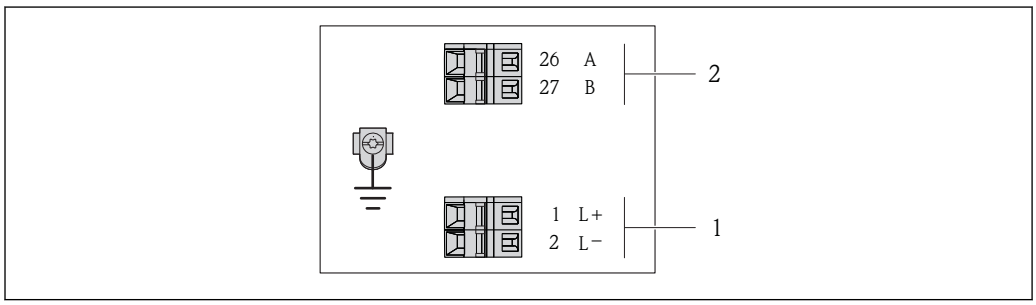
Order code for "Output"	Terminal number					
	Power supply		Output 1		Output 2	
	2 (L-)	1 (L+)	27 (–)	26 (+)	25 (–)	24 (+)
Option **B**	DC 24 V		4-20 mA HART (active)		Pulse/frequency/switch output (passive)	
Order code for "Output": Option **B**: 4-20 mA HART with pulse/frequency/switch output						

PROFIBUS DP connection version for use in non-hazardous areas and Zone 2/Div. 2

Order code for "Output", option **L**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Option **A**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Option **A**	Device plug (→ 🖹 21)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Option **A**	Device plug (→ 🖹 21)	Device plug (→ 🖹 21)	Option **Q**: 2 x plug M12x1
Order code for "Housing": Option **A**: compact, coated aluminum			



3 PROFIBUS DP terminal assignment

1 Power supply: DC 24 V
2 PROFIBUS DP

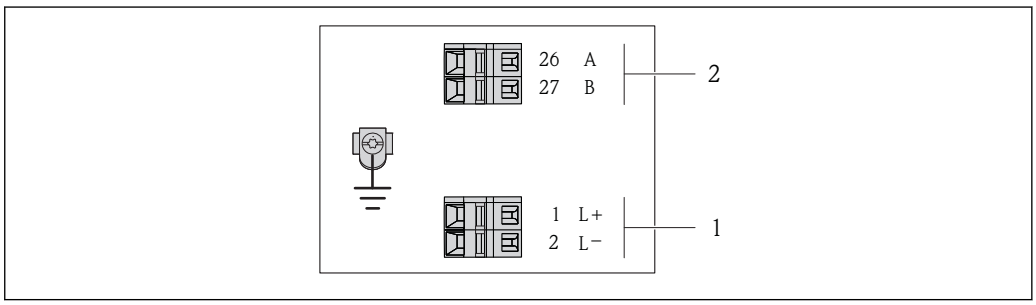
Order code for "Output"	Terminal number			
	Power supply		Output	
	2 (L-)	1 (L+)	27 (B)	26 (A)
Option **L**	DC 24 V		PROFIBUS DP	
Order code for "Output": Option **L**: PROFIBUS DP, for use in non-hazardous areas and Zone 2/div. 2				

Connection version Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2

Order code for "Output", option **M**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Option **A**	Terminals	Terminals	▪ Option **A**: coupling M20x1 ▪ Option **B**: thread M20x1 ▪ Option **C**: thread G ½" ▪ Option **D**: thread NPT ½"
Option **A**	Device plug (→ 🖹 21)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Option **A**	Device plug (→ 🖹 21)	Device plug (→ 🖹 21)	Option **Q**: 2 x plug M12x1
Order code for "Housing": Option **A**: compact, coated aluminum			



🖼 4 *Modbus RS485 terminal assignment*

1 Power supply: DC 24 V
2 Modbus RS485

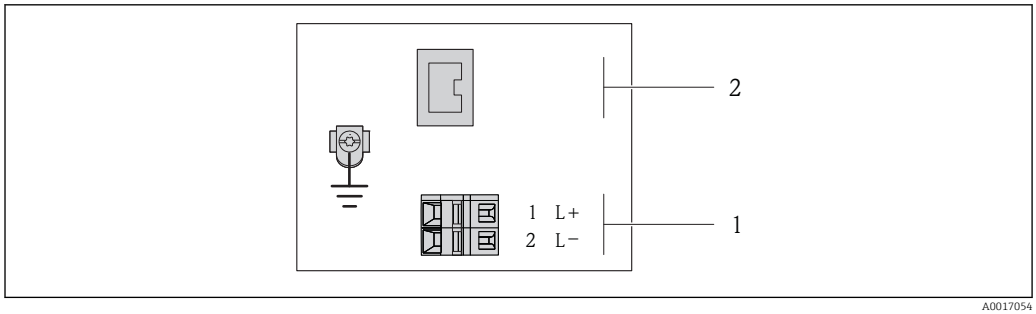
Order code for "Output"	Terminal number			
	Power supply		Output	
	2 (L-)	1 (L+)	27 (B)	26 (A)
Option **M**	DC 24 V		Modbus RS485	
Order code for "Output": Option **M**: Modbus RS485, for use in non-hazardous areas and Zone 2/Div. 2				

EtherNet/IP connection version

Order code for "Output", option **N**

Depending on the housing version, the transmitters can be ordered with terminals or device plugs.

Order code for "Housing"	Connection methods available		Possible options for order code "Electrical connection"
	Output	Power supply	
Option **A**	Device plug (→ 22)	Terminals	▪ Option **L**: plug M12x1 + thread NPT ½" ▪ Option **N**: plug M12x1 + coupling M20 ▪ Option **P**: plug M12x1 + thread G ½" ▪ Option **U**: plug M12x1 + thread M20
Option **A**	Device plug (→ 22)	Device plug (→ 22)	Option **Q**: 2 x plug M12x1
Order code for "Housing": Option **A**: compact, coated aluminum			



5 EtherNet/IP terminal assignment

1 Power supply: DC 24 V
2 EtherNet/IP

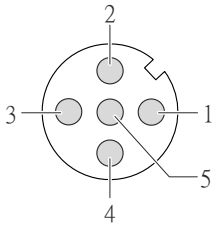
Order code for "Output"	Terminal number		
	Power supply		Output
	2 (L-)	1 (L+)	Device plug M12x1
Option **N**	DC 24 V		EtherNet/IP
Order code for "Output": Option **N**: EtherNet/IP			

Pin assignment, device plug

Order codes for the M12x1 plug, see the "Order code for **electrical connection**" column:
- 4-20 mA HART, pulse/frequency/switch output (→ 17)
- Modbus RS485 (→ 19)
- EtherNet/IP (→ 20)

Supply voltage

Supply voltage for all communication types (on the device side)

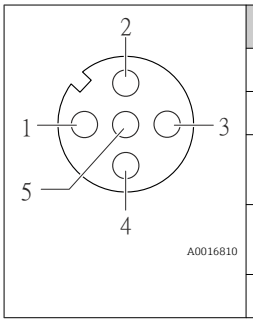


Pin	Assignment		Coding	Plug/socket
1	L+	DC24 V	A	Plug
2				
3				
4	L-	DC24 V		
5		Grounding/shielding		

The following is recommended as a socket:
- Binder, series 763, part no. 79 3440 35 05
- Alternatively: Phoenix part no. 1669767 SAC-5P-M12MS
  - With the order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
  - With the order code for "Output", option **N**: EtherNet/IP
- When using the device in a hazardous location: Use a suitably certified socket.

4-20 mA HART with pulse/frequency/switch output

4-20 mA HART with pulse/frequency/switch output (on the device side)

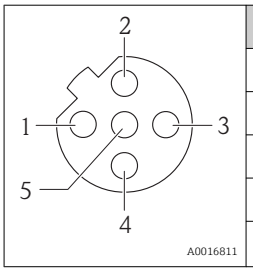


Pin		Assignment	Coding	Plug/socket
1	+	4-20 mA HART (active)	A	Socket
2	-	4-20 mA HART (active)		
3	+	Pulse/frequency/switch output (passive)		
4	-	Pulse/frequency/switch output (passive)		
5		Grounding/shielding		

- Recommended plug: Binder, series 763, part no. 79 3439 12 05
- When using the device in a hazardous location: Use a suitably certified plug.

PROFIBUS DP

PROFIBUS DP, non-hazardous area and Zone 2/Div. 2 (on the device side)

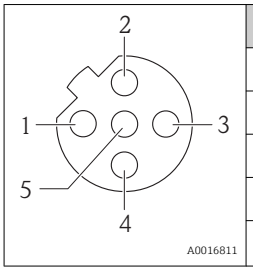


Pin		Assignment	Coding	Plug/socket
1			B	Socket
2	A	PROFIBUS DP		
3				
4	B	PROFIBUS DP		
5		Grounding/shielding		

- Recommended plug: Binder, series 763, part no. 79 4449 20 05
- When using the device in a hazardous location: Use a suitably certified plug.

Modbus RS485

Modbus RS485, non-hazardous area and Zone 2/Div. 2 (on the device side)

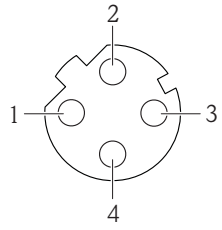


Pin		Assignment	Coding	Plug/socket
1			B	Socket
2	A	Modbus RS485		
3				
4	B	Modbus RS485		
5		Grounding/shielding		

- Recommended plug: Binder, series 763, part no. 79 4449 20 05
- When using the device in a hazardous location: Use a suitably certified plug.

EtherNet/IP

EtherNet/IP (on the device side)



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

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q
- When using the device in a hazardous location: Use a suitably certified plug.

Supply voltage

Transmitter

For device version with all communication types: DC 20 to 30 V

The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV).

Power consumption

Transmitter

Order code for "Output"	Maximum Power consumption
Option **B**: 4-20mA HART, pulse/frequency/switch output	3.5 W
Option **L**: PROFIBUS DP	3.5 W
Option **M**: Modbus RS485	3.5 W
Option **N**: EtherNet/IP	3.5 W

Current consumption

Transmitter

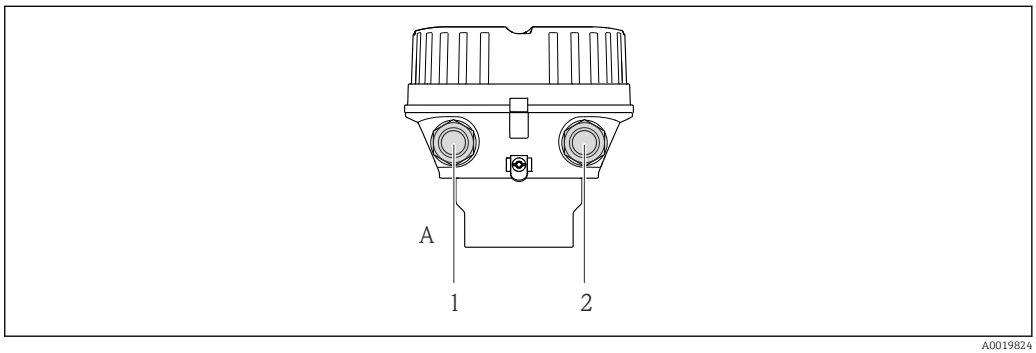
Order code for "Output"	Maximum Current consumption	Maximum switch-on current
Option **B**: 4-20mA HART, pul./ freq./switch output	145 mA	18 A (<0.125 ms)
Option **L**: PROFIBUS DP	145 mA	18 A (<0.125 ms)
Option **M**: Modbus RS485	90 mA	10 A (<0.8 ms)
Option **N**: EtherNet/IP	145 mA	18 A (<0.125 ms)

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 plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

Electrical connection

Connecting the transmitter



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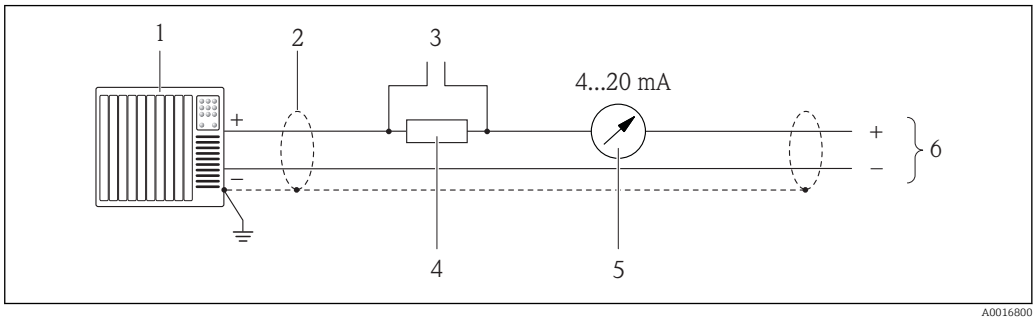
A Housing version: compact, aluminum coated
1 Cable entry or device plug for signal transmission
2 Cable entry or device plug for supply voltage

- Terminal assignment (→ 17)
- Pin assignment, device plug (→ 20)

In the case of device versions with a connector, the transmitter housing does not need to be opened to connect the signal cable or power supply cable.

Connection examples

Current output 4-20 mA HART



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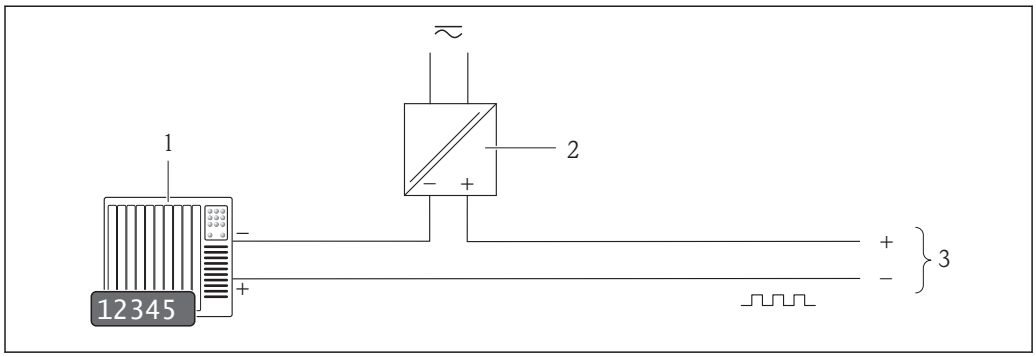
6 Connection example for 4-20 mA HART current output (active)

1 Automation system with current input (e.g. PLC)
2 Cable shield, observe cable specifications (→ 29)
3 Connection for HART operating devices (→ 48)
4 Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)
5 Analog display unit: observe maximum load (→ 8)
6 Transmitter

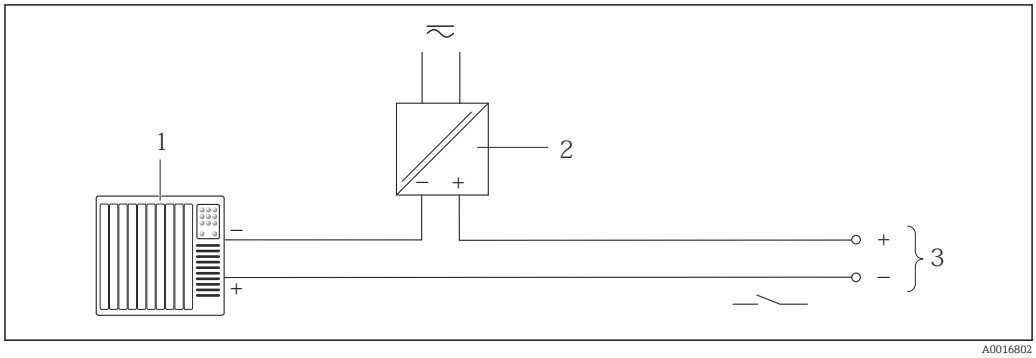
Pulse/frequency output



7 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 (→ 8)

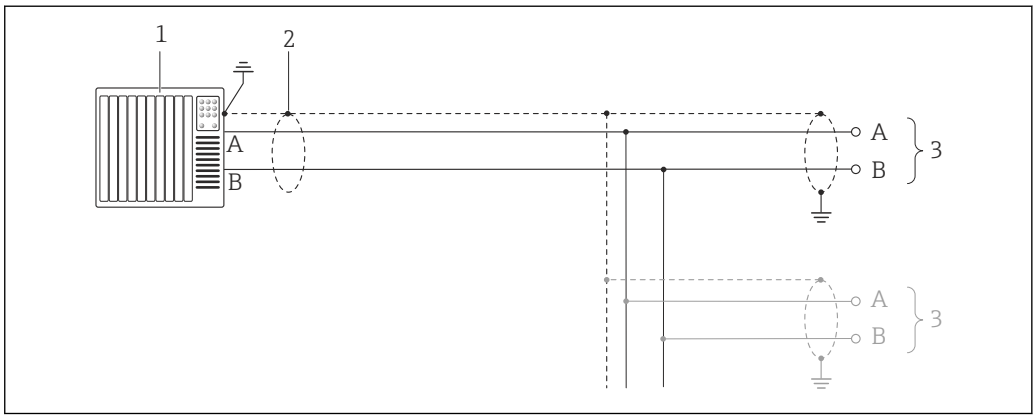
Switch output



8 Connection example for switch output (passive)

1 Automation system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: observe input values (→ 8)

PROFIBUS DP

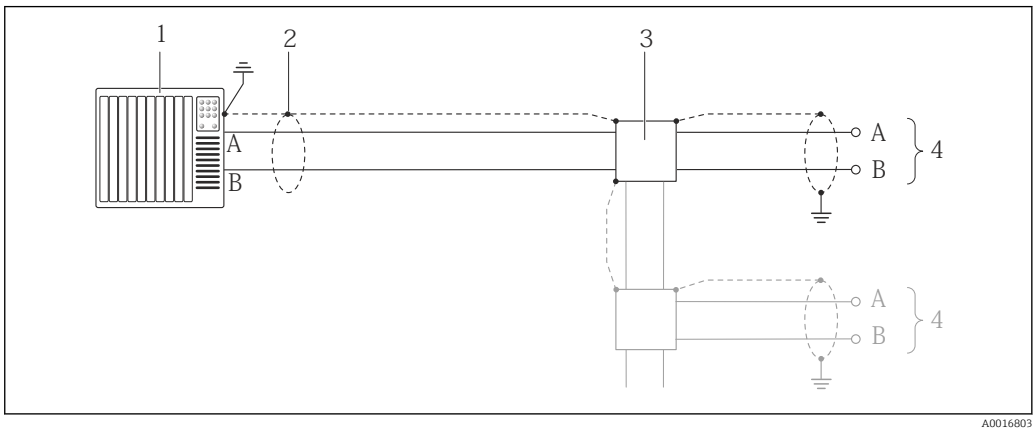


9 Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2

1 Control system (e.g. PLC)
2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications (→ 30)
3 Distribution box
4 Transmitter

If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

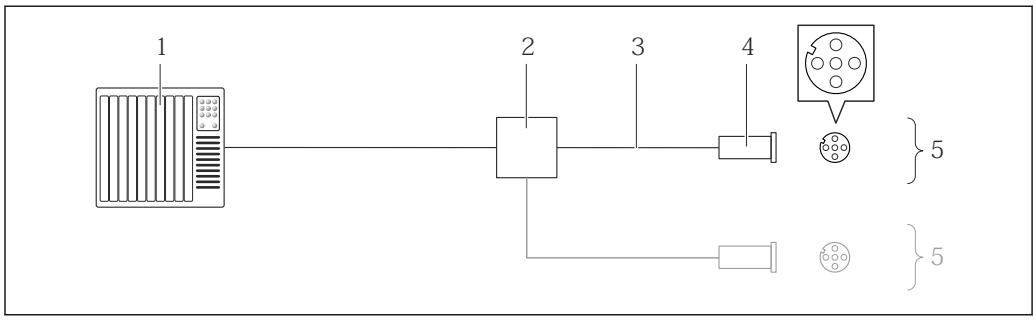
Modbus RS485



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

1 Control system (e.g. PLC)
2 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications (→ 30)
3 Distribution box
4 Transmitter

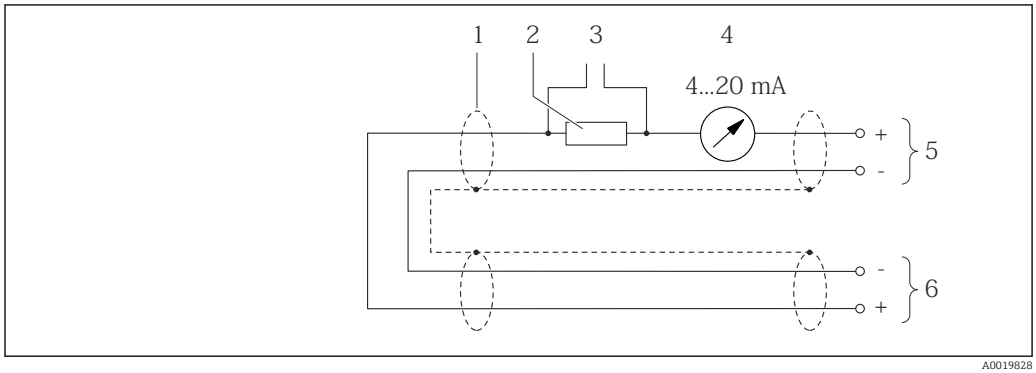
EtherNet/IP



11 Connection example for EtherNet/IP

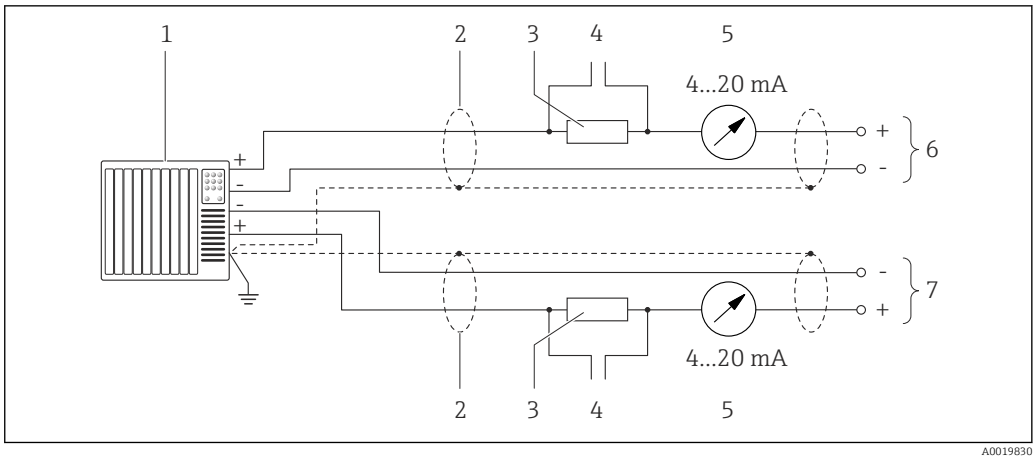
1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications (→ 30)*
4 *Device plug*
5 *Transmitter*

HART input



12 Connection example for HART input (burst mode) via current output (active)

1 *Cable shield, observe cable specifications (→ 29)*
2 *Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)*
3 *Connection for HART operating devices (→ 48)*
4 *Analog display unit*
5 *Transmitter*
6 *Sensor for external measured variable*



13 *Connection example for HART input (master mode) via current output (active)*

1 *Automation system with current input (e.g. PLC).*
Prerequisite: automation system with HART version 6, HART commands 113 and 114 can be processed.
2 *Cable shield, observe cable specifications (→ 29)*
3 *Resistor for HART communication (≥ 250 Ω): observe maximum load (→ 8)*
4 *Connection for HART operating devices (→ 48)*
5 *Analog display unit*
6 *Transmitter*
7 *Sensor for external measured variable*

Potential equalization

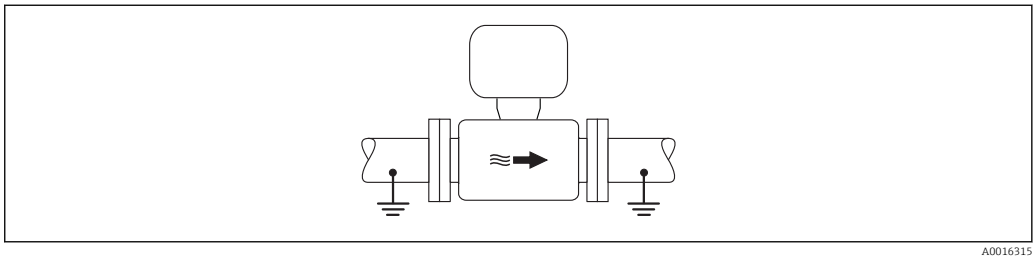
Requirements

Please consider the following to ensure correct measurement:
- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding

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

Connection examples for standard situations

Metal, grounded pipe

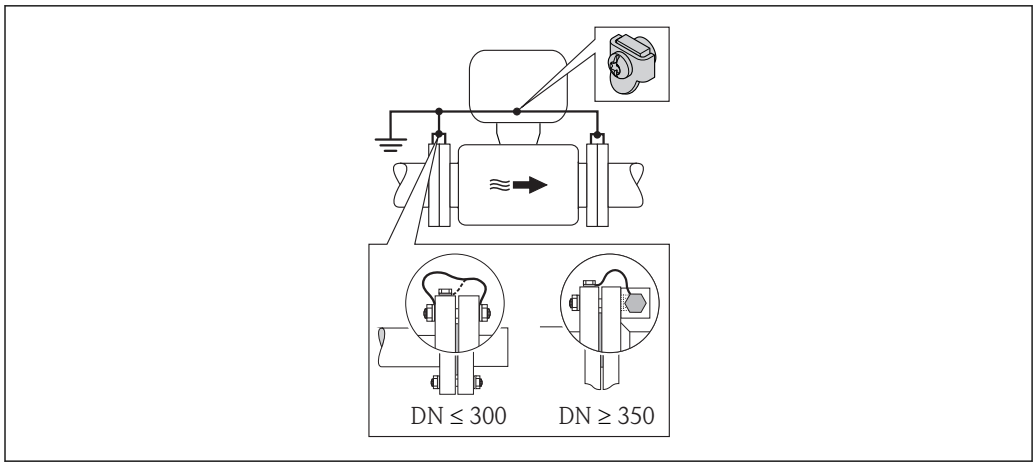


14 *Potential equalization via measuring tube*

Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present



15 *Potential equalization via ground terminal and pipe flanges*

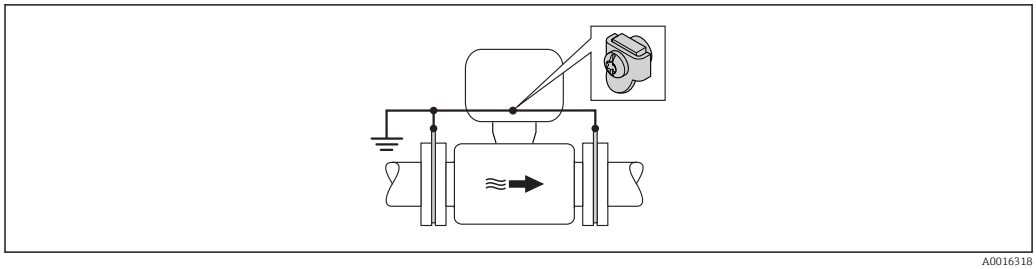
Note the following when installing:
- Connect both sensor flanges to the pipe flange via a ground cable and ground them.
- Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose.To mount the ground cable:
  - If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
  - If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket.

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

The necessary ground cable can be ordered from Endress+Hauser .

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present



16 *Potential equalization via ground terminal and ground disks*

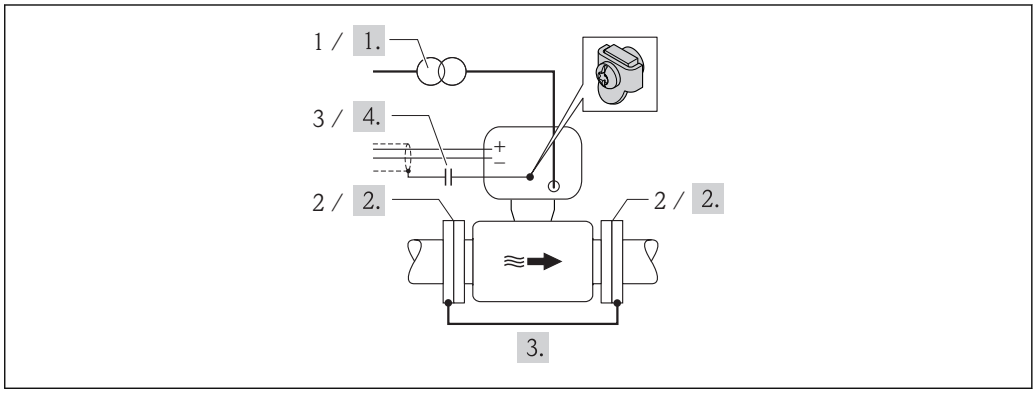
Note the following when installing:
The ground disks must be connected to the ground terminal via the ground cable and be connected to ground potential.

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

The ground cable and ground disks can be ordered from Endress+Hauser (→ 54).

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:
- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment



17 *Potential equalization and cathodic protection*

1 *Isolation transformer power supply*
2 *Electrically isolated from the pipe*
3 *Capacitor*

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)

1. Connect the measuring device to the power supply such that it is floating in relation to the protective ground.
2. Install the sensor in the pipe in a way that provides electrical insulation.
3. Connect the two flanges of the pipe to one another via a ground cable.
4. Guide the shield of the signal lines through a capacitor.

The necessary ground cable can be ordered from Endress+Hauser .

Terminals

Transmitter
Spring terminals for wire cross-sections0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries

- Cable gland: M20 × 1.5 with cable Φ6 to 12 mm (0.24 to 0.47 in)
- Thread for cable entry:
  - NPT ½"
  - G ½"
  - M20

Cable specification

Permitted temperature range

- −40 °C (−40 °F) to +80 °C (+176 °F)
- Minimum requirement: cable temperature range ≥ ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output

For 4-20 mA HART: Shielded cable recommended. Observe grounding concept of the plant.

Pulse/frequency/switch output

Standard installation cable is sufficient.

PROFIBUS DP

The IEC 61158 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 Ωat 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
Shielding	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the 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 Ωat 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
Shielding	Copper braided shielding or braided shielding with foil shield. When grounding the cable shield, observe the grounding concept of the plant.

EtherNet/IP

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of the ODVA Organization.

Performance characteristics

Reference operating conditions

In accordance with DIN EN 29104
- Fluid temperature: +28±2 °C (+82±4 °F)
- Ambient temperature range: +22±2 °C (+72±4 °F)
- Warm-up period:30 min

Installation
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

To calculate the measuring range, use the *Applicator* sizing tool (→ 🖹 55)

Maximum measured error

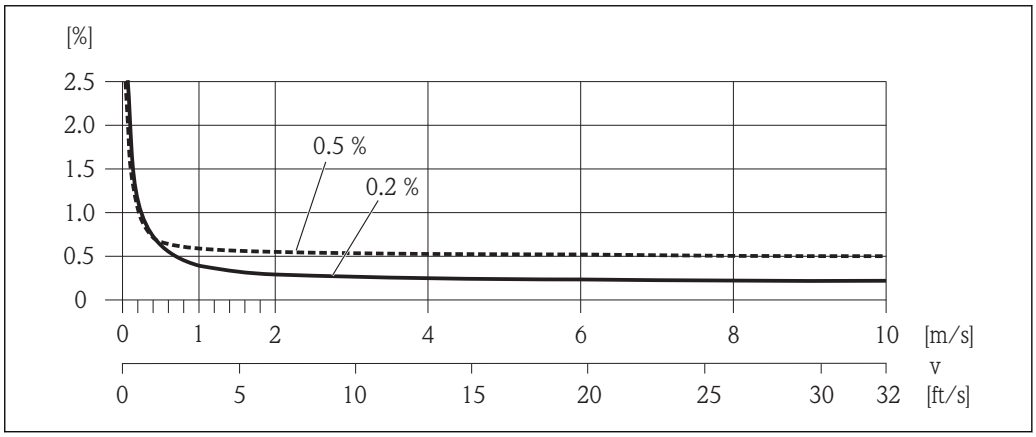
Error limits under reference operating conditions

o.r. = of reading

Volume flow

- ±0.5 % o.r. ± 1 mm/s (0.04 in/s)
- Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)

Fluctuations in the supply voltage do not have any effect within the specified range.



18 *Maximum measured error in % o.r.*

Electrical conductivity

Max. measured error not specified.

Accuracy of outputs

o.r. = of reading; o.f.s. = of full scale value

The output accuracy must be factored into the measured error if analog outputs are used, but can be ignored for fieldbus outputs (e.g. Modbus RS485, EtherNet/IP).

Current output

Accuracy	Max. ±0.05 % o.f.s. or ±5 µA

Pulse/frequency output

Accuracy	Max. ±50 ppm o.r.

Repeatability

o.r. = of reading

Volume flow

Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity

Max. ±5 % o.r.

Temperature measurement response time

T_{90} < 15 s

Influence of ambient temperature

o.r. = of reading; o.f.s. = of full scale value

Current output

Temperature coefficient	Max. ±50 ppm/°C o.f.s. or ±1 µA/°C

Pulse/frequency output

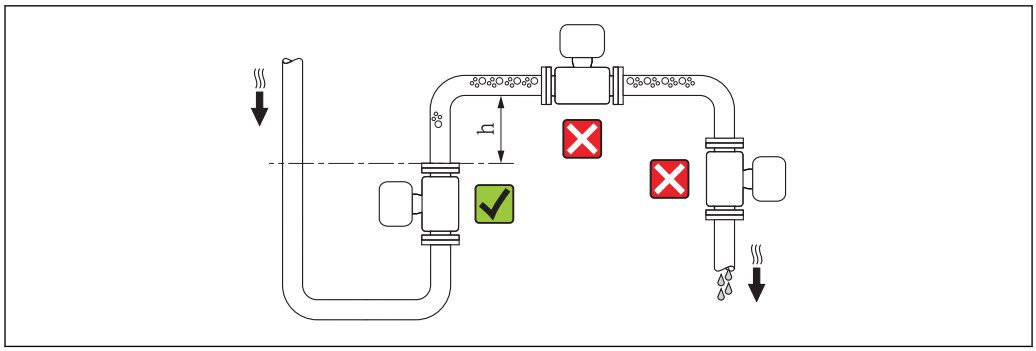
Temperature coefficient	Max. ±50 ppm o.r./100 °C

Installation

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

Mounting location

Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN



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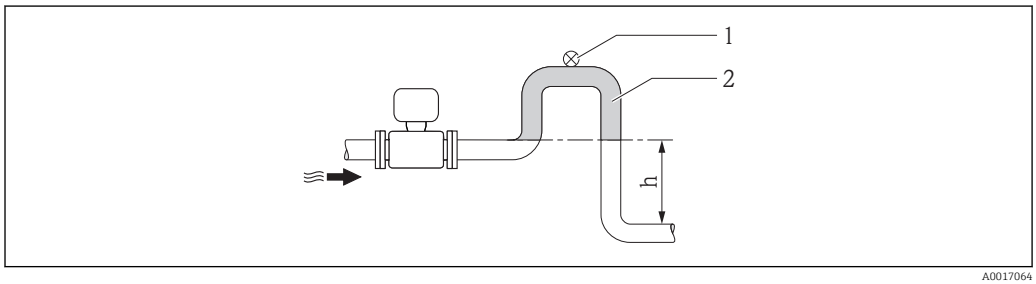
To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:
- Highest point of a pipeline.
- Directly upstream of a free pipe outlet in a down pipe.

Installation in down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime, which could cause air pockets.

For information on the liner's resistance to partial vacuum (→ 39)



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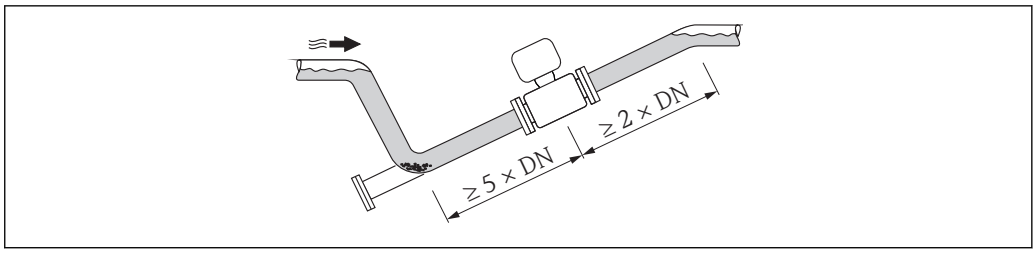
19 *Installation in a down pipe*

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.

- Do not install the sensor at the lowest point in the drain: risk of solids accumulating.
- It is advisable to install a cleaning valve.



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Orientation

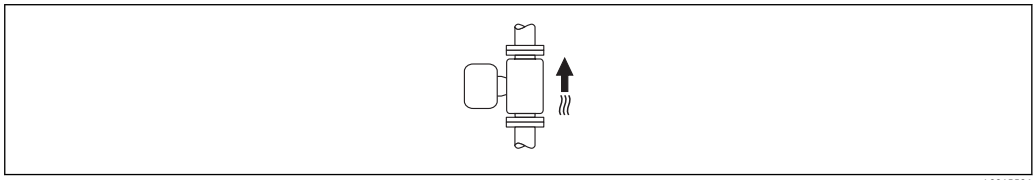
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

The measuring device also offers the empty pipe detection function to detect partially filled measuring pipes in the event of outgassing fluids or variable process pressures.

Vertical

This is the optimum orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



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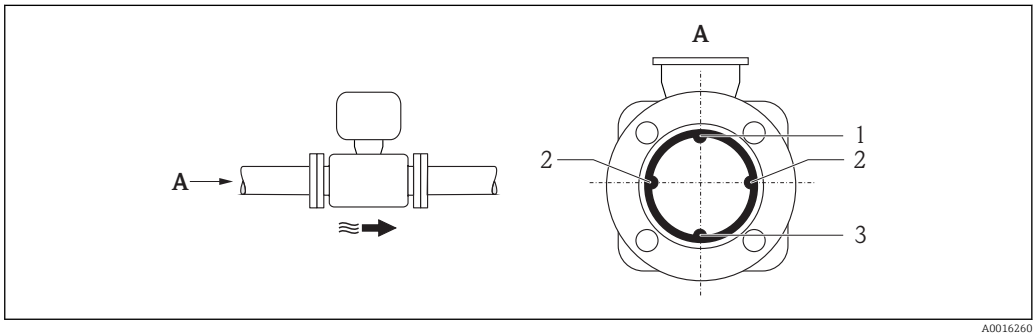
Horizontal

The measuring electrode plane must be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

With horizontal orientation, empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.



A0016260

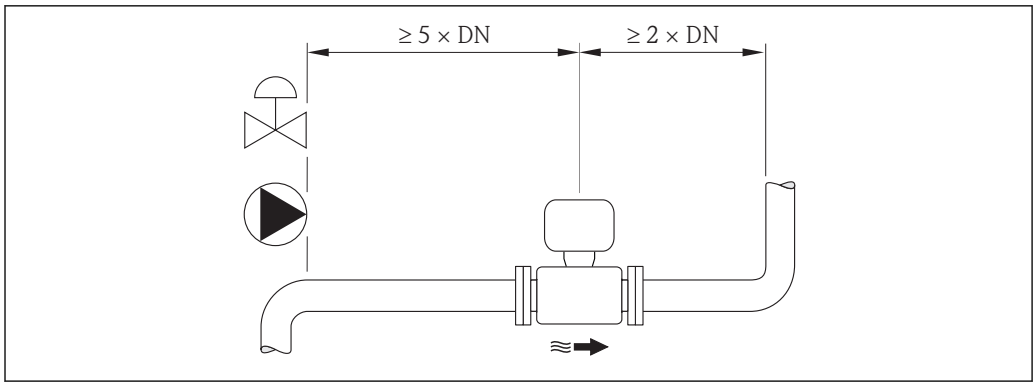
20 *Horizontal orientation*

1 *EPD electrode for empty pipe detection*
2 *Measuring electrodes for signal detection*
3 *Reference electrode for potential equalization*

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:
- Inlet run ≥ 5 × DN
- Outlet run ≥ 2 × DN



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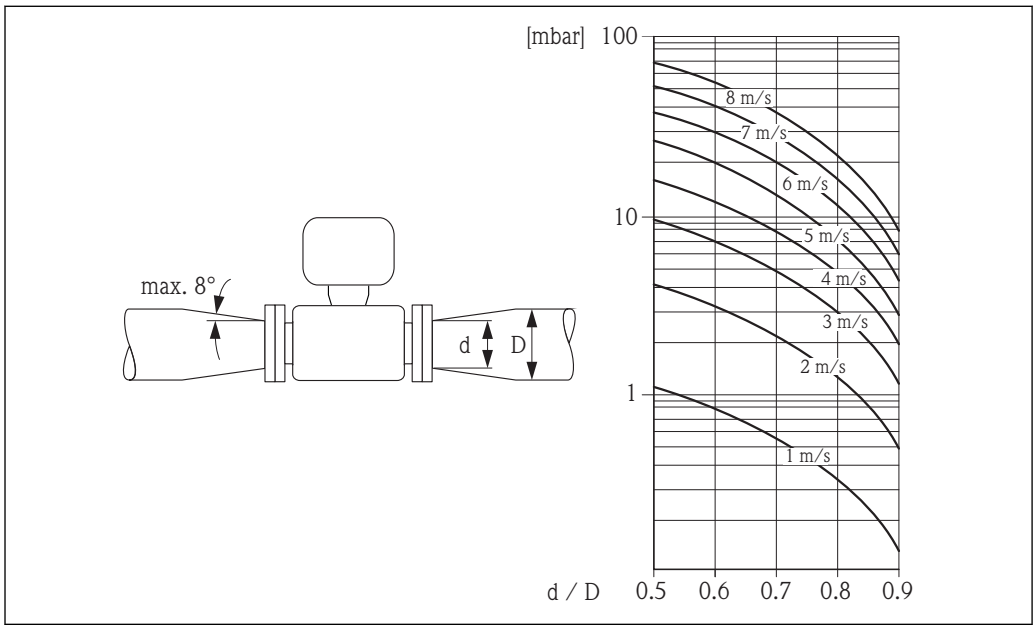
Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids.

The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders:

- Calculate the ratio of the diameters d/D.
- From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

The nomogram only applies to liquids with a viscosity similar to that of water.



A0016359

Environment

Ambient temperature range

Transmitter	−40 to +60 °C (−40 to +140 °F)
Sensor	▪ Flange material carbon steel: −10 to +60 °C (+14 to +140 °F) ▪ Flange material stainless steel: −40 to +60 °C (−40 to +140 °F)
Liner	Do not exceed or fall below the permitted temperature range of the liner (→ 36).

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

Temperature tables

The following interdependencies between the permitted ambient and fluid temperatures apply when operating the device in hazardous areas:

Ex nA, $_{C}CSA_{US}$ NI

SI units

T_a [°C]	T6 [85 °C]	T5 [100 °C]	T4 [135 °C]	T3 [200 °C]	T2 [300 °C]	T1 [450 °C]
30	50	95	130	150	150	150
50	–	95	130	150	150	150
60	–	95	110	110	110	110

US units

T_a [°F]	T6 [185 °F]	T5 [212 °F]	T4 [275 °F]	T3 [392 °F]	T2 [572 °F]	T1 [842 °F]
86	122	203	266	302	302	302
122	–	203	266	302	302	302
140	–	203	230	230	230	230

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Degree of protection

Transmitter and sensor
- As standard: IP66/67, type 4X enclosure
- With the order code for "Sensor options", option **CM**: IP69K can also be ordered
- When housing is open: IP20, type 1 enclosure

Shock resistance

As per IEC/EN 60068-2-31

Vibration resistance

Acceleration up to 2 g following IEC 60068-2-6

Mechanical load

- Protect the transmitter housing against mechanical effects, such as shock or impact.
- Never use the transmitter housing as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Complies with emission limits for industry as per EN 55011 (Class A)
- Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784

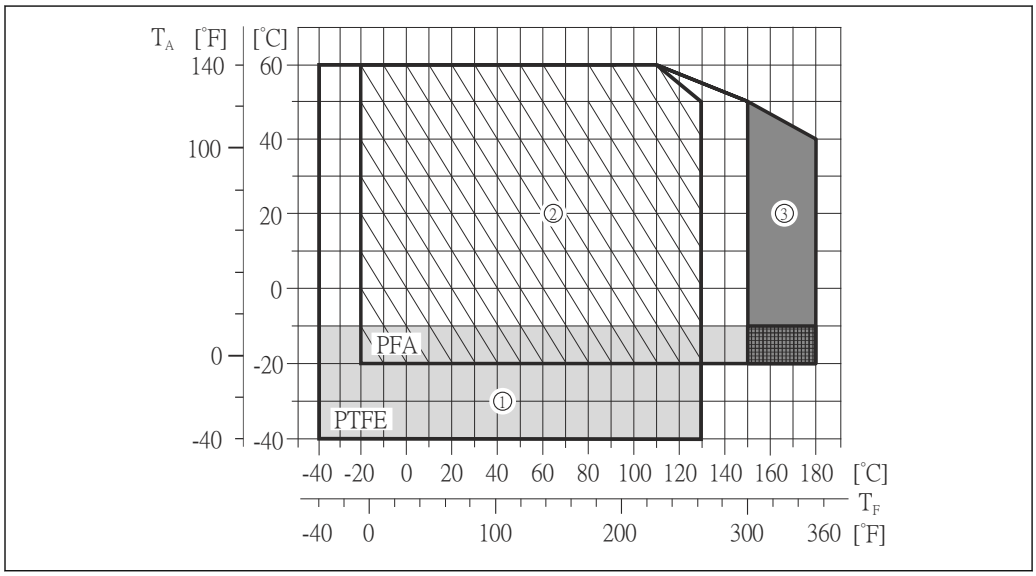
The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Details are provided in the Declaration of Conformity.

Process

Medium temperature range

- −20 to +150 °C (−4 to +302 °F) for PFA, DN 25 to 200 (1 to 8")
- −20 to +180 °C (−4 to +356 °F) for PFA high-temperature, DN 25 to 200 (1 to 8")
- −40 to +130 °C (−40 to +266 °F) for PTFE, DN 15 to 600 (½ to 24")



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T_A	Ambient temperature
T_F	Medium temperature
1	Gray area: the ambient temperature range of −10 to −40 °C (−14 to −40 °F) applies to stainless flanges only
2	Hatched area: harsh environment and IP68 only up to +130 °C (+266 °F)
3	Dark-gray area: high-temperature version with insulation

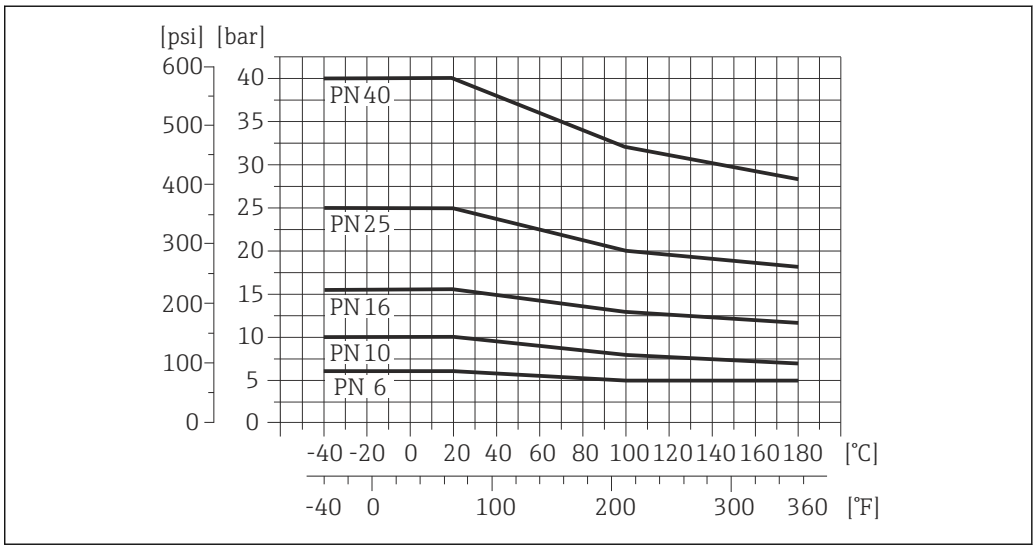
Conductivity

≥ 5 µS/cm for liquids in general

Pressure-temperature ratings

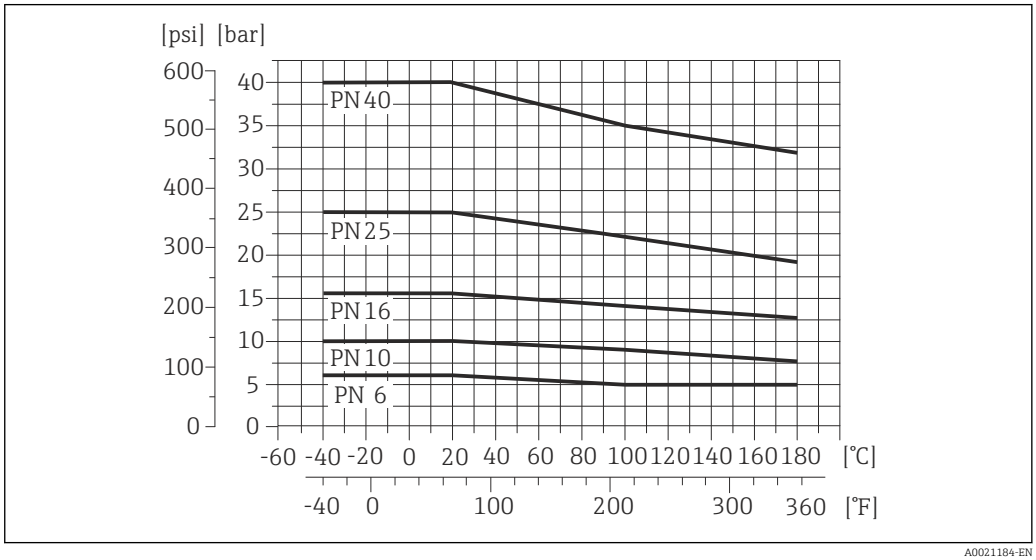
The following material load diagrams refer to the entire device and not just the process connection.

Flange connection according to EN 1092-1 (DIN 2501)



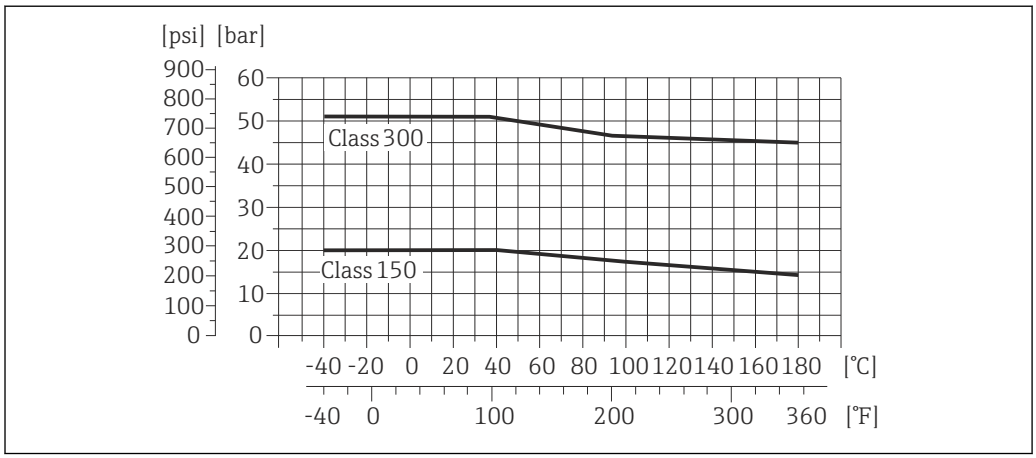
21 *Materials C22, FE 410W B and S235JRG2*

Flange connection according to EN 1092-1 (DIN 2501)



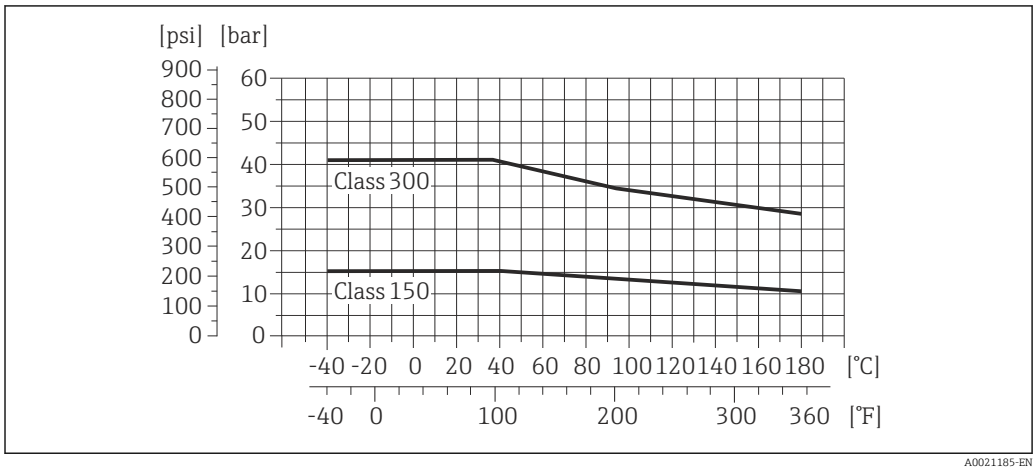
22 *Material 1.4571 (316L)*

Flange connection according to ASME B16.5



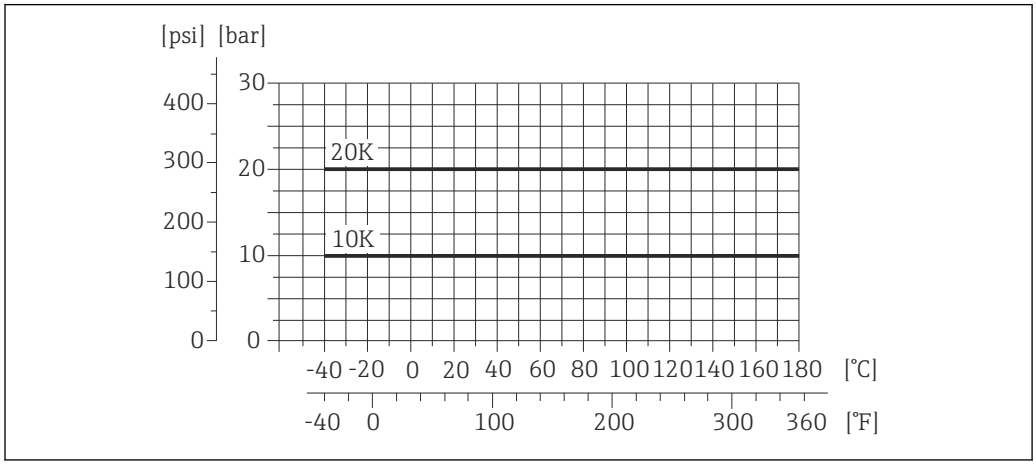
23 Material A105

Flange connection according to ASME B16.5



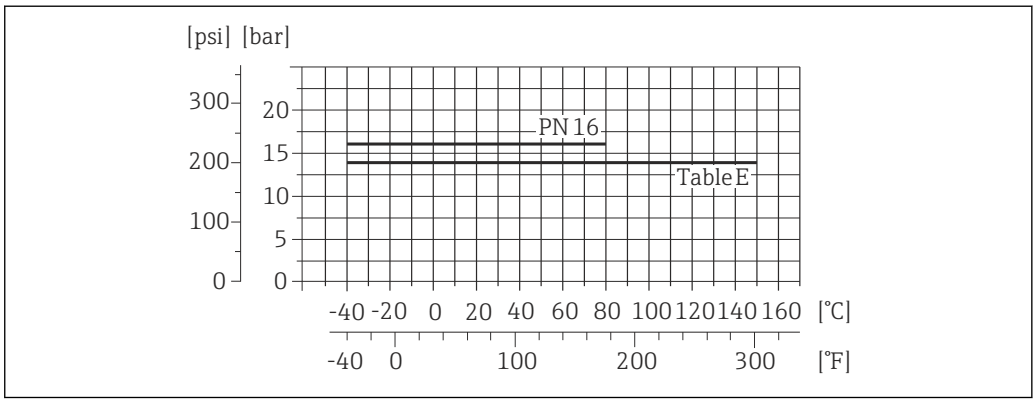
24 Material F316L

Flange connection according to JIS B2220



25 Materials 1.0425 (316L), HII, S235JRG2

Flange connection according to AS 2129 (Table E) or AS 4087 (PN 16)



26 Materials A105, S235JRG2, S275JR

Pressure tightness

"–" = no specifications possible

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 to +180 °C (+212 to +356 °F)
25	1	0 (0)	0 (0)	0 (0)
32	–	0 (0)	0 (0)	0 (0)
40	1 ½	0 (0)	0 (0)	0 (0)
50	2	0 (0)	0 (0)	0 (0)
65	–	0 (0)	–	0 (0)
80	3	0 (0)	–	0 (0)
100	4	0 (0)	–	0 (0)
125	–	0 (0)	–	0 (0)
150	6	0 (0)	–	0 (0)
200	8	0 (0)	–	0 (0)

Liner: PTFE

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
15	½	0 (0)	0 (0)	0 (0)	100 (1.45)
25	1	0 (0)	0 (0)	0 (0)	100 (1.45)
32	–	0 (0)	0 (0)	0 (0)	100 (1.45)
40	1 ½	0 (0)	0 (0)	0 (0)	100 (1.45)
50	2	0 (0)	0 (0)	0 (0)	100 (1.45)
65	–	0 (0)	–	40 (0.58)	130 (1.89)
80	3	0 (0)	–	40 (0.58)	130 (1.89)
100	4	0 (0)	–	135 (1.96)	170 (2.47)
125	–	135 (1.96)	–	240 (3.48)	385 (5.58)
150	6	135 (1.96)	–	240 (3.48)	385 (5.58)
200	8	200 (2.90)	–	290 (4.21)	410 (5.95)
250	10	330 (4.79)	–	400 (5.80)	530 (7.69)

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
300	12	400 (5.80)	–	500 (7.25)	630 (9.14)
350	14	470 (6.82)	–	600 (8.70)	730 (10.6)
400	16	540 (7.83)	–	670 (9.72)	800 (11.6)
450	18	No negative pressure permitted!			
500	20				
600	24				

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum flow velocity is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludges)

For an overview of the measuring range full scale values, see the "Measuring range" section (→ 6)

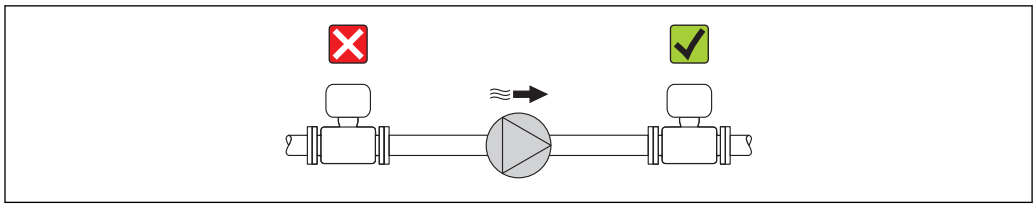
Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 34)

System pressure

- Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.
- Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- For information on the liner's resistance to partial vacuum (→ 39)
- For information on the measuring system's resistance to vibration and shock (→ 35), (→ 35)



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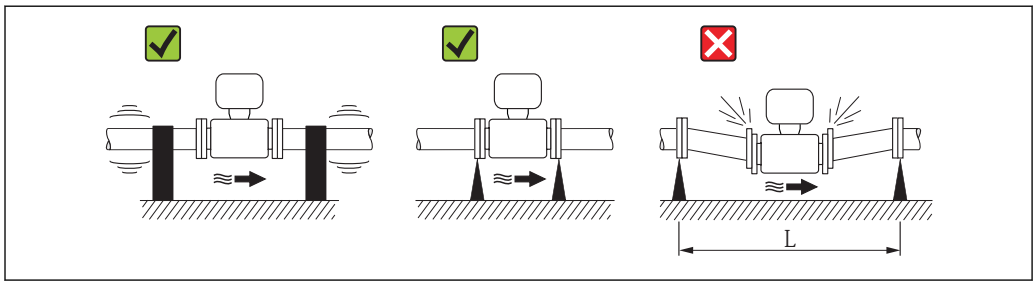
Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

For information on the permitted resistance to vibration and shock (→ 35), (→ 35)



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27 *Measures to prevent vibration of the device*

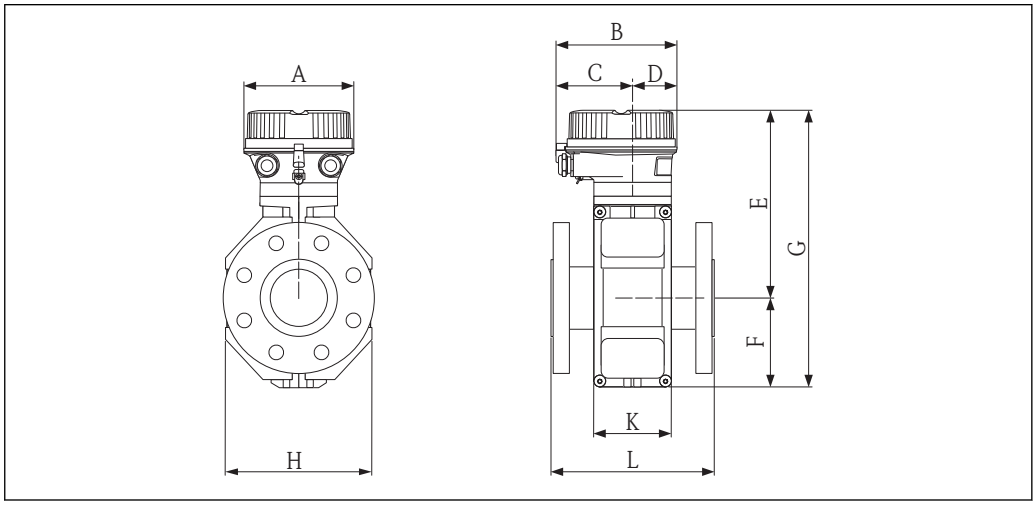
L > 10 m (33 ft)

Mechanical construction

Design, dimensions

Compact version

Order code for "Housing", option A "Compact, coated aluminum" with DN 15 to 300 (½ to 12")



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Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [2)] [mm]	F [mm]	G [2)] [mm]	H [mm]	K [mm]
15	200	136	147.5	93.5	54	197	84	281	120	94
25	200	136	147.5	93.5	54	197	84	281	120	94
32	200	136	147.5	93.5	54	197	84	281	120	94
40	200	136	147.5	93.5	54	197	84	281	120	94
50	200	136	147.5	93.5	54	197	84	281	120	94
65	200	136	147.5	93.5	54	222	109	331	180	94
80	200	136	147.5	93.5	54	222	109	331	180	94
100	250	136	147.5	93.5	54	222	109	331	180	94
125	250	136	147.5	93.5	54	262	150	412	260	140
150	300	136	147.5	93.5	54	262	150	412	260	140
200	350	136	147.5	93.5	54	287	180	467	324	156
250	450	136	147.5	93.5	54	312	205	517	400	166
300	500	136	147.5	93.5	54	337	203	567	460	166

1) The length (L) is always the same and does not depend on the selected pressure rating.
2) For high-temperature version: values + 110 mm

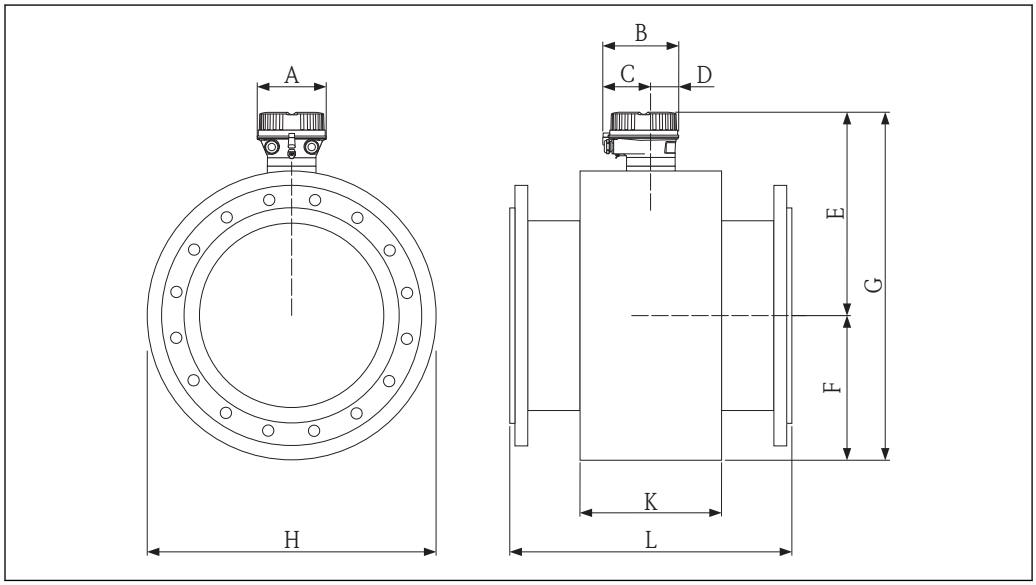
Dimensions in US units

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [2)] [in]	F [in]	G [2)] [in]	H [in]	K [in]
½	7.87	5.35	5.81	3.68	2.13	7.76	3.31	11.1	4.72	3.70
1	7.87	5.35	5.81	3.68	2.13	7.76	3.31	11.1	4.72	3.70
1 ½	7.87	5.35	5.81	3.68	2.13	7.76	3.31	11.1	4.72	3.70
2	7.87	5.35	5.81	3.68	2.13	7.76	3.31	11.1	4.72	3.70

DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [2)] [in]	F [in]	G [2)] [in]	H [in]	K [in]
3	7.87	5.35	5.81	3.68	2.13	8.74	4.29	13.0	7.09	3.70
4	9.84	5.35	5.81	3.68	2.13	8.74	4.29	13.0	7.09	3.70
6	11.8	5.35	5.81	3.68	2.13	10.3	5.91	16.2	10.2	5.51
8	13.8	5.35	5.81	3.68	2.13	11.3	7.09	18.4	12.8	6.14
10	17.7	5.35	5.81	3.68	2.13	12.3	8.07	20.4	15.8	6.54
12	19.7	5.35	5.81	3.68	2.13	13.3	7.99	22.3	18.1	6.54

1) The length (L) is always the same and does not depend on the selected pressure rating.
2) For high-temperature version: values + 4.33 in

Order code for "Housing", option A "Compact, coated aluminum" with DN 350 to 600 (14 to 24")



A0019493

Dimensions in SI units

DN [mm]	L [1)] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [2)] [mm]	F [mm]	G [2)] [mm]	H [mm]	K [mm]
350	550	136	147.5	93.5	54	399	282	681	564	276
400	600	136	147.5	93.5	54	425	308	733	616	276
450	650	136	147.5	93.5	54	450	333	783	666	292
500	650	136	147.5	93.5	54	476	359	835	717	292
600	780	136	147.5	93.5	54	528	411	939	821	402

1) The length (L) is always the same and does not depend on the selected pressure rating.
2) For high-temperature version: values + 110 mm

Dimensions in US units

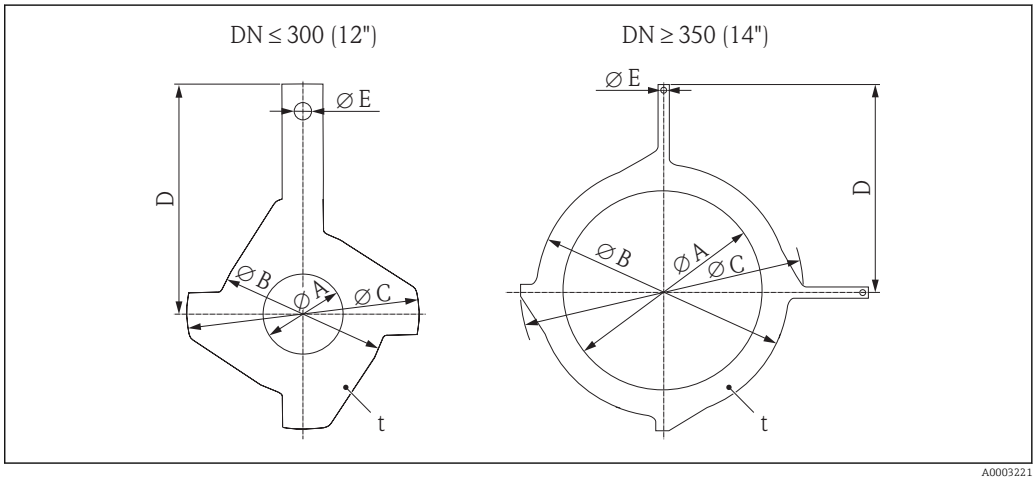
DN [in]	L [1)] [in]	A [in]	B [in]	C [in]	D [in]	E [2)] [in]	F [in]	G [2)] [in]	H [in]	K [in]
14	21.7	5.35	5.81	3.68	2.13	15.7	11.1	26.8	22.2	10.9
16	23.6	5.35	5.81	3.68	2.13	16.7	12.1	28.9	24.3	10.9

DN [in]	L [1] [in]	A [in]	B [in]	C [in]	D [in]	E [2] [in]	F [in]	G [2] [in]	H [in]	K [in]
18	25.6	5.35	5.81	3.68	2.13	17.7	13.1	30.8	26.2	11.5
20	25.6	5.35	5.81	3.68	2.13	18.7	14.1	32.9	28.2	11.5
24	30.7	5.35	5.81	3.68	2.13	20.8	16.2	37.0	32.3	15.8

1) The length (L) is always the same and does not depend on the selected pressure rating.
2) For high-temperature version: values + 4.33 in

Accessories

Ground disk for flange connection



Dimensions in SI units

DN [1] EN (DIN), JIS, AS [2] [mm]	A PFA, PTFE [mm]	B [mm]	C [mm]	D [mm]	E [mm]	t [mm]
15	16	43	61.5	73	6.5	2
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5	6.5	2
40	41	82	101	103	6.5	2
50	52	101	115.5	108	6.5	2
65	68	121	131.5	118	6.5	2
80	80	131	154.5	135	6.5	2
100	104	156	186.5	153	6.5	2
125	130	187	206.5	160	6.5	2
150	158	217	256	184	6.5	2
200	206	267	288	205	6.5	2
250	260	328	359	240	6.5	2
300 [3]	312	375	413	273	6.5	2
300 [4]	310	375	404	268	6.5	2
350 [3]	343	433	479	365	9.0	2
400 [3]	393	480	542	395	9.0	2

DN [1] EN (DIN), JIS, AS [2] [mm]	A PFA, PTFE [mm]	B [mm]	C [mm]	D [mm]	E [mm]	t [mm]
450 [3]	439	538	583	417	9.0	2
500 [3]	493	592	650	460	9.0	2
600 [3]	593	693	766	522	9.0	2

1) Ground disks DN 15 to 250 (½ to 10") can be used for all available flange standards/pressure ratings.
2) For flanges to AS, only DN 25 and DN 50 are available.
3) PN 10/16
4) PN 25, JIS 10K/20K

Dimensions in US units

DN [1] ASME [in]	A PFA, PTFE [in]	B [in]	C [in]	D [in]	E [in]	t [in]
½	0.63	1.69	2.42	2.87	0.26	0.08
1	1.02	2.44	3.05	3.44	0.26	0.08
1 ½	1.61	3.23	3.98	4.06	0.26	0.08
2	2.05	3.98	4.55	4.25	0.26	0.08
3	3.15	5.16	6.08	5.31	0.26	0.08
4	4.09	6.14	7.34	6.02	0.26	0.08
6	6.22	8.54	10.08	7.24	0.26	0.08
8	8.11	10.51	11.34	8.07	0.26	0.08
10	10.24	12.91	14.13	9.45	0.26	0.08
12	12.28	14.76	16.26	10.75	0.26	0.08
14	13.50	17.05	18.86	14.37	0.35	0.08
16	15.47	18.90	21.34	15.55	0.35	0.08
18	17.28	21.18	22.95	16.42	0.35	0.08
20	19.41	23.31	25.59	18.11	0.35	0.08
24	23.35	27.28	30.16	20.55	0.35	0.08

1) Ground disks can be used for all available pressure ratings.

Weight

Compact version

- Including the transmitter
- High-temperature version + 1.5 kg (3.31 lbs)
- Weight specifications apply to standard pressure ratings and without packaging material.

Weight in SI units

Nominal diameter		EN (DIN), AS [1]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
15	½	PN 40	4.5	Class 150	4.5	10K	4.5
25	1	PN 40	5.3	Class 150	5.3	10K	5.3
32	–	PN 40	6	Class 150	–	10K	5.3
40	1 ½	PN 40	7.4	Class 150	7.4	10K	6.3
50	2	PN 40	8.6	Class 150	8.6	10K	7.3

Nominal diameter		EN (DIN), AS [1]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
65	–	PN 16	10	Class 150	–	10K	9.1
80	3	PN 16	12	Class 150	12	10K	10.5
100	4	PN 16	14	Class 150	14	10K	12.7
125	–	PN 16	19.5	Class 150	–	10K	19
150	6	PN 16	23.5	Class 150	23.5	10K	22.5
200	8	PN 10	43	Class 150	43	10K	39.9
250	10	PN 10	63	Class 150	73	10K	67.4
300	12	PN 10	68	Class 150	108	10K	70.3
350	14	PN 10	103	Class 150	173		
400	16	PN 10	118	Class 150	203		
450	18	PN 10	159	Class 150	253		
500	20	PN 10	154	Class 150	283		
600	24	PN 10	206	Class 150	403		

1) For flanges to AS, only DN 25 and 50 are available.

Weight in US units

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
15	½	Class 150	9.92
25	1	Class 150	11.7
40	1 ½	Class 150	16.3
50	2	Class 150	19.0
80	3	Class 150	26.5
100	4	Class 150	30.9
150	6	Class 150	51.8
200	8	Class 150	94.8
250	10	Class 150	161.0
300	12	Class 150	238.1
350	14	Class 150	381.5
400	16	Class 150	447.6
450	18	Class 150	557.9
500	20	Class 150	624.0
600	24	Class 150	888.6

Measuring tube specification

Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
15	½	PN 40	Class 150	–	–	20K	–	–	15	0.59
25	1	PN 40	Class 150	Table E	–	20K	23	0.91	26	1.02
32	–	PN 40	–	–	–	20K	32	1.26	35	1.38

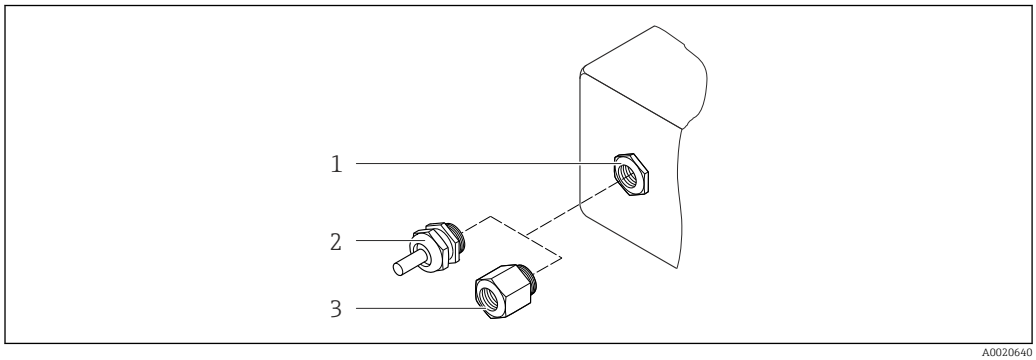
Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
40	1 ½	PN 40	Class 150	–	–	20K	36	1.42	41	1.61
50	2	PN 40	Class 150	Table E	PN 16	10K	48	1.89	52	2.05
65	–	PN 16	–	–	–	10K	63	2.48	67	2.64
80	3	PN 16	Class 150	–	–	10K	75	2.95	80	3.15
100	4	PN 16	Class 150	–	–	10K	101	3.98	104	4.09
125	–	PN 16	–	–	–	10K	126	4.96	129	5.08
150	6	PN 16	Class 150	–	–	10K	154	6.06	156	6.14
200	8	PN 10	Class 150	–	–	10K	201	7.91	202	7.95
250	10	PN 10	Class 150	–	–	10K	–	–	256	10.1
300	12	PN 10	Class 150	–	–	10K	–	–	306	12.0
350	14	PN 10	Class 150	–	–	–	–	–	337	13.3
400	16	PN 10	Class 150	–	–	–	–	–	387	15.2
450	18	PN 10	Class 150	–	–	–	–	–	432	17.0
500	20	PN 10	Class 150	–	–	–	–	–	487	19.2
600	24	PN 10	Class 150	–	–	–	–	23	593	23.3

Materials

Transmitter housing

Order code for "Housing", option **A** "Compact, aluminum coated":
Coated aluminum AlSi10Mg

Cable entries/cable glands



A0020640

28 Possible cable entries/cable glands

1 Cable entry in transmitter housing, wall-mount housing or connection housing with internal thread M20 x 1.5
2 Cable gland M20 x 1.5
3 Adapter for cable entry with internal thread G ½" or NPT ½"

Order code for "Housing", option A "Compact, coated aluminum"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Nickel-plated brass
Adapter for cable entry with internal thread G ½"	
Adapter for cable entry with internal thread NPT ½"	

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Sensor housing

- DN 15 to 300 (½ to 12"): coated aluminum AlSi10Mg
- DN 350 to 600 (14 to 24"): carbon steel with protective varnish

Measuring tubes

Stainless steel 1.4301 (304) or 1.4306 (304L); for flanges made of carbon with Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))

Liner

- PFA
- PTFE

Process connections

EN 1092-1 (DIN 2501)
1.4571 (316L), C22, FE 410W B [1], S235JRG2

ASME B16.5
A105, F316L [1]

JIS B2220
1.0425 (316L) [1], HII, S235JRG2

AS 2129 Table E
- DN 25 (1"): A105 or S235JRG2
- DN 40 (1 ½"): A105 or S275JR

AS 4087 PN 16
A105 or S275JR

List of all available process connections (→ 48)

Electrodes

1.4435 (316L), Alloy C22, platinum, tantalum, titanium

Seals

In accordance with DIN EN 1514-1

Accessories

Ground disks

1.4435 (316L), Alloy C22, tantalum, titanium

1) DN 15 to 300 (½ to 12") with Al/Zn protective coating; DN 350 to 600 (14 to 24") with protective varnish

Fitted electrodes

Measuring electrodes, reference electrodes and electrodes for empty pipe detection:
- Standard: 1.4435 (316L), Alloy C22, platinum, tantalum
- Optional: only measuring electrodes made from platinum or tantalum

Process connections

- EN 1092-1 (DIN 2501): DN ≤ 300 (12") form A, DN ≥ 350 (14") flat face; dimensions as per DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 only as per EN 1092-1
- ASME B16.5
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16

For information on the materials of the process connections (→ 47)

Surface roughness

Electrodes with 1.4435 (304L), Alloy C22, platinum, tantalum:
≤ 0.3 to 0.5 µm (11.8 to 19.7 in)
(All data relate to parts in contact with fluid)

Liner with PFA:
≤ 0.4 µm (15.7 µin)
(All data relate to parts in contact with fluid)

Operability

Operating concept

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

Rapid and safe commissioning
- Individual menus for applications
- Menu guidance with brief explanations of the individual parameter functions

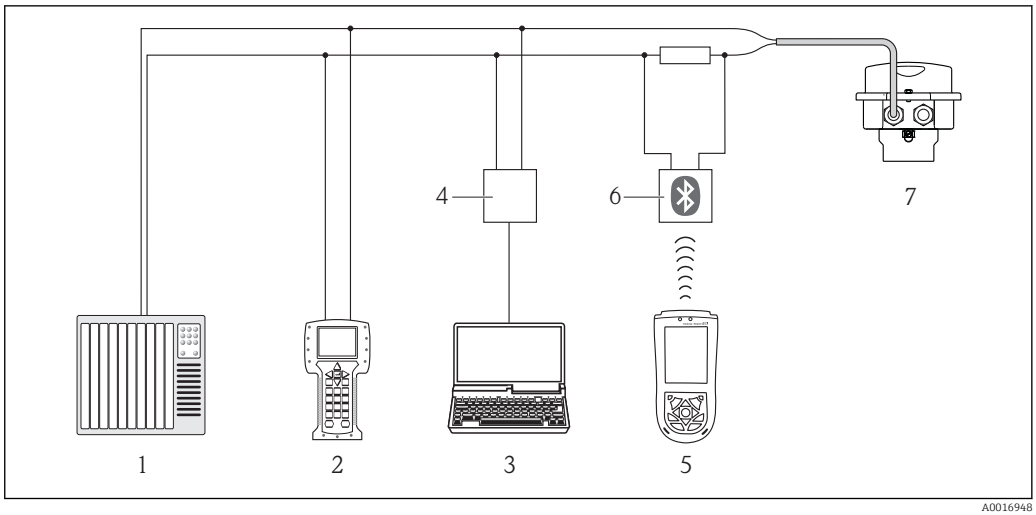
Reliable operation
- Operation in the following languages:
  - Via "FieldCare" operating tool:
    English, German, French, Spanish, Italian, Dutch, Chinese, Japanese
  - Via Web browser:
    English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech
- Uniform operating philosophy applied to operating tools and Web browser
- If replacing the electronic module, transfer the device configuration via the plug-in memory (HistoROM DAT) which contains the process and measuring device data and the event logbook. No need to reconfigure.
  For devices with Modbus RS485, the data recovery function is implemented without the plug-in memory (HistoROM DAT).

Efficient diagnostics increase measurement availability
- Troubleshooting measures can be called up via the operating tools and Web browser
- Diverse simulation options
- Status indicated by several light emitting diodes (LEDs) on the electronic module in the housing compartment

Remote operation

Via HART protocol

This communication interface is present in the following device version:
Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output



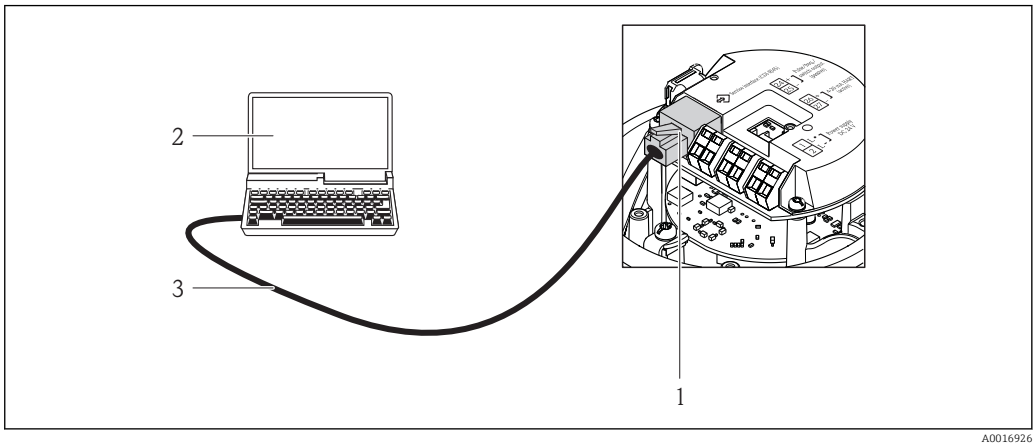
A0016948

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 SFX100*
6 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

Via service interface (CDI-RJ45)

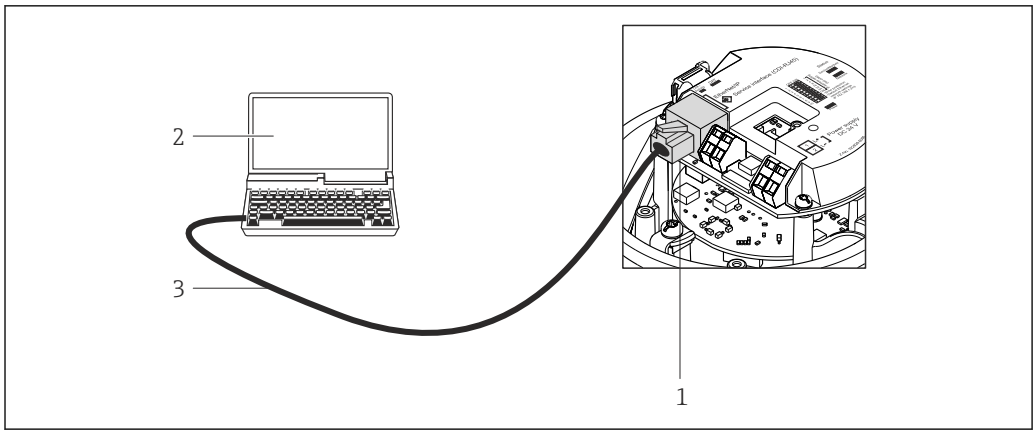
This communication interface is present in the following device version:
- Order code for "Output", option **B**: 4-20 mA HART, pulse/frequency/switch output
- Order code for "Output", option **L**: PROFIBUS DP
- Order code for "Output", option **N**: EtherNet/IP



A0016926

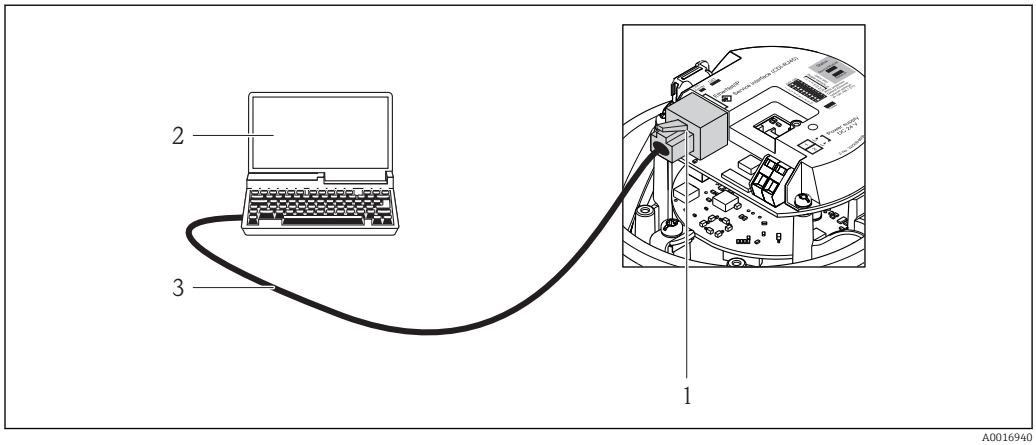
30 *Connection for the order code for "Output", option B: 4-20 mA HART, pulse/frequency/switch output*

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



31 Connection for order code for "Output", option L: PROFIBUS DP

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

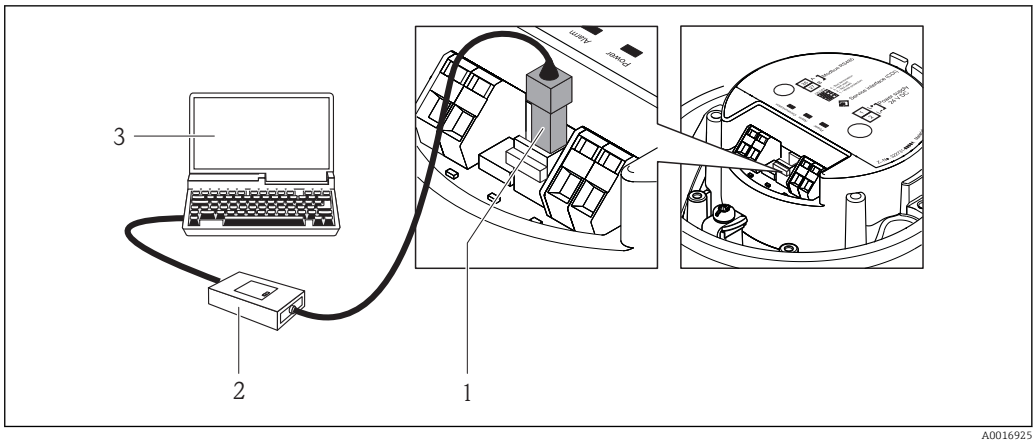


32 Connection for order code for "Output", option N: EtherNet/IP

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

Via service interface (CDI)

This communication interface is present in the following device version:
Order code for "Output", option **M**: Modbus RS485

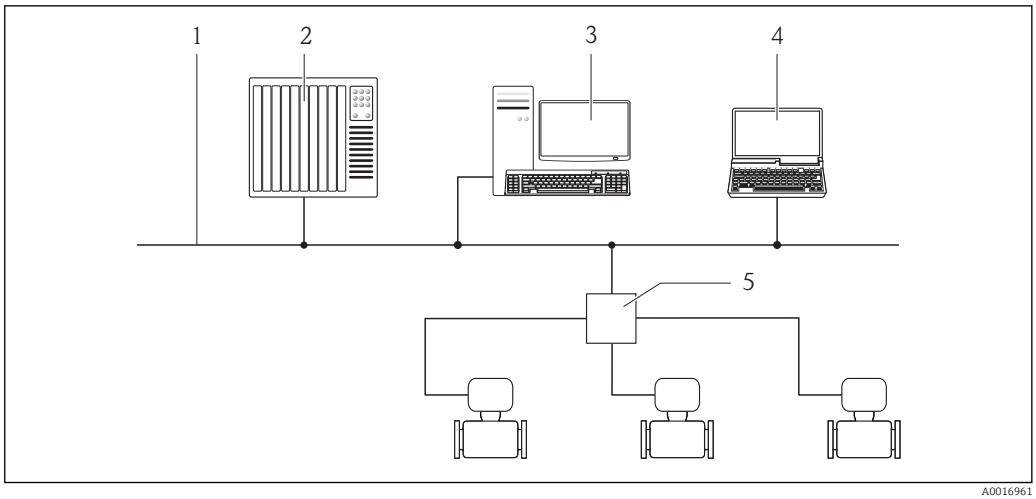


A0016925

1 Service interface (CDI) of the measuring device
2 Commubox FXA291
3 Computer with "FieldCare" operating tool with COM DTM "CDI Communication FXA291"

Via Ethernet network

This communication interface is present in the following device version:
Order code for "Output", option **N**: EtherNet/IP

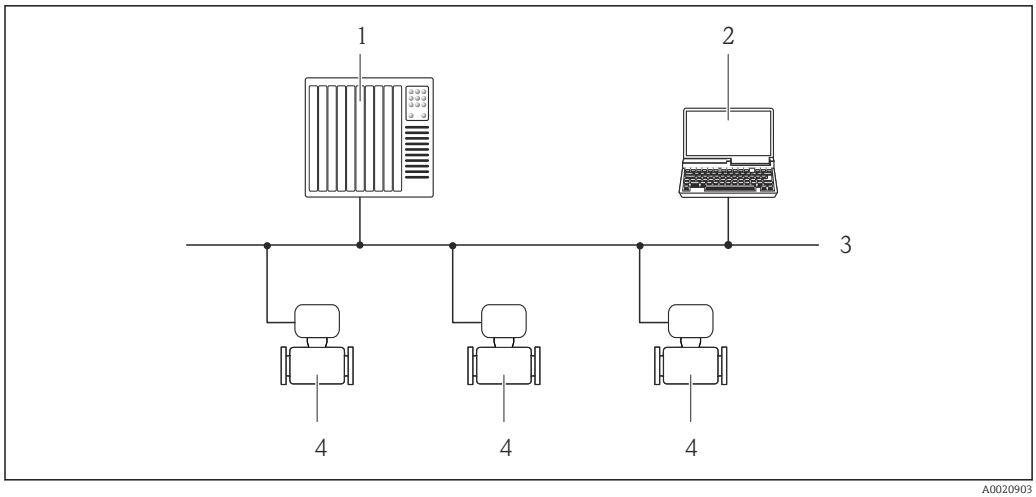


A0016961

1 Ethernet network
2 Automation system, e.g. "RSLogix" (Rockwell Automation)
3 Workstation for measuring device operation: with Add-on Profile Level 3 for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)
4 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or with "FieldCare" operating tool with COM DTM "CDI Communication TCP/IP"
5 Ethernet switch

Via PROFIBUS DP network

This communication interface is present in the following device version:
Order code for "Output", option **L**: PROFIBUS DP



1 *Automation system*
2 *Computer with PROFIBUS network card*
3 *PROFIBUS DP network*
4 *Measuring device*

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied.

Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-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.

ATEX, IECEx

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

Ex nA

Category	Type of protection
II3G	Ex nA IIC T6-T1 Gc

cCSAus

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

NI

Category	Type of protection
Class I Division 2 Groups ABCD	NI (Non-incendive version), NIFW parameter [1)]

1) Entity and NIFW parameter in accordance with Control Drawings

Certification PROFIBUS	**PROFIBUS interface** The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications: ▪ Certified in accordance with PROFIBUS PA Profile 3.02 ▪ 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/TCP conformity test and has the "MODBUS/TCP Conformance Test Policy, Version 2.0". The measuring device has successfully passed all the test procedures carried out and is certified by the “MODBUS/TCP Conformance Test Laboratory” of the University of Michigan.
EtherNet/IP certification	The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications: ▪ Certified in accordance with the ODVA Conformance Test ▪ EtherNet/IP Performance Test ▪ EtherNet/IP PlugFest compliance ▪ The device can also be operated with certified devices of other manufacturers (interoperability)
Pressure Equipment Directive	The devices can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary. ▪ With the PED/G1/x (x = category) marking on the sensor nameplate, Endress+Hauser confirms compliance with the "Essential Safety Requirements" specified in Annex I of the Pressure Equipment Directive 97/23/EC. ▪ Devices bearing this marking (PED) are suitable for the following types of medium: Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to0.5 bar (7.3 psi) ▪ Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Art.3 Section 3 of the Pressure Equipment Directive 97/23/EC. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive.
Other standards and guidelines	▪ EN 60529 Degrees of protection by housing (IP code) ▪ EN 61010-1 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ▪ 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 from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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 from Endress+Hauser either directly with the device or subsequently. 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.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**Heartbeat Monitoring:** Continuously supplies monitoring data, which are characteristic of the measuring principle, for an external condition monitoring system. This makes it possible 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 product quality, e.g. gas pockets. **Heartbeat Verification:** Makes it possible to check the device functionality on demand when the device is installed, without having to interrupt the process. ▪ Access via onsite operation or other interfaces (requires no on-site presence). ▪ Ideal solution for recurring device checks (SIL). ▪ End-to-end, traceable documentation of the verification results and verification report. ▪ Extension of calibration intervals.

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
Ground cable	Set, consisting of two ground cables for potential equalization.

For the sensor

Accessories	Description
Ground disks	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "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. For details, see "Technical Information" TI00405C
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and 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. For details, see Operating Instructions BA00061S
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX100	Compact, flexible and robust industry handheld terminal for remote configuration and for obtaining measured values via the HART current output (4-20 mA). For details, see Operating Instructions BA00060S

Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: ▪ Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections. ▪ Graphic illustration of the calculation results 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://wapps.endress.com/applicator ▪ On CD-ROM for local PC installation.

W@M	Life cycle management for your plant W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress +Hauser also takes care of maintaining and updating the data records. W@M is available: ▪ Via the Internet: www.endress.com/lifecyclemanagement ▪ On CD-ROM for local PC installation.
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. For details, see Operating Instructions BA00027S and BA00059S

System components

Accessories	Description
Memograph M graphic display recorder	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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

Documentation

The following document types are available:
- On the CD-ROM supplied with the device
- In the Download Area of the Endress+Hauser Internet site: www.endress.com → Download

Standard documentation

Communication	Document type	Documentation code
HART	Operating Instructions	BA01172D
EtherNet IP	Operating Instructions	BA01174D
Modbus	Operating Instructions	BA01176D
PROFIBUS DP	Operating Instructions	BA01238D
- - - -	Brief Operating Instructions	KA01143D

Supplementary device-dependent documentation

Document type	Approval	Documentation code
Safety Instructions	ATEX/IECEx Ex nA	XA01090D
Special Documentation	Information on the Pressure Equipment Directive	SD01056D
Special Documentation	Modbus RS485 Register Information	SD01148D
Special Documentation	Heartbeat Technology	SD01149D
Installation Instructions		Specified for each individual accessory (→ 54)

Registered trademarks

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

PROFIBUS®
Registered trademark of the PROFIBUS User Organization, Karlsruhe, Germany

Modbus®
Registered trademark of SCHNEIDER AUTOMATION, INC.

EtherNet/IP™
Trademark of ODVA, Inc.

Microsoft®
Registered trademark of the Microsoft Corporation, Redmond, Washington, USA

Applicator®, FieldCare®, Field Xpert™, HistoROM®, Heartbeat Technology™
Registered or registration-pending trademarks of the Endress+Hauser Group

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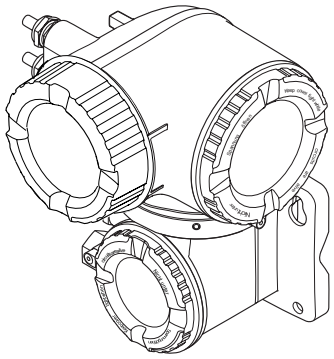
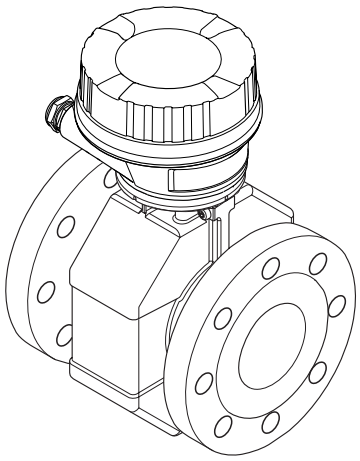
Endress+Hauser
People for Process Automation

Operating Instructions
Proline Promag W 500 HART

Electromagnetic flowmeter





Endress+Hauser
People for Process Automation

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

Table of contents

1 Document information

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 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 ground connection** A terminal which must be connected to ground prior to establishing any other connections.
⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Communication symbols

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

Symbol	Meaning
	**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is flashing.

1.2.4 Tool symbols

Symbol	Meaning
	Torx screwdriver
	Phillips head screwdriver
	Open-ended wrench

1.2.5 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
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.6 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

Symbol	Meaning
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

1.3 Documentation

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

For a detailed list of the individual documents along with the documentation code → 193

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Sensor Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 1** The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device. ▪ Incoming acceptance and product identification ▪ Storage and transport ▪ Installation
Transmitter Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 2** The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value). ▪ Product description ▪ Installation ▪ Electrical connection ▪ Operation options ▪ System integration ▪ Commissioning ▪ Diagnostic information
Description of Device Parameters	**Reference for your parameters** The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

1.3.2 Supplementary device-dependent documentation

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

1.4 Registered trademarks

HART®
Registered trademark of the FieldComm Group, Austin, Texas, USA

Applicator®, FieldCare®, DeviceCare ®, Field Xpert™, HistoROM®, Heartbeat Technology™
Registered or registration-pending trademarks of the Endress+Hauser Group

2 Basic safety instructions

2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

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

2.2 Designated use

Application and media
The measuring device described in this manual is intended only for flow measurement of liquids with a minimum conductivity of 5 µS/cm.

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, in hygienic applications or where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section.→ 8.
- Protect the measuring device permanently against corrosion from environmental influences.

Incorrect use
Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

⚠ WARNING
Danger of breakage due to corrosive or abrasive fluids!
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Keep within the specified pressure and temperature range.

NOTICE

Verification for borderline cases:

- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks

WARNING

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

- For elevated fluid temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.

For welding work on the piping:

- Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:

- Due to the increased risk of electric shock, gloves must be worn.

2.4 Operational safety

Risk of injury.

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability,

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to repair of an electrical device.
- Use original spare parts and accessories from Endress+Hauser only.

2.5 Product safety

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

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.6 IT security

We only provide a warranty 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 device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

2.7 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.

2.7.1 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 → 126.

2.7.2 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). Is equivalent to hardware write protection in terms of functionality.
- 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, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 125).

When the device is delivered, the device does not have an access code and is equivalent to *0000* (open).

WLAN passphrase

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface (→ 77) which can be ordered as an option 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→ 118.

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.

2.7.3 Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to *"Read only"* access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

Additional information: "Description of Device Parameters" document pertaining to the device → 193.

2.7.4 Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 70). 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.

Additional information: "Description of Device Parameters" document pertaining to the device → 193.

3 Product description

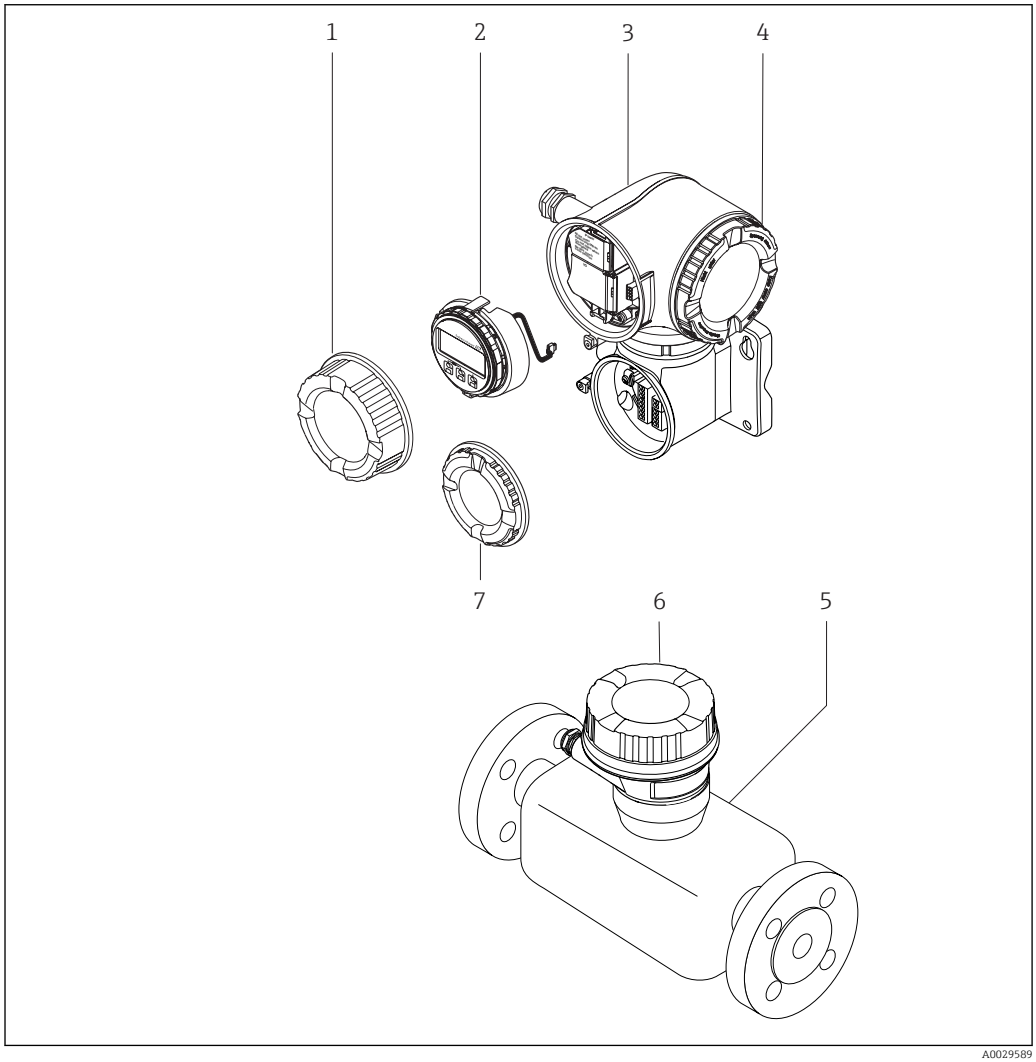
The measuring system consists of a transmitter and a sensor. The transmitter and sensor are mounted in physically separate locations. They are interconnected by two connecting cable(s).

3.1 Product design

Two versions of the transmitter are available.

For use in applications required to meet special requirements due to ambient or operating conditions.

As the electronics are located in the transmitter, the device is ideal in the event of:
- Sensor operation in underground installations.
- Permanent sensor immersion in water.

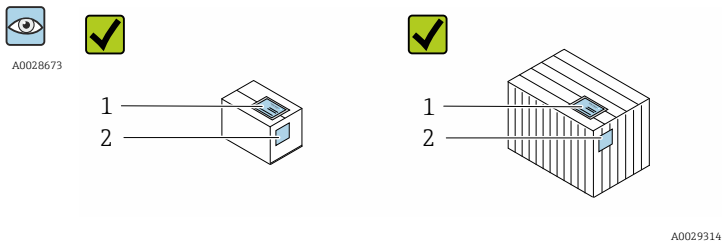


1 Important components of a measuring device

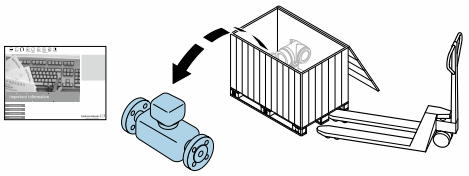
1 *Connection compartment cover*
2 *Display module*
3 *Transmitter housing (incl. integrated HistoROM)*
4 *Electronics compartment cover*
5 *Sensor*
6 *Sensor connection housing: connecting cable connection*
7 *Connection compartment cover: connecting cable connection*

4 Incoming acceptance and product identification

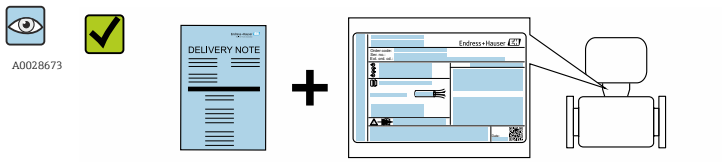
4.1 Incoming acceptance



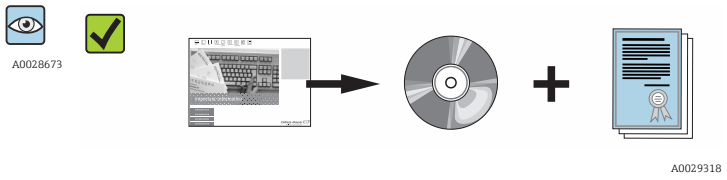
Are the order codes on the delivery note (1) and the product sticker (2) identical?



Are the goods undamaged?



Do the nameplate data match the ordering information on the delivery note?



Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?

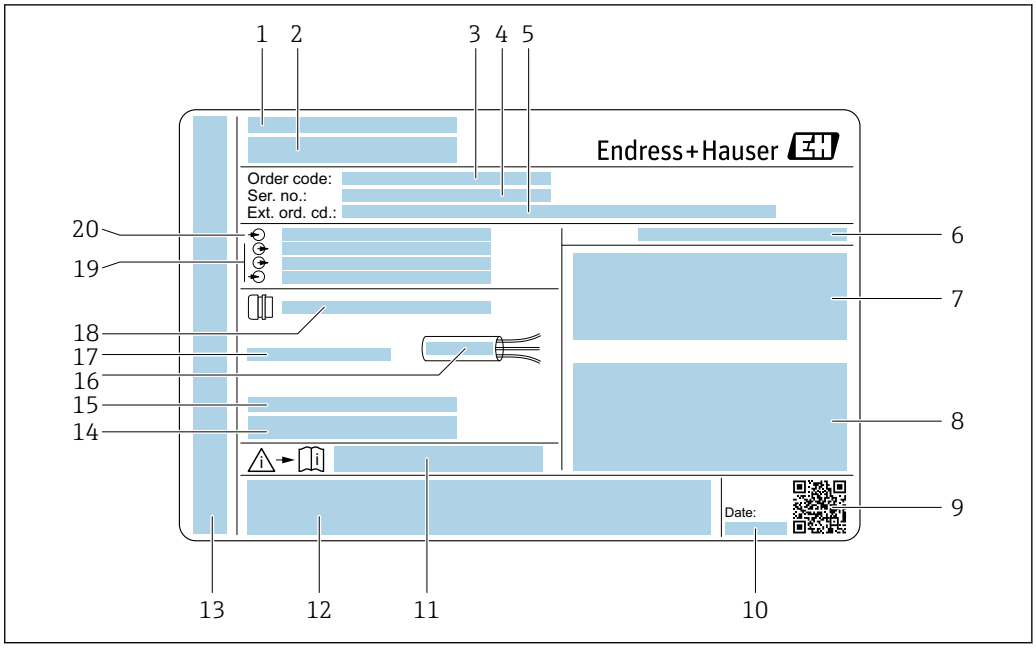
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 16.

4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The chapters "Additional standard documentation on the device" → 8 and "Supplementary device-dependent documentation" → 8
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

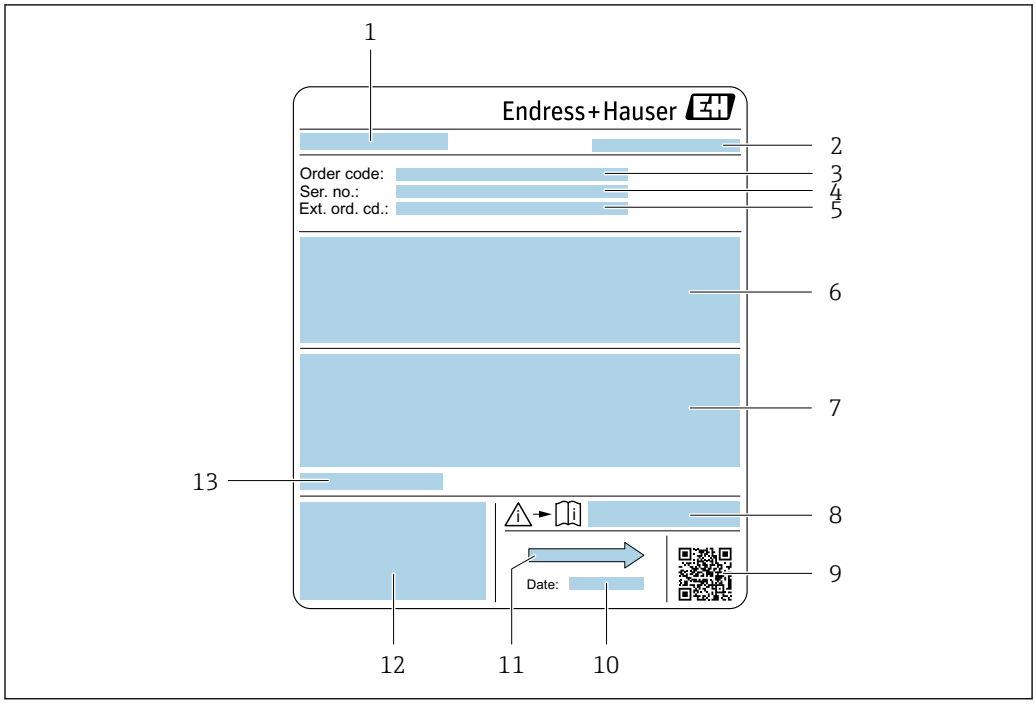
4.2.1 Transmitter nameplate



2 *Example of a transmitter nameplate*

1 *Manufacturing location*
2 *Name of the transmitter*
3 *Order code*
4 *Serial number (ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Degree of protection*
7 *Space for approvals: use in hazardous areas*
8 *Electrical connection data: available inputs and outputs*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Document number of safety-related supplementary documentation*
12 *Space for approvals and certificates: e.g. CE mark, C-Tick*
13 *Space for degree of protection of connection and electronics compartment when used in hazardous areas*
14 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
15 *Space for additional information in the case of special products*
16 *Permitted temperature range for cable*
17 *Permitted ambient temperature (T_a)*
18 *Information on cable gland*
19 *Available inputs and outputs, supply voltage*
20 *Electrical connection data: supply voltage*

4.2.2 Sensor nameplate



3 *Example of sensor nameplate*

1 *Name of the sensor*
2 *Manufacturing location*
3 *Order code*
4 *Serial number (ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Flow; nominal diameter of the sensor; pressure rating; nominal pressure; system pressure; fluid temperature range; material of liner and electrodes*
7 *Approval information for explosion protection, Pressure Equipment Directive and degree of protection*
8 *Document number of safety-related supplementary documentation→ 193*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Flow direction*
12 *CE mark, C-Tick*
13 *Permitted ambient temperature (T_a)*

Order code
The measuring device is reordered using the order code.

Extended order code
- The device type (product root) and basic specifications (mandatory features) are always listed.
- Of the optional specifications (optional features), only the safety and approval-related specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the # placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the + placeholder symbol (e.g. XXXXXX-ABCDE +).

4.2.3 Symbols on measuring device

Symbol	Meaning
	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	**Reference to documentation** Refers to the corresponding device documentation.
	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

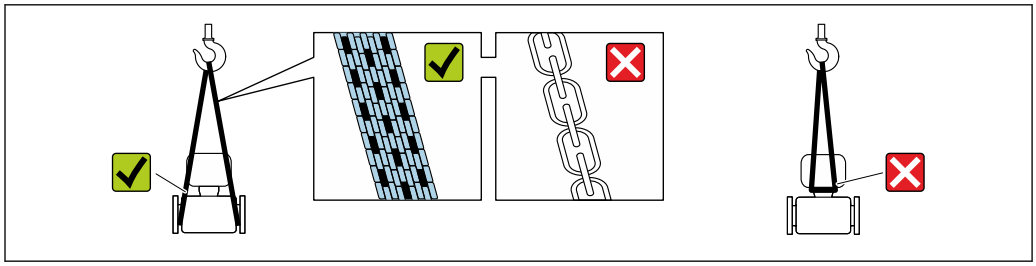
5.1 Storage conditions

Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus and bacteria infestation can damage the lining.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature → 177

5.2 Transporting the product

Transport the measuring device to the measuring point in the original packaging.



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Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

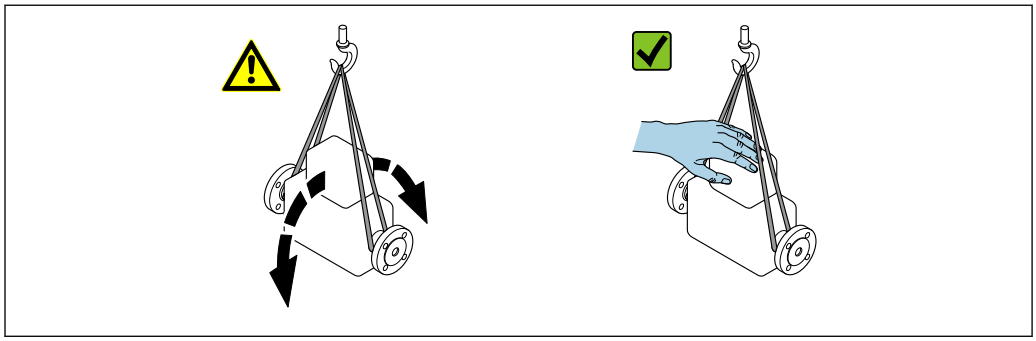
5.2.1 Measuring devices without lifting lugs

WARNING

Center of gravity of the measuring device is higher than the suspension points of the webbing slings.

Risk of injury if the measuring device slips.

- ▶ Secure the measuring device against slipping or turning.
- ▶ Observe the weight specified on the packaging (stick-on label).



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5.2.2 Measuring devices with lifting lugs

⚠ CAUTION

Special transportation instructions for devices with lifting lugs

- Only use the lifting lugs fitted on the device or flanges to transport the device.
- The device must always be secured at two lifting lugs at least.

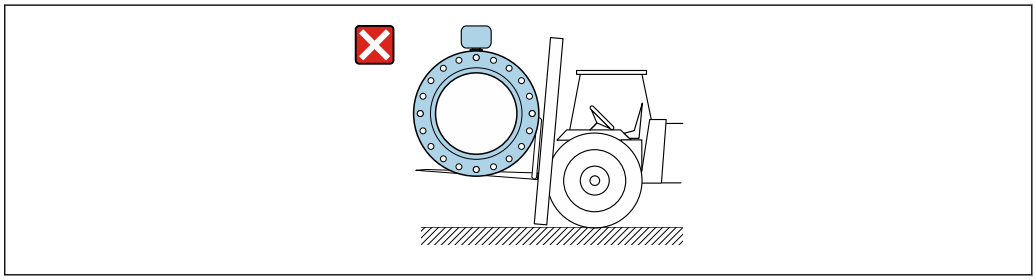
5.2.3 Transporting with a fork lift

If transporting in wood crates, the floor structure enables the crates to be lifted lengthwise or at both sides using a forklift.

⚠ CAUTION

Risk of damaging the magnetic coil

- If transporting by forklift, do not lift the sensor by the metal casing.
- This would buckle the casing and damage the internal magnetic coils.



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5.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

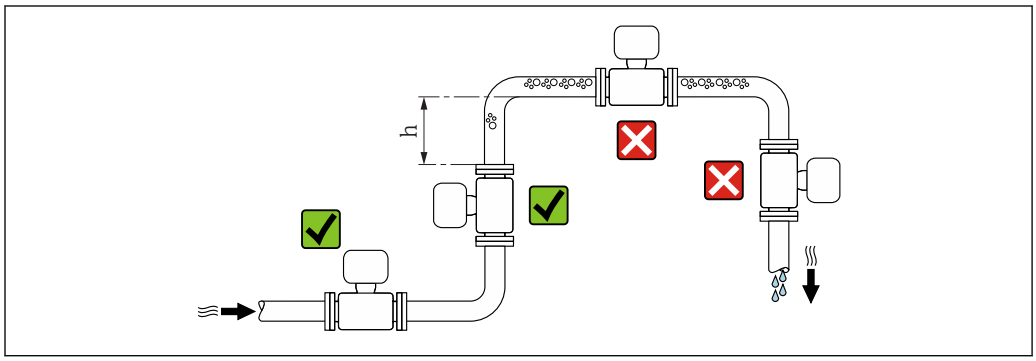
- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
  - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
    or
  - Carton in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed RESY symbol.
- Seaworthy packaging (optional): Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
- Carrying and mounting hardware:
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Dunnage: Paper cushion

6 Installation

6.1 Installation conditions

6.1.1 Mounting position

Mounting location



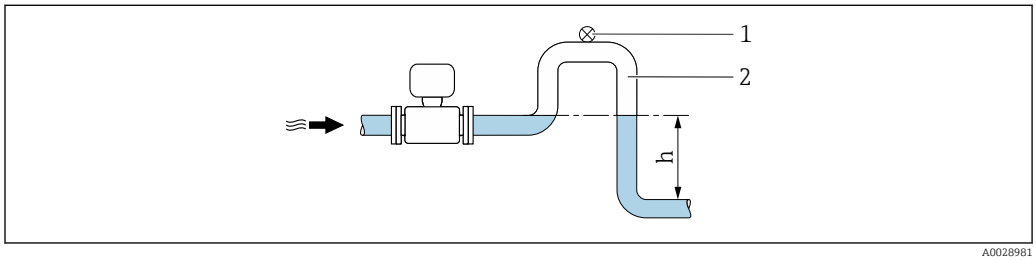
Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

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.

Installation in down pipes

Install a siphon with a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.

For information on the liner's resistance to partial vacuum

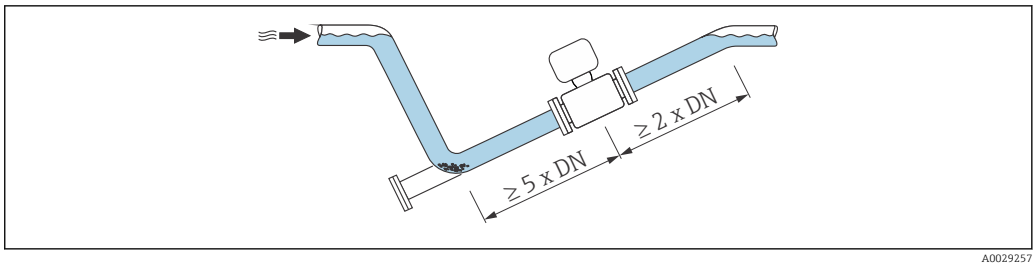


4 *Installation in a down pipe*

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.



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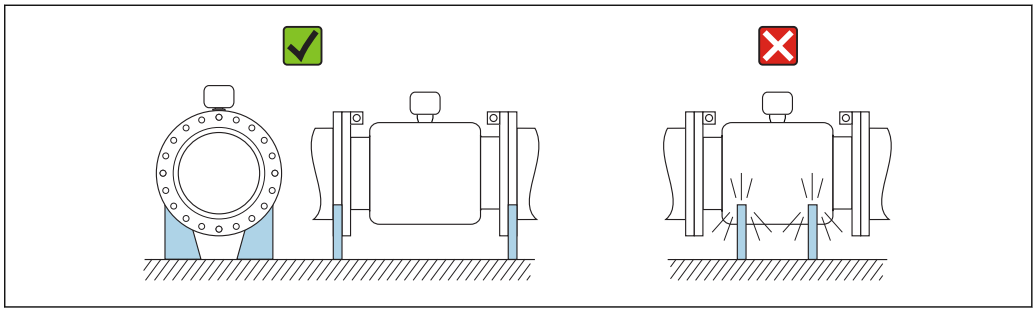
For heavy sensors DN ≥ 350 (14")



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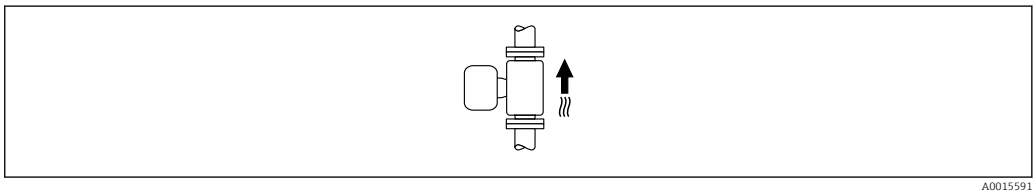
Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

The measuring device also offers the empty pipe detection function to detect partially filled measuring pipes in the event of outgassing fluids or variable process pressures.

Vertical



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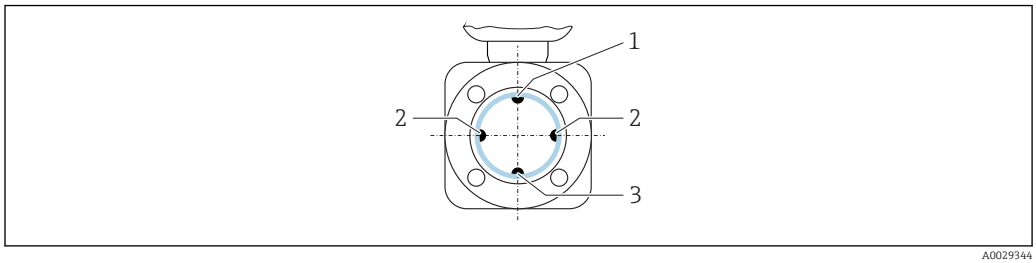
Optimum for self-emptying pipe systems and for use in conjunction with empty pipe detection.

Horizontal



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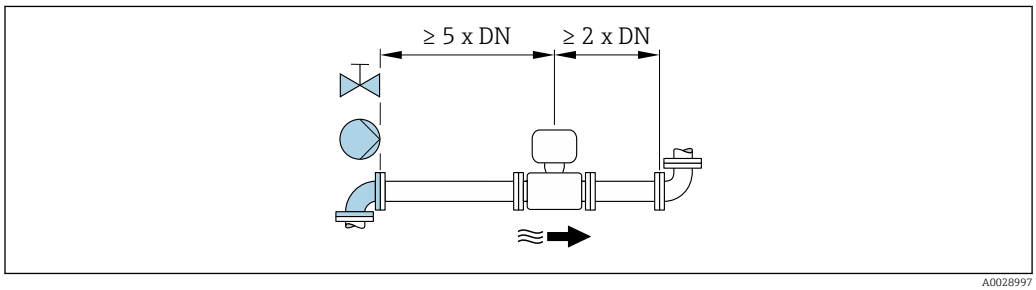
1 *EPD electrode for empty pipe detection*
2 *Measuring electrodes for signal detection*
3 *Reference electrode for potential equalization*

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



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Installation dimensions

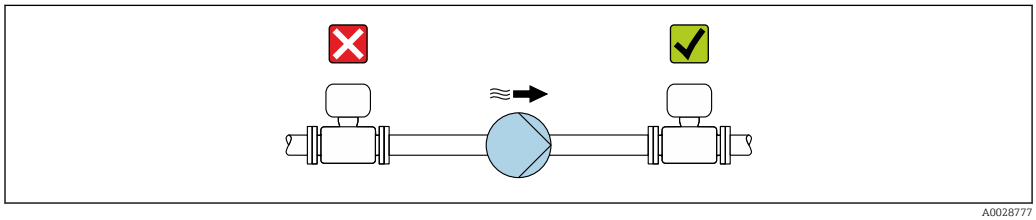
For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

6.1.2 Requirements from environment and process

Ambient temperature range

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

System pressure



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Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

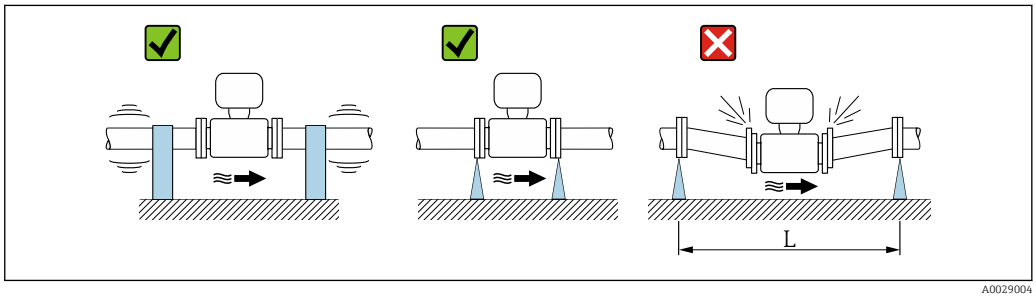
- For information on the liner's resistance to partial vacuum
- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system

Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

It is also advisable to mount the sensor and transmitter separately.

- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system



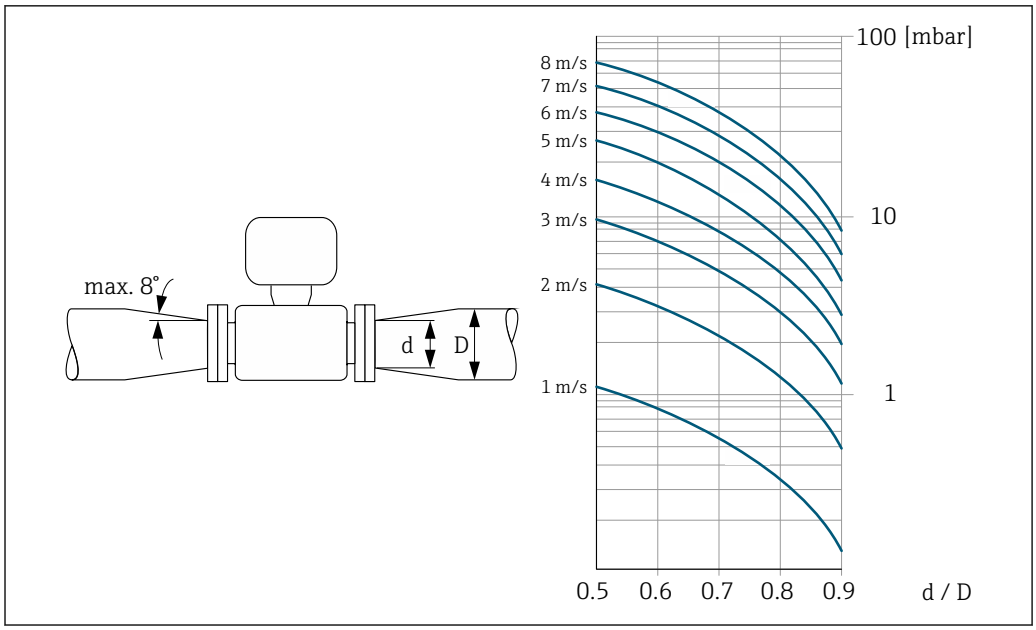
5 *Measures to avoid device vibrations (L > 10 m (33 ft))*

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

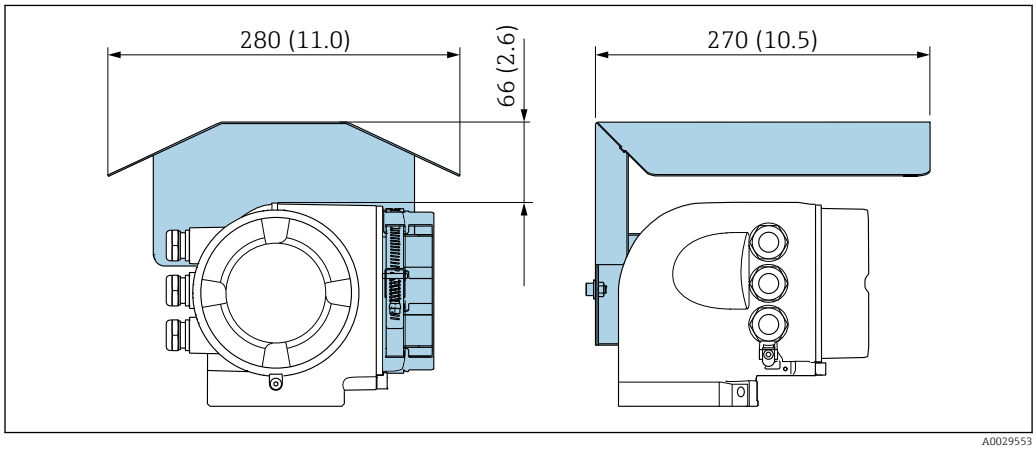
The nomogram only applies to liquids with a viscosity similar to that of water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.



6.1.3 Special mounting instructions

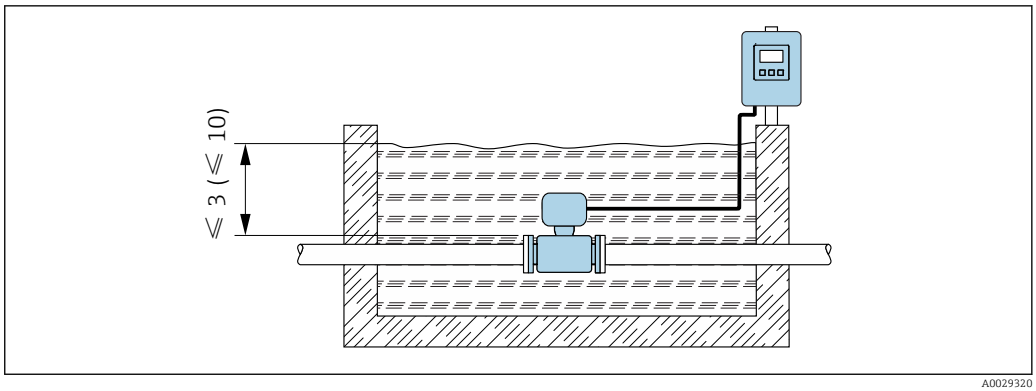
Protective cover



6 Weather protection cover for Proline 500

Permanent immersion in water

A fully welded remote version with IP68 protection is optionally available for permanent immersion in water ≤ 3 m (10 ft) or in exceptional cases for use for up to 48 hours at ≤ 10 m (30 ft). The measuring device meets the requirements of corrosion categories C5-M and Im1/Im2/Im3. The fully welded design along with the connection compartment sealing system ensure that moisture cannot enter the measuring device.



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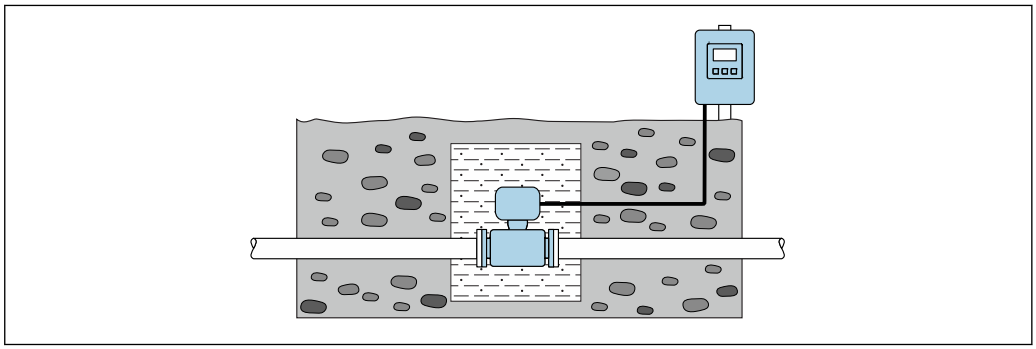
7 *Engineering unit in m(ft)*

Replacement of cable gland on connection housing

Buried applications

A remote version with IP68 protection is optionally available for buried applications. The measuring device satisfies the certified corrosion protection Im1/Im2/Im3 in accordance with EN ISO 12944. It can be used directly underground without the need for additional protective measures. The device is mounted in accordance with the usual regional installation regulations (e.g. EN DIN 1610).



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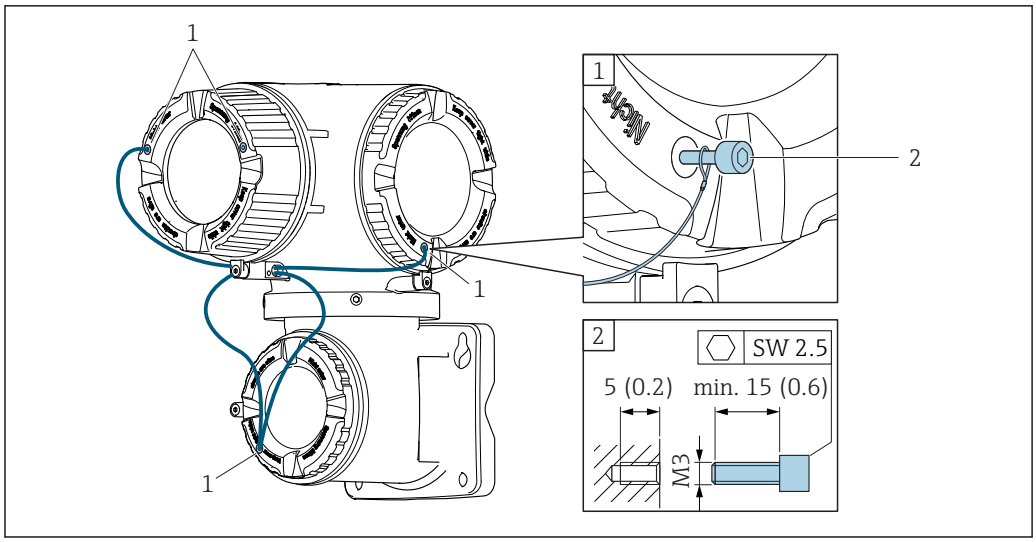
Cover locking

NOTICE

Order code for "Housing", option L "Cast, stainless": The covers of the transmitter housing are provided with a borehole to lock the cover.

The cover can be locked using screws and a chain or cable provided by the customer.

- It is recommended to use stainless steel cables or chains.
- If a protective coating is applied, it is recommended to use a heat shrink tube to protect the housing paint.



1 *Cover borehole for the securing screw*
2 *Securing screw to lock the cover*

6.2 Mounting the measuring device

6.2.1 Required tools

For transmitter

For mounting on a post:
Open-ended wrench AF 13

For wall mounting:
Drill with drill bit Ø 6.0 mm

For sensor

For flanges and other process connections:
- Screws, nuts, seals etc. are not included in the scope of supply and must be provided by the customer.
- Appropriate mounting tools

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.
3. Remove stick-on label on the electronics compartment cover.

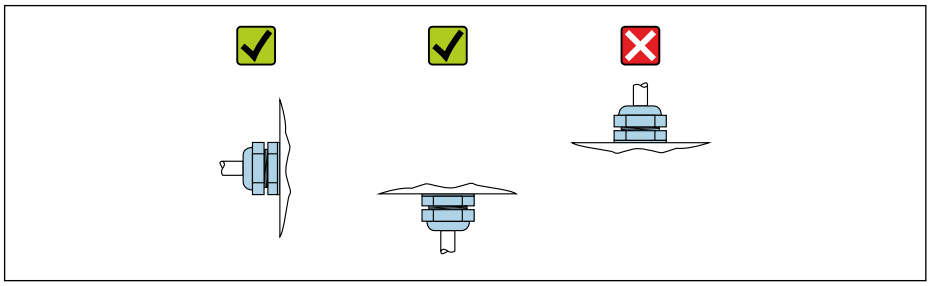
6.2.3 Mounting the sensor

⚠ WARNING

Danger due to improper process sealing!
- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ▶ Ensure that the gaskets are clean and undamaged.
- ▶ Install the gaskets correctly.

1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.

2. To ensure compliance with device specifications, install the measuring device between the pipe flanges in a way that it is centered in the measurement section.
3. If using ground disks, comply with the Installation Instructions provided.
4. Observe required screw tightening torques → 29.
5. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.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Mounting the seals

CAUTION

An electrically conductive layer could form on the inside of the measuring tube!
Risk of measuring signal short circuit.
▶ Do not use electrically conductive sealing compounds such as graphite.

Comply with the following instructions when installing seals:

1. Make sure that the seals do not protrude into the piping cross-section.
2. For DIN flanges: only use seals according to DIN EN 1514-1.
3. For "hard rubber" lining: additional seals are **always** required.
4. For "polyurethane" lining: generally additional seals are **not** required.

Mounting the ground cable/ground disks

Comply with the information on potential equalization and detailed mounting instructions for the use of ground cables/ground disks .

Screw tightening torques

Please note the following:
- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Screw tightening torques for EN 1092-1 (DIN 2501), PN 6/10/16/25/40

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			Hard rubber	Polyurethane
25	PN 40	4 × M12	–	15
32	PN 40	4 × M16	–	24
40	PN 40	4 × M16	–	31
50	PN 40	4 × M16	48	40
65 [1)]	PN 16	8 × M16	32	27
65	PN 40	8 × M16	32	27
80	PN 16	8 × M16	40	34

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			Hard rubber	Polyurethane
80	PN 40	8 × M16	40	34
100	PN 16	8 × M16	43	36
100	PN 40	8 × M20	59	50
125	PN 16	8 × M16	56	48
125	PN 40	8 × M24	83	71
150	PN 16	8 × M20	74	63
150	PN 40	8 × M24	104	88
200	PN 10	8 × M20	106	91
200	PN 16	12 × M20	70	61
200	PN 25	12 × M24	104	92
250	PN 10	12 × M20	82	71
250	PN 16	12 × M24	98	85
250	PN 25	12 × M27	150	134
300	PN 10	12 × M20	94	81
300	PN 16	12 × M24	134	118
300	PN 25	16 × M27	153	138
350	PN 6	12 × M20	111	120
350	PN 10	16 × M20	112	118
350	PN 16	16 × M24	152	165
350	PN 25	16 × M30	227	252
400	PN 6	16 × M20	90	98
400	PN 10	16 × M24	151	167
400	PN 16	16 × M27	193	215
400	PN 25	16 × M33	289	326
450	PN 6	16 × M20	112	126
450	PN 10	20 × M24	153	133
450	PN 16	20 × M27	198	196
450	PN 25	20 × M33	256	253
500	PN 6	20 × M20	119	123
500	PN 10	20 × M24	155	171
500	PN 16	20 × M30	275	300
500	PN 25	20 × M33	317	360
600	PN 6	20 × M24	139	147
600	PN 10	20 × M27	206	219
600 [1)]	PN 16	20 × M33	415	443
600	PN 25	20 × M36	431	516
700	PN 6	24 × M24	148	139
700	PN 10	24 × M27	246	246
700	PN 16	24 × M33	278	318
700	PN 25	24 × M39	449	507
800	PN 6	24 × M27	206	182
800	PN 10	24 × M30	331	316

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			Hard rubber	Polyurethane
800	PN 16	24 × M36	369	385
800	PN 25	24 × M45	664	721
900	PN 6	24 × M27	230	637
900	PN 10	28 × M30	316	307
900	PN 16	28 × M36	353	398
900	PN 25	28 × M45	690	716
1000	PN 6	28 × M27	218	208
1000	PN 10	28 × M33	402	405
1000	PN 16	28 × M39	502	518
1000	PN 25	28 × M52	970	971
1200	PN 6	32 × M30	319	299
1200	PN 10	32 × M36	564	568
1200	PN 16	32 × M45	701	753
1400	PN 6	36 × M33	430	398
1400	PN 10	36 × M39	654	618
1400	PN 16	36 × M45	729	762
1600	PN 6	40 × M33	440	417
1600	PN 10	40 × M45	946	893
1600	PN 16	40 × M52	1007	1100
1800	PN 6	44 × M36	547	521
1800	PN 10	44 × M45	961	895
1800	PN 16	44 × M52	1108	1003
2000	PN 6	48 × M39	629	605
2000	PN 10	48 × M45	1047	1092
2000	PN 16	48 × M56	1324	1261

1) Designed acc. to EN 1092-1 (not to DIN 2501)

Screw tightening torques for ASME B16.5, Class 150/300

Nominal diameter		Pressure rating	Threaded fasteners	Max. screw tightening torque [Nm] ([lbf · ft])	
[mm]	[in]	[psi]	[in]	Hard rubber	Polyurethane
25	1	Class 150	4 × ½	–	7 (5)
25	1	Class 300	4 × 5/8	–	8 (6)
40	1 ½	Class 150	4 × ½	–	10 (7)
40	1 ½	Class 300	4 × ¾	–	15 (11)
50	2	Class 150	4 × 5/8	35 (26)	22 (16)
50	2	Class 300	8 × 5/8	18 (13)	11 (8)
80	3	Class 150	4 × 5/8	60 (44)	43 (32)
80	3	Class 300	8 × ¾	38 (28)	26 (19)
100	4	Class 150	8 × 5/8	42 (31)	31 (23)
100	4	Class 300	8 × ¾	58 (43)	40 (30)

Nominal diameter		Pressure rating	Threaded fasteners	Max. screw tightening torque [Nm] ([lbf · ft])	
[mm]	[in]	[psi]	[in]	Hard rubber	Polyurethane
150	6	Class 150	8 × ¾	79 (58)	59 (44)
150	6	Class 300	12 × ¾	70 (52)	51 (38)
200	8	Class 150	8 × ¾	107 (79)	80 (59)
250	10	Class 150	12 × 7/8	101 (74)	75 (55)
300	12	Class 150	12 × 7/8	133 (98)	103 (76)
350	14	Class 150	12 × 1	135 (100)	158 (117)
400	16	Class 150	16 × 1	128 (94)	150 (111)
450	18	Class 150	16 × 1 1/8	204 (150)	234 (173)
500	20	Class 150	20 × 1 1/8	183 (135)	217 (160)
600	24	Class 150	20 × 1 ¼	268 (198)	307 (226)

Screw tightening torques for AWWA C207, Class D

Nominal diameter		Threaded fasteners	Max. screw tightening torque [Nm] ([lbf · ft])	
[mm]	[in]	[in]	Hard rubber	Polyurethane
700	28	28 × 1 ¼	247 (182)	292 (215)
750	30	28 × 1 ¼	287 (212)	302 (223)
800	32	28 × 1 ½	394 (291)	422 (311)
900	36	32 × 1 ½	419 (309)	430 (317)
1000	40	36 × 1 ½	420 (310)	477 (352)
1050	42	36 × 1 ½	528 (389)	518 (382)
1200	48	44 × 1 ½	552 (407)	531 (392)
1350	54	44 × 1 ¾	730 (538)	–
1500	60	52 × 1 ¾	758 (559)	–
1650	66	52 × 1 ¾	946 (698)	–
1800	72	60 × 1 ¾	975 (719)	–
2000	78	64 × 2	853 (629)	–

Screw tightening torques for AS 2129, Table E

Nominal diameter	Threaded fasteners	Max. screw tightening torque [Nm]	
[mm]	[mm]	Hard rubber	Polyurethane
50	4 × M16	32	–
80	4 × M16	49	–
100	8 × M16	38	–
150	8 × M20	64	–
200	8 × M20	96	–
250	12 × M20	98	–
300	12 × M24	123	–
350	12 × M24	203	–
400	12 × M24	226	–
450	16 × M24	226	–

Nominal diameter [mm]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
		Hard rubber	Polyurethane
500	16 × M24	271	–
600	16 × M30	439	–
700	20 × M30	355	–
750	20 × M30	559	–
800	20 × M30	631	–
900	24 × M30	627	–
1000	24 × M30	634	–
1200	32 × M30	727	–

Screw tightening torques for AS 4087, PN 16

Nominal diameter [mm]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
		Hard rubber	Polyurethane
50	4 × M16	32	–
80	4 × M16	49	–
100	4 × M16	76	–
150	8 × M20	52	–
200	8 × M20	77	–
250	8 × M20	147	–
300	12 × M24	103	–
350	12 × M24	203	–
375	12 × M24	137	–
400	12 × M24	226	–
450	12 × M24	301	–
500	16 × M24	271	–
600	16 × M27	393	–
700	20 × M27	330	–
750	20 × M30	529	–
800	20 × M33	631	–
900	24 × M33	627	–
1000	24 × M33	595	–
1200	32 × M33	703	–

Screw tightening torques for JIS B2220, 10/20K

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			Hard rubber	Polyurethane
25	10K	4 × M16	–	19
25	20K	4 × M16	–	19
32	10K	4 × M16	–	22
32	20K	4 × M16	–	22
40	10K	4 × M16	–	24
40	20K	4 × M16	–	24

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			Hard rubber	Polyurethane
50	10K	4 × M16	40	33
50	20K	8 × M16	20	17
65	10K	4 × M16	55	45
65	20K	8 × M16	28	23
80	10K	8 × M16	29	23
80	20K	8 × M20	42	35
100	10K	8 × M16	35	29
100	20K	8 × M20	56	48
125	10K	8 × M20	60	51
125	20K	8 × M22	91	79
150	10K	8 × M20	75	63
150	20K	12 × M22	81	72
200	10K	12 × M20	61	52
200	20K	12 × M22	91	80
250	10K	12 × M22	100	87
250	20K	12 × M24	159	144
300	10K	16 × M22	74	63
300	20K	16 × M24	138	124

6.2.4 Mounting the transmitter housing

⚠ CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature .
- ▶ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

⚠ CAUTION

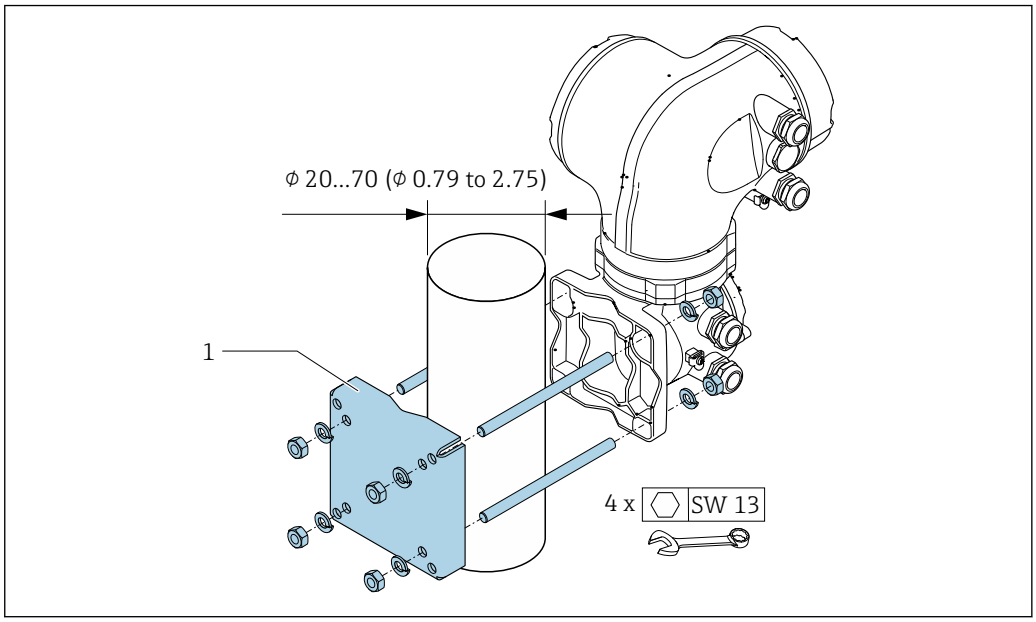
Excessive force can damage the housing!

- ▶ Avoid excessive mechanical stress.

The transmitter can be mounted in the following ways:

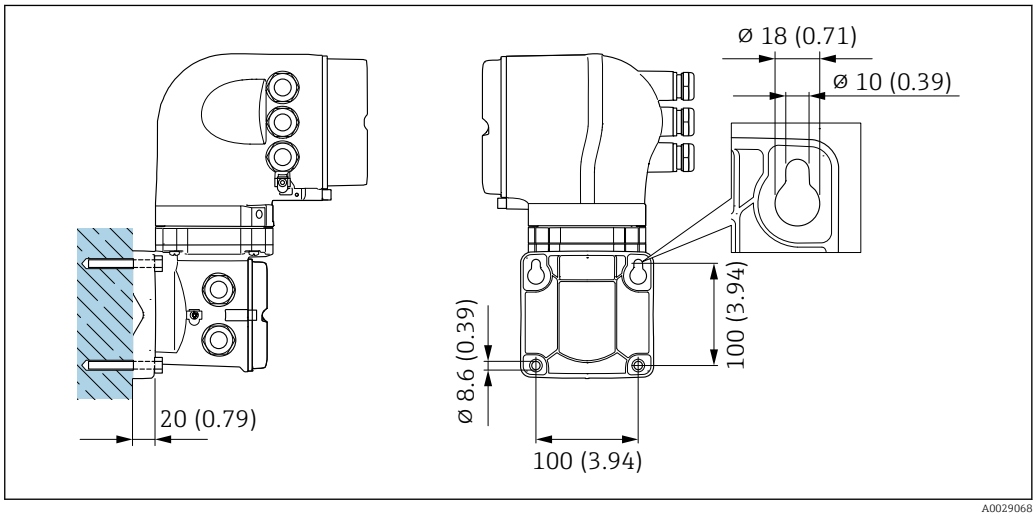
- Post mounting
- Wall mounting

Post mounting



8 *Engineering unit mm (in)*

Wall mounting

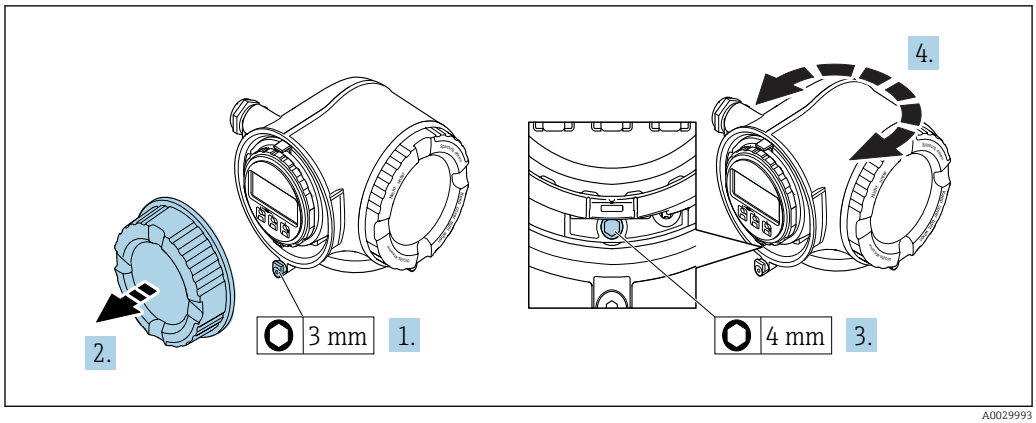


9 *Engineering unit mm (in)*

1. Drill the holes.
2. Insert wall plugs into the drilled holes.
3. Screw in the securing screws slightly at first.
4. Fit the transmitter housing over the securing screws and mount in place.
5. Tighten the securing screws.

6.2.5 Turning the transmitter housing

To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



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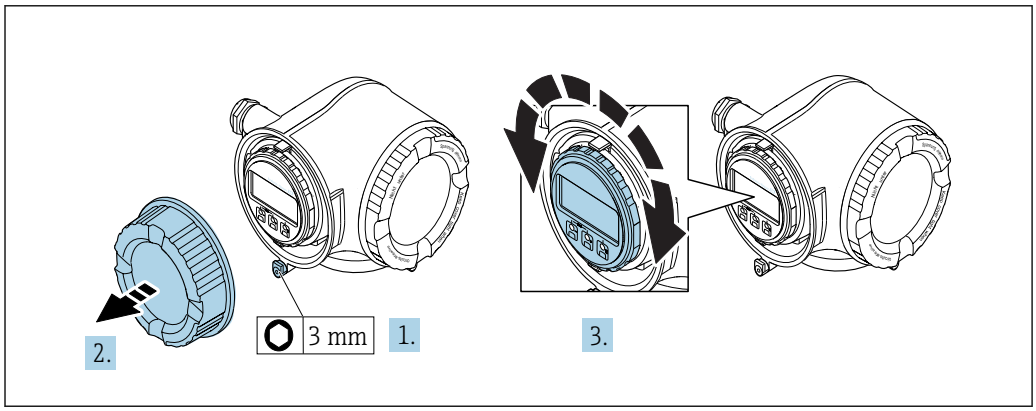
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Release the fixing screw.
4. Turn the housing to the desired position.
5. Firmly tighten the securing screw.
6. Screw on the connection compartment cover
7. Fit the securing clamp of the connection compartment cover.

6.2.6 Turning the display module

The display module can be turned to optimize display readability and operability.



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1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Turn the display module to the desired position: max. 8 × 45° in every direction.
4. Screw on the connection compartment cover.
5. Fit the securing clamp of the connection compartment cover.

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected ? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping ?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Have the fixing screws been tightened with the correct tightening torque?	❑

7 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

- ▶ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
- ▶ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 10 A) should be integrated into the system installation.

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp: Allen key 3 mm
- Wire stripper
- When using stranded cables: crimper for wire end ferrule
- For removing cables from terminal: Flat blade screwdriver ≤ 3 mm (0.12 in)

7.1.2 Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

Electrical safety

In accordance with applicable federal/national regulations.

Protective ground cable

Cable: 2.1 mm^2 (14 AWG)

The grounding impedance must be less than 1 Ω.

Permitted temperature range

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

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe 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.

Double pulse output

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.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
  Conductor cross-section0.2 to 2.5 mm^2 (24 to 12 AWG)

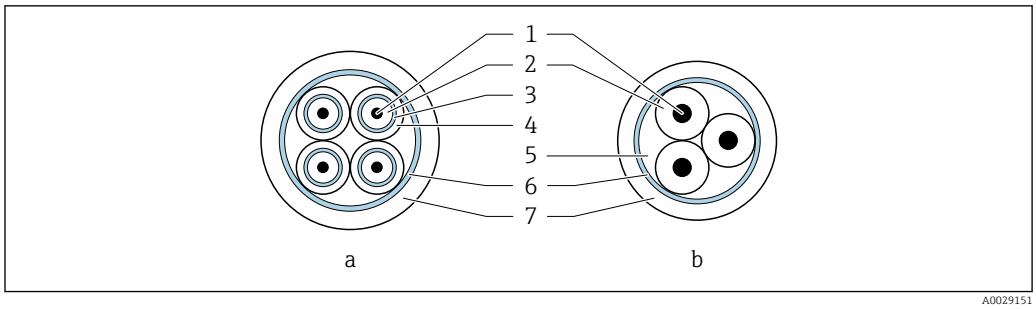
Connecting cable for sensor - transmitter

Signal cable

Standard cable	3 × 0.38 mm^2 (20 AWG) with common, braided copper shield (Ø ~ 9.5 mm (0.37 in)) and individual shielded cores
Cable for empty pipe detection (EPD)	4 × 0.38 mm^2 (20 AWG) with common, braided copper shield (Ø ~ 9.5 mm (0.37 in)) and individual shielded cores
Conductor resistance	≤50 Ω/km (0.015 Ω/ft)
Capacitance: core/shield	≤420 pF/m (128 pF/ft)
Cable length (max.)	Depends on the medium conductivity, max. 200 m (656 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (32 ft), 20 m (65 ft) or variable length up to max. 200 m (656 ft)
Operating temperature	–20 to +80 °C (–68 to +176 °F)

Coil current cable

Standard cable	3 × 0.75 mm^2 (18 AWG) with common, braided copper shield (Ø ~ 9 mm (0.35 in)) and individual shielded cores
Conductor resistance	≤37 Ω/km (0.011 Ω/ft)
Capacitance: core/core, shield grounded	≤120 pF/m (37 pF/ft)
Cable length (max.)	Depends on the medium conductivity, max. 200 m (656 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (32 ft), 20 m (65 ft) or variable length up to max. 200 m (656 ft)
Operating temperature	–20 to +80 °C (–68 to +176 °F)
Test voltage for cable insulation	≤ AC 1433 V rms 50/60 Hz or ≥ DC 2026 V



10 *Cable cross-section*

a *Electrode cable*
b *Coil current cable*
1 *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

Reinforced connecting cables

Reinforced connecting cables with an additional, reinforcing metal braid should be used for:
- When laying the cable directly in the ground
- Where there is a risk of damage from rodents
- If using the device below IP68 degree of protection

Operation in zones of severe electrical interference

The measuring system meets the general safety requirements → 191 and EMC specifications → 178.

Grounding is by means of the ground terminal provided for the purpose inside the connection housing. The stripped and twisted lengths of cable shield to the ground terminal must be as short as possible.

7.1.3 Terminal assignment

Transmitter: supply voltage, input/outputs

The terminal assignment of the inputs and outputs depends on the individual order version of the device. The device-specific terminal assignment is documented on an adhesive label in the terminal cover.

Supply voltage		Input/output 1		Input/output 2		Input/output 3		Input/output 4	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (+)	23 (–)	20 (+)	21 (–)
		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 → 43

7.1.4 Preparing the measuring device

Carry out the steps in the following order:

1. Mount the sensor and transmitter.
2. Connection housing, sensor: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect signal cable and cable for supply voltage.

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

▶ Use suitable cable glands corresponding to the degree of protection.

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 38.

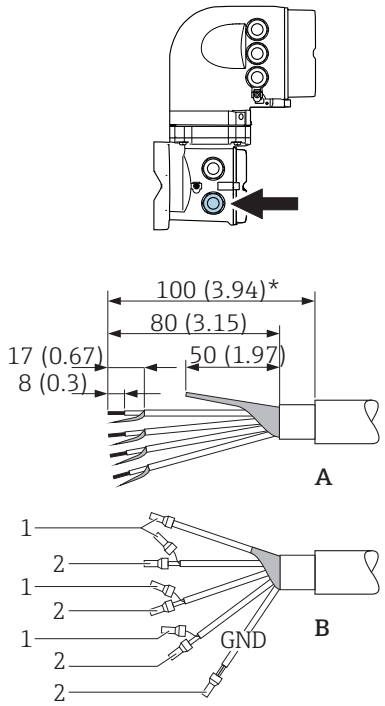
7.1.5 Preparing the connecting cable

When terminating the connecting cable, pay attention to the following points:

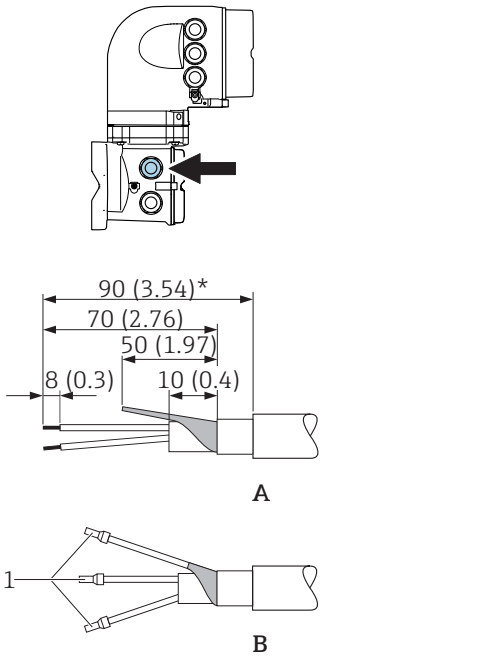
1. In the case of the electrode cable:
   Make sure that the ferrules do not touch the core shields on the sensor side.
   Minimum distance = 1 mm (exception: green “GND” cable)
2. In the case of the coil current cable:
   Insulate one core of the three-core cable at the level of the core reinforcement. You only require two cores for the connection.
3. For cables with fine-wire cores (stranded cables):
   Fit the cores with ferrules.

Transmitter

Electrode cable

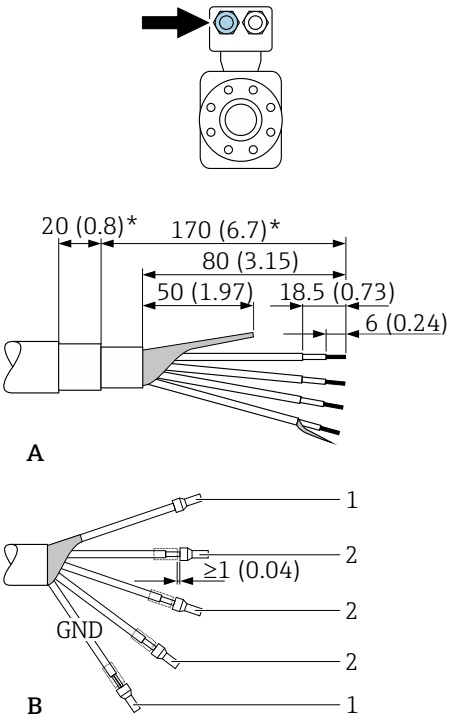


Coil current cable

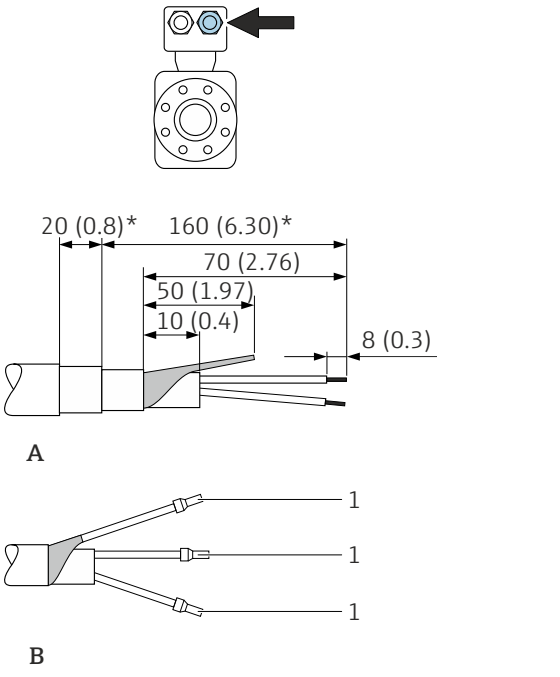


Sensor

Electrode cable



Coil current cable



Engineering unit mm (in)
A = Terminate the cable
B = Fit ferrules on cables with fine-wire cores (stranded cables)
1 = Red ferrules, ϕ 1.0 mm (0.04 in)
2 = White ferrules, ϕ 0.5 mm (0.02 in)
* = Stripping only for reinforced cables

7.2 Connecting the measuring device

NOTICE

Limitation of electrical safety due to incorrect connection!

- Have electrical connection work carried out by correspondingly trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable ⏚ before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

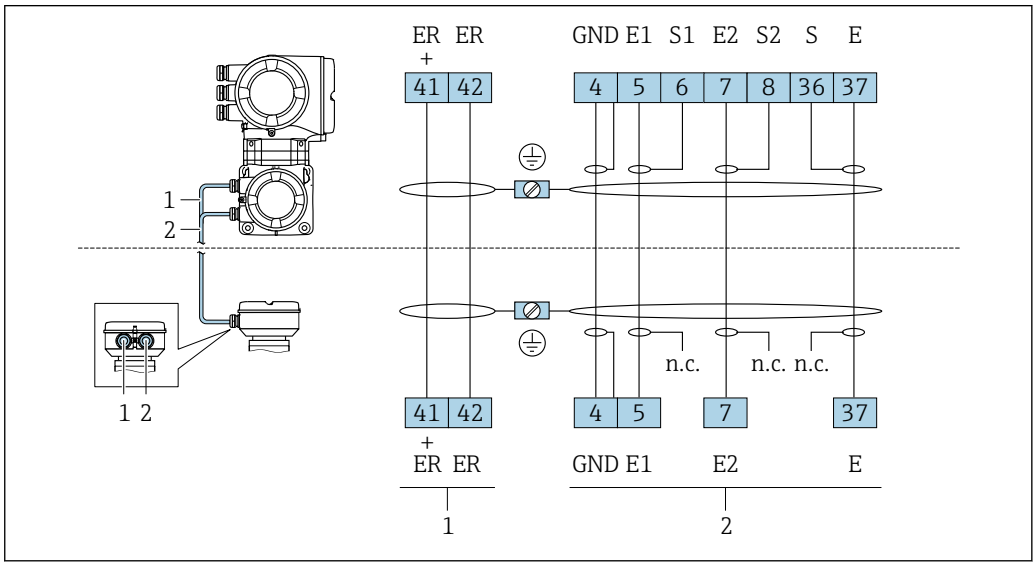
7.2.1 Connecting the connecting cable

⚠ WARNING

Risk of damaging the electronic components!

- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.
- Ground the connection housing of the sensor via the external screw terminal.

Terminal assignment



1 Coil current cable
2 Signal cable

Connecting the connecting cable to the sensor connection housing

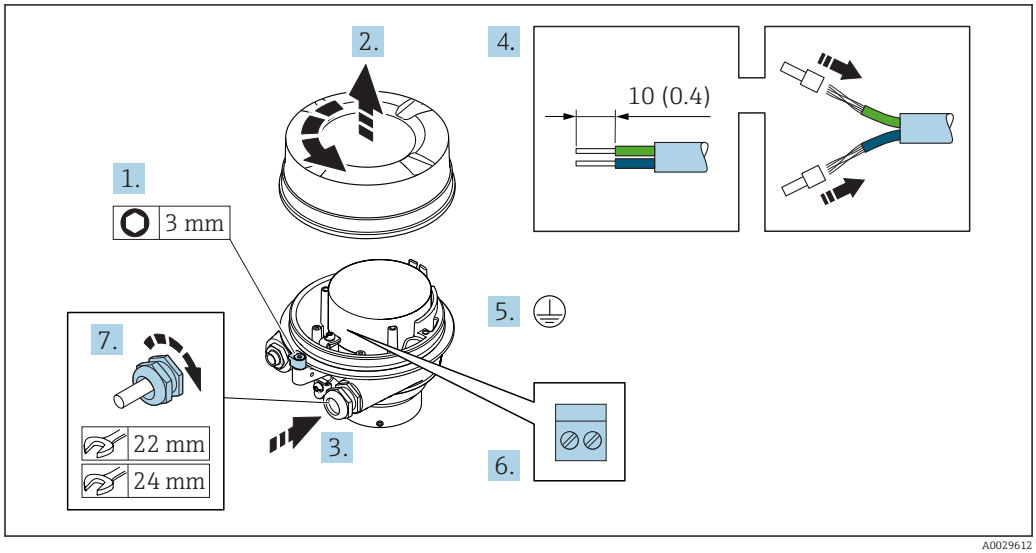
Connection via terminals with order code for "Housing":
– Option **A** "Aluminum coated"→ 🖹 44
– Option **D** "Polycarbonate"→ 🖹 44

Connecting the connecting cable to the transmitter

The cable is connected to the transmitter via terminals → 🖹 45.

Connecting the sensor connection housing via terminals

For the device version with the order code for "Housing":
- Option **A** "Aluminum coated"
- Option **D** "Polycarbonate"



A0029612

1. Loosen the securing clamp of the housing cover.
2. Unscrew the housing cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
5. Connect the protective ground.
6. Connect the cable in accordance with the terminal assignment → 43.
7. Firmly tighten the cable glands.
   ↳ This concludes the process for connecting the connecting cables.

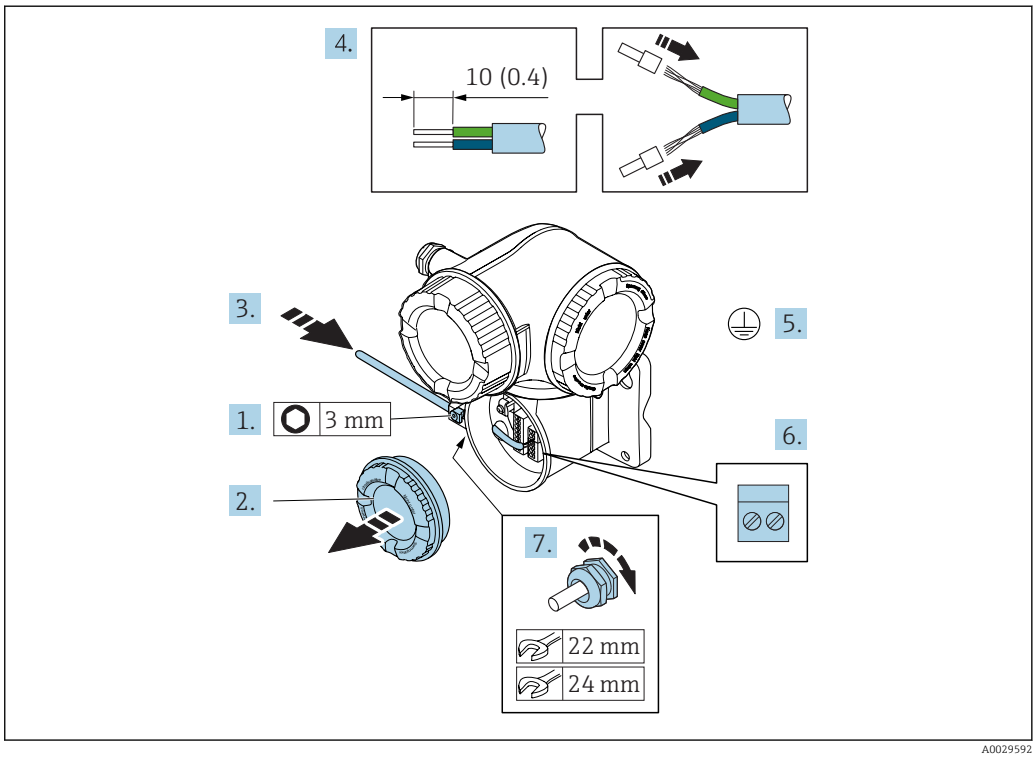
WARNING

Housing degree of protection voided due to insufficient sealing of the housing.

▶ Screw in the thread on the cover without using any lubricant. The thread on the cover is coated with a dry lubricant.

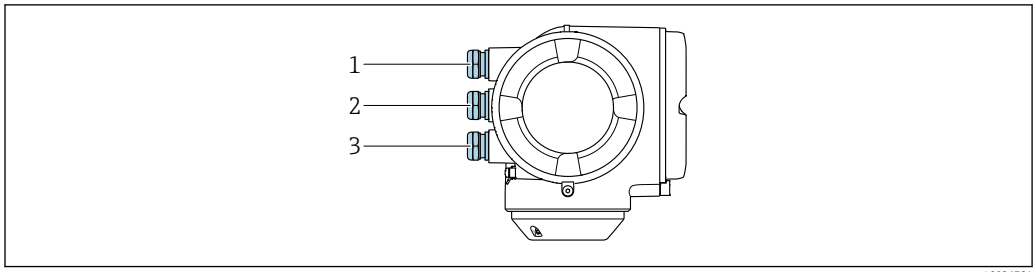
8. Screw on the housing cover.
9. Tighten the securing clamp of the housing cover.

Connecting the connecting cable to the transmitter



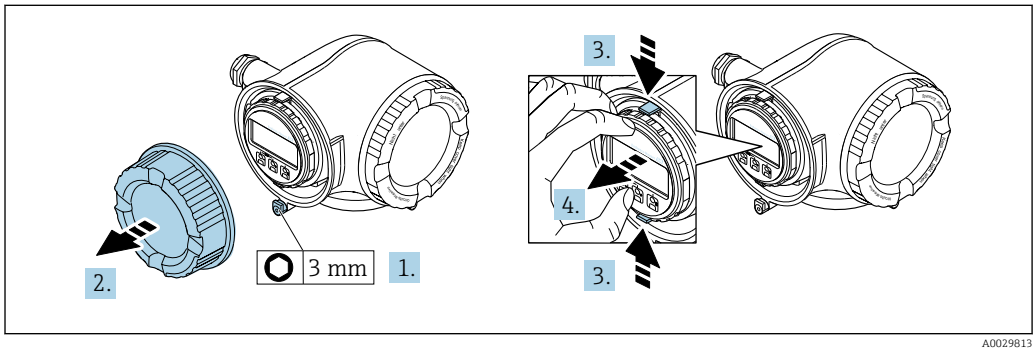
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the protective ground.
6. Connect the cable in accordance with the terminal assignment → 43.
7. Firmly tighten the cable glands.
   ↳ This concludes the process for connecting the connecting cables.
8. Screw on the connection compartment cover.
9. Tighten the securing clamp of the connection compartment cover.
10. After connecting the connecting cables:
    Connect the signal cable and the supply voltage cable → 46.

7.2.2 Connecting the signal cable and the supply voltage cable



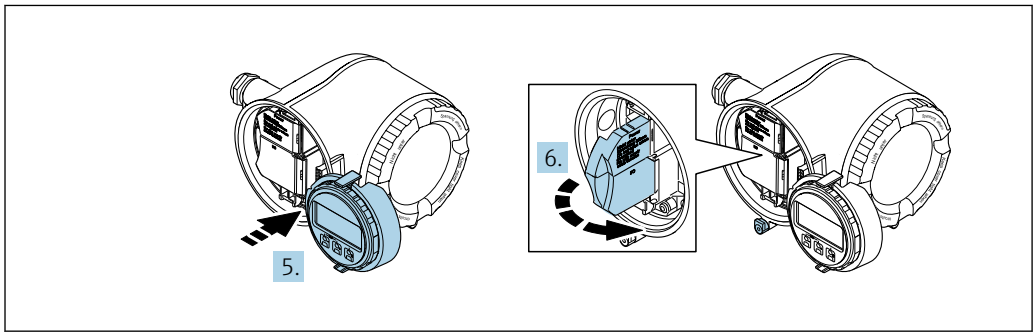
A0026781

1 Cable entry for supply voltage
2 Cable entry for signal transmission, input/output 1 and 2
3 Cable entry for input/output signal transmission; Optional: connection of external WLAN antenna or service plug



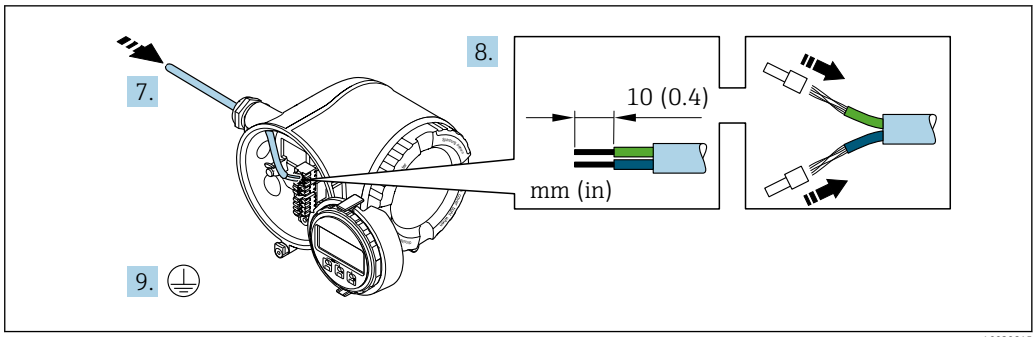
A0029813

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze the tabs of the display module holder together.
4. Remove the display module holder.



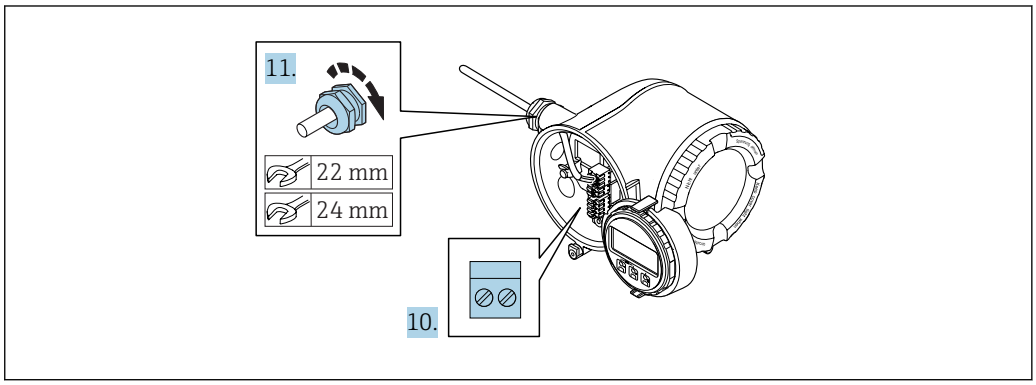
A0029814

5. Attach the holder to the edge of the electronics compartment.
6. Open the terminal cover.



A0029815

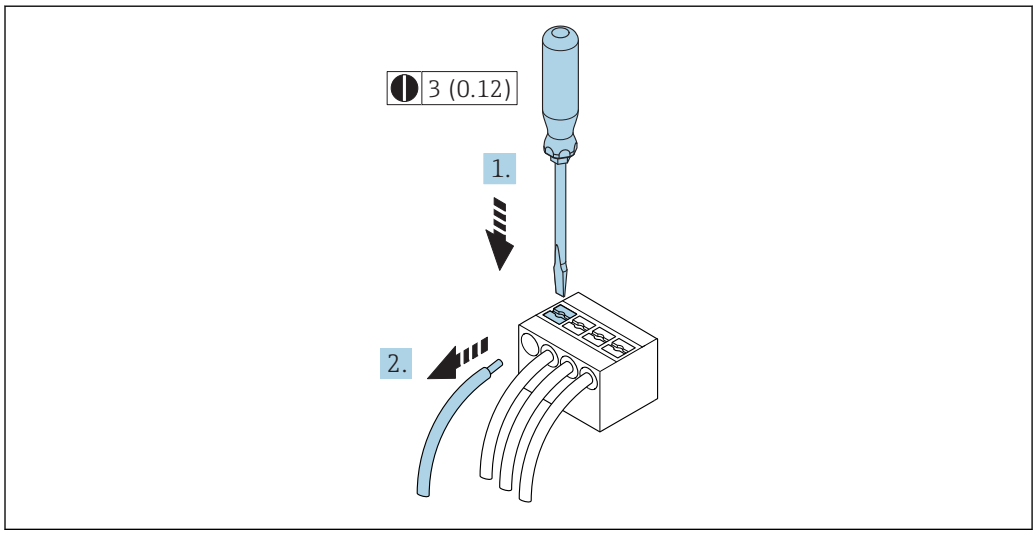
7. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
8. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
9. Connect the protective ground.



A0029816

10. Connect the cable in accordance with the terminal assignment .
    ↳ **Signal cable terminal assignment:** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
    Supply voltage terminal assignment: Adhesive label in the terminal cover or → 40.
11. Firmly tighten the cable glands.
    ↳ This concludes the cable connection process.
12. Close the terminal cover.
13. Fit the display module holder in the electronics compartment.
14. Screw on the connection compartment cover.
15. Secure the securing clamp of the connection compartment cover.

Removing a cable



11 *Engineering unit mm (in)*

1. To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes
2. while simultaneously pulling the cable end out of the terminal.

7.3 Ensure potential equalization

7.3.1 Requirements

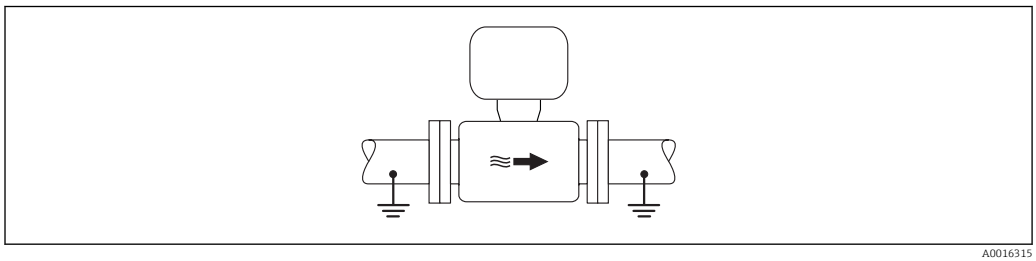
CAUTION

Electrode damage can result in the complete failure of the device!

- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding

7.3.2 Connection example, standard scenario

Metal, grounded pipe



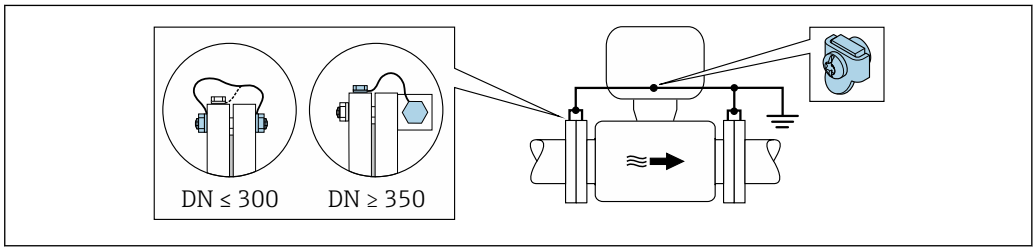
12 *Potential equalization via measuring tube*

7.3.3 Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



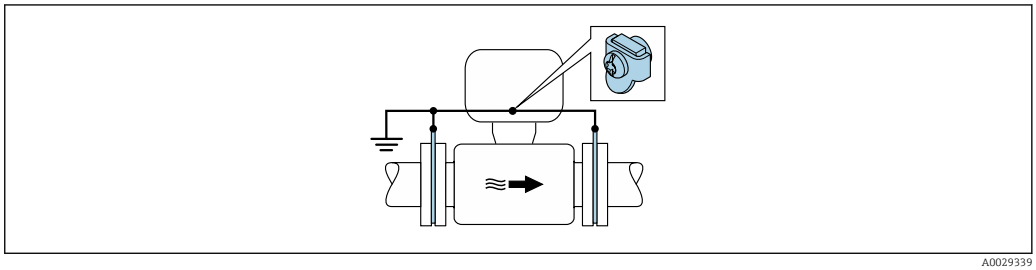
13 *Potential equalization via ground terminal and pipe flanges*

1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.
2. If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
3. If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe screw tightening torques: see the Sensor Brief Operating Instructions.
4. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose.

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



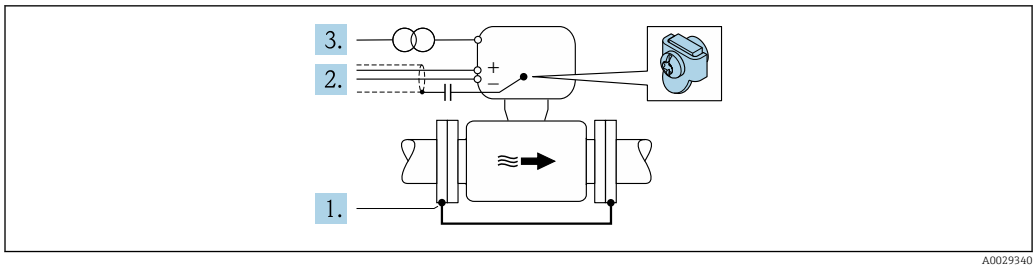
14 *Potential equalization via ground terminal and ground disks*

1. Connect the ground disks to the ground terminal via the ground cable.
2. Connect the ground disks to ground potential.

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:
- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



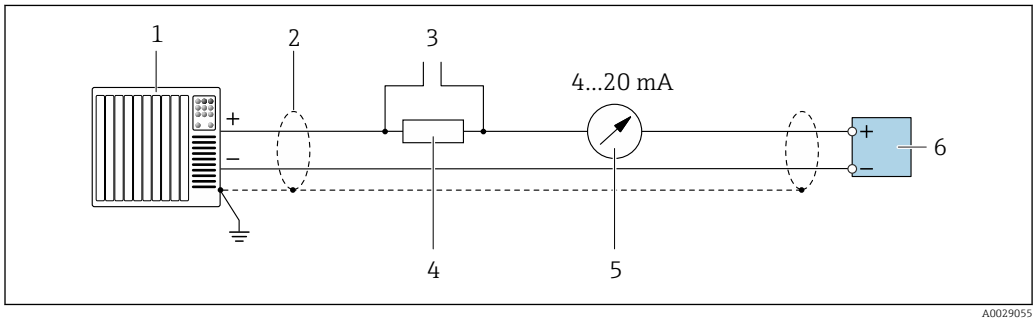
Prerequisite: The sensor is installed in the pipe in a way that provides electrical insulation.

1. Connect the two flanges of the pipe to one another via a ground cable.
2. Guide the shield of the signal lines through a capacitor.
3. Connect the measuring device to the power supply such that it is floating in relation to the protective ground (isolation transformer).

7.4 Special connection instructions

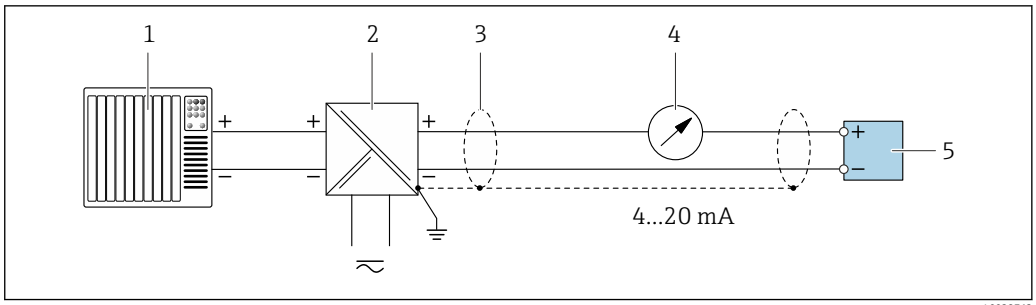
7.4.1 Connection examples

Current output 4 to 20 mA HART



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

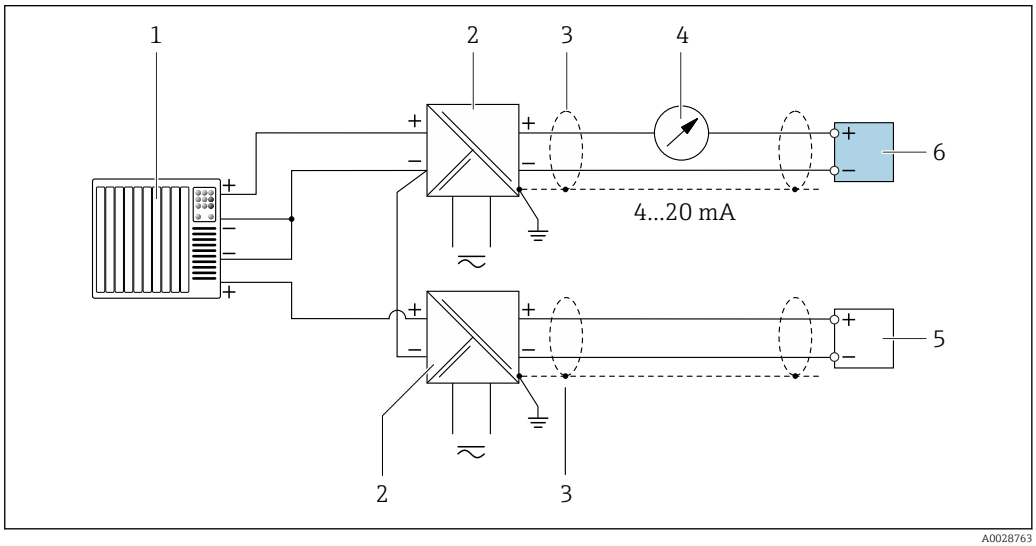
1 *Automation system with current input (e.g. PLC)*
2 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Connection for HART operating devices → 76*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 169*
5 *Analog display unit: observe maximum load → 169*
6 *Transmitter*



16 *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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load → 169*
5 *Transmitter*

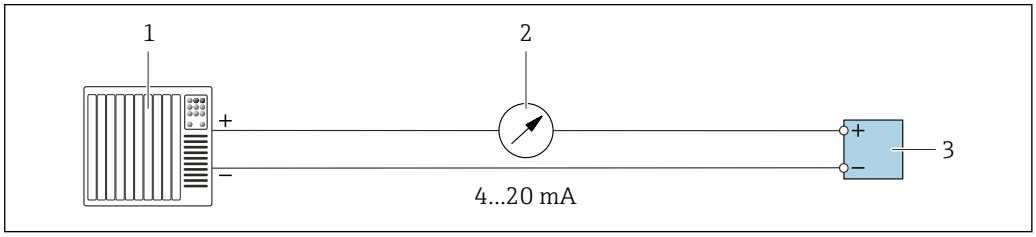
HART input



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

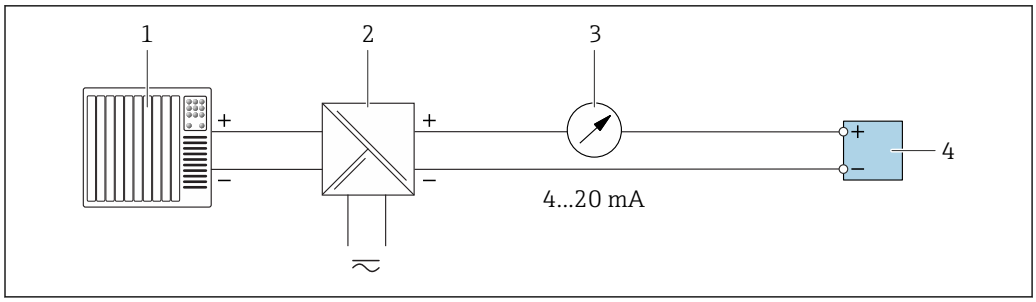
1 *Automation system with HART output (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)*
3 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load*
5 *Pressure transmitter (e.g.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

Current output 4-20 mA



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

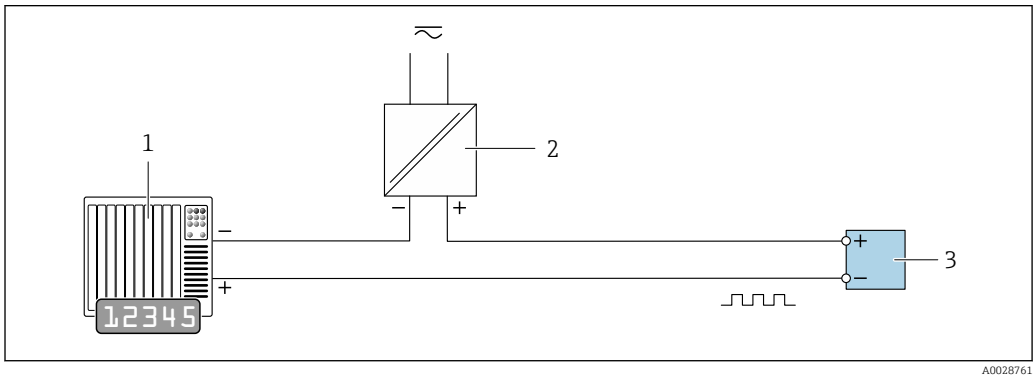
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load*
3 *Transmitter*



19 *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*
4 *Transmitter*

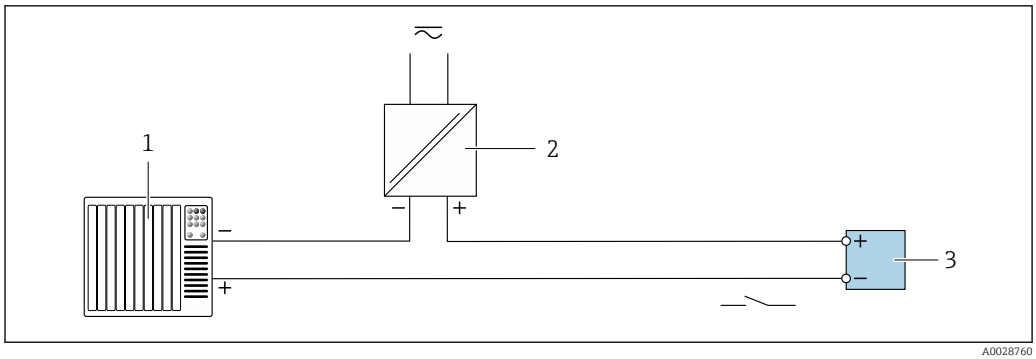
Pulse/frequency output



20 *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 → 169*

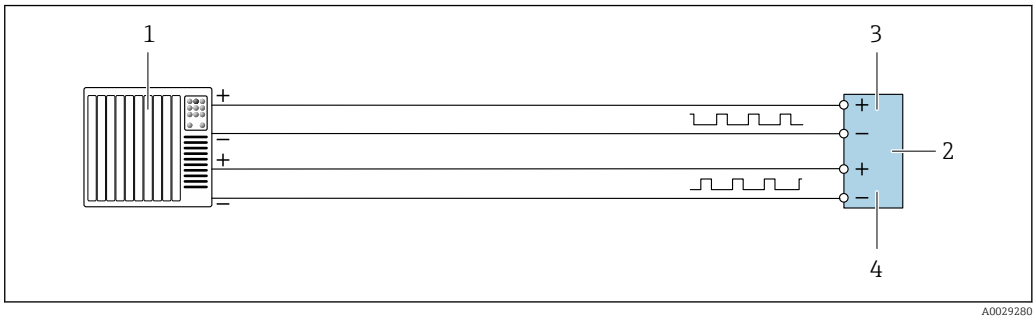
Switch output



21 *Connection example for switch output (passive)*

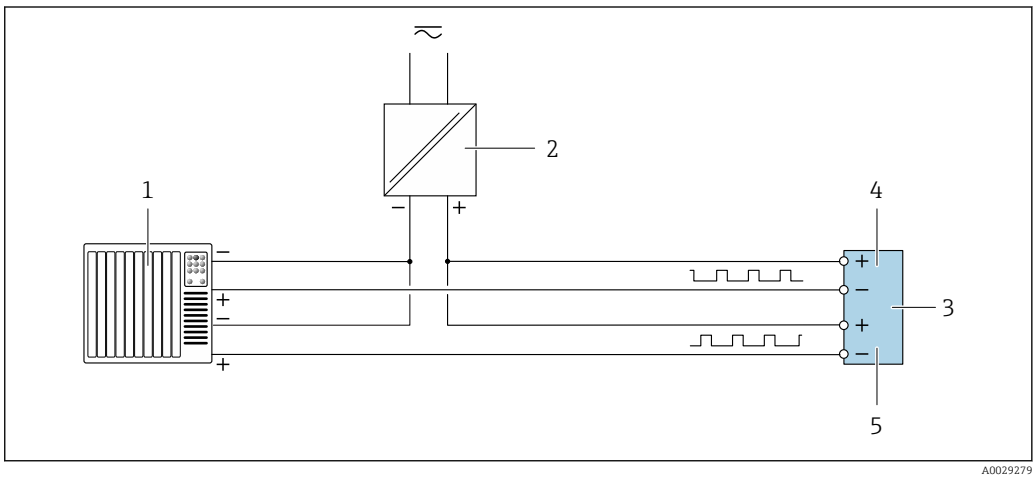
1 *Automation system with switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 169*

Double pulse output



22 *Connection example for double pulse output (active)*

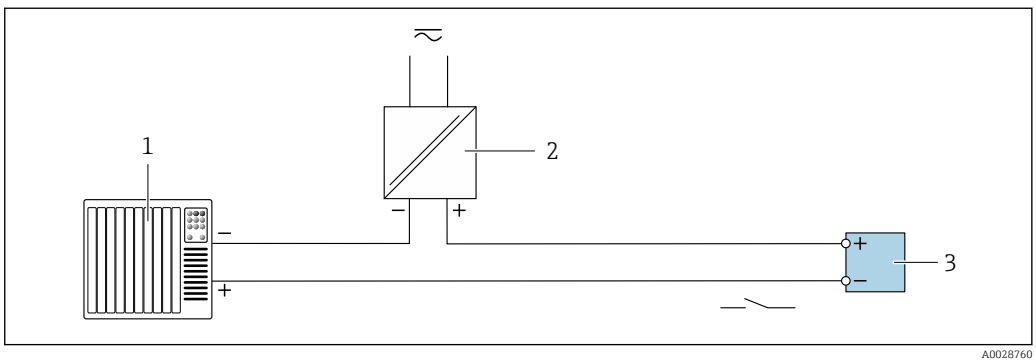
1 *Automation system with double pulse input (e.g. PLC)*
2 *Transmitter: Observe input values → 171*
3 *Double pulse output*
4 *Double pulse output (slave), phase-shifted*



23 *Connection example for double pulse output (passive)*

1 *Automation system with double pulse input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 171*
4 *Double pulse output*
5 *Double pulse output (slave), phase-shifted*

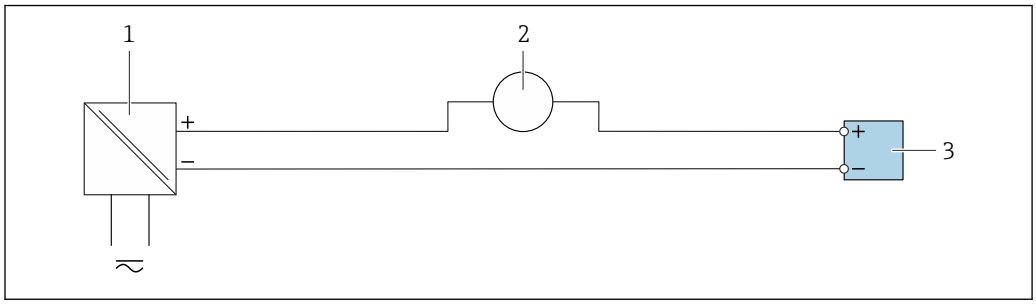
Relay output



24 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 171*

Current input



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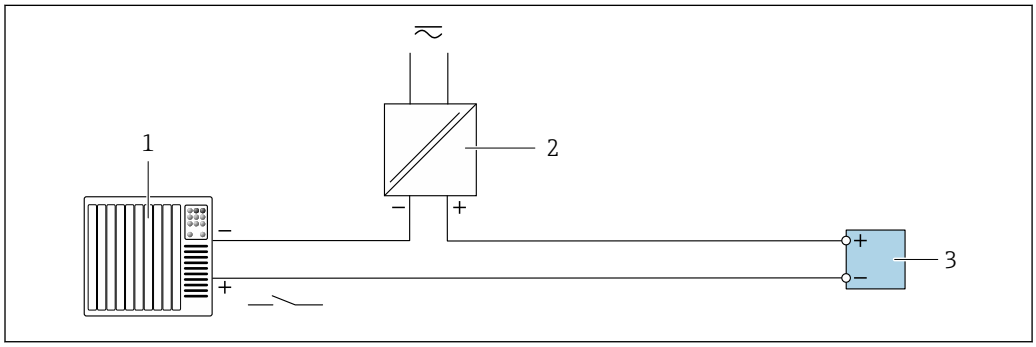
25 *Connection example for 4 to 20 mA current input*

1 *Power supply*
2 *External measuring device (for reading in pressure or temperature, for instance)*
3 *Transmitter: Observe input values*

Status input



A0028764

26 *Connection example for status input*

1 *Automation system with status output (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values*

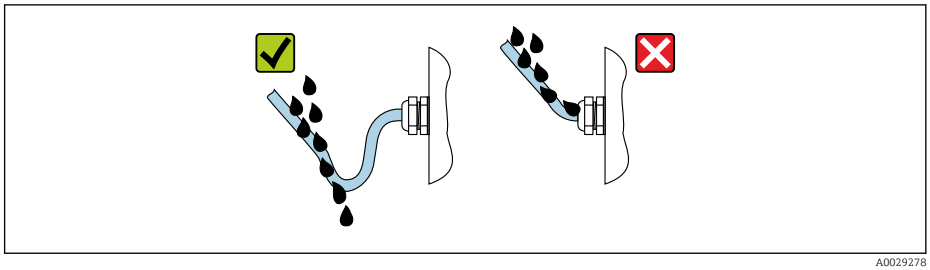
7.5 Ensuring the degree of protection

The measuring device fulfills all the requirements for the IP66/67 degree of protection, Type 4X enclosure.

To guarantee IP66/67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.

5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").
   ↳



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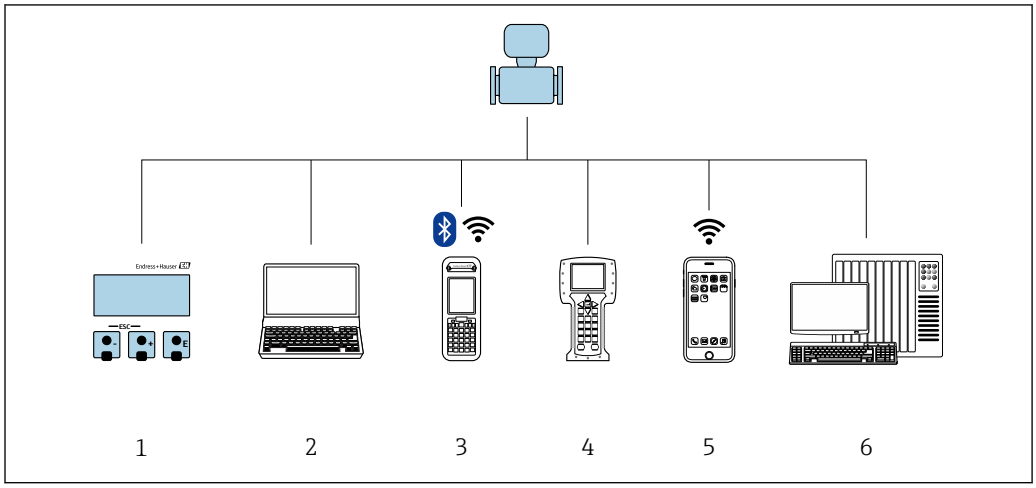
6. Insert dummy plugs into unused cable entries.

7.6 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used meet the requirements?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 54 ?	❑
Is the potential equalization established correctly ?	❑

8 Operation options

8.1 Overview of operation options



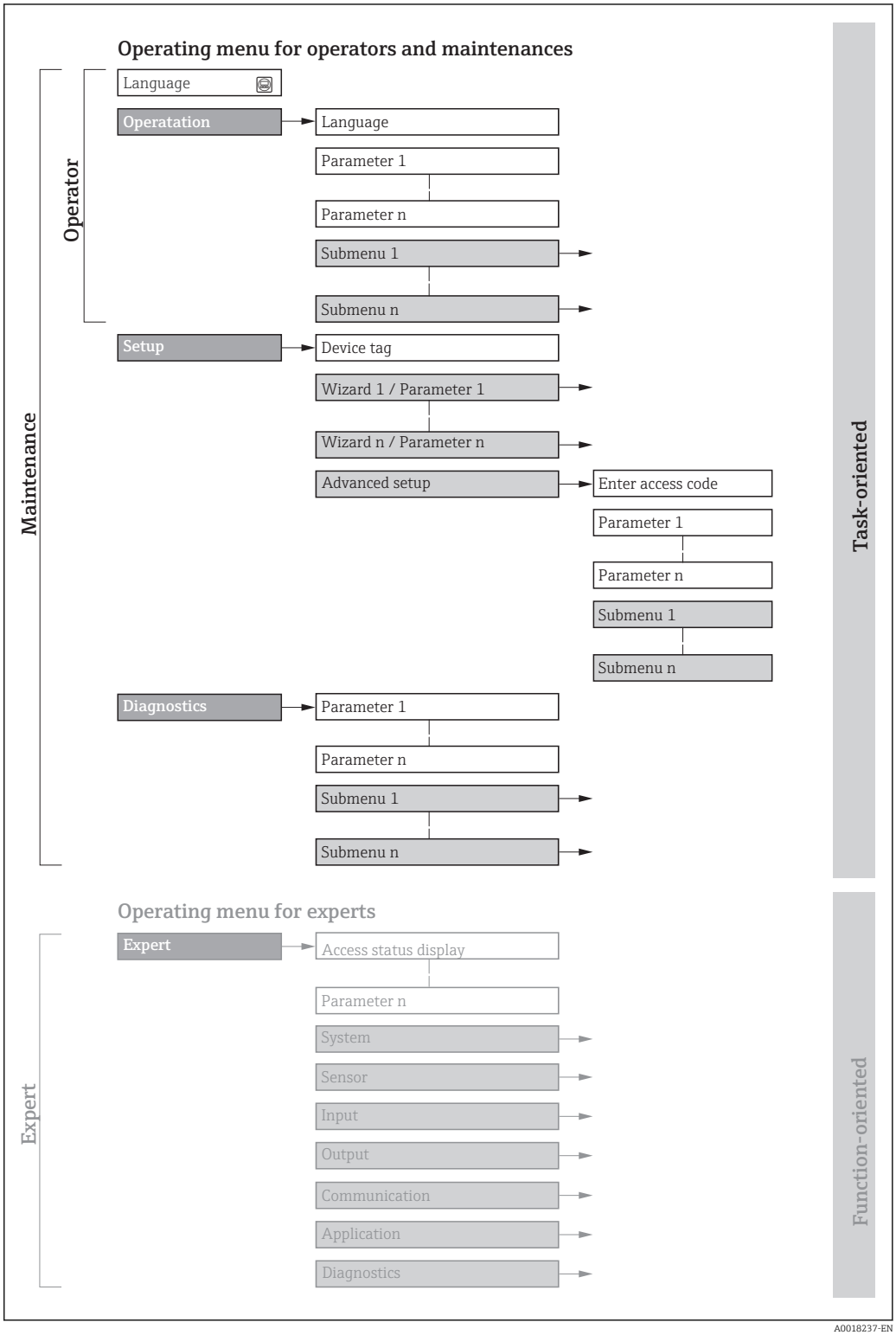
A0029295

1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Field Xpert SFX350 or SFX370*
4 *Field Communicator 475*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

For an overview of the operating menu for experts: "Description of Device Parameters" document supplied with the device→ 193



27 *Schematic structure of the operating menu*

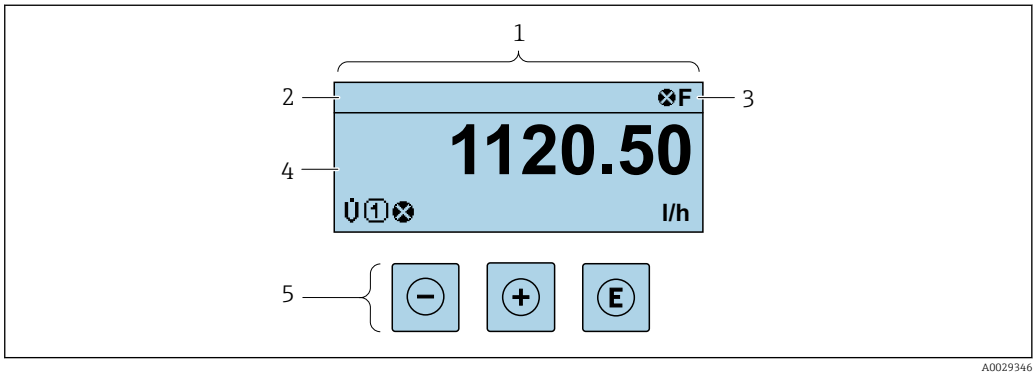
8.2.2 Operating philosophy

The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	**Role "Operator", "Maintenance"** Tasks during operation: ▪ Configuring the operational display ▪ Reading measured values	▪ Defining the operating language ▪ Defining the Web server operating language ▪ Resetting and controlling totalizers
Operation			▪ Configuring the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: ▪ Configuration of the measurement ▪ Configuration of the inputs and outputs ▪ Configuration of the communication interface	Wizards for fast commissioning: ▪ Set the system units ▪ Display I/O/configuration ▪ Configure the inputs ▪ Configure the outputs ▪ Configuring the operational display ▪ Define the output conditioning ▪ Set the low flow cut off ▪ Configure empty pipe detection Advanced setup ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configuration of electrode cleaning (optional) ▪ Configure the WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		**"Maintenance" role** Fault elimination: ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: ▪ Diagnostic list Contains up to 5 currently pending diagnostic messages. ▪ Event logbook Contains event messages that have occurred. ▪ Device information Contains information for identifying the device. ▪ Measured values Contains all current measured values. ▪ **Data logging** submenu with "Extended HistoROM" order option Storage and visualization of measured values ▪ Heartbeat The functionality of the device is checked on demand and the verification results are documented. ▪ Simulation Is used to simulate measured values or output values.
Expert	function-oriented	Tasks that require detailed knowledge of the function of the device: ▪ Commissioning measurements under difficult conditions ▪ Optimal adaptation of the measurement to difficult conditions ▪ Detailed configuration of the communication interface ▪ Error diagnostics in difficult cases	Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: ▪ System Contains all higher-order device parameters which do not concern the measurement or the communication interface. ▪ Sensor Configuration of the measurement. ▪ Input Configuring the status input. ▪ Output Configuring of the analog current outputs as well as the pulse/frequency and switch output. ▪ Communication Configuration of the digital communication interface and the Web server. ▪ Application Configure the functions that go beyond the actual measurement (e.g. totalizer). ▪ Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to the operating menu via the local display

8.3.1 Operational display



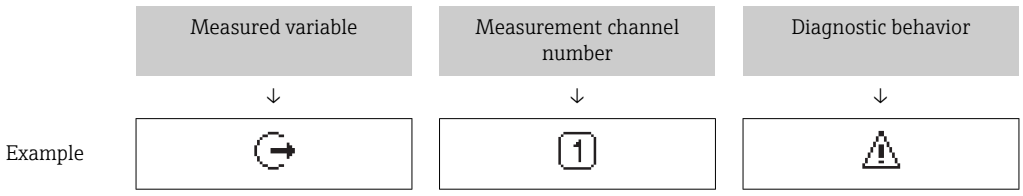
1 *Operational display*
2 *Device tag→ 🖹 89*
3 *Status area*
4 *Display area for measured values (4-line)*
5 *Operating elements→ 🖹 64*

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 🖹 142
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 🖹 143
  - ⊗: Alarm
  - ⚠: Warning
- 🔒: Locking (the device is locked via the hardware)
- ⇆: Communication (communication via remote operation is active)

Display area

In the display area, each measured value is prefaced by certain symbol types for further description:



Appears only if a diagnostics event is present for this measured variable.

Measured values

Symbol	Meaning
$\dot{V}$	Volume flow
G	Conductivity

	Mass flow
	Totalizer The measurement channel number indicates which of the three totalizers is displayed.
	Output The measurement channel number indicates which of the outputs is displayed.
	Status input

Measurement channel numbers

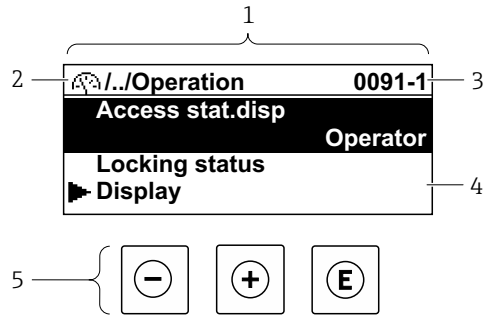
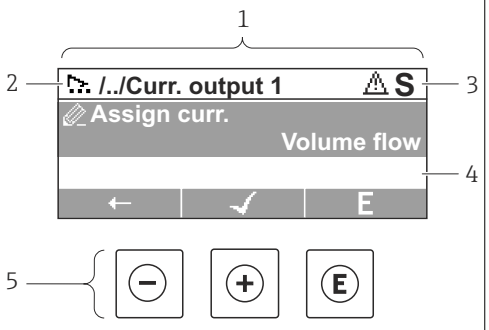
Symbol	Meaning
1 ... 4	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).	

Diagnostic behavior

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable. For information on the symbols → 143

The number and display format of the measured values can be configured via the **"Format display" parameter** → 102. Operation → Display → Format display

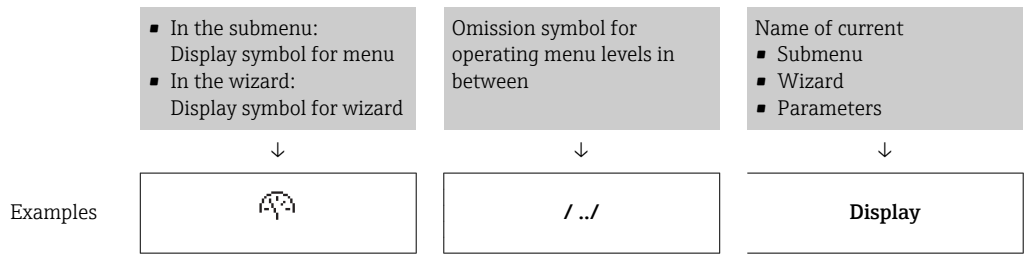
8.3.2 Navigation view

In the submenu	In the wizard
	

1 Navigation view
2 Navigation path to current position
3 Status area
4 Display area for navigation
5 Operating elements → 64

Navigation path

The navigation path - displayed at the top left in the navigation view - consists of the following elements:



	/ ../	Display

For more information about the icons in the menu, refer to the "Display area" section → 61

Status area

The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code for the parameter you are navigating to (e.g. 0022-1)
  - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard
  If a diagnostic event is present, the diagnostic behavior and status signal

- For information on the diagnostic behavior and status signal → 142
- For information on the function and entry of the direct access code → 66

Display area

Menus

Symbol	Meaning
	Operation Appears: ▪ In the menu next to the "Operation" selection ▪ At the left in the navigation path in the **Operation** menu
	Setup Appears: ▪ In the menu next to the "Setup" selection ▪ At the left in the navigation path in the **Setup** menu
	Diagnostics Appears: ▪ In the menu next to the "Diagnostics" selection ▪ At the left in the navigation path in the **Diagnostics** menu
	Expert Appears: ▪ In the menu next to the "Expert" selection ▪ At the left in the navigation path in the **Expert** menu

Submenus, wizards, parameters

Symbol	Meaning
	Submenu
	Wizard
	Parameters within a wizard No display symbol exists for parameters in submenus.

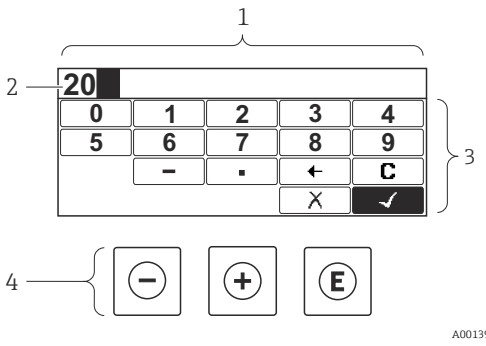
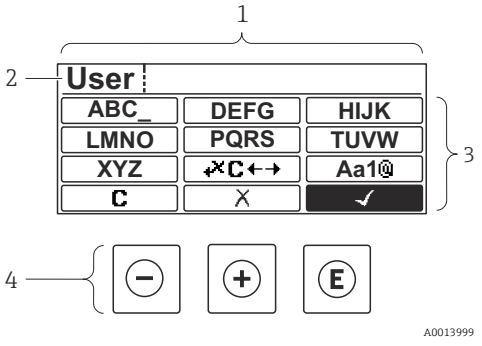
Locking

Symbol	Meaning
	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. ▪ By a user-specific access code ▪ By the hardware write protection switch

Wizard operation

Symbol	Meaning
←	Switches to the previous parameter.
✓	Confirms the parameter value and switches to the next parameter.
E	Opens the editing view of the parameter.

8.3.3 Editing view

Numeric editor	Text editor
	

1 Editing view
2 Display area of the entered values
3 Input mask
4 Operating elements → 64

Input mask

The following input symbols are available in the input mask of the numeric and text editor:

Numeric editor

Symbol	Meaning
0 … 9	Selection of numbers from 0 to 9.
.	Inserts decimal separator at the input position.
–	Inserts minus sign at the input position.
✓	Confirms selection.
←	Moves the input position one position to the left.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Text editor

Symbol	Meaning
Aa1@	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters
ABC_ ... XYZ	Selection of letters from A to Z.
abc _ ... xyz	Selection of letters from a to z.
"'^ _ ... ~& _	Selection of special characters.
✓	Confirms selection.
✗C↔	Switches to the selection of the correction tools.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Correction symbols under ✗C↔

Symbol	Meaning
C	Clears all entered characters.
→	Moves the input position one position to the right.
←	Moves the input position one position to the left.
✗	Deletes one character immediately to the left of the input position.

8.3.4 Operating elements

Key	Meaning
⊖	**Minus key** *In a menu, submenu* Moves the selection bar upwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the previous parameter. *With a text and numeric editor* In the input mask, moves the selection bar to the left (backwards).
⊕	**Plus key** *In a menu, submenu* Moves the selection bar downwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the next parameter. *With a text and numeric editor* Moves the selection bar to the right (forwards) in an input screen.
Ⓔ	**Enter key** *For operational display* ▪ Pressing the key briefly opens the operating menu. ▪ Pressing the key for 2 s opens the context menu. *In a menu, submenu* ▪ Pressing the key briefly: – Opens the selected menu, submenu or parameter. – Starts the wizard. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. *With a Wizard* Opens the editing view of the parameter. *With a text and numeric editor* ▪ Pressing the key briefly: – Opens the selected group. – Carries out the selected action. ▪ Pressing the key for 2 s confirms the edited parameter value.
⊖ + ⊕	**Escape key combination (press keys simultaneously)** *In a menu, submenu* ▪ Pressing the key briefly: – Exits the current menu level and takes you to the next higher level. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s returns you to the operational display ("home position"). *With a Wizard* Exits the wizard and takes you to the next higher level. *With a text and numeric editor* Closes the text or numeric editor without applying changes.
⊖ + Ⓔ	**Minus/Enter key combination (press the keys simultaneously)** Reduces the contrast (brighter setting).
⊕ + Ⓔ	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
⊖ + ⊕ + Ⓔ	**Minus/Plus/Enter key combination (press the keys simultaneously)** *For operational display* Enables or disables the keypad lock (only SD02 display module).

8.3.5 Opening the context menu

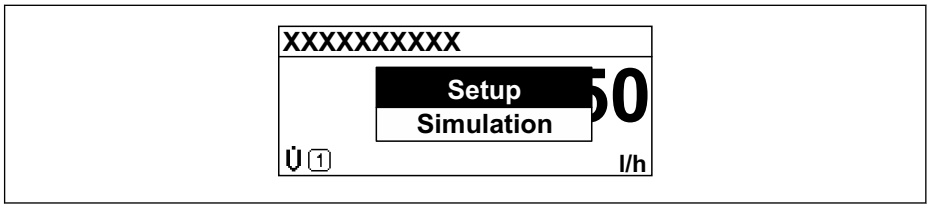
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Data backup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

1. Press E for 2 s.
   ↳ The context menu opens.



2. Press − + + simultaneously.
   ↳ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

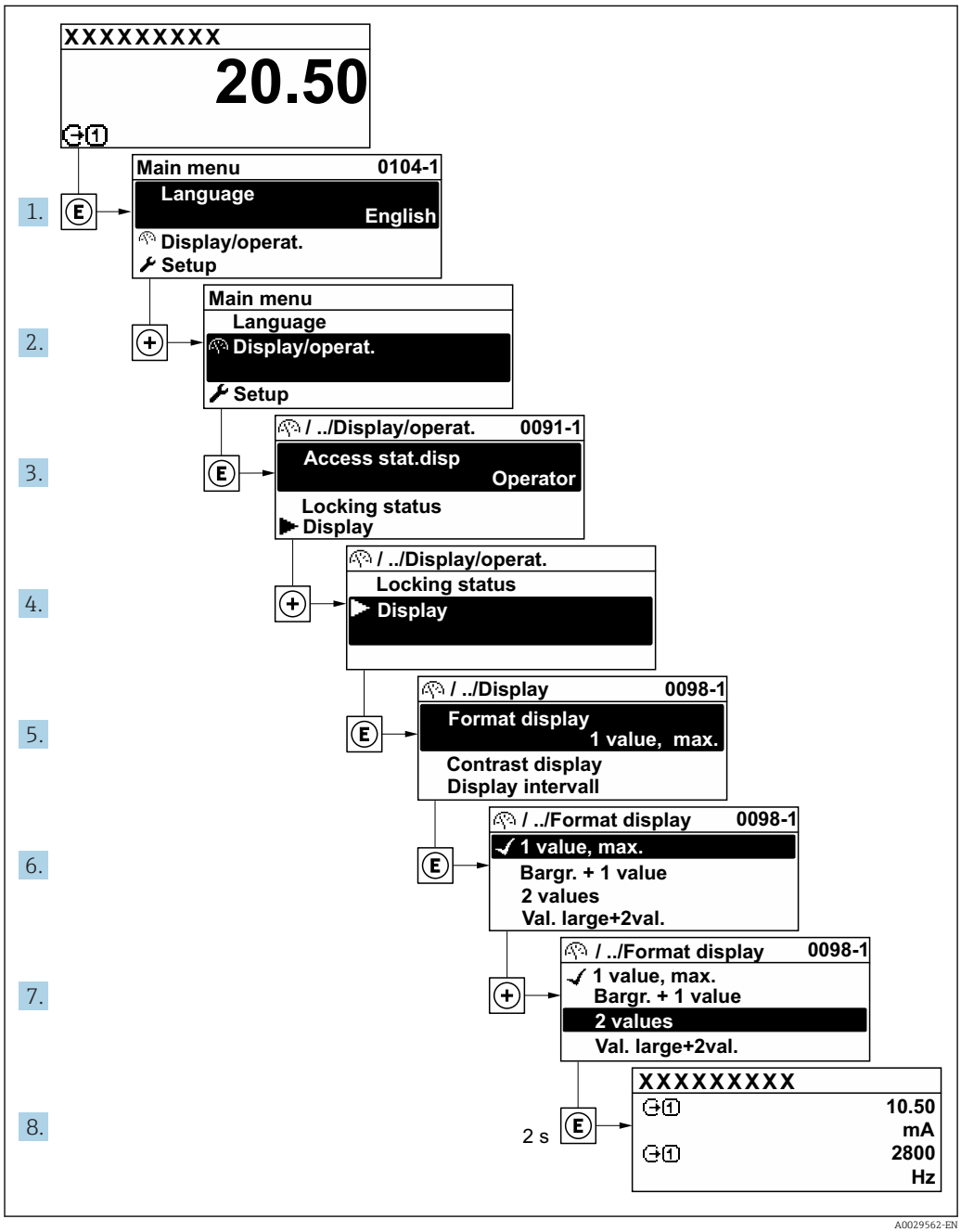
1. Open the context menu.
2. Press + to navigate to the desired menu.
3. Press E to confirm the selection.
   ↳ The selected menu opens.

8.3.6 Navigating and selecting from list

Different operating elements are used to navigate through the operating menu. The navigation path is displayed on the left in the header. Icons are displayed in front of the individual menus. These icons are also shown in the header during navigation.

For an explanation of the navigation view with symbols and operating elements
→ 60

Example: Setting the number of displayed measured values to "2 values"

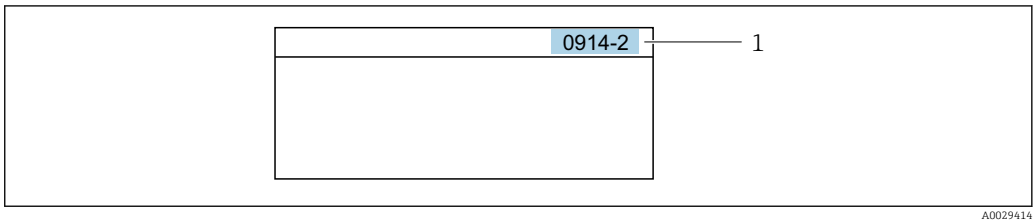


8.3.7 Calling the parameter directly

A parameter number is assigned to every parameter to be able to access a parameter directly via the onsite display. Entering this access code in the **Direct access** parameter calls up the desired parameter directly.

Navigation path
Expert → Direct access

The direct access code consists of a 4-digit number and the channel number, which identifies the channel of a process variable: e.g. 0914-1. In the navigation view, this appears on the right-hand side in the header of the selected parameter.



1 Direct access code

Note the following when entering the direct access code:
- The leading zeros in the direct access code do not have to be entered.
  Example: Input of **"914"** instead of **"0914"**
- If no channel number is entered, channel 1 is jumped to automatically.
  Example: Enter **0914** → **Assign process variable** parameter
- If a different channel is jumped to: Enter the direct access code with the corresponding channel number.
  Example: Enter **0914-2** → **Assign process variable** parameter

For the direct access codes of the individual parameters, see the "Description of Device Parameters" document for the device

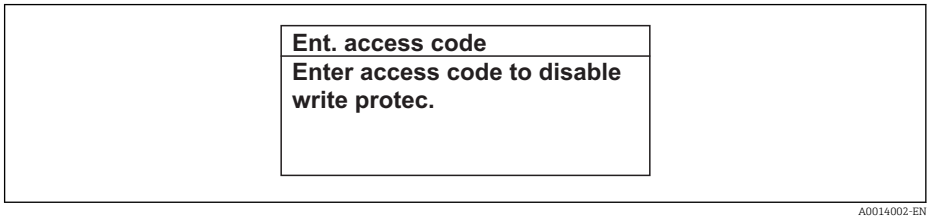
8.3.8 Calling up help text

Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Calling up and closing the help text

The user is in the navigation view and the selection bar is on a parameter.

1. Press E for 2 s.
   ↳ The help text for the selected parameter opens.



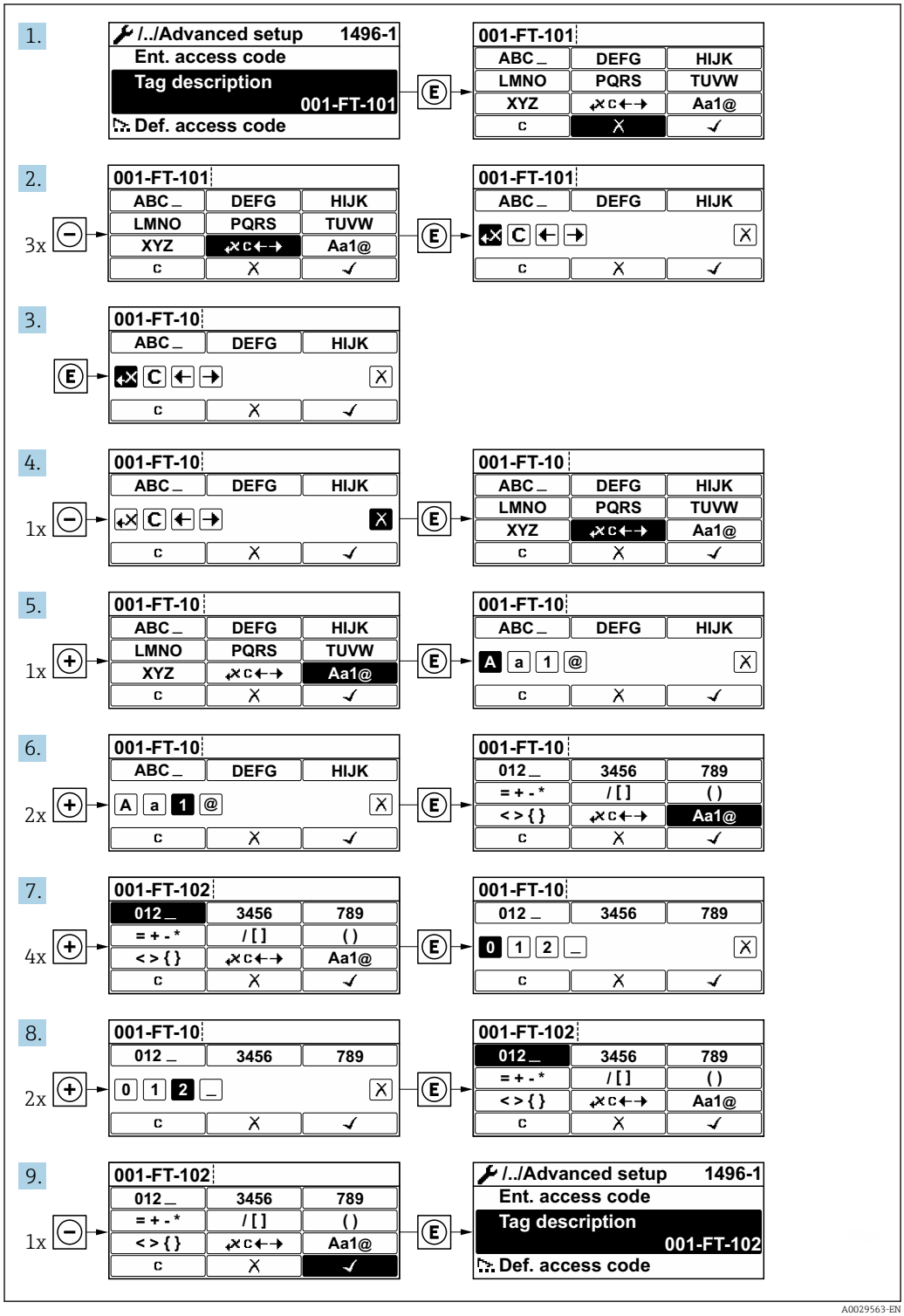
28 Example: Help text for parameter "Enter access code"

2. Press − + + simultaneously.
   ↳ The help text is closed.

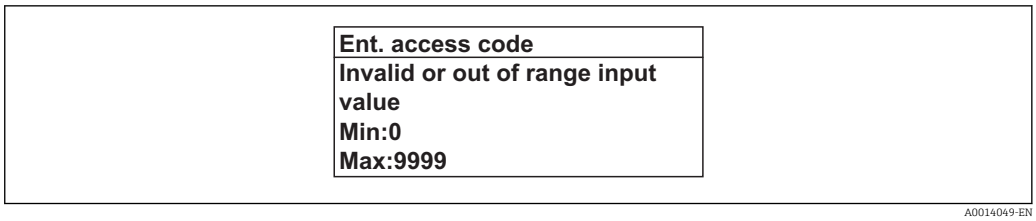
8.3.9 Changing the parameters

For a description of the editing display - consisting of text editor and numeric editor - with symbols → 62, for a description of the operating elements → 64

Example: Changing the tag name in the "Tag description" parameter from 001-FT-101 to 001-FT-102



A message is displayed if the value entered is outside the permitted value range.



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8.3.10 User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access → 125.

Access authorization to parameters: "Operator" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	–– [1]

1) Despite the defined access code, certain parameters can always be modified and thus are excepted from the write protection, as they do not affect the measurement. Refer to the "Write protection via access code" section

Access authorization to parameters: "Maintenance" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	✔ [1]

1) If an incorrect access code is entered, the user obtains the access rights of the "Operator" user role.

The user role with which the user is currently logged on is indicated by the **Access status** parameter. Navigation path: Operation → Access status

8.3.11 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 125.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter via the respective access option.

1. After you press E, the input prompt for the access code appears.
2. Enter the access code.
   ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

Local operation with touch control

The keypad lock is switched on and off via the context menu.

Switching on the keypad lock

The keypad lock is switched on automatically:
- Each time the device is restarted.
- If the device has not been operated for longer than one minute in the measured value display.

1. The device is in the measured value display.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu, select the **Keylock on** option.
   ↳ The keypad lock is switched on.

If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock

1. The keypad lock is switched on.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu, select the **Keylock off** option.
   ↳ The keypad lock is switched off.

8.4 Access to the operating menu via the Web browser

8.4.1 Function range

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 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 measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

For additional information on the Web server, refer to the Special Documentation for the device → 194

8.4.2 Prerequisites

Computer hardware

Hardware	Interface	
	CDI-RJ45	WLAN
Interface	The computer must have an RJ45 interface.	The operating unit must have a WLAN interface.
Connection	Standard Ethernet cable with RJ45 connector.	Connection via Wireless LAN.
Screen	Recommended size: ≥12" (depends on the screen resolution)	

Computer software

Software	Interface	
	CDI-RJ45	WLAN
Recommended operating systems	▪ Microsoft Windows 7 or higher. ▪ Mobile operating systems: – iOS – Android Microsoft Windows XP is supported.	
Web browsers supported	▪ Microsoft Internet Explorer 8 or higher ▪ Microsoft Edge ▪ Mozilla Firefox ▪ Google Chrome ▪ Safari	

Computer settings

Settings	Interface	
	CDI-RJ45	WLAN
User rights	Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (for adjusting the IP address, subnet mask etc.).	
Proxy server settings of the Web browser	The Web browser setting *Use a Proxy Server for Your LAN* must be **deselected** .	
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser. When installing a new firmware version: To enable correct data display, clear the temporary memory (cache) of the Web browser under **Internet options**.	
Network connections	Only the active network connections to the measuring device should be used.	
	Switch off all other network connections such as WLAN.	Switch off all other network connections.

In the event of connection problems: → 139

Measuring device

Device	Interface	
	CDI-RJ45	WLAN
Measuring device	The measuring device has an RJ45 interface.	The measuring device has a WLAN antenna: ▪ Transmitter with integrated WLAN antenna ▪ Transmitter with external WLAN antenna
Web server	Web server must be enabled; factory setting: ON For information on enabling the Web server → 75	Web server and WLAN must be enabled; factory setting: ON For information on enabling the Web server → 75

8.4.3 Establishing a connection

Via service interface (CDI-RJ45)

Configuring the Internet protocol of the computer

The following information refers to the default Ethernet settings of the device.

IP address of the device: 192.168.1.212 (factory setting)

1. Switch on the measuring device.
2. Connect to the computer using a cable → 77.
3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

IP address	192.168.1.XXX; for XXX all numerical sequences except: 0, 212 and 255 → e.g. 192.168.1.213
Subnet mask	255.255.255.0
Default gateway	192.168.1.212 or leave cells empty

Via WLAN interface

Configuring the Internet protocol of the operating unit

NOTICE

If the WLAN connection is lost during the configuration, settings made may be lost.

- Make sure that the WLAN connection is not disconnected while configuring the device.

NOTICE

In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same operating unit. This could cause a network conflict.

- Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
- If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparation

- Enable WLAN reception on the operating unit.

Establishing a connection

1. Select the measuring device using the SSID (e.g. EH_Promag_500_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

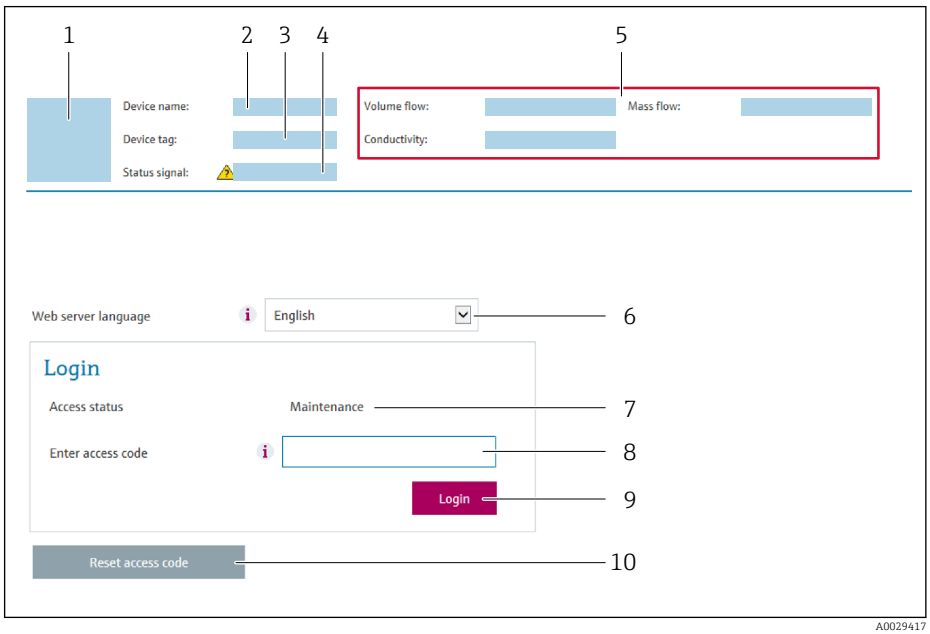
The serial number can be found on the nameplate.

Disconnecting

- Once the configuration is completed, disconnect the WLAN connection between the operating unit and the measuring device.

Starting the Web browser

1. Start the Web browser on the computer.
2. Enter the IP address of the Web server in the address line of the Web browser: 192.168.1.212
   ↳ The login page appears.



1 *Picture of device*
2 *Device name*
3 *Device tag (→ 89)*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 121)*

If a login page does not appear, or if the page is incomplete → 139

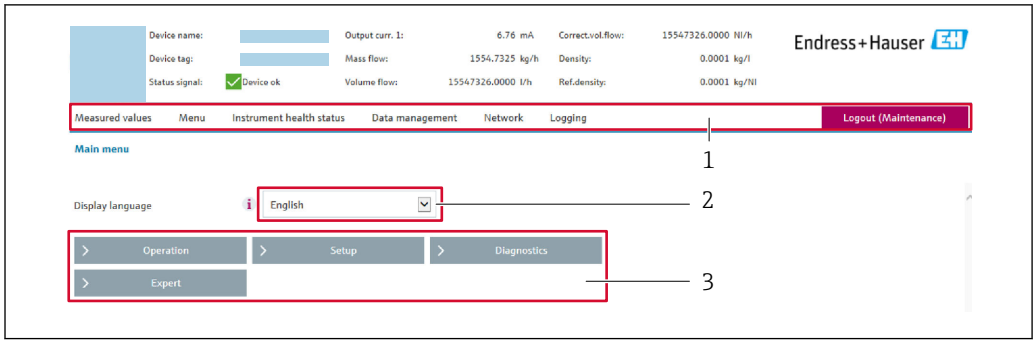
8.4.4 Logging on

1. Select the preferred operating language for the Web browser.
2. Enter the user-specific access code.
3. Press **OK** to confirm your entry.

Access code	0000 (factory setting); can be changed by customer

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

8.4.5 User interface



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1 *Function row*
2 *Operating language*
3 *Navigation area*

Header

The following information appears in the header:
- Device tag
- Device status with status signal → 🖹 145
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring device
Menu	▪ Access to the operating menu from the measuring device ▪ The structure of the operating menu is the same as for the local display For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device
Device status	Displays the diagnostic messages currently pending, listed in order of priority
Data management	▪ Data exchange between PC and measuring device: – Load the configuration from the measuring device (XML format, save configuration) – Save the configuration to the measuring device (XML format, restore configuration) – Export the event list (.csv file) – Export parameter settings (.csv file, create documentation of the measuring point configuration) – Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package) ▪ If using fieldbuses, upload device drivers for system integration from the measuring device: HART: DD file ▪ Flashing a firmware version
Network configuration	Configuration and checking of all the parameters required for establishing the connection to the measuring device: ▪ Network settings (e.g. IP address, MAC address) ▪ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:
- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

8.4.6 Disabling the Web server

The Web server of the measuring device can be switched on and off as required using the **Web server functionality** parameter.

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Web server functionality	Switch the Web server on and off.	▪ Off ▪ On	On

Function scope of the "Web server functionality" parameter

Option	Description
Off	▪ The web server is completely disabled. ▪ Port 80 is locked.
On	▪ The complete functionality of the web server is available. ▪ JavaScript is used. ▪ The password is transferred in an encrypted state. ▪ Any change to the password is also transferred in an encrypted state.

Enabling the Web server

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:
- Via local display
- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

8.4.7 Logging out

Before logging out, perform a data backup via the **Data management** function (upload configuration from device) if necessary.

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. Reset the modified properties of the Internet protocol (TCP/IP) if they are no longer needed → 72.

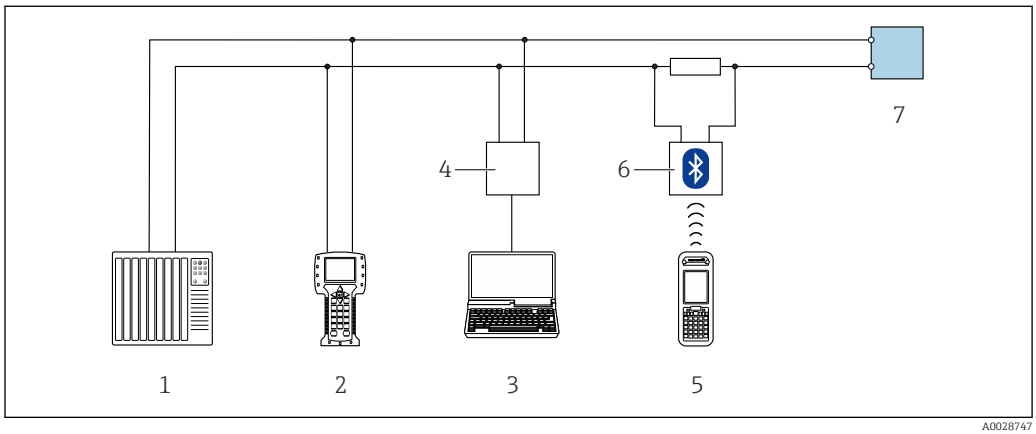
8.5 Access to the operating menu via the operating tool

The structure of the operating menu in the operating tools is the same as for operation via the local display.

8.5.1 Connecting the operating tool

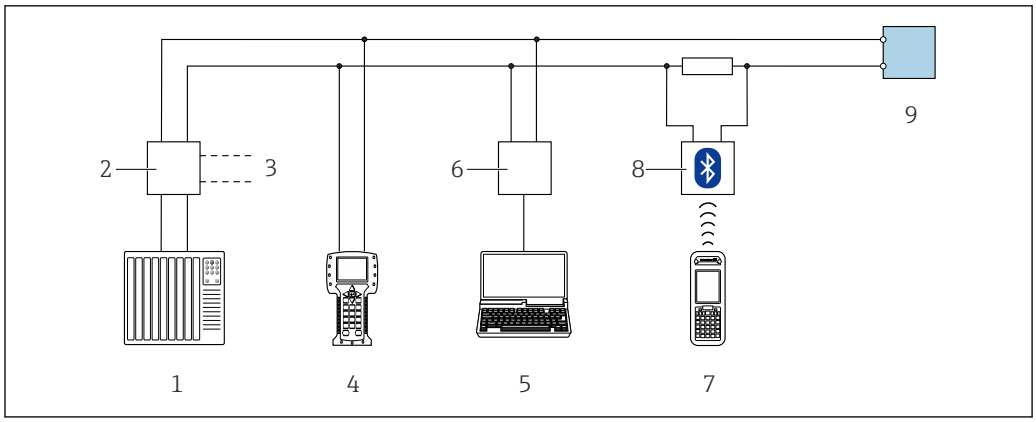
Via HART protocol

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



29 *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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

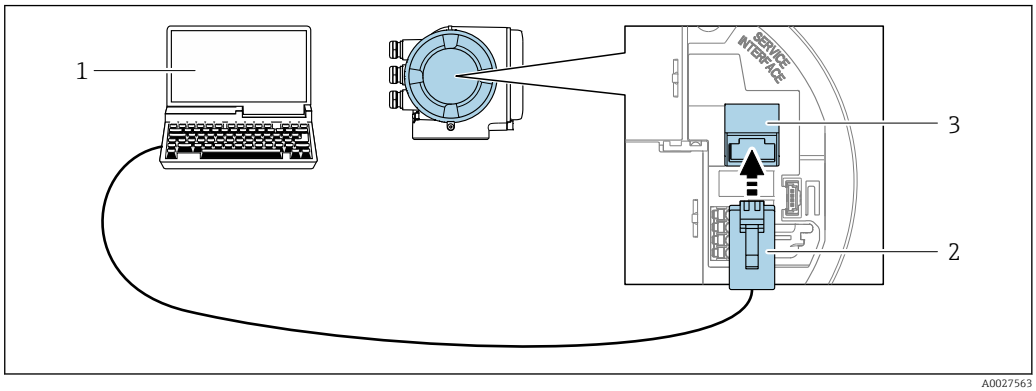


30 *Options for remote operation via HART protocol (passive)*

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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

Service interface

Via service interface (CDI-RJ45)

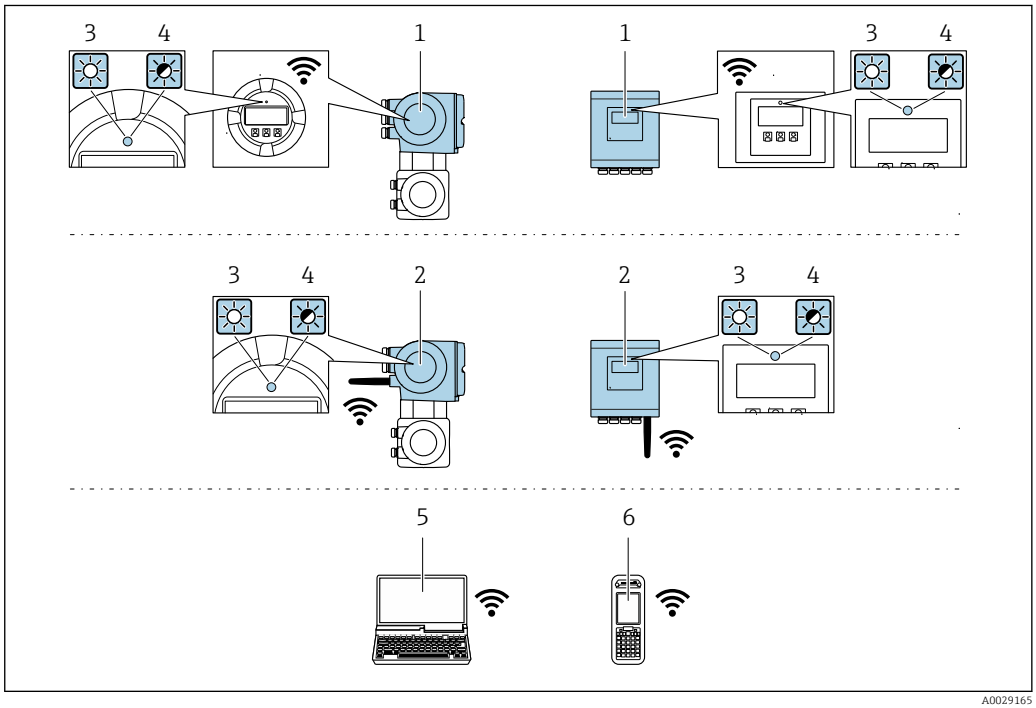


31 Connection via service interface (CDI-RJ45)

1 *Computer with Web browser (e.g. Microsoft Internet Explorer, Microsoft Edge) for accessing the integrated device Web server or with "FieldCare", "DeviceCare" operating tool with COM DTM "CDI Communication TCP/IP"*
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, backlit, graphic display; touch control + WLAN"



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)*

Wireless LAN	IEEE 802.11 b/g (2.4 GHz) WLAN
Encryption	WPA2 PSK/TKIP AES-128
Configurable channels	1 to 11
Function	Access point with DHCP
Range with integrated antenna	Max. 10 m (32 ft)
Range with external antenna	Max. 50 m (164 ft)

Configuring the Internet protocol of the operating unit

NOTICE

If the WLAN connection is lost during the configuration, settings made may be lost.

- Make sure that the WLAN connection is not disconnected while configuring the device.

NOTICE

In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same operating unit. This could cause a network conflict.

- Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
- If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparation

- Enable WLAN reception on the operating unit.

Establishing a connection

1. Select the measuring device using the SSID (e.g. EH_Promag_500_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

Disconnecting

- Once the configuration is completed, disconnect the WLAN connection between the operating unit and the measuring device.

8.5.2 Field Xpert SFX350, SFX370

Function scope

Field Xpert SFX350 and Field Xpert SFX370 are mobile computers for commissioning and maintenance. They enable efficient device configuration and diagnostics for HART and FOUNDATION fieldbus devices in the **non-Ex area** (SFX350, SFX370) and the **Ex area** (SFX370).

For details, see Operating Instructions BA01202S

Source for device description files

See data → 82

8.5.3 FieldCare

Function scope

FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a 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.

Access is via:
- HART protocol
- CDI-RJ45 service interface → 77
- WLAN interface→ 77

Typical functions:
- Configuring parameters of transmitters
- Loading and saving device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook

For additional information about FieldCare, see Operating Instructions BA00027S and BA00059S

Source for device description files

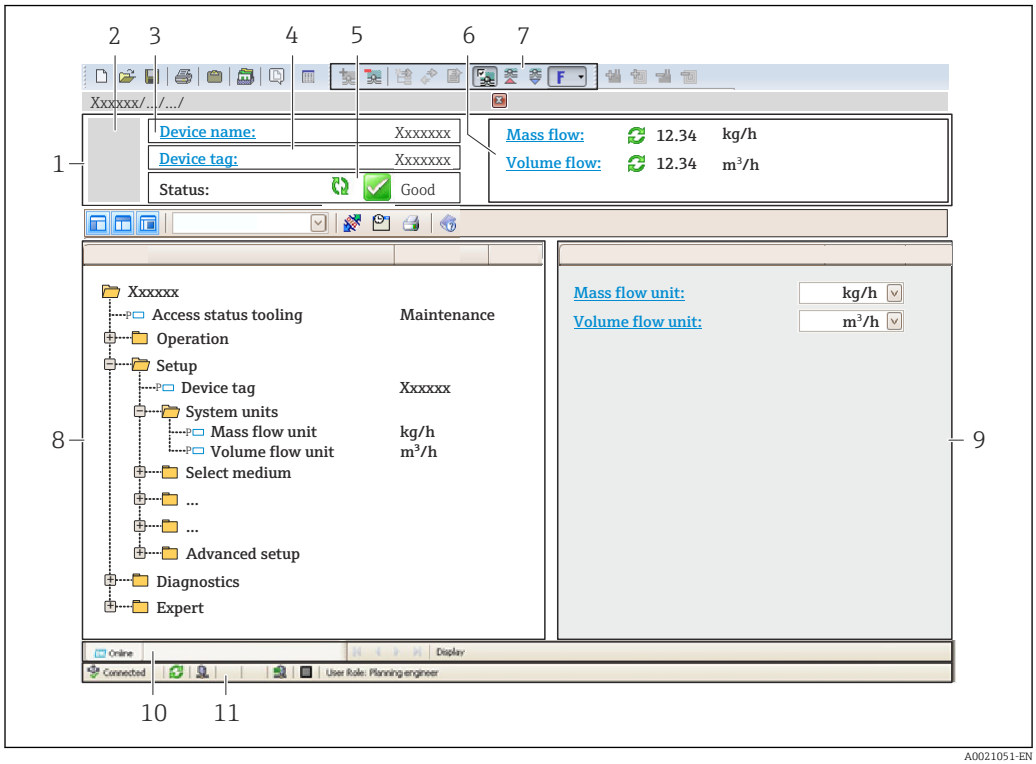
See information → 82

Establishing a connection

1. Start FieldCare and launch the project.
2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.
5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.
6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.
7. Establish the online connection to the device.

For additional information, see Operating Instructions BA00027S and BA00059S

User interface



1 *Header*
2 *Picture of device*
3 *Device name*
4 *Tag name*
5 *Status area with status signal→ 145*
6 *Display area for current measured values*
7 *Edit toolbar with additional functions such as save/restore, event list and create documentation*
8 *Navigation area with operating menu structure*
9 *Working area*
10 *Range of action*
11 *Status area*

8.5.4 DeviceCare

Function scope

Tool to connect and configure Endress+Hauser field devices.

The fastest way to configure Endress+Hauser field devices is with the dedicated "DeviceCare" tool. Together with the device type managers (DTMs) it presents a convenient, comprehensive solution.

For details, see Innovation Brochure IN01047S

Source for device description files

See information → 82

8.5.5 AMS Device Manager

Function scope

Program from Emerson Process Management for operating and configuring measuring devices via HART protocol.

Source for device description files

See data → 82

8.5.6 SIMATIC PDM

Function scope

SIMATIC PDM is a standardized, manufacturer-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via HART protocol.

Source for device description files

See data → 82

8.5.7 Field Communicator 475

Function scope

Industrial handheld terminal from Emerson Process Management for remote configuration and measured value display via HART protocol.

Source for device description files

See data → 82

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.00.zz	▪ On the title page of the Operating instructions ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	08.2016	---
Manufacturer ID	0x11	Manufacturer ID Diagnostics → Device information → Manufacturer ID
Device type ID	0x3C	Device type Diagnostics → Device information → Device type
HART protocol revision	7	---
Device revision	1	▪ On the transmitter nameplate ▪ Device revision Diagnostics → Device information → Device revision

For an overview of the different firmware versions for the device → 158

9.1.2 Operating tools

The suitable device description file for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

Operating tool via HART protocol	Sources for obtaining device descriptions
FieldCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
▪ Field Xpert SFX350 ▪ Field Xpert SFX370	Use update function of handheld terminal
AMS Device Manager (Emerson Process Management)	www.endress.com → Download Area
SIMATIC PDM (Siemens)	www.endress.com → Download Area
Field Communicator 475 (Emerson Process Management)	Use update function of handheld terminal

9.2 Measured variables via HART protocol

The following measured variables (HART device variables) are assigned to the dynamic variables at the factory:

Dynamic variables	Measured variables (HART device variables)
Primary dynamic variable (PV)	Volume flow
Secondary dynamic variable (SV)	Totalizer 1
Tertiary dynamic variable (TV)	Totalizer 2
Quaternary dynamic variable (QV)	Totalizer 3

The assignment of the measured variables to the dynamic variables can be modified and assigned as desired via local operation and the operating tool using the following parameters:

- Expert → Communication → HART output → Output → Assign PV
- Expert → Communication → HART output → Output → Assign SV
- Expert → Communication → HART output → Output → Assign TV
- Expert → Communication → HART output → Output → Assign QV

The following measured variables can be assigned to the dynamic variables:

Measured variables for PV (primary dynamic variable)
- Off
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [1)]
- Electronic temperature

Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [2)]
- Electronic temperature
- Totalizer 1
- Totalizer 2
- Totalizer 3

The range of options increases if the measuring device has one or more application packages.

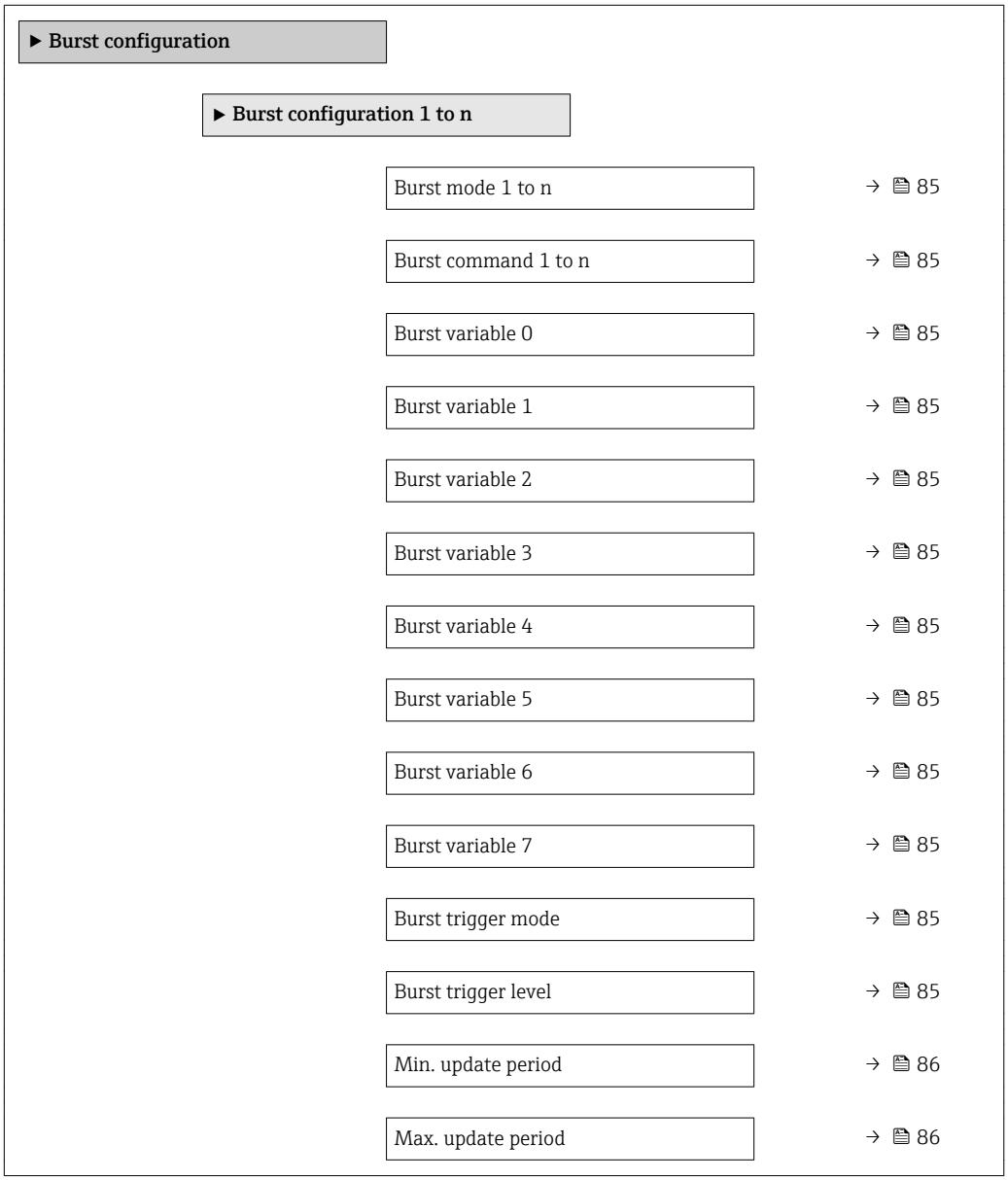
Device variables
The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:
- 0 = volume flow
- 1 = mass flow
- 2 = corrected volume flow
- 3 = flow velocity
- 4 = conductivity
- 7 = electronic temperature
- 8 = totalizer 1
- 9 = totalizer 2
- 10 = totalizer 3

1) Visibility depends on order options or device settings
2) Visibility depends on order options or device settings

9.3 Other settings

9.3.1 Burst mode functionality in accordance with HART 7 Specification

Navigation
"Expert" menu → Communication → HART output → Burst configuration → Burst configuration 1 to n



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Burst mode 1 to n	Activate the HART burst mode for burst message X.	▪ Off ▪ On	Off
Burst command 1 to n	Select the HART command that is sent to the HART master.	▪ Command 1 ▪ Command 2 ▪ Command 3 ▪ Command 9 ▪ Command 33 ▪ Command 48	Command 2
Burst variable 0	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Density ▪ HART input ▪ Percent of range ▪ Measured current ▪ Primary variable (PV) ▪ Secondary variable (SV) ▪ Tertiary variable (TV) ▪ Quaternary variable (QV) ▪ Not used	Volume flow
Burst variable 1	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 2	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 3	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 4	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 5	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 6	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 7	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst trigger mode	Select the event that triggers burst message X.	▪ Continuous ▪ Window ▪ Rising ▪ Falling ▪ On change	Continuous
Burst trigger level	Enter the burst trigger value. Together with the option selected in the **Burst trigger mode** parameter the burst trigger value determines the time of burst message X.	Positive floating-point number	–

Parameter	Description	Selection / User entry	Factory setting
Min. update period	Enter the minimum time span between two burst responses of one burst message.	Positive integer	1 000 ms
Max. update period	Enter the maximum time span between two burst responses of one burst message.	Positive integer	2 000 ms

* Visibility depends on order options or device settings

10 Commissioning

10.1 Function check

Before commissioning the measuring device:

▶ Make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist → 37
- "Post-connection check" checklist → 55

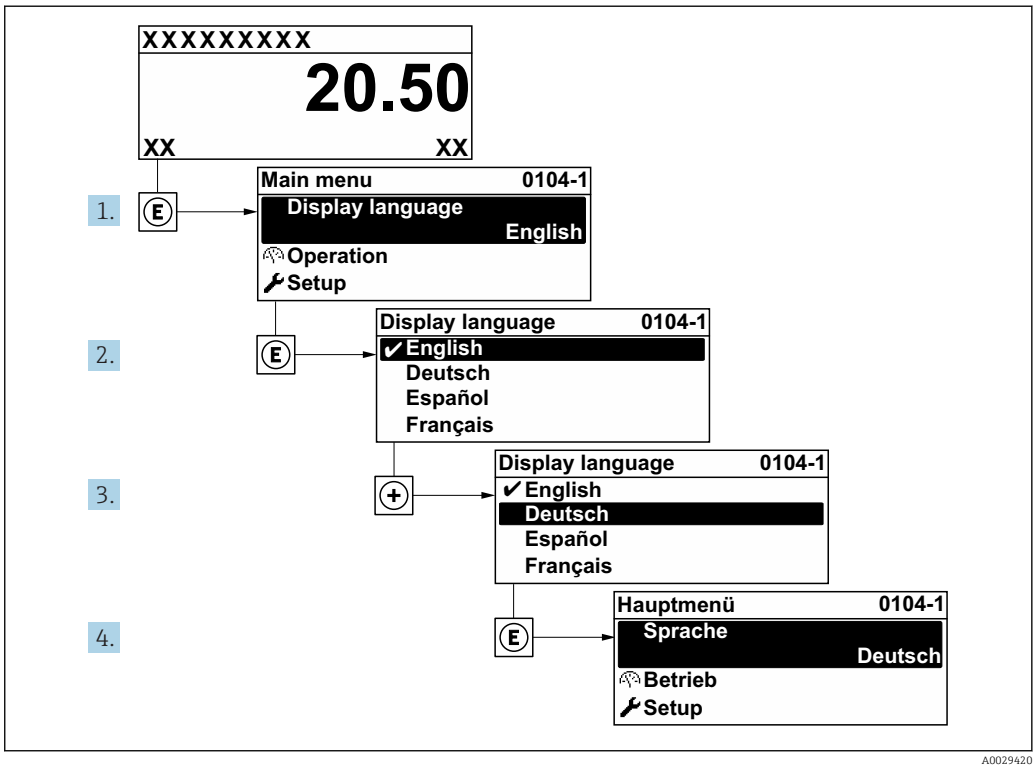
10.2 Switching on the measuring device

▶ After a successful function check, switch on the measuring device.
↳ After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 138.

10.3 Setting the operating language

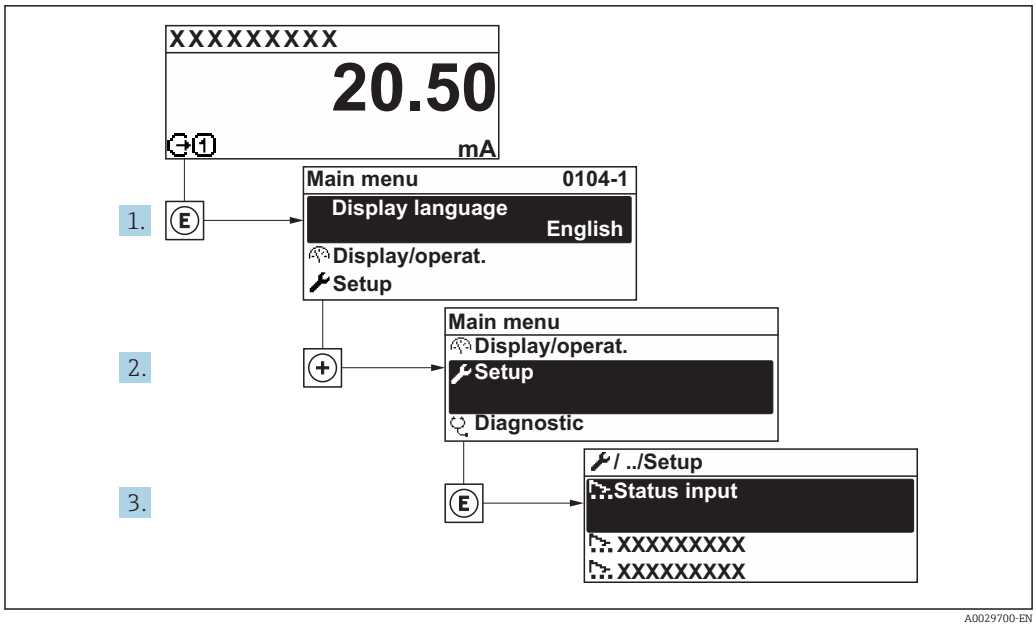
Factory setting: English or ordered local language



32 *Taking the example of the local display*

10.4 Configuring the measuring device

- The **Setup** menuwith its guided wizards contains all the parameters needed for standard operation.
- Navigation to the **Setup** menu



33 *Taking the example of the local display*

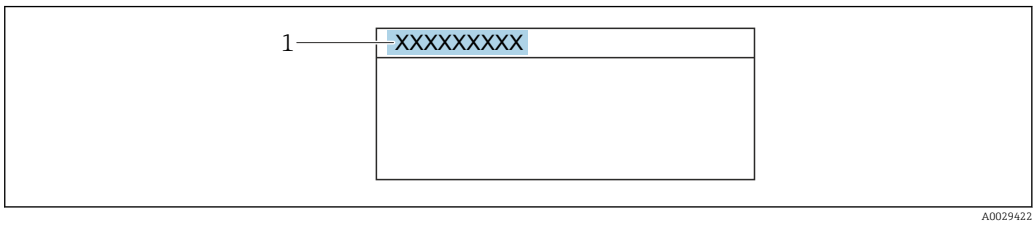
Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Setup

Device tag	→ 89
▶ System units	→ 89
▶ I/O configuration	→ 91
▶ Current input 1 to n	→ 92
▶ Status input 1 to n	→ 91
▶ Current output 1 to n	→ 93
▶ Pulse/frequency/switch output 1 to n	→ 96
▶ Relay output 1 to n	→ 107
▶ Double pulse output	→ 109
▶ Display	→ 102
▶ Low flow cut off	→ 104
▶ Empty pipe detection	→ 105
▶ Advanced setup	→ 111

10.4.1 Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a unique designation using the **Device tag** parameter and thus change the factory setting.



34 *Header of the operational display with tag name*

1 Tag name

Enter the tag name in the "FieldCare" operating tool → 80

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

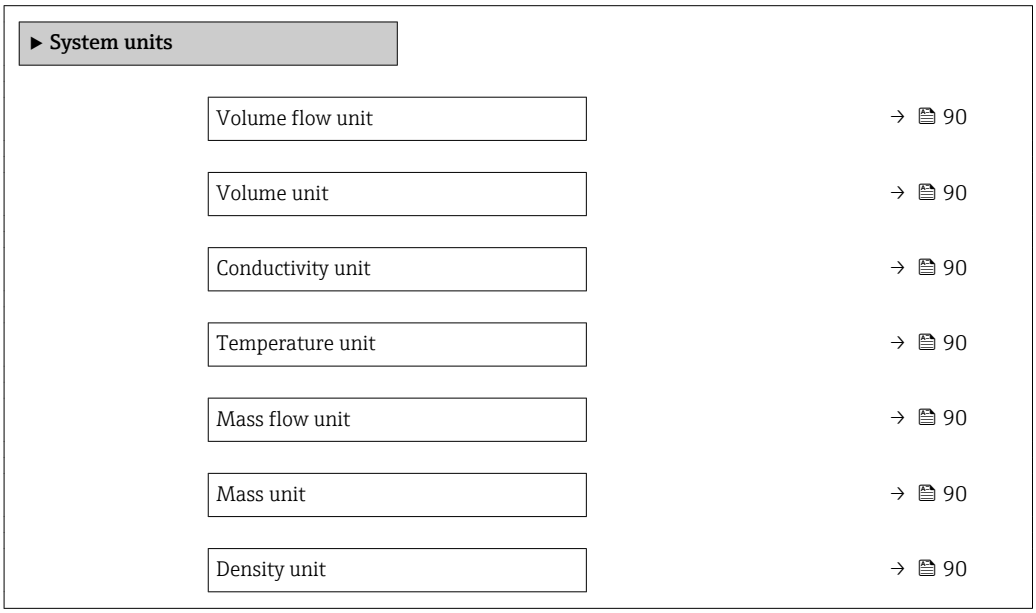
Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag

10.4.2 Setting the system units

In the **System units** submenu the units of all the measured values can be set.

Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Navigation
"Setup" menu → System units



Corrected volume flow unit	→ 90
Corrected volume unit	→ 90

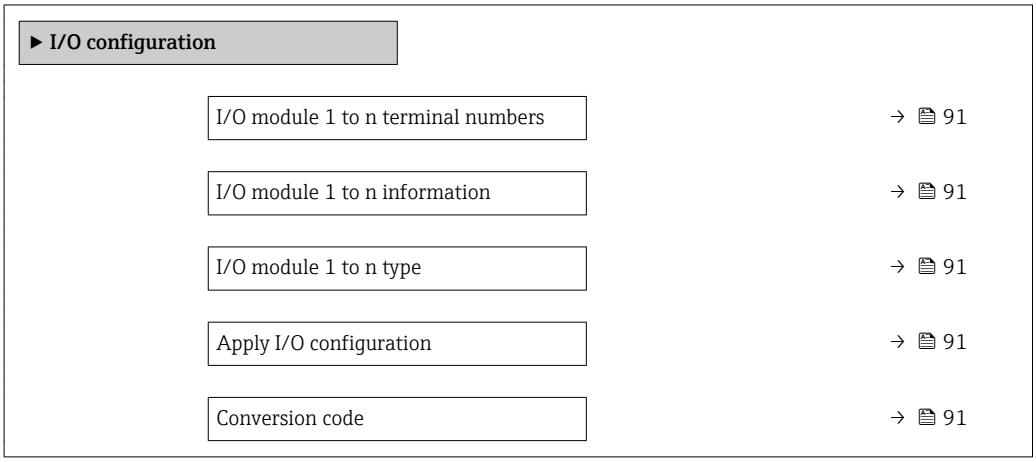
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Volume flow unit	–	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Volume unit	–	Select volume unit.	Unit choose list	Country-specific: ▪ m^3 ▪ gal (us)
Conductivity unit	The **On** option is selected in the **Conductivity measurement** parameter parameter.	Select conductivity unit. *Effect* The selected unit applies for: ▪ Current output ▪ Frequency output ▪ Switch output ▪ Simulation process variable	Unit choose list	µS/cm
Temperature unit	–	Select temperature unit. *Result* The selected unit applies for: ▪ **Temperature** parameter ▪ **Maximum value** parameter ▪ **Minimum value** parameter ▪ **External temperature** parameter ▪ **Maximum value** parameter ▪ **Minimum value** parameter	Unit choose list	Country-specific: ▪ °C ▪ °F
Mass flow unit	–	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min
Mass unit	–	Select mass unit.	Unit choose list	Country-specific: ▪ kg ▪ lb
Density unit	–	Select density unit. *Result* The selected unit applies for: ▪ Output ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/l ▪ lb/ft^3
Corrected volume flow unit	–	Select corrected volume flow unit. *Result* The selected unit applies for: **Corrected volume flow** parameter (→ 129)	Unit choose list	Country-specific: ▪ Nl/h ▪ Sft^3/h
Corrected volume unit	–	Select corrected volume unit.	Unit choose list	Country-specific: ▪ Nm^3 ▪ Sft^3

10.4.3 Displaying the I/O configuration

The **I/O configuration** submenu guides the user systematically through all the parameters in which the configuration of the I/O modules is displayed.

Navigation
"Setup" menu → I/O configuration



Parameter overview with brief description

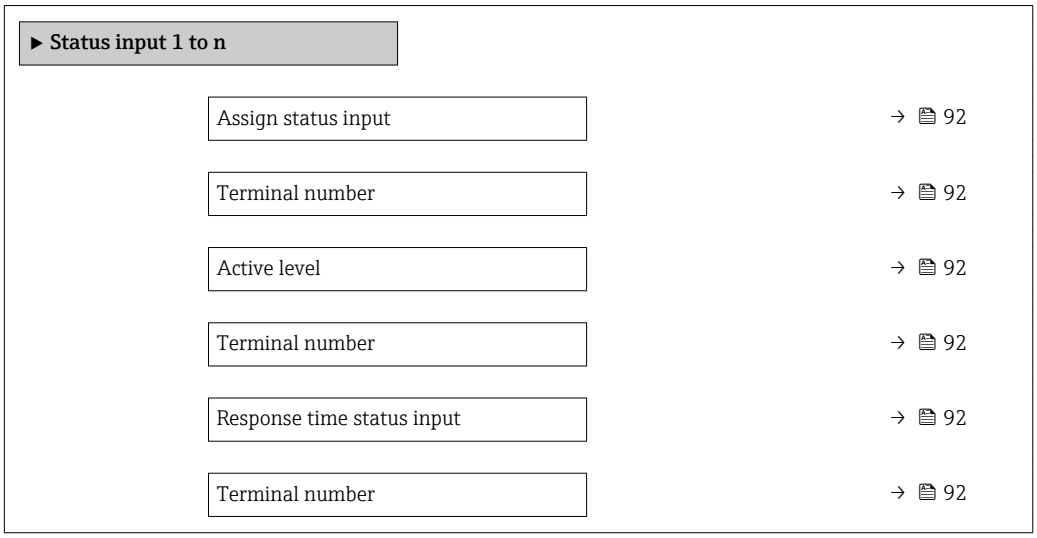
Parameter	Description	User interface / Selection / User entry	Factory setting
I/O module 1 to n terminal numbers	Shows the terminal numbers used by the I/O module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
I/O module 1 to n information	Shows information of the plugged I/O module.	▪ Not plugged ▪ Invalid ▪ Not configurable ▪ Configurable ▪ Fieldbus	–
I/O module 1 to n type	Shows the I/O module type.	▪ Off ▪ Current output * ▪ Current input * ▪ Status input * ▪ Pulse/frequency/switch output *	Off
Apply I/O configuration	Apply parameterization of the freely configurable I/O module.	▪ No ▪ Yes	No
Conversion code	Enter the code in order to change the I/O configuration.	Positive integer	0

* Visibility depends on order options or device settings

10.4.4 Configuring the status input

The **Status input** submenu guides the user systematically through all the parameters that have to be set for configuring the status input.

Navigation
"Setup" menu → Status input



Parameter overview with brief description

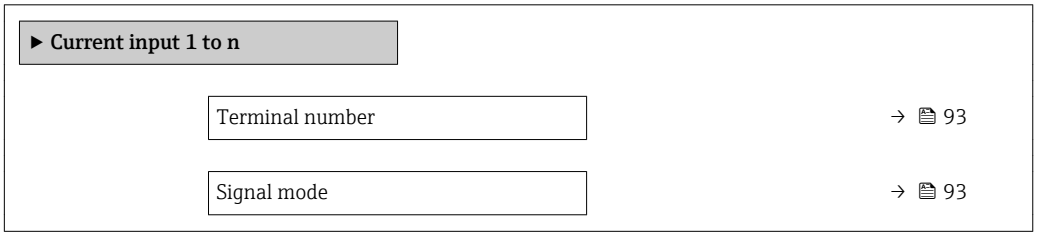
Parameter	Description	User interface / Selection / User entry	Factory setting
Terminal number	Shows the terminal numbers used by the status input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Assign status input	Select function for the status input.	▪ Off ▪ Reset totalizer 1 ▪ Reset totalizer 2 ▪ Reset totalizer 3 ▪ Reset all totalizers ▪ Flow override	Off
Active level	Define input signal level at which the assigned function is triggered.	▪ High ▪ Low	High
Response time status input	Define the minimum amount of time the input signal level must be present before the selected function is triggered.	5 to 200 ms	50 ms

* Visibility depends on order options or device settings

10.4.5 Configuring the current input

The **"Current input" wizard** guides the user systematically through all the parameters that have to be set for configuring the current input.

Navigation
"Setup" menu → Current input



0/4 mA value	→ 93
20 mA value	→ 93
Current span	→ 93
Failure mode	→ 93
Failure value	→ 93

Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	The measuring device is **not** approved for use in the hazardous area with type of protection Ex-i.	Select the signal mode for the current input.	▪ Passive ▪ Active	Passive
0/4 mA value	–	Enter 4 mA value.	Signed floating-point number	0
20 mA value	–	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 0...20 mA	Country-specific: ▪ 4...20 mA NAMUR ▪ 4...20 mA US
Failure mode	–	Define input behavior in alarm condition.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

* Visibility depends on order options or device settings

10.4.6 Configuring the current output

The **Current output** wizard guides you systematically through all the parameters that have to be set for configuring the current output.

Navigation

"Setup" menu → Current output

► **Current output 1 to n**	
Terminal number	→ 94

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Assign current output 1 to n	–	Select process variable for current output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Volume flow
Terminal number	–	Shows the terminal numbers used by the current output module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA ▪ Fixed current	Country-specific: ▪ 4...20 mA NAMUR ▪ 4...20 mA US
Signal mode	–	Select the signal mode for the current output.	▪ Passive ▪ Active	Passive
0/4 mA value	One of the following options is selected in the **Current span** parameter (→ 94): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Enter 4 mA value.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
20 mA value	One of the following options is selected in the **Current span** parameter (→ 94): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Fixed current	In the **Current span** parameter (→ 🖹 94), the **Fixed current** option is selected.	Defines the fixed output current.	0 to 22.5 mA	22.5 mA
Failure mode	One of the following options is selected in the **Assign current output** parameter (→ 🖹 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature One of the following options is selected in the **Current span** parameter (→ 🖹 94): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Define output behavior in alarm condition.	▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Defined value	Max.
Failure current	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter current output value in alarm condition.	0 to 22.5 mA	22.5 mA

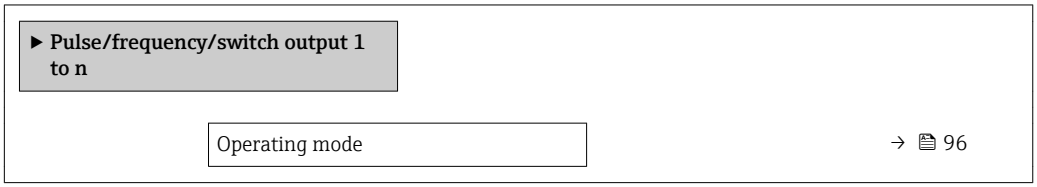
* Visibility depends on order options or device settings

10.4.7 Configuring the pulse/frequency/switch output

The **Pulse/frequency/switch output** wizard guides you systematically through all the parameters that can be set for configuring the selected output type.

Navigation

"Setup" menu → Advanced setup → Pulse/frequency/switch output



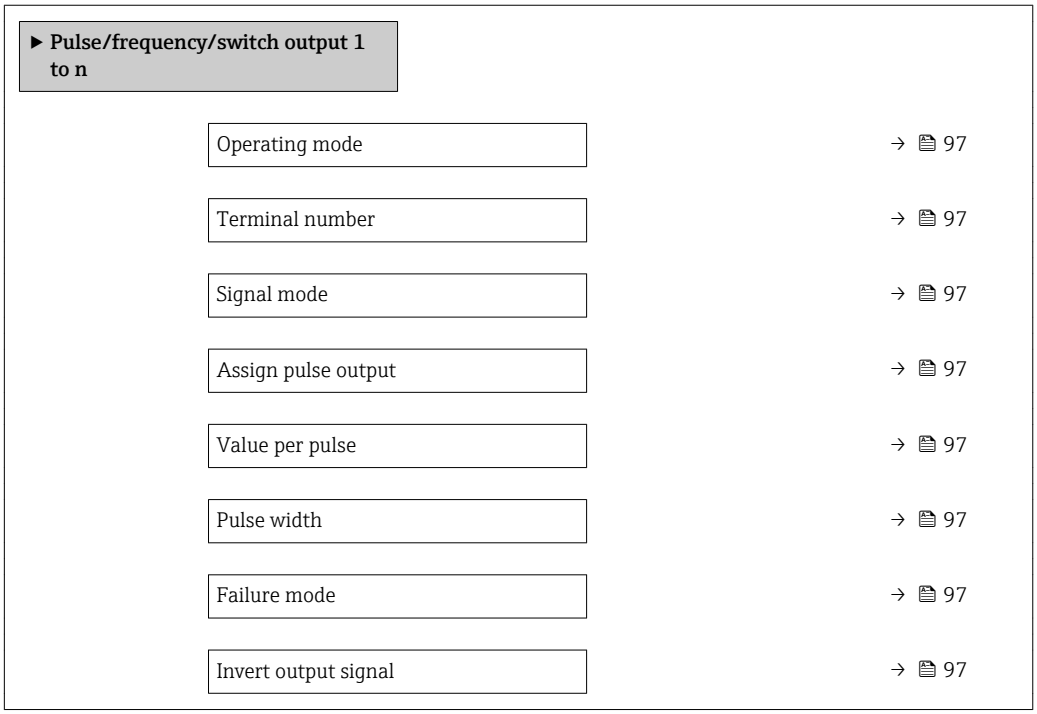
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

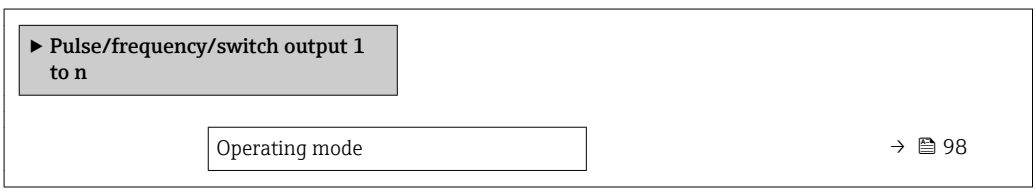
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive
Assign pulse output 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Off
Value per pulse	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 97): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 97): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Define time width of the output pulse.	0.05 to 2 000 ms	100 ms
Failure mode	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 97): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

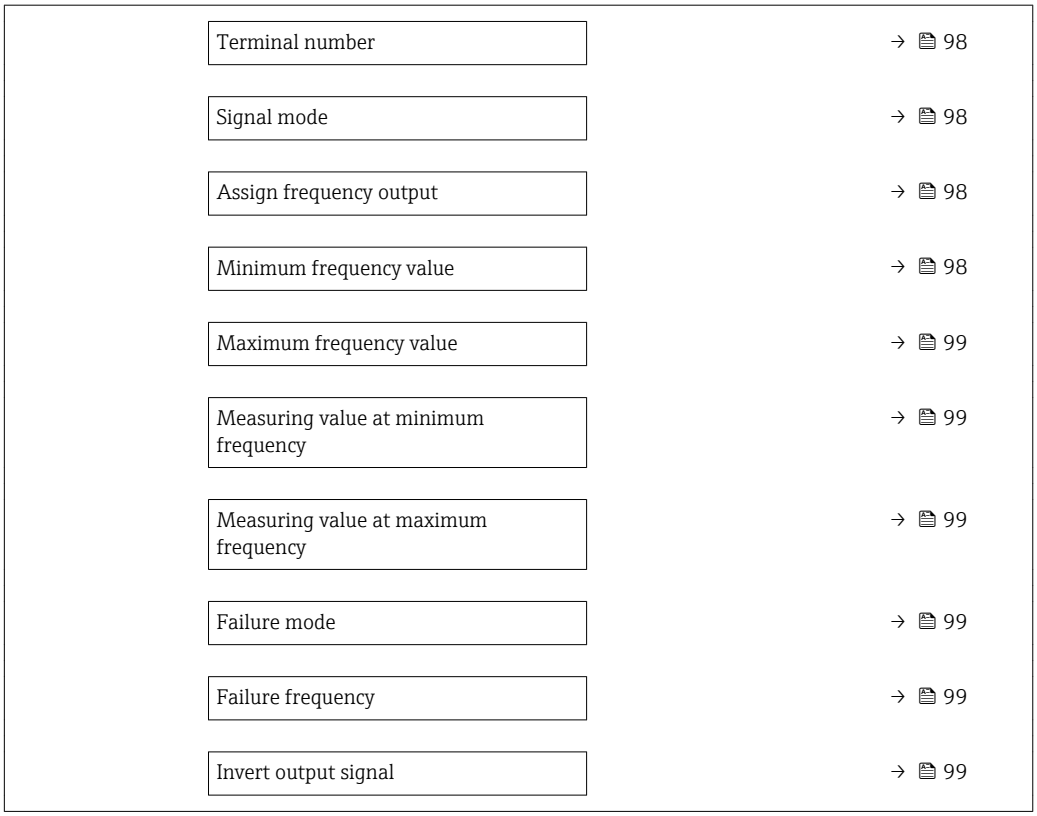
* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output





Parameter overview with brief description

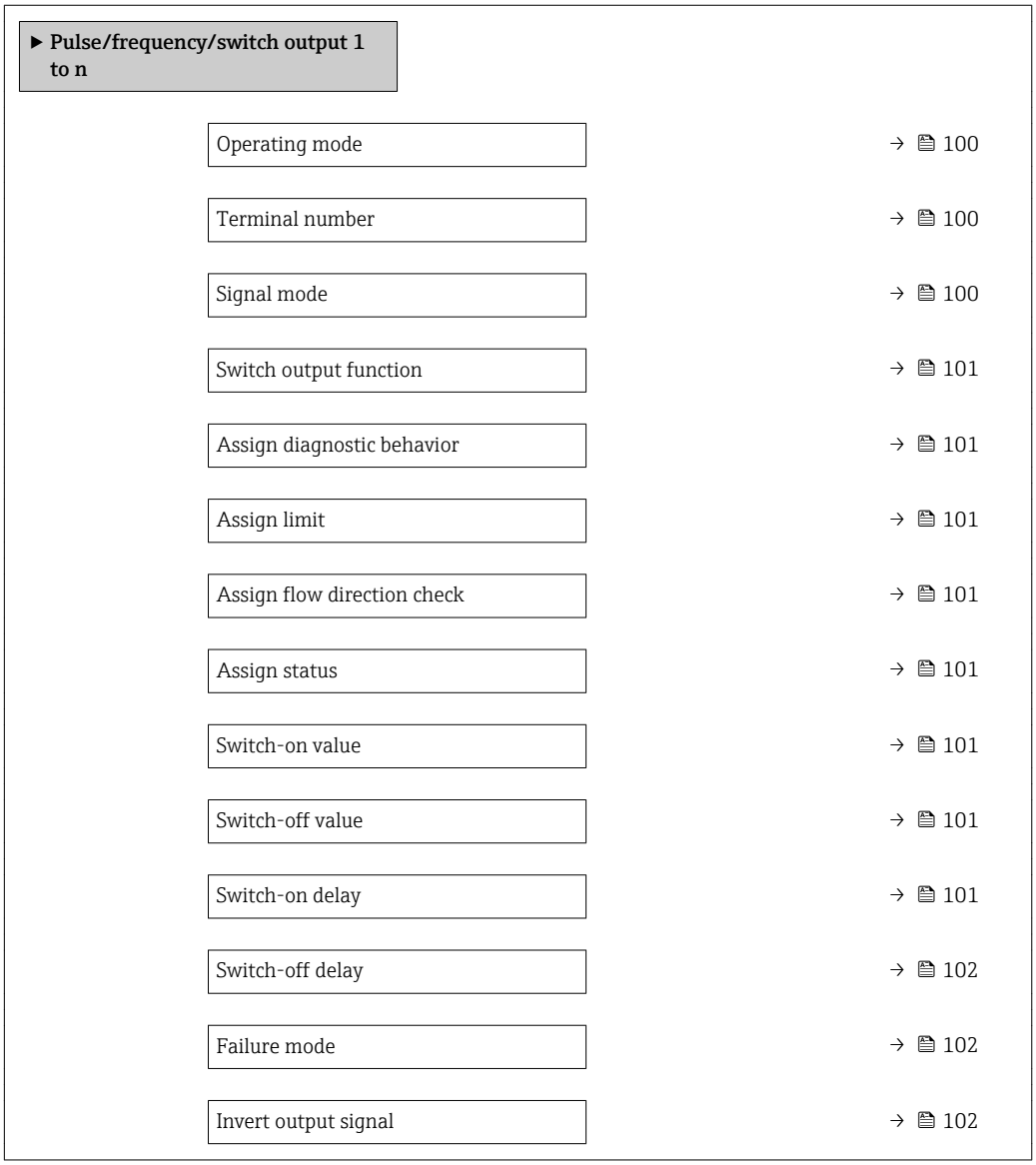
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive
Assign frequency output	In the **Operating mode** parameter (→ 96), the **Frequency** option is selected.	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Off
Minimum frequency value	One of the following options is selected in the **Assign current output** parameter (→ 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter minimum frequency.	0.0 to 10 000.0 Hz	0.0 Hz

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Maximum frequency value	One of the following options is selected in the **Assign current output** parameter (→ 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter maximum frequency.	0.0 to 10 000.0 Hz	10 000.0 Hz
Measuring value at minimum frequency	One of the following options is selected in the **Assign current output** parameter (→ 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter measured value for minmum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum frequency	One of the following options is selected in the **Assign current output** parameter (→ 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter
Failure mode	One of the following options is selected in the **Assign current output** parameter (→ 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Define output behavior in alarm condition.	▪ Actual value ▪ Defined value ▪ 0 Hz	0 Hz
Failure frequency	One of the following options is selected in the **Assign current output** parameter (→ 94): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	0.0 Hz
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

Configuring the switch output

Navigation
"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch output function	In the **Operating mode** parameter the **Switch** option is selected.	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	Off
Assign diagnostic behavior	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign limit	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Electronic temperature	Volume flow
Assign flow direction check	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Flow direction check** option is selected in the **Switch output function** parameter.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign status	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Status** option is selected in the **Switch output function** parameter.	Select device status for switch output.	▪ Empty pipe detection ▪ Low flow cut off	Empty pipe detection
Switch-on value	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
Switch-off value	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
Switch-on delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s

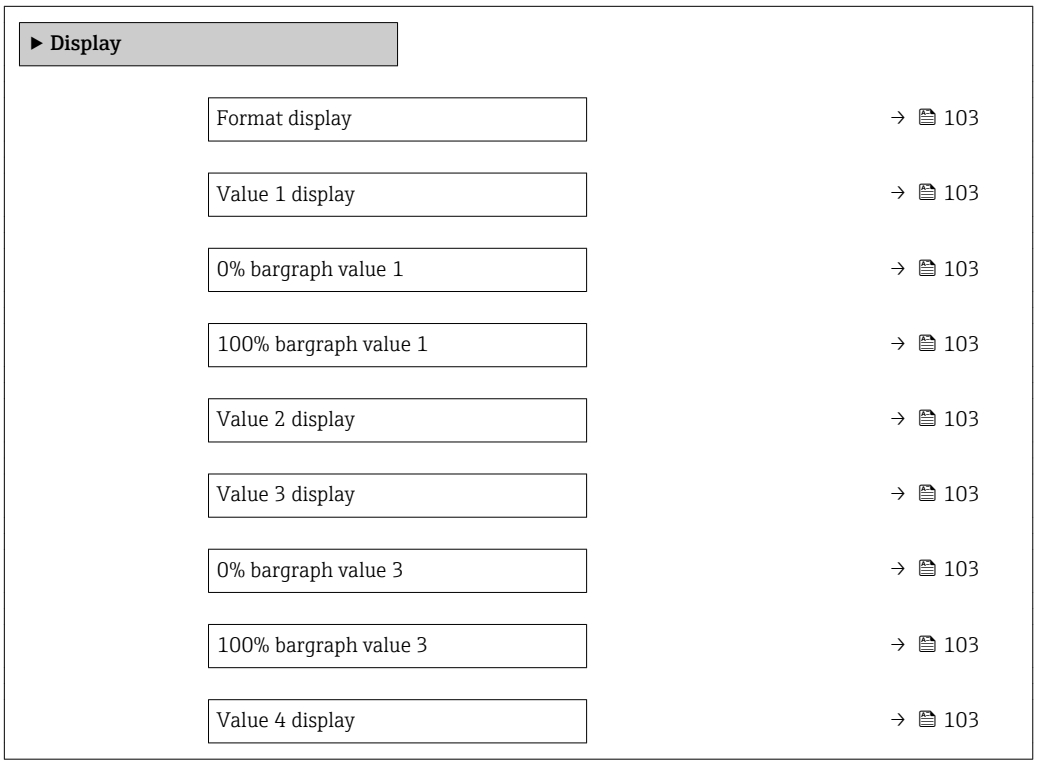
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch-off delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

10.4.8 Configuring the local display

The **Display** wizard guides you systematically through all the parameters that can configured for configuring the local display.

Navigation
"Setup" menu → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	None
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 103)	None
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 103)	None

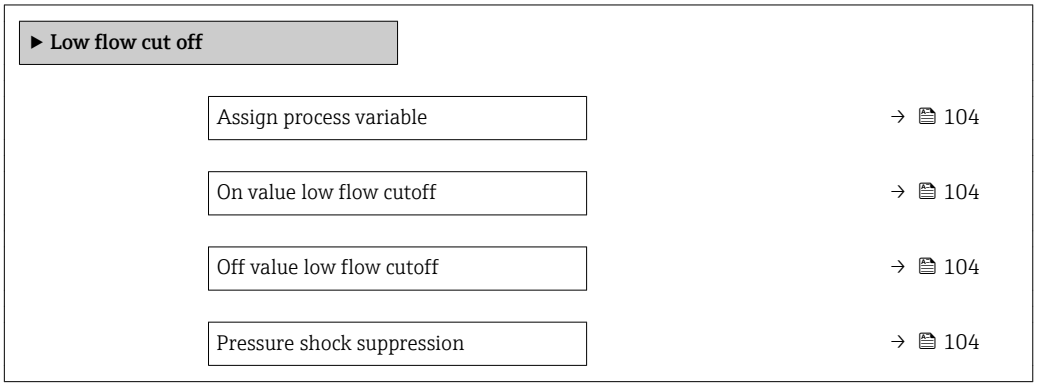
* Visibility depends on order options or device settings

10.4.9 Configuring the low flow cut off

The **Low flow cut off** wizard systematically guides the user through all the parameters that must be set to configure low flow cut off.

Navigation

"Setup" menu → Low flow cut off



Parameter overview with brief description

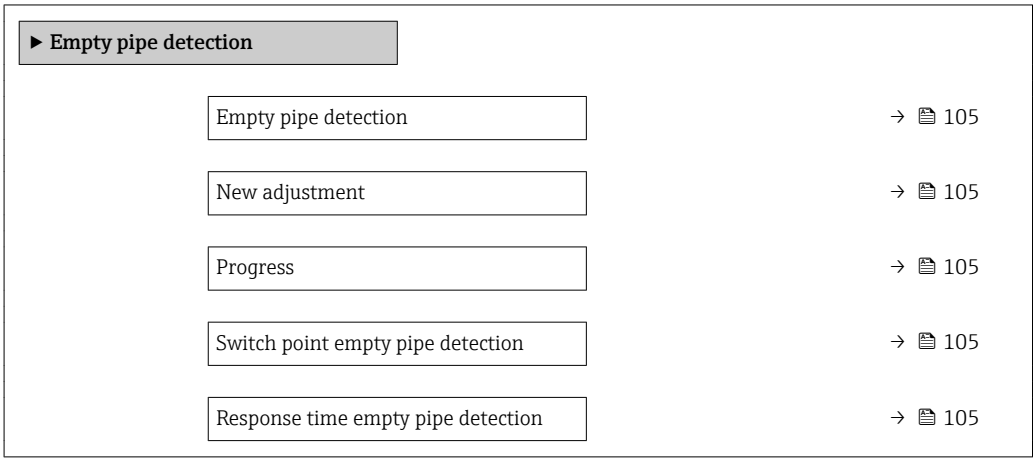
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
On value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 104): ▪ Volume flow ▪ Mass flow	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 104): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	One of the following options is selected in the **Assign process variable** parameter (→ 104): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

10.4.10 Configuring empty pipe detection

The **Empty pipe detection** submenu contains parameters that must be configured for the configuration of empty pipe detection.

Navigation

"Setup" menu → Empty pipe detection



Parameter overview with brief description

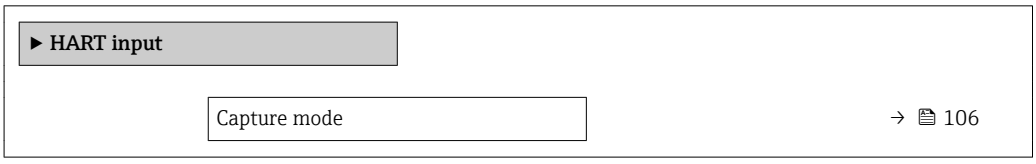
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Empty pipe detection	–	Switch empty pipe detection on and off.	▪ Off ▪ On	Off
New adjustment	The **On** option is selected in the **Empty pipe detection** parameter.	Select type of adjustment.	▪ Cancel ▪ Empty pipe adjust ▪ Full pipe adjust	Cancel
Progress	The **On** option is selected in the **Empty pipe detection** parameter.	Shows the progress.	▪ Ok ▪ Busy ▪ Not ok	–
Switch point empty pipe detection	The **On** option is selected in the **Empty pipe detection** parameter.	Enter hysteresis in %, below this value the measuring tube will detected as empty.	0 to 100 %	50 %
Response time empty pipe detection	In the **Empty pipe detection** parameter (→ 105), the **On** option is selected.	Enter the time before diagnostic message S862 "Pipe empty" is displayed for empty pipe detection.	0 to 100 s	1 s

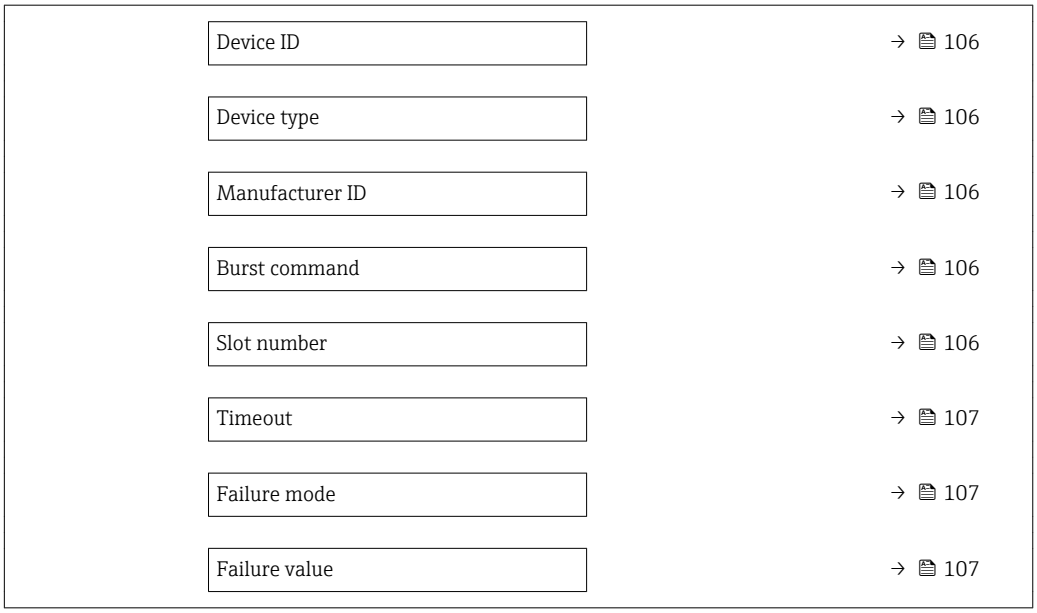
10.4.11 Configuring the HART input

The **HART input** wizard contains all the parameters that must be configured for the configuration of the HART input.

Navigation

"Setup" menu → HART input





"Configuration" submenu

Navigation
"Expert" menu → Communication → HART input → Configuration

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Capture mode	–	Select capture mode via burst or master communication.	▪ Off ▪ Burst network ▪ Master network	Off
Device ID	The **Master network** option is selected in the **Capture mode** parameter.	Enter device ID of external device.	6-digit value: ▪ Via local operation: enter as hexadecimal or decimal number ▪ Via operating tool: enter as decimal number	0
Device type	In the **Capture mode** parameter, the **Master network** option is selected.	Enter device type of external device.	2-digit hexadecimal number	0x00
Manufacturer ID	The **Master network** option is selected in the **Capture mode** parameter.	Enter manufacture ID of external device.	2-digit value: ▪ Via local operation: enter as hexadecimal or decimal number ▪ Via operating tool: enter as decimal number	0
Burst command	The **Burst network** option or the **Master network** option are selected in the **Capture mode** parameter.	Select command to read in external process variable.	▪ Command 1 ▪ Command 3 ▪ Command 9 ▪ Command 33	Command 1
Slot number	The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter.	Define position of external process variable in burst command.	1 to 8	1

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Timeout	The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter.	Enter deadline for process variable of external device. If the waiting time is exceeded, the diagnostic message ⊗**F410 Data transfer** is displayed.	1 to 120 s	5 s
Failure mode	In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected.	Define behavior if external process variable is missed.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	The following conditions are met: ▪ In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected. ▪ In the **Failure mode** parameter, the **Defined value** option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

"Input" submenu

Navigation
"Expert" menu → Communication → HART input → Input

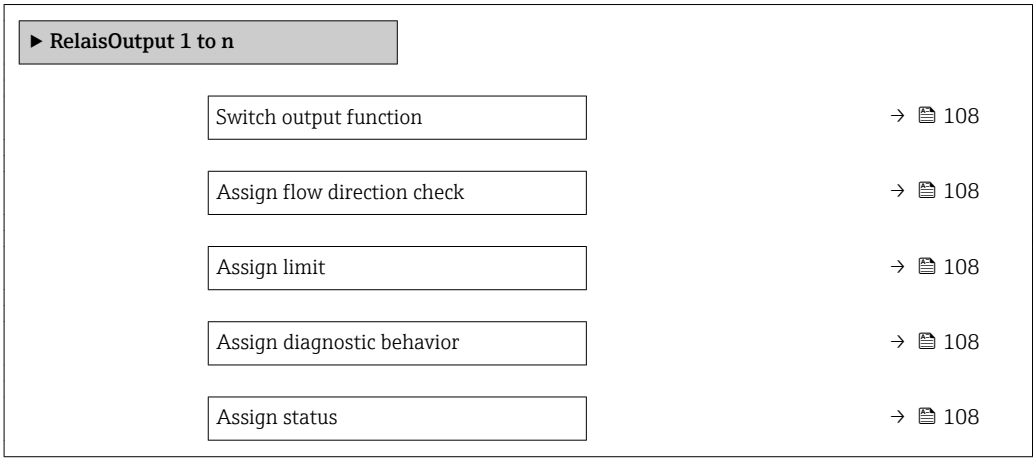
Parameter overview with brief description

Parameter	Description	User interface
Value		Signed floating-point number
Status		▪ Manual/Fixed ▪ Good ▪ Poor accuracy ▪ Bad

10.4.12 Configuring the relay output

The **Relay output** wizard guides the user systematically through all the parameters that have to be set for configuring the relay output.

Navigation
"Setup" menu → Relay output 1 to n



Switch-off value	→ 108
Switch-on value	→ 108
Failure mode	→ 109

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Relay output function	–	Select the function for the relay output.	▪ Closed ▪ Open ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Digital Output	Closed
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4)	–
Assign flow direction check	In the **Relay output function** parameter, the **Flow direction check** option is selected.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign limit	In the **Relay output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Electronic temperature	Volume flow
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select device status for switch output.	▪ Partially filled pipe detection ▪ Low flow cut off	Partially filled pipe detection
Switch-off value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal(us)/min
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Switch-on value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal(us)/min

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch-on delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open

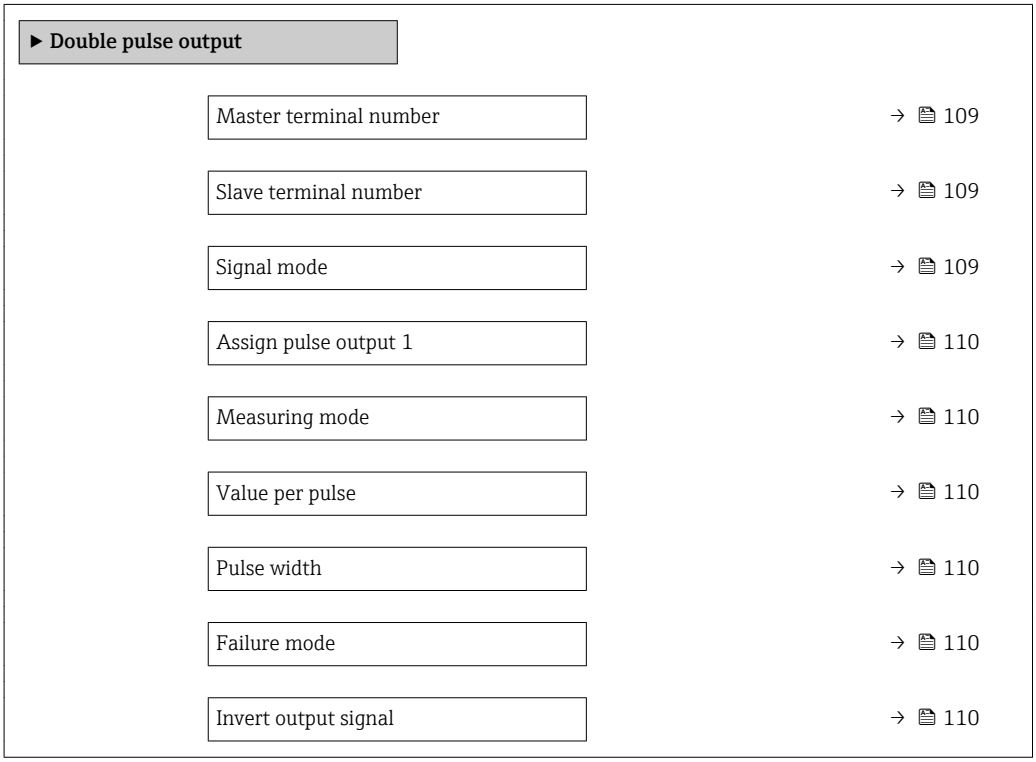
* Visibility depends on order options or device settings

10.4.13 Configuring the double pulse output

The **Double pulse output** submenu guides the user systematically through all the parameters that have to be set for configuring the double pulse output.

Navigation

"Setup" menu → Double pulse output



Parameter overview with brief description

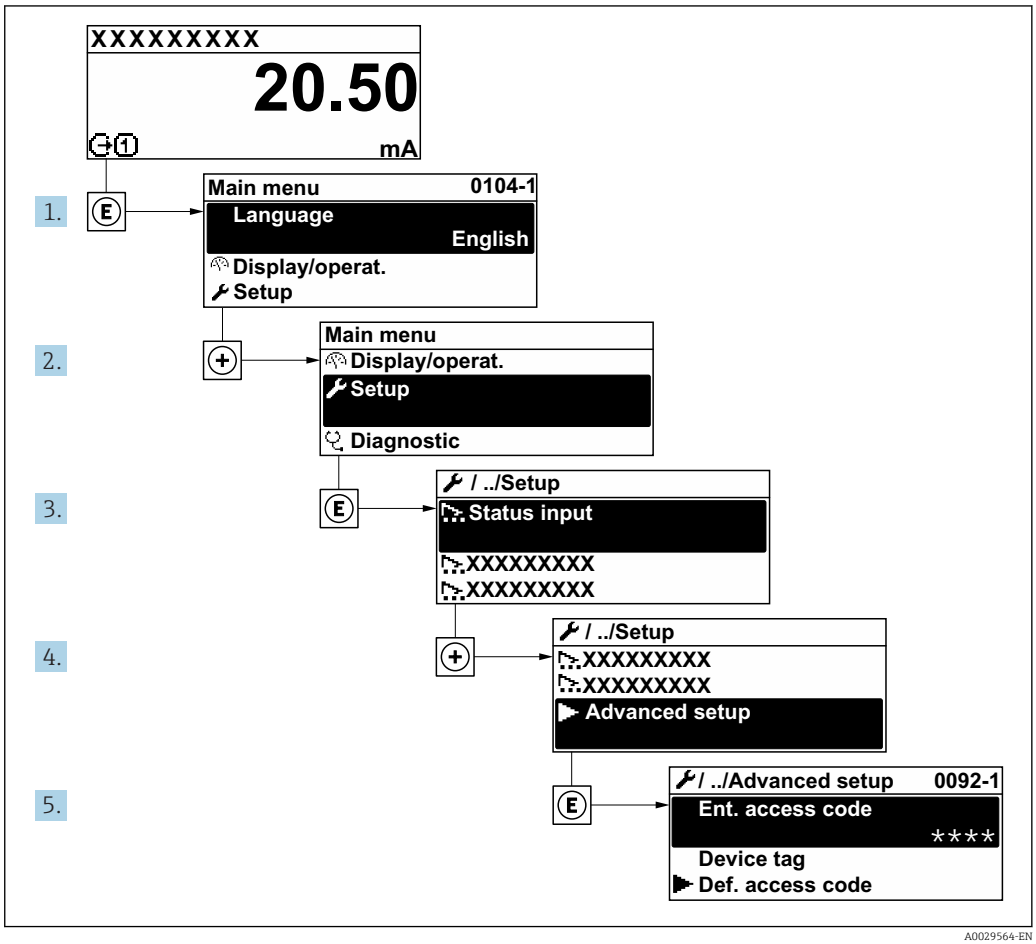
Parameter	Description	Selection / User interface / User entry	Factory setting
Signal mode	Select the signal mode for the double pulse output.	▪ Passive ▪ Active ▪ Passive NAMUR	Passive
Master terminal number	Shows the terminal numbers used by the master of the double pulse output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Slave terminal number		▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–

Parameter	Description	Selection / User interface / User entry	Factory setting
Assign pulse output 1	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Off
Measuring mode	Select measuring mode for pulse output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow ▪ Reverse flow compensation	Forward flow
Value per pulse	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	Define time width of the output pulse.	0.5 to 2 000 ms	0.5 ms
Failure mode	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	Invert the output signal.	▪ No ▪ Yes	No

10.5 Advanced settings

The **Advanced setup** submenu together with its submenus contains parameters for specific settings.

Navigation to the "Advanced setup" submenu



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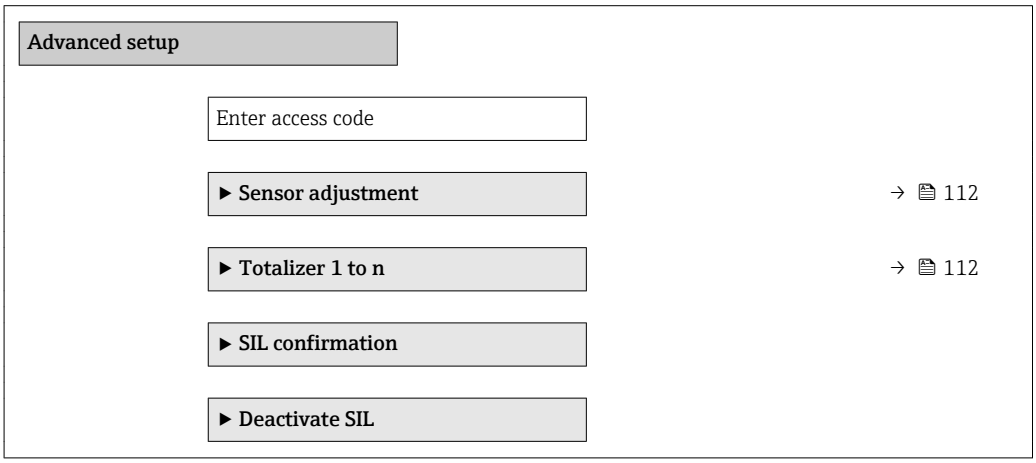
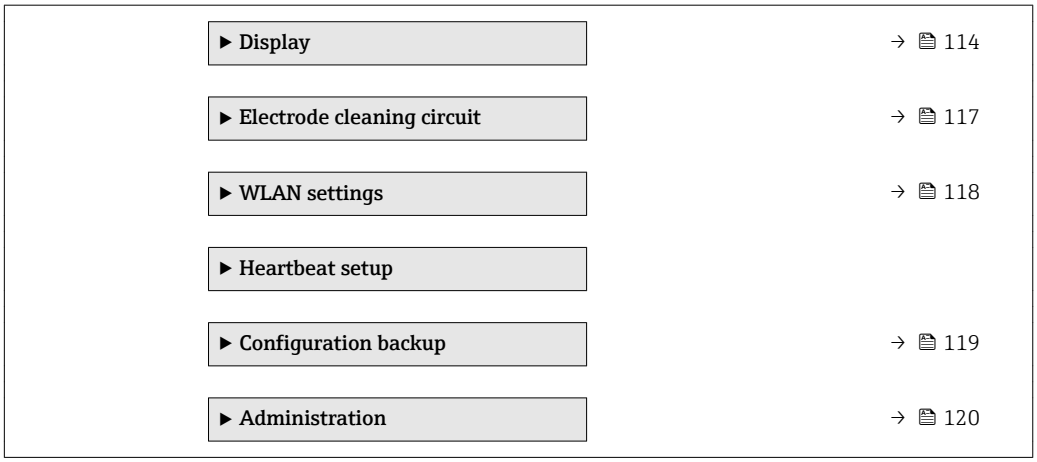
The number of submenus can vary depending on the device version. Some submenus are not dealt with in the Operating Instructions. These submenus and the parameters they contain are explained in the Special Documentation for the device.

Navigation

"Setup" menu → Advanced setup

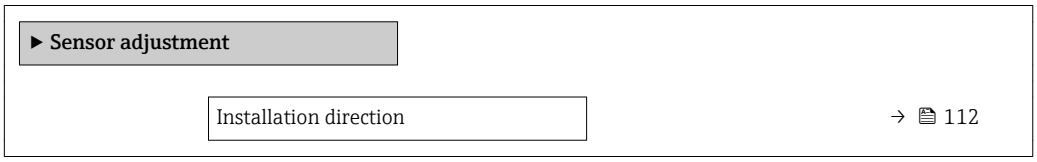




10.5.1 Carrying out a sensor adjustment

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

Navigation
"Setup" menu → Advanced setup → Sensor adjustment



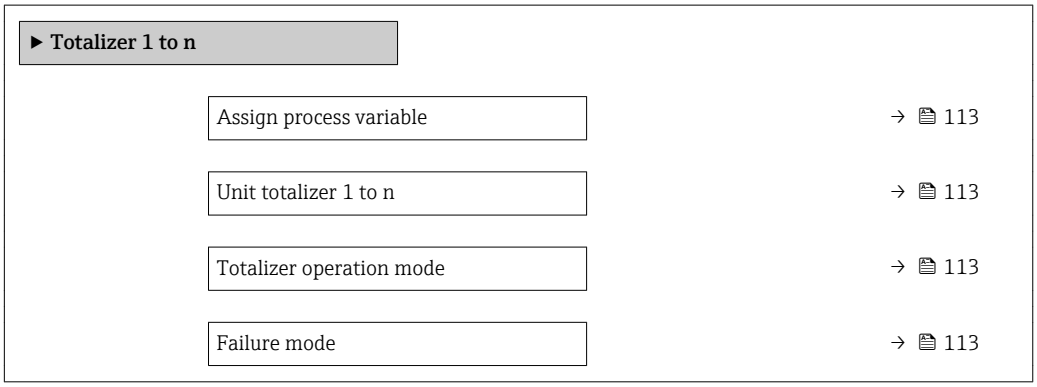
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	▪ Flow in arrow direction ▪ Flow against arrow direction	Flow in arrow direction

10.5.2 Configuring the totalizer

In the **"Totalizer 1 to n" submenu** the individual totalizer can be configured.

Navigation
"Setup" menu → Advanced setup → Totalizer 1 to n



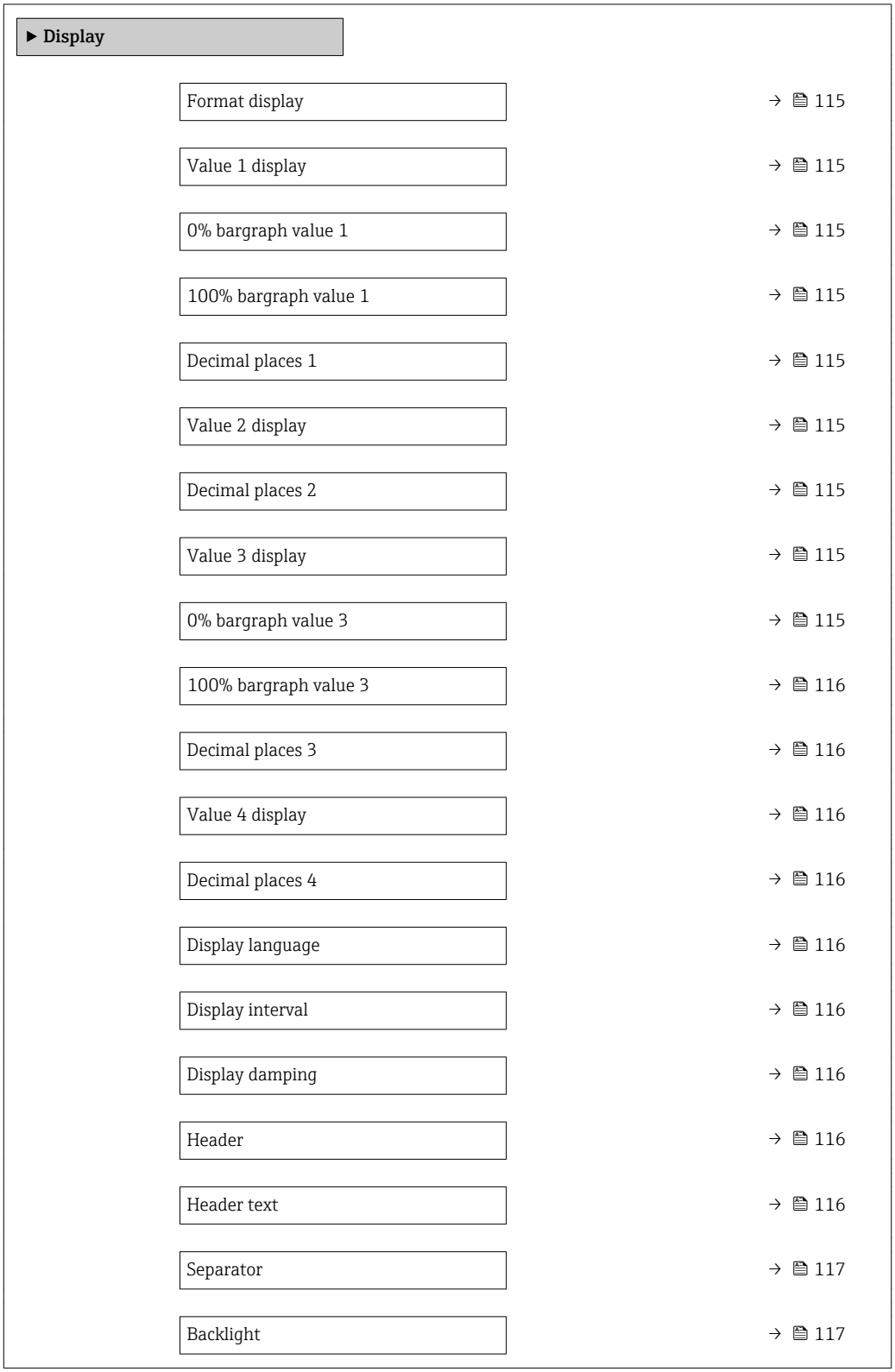
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Assign process variable	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Unit totalizer 1 to n	Select process variable totalizer unit.	Unit choose list	l
Totalizer operation mode	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total
Failure mode	Define totalizer behavior in alarm condition.	▪ Stop ▪ Actual value ▪ Last valid value	Stop

10.5.3 Carrying out additional display configurations

In the **Display** submenu you can set all the parameters associated with the configuration of the local display.

Navigation
"Setup" menu → Advanced setup → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is specified in the **Value 1 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	None
Decimal places 2	A measured value is specified in the **Value 2 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 103)	None
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Decimal places 3	A measured value is specified in the **Value 3 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 103)	None
Decimal places 4	A measured value is specified in the **Value 4 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Display language	A local display is provided.	Set display language.	▪ English ▪ Deutsch * ▪ Français * ▪ Español * ▪ Italiano * ▪ Nederlands * ▪ Portuguesa * ▪ Polski * ▪ русский язык (Russian) * ▪ Svenska * ▪ Türkçe * ▪ 中文 (Chinese) * ▪ 日本語 (Japanese) * ▪ 한국어 (Korean) * ▪ العَرَبيّة (Arabic) * ▪ Bahasa Indonesia * ▪ ภาษาไทย (Thai) * ▪ tiếng Việt (Vietnamese) * ▪ čeština (Czech) *	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	▪ Device tag ▪ Free text	Device tag
Header text	In the **Header** parameter, the **Free text** option is selected.	Enter display header text.	Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /)	----------

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	▪ . (point) ▪ , (comma)	. (point)
Backlight	One of the following conditions is met: ▪ Order code for "Display; operation", option **F** "4-line, illum.; touch control" ▪ Order code for "Display; operation", option **G** "4-line, illum.; touch control +WLAN"	Switch the local display backlight on and off.	▪ Disable ▪ Enable	Enable

* Visibility depends on order options or device settings

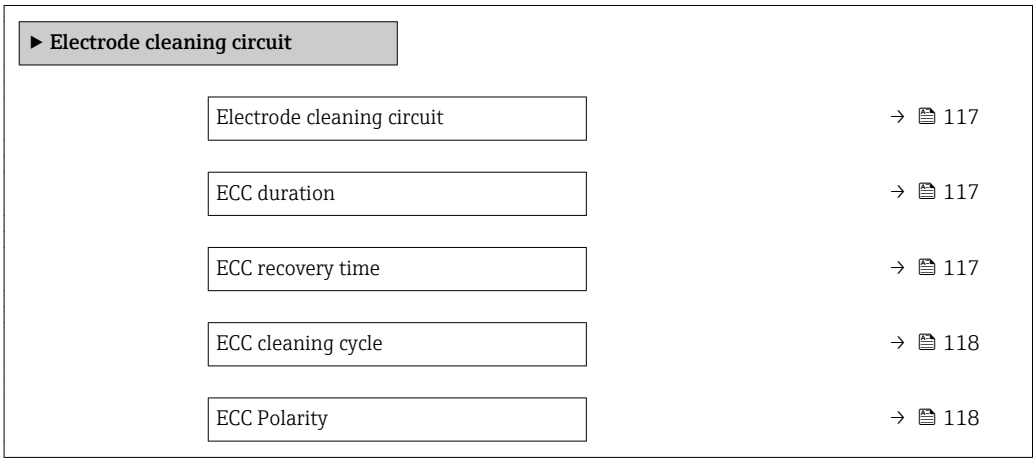
10.5.4 Performing electrode cleaning

The **Electrode cleaning circuit** submenu contains parameters that must be configured for the configuration of electrode cleaning.

The submenu is only available if the device was ordered with electrode cleaning.

Navigation

"Setup" menu → Advanced setup → Electrode cleaning circuit



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Electrode cleaning circuit	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enable the cyclic electrode cleaning circuit.	▪ Off ▪ On	Off
ECC duration	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enter the duration of electrode cleaning in seconds.	0.01 to 30 s	2 s
ECC recovery time	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Define recovery time after electrode cleaning. During this time the current output values will be held at last valid value.	1 to 600 s	60 s

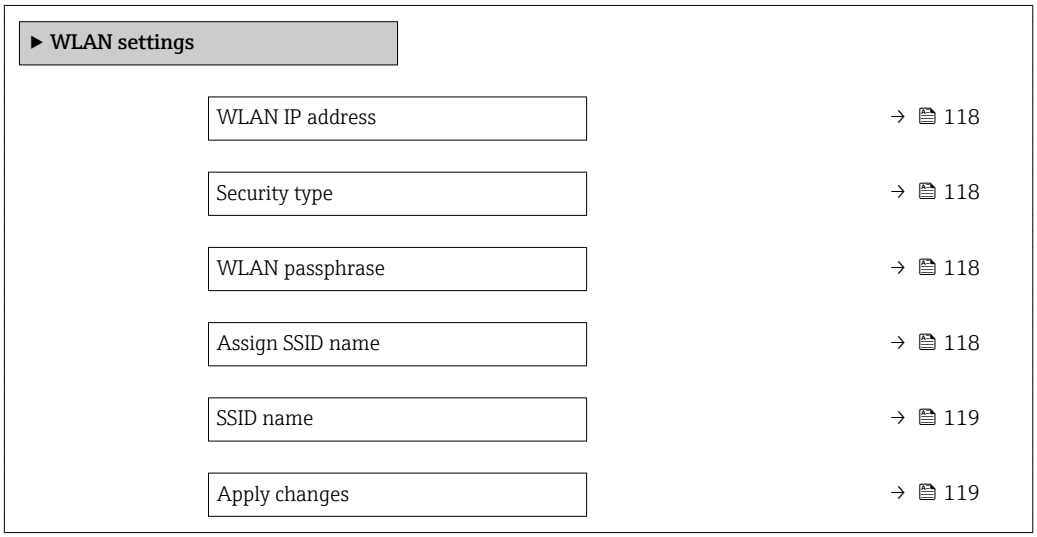
Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
ECC cleaning cycle	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enter the pause duration between electrode cleaning cycles.	0.5 to 168 h	0.5 h
ECC Polarity	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Select the polarity of the electrode cleaning circuit.	▪ Positive ▪ Negative	Depends on the electrode material: ▪ Platinum: **Negative** option ▪ Tantalum, Alloy C22, stainless steel: **Positive** option

10.5.5 WLAN configuration

The **WLAN Settings** submenu guides the user systematically through all the parameters that have to be set for the WLAN configuration.

Navigation

"Setup" menu → Advanced setup → WLAN Settings



Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
WLAN IP address	–	Enter IP address of the device WLAN interface.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
Security type	–	Select the security type of the WLAN interface.	▪ Unsecured ▪ WPA2-PSK	WPA2-PSK
WLAN passphrase	In the **Security type** parameter, the **WPA2-PSK** option is selected.	Enter the network key (8 to 32 characters). The network key supplied with the device should be changed during commissioning for security reasons.	8 to 32-digit character string comprising numbers, letters and special characters	Serial number of the measuring device (e.g. L100A802000)
Assign SSID name	–	Select which name will be used for SSID: device tag or user-defined name.	▪ Device tag ▪ User-defined	User-defined

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
SSID name	In the **Assign SSID name** parameter, the **User-defined** option is selected.	Enter the user-defined SSID name (max. 32 characters). The user-defined SSID name may only be assigned once. If the SSID name is assigned more than once, the devices can interfere with one another.	Max. 32-digit character string comprising numbers, letters and special characters	EH_device designation_last 7 digits of the serial number (e.g. EH_Promag_500_A 802000)
Apply changes	–	Use changed WLAN settings.	▪ Cancel ▪ Ok	Cancel

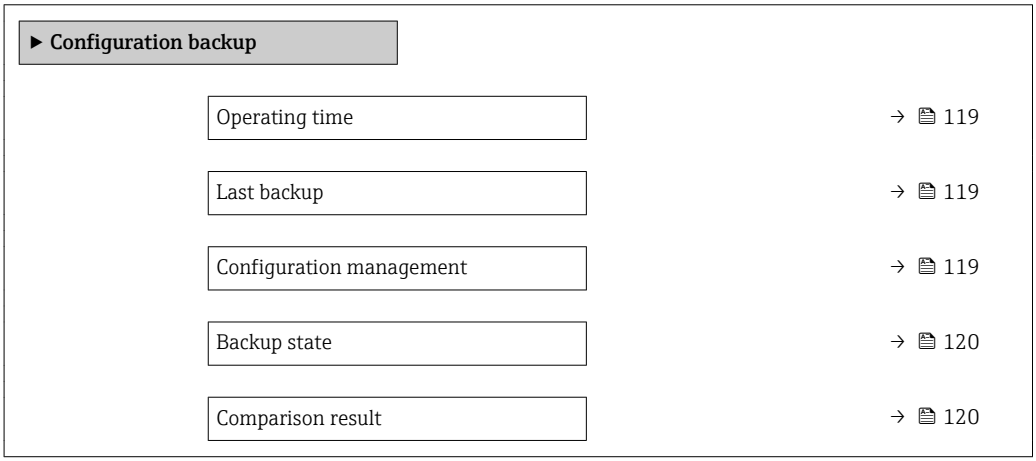
10.5.6 Configuration management

After commissioning, you can save the current device configurationor restore the previous device configuration.

You can do so using the **Configuration management** parameter and the related options found in the **Configuration backup** submenu.

Navigation

"Setup" menu → Advanced setup → Configuration backup



Parameter overview with brief description

Parameter	Description	User interface / Selection	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Last backup	Shows when the last data backup was saved to embedded HistoROM.	Days (d), hours (h), minutes (m) and seconds (s)	–
Configuration management	Select action for managing the device data in the embedded HistoROM.	▪ Cancel ▪ Execute backup ▪ Restore ▪ Compare ▪ Clear backup data	Cancel

Parameter	Description	User interface / Selection	Factory setting
Backup state	Shows the current status of data saving or restoring.	▪ None ▪ Backup in progress ▪ Restoring in progress ▪ Delete in progress ▪ Compare in progress ▪ Restoring failed ▪ Backup failed	None
Comparison result	Comparison of current device data with embedded HistoROM.	▪ Settings identical ▪ Settings not identical ▪ No backup available ▪ Backup settings corrupt ▪ Check not done ▪ Dataset incompatible	Check not done

Function scope of the "Configuration management" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Execute backup	A backup copy of the current device configuration is saved from the integrated HistoROM to the memory of the device. The backup copy includes the transmitter data of the device.
Restore	The last backup copy of the device configuration is restored from the device memory to the device's integrated HistoROM. The backup copy includes the transmitter data of the device.
Compare	The device configuration saved in the device memory is compared with the current device configuration of the integrated HistoROM.
Clear backup data	The backup copy of the device configuration is deleted from the memory of the device.

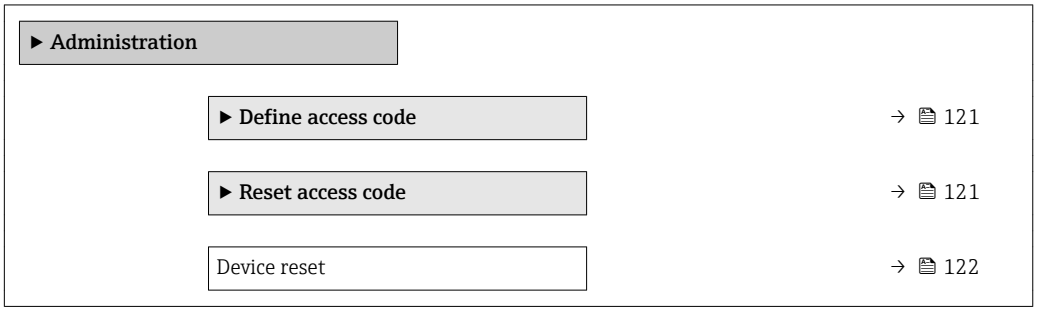
Integrated HistoROM
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

10.5.7 Using parameters for device administration

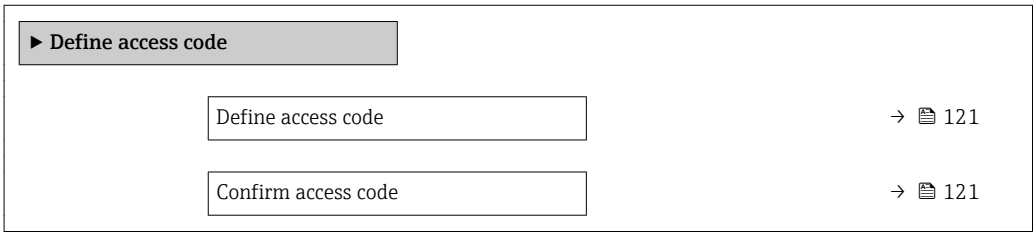
The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation
"Setup" menu → Advanced setup → Administration



Using the parameter to define the access code

Navigation
"Setup" menu → Advanced setup → Administration → Define access code

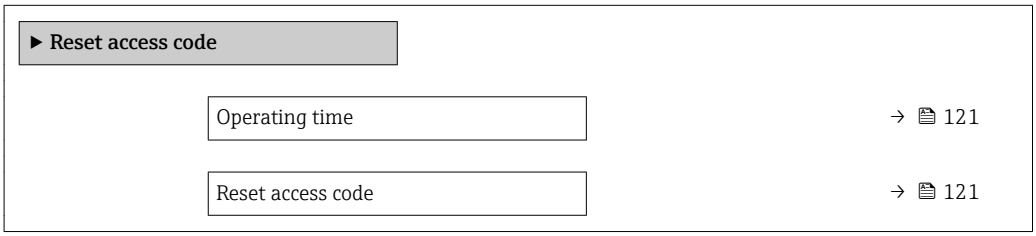


Parameter overview with brief description

Parameter	Description	User entry
Define access code	Restrict write-access to parameters to protect the configuration of the device against unintentional changes.	Max. 16-digit character string comprising numbers, letters and special characters
Confirm access code	Confirm the entered access code.	Max. 16-digit character string comprising numbers, letters and special characters

Using the parameter to reset the access code

Navigation
"Setup" menu → Advanced setup → Administration → Reset access code



Parameter overview with brief description

Parameter	Description	User interface / User entry	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Reset access code	Reset access code to factory settings. For a reset code, contact your Endress+Hauser service organization. The reset code can only be entered via: ▪ Web browser ▪ DeviceCare, FieldCare (via service interface CDI-RJ45) ▪ Fieldbus	Character string comprising numbers, letters and special characters	0x00

Using the parameter to reset the device

Navigation
"Setup" menu → Advanced setup → Administration

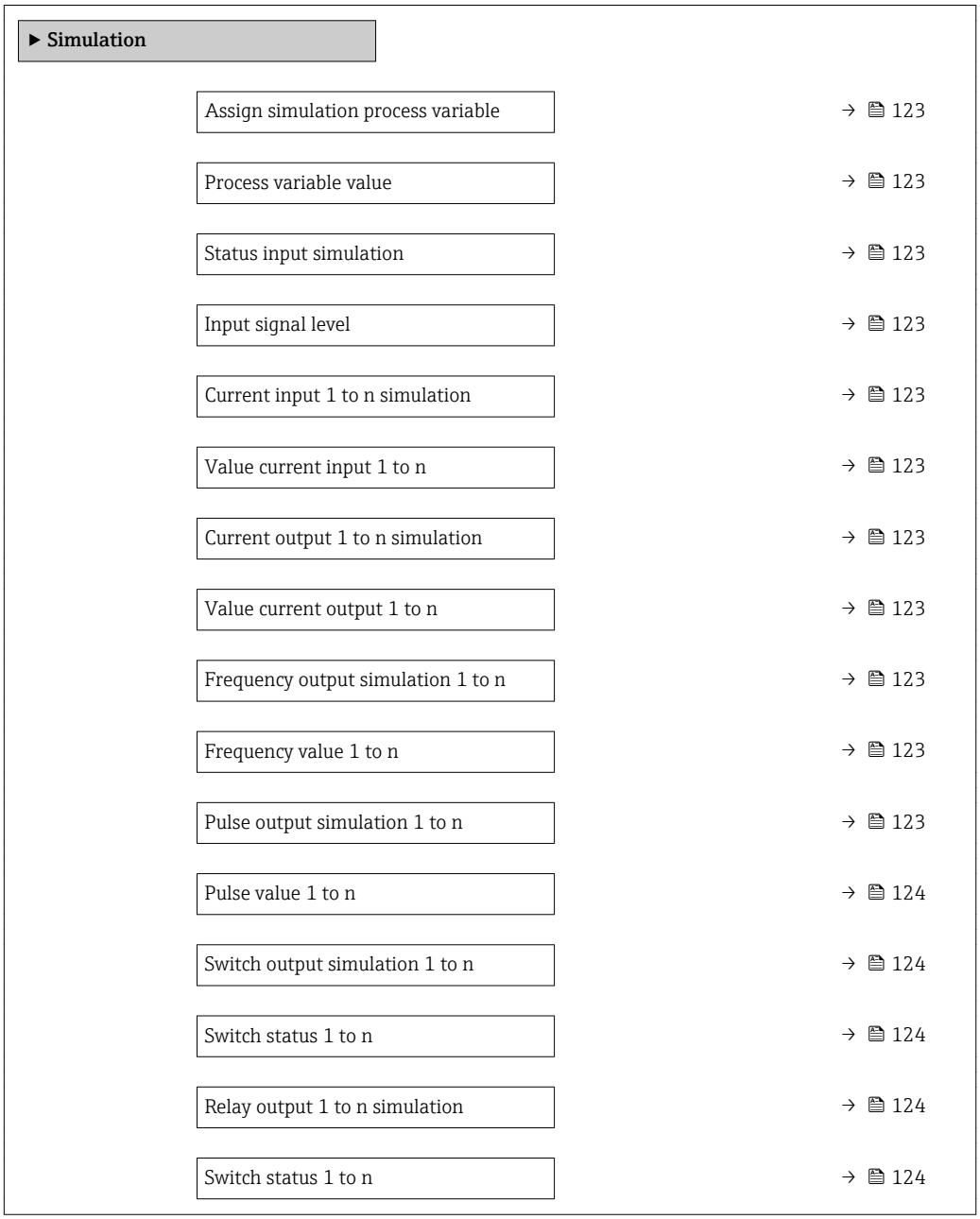
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	▪ Cancel ▪ To delivery settings ▪ Restart device ▪ Restore S-DAT backup	Cancel

10.6 Simulation

The **Simulation** submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

Navigation
"Diagnostics" menu → Simulation



Pulse output simulation	→ 124
Pulse value	→ 124
Device alarm simulation	→ 124
Diagnostic event category	→ 124
Diagnostic event simulation	→ 124

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity *	Off
Process variable value	–	Enter the simulation value for the selected process variable.	Depends on the process variable selected	0
Status input simulation	–	Switch simulation of the status input on and off.	▪ Off ▪ On	Off
Input signal level	In the **Status input simulation** parameter, the **On** option is selected.	Select the signal level for the simulation of the status input.	▪ High ▪ Low	High
Current input 1 to n simulation	–	Switch simulation of the current input on and off.	▪ Off ▪ On	Off
Value current input 1 to n	In the **Current input 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	0 to 22.5 mA	0 mA
Current output 1 to n simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On	Off
Value current output 1 to n	In the **Current output 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA	3.59 mA
Frequency output simulation 1 to n	In the **Operating mode** parameter, the **Frequency** option is selected.	Switch the simulation of the frequency output on and off.	▪ Off ▪ On	Off
Frequency value 1 to n	In the **Frequency output simulation 1 to n** parameter, the **On** option is selected.	Enter the frequency value for the simulation.	0.0 to 12 500.0 Hz	0.0 Hz
Pulse output simulation 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter (→ 97) defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Pulse value 1 to n	In the **Pulse output simulation 1 to n** parameter, the **Down-counting value** option is selected.	Enter the number of pulses for simulation.	0 to 65 535	0
Switch output simulation 1 to n	In the **Operating mode** parameter, the **Switch** option is selected.	Switch the simulation of the switch output on and off.	▪ Off ▪ On	Off
Switch status 1 to n	–	Select the status of the status output for the simulation.	▪ Open ▪ Closed	Open
Relay output 1 to n simulation	–	Switch simulation of the relay output on and off.	▪ Off ▪ On	Off
Switch status 1 to n	In the **Switch output simulation 1 to n** parameter, the **On** option is selected.	Select status of the relay output for the simulation.	▪ Open ▪ Closed	Open
Pulse output simulation	–	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off
Pulse value	In the **Pulse output simulation** parameter, the **Down-counting value** option is selected.	Set and switch off the pulse output simulation.	0 to 65 535	0
Device alarm simulation	–	Switch the device alarm on and off.	▪ Off ▪ On	Off
Diagnostic event category	–	Select a diagnostic event category.	▪ Sensor ▪ Electronics ▪ Configuration ▪ Process	Process
Diagnostic event simulation	–	Select a diagnostic event to simulate this event.	▪ Off ▪ Diagnostic event picklist (depends on the category selected)	Off
Logging interval	–	Define the logging interval tlog for data logging. This value defines the time interval between the individual data points in the memory.	1.0 to 3 600.0 s	–

* Visibility depends on order options or device settings

10.7 Protecting settings from unauthorized access

The following write protection options exist in order to protect the configuration of the measuring device from unintentional modification:
- Protect access to parameters via access code → 125
- Protect access to local operation via key locking → 69
- Protect access to measuring device via write protection switch → 126

10.7.1 Write protection via access code

The effects of the user-specific access code are as follows:
- Via local operation, the parameters for the measuring device configuration are write-protected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.
- Device access is protected via FieldCare or DeviceCare (via CDI-RJ45 service interface), as are the parameters for the measuring device configuration.

Defining the access code via local display

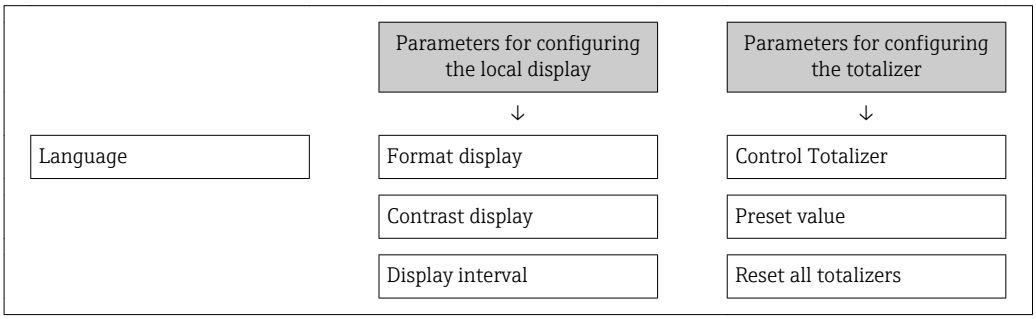
1. Navigate to the **Define access code** parameter (→ 121).
2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 121) to confirm the code.
   ↳ The -symbol appears in front of all write-protected parameters.

The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 69.
- The user role with which the user is currently logged on via the local display is indicated by the → 69 **Access status** parameter. Navigation path: Operation → Access status

Parameters which can always be modified via the local display

Certain parameters that do not affect the measurement are excepted from parameter write protection via the local display. Despite the user-specific access code, they can always be modified, even if the other parameters are locked.



Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 121).
2. Max. Define a max. 4-digit numeric code as an access code.

3. Enter the access code again in the **Confirm access code** parameter (→ 121) to confirm the code.
   ↳ The Web browser switches to the login page.

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 69.
- The user role with which the user is currently logged on via Web browser is indicated by the **Access status** parameter. Navigation path: Operation → Access status

Resetting the access code

If you misplace the user-specific access code, it is possible to reset the code to the factory setting. A reset code must be entered for this purpose. The user-specific access code can then be defined again afterwards.

Via Web browser, FieldCare, DeviceCare (via CDI-RJ45 service interface), fieldbus

For a reset code, contact your Endress+Hauser service organization.

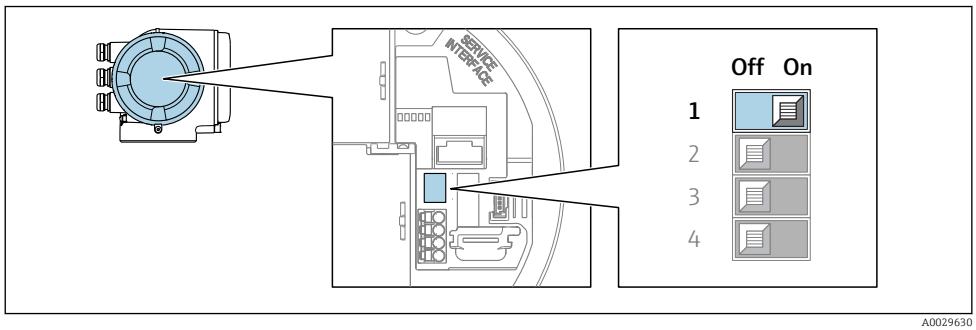
1. Navigate to the **Reset access code** parameter (→ 121).
2. Enter the reset code.
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 125.

10.7.2 Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for the **"Contrast display" parameter** - to be locked.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via HART protocol

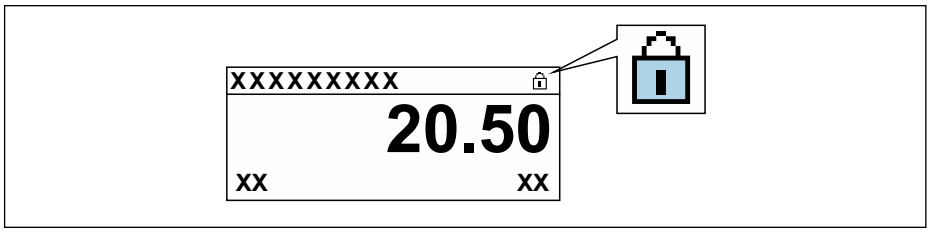
1.



A0029630

Setting the write protection (WP) switch on the main electronics module to the **ON** position enables hardware write protection.

↳ In the **Locking status** parameter the **Hardware locked** option is displayed → 🖹 128. In addition, on the local display the 🔒-symbol appears in front of the parameters in the header of the operational display and in the navigation view.



A0029425

2. Setting the write protection (WP) switch on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.

↳ No option is displayed in the **Locking status** parameter → 🖹 128. On the local display, the 🔒-symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

11 Operation

11.1 Reading the device locking status

Device active write protection: **Locking status** parameter

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access status displayed in the **Access status** parameter applies → 69. Only appears on local display.
Hardware locked	The DIP switch for hardware locking is activated on the PCB board. This locks write access to the parameters (e.g. via local display or operating tool).
SIL locked	The SIL mode is enabled. This locks write access to the parameters (e.g. via local display or operating tool).
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc.). Once the internal processing has been completed, the parameters can be changed once again.

11.2 Adjusting the operating language

Detailed information:
- To configure the operating language → 87
- For information on the operating languages supported by the measuring device → 187

11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 102
- On the advanced settings for the local display → 114

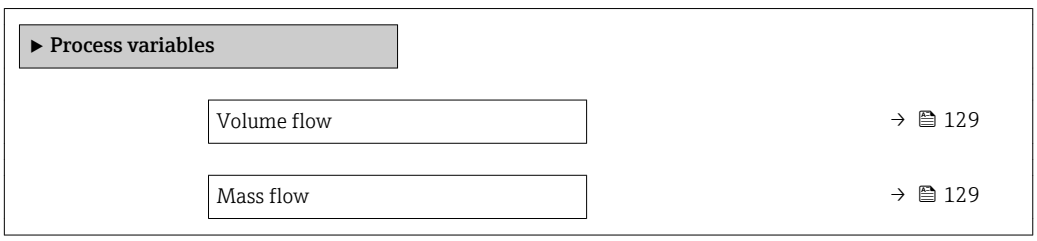
11.4 Reading measured values

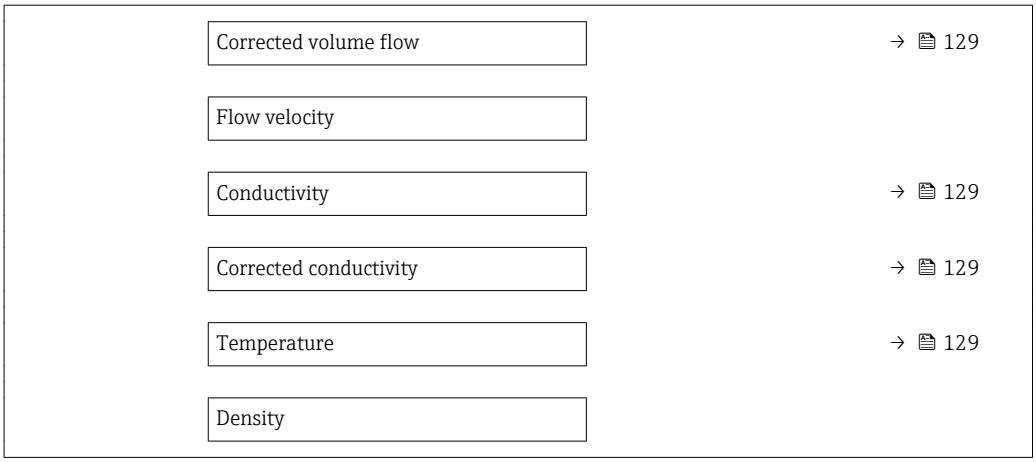
With the **Measured values** submenu, it is possible to read all the measured values.

11.4.1 Process variables

The **Measured variables** submenu contains all the parameters needed to display the current measured values for each process variable.

Navigation
"Diagnostics" menu → Measured values → Process variables





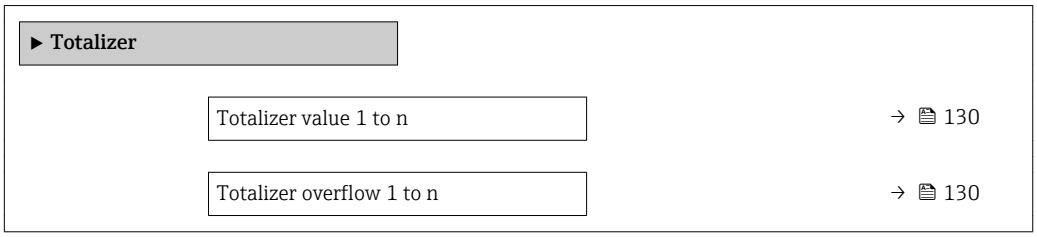
Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Volume flow	–	Displays the volume flow currently measured. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 90).	Signed floating-point number
Mass flow	–	Displays the mass flow currently calculated. *Dependency* The unit is taken from the **Mass flow unit** parameter (→ 90).	Signed floating-point number
Conductivity	–	Displays the conductivity currently measured. *Dependency* The unit is taken from the **Conductivity unit** parameter (→ 90).	Signed floating-point number
Corrected volume flow	–	Displays the corrected volume flow currently calculated. *Dependency* The unit is taken from the **Corrected volume flow unit** parameter (→ 90).	Signed floating-point number
Temperature	One of the following conditions is met: ▪ Order code for "Sensor option", option **CI** "Medium temperature measurement" or ▪ The temperature is read into the flowmeter from an external device.	Displays the temperature currently calculated. *Dependency* The unit is taken from the **Temperature unit** parameter (→ 90).	Positive floating-point number
Corrected conductivity	One of the following conditions is met: ▪ Order code for "Sensor option", option **CI** "Medium temperature measurement" or ▪ The temperature is read into the flowmeter from an external device.	Displays the conductivity currently corrected. *Dependency* The unit is taken from the **Conductivity unit** parameter (→ 90).	Positive floating-point number

11.4.2 "Totalizer" submenu

The **Totalizer** submenu contains all the parameters needed to display the current measured values for every totalizer.

Navigation
"Diagnostics" menu → Measured values → Totalizer



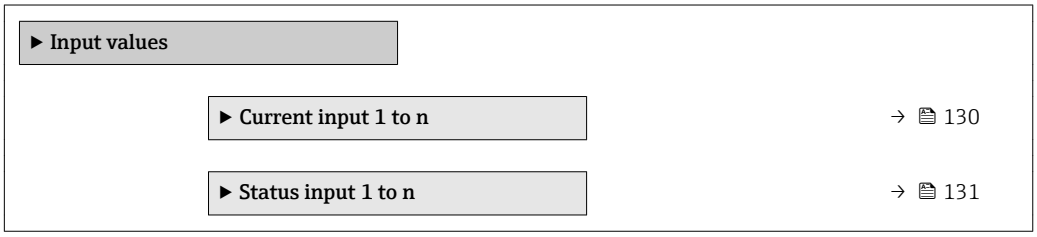
Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Totalizer value 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 113) of the **Totalizer 1 to n** submenu.	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 113) of the **Totalizer 1 to n** submenu.	Displays the current totalizer overflow.	Integer with sign

11.4.3 "Input values" submenu

The **Input values** submenu guides you systematically to the individual input values.

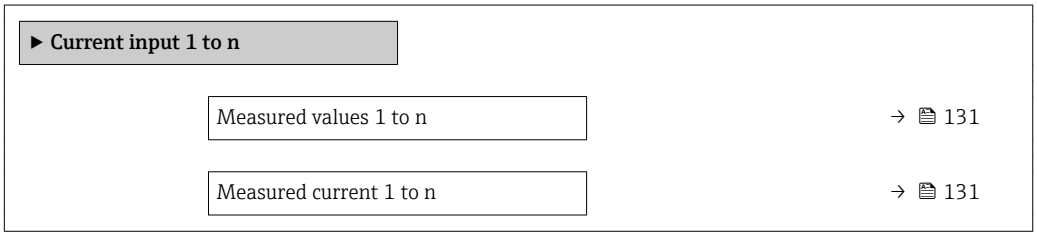
Navigation
"Diagnostics" menu → Measured values → Input values



Input values of current input

The **Current input 1 to n** submenu contains all the parameters needed to display the current measured values for every current input.

Navigation
"Diagnostics" menu → Measured values → Input values → Current input 1 to n



Parameter overview with brief description

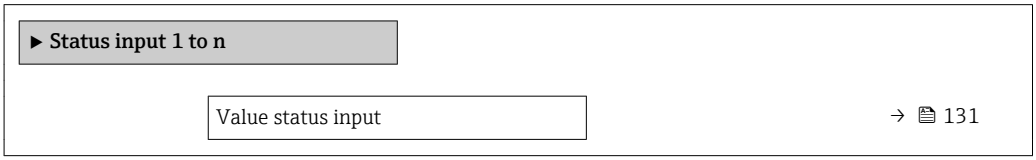
Parameter	Description	User interface
Measured values 1 to n	Displays the current input value.	Signed floating-point number
Measured current 1 to n	Displays the current value of the current input.	0 to 22.5 mA

Input values of status input

The **Status input 1 to n** submenu contains all the parameters needed to display the current measured values for every status input.

Navigation

"Diagnostics" menu → Measured values → Input values → Status input 1 to n



Parameter overview with brief description

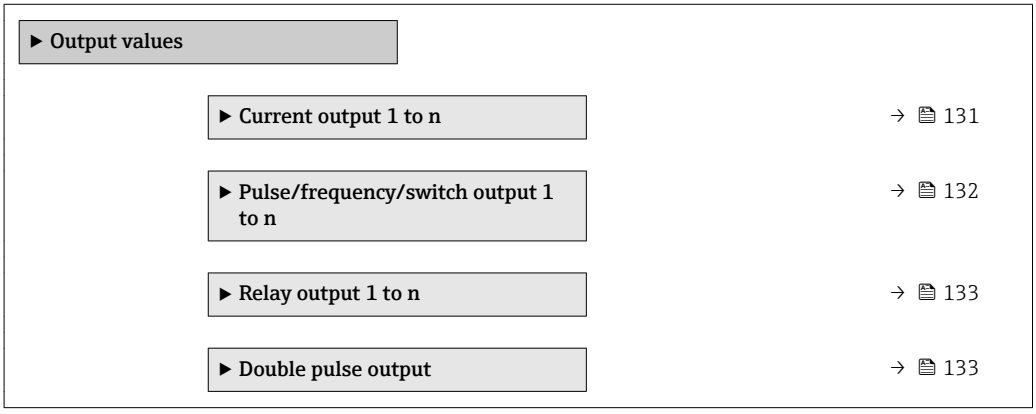
Parameter	Description	User interface
Value status input	Shows the current input signal level.	▪ High ▪ Low

11.4.4 Output values

The **Output values** submenu contains all the parameters needed to display the current measured values for every output.

Navigation

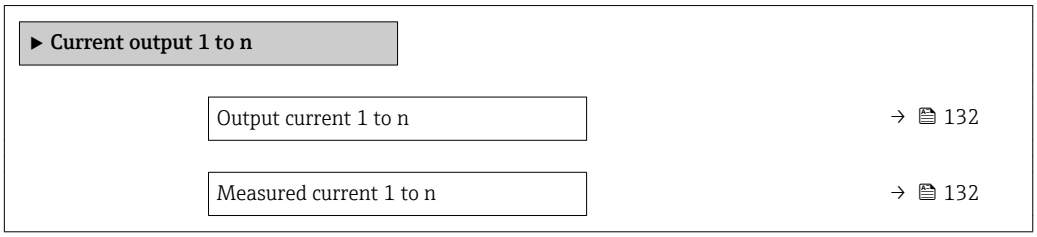
"Diagnostics" menu → Measured values → Output values



Output values of current output

The **Value current output** submenu contains all the parameters needed to display the current measured values for every current output.

Navigation
"Diagnostics" menu → Measured values → Output values → Value current output 1 to n



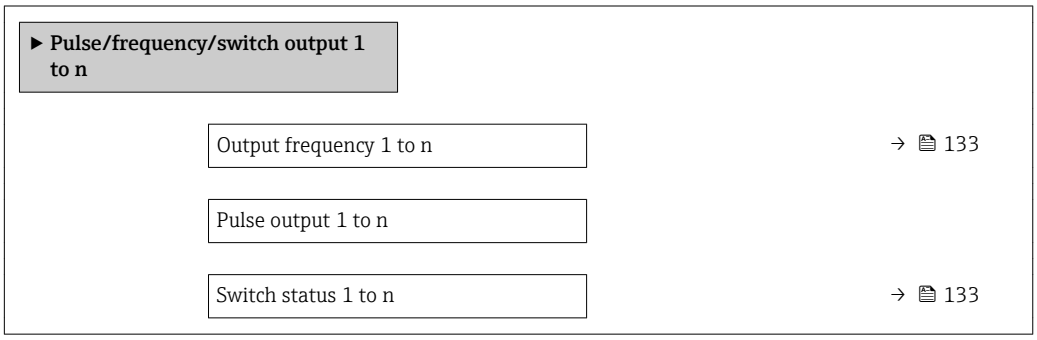
Parameter overview with brief description

Parameter	Description	User interface
Output current 1	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current	Displays the current value currently measured for the current output.	0 to 30 mA

Output values for pulse/frequency/switch output

The **Pulse/frequency/switch output 1 to n** submenu contains all the parameters needed to display the current measured values for every pulse/frequency/switch output.

Navigation
"Diagnostics" menu → Measured values → Output values → Pulse/frequency/switch output 1 to n



Parameter overview with brief description

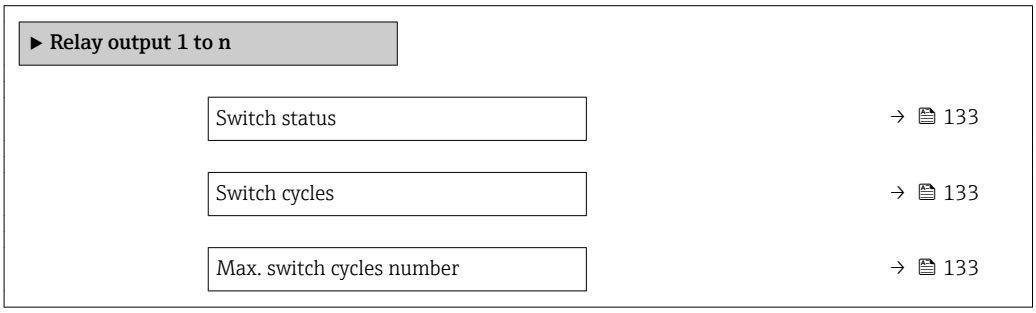
Parameter	Prerequisite	Description	User interface / User entry	Factory setting
Output frequency	In the **Operating mode** parameter, the **Frequency** option is selected.	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz	–
Value per pulse	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 97): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Switch status	The **Switch** option is selected in the **Operating mode** parameter.	Displays the current switch output status.	▪ Open ▪ Closed	–

Output values for relay output

The **Relay output 1 to n** submenu contains all the parameters needed to display the current measured values for every relay output.

Navigation

"Diagnostics" menu → Measured values → Output values → Relay output 1 to n



Parameter overview with brief description

Parameter	Description	User interface
Switch status	Shows the current relay switch status.	▪ Open ▪ Closed
Switch cycles	Shows number of all performed switch cycles.	Positive integer
Max. switch cycles number	Shows the maximal number of guaranteed switch cycles.	Positive integer

Output values for double pulse output

The **Double pulse output** submenu contains all the parameters needed to display the current measured values for every double pulse output.

Navigation
"Diagnostics" menu → Measured values → Output values → Double pulse output

▶ Double pulse output		
	Pulse output	→ 134

Parameter overview with brief description

Parameter	Description	User interface
Pulse output	Shows the currently output pulse frequency.	Positive floating-point number

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 87)
- Advanced settings using the**Advanced setup** submenu (→ 111)

11.6 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:
- Control Totalizer
- Reset all totalizers

Navigation
"Operation" menu → Totalizer handling

▶ Totalizer handling		
	Control Totalizer 1 to n	→ 135
	Preset value 1 to n	→ 135
	Reset all totalizers	→ 135

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Control Totalizer 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 113)**Totalizer 1 to n** submenu: Volume flow	Control totalizer value.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize ▪ Hold	Totalize
Preset value 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 113)**Totalizer 1 to n** submenu: Volume flow	Specify start value for totalizer. *Dependency* The unit of the selected process variable is specified for the totalizer in the **Unit totalizer** parameter (→ 113).	Signed floating-point number	0 l
Reset all totalizers	–	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	Cancel

11.6.1 Function scope of the "Control Totalizer" parameter

Options	Description
Totalize	The totalizer is started or continues running.
Reset + hold	The totaling process is stopped and the totalizer is reset to 0.
Preset + hold	The totaling process is stopped and the totalizer is set to its defined start value from the **Preset value** parameter.
Reset + totalize	The totalizer is reset to 0 and the totaling process is restarted.
Preset + totalize	The totalizer is set to the defined start value from the **Preset value** parameter and the totaling process is restarted.
Hold	Totalizing is stopped.

11.6.2 Function scope of the "Reset all totalizers" parameter

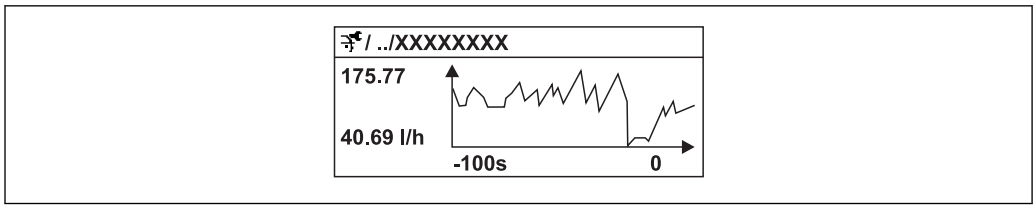
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

11.7 Showing data logging

The **Extended HistoROM** application package must be enabled in the device (order option) for the **Data logging** submenu to appear. This contains all the parameters for the measured value history.

Data logging is also available via:
- Plant Asset Management Tool FieldCare → 79.
- Web browser→ 70

Function range
- A total of 1000 measured values can be stored
- 4 logging channels
- Adjustable logging interval for data logging
- Display of the measured value trend for each logging channel in the form of a chart

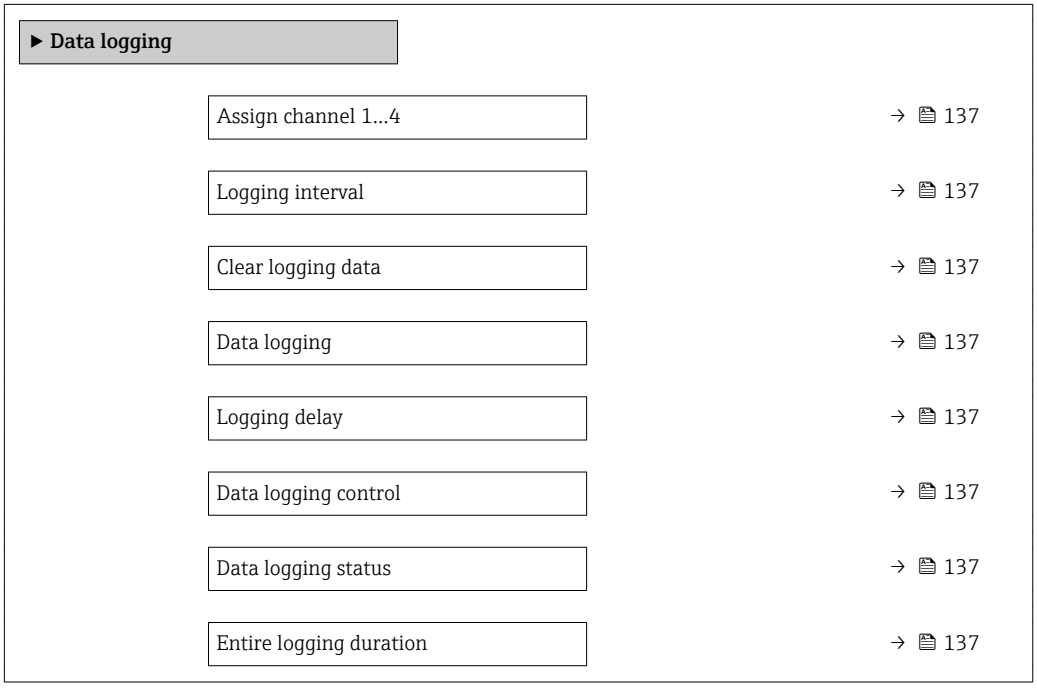


35 *Chart of a measured value trend*

- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

If the length of the logging interval or the assignment of the process variables to the channels is changed, the content of the data logging is deleted.

Navigation
"Diagnostics" menu → Data logging



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign channel 1 to n	The **Extended HistoROM** application package is available.	Assign process variable to logging channel.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Off
Logging interval	The **Extended HistoROM** application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	0.1 to 999.0 s	1.0 s
Clear logging data	The **Extended HistoROM** application package is available.	Clear the entire logging data.	▪ Cancel ▪ Clear data	Cancel
Data logging	–	Select the data logging method.	▪ Overwriting ▪ Not overwriting	Overwriting
Logging delay	In the **Data logging** parameter, the **Not overwriting** option is selected.	Enter the time delay for measured value logging.	0 to 999 h	0 h
Data logging control	In the **Data logging** parameter, the **Not overwriting** option is selected.	Start and stop measured value logging.	▪ None ▪ Delete + start ▪ Stop	None
Data logging status	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the measured value logging status.	▪ Done ▪ Delay active ▪ Active ▪ Stopped	Done
Entire logging duration	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the total logging duration.	Positive floating-point number	0 s

* Visibility depends on order options or device settings

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Error	Possible causes	Solution
Local display dark and no output signals	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage .
Local display dark and no output signals	The polarity of the supply voltage is wrong.	Correct the polarity.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
Local display dark and no output signals	Terminals are not plugged into the I/O electronics module correctly. Terminals are not plugged into the main electronics module correctly.	Check terminals.
Local display dark and no output signals	I/O electronics module is defective. Main electronics module is defective.	Order spare part → 160.
Local display dark and no output signals	The connector between the main electronics module and display module is not plugged in correctly.	Check the connection and correct if necessary.
Local display dark and no output signals	The connecting cable is not plugged in correctly.	1. Check the connection of the electrode cable and correct if necessary. 2. Check the connection of the coil current cable and correct if necessary.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 160.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured.	1. Press ⊟ + ⊞ for 2 s ("home position"). 2. Press Ⓔ. 3. Set the desired language in the **Display language** parameter (→ 116).
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	▪ Check the cable and the connector between the main electronics module and display module. ▪ Order spare part → 160.

For output signals

Error	Possible causes	Solution
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 160.
Signal output outside the valid current range (< 3.6 mA or > 22 mA)	Main electronics module is defective. I/O electronics module is defective.	Order spare part → 160.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error	Check and correct the parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

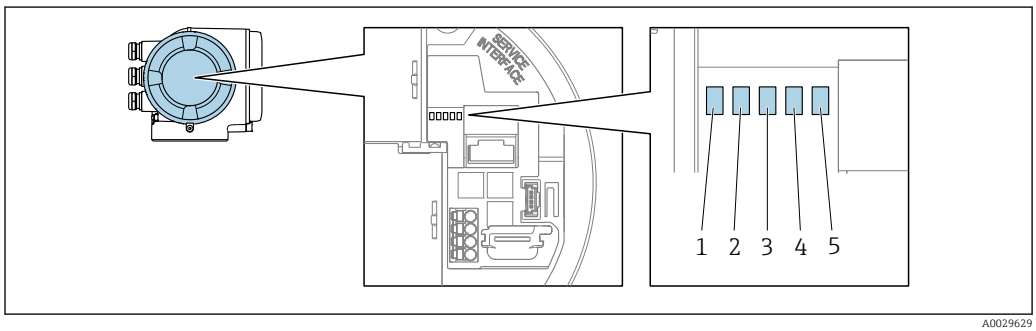
Error	Possible causes	Solution
No write access to parameters	Hardware write protection enabled	Set the write protection switch on main electronics module to the **Off** position → 126.
No write access to parameters	Current user role has limited access authorization	1. Check user role → 69. 2. Enter correct customer-specific access code → 69.
No connection via HART protocol	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω) correctly. Observe the maximum load → 169.
No connection via HART protocol	Commubox ▪ Connected incorrectly ▪ Configured incorrectly ▪ Drivers not installed correctly ▪ USB interface on computer configured incorrectly	Observe the documentation for the Commubox. FXA195 HART: Document "Technical Information" TI00404F
Not connecting to Web server	Web server disabled	Using the "FieldCare" or "DeviceCare" operating tool, check whether the web server of the measuring device is enabled, and enable it if necessary → 75.
	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) → 72. 2. Check the network settings with the IT manager.
Not connecting to Web server	Incorrect IP address	Check the IP address: 192.168.1.212 → 72
Not connecting to Web server	Incorrect WLAN access data	▪ Check WLAN network status. ▪ Log on to the device again using WLAN access data. ▪ Verify that WLAN is enabled on the measuring device and operating device → 72.
	WLAN communication disabled	–
Not connecting to web server, FieldCare or DeviceCare	No WLAN network available	▪ Check if WLAN reception is present: LED on display module is lit blue ▪ Check if WLAN connection is enabled: LED on display module flashes blue ▪ Switch on instrument function.

Error	Possible causes	Solution
Network connection not present or unstable	WLAN network is weak.	▪ Operating device is outside of reception range: Check network status on operating device. ▪ To improve network performance, use an external WLAN antenna.
	Parallel WLAN and Ethernet communication	▪ Check network settings. ▪ Temporarily enable only the WLAN as an interface.
Web browser frozen and operation no longer possible	Data transfer active	Wait until data transfer or current action is finished.
	Connection lost	1. Check cable connection and power supply. 2. Refresh the Web browser and restart if necessary.
Content of Web browser incomplete or difficult to read	Not using optimum version of Web server.	1. Use the correct Web browser version . 2. Clear the Web browser cache and restart the Web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No or incomplete display of contents in the Web browser	▪ JavaScript not enabled ▪ JavaScript cannot be enabled	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.
Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

Different LEDs in the transmitter provide information on the device status.



A0029629

1 *Supply voltage*
2 *Device status*
3 *Not used*
4 *Communication*
5 *Service interface (CDI) active*

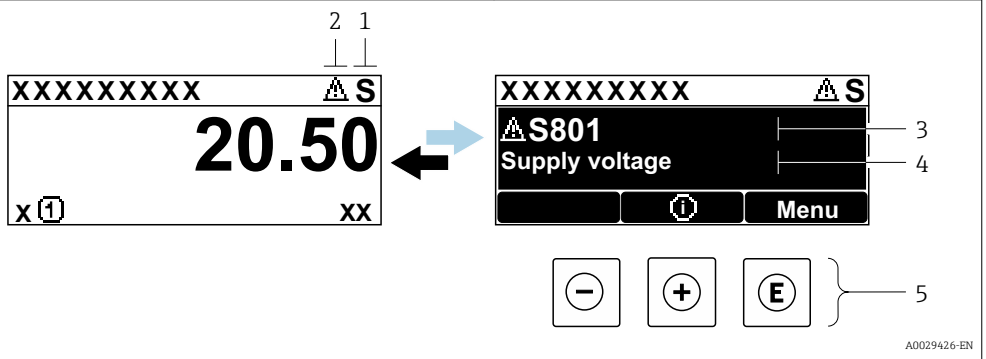
LED		Color	Meaning
1	Supply voltage	Green	Supply voltage is ok
		Off	Supply voltage is off or too low
2	Device status	Red	Error
		Flashing red	Warning
3	Not used	–	–
4	Communication	White	Communication active
5	Service interface (CDI)	Yellow	Connection established
		Flashing yellow	Communication active
		Off	No connection

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.

Operational display in alarm condition	Diagnostic message



1 *Status signal*
2 *Diagnostic behavior*
3 *Diagnostic behavior with diagnostic code*
4 *Short text*
5 *Operating elements*

If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter
- Via submenus → 153

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

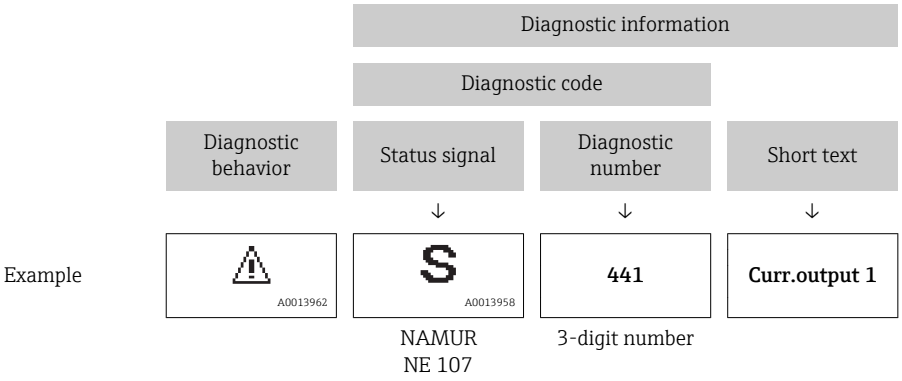
Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
M	**Maintenance required** Maintenance is required. The measured value remains valid.

Diagnostic behavior

Symbol	Meaning
	**Alarm** ▪ Measurement is interrupted. ▪ Signal outputs and totalizers assume the defined alarm condition. ▪ A diagnostic message is generated.
	**Warning** Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

Diagnostic information

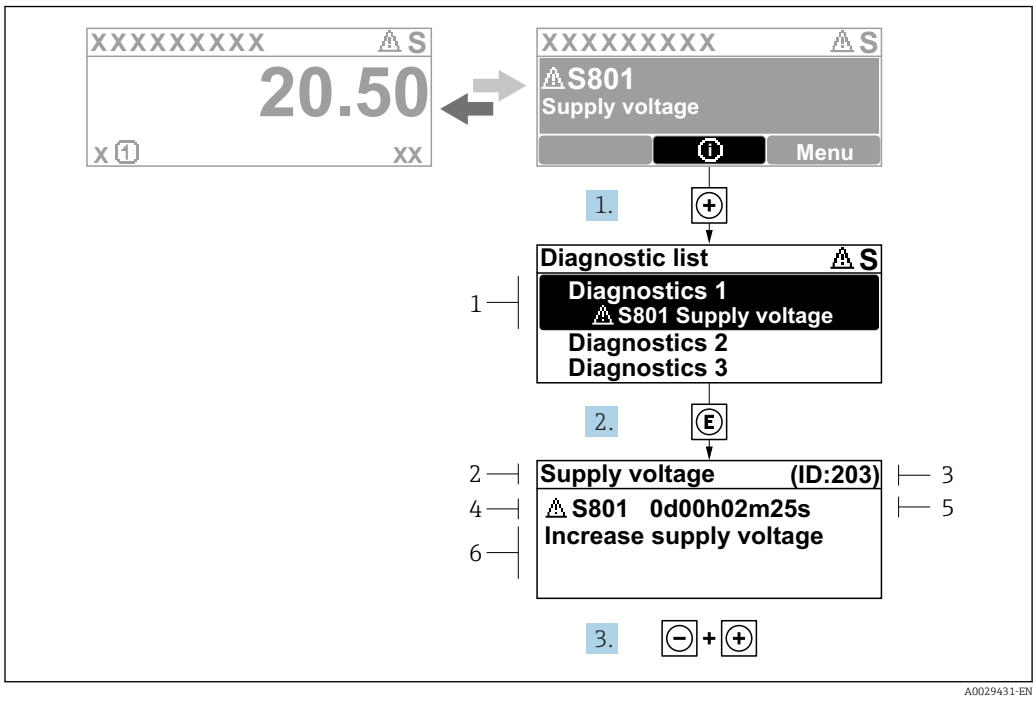
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Key	Meaning
	**Plus key** *In a menu, submenu* Opens the message about remedy information.
	**Enter key** *In a menu, submenu* Opens the operating menu.

12.3.2 Calling up remedial measures



36 *Message for remedial measures*

1 *Diagnostic information*
2 *Short text*
3 *Service ID*
4 *Diagnostic behavior with diagnostic code*
5 *Operation time of occurrence*
6 *Remedial measures*

The user is in the diagnostic message.

1. Press ⊞ (ⓘ symbol).
   ↳ The **Diagnostic list** submenu opens.
2. Select the desired diagnostic event with ⊞ or ⊟ and press Ⓔ .
   ↳ The message for the remedial measures for the selected diagnostic event opens.
3. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

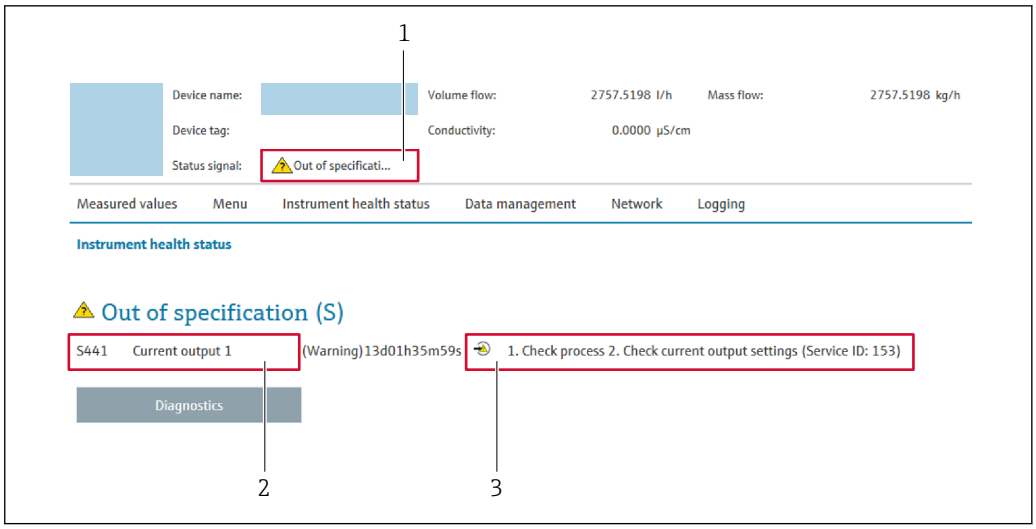
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

1. Press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

12.4 Diagnostic information in the Web browser

12.4.1 Diagnostic options

Any faults detected by the measuring device are displayed in the Web browser on the home page once the user has logged on.



A0031056

1 *Status area with status signal*
2 *Diagnostic information* → 143
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter
- Via submenu → 153

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
	Failure A device error has occurred. The measured value is no longer valid.
	Function check The device is in service mode (e.g. during a simulation).
	Out of specification The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
	Maintenance required Maintenance is required. The measured value is still valid.

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

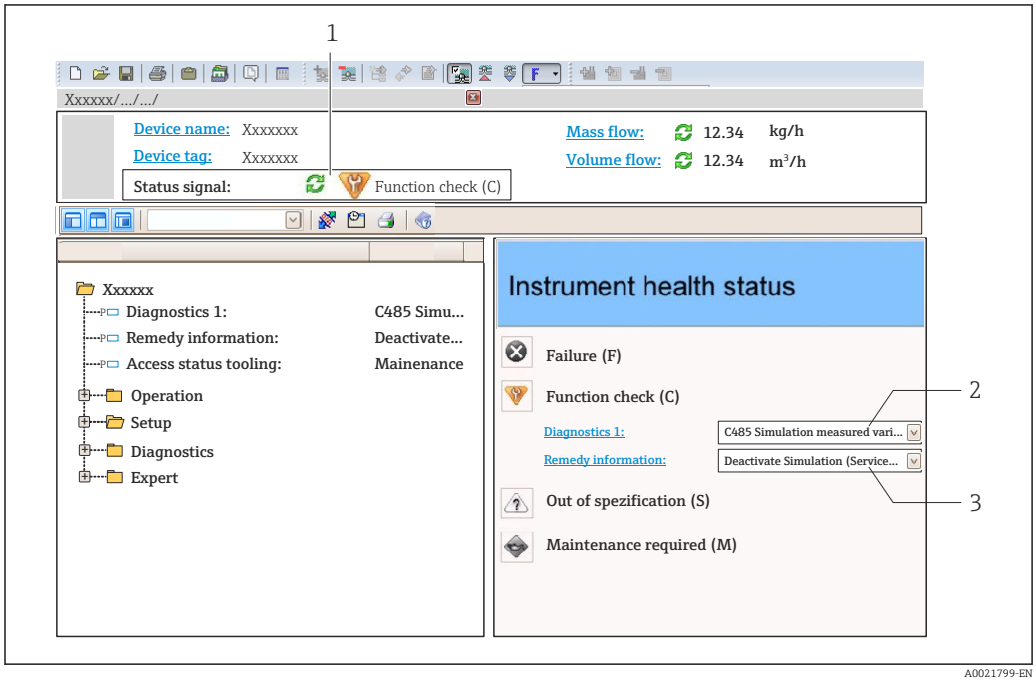
12.4.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly. These measures are displayed in red along with the diagnostic event and the related diagnostic information.

12.5 Diagnostic information in DeviceCare or FieldCare

12.5.1 Diagnostic options

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.

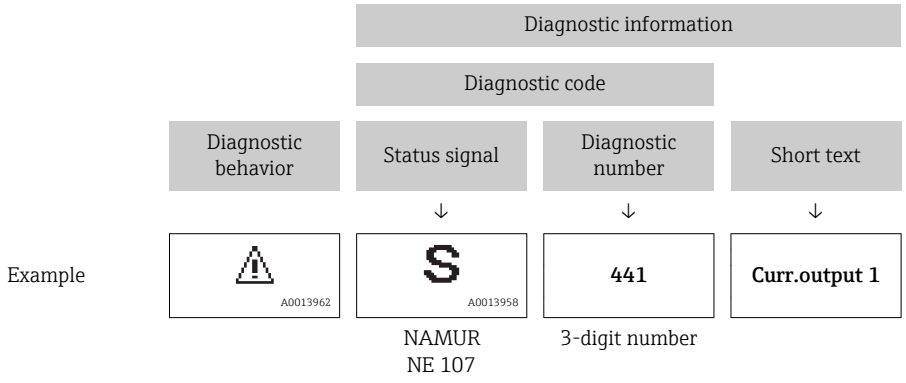


1 *Status area with status signal→ 142*
2 *Diagnostic information→ 143*
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter
- Via submenu → 153

Diagnostic information

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



12.5.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:

- On the home page
  Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu
  Remedy information can be called up in the working area of the user interface.

The user is in the **Diagnostics** menu.

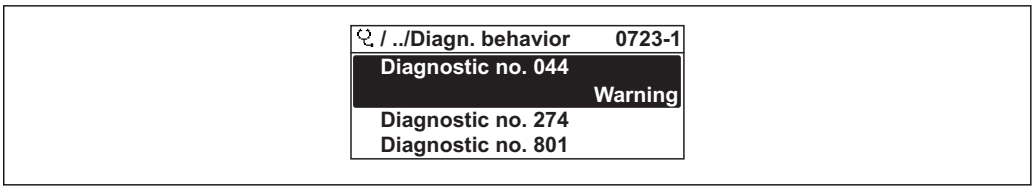
1. Call up the desired parameter.
2. On the right in the working area, mouse over the parameter.
   ↳ A tool tip with remedy information for the diagnostic event appears.

12.6 Adapting the diagnostic information

12.6.1 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic behavior** submenu.

Expert → System → Diagnostic handling → Diagnostic behavior



37 *Taking the example of the local display*

You can assign the following options to the diagnostic number as the diagnostic behavior:

Options	Description
Alarm	The device stops measurement. The signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. The background lighting changes to red.
Warning	The device continues to measure. The signal outputs and totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is displayed only in the **Event logbook** submenu (**Event list** submenu) and is not displayed in alternation with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.6.2 Adapting the status signal

Each item of diagnostic information is assigned a specific status signal at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic event category** submenu.

Expert → Communication → Diagnostic event category

Available status signals

Configuration as per HART 7 Specification (Condensed Status), in accordance with NAMUR NE107.

Symbol	Meaning
F A0013956	**Failure** A device error is present. The measured value is no longer valid.
C A0013959	**Function check** The device is in service mode (e.g. during a simulation).
S A0013958	**Out of specification** The device is being operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
M A0013957	**Maintenance required** Maintenance is required. The measured value is still valid.
N A0023076	Has no effect on the condensed status.

12.7 Overview of diagnostic information

The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information → 147

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
043	Sensor short circuit	1. Check sensor cable and sensor 2. Execute Heartbeat Verification 3. Replace sensor cable or sensor	S	Warning [1]
082	Data storage	1. Check module connections 2. Contact service	F	Alarm
083	Memory content	1. Restart device 2. Restore HistoROM S-DAT backup ('Device reset' parameter) 3. Replace HistoROM S-DAT	F	Alarm
170	Coil resistance	Check ambient and process temperature	F	Alarm
180	Temperature sensor defective	1. Check sensor connections 2. Replace sensor cable or sensor 3. Turn off temperature measurement	F	Warning
181	Sensor connection	1. Check sensor cable and sensor 2. Execute Heartbeat Verification 3. Replace sensor cable or sensor	F	Alarm
Diagnostic of electronic				
201	Device failure	1. Restart device 2. Contact service	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change electronic modules	F	Alarm
262	Sensor electronic connection faulty	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics 2. Check or replace ISEM or main electronics	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	Change electronic	F	Alarm
275	I/O module 1 to n defective	Change I/O module	F	Alarm
276	I/O module 1 to n faulty	1. Restart device 2. Change I/O module	F	Alarm
283	Memory content	1. Reset device 2. Contact service	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning
311	Electronic failure	1. Do not reset device 2. Contact service	M	Warning
332	Writing in embedded HistoROM failed	Replace user interface board Ex d/XP: replace transmitter	F	Alarm
361	I/O module 1 to n faulty	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
372	Sensor electronic (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
373	Sensor electronic (ISEM) faulty	1. Transfer data or reset device 2. Contact service	F	Alarm
375	I/O- 1 to n communication failed	1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules	F	Alarm
376	Sensor electronic (ISEM) faulty	1. Replace sensor electronic module (ISEM) 2. Turn off diagnostic message	F	Warning [1)]
377	Sensor electronic (ISEM) faulty	1. Check sensor cable and sensor 2. Perform Heartbeat Verification 3. Replace sensor cable or sensor	F	Warning [1)]
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	1. Restart device 2. Delete T-DAT via 'Reset device' parameter 3. Replace T-DAT	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
387	Embedded HistoROM failed	Contact service organization	F	Alarm
512	Sensor electronic (ISEM) faulty	1. Check ECC recovery time 2. Turn off ECC	F	Alarm
Diagnostic of configuration				
303	I/O 1 to n configuration changed	1. Apply I/O module configuration (parameter 'Apply I/O configuration') 2. Afterwards reload device description and check wiring	M	Warning
330	Flash file invalid	1. Update firmware of device 2. Restart device	M	Warning
331	Firmware update failed	1. Update firmware of device 2. Restart device	F	Warning
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 to n	Carry out trim	C	Warning
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1 to n	1. Check process 2. Check current output settings	S	Warning [1)]
442	Frequency output 1 to n	1. Check process 2. Check frequency output settings	S	Warning [1)]
443	Pulse output 1 to n	1. Check process 2. Check pulse output settings	S	Warning [1)]
444	Current input 1 to n	1. Check process 2. Check current input settings	S	Warning [1)]
453	Flow override	Deactivate flow override	C	Warning
484	Failure mode simulation	Deactivate simulation	C	Alarm
485	Measured variable simulation	Deactivate simulation	C	Warning
486	Current input 1 to n simulation	Deactivate simulation	C	Warning
491	Current output 1 to n simulation	Deactivate simulation	C	Warning
492	Simulation frequency output 1 to n	Deactivate simulation frequency output	C	Warning
493	Simulation pulse output 1 to n	Deactivate simulation pulse output	C	Warning
494	Switch output simulation 1 to n	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation	Deactivate simulation	C	Warning
496	Status input simulation	Deactivate simulation status input	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
502	CT activation/ deactivation failed	Follow the sequence of the custody transfer activation/deactivation: First authorized user login, then set the DIP switch on the main electonic module	C	Warning
511	Sensor electronic (ISEM) faulty	1. Check measuring period and integration time 2. Check sensor properties	C	Alarm
520	I/O 1 to n hardware configuration invalid	1. Check I/O hardware configuration 2. Replace wrong I/O module 3. Plug the module of double pulse output on correct slot	F	Alarm
530	Electrode cleaning is running	Turn off ECC	C	Warning
531	Empty pipe detection	Execute EPD adjustment	S	Warning [1)]
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
540	Custody transfer mode failed	1. Deactivate custody transfer mode 2. Reactivate custody transfer mode	F	Alarm
543	Double pulse output	1. Check process 2. Check pulse output settings	S	Warning [1)]
593	Double pulse output simulation	Deactivate simulation pulse output	C	Warning
594	Relay output simulation	Deactivate simulation switch output	C	Warning
599	Custody transfer logbook full	1. Deactivate custody transfer mode 2. Clear custody transfer logbook (all 30 entries) 3. Activate custody transfer mode	F	Warning
Diagnostic of process				
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
832	Electronic temperature too high	Reduce ambient temperature	S	Warning [1)]
833	Electronic temperature too low	Increase ambient temperature	S	Warning [1)]
834	Process temperature too high	Reduce process temperature	S	Warning [1)]
835	Process temperature too low	Increase process temperature	S	Warning [1)]
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning
882	Input signal	1. Check input configuration 2. Check external device or process conditions	F	Alarm
937	EMC interference	1. Eliminate external magnetic field near sensor 2. Turn off diagnostic message	S	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
938	EMC interference	1. Check ambient conditions regarding EMC influence 2. Turn off diagnostic message	F	Alarm [1]
962	Empty pipe	1. Perform full pipe adjustment 2. Perform empty pipe adjustment 3. Turn off empty pipe detection	S	Warning [1]

1) Diagnostic behavior can be changed.

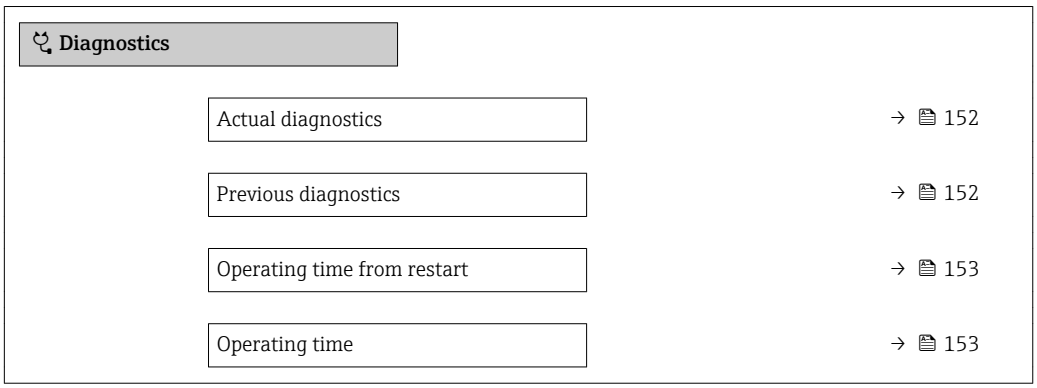
12.8 Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:
- Via local display → 144
- Via Web browser → 145
- Via "FieldCare" operating tool → 147
- Via "DeviceCare" operating tool → 147

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 153

Navigation
"Diagnostics" menu



Parameter overview with brief description

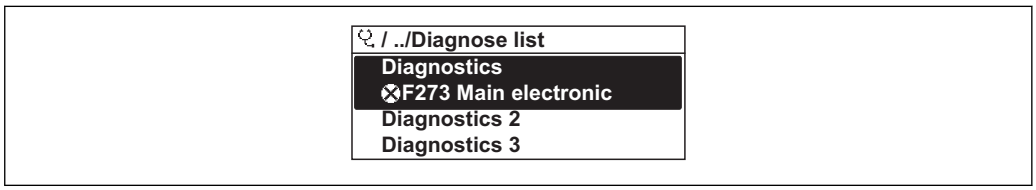
Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occured diagnostic event along with its diagnostic information. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Symbol for diagnostic behavior, diagnostic code and short message.
Previous diagnostics	Two diagnostic events have already occurred.	Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.

Parameter	Prerequisite	Description	User interface
Operating time from restart	–	Shows the time the device has been in operation since the last device restart.	Days (d), hours (h), minutes (m) and seconds (s)
Operating time	–	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)

12.9 Diagnostic list

Up to 5 currently pending diagnostic events can be displayed in the **Diagnostic list** submenu along with the associated diagnostic information. If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

Navigation path
Diagnostics → Diagnostic list



38 *Taking the example of the local display*

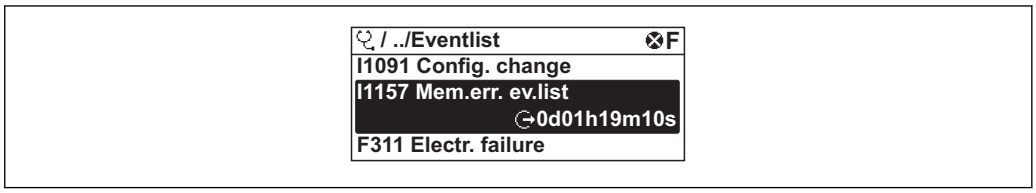
To call up the measures to rectify a diagnostic event:
- Via local display → 144
- Via Web browser → 145
- Via "FieldCare" operating tool → 147
- Via "DeviceCare" operating tool → 147

12.10 Event logbook

12.10.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Events list** submenu.

Navigation path
Diagnostics menu → **Event logbook** submenu → Event list



39 *Taking the example of the local display*

- Max. 20 event messages can be displayed in chronological order.
- If the **Extended HistoROM** application package (order option) is enabled in the device, the event list can contain up to 100 entries .

The event history includes entries for:
- Diagnostic events → 148
- Information events → 154

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostic event
  - ⊕: Occurrence of the event
  - ⊖: End of the event
- Information event
  ⊕: Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 144
- Via Web browser → 145
- Via "FieldCare" operating tool → 147
- Via "DeviceCare" operating tool → 147

For filtering the displayed event messages → 154

12.10.2 Filtering the event logbook

Using the **Filter options** parameter you can define which category of event message is displayed in the **Events list** submenu.

Navigation path
Diagnostics → Event logbook → Filter options

Filter categories
- All
- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
- Information (I)

12.10.3 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Embedded HistoROM deleted
I1137	Electronic changed
I1151	History reset
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1184	Display connected
I1256	Display: access status changed
I1264	Safety sequence aborted
I1278	I/O module reset detected
I1335	Firmware changed

Info number	Info name
I1351	Empty pipe detection adjustment failure
I1353	Empty pipe detection adjustment ok
I1361	Web server login failed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1443	Coating thickness not determined
I1444	Device verification passed
I1445	Device verification failed
I1450	Monitoring off
I1451	Monitoring on
I1457	Measured error verification failed
I1459	I/O module verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1517	Custody transfer active
I1518	Custody transfer inactive
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off
I1618	I/O module replaced
I1619	I/O module replaced
I1621	I/O module replaced
I1622	Calibration changed
I1624	Reset all totalizers
I1625	Write protection activated
I1626	Write protection deactivated
I1627	Web server login successful
I1628	Display login successful
I1629	CDI login successful
I1631	Web server access changed
I1632	Display login failed
I1633	CDI login failed
I1634	Parameter factory reset
I1635	Parameter delivery reset
I1639	Max. switch cycles number reached
I1643	Custody transfer logbook cleared
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1651	Custody transfer parameter changed

Info number	Info name
I1712	New flash file received
I1725	Sensor electronic module (ISEM) changed
I1726	Configuration backup failed

12.11 Resetting the measuring device

Using the**Device reset** parameter (→ 122) it is possible to reset the entire device configuration or some of the configuration to a defined state.

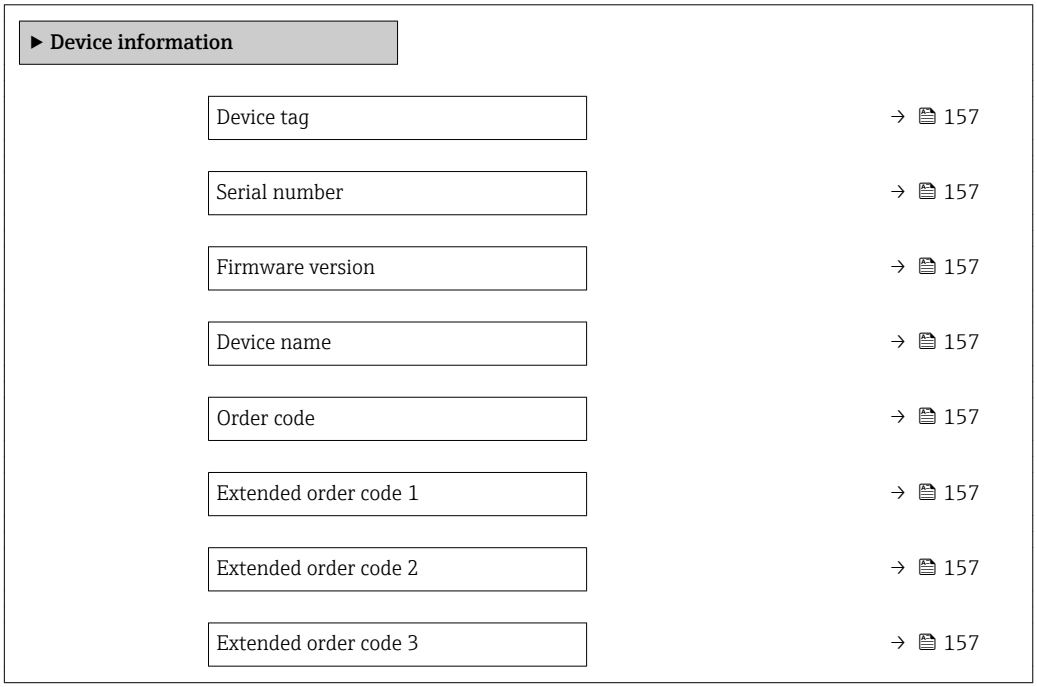
12.11.1 Function scope of the "Device reset" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.
Restart device	The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restore the data that are saved on the S-DAT. The data record is restored from the electronics memory to the S-DAT.

12.12 Device information

The **Device information** submenu contains all parameters that display different information for device identification.

Navigation
"Diagnostics" menu → Device information



Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag300/500
Serial number	Shows the serial number of the measuring device.	A maximum of 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	–
Device name	Shows the name of the transmitter. The name can be found on the nameplate of the transmitter.	Promag300/500	–
Order code	Shows the device order code. The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field.	Character string composed of letters, numbers and certain punctuation marks (e.g. /).	–
Extended order code 1	Shows the 1st part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00
Device revision	Shows the device revision with which the device is registered with the HART Communication Foundation.	2-digit hexadecimal number	1
Device ID	Shows the device ID for identifying the device in a HART network.	6-digit hexadecimal number	–

Parameter	Description	User interface	Factory setting
Device type	Shows the device type with which the measuring device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x3A (for Promag 500)
Manufacturer ID	Shows the manufacturer ID device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x11 (for Endress+Hauser)

12.13 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
08.2016	01.00.zz	Option **76**	Original firmware	Operating Instructions	BA01400D/06/EN/01.16

It is possible to flash the firmware to the current version or the previous version using the service interface.

For the compatibility of the firmware version with the previous version, the installed device description files and operating tools, observe the information about the device in the "Manufacturer's information" document.

The manufacturer's information is available:
- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 5H5B
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

⚠ WARNING

Cleaning agents can damage the plastic transmitter housing!

- ▶ Do not use high-pressure steam.
- ▶ Only use the permitted cleaning agents specified.

Permitted cleaning agents for the plastic transmitter housing

- Commercially available household cleaners
- Methyl alcohol or isopropyl alcohol
- Mild soap solutions

13.1.2 Interior cleaning

No interior cleaning is planned for the device.

13.1.3 Replacing seals

The sensor's seals (particularly aseptic molded seals) must be replaced periodically.

The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.

Replacement seals (accessory) → 🖹 192

13.2 Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

List of some of the measuring and testing equipment: → 🖹 162

13.3 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14 Repairs

14.1 General notes

14.1.1 Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to other certified devices by Endress+Hauser Service or at the factory.

14.1.2 Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:
- ▶ Use only original Endress+Hauser spare parts.
- ▶ Carry out the repair according to the Installation Instructions.
- ▶ Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- ▶ Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

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

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→ 157) in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14.4 Return

The measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at
http://www.endress.com/support/return-material

14.5 Disposal

14.5.1 Removing the measuring device

1. Switch off the device.

⚠ WARNING

Danger to persons from process conditions.

- Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring device

⚠ WARNING

Danger to personnel and environment from fluids that are hazardous to health.

- Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

15 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.

15.1 Device-specific accessories

15.1.1 For the transmitter

Accessories	Description
Transmitter Proline 500	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 EA01152 Proline 500 transmitter for replacement: the serial number of the current transmitter should always be quoted when ordering. On the basis of the serial number, the device-specific data of the replacement device can also be used for the new transmitter.
WLAN antenna Wide range	External WLAN antenna for a range of up to 50 m (165 ft). Further information on the WLAN interface → 77.
Post mounting kit	Post mounting kit for transmitter. The post mounting kit can only be ordered together with a transmitter.
Protective cover Proline 500	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. For details, see Installation Instructions EA01160
Ground cable	Set, consisting of two ground cables for potential equalization.
Connecting cable Sensor – Transmitter	The following cable lengths are available: order code for "Cable, sensor connection" ▪ Option **1**: 5 m (16 ft) ▪ Option **2**: 10 m (32 ft) ▪ Option **3**: 20 m (65 ft) ▪ Option **4**: User-configurable cable length (m) ▪ Option **5**: User-configurable cable length (ft) Reinforced connecting cable with an additional, reinforcing metal braid: ▪ Option **6**: User-configurable cable length (m) ▪ Option **7**: User-configurable cable length (ft) Possible cable length: depends on the medium conductivity, max. 200 m (660 ft)

15.1.2 For the sensor

Accessories	Description
Ground disks	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

15.2 Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Fieldgate FXA320	Gateway for the remote monitoring of connected 4 to 20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

15.3 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://wapps.endress.com/applicator ▪ As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management 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. 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. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement

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. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S

15.4 System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all 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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

16 Technical data

16.1 Application

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are sufficiently resistant.

16.2 Function and system design

Measuring principle

Electromagnetic flow measurement on the basis of *Faraday's law of magnetic induction*.

Measuring system

The measuring system consists of a transmitter and a sensor. The transmitter and sensor are mounted in physically separate locations. They are interconnected by two connecting cable(s).

For information on the structure of the device → 14

16.3 Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity

Calculated measured variables

Mass flow

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Electrical conductivity: ≥ 5 µS/cm for liquids in general

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
25	1	9 to 300 dm³/min	75 dm³/min	0.5 dm³	1 dm³/min
32	–	15 to 500 dm³/min	125 dm³/min	1 dm³	2 dm³/min
40	1 ½	25 to 700 dm³/min	200 dm³/min	1.5 dm³	3 dm³/min
50	2	35 to 1 100 dm³/min	300 dm³/min	2.5 dm³	5 dm³/min
65	–	60 to 2 000 dm³/min	500 dm³/min	5 dm³	8 dm³/min
80	3	90 to 3 000 dm³/min	750 dm³/min	5 dm³	12 dm³/min
100	4	145 to 4 700 dm³/min	1 200 dm³/min	10 dm³	20 dm³/min
125	–	220 to 7 500 dm³/min	1 850 dm³/min	15 dm³	30 dm³/min

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
150	6	20 to 600	150	0.025	2.5
200	8	35 to 1 100	300	0.05	5
250	10	55 to 1 700	500	0.05	7.5
300	12	80 to 2 400	750	0.1	10
350	14	110 to 3 300	1 000	0.1	15
375	15	140 to 4 200	1 200	0.15	20
400	16	140 to 4 200	1 200	0.15	20
450	18	180 to 5 400	1 500	0.25	25
500	20	220 to 6 600	2 000	0.25	30
600	24	310 to 9 600	2 500	0.3	40
700	28	420 to 13 500	3 500	0.5	50
750	30	480 to 15 000	4 000	0.5	60
800	32	550 to 18 000	4 500	0.75	75
900	36	690 to 22 500	6 000	0.75	100
1 000	40	850 to 28 000	7 000	1	125
–	42	950 to 30 000	8 000	1	125
1 200	48	1 250 to 40 000	10 000	1.5	150
–	54	1 550 to 50 000	13 000	1.5	200
1 400	–	1 700 to 55 000	14 000	2	225
–	60	1 950 to 60 000	16 000	2	250
1 600	–	2 200 to 70 000	18 000	2.5	300
–	66	2 500 to 80 000	20 500	2.5	325
1 800	72	2 800 to 90 000	23 000	3	350
–	78	3 300 to 100 000	28 500	3.5	450
2 000	–	3 400 to 110 000	28 500	3.5	450

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
1	25	2.5 to 80	18	0.2	0.25
–	32	4 to 130	30	0.2	0.5
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
–	65	16 to 500	130	1	2
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
–	125	60 to 1 950	450	5	7
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1 200	10	15
10	250	250 to 7 500	1 500	15	30
12	300	350 to 10 600	2 400	25	45
14	350	500 to 15 000	3 600	30	60
15	375	600 to 19 000	4 800	50	60
16	400	600 to 19 000	4 800	50	60
18	450	800 to 24 000	6 000	50	90
20	500	1 000 to 30 000	7 500	75	120
24	600	1 400 to 44 000	10 500	100	180
28	700	1 900 to 60 000	13 500	125	210
30	750	2 150 to 67 000	16 500	150	270
32	800	2 450 to 80 000	19 500	200	300
36	900	3 100 to 100 000	24 000	225	360
40	1 000	3 800 to 125 000	30 000	250	480
42	–	4 200 to 135 000	33 000	250	600
48	1 200	5 500 to 175 000	42 000	400	600
54	–	9 to 300 Mgal/d	75 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
–	1 400	10 to 340 Mgal/d	85 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
60	–	12 to 380 Mgal/d	95 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
–	1 600	13 to 450 Mgal/d	110 Mgal/d	0.0008 Mgal/d	1.7 Mgal/d
66	–	14 to 500 Mgal/d	120 Mgal/d	0.0008 Mgal/d	2.2 Mgal/d
72	1 800	16 to 570 Mgal/d	140 Mgal/d	0.0008 Mgal/d	2.6 Mgal/d
78	–	18 to 650 Mgal/d	175 Mgal/d	0.0010 Mgal/d	3.0 Mgal/d
–	2 000	20 to 700 Mgal/d	175 Mgal/d	0.0010 Mgal/d	2.9 Mgal/d

Recommended measuring range

"Flow limit" section → 179

Operable flow range

Over 1000 : 1

Input signal

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device:

- Fluid temperature to increase the accuracy of the electrical conductivity (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 164

It is recommended to read in external measured values to calculate the following measured variables:
Corrected volume flow

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 → 168.

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 µA
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	▪ Pressure ▪ Temperature ▪ Density

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Adjustable: 5 to 200 ms
Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

16.4 Output

Output signal

HART current output

Current output	4 to 20 mA HART
Current span	Can be set to: 4 to 20 mA (active/passive)
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Current output 0/4 to 20 mA

Current output	0/4 to 20 mA
Maximum output values	22.5 mA
Current span	Can be set to: ▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
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	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: ▪ 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	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume 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	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature
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	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ 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
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)
Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

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:

Current output 0/4 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 ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value (f_{max} 2 to 12 500 Hz)
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: ▪ 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
- Via service interface

Plain text display	With information on cause and remedial measures

Web server

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 Diagnostic information via light emitting diodes

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).

Protocol-specific data

Manufacturer ID	0x11
Device type ID	0x3C
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: 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 ▪ Corrected volume flow ▪ Flow velocity ▪ Temperature ▪ Electronic temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Temperature ▪ Electronic 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 = corrected volume flow ▪ 3 = flow velocity ▪ 4 = conductivity ▪ 5 = corrected conductivity ▪ 6 = temperature ▪ 7 = electronic temperature ▪ 8 = totalizer 1 ▪ 9 = totalizer 2 ▪ 10 = totalizer 3

16.5 Power supply

Terminal assignment

→ 40

Supply voltage

Order code for "Power supply"	terminal voltage		Frequency range
Option **D**	DC 24 V	±20%	–
Option **E**	AC100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz

Power consumption

Transmitter

Max. 10 W (active power)

Current consumption

Transmitter

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

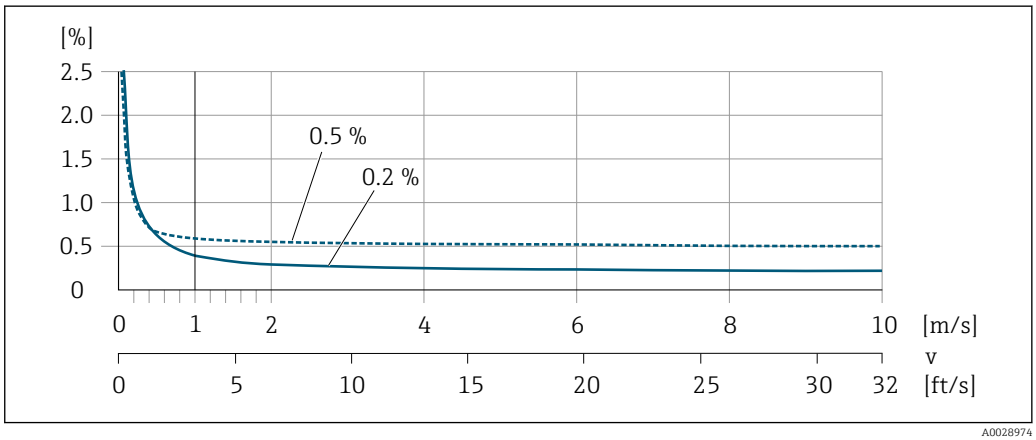
Power supply failure

- Totalizers stop at the last value measured.
- Configuration is retained in the plug-in memory (HistoROM DAT).
- Error messages (incl. total operated hours) are stored.

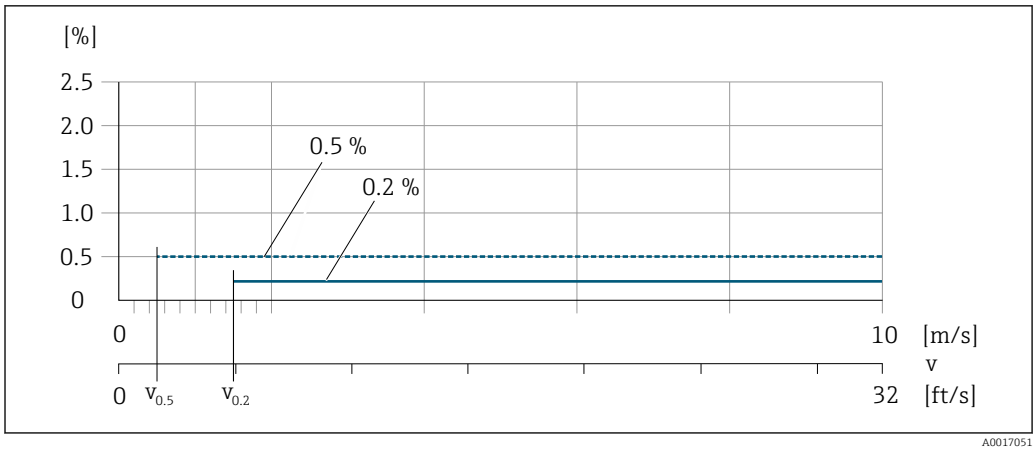
Electrical connection	
Potential equalization	→ 48
Terminals	**Transmitter** Spring terminals for conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG)
Cable entries	▪ Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in) ▪ Thread for cable entry: – NPT ½" – G ½" – M20
Cable specification	→ 38

16.6 Performance characteristics

Reference operating conditions	▪ Error limits following DIN EN 29104, in future ISO 20456 ▪ Water, typically +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi) ▪ Data as indicated in the calibration protocol ▪ Accuracy based on accredited calibration rigs according to ISO 17025
Maximum measured error	**Error limits under reference operating conditions** o.r. = of reading **Volume flow** ▪ ±0.5 % o.r. ± 1 mm/s (0.04 in/s) ▪ Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s) Fluctuations in the supply voltage do not have any effect within the specified range.



40 *Maximum measured error in % o.r.*



41 *Flat Spec in % o.r.*

Flat Spec flow values0.5 %

Nominal diameter		$v_{0.5}$	
[mm]	[in]	[m/s]	[ft/s]
25 to 600	1 to 24	0.5	1.64

Flat Spec flow values0.2 %

Nominal diameter		$v_{0.2}$	
[mm]	[in]	[m/s]	[ft/s]
25 to 600	1 to 24	1.5	4.92

Electrical conductivity
Max. measured error not specified.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

o.r. = of reading

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

Repeatability

o.r. = of reading

Volume flow
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity
Max. ±5 % o.r.

Influence of ambient temperature

Current output

o.r. = of reading

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

16.7 Installation

"Mounting requirements" → 22

16.8 Environment

Ambient temperature range

→ 24

Temperature tables

Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

Storage temperature

−50 to +80 °C (−58 to +176 °F)

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Degree of protection

Transmitter
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Sensor
- As standard: IP66/67, type 4X enclosure
- Optionally available for order:
  - IP66/67, type 4X enclosure; fully welded, with protective varnish EN ISO 12944 C5-M. Suitable for use in corrosive atmospheres.
  - IP68, type 6P enclosure; fully welded, with protective varnish as per EN ISO 12944 C5-M. Suitable for permanent immersion in water ≤ 3 m (10 ft) or up to 48 hours at depths ≤ 10 m (30 ft).
  - IP68, type 6P enclosure; fully welded, with protective varnish as per EN ISO 12944 Im1/Im2/Im3. Suitable for permanent immersion in saline water ≤ 3 m (10 ft) or up to 48 hours at depths ≤ 10 m (30 ft) or in buried applications.

External WLAN antenna
IP67

Vibration resistance	▪ Vibration, sinusoidal according to IEC 60068-2-6 – 2 to 8.4 Hz, 3.5 mm peak – 8.4 to 2 000 Hz, 1 g peak ▪ Vibration broad-band random, according to IEC 60068-2-64 – 10 to 200 Hz, 0.003 g^2/Hz – 200 to 2 000 Hz, 0.001 g^2/Hz – Total: 1.54 g rms
Shock resistance	Shock, half-sine according to IEC 60068-2-27 6 ms 30 g
Impact resistance	Rough handling shocks according to IEC 60068-2-31
Mechanical load	▪ Protect the transmitter housing against mechanical effects, such as shock or impact; the use of the remote version is sometimes preferable. ▪ Never use the transmitter housing as a ladder or climbing aid.
Electromagnetic compatibility (EMC)	As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) For details, refer to the Declaration of Conformity.

16.9 Process

Medium temperature range	▪ 0 to +80 °C (+32 to +176 °F) for hard rubber, DN 50 to 2000 (2 to 78") ▪ –20 to +50 °C (–4 to +122 °F) for polyurethane, DN 25 to 1200 (1 to 48")
Conductivity	≥ 5 µS/cm for liquids in general. Stronger filter damping is required for very low conductivity values. Proline 500 The necessary minimum conductivity also depends on the cable length .
Pressure-temperature ratings	An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document
Pressure tightness	*Liner: hard rubber*

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+50 °C (+122 °F)	+80 °C (+176 °F)
50...2000	2...78	0 (0)	0 (0)	0 (0)

Liner: polyurethane

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:	
[mm]	[in]	+25 °C (+77 °F)	+50 °C (+122 °F)
25...1200	1...48	0 (0)	0 (0)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludge)

A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

For an overview of the full scale values for the measuring range, see the "Measuring range" section → 165

Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 25

System pressure

→ 24

Vibrations

→ 25

16.10 Mechanical construction

Design, dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

Weight

Excluding the transmitter
- Aluminum
  - 6.5 kg (14.3 lbs)
  - Digital: 2.4 kg (5.3 lbs)
- Cast, stainless:15.6 kg (34.4 lbs)

Weight specifications apply to standard pressure ratings and without packaging material.

Weight in SI units

Nominal diameter		EN (DIN), AS [1]		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]
25	1	PN 40	5	10K	5
32	–	PN 40	6	10K	5
40	1 ½	PN 40	7	10K	6
50	2	PN 40	9	10K	7
65	–	PN 16	10	10K	9
80	3	PN 16	12	10K	11
100	4	PN 16	14	10K	13
125	–	PN 16	20	10K	19
150	6	PN 16	24	10K	23
200	8	PN 10	43	10K	40
250	10	PN 10	63	10K	67
300	12	PN 10	68	10K	70

Nominal diameter		EN (DIN), AS [1)]		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]
350	14	PN 6	103		
375	15	PN 6	118		
400	16	PN 6	118		
450	18	PN 6	159		
500	20	PN 6	154		
600	24	PN 6	206		
700	28	PN 6	302		
800	32	PN 6	355		
900	36	PN 6	483		
1000	40	PN 6	587		
1200	48	PN 6	848		
1400	–	PN 6	1298		
1600	–	PN 6	1698		
1800	72	PN 6	2198		
2000	–	PN 6	2798		

1) For flanges according to AS, only DN 80 to 150 are available.

Order code for "Design", option A

Option A *"Insertion length short; ISO/DVGW to DN400, DN450-2000 1:1"*

EN 1092-1 (DIN 2501)			
DN [mm]	Weight [kg]		
	PN 6	PN 10	PN 16
450	98	111	139
500	113	131	179
600	154	161	224
700	190	240	288
800	240	315	350
900	308	393	441
1000	359	468	563
1200	529	717	840
1400	784	1114	1200
1600	1058	1624	1841
1800	1418	2107	2353
2000	1877	2630	2925

AS 2129, Table E	
DN [mm]	Weight [kg]
450	142
500	181
600	259

AS 2129, Table E	
DN [mm]	Weight [kg]
700	346
750	433
800	493
900	690
1000	761
1200	1237

AS 4087, PN 16	
DN [mm]	Weight [kg]
450	132
500	181
600	259
700	367
750	445
800	503
900	702
1000	759
1200	1219

Weight in US units

Nominal diameter		ASME		AWWA	
[mm]	[in]	Pressure rating	[lbs]	Pressure rating	[lbs]
25	1	Class 150	11		
40	1 ½	Class 150	15		
50	2	Class 150	20		
80	3	Class 150	26		
100	4	Class 150	31		
150	6	Class 150	53		
200	8	Class 150	95		
250	10	Class 150	161		
300	12	Class 150	238		
350	14	Class 150	381		
400	16	Class 150	448		
450	18	Class 150	558		
500	20	Class 150	624		
600	24	Class 150	889		
700	28			Class D	878
–	30			Class D	1010
800	32			Class D	1208

Nominal diameter		ASME		AWWA	
[mm]	[in]	Pressure rating	[lbs]	Pressure rating	[lbs]
900	36			Class D	1760
1000	40			Class D	1980
–	42			Class D	2421
1200	48			Class D	3083
–	54			Class D	4847
–	60			Class D	5949
–	66			Class D	8154
1800	72			Class D	9036
–	78			Class D	10139

Order code for "Design", option A

Option A *"Insertion length short; ISO/DVGW to DN400, DN450-2000 1:1"*

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
18	420
20	501
24	664

AWWA C207, Class D	
DN [in]	Weight [lbs]
28	587
30	701
32	845
36	1036
40	1294
42	1477
48	1987
54	1273
60	3515
66	4699
72	5662
78	6864

Measuring tube specification

Nominal diameter		Pressure rating				Measuring tube internal diameter			
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	JIS	Hard rubber		Polyurethane	
[mm]	[in]					[mm]	[in]	[mm]	[in]
25	1	PN 40	Class 150	–	20K	–	–	24	0.94
32	–	PN 40	–	–	20K	–	–	32	1.26

Nominal diameter		Pressure rating				Measuring tube internal diameter			
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	JIS	Hard rubber		Polyurethane	
[mm]	[in]					[mm]	[in]	[mm]	[in]
40	1 ½	PN 40	Class 150	–	20K	–	–	38	1.50
50	2	PN 40	Class 150	Table E, PN 16	10K	50	1.97	50	1.97
65	–	PN 16	–	–	10K	66	2.60	66	2.60
80	3	PN 16	Class 150	Table E, PN 16	10K	79	3.11	79	3.11
100	4	PN 16	Class 150	Table E, PN 16	10K	102	4.02	102	4.02
125	–	PN 16	–	–	10K	127	5.00	127	5.00
150	6	PN 16	Class 150	Table E, PN 16	10K	156	6.14	156	6.14
200	8	PN 10	Class 150	Table E, PN 16	10K	204	8.03	204	8.03
250	10	PN 10	Class 150	Table E, PN 16	10K	258	10.2	258	10.2
300	12	PN 10	Class 150	Table E, PN 16	10K	309	12.2	309	12.2
350	14	PN 6	Class 150	Table E, PN 16	–	342	13.5	342	13.5
375	15	–	–	PN 16	–	392	15.4	–	–
400	16	PN 6	Class 150	Table E, PN 16	–	392	15.4	392	15.4
450	18	PN 6	Class 150	–	–	437	17.2	437	17.2
500	20	PN 6	Class 150	Table E, PN 16	–	492	19.4	492	19.4
600	24	PN 6	Class 150	Table E, PN 16	–	594	23.4	594	23.4
700	28	PN 6	Class D	Table E, PN 16	–	692	27.2	692	27.2
750	30	–	Class D	Table E, PN 16	–	742	29.2	742	29.2
800	32	PN 6	Class D	Table E, PN 16	–	794	31.3	794	31.3
900	36	PN 6	Class D	Table E, PN 16	–	891	35.1	891	35.1
1 000	40	PN 6	Class D	Table E, PN 16	–	994	39.1	994	39.1
–	42	–	Class D	–	–	1 043	41.1	1 043	41.1
1 200	48	PN 6	Class D	Table E, PN 16	–	1 197	47.1	1 197	47.1
–	54	–	Class D	–	–	1 339	52.7	–	–
1 400	–	PN 6	–	–	–	1 402	55.2	–	–
–	60	–	Class D	–	–	1 492	58.7	–	–
1 600	–	PN 6	–	–	–	1 600	63.0	–	–
–	66	–	Class D	–	–	1 638	64.5	–	–
1 800	72	PN 6	Class D	–	–	1 786	70.3	–	–
2 000	78	PN 6	Class D	–	–	1 989	78.3	–	–

Materials

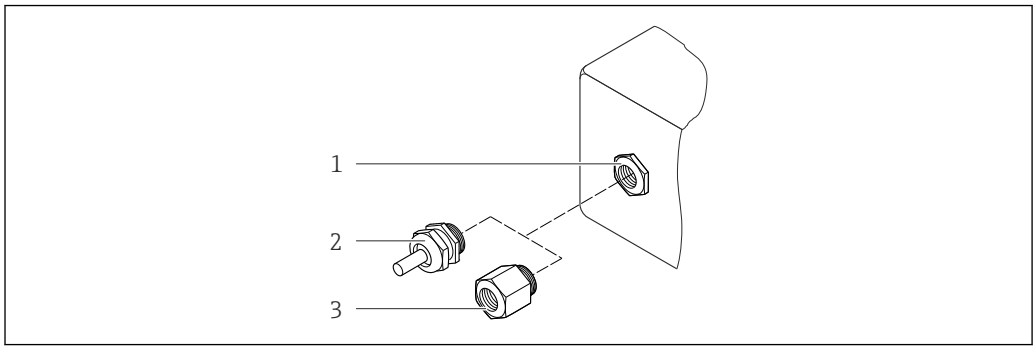
Transmitter housing

Order code for "Transmitter housing":
Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated

Window material

Order code for "Transmitter housing":
Option **A** "Aluminum, coated": glass

Cable entries/cable glands



42 *Possible cable entries/cable glands*

1 *Cable entry with M20 × 1.5 internal thread*
2 *Cable gland M20 × 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*

Cable entries and adapters	Material
Cable gland M20 × 1.5	Plastic
▪ Adapter for cable entry with internal thread G ½" ▪ Adapter for cable entry with internal thread NPT ½" Only available for certain device versions: ▪ Order code for "Transmitter housing": Option **A** "Aluminum, coated" ▪ Order code for "Sensor connection housing": Option **A** "Aluminum coated"	Nickel-plated brass

Connecting cable

Connecting cable for sensor - transmitter

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor connection housing

Order code for "Sensor connection housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **D** "Polycarbonate":
  - Polycarbonate
  - Optional: Order code for "Sensor option", option **CB...CE** "Corrosion protection": polycarbonate

Sensor housing

- DN 25 to 300 (1 to 12"):
  - Aluminum, AlSi10Mg, coated
  - Carbon steel with Al/Zn protective coating
- DN 50 to 300 (2 to 12"):
  Carbon steel with protective varnish (IP68)
- DN 350 to 2000 (14 to 78"):
  Carbon steel with protective varnish

Measuring tubes

- DN 25 to 300 (1 to 12") [3]: stainless steel, 1.4301/1.4306/304/304L
- DN 350 to 1200 (14 to 48") [3]: stainless steel, 1.4301/304
- DN 1350 to 2000 (54 to 78") [3]: stainless steel, 1.4301 similar to 304

Liner

- DN 25 to 1200 (1 to 48"): polyurethane
- DN 50 to 2000 (2 to 78"): hard rubber

Electrodes

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Process connections

EN 1092-1 (DIN 2501)

- DN 25 to 1200 [3]:
  - Stainless steel, 1.4404/1.4571/F316L
  - Carbon steel, A105/FE410WB/P250GH/S235JRG2/S235JR+N
- DN 1350 to 2000 [3]:
  - Stainless steel ,1.4404/1.4571
  - Carbon steel, P250GH/S235JRG2
- DN 450 to 2000 [4]:
  Carbon steel, A105/S235JRG2

EN 1092-1 (DIN 2501), PN6:
DN 350 to 1000 [3]:
Carbon steel, A105/FE410WB/S235JRG2

ASME B16.5

- DN 25 to 1200 (1 to 48"):
  Stainless steel, F316L similar to 1.4404
- DN 25 to 300 (1 to 12") [4]:
  Carbon steel, A105 similar to 1.0432
- DN 350 to 1200 (14 to 48") [4]:
  Carbon steel, A105/A515 Grade 70

AWWA C207

- DN 48":
  Carbon steel, A105/A181/P265GH/S275JR
- DN 54 to 72":
  Carbon steel, P265GH similar to 1.0425
- DN 48 to 78" [4]:
  Carbon steel, A105/A181/P265GH/S275JR

AS 2129

- DN 50 to 1200:
  Carbon steel, A105/S235JRG2
- DN 350 to 1200 [4]:
  Carbon steel, A105/FE410WB/P235GH/P265GH/S235JRG2

3) For carbon steel flange material with Al/Zn protective coating (DN 25 to 300 (1 to 12")), protective varnish (IP68) (DN 50 to 300 (2 to 12")) or protective varnish ≥ DN 350 (14")
4) Order Code for "Design", Option A "Insertion length short"

AS 4087

- DN 50 to 1200:
  Carbon steel, A105/S275JR
- DN 350 to 1200 [4]:
  Carbon steel, A105/P265GH/S275JR

JIS B2220

- Stainless steel, F316L similar to 1.4404
- Carbon steel, A105/A350LF2 [3]

Seals

In accordance with DIN EN 1514-1

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

- WLAN antenna:
  ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter:
  Stainless steel and copper

Ground disks

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Fitted electrodes

Measurement, reference and empty pipe detection electrodes available as standard with:
- 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)
- Tantalum

Optionally available with DN 350 to 2000 (14 to 78"):
Exchangeable measuring electrodes made from 1.4435 (316L)

Process connections

- EN 1092-1 (DIN 2501) [5]
  - DN ≤ 300: fixed flange (PN 10/16/25/40) = form A
  - DN ≥ 350: fixed flange (PN 6/10/16/25) = flat face
  - DN 450 to 2000 [6]: fixed flange (PN 6/10/16) = flat face
- ASME B16.5
  - DN 25 to 600 (1 to 24"): fixed flange (Class 150)
  - DN 350 to 2000 (14 to 78") [6]: fixed flange (Class 150)
  - DN 25 to 150 (1 to 6"): fixed flange (Class 300)
- AWWA C207
  - DN 48 to 72": fixed flange (Class D)
  - DN 48 to 78" [6]: fixed flange (Class D)

5) Dimensions as per DIN 2501, DN 65 (2 ½") PN 16 and DN 600 (24") PN 16 only as per EN 1092-1
6) Order code for "Design", option A "Insertion length short"

- AS 2129
  - DN 50 to 1200: fixed flange (Table E)
  - DN 350 to 1200 [6]: fixed flange (Table E)
- AS 4087
  - DN 50 to 1200): fixed flange (PN 16)
  - DN 350 to 1200 [6]: fixed flange (PN 16)
- JIS B2220
  - DN 50 to 300: fixed flange (10K)
  - DN 25 to 300: fixed flange (20K)

For information on the different materials used in the process connections → 185

Surface roughness

Electrodes with 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum:
≤ 0.3 to 0.5 µm (11.8 to 19.7 µin)
(All data relate to parts in contact with fluid)

16.11 Operability

Languages

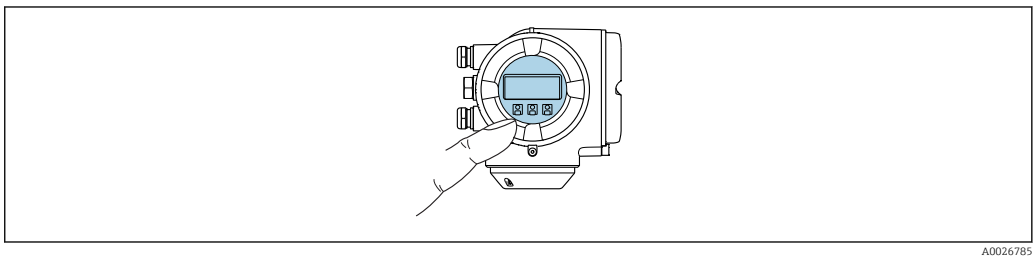
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via Web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation

Via display module

Two display modules are available:
- Order code for "Display; operation", option **F** "4-line, backlit, graphic display; touch control"
- Order code for "Display; operation", option **G** "4-line, backlit, graphic display; touch control + WLAN"

Information about WLAN interface → 77



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43 *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
- 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 various hazardous areas

Remote operation → 76

Service interface → 77

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 the device → 194
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 163
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 163
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus 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:

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

The associated device description files are available at: 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 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 measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
- Uploading 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, create documentation of 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

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:

	Device memory	T-DAT	S-DAT
Available data	▪ Event history, such as diagnostic events ▪ Parameter data record backup ▪ Device firmware package ▪ Driver for system integration e.g.: DD for HART	▪ Measured value memory ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Maximum indicators (min/max values) ▪ Totalizer values	▪ Sensor data: diameter etc. ▪ Serial number ▪ User-specific access code (to use the "Maintenance" user role) ▪ Calibration data ▪ 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	Can be plugged into 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

Manual
Additional parameter data record (complete parameter settings) in the integrated device memory for:
- Data backup function
  Backup and subsequent restoration of a device configuration in the device memory
- Data comparison function
  Comparison of the current device configuration with the device configuration saved in the device memory

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 1000 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
- Use the recorded measured value data in the integrated device simulation function in the **Diagnostics** submenu (→ 152).

Service logbook

Manual
- Create up to 20 user-specific events with a date and customized text in a separate logbook for documentation of the measuring point
- Use for calibration or service operations, for example, or for maintenance or revision work that has been performed

16.12 Certificates and approvals

CE mark

The measuring system is in conformity with the statutory 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.

C-Tick symbol

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 "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
Drinking water approval	▪ ACS ▪ KTW/W270 ▪ NSF 61 ▪ WRAS BS 6920
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	Europe: RED 2014/53/EU United States of America: CFR Title 47, FCC Part 15.247 Canada: RSS-247 Issue 1 Japan: Article 2 clause 1 item 19 Additional country-specific approvals on request.
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

16.13 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.

Diagnostics functions

Package	Description
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.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**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 process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets. **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.

Cleaning

Package	Description
Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to AVOID build up of highly conductive matter and thin layers (typical of magnetite).

16.14 Accessories

Overview of accessories available for order → 162

16.15 Supplementary documentation

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

Standard documentation

Brief Operating Instructions

Part 1 of 2: Sensor

Measuring device	Documentation code
Proline Promag	KA01216D

Part 2 of 2: Transmitter

Measuring device	Documentation code
Proline 500	KA01230D

Technical Information

Measuring device	Documentation code
Promag W 500	TI01227D

Description of device parameters

Measuring device	Documentation code
Promag 500	GP01054D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex i	XA01522D
ATEX/IECEx Ex ec	XA01523D
cCSAus IS	XA01524D
cCSAus Ex e ia / Ex d ia	XA01525D
cCSAus Ex nA	XA01526D
INMETRO Ex i	XA01527D
INMETRO Ex ec	XA01528D
NEPSI Ex i	XA01529D
NEPSI Ex nA	XA01530D

Special documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Heartbeat Technology	SD01641D
Web server	SD01658D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Overview of accessories available for order → 162

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روبـروی پالایشگاه نفت پـارس، پلاک ۱۲

www.addresses.endress.com

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promag 10H

Electromagnetic Flow Measuring System
Flow measurement of liquids in hygienic, food or process applications

Application
Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 50 µS/cm:

- Beverages, e.g. fruit juice, beer, wine
- Dairy products, fruit juice mixes
- Saline solutions
- Acid, alkalis etc.

- Flow measurement up to 600 m^3/h (2650 gal/min)
- Fluid temperature up to +150 °C (+302 °F)
- Process pressures up to 40 bar (580 psi)
- CIP-/SIP cleaning

Approvals in food sector/hygiene sector:
- 3A approval, EHEDG-certified, conform to FDA, USP Class VI

Application-specific lining material:
- PFA

Your benefits
Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:
- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:
- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

TI00095D/06/EN/13.12
71162123

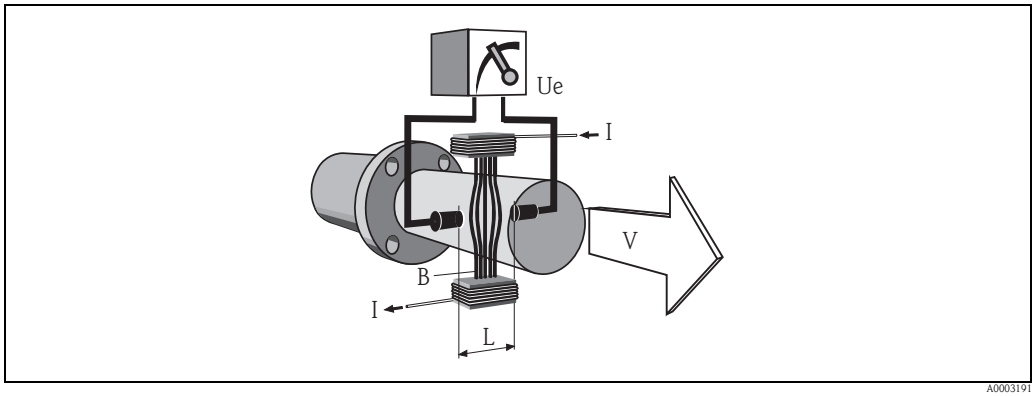
Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.
In the electromagnetic measuring principle, the flowing medium is the moving conductor.
The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated by means of the pipe cross-sectional area. The DC magnetic field is created through a switched direct current of alternating polarity.



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$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
v *Flow velocity*
Q *Volume flow*
A *Pipe cross-section*
I *Current strength*

Measuring system

The measuring system consists of a transmitter and a sensor.
Two versions are available:
- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:
- Promag 10 (key operation, two-line, unilluminated display)

Sensor:
- Promag H (DN 2 to 150 / 1/12 to 6")

Input

Measured variable

Flow velocity (proportional to induced voltage)

Measuring ranges

Measuring ranges for liquids
Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Flow characteristic values (SI units)

Nominal diameter		Recommended flow rate	Factory settings		
[mm]	[inch]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value, current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
2	1/12"	0.06 to 1.8 dm^3/min	0.5 dm^3/min	0.005 dm^3	0.01 dm^3/min
4	1/8"	0.25 to 7 dm^3/min	2 dm^3/min	0.025 dm^3	0.05 dm^3/min
8	3/8"	1 to 30 dm^3/min	8 dm^3/min	0.1 dm^3	0.1 dm^3/min
15	½"	4 to 100 dm^3/min	25 dm^3/min	0.2 dm^3	0.5 dm^3/min
25	1"	9 to 300 dm^3/min	75 dm^3/min	0.5 dm^3	1 dm^3/min
40	1½"	25 to 700 dm^3/min	200 dm^3/min	1.5 dm^3	3 dm^3/min
50	2"	35 to 1100 dm^3/min	300 dm^3/min	2.5 dm^3	5 dm^3/min
65	–	60 to 2000 dm^3/min	500 dm^3/min	5 dm^3	8 dm^3/min
80	3"	90 to 3000 dm^3/min	750 dm^3/min	5 dm^3	12 dm^3/min
100	4"	145 to 4700 dm^3/min	1200 dm^3/min	10 dm^3	20 dm^3/min
125	5"	220 to 7500 dm^3/min	1850 dm^3/min	15 dm^3	30 dm^3/min
150	6"	20 to 600 m^3/h	150 m^3/h	0.03 m^3	2.5 m^3/h

Flow characteristic values (US units)

Nominal diameter		Recommended flow rate	Factory settings		
[inch]	[mm]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value, current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
1/12"	2	0.015 to 0.5 gal/min	0.1 gal/min	0.001 gal	0.002 gal/min
1/8"	4	0.07 to 2 gal/min	0.5 gal/min	0.005 gal	0.008 gal/min
3/8"	8	0.25 to 8 gal/min	2 gal/min	0.02 gal	0.025 gal/min
½"	15	1.0 to 27 gal/min	6 gal/min	0.05 gal	0.10 gal/min
1"	25	2.5 to 80 gal/min	18 gal/min	0.2 gal	0.25 gal/min
1½"	40	7 to 190 gal/min	50 gal/min	0.5 gal	0.75 gal/min
2"	50	10 to 300 gal/min	75 gal/min	0.5 gal	1.25 gal/min
3"	80	24 to 800 gal/min	200 gal/min	2 gal	2.5 gal/min
4"	100	40 to 1250 gal/min	300 gal/min	2 gal	4 gal/min
5"	125	60 to 1950 gal/min	450 gal/min	5 gal	7 gal/min
6"	150	90 to 2650 gal/min	600 gal/min	5 gal	12 gal/min

Operable flow range

Over 1000 : 1

Output

Output signal

Current output

- Galvanically isolated
- Active: 4 to 20 mA, R_L < 700 Ω (for HART: $R_L \geq 250$ Ω)
- Full scale value adjustable
- Temperature coefficient: typ. 2 µA/°C, resolution: 1.5 µA

Pulse/status output

- Galvanically isolated
- Passive: 30 V DC/250 mA
- Open collector
- Can be configured as:
  - Pulse output: Pulse value and pulse polarity can be selected, max. pulse width adjustable (5 to 2000 ms), pulse frequency max. 100 Hz
  - Status output: for example, can be configured for error messages, empty pipe detection, flow recognition, limit value

Signal on alarm

- Current output → Failsafe mode can be selected
- Pulse output → Failsafe mode can be selected
- Status output → "Not conductive" in the event of fault or power supply failure

Load

See "output signal"

Low flow cutoff

Switch points for low flow cutoff are selectable.

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other.

Power supply

Terminal assignment

Order version	Terminal No.					
	24 (+)	25 (–)	26 (+)	27 (–)	1 (L1/L+)	2 (N/L–)
10***-**********A	Pulse/status output		HART current output		Power supply	
Functional values	→ Section "Output signal"				→ Section "Supply voltage"	

Supply voltage

- 85 to 250 V AC, 45 to 65 Hz
- 20 to 28 V AC, 45 to 65 Hz
- 11 to 40 V DC

Power consumption

- 85 to 250 V AC: < 12 VA (incl. sensor)
- 20 to 28 V AC: < 8 VA (incl. sensor)
- 11 to 40 V DC: < 6 W (incl. sensor)

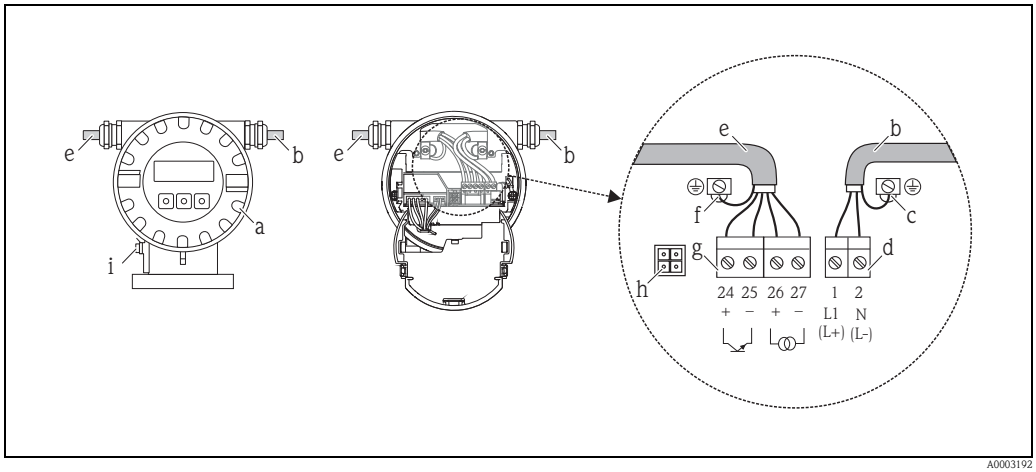
Switch-on current:

- Max. 16 A (< 5 ms) for 250 V AC
- Max. 5.5 A (< 5 ms) for 28 V AC
- Max. 3.3 A (< 5 ms) for 24 V DC

Power supply failure

Lasting min. ½ cycle frequency: EEPROM saves measuring system data

Electrical connection



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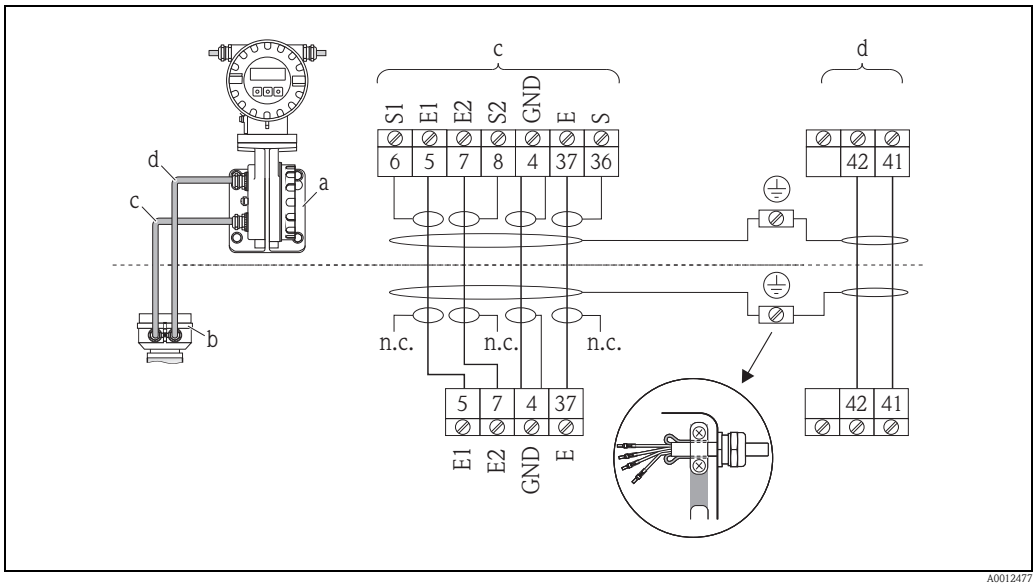
Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)

- *a* *Electronics compartment cover*
- *b* *Power supply cable*
- *c* *Ground terminal for power supply cable*
- *d* *Terminal connector for power supply cable*
- *e* *Signal cable*
- *f* *Ground terminal for signal cable*
- *g* *Terminal connector for signal cable*
- *h* *Service connector*
- *i* *Ground terminal for potential equalization*

Electrical connection, remote version



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Connecting the remote version

- *a* *Wall-mount housing connection compartment*
- *b* *Sensor connection housing cover*
- *c* *Signal cable*
- *d* *Coil current cable*
- *n.c.* *Not connected, insulated cable shields*

Terminal numbers and cable colors:
5/6 = brown, 7/8 = white, 4 = green, 37/36 = yellow

Note!
Grounding the cable shielding in the sensor takes place by means of the strain relief terminal.

Potential equalization

To guarantee perfect measurement, the sensor and the fluid have to be on the same electric potential. Potential equalization can take place by means of the metal, process connections in contact with the medium which are mounted directly on the sensors. As a result, further measures for potential equalization are generally not required.

Cable entries

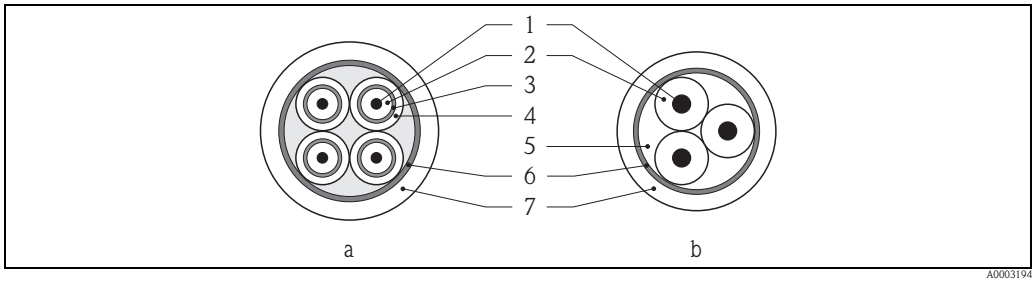
Power supply and signal cables (inputs/outputs):
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Remote version cable specifications

Coil cable
- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤ 37 Ω/km (≤ 0.011 Ω/ft)
- Capacitance core/core, shield grounded: ≤ 120 pF/m (≤ 37 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)
- Test voltage for cable insulation: ≤ 1433 AC r.m.s 50/60 Hz or ≥ 2026 V DC

Signal cable
- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- With empty pipe detection (EPD): 4 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)



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a *Signal cable*
b *Coil current cable*

1 *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

Operation in zones of severe electrical interference
The measuring device complies with the general safety requirements in accordance with EN 61010 and the EMC requirements of IEC/EN 61326.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

Performance characteristics

Reference operating conditions

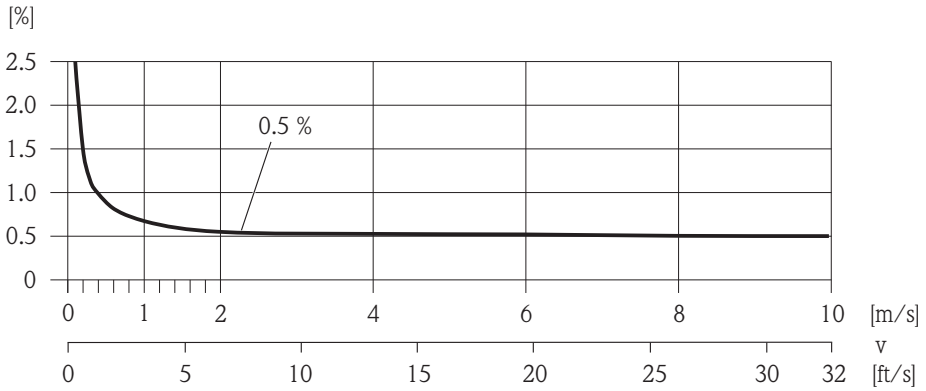
As per DIN EN 29104
- Medium temperature: (+28 ± 2) °C / (+82 ± 4) °F
- Ambient temperature: (+22 ± 2) °C / (+72 ± 4) °F
- Warm-up period: 30 minutes

Installation conditions
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

- Pulse output: ±0.5% o.r. ± 2 mm/s (o.r. = of reading)
- Current output: also typically ± 5 µA

Fluctuations in the supply voltage do not have any effect within the specified range.



Max. measured error in % of reading

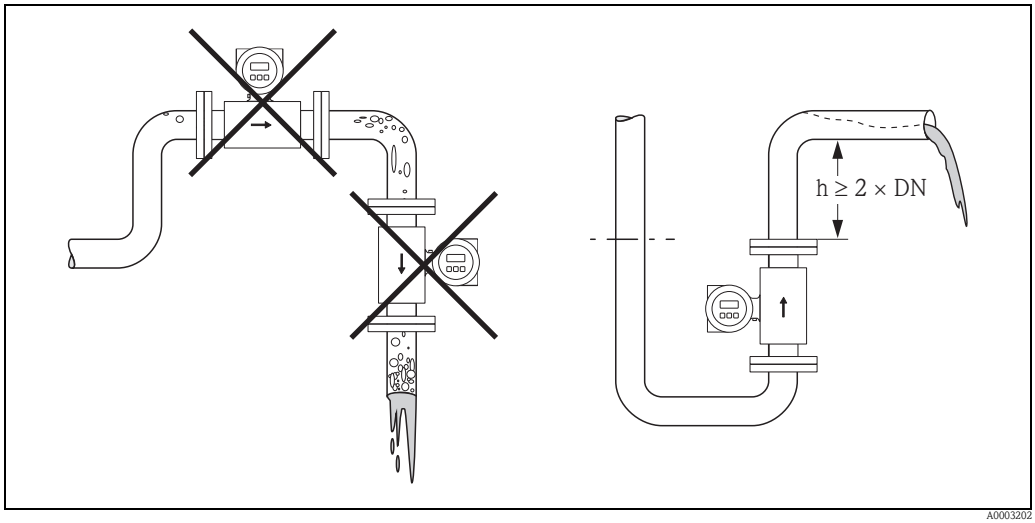
Repeatability

Max. ±0.2% o.r. ± 2 mm/s (o.r. = of reading)

Installation

Mounting location

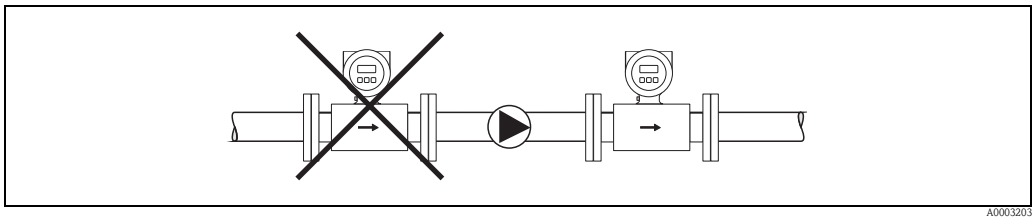
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



Mounting location

Installation of pumps

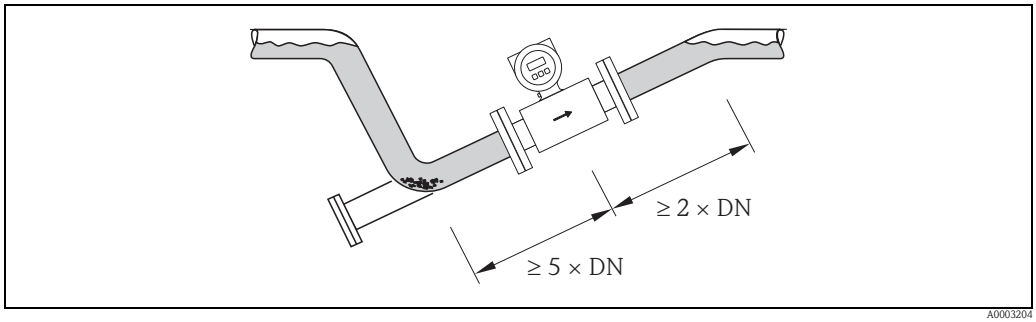
Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 16, Section "Pressure tightness".
It might be necessary to install pulse dampers in systems incorporating reciprocating, diaphragm or peristaltic pumps. Information on the shock and vibration resistance of the measuring system → 14, Section "Shock and vibration resistance".



Installation of pumps

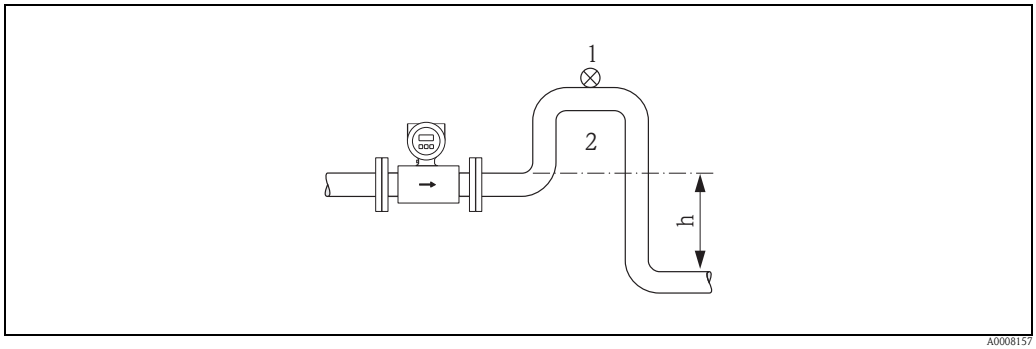
Partially filled pipes
Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



Installation with partially filled pipes

Down pipes
Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 16, Section "Pressure tightness".



Installation measures for vertical pipes

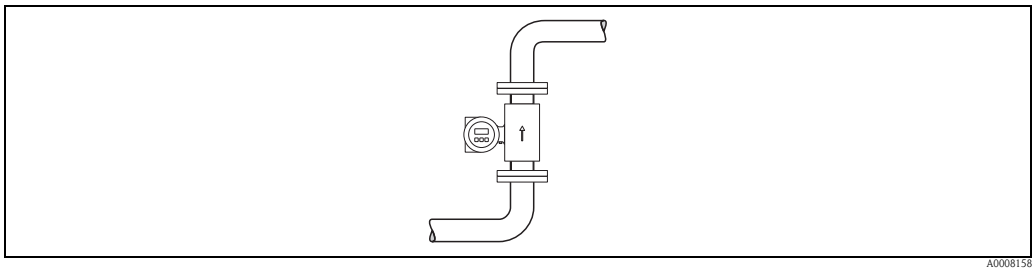
1 Vent valve
2 Pipe siphon
h Length of the down pipe

Orientation

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube. The measuring device also offers the additional empty pipe detection function (EPD) for the detection of partially filled measuring tubes, e.g. in the case of degassing fluids or varying process pressures.

Vertical orientation

This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



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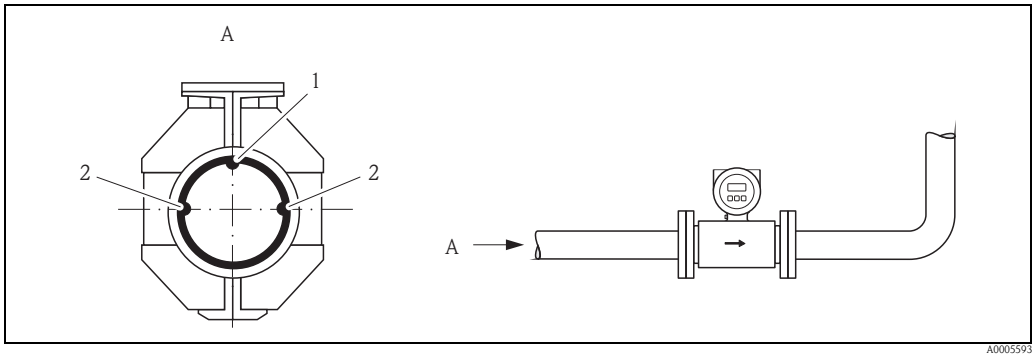
Vertical orientation

Horizontal orientation

The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!
Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.



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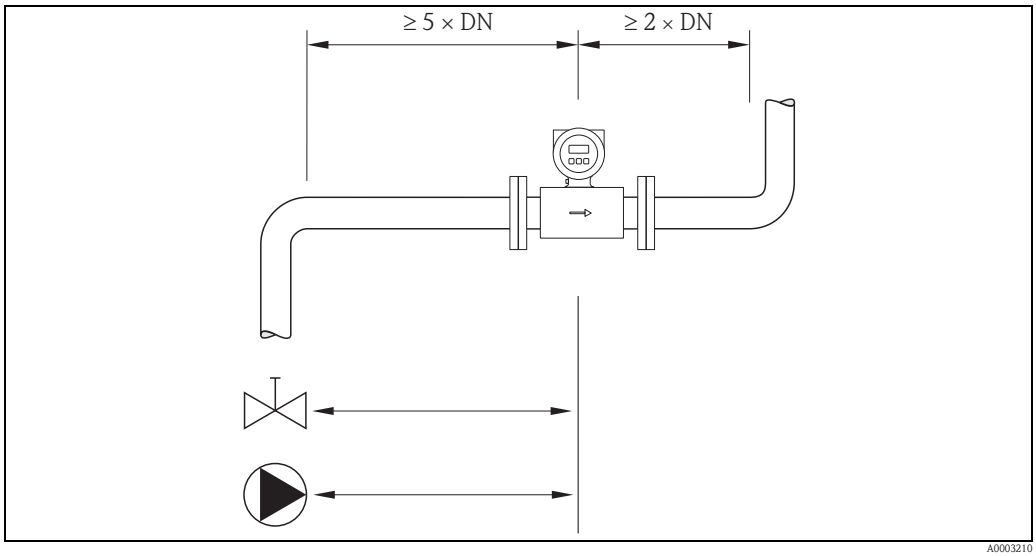
Horizontal orientation

1 EPD electrode for empty pipe detection (not for DN 2 to 15 / 1/12 to ½")
2 Measuring electrodes for signal detection

Inlet and outlet runs

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

Note the following inlet and outlet runs to comply with measuring accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN



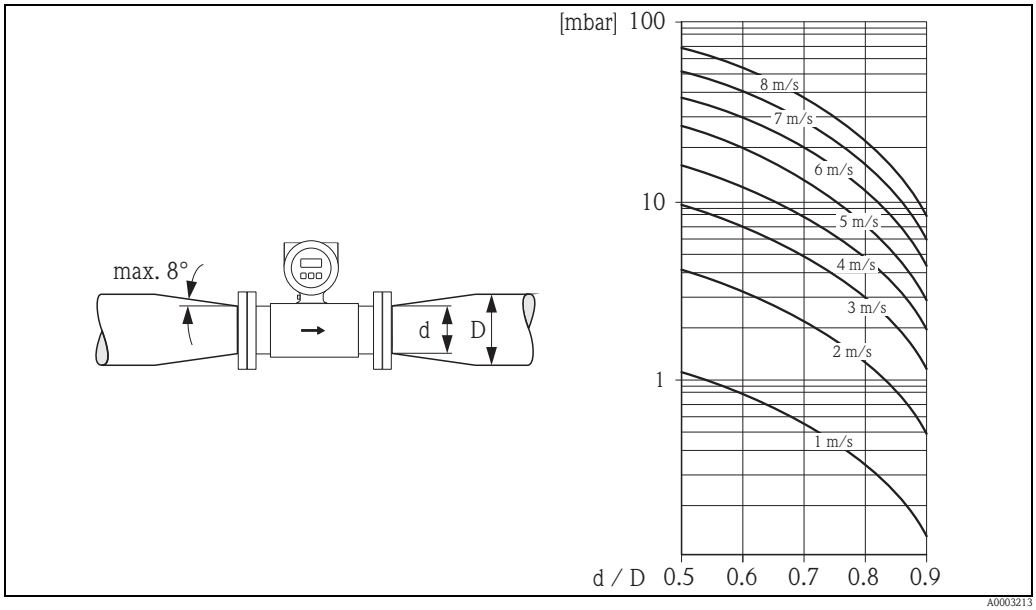
Inlet and outlet runs

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

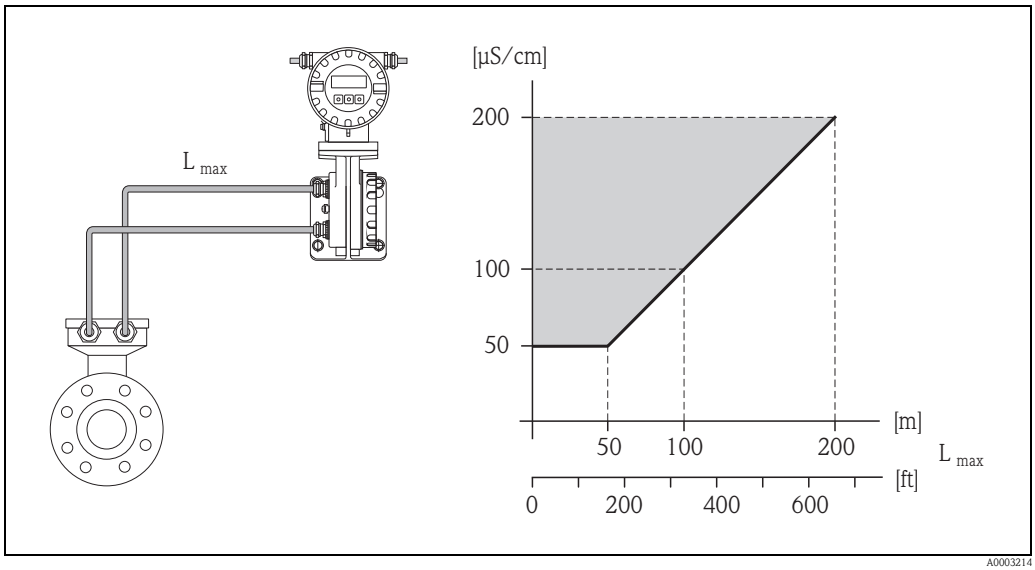


Pressure loss due to adapters

Length of connecting cable

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length L_{max} is determined by the fluid conductivity. A minimum conductivity of 50 µS/cm is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).



Permitted length of connecting cable for remote version
Area marked in gray = permitted range; L_{max} = length of connecting cable in [m] ([ft]); fluid conductivity in [µS/cm]

Environment

Ambient temperature range

- Transmitter: –20 to +60 °C (–4 to +140 °F)

Note!
At ambient temperatures below –20 °C (–4 °F), the readability of the display may be impaired.

- Sensor: –40 to +60 °C (–40 to +140 °F)

Caution!
- The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ 15, Section "Medium temperature range").
- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.
- If protecting caps or protective covers are mounted, these must not be removed before mounting the device.

Degree of protection

- Standard: IP 67 (NEMA 4X) for transmitter and sensor.

Shock and vibration resistance

Acceleration up to 2 g following IEC 68-2-6

Interior cleaning

- CIP cleaning
- SIP cleaning

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR recommendation NE 21
- Emission: to limit value for industry EN 55011

Process

Medium temperature range

Sensor:
- DN 2 to 150 (1/12 to 6"): –20 to +150 °C (–4 to +302 °F)

Seals:
- EPDM: –20 to +150 °C (–4 to 302 °F)
- Viton (FKM): –20 to +150 °C (–4 to 302 °F)
- Kalrez: –20 to +150 °C (–4 to 302 °F)

Conductivity

The minimum conductivity is: ≥ 50 µS/cm

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 13, Section "Length of connecting cable").

Medium pressure range (nominal pressure)

The permitted nominal pressure depends on the process connection, the seal and the nominal diameter.

Process connections DN 2 to 25 (1/12 to 1") with O-ring seal

Nominal diameter [mm]	2	4	8	15	25
[inch]	1/12"	1/8"	3/8"	½"	1"
Couplings: ISO 228/DIN 2999, NPT	1.4404/316L: PN 40 (580 psi)				
Flange: EN 1092-1 (DIN 2501)					
Flange: ANSI B16.5	1.4404/316L: Class 150				
Flange: JIS B2220	1.4404/316L: 20 K				

Process connections DN 2 to 25 (1/12 to 1") with aseptic gasket seal

Nominal diameter [mm]	2	4	8	15	25
[inch]	1/12"	1/8"	3/8"	½"	1"
Welding nipple: DIN 11850, ODT/SMS	1.4404/316L: PN 16 (232 psi)				
Couplings: SC DIN 11851, DIN 11864-1, SMS 1145					
Clamp: L14 AM7					
Flange: DIN 11864-2					

Process connections DN 40 to 150 (1½ to 6") with aseptic gasket seal (1.44404/316L)

Nominal diameter [mm]	40	50	65	80	100	125	150
[inch]	1½"	2"	-	3"	4"	5"	6"
Welding nipple: ODT/SMS	PN 16 (232 psi)						
Welding nipple: DIN 11850	PN 16 (232 psi)						
– For order codes with suffixes +CA/+CB	PN 40 (580 psi)	PN 25 (362.5 psi)				PN 16 (232 psi)	
Welding nipple: ISO 2037	PN 40 (580 psi)	PN 25 (362.5 psi)				PN16 (232 psi)	
Welding nipple: ASME BPE	PN 40 (580 psi)	PN 25 (362.5 psi)				-	PN 16 (232 psi)
Clamp: L14 AM7	PN 16 (232 psi)					PN 10 (145 psi)	
Coupling: SC DIN 11851	PN 16 (232 psi)						
– For order codes with suffixes +CA/+CB	PN 40 (580 psi)	PN 25 (362.5 psi)				PN 16 (232 psi)	
Coupling: SMS 1145	PN 16 (232 psi)						
Coupling: DIN 11864-1	PN 16 (232 psi)						
– For order codes with suffixes +CA/+CB	PN 40 (580 psi)	PN 25 (362.5 psi)				-	
Flange: DIN 11864-2	PN 16 (232 psi)						
– For order codes with suffixes +CA/+CB	PN 25 (362.5 psi)	PN 16 (232 psi)				PN 10 (145 psi)	

Pressure tightness

Measuring tube lining: PFA

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:				
[mm]	[inch]	25 °C (77 °F)	80 °C (176 °F)	100 °C (212 °F)	130 °C (266 °F)	150 °C (302 °F)
2 to 150	1/12 to 6"	0	0	0	0	0

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.
The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.5 ft/s): for small conductivities
- v > 2 m/s (6.5 ft/s): for fluids causing build-up such as high-fat milk etc.

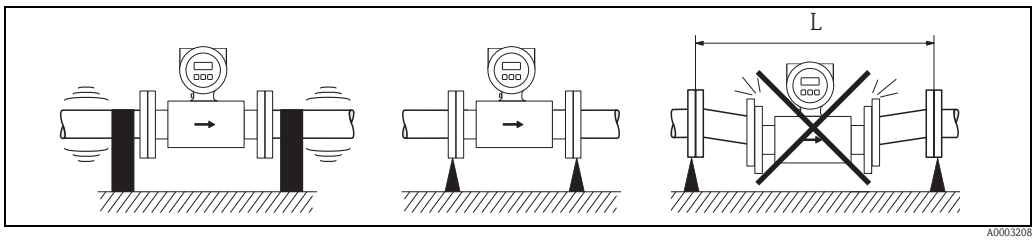
Pressure loss

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 12, Section "Adapters").

Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 14, Section "Shock and vibration resistance".



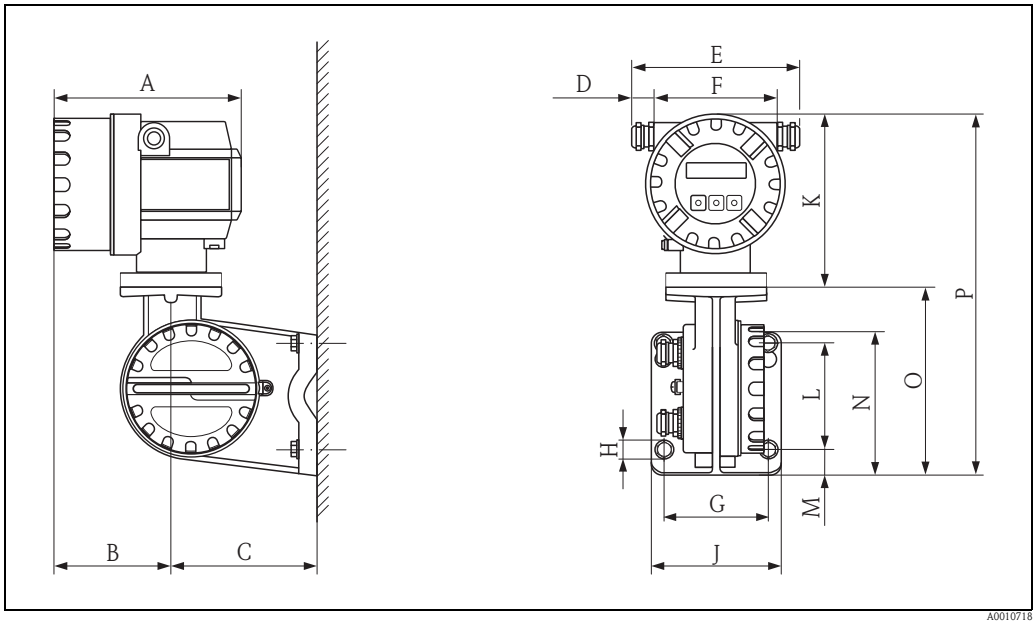
Measures to prevent vibration of the measuring device

L > 10 m (33 ft)

Mechanical construction

Design, dimensions

Transmitter, remote version



Transmitter dimensions, remote version

Dimensions in SI units

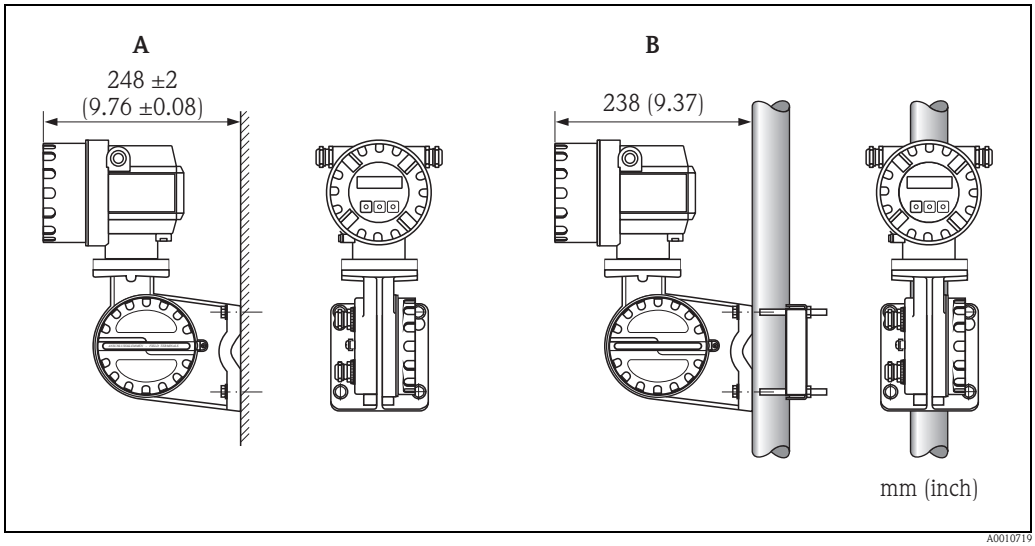
A	B	C	D	E	F	G	Ø H
178	113	135	20 to 30	161 to 181	121	100	8.6 (M8)
J	K	L	M	N	O	P	
123	150	100	25	133	177.5	327.5	

All dimensions in [mm]

Dimensions in US units

A	B	C	D	E	F	G	Ø H
7.00	4.45	5.31	0.79 to 1.81	6.34 to 7.13	4.76	3.94	0.34 (M8)
J	K	L	M	N	O	P	
4.84	5.90	3.94	0.98	5.24	6.99	12.89	

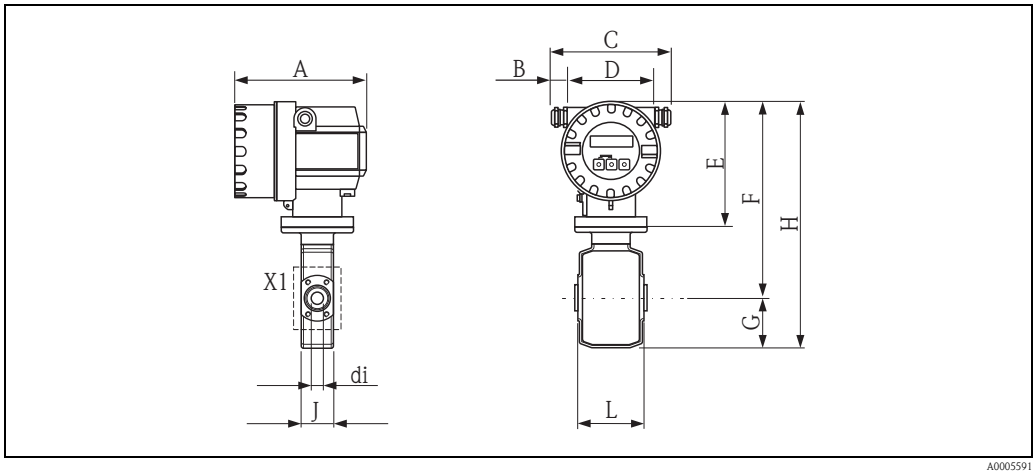
All dimensions in [inch]



Transmitter mounting, remote version

A Direct wall mounting
B Pipe mounting

Compact version DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

DN	L	A	B	C	D	E	F	G	H	J	X1	di
2	86	178	20 to 30	161 to 181	113	150	242	55	297	43	M6 × 4	2.25
4										43		4.5
8										43		9.0
15										43		16.0
25										56		26.0

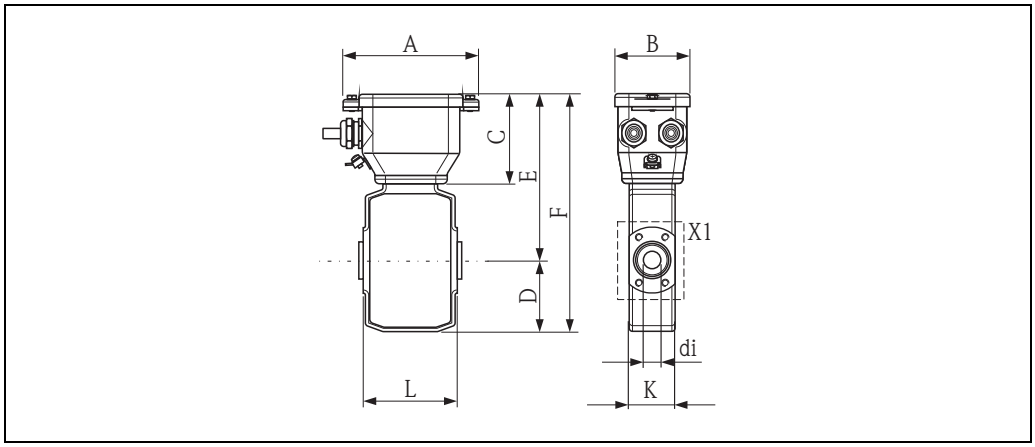
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	G	H	J	X1	di
1/12"	3.39	7.01	0.79 to 1.81	6.34 to 7.13	4.45	5.91	9.53	2.17	11.7	1.69	M6 × 4	0.09
1/8"										1.69		0.18
3/8"										1.69		0.35
½"										1.69		0.63
1"										2.20		0.89

Total length depends on the process connections.
All dimensions in [inch]

Sensor, remote version DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

DN	L	A	B	C	D	E	F	K	X1	di
2	86	127	70	75	55	136	191	43	M6 × 4	2.25
4								43		4.5
8								43		9.0
15								43		16.0
25								56		26.0

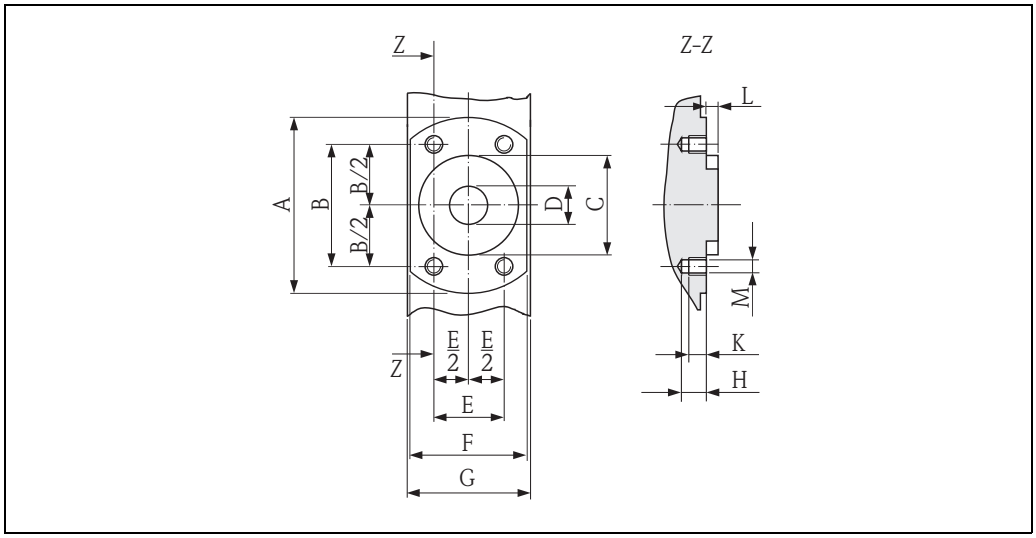
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	K	X1	di
1/12"	3.39	5.00	2.76	2.95	2.17	5.35	7.52	1.69	M6 × 4	0.09
1/8"								1.69		0.18
3/8"								1.69		0.35
½"								1.69		0.63
1"								2.20		0.89

Total length depends on the process connections.
All dimensions in [inch]

Sensor, front view (without process connections) DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

DN	A	B	C	D	E	F	G	H	K	L	M
2	62	41.6	34	9	24	42	43	8.5	6	4	M6
4				9							
8				9							
15				16							
25	72	50.2	44	26	29	55	56				

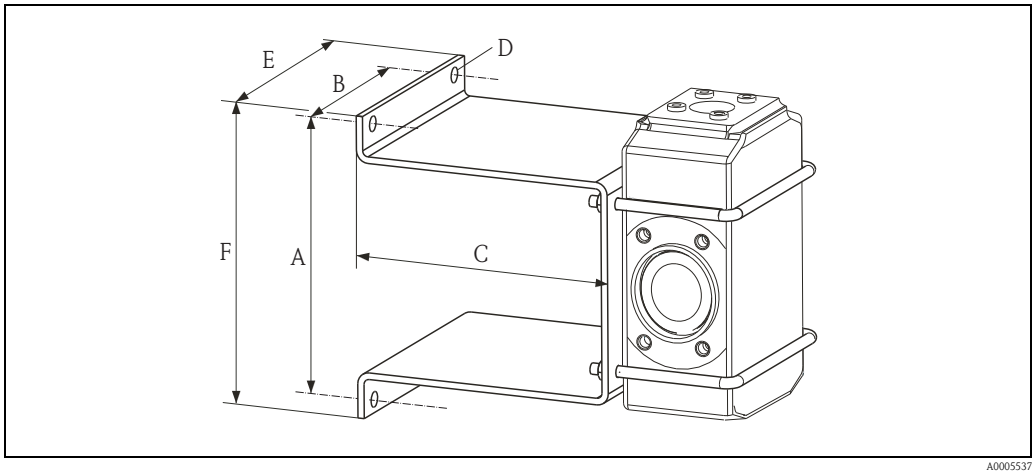
All dimensions in [mm]

Dimensions in US units

DN	A	B	C	D	E	F	G	H	K	L	M
1/12"	2.44	1.64	1.34	0.35	0.94	1.65	1.69	0.33	0.24	0.16	M6
1/8"				0.35							
3/8"				0.35							
½"				0.63							
1"	2.83	1.98	1.73	0.89	1.14	2.17	2.20				

All dimensions in [inch]

Sensor, wall mounting kit DN 2 to 25 (1/12 to 1")

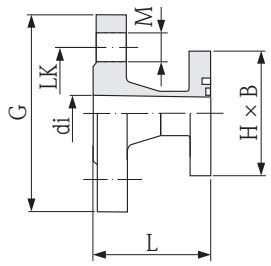


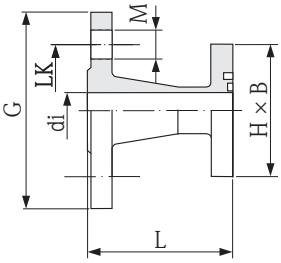
A0005537

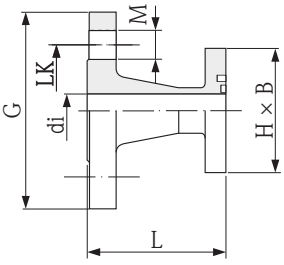
Dimensions in mm (inch)

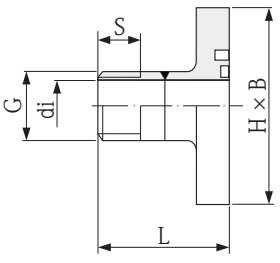
A	B	C	Ø D	E	F
125 (4.92")	88 (3.46")	120 (4.72")	7 (0.28")	110 (4.33")	140 (5.51")

Process connections (DN 2 to 25 / 1/12 to 1") with O-ring seal

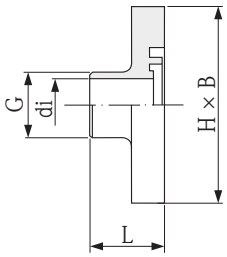
Flange for EN 1092-1 (DIN 2501), Form B, 1.4404/316L, PN 40	Sensor DN	Fits to flange [1]	di	G	L	LK	M	H × B
10H**-D**********	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	2 to 8	DN 15	17.3	95	56.2	65	14	62 × 42
	15	DN 15	17.3	95	56.2	65	14	62 × 42
	25 (DIN)	DN 25	28.5	115	56.2	85	14	72 × 55
	[1] EN 1092-1 (DIN 2501) ■ Fitting length = (2 × L) + 86 mm ■ Fitting length to DVGW (200 mm)							

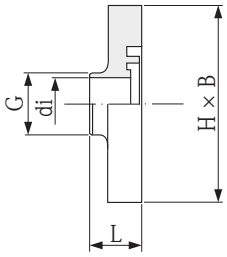
Flange for ANSI B16.5, 1.4404/316L, Cl. 150	Sensor DN	Fits to flange[1]	di	G	L	LK	M	H × B
10H**-E**********	[mm]	[inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	2 to 8	½"	15.7	89	66.0	60.5	15.7	62 × 42
	15	½"	16.0	89	66.0	60.5	15.7	62 × 42
	25 (1" ANSI)	1"	26.7	108	71.8	79.2	15.7	72 × 55
	[1] ANSI B16.5 ■ Fitting length = (2 × L) + 86 mm							

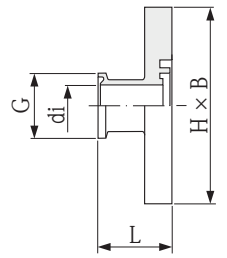
Flange for JIS B2220, 1.4404/316L, 20K	Sensor DN	Fits to flange	di	G	L	LK	M	H × B
10H**-F**********	[mm]	B2220	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	2 to 8	ND 15	15	95	67	70	15	62 × 42
	15	ND 15	16	95	67	70	15	62 × 42
	25 (DIN)	ND 25	26	125	67	90	19	72 × 55
	■ Fitting length = (2 × L) + 86 mm							

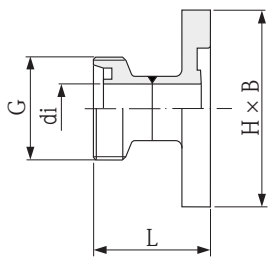
External pipe thread, ISO 228/DIN 2999, 1.4404/316L	Sensor DN	Fits to internal thread	di	G	L	S	H × B
10H**-K**********	[mm]	[inch]	[mm]	[inch]	[mm]	[mm]	[mm]
	2 to 8	R 3/8"	10	3/8"	40	10.1	62 × 42
	15	R ½"	16	½"	40	13.2	62 × 42
	25 (1" ANSI)	R 1"	25	1"	42	16.5	72 × 55
	■ Fitting length = (2 × L) + 86 mm						

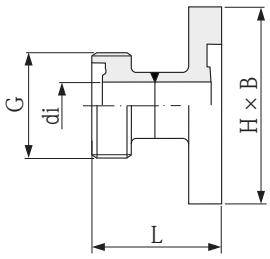
Process connections (DN 2 to 25 / 1/12 to 1") with aseptic gasket seal

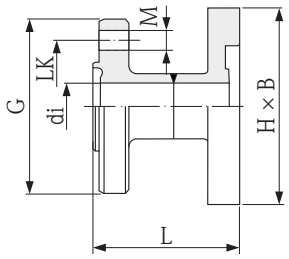
Welding nipple for DIN, 1.4404/316L	Sensor DN	Fits to piping	di	G	L	H × B
10H**-U**********	[mm]	DIN 11850	[mm]	[mm]	[mm]	[mm]
 A0003870	2 to 8	14 × 2	10	14	23.3	62 × 42
	15	20 × 2	16	20	23.3	62 × 42
	25 (DIN)	30 × 2	26	30	23.3	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

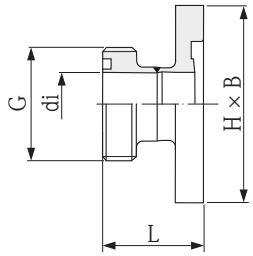
Welding nipple for ODT/SMS, 1.4404/316L	Sensor DN	Fits to piping	di	G	L	H × B
10H**-V**********	[mm]	ODT/SMS	[mm]	[mm]	[mm]	[mm]
 A0003871	2 to 8	12.7 × 1.65	9.0	12.7	16.1	62 × 42
	15	19.1 × 1.65	16.0	19.1	16.1	62 × 42
	25 (1" ANSI)	25.4 × 1.65	22.6	25.4	16.1	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

Tri-Clamp for L14 AM7, 1.4404/316L	Sensor DN	Fits to piping	di	G	L	H × B
10H**-1**********	[mm]	OD	[mm]	[mm]	[mm]	[mm]
 A0003872	2 to 8	Tube 12.7 × 1.65 (OD ½")	9.4	25.0	28.5	62 × 42
	15	Tube 19.1 × 1.65 (ODT ¾")	15.8	25.0	28.5	62 × 42
	25 (1" ANSI)	Tube 25.4 × 1.65 (ODT 1")	22.1	50.4	28.5	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

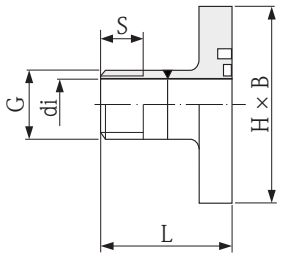
Coupling SC DIN 11851, threaded adapter, 1.4404/316L	Sensor DN	Fits to piping	di	G	L	H × B
10H**-2**********	[mm]	DIN 11850	[mm]	[mm]	[mm]	[mm]
 A0005553	2 to 8	Tube 12 × 1 (DN 10)	10	Rd 28 × 1/8"	44	62 × 42
	15	Tube 18 × 1.5 (DN 15)	16	Rd 34 × 1/8"	44	62 × 42
	25 (DIN)	Tube 28 × 1 or 28 × 1.5 (DN 25)	26	Rd 52 × 1/6"	52	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

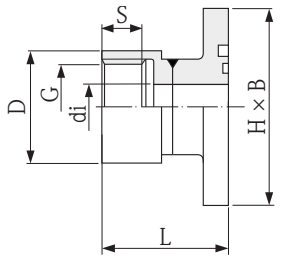
Coupling DIN 11864-1, aseptic threaded adapter, Form A, 1.4404/316L	Sensor DN	Fits to piping	di	G	L	H × B
10H**-3**********	[mm]	DIN 11850	[mm]	[mm]	[mm]	[mm]
 A0005558	2 to 8	Tube 13 × 1.5 (DN 10)	10	Rd 28 × 1/8"	42	62 × 42
	15	Tube 19 × 1.5 (DN 15)	16	Rd 34 × 1/8"	42	62 × 42
	25 (DIN)	Tube 29 × 1.5 (DN 25)	26	Rd 52 × 1/6"	49	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

Flange DIN 11864-2, aseptic grooved flange, Form A, 1.4404/316L	Sensor DN	Fits to piping	di	G	L	LK	M	H × B
10H**-4**********	[mm]	DIN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005559	2 to 8	Tube 13 × 1.5 (DN 10)	10	54	48.5	37	9	62 × 42
	15	Tube 19 × 1.5 (DN 15)	16	59	48.5	42	9	62 × 42
	25 (DIN)	Tube 29 × 1.5 (DN 25)	26	70	48.5	53	9	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

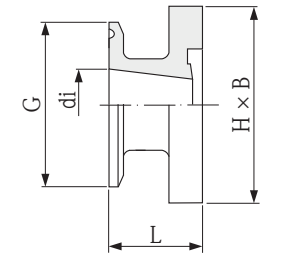
Coupling SMS 1145, threaded adapter, 1.4404/316L	Sensor DN	Fits to piping	SMS 1145 DN	di	G	L	H × B
10H10H**-5**********	[mm]	OD	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005564	25 (1" ANSI)	1"	25	22.6	Rd 40 × 1/6"	30.8	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!						

Process connections orderable only as accessories with O-ring seal (DN 2 to 25 / 1/12 to 1")

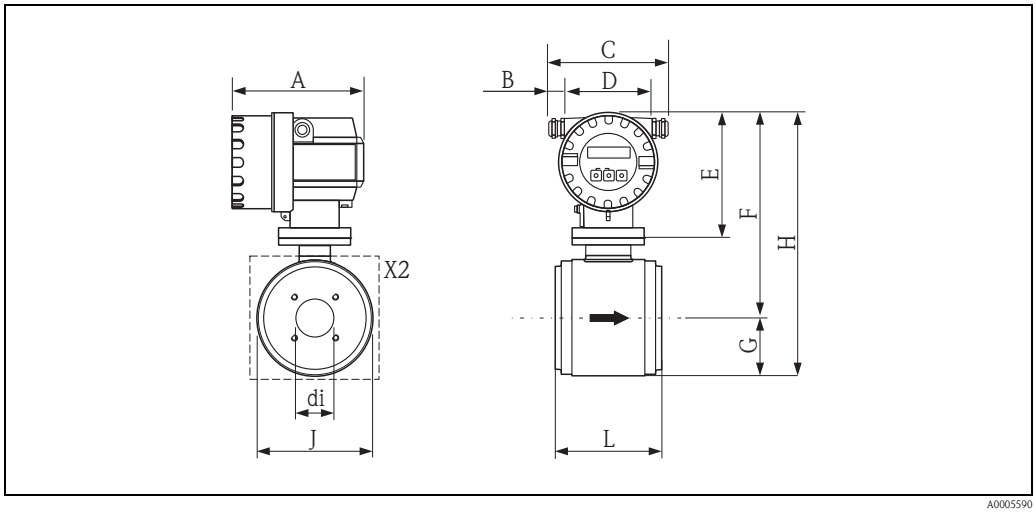
External pipe thread, 1.4404/316L	Sensor DN	Fits to internal thread	di	G	L	S	H × B
DKH**-GD**	[mm]	Internal pipe thread	[mm]	[inch]	[mm]	[mm]	[mm]
	2 to 8	NPT 3/8"	10	3/8"	50	15.5	62 × 42
	15	NPT ½"	16	½"	50	20.0	62 × 42
	25 (1" ANSI)	NPT 1"	25	1"	55	25.0	72 × 55
	▪ Fitting length = (2 × L) + 86 mm						

Internal thread, 1.4404/316L	Sensor DN	Fits to external thread	di	G	D	L	S	H × B
DKH**-GC**	DN [mm]	NP External pipe thread	[mm]	[inch]	[mm]	[mm]	[mm]	[mm]
	2 to 8	NPT 3/8"	8.9	3/8"	22	45	13	62 × 42
	15	NPT ½"	16.0	½"	27	45	14	62 × 42
	25 (1" ANSI)	NPT 1"	27.2	1"	40	51	17	72 × 55
	▪ Fitting length = (2 × L) + 86 mm							

Process connections orderable only as accessories with aseptic gasket seal (DN 15)

Tri-Clamp L14 AM17 1.4404/316L	Sensor DN	Fits to piping	di	G	L	H × B
DKH**-HF**	[mm]	OD	[mm]	[mm]	[mm]	[mm]
	15	Tube 25.4 × 1.65 (ODT 1")	22.1	50.4	28.5	62 × 42
	▪ Fitting length = (2 × L) + 86 mm ▪ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

Compact version DN 40 to 150 (1½ to 6")



Dimensions in SI units

DN	L	A	B	C	D	E	F	G	H	J	X2	di
40	140	178	20 to 30	161 to 181	113	150	242	53.5	295.5	107	M8 × 4	34.8
50	140						248.5	60	308.5	120	M8 × 4	47.5
65	140						256	67.5	323.5	135	M8 × 6	60.2
80	140						262.5	74	336.5	148	M8 × 6	72.9
100	140						275.5	87	362.5	174	M8 × 6	97.4
125	200						291.5	103	394.5	206	M10 × 6	120.0
150	200						305.5	117	422.5	234	M10 × 6	146.9

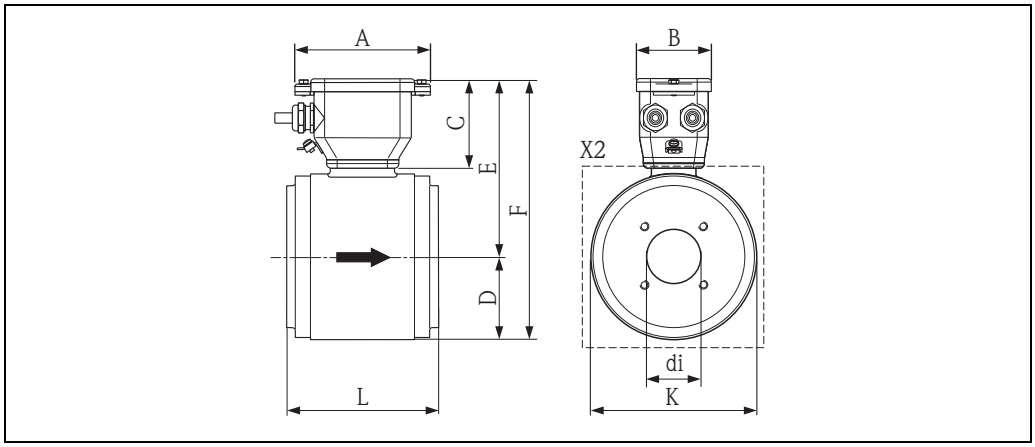
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	G	H	J	X2	di
1½"	5.51	7.01	0.79 to 1.81	6.34 to 7.13	4.45	5.91	9.53	2.11	11.63	4.21	M8 × 4	1.37
2"	5.51						9.78	2.36	12.15	4.72	M8 × 4	1.87
3"	5.51						10.33	2.91	13.25	5.83	M8 × 6	2.87
4"	5.51						10.85	3.43	14.27	6.85	M8 × 6	3.83
5"	7.87						11.48	4.06	15.53	8.11	M10 × 6	4.72
6"	7.87						12.03	4.61	16.63	9.21	M10 × 6	5.78

Total length depends on the process connections.
All dimensions in [inch]

Sensor, remote version DN 40 to 150 (1½ to 6")



A0005535

Dimensions in SI units

DN	L	A	B	C	D	E	F	K	X2	di
40	140	125	70	75	53.3	138.5	191.8	106	M8 × 4	34.8
50	140				59.8	145.0	204.8	119	M8 × 4	47.5
65	140				67.3	152.5	219.8	134	M8 × 6	60.2
80	140				73.8	159.0	232.8	147	M8 × 6	72.9
100	140				86.8	172.0	258.8	173	M8 × 6	97.4
125	200				102.8	188.0	290.8	205	M10 × 6	120.0
150	200				116.8	202.0	318.8	233	M10 × 6	146.9

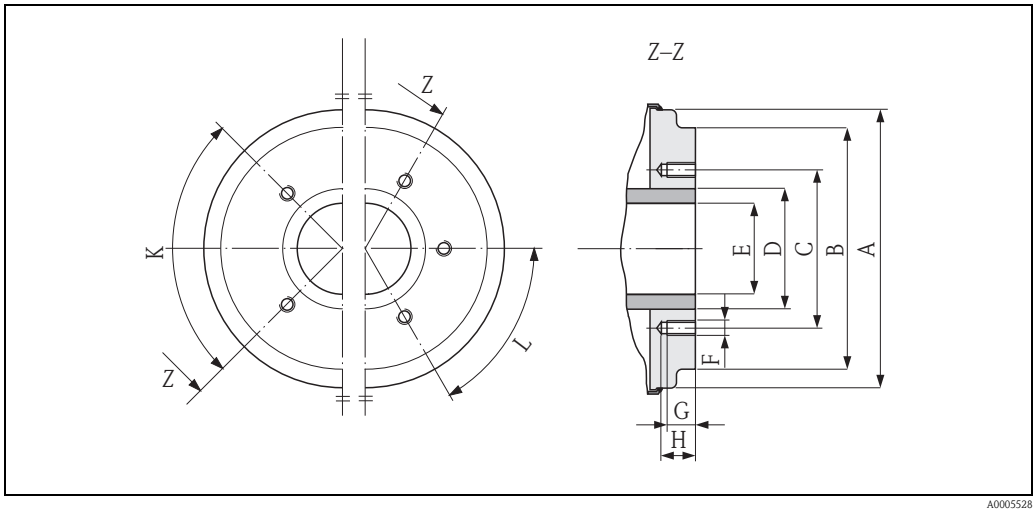
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	K	X2	di
1½"	5.51	4.92	2.76	2.95	2.10	5.45	7.55	4.17	M8 × 4	1.37
2"	5.51				2.35	5.71	8.06	4.69	M8 × 4	1.87
3"	5.51				2.91	6.26	9.17	5.79	M8 × 6	2.87
4"	5.51				3.42	6.77	10.19	6.81	M8 × 6	3.83
5"	7.87				4.05	7.40	11.49	8.07	M10 × 6	4.72
6"	7.87				4.60	7.95	12.55	9.17	M10 × 6	5.78

Total length depends on the process connections.
All dimensions in [inch]

Sensor, front view (without process connections) DN 40 to 150 (1½ to 6")



A0005528

Dimensions in SI units

DN	A	B	C	D	E	F	G	H	K 90° ±0.5°	L 60° ±0.5°
									Threaded holes	
40	99.7	85.8	71.0	48.3	34.8	M 8	12	17	4	–
50	112.7	98.8	83.5	60.3	47.5	M 8	12	17	4	–
65	127.7	114.8	100.0	76.1	60.2	M 8	12	17	–	6
80	140.7	133.5	114.0	88.9	72.9	M 8	12	17	–	6
100	166.7	159.5	141.0	114.3	97.4	M 8	12	17	–	6
125	198.7	191.5	171.0	139.7	120.0	M 10	15	20	–	6
150	226.7	219.5	200.0	168.3	146.9	M 10	15	20	–	6

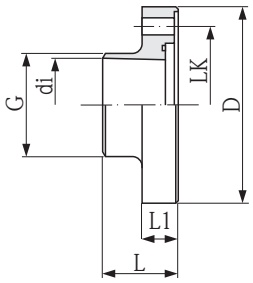
All dimensions in [mm]

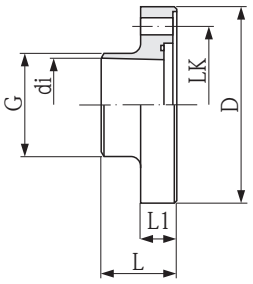
Dimensions in US units

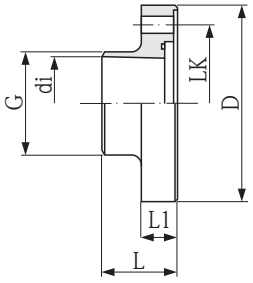
DN	A	B	C	D	E	F	G	H	K 90° ±0.5°	L 60° ±0.5°
									Threaded holes	
1½"	3.93	3.38	2.80	1.90	1.37	M 8	0.47	0.67	4	–
2"	4.44	3.89	3.29	2.37	1.87	M 8	0.47	0.67	4	–
3"	5.54	5.26	4.49	3.50	2.87	M 8	0.47	0.67	–	6
4"	6.56	6.28	5.55	4.50	3.83	M 8	0.47	0.67	–	6
5"	7.82	7.54	6.73	5.50	4.72	M 10	0.59	0.79	–	6
6"	8.93	8.64	7.87	6.63	5.78	M 10	0.59	0.79	–	6

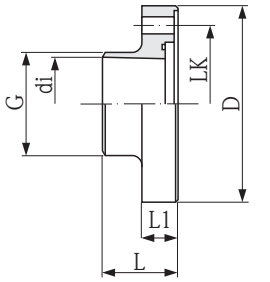
All dimensions in [inch]

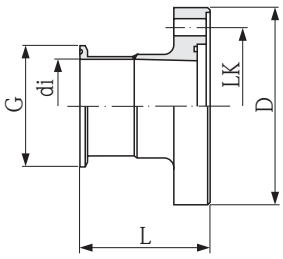
Process connections DN 40 to 150 (1½ to 6") with aseptic gasket seal

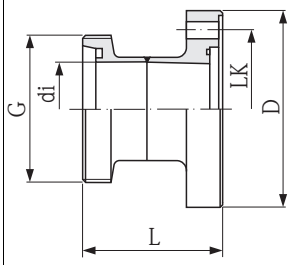
Welding nipple for DIN, 1.4404/316L	Sensor DN	Fits to piping	di	G	D	L	L1	LK	L_{tot} [1]
 A0005541	[mm]	DIN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-U**********, DKH**-HR**								
	40	41 × 1.5	38	43	92.0	42	19	71.0	220
	50	53 × 1.5	50	55	105.0	42	19	83.5	220
	65	70 × 2	66	72	121.0	42	21	100.0	220
	80	85 × 2	81	87	140.7	73	18	114.0	280
	100	104 × 2	100	106	166.7	73	18	141.0	280
	125	129 × 2	125	129	198.7	53	25	171.0	300
	150	154 × 2	150	154	226.7	53	25	200.0	300
	Order codes: 10H**-U**********+CA/+CB, DKH**-HR**+CA/+CB								
	40	41 × 1.5	38.0	41	99.7	43	18	71.0	220
	50	53 × 1.5	50.0	53	112.7	43	18	83.5	220
	65	70 × 2	66.0	70	127.7	43	18	100.0	220
	80	85 × 2	81.0	85	140.7	43	18	114.0	220
	100	104 × 2	100.0	104	166.7	43	18	141.0	220
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!								

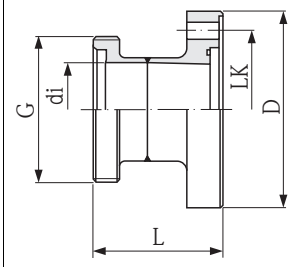
Welding nipple for ODT/SMS, 1.4404/316L	Sensor DN	Fits to Piping	di	G	D	L	L1	LK	L_{tot} [1]
 A0005541	[mm]	OD/SMS	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-V**********, DKH**-HB**								
	40	38.1 × 1.65	35.3	40	92	42	19	71.0	220
	50	50.8 × 1.65	48.1	55	105	42	19	83.5	220
	65	63.5 × 1.65	59.9	66	121	42	21	100.0	220
	80	76.2 × 1.65	72.6	79	140.7	73	18	114.0	280
	100	101.6 × 1.65	97.5	104	166.7	73	18	141.0	280
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!								

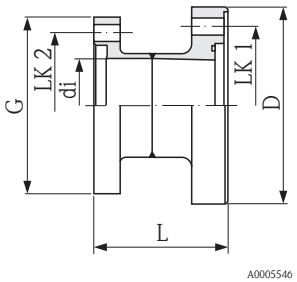
Welding nipple ASME BPE, 1.4404/316L	Sensor DN		Fits to Piping	di	G	D	L	L1	LK	L_{tot} [1]
 A0005541	[mm]	[inch]	ASME BPE	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-Q**********, DKH**-HN**									
	40	1½"	38.1 × 1.65	34.8	38.1	99.7	43	18	71.0	220
	50	2"	50.8 × 1.65	47.5	50.8	112.7	43	18	83.5	220
	65	–	63.5 × 1.65	60.2	63.5	127.7	43	18	100.0	220
	80	3"	76.2 × 1.65	72.9	76.2	140.7	43	18	114.0	220
	100	4"	101.6 × 2.11	97.4	101.6	166.7	43	18	141.0	220
	150	6"	152.4 × 2.77	149.9	152.4	226.7	53	25	200.0	300
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!									

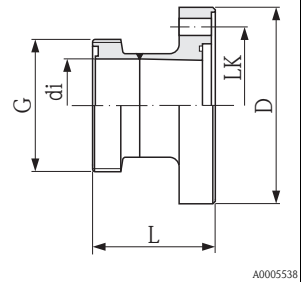
Welding nipple ISO 2037, 1.4404/316L	Sensor DN	Fits to Piping	di	G	D	L	L1	LK	L_{tot} 1)
	[mm]	ISO 2037	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-T**********, DKH**-HP**								
	40	38 × 1.2	35.6	38	99.7	43	18	71.0	220
	50	51 × 1.2	48.6	51	112.7	43	18	83.5	220
	65	63.5 × 1.6	60.3	63.5	127.7	43	18	100.0	220
	80	76.1 × 1.6	72.9	76.1	140.7	43	18	114.0	220
	100	101.6 × 2	97.6	101.6	166.7	43	18	141.0	220
	125	139.7 × 2	135.7	139.7	198.7	93	25	171.0	380
	150	168.3 × 2.6	163.1	168.3	226.7	93	25	200.0	380
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!								

Tri-Clamp L14 AM7, 1.4404/316L	Sensor DN		Fits to piping	di	G	D	L	LK	L_{tot} 1)
	[mm]	[inch]	ASME BPE	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-1**********, DKH**-HE**								
	40	1½"	38.1 × 1.65	34.8	50.4	92.0	68.6	71.0	273.2
	50	2"	50.8 × 1.65	47.5	63.9	105.0	68.6	83.5	273.2
	65	–	63.5 × 1.65	60.2	77.4	121.0	68.6	100.0	273.2
	80	3"	76.2 × 1.65	72.9	90.9	140.7	99.6	114.0	333.2
	100	4"	101.6 × 2.11	97.4	118.9	166.7	99.6	141.0	333.2
	150	6"	152.4 × 2.77	146.9	166.9	226.7	53	200.0	300
	Order codes: 10H**-1**********+CA/+CB, DKH**-HE**+CA/+CB								
	40	1½"	38.1 × 1.65	34.8	50.4	99.7	43	71.0	220
	50	2"	50.8 × 1.65	47.5	63.9	112.7	43	83.5	220
	65	–	63.5 × 1.65	60.2	77.4	127.7	43	100.0	220
	80	3"	76.2 × 1.65	72.9	90.9	140.7	43	114.0	220
	100	4"	101.6 × 1.65	97.4	118.9	166.7	43	141.0	220
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!								

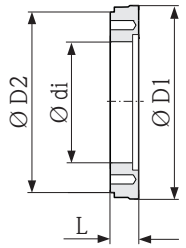
Coupling SC DIN 11851, 1.4404/316L	Sensor DN	Fits to piping	di	G	D	L	LK	L_{tot} 1)
 A0005540	[mm]	DN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-2**********, DKH**-HG**							
	40	42 × 1.5	38	Rd 65 × 1/6"	92.0	72	71.0	280
	50	54 × 1.5	50	Rd 78 × 1/6"	105.0	74	83.5	284
	65	70 × 2	66	Rd 95 × 1/6"	121.0	78	100.0	292
	80	85 × 2	81	Rd 110 × 1/4"	140.7	114	114.0	362
	100	104 × 2	100	Rd 130 × 1/4"	166.7	123	141.0	380
	125	129 × 2	125	Rd 160 × 1/4"	198.7	93	171.0	380
	150	154 × 2	150	Rd 160 × 1/4"	226.7	98	200.0	390
	Order codes: 10H**-2**********+CA/+CB, DKH**-HG**+CA/+CB							
	40	42 × 1.5	38	Rd 65 × 1/6"	99.7	63	71.0	260
	50	54 × 1.5	50	Rd 78 × 1/6"	112.7	63	83.5	260
	65	70 × 2	66	Rd 95 × 1/6"	127.7	68	100.0	270
	80	85 × 2	81	Rd 110 × 1/4"	140.7	73	114.0	280
	100	104 × 2	100	Rd 130 × 1/4"	166.7	78	141.0	290
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

Coupling DIN 11864-1, Aseptic threaded adapter, Form A, 1.4404/316L	Sensor DN	Fits to piping	di	G	D	L	LK	L_{tot} 1)
 A0005545	[mm]	DN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-3**********, DKH**-HH**							
	40	42 × 1.5	38	Rd 65 × 1/6"	92.0	71	71.0	278
	50	54 × 1.5	50	Rd 78 × 1/6"	105.0	71	83.5	278
	65	70 × 2	66	Rd 95 × 1/6"	121.0	76	100.0	288
	80	85 × 2	81	Rd 110 × 1/4"	140.7	113	114.0	360
	100	104 × 2	100	Rd 130 × 1/4"	166.7	121	141.0	376
	Order codes: 10H**-3**********+CA/+CB, DKH**-HH**+CA/+CB							
	40	42 × 1.5	38	Rd 65 × 1/6"	99.7	61	71.0	256
	50	54 × 1.5	50	Rd 78 × 1/6"	112.7	61	83.5	256
	65	70 × 2	66	Rd 95 × 1/6"	127.7	66	100.0	266
	80	85 × 2	81	Rd 110 × 1/4"	140.7	71	114.0	276
	100	104 × 2	100	Rd 130 × 1/4"	166.7	76	141.0	286
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

Flange DIN 11864-2, Aseptic flat flange, Form A, 1.4404/316L	Sensor DN	Fits to piping	di	G	D	L	LK 1	LK 2	L_{tot} 1)
	[mm]	DN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-4**********, DKH**-HJ**								
	40	42 × 1.5	38	82	92.0	64	71.0	65	264
	50	54 × 1.5	50	94	105.0	64	83.5	77	264
	65	70 × 2	66	113	121.0	64	100.0	95	264
	80	85 × 2	81	133	140.7	129	114.0	112	392
	100	104 × 2	100	159	166.7	129	141.0	137	392
	125	129 × 2	125	190	198.7	84	171.0	161	362
	150	154 × 2	150	220	226.7	84	200.0	188	362
	Order codes: 10H**-4**********+CA/+CB, DKH**-HJ**+CA/+CB								
	40	42 × 1.5	38	82	99.7	56	71.0	65	246
	50	54 × 1.5	50	94	112.7	56	83.5	77	246
	65	70 × 2	66	113	127.7	56	100.0	95	246
	80	85 × 2	81	133	140.7	68	114.0	112	270
	100	104 × 2	100	159	166.7	72	141.0	137	278
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!								

Coupling SMS 1145, threaded adapter, 1.4404/316L	Sensor DN	Fits to piping	SMS 1145 DN	di	G	D	L	LK	L_{tot} 1)
	[mm]	OD	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	Order codes: 10H**-5**********, DKH**-HK**								
	40	38.1 × 1.65	38.0	35.5	Rd 60 × 1/6"	92.0	63	71.0	262
	50	50.8 × 1.65	51.0	48.5	Rd 70 × 1/6"	105.0	65	83.5	266
	65	63.5 × 1.65	63.5	60.5	Rd 85 × 1/6"	121.0	70	100.0	276
	80	76.2 × 1.65	76.0	72.6	Rd 98 × 1/6"	140.7	106	114.0	346
	100	101.6 × 1.65	101.6	97.5	Rd 132 × 1/6"	166.7	101	141.0	336
	Order codes: 10H**-5**********+CA/+CB, DKH**-HK**+CA/+CB								
	40	38.1 × 1.65	38.0	34.8	Rd 60 × 1/6"	99.7	61	71.0	256
	50	50.8 × 1.65	51.0	47.5	Rd 70 × 1/6"	112.7	61	83.5	256
	65	63.5 × 1.65	63.5	60.2	Rd 85 × 1/6"	127.7	66	100.0	266
	80	76.2 × 1.65	76.0	72.6	Rd 98 × 1/6"	140.7	71	114.0	276
	100	101.6 × 1.65	101.6	97.4	Rd 132 × 1/6"	166.7	76	141.0	286
	1) L_{tot} = fitting length If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!								

Spacer (accessory for DN 80 to 100/3 to 4")

Spacer, 1.4435/316L	Sensor DN		di	D1	D2	L
DK5HB - ****	[mm]	[inch]	[mm]	[mm]	[mm]	[mm]
 A0017294	80	3"	72.9	140.7	141	33
	100	4"	97.4	166.7	162	33

Weight

Nominal diameter		Compact version (DIN)		Remote version (without cable; DIN)			
				Sensor		Transmitter (wall-mount housing)	
[mm]	[inch]	[kg]	[lbs]	[kg]	[lbs]	[kg]	[lbs]
2	1/12"	3.6	8.0	2.0	4.0	3.1	7.0
4	1/8"	3.6	8.0	2.0	4.0	3.1	7.0
8	3/8"	3.6	8.0	2.0	4.0	3.1	7.0
15	½"	3.7	8.0	1.9	4.0	3.1	7.0
25	1"	3.9	9.0	2.8	6.0	3.1	7.0
40	1½"	5.5	12.1	4.1	4.1	3.1	7.0
50	2"	6.0	13.2	4.6	4.1	3.1	7.0
65	–	6.8	15.0	5.4	4.6	3.1	7.0
80	3"	7.4	16.3	6.0	6.0	3.1	7.0
100	4"	8.7	19.2	7.3	7.3	3.1	7.0
125	5"	14.1	31.1	12.7	12.7	3.1	7.0
150	6"	16.5	36.4	15.1	15.1	3.1	7.0

- Transmitter (compact version): 1.8 kg (3.97 lbs)
- Weight data valid for standard pressure ratings and without packaging material.

Measuring tube specifications

Nominal diameter		Pressure rating[1]	Internal diameter[2]	
		EN (DIN)	PFA	
[mm]	[inch]	[bar]	[mm]	[inch]
2	1/12"	PN 16 / PN 40	2.25	0.09
4	1/8"	PN 16 / PN 40	4.5	0.18
8	3/8"	PN 16 / PN 40	9.0	0.35
15	½"	PN 16 / PN 40	16.0	0.63
–	1"	PN 16 / PN 40	22.6	0.89
25	–	PN 16 / PN 40	26.0	1.02
40	1½"	PN 16 / PN 25 / PN 40	35.3	1.39
50	2"	PN 16 / PN 25 / PN 40	48.1	1.89
65	–	PN 16 / PN 25 / PN 40	59.9	2.36
80	3"	PN 16 / PN 25 / PN 40	72.6	2.86
100	4"	PN 16 / PN 25 / PN 40	97.5	3.84
125	5"	PN 10 / PN 16	120.0	4.72
150	6"	PN 10 / PN 16	146.5	5.77

[1] Pressure rating depends on the process connection and the seals used.
[2] Internal diameter of process connections.

Material

- Transmitter housing: powder-coated die-cast aluminum
- Window material: glass
- Sensor housing: 1.4301/304
- Wall mounting kit: 1.4301/304
- Measuring tube: 1.4301/304
- Lining material: PFA (USP Class VI; FDA 21 CFR 177.1550; 3A)
- Ground rings: 1.4435/316L (optional: Alloy C-22)
- Electrodes: 1.4435/316L (optional: Alloy C-22)
- Seals:
  – DN 2 to 25 (1/12 to 1"): O-Ring (EPDM, Viton, Kalrez), gasket seal (EPDM*, Viton)
  – DN 40 to 150 (1½ to 6"): gasket seal (EPDM*)

  * = USP Class VI; FDA 21 CFR 177.2600; 3A

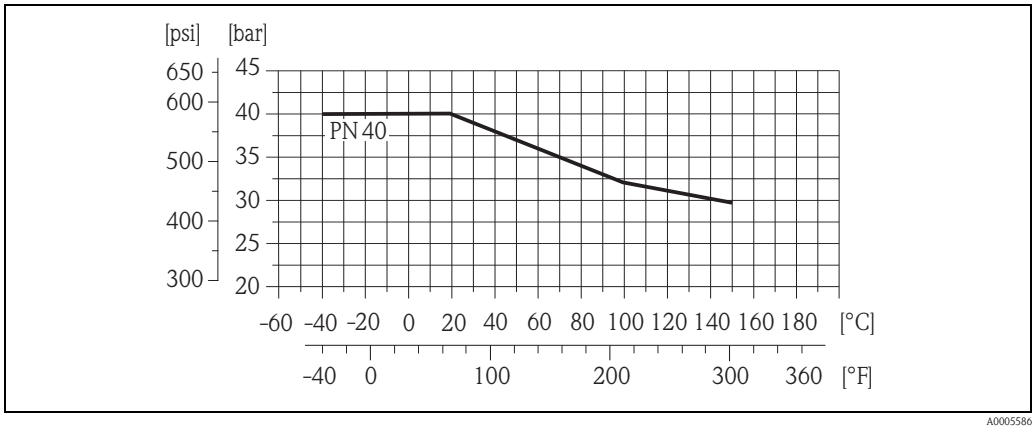
Material load diagram

Caution!
The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature.

Process connections 2 to 25 (1/12 to 1") with O-ring seal

Coupling to ISO 228/DIN 2999, NPT
Flange connection to EN 1092-1 (DIN 2501)

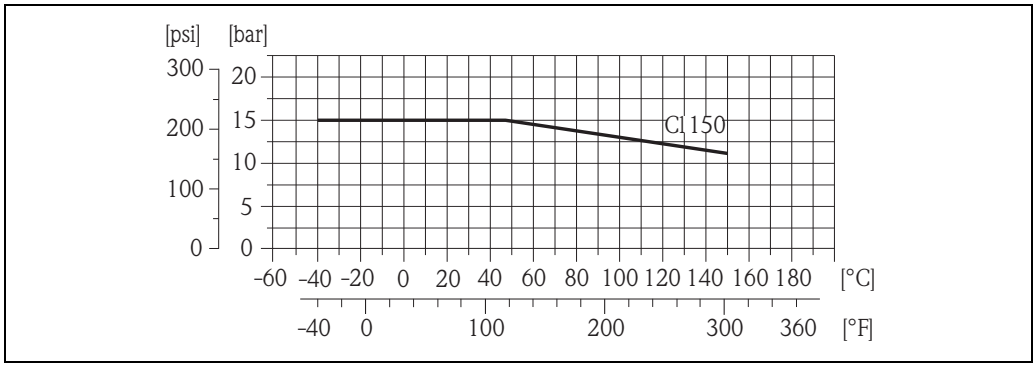
Materials: 1.4404/316L



A0005586

Flange connection to ANSI B16.5

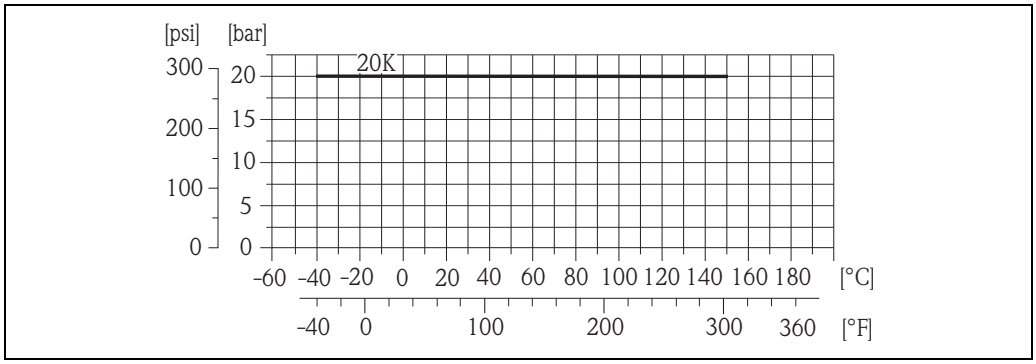
Materials: 1.4404/316L



A0005587

Flange connection to JIS B2220

Materials: 1.4404/316L

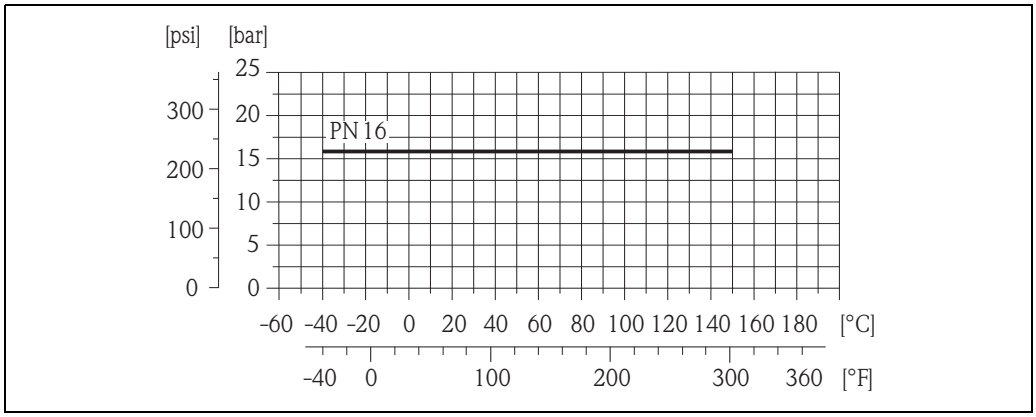


A0005588

Process connections 2 to 25 (1/12 to 1") with aseptic gasket seal

Welding nipple to DIN 11850, ODT/SMS;
Coupling to SC DIN 11851, DIN 11864-1, SMS 1145
Clamp to L14 AM7
Flange to DIN 11864-2

Material: 1.4404/316L

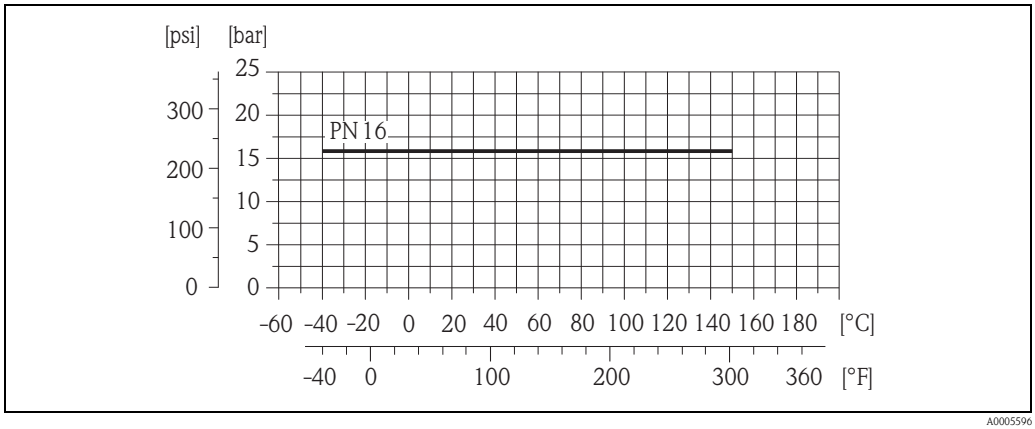


A0005596

Process connections 40 to 150 (1½ to 6") with aseptic gasket seal

Welding nipple to ODT/SMS
Coupling to SMS 1145

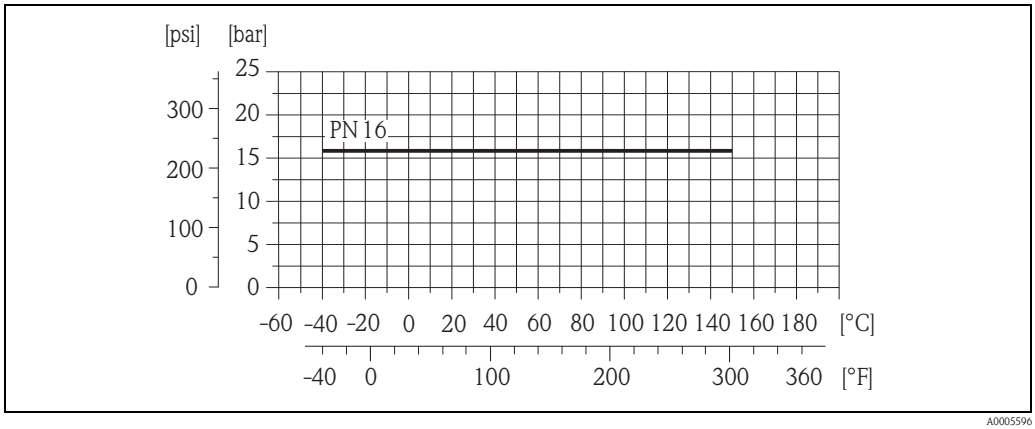
Material: 1.4404 / 316L



A0005596

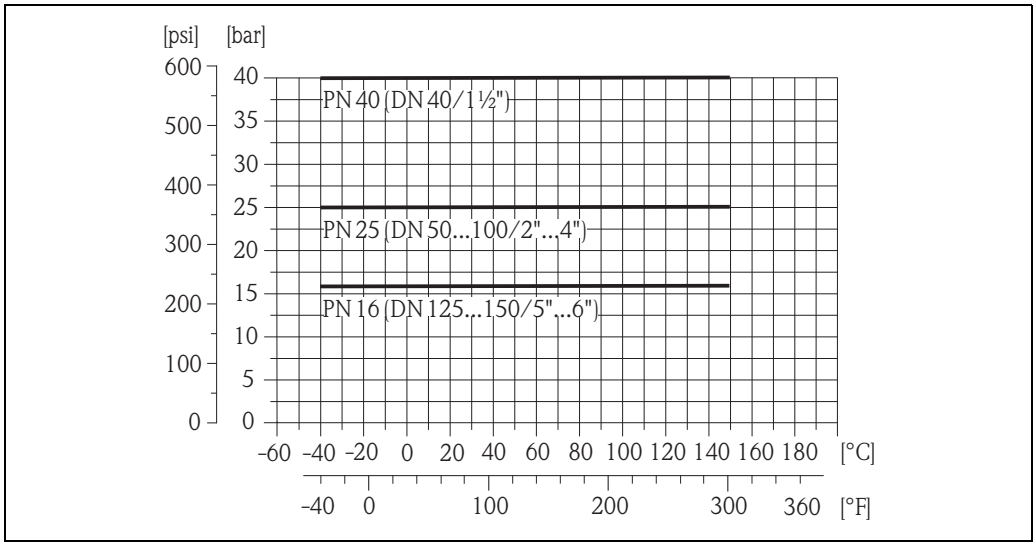
Welding nipple to DIN 11850
Coupling to SC DIN 11851

Material: 1.4404/316L



A0005596

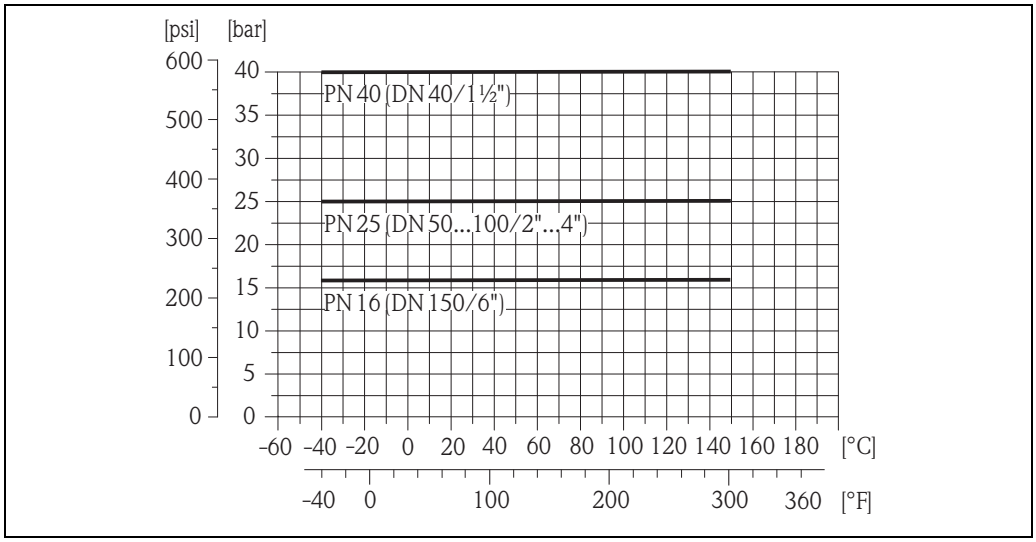
For order codes with suffixes +CA/+CB:



A0017301

Welding nipple to ASME BPE

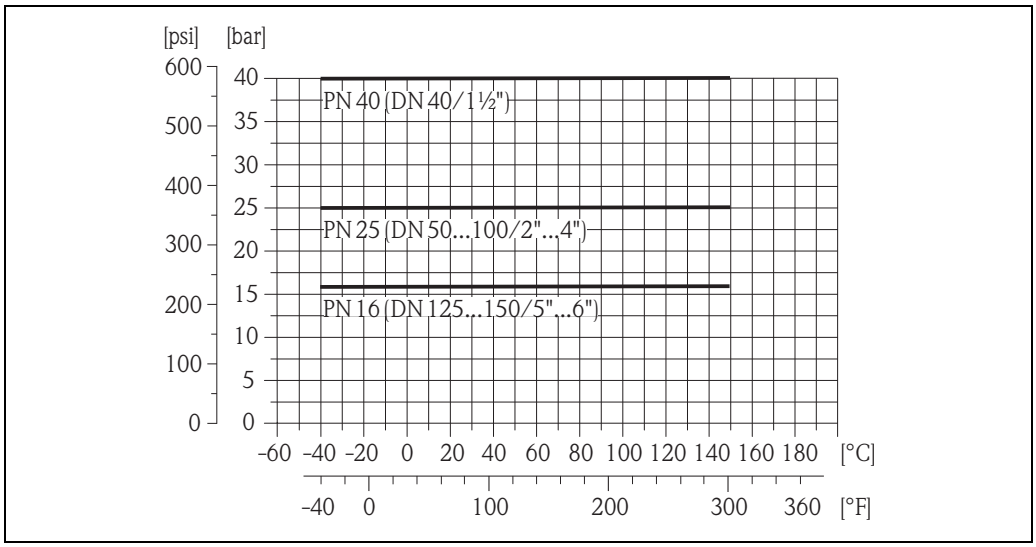
Material: 1.4404/316L



A0017302

Welding nipple to ISO 2037

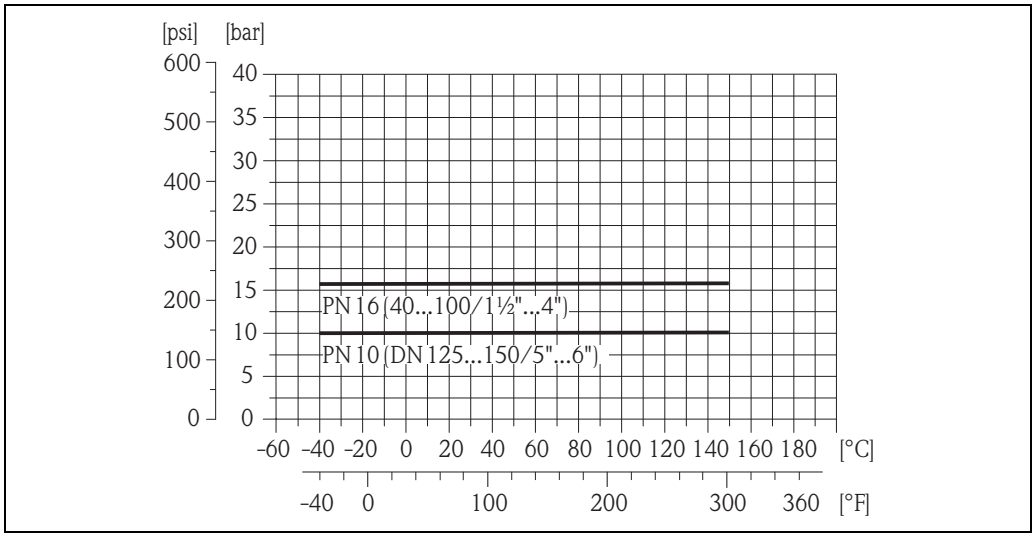
Material: 1.4404 / 316L



A0017301

Clamp to L14 AM7

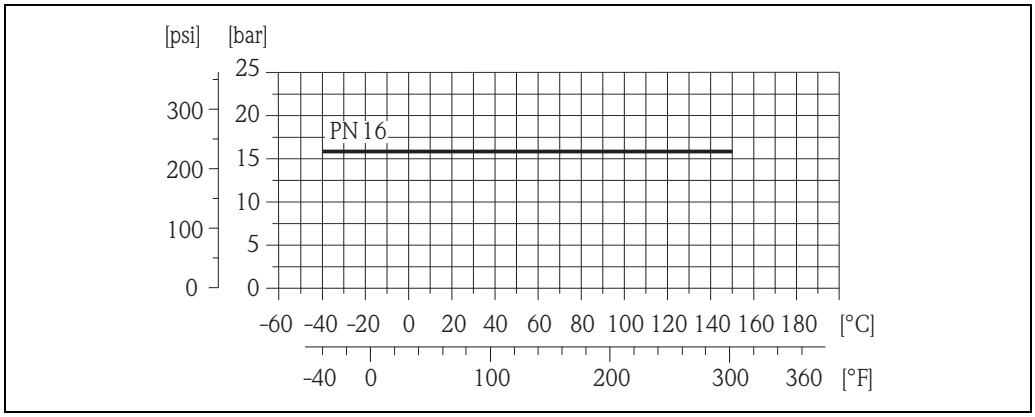
Material: 1.4404/316L



A0017314

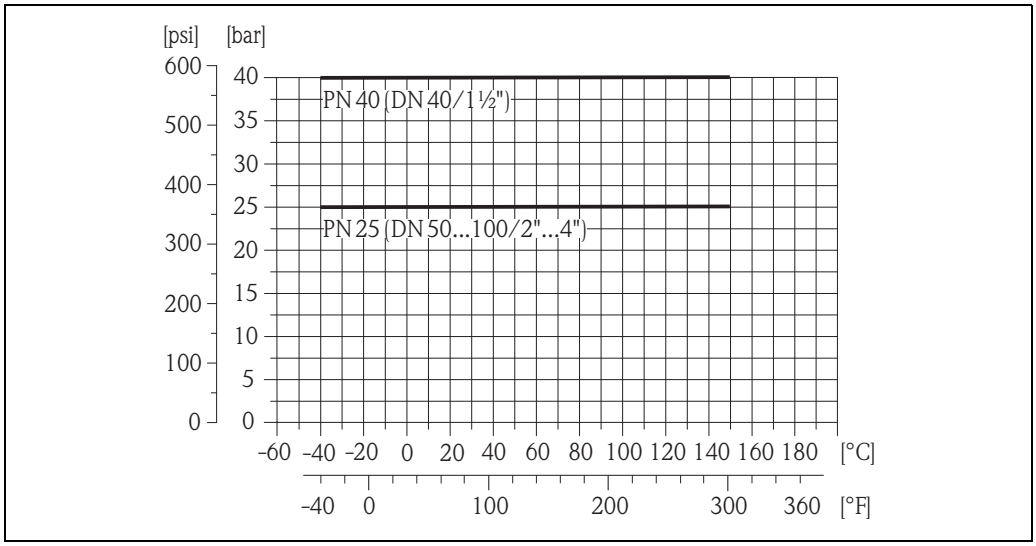
Coupling to DIN 11864-1

Material: 1.4404/316L



A0005596

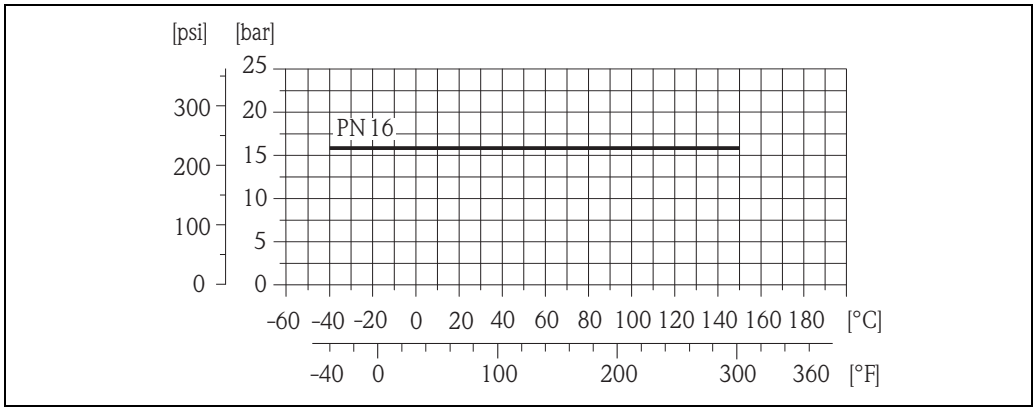
For order codes with suffixes +CA/+CB:



A0017297

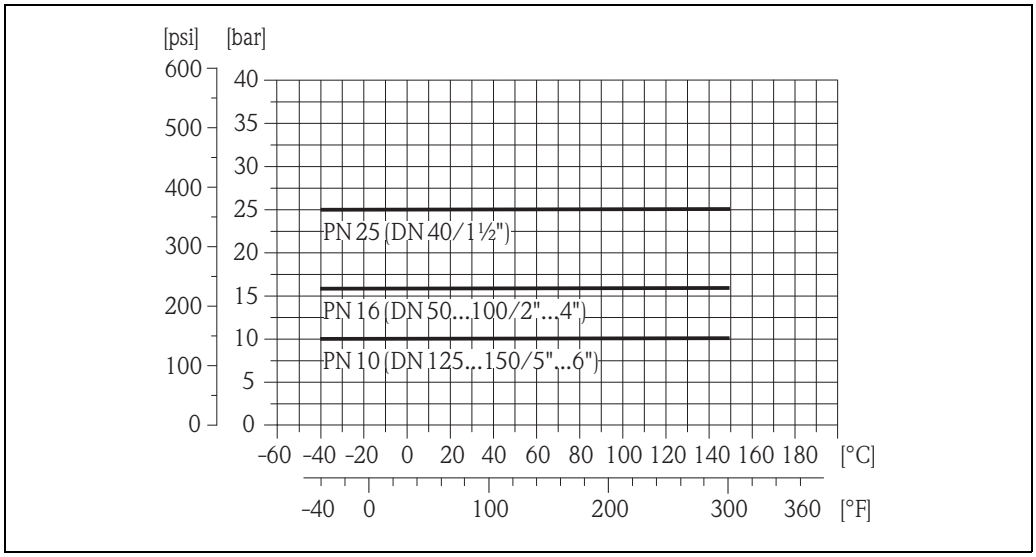
Flange connection to DIN 11864-2

Material: 1.4404/316L



A0005596

For order codes with suffixes +CA/+CB:



A0017315

Fitted electrodes

Measuring electrodes and empty pipe detection electrodes
- Available as standard with: 1.4435/316L, Alloy C-22
- DN 2 to 15 (1/12 to ½"): without empty pipe detection electrode

Process connections

With O-ring:
- Flange EN (DIN), ANSI, JIS
- Coupling: ISO 228/DIN 2999, NPT

With gasket seals:
- Welding nipples (DIN 11850, ODT/SMS, ASME BPE, ISO 2037)
- TriClamp (L14 AM7)
- Coupling (SC DIN 11851, DIN 11864-1, SMS 1145)
- Flange (DIN 11864-2)

Surface roughness

(All data refer to parts in contact with medium)
- Measuring tube lining with PFA: ≤ 0.4 µm (15 µin)
- Electrodes with 1.4435/316L, Alloy C-22: ≤ 0.3 to 0.5 µm (12 to 20 µin)
- Process connection made of stainless steel: ≤ 0.8 µm (31 µin)

Operability

Local operation

Display elements

- Liquid crystal display: unilluminated, two-line, 16 characters per line
- Display (operating mode) preconfigured: volume flow and totalizer status
- 1 totalizer

Operating elements

Local operation via three keys (−, +, E)

Remote operation

Operation via HART protocol and FieldCare

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-tick symbol

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

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your Endress +Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Sanitary compatibility

- 3A approval and EHEDG-certified
- Seals → conform to FDA (apart from Kalrez seals)

Pressure equipment directive

The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.

- With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.
- Devices with this identification (with PED) are suitable for the following types of fluid:
  – Fluids of Group 1 and 2 with a steam pressure of greater than, or smaller and equal to 0.5 bar (7.3 psi)
  – Unstable gases
- Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010
  Safety requirements for electrical equipment for measurement, control and laboratory use.
- IEC/EN 61326
  "Emission in accordance with requirements for Class A".
  Electromagnetic compatibility (EMC requirements)
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 No. 1010.1-92
  Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II

Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser Sales Center: www.endress.com/worldwide

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
  Output format
- Ability to order directly in the Endress+Hauser Online Shop

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

Device-specific accessories

For the transmitter

Accessory	Description
Transmitter	Transmitter for replacement or for stock. Use the order code to define the following specifications: ■ Approvals ■ Degree of protection / version ■ Cable for remote version ■ Cable entries ■ Display / power supply / operation ■ Software ■ Outputs / inputs
Mounting kit for transmitter	Mounting kit for aluminum field housing (remote version). Suitable for pipe mounting.
Wall mounting kit	Wall mounting kit for transmitter.
Cable for remote version	Coil and signal cables, various lengths.
Process display RIA45	Multifunctional 1-channel display unit with: ■ Universal input ■ Transmitter power supply ■ Limit relay ■ Analog output
Process display RIA251	Digital display unit for integration into 4 to 20 mA current loop.
Field display unit RIA16	Digital field display unit for integration into 4 to 20 mA current loop.
Application Manager RMM621	Electronic recording, display, balancing, control, saving and event and alarm monitoring of analog and digital input signals. Values and status output via analog and digital output signals. Remote transmission of alarms, input values and calculated values using a PSTN or GSM modem.

For the sensor

Accessory	Description
Mounting kit	Mounting kit for Promag H, comprising: ■ 2 Process connections ■ Screws ■ Seals
Adapter connection	Adapter connections for installing a Promag H instead of a Promag 30/33 A or Promag 30/33 H DN 25.
Set of seals	For regular replacement of the seals of the sensor.
Welding jig	Welding nipples as process connection: Welding jig for installation in pipes.
Spacer	A spacer is required if a sensor of DN 80 to 100 is replaced in an existing installation and the new sensor is shorter.

Communication-specific accessories

Accessory	Description
HART handheld terminal Field Xpert SFX 100	Handheld terminal for remote configuration and for obtaining measured values via the HART current output (4 to 20 mA). Contact your Endress+Hauser representative for more information.
Fieldgate FXA320	Gateway for remote interrogation of HART sensors and actuators via web browser: ■ 2-channel analog input (4 to 20 mA) ■ 4 binary inputs with event counter function and frequency measurement ■ Communication via modem, Ethernet or GSM ■ Visualization via Internet/Intranet in the web browser and/or WAP cellular phone ■ Limit value monitoring with alarm signaling by e-mail or SMS ■ Synchronized time stamping of all measured values.
Fieldgate FXA520	Gateway for remote interrogation of HART sensors and actuators via web browser: ■ Web server for remote monitoring of up to 30 measuring points ■ Intrinsically safe version [EEx ia]IIC for applications in hazardous areas ■ Communication via modem, Ethernet or GSM ■ Visualization via Internet/Intranet in the web browser and/or WAP cellular phone ■ Limit value monitoring with alarm signaling by e-mail or SMS ■ Synchronized time stamping of all measured values ■ Remote diagnostics and remote configuration of connected HART devices
FXA195	The Commubox FXA195 connects intrinsically safe smart transmitters using the HART protocol to the USB port of a personal computer. This enables remote operation of the transmitter with operating software (e.g. FieldCare). Power is supplied to the Commubox via the USB port.

Service-specific accessories

Accessory	Description
Applicator	Software for selecting and configuring flowmeters. Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. 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.
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process 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 DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.
FXA193	Service interface connects the device to the PC for operation via FieldCare.

Documentation

- System Information Promag 10 (SI042D/06)
- Operating Instructions Promag 10 (BA082D/06)

Registered trademarks

KALREZ® and VITON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

FieldCare®, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

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Endress+Hauser
People for Process Automation

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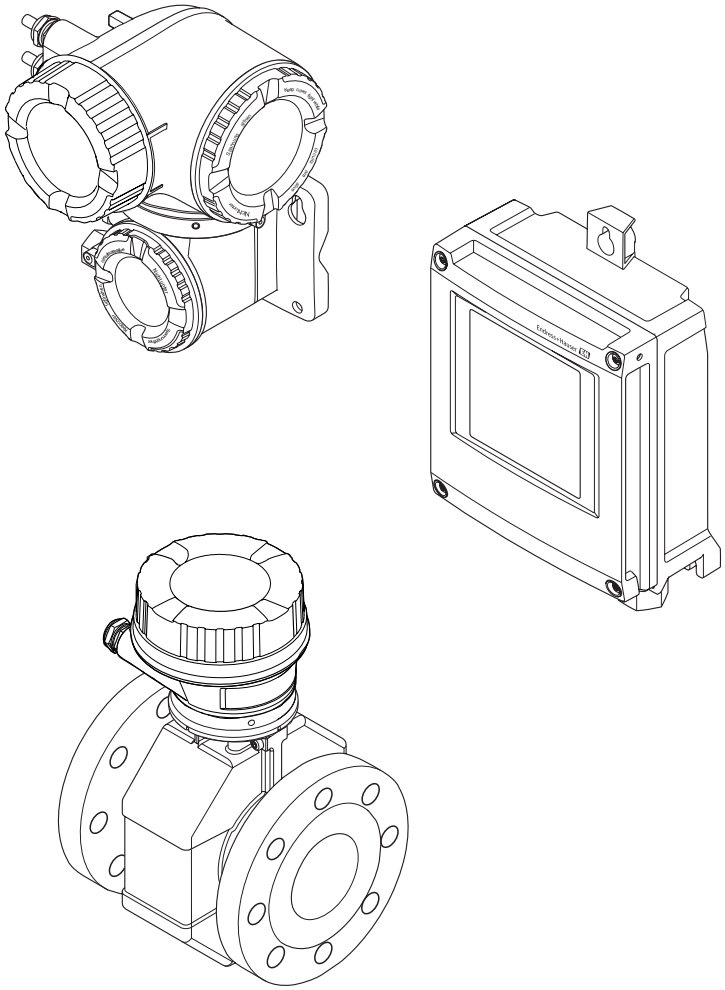
FM+SGML9.0 ProMoDo

Operating Instructions
Proline Promag P 500 HART

Electromagnetic flowmeter



Endress+Hauser
People for Process Automation

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

Table of contents

1 Document information

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 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 ground connection** A terminal which must be connected to ground prior to establishing any other connections.
⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Communication symbols

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

Symbol	Meaning
	**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is flashing.

1.2.4 Tool symbols

Symbol	Meaning
	Torx screwdriver
	Phillips head screwdriver
	Open-ended wrench

1.2.5 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
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.6 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

Symbol	Meaning
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

1.3 Documentation

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

For a detailed list of the individual documents along with the documentation code → 197

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Sensor Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 1** The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device. ▪ Incoming acceptance and product identification ▪ Storage and transport ▪ Installation
Transmitter Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 2** The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value). ▪ Product description ▪ Installation ▪ Electrical connection ▪ Operation options ▪ System integration ▪ Commissioning ▪ Diagnostic information
Description of Device Parameters	**Reference for your parameters** The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

1.3.2 Supplementary device-dependent documentation

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

1.4 Registered trademarks

HART®
Registered trademark of the FieldComm Group, Austin, Texas, USA

Applicator®, FieldCare®, DeviceCare ®, Field Xpert™, HistoROM®, Heartbeat Technology™
Registered or registration-pending trademarks of the Endress+Hauser Group

2 Basic safety instructions

2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

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

2.2 Designated use

Application and media
The measuring device described in this manual is intended only for flow measurement of liquids with a minimum conductivity of 5 µS/cm.

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, in hygienic applications or where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section.→ 8.
- Protect the measuring device permanently against corrosion from environmental influences.

Incorrect use
Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

⚠ WARNING
Danger of breakage due to corrosive or abrasive fluids!
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Keep within the specified pressure and temperature range.

NOTICE

Verification for borderline cases:

- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks

WARNING

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

- For elevated fluid temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.

For welding work on the piping:

- Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:

- Due to the increased risk of electric shock, gloves must be worn.

2.4 Operational safety

Risk of injury.

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability,

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to repair of an electrical device.
- Use original spare parts and accessories from Endress+Hauser only.

2.5 Product safety

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

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.6 IT security

We only provide a warranty 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 device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

2.7 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.

2.7.1 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 → 131.

2.7.2 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). Is equivalent to hardware write protection in terms of functionality.
- 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, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 130).

When the device is delivered, the device does not have an access code and is equivalent to *0000* (open).

WLAN passphrase

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface (→ 82) which can be ordered as an option 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→ 123.

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.

2.7.3 Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to *"Read only"* access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

Additional information: "Description of Device Parameters" document pertaining to the device → 198.

2.7.4 Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 75). 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.

Additional information: "Description of Device Parameters" document pertaining to the device → 198.

3 Product description

The measuring system consists of a transmitter and a sensor. The transmitter and sensor are mounted in physically separate locations. They are interconnected by one or two connecting cable(s).

3.1 Product design

Two versions of the transmitter are available.

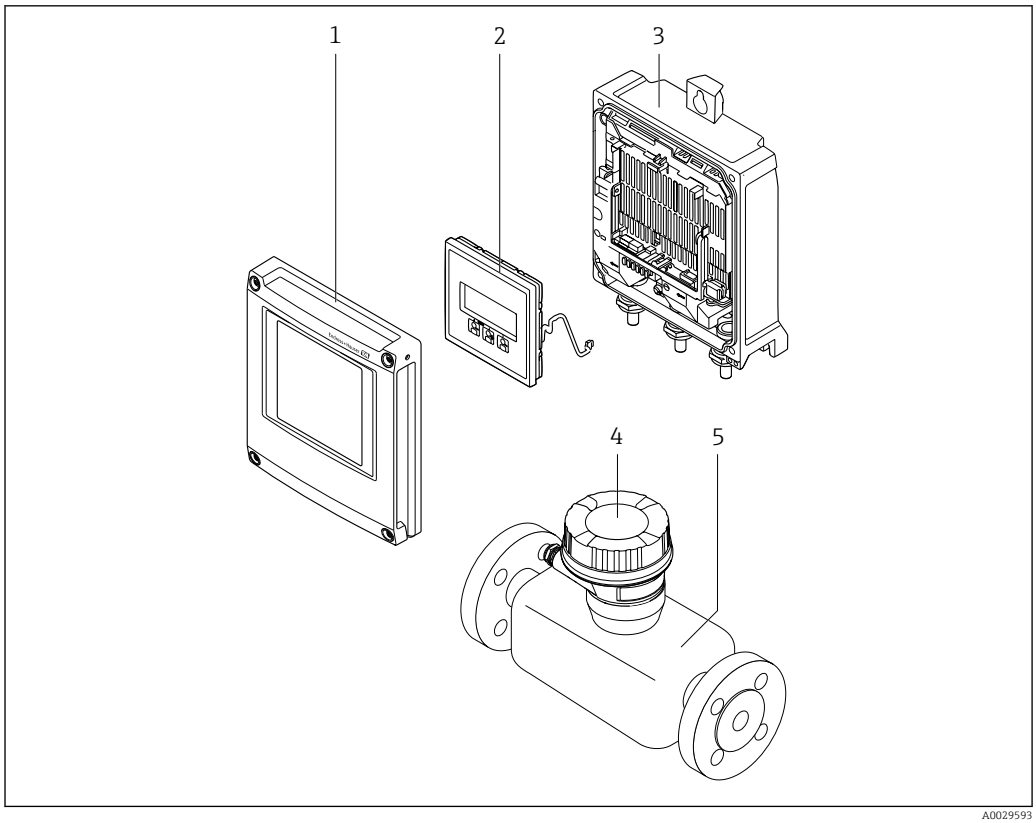
3.1.1 Proline 500 – digital

Signal transmission: digital
Order code for "Integrated ISEM electronics", option **A** "Sensor"

For use in applications not required to meet special requirements due to ambient or operating conditions.

As the electronics are located in the sensor, the device is ideal:
For simple transmitter replacement.

- A standard cable can be used as the connecting cable.
- Not sensitive to external EMC interference.



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1 Important components of a measuring device

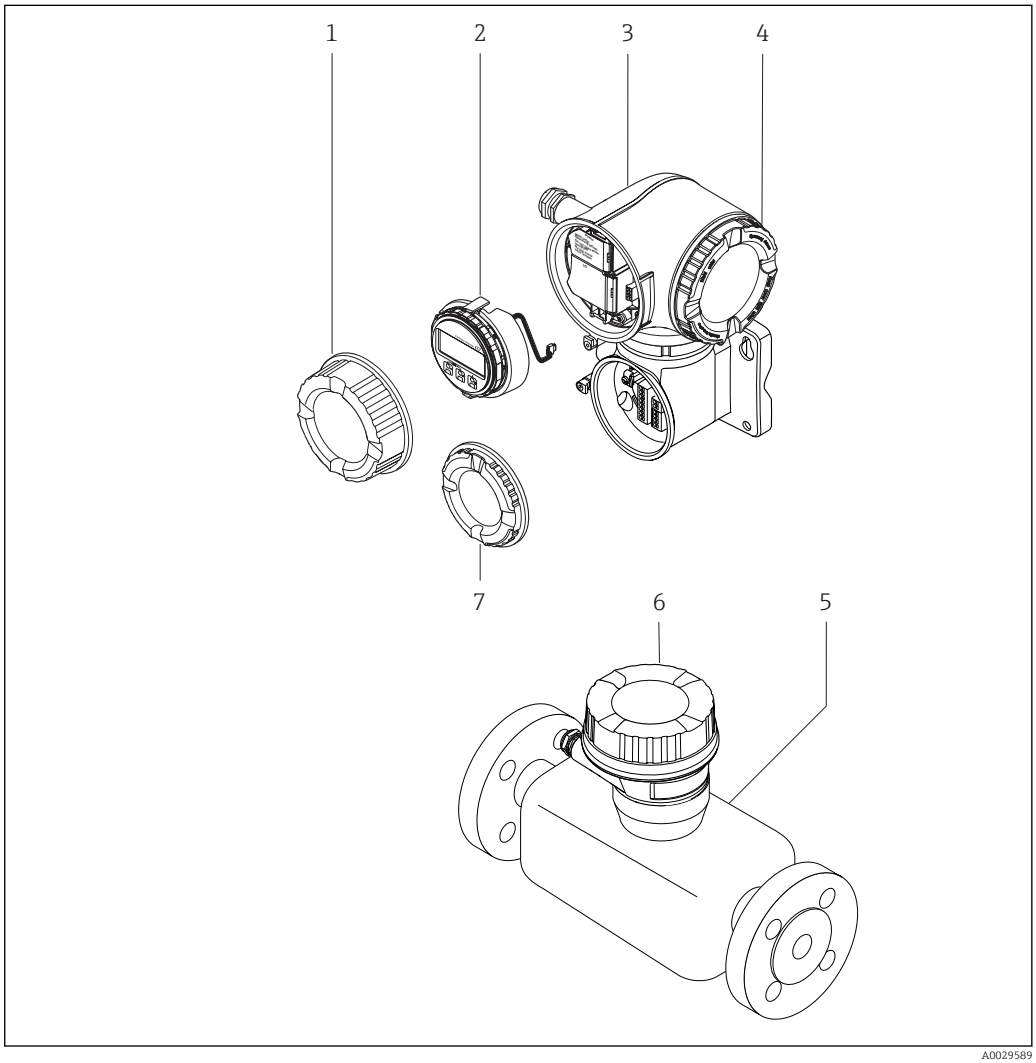
1 Electronics compartment cover
2 Display module
3 Transmitter housing
4 Sensor connection housing with integrated ISEM electronics: connecting cable connection
5 Sensor

3.1.2 Proline 500

Signal transmission: analog
Order code for "Integrated ISEM electronics", option **B** "Transmitter"

For use in applications required to meet special requirements due to ambient or operating conditions.

As the electronics are located in the transmitter, the device is ideal in the event of:
- Sensor operation in underground installations.
- Permanent sensor immersion in water.



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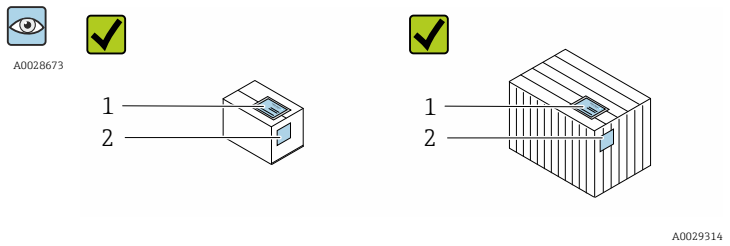
2 *Important components of a measuring device*

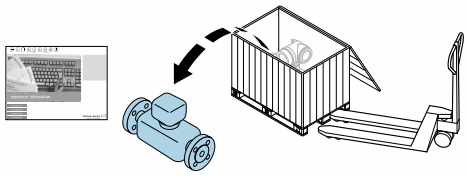
1 *Connection compartment cover*
2 *Display module*
3 *Transmitter housing with integrated ISEM electronics*
4 *Electronics compartment cover*
5 *Sensor*
6 *Sensor connection housing: connecting cable connection*
7 *Connection compartment cover: connecting cable connection*

4 Incoming acceptance and product identification

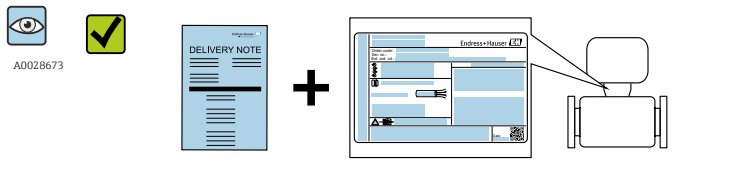
4.1 Incoming acceptance



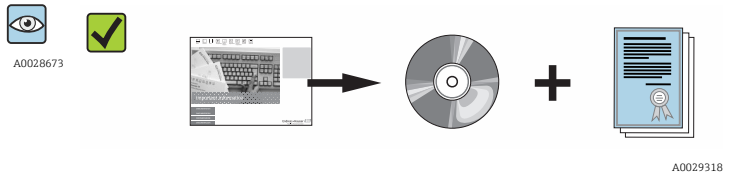
Are the order codes on the delivery note (1) and the product sticker (2) identical?



Are the goods undamaged?



Do the nameplate data match the ordering information on the delivery note?



Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?

- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 17.

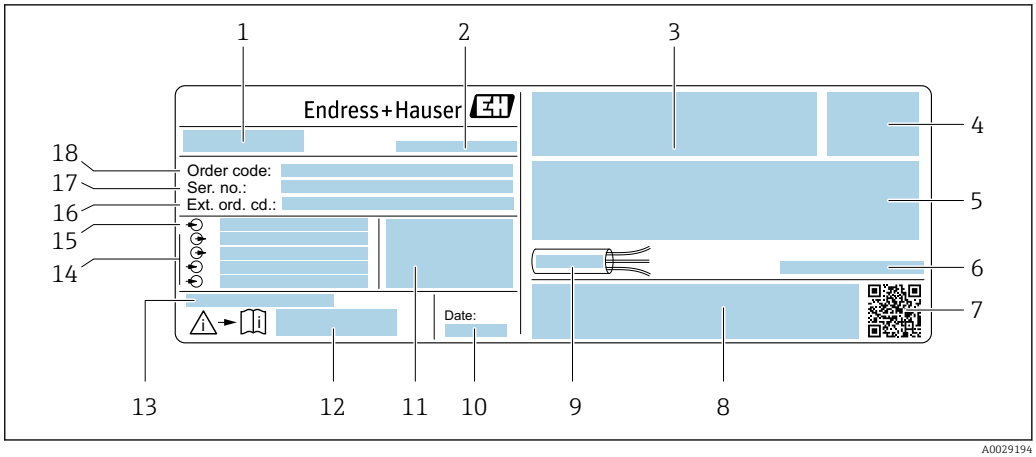
4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The chapters "Additional standard documentation on the device" → 8 and "Supplementary device-dependent documentation" → 8
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

4.2.1 Transmitter nameplate

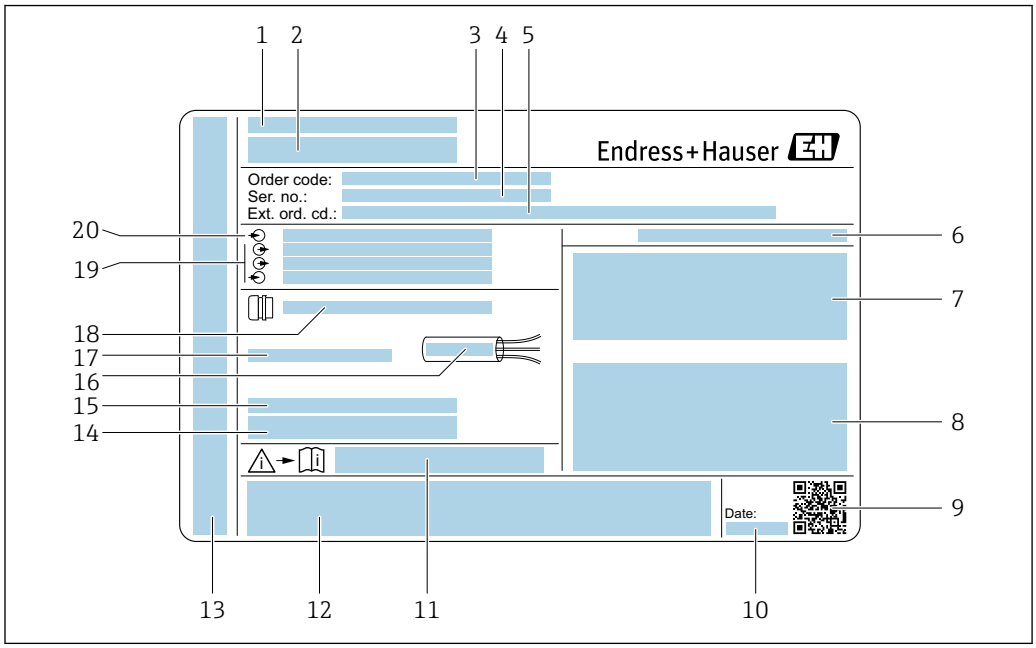
Proline 500 – digital



3 *Example of a transmitter nameplate*

1 *Name of the transmitter*
2 *Manufacturing location*
3 *Space for approvals: use in hazardous areas*
4 *Degree of protection*
5 *Electrical connection data: available inputs and outputs*
6 *Permitted ambient temperature (T_a)*
7 *2-D matrix code*
8 *Space for approvals and certificates: e.g. CE mark, C-Tick*
9 *Permitted temperature range for cable*
10 *Manufacturing date: year-month*
11 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
12 *Document number of safety-related supplementary documentation*
13 *Space for additional information in the case of special products*
14 *Available inputs and outputs, supply voltage*
15 *Electrical connection data: supply voltage*
16 *Extended order code (Ext. ord. cd.)*
17 *Serial number (ser. no.)*
18 *Order code*

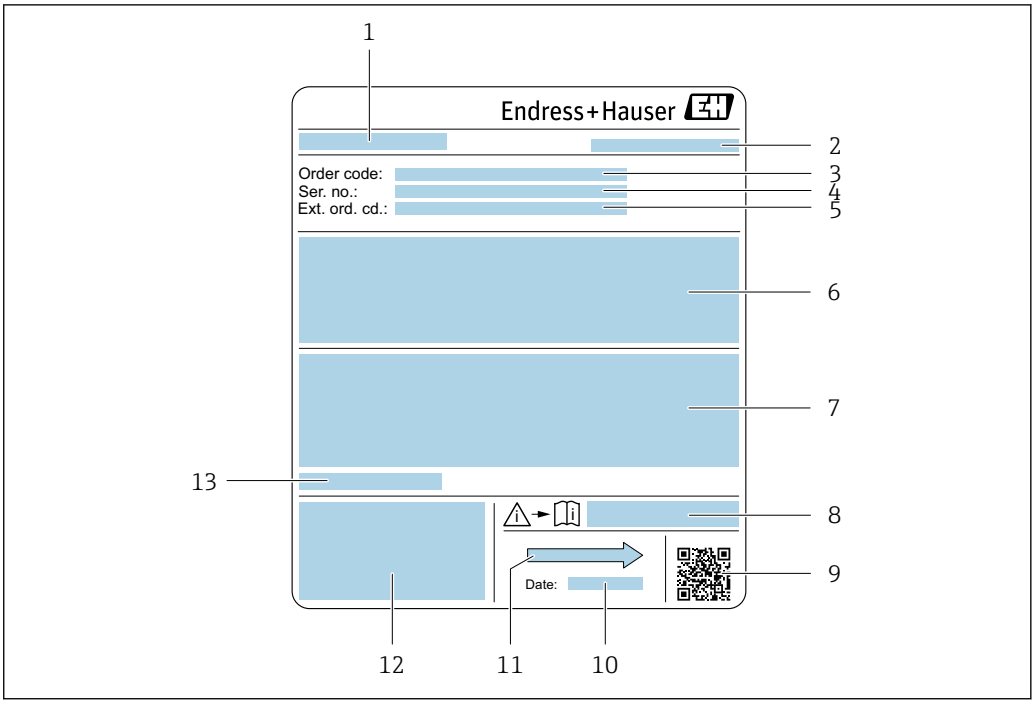
Proline 500



4 *Example of a transmitter nameplate*

1 *Manufacturing location*
2 *Name of the transmitter*
3 *Order code*
4 *Serial number (ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Degree of protection*
7 *Space for approvals: use in hazardous areas*
8 *Electrical connection data: available inputs and outputs*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Document number of safety-related supplementary documentation*
12 *Space for approvals and certificates: e.g. CE mark, C-Tick*
13 *Space for degree of protection of connection and electronics compartment when used in hazardous areas*
14 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
15 *Space for additional information in the case of special products*
16 *Permitted temperature range for cable*
17 *Permitted ambient temperature (T_a)*
18 *Information on cable gland*
19 *Available inputs and outputs, supply voltage*
20 *Electrical connection data: supply voltage*

4.2.2 Sensor nameplate



5 *Example of sensor nameplate*

1 *Name of the sensor*
2 *Manufacturing location*
3 *Order code*
4 *Serial number (ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Flow; nominal diameter of the sensor; pressure rating; nominal pressure; system pressure; fluid temperature range; material of liner and electrodes*
7 *Approval information for explosion protection, Pressure Equipment Directive and degree of protection*
8 *Document number of safety-related supplementary documentation→ 198*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Flow direction*
12 *CE mark, C-Tick*
13 *Permitted ambient temperature (T_a)*

Order code

The measuring device is reordered using the order code.

Extended order code

- The device type (product root) and basic specifications (mandatory features) are always listed.
- Of the optional specifications (optional features), only the safety and approval-related specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the # placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the + placeholder symbol (e.g. XXXXXX-ABCDE +).

4.2.3 Symbols on measuring device

Symbol	Meaning
	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	**Reference to documentation** Refers to the corresponding device documentation.
	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

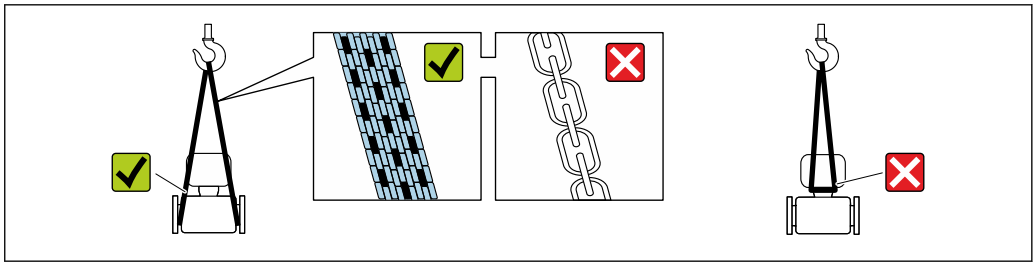
5.1 Storage conditions

Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus and bacteria infestation can damage the lining.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature → 183

5.2 Transporting the product

Transport the measuring device to the measuring point in the original packaging.



A0029252

Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

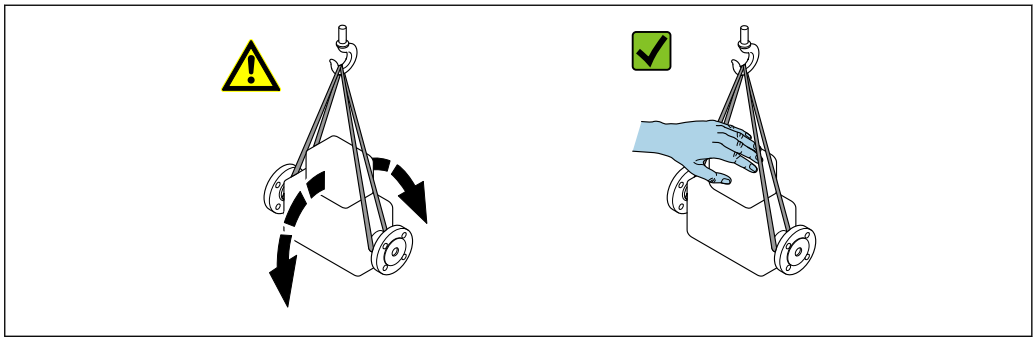
5.2.1 Measuring devices without lifting lugs

WARNING

Center of gravity of the measuring device is higher than the suspension points of the webbing slings.

Risk of injury if the measuring device slips.

- ▶ Secure the measuring device against slipping or turning.
- ▶ Observe the weight specified on the packaging (stick-on label).



A0029214

5.2.2 Measuring devices with lifting lugs

⚠ CAUTION

Special transportation instructions for devices with lifting lugs

- ▶ Only use the lifting lugs fitted on the device or flanges to transport the device.
- ▶ The device must always be secured at two lifting lugs at least.

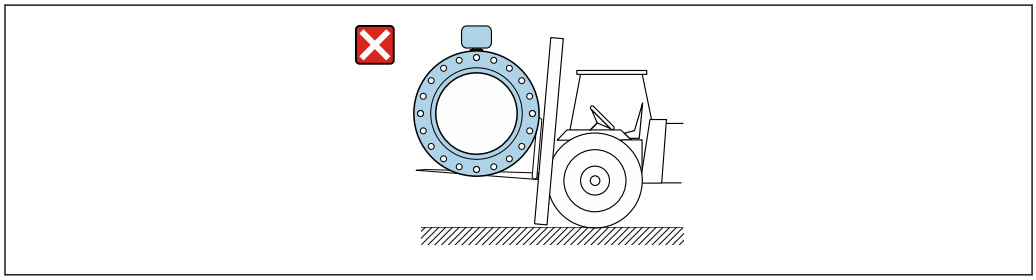
5.2.3 Transporting with a fork lift

If transporting in wood crates, the floor structure enables the crates to be lifted lengthwise or at both sides using a forklift.

⚠ CAUTION

Risk of damaging the magnetic coil

- ▶ If transporting by forklift, do not lift the sensor by the metal casing.
- ▶ This would buckle the casing and damage the internal magnetic coils.



A0029319

5.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

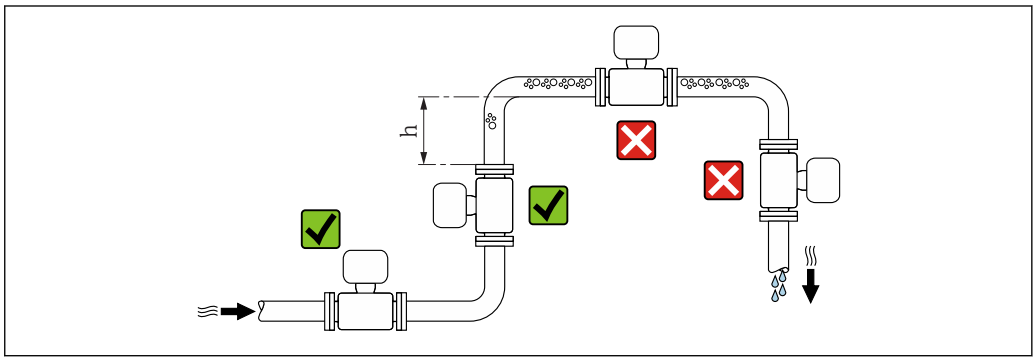
- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
  - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
    or
  - Carton in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed RESY symbol.
- Seaworthy packaging (optional): Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
- Carrying and mounting hardware:
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Dunnage: Paper cushion

6 Installation

6.1 Installation conditions

6.1.1 Mounting position

Mounting location



A0029343

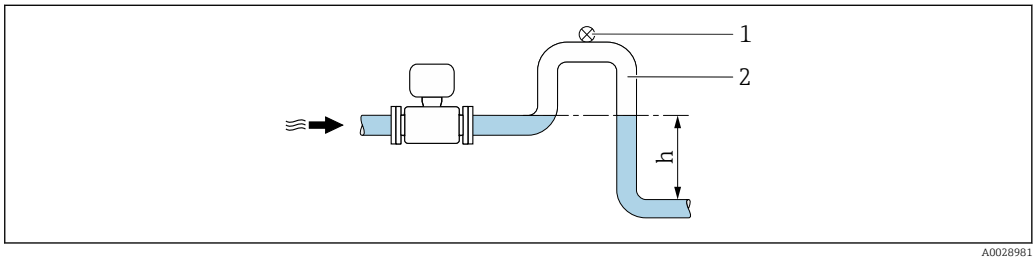
Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

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.

Installation in down pipes

Install a siphon with a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.

For information on the liner's resistance to partial vacuum



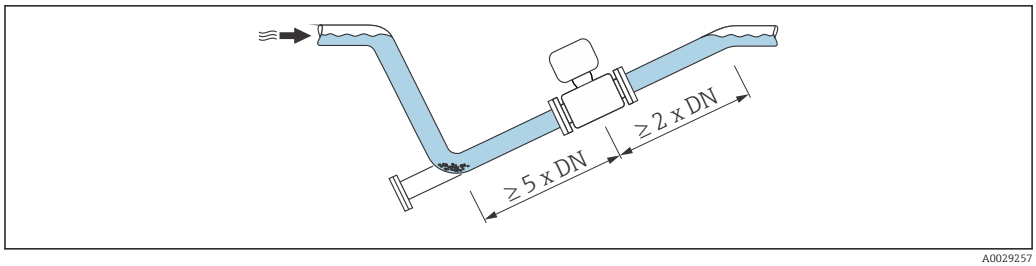
A0028981

6 *Installation in a down pipe*

1 *Vent valve*
2 *Pipe siphon*
h *Length of down pipe*

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.



A0029257

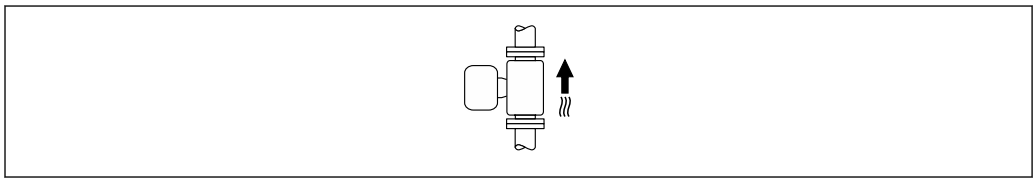
Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

The measuring device also offers the empty pipe detection function to detect partially filled measuring pipes in the event of outgassing fluids or variable process pressures.

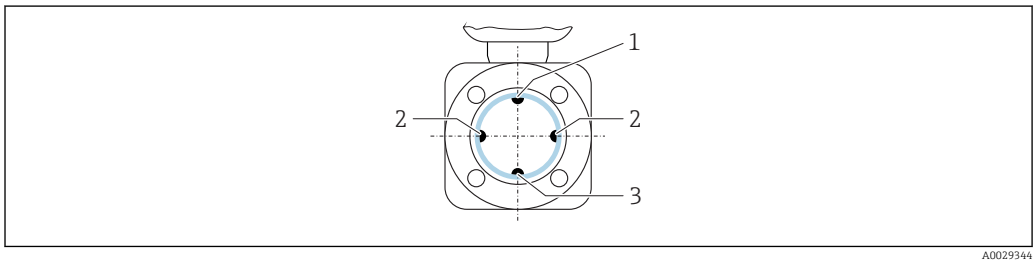
Vertical



A0015591

Optimum for self-emptying pipe systems and for use in conjunction with empty pipe detection.

Horizontal



A0029344

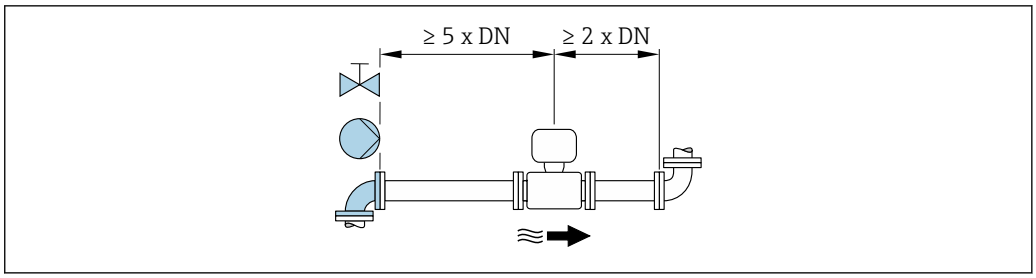
1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



A0028997

Installation dimensions

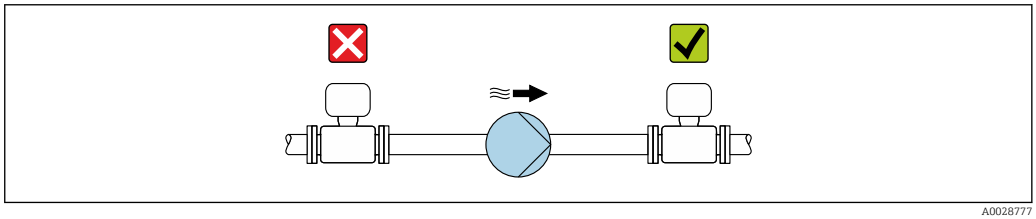
For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

6.1.2 Requirements from environment and process

Ambient temperature range

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

System pressure



A0028777

Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

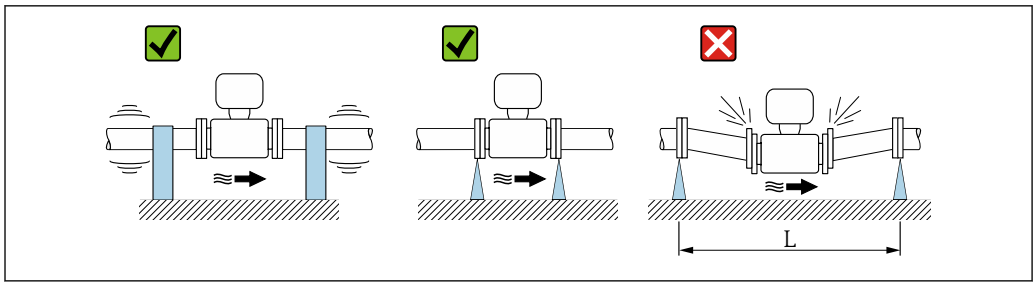
Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- For information on the liner's resistance to partial vacuum
- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system

Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system



7 *Measures to avoid device vibrations (L > 10 m (33 ft))*

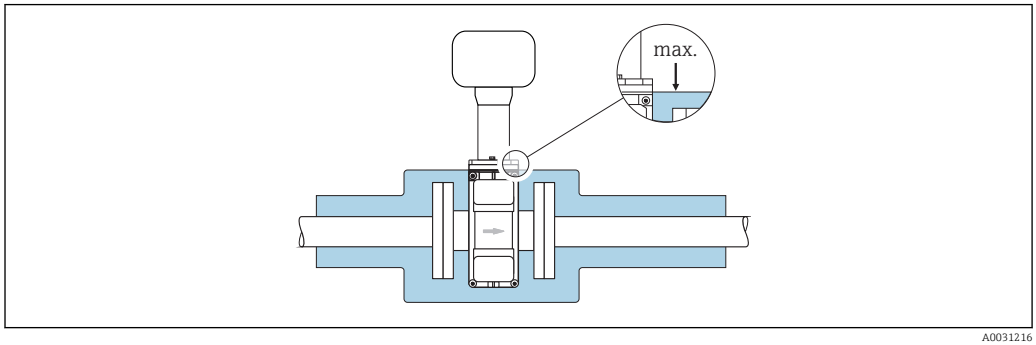
Thermal insulation

Pipes generally have to be insulated if they carry very hot fluids to avoid energy losses and prevent accidental contact with pipes at temperatures that could cause injury. Guidelines regulating the insulation of pipes have to be taken into account.

WARNING

Electronics overheating on account of thermal insulation!

- The housing support dissipates heat and its entire surface area must remain uncovered. Make sure that the sensor insulation does not extend past the top of the two sensor half-shells.

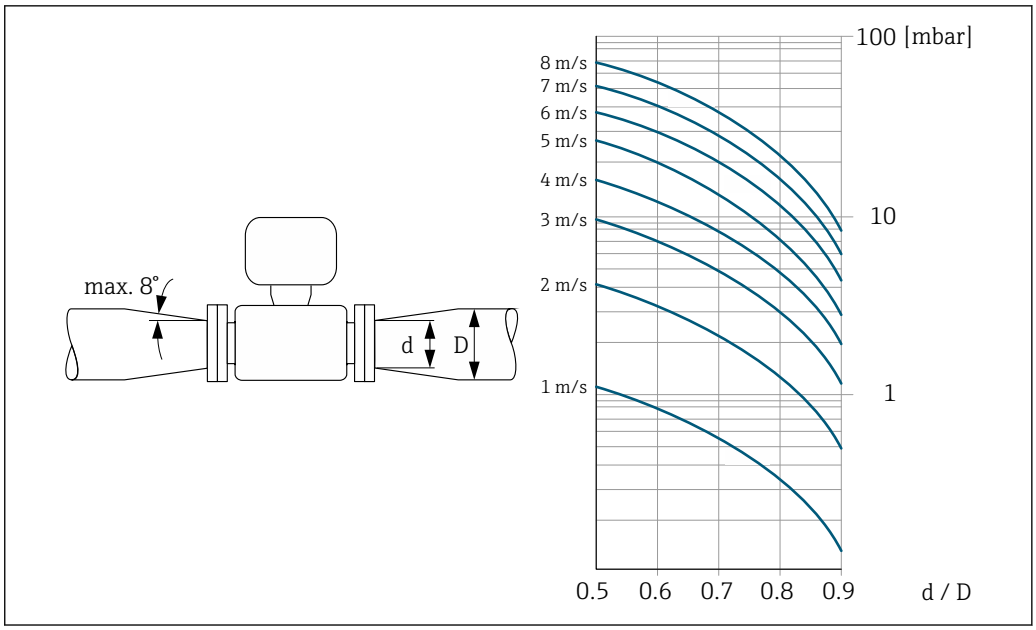


Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

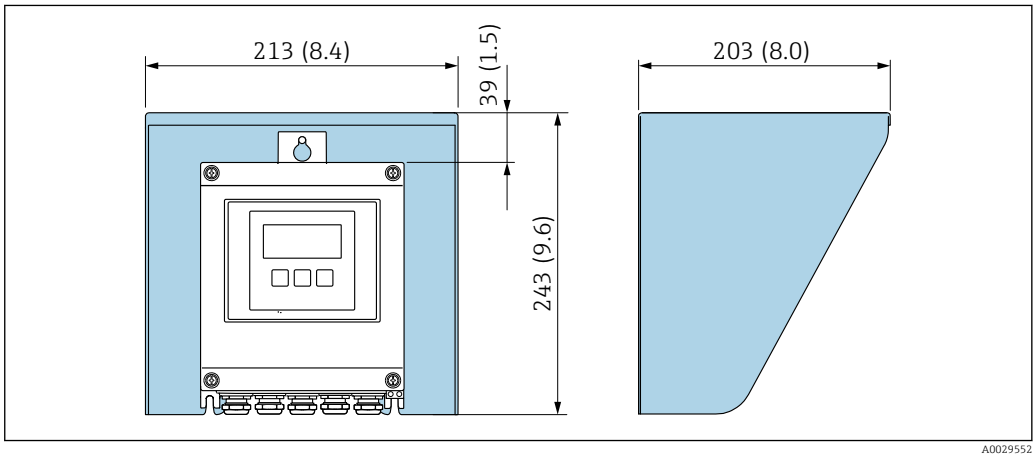
The nomogram only applies to liquids with a viscosity similar to that of water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

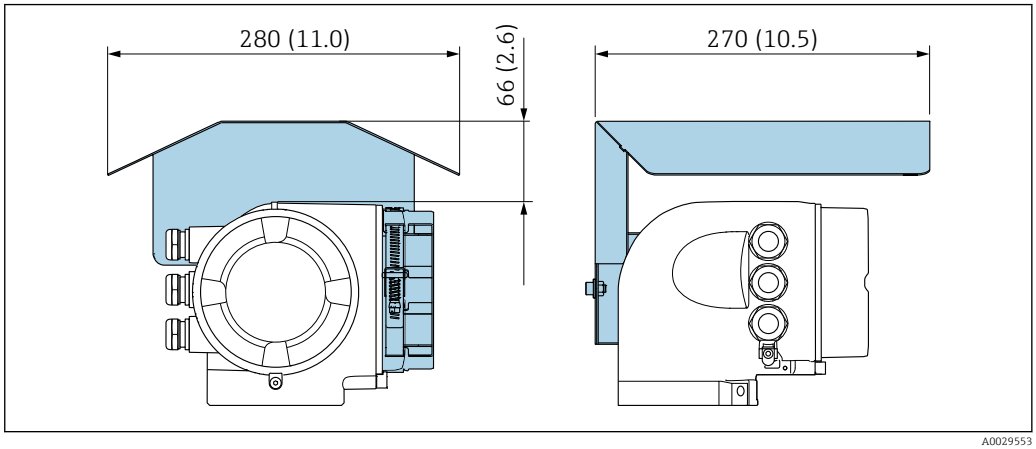


6.1.3 Special mounting instructions

Protective cover



8 Weather protection cover for Proline 500 – digital



9 Weather protection cover for Proline 500

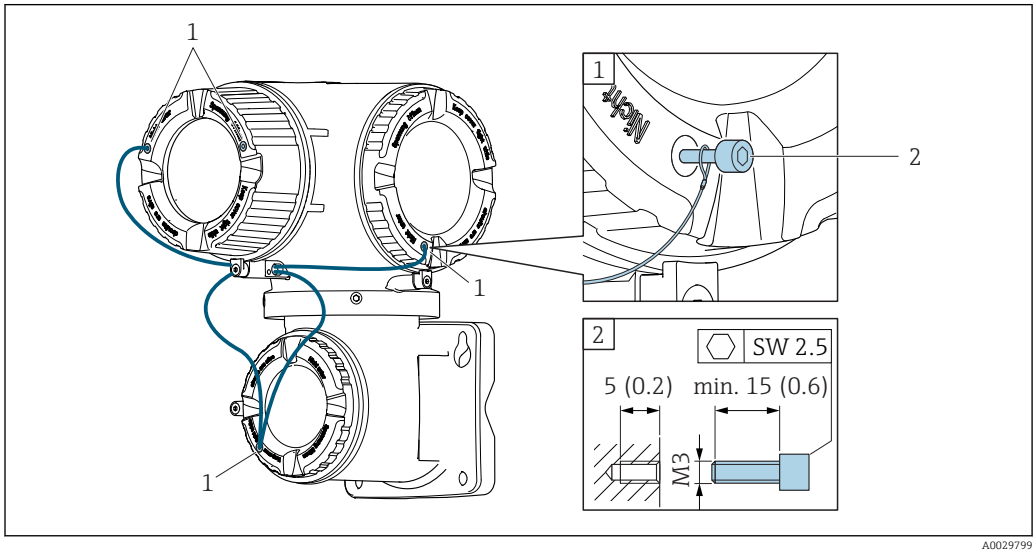
Cover locking: Proline 500

NOTICE

Order code for "Housing", option L "Cast, stainless": The covers of the transmitter housing are provided with a borehole to lock the cover.

The cover can be locked using screws and a chain or cable provided by the customer.

- ▶ It is recommended to use stainless steel cables or chains.
- ▶ If a protective coating is applied, it is recommended to use a heat shrink tube to protect the housing paint.



1 *Cover borehole for the securing screw*
2 *Securing screw to lock the cover*

6.2 Mounting the measuring device

6.2.1 Required tools

For transmitter

For mounting on a post:

- Proline 500 – digital transmitter
  - Open-ended wrench AF 10
  - Torx screwdriver TX 25
- Proline 500 transmitter
  Open-ended wrench AF 13

For wall mounting:
Drill with drill bit Ø 6.0 mm

For sensor

For flanges and other process connections:

- Screws, nuts, seals etc. are not included in the scope of supply and must be provided by the customer.
- Appropriate mounting tools

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.

3. Remove stick-on label on the electronics compartment cover.

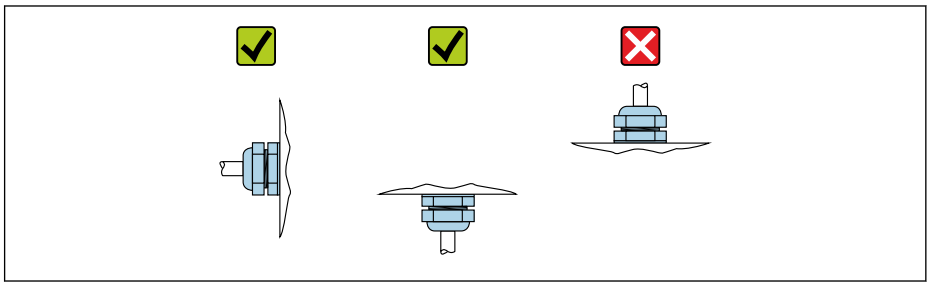
6.2.3 Mounting the sensor

⚠ WARNING

Danger due to improper process sealing!

- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ▶ Ensure that the gaskets are clean and undamaged.
- ▶ Install the gaskets correctly.

1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
2. To ensure compliance with device specifications, install the measuring device between the pipe flanges in a way that it is centered in the measurement section.
3. If using ground disks, comply with the Installation Instructions provided.
4. Observe required screw tightening torques → 29.
5. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.



A0029263

Mounting the seals

⚠ CAUTION

An electrically conductive layer could form on the inside of the measuring tube!

Risk of measuring signal short circuit.

- ▶ Do not use electrically conductive sealing compounds such as graphite.

Comply with the following instructions when installing seals:

1. For DIN flanges: only use seals according to DIN EN 1514-1.
2. For "PFA" lining: generally additional seals are **not** required.
3. For "PTFE" lining: generally additional seals are **not** required.

Mounting the ground cable/ground disks

Comply with the information on potential equalization and detailed mounting instructions for the use of ground cables/ground disks .

Screw tightening torques

Please note the following:

- The screw tightening torques listed below apply only to lubricated threads and to pipes not subjected to tensile stress.
- Tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.

Screw tightening torques for EN 1092-1 (DIN 2501), PN 40/25

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			PTFE	PFA
15	PN 40	4 × M12	11	–
25	PN 40	4 × M12	26	20
32	PN 40	4 × M16	41	35
40	PN 40	4 × M16	52	47
50	PN 40	4 × M16	65	59
65 [1)]	PN 16	8 × M16	43	40
65	PN 40	8 × M16	43	40
80	PN 16	8 × M16	53	48
80	PN 40	8 × M16	53	48
100	PN 16	8 × M16	57	51
100	PN 40	8 × M20	78	70
125	PN 16	8 × M16	75	67
125	PN 40	8 × M24	111	99
150	PN 16	8 × M20	99	85
150	PN 40	8 × M24	136	120
200	PN 10	8 × M20	141	101
200	PN 16	12 × M20	94	67
200	PN 25	12 × M24	138	105
250	PN 10	12 × M20	110	–
250	PN 16	12 × M24	131	–
250	PN 25	12 × M27	200	–
300	PN 10	12 × M20	125	–
300	PN 16	12 × M24	179	–
300	PN 25	16 × M27	204	–
350	PN 10	16 × M20	188	–
350	PN 16	16 × M24	254	–
350	PN 25	16 × M30	380	–
400	PN 10	16 × M24	260	–
400	PN 16	16 × M27	330	–
400	PN 25	16 × M33	488	–
450	PN 10	20 × M24	235	–
450	PN 16	20 × M27	300	–
450	PN 25	20 × M33	385	–
500	PN 10	20 × M24	265	–
500	PN 16	20 × M30	448	–
500	PN 25	20 × M33	533	–
600	PN 10	20 × M27	345	–
600 [1)]	PN 16	20 × M33	658	–
600	PN 25	20 × M36	731	–

1) Designed acc. to EN 1092-1 (not to DIN 2501)

Screw tightening torques for ASME B16.5, Class 150/300

Nominal diameter		Pressure rating	Threaded fasteners	Max. screw tightening torque [Nm] ([lbf · ft])	
[mm]	[in]	[psi]	[in]	PTFE	PFA
15	½	Class 150	4 × ½	6 (4)	– (–)
15	½	Class 300	4 × ½	6 (4)	– (–)
25	1	Class 150	4 × ½	11 (8)	10 (7)
25	1	Class 300	4 × 5/8	14 (10)	12 (9)
40	1 ½	Class 150	4 × ½	24 (18)	21 (15)
40	1 ½	Class 300	4 × ¾	34 (25)	31 (23)
50	2	Class 150	4 × 5/8	47 (35)	44 (32)
50	2	Class 300	8 × 5/8	23 (17)	22 (16)
80	3	Class 150	4 × 5/8	79 (58)	67 (49)
80	3	Class 300	8 × ¾	47 (35)	42 (31)
100	4	Class 150	8 × 5/8	56 (41)	50 (37)
100	4	Class 300	8 × ¾	67 (49)	59 (44)
150	6	Class 150	8 × ¾	106 (78)	86 (63)
150	6	Class 300	12 × ¾	73 (54)	67 (49)
200	8	Class 150	8 × ¾	143 (105)	109 (80)
250	10	Class 150	12 × 7/8	135 (100)	– (–)
300	12	Class 150	12 × 7/8	178 (131)	– (–)
350	14	Class 150	12 × 1	260 (192)	– (–)
400	16	Class 150	16 × 1	246 (181)	– (–)
450	18	Class 150	16 × 1 1/8	371 (274)	– (–)
500	20	Class 150	20 × 1 1/8	341 (252)	– (–)
600	24	Class 150	20 × 1 ¼	477 (352)	– (–)

Screw tightening torques for JIS B2220, 10/20K

Nominal diameter	Pressure rating	Threaded fasteners	Max. screw tightening torque [Nm]	
[mm]	[bar]	[mm]	PTFE	PFA
25	10K	4 × M16	32	27
25	20K	4 × M16	32	27
32	10K	4 × M16	38	–
32	20K	4 × M16	38	–
40	10K	4 × M16	41	37
40	20K	4 × M16	41	37
50	10K	4 × M16	54	46
50	20K	8 × M16	27	23
65	10K	4 × M16	74	63
65	20K	8 × M16	37	31
80	10K	8 × M16	38	32
80	20K	8 × M20	57	46
100	10K	8 × M16	47	38
100	20K	8 × M20	75	58

Nominal diameter [mm]	Pressure rating [bar]	Threaded fasteners [mm]	Max. screw tightening torque [Nm]	
			PTFE	PFA
125	10K	8 × M20	80	66
125	20K	8 × M22	121	103
150	10K	8 × M20	99	81
150	20K	12 × M22	108	72
200	10K	12 × M20	82	54
200	20K	12 × M22	121	88
250	10K	12 × M22	133	–
250	20K	12 × M24	212	–
300	10K	16 × M22	99	–
300	20K	16 × M24	183	–

Screw tightening torques for AS 2129, Table E

Nominal diameter [mm]	Threaded fasteners [mm]	Max. screw tightening torque [Nm] PTFE
25	4 × M12	21
50	4 × M16	42

Screw tightening torques for AS 4087, PN 16

Nominal diameter [mm]	Threaded fasteners [mm]	Max. screw tightening torque [Nm] PTFE
50	4 × M16	42

6.2.4 Mounting the transmitter housing: Proline 500 – digital

⚠ CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ▶ Do not exceed the permitted maximum ambient temperature .
- ▶ If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

⚠ CAUTION

Excessive force can damage the housing!

- ▶ Avoid excessive mechanical stress.

The transmitter can be mounted in the following ways:

- Post mounting
- Wall mounting

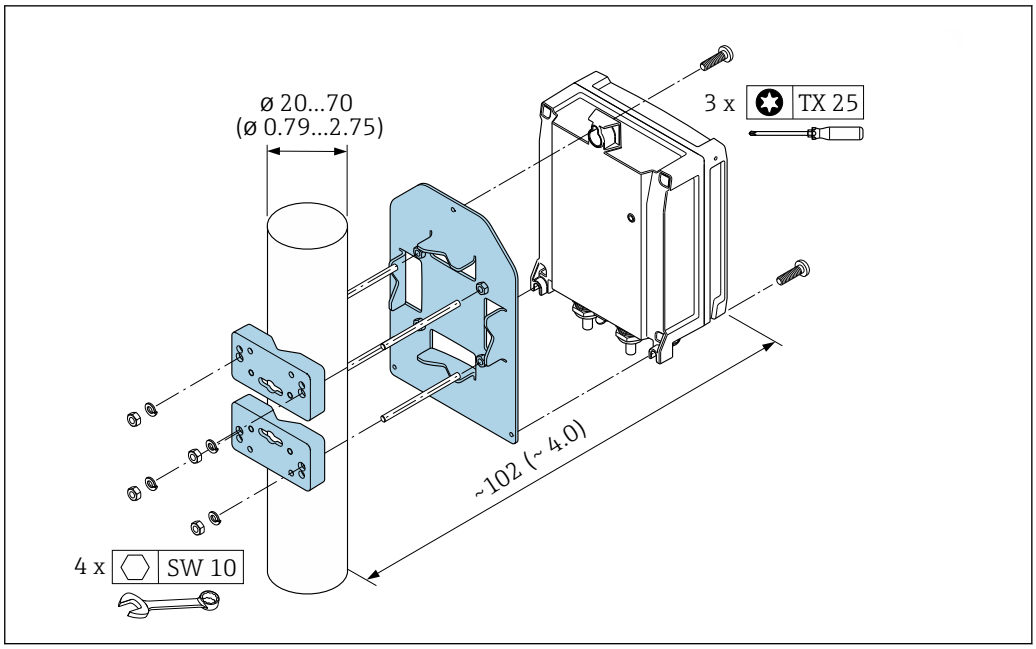
Post mounting

⚠ WARNING

Excessive tightening torque applied to the fixing screws!

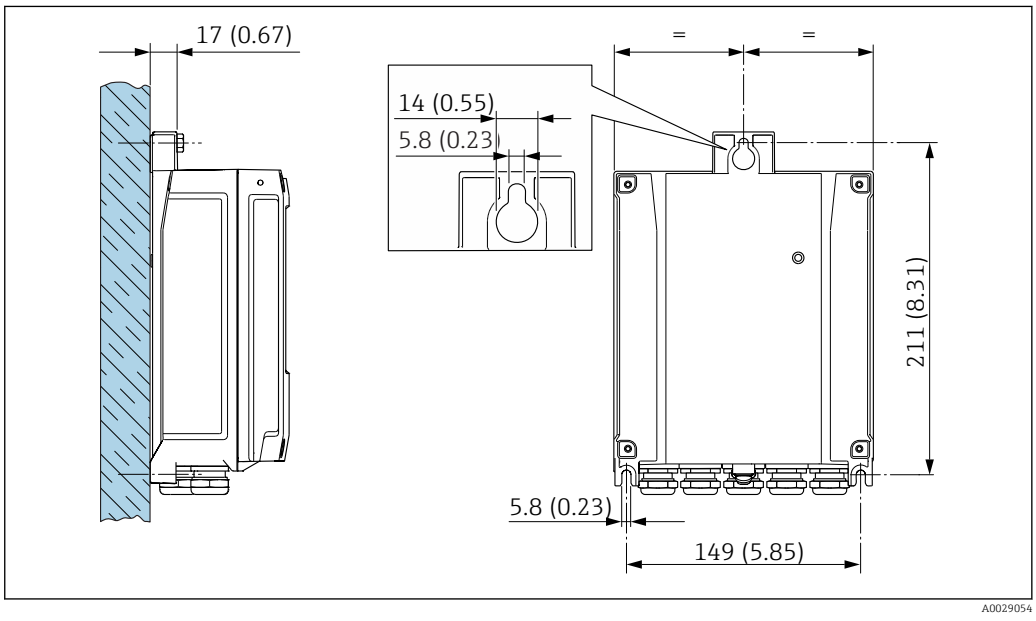
Risk of damaging the plastic transmitter.

- ▶ Tighten the fixing screws as per the tightening torque: 2 Nm (1.5 lbf ft).



10 *Engineering unit mm (in)*

Wall mounting



11 *Engineering unit mm (in)*

1. Drill the holes.
2. Insert wall plugs into the drilled holes.
3. Screw in the securing screws slightly at first.
4. Fit the transmitter housing over the securing screws and mount in place.
5. Tighten the securing screws.

6.2.5 Mounting the transmitter housing: Proline 500

⚠ CAUTION

Ambient temperature too high!

Danger of electronics overheating and housing deformation.

- ► Do not exceed the permitted maximum ambient temperature .
- ► If operating outdoors: Avoid direct sunlight and exposure to weathering, particularly in warm climatic regions.

⚠ CAUTION

Excessive force can damage the housing!

- ► Avoid excessive mechanical stress.

The transmitter can be mounted in the following ways:

- Post mounting
- Wall mounting

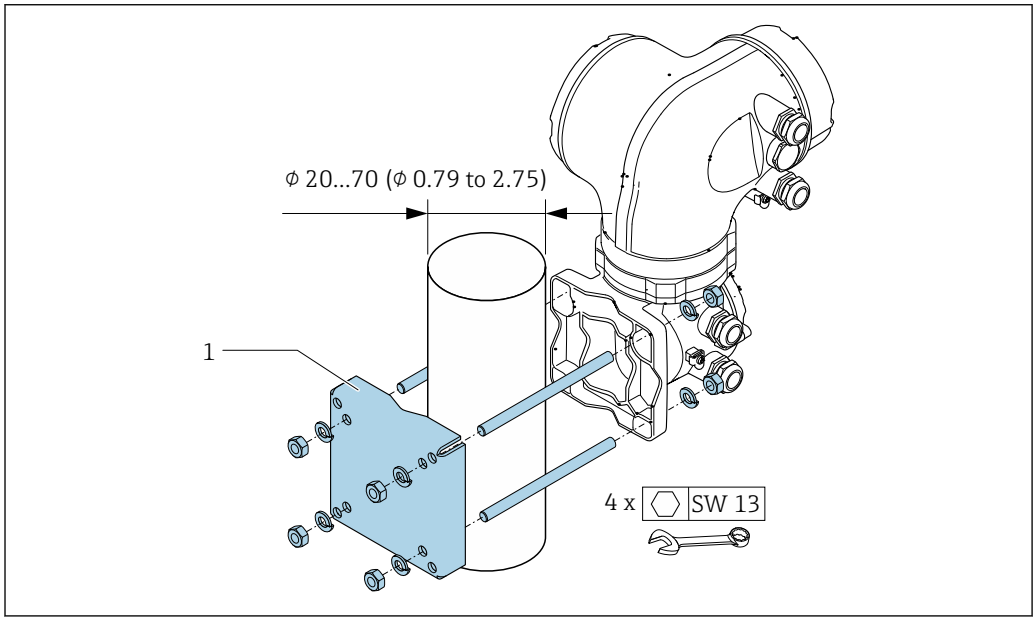
Post mounting

⚠ WARNING

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

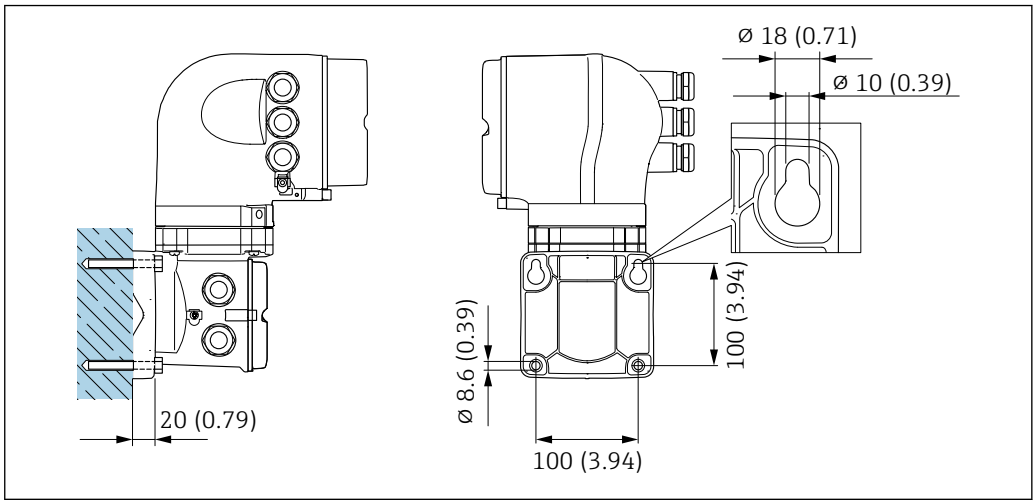
They are unstable if they are not mounted on a secure, fixed post.

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



12 *Engineering unit mm (in)*

Wall mounting

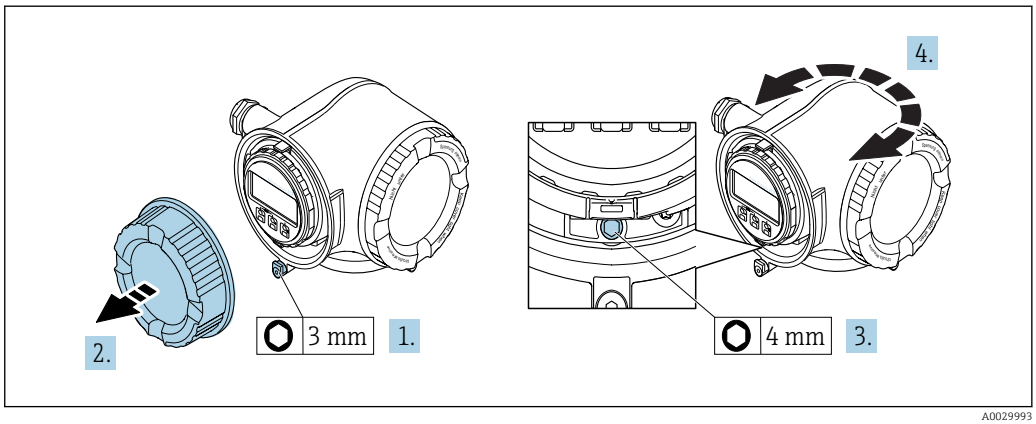


13 *Engineering unit mm (in)*

1. Drill the holes.
2. Insert wall plugs into the drilled holes.
3. Screw in the securing screws slightly at first.
4. Fit the transmitter housing over the securing screws and mount in place.
5. Tighten the securing screws.

6.2.6 Turning the transmitter housing: Proline 500

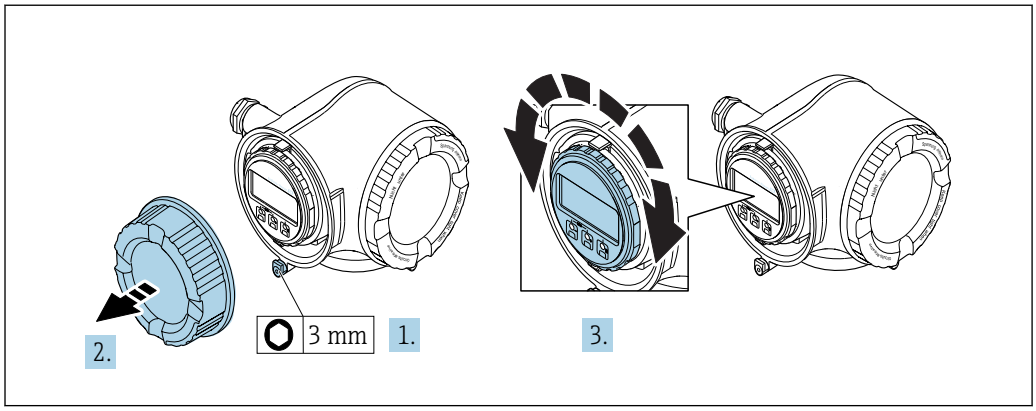
To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Release the fixing screw.
4. Turn the housing to the desired position.
5. Firmly tighten the securing screw.
6. Screw on the connection compartment cover
7. Fit the securing clamp of the connection compartment cover.

6.2.7 Turning the display module: Proline 500

The display module can be turned to optimize display readability and operability.



A0030035

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Turn the display module to the desired position: max. 8 × 45° in every direction.
4. Screw on the connection compartment cover.
5. Fit the securing clamp of the connection compartment cover.

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected ? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping ?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Is the device adequately protected from precipitation and direct sunlight?	❑
Have the fixing screws been tightened with the correct tightening torque?	❑

7 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

- ▶ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
- ▶ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 10 A) should be integrated into the system installation.

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp: Allen key 3 mm
- Wire stripper
- When using stranded cables: crimper for wire end ferrule
- For removing cables from terminal: Flat blade screwdriver ≤ 3 mm (0.12 in)

7.1.2 Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

Electrical safety

In accordance with applicable federal/national regulations.

Protective ground cable

Cable: 2.1 mm^2 (14 AWG)

The grounding impedance must be less than 1 Ω.

Permitted temperature range

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

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe 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.

Double pulse output

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.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
  Conductor cross-section0.2 to 2.5 mm² (24 to 12 AWG)

Connecting cable for sensor - transmitter: Proline 500 – digital

Standard cable

A standard cable can be used as the connecting cable.

Standard cable	4 cores (2 pairs); twisted pair with common shield
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Cable length	Maximum 300 m (1000 ft), see the following table.

Cross-section	Cable lengths for use in	
	Non-hazardous area, Ex Zone 2, Class I, Division 2	Hazardous area, Ex Zone 1, Class I, Division 1
0.34 mm² (AWG 22)	80 m (270 ft)	50 m (165 ft)
0.50 mm² (AWG 20)	120 m (400 ft)	60 m (200 ft)
0.75 mm² (AWG 18)	180 m (600 ft)	90 m (300 ft)
1.00 mm² (AWG 17)	240 m (800 ft)	120 m (400 ft)
1.50 mm² (AWG 15)	300 m (1000 ft)	180 m (600 ft)
2.50 mm² (AWG 13)	300 m (1000 ft)	300 m (1000 ft)

Optionally available connecting cable

Standard cable	2 × 2 × 0.34 mm² (AWG 22) PVC cable with common shield (2 pairs, twisted pair)
Flame resistance	According to DIN EN 60332-1-2
Oil resistance	According to DIN EN 60811-2-1
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)
Available cable length	Fixed: 20 m (65 ft); variable: up to maximum 50 m (165 ft)

Connecting cable for sensor - Proline 500 transmitter

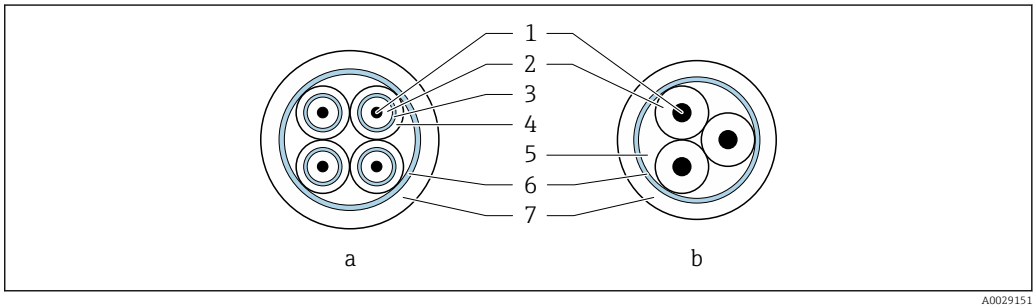
Signal cable

Standard cable	3 × 0.38 mm² (20 AWG) with common, braided copper shield (Ø ~ 9.5 mm (0.37 in)) and individual shielded cores
Conductor resistance	≤50 Ω/km (0.015 Ω/ft)

Capacitance: core/shield	≤420 pF/m (128 pF/ft)
Cable length (max.)	Depends on the medium conductivity, max. 200 m (656 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (32 ft), 20 m (65 ft) or variable length up to max. 200 m (656 ft)
Operating temperature	–20 to +80 °C (–68 to +176 °F)

Coil current cable

Standard cable	3 × 0.75 mm² (18 AWG) with common, braided copper shield (Ø ~ 9 mm (0.35 in)) and individual shielded cores
Conductor resistance	≤37 Ω/km (0.011 Ω/ft)
Capacitance: core/core, shield grounded	≤120 pF/m (37 pF/ft)
Cable length (max.)	Depends on the medium conductivity, max. 200 m (656 ft)
Cable lengths (available for order)	5 m (15 ft), 10 m (32 ft), 20 m (65 ft) or variable length up to max. 200 m (656 ft)
Operating temperature	–20 to +80 °C (–68 to +176 °F)
Test voltage for cable insulation	≤ AC 1433 V rms 50/60 Hz or ≥ DC 2026 V



A0029151

14 *Cable cross-section*

a Electrode cable
b Coil current cable
1 Core
2 Core insulation
3 Core shield
4 Core jacket
5 Core reinforcement
6 Cable shield
7 Outer jacket

Reinforced connecting cables

Reinforced connecting cables with an additional, reinforcing metal braid should be used for:
- When laying the cable directly in the ground
- Where there is a risk of damage from rodents

Operation in zones of severe electrical interference

The measuring system meets the general safety requirements → 196 and EMC specifications → 184.

Grounding is by means of the ground terminal provided for the purpose inside the connection housing. The stripped and twisted lengths of cable shield to the ground terminal must be as short as possible.

7.1.3 Terminal assignment

Transmitter: supply voltage, input/outputs

The terminal assignment of the inputs and outputs depends on the individual order version of the device. The device-specific terminal assignment is documented on an adhesive label in the terminal cover.

Supply voltage		Input/output 1		Input/output 2		Input/output 3		Input/output 4	
1 (+)	2 (–)	26 (+)	27 (–)	24 (+)	25 (–)	22 (+)	23 (–)	20 (+)	21 (–)
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 – digital→ 📄 43
- Proline 500 → 📄 48

7.1.4 Preparing the measuring device

Carry out the steps in the following order:

1. Mount the sensor and transmitter.
2. Connection housing, sensor: Connect connecting cable.
3. Transmitter: Connect connecting cable.
4. Transmitter: Connect signal cable and cable for supply voltage.

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

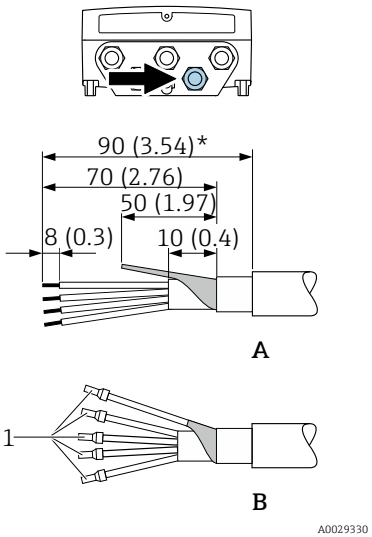
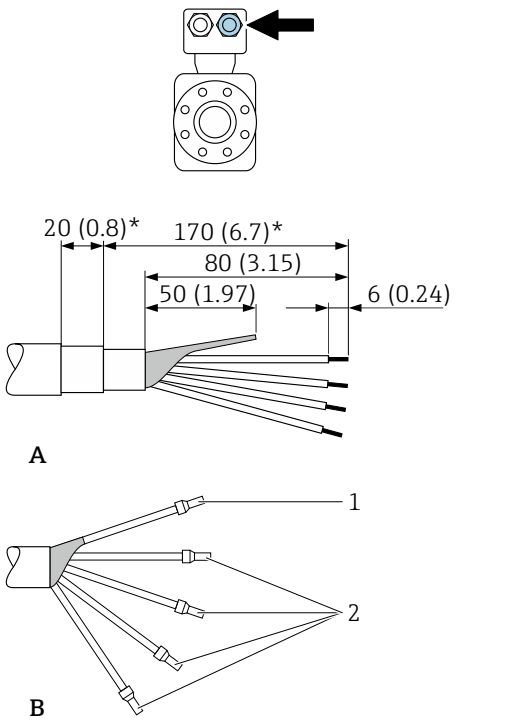
▶ Use suitable cable glands corresponding to the degree of protection.

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 📄 37.

7.1.5 Preparing the connecting cable: Proline 500 – digital

When terminating the connecting cable, pay attention to the following points:

- For cables with fine-wire cores (stranded cables):
  Fit the cores with ferrules.

Transmitter	Sensor
	

Engineering unit mm (in)
A = Terminate the cable
B = Fit ferrules on cables with fine-wire cores (stranded cables)
1 = Red ferrules, ϕ 1.0 mm (0.04 in)
2 = White ferrules, ϕ 0.5 mm (0.02 in)
* = Stripping only for reinforced cables

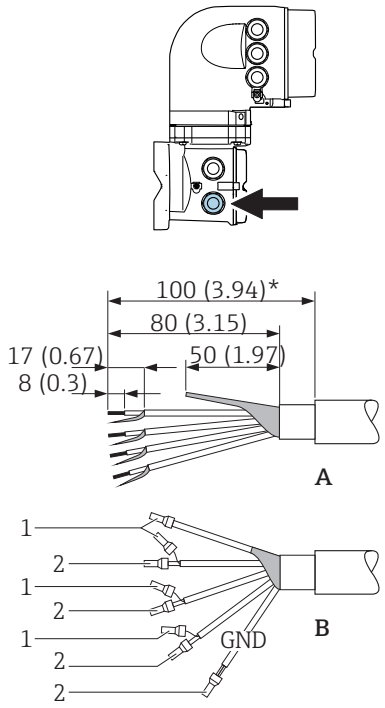
7.1.6 Preparing the connecting cable: Proline 500

When terminating the connecting cable, pay attention to the following points:

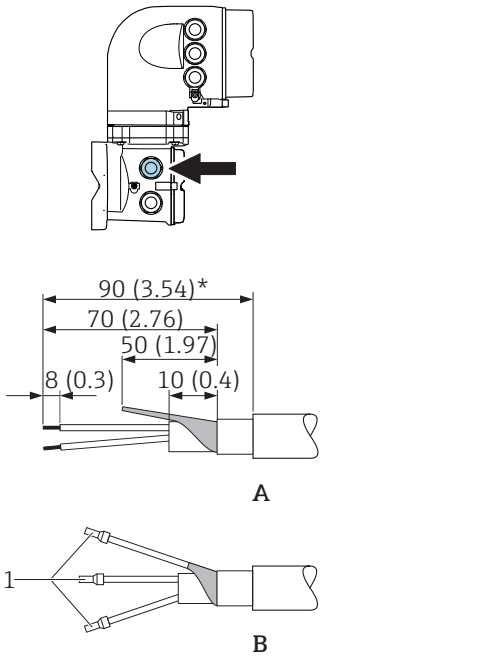
1. In the case of the electrode cable:
   Make sure that the ferrules do not touch the core shields on the sensor side.
   Minimum distance = 1 mm (exception: green “GND” cable)
2. In the case of the coil current cable:
   Insulate one core of the three-core cable at the level of the core reinforcement. You only require two cores for the connection.
3. For cables with fine-wire cores (stranded cables):
   Fit the cores with ferrules.

Transmitter

Electrode cable

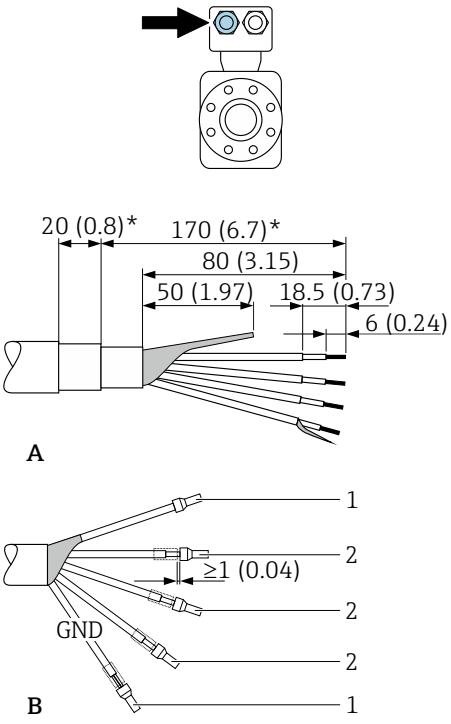


Coil current cable

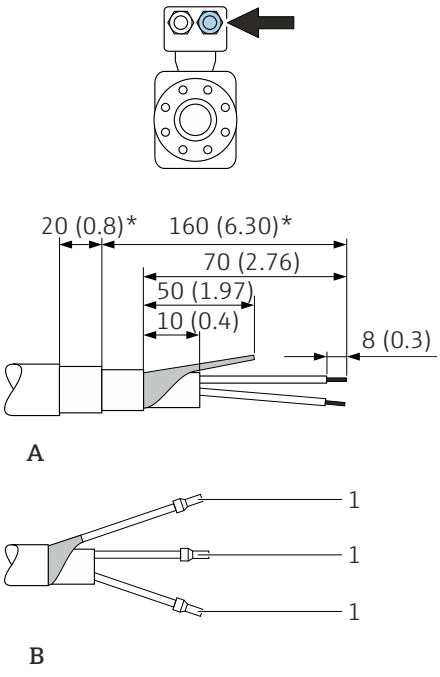


Sensor

Electrode cable



Coil current cable



Engineering unit mm (in)
A = Terminate the cable
B = Fit ferrules on cables with fine-wire cores (stranded cables)
1 = Red ferrules, ϕ 1.0 mm (0.04 in)
2 = White ferrules, ϕ 0.5 mm (0.02 in)
* = Stripping only for reinforced cables

7.2 Connecting the measuring device: Proline 500 – digital

NOTICE

Limitation of electrical safety due to incorrect connection!

- Have electrical connection work carried out by correspondingly trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable ⏚ before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

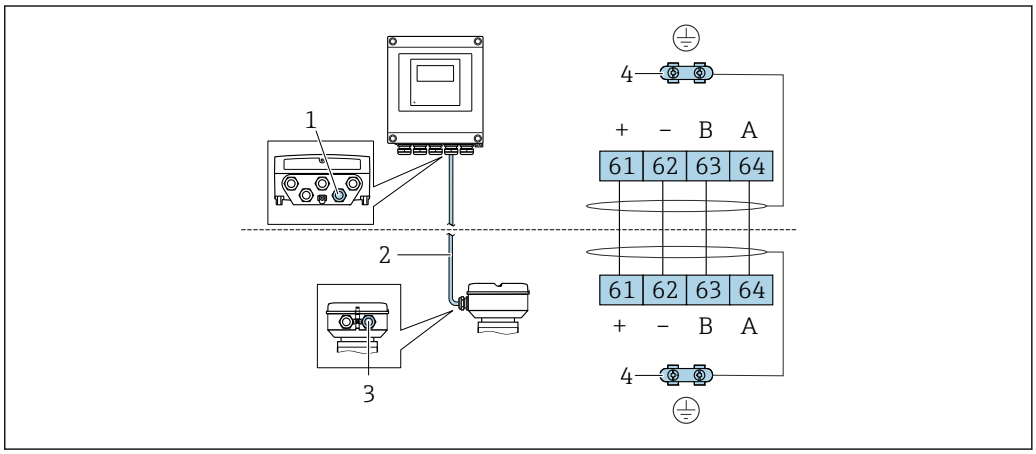
7.2.1 Connecting the connecting cable

⚠ WARNING

Risk of damaging the electronic components!

- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.
- Ground the connection housing of the sensor via the external screw terminal.

Terminal assignment



1 Cable entry for connecting cable on transmitter housing
2 Connecting cable ISEM communication
3 Cable entry for connecting cable or connector on sensor connection housing
4 Grounding via cable strain relief

Connecting the connecting cable to the sensor connection housing

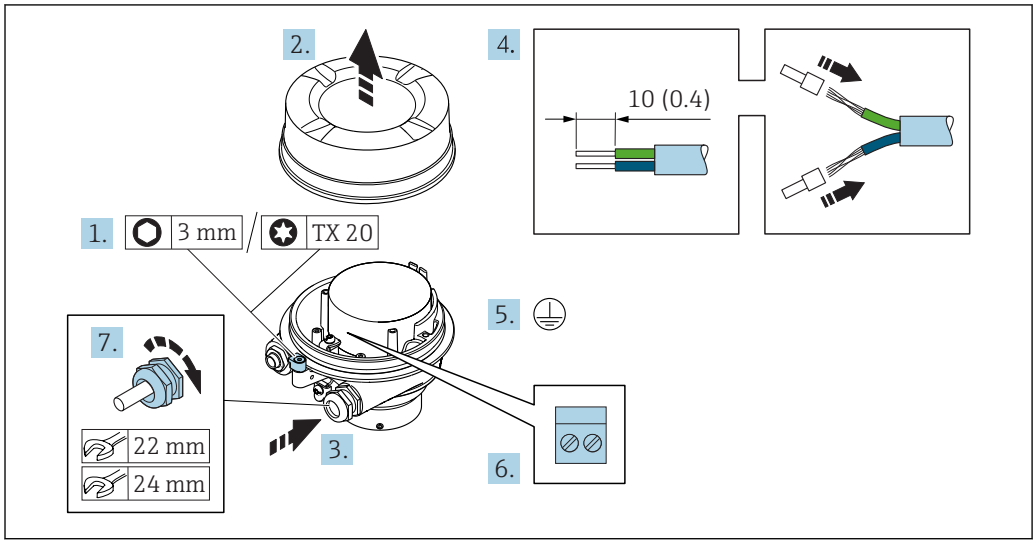
Connection via terminals with order code for "Sensor connection housing":
– Option **A** "Aluminum, coated"→ 🖹 44
– Option **L** "Cast, stainless"→ 🖹 44

Connecting the connecting cable to the transmitter

The cable is connected to the transmitter via terminals → 🖹 45.

Connecting the sensor connection housing via terminals

For the device version with the order code for "Sensor connection housing":
- Option **A** "Aluminum coated"
- Option **L** "Cast, stainless"



A0029616

1. Loosen the securing clamp of the housing cover.
2. Unscrew the housing cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
5. Connect the protective ground.
6. Connect the cable in accordance with the terminal assignment → 43.
7. Firmly tighten the cable glands.
   ↳ This concludes the process for connecting the connecting cable.

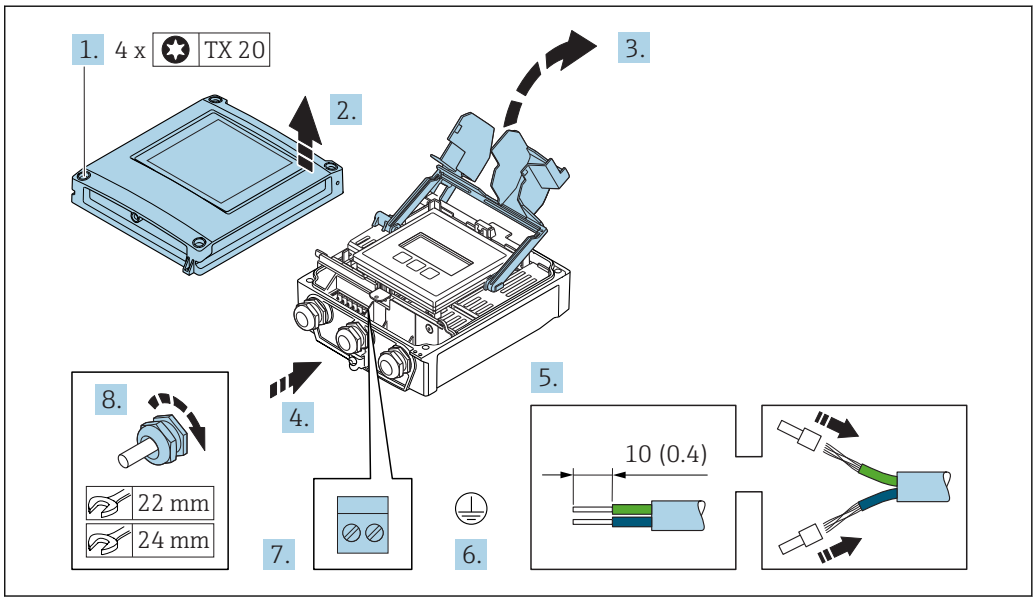
WARNING

Housing degree of protection voided due to insufficient sealing of the housing.

► Screw in the thread on the cover without using any lubricant. The thread on the cover is coated with a dry lubricant.

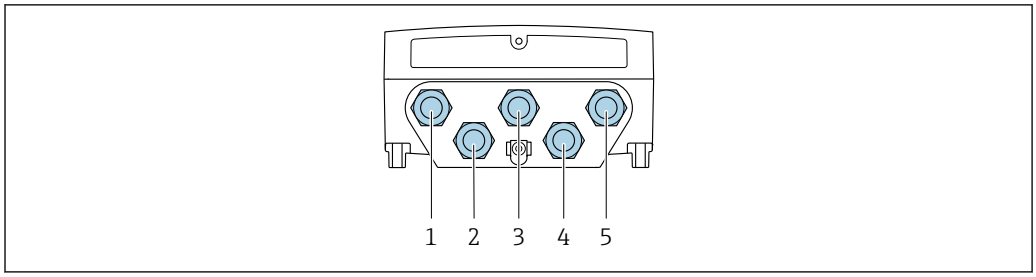
8. Screw on the housing cover.
9. Tighten the securing clamp of the housing cover.

Connecting the connecting cable to the transmitter



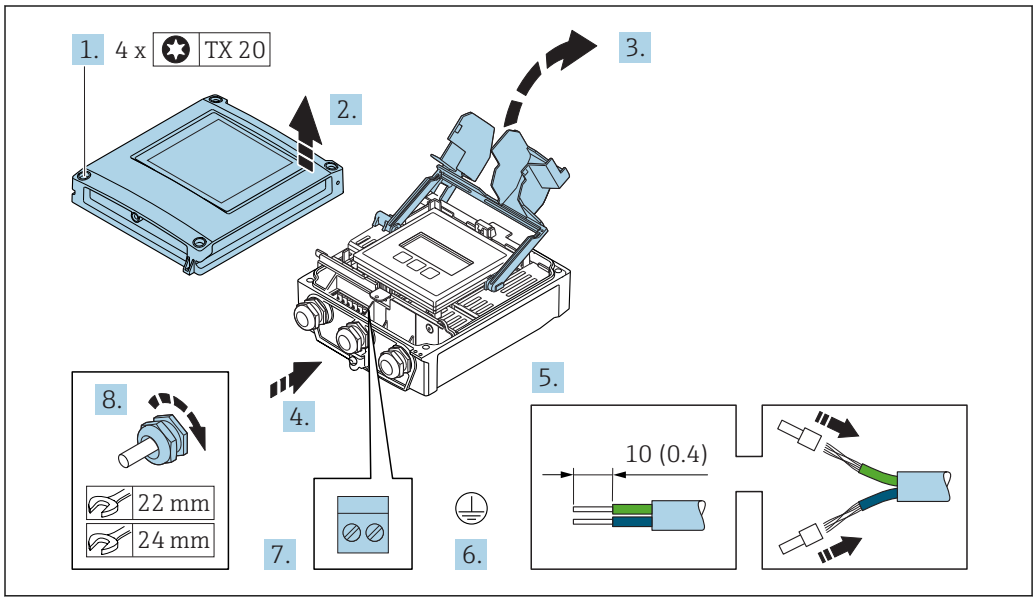
1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Fold open the terminal cover.
4. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
5. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
6. Connect the protective ground.
7. Connect the cable in accordance with the terminal assignment → 43.
8. Firmly tighten the cable glands.
   ↳ This concludes the process for connecting the connecting cable.
9. Close the housing cover.
10. Tighten the securing screw of the housing cover.
11. After connecting the connecting cable:
    Connect the signal cable and the supply voltage cable → 46.

7.2.2 Connecting the signal cable and the supply voltage cable



A0028200

1 *Cable entry for supply voltage*
2 *Cable entry for cable or connection of device plug for signal transmission*
3 *Cable entry for cable or connection of device plug for signal transmission*
4 *Cable entry for sensor - transmitter connecting cable*
5 *Cable entry for cable or connection of device plug for signal transmission, optional: connection of external WLAN antenna or service connector*



A0029597

1. Loosen the 4 fixing screws on the housing cover.
2. Open the housing cover.
3. Fold open the terminal cover.
4. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
5. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
6. Connect the protective ground.
7. Connect the cable in accordance with the terminal assignment .
   ↳ **Signal cable terminal assignment:** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
   Supply voltage terminal assignment: Adhesive label in the terminal cover or → 40.
8. Firmly tighten the cable glands.
   ↳ This concludes the cable connection process.
9. Close the terminal cover.
10. Close the housing cover.

⚠ WARNING

Housing degree of protection may be voided due to insufficient sealing of the housing.

- ▶ Screw in the screw without using any lubricant.

⚠ WARNING

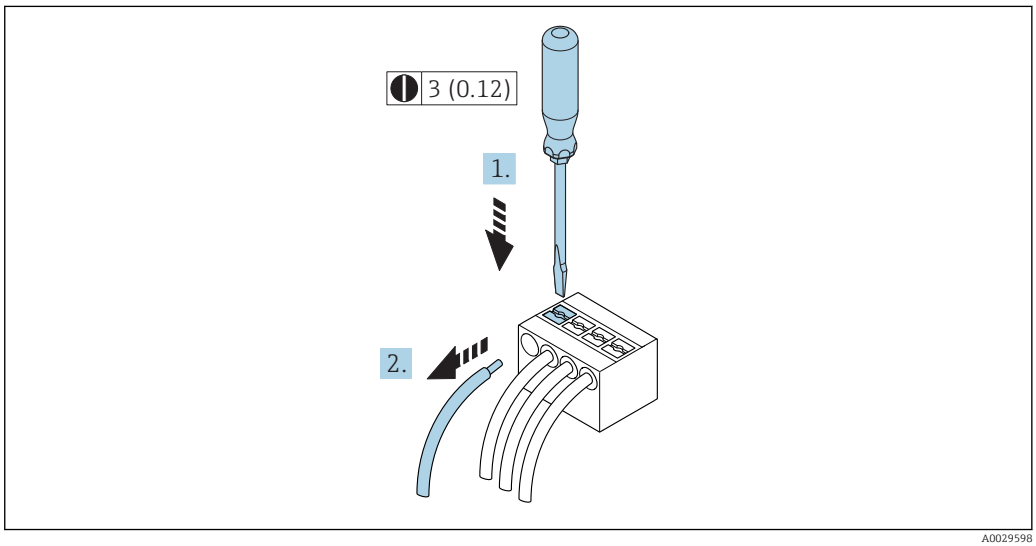
Excessive tightening torque applied to the fixing screws!

Risk of damaging the plastic transmitter.

- ▶ Tighten the fixing screws as per the tightening torque: 2 Nm (1.5 lbf ft).

11. Tighten the 4 fixing screws on the housing cover.

Removing a cable



15 *Engineering unit mm (in)*

1. To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes
2. while simultaneously pulling the cable end out of the terminal.

7.3 Connecting the measuring device: Proline 500

NOTICE

Limitation of electrical safety due to incorrect connection!

- Have electrical connection work carried out by correspondingly trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable ⏚ before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

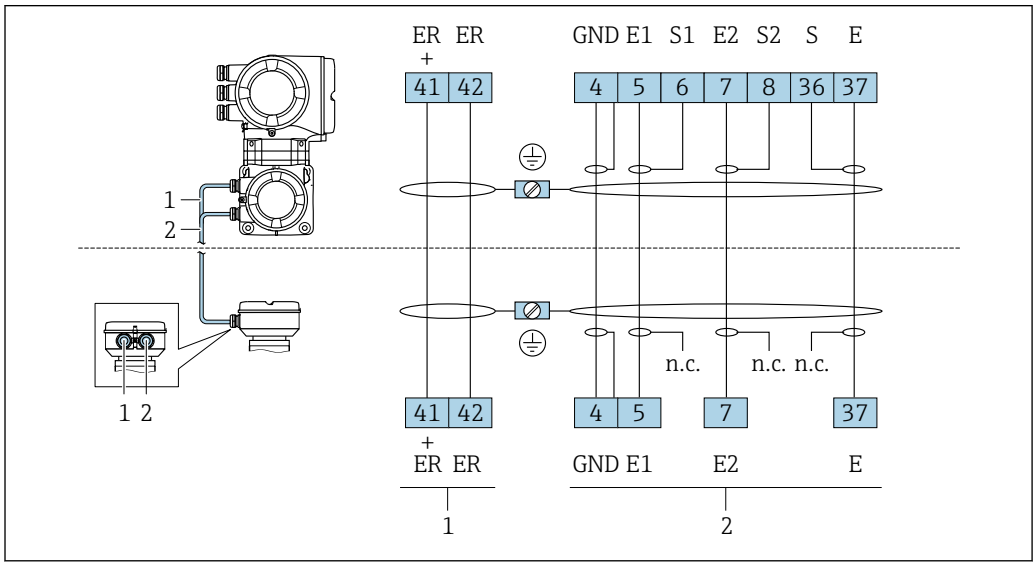
7.3.1 Connecting the connecting cable

⚠ WARNING

Risk of damaging the electronic components!

- Connect the sensor and transmitter to the same potential equalization.
- Only connect the sensor to a transmitter with the same serial number.
- Ground the connection housing of the sensor via the external screw terminal.

Terminal assignment



1 *Coil current cable*
2 *Signal cable*

Connecting the connecting cable to the sensor connection housing

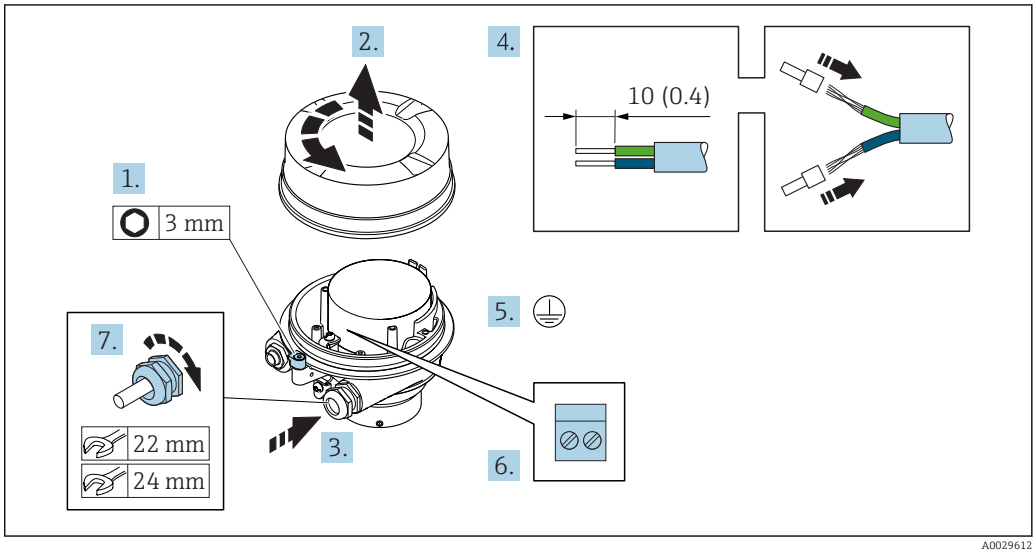
Connection via terminals with order code for "Housing":
Option **A** "Aluminum coated"→ 49

Connecting the connecting cable to the transmitter

The cable is connected to the transmitter via terminals → 50.

Connecting the sensor connection housing via terminals

For the device version with the order code for "Housing":
- Option **A** "Aluminum coated"
- Option **L** "Cast, stainless"



1. Loosen the securing clamp of the housing cover.
2. Unscrew the housing cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, fit ferrules.
5. Connect the protective ground.
6. Connect the cable in accordance with the terminal assignment → 48.
7. Firmly tighten the cable glands.
   ↳ This concludes the process for connecting the connecting cables.

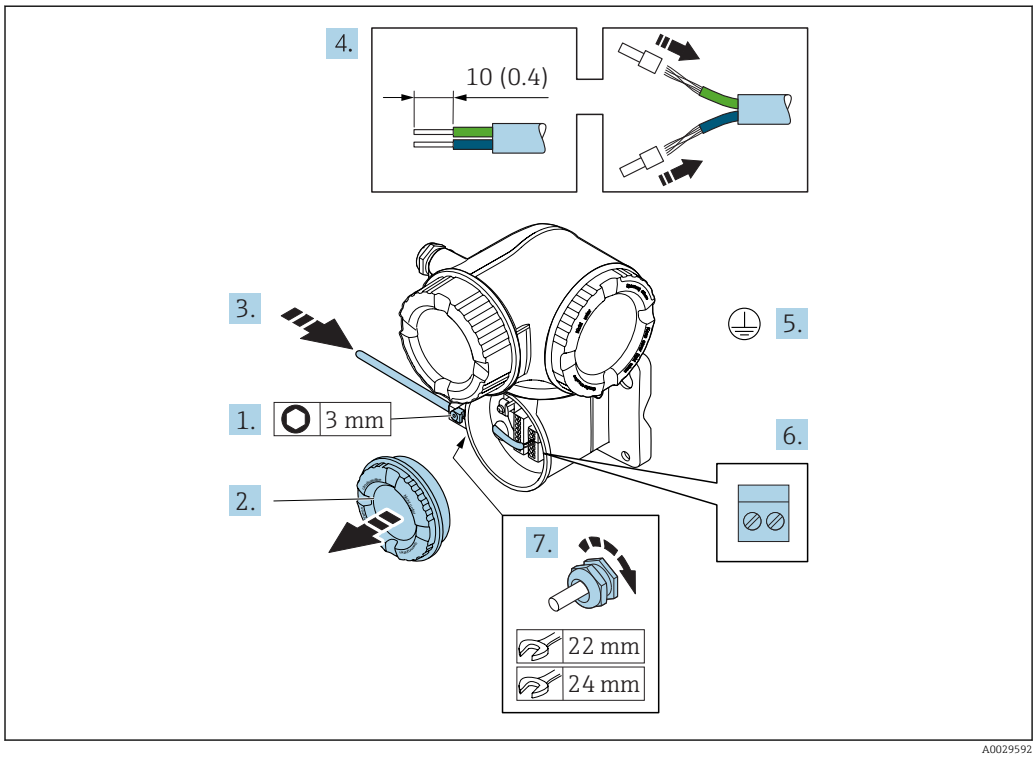
⚠ WARNING

Housing degree of protection voided due to insufficient sealing of the housing.

▶ Screw in the thread on the cover without using any lubricant. The thread on the cover is coated with a dry lubricant.

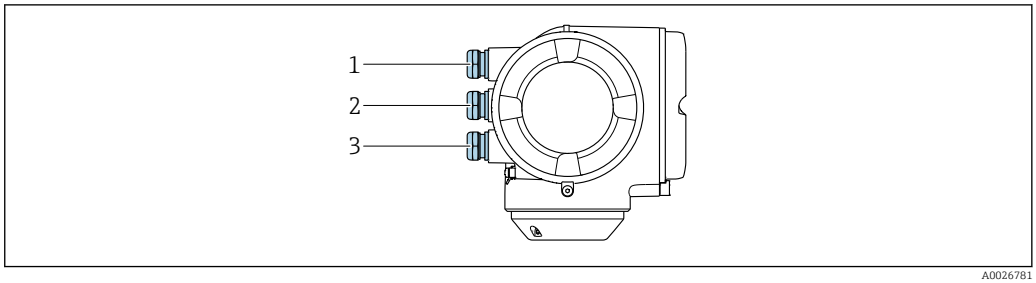
8. Screw on the housing cover.
9. Tighten the securing clamp of the housing cover.

Connecting the connecting cable to the transmitter



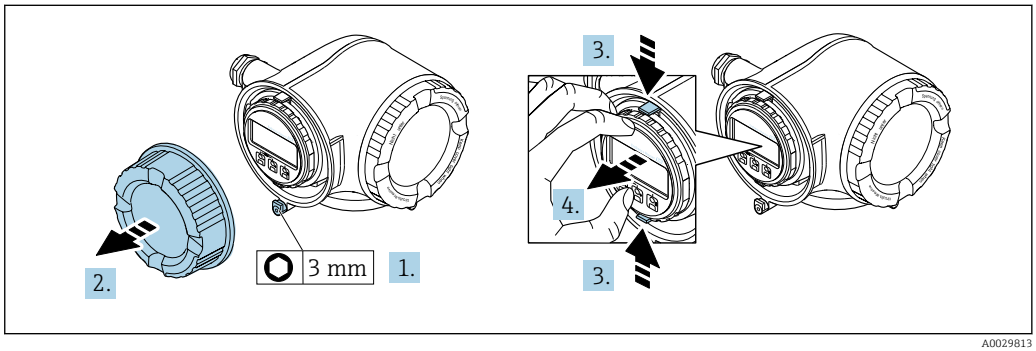
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
4. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
5. Connect the protective ground.
6. Connect the cable in accordance with the terminal assignment → 48.
7. Firmly tighten the cable glands.
   ↳ This concludes the process for connecting the connecting cables.
8. Screw on the connection compartment cover.
9. Tighten the securing clamp of the connection compartment cover.
10. After connecting the connecting cables:
    Connect the signal cable and the supply voltage cable → 51.

7.3.2 Connecting the signal cable and the supply voltage cable



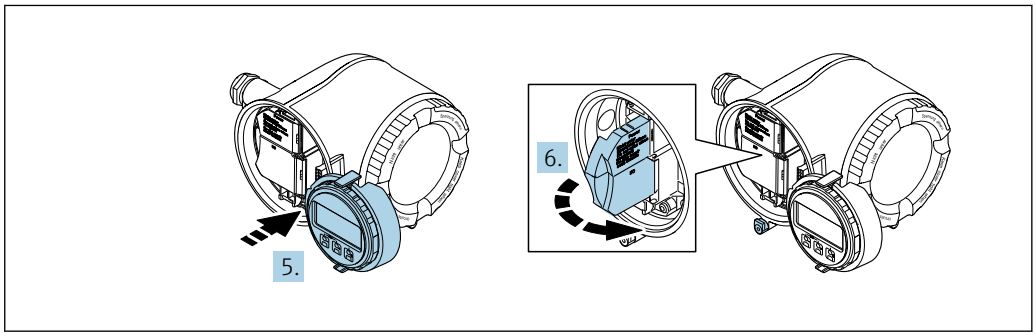
A0026781

1 Cable entry for supply voltage
2 Cable entry for signal transmission, input/output 1 and 2
3 Cable entry for input/output signal transmission; Optional: connection of external WLAN antenna or service plug



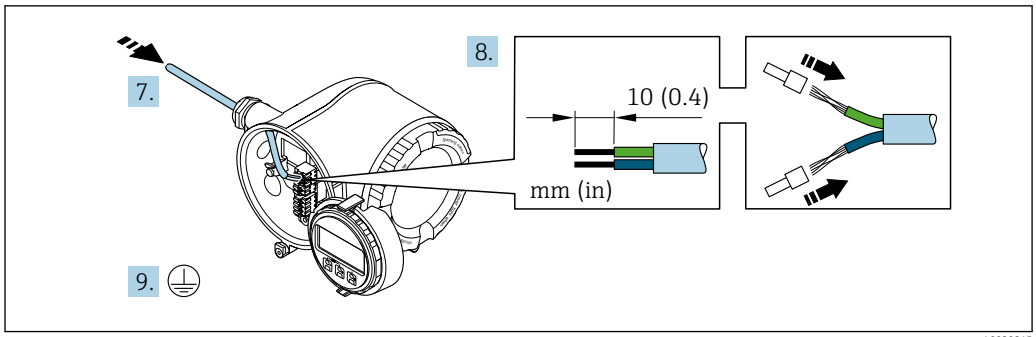
A0029813

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze the tabs of the display module holder together.
4. Remove the display module holder.



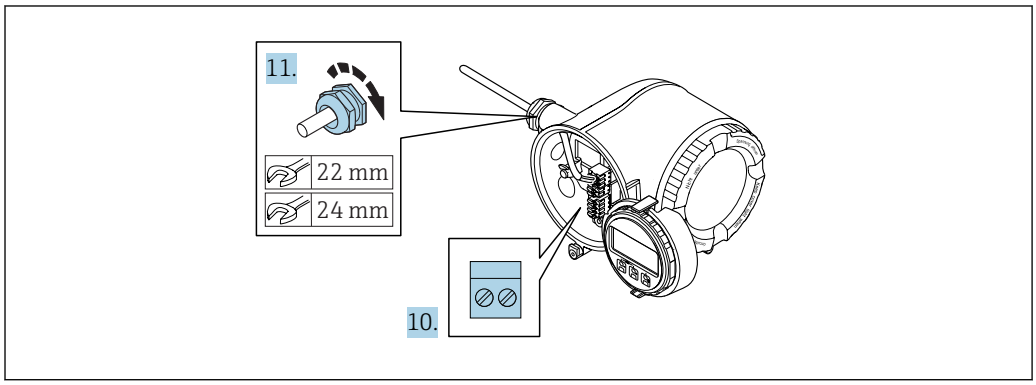
A0029814

5. Attach the holder to the edge of the electronics compartment.
6. Open the terminal cover.



A0029815

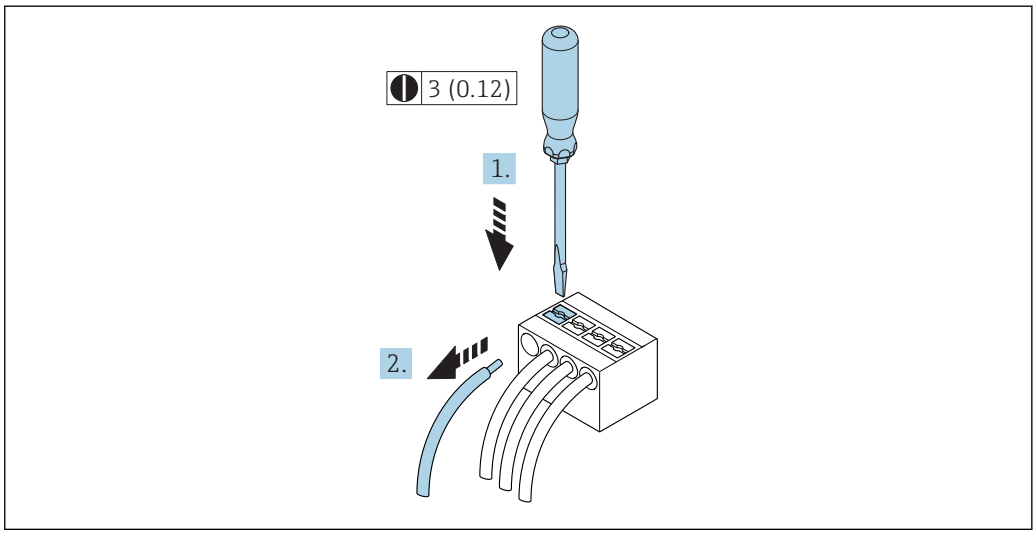
7. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
8. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
9. Connect the protective ground.



A0029816

10. Connect the cable in accordance with the terminal assignment .
    ↳ **Signal cable terminal assignment:** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
    Supply voltage terminal assignment: Adhesive label in the terminal cover or → 40.
11. Firmly tighten the cable glands.
    ↳ This concludes the cable connection process.
12. Close the terminal cover.
13. Fit the display module holder in the electronics compartment.
14. Screw on the connection compartment cover.
15. Secure the securing clamp of the connection compartment cover.

Removing a cable



16 *Engineering unit mm (in)*

1. To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes
2. while simultaneously pulling the cable end out of the terminal.

7.4 Ensure potential equalization

7.4.1 Requirements

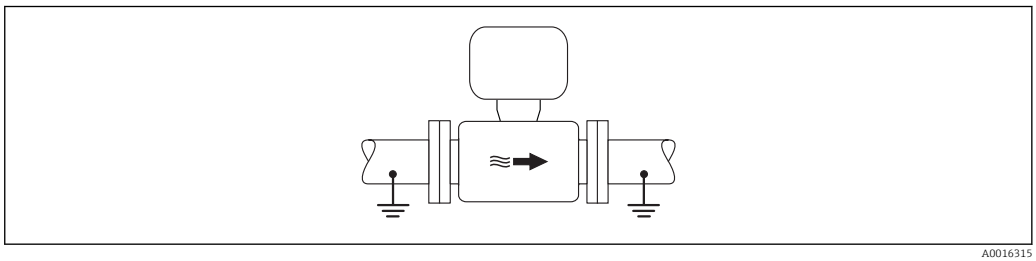
CAUTION

Electrode damage can result in the complete failure of the device!

- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding

7.4.2 Connection example, standard scenario

Metal, grounded pipe



17 *Potential equalization via measuring tube*

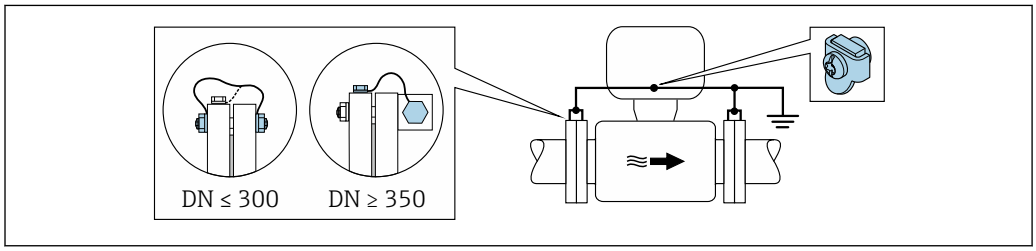
7.4.3 Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:

- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



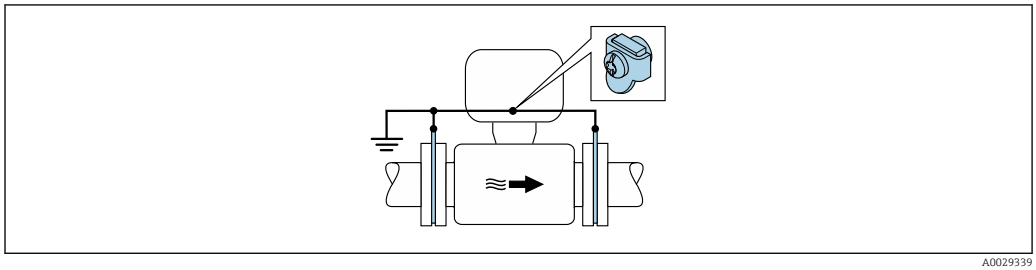
18 *Potential equalization via ground terminal and pipe flanges*

1. Connect both sensor flanges to the pipe flange via a ground cable and ground them.
2. If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
3. If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket. Observe screw tightening torques: see the Sensor Brief Operating Instructions.
4. Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose.

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



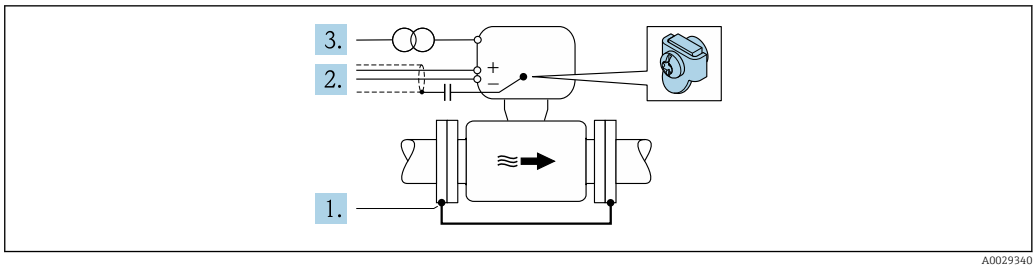
19 *Potential equalization via ground terminal and ground disks*

1. Connect the ground disks to the ground terminal via the ground cable.
2. Connect the ground disks to ground potential.

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:
- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



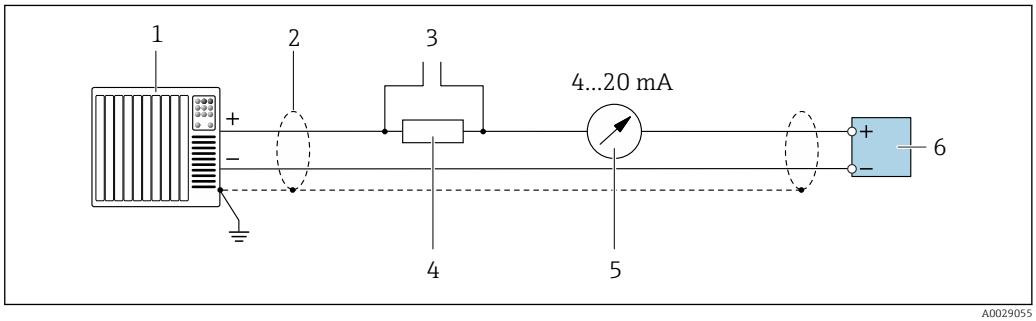
Prerequisite: The sensor is installed in the pipe in a way that provides electrical insulation.

1. Connect the two flanges of the pipe to one another via a ground cable.
2. Guide the shield of the signal lines through a capacitor.
3. Connect the measuring device to the power supply such that it is floating in relation to the protective ground (isolation transformer).

7.5 Special connection instructions

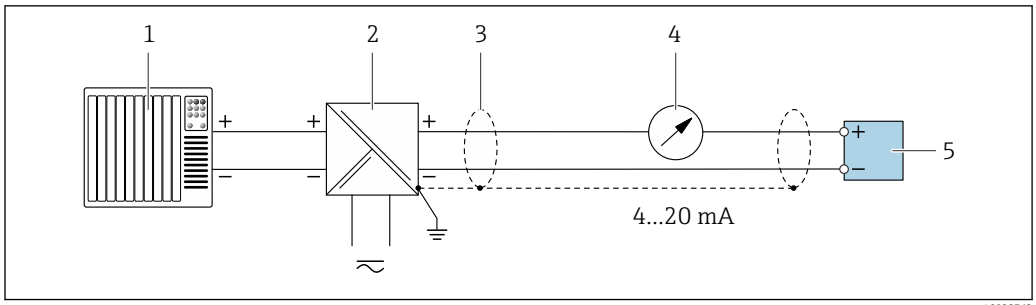
7.5.1 Connection examples

Current output 4 to 20 mA HART



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

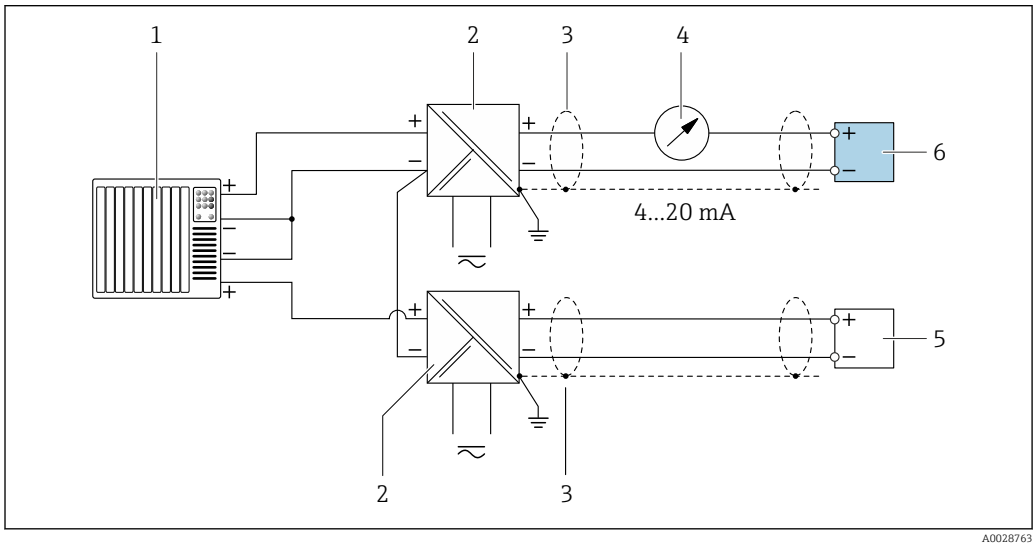
1 *Automation system with current input (e.g. PLC)*
2 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Connection for HART operating devices → 81*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 176*
5 *Analog display unit: observe maximum load → 176*
6 *Transmitter*



21 *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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load → 176*
5 *Transmitter*

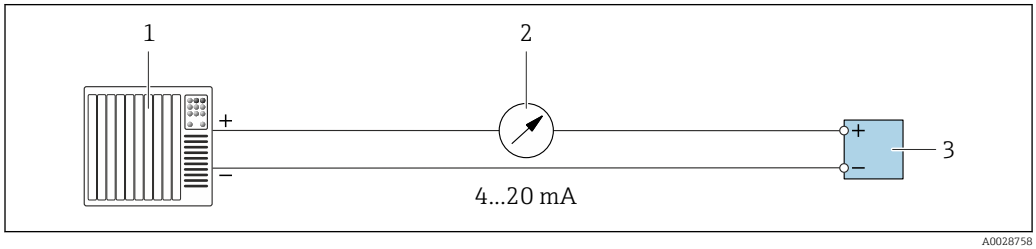
HART input



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

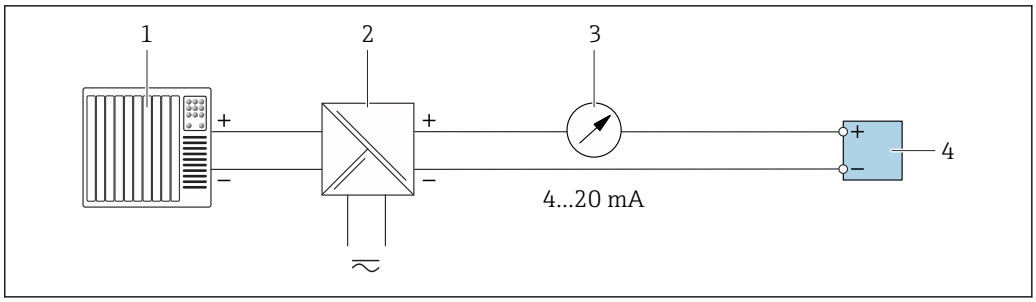
1 *Automation system with HART output (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)*
3 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load*
5 *Pressure transmitter (e.g.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

Current output 4-20 mA



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

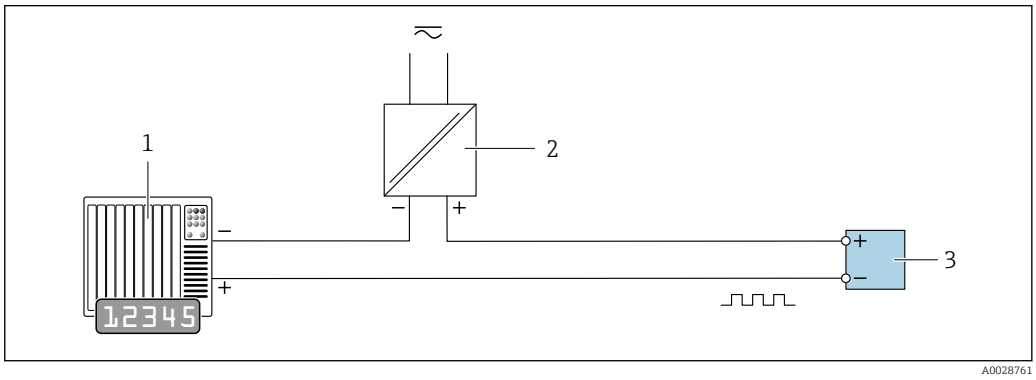
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load*
3 *Transmitter*



24 *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*
4 *Transmitter*

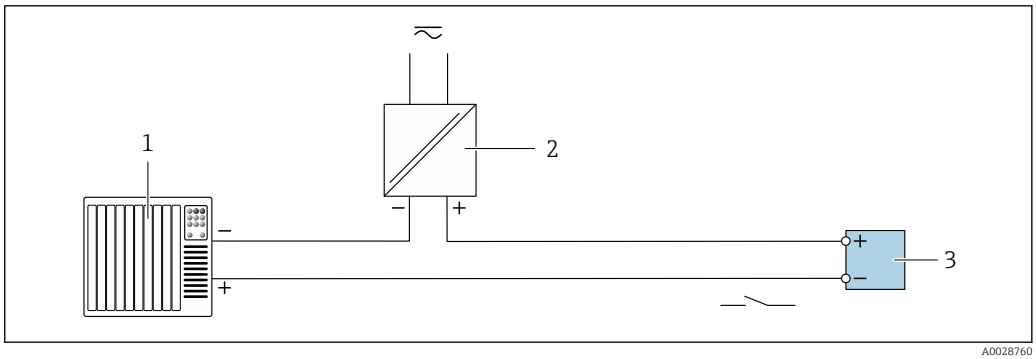
Pulse/frequency output



25 *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 → 176*

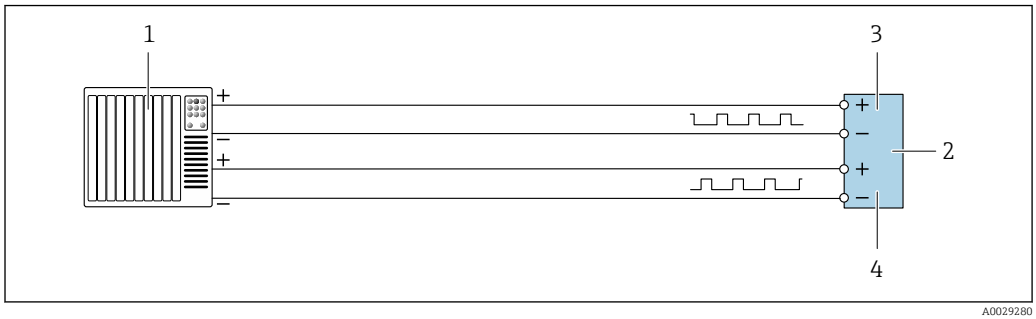
Switch output



26 *Connection example for switch output (passive)*

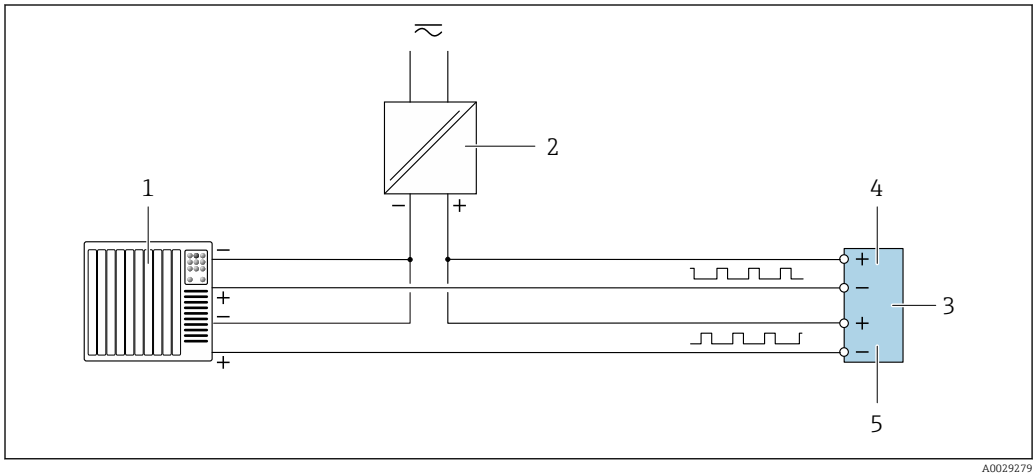
1 *Automation system with switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 176*

Double pulse output



27 *Connection example for double pulse output (active)*

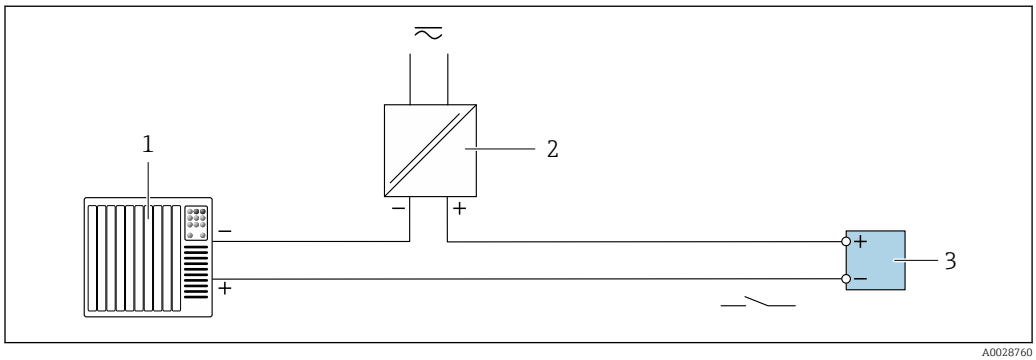
1 *Automation system with double pulse input (e.g. PLC)*
2 *Transmitter: Observe input values → 178*
3 *Double pulse output*
4 *Double pulse output (slave), phase-shifted*



28 *Connection example for double pulse output (passive)*

1 *Automation system with double pulse input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 178*
4 *Double pulse output*
5 *Double pulse output (slave), phase-shifted*

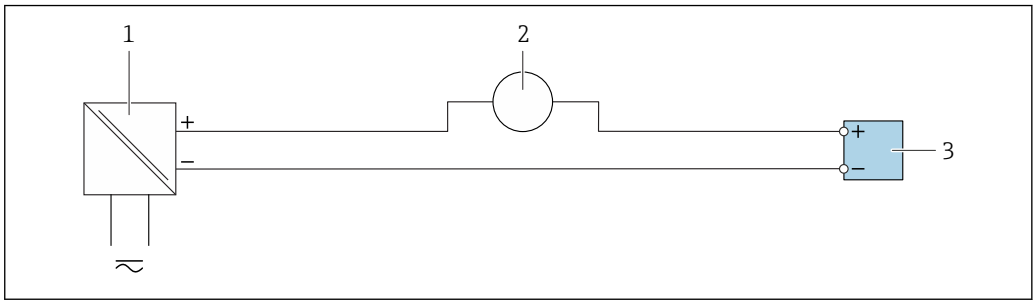
Relay output



29 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 178*

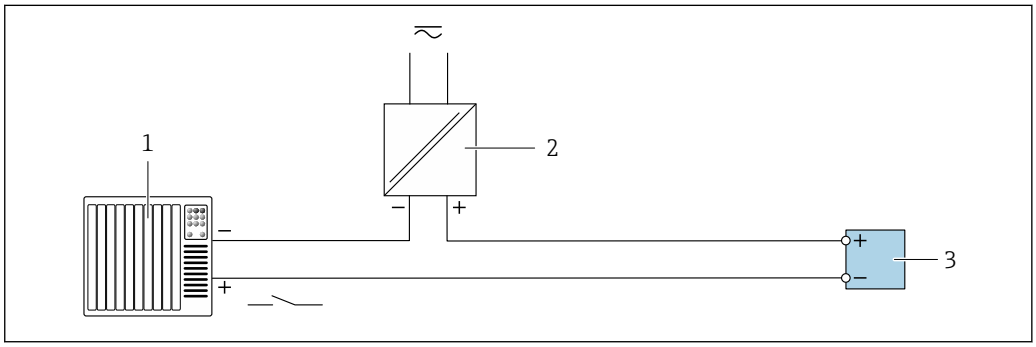
Current input



30 *Connection example for 4 to 20 mA current input*

1 *Power supply*
2 *External measuring device (for reading in pressure or temperature, for instance)*
3 *Transmitter: Observe input values*

Status input



31 *Connection example for status input*

1 *Automation system with status output (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values*

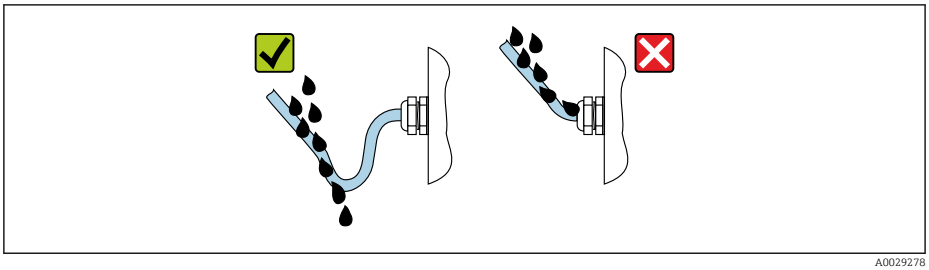
7.6 Ensuring the degree of protection

The measuring device fulfills all the requirements for the IP66/67 degree of protection, Type 4X enclosure.

To guarantee IP66/67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.

5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").
   ↳



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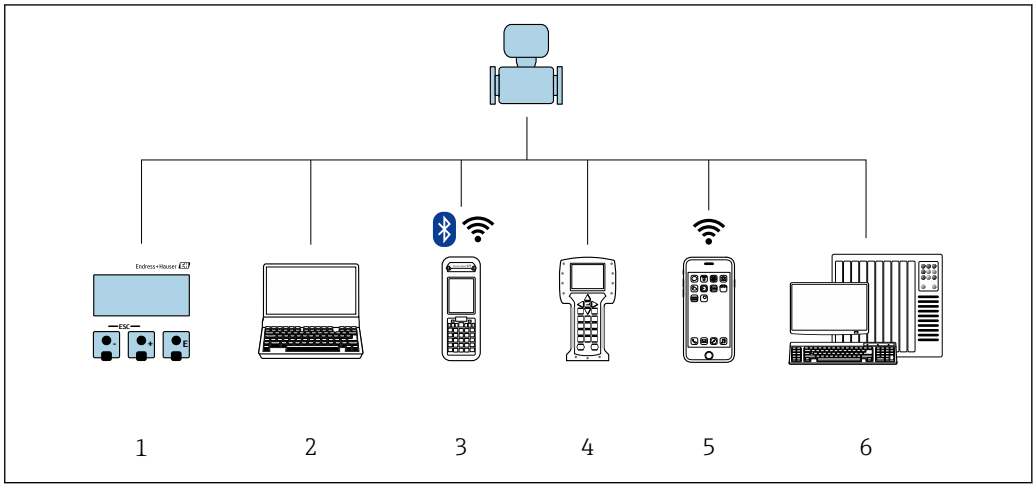
6. Insert dummy plugs into unused cable entries.

7.7 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used meet the requirements?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 59 ?	❑
Is the potential equalization established correctly ?	❑

8 Operation options

8.1 Overview of operation options



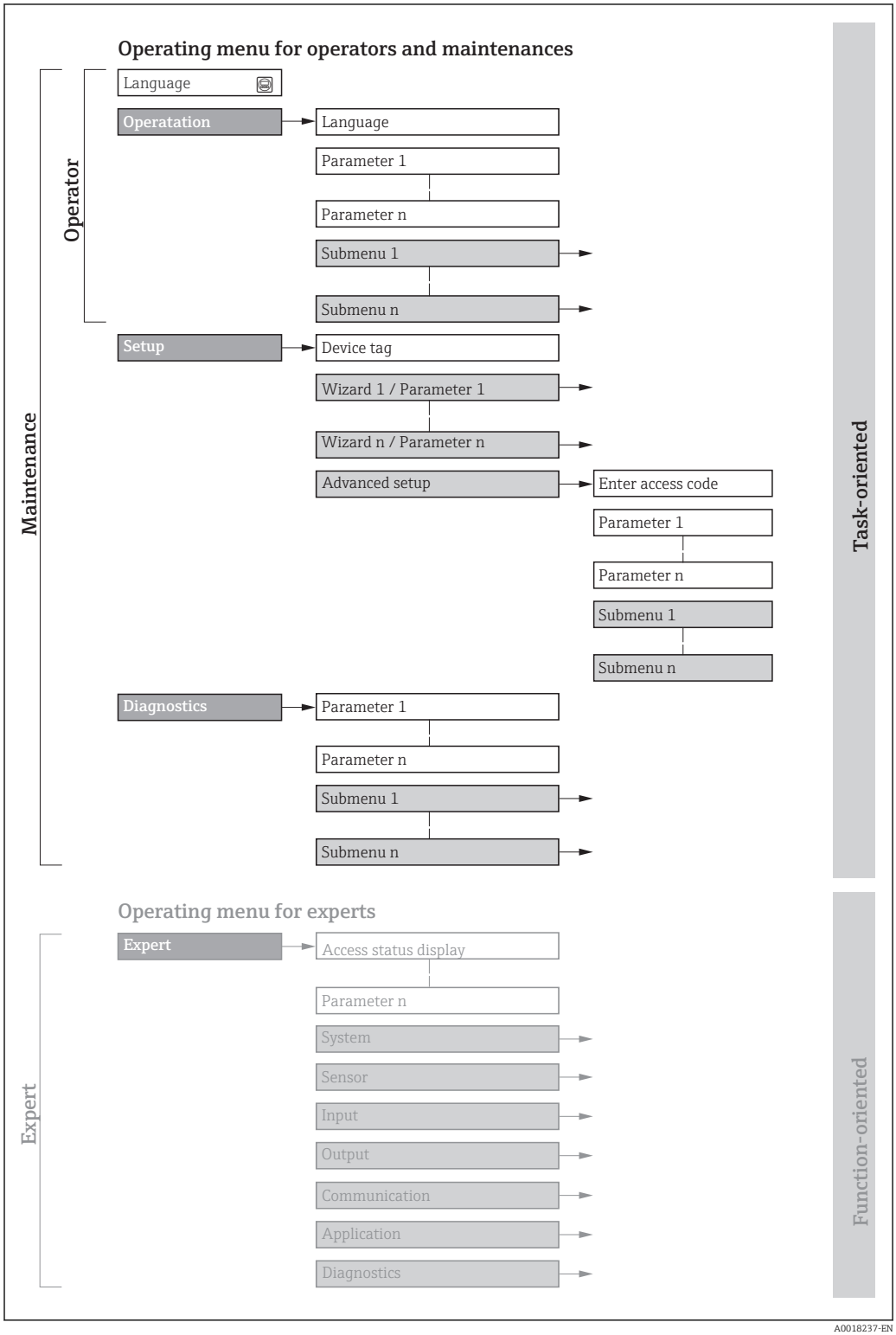
A0029295

1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Field Xpert SFX350 or SFX370*
4 *Field Communicator 475*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

For an overview of the operating menu for experts: "Description of Device Parameters" document supplied with the device→ 198



32 *Schematic structure of the operating menu*

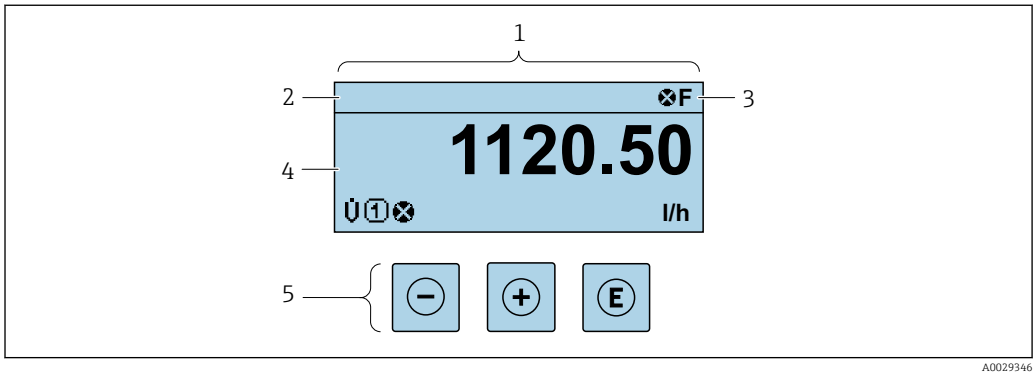
8.2.2 Operating philosophy

The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	**Role "Operator", "Maintenance"** Tasks during operation: ▪ Configuring the operational display ▪ Reading measured values	▪ Defining the operating language ▪ Defining the Web server operating language ▪ Resetting and controlling totalizers
Operation			▪ Configuring the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: ▪ Configuration of the measurement ▪ Configuration of the inputs and outputs ▪ Configuration of the communication interface	Wizards for fast commissioning: ▪ Set the system units ▪ Display I/O/configuration ▪ Configure the inputs ▪ Configure the outputs ▪ Configuring the operational display ▪ Define the output conditioning ▪ Set the low flow cut off ▪ Configure empty pipe detection Advanced setup ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configuration of electrode cleaning (optional) ▪ Configure the WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		**"Maintenance" role** Fault elimination: ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: ▪ Diagnostic list Contains up to 5 currently pending diagnostic messages. ▪ Event logbook Contains event messages that have occurred. ▪ Device information Contains information for identifying the device. ▪ Measured values Contains all current measured values. ▪ **Data logging** submenu with "Extended HistoROM" order option Storage and visualization of measured values ▪ Heartbeat The functionality of the device is checked on demand and the verification results are documented. ▪ Simulation Is used to simulate measured values or output values.
Expert	function-oriented	Tasks that require detailed knowledge of the function of the device: ▪ Commissioning measurements under difficult conditions ▪ Optimal adaptation of the measurement to difficult conditions ▪ Detailed configuration of the communication interface ▪ Error diagnostics in difficult cases	Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: ▪ System Contains all higher-order device parameters which do not concern the measurement or the communication interface. ▪ Sensor Configuration of the measurement. ▪ Input Configuring the status input. ▪ Output Configuring of the analog current outputs as well as the pulse/frequency and switch output. ▪ Communication Configuration of the digital communication interface and the Web server. ▪ Application Configure the functions that go beyond the actual measurement (e.g. totalizer). ▪ Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to the operating menu via the local display

8.3.1 Operational display



1 *Operational display*
2 *Device tag* → 94
3 *Status area*
4 *Display area for measured values (4-line)*
5 *Operating elements* → 69

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals → 150
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior → 151
  - : Alarm
  - : Warning
- : Locking (the device is locked via the hardware)
- : Communication (communication via remote operation is active)

Display area

In the display area, each measured value is prefaced by certain symbol types for further description:

	Measured variable	Measurement channel number	Diagnostic behavior
Example		1	

Appears only if a diagnostics event is present for this measured variable.

Measured values

Symbol	Meaning
	Volume flow
	Conductivity

	Mass flow
	Totalizer The measurement channel number indicates which of the three totalizers is displayed.
	Output The measurement channel number indicates which of the outputs is displayed.
	Status input

Measurement channel numbers

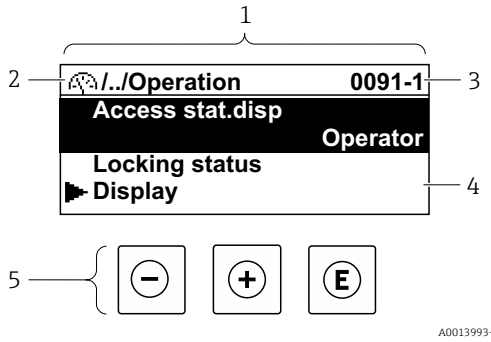
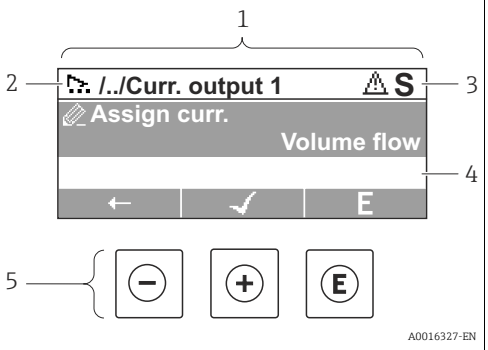
Symbol	Meaning
1 ... 4	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).	

Diagnostic behavior

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable.
For information on the symbols → 151

The number and display format of the measured values can be configured via the **"Format display" parameter** → 107. Operation → Display → Format display

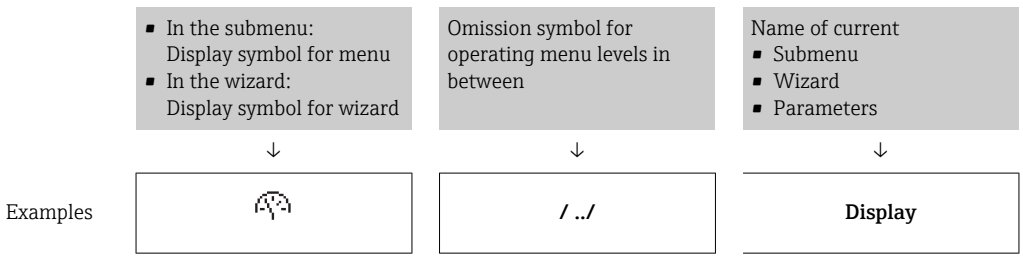
8.3.2 Navigation view

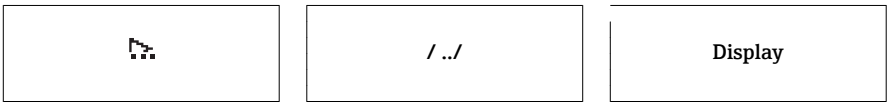
In the submenu	In the wizard
	

1 Navigation view
2 Navigation path to current position
3 Status area
4 Display area for navigation
5 Operating elements → 69

Navigation path

The navigation path - displayed at the top left in the navigation view - consists of the following elements:





For more information about the icons in the menu, refer to the "Display area" section → 66

Status area

The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code for the parameter you are navigating to (e.g. 0022-1)
  - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard
  If a diagnostic event is present, the diagnostic behavior and status signal

- For information on the diagnostic behavior and status signal → 150
- For information on the function and entry of the direct access code → 71

Display area

Menus

Symbol	Meaning
	Operation Appears: ▪ In the menu next to the "Operation" selection ▪ At the left in the navigation path in the **Operation** menu
	Setup Appears: ▪ In the menu next to the "Setup" selection ▪ At the left in the navigation path in the **Setup** menu
	Diagnostics Appears: ▪ In the menu next to the "Diagnostics" selection ▪ At the left in the navigation path in the **Diagnostics** menu
	Expert Appears: ▪ In the menu next to the "Expert" selection ▪ At the left in the navigation path in the **Expert** menu

Submenus, wizards, parameters

Symbol	Meaning
	Submenu
	Wizard
	Parameters within a wizard No display symbol exists for parameters in submenus.

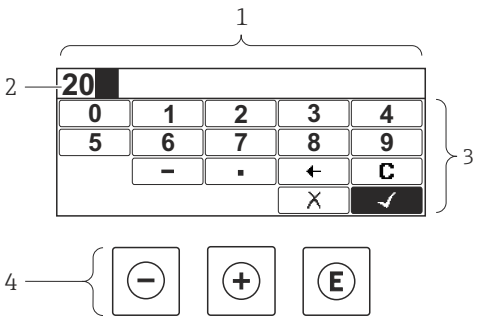
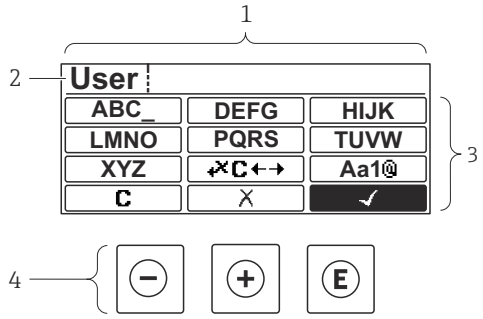
Locking

Symbol	Meaning
	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. ▪ By a user-specific access code ▪ By the hardware write protection switch

Wizard operation

Symbol	Meaning
←	Switches to the previous parameter.
✓	Confirms the parameter value and switches to the next parameter.
E	Opens the editing view of the parameter.

8.3.3 Editing view

Numeric editor	Text editor
	

1 Editing view
2 Display area of the entered values
3 Input mask
4 Operating elements → 69

Input mask

The following input symbols are available in the input mask of the numeric and text editor:

Numeric editor

Symbol	Meaning
0 … 9	Selection of numbers from 0 to 9.
.	Inserts decimal separator at the input position.
−	Inserts minus sign at the input position.
✓	Confirms selection.
←	Moves the input position one position to the left.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Text editor

Symbol	Meaning
Aa1@	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters
ABC_ ... XYZ	Selection of letters from A to Z.
abc _ ... xyz	Selection of letters from a to z.
'"^ _ ... ~& _	Selection of special characters.
✓	Confirms selection.
✗C↔	Switches to the selection of the correction tools.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Correction symbols under ✗C↔

Symbol	Meaning
C	Clears all entered characters.
→	Moves the input position one position to the right.
←	Moves the input position one position to the left.
✗	Deletes one character immediately to the left of the input position.

8.3.4 Operating elements

Key	Meaning
⊖	**Minus key** *In a menu, submenu* Moves the selection bar upwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the previous parameter. *With a text and numeric editor* In the input mask, moves the selection bar to the left (backwards).
⊕	**Plus key** *In a menu, submenu* Moves the selection bar downwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the next parameter. *With a text and numeric editor* Moves the selection bar to the right (forwards) in an input screen.
Ⓔ	**Enter key** *For operational display* ▪ Pressing the key briefly opens the operating menu. ▪ Pressing the key for 2 s opens the context menu. *In a menu, submenu* ▪ Pressing the key briefly: – Opens the selected menu, submenu or parameter. – Starts the wizard. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. *With a Wizard* Opens the editing view of the parameter. *With a text and numeric editor* ▪ Pressing the key briefly: – Opens the selected group. – Carries out the selected action. ▪ Pressing the key for 2 s confirms the edited parameter value.
⊖ + ⊕	**Escape key combination (press keys simultaneously)** *In a menu, submenu* ▪ Pressing the key briefly: – Exits the current menu level and takes you to the next higher level. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s returns you to the operational display ("home position"). *With a Wizard* Exits the wizard and takes you to the next higher level. *With a text and numeric editor* Closes the text or numeric editor without applying changes.
⊖ + Ⓔ	**Minus/Enter key combination (press the keys simultaneously)** Reduces the contrast (brighter setting).
⊕ + Ⓔ	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
⊖ + ⊕ + Ⓔ	**Minus/Plus/Enter key combination (press the keys simultaneously)** *For operational display* Enables or disables the keypad lock (only SD02 display module).

8.3.5 Opening the context menu

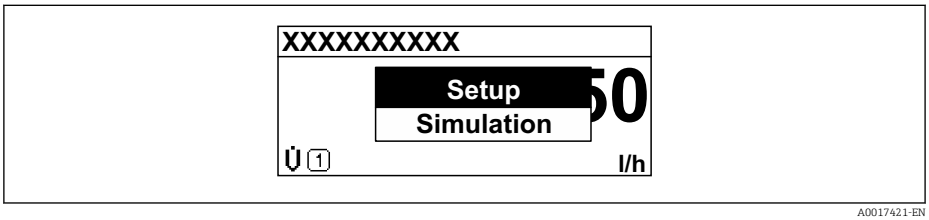
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Data backup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

1. Press E for 2 s.
   ↳ The context menu opens.



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2. Press − + + simultaneously.
   ↳ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

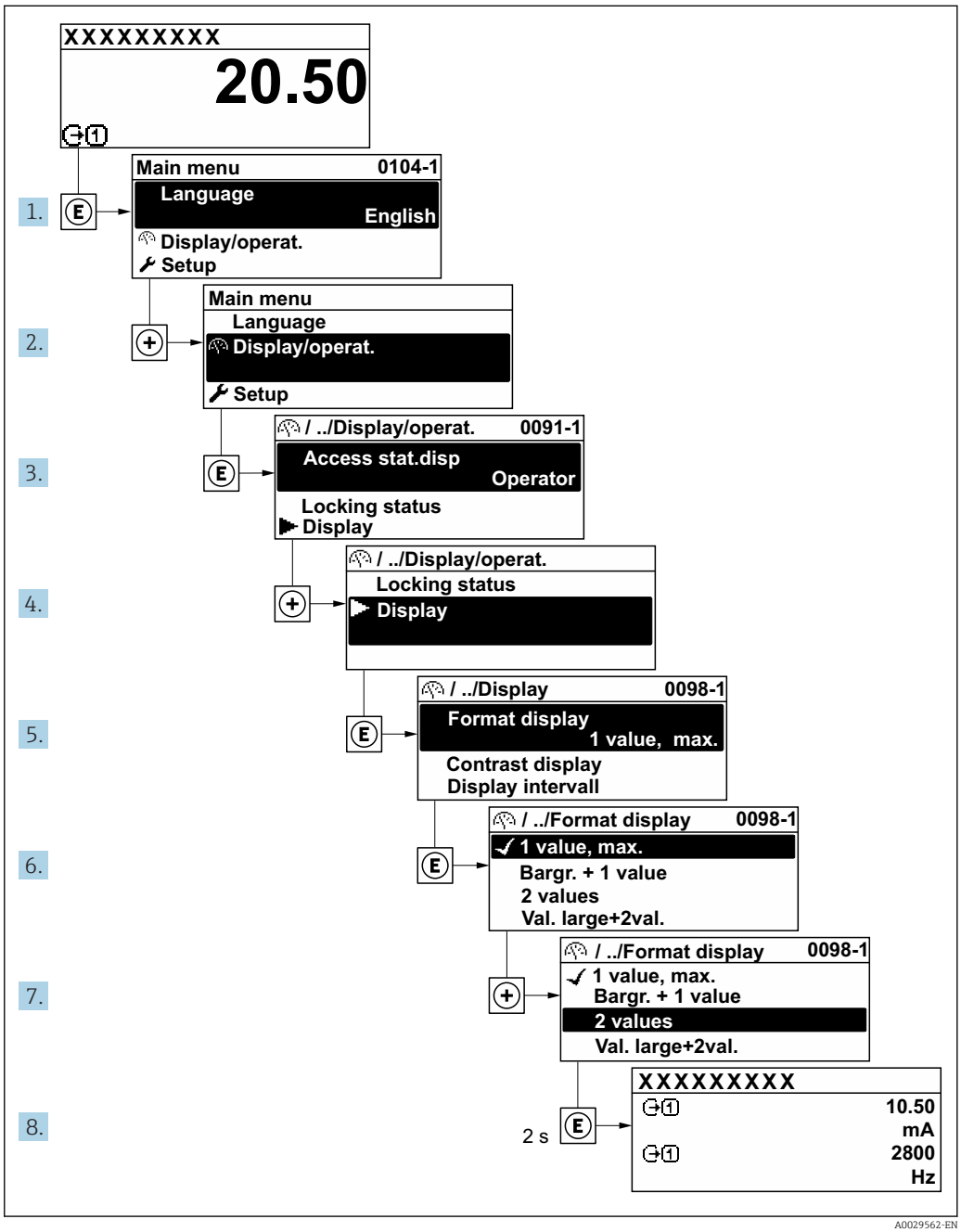
1. Open the context menu.
2. Press + to navigate to the desired menu.
3. Press E to confirm the selection.
   ↳ The selected menu opens.

8.3.6 Navigating and selecting from list

Different operating elements are used to navigate through the operating menu. The navigation path is displayed on the left in the header. Icons are displayed in front of the individual menus. These icons are also shown in the header during navigation.

For an explanation of the navigation view with symbols and operating elements
→ 65

Example: Setting the number of displayed measured values to "2 values"

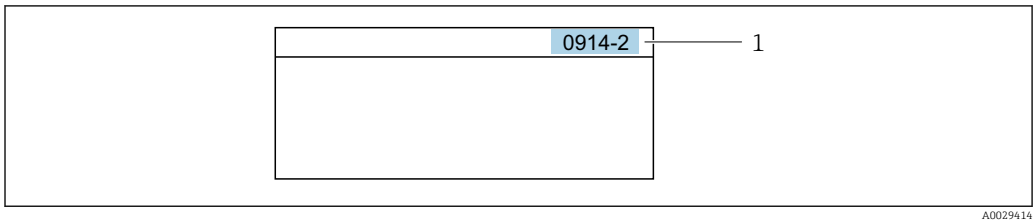


8.3.7 Calling the parameter directly

A parameter number is assigned to every parameter to be able to access a parameter directly via the onsite display. Entering this access code in the **Direct access** parameter calls up the desired parameter directly.

Navigation path
Expert → Direct access

The direct access code consists of a 4-digit number and the channel number, which identifies the channel of a process variable: e.g. 0914-1. In the navigation view, this appears on the right-hand side in the header of the selected parameter.



1 Direct access code

Note the following when entering the direct access code:
- The leading zeros in the direct access code do not have to be entered.
  Example: Input of **"914"** instead of **"0914"**
- If no channel number is entered, channel 1 is jumped to automatically.
  Example: Enter **0914** → **Assign process variable** parameter
- If a different channel is jumped to: Enter the direct access code with the corresponding channel number.
  Example: Enter **0914-2** → **Assign process variable** parameter

For the direct access codes of the individual parameters, see the "Description of Device Parameters" document for the device

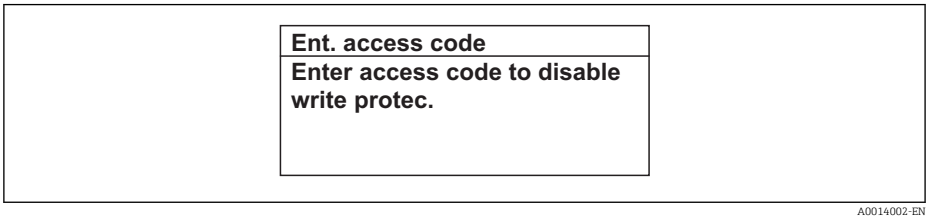
8.3.8 Calling up help text

Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Calling up and closing the help text

The user is in the navigation view and the selection bar is on a parameter.

1. Press E for 2 s.
   ↳ The help text for the selected parameter opens.



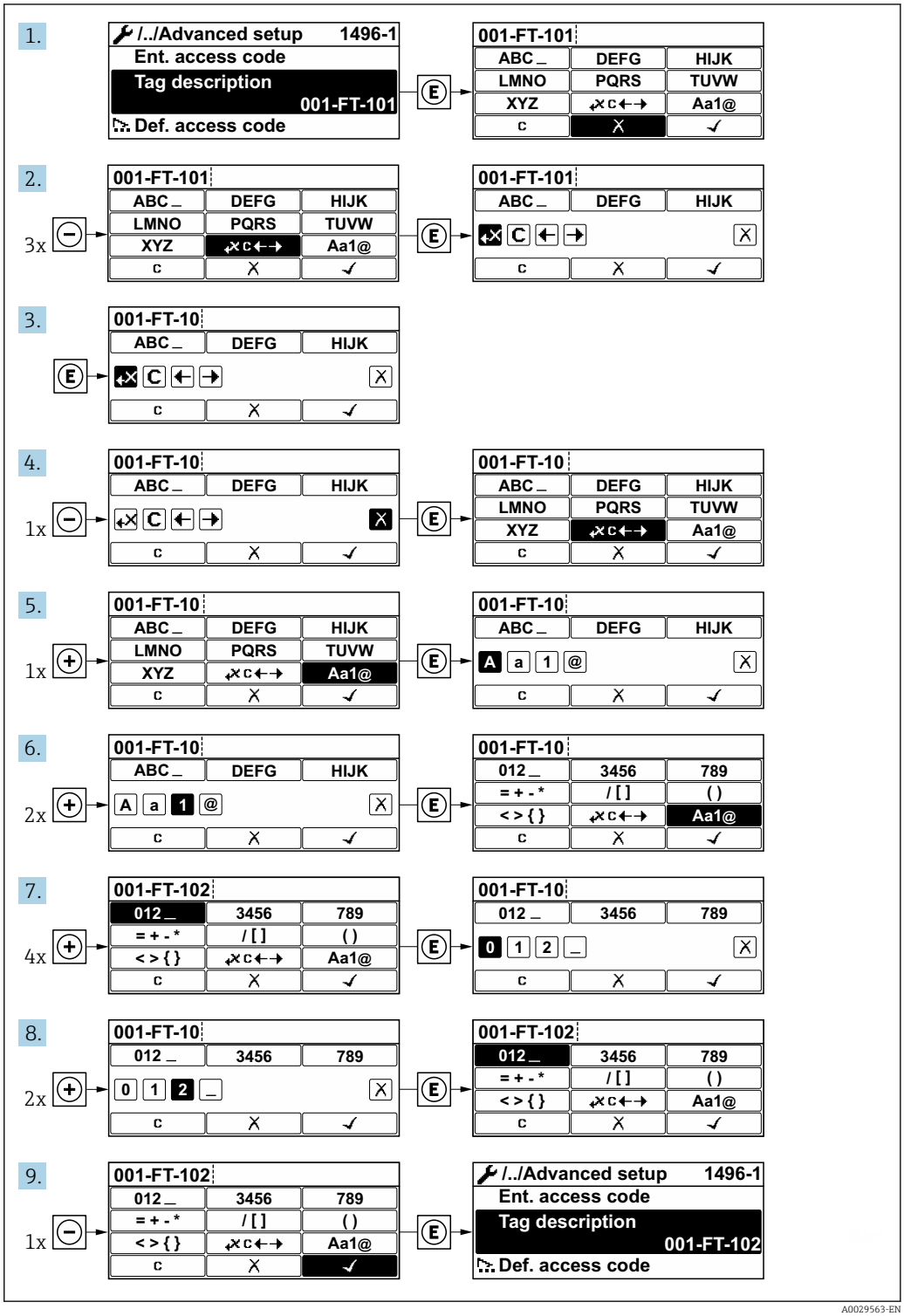
33 Example: Help text for parameter "Enter access code"

2. Press − + + simultaneously.
   ↳ The help text is closed.

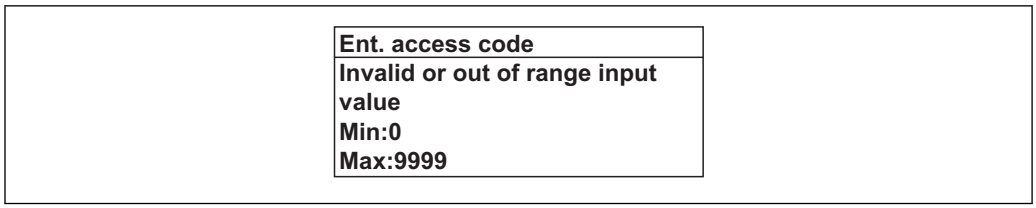
8.3.9 Changing the parameters

For a description of the editing display - consisting of text editor and numeric editor - with symbols → 67, for a description of the operating elements → 69

Example: Changing the tag name in the "Tag description" parameter from 001-FT-101 to 001-FT-102



A message is displayed if the value entered is outside the permitted value range.



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8.3.10 User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access → 130.

Access authorization to parameters: "Operator" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	–– [1]

1) Despite the defined access code, certain parameters can always be modified and thus are excepted from the write protection, as they do not affect the measurement. Refer to the "Write protection via access code" section

Access authorization to parameters: "Maintenance" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	✔ [1]

1) If an incorrect access code is entered, the user obtains the access rights of the "Operator" user role.

The user role with which the user is currently logged on is indicated by the **Access status** parameter. Navigation path: Operation → Access status

8.3.11 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 130.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter via the respective access option.

1. After you press E, the input prompt for the access code appears.
2. Enter the access code.
   ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

Local operation with touch control

The keypad lock is switched on and off via the context menu.

Switching on the keypad lock

The keypad lock is switched on automatically:
- Each time the device is restarted.
- If the device has not been operated for longer than one minute in the measured value display.

1. The device is in the measured value display.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu, select the **Keylock on** option.
   ↳ The keypad lock is switched on.

If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock

1. The keypad lock is switched on.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu, select the **Keylock off** option.
   ↳ The keypad lock is switched off.

8.4 Access to the operating menu via the Web browser

8.4.1 Function range

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 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 measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

For additional information on the Web server, refer to the Special Documentation for the device → 198

8.4.2 Prerequisites

Computer hardware

Hardware	Interface	
	CDI-RJ45	WLAN
Interface	The computer must have an RJ45 interface.	The operating unit must have a WLAN interface.
Connection	Standard Ethernet cable with RJ45 connector.	Connection via Wireless LAN.
Screen	Recommended size: ≥12" (depends on the screen resolution)	

Computer software

Software	Interface	
	CDI-RJ45	WLAN
Recommended operating systems	▪ Microsoft Windows 7 or higher. ▪ Mobile operating systems: – iOS – Android Microsoft Windows XP is supported.	
Web browsers supported	▪ Microsoft Internet Explorer 8 or higher ▪ Microsoft Edge ▪ Mozilla Firefox ▪ Google Chrome ▪ Safari	

Computer settings

Settings	Interface	
	CDI-RJ45	WLAN
User rights	Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (for adjusting the IP address, subnet mask etc.).	
Proxy server settings of the Web browser	The Web browser setting *Use a Proxy Server for Your LAN* must be **deselected** .	
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser. When installing a new firmware version: To enable correct data display, clear the temporary memory (cache) of the Web browser under **Internet options**.	
Network connections	Only the active network connections to the measuring device should be used.	
	Switch off all other network connections such as WLAN.	Switch off all other network connections.

In the event of connection problems: → 145

Measuring device

Device	Interface	
	CDI-RJ45	WLAN
Measuring device	The measuring device has an RJ45 interface.	The measuring device has a WLAN antenna: ▪ Transmitter with integrated WLAN antenna ▪ Transmitter with external WLAN antenna
Web server	Web server must be enabled; factory setting: ON For information on enabling the Web server → 80	Web server and WLAN must be enabled; factory setting: ON For information on enabling the Web server → 80

8.4.3 Establishing a connection

Via service interface (CDI-RJ45)

Configuring the Internet protocol of the computer

The following information refers to the default Ethernet settings of the device.

IP address of the device: 192.168.1.212 (factory setting)

1. Switch on the measuring device.
2. Connect to the computer using a cable → 82.
3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

IP address	192.168.1.XXX; for XXX all numerical sequences except: 0, 212 and 255 → e.g. 192.168.1.213
Subnet mask	255.255.255.0
Default gateway	192.168.1.212 or leave cells empty

Via WLAN interface

Configuring the Internet protocol of the operating unit

NOTICE

If the WLAN connection is lost during the configuration, settings made may be lost.

- Make sure that the WLAN connection is not disconnected while configuring the device.

NOTICE

In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same operating unit. This could cause a network conflict.

- Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
- If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparation

- Enable WLAN reception on the operating unit.

Establishing a connection

1. Select the measuring device using the SSID (e.g. EH_Promag_500_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

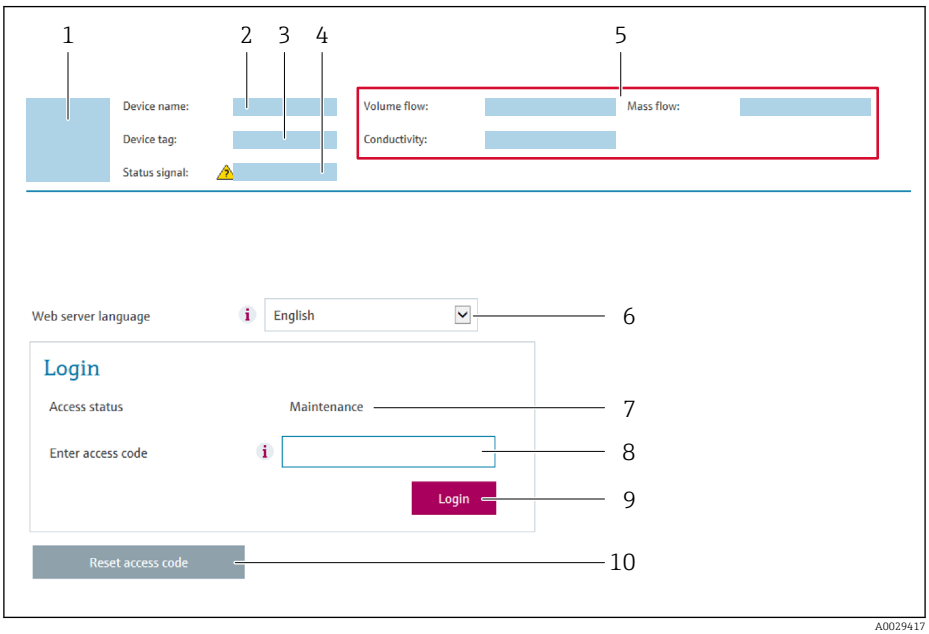
The serial number can be found on the nameplate.

Disconnecting

- Once the configuration is completed, disconnect the WLAN connection between the operating unit and the measuring device.

Starting the Web browser

1. Start the Web browser on the computer.
2. Enter the IP address of the Web server in the address line of the Web browser: 192.168.1.212
   ↳ The login page appears.



1 *Picture of device*
2 *Device name*
3 *Device tag (→ 94)*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 126)*

If a login page does not appear, or if the page is incomplete → 145

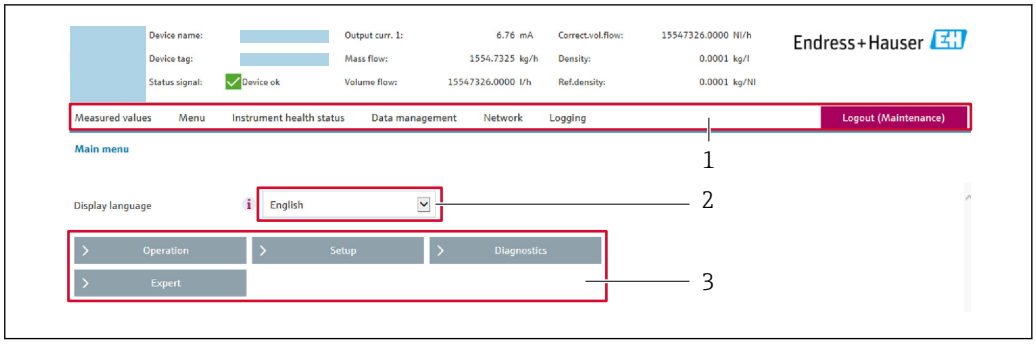
8.4.4 Logging on

1. Select the preferred operating language for the Web browser.
2. Enter the user-specific access code.
3. Press **OK** to confirm your entry.

Access code	0000 (factory setting); can be changed by customer

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

8.4.5 User interface



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1 *Function row*
2 *Operating language*
3 *Navigation area*

Header

The following information appears in the header:
- Device tag
- Device status with status signal → 153
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring device
Menu	▪ Access to the operating menu from the measuring device ▪ The structure of the operating menu is the same as for the local display For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device
Device status	Displays the diagnostic messages currently pending, listed in order of priority
Data management	▪ Data exchange between PC and measuring device: – Load the configuration from the measuring device (XML format, save configuration) – Save the configuration to the measuring device (XML format, restore configuration) – Export the event list (.csv file) – Export parameter settings (.csv file, create documentation of the measuring point configuration) – Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package) ▪ If using fieldbuses, upload device drivers for system integration from the measuring device: HART: DD file ▪ Flashing a firmware version
Network configuration	Configuration and checking of all the parameters required for establishing the connection to the measuring device: ▪ Network settings (e.g. IP address, MAC address) ▪ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:
- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

8.4.6 Disabling the Web server

The Web server of the measuring device can be switched on and off as required using the **Web server functionality** parameter.

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Web server functionality	Switch the Web server on and off.	▪ Off ▪ On	On

Function scope of the "Web server functionality" parameter

Option	Description
Off	▪ The web server is completely disabled. ▪ Port 80 is locked.
On	▪ The complete functionality of the web server is available. ▪ JavaScript is used. ▪ The password is transferred in an encrypted state. ▪ Any change to the password is also transferred in an encrypted state.

Enabling the Web server

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:
- Via local display
- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

8.4.7 Logging out

Before logging out, perform a data backup via the **Data management** function (upload configuration from device) if necessary.

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. Reset the modified properties of the Internet protocol (TCP/IP) if they are no longer needed → 77.

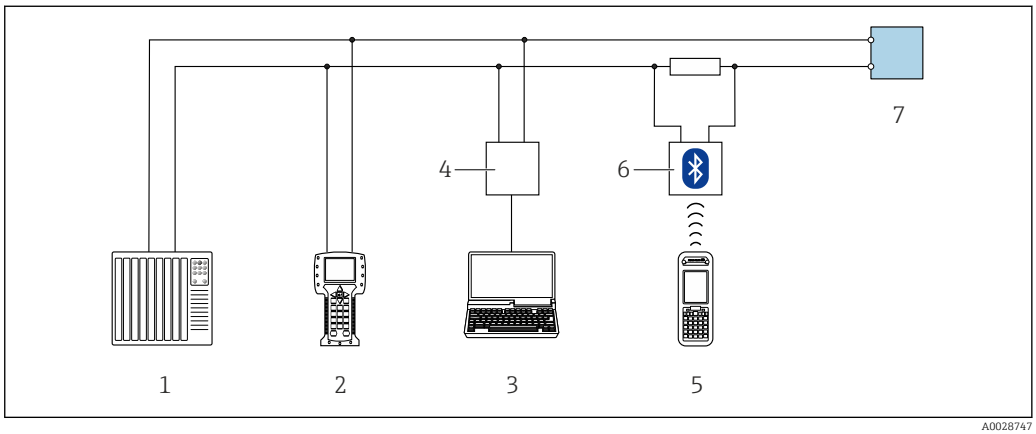
8.5 Access to the operating menu via the operating tool

The structure of the operating menu in the operating tools is the same as for operation via the local display.

8.5.1 Connecting the operating tool

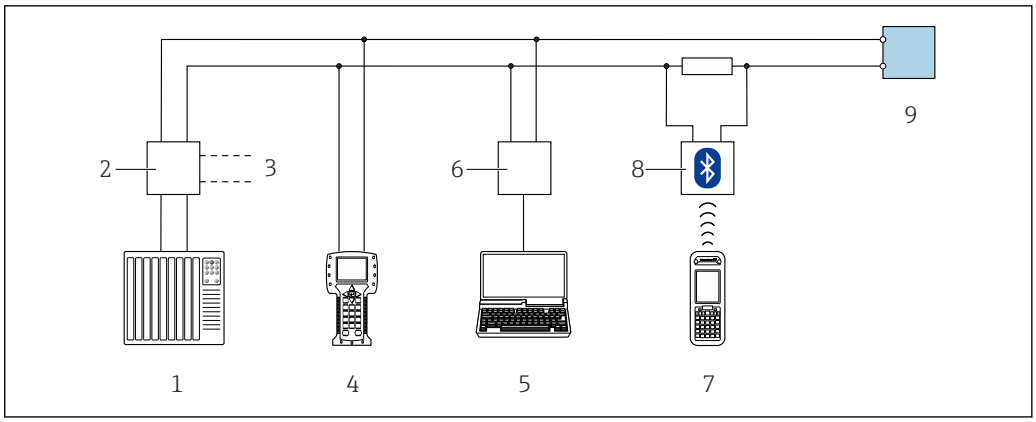
Via HART protocol

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



34 *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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*



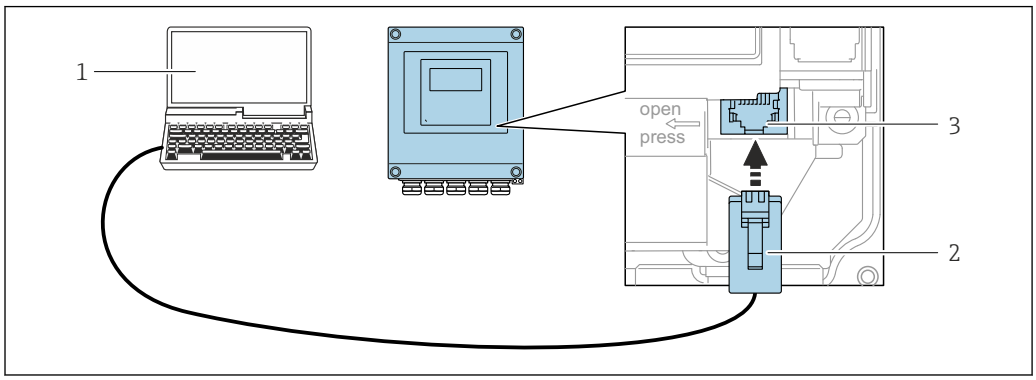
35 *Options for remote operation via HART protocol (passive)*

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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

Service interface

Via service interface (CDI-RJ45)

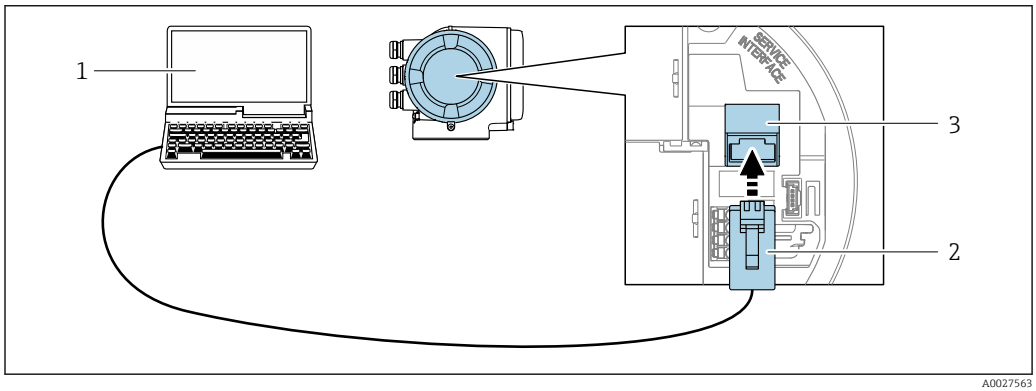
Proline 500 – digital transmitter



36 *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"*
2 *Standard Ethernet connecting cable with RJ45 connector*
3 *Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server*

Proline 500 transmitter

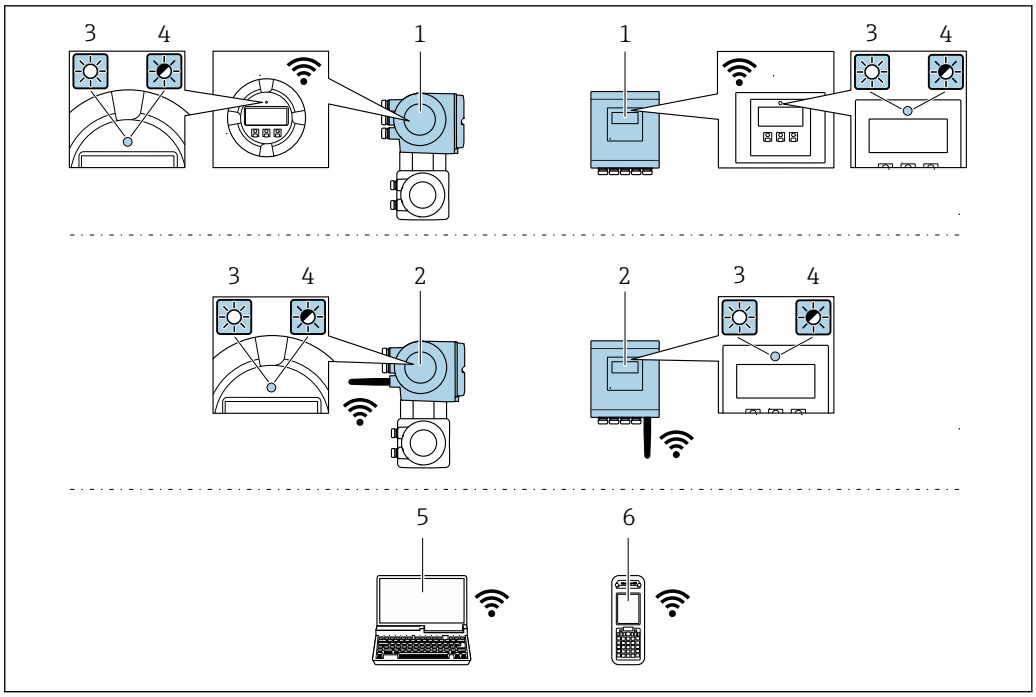


37 *Connection via service interface (CDI-RJ45)*

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"*
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, backlit, graphic display; touch control + WLAN"



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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)*

Wireless LAN	IEEE 802.11 b/g (2.4 GHz) WLAN
Encryption	WPA2 PSK/TKIP AES-128
Configurable channels	1 to 11
Function	Access point with DHCP
Range with integrated antenna	Max. 10 m (32 ft)
Range with external antenna	Max. 50 m (164 ft)

Configuring the Internet protocol of the operating unit

NOTICE

If the WLAN connection is lost during the configuration, settings made may be lost.

- ▶ Make sure that the WLAN connection is not disconnected while configuring the device.

NOTICE

In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same operating unit. This could cause a network conflict.

- ▶ Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
- ▶ If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparation

- ▶ Enable WLAN reception on the operating unit.

Establishing a connection

1. Select the measuring device using the SSID (e.g. EH_Promag_500_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

Disconnecting

- Once the configuration is completed, disconnect the WLAN connection between the operating unit and the measuring device.

8.5.2 Field Xpert SFX350, SFX370

Function scope

Field Xpert SFX350 and Field Xpert SFX370 are mobile computers for commissioning and maintenance. They enable efficient device configuration and diagnostics for HART and FOUNDATION fieldbus devices in the **non-Ex area** (SFX350, SFX370) and the **Ex area** (SFX370).

For details, see Operating Instructions BA01202S

Source for device description files

See data → 87

8.5.3 FieldCare

Function scope

FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a 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.

Access is via:
- HART protocol
- CDI-RJ45 service interface → 82
- WLAN interface→ 82

Typical functions:
- Configuring parameters of transmitters
- Loading and saving device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook

For additional information about FieldCare, see Operating Instructions BA00027S and BA00059S

Source for device description files

See information → 87

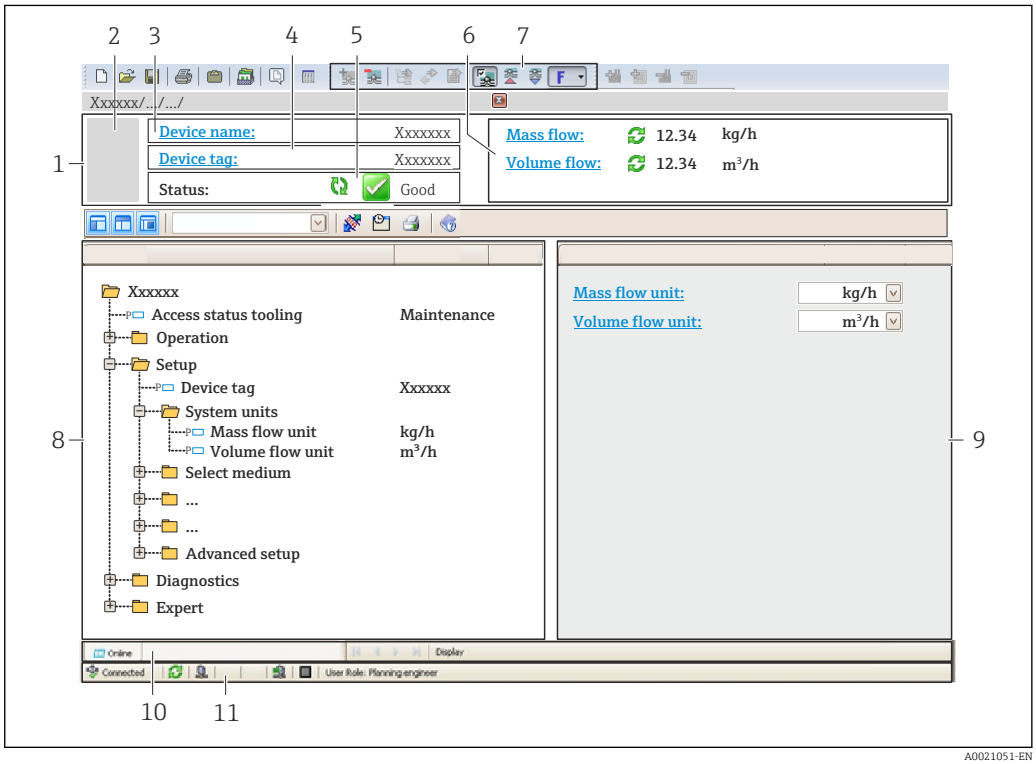
Establishing a connection

1. Start FieldCare and launch the project.

2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.
5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.
6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.
7. Establish the online connection to the device.

For additional information, see Operating Instructions BA00027S and BA00059S

User interface



1 *Header*
2 *Picture of device*
3 *Device name*
4 *Tag name*
5 *Status area with status signal→ 153*
6 *Display area for current measured values*
7 *Edit toolbar with additional functions such as save/restore, event list and create documentation*
8 *Navigation area with operating menu structure*
9 *Working area*
10 *Range of action*
11 *Status area*

8.5.4 DeviceCare

Function scope

Tool to connect and configure Endress+Hauser field devices.

The fastest way to configure Endress+Hauser field devices is with the dedicated "DeviceCare" tool. Together with the device type managers (DTMs) it presents a convenient, comprehensive solution.

For details, see Innovation Brochure IN01047S

Source for device description files

See information → 87

8.5.5 AMS Device Manager

Function scope

Program from Emerson Process Management for operating and configuring measuring devices via HART protocol.

Source for device description files

See data → 87

8.5.6 SIMATIC PDM

Function scope

SIMATIC PDM is a standardized, manufacturer-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via HART protocol.

Source for device description files

See data → 87

8.5.7 Field Communicator 475

Function scope

Industrial handheld terminal from Emerson Process Management for remote configuration and measured value display via HART protocol.

Source for device description files

See data → 87

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.00.zz	▪ On the title page of the Operating instructions ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	08.2016	---
Manufacturer ID	0x11	Manufacturer ID Diagnostics → Device information → Manufacturer ID
Device type ID	0x3C	Device type Diagnostics → Device information → Device type
HART protocol revision	7	---
Device revision	1	▪ On the transmitter nameplate ▪ Device revision Diagnostics → Device information → Device revision

For an overview of the different firmware versions for the device → 166

9.1.2 Operating tools

The suitable device description file for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

Operating tool via HART protocol	Sources for obtaining device descriptions
FieldCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
▪ Field Xpert SFX350 ▪ Field Xpert SFX370	Use update function of handheld terminal
AMS Device Manager (Emerson Process Management)	www.endress.com → Download Area
SIMATIC PDM (Siemens)	www.endress.com → Download Area
Field Communicator 475 (Emerson Process Management)	Use update function of handheld terminal

9.2 Measured variables via HART protocol

The following measured variables (HART device variables) are assigned to the dynamic variables at the factory:

Dynamic variables	Measured variables (HART device variables)
Primary dynamic variable (PV)	Volume flow
Secondary dynamic variable (SV)	Totalizer 1
Tertiary dynamic variable (TV)	Totalizer 2
Quaternary dynamic variable (QV)	Totalizer 3

The assignment of the measured variables to the dynamic variables can be modified and assigned as desired via local operation and the operating tool using the following parameters:

- Expert → Communication → HART output → Output → Assign PV
- Expert → Communication → HART output → Output → Assign SV
- Expert → Communication → HART output → Output → Assign TV
- Expert → Communication → HART output → Output → Assign QV

The following measured variables can be assigned to the dynamic variables:

Measured variables for PV (primary dynamic variable)
- Off
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [1)]
- Electronic temperature

Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [2)]
- Electronic temperature
- Totalizer 1
- Totalizer 2
- Totalizer 3

The range of options increases if the measuring device has one or more application packages.

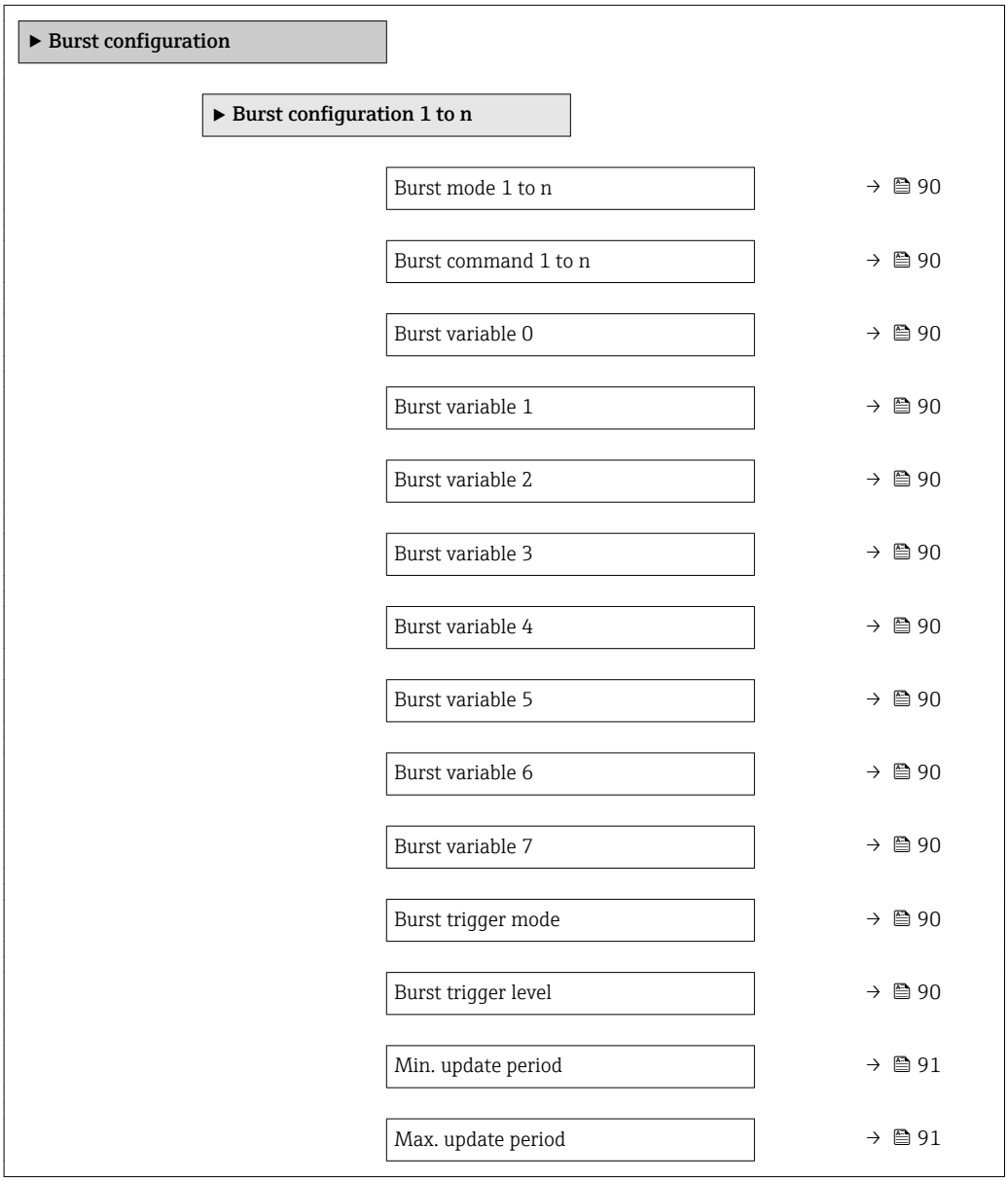
Device variables
The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:
- 0 = volume flow
- 1 = mass flow
- 2 = corrected volume flow
- 3 = flow velocity
- 4 = conductivity
- 7 = electronic temperature
- 8 = totalizer 1
- 9 = totalizer 2
- 10 = totalizer 3

1) Visibility depends on order options or device settings
2) Visibility depends on order options or device settings

9.3 Other settings

9.3.1 Burst mode functionality in accordance with HART 7 Specification

Navigation
"Expert" menu → Communication → HART output → Burst configuration → Burst configuration 1 to n



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Burst mode 1 to n	Activate the HART burst mode for burst message X.	▪ Off ▪ On	Off
Burst command 1 to n	Select the HART command that is sent to the HART master.	▪ Command 1 ▪ Command 2 ▪ Command 3 ▪ Command 9 ▪ Command 33 ▪ Command 48	Command 2
Burst variable 0	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Density ▪ HART input ▪ Percent of range ▪ Measured current ▪ Primary variable (PV) ▪ Secondary variable (SV) ▪ Tertiary variable (TV) ▪ Quaternary variable (QV) ▪ Not used	Volume flow
Burst variable 1	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 2	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 3	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 4	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 5	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 6	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 7	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst trigger mode	Select the event that triggers burst message X.	▪ Continuous ▪ Window ▪ Rising ▪ Falling ▪ On change	Continuous
Burst trigger level	Enter the burst trigger value. Together with the option selected in the **Burst trigger mode** parameter the burst trigger value determines the time of burst message X.	Positive floating-point number	–

Parameter	Description	Selection / User entry	Factory setting
Min. update period	Enter the minimum time span between two burst responses of one burst message.	Positive integer	1 000 ms
Max. update period	Enter the maximum time span between two burst responses of one burst message.	Positive integer	2 000 ms

* Visibility depends on order options or device settings

10 Commissioning

10.1 Function check

Before commissioning the measuring device:

▶ Make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist → 36
- "Post-connection check" checklist → 60

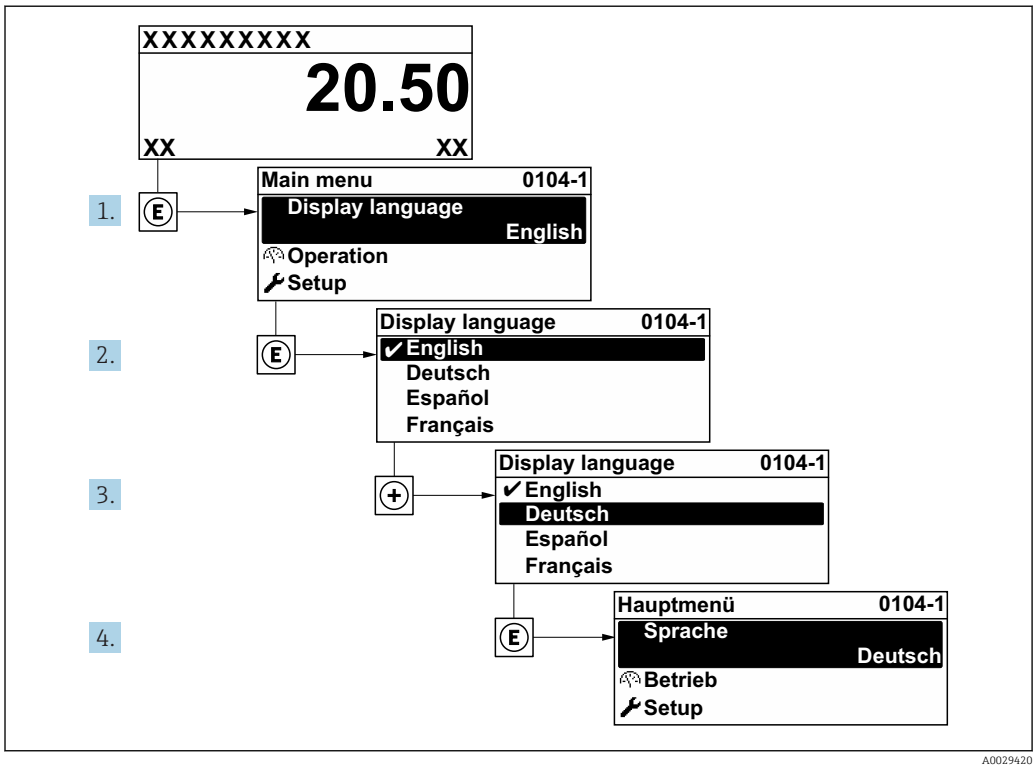
10.2 Switching on the measuring device

▶ After a successful function check, switch on the measuring device.
  ↳ After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 144.

10.3 Setting the operating language

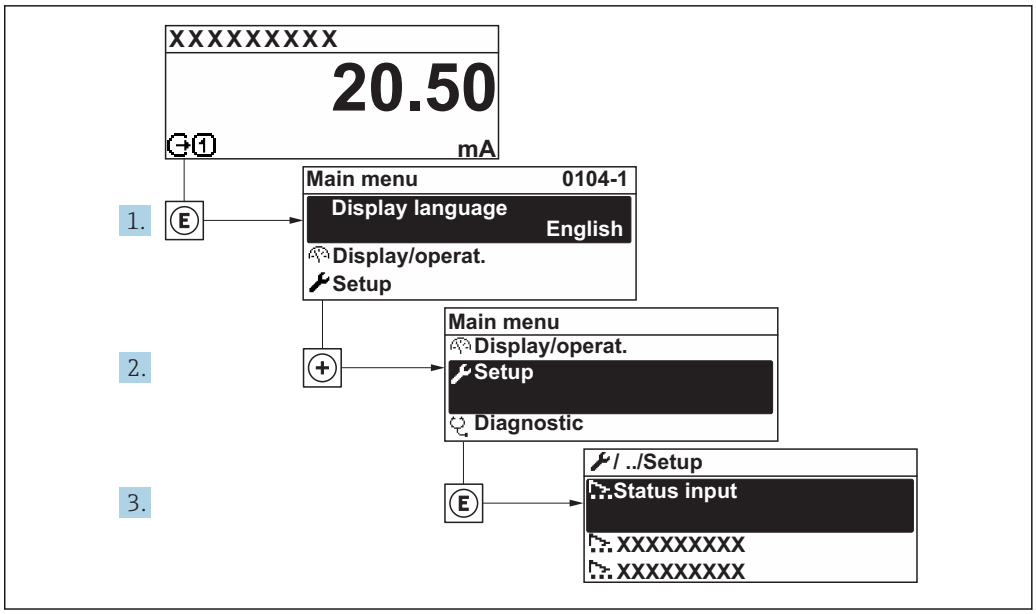
Factory setting: English or ordered local language



38 *Taking the example of the local display*

10.4 Configuring the measuring device

- The **Setup** menuwith its guided wizards contains all the parameters needed for standard operation.
- Navigation to the **Setup** menu



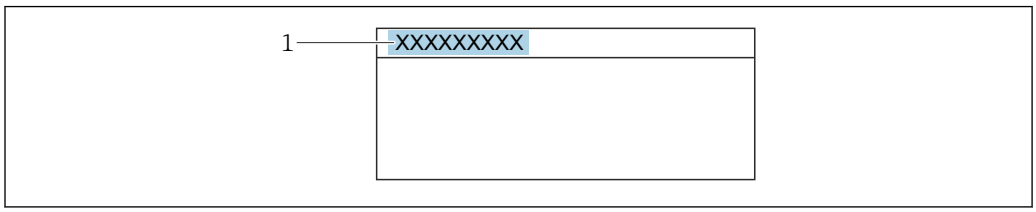
39 *Taking the example of the local display*

Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Setup

10.4.1 Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a unique designation using the **Device tag** parameter and thus change the factory setting.



40 *Header of the operational display with tag name*

1 Tag name

Enter the tag name in the "FieldCare" operating tool → 85

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

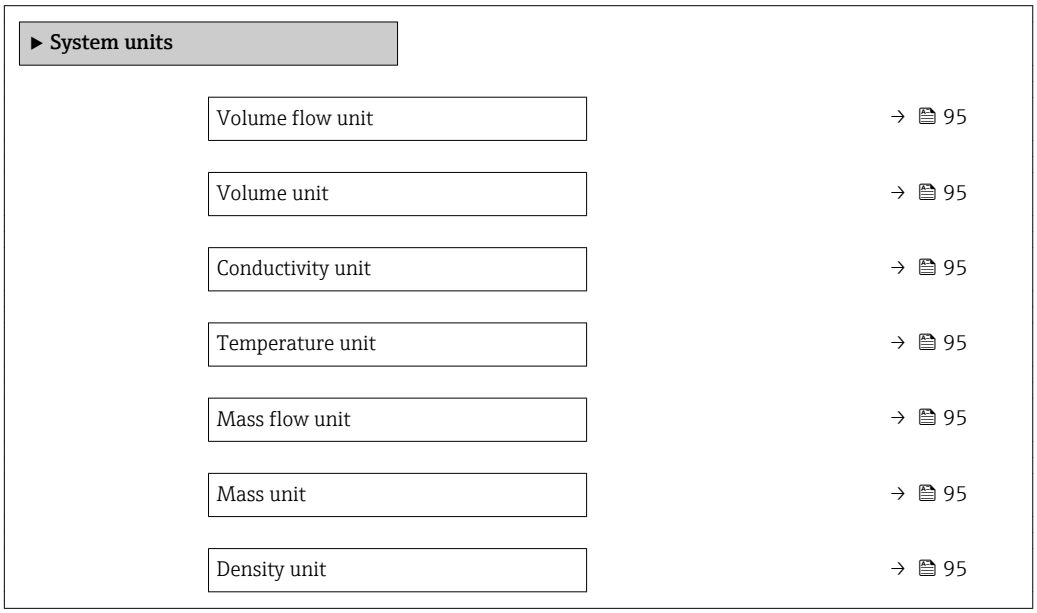
Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag

10.4.2 Setting the system units

In the **System units** submenu the units of all the measured values can be set.

Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Navigation
"Setup" menu → System units



Corrected volume flow unit	→ 95
Corrected volume unit	→ 95

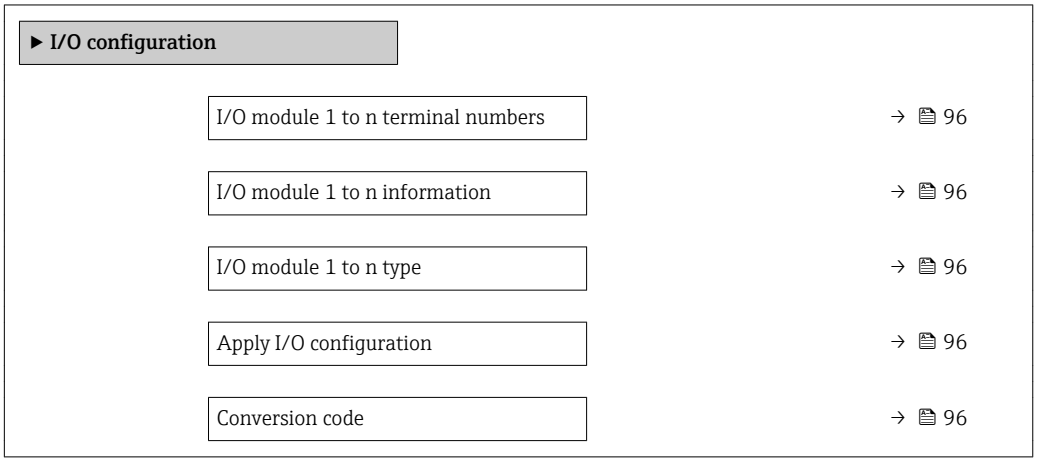
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Volume flow unit	–	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Volume unit	–	Select volume unit.	Unit choose list	Country-specific: ▪ m^3 ▪ gal (us)
Conductivity unit	The **On** option is selected in the **Conductivity measurement** parameter parameter.	Select conductivity unit. *Effect* The selected unit applies for: ▪ Current output ▪ Frequency output ▪ Switch output ▪ Simulation process variable	Unit choose list	µS/cm
Temperature unit	–	Select temperature unit. *Result* The selected unit applies for: ▪ **Temperature** parameter ▪ **Maximum value** parameter ▪ **Minimum value** parameter ▪ **External temperature** parameter ▪ **Maximum value** parameter ▪ **Minimum value** parameter	Unit choose list	Country-specific: ▪ °C ▪ °F
Mass flow unit	–	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min
Mass unit	–	Select mass unit.	Unit choose list	Country-specific: ▪ kg ▪ lb
Density unit	–	Select density unit. *Result* The selected unit applies for: ▪ Output ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/l ▪ lb/ft^3
Corrected volume flow unit	–	Select corrected volume flow unit. *Result* The selected unit applies for: **Corrected volume flow** parameter (→ 135)	Unit choose list	Country-specific: ▪ Nl/h ▪ Sft^3/h
Corrected volume unit	–	Select corrected volume unit.	Unit choose list	Country-specific: ▪ Nm^3 ▪ Sft^3

10.4.3 Displaying the I/O configuration

The **I/O configuration** submenu guides the user systematically through all the parameters in which the configuration of the I/O modules is displayed.

Navigation
"Setup" menu → I/O configuration



Parameter overview with brief description

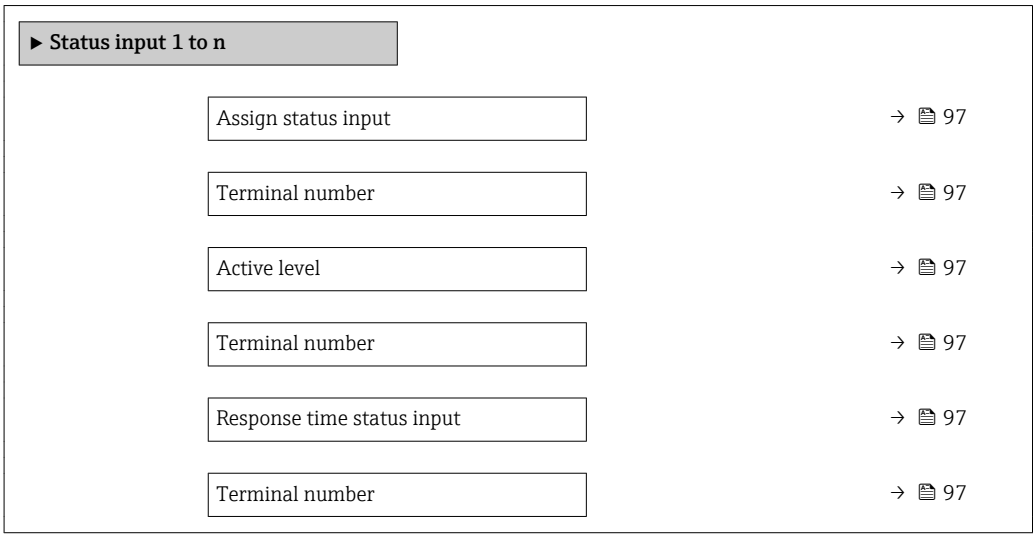
Parameter	Description	User interface / Selection / User entry	Factory setting
I/O module 1 to n terminal numbers	Shows the terminal numbers used by the I/O module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
I/O module 1 to n information	Shows information of the plugged I/O module.	▪ Not plugged ▪ Invalid ▪ Not configurable ▪ Configurable ▪ Fieldbus	–
I/O module 1 to n type	Shows the I/O module type.	▪ Off ▪ Current output * ▪ Current input * ▪ Status input * ▪ Pulse/frequency/switch output *	Off
Apply I/O configuration	Apply parameterization of the freely configurable I/O module.	▪ No ▪ Yes	No
Conversion code	Enter the code in order to change the I/O configuration.	Positive integer	0

* Visibility depends on order options or device settings

10.4.4 Configuring the status input

The **Status input** submenu guides the user systematically through all the parameters that have to be set for configuring the status input.

Navigation
"Setup" menu → Status input



Parameter overview with brief description

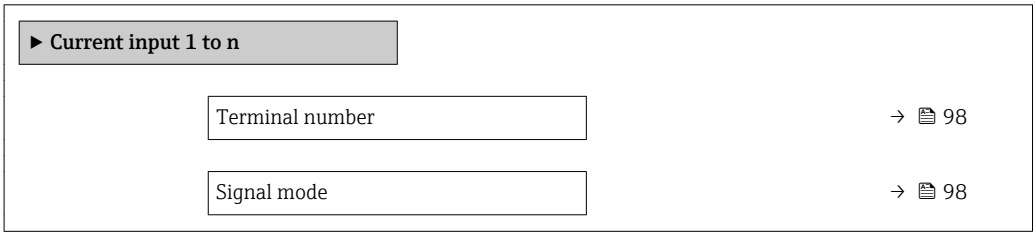
Parameter	Description	User interface / Selection / User entry	Factory setting
Terminal number	Shows the terminal numbers used by the status input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Assign status input	Select function for the status input.	▪ Off ▪ Reset totalizer 1 ▪ Reset totalizer 2 ▪ Reset totalizer 3 ▪ Reset all totalizers ▪ Flow override	Off
Active level	Define input signal level at which the assigned function is triggered.	▪ High ▪ Low	High
Response time status input	Define the minimum amount of time the input signal level must be present before the selected function is triggered.	5 to 200 ms	50 ms

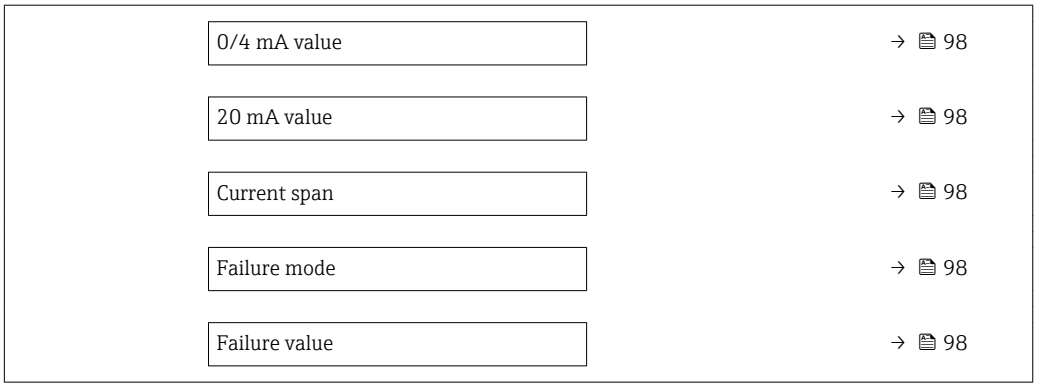
* Visibility depends on order options or device settings

10.4.5 Configuring the current input

The **"Current input" wizard** guides the user systematically through all the parameters that have to be set for configuring the current input.

Navigation
"Setup" menu → Current input





Parameter overview with brief description

Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	The measuring device is **not** approved for use in the hazardous area with type of protection Ex-i.	Select the signal mode for the current input.	▪ Passive ▪ Active	Passive
0/4 mA value	–	Enter 4 mA value.	Signed floating-point number	0
20 mA value	–	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 0...20 mA	Country-specific: ▪ 4...20 mA NAMUR ▪ 4...20 mA US
Failure mode	–	Define input behavior in alarm condition.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

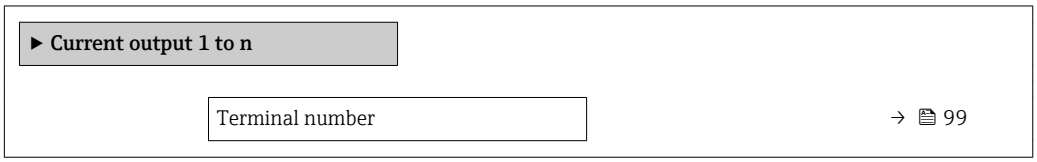
* Visibility depends on order options or device settings

10.4.6 Configuring the current output

The **Current output** wizard guides you systematically through all the parameters that have to be set for configuring the current output.

Navigation

"Setup" menu → Current output



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Assign current output 1 to n	–	Select process variable for current output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Volume flow
Terminal number	–	Shows the terminal numbers used by the current output module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA ▪ Fixed current	Country-specific: ▪ 4...20 mA NAMUR ▪ 4...20 mA US
Signal mode	–	Select the signal mode for the current output.	▪ Passive ▪ Active	Passive
0/4 mA value	One of the following options is selected in the **Current span** parameter (→ 99): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Enter 4 mA value.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
20 mA value	One of the following options is selected in the **Current span** parameter (→ 99): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Fixed current	In the **Current span** parameter (→ 🖹 99), the **Fixed current** option is selected.	Defines the fixed output current.	0 to 22.5 mA	22.5 mA
Failure mode	One of the following options is selected in the **Assign current output** parameter (→ 🖹 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity* ▪ Electronic temperature One of the following options is selected in the **Current span** parameter (→ 🖹 99): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Define output behavior in alarm condition.	▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Defined value	Max.
Failure current	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter current output value in alarm condition.	0 to 22.5 mA	22.5 mA

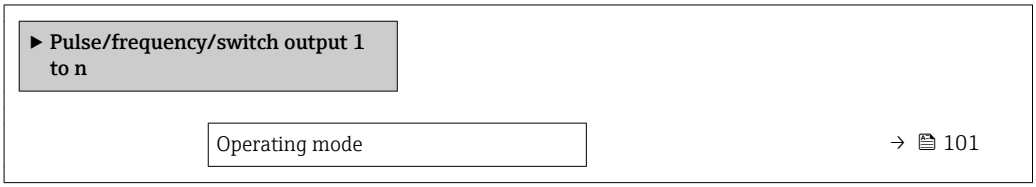
* Visibility depends on order options or device settings

10.4.7 Configuring the pulse/frequency/switch output

The **Pulse/frequency/switch output** wizard guides you systematically through all the parameters that can be set for configuring the selected output type.

Navigation

"Setup" menu → Advanced setup → Pulse/frequency/switch output



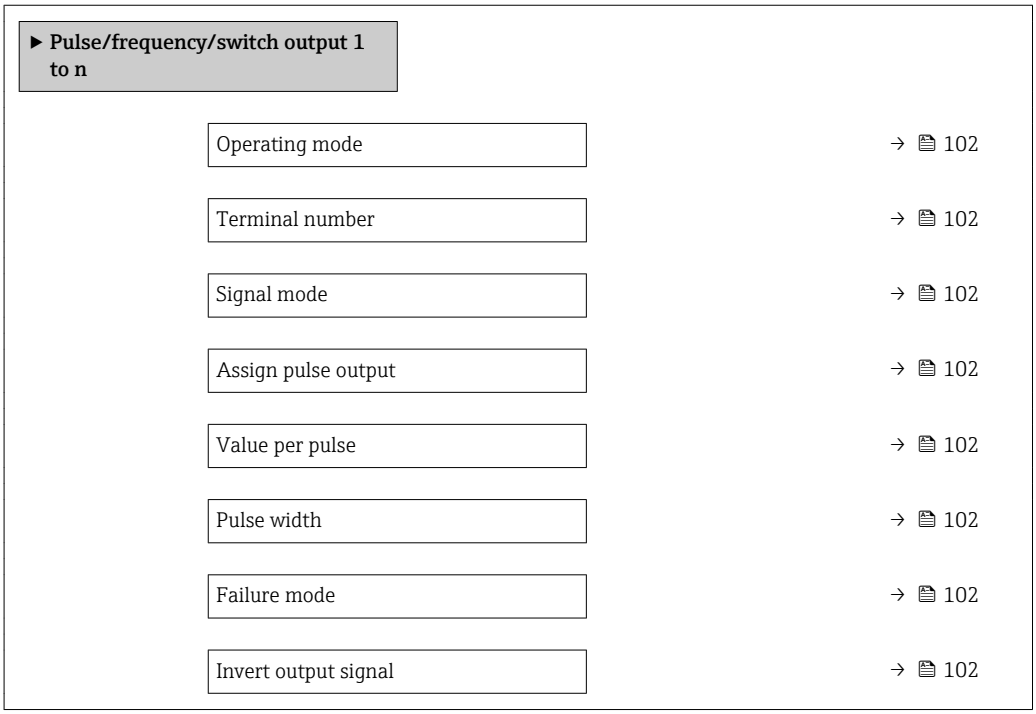
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive
Assign pulse output 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Off
Value per pulse	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 102): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 102): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Define time width of the output pulse.	0.05 to 2 000 ms	100 ms
Failure mode	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 102): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output

▶ **Pulse/frequency/switch output 1 to n**

Operating mode → 🖹 103

Terminal number	→ 103
Signal mode	→ 103
Assign frequency output	→ 103
Minimum frequency value	→ 103
Maximum frequency value	→ 104
Measuring value at minimum frequency	→ 104
Measuring value at maximum frequency	→ 104
Failure mode	→ 104
Failure frequency	→ 104
Invert output signal	→ 104

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive
Assign frequency output	In the **Operating mode** parameter (→ 101), the **Frequency** option is selected.	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Off
Minimum frequency value	One of the following options is selected in the **Assign current output** parameter (→ 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter minimum frequency.	0.0 to 10 000.0 Hz	0.0 Hz

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Maximum frequency value	One of the following options is selected in the **Assign current output** parameter (→ 🖹 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter maximum frequency.	0.0 to 10 000.0 Hz	10 000.0 Hz
Measuring value at minimum frequency	One of the following options is selected in the **Assign current output** parameter (→ 🖹 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter measured value for minmum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum frequency	One of the following options is selected in the **Assign current output** parameter (→ 🖹 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter
Failure mode	One of the following options is selected in the **Assign current output** parameter (→ 🖹 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Define output behavior in alarm condition.	▪ Actual value ▪ Defined value ▪ 0 Hz	0 Hz
Failure frequency	One of the following options is selected in the **Assign current output** parameter (→ 🖹 99): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	0.0 Hz
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

Configuring the switch output

Navigation
"Setup" menu → Pulse/frequency/switch output

▶ **Pulse/frequency/switch output 1 to n**	
Operating mode	→ 105
Terminal number	→ 105
Signal mode	→ 105
Switch output function	→ 106
Assign diagnostic behavior	→ 106
Assign limit	→ 106
Assign flow direction check	→ 106
Assign status	→ 106
Switch-on value	→ 106
Switch-off value	→ 106
Switch-on delay	→ 106
Switch-off delay	→ 107
Failure mode	→ 107
Invert output signal	→ 107

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4) *	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch output function	In the **Operating mode** parameter the **Switch** option is selected.	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	Off
Assign diagnostic behavior	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign limit	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Electronic temperature	Volume flow
Assign flow direction check	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Flow direction check** option is selected in the **Switch output function** parameter.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign status	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Status** option is selected in the **Switch output function** parameter.	Select device status for switch output.	▪ Empty pipe detection ▪ Low flow cut off	Empty pipe detection
Switch-on value	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
Switch-off value	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
Switch-on delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s

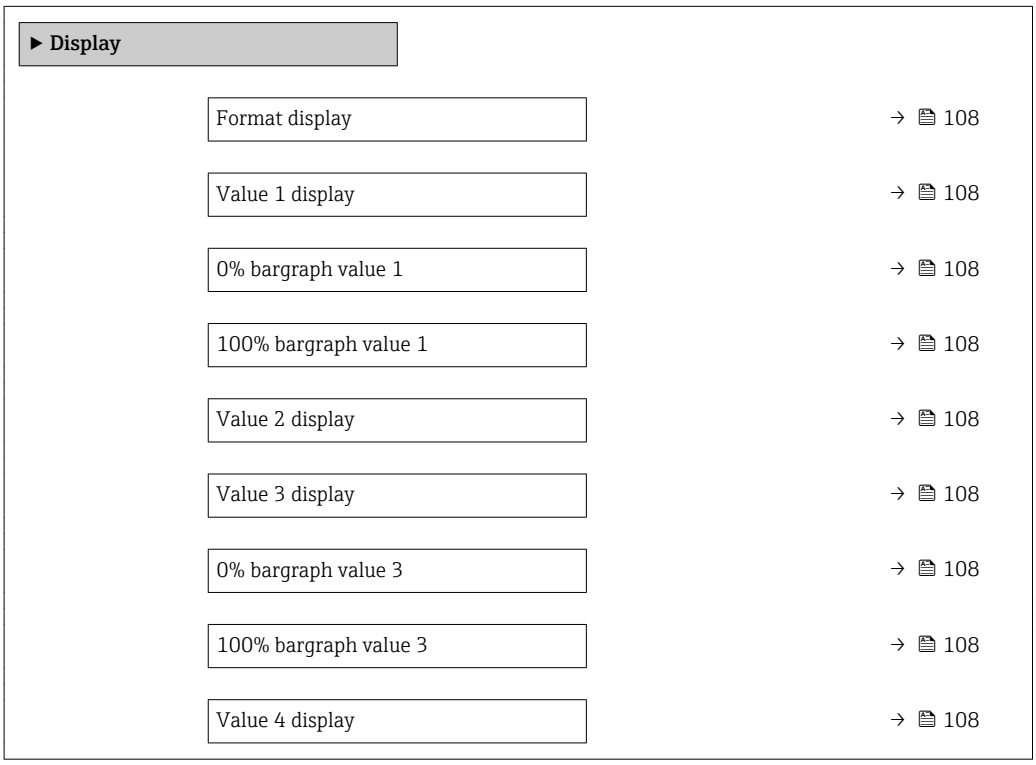
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch-off delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

10.4.8 Configuring the local display

The **Display** wizard guides you systematically through all the parameters that can configured for configuring the local display.

Navigation
"Setup" menu → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	None
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 108)	None
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 108)	None

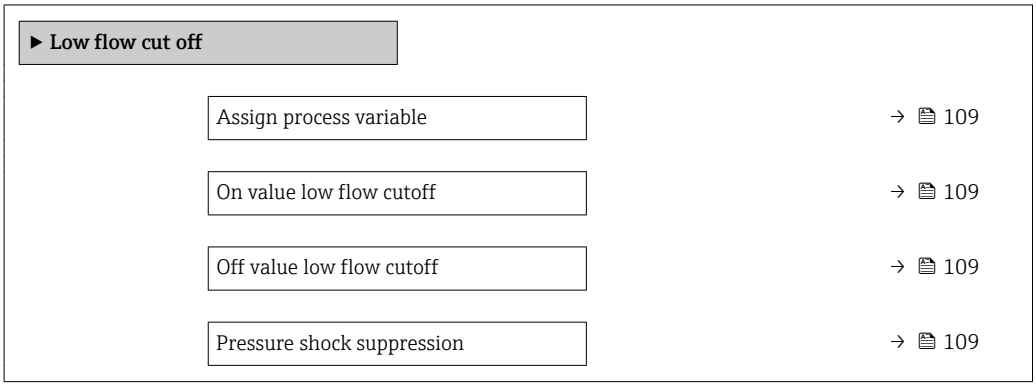
* Visibility depends on order options or device settings

10.4.9 Configuring the low flow cut off

The **Low flow cut off** wizard systematically guides the user through all the parameters that must be set to configure low flow cut off.

Navigation

"Setup" menu → Low flow cut off



Parameter overview with brief description

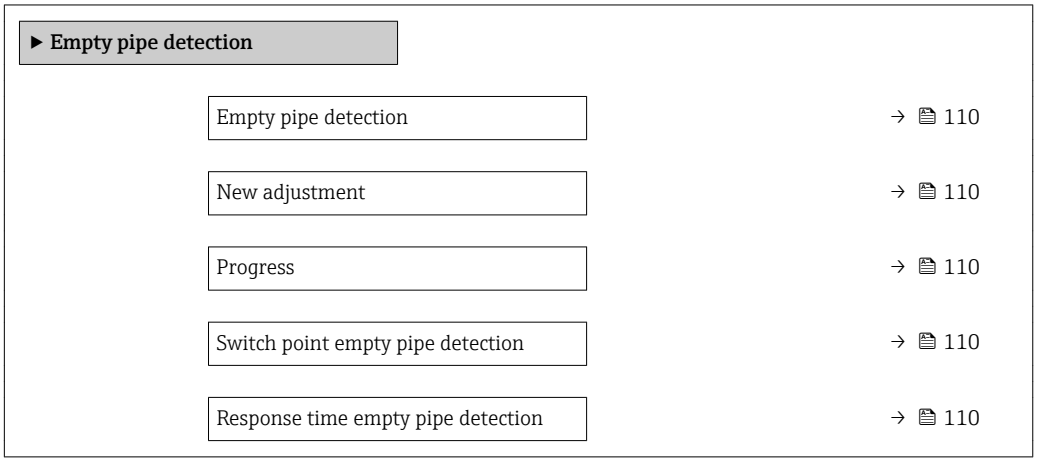
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
On value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 109): ▪ Volume flow ▪ Mass flow	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 109): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	One of the following options is selected in the **Assign process variable** parameter (→ 109): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

10.4.10 Configuring empty pipe detection

The **Empty pipe detection** submenu contains parameters that must be configured for the configuration of empty pipe detection.

Navigation

"Setup" menu → Empty pipe detection



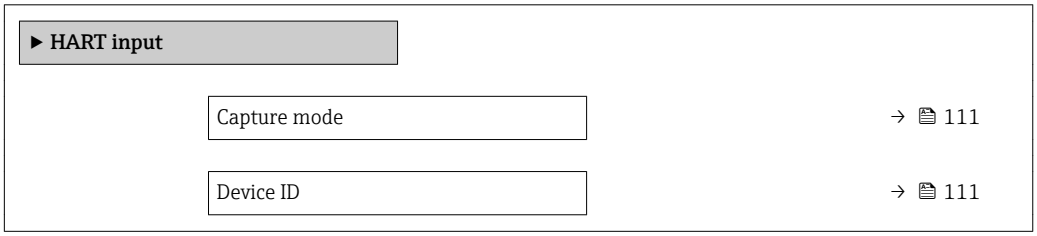
Parameter overview with brief description

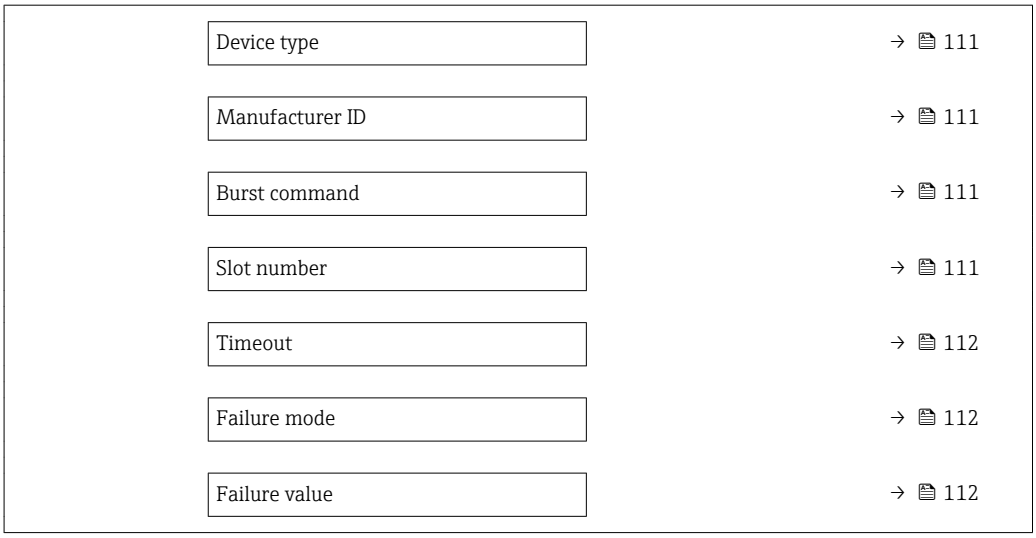
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Empty pipe detection	–	Switch empty pipe detection on and off.	▪ Off ▪ On	Off
New adjustment	The **On** option is selected in the **Empty pipe detection** parameter.	Select type of adjustment.	▪ Cancel ▪ Empty pipe adjust ▪ Full pipe adjust	Cancel
Progress	The **On** option is selected in the **Empty pipe detection** parameter.	Shows the progress.	▪ Ok ▪ Busy ▪ Not ok	–
Switch point empty pipe detection	The **On** option is selected in the **Empty pipe detection** parameter.	Enter hysteresis in %, below this value the measuring tube will detected as empty.	0 to 100 %	10 %
Response time empty pipe detection	In the **Empty pipe detection** parameter (→ 110), the **On** option is selected.	Enter the time before diagnostic message S862 "Pipe empty" is displayed for empty pipe detection.	0 to 100 s	1 s

10.4.11 Configuring the HART input

Navigation

"Setup" menu → HART input





"Configuration" submenu

Navigation
"Expert" menu → Communication → HART input → Configuration

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Capture mode	–	Select capture mode via burst or master communication.	▪ Off ▪ Burst network ▪ Master network	Off
Device ID	The **Master network** option is selected in the **Capture mode** parameter.	Enter device ID of external device.	6-digit value: ▪ Via local operation: enter as hexadecimal or decimal number ▪ Via operating tool: enter as decimal number	0
Device type	In the **Capture mode** parameter, the **Master network** option is selected.	Enter device type of external device.	2-digit hexadecimal number	0x00
Manufacturer ID	The **Master network** option is selected in the **Capture mode** parameter.	Enter manufacture ID of external device.	2-digit value: ▪ Via local operation: enter as hexadecimal or decimal number ▪ Via operating tool: enter as decimal number	0
Burst command	The **Burst network** option or the **Master network** option are selected in the **Capture mode** parameter.	Select command to read in external process variable.	▪ Command 1 ▪ Command 3 ▪ Command 9 ▪ Command 33	Command 1
Slot number	The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter.	Define position of external process variable in burst command.	1 to 8	1

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Timeout	The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter.	Enter deadline for process variable of external device. If the waiting time is exceeded, the diagnostic message **F410 Data transfer** is displayed.	1 to 120 s	5 s
Failure mode	In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected.	Define behavior if external process variable is missed.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	The following conditions are met: ▪ In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected. ▪ In the **Failure mode** parameter, the **Defined value** option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

"Input" submenu

Navigation
"Expert" menu → Communication → HART input → Input

Parameter overview with brief description

Parameter	Description	User interface
Value		Signed floating-point number
Status		▪ Manual/Fixed ▪ Good ▪ Poor accuracy ▪ Bad

10.4.12 Configuring the relay output

The **Relay output** wizard guides the user systematically through all the parameters that have to be set for configuring the relay output.

Navigation
"Setup" menu → Relay output 1 to n

▶ **RelaisOutput 1 to n**

Switch output function	→ 113
Assign flow direction check	→ 113
Assign limit	→ 113
Assign diagnostic behavior	→ 113
Assign status	→ 113

Switch-off value	→ 113
Switch-on value	→ 113
Failure mode	→ 114

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Relay output function	–	Select the function for the relay output.	▪ Closed ▪ Open ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Digital Output	Closed
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3) ▪ 20-21 (I/O 4)	–
Assign flow direction check	In the **Relay output function** parameter, the **Flow direction check** option is selected.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign limit	In the **Relay output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Electronic temperature	Volume flow
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select device status for switch output.	▪ Partially filled pipe detection ▪ Low flow cut off	Partially filled pipe detection
Switch-off value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal(us)/min
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Switch-on value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal(us)/min

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch-on delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open

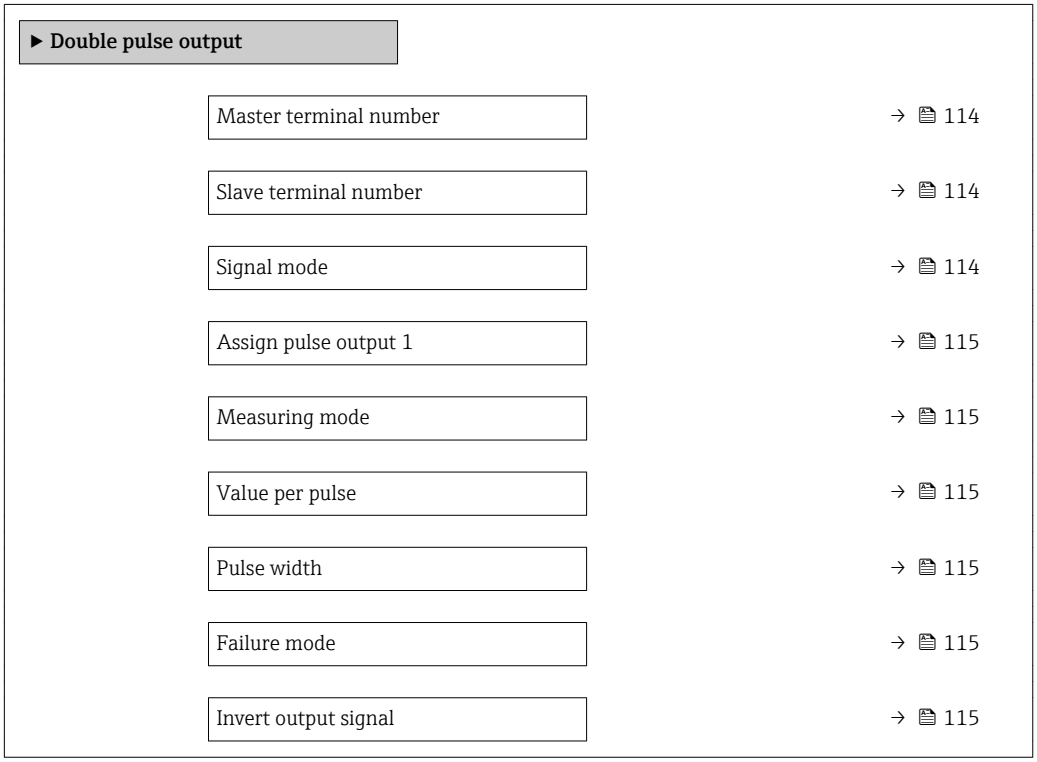
* Visibility depends on order options or device settings

10.4.13 Configuring the double pulse output

The **Double pulse output** submenu guides the user systematically through all the parameters that have to be set for configuring the double pulse output.

Navigation

"Setup" menu → Double pulse output



Parameter overview with brief description

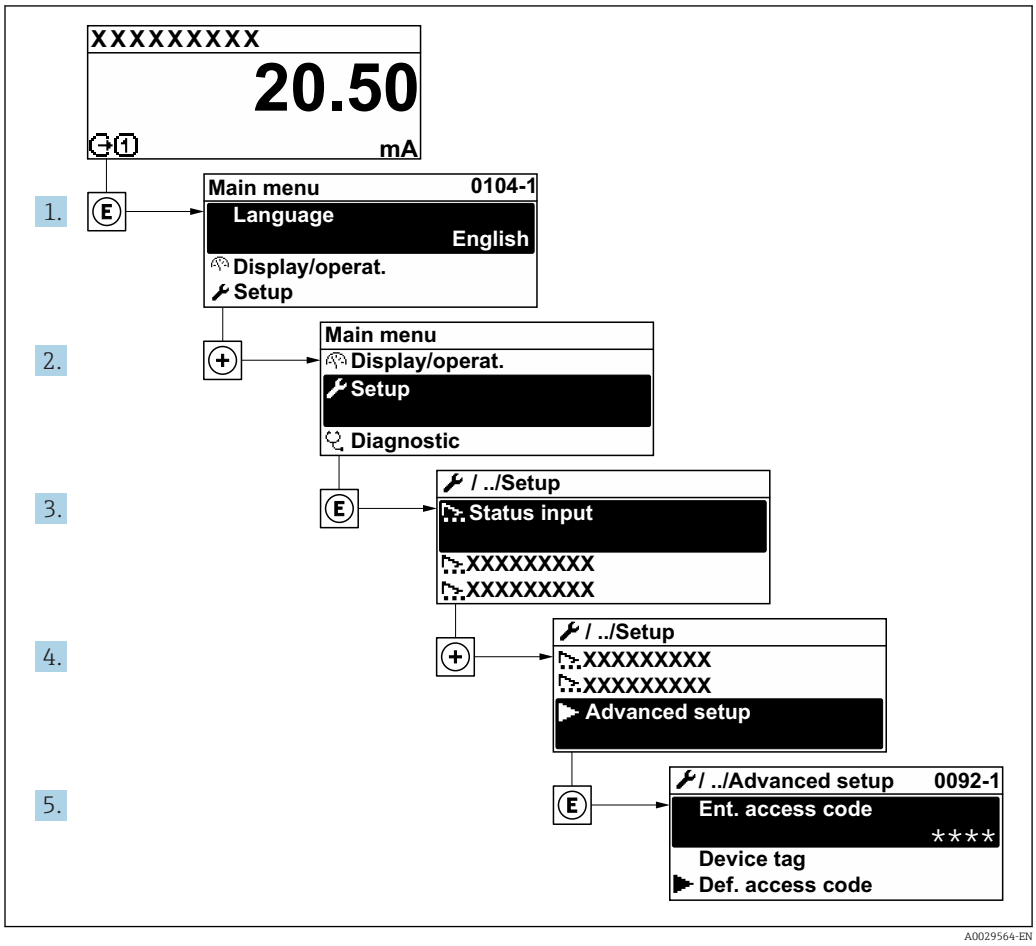
Parameter	Description	Selection / User interface / User entry	Factory setting
Signal mode	Select the signal mode for the double pulse output.	▪ Passive ▪ Active ▪ Passive NAMUR	Passive
Master terminal number	Shows the terminal numbers used by the master of the double pulse output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Slave terminal number		▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–

Parameter	Description	Selection / User interface / User entry	Factory setting
Assign pulse output 1	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Off
Measuring mode	Select measuring mode for pulse output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow ▪ Reverse flow compensation	Forward flow
Value per pulse	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	Define time width of the output pulse.	0.5 to 2 000 ms	0.5 ms
Failure mode	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	Invert the output signal.	▪ No ▪ Yes	No

10.5 Advanced settings

The **Advanced setup** submenu together with its submenus contains parameters for specific settings.

Navigation to the "Advanced setup" submenu



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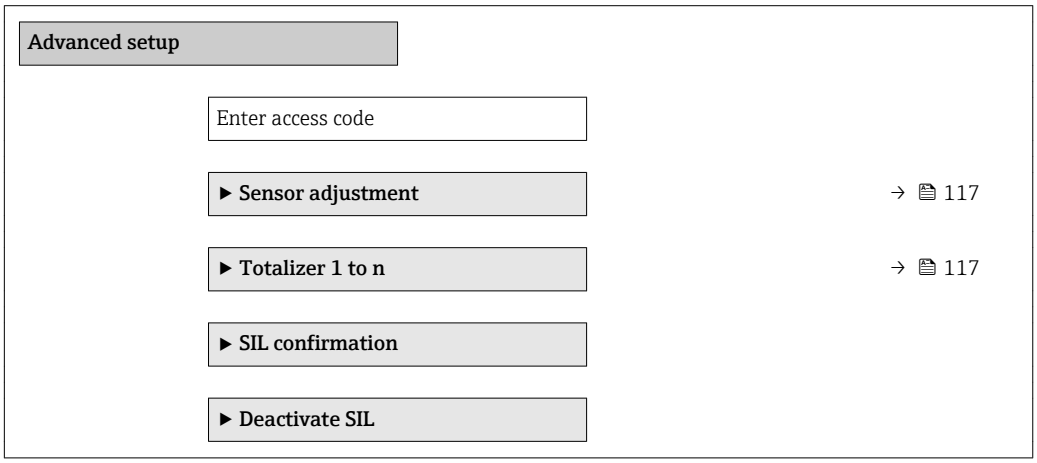
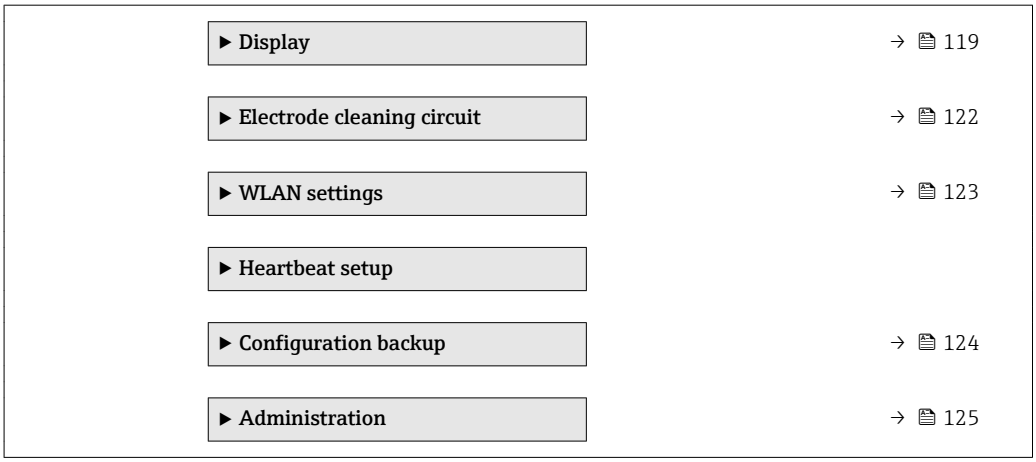
The number of submenus can vary depending on the device version. Some submenus are not dealt with in the Operating Instructions. These submenus and the parameters they contain are explained in the Special Documentation for the device.

Navigation

"Setup" menu → Advanced setup



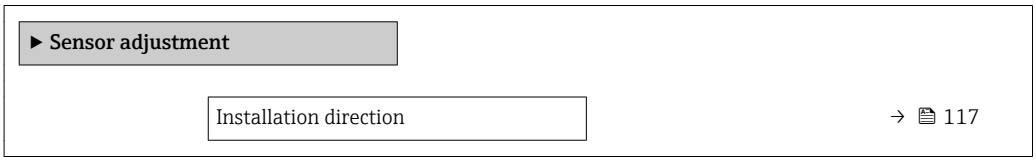


10.5.1 Carrying out a sensor adjustment

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

Navigation

"Setup" menu → Advanced setup → Sensor adjustment



Parameter overview with brief description

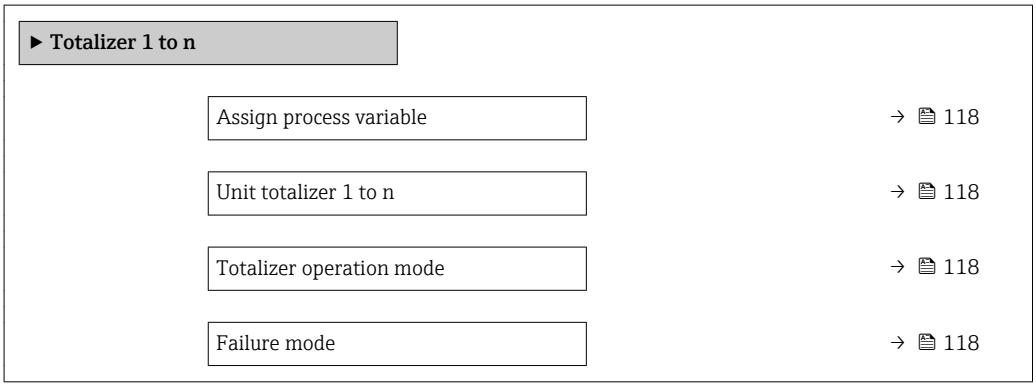
Parameter	Description	Selection	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	▪ Flow in arrow direction ▪ Flow against arrow direction	Flow in arrow direction

10.5.2 Configuring the totalizer

In the **"Totalizer 1 to n" submenu** the individual totalizer can be configured.

Navigation

"Setup" menu → Advanced setup → Totalizer 1 to n



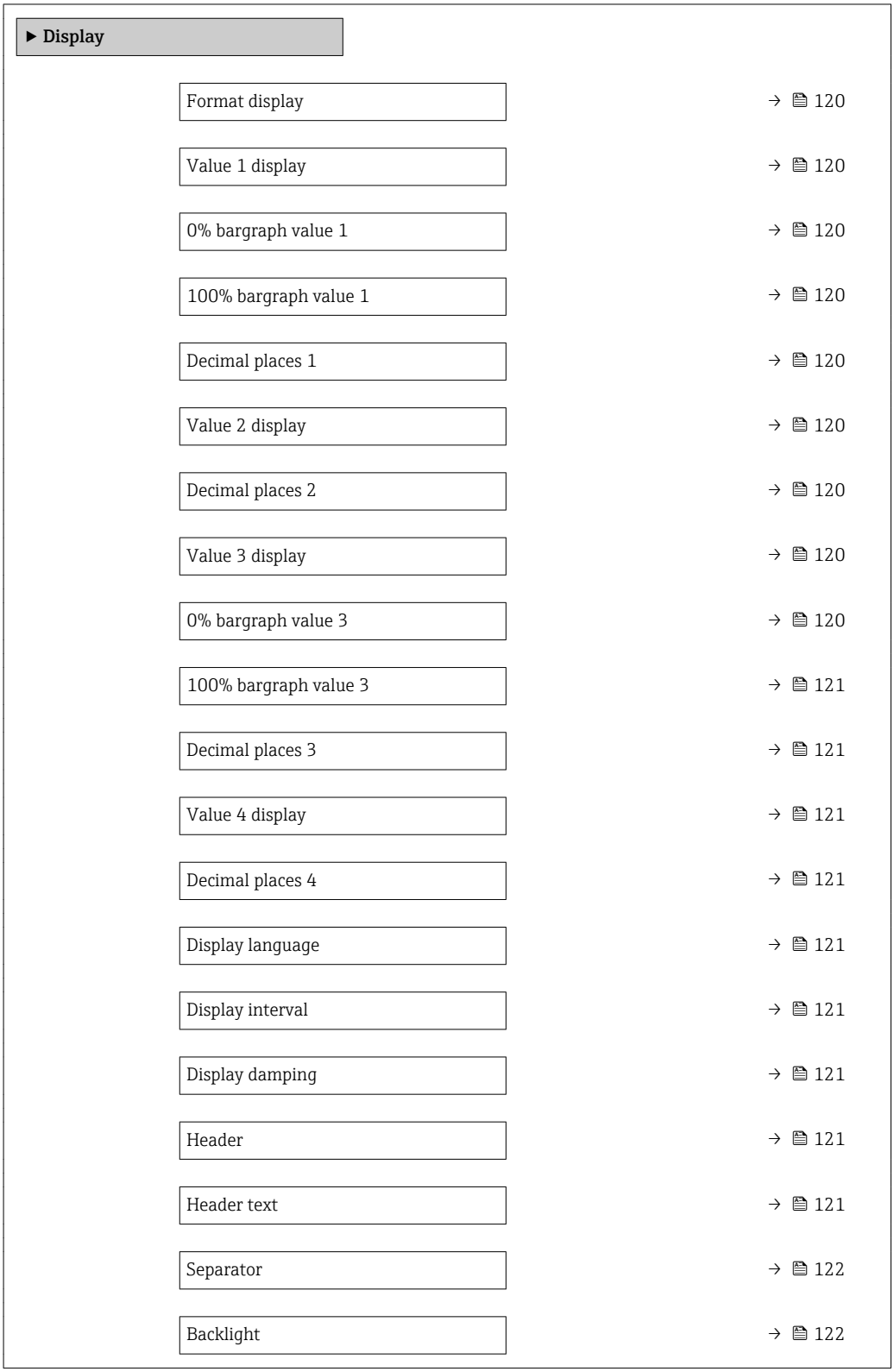
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Assign process variable	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Unit totalizer 1 to n	Select process variable totalizer unit.	Unit choose list	l
Totalizer operation mode	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total
Failure mode	Define totalizer behavior in alarm condition.	▪ Stop ▪ Actual value ▪ Last valid value	Stop

10.5.3 Carrying out additional display configurations

In the **Display** submenu you can set all the parameters associated with the configuration of the local display.

Navigation
"Setup" menu → Advanced setup → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is specified in the **Value 1 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	None
Decimal places 2	A measured value is specified in the **Value 2 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 108)	None
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Decimal places 3	A measured value is specified in the **Value 3 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 108)	None
Decimal places 4	A measured value is specified in the **Value 4 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Display language	A local display is provided.	Set display language.	▪ English ▪ Deutsch * ▪ Français * ▪ Español * ▪ Italiano * ▪ Nederlands * ▪ Portuguesa * ▪ Polski * ▪ русский язык (Russian) * ▪ Svenska * ▪ Türkçe * ▪ 中文 (Chinese) * ▪ 日本語 (Japanese) * ▪ 한국어 (Korean) * ▪ العَرَبِيّة (Arabic) * ▪ Bahasa Indonesia * ▪ ภาษาไทย (Thai) * ▪ tiếng Việt (Vietnamese) * ▪ čeština (Czech) *	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	▪ Device tag ▪ Free text	Device tag
Header text	In the **Header** parameter, the **Free text** option is selected.	Enter display header text.	Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /)	----------

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	▪ . (point) ▪ , (comma)	. (point)
Backlight	One of the following conditions is met: ▪ Order code for "Display; operation", option **F** "4-line, illum.; touch control" ▪ Order code for "Display; operation", option **G** "4-line, illum.; touch control +WLAN"	Switch the local display backlight on and off.	▪ Disable ▪ Enable	Enable

* Visibility depends on order options or device settings

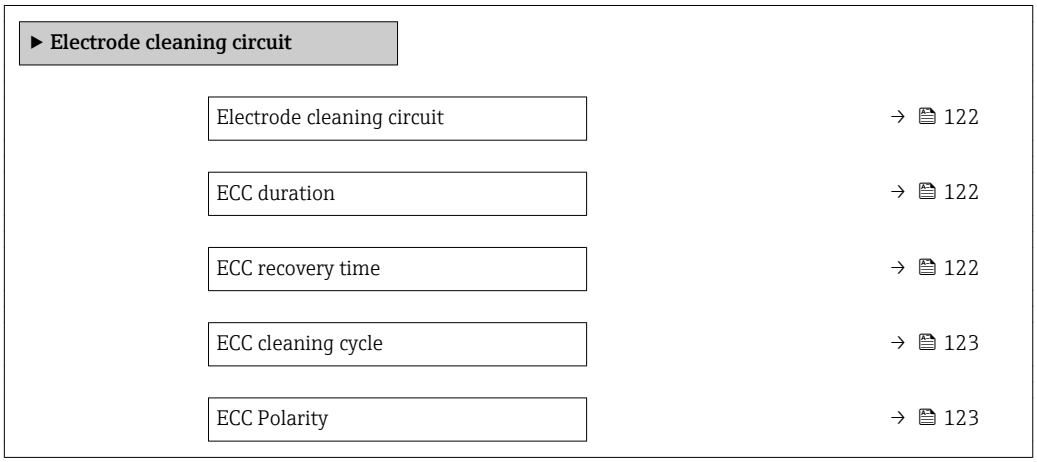
10.5.4 Performing electrode cleaning

The **Electrode cleaning circuit** submenu contains parameters that must be configured for the configuration of electrode cleaning.

The submenu is only available if the device was ordered with electrode cleaning.

Navigation

"Setup" menu → Advanced setup → Electrode cleaning circuit



Parameter overview with brief description

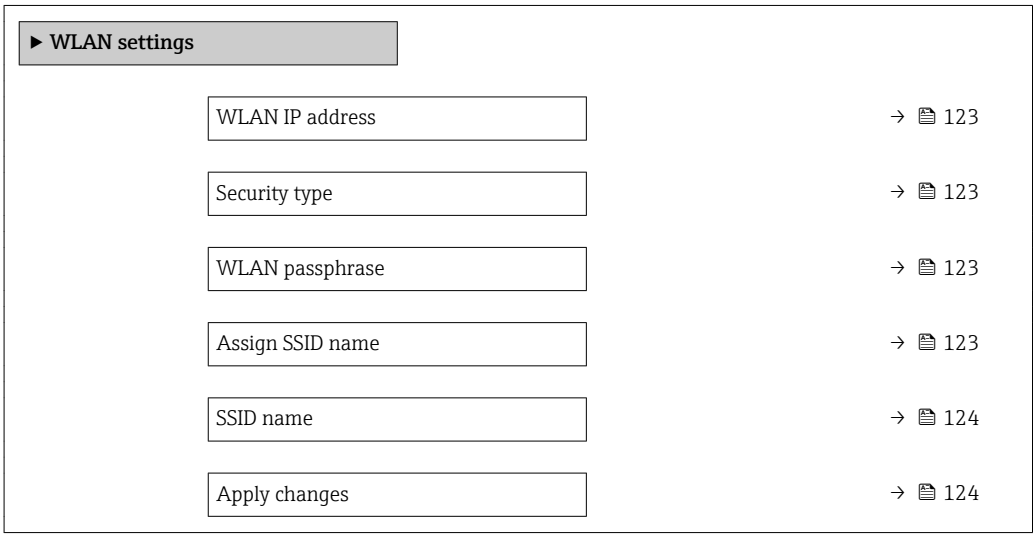
Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Electrode cleaning circuit	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enable the cyclic electrode cleaning circuit.	▪ Off ▪ On	Off
ECC duration	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enter the duration of electrode cleaning in seconds.	0.01 to 30 s	2 s
ECC recovery time	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Define recovery time after electrode cleaning. During this time the current output values will be held at last valid value.	1 to 600 s	60 s

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
ECC cleaning cycle	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enter the pause duration between electrode cleaning cycles.	0.5 to 168 h	0.5 h
ECC Polarity	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Select the polarity of the electrode cleaning circuit.	▪ Positive ▪ Negative	Depends on the electrode material: ▪ Platinum: **Negative** option ▪ Tantalum, Alloy C22, stainless steel: **Positive** option

10.5.5 WLAN configuration

The **WLAN Settings** submenu guides the user systematically through all the parameters that have to be set for the WLAN configuration.

Navigation
"Setup" menu → Advanced setup → WLAN Settings



Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
WLAN IP address	–	Enter IP address of the device WLAN interface.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
Security type	–	Select the security type of the WLAN interface.	▪ Unsecured ▪ WPA2-PSK	WPA2-PSK
WLAN passphrase	In the **Security type** parameter, the **WPA2-PSK** option is selected.	Enter the network key (8 to 32 characters). The network key supplied with the device should be changed during commissioning for security reasons.	8 to 32-digit character string comprising numbers, letters and special characters	Serial number of the measuring device (e.g. L100A802000)
Assign SSID name	–	Select which name will be used for SSID: device tag or user-defined name.	▪ Device tag ▪ User-defined	User-defined

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
SSID name	In the **Assign SSID name** parameter, the **User-defined** option is selected.	Enter the user-defined SSID name (max. 32 characters). The user-defined SSID name may only be assigned once. If the SSID name is assigned more than once, the devices can interfere with one another.	Max. 32-digit character string comprising numbers, letters and special characters	EH_device designation_last 7 digits of the serial number (e.g. EH_Promag_500_A 802000)
Apply changes	–	Use changed WLAN settings.	▪ Cancel ▪ Ok	Cancel

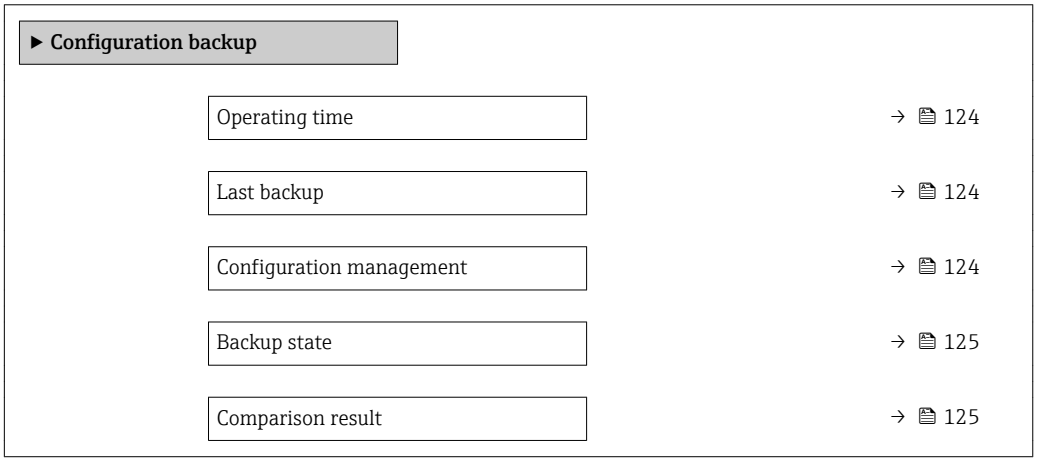
10.5.6 Configuration management

After commissioning, you can save the current device configurationor restore the previous device configuration.

You can do so using the **Configuration management** parameter and the related options found in the **Configuration backup** submenu.

Navigation

"Setup" menu → Advanced setup → Configuration backup



Parameter overview with brief description

Parameter	Description	User interface / Selection	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Last backup	Shows when the last data backup was saved to embedded HistoROM.	Days (d), hours (h), minutes (m) and seconds (s)	–
Configuration management	Select action for managing the device data in the embedded HistoROM.	▪ Cancel ▪ Execute backup ▪ Restore ▪ Compare ▪ Clear backup data	Cancel

Parameter	Description	User interface / Selection	Factory setting
Backup state	Shows the current status of data saving or restoring.	▪ None ▪ Backup in progress ▪ Restoring in progress ▪ Delete in progress ▪ Compare in progress ▪ Restoring failed ▪ Backup failed	None
Comparison result	Comparison of current device data with embedded HistoROM.	▪ Settings identical ▪ Settings not identical ▪ No backup available ▪ Backup settings corrupt ▪ Check not done ▪ Dataset incompatible	Check not done

Function scope of the "Configuration management" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Execute backup	A backup copy of the current device configuration is saved from the integrated HistoROM to the memory of the device. The backup copy includes the transmitter data of the device.
Restore	The last backup copy of the device configuration is restored from the device memory to the device's integrated HistoROM. The backup copy includes the transmitter data of the device.
Compare	The device configuration saved in the device memory is compared with the current device configuration of the integrated HistoROM.
Clear backup data	The backup copy of the device configuration is deleted from the memory of the device.

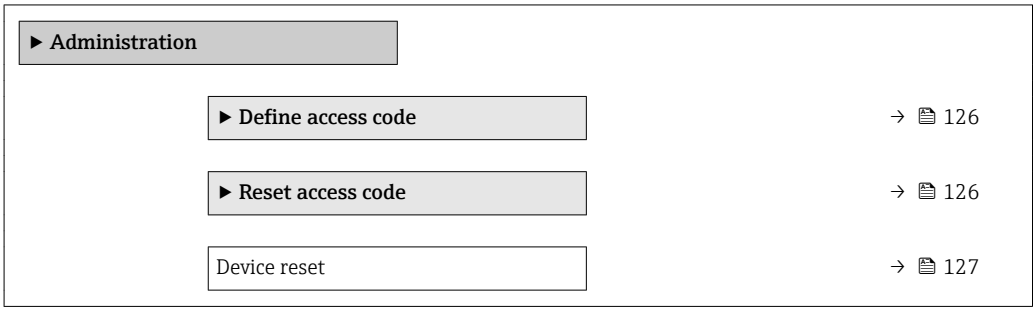
Integrated HistoROM
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

10.5.7 Using parameters for device administration

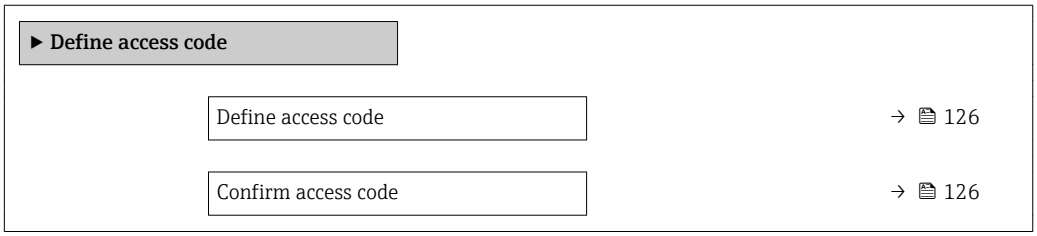
The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation
"Setup" menu → Advanced setup → Administration



Using the parameter to define the access code

Navigation
"Setup" menu → Advanced setup → Administration → Define access code

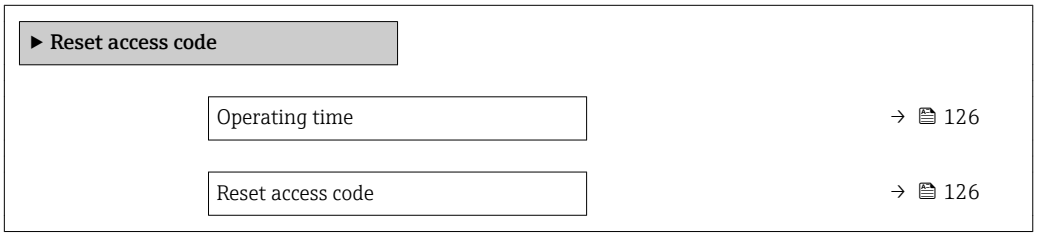


Parameter overview with brief description

Parameter	Description	User entry
Define access code	Restrict write-access to parameters to protect the configuration of the device against unintentional changes.	Max. 16-digit character string comprising numbers, letters and special characters
Confirm access code	Confirm the entered access code.	Max. 16-digit character string comprising numbers, letters and special characters

Using the parameter to reset the access code

Navigation
"Setup" menu → Advanced setup → Administration → Reset access code



Parameter overview with brief description

Parameter	Description	User interface / User entry	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Reset access code	Reset access code to factory settings. For a reset code, contact your Endress+Hauser service organization. The reset code can only be entered via: ▪ Web browser ▪ DeviceCare, FieldCare (via service interface CDI-RJ45) ▪ Fieldbus	Character string comprising numbers, letters and special characters	0x00

Using the parameter to reset the device

Navigation
"Setup" menu → Advanced setup → Administration

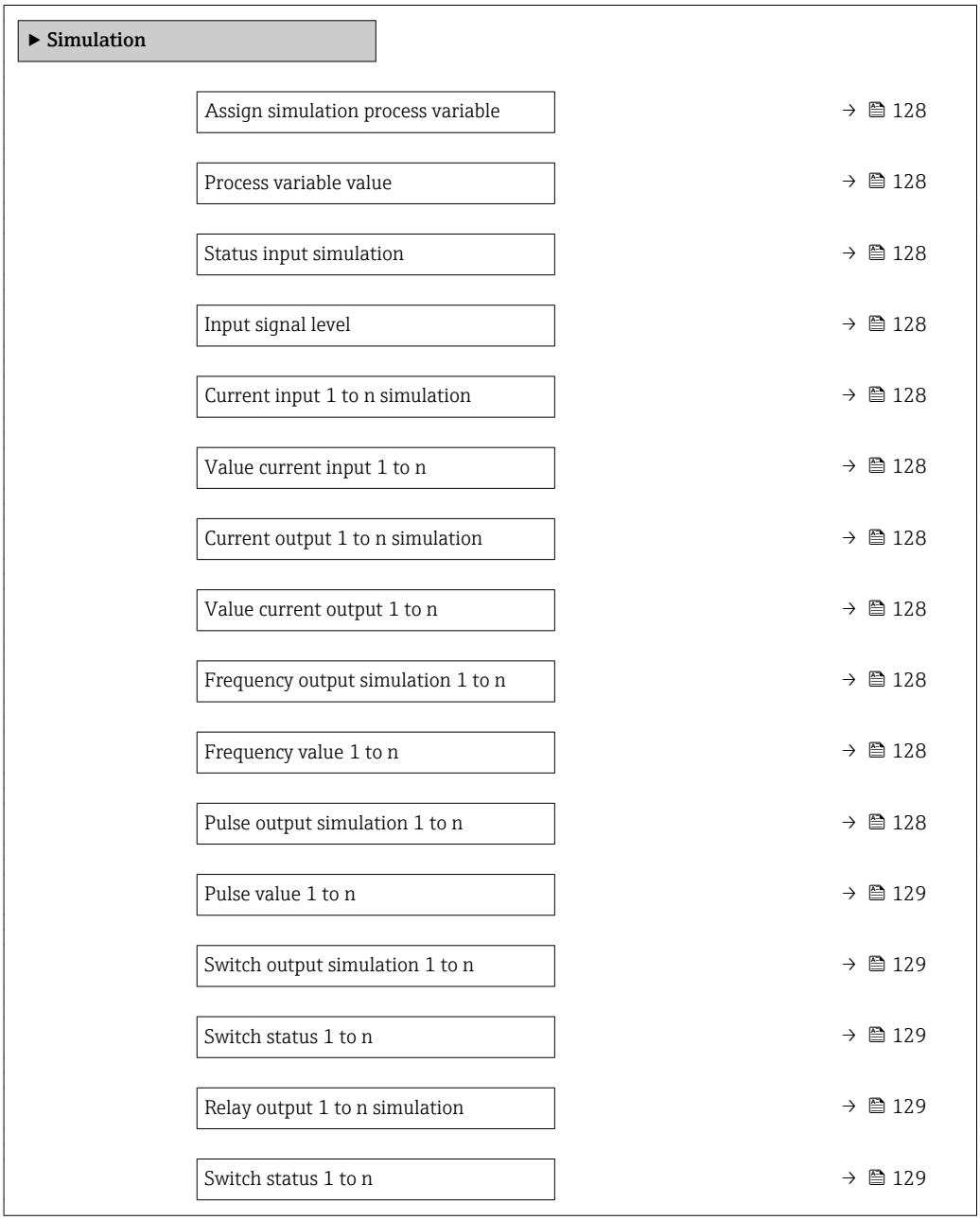
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	▪ Cancel ▪ To delivery settings ▪ Restart device ▪ Restore S-DAT backup	Cancel

10.6 Simulation

The **Simulation** submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

Navigation
"Diagnostics" menu → Simulation



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity*	Off
Process variable value	–	Enter the simulation value for the selected process variable.	Depends on the process variable selected	0
Status input simulation	–	Switch simulation of the status input on and off.	▪ Off ▪ On	Off
Input signal level	In the **Status input simulation** parameter, the **On** option is selected.	Select the signal level for the simulation of the status input.	▪ High ▪ Low	High
Current input 1 to n simulation	–	Switch simulation of the current input on and off.	▪ Off ▪ On	Off
Value current input 1 to n	In the **Current input 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	0 to 22.5 mA	0 mA
Current output 1 to n simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On	Off
Value current output 1 to n	In the **Current output 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA	3.59 mA
Frequency output simulation 1 to n	In the **Operating mode** parameter, the **Frequency** option is selected.	Switch the simulation of the frequency output on and off.	▪ Off ▪ On	Off
Frequency value 1 to n	In the **Frequency output simulation 1 to n** parameter, the **On** option is selected.	Enter the frequency value for the simulation.	0.0 to 12 500.0 Hz	0.0 Hz
Pulse output simulation 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter (→ 102) defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Pulse value 1 to n	In the **Pulse output simulation 1 to n** parameter, the **Down-counting value** option is selected.	Enter the number of pulses for simulation.	0 to 65 535	0
Switch output simulation 1 to n	In the **Operating mode** parameter, the **Switch** option is selected.	Switch the simulation of the switch output on and off.	▪ Off ▪ On	Off
Switch status 1 to n	–	Select the status of the status output for the simulation.	▪ Open ▪ Closed	Open
Relay output 1 to n simulation	–	Switch simulation of the relay output on and off.	▪ Off ▪ On	Off
Switch status 1 to n	In the **Switch output simulation 1 to n** parameter, the **On** option is selected.	Select status of the relay output for the simulation.	▪ Open ▪ Closed	Open
Pulse output simulation	–	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off
Pulse value	In the **Pulse output simulation** parameter, the **Down-counting value** option is selected.	Set and switch off the pulse output simulation.	0 to 65 535	0
Device alarm simulation	–	Switch the device alarm on and off.	▪ Off ▪ On	Off
Diagnostic event category	–	Select a diagnostic event category.	▪ Sensor ▪ Electronics ▪ Configuration ▪ Process	Process
Diagnostic event simulation	–	Select a diagnostic event to simulate this event.	▪ Off ▪ Diagnostic event picklist (depends on the category selected)	Off
Logging interval	–	Define the logging interval tlog for data logging. This value defines the time interval between the individual data points in the memory.	1.0 to 3 600.0 s	–

* Visibility depends on order options or device settings

10.7 Protecting settings from unauthorized access

The following write protection options exist in order to protect the configuration of the measuring device from unintentional modification:

- Protect access to parameters via access code → 130
- Protect access to local operation via key locking → 74
- Protect access to measuring device via write protection switch → 131

10.7.1 Write protection via access code

The effects of the user-specific access code are as follows:
- Via local operation, the parameters for the measuring device configuration are write-protected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.
- Device access is protected via FieldCare or DeviceCare (via CDI-RJ45 service interface), as are the parameters for the measuring device configuration.

Defining the access code via local display

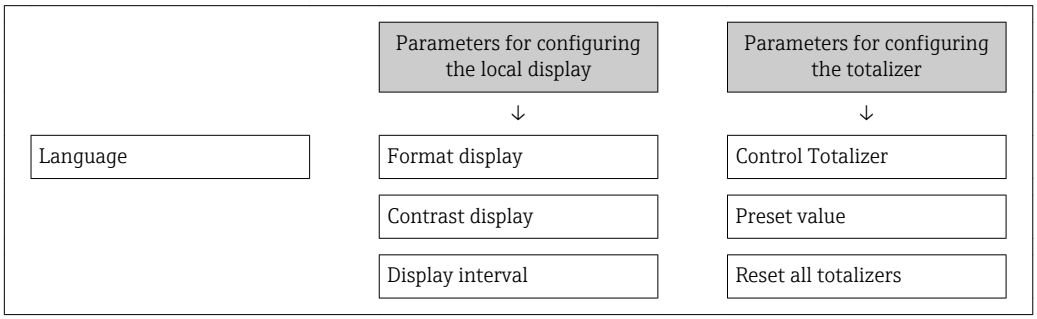
1. Navigate to the **Define access code** parameter (→ 126).
2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 126) to confirm the code.
   ↳ The -symbol appears in front of all write-protected parameters.

The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 74.
- The user role with which the user is currently logged on via the local display is indicated by the → 74 **Access status** parameter. Navigation path: Operation → Access status

Parameters which can always be modified via the local display

Certain parameters that do not affect the measurement are excepted from parameter write protection via the local display. Despite the user-specific access code, they can always be modified, even if the other parameters are locked.



Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 126).
2. Max. Define a max. 4-digit numeric code as an access code.

3. Enter the access code again in the **Confirm access code** parameter (→ 126) to confirm the code.
   ↳ The Web browser switches to the login page.

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 74.
- The user role with which the user is currently logged on via Web browser is indicated by the **Access status** parameter. Navigation path: Operation → Access status

Resetting the access code

If you misplace the user-specific access code, it is possible to reset the code to the factory setting. A reset code must be entered for this purpose. The user-specific access code can then be defined again afterwards.

Via Web browser, FieldCare, DeviceCare (via CDI-RJ45 service interface), fieldbus

For a reset code, contact your Endress+Hauser service organization.

1. Navigate to the **Reset access code** parameter (→ 126).
2. Enter the reset code.
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 130.

10.7.2 Write protection via write protection switch

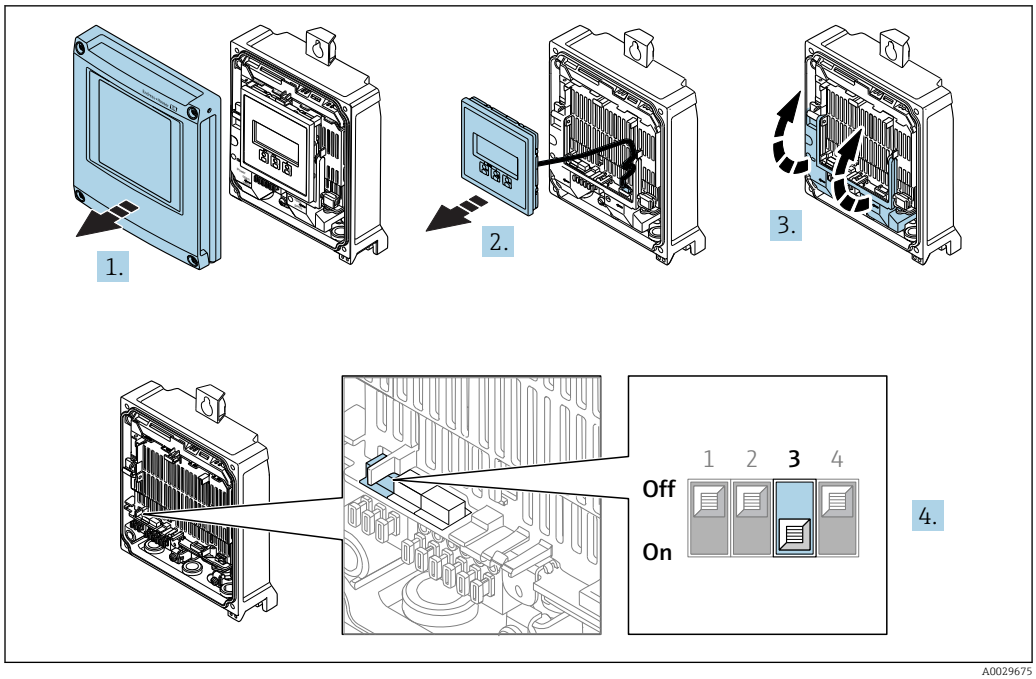
Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for the **"Contrast display" parameter** - to be locked.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via HART protocol

Proline 500 – digital

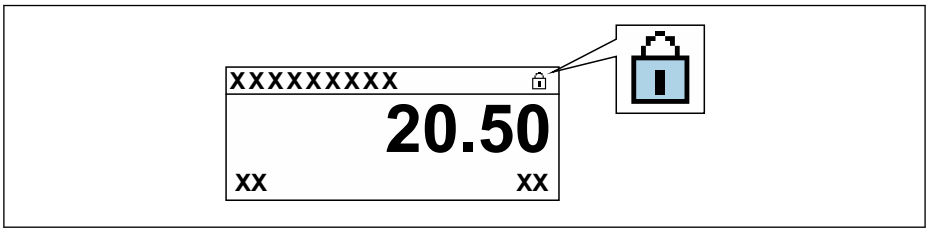
WARNING

Excessive tightening torque applied to the fixing screws!
Risk of damaging the plastic transmitter.
- Tighten the fixing screws as per the tightening torque: 2 Nm (1.5 lbf ft).



A0029675

1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.
4. Setting the write protection (WP) switch on the main electronics module to the **ON** position enables hardware write protection.
   ↳ In the **Locking status** parameter the **Hardware locked** option is displayed → 134. In addition, on the local display the 🔒-symbol appears in front of the parameters in the header of the operational display and in the navigation view.

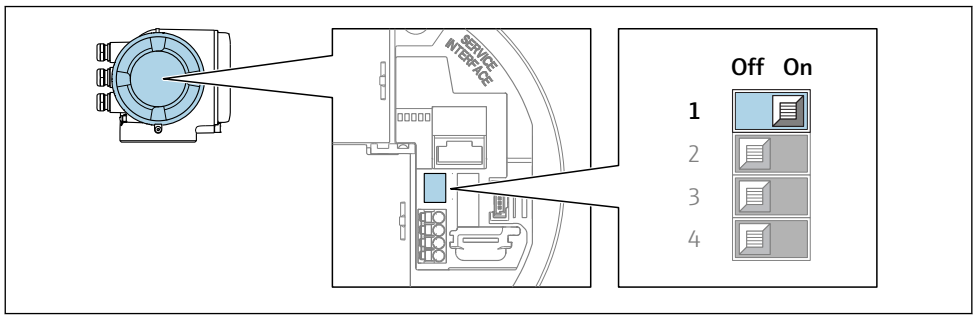


A0029425

5. Setting the write protection (WP) switch on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.
   ↳ No option is displayed in the **Locking status** parameter → 134. On the local display, the 🔒-symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

Proline 500

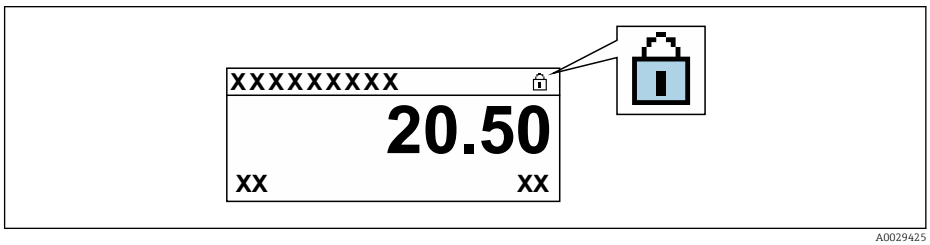
1.



A0029630

Setting the write protection (WP) switch on the main electronics module to the **ON** position enables hardware write protection.

↳ In the **Locking status** parameter the **Hardware locked** option is displayed → 134. In addition, on the local display the -symbol appears in front of the parameters in the header of the operational display and in the navigation view.



A0029425

2. Setting the write protection (WP) switch on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.

↳ No option is displayed in the **Locking status** parameter → 134. On the local display, the -symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

11 Operation

11.1 Reading the device locking status

Device active write protection: **Locking status** parameter

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access status displayed in the **Access status** parameter applies → 74. Only appears on local display.
Hardware locked	The DIP switch for hardware locking is activated on the PCB board. This locks write access to the parameters (e.g. via local display or operating tool).
SIL locked	The SIL mode is enabled. This locks write access to the parameters (e.g. via local display or operating tool).
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc.). Once the internal processing has been completed, the parameters can be changed once again.

11.2 Adjusting the operating language

Detailed information:
- To configure the operating language → 92
- For information on the operating languages supported by the measuring device → 192

11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 107
- On the advanced settings for the local display → 119

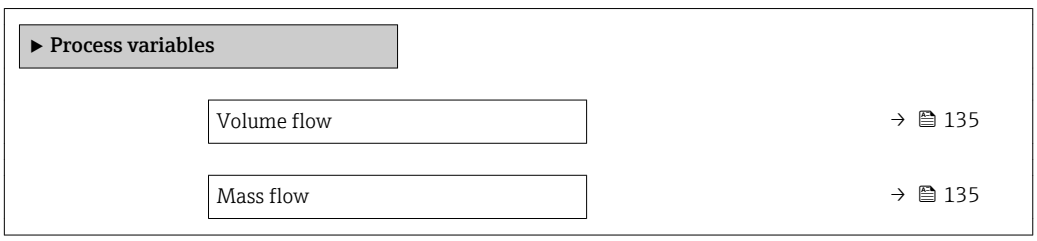
11.4 Reading measured values

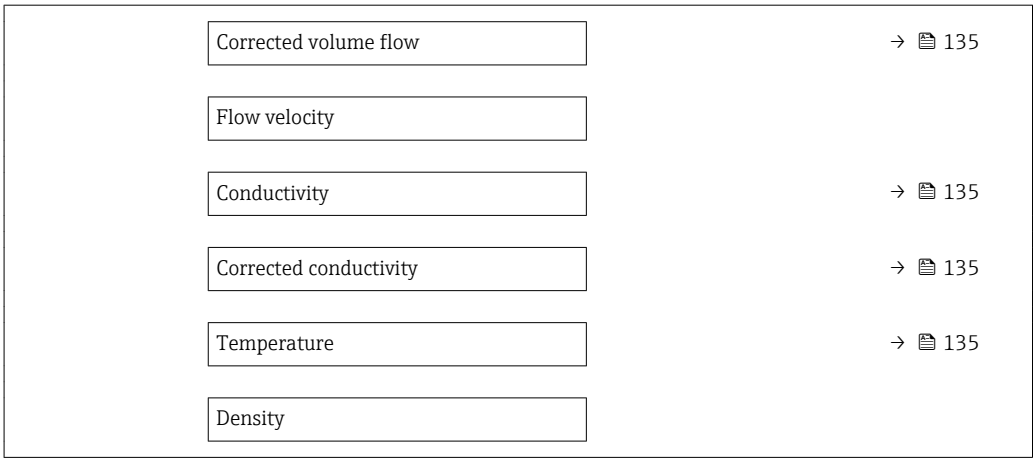
With the **Measured values** submenu, it is possible to read all the measured values.

11.4.1 Process variables

The **Measured variables** submenu contains all the parameters needed to display the current measured values for each process variable.

Navigation
"Diagnostics" menu → Measured values → Process variables





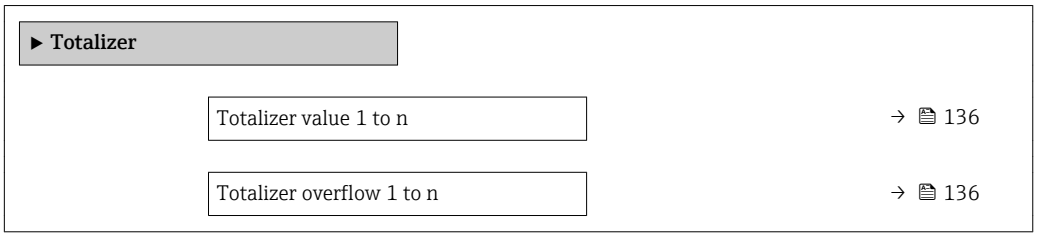
Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Volume flow	–	Displays the volume flow currently measured. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 95).	Signed floating-point number
Mass flow	–	Displays the mass flow currently calculated. *Dependency* The unit is taken from the **Mass flow unit** parameter (→ 95).	Signed floating-point number
Conductivity	–	Displays the conductivity currently measured. *Dependency* The unit is taken from the **Conductivity unit** parameter (→ 95).	Signed floating-point number
Corrected volume flow	–	Displays the corrected volume flow currently calculated. *Dependency* The unit is taken from the **Corrected volume flow unit** parameter (→ 95).	Signed floating-point number
Temperature	One of the following conditions is met: ▪ Order code for "Sensor option", option **CI** "Medium temperature measurement" or ▪ The temperature is read into the flowmeter from an external device.	Displays the temperature currently calculated. *Dependency* The unit is taken from the **Temperature unit** parameter (→ 95).	Positive floating-point number
Corrected conductivity	One of the following conditions is met: ▪ Order code for "Sensor option", option **CI** "Medium temperature measurement" or ▪ The temperature is read into the flowmeter from an external device.	Displays the conductivity currently corrected. *Dependency* The unit is taken from the **Conductivity unit** parameter (→ 95).	Positive floating-point number

11.4.2 "Totalizer" submenu

The **Totalizer** submenu contains all the parameters needed to display the current measured values for every totalizer.

Navigation
"Diagnostics" menu → Measured values → Totalizer



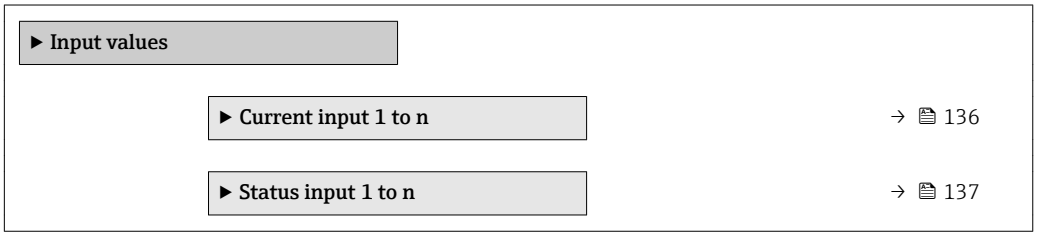
Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Totalizer value 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 118) of the **Totalizer 1 to n** submenu.	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 118) of the **Totalizer 1 to n** submenu.	Displays the current totalizer overflow.	Integer with sign

11.4.3 "Input values" submenu

The **Input values** submenu guides you systematically to the individual input values.

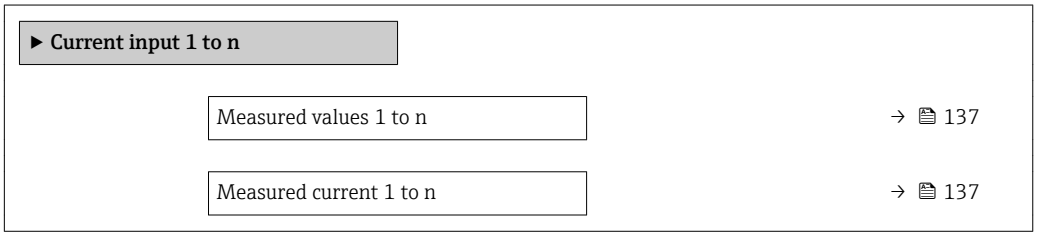
Navigation
"Diagnostics" menu → Measured values → Input values



Input values of current input

The **Current input 1 to n** submenu contains all the parameters needed to display the current measured values for every current input.

Navigation
"Diagnostics" menu → Measured values → Input values → Current input 1 to n



Parameter overview with brief description

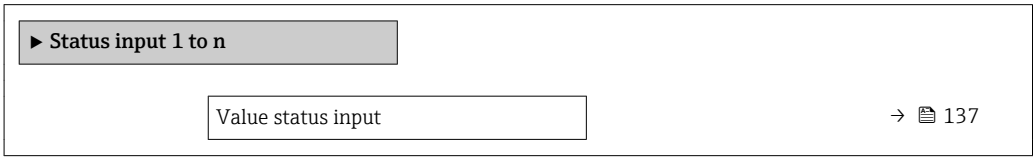
Parameter	Description	User interface
Measured values 1 to n	Displays the current input value.	Signed floating-point number
Measured current 1 to n	Displays the current value of the current input.	0 to 22.5 mA

Input values of status input

The **Status input 1 to n** submenu contains all the parameters needed to display the current measured values for every status input.

Navigation

"Diagnostics" menu → Measured values → Input values → Status input 1 to n



Parameter overview with brief description

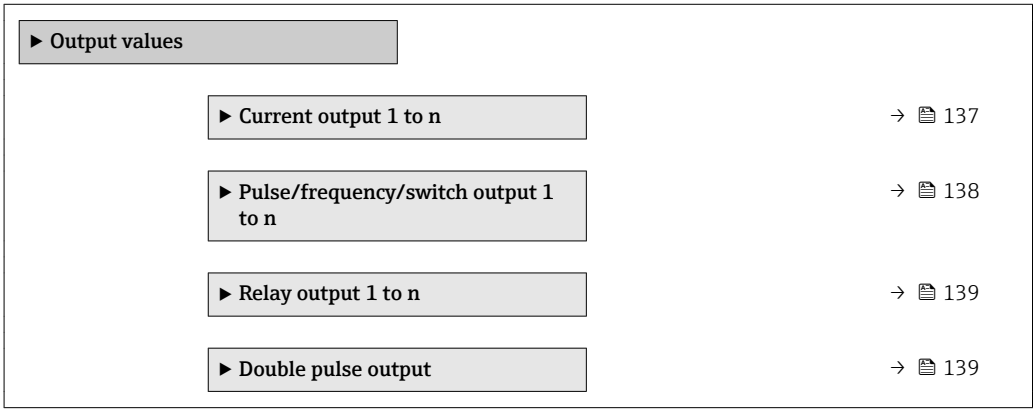
Parameter	Description	User interface
Value status input	Shows the current input signal level.	▪ High ▪ Low

11.4.4 Output values

The **Output values** submenu contains all the parameters needed to display the current measured values for every output.

Navigation

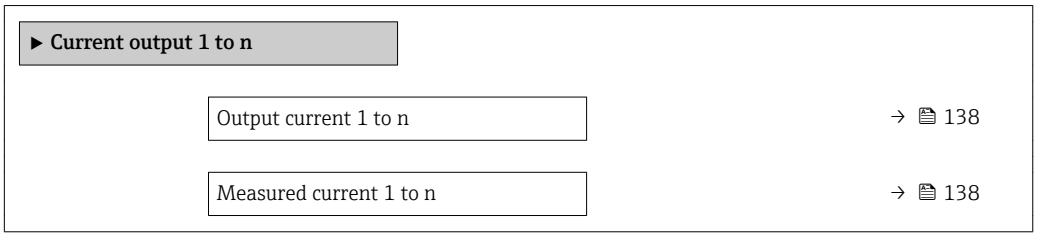
"Diagnostics" menu → Measured values → Output values



Output values of current output

The **Value current output** submenu contains all the parameters needed to display the current measured values for every current output.

Navigation
"Diagnostics" menu → Measured values → Output values → Value current output 1 to n



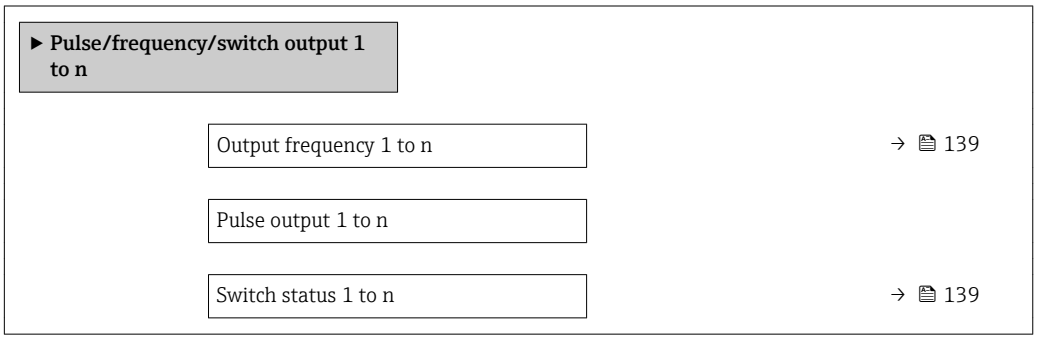
Parameter overview with brief description

Parameter	Description	User interface
Output current 1	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current	Displays the current value currently measured for the current output.	0 to 30 mA

Output values for pulse/frequency/switch output

The **Pulse/frequency/switch output 1 to n** submenu contains all the parameters needed to display the current measured values for every pulse/frequency/switch output.

Navigation
"Diagnostics" menu → Measured values → Output values → Pulse/frequency/switch output 1 to n



Parameter overview with brief description

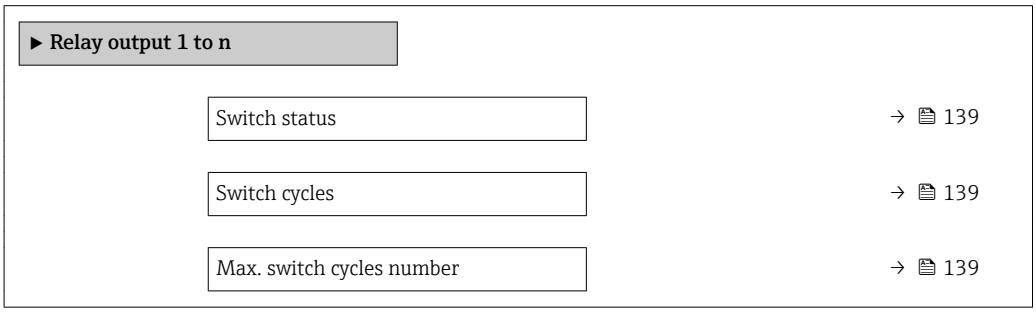
Parameter	Prerequisite	Description	User interface / User entry	Factory setting
Output frequency	In the **Operating mode** parameter, the **Frequency** option is selected.	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz	–
Value per pulse	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 102): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Switch status	The **Switch** option is selected in the **Operating mode** parameter.	Displays the current switch output status.	▪ Open ▪ Closed	–

Output values for relay output

The **Relay output 1 to n** submenu contains all the parameters needed to display the current measured values for every relay output.

Navigation

"Diagnostics" menu → Measured values → Output values → Relay output 1 to n



Parameter overview with brief description

Parameter	Description	User interface
Switch status	Shows the current relay switch status.	▪ Open ▪ Closed
Switch cycles	Shows number of all performed switch cycles.	Positive integer
Max. switch cycles number	Shows the maximal number of guaranteed switch cycles.	Positive integer

Output values for double pulse output

The **Double pulse output** submenu contains all the parameters needed to display the current measured values for every double pulse output.

Navigation
"Diagnostics" menu → Measured values → Output values → Double pulse output

▶ Double pulse output		
	Pulse output	→ 140

Parameter overview with brief description

Parameter	Description	User interface
Pulse output	Shows the currently output pulse frequency.	Positive floating-point number

11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 92)
- Advanced settings using the**Advanced setup** submenu (→ 116)

11.6 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:
- Control Totalizer
- Reset all totalizers

Navigation
"Operation" menu → Totalizer handling

▶ Totalizer handling		
	Control Totalizer 1 to n	→ 141
	Preset value 1 to n	→ 141
	Reset all totalizers	→ 141

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Control Totalizer 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 118)**Totalizer 1 to n** submenu: Volume flow	Control totalizer value.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize ▪ Hold	Totalize
Preset value 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 118)**Totalizer 1 to n** submenu: Volume flow	Specify start value for totalizer. *Dependency* The unit of the selected process variable is specified for the totalizer in the **Unit totalizer** parameter (→ 118).	Signed floating-point number	0 l
Reset all totalizers	–	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	Cancel

11.6.1 Function scope of the "Control Totalizer" parameter

Options	Description
Totalize	The totalizer is started or continues running.
Reset + hold	The totaling process is stopped and the totalizer is reset to 0.
Preset + hold	The totaling process is stopped and the totalizer is set to its defined start value from the **Preset value** parameter.
Reset + totalize	The totalizer is reset to 0 and the totaling process is restarted.
Preset + totalize	The totalizer is set to the defined start value from the **Preset value** parameter and the totaling process is restarted.
Hold	Totalizing is stopped.

11.6.2 Function scope of the "Reset all totalizers" parameter

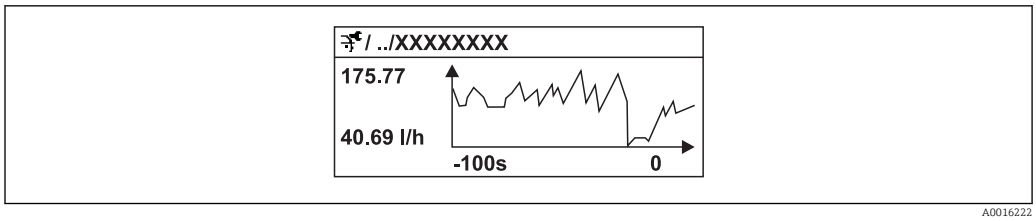
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

11.7 Showing data logging

The **Extended HistoROM** application package must be enabled in the device (order option) for the **Data logging** submenu to appear. This contains all the parameters for the measured value history.

Data logging is also available via:
- Plant Asset Management Tool FieldCare → 84.
- Web browser→ 75

Function range
- A total of 1000 measured values can be stored
- 4 logging channels
- Adjustable logging interval for data logging
- Display of the measured value trend for each logging channel in the form of a chart



41 *Chart of a measured value trend*

- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

If the length of the logging interval or the assignment of the process variables to the channels is changed, the content of the data logging is deleted.

Navigation
"Diagnostics" menu → Data logging

▶ Data logging	
Assign channel 1...4	→ 143
Logging interval	→ 143
Clear logging data	→ 143
Data logging	→ 143
Logging delay	→ 143
Data logging control	→ 143
Data logging status	→ 143
Entire logging duration	→ 143

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign channel 1 to n	The **Extended HistoROM** application package is available.	Assign process variable to logging channel.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Electronic temperature ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Off
Logging interval	The **Extended HistoROM** application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	0.1 to 999.0 s	1.0 s
Clear logging data	The **Extended HistoROM** application package is available.	Clear the entire logging data.	▪ Cancel ▪ Clear data	Cancel
Data logging	–	Select the data logging method.	▪ Overwriting ▪ Not overwriting	Overwriting
Logging delay	In the **Data logging** parameter, the **Not overwriting** option is selected.	Enter the time delay for measured value logging.	0 to 999 h	0 h
Data logging control	In the **Data logging** parameter, the **Not overwriting** option is selected.	Start and stop measured value logging.	▪ None ▪ Delete + start ▪ Stop	None
Data logging status	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the measured value logging status.	▪ Done ▪ Delay active ▪ Active ▪ Stopped	Done
Entire logging duration	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the total logging duration.	Positive floating-point number	0 s

* Visibility depends on order options or device settings

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Error	Possible causes	Solution
Local display dark and no output signals	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage .
Local display dark and no output signals	The polarity of the supply voltage is wrong.	Correct the polarity.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
Local display dark and no output signals	Terminals are not plugged into the I/O electronics module correctly. Terminals are not plugged into the main electronics module correctly.	Check terminals.
Local display dark and no output signals	I/O electronics module is defective. Main electronics module is defective.	Order spare part → 168.
Local display dark and no output signals	The connector between the main electronics module and display module is not plugged in correctly.	Check the connection and correct if necessary.
Local display dark and no output signals	The connecting cable is not plugged in correctly.	1. Check the connection of the electrode cable and correct if necessary. 2. Check the connection of the coil current cable and correct if necessary.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 168.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured.	1. Press ⊟ + ⊞ for 2 s ("home position"). 2. Press Ⓔ. 3. Set the desired language in the **Display language** parameter (→ 121).
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	▪ Check the cable and the connector between the main electronics module and display module. ▪ Order spare part → 168.

For output signals

Error	Possible causes	Solution
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 168.
Signal output outside the valid current range (< 3.6 mA or > 22 mA)	Main electronics module is defective. I/O electronics module is defective.	Order spare part → 168.
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error	Check and correct the parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

Error	Possible causes	Solution
No write access to parameters	Hardware write protection enabled	Set the write protection switch on main electronics module to the **Off** position → 131.
No write access to parameters	Current user role has limited access authorization	1. Check user role → 74. 2. Enter correct customer-specific access code → 74.
No connection via HART protocol	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω) correctly. Observe the maximum load → 176.
No connection via HART protocol	Commubox ▪ Connected incorrectly ▪ Configured incorrectly ▪ Drivers not installed correctly ▪ USB interface on computer configured incorrectly	Observe the documentation for the Commubox. FXA195 HART: Document "Technical Information" TI00404F
Not connecting to Web server	Web server disabled	Using the "FieldCare" or "DeviceCare" operating tool, check whether the web server of the measuring device is enabled, and enable it if necessary → 80.
	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) → 77. 2. Check the network settings with the IT manager.
Not connecting to Web server	Incorrect IP address	Check the IP address: 192.168.1.212 → 77
Not connecting to Web server	Incorrect WLAN access data	▪ Check WLAN network status. ▪ Log on to the device again using WLAN access data. ▪ Verify that WLAN is enabled on the measuring device and operating device → 77.
	WLAN communication disabled	–
Not connecting to web server, FieldCare or DeviceCare	No WLAN network available	▪ Check if WLAN reception is present: LED on display module is lit blue ▪ Check if WLAN connection is enabled: LED on display module flashes blue ▪ Switch on instrument function.

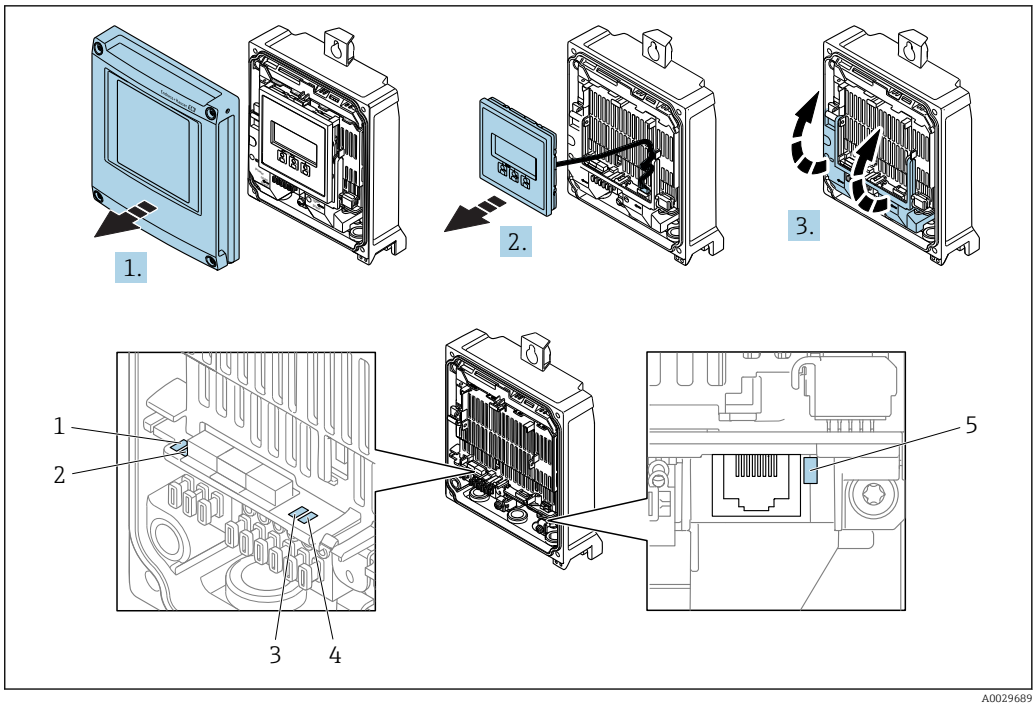
Error	Possible causes	Solution
Network connection not present or unstable	WLAN network is weak.	▪ Operating device is outside of reception range: Check network status on operating device. ▪ To improve network performance, use an external WLAN antenna.
	Parallel WLAN and Ethernet communication	▪ Check network settings. ▪ Temporarily enable only the WLAN as an interface.
Web browser frozen and operation no longer possible	Data transfer active	Wait until data transfer or current action is finished.
	Connection lost	1. Check cable connection and power supply. 2. Refresh the Web browser and restart if necessary.
Content of Web browser incomplete or difficult to read	Not using optimum version of Web server.	1. Use the correct Web browser version . 2. Clear the Web browser cache and restart the Web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No or incomplete display of contents in the Web browser	▪ JavaScript not enabled ▪ JavaScript cannot be enabled	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.
Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

Proline 500 – digital

Different LEDs in the transmitter provide information on the device status.



A0029689

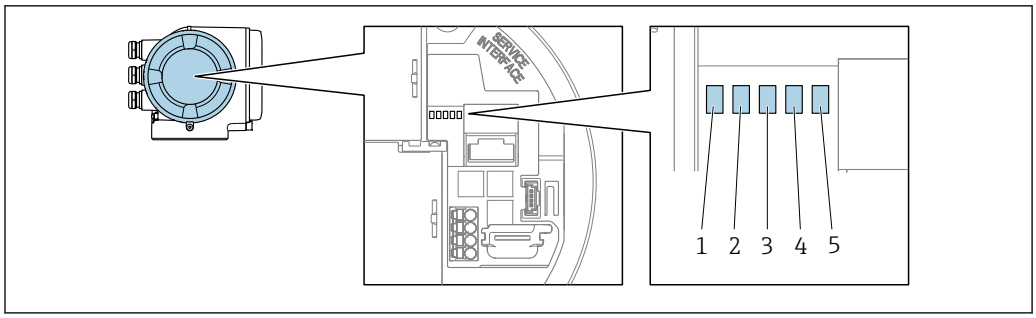
1 *Supply voltage*
2 *Device status*
3 *Not used*
4 *Communication*
5 *Service interface (CDI) active*

1. Open the housing cover.
2. Remove the display module.
3. Fold open the terminal cover.

LED		Color	Meaning
1	Supply voltage	Green	Supply voltage is ok
		Off	Supply voltage is off or too low
2	Device status	Green	Device is OK
		Red	Error
		Flashing red	Warning
3	Not used	–	–
4	Communication	Flashing white	Communication active
5	Service interface (CDI)	Yellow	Connection established
		Flashing yellow	Communication active
		Off	No connection

Proline 500

Different LEDs in the transmitter provide information on the device status.



A0029629

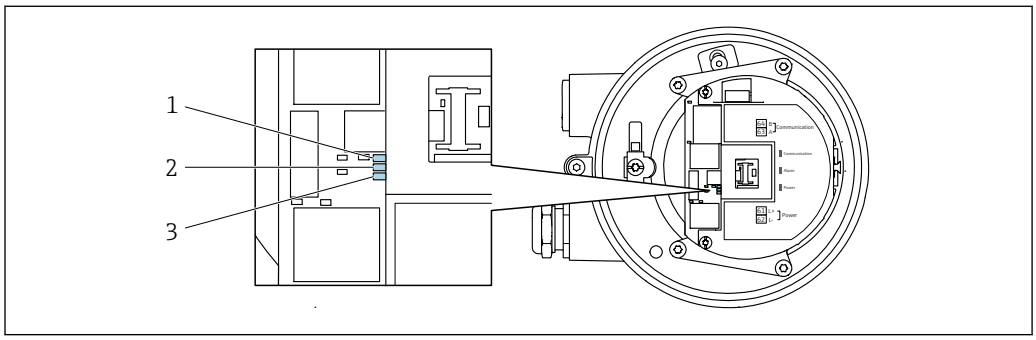
1 *Supply voltage*
2 *Device status*
3 *Not used*
4 *Communication*
5 *Service interface (CDI) active*

LED		Color	Meaning
1	Supply voltage	Green	Supply voltage is ok
		Off	Supply voltage is off or too low
2	Device status	Red	Error
		Flashing red	Warning
3	Not used	–	–
4	Communication	White	Communication active
5	Service interface (CDI)	Yellow	Connection established
		Flashing yellow	Communication active
		Off	No connection

12.2.2 Sensor connection housing

Proline 500 – digital

Various light emitting diodes (LED) on the ISEM electronics (Intelligent Sensor Electronic Module) in the sensor connection housing provide information on the device status.



A0029699

1 *Communication*
2 *Device status*
3 *Supply voltage*

LED		Color	Meaning
1	Communication	White	Communication active
2	Device status	Red	Error
		Flashing red	Warning

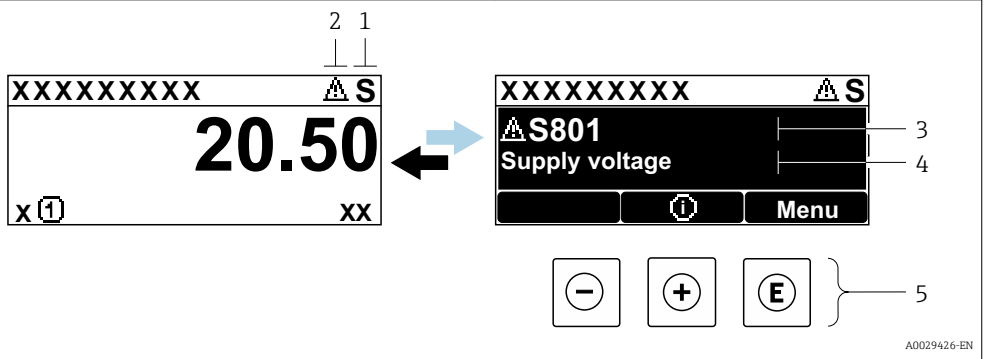
LED		Color	Meaning
3	Supply voltage	Green	Supply voltage is ok
		Off	Supply voltage is off or too low

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.

Operational display in alarm condition	Diagnostic message



1 *Status signal*
2 *Diagnostic behavior*
3 *Diagnostic behavior with diagnostic code*
4 *Short text*
5 *Operating elements*

If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter
- Via submenus → 161

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

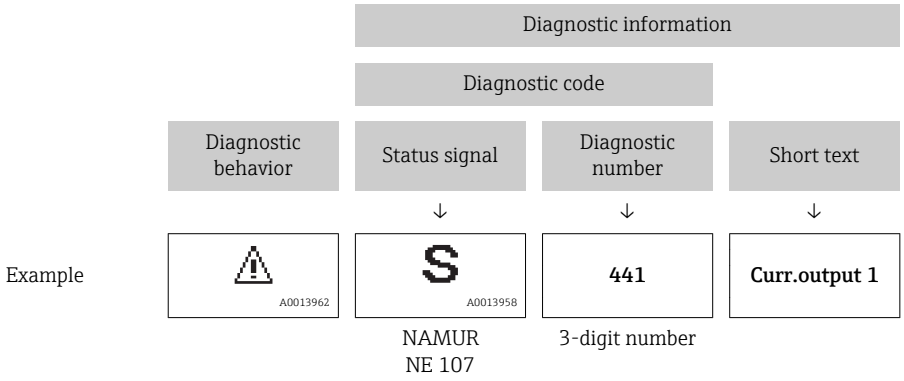
Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
M	**Maintenance required** Maintenance is required. The measured value remains valid.

Diagnostic behavior

Symbol	Meaning
	**Alarm** ▪ Measurement is interrupted. ▪ Signal outputs and totalizers assume the defined alarm condition. ▪ A diagnostic message is generated.
	**Warning** Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

Diagnostic information

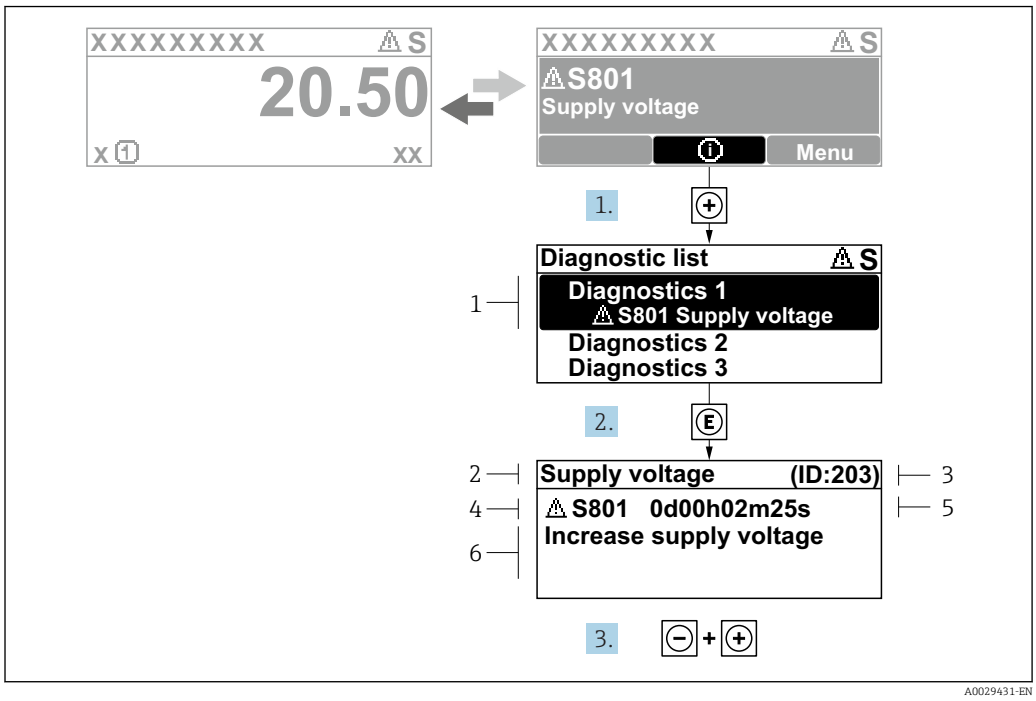
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Key	Meaning
	**Plus key** *In a menu, submenu* Opens the message about remedy information.
	**Enter key** *In a menu, submenu* Opens the operating menu.

12.3.2 Calling up remedial measures



42 *Message for remedial measures*

1 *Diagnostic information*
2 *Short text*
3 *Service ID*
4 *Diagnostic behavior with diagnostic code*
5 *Operation time of occurrence*
6 *Remedial measures*

The user is in the diagnostic message.

1. Press ⊞ (ⓘ symbol).
   ↳ The **Diagnostic list** submenu opens.
2. Select the desired diagnostic event with ⊞ or ⊟ and press Ⓔ .
   ↳ The message for the remedial measures for the selected diagnostic event opens.
3. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

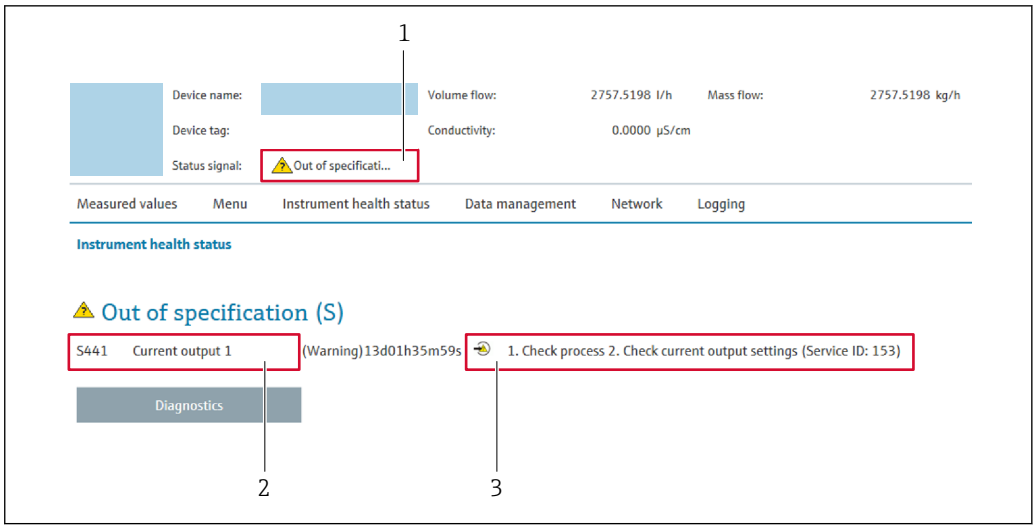
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

1. Press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

12.4 Diagnostic information in the Web browser

12.4.1 Diagnostic options

Any faults detected by the measuring device are displayed in the Web browser on the home page once the user has logged on.



A0031056

1 *Status area with status signal*
2 *Diagnostic information→ 151*
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter
- Via submenu → 161

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
	Failure A device error has occurred. The measured value is no longer valid.
	Function check The device is in service mode (e.g. during a simulation).
	Out of specification The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
	Maintenance required Maintenance is required. The measured value is still valid.

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

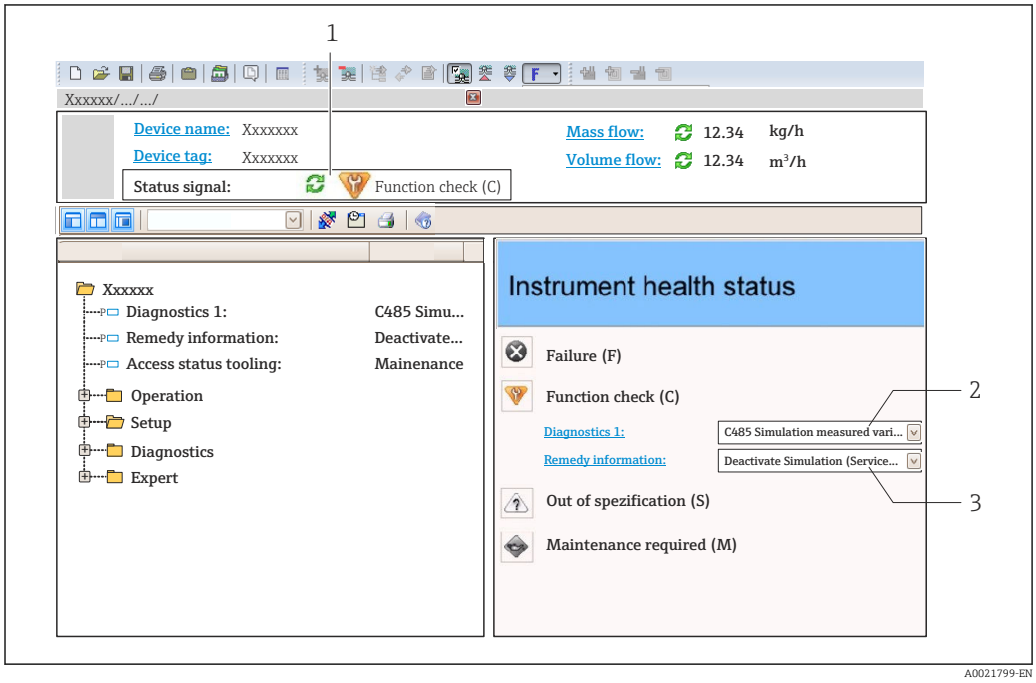
12.4.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly. These measures are displayed in red along with the diagnostic event and the related diagnostic information.

12.5 Diagnostic information in DeviceCare or FieldCare

12.5.1 Diagnostic options

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.

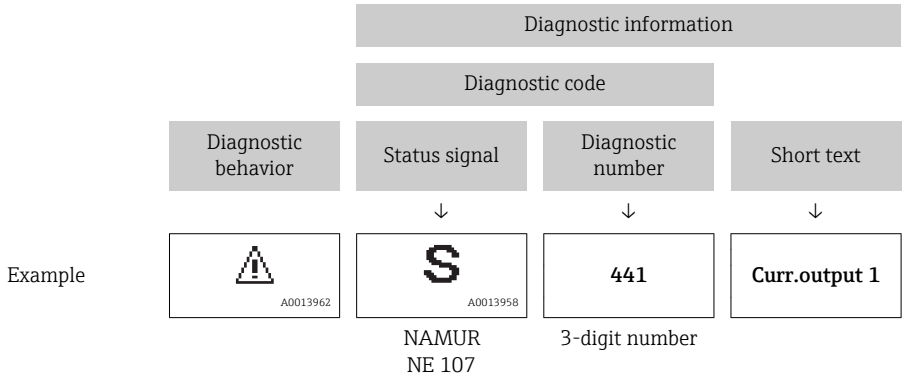


1 *Status area with status signal* → 150
2 *Diagnostic information* → 151
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter
- Via submenu → 161

Diagnostic information

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



12.5.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:

- On the home page
  Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu
  Remedy information can be called up in the working area of the user interface.

The user is in the **Diagnostics** menu.

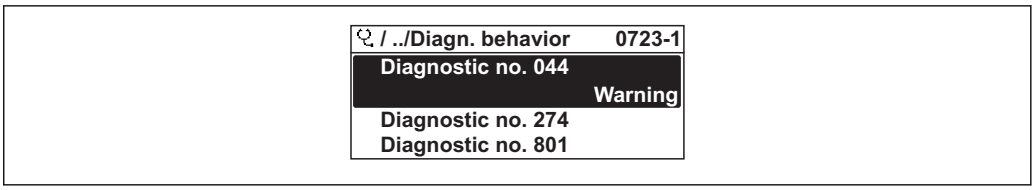
1. Call up the desired parameter.
2. On the right in the working area, mouse over the parameter.
   ↳ A tool tip with remedy information for the diagnostic event appears.

12.6 Adapting the diagnostic information

12.6.1 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic behavior** submenu.

Expert → System → Diagnostic handling → Diagnostic behavior



43 *Taking the example of the local display*

You can assign the following options to the diagnostic number as the diagnostic behavior:

Options	Description
Alarm	The device stops measurement. The signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. The background lighting changes to red.
Warning	The device continues to measure. The signal outputs and totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is displayed only in the **Event logbook** submenu (**Event list** submenu) and is not displayed in alternation with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.6.2 Adapting the status signal

Each item of diagnostic information is assigned a specific status signal at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic event category** submenu.

Expert → Communication → Diagnostic event category

Available status signals

Configuration as per HART 7 Specification (Condensed Status), in accordance with NAMUR NE107.

Symbol	Meaning
F A0013956	**Failure** A device error is present. The measured value is no longer valid.
C A0013959	**Function check** The device is in service mode (e.g. during a simulation).
S A0013958	**Out of specification** The device is being operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
M A0013957	**Maintenance required** Maintenance is required. The measured value is still valid.
N A0023076	Has no effect on the condensed status.

12.7 Overview of diagnostic information

The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information → 155

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
043	Sensor short circuit	1. Check sensor cable and sensor 2. Execute Heartbeat Verification 3. Replace sensor cable or sensor	S	Warning [1]
082	Data storage	1. Check module connections 2. Contact service	F	Alarm
083	Memory content	1. Restart device 2. Restore HistoROM S-DAT backup ('Device reset' parameter) 3. Replace HistoROM S-DAT	F	Alarm
170	Coil resistance	Check ambient and process temperature	F	Alarm
180	Temperature sensor defective	1. Check sensor connections 2. Replace sensor cable or sensor 3. Turn off temperature measurement	F	Warning
181	Sensor connection	1. Check sensor cable and sensor 2. Execute Heartbeat Verification 3. Replace sensor cable or sensor	F	Alarm
Diagnostic of electronic				
201	Device failure	1. Restart device 2. Contact service	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change electronic modules	F	Alarm
262	Sensor electronic connection faulty	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics 2. Check or replace ISEM or main electronics	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	Change electronic	F	Alarm
275	I/O module 1 to n defective	Change I/O module	F	Alarm
276	I/O module 1 to n faulty	1. Restart device 2. Change I/O module	F	Alarm
283	Memory content	1. Reset device 2. Contact service	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning
311	Electronic failure	1. Do not reset device 2. Contact service	M	Warning
332	Writing in embedded HistoROM failed	Replace user interface board Ex d/XP: replace transmitter	F	Alarm
361	I/O module 1 to n faulty	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
372	Sensor electronic (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
373	Sensor electronic (ISEM) faulty	1. Transfer data or reset device 2. Contact service	F	Alarm
375	I/O- 1 to n communication failed	1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules	F	Alarm
376	Sensor electronic (ISEM) faulty	1. Replace sensor electronic module (ISEM) 2. Turn off diagnostic message	F	Warning [1)]
377	Sensor electronic (ISEM) faulty	1. Check sensor cable and sensor 2. Perform Heartbeat Verification 3. Replace sensor cable or sensor	F	Warning [1)]
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	1. Restart device 2. Delete T-DAT via 'Reset device' parameter 3. Replace T-DAT	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
387	Embedded HistoROM failed	Contact service organization	F	Alarm
512	Sensor electronic (ISEM) faulty	1. Check ECC recovery time 2. Turn off ECC	F	Alarm
Diagnostic of configuration				
303	I/O 1 to n configuration changed	1. Apply I/O module configuration (parameter 'Apply I/O configuration') 2. Afterwards reload device description and check wiring	M	Warning
330	Flash file invalid	1. Update firmware of device 2. Restart device	M	Warning
331	Firmware update failed	1. Update firmware of device 2. Restart device	F	Warning
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 to n	Carry out trim	C	Warning
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1 to n	1. Check process 2. Check current output settings	S	Warning [1)]
442	Frequency output 1 to n	1. Check process 2. Check frequency output settings	S	Warning [1)]
443	Pulse output 1 to n	1. Check process 2. Check pulse output settings	S	Warning [1)]
444	Current input 1 to n	1. Check process 2. Check current input settings	S	Warning [1)]
453	Flow override	Deactivate flow override	C	Warning
484	Failure mode simulation	Deactivate simulation	C	Alarm
485	Measured variable simulation	Deactivate simulation	C	Warning
486	Current input 1 to n simulation	Deactivate simulation	C	Warning
491	Current output 1 to n simulation	Deactivate simulation	C	Warning
492	Simulation frequency output 1 to n	Deactivate simulation frequency output	C	Warning
493	Simulation pulse output 1 to n	Deactivate simulation pulse output	C	Warning
494	Switch output simulation 1 to n	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation	Deactivate simulation	C	Warning
496	Status input simulation	Deactivate simulation status input	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
502	CT activation/ deactivation failed	Follow the sequence of the custody transfer activation/deactivation: First authorized user login, then set the DIP switch on the main electonic module	C	Warning
511	Sensor electronic (ISEM) faulty	1. Check measuring period and integration time 2. Check sensor properties	C	Alarm
520	I/O 1 to n hardware configuration invalid	1. Check I/O hardware configuration 2. Replace wrong I/O module 3. Plug the module of double pulse output on correct slot	F	Alarm
530	Electrode cleaning is running	Turn off ECC	C	Warning
531	Empty pipe detection	Execute EPD adjustment	S	Warning [1)]
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
540	Custody transfer mode failed	1. Deactivate custody transfer mode 2. Reactivate custody transfer mode	F	Alarm
543	Double pulse output	1. Check process 2. Check pulse output settings	S	Warning [1)]
593	Double pulse output simulation	Deactivate simulation pulse output	C	Warning
594	Relay output simulation	Deactivate simulation switch output	C	Warning
599	Custody transfer logbook full	1. Deactivate custody transfer mode 2. Clear custody transfer logbook (all 30 entries) 3. Activate custody transfer mode	F	Warning
Diagnostic of process				
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
832	Electronic temperature too high	Reduce ambient temperature	S	Warning [1)]
833	Electronic temperature too low	Increase ambient temperature	S	Warning [1)]
834	Process temperature too high	Reduce process temperature	S	Warning [1)]
835	Process temperature too low	Increase process temperature	S	Warning [1)]
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning
882	Input signal	1. Check input configuration 2. Check external device or process conditions	F	Alarm
937	EMC interference	1. Eliminate external magnetic field near sensor 2. Turn off diagnostic message	S	Warning [1)]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
938	EMC interference	1. Check ambient conditions regarding EMC influence 2. Turn off diagnostic message	F	Alarm [1]
962	Empty pipe	1. Perform full pipe adjustment 2. Perform empty pipe adjustment 3. Turn off empty pipe detection	S	Warning [1]

1) Diagnostic behavior can be changed.

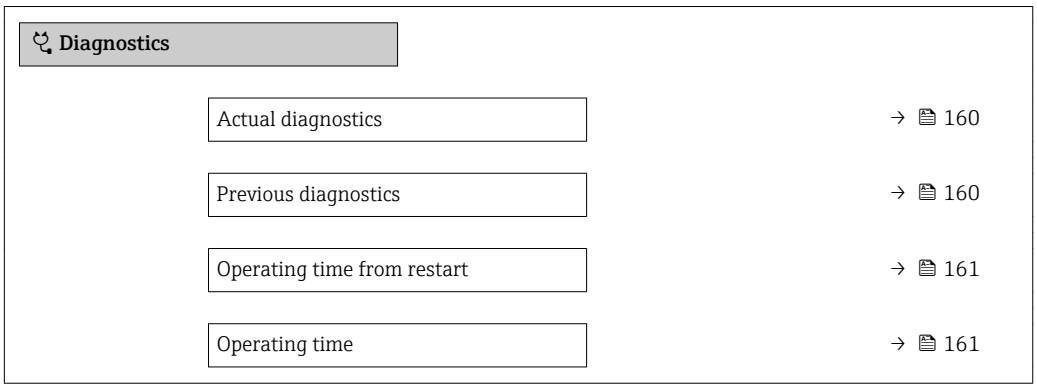
12.8 Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:
- Via local display → 152
- Via Web browser → 153
- Via "FieldCare" operating tool → 155
- Via "DeviceCare" operating tool → 155

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 161

Navigation
"Diagnostics" menu



Parameter overview with brief description

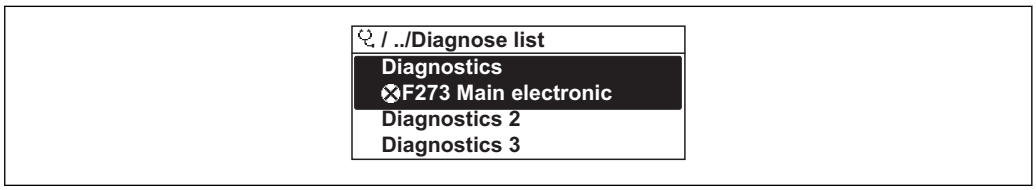
Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occured diagnostic event along with its diagnostic information. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Symbol for diagnostic behavior, diagnostic code and short message.
Previous diagnostics	Two diagnostic events have already occurred.	Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.

Parameter	Prerequisite	Description	User interface
Operating time from restart	–	Shows the time the device has been in operation since the last device restart.	Days (d), hours (h), minutes (m) and seconds (s)
Operating time	–	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)

12.9 Diagnostic list

Up to 5 currently pending diagnostic events can be displayed in the **Diagnostic list** submenu along with the associated diagnostic information. If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

Navigation path
Diagnostics → Diagnostic list



44 *Taking the example of the local display*

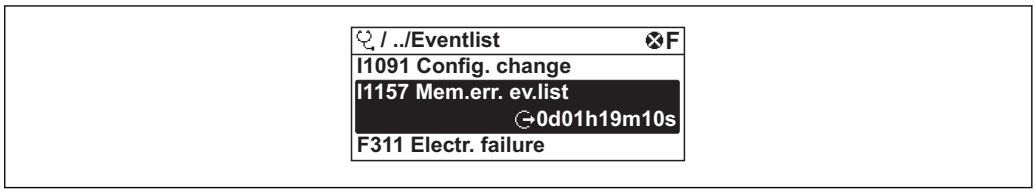
To call up the measures to rectify a diagnostic event:
- Via local display → 152
- Via Web browser → 153
- Via "FieldCare" operating tool → 155
- Via "DeviceCare" operating tool → 155

12.10 Event logbook

12.10.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Events list** submenu.

Navigation path
Diagnostics menu → **Event logbook** submenu → Event list



45 *Taking the example of the local display*

- Max. 20 event messages can be displayed in chronological order.
- If the **Extended HistoROM** application package (order option) is enabled in the device, the event list can contain up to 100 entries .

The event history includes entries for:
- Diagnostic events → 156
- Information events → 162

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostic event
  - ⊕: Occurrence of the event
  - ⊖: End of the event
- Information event
  ⊕: Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 📄 152
- Via Web browser → 📄 153
- Via "FieldCare" operating tool → 📄 155
- Via "DeviceCare" operating tool → 📄 155

For filtering the displayed event messages → 📄 162

12.10.2 Filtering the event logbook

Using the **Filter options** parameter you can define which category of event message is displayed in the **Events list** submenu.

Navigation path
Diagnostics → Event logbook → Filter options

Filter categories
- All
- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
- Information (I)

12.10.3 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Embedded HistoROM deleted
I1137	Electronic changed
I1151	History reset
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1184	Display connected
I1256	Display: access status changed
I1264	Safety sequence aborted
I1278	I/O module reset detected
I1335	Firmware changed

Info number	Info name
I1351	Empty pipe detection adjustment failure
I1353	Empty pipe detection adjustment ok
I1361	Web server login failed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1443	Coating thickness not determined
I1444	Device verification passed
I1445	Device verification failed
I1450	Monitoring off
I1451	Monitoring on
I1457	Measured error verification failed
I1459	I/O module verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1517	Custody transfer active
I1518	Custody transfer inactive
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off
I1618	I/O module replaced
I1619	I/O module replaced
I1621	I/O module replaced
I1622	Calibration changed
I1624	Reset all totalizers
I1625	Write protection activated
I1626	Write protection deactivated
I1627	Web server login successful
I1628	Display login successful
I1629	CDI login successful
I1631	Web server access changed
I1632	Display login failed
I1633	CDI login failed
I1634	Parameter factory reset
I1635	Parameter delivery reset
I1639	Max. switch cycles number reached
I1643	Custody transfer logbook cleared
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1651	Custody transfer parameter changed

Info number	Info name
I1712	New flash file received
I1725	Sensor electronic module (ISEM) changed
I1726	Configuration backup failed

12.11 Resetting the measuring device

Using the**Device reset** parameter (→ 127) it is possible to reset the entire device configuration or some of the configuration to a defined state.

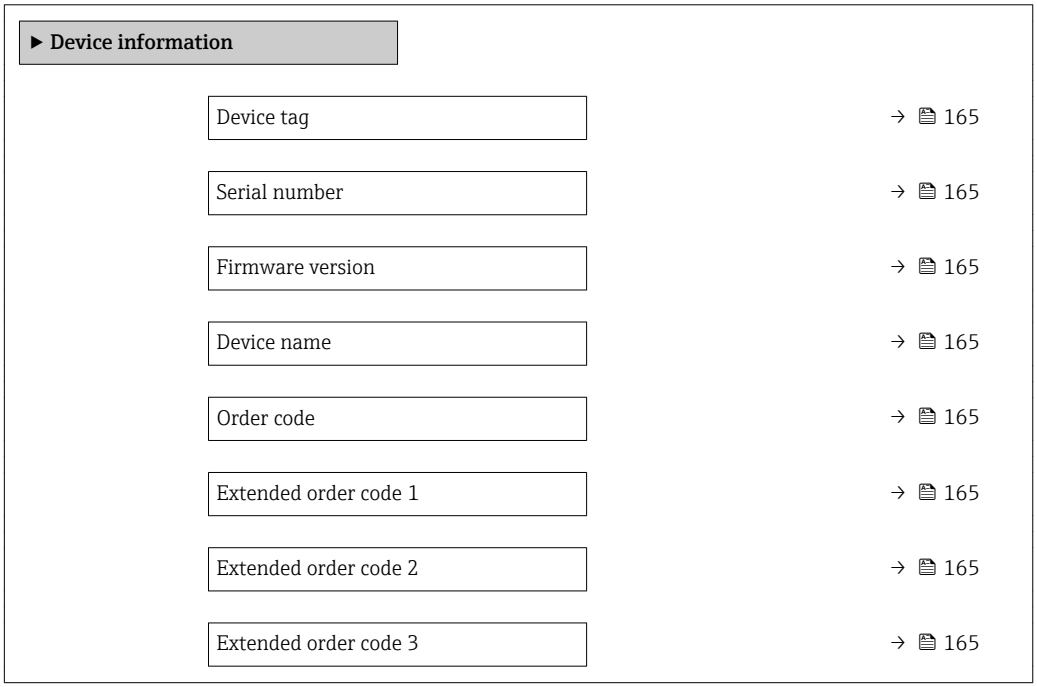
12.11.1 Function scope of the "Device reset" parameter

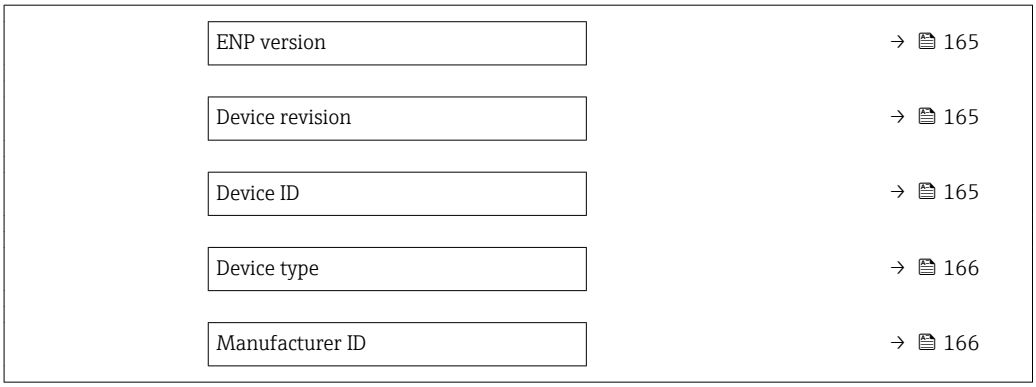
Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.
Restart device	The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restore the data that are saved on the S-DAT. The data record is restored from the electronics memory to the S-DAT.

12.12 Device information

The **Device information** submenu contains all parameters that display different information for device identification.

Navigation
"Diagnostics" menu → Device information





Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag300/500
Serial number	Shows the serial number of the measuring device.	A maximum of 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	–
Device name	Shows the name of the transmitter. The name can be found on the nameplate of the transmitter.	Promag300/500	–
Order code	Shows the device order code. The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field.	Character string composed of letters, numbers and certain punctuation marks (e.g. /).	–
Extended order code 1	Shows the 1st part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00
Device revision	Shows the device revision with which the device is registered with the HART Communication Foundation.	2-digit hexadecimal number	1
Device ID	Shows the device ID for identifying the device in a HART network.	6-digit hexadecimal number	–

Parameter	Description	User interface	Factory setting
Device type	Shows the device type with which the measuring device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x3A (for Promag 500)
Manufacturer ID	Shows the manufacturer ID device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x11 (for Endress+Hauser)

12.13 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
08.2016	01.00.zz	Option **76**	Original firmware	Operating Instructions	BA01399D/06/EN/01.16

It is possible to flash the firmware to the current version or the previous version using the service interface.

For the compatibility of the firmware version with the previous version, the installed device description files and operating tools, observe the information about the device in the "Manufacturer's information" document.

The manufacturer's information is available:
- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 5H5B
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

13.1.2 Interior cleaning

No interior cleaning is planned for the device.

13.1.3 Replacing seals

The sensor's seals (particularly aseptic molded seals) must be replaced periodically.

The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.

Replacement seals (accessory) → 197

13.2 Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

List of some of the measuring and testing equipment: → 170

13.3 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14 Repairs

14.1 General notes

14.1.1 Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to other certified devices by Endress+Hauser Service or at the factory.

14.1.2 Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:
- ▶ Use only original Endress+Hauser spare parts.
- ▶ Carry out the repair according to the Installation Instructions.
- ▶ Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- ▶ Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

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

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→ 165) in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14.4 Return

The measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at
http://www.endress.com/support/return-material

14.5 Disposal

14.5.1 Removing the measuring device

1. Switch off the device.

⚠ WARNING

Danger to persons from process conditions.

- Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring device

⚠ WARNING

Danger to personnel and environment from fluids that are hazardous to health.

- Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

15 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.

15.1 Device-specific accessories

15.1.1 For the transmitter

Accessories	Description
Transmitter ▪ Proline 500 ▪ Proline 500 – digital	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 EA01150 For details ▪ Proline 500 – digital transmitter: Installation Instructions EA01151 ▪ Proline 500 transmitter: Installation Instructions EA01152 Proline 500 transmitter for replacement: the serial number of the current transmitter should always be quoted when ordering. On the basis of the serial number, the device-specific data of the replacement device can also be used for the new transmitter.
WLAN antenna Wide range	External WLAN antenna for a range of up to 50 m (165 ft). Further information on the WLAN interface → 82.
Post mounting kit	Post mounting kit for transmitter. The post mounting kit can only be ordered together with a transmitter.
Protective cover Proline 500	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. For details, see Installation Instructions EA01160
Display guard Proline 500 – digital	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. For details, see Installation Instructions EA01161
Ground cable	Set, consisting of two ground cables for potential equalization.

Connecting cable Proline 500 – digital Sensor – Transmitter	The following cable lengths are available: order code for "Cable, sensor connection" ▪ Option **B**: 20 m (65 ft) ▪ Option **E**: User configurable up to max. 50 m ▪ Option **F**: User configurable up to max. 165 ft Maximum possible cable length for a Proline 500 – digital connecting cable: 300 m (1 000 ft)
Connecting cable Proline 500 Sensor – Transmitter	The following cable lengths are available: order code for "Cable, sensor connection" ▪ Option **1**: 5 m (16 ft) ▪ Option **2**: 10 m (32 ft) ▪ Option **3**: 20 m (65 ft) ▪ Option **4**: User-configurable cable length (m) ▪ Option **5**: User-configurable cable length (ft) Reinforced connecting cable with an additional, reinforcing metal braid: ▪ Option **6**: User-configurable cable length (m) ▪ Option **7**: User-configurable cable length (ft) Possible cable length for a Proline 500 connecting cable: depends on the medium conductivity, max. 200 m (660 ft)

15.1.2 For the sensor

Accessories	Description
Ground disks	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

15.2 Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Fieldgate FXA320	Gateway for the remote monitoring of connected 4 to 20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

15.3 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://wapps.endress.com/applicator ▪ As a downloadable DVD for local PC installation.
W@M	W@M Life Cycle Management 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. 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. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement
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. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S

15.4 System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all 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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

16 Technical data

16.1 Application

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are sufficiently resistant.

16.2 Function and system design

Measuring principle

Electromagnetic flow measurement on the basis of *Faraday's law of magnetic induction*.

Measuring system

The measuring system consists of a transmitter and a sensor. The transmitter and sensor are mounted in physically separate locations. They are interconnected by one or two connecting cable(s).

For information on the structure of the device → 14

16.3 Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity

Calculated measured variables

- Mass flow
- Corrected volume flow

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
32	–	15 to 500	125	1	2
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1200	10	20

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
125	–	220 to 7 500	1850	15	30
150	6	20 to 600 m³/h	150 m³/h	0.03 m³	2.5 m³/h
200	8	35 to 1 100 m³/h	300 m³/h	0.05 m³	5 m³/h
250	10	55 to 1 700 m³/h	500 m³/h	0.05 m³	7.5 m³/h
300	12	80 to 2 400 m³/h	750 m³/h	0.1 m³	10 m³/h
350	14	110 to 3 300 m³/h	1 000 m³/h	0.1 m³	15 m³/h
400	16	140 to 4 200 m³/h	1 200 m³/h	0.15 m³	20 m³/h
450	18	180 to 5 400 m³/h	1 500 m³/h	0.25 m³	25 m³/h
500	20	220 to 6 600 m³/h	2 000 m³/h	0.25 m³	30 m³/h
600	24	310 to 9 600 m³/h	2 500 m³/h	0.3 m³	40 m³/h

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
½	15	1.0 to 27	6	0.1	0.15
1	25	2.5 to 80	18	0.2	0.25
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1200	10	15
10	250	250 to 7 500	1500	15	30
12	300	350 to 10 600	2400	25	45
14	350	500 to 15 000	3600	30	60
16	400	600 to 19 000	4800	50	60
18	450	800 to 24 000	6000	50	90
20	500	1 000 to 30 000	7500	75	120
24	600	1 400 to 44 000	10500	100	180

Recommended measuring range

"Flow limit" section → 187

Operable flow range — Over 1000 : 1

Input signal

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device:
- Fluid temperature to increase the accuracy of the electrical conductivity (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 172

It is recommended to read in external measured values to calculate the following measured variables:
Corrected volume flow

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 → 175.

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 µA
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	▪ Pressure ▪ Temperature ▪ Density

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Adjustable: 5 to 200 ms
Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

16.4 Output

Output signal

HART current output

Current output	4 to 20 mA HART
Current span	Can be set to: 4 to 20 mA (active/passive)
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Current output 0/4 to 20 mA

Current output	0/4 to 20 mA
Maximum output values	22.5 mA
Current span	Can be set to: ▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
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	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: ▪ 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	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume 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	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature
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	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ 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
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)
Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

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:

Current output 0/4 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 ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value (f_{max} 2 to 12 500 Hz)
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: ▪ 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
- Via service interface

Plain text display	With information on cause and remedial measures

Web server

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 Diagnostic information via light emitting diodes

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).

Protocol-specific data

Manufacturer ID	0x11
Device type ID	0x3C
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: 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 ▪ Corrected volume flow ▪ Flow velocity ▪ Temperature ▪ Electronic temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Temperature ▪ Electronic 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 = corrected volume flow ▪ 3 = flow velocity ▪ 4 = conductivity ▪ 5 = corrected conductivity ▪ 6 = temperature ▪ 7 = electronic temperature ▪ 8 = totalizer 1 ▪ 9 = totalizer 2 ▪ 10 = totalizer 3

16.5 Power supply

Terminal assignment

→ 40

Supply voltage

Order code for "Power supply"	terminal voltage		Frequency range
Option **D**	DC 24 V	±20%	–
Option **E**	AC100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz
Option **I**	DC 24 V	±20%	–
	AC100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz

Power consumption

Transmitter

Max. 10 W (active power)

Current consumption

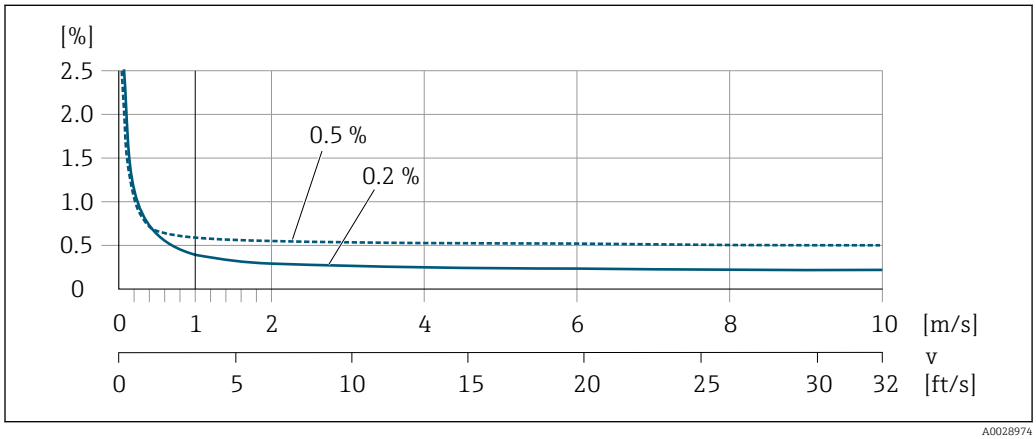
Transmitter

- 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. ▪ Configuration is retained in the plug-in memory (HistoROM DAT). ▪ Error messages (incl. total operated hours) are stored.
Electrical connection	→ 📄 43
Potential equalization	→ 📄 53
Terminals	**Transmitter** Spring terminals for conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG)
Cable entries	▪ Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in) ▪ Thread for cable entry: – NPT ½" – G ½" – M20
Cable specification	→ 📄 37

16.6 Performance characteristics

Reference operating conditions	▪ Error limits following DIN EN 29104, in future ISO 20456 ▪ Water, typically +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi) ▪ Data as indicated in the calibration protocol ▪ Accuracy based on accredited calibration rigs according to ISO 17025
Maximum measured error	**Error limits under reference operating conditions** o.r. = of reading **Volume flow** ▪ ±0.5 % o.r. ± 1 mm/s (0.04 in/s) ▪ Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s) Fluctuations in the supply voltage do not have any effect within the specified range.



46 *Maximum measured error in % o.r.*

Electrical conductivity
Max. measured error not specified.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

o.r. = of reading

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

Repeatability

o.r. = of reading

Volume flow
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity
Max. ±5 % o.r.

Influence of ambient temperature

Current output

o.r. = of reading

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

16.7 Installation

"Mounting requirements" → 23

16.8 Environment

Ambient temperature range

→ 25

Temperature tables

Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

Storage temperature

−50 to +80 °C (−58 to +176 °F)

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Degree of protection

Transmitter
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

Sensor
As standard: IP66/67, type 4X enclosure

External WLAN antenna
IP67

Vibration resistance

- Vibration, sinusoidal according to IEC 60068-2-6
  - 2 to 8.4 Hz, 3.5 mm peak
  - 8.4 to 2 000 Hz, 1 g peak
- Vibration broad-band random, according to IEC 60068-2-64
  - 10 to 200 Hz, 0.003 g^2/Hz
  - 200 to 2 000 Hz, 0.001 g^2/Hz
  - Total: 1.54 g rms

Shock resistance

Shock, half-sine according to IEC 60068-2-27
6 ms 30 g

Impact resistance

Rough handling shocks according to IEC 60068-2-31

Mechanical load

- Protect the transmitter housing against mechanical effects, such as shock or impact.
- Never use the transmitter housing as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

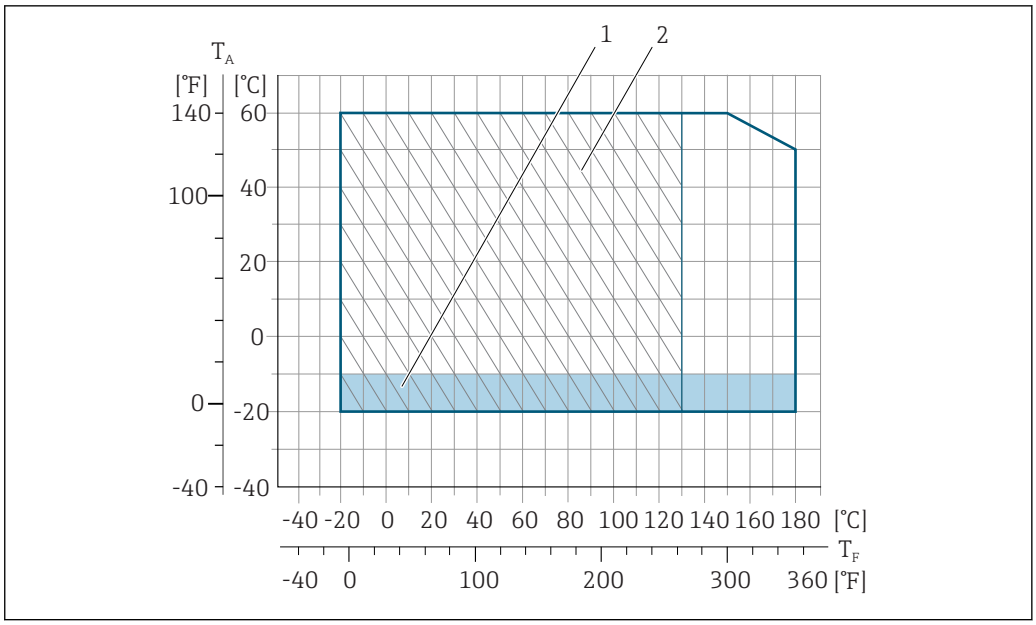
As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)

For details, refer to the Declaration of Conformity.

16.9 Process

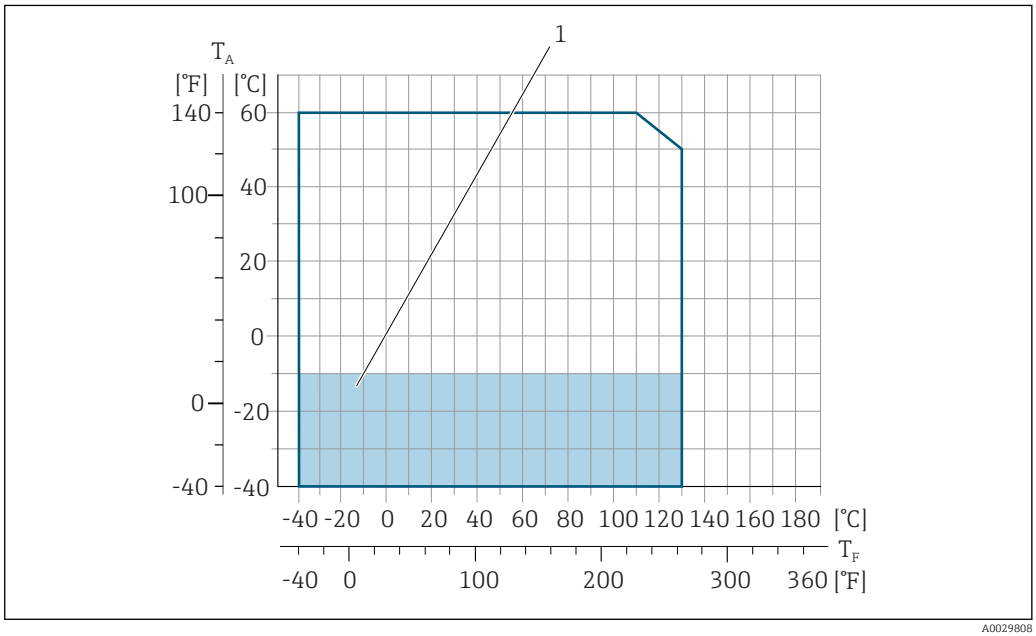
Medium temperature range

- −20 to +150 °C (−4 to +302 °F) for PFA, DN 25 to 200 (1 to 8")
- −20 to +180 °C (−4 to +356 °F) for PFA high-temperature, DN 25 to 200 (1 to 8")
- −40 to +130 °C (−40 to +266 °F) for PTFE, DN 15 to 600 (½ to 24")



47 *PFA*

T_A *Ambient temperature range*
T_F *Fluid temperature*
1 *Colored area: the ambient temperature range −10 to −20 °C (+14 to −4 °F) applies to stainless flanges only*
2 *Hatched area: harsh environment IP69K only for fluid temperature range −20 to +130 °C (−4 to +266 °F)*



48 *PTFE*

T_A *Ambient temperature range*
T_F *Fluid temperature*
1 *Colored area: the ambient temperature range of −10 to −40 °C (+14 to −40 °F) applies to stainless flanges only*

Conductivity

≥ 5 µS/cm for liquids in general. Stronger filter damping is required for very low conductivity values.

Proline 500
The necessary minimum conductivity also depends on the cable length .

Pressure-temperature ratings

An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document

Pressure tightness

"–" = no specifications possible

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 to +180 °C (+212 to +356 °F)
25	1	0 (0)	0 (0)	0 (0)
32	–	0 (0)	0 (0)	0 (0)
40	1 ½	0 (0)	0 (0)	0 (0)
50	2	0 (0)	0 (0)	0 (0)
65	–	0 (0)	–	0 (0)
80	3	0 (0)	–	0 (0)
100	4	0 (0)	–	0 (0)
125	–	0 (0)	–	0 (0)
150	6	0 (0)	–	0 (0)
200	8	0 (0)	–	0 (0)

Liner: PTFE

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
15	½	0 (0)	0 (0)	0 (0)	100 (1.45)
25	1	0 (0)	0 (0)	0 (0)	100 (1.45)
32	–	0 (0)	0 (0)	0 (0)	100 (1.45)
40	1 ½	0 (0)	0 (0)	0 (0)	100 (1.45)
50	2	0 (0)	0 (0)	0 (0)	100 (1.45)
65	–	0 (0)	–	40 (0.58)	130 (1.89)
80	3	0 (0)	–	40 (0.58)	130 (1.89)
100	4	0 (0)	–	135 (1.96)	170 (2.47)
125	–	135 (1.96)	–	240 (3.48)	385 (5.58)
150	6	135 (1.96)	–	240 (3.48)	385 (5.58)
200	8	200 (2.90)	–	290 (4.21)	410 (5.95)
250	10	330 (4.79)	–	400 (5.80)	530 (7.69)
300	12	400 (5.80)	–	500 (7.25)	630 (9.14)
350	14	470 (6.82)	–	600 (8.70)	730 (10.6)
400	16	540 (7.83)	–	670 (9.72)	800 (11.6)
450	18	No negative pressure permitted!			
500	20				
600	24				

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludge)

A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

For an overview of the full scale values for the measuring range, see the "Measuring range" section → 173

Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 26

System pressure

→ 25

Vibrations

→ 25

16.10 Mechanical construction

Design, dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

Weight

Excluding the transmitter
- Aluminum
  - 6.5 kg (14.3 lbs)
  - Digital: 2.4 kg (5.3 lbs)
- Polycarbonate: 1.4 kg (3.1 lbs)
- Cast, stainless:15.6 kg (34.4 lbs)

Weight specifications apply to standard pressure ratings and without packaging material.

Cast connection housing version, stainless: +3.7 kg (+8.2 lbs)

Weight in SI units

Nominal diameter		EN (DIN), AS [1)]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
15	½	PN 40	4.5	Class 150	4.5	10K	4.5
25	1	PN 40	5.3	Class 150	5.3	10K	5.3
32	–	PN 40	6	Class 150	–	10K	5.3
40	1 ½	PN 40	7.4	Class 150	7.4	10K	6.3
50	2	PN 40	8.6	Class 150	8.6	10K	7.3
65	–	PN 16	10	Class 150	–	10K	9.1
80	3	PN 16	12	Class 150	12	10K	10.5
100	4	PN 16	14	Class 150	14	10K	12.7
125	–	PN 16	19.5	Class 150	–	10K	19
150	6	PN 16	23.5	Class 150	23.5	10K	22.5

Nominal diameter		EN (DIN), AS [1)]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
200	8	PN 10	43	Class 150	43	10K	39.9
250	10	PN 10	63	Class 150	73	10K	67.4
300	12	PN 10	68	Class 150	108	10K	70.3
350	14	PN 10	103	Class 150	173		
400	16	PN 10	118	Class 150	203		
450	18	PN 10	159	Class 150	253		
500	20	PN 10	154	Class 150	283		
600	24	PN 10	206	Class 150	403		

1) For flanges to AS, only DN 25 and 50 are available.

Weight in US units

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
15	½	Class 150	9.92
25	1	Class 150	11.7
40	1 ½	Class 150	16.3
50	2	Class 150	19.0
80	3	Class 150	26.5
100	4	Class 150	30.9
150	6	Class 150	51.8
200	8	Class 150	94.8
250	10	Class 150	161.0
300	12	Class 150	238.1
350	14	Class 150	381.5
400	16	Class 150	447.6
450	18	Class 150	557.9
500	20	Class 150	624.0
600	24	Class 150	888.6

Measuring tube specification

Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
15	½	PN 40	Class 150	–	–	20K	–	–	15	0.59
25	1	PN 40	Class 150	Table E	–	20K	23	0.91	26	1.02
32	–	PN 40	–	–	–	20K	32	1.26	35	1.38
40	1 ½	PN 40	Class 150	–	–	20K	36	1.42	41	1.61
50	2	PN 40	Class 150	Table E	PN 16	10K	48	1.89	52	2.05
65	–	PN 16	–	–	–	10K	63	2.48	67	2.64
80	3	PN 16	Class 150	–	–	10K	75	2.95	80	3.15

Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
100	4	PN 16	Class 150	–	–	10K	101	3.98	104	4.09
125	–	PN 16	–	–	–	10K	126	4.96	129	5.08
150	6	PN 16	Class 150	–	–	10K	154	6.06	156	6.14
200	8	PN 10	Class 150	–	–	10K	201	7.91	202	7.95

Materials

Transmitter housing

Proline 500 – digital transmitter housing

Order code for "Transmitter housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **D** "Polycarbonate": polycarbonate

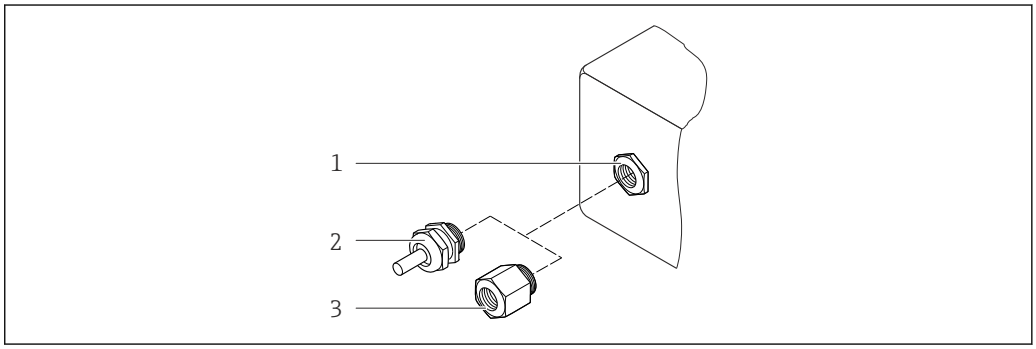
Proline 500 transmitter housing

Order code for "Transmitter housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **L** "Cast, stainless": cast, stainless steel, 1.4409 (CF3M) similar to 316L

Window material

Order code for "Transmitter housing":
- Option **A** "Aluminum, coated": glass
- Option **D** "Polycarbonate": plastic
- Option **L** "Cast, stainless": glass

Cable entries/cable glands



49 *Possible cable entries/cable glands*

1 *Cable entry with M20 × 1.5 internal thread*
2 *Cable gland M20 × 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*

Cable entries and adapters	Material
Cable gland M20 × 1.5	Plastic
▪ Adapter for cable entry with internal thread G ½" ▪ Adapter for cable entry with internal thread NPT ½" Only available for certain device versions: ▪ Order code for "Transmitter housing": – Option **A** "Aluminum, coated" – Option **D** "Polycarbonate" ▪ Order code for "Sensor connection housing": Option **A** "Aluminum coated"	Nickel-plated brass
▪ Adapter for cable entry with internal thread G ½" ▪ Adapter for cable entry with internal thread NPT ½" Only available for certain device versions: ▪ Order code for "Transmitter housing": Option **L** "Cast, stainless" ▪ Order code for "Sensor connection housing": Option **L** "Cast, stainless"	Stainless steel, 1.4404 (316L)

Connecting cable

Connecting cable for sensor - Proline 500 – digital transmitter

PVC cable with copper shield

Connecting cable for sensor - Proline 500 transmitter

- Standard cable: PVC cable with copper shield
- Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor connection housing

Order code for "Sensor connection housing":
- Option **A** "Aluminum coated": aluminum, AlSi10Mg, coated
- Option **L** "Cast, stainless": 1.4409 (CF3M) similar to 316L

Sensor housing

- DN 15 to 300 (½ to 12"): coated aluminum AlSi10Mg
- DN 350 to 600 (14 to 24"): carbon steel with protective varnish

Measuring tubes

Stainless steel, 1.4301/304/1.4306/304L; for flanges made of carbon with Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))

Liner

- PFA
- PTFE

Process connections

EN 1092-1 (DIN 2501)
Stainless steel, 1.4571 (F316L); carbon steel, FE410WB [3]/S235JRG2; Alloy C22, 2.4602 (UNS N06022)

ASME B16.5
Stainless steel, F316L; carbon steel, A105 [3]

3) DN 15 to 300 (½ to 12") with Al/Zn protective coating; DN 350 to 600 (14 to 24") with protective varnish

JIS B2220
Stainless steel, 1.0425 (F316L) [3]; carbon steel, S235JRG2/HII

AS 2129 Table E
- DN 25 (1"): carbon steel, A105/S235JRG2
- DN 40 (1 ½"): carbon steel, A105/S275JR

AS 4087 PN 16
Carbon steel, A105/S275JR

Electrodes

Stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium

Seals

In accordance with DIN EN 1514-1

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

- WLAN antenna:
  ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter:
  Stainless steel and copper

Ground disks

Stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); tantalum; titanium

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Fitted electrodes

Measuring electrodes, reference electrodes and electrodes for empty pipe detection:
- Standard: stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); tantalum, titanium
- Optional: only platinum measuring electrodes

Process connections

- ASME B16.5
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16

For information on the different materials used in the process connections → 190

Surface roughness

Stainless steel electrodes, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium:
≤ 0.3 to 0.5 µm (11.8 to 19.7 µin)
(All data relate to parts in contact with fluid)

Liner with PFA:
≤ 0.4 µm (15.7 µin)
(All data relate to parts in contact with fluid)

16.11 Operability

Languages

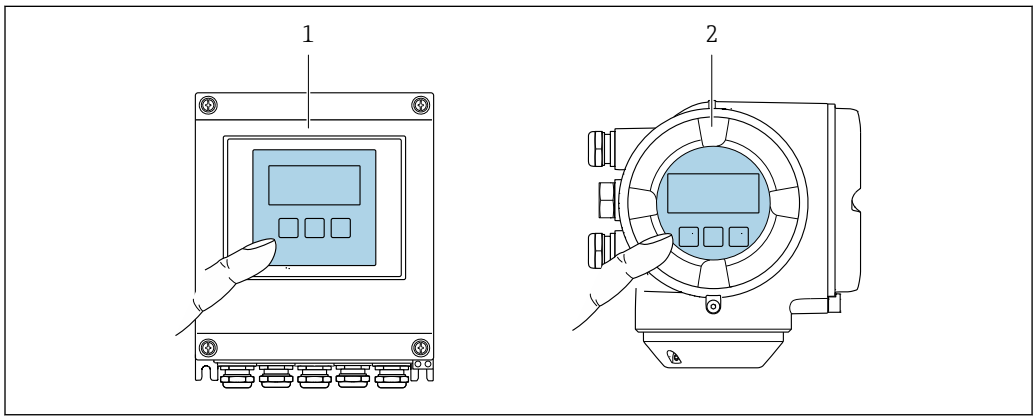
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via Web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation

Via display module

Two display modules are available:
- Order code for "Display; operation", option **F** "4-line, backlit, graphic display; touch control"
- Order code for "Display; operation", option **G** "4-line, backlit, graphic display; touch control + WLAN"

Information about WLAN interface → 82



50 *Operation with touch control*

1 *Proline 500 – digital*
2 *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 various hazardous areas

Remote operation → 81

Service interface → 82

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 the device → 198
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 172
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 172
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus 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:

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

The associated device description files are available at: 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 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 measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
- Uploading 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, create documentation of 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

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:

	Device memory	T-DAT	S-DAT
Available data	▪ Event history, such as diagnostic events ▪ Parameter data record backup ▪ Device firmware package ▪ Driver for system integration e.g.: DD for HART	▪ Measured value memory ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Maximum indicators (min/max values) ▪ Totalizer values	▪ Sensor data: diameter etc. ▪ Serial number ▪ User-specific access code (to use the "Maintenance" user role) ▪ Calibration data ▪ 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	Can be plugged into 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

Manual

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

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

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
- Use the recorded measured value data in the integrated device simulation function in the **Diagnostics** submenu (→ 160).

Service logbook

Manual

- Create up to 20 user-specific events with a date and customized text in a separate logbook for documentation of the measuring point
- Use for calibration or service operations, for example, or for maintenance or revision work that has been performed

16.12 Certificates and approvals

CE mark	The measuring system is in conformity with the statutory 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.
C-Tick symbol	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 "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
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 (multichannel architecture with homogeneous redundancy) and is independently evaluated and certified by the TÜV 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 → 198

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	Europe: RED 2014/53/EU United States of America: CFR Title 47, FCC Part 15.247 Canada: RSS-247 Issue 1 Japan: Article 2 clause 1 item 19 Additional country-specific approvals on request.
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

16.13 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.

Diagnostics functions

Package	Description
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.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**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 process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets. **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.

Cleaning

Package	Description
Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to AVOID build up of highly conductive matter and thin layers (typical of magnetite).

16.14 Accessories

Overview of accessories available for order → 170

16.15 Supplementary documentation

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

Standard documentation

Brief Operating Instructions

Part 1 of 2: Sensor

Measuring device	Documentation code
Proline Promag	KA01216D

Part 2 of 2: Transmitter

Measuring device	Documentation code
Proline 500	KA01230D

Technical Information

Measuring device	Documentation code
Promag P 500	TI01226D

Description of device parameters

Measuring device	Documentation code
Promag 500	GP01054D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex i	XA01522D
ATEX/IECEx Ex ec	XA01523D
cCSAus IS	XA01524D
cCSAus Ex e ia / Ex d ia	XA01525D
cCSAus Ex nA	XA01526D
INMETRO Ex i	XA01527D
INMETRO Ex ec	XA01528D
NEPSI Ex i	XA01529D
NEPSI Ex nA	XA01530D

Special documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Functional Safety Manual	SD01741D
Heartbeat Technology	SD01641D
Web server	SD01658D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Overview of accessories available for order → 170

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V

W

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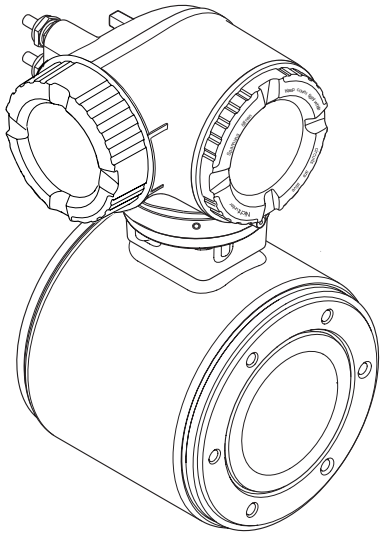
روبـروی پالایشگاه نفت پـارس، پلاک ۱۲

www.addresses.endress.com

Operating Instructions
Proline Promag H 300 HART

Electromagnetic flowmeter



Endress+Hauser
People for Process Automation

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

Table of contents

1 Document information

1.1 Document function

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
DANGER	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 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 ground connection** A terminal which must be connected to ground prior to establishing any other connections.
⏚	**Equipotential connection** A connection that has to be connected to the plant grounding system: This may be a potential equalization line or a star grounding system depending on national or company codes of practice.

1.2.3 Communication symbols

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

Symbol	Meaning
	**LED** Light emitting diode is off.
	**LED** Light emitting diode is on.
	**LED** Light emitting diode is flashing.

1.2.4 Tool symbols

Symbol	Meaning
	Flat blade screwdriver
	Allen key
	Open-ended wrench

1.2.5 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
	Notice or individual step to be observed
1., 2., 3...	Series of steps
	Result of a step
	Help in the event of a problem
	Visual inspection

1.2.6 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

Symbol	Meaning
	Hazardous area
	Safe area (non-hazardous area)
	Flow direction

1.3 Documentation

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

For a detailed list of the individual documents along with the documentation code → 175

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	**Planning aid for your device** The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.
Sensor Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 1** The Sensor Brief Operating Instructions are aimed at specialists with responsibility for installing the measuring device. ▪ Incoming acceptance and product identification ▪ Storage and transport ▪ Installation
Transmitter Brief Operating Instructions	**Guides you quickly to the 1st measured value - Part 2** The Transmitter Brief Operating Instructions are aimed at specialists with responsibility for commissioning, configuring and parameterizing the measuring device (until the first measured value). ▪ Product description ▪ Installation ▪ Electrical connection ▪ Operation options ▪ System integration ▪ Commissioning ▪ Diagnostic information
Description of Device Parameters	**Reference for your parameters** The document provides a detailed explanation of each individual parameter in the Expert operating menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

1.3.2 Supplementary device-dependent documentation

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

1.4 Registered trademarks

HART®
Registered trademark of the FieldComm Group, Austin, Texas, USA

Applicator®, FieldCare®, DeviceCare ®, Field Xpert™, HistoROM®, Heartbeat Technology™
Registered or registration-pending trademarks of the Endress+Hauser Group

2 Basic safety instructions

2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:
- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

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

2.2 Designated use

Application and media
The measuring device described in this manual is intended only for flow measurement of liquids with a minimum conductivity of 5 µS/cm.

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

Measuring devices for use in hazardous areas, in hygienic applications or where there is an increased risk due to process pressure, are labeled accordingly on the nameplate.

To ensure that the measuring device remains in proper condition for the operation time:
- Only use the measuring device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- Based on the nameplate, check whether the ordered device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- Use the measuring device only for media to which the process-wetted materials are sufficiently resistant.
- If the measuring device is not operated at atmospheric temperature, compliance with the relevant basic conditions specified in the associated device documentation is absolutely essential: "Documentation" section.→ 8.
- Protect the measuring device permanently against corrosion from environmental influences.

Incorrect use
Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

WARNING
Danger of breakage due to corrosive or abrasive fluids!
- Verify the compatibility of the process fluid with the sensor material.
- Ensure the resistance of all fluid-wetted materials in the process.
- Keep within the specified pressure and temperature range.

NOTICE

Verification for borderline cases:

- For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks

WARNING

The electronics and the medium may cause the surfaces to heat up. This presents a burn hazard!

- For elevated fluid temperatures, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:

- Wear the required personal protective equipment according to federal/national regulations.

For welding work on the piping:

- Do not ground the welding unit via the measuring device.

If working on and with the device with wet hands:

- Due to the increased risk of electric shock, gloves must be worn.

2.4 Operational safety

Risk of injury.

- Operate the device in proper technical condition and fail-safe condition only.
- The operator is responsible for interference-free operation of the device.

Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.

- If, despite this, modifications are required, consult with Endress+Hauser.

Repair

To ensure continued operational safety and reliability,

- Carry out repairs on the device only if they are expressly permitted.
- Observe federal/national regulations pertaining to repair of an electrical device.
- Use original spare parts and accessories from Endress+Hauser only.

2.5 Product safety

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

It meets general safety standards and legal requirements. It also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

2.6 IT security

We only provide a warranty 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 device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

2.7 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.

2.7.1 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 → 🖹 113.

2.7.2 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). Is equivalent to hardware write protection in terms of functionality.
- 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, Web browser or operating tool (e.g. FieldCare, DeviceCare) can be protected by the modifiable, user-specific access code (→ 🖹 112).

When the device is delivered, the device does not have an access code and is equivalent to *0000* (open).

WLAN passphrase

A connection between an operating unit (e.g. notebook or tablet) and the device via the WLAN interface (→ 🖹 64) which can be ordered as an option 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→ 🖹 105.

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.

2.7.3 Access via fieldbus

When communicating via fieldbus, access to the device parameters can be restricted to *"Read only"* access. The option can be changed in the **Fieldbus writing access** parameter.

This does not affect cyclic measured value transmission to the higher-order system, which is always guaranteed.

Additional information: "Description of Device Parameters" document pertaining to the device → 175.

2.7.4 Access via Web server

The device can be operated and configured via a Web browser with the integrated Web server (→ 57). 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.

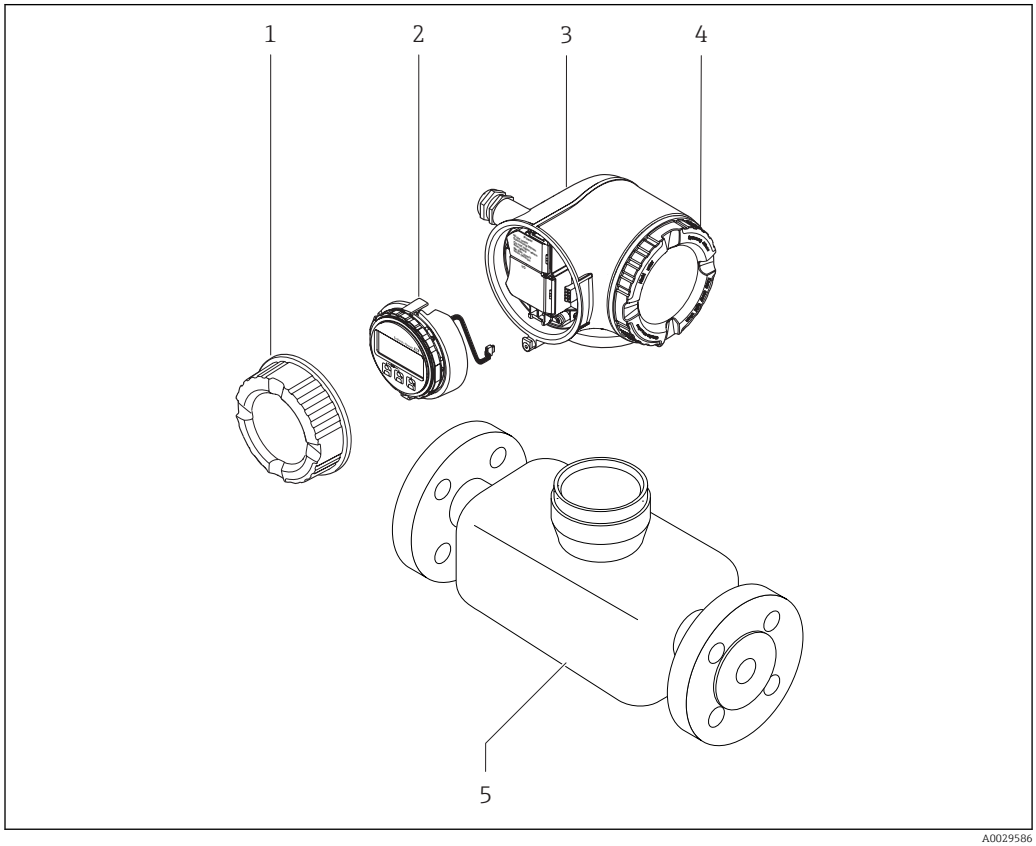
Additional information: "Description of Device Parameters" document pertaining to the device → 175.

3 Product description

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

3.1 Product design

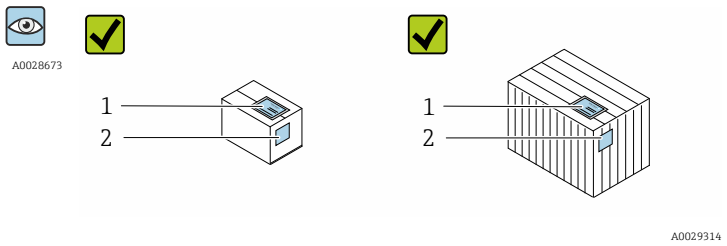


1 *Important components of a measuring device*

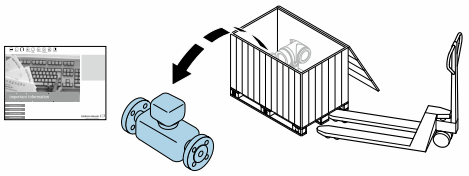
1 *Connection compartment cover*
2 *Display module*
3 *Transmitter housing*
4 *Electronics compartment cover*
5 *Sensor*

4 Incoming acceptance and product identification

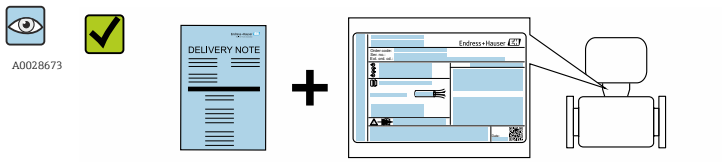
4.1 Incoming acceptance



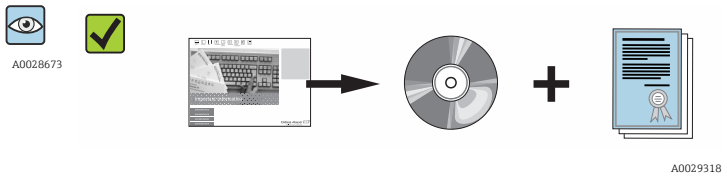
Are the order codes on the delivery note (1) and the product sticker (2) identical?



Are the goods undamaged?



Do the nameplate data match the ordering information on the delivery note?



Is the CD-ROM with the Technical Documentation (depends on device version) and documents present?

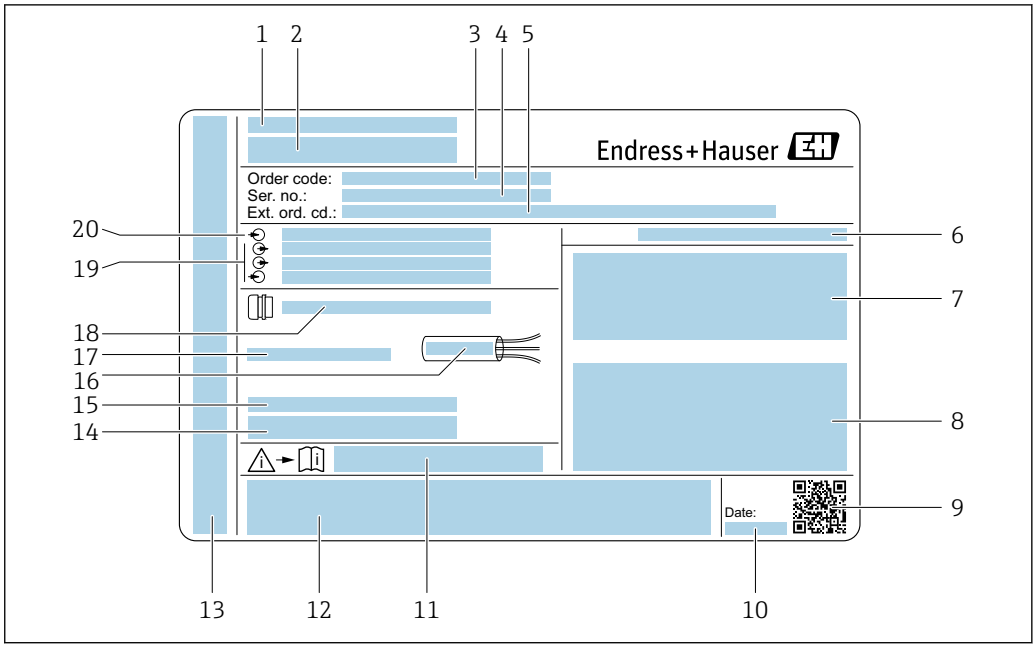
- If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.
- Depending on the device version, the CD-ROM might not be part of the delivery! The Technical Documentation is available via the Internet or via the *Endress+Hauser Operations App*, see the "Product identification" section → 16.

4.2 Product identification

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

For an overview of the scope of the associated Technical Documentation, refer to the following:
- The chapters "Additional standard documentation on the device" → 8 and "Supplementary device-dependent documentation" → 8
- The *W@M Device Viewer*: Enter the serial number from the nameplate (www.endress.com/deviceviewer)
- The *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2-D matrix code (QR code) on the nameplate.

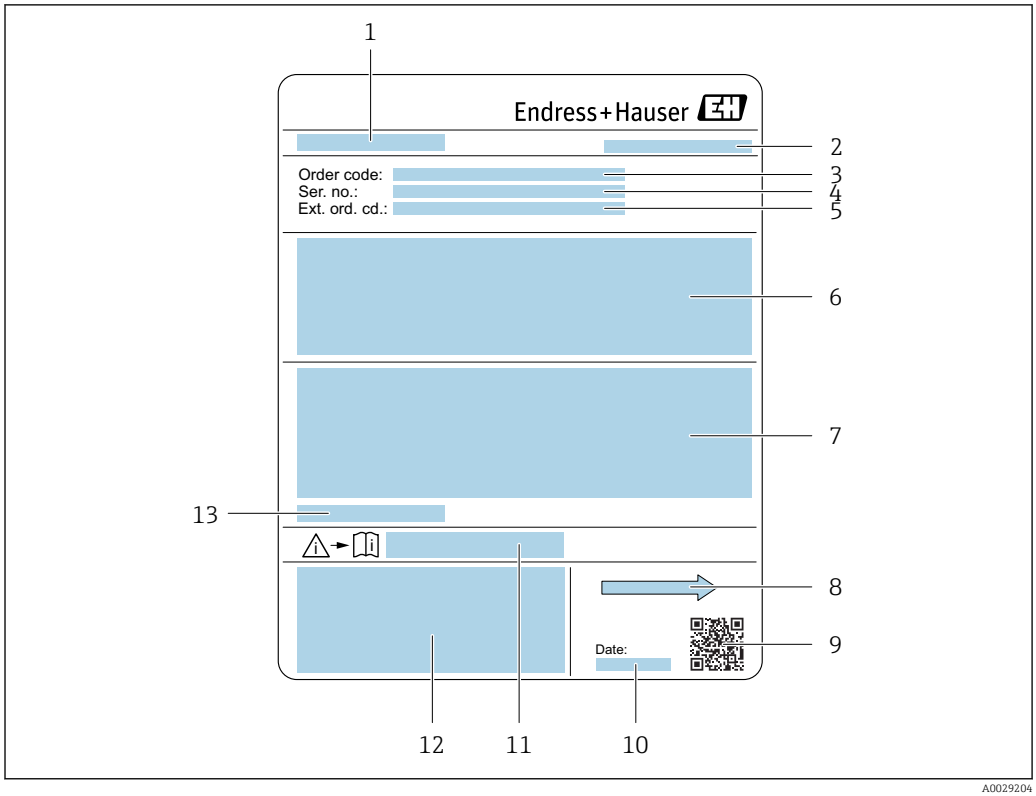
4.2.1 Transmitter nameplate



2 *Example of a transmitter nameplate*

1 *Manufacturing location*
2 *Name of the transmitter*
3 *Order code*
4 *Serial number (ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Degree of protection*
7 *Space for approvals: use in hazardous areas*
8 *Electrical connection data: available inputs and outputs*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Document number of safety-related supplementary documentation*
12 *Space for approvals and certificates: e.g. CE mark, C-Tick*
13 *Space for degree of protection of connection and electronics compartment when used in hazardous areas*
14 *Firmware version (FW) and device revision (Dev.Rev.) from the factory*
15 *Space for additional information in the case of special products*
16 *Permitted temperature range for cable*
17 *Permitted ambient temperature (T_a)*
18 *Information on cable gland*
19 *Available inputs and outputs, supply voltage*
20 *Electrical connection data: supply voltage*

4.2.2 Sensor nameplate



3 *Example of sensor nameplate*

1 *Name of the sensor*
2 *Manufacturing location*
3 *Order code*
4 *Serial number (ser. no.)*
5 *Extended order code (Ext. ord. cd.)*
6 *Flow; nominal diameter of the sensor; pressure rating; nominal pressure; system pressure; fluid temperature range; material of liner and electrodes*
7 *Approval information for explosion protection, Pressure Equipment Directive and degree of protection*
8 *Flow direction*
9 *2-D matrix code*
10 *Manufacturing date: year-month*
11 *Document number of safety-related supplementary documentation→ 175*
12 *CE mark, C-Tick*
13 *Permitted ambient temperature (T_a)*

Order code

The measuring device is reordered using the order code.

Extended order code

- The device type (product root) and basic specifications (mandatory features) are always listed.
- Of the optional specifications (optional features), only the safety and approval-related specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the # placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the + placeholder symbol (e.g. XXXXXX-ABCDE +).

4.2.3 Symbols on measuring device

Symbol	Meaning
	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
	**Reference to documentation** Refers to the corresponding device documentation.
	**Protective ground connection** A terminal which must be connected to ground prior to establishing any other connections.

5 Storage and transport

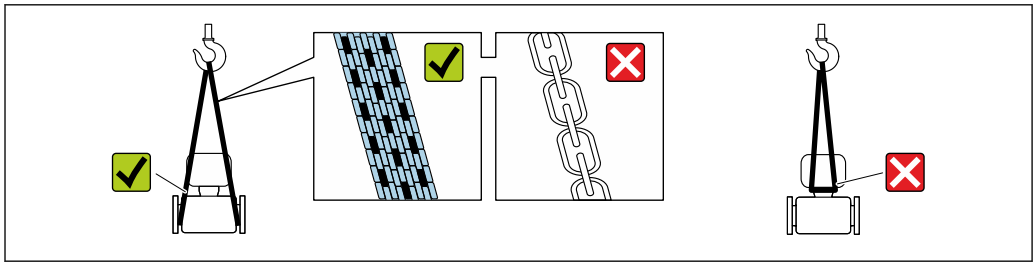
5.1 Storage conditions

Observe the following notes for storage:
- Store in the original packaging to ensure protection from shock.
- Do not remove protective covers or protective caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus and bacteria infestation can damage the lining.
- Store in a dry and dust-free place.
- Do not store outdoors.

Storage temperature → 163

5.2 Transporting the product

Transport the measuring device to the measuring point in the original packaging.



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Do not remove protective covers or caps installed on process connections. They prevent mechanical damage to the sealing surfaces and contamination in the measuring tube.

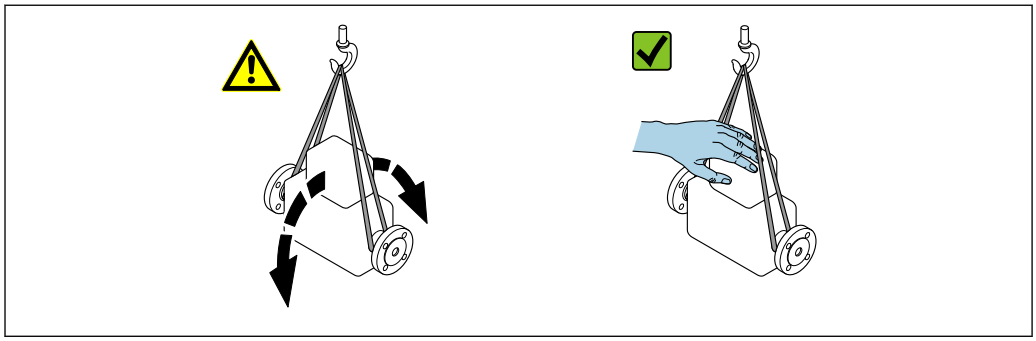
5.2.1 Measuring devices without lifting lugs

WARNING

Center of gravity of the measuring device is higher than the suspension points of the webbing slings.

Risk of injury if the measuring device slips.

- ▶ Secure the measuring device against slipping or turning.
- ▶ Observe the weight specified on the packaging (stick-on label).



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5.2.2 Measuring devices with lifting lugs

⚠ CAUTION

Special transportation instructions for devices with lifting lugs

- Only use the lifting lugs fitted on the device or flanges to transport the device.
- The device must always be secured at two lifting lugs at least.

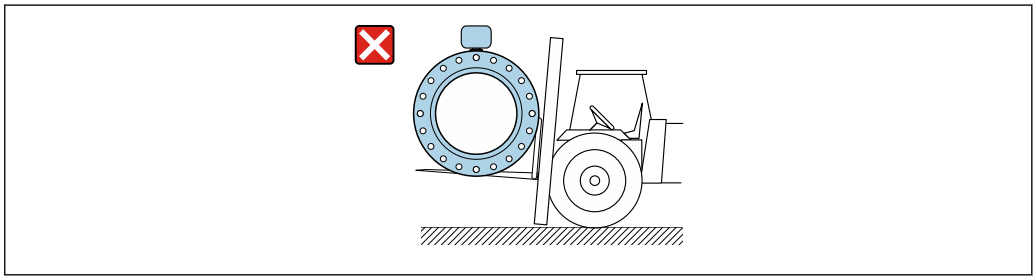
5.2.3 Transporting with a fork lift

If transporting in wood crates, the floor structure enables the crates to be lifted lengthwise or at both sides using a forklift.

⚠ CAUTION

Risk of damaging the magnetic coil

- If transporting by forklift, do not lift the sensor by the metal casing.
- This would buckle the casing and damage the internal magnetic coils.



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5.3 Packaging disposal

All packaging materials are environmentally friendly and 100% recyclable:

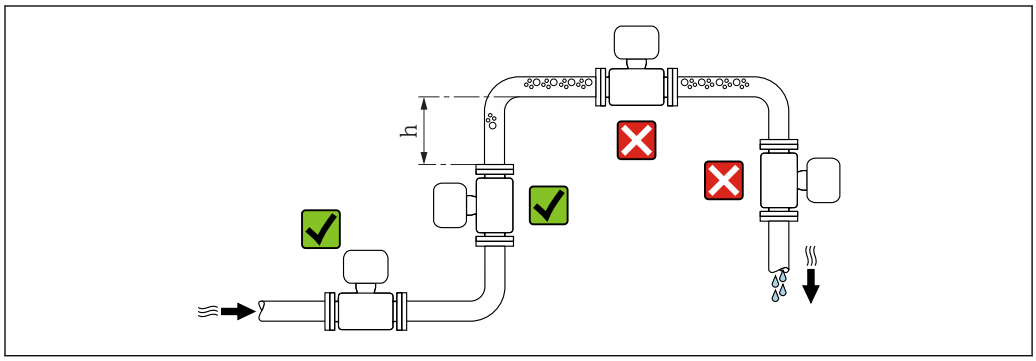
- Measuring device secondary packaging: polymer stretch film that conforms to EC Directive 2002/95/EC (RoHS).
- Packaging:
  - Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
    or
  - Carton in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed RESY symbol.
- Seaworthy packaging (optional): Wood crate, treated in accordance with ISPM 15 standard, which is confirmed by the affixed IPPC logo.
- Carrying and mounting hardware:
  - Disposable plastic pallet
  - Plastic straps
  - Plastic adhesive strips
- Dunnage: Paper cushion

6 Installation

6.1 Installation conditions

6.1.1 Mounting position

Mounting location



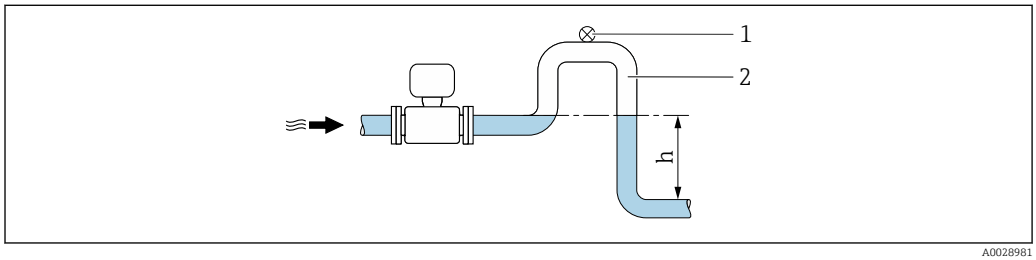
Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

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.

Installation in down pipes

Install a siphon with a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.

For information on the liner's resistance to partial vacuum

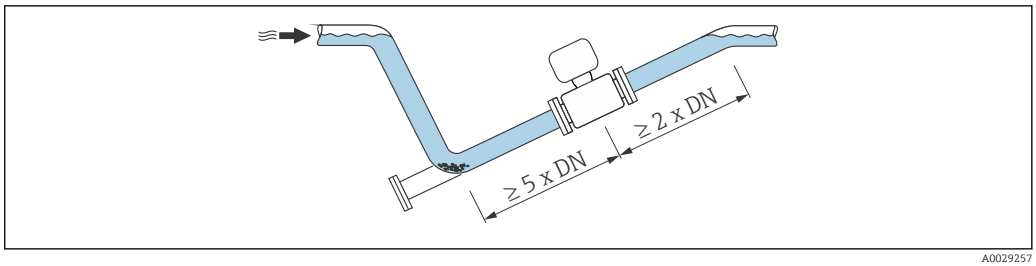


4 *Installation in a down pipe*

1 Vent valve
2 Pipe siphon
h Length of down pipe

Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration. The empty pipe detection (EPD) function offers additional protection by detecting empty or partially filled pipes.



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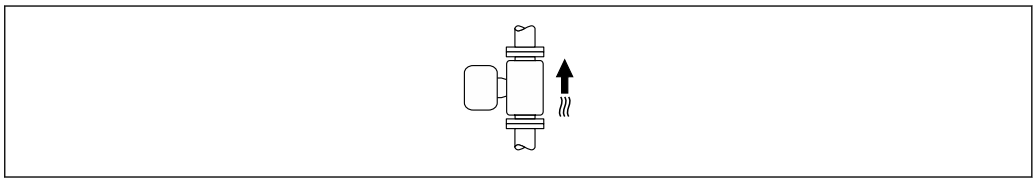
Orientation

The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube.

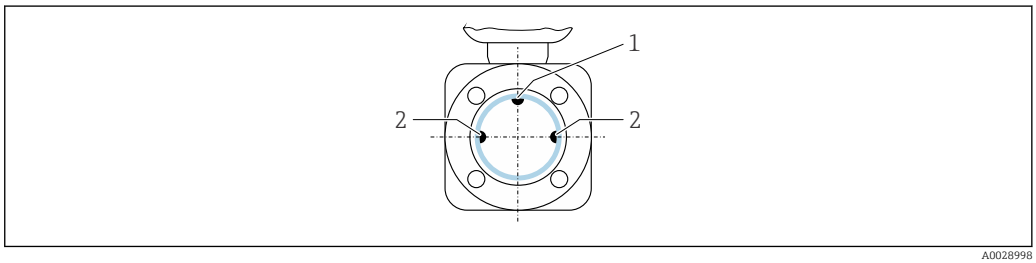
The measuring device also offers the empty pipe detection function to detect partially filled measuring pipes in the event of outgassing fluids or variable process pressures.

Vertical


A0015591

Optimum for self-emptying pipe systems and for use in conjunction with empty pipe detection.

Horizontal



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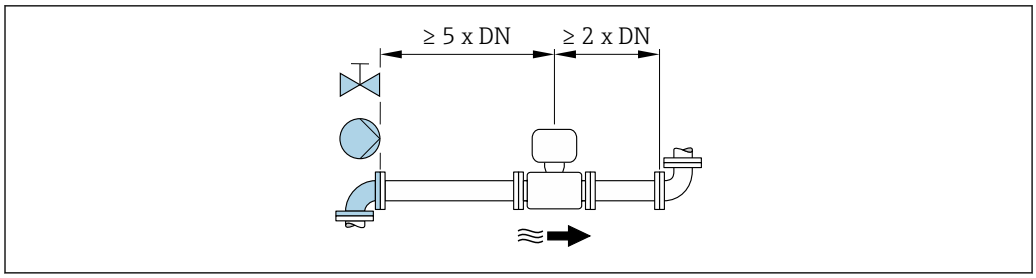
1 *EPD electrode for empty pipe detection*
2 *Measuring electrodes for signal detection*

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



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Installation dimensions

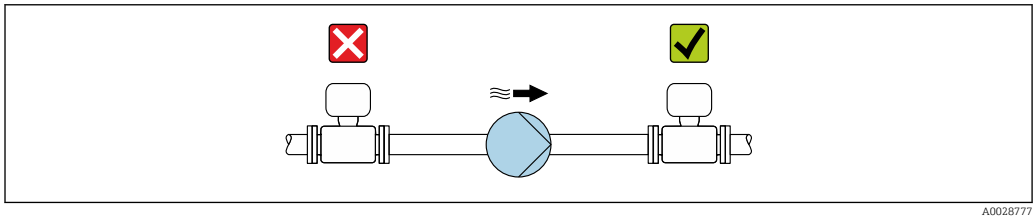
For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

6.1.2 Requirements from environment and process

Ambient temperature range

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

System pressure



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Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

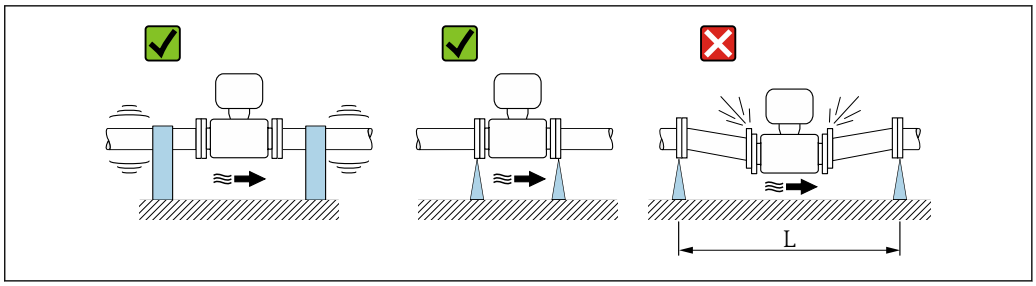
Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- For information on the liner's resistance to partial vacuum
- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system

Vibrations

In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system



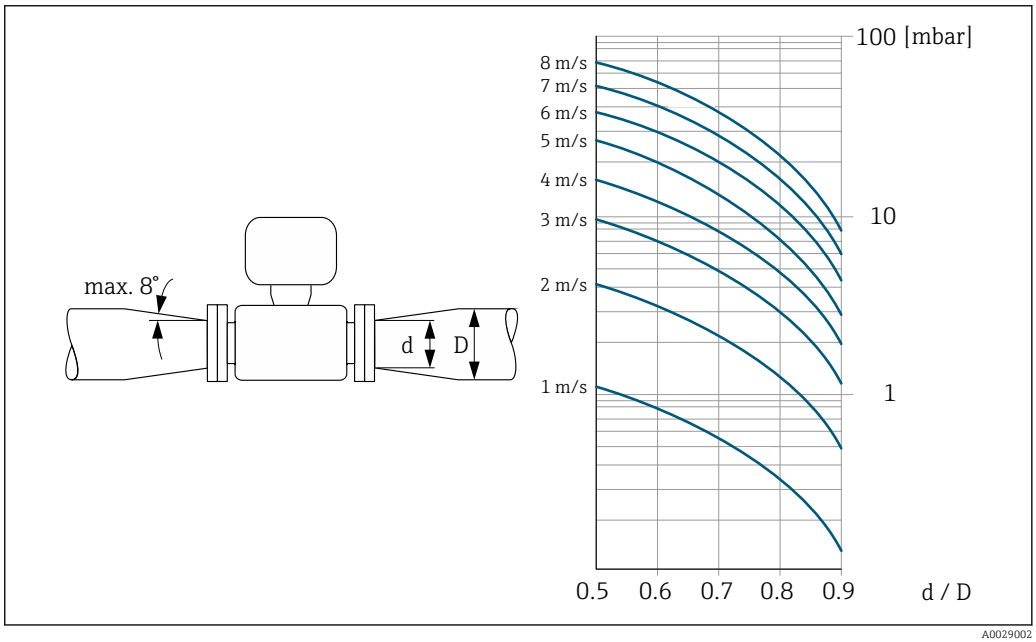
5 *Measures to avoid device vibrations (L > 10 m (33 ft))*

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

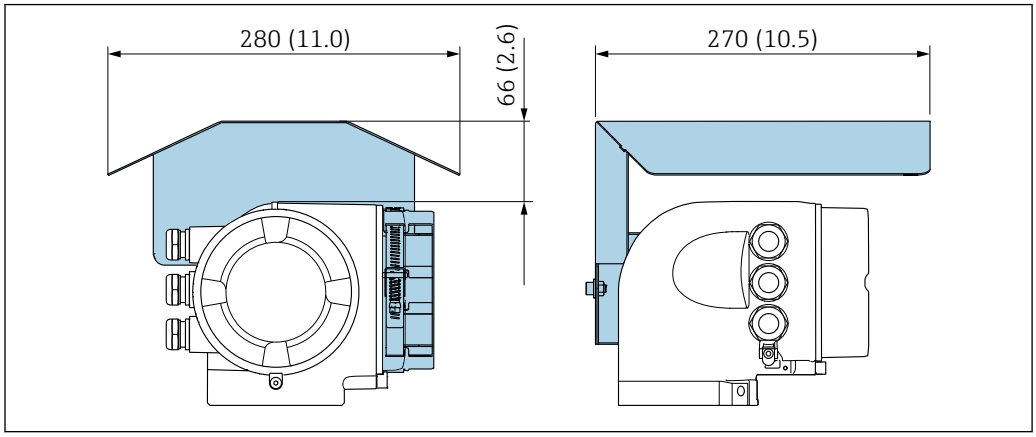
- The nomogram only applies to liquids with a viscosity similar to that of water.
- If the medium has a high viscosity, a larger measuring tube diameter can be considered in order to reduce pressure loss.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.



6.1.3 Special mounting instructions

Protective cover



6.2 Mounting the measuring device

6.2.1 Required tools

For sensor

For flanges and other process connections:
- Screws, nuts, seals etc. are not included in the scope of supply and must be provided by the customer.
- Appropriate mounting tools

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove any protective covers or protective caps present from the sensor.
3. Remove stick-on label on the electronics compartment cover.

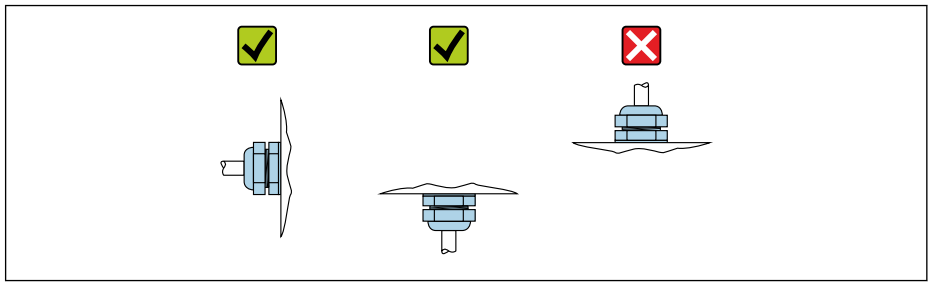
6.2.3 Mounting the sensor

⚠ WARNING

Danger due to improper process sealing!
- ▶ Ensure that the inside diameters of the gaskets are greater than or equal to that of the process connections and piping.
- ▶ Ensure that the gaskets are clean and undamaged.
- ▶ Install the gaskets correctly.

1. Ensure that the direction of the arrow on the sensor matches the flow direction of the medium.
2. To ensure compliance with device specifications, install the measuring device between the pipe flanges in a way that it is centered in the measurement section.

3. Install the measuring device or turn the transmitter housing so that the cable entries do not point upwards.



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The sensor is supplied to order, with or without pre-installed process connections. Pre-installed process connections are firmly secured to the sensor by 4 or 6 hexagonal-headed bolts.

- Depending on the application and pipe length:
  Support the sensor or secure it additionally.
- If using plastic process connections:
  It is absolutely essential to secure the sensor.

An appropriate wall mounting kit can be ordered separately as an accessory from Endress+Hauser → 174.

Welding the sensor into the pipe (welding connections)

WARNING

Risk of destroying the electronics!

- Make sure that the welding system is not grounded via the sensor or transmitter.

1. Tack-weld the sensor to secure it in the pipe. A suitable welding aid can be ordered separately as an accessory → 174.
2. Release the screws on the process connection flange and remove the sensor, along with the seal, from the pipe.
3. Weld the process connection into the pipe.
4. Reinstall the sensor in the pipe, and in doing so make sure that the seal is clean and in the right position.

- If thin-walled pipes carrying food are welded correctly:
  Disassemble the sensor and seal even if the seal is not damaged by the heat when mounted.

It must be possible to open the pipe by at least 8 mm (0.31 in) to permit disassembly.

Mounting the seals

Comply with the following instructions when installing seals:

1. In the case of metal process connections, the screws must be tightened securely. The process connection forms a metal connection with the sensor, which ensures a defined compression of the seal.
2. In the case of plastic process connections, observe the maximum torques for lubricated threads: 7 Nm (5.2 lbf ft); always insert a seal between the connection and the counterflange in the case of plastic flanges.

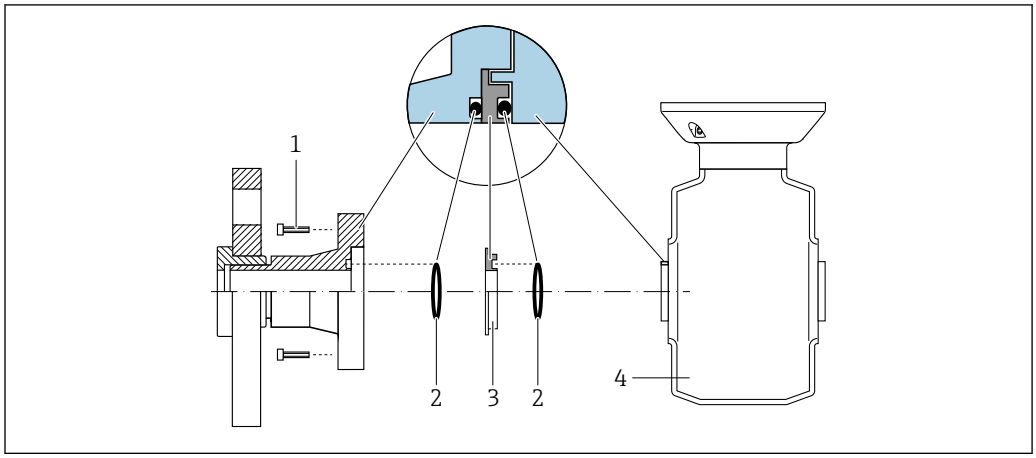
3. Depending on the application the seals should be replaced periodically, particularly if molded seals are used (aseptic version)! The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature. Replacement seals can be ordered as an accessory → 174.

Mounting grounding rings (DN 2 to 25 (1/12 to 1"))

Pay attention to the information on potential equalization .

In the case of plastic process connections (e.g. flange connections or adhesive fittings), additional ground rings must be used to ensure potential matching between the sensor and the fluid. If grounding rings are not installed, this can affect the measuring accuracy or cause the destruction of the sensor as a result of the electrochemical decomposition of the electrodes.

- Depending on the option ordered, plastic disks are used instead of grounding rings on some process connections. These plastic disks only act as "spacers" and do not have any potential matching function. Furthermore, they also perform a significant sealing function at the sensor/process connection interface. Therefore, in the case of process connections without metal grounding rings, these plastic disks/seals should never be removed and should always be installed!
- Grounding rings can be ordered separately as an accessory from Endress+Hauser → 174. When ordering make sure that the grounding rings are compatible with the material used for the electrodes, as otherwise there is the danger that the electrodes could be destroyed by electrochemical corrosion!
  Material specifications → 166.
- Grounding rings, including seals, are mounted inside the process connections. Therefore the installation length is not affected.



6 *Installing grounding rings*

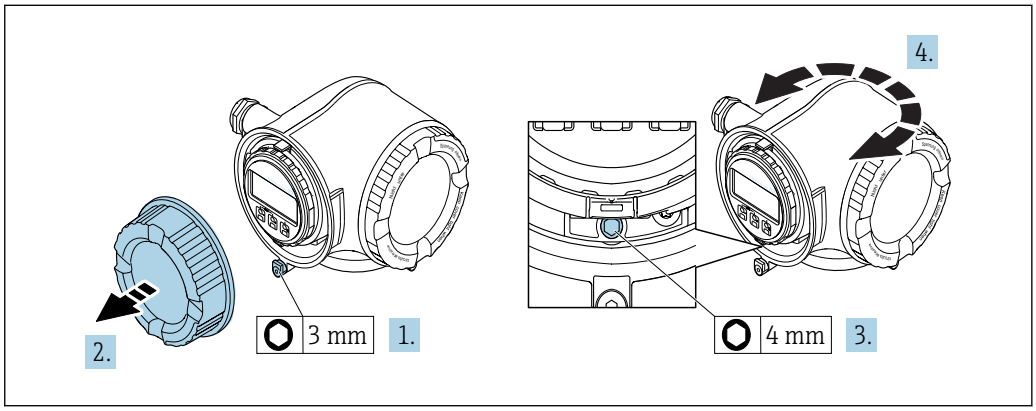
1 Hexagonal-headed bolts of process connection
2 O-ring seals
3 Grounding ring or plastic disk (spacer)
4 Sensor

1. Release the 4 or 6 hexagonal-headed bolts (1) and remove the process connection from the sensor (4).
2. Remove the plastic disk (3), along with the two O-ring seals (2), from the process connection.
3. Place the first O-ring seal (2) back into the groove of the process connection.
4. Fit the metal grounding ring (3) in the process connection as illustrated.
5. Place the second O-ring seal (2) into the groove of the grounding ring.

6. Mount the process connection back on the sensor. When doing so, make sure to observe the maximum screw tightening torques for lubricated threads:
7 Nm (5.2 lbf ft)

6.2.4 Turning the transmitter housing

To provide easier access to the connection compartment or display module, the transmitter housing can be turned.



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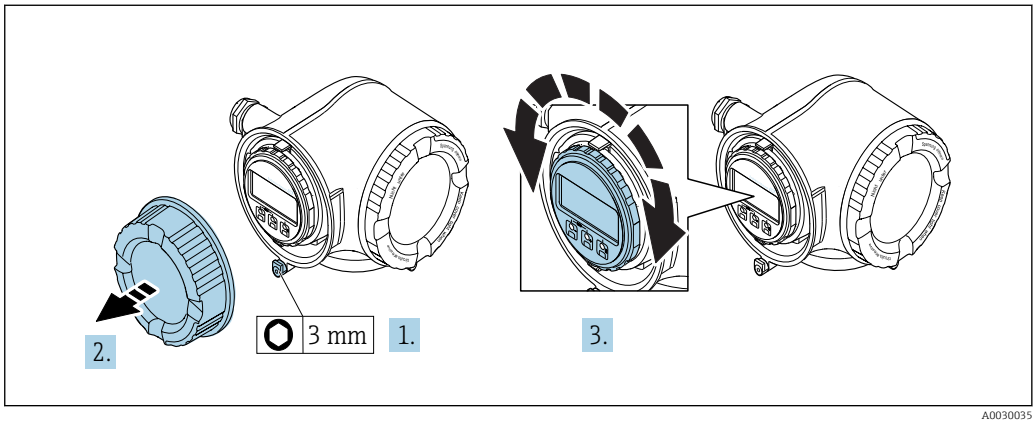
1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Release the fixing screw.
4. Turn the housing to the desired position.
5. Firmly tighten the securing screw.
6. Screw on the connection compartment cover
7. Fit the securing clamp of the connection compartment cover.

6.2.5 Turning the display module

The display module can be turned to optimize display readability and operability.



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1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Turn the display module to the desired position: max. 8 × 45° in every direction.
4. Screw on the connection compartment cover.
5. Fit the securing clamp of the connection compartment cover.

6.3 Post-installation check

Is the device undamaged (visual inspection)?	❑
Does the measuring device conform to the measuring point specifications? For example: ▪ Process temperature ▪ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ▪ Ambient temperature ▪ Measuring range	❑
Has the correct orientation for the sensor been selected ? ▪ According to sensor type ▪ According to medium temperature ▪ According to medium properties (outgassing, with entrained solids)	❑
Does the arrow on the sensor nameplate match the direction of flow of the fluid through the piping ?	❑
Are the measuring point identification and labeling correct (visual inspection)?	❑
Have the fixing screws been tightened with the correct tightening torque?	❑

7 Electrical connection

NOTICE

The measuring device does not have an internal circuit breaker.

- ▶ For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.
- ▶ Although the measuring device is equipped with a fuse, additional overcurrent protection (maximum 10 A) should be integrated into the system installation.

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use corresponding tools
- For securing clamp: Allen key 3 mm
- Wire stripper
- When using stranded cables: Crimper for wire end ferrule
- For removing cables from terminal: Flat blade screwdriver ≤ 3 mm (0.12 in)

7.1.2 Requirements for connecting cable

The connecting cables provided by the customer must fulfill the following requirements.

Electrical safety

In accordance with applicable federal/national regulations.

Protective ground cable

Cable: 2.1 mm^2 (14 AWG)

The grounding impedance must be less than 1 Ω.

Permitted temperature range

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

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output 4 to 20 mA HART

A shielded cable is recommended. Observe 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.

Double pulse output

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.

Cable diameter

- Cable glands supplied:
  M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in)
- Spring terminals:
  Conductor cross-section0.2 to 2.5 mm² (24 to 12 AWG)

Connecting cable for transmitter - remote display and operating module DKX001

Standard cable

A standard cable can be used as the connecting cable.

Standard cable	4 cores (2 pairs); pair-stranded with common shield
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	Maximum 1 000 nF for Zone 1, Class I, Division 1
L/R	Maximum 24 µH/Ω for Zone 1, Class I, Division 1
Cable length	Maximum 300 m (1 000 ft), see the following table

Cross-section	**Cable length for use in non-hazardous area, Ex Zone 2, Class I, Division 2 Ex Zone 1, Class I, Division 1**
0.34 mm² (22 AWG)	80 m (270 ft)
0.50 mm² (20 AWG)	120 m (400 ft)
0.75 mm² (18 AWG)	180 m (600 ft)
1.00 mm² (17 AWG)	240 m (800 ft)
1.50 mm² (15 AWG)	300 m (1 000 ft)

Optionally available connecting cable

Standard cable	2 × 2 × 0.34 mm² (22 AWG) PVC cable with common shield (2 pairs, pair-stranded)
Flame resistance	According to DIN EN 60332-1-2
Oil-resistance	According to DIN EN 60811-2-1
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	≤200 pF/m
L/R	≤24 µH/Ω
Available cable length	10 m (35 ft)
Operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

7.1.3 Terminal assignment

Transmitter: supply voltage, input/outputs

The terminal assignment of the inputs and outputs depends on the individual order version of the device. The device-specific terminal assignment is documented on an adhesive label in the terminal cover.

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.					

Terminal assignment of the remote display and operating module: → 36

7.1.4 Preparing the measuring device

NOTICE

Insufficient sealing of the housing!

Operational reliability of the measuring device could be compromised.

- Use suitable cable glands corresponding to the degree of protection.

1. Remove dummy plug if present.
2. If the measuring device is supplied without cable glands:
   Provide suitable cable gland for corresponding connecting cable.
3. If the measuring device is supplied with cable glands:
   Observe requirements for connecting cables → 31.

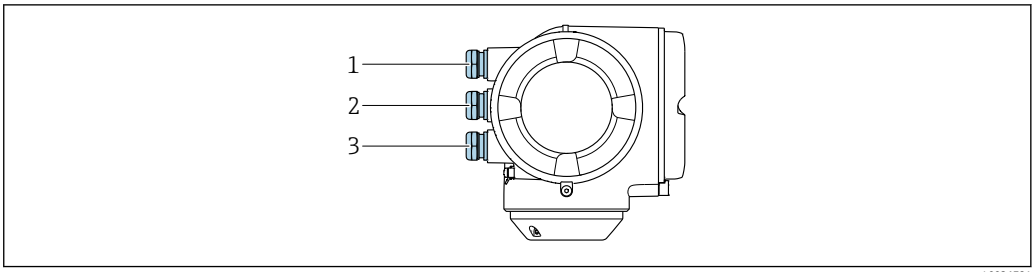
7.2 Connecting the measuring device

NOTICE

Limitation of electrical safety due to incorrect connection!

- Have electrical connection work carried out by correspondingly trained specialists only.
- Observe applicable federal/national installation codes and regulations.
- Comply with local workplace safety regulations.
- Always connect the protective ground cable ⏚ before connecting additional cables.
- For use in potentially explosive atmospheres, observe the information in the device-specific Ex documentation.

7.2.1 Connecting the transmitter



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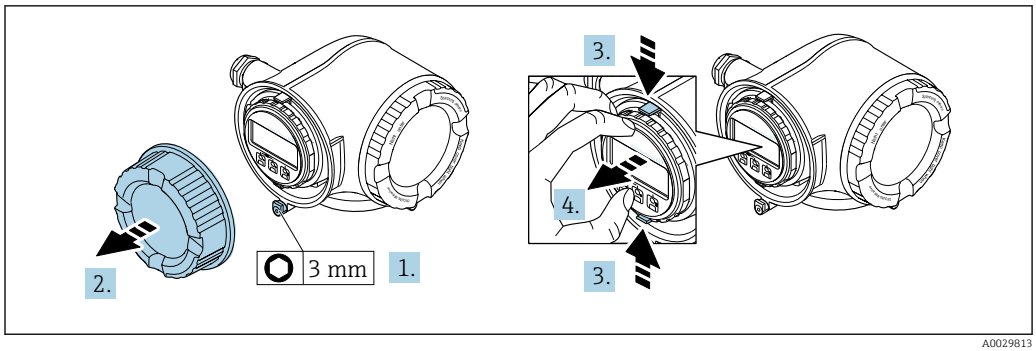
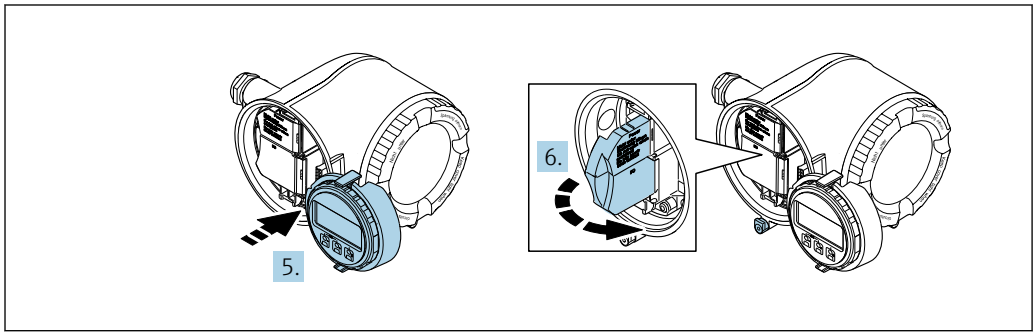
1 Cable entry for supply voltage
2 Cable entry for signal transmission, input/output 1 and 2
3 Cable entry for input/output signal transmission; Optional: connection of external WLAN antenna, connection of remote display and operating module DKX001 or service plug



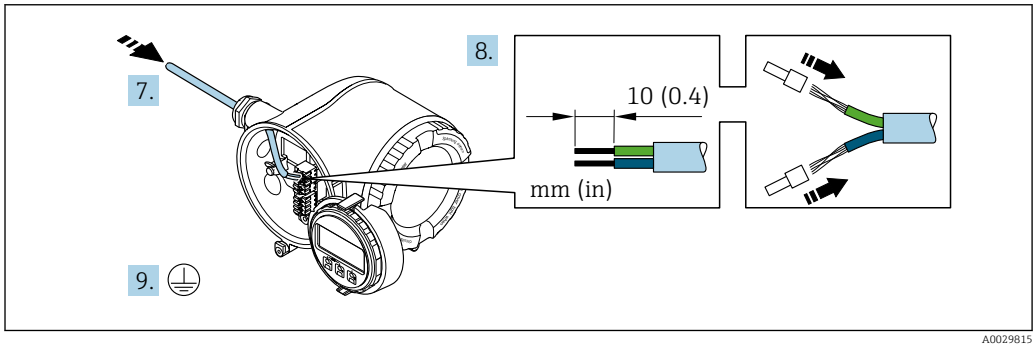
A0029813

1. Loosen the securing clamp of the connection compartment cover.
2. Unscrew the connection compartment cover.
3. Squeeze the tabs of the display module holder together.
4. Remove the display module holder.



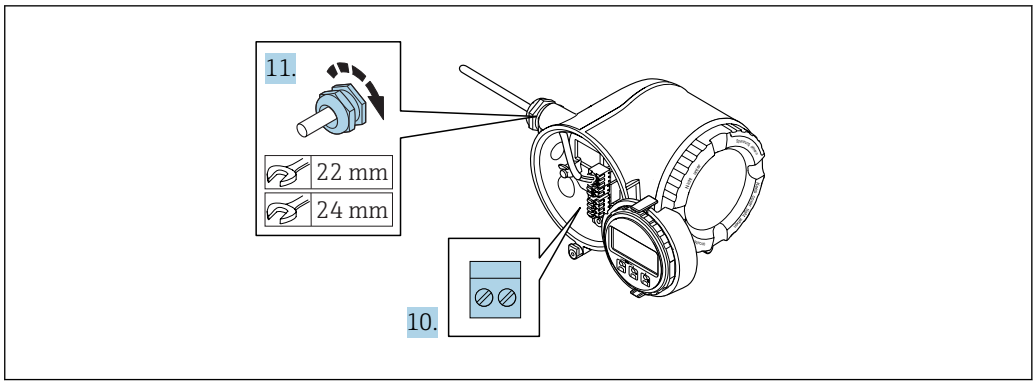
A0029814

5. Attach the holder to the edge of the electronics compartment.
6. Open the terminal cover.



A0029815

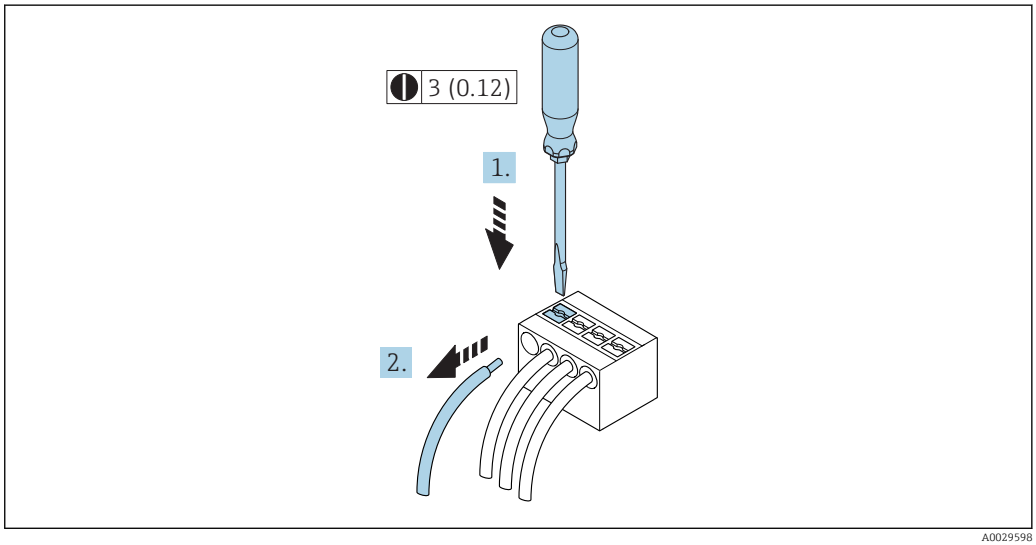
7. Push the cable through the cable entry . To ensure tight sealing, do not remove the sealing ring from the cable entry.
8. Strip the cable and cable ends. In the case of stranded cables, also fit ferrules.
9. Connect the protective ground.



A0029816

10. Connect the cable in accordance with the terminal assignment .
    ↳ **Signal cable terminal assignment:** The device-specific terminal assignment is documented on an adhesive label in the terminal cover.
    Supply voltage terminal assignment: Adhesive label in the terminal cover or → 33.
11. Firmly tighten the cable glands.
    ↳ This concludes the cable connection process.
12. Close the terminal cover.
13. Fit the display module holder in the electronics compartment.
14. Screw on the connection compartment cover.
15. Secure the securing clamp of the connection compartment cover.

Removing a cable



A0029598

7 *Engineering unit mm (in)*

1. To remove a cable from the terminal, use a flat-blade screwdriver to push the slot between the two terminal holes
2. while simultaneously pulling the cable end out of the terminal.

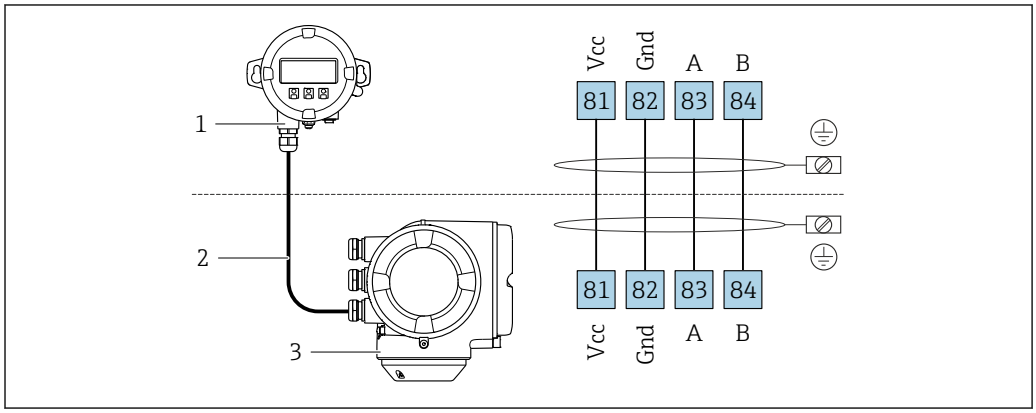
7.2.2 Connecting remote display and operating module DKX001

NOTICE

If ordered subsequently: only one display or operation unit may be connected to the transmitter at any one time.

The remote display and operating module DKX001 cannot be connected at the same time as the existing display or operation unit.

- ▶ Existing integrated display module: disconnect electrical connection.
- ▶ Connect the remote display and operating module DKX001.



1 *Remote display and operating module DKX001*
2 *Connecting cable*
3 *Measuring device*

Remote display and operating module DKX001 → 149

7.3 Ensure potential equalization

7.3.1 Requirements

CAUTION

Electrode damage can result in the complete failure of the device!

- ▶ Same electrical potential for the fluid and sensor
- ▶ Company-internal grounding concepts
- ▶ Pipe material and grounding

7.3.2 Connection example, standard scenario

Metal process connections

Potential equalization is generally via the metal process connections that are in contact with the medium and mounted directly on the sensor. Therefore there is generally no need for additional potential equalization measures.

7.3.3 Connection example in special situations

Plastic process connections

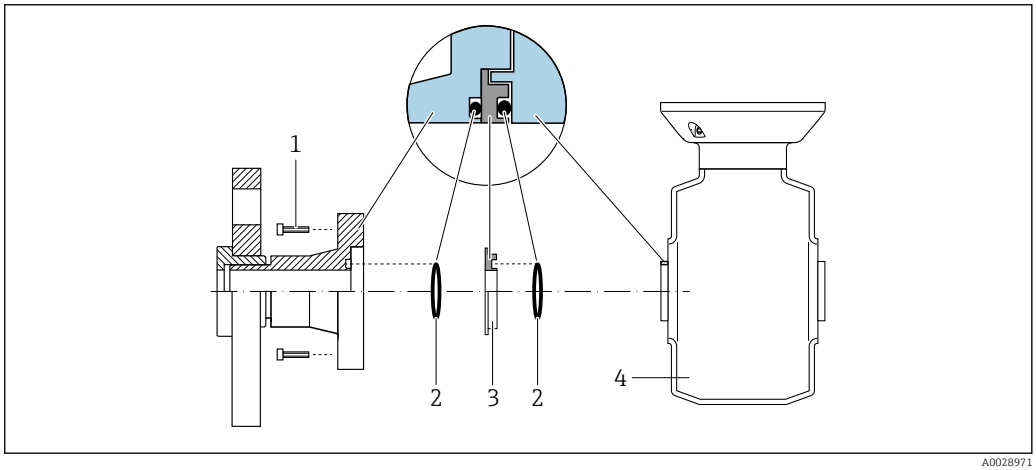
In the case of plastic process connections, additional grounding rings or process connections with an integrated grounding electrode must be used to ensure potential matching between the sensor and the fluid. If there is no potential matching, this can

affect the measuring accuracy or cause the destruction of the sensor as a result of the electrochemical decomposition of the electrodes.

Note the following when using grounding rings:

- Depending on the option ordered, plastic disks are used instead of grounding rings on some process connections. These plastic disks only act as "spacers" and do not have any potential matching function. Furthermore, they also perform a significant sealing function at the sensor/connection interface. Therefore, in the case of process connections without metal grounding rings, these plastic disks/seals should never be removed and should always be installed!
- Grounding rings can be ordered separately as an accessory from Endress+Hauser . When ordering make sure that the grounding rings are compatible with the material used for the electrodes, as otherwise there is the danger that the electrodes could be destroyed by electrochemical corrosion!
- Grounding rings, including seals, are mounted inside the process connections. Therefore the installation length is not affected.

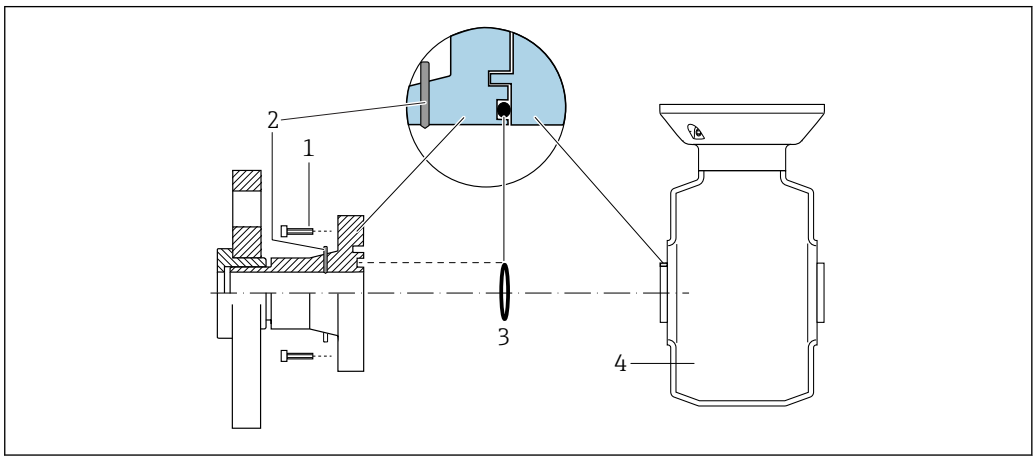
Potential equalization via additional grounding ring



A0028971

1 Hexagonal-headed bolts of process connection
2 O-ring seals
3 Plastic disk (spacer) or grounding ring
4 Sensor

Potential equalization via grounding electrodes on process connection



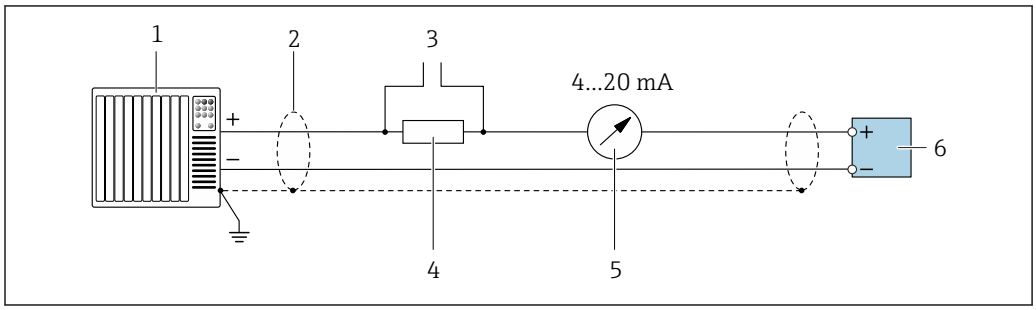
A0028972

1 Hexagonal-headed bolts of process connection
2 Integrated grounding electrodes
3 O-ring seal
4 Sensor

7.4 Special connection instructions

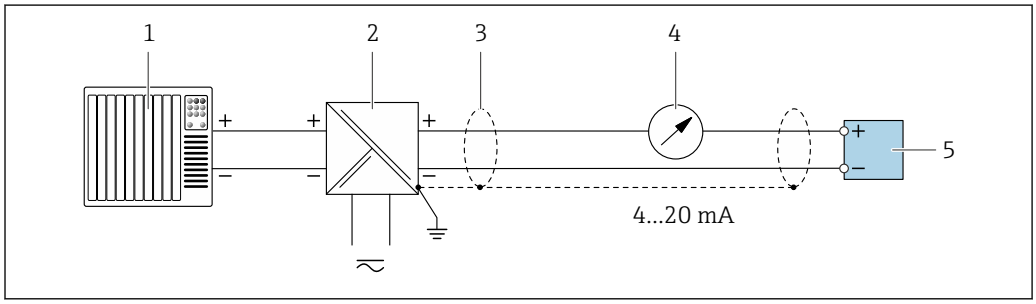
7.4.1 Connection examples

Current output 4 to 20 mA HART



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

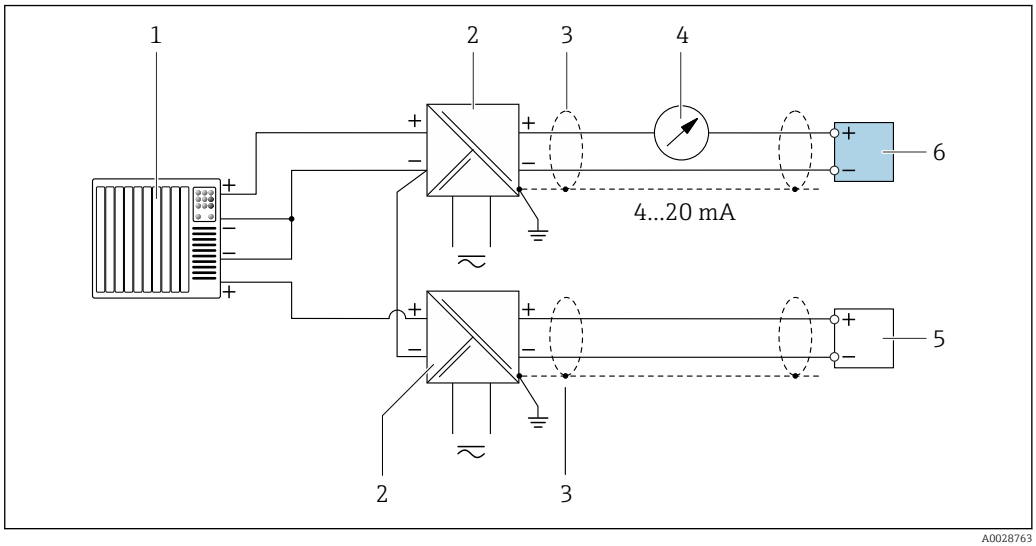
1 *Automation system with current input (e.g. PLC)*
2 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Connection for HART operating devices → 63*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 155*
5 *Analog display unit: observe maximum load → 155*
6 *Transmitter*



9 *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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load → 155*
5 *Transmitter*

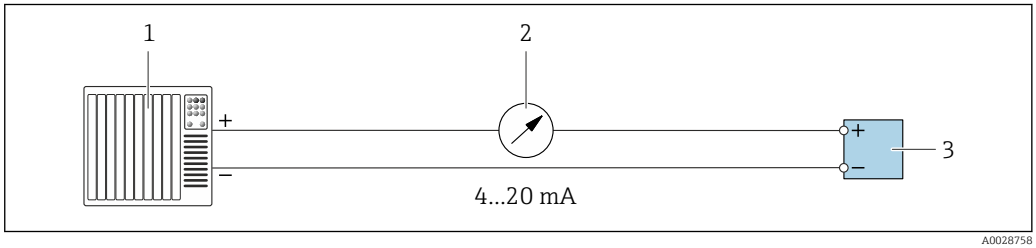
HART input



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

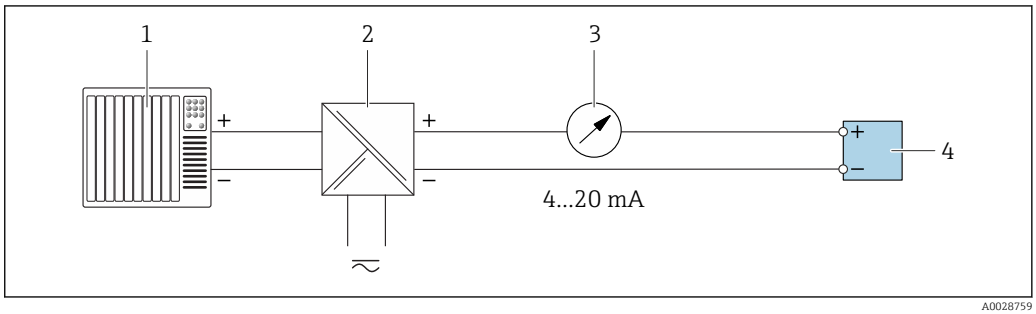
1 *Automation system with HART output (e.g. PLC)*
2 *Active barrier for power supply (e.g. RN221N)*
3 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load*
5 *Pressure transmitter (e.g.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

Current output 4-20 mA



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

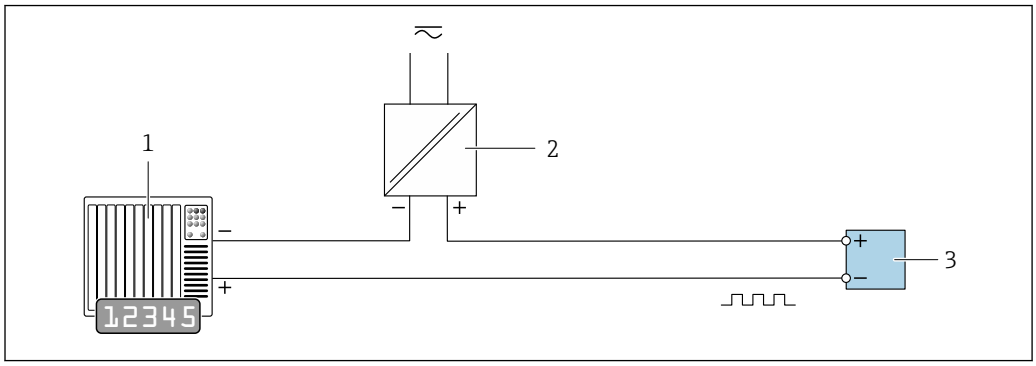
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load*
3 *Transmitter*



12 *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*
4 *Transmitter*

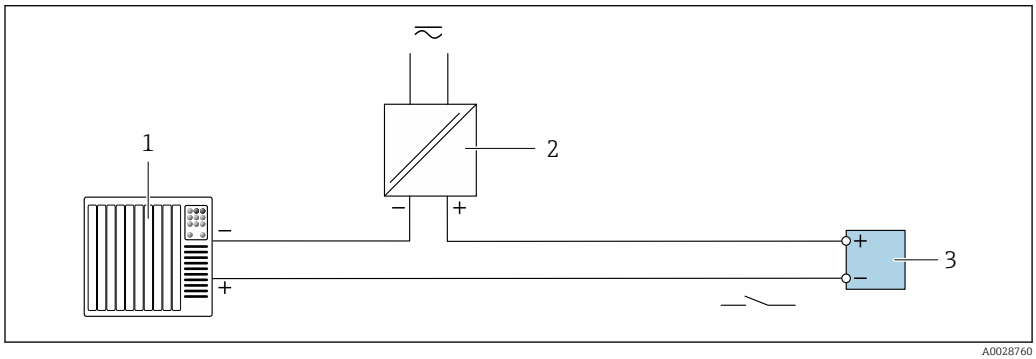
Pulse/frequency output



13 *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 → 155*

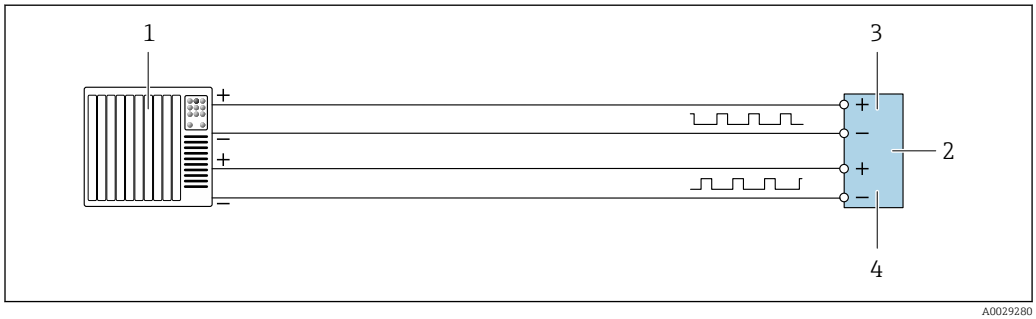
Switch output



14 *Connection example for switch output (passive)*

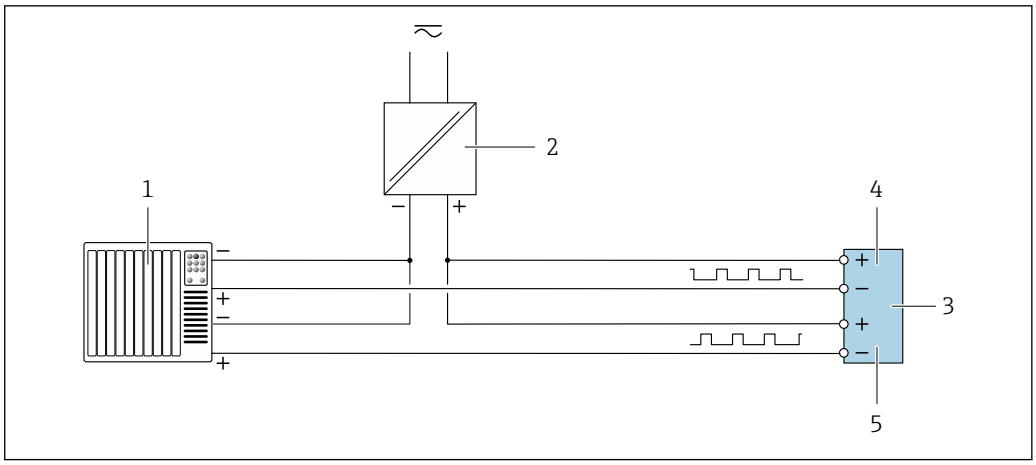
1 *Automation system with switch input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 155*

Double pulse output



15 *Connection example for double pulse output (active)*

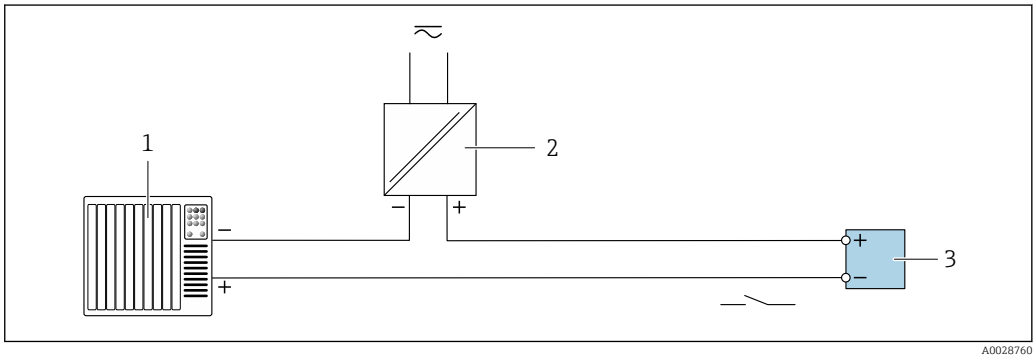
1 *Automation system with double pulse input (e.g. PLC)*
2 *Transmitter: Observe input values → 157*
3 *Double pulse output*
4 *Double pulse output (slave), phase-shifted*



16 *Connection example for double pulse output (passive)*

1 *Automation system with double pulse input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 157*
4 *Double pulse output*
5 *Double pulse output (slave), phase-shifted*

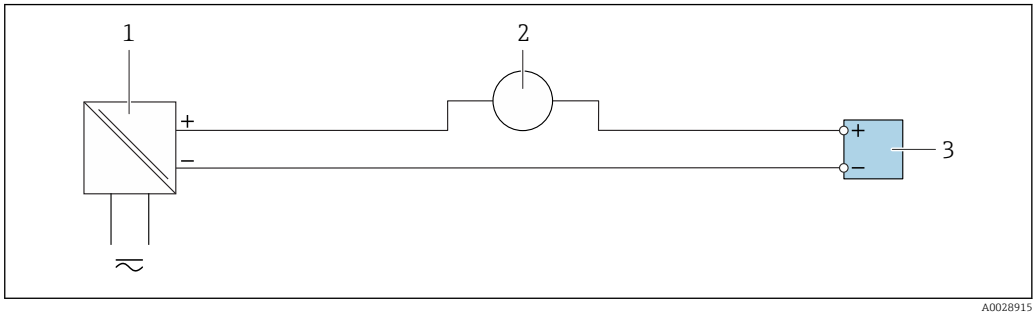
Relay output



17 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 157*

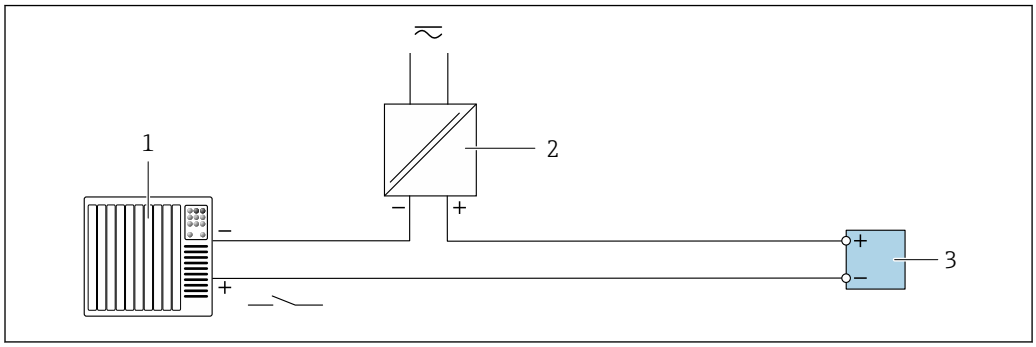
Current input



18 *Connection example for 4 to 20 mA current input*

1 *Power supply*
2 *External measuring device (for reading in pressure or temperature, for instance)*
3 *Transmitter: Observe input values*

Status input



19 *Connection example for status input*

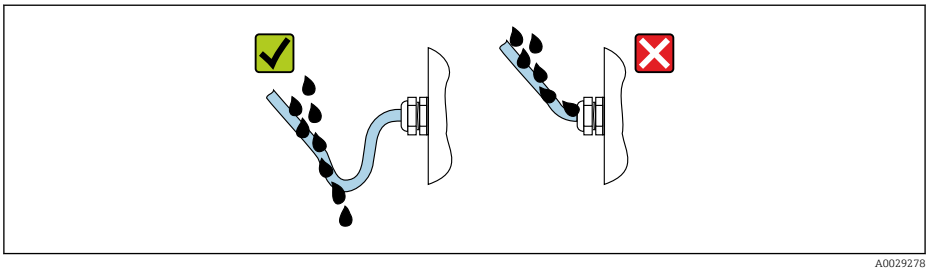
1 *Automation system with status output (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values*

7.5 Ensuring the degree of protection

The measuring device fulfills all the requirements for the IP66/67 degree of protection, Type 4X enclosure.

To guarantee IP66/67 degree of protection, Type 4X enclosure, carry out the following steps after the electrical connection:

1. Check that the housing seals are clean and fitted correctly.
2. Dry, clean or replace the seals if necessary.
3. Tighten all housing screws and screw covers.
4. Firmly tighten the cable glands.
5. To ensure that moisture does not enter the cable entry:
   Route the cable so that it loops down before the cable entry ("water trap").



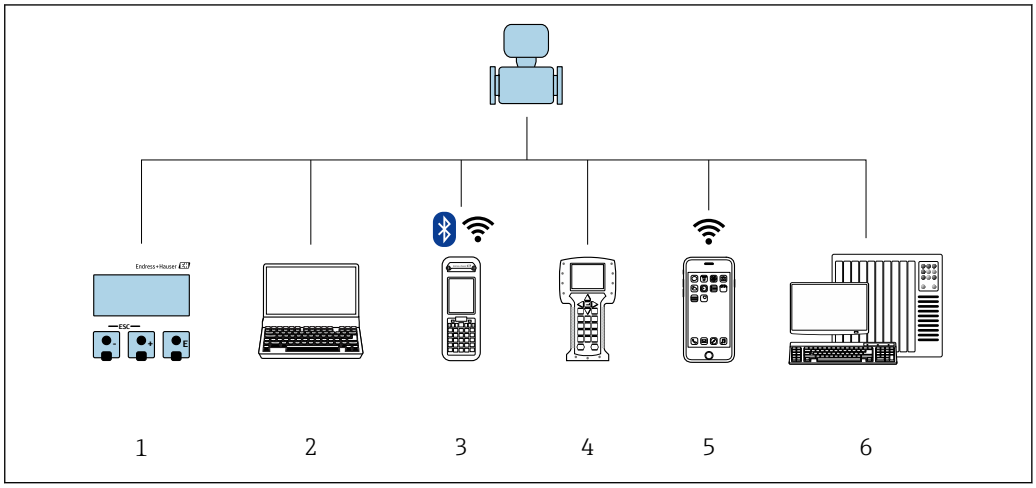
6. Insert dummy plugs into unused cable entries.

7.6 Post-connection check

Are cables or the device undamaged (visual inspection)?	❑
Do the cables used meet the requirements?	❑
Do the cables have adequate strain relief?	❑
Are all the cable glands installed, firmly tightened and leak-tight? Cable run with "water trap" → 🖹 42 ?	❑
If supply voltage is present, do values appear on the display module?	❑
Is the potential equalization established correctly ?	❑

8 Operation options

8.1 Overview of operation options



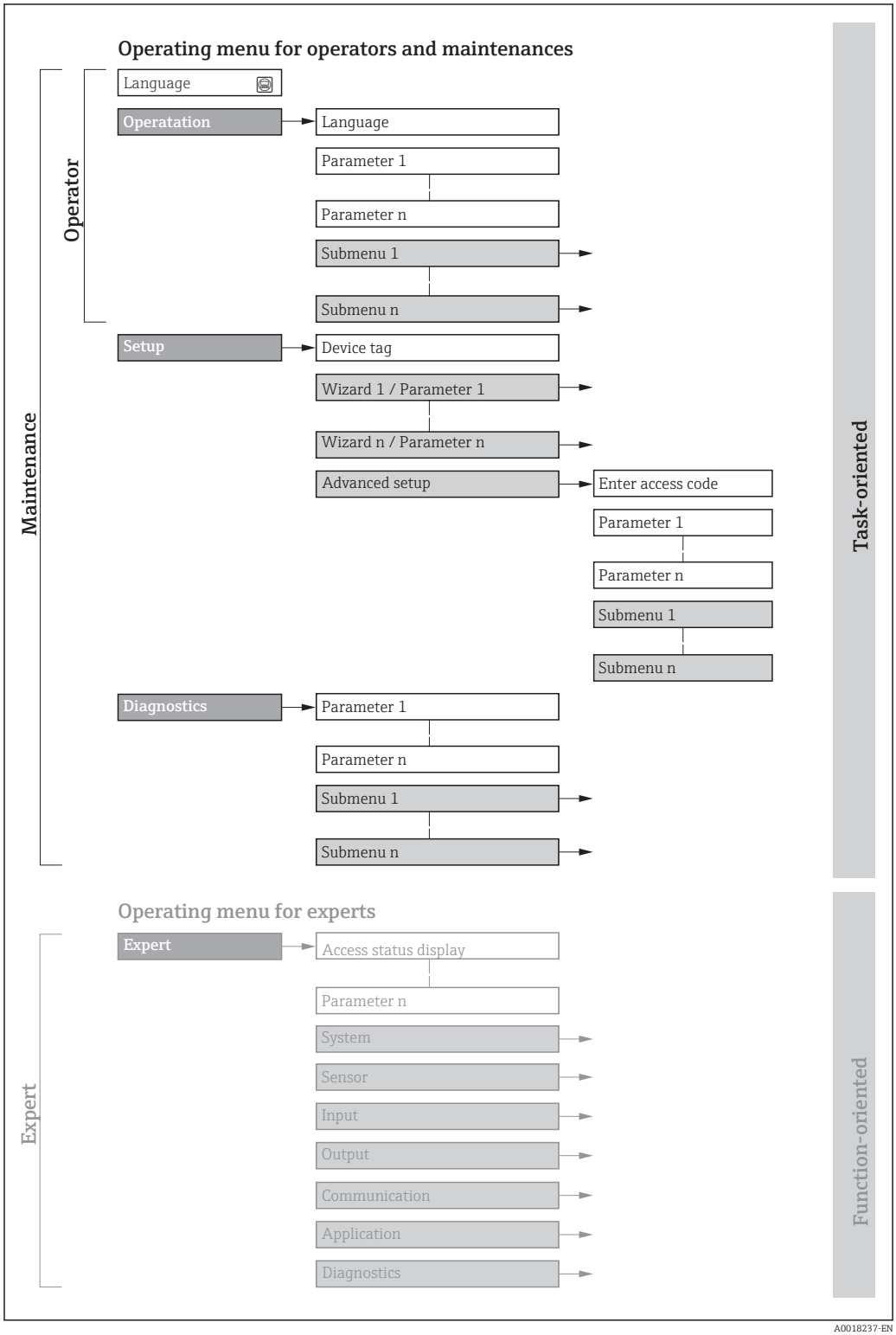
A0029295

1 *Local operation via display module*
2 *Computer with Web browser (e.g. Internet Explorer) or with operating tool (e.g. FieldCare, DeviceCare, AMS Device Manager, SIMATIC PDM)*
3 *Field Xpert SFX350 or SFX370*
4 *Field Communicator 475*
5 *Mobile handheld terminal*
6 *Control system (e.g. PLC)*

8.2 Structure and function of the operating menu

8.2.1 Structure of the operating menu

For an overview of the operating menu for experts: "Description of Device Parameters" document supplied with the device→ 175



20 *Schematic structure of the operating menu*

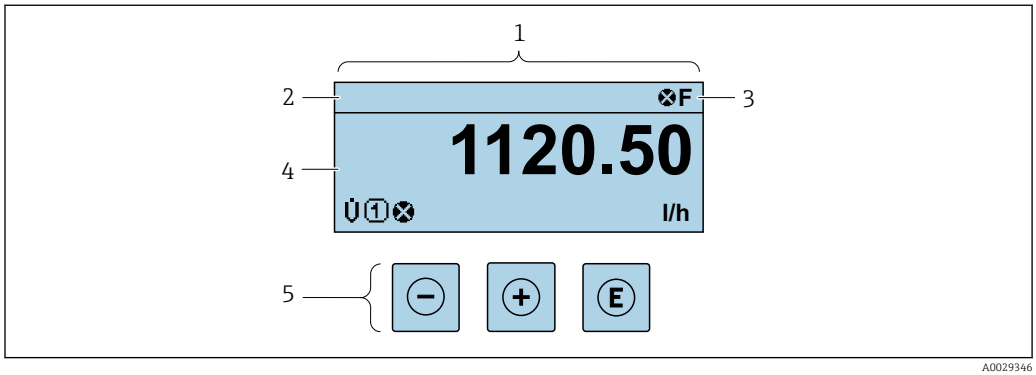
8.2.2 Operating philosophy

The individual parts of the operating menu are assigned to certain user roles (operator, maintenance etc.). Each user role contains typical tasks within the device lifecycle.

Menu/parameter		User role and tasks	Content/meaning
Language	task-oriented	**Role "Operator", "Maintenance"** Tasks during operation: ▪ Configuring the operational display ▪ Reading measured values	▪ Defining the operating language ▪ Defining the Web server operating language ▪ Resetting and controlling totalizers
Operation			▪ Configuring the operational display (e.g. display format, display contrast) ▪ Resetting and controlling totalizers
Setup		**"Maintenance" role** Commissioning: ▪ Configuration of the measurement ▪ Configuration of the inputs and outputs ▪ Configuration of the communication interface	Wizards for fast commissioning: ▪ Set the system units ▪ Display I/O/configuration ▪ Configure the inputs ▪ Configure the outputs ▪ Configuring the operational display ▪ Define the output conditioning ▪ Set the low flow cut off ▪ Configure empty pipe detection Advanced setup ▪ For more customized configuration of the measurement (adaptation to special measuring conditions) ▪ Configuration of totalizers ▪ Configuration of electrode cleaning (optional) ▪ Configure the WLAN settings ▪ Administration (define access code, reset measuring device)
Diagnostics		**"Maintenance" role** Fault elimination: ▪ Diagnostics and elimination of process and device errors ▪ Measured value simulation	Contains all parameters for error detection and analyzing process and device errors: ▪ Diagnostic list Contains up to 5 currently pending diagnostic messages. ▪ Event logbook Contains event messages that have occurred. ▪ Device information Contains information for identifying the device. ▪ Measured values Contains all current measured values. ▪ **Data logging** submenu with "Extended HistoROM" order option Storage and visualization of measured values ▪ Heartbeat The functionality of the device is checked on demand and the verification results are documented. ▪ Simulation Is used to simulate measured values or output values.
Expert	function-oriented	Tasks that require detailed knowledge of the function of the device: ▪ Commissioning measurements under difficult conditions ▪ Optimal adaptation of the measurement to difficult conditions ▪ Detailed configuration of the communication interface ▪ Error diagnostics in difficult cases	Contains all the parameters of the device and makes it possible to access these parameters directly using an access code. The structure of this menu is based on the function blocks of the device: ▪ System Contains all higher-order device parameters which do not concern the measurement or the communication interface. ▪ Sensor Configuration of the measurement. ▪ Input Configuring the status input. ▪ Output Configuring of the analog current outputs as well as the pulse/frequency and switch output. ▪ Communication Configuration of the digital communication interface and the Web server. ▪ Application Configure the functions that go beyond the actual measurement (e.g. totalizer). ▪ Diagnostics Error detection and analysis of process and device errors and for device simulation and Heartbeat Technology.

8.3 Access to the operating menu via the local display

8.3.1 Operational display



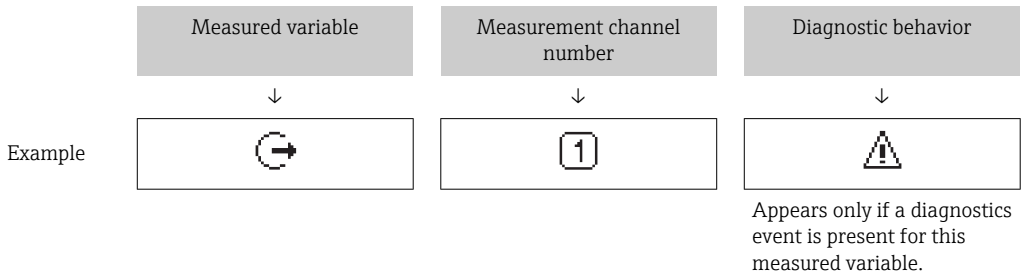
1 *Operational display*
2 *Device tag→ 76*
3 *Status area*
4 *Display area for measured values (4-line)*
5 *Operating elements→ 51*

Status area

The following symbols appear in the status area of the operational display at the top right:
- Status signals→ 129
  - **F**: Failure
  - **C**: Function check
  - **S**: Out of specification
  - **M**: Maintenance required
- Diagnostic behavior→ 130
  - : Alarm
  - : Warning
- : Locking (the device is locked via the hardware)
- : Communication (communication via remote operation is active)

Display area

In the display area, each measured value is prefaced by certain symbol types for further description:



Measured values

Symbol	Meaning
U̇	Volume flow
G	Conductivity

	Mass flow
	Totalizer The measurement channel number indicates which of the three totalizers is displayed.
	Output The measurement channel number indicates which of the outputs is displayed.
	Status input

Measurement channel numbers

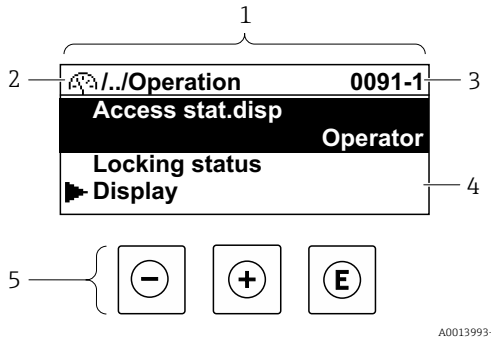
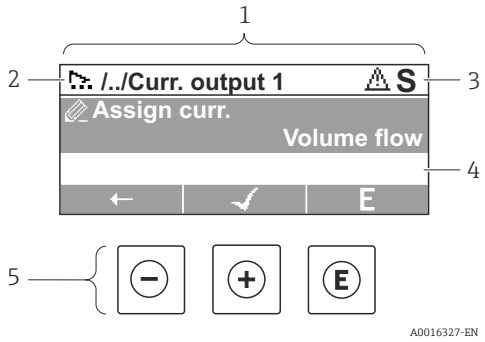
Symbol	Meaning
1 ... 4	Measurement channel 1 to 4
The measurement channel number is displayed only if more than one channel is present for the same measured variable type (e.g. Totalizer 1 to 3).	

Diagnostic behavior

The diagnostic behavior pertains to a diagnostic event that is relevant to the displayed measured variable.
For information on the symbols → 130

The number and display format of the measured values can be configured via the **"Format display" parameter** → 89. Operation → Display → Format display

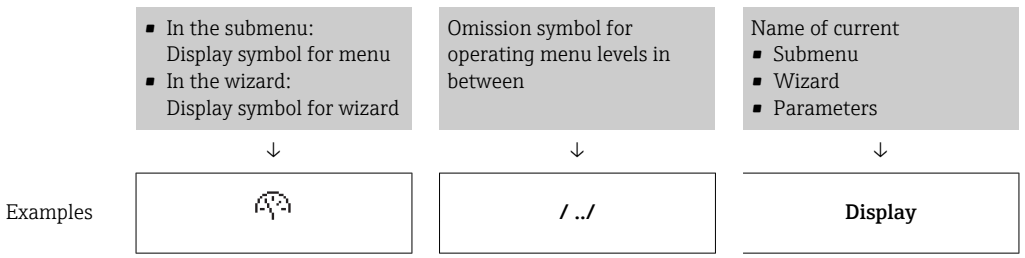
8.3.2 Navigation view

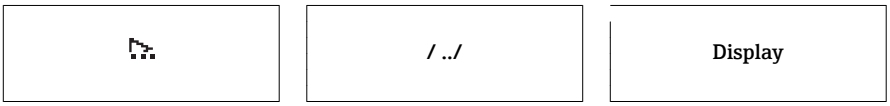
In the submenu	In the wizard
	

1 Navigation view
2 Navigation path to current position
3 Status area
4 Display area for navigation
5 Operating elements → 51

Navigation path

The navigation path - displayed at the top left in the navigation view - consists of the following elements:





For more information about the icons in the menu, refer to the "Display area" section → 48

Status area

The following appears in the status area of the navigation view in the top right corner:
- In the submenu
  - The direct access code for the parameter you are navigating to (e.g. 0022-1)
  - If a diagnostic event is present, the diagnostic behavior and status signal
- In the wizard
  If a diagnostic event is present, the diagnostic behavior and status signal

- For information on the diagnostic behavior and status signal → 129
- For information on the function and entry of the direct access code → 53

Display area

Menus

Symbol	Meaning
	Operation Appears: ▪ In the menu next to the "Operation" selection ▪ At the left in the navigation path in the **Operation** menu
	Setup Appears: ▪ In the menu next to the "Setup" selection ▪ At the left in the navigation path in the **Setup** menu
	Diagnostics Appears: ▪ In the menu next to the "Diagnostics" selection ▪ At the left in the navigation path in the **Diagnostics** menu
	Expert Appears: ▪ In the menu next to the "Expert" selection ▪ At the left in the navigation path in the **Expert** menu

Submenus, wizards, parameters

Symbol	Meaning
	Submenu
	Wizard
	Parameters within a wizard No display symbol exists for parameters in submenus.

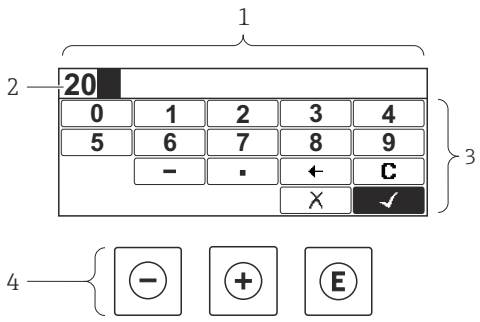
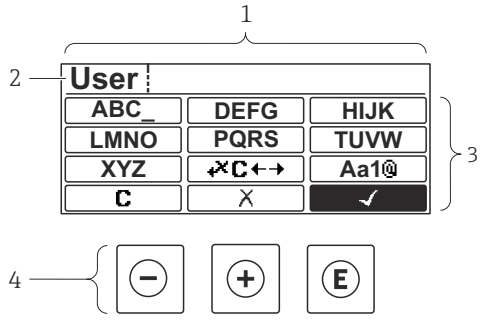
Locking

Symbol	Meaning
	Parameter locked When displayed in front of a parameter name, indicates that the parameter is locked. ▪ By a user-specific access code ▪ By the hardware write protection switch

Wizard operation

Symbol	Meaning
←	Switches to the previous parameter.
✓	Confirms the parameter value and switches to the next parameter.
E	Opens the editing view of the parameter.

8.3.3 Editing view

Numeric editor	Text editor
	

1 Editing view
2 Display area of the entered values
3 Input mask
4 Operating elements → 51

Input mask

The following input symbols are available in the input mask of the numeric and text editor:

Numeric editor

Symbol	Meaning
0 … 9	Selection of numbers from 0 to 9.
.	Inserts decimal separator at the input position.
−	Inserts minus sign at the input position.
✓	Confirms selection.
←	Moves the input position one position to the left.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Text editor

Symbol	Meaning
Aa1@	Toggle ▪ Between upper-case and lower-case letters ▪ For entering numbers ▪ For entering special characters
ABC_ ... XYZ	Selection of letters from A to Z.
abc _ ... xyz	Selection of letters from a to z.
'"^ _ ... ~& _	Selection of special characters.
✓	Confirms selection.
✓C↔	Switches to the selection of the correction tools.
✗	Exits the input without applying the changes.
C	Clears all entered characters.

Correction symbols under ✓C↔

Symbol	Meaning
C	Clears all entered characters.
→	Moves the input position one position to the right.
←	Moves the input position one position to the left.
✓	Deletes one character immediately to the left of the input position.

8.3.4 Operating elements

Key	Meaning
⊖	**Minus key** *In a menu, submenu* Moves the selection bar upwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the previous parameter. *With a text and numeric editor* In the input mask, moves the selection bar to the left (backwards).
⊕	**Plus key** *In a menu, submenu* Moves the selection bar downwards in a choose list. *With a Wizard* Confirms the parameter value and goes to the next parameter. *With a text and numeric editor* Moves the selection bar to the right (forwards) in an input screen.
Ⓔ	**Enter key** *For operational display* ▪ Pressing the key briefly opens the operating menu. ▪ Pressing the key for 2 s opens the context menu. *In a menu, submenu* ▪ Pressing the key briefly: – Opens the selected menu, submenu or parameter. – Starts the wizard. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s for parameter: If present, opens the help text for the function of the parameter. *With a Wizard* Opens the editing view of the parameter. *With a text and numeric editor* ▪ Pressing the key briefly: – Opens the selected group. – Carries out the selected action. ▪ Pressing the key for 2 s confirms the edited parameter value.
⊖ + ⊕	**Escape key combination (press keys simultaneously)** *In a menu, submenu* ▪ Pressing the key briefly: – Exits the current menu level and takes you to the next higher level. – If help text is open, closes the help text of the parameter. ▪ Pressing the key for 2 s returns you to the operational display ("home position"). *With a Wizard* Exits the wizard and takes you to the next higher level. *With a text and numeric editor* Closes the text or numeric editor without applying changes.
⊖ + Ⓔ	**Minus/Enter key combination (press the keys simultaneously)** Reduces the contrast (brighter setting).
⊕ + Ⓔ	**Plus/Enter key combination (press and hold down the keys simultaneously)** Increases the contrast (darker setting).
⊖ + ⊕ + Ⓔ	**Minus/Plus/Enter key combination (press the keys simultaneously)** *For operational display* Enables or disables the keypad lock (only SD02 display module).

8.3.5 Opening the context menu

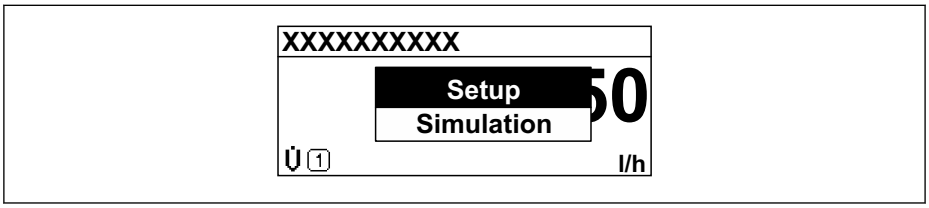
Using the context menu, the user can call up the following menus quickly and directly from the operational display:

- Setup
- Data backup
- Simulation

Calling up and closing the context menu

The user is in the operational display.

1. Press E for 2 s.
   ↳ The context menu opens.



2. Press − + + simultaneously.
   ↳ The context menu is closed and the operational display appears.

Calling up the menu via the context menu

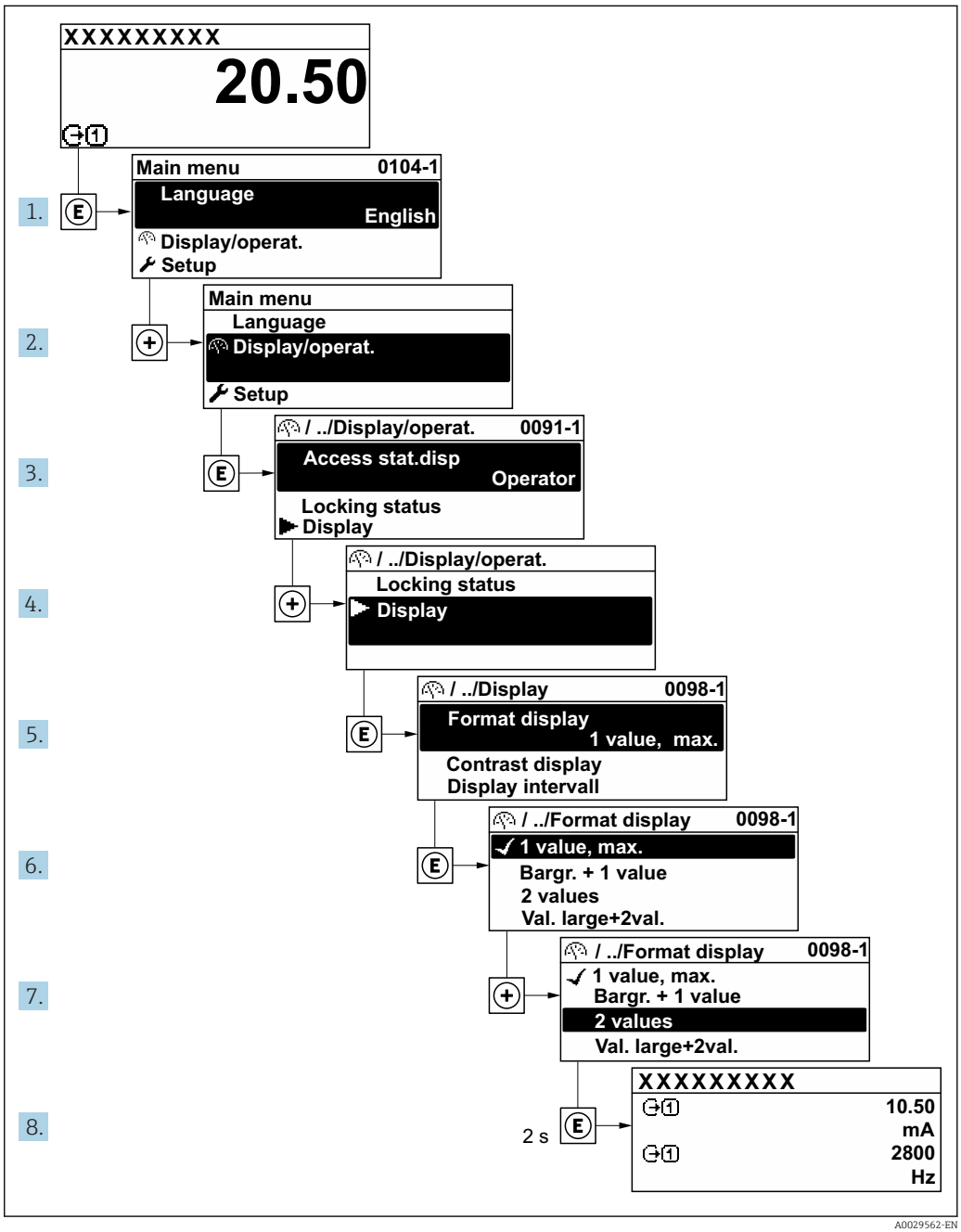
1. Open the context menu.
2. Press + to navigate to the desired menu.
3. Press E to confirm the selection.
   ↳ The selected menu opens.

8.3.6 Navigating and selecting from list

Different operating elements are used to navigate through the operating menu. The navigation path is displayed on the left in the header. Icons are displayed in front of the individual menus. These icons are also shown in the header during navigation.

For an explanation of the navigation view with symbols and operating elements
→ 47

Example: Setting the number of displayed measured values to "2 values"

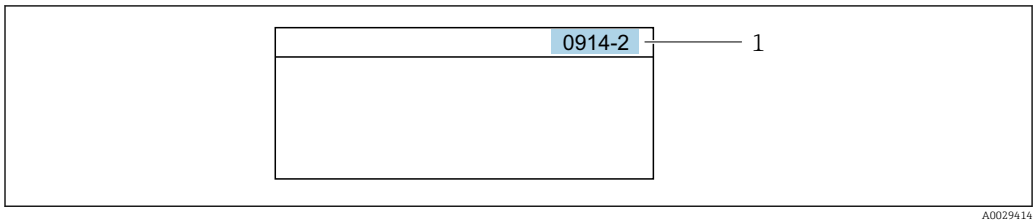


8.3.7 Calling the parameter directly

A parameter number is assigned to every parameter to be able to access a parameter directly via the onsite display. Entering this access code in the **Direct access** parameter calls up the desired parameter directly.

Navigation path
Expert → Direct access

The direct access code consists of a 4-digit number and the channel number, which identifies the channel of a process variable: e.g. 0914-1. In the navigation view, this appears on the right-hand side in the header of the selected parameter.



1 Direct access code

Note the following when entering the direct access code:
- The leading zeros in the direct access code do not have to be entered.
  Example: Input of **"914"** instead of **"0914"**
- If no channel number is entered, channel 1 is jumped to automatically.
  Example: Enter **0914** → **Assign process variable** parameter
- If a different channel is jumped to: Enter the direct access code with the corresponding channel number.
  Example: Enter **0914-2** → **Assign process variable** parameter

For the direct access codes of the individual parameters, see the "Description of Device Parameters" document for the device

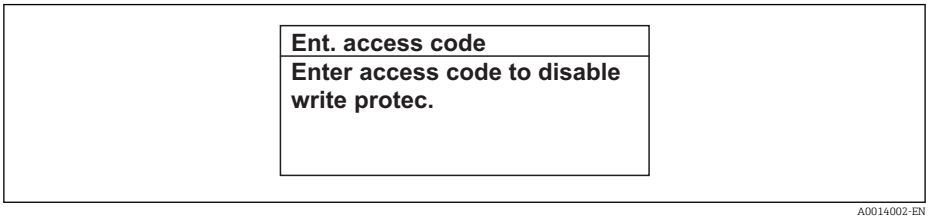
8.3.8 Calling up help text

Help text is available for some parameters and can be called up from the navigation view. The help text provides a brief explanation of the parameter function and thereby supports swift and safe commissioning.

Calling up and closing the help text

The user is in the navigation view and the selection bar is on a parameter.

1. Press E for 2 s.
   ↳ The help text for the selected parameter opens.



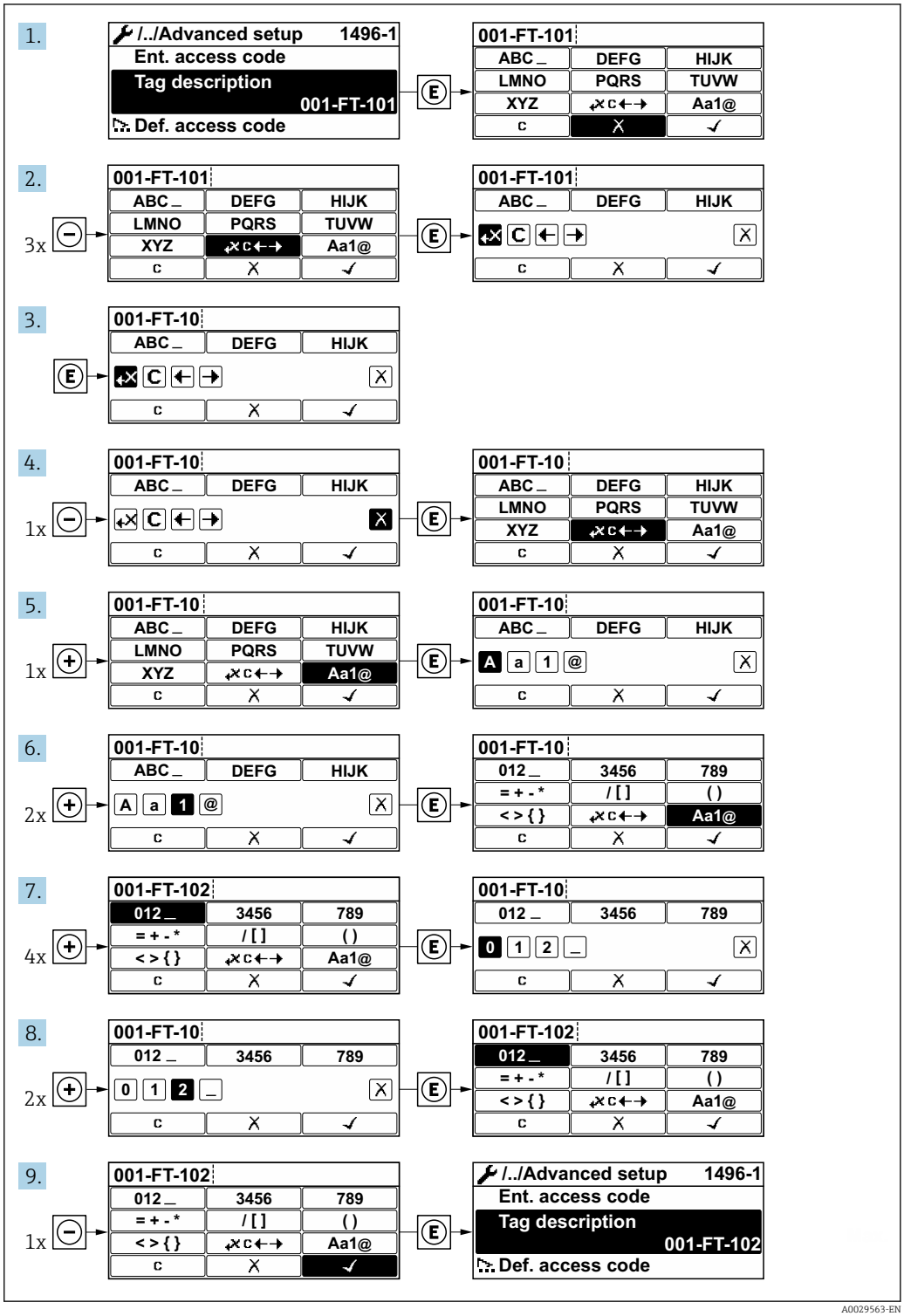
21 Example: Help text for parameter "Enter access code"

2. Press − + + simultaneously.
   ↳ The help text is closed.

8.3.9 Changing the parameters

For a description of the editing display - consisting of text editor and numeric editor - with symbols → 49, for a description of the operating elements → 51

Example: Changing the tag name in the "Tag description" parameter from 001-FT-101 to 001-FT-102



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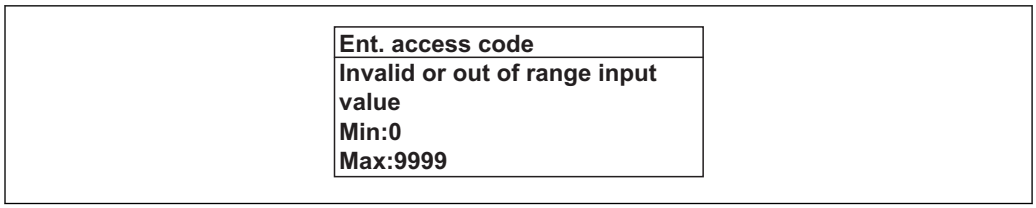
A message is displayed if the value entered is outside the permitted value range.



A0014049-EN

8.3.10 User roles and related access authorization

The two user roles "Operator" and "Maintenance" have different write access to the parameters if the customer defines a user-specific access code. This protects the device configuration via the local display from unauthorized access → 112.

Access authorization to parameters: "Operator" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	–– [1]

1) Despite the defined access code, certain parameters can always be modified and thus are excepted from the write protection, as they do not affect the measurement. Refer to the "Write protection via access code" section

Access authorization to parameters: "Maintenance" user role

Access code status	Read access	Write access
An access code has not yet been defined (factory setting).	✔	✔
After an access code has been defined.	✔	✔ [1]

1) If an incorrect access code is entered, the user obtains the access rights of the "Operator" user role.

The user role with which the user is currently logged on is indicated by the **Access status** parameter. Navigation path: Operation → Access status

8.3.11 Disabling write protection via access code

If the 🔒-symbol appears on the local display in front of a parameter, the parameter is write-protected by a user-specific access code and its value cannot be changed at the moment using local operation → 112.

Parameter write protection via local operation can be disabled by entering the user-specific access code in the **Enter access code** parameter via the respective access option.

1. After you press E, the input prompt for the access code appears.
2. Enter the access code.
   ↳ The 🔒-symbol in front of the parameters disappears; all previously write-protected parameters are now re-enabled.

8.3.12 Enabling and disabling the keypad lock

The keypad lock makes it possible to block access to the entire operating menu via local operation. As a result, it is no longer possible to navigate through the operating menu or change the values of individual parameters. Users can only read the measured values on the operational display.

Local operation with touch control

The keypad lock is switched on and off via the context menu.

Switching on the keypad lock

The keypad lock is switched on automatically:
- Each time the device is restarted.
- If the device has not been operated for longer than one minute in the measured value display.

1. The device is in the measured value display.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu, select the **Keylock on** option.
   ↳ The keypad lock is switched on.

If the user attempts to access the operating menu while the keypad lock is active, the message **Keylock on** appears.

Switching off the keypad lock

1. The keypad lock is switched on.
   Press E for at least 2 seconds.
   ↳ A context menu appears.
2. In the context menu, select the **Keylock off** option.
   ↳ The keypad lock is switched off.

8.4 Access to the operating menu via the Web browser

8.4.1 Function range

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 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 measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

For additional information on the Web server, refer to the Special Documentation for the device → 176

8.4.2 Prerequisites

Computer hardware

Hardware	Interface	
	CDI-RJ45	WLAN
Interface	The computer must have an RJ45 interface.	The operating unit must have a WLAN interface.
Connection	Standard Ethernet cable with RJ45 connector.	Connection via Wireless LAN.
Screen	Recommended size: ≥12" (depends on the screen resolution)	

Computer software

Software	Interface	
	CDI-RJ45	WLAN
Recommended operating systems	▪ Microsoft Windows 7 or higher. ▪ Mobile operating systems: – iOS – Android Microsoft Windows XP is supported.	
Web browsers supported	▪ Microsoft Internet Explorer 8 or higher ▪ Microsoft Edge ▪ Mozilla Firefox ▪ Google Chrome ▪ Safari	

Computer settings

Settings	Interface	
	CDI-RJ45	WLAN
User rights	Appropriate user rights (e.g. administrator rights) for TCP/IP and proxy server settings are necessary (for adjusting the IP address, subnet mask etc.).	
Proxy server settings of the Web browser	The Web browser setting *Use a Proxy Server for Your LAN* must be **deselected** .	
JavaScript	JavaScript must be enabled. If JavaScript cannot be enabled: enter http://192.168.1.212/basic.html in the address line of the Web browser. A fully functional but simplified version of the operating menu structure starts in the Web browser. When installing a new firmware version: To enable correct data display, clear the temporary memory (cache) of the Web browser under **Internet options**.	
Network connections	Only the active network connections to the measuring device should be used.	
	Switch off all other network connections such as WLAN.	Switch off all other network connections.

In the event of connection problems: → 126

Measuring device

Device	Interface	
	CDI-RJ45	WLAN
Measuring device	The measuring device has an RJ45 interface.	The measuring device has a WLAN antenna: ▪ Transmitter with integrated WLAN antenna ▪ Transmitter with external WLAN antenna
Web server	Web server must be enabled; factory setting: ON For information on enabling the Web server → 62	Web server and WLAN must be enabled; factory setting: ON For information on enabling the Web server → 62

8.4.3 Establishing a connection

Via service interface (CDI-RJ45)

Configuring the Internet protocol of the computer

The following information refers to the default Ethernet settings of the device.

IP address of the device: 192.168.1.212 (factory setting)

1. Switch on the measuring device.
2. Connect to the computer using a cable → 64.
3. If a 2nd network card is not used, close all the applications on the notebook.
   ↳ Applications requiring Internet or a network, such as e-mail, SAP applications, Internet or Windows Explorer.
4. Close any open Internet browsers.
5. Configure the properties of the Internet protocol (TCP/IP) as defined in the table:

IP address	192.168.1.XXX; for XXX all numerical sequences except: 0, 212 and 255 → e.g. 192.168.1.213
Subnet mask	255.255.255.0
Default gateway	192.168.1.212 or leave cells empty

Via WLAN interface

Configuring the Internet protocol of the operating unit

NOTICE

If the WLAN connection is lost during the configuration, settings made may be lost.

- Make sure that the WLAN connection is not disconnected while configuring the device.

NOTICE

In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same operating unit. This could cause a network conflict.

- Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
- If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparation

- Enable WLAN reception on the operating unit.

Establishing a connection

1. Select the measuring device using the SSID (e.g. EH_Promag_300_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

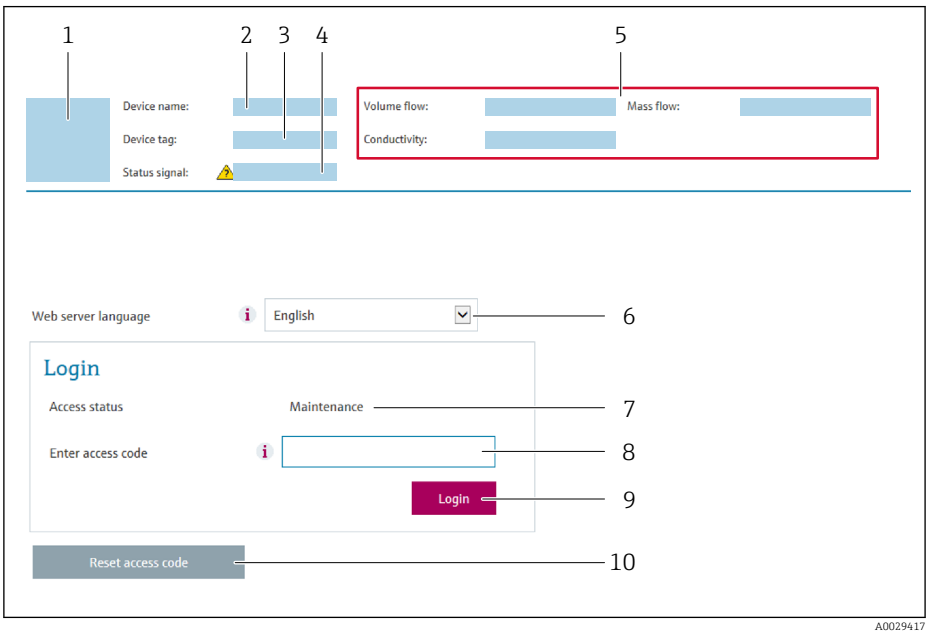
The serial number can be found on the nameplate.

Disconnecting

- Once the configuration is completed, disconnect the WLAN connection between the operating unit and the measuring device.

Starting the Web browser

1. Start the Web browser on the computer.
2. Enter the IP address of the Web server in the address line of the Web browser: 192.168.1.212
   ↳ The login page appears.



1 *Picture of device*
2 *Device name*
3 *Device tag (→ 76)*
4 *Status signal*
5 *Current measured values*
6 *Operating language*
7 *User role*
8 *Access code*
9 *Login*
10 *Reset access code (→ 108)*

If a login page does not appear, or if the page is incomplete → 126

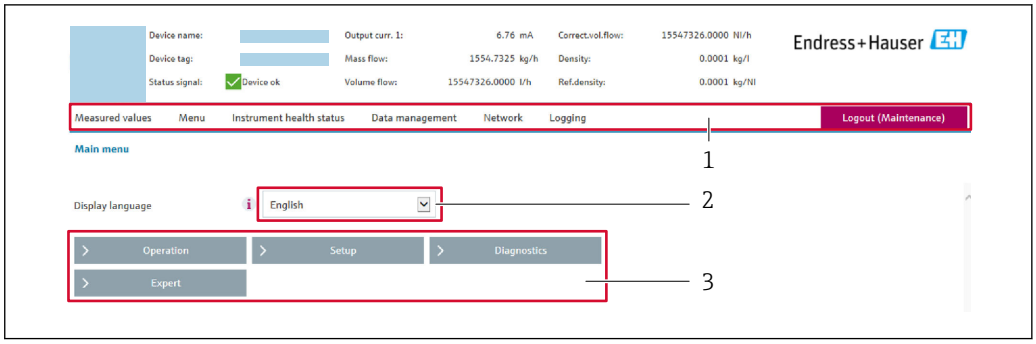
8.4.4 Logging on

1. Select the preferred operating language for the Web browser.
2. Enter the user-specific access code.
3. Press **OK** to confirm your entry.

Access code	0000 (factory setting); can be changed by customer

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

8.4.5 User interface



A0029418

1 *Function row*
2 *Operating language*
3 *Navigation area*

Header

The following information appears in the header:
- Device tag
- Device status with status signal → 132
- Current measured values

Function row

Functions	Meaning
Measured values	Displays the measured values of the measuring device
Menu	▪ Access to the operating menu from the measuring device ▪ The structure of the operating menu is the same as for the local display For detailed information on the structure of the operating menu, see the Operating Instructions for the measuring device
Device status	Displays the diagnostic messages currently pending, listed in order of priority
Data management	▪ Data exchange between PC and measuring device: – Load the configuration from the measuring device (XML format, save configuration) – Save the configuration to the measuring device (XML format, restore configuration) – Export the event list (.csv file) – Export parameter settings (.csv file, create documentation of the measuring point configuration) – Export the Heartbeat verification log (PDF file, only available with the "Heartbeat Verification" application package) ▪ If using fieldbuses, upload device drivers for system integration from the measuring device: HART: DD file ▪ Flashing a firmware version
Network configuration	Configuration and checking of all the parameters required for establishing the connection to the measuring device: ▪ Network settings (e.g. IP address, MAC address) ▪ Device information (e.g. serial number, firmware version)
Logout	End the operation and call up the login page

Navigation area

If a function is selected in the function bar, the submenus of the function open in the navigation area. The user can now navigate through the menu structure.

Working area

Depending on the selected function and the related submenus, various actions can be performed in this area:
- Configuring parameters
- Reading measured values
- Calling up help text
- Starting an upload/download

8.4.6 Disabling the Web server

The Web server of the measuring device can be switched on and off as required using the **Web server functionality** parameter.

Navigation

"Expert" menu → Communication → Web server

Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Web server functionality	Switch the Web server on and off.	▪ Off ▪ On	On

Function scope of the "Web server functionality" parameter

Option	Description
Off	▪ The web server is completely disabled. ▪ Port 80 is locked.
On	▪ The complete functionality of the web server is available. ▪ JavaScript is used. ▪ The password is transferred in an encrypted state. ▪ Any change to the password is also transferred in an encrypted state.

Enabling the Web server

If the Web server is disabled it can only be re-enabled with the **Web server functionality** parameter via the following operating options:
- Via local display
- Via Bedientool "FieldCare"
- Via "DeviceCare" operating tool

8.4.7 Logging out

Before logging out, perform a data backup via the **Data management** function (upload configuration from device) if necessary.

1. Select the **Logout** entry in the function row.
   ↳ The home page with the Login box appears.
2. Close the Web browser.
3. Reset the modified properties of the Internet protocol (TCP/IP) if they are no longer needed → 59.

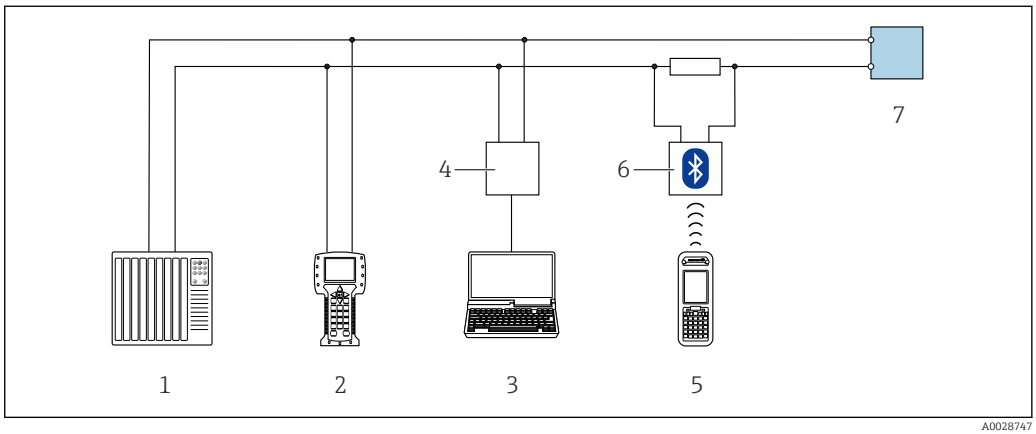
8.5 Access to the operating menu via the operating tool

The structure of the operating menu in the operating tools is the same as for operation via the local display.

8.5.1 Connecting the operating tool

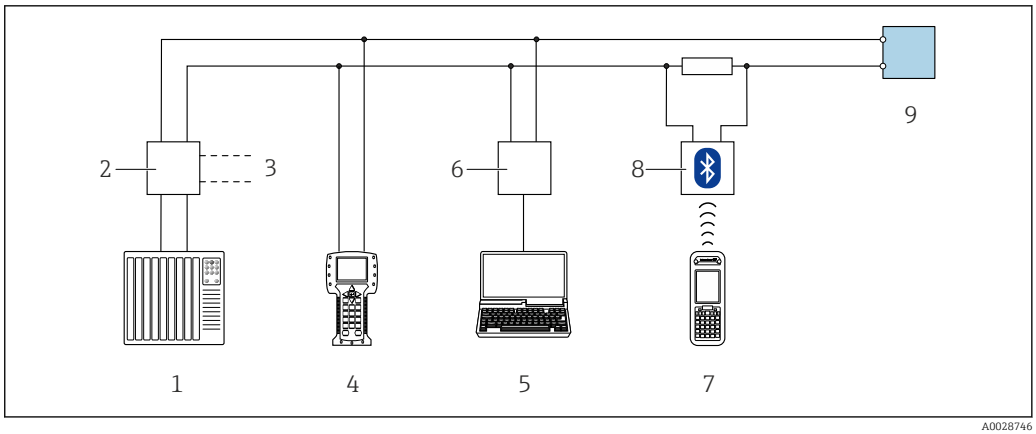
Via HART protocol

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



22 *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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
7 *Transmitter*

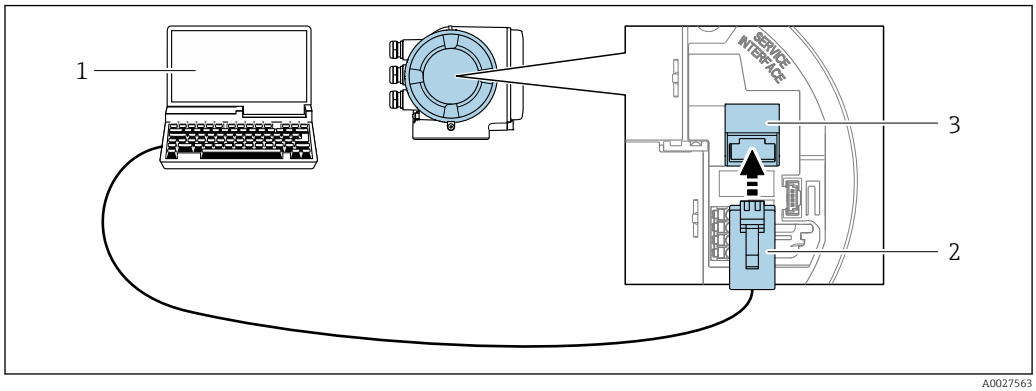


23 *Options for remote operation via HART protocol (passive)*

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 accessing the integrated device Web server or computer with 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 *VIATOR Bluetooth modem with connecting cable*
9 *Transmitter*

Service interface

Via service interface (CDI-RJ45)

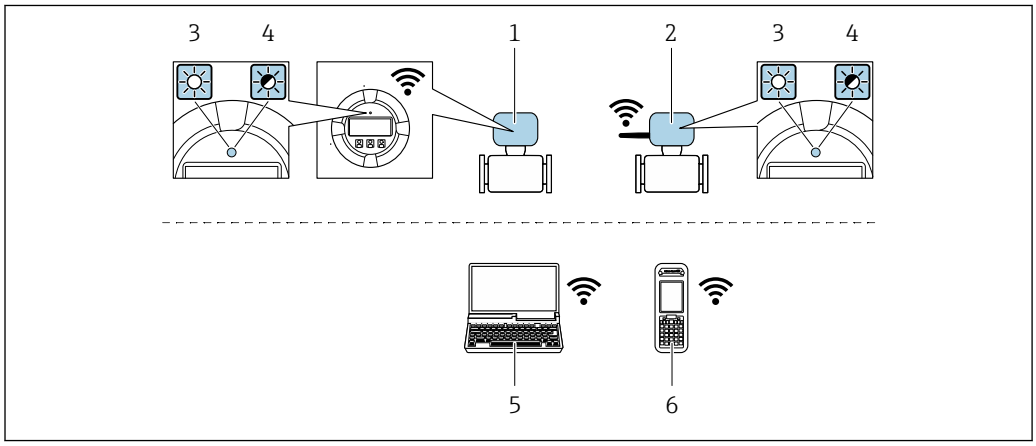


24 *Connection via service interface (CDI-RJ45)*

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"*
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, backlit, graphic display; touch control + WLAN"



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)*

Wireless LAN	IEEE 802.11 b/g (2.4 GHz) WLAN
Encryption	WPA2 PSK/TKIP AES-128
Configurable channels	1 to 11
Function	Access point with DHCP

Range with integrated antenna	Max. 10 m (32 ft)
Range with external antenna	Max. 50 m (164 ft)

Configuring the Internet protocol of the operating unit

NOTICE

If the WLAN connection is lost during the configuration, settings made may be lost.

- Make sure that the WLAN connection is not disconnected while configuring the device.

NOTICE

In principle, avoid simultaneous access to the measuring device via the service interface (CDI-RJ45) and the WLAN interface from the same operating unit. This could cause a network conflict.

- Only activate one service interface (CDI-RJ45 service interface or WLAN interface).
- If simultaneous communication is necessary: configure different IP address ranges, e.g. 192.168.0.1 (WLAN interface) and 192.168.1.212 (CDI-RJ45 service interface).

Preparation

- Enable WLAN reception on the operating unit.

Establishing a connection

1. Select the measuring device using the SSID (e.g. EH_Promag_300_A802000).
2. If necessary, select the WPA2 encryption method.
3. Enter the password: serial number of the measuring device ex-works (e.g. L100A802000).
   ↳ LED on display module flashes: it is now possible to operate the measuring device with the Web browser, FieldCare or DeviceCare.

The serial number can be found on the nameplate.

Disconnecting

- Once the configuration is completed, disconnect the WLAN connection between the operating unit and the measuring device.

8.5.2 Field Xpert SFX350, SFX370

Function scope

Field Xpert SFX350 and Field Xpert SFX370 are mobile computers for commissioning and maintenance. They enable efficient device configuration and diagnostics for HART and FOUNDATION fieldbus devices in the **non-Ex area** (SFX350, SFX370) and the **Ex area** (SFX370).

For details, see Operating Instructions BA01202S

Source for device description files

See data → 69

8.5.3 FieldCare

Function scope

FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field devices in a 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.

Access is via:
- HART protocol
- CDI-RJ45 service interface → 64
- WLAN interface→ 64

Typical functions:
- Configuring parameters of transmitters
- Loading and saving device data (upload/download)
- Documentation of the measuring point
- Visualization of the measured value memory (line recorder) and event logbook

For additional information about FieldCare, see Operating Instructions BA00027S and BA00059S

Source for device description files

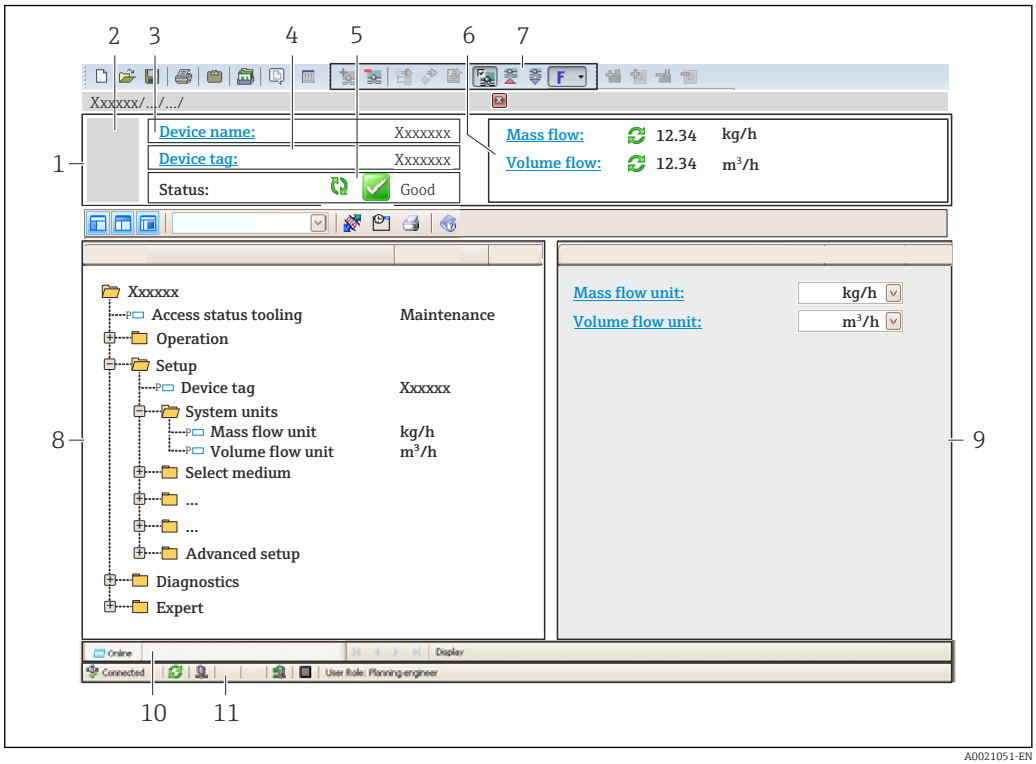
See information → 69

Establishing a connection

1. Start FieldCare and launch the project.
2. In the network: Add a device.
   ↳ The **Add device** window opens.
3. Select the **CDI Communication TCP/IP** option from the list and press **OK** to confirm.
4. Right-click **CDI Communication TCP/IP** and select the **Add device** option in the context menu that opens.
5. Select the desired device from the list and press **OK** to confirm.
   ↳ The **CDI Communication TCP/IP (Configuration)** window opens.
6. Enter the device address in the **IP address** field: 192.168.1.212 and press **Enter** to confirm.
7. Establish the online connection to the device.

For additional information, see Operating Instructions BA00027S and BA00059S

User interface



1 *Header*
2 *Picture of device*
3 *Device name*
4 *Tag name*
5 *Status area with status signal* → 🖹 *132*
6 *Display area for current measured values*
7 *Edit toolbar with additional functions such as save/restore, event list and create documentation*
8 *Navigation area with operating menu structure*
9 *Working area*
10 *Range of action*
11 *Status area*

8.5.4 DeviceCare

Function scope

Tool to connect and configure Endress+Hauser field devices.

The fastest way to configure Endress+Hauser field devices is with the dedicated "DeviceCare" tool. Together with the device type managers (DTMs) it presents a convenient, comprehensive solution.

For details, see Innovation Brochure IN01047S

Source for device description files

See information → 🖹 69

8.5.5 AMS Device Manager

Function scope

Program from Emerson Process Management for operating and configuring measuring devices via HART protocol.

Source for device description files

See data → 69

8.5.6 SIMATIC PDM

Function scope

SIMATIC PDM is a standardized, manufacturer-independent program from Siemens for the operation, configuration, maintenance and diagnosis of intelligent field devices via HART protocol.

Source for device description files

See data → 69

8.5.7 Field Communicator 475

Function scope

Industrial handheld terminal from Emerson Process Management for remote configuration and measured value display via HART protocol.

Source for device description files

See data → 69

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	01.00.zz	▪ On the title page of the Operating instructions ▪ On the transmitter nameplate ▪ Firmware version Diagnostics → Device information → Firmware version
Release date of firmware version	08.2016	---
Manufacturer ID	0x11	Manufacturer ID Diagnostics → Device information → Manufacturer ID
Device type ID	0x3C	Device type Diagnostics → Device information → Device type
HART protocol revision	7	---
Device revision	1	▪ On the transmitter nameplate ▪ Device revision Diagnostics → Device information → Device revision

For an overview of the different firmware versions for the device → 145

9.1.2 Operating tools

The suitable device description file for the individual operating tools is listed in the table below, along with information on where the file can be acquired.

Operating tool via HART protocol	Sources for obtaining device descriptions
FieldCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
DeviceCare	▪ www.endress.com → Download Area ▪ CD-ROM (contact Endress+Hauser) ▪ DVD (contact Endress+Hauser)
▪ Field Xpert SFX350 ▪ Field Xpert SFX370	Use update function of handheld terminal
AMS Device Manager (Emerson Process Management)	www.endress.com → Download Area
SIMATIC PDM (Siemens)	www.endress.com → Download Area
Field Communicator 475 (Emerson Process Management)	Use update function of handheld terminal

9.2 Measured variables via HART protocol

The following measured variables (HART device variables) are assigned to the dynamic variables at the factory:

Dynamic variables	Measured variables (HART device variables)
Primary dynamic variable (PV)	Volume flow
Secondary dynamic variable (SV)	Totalizer 1
Tertiary dynamic variable (TV)	Totalizer 2
Quaternary dynamic variable (QV)	Totalizer 3

The assignment of the measured variables to the dynamic variables can be modified and assigned as desired via local operation and the operating tool using the following parameters:

- Expert → Communication → HART output → Output → Assign PV
- Expert → Communication → HART output → Output → Assign SV
- Expert → Communication → HART output → Output → Assign TV
- Expert → Communication → HART output → Output → Assign QV

The following measured variables can be assigned to the dynamic variables:

Measured variables for PV (primary dynamic variable)
- Off
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [1)]
- Corrected conductivity [1)]
- Temperature [1)]
- Electronic temperature

Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)
- Volume flow
- Mass flow
- Corrected volume flow
- Flow velocity
- Conductivity [2)]
- Corrected conductivity [2)]
- Temperature [2)]
- Electronic temperature
- Totalizer 1
- Totalizer 2
- Totalizer 3

The range of options increases if the measuring device has one or more application packages.

Device variables
The device variables are permanently assigned. A maximum of 8 device variables can be transmitted:
- 0 = volume flow
- 1 = mass flow
- 2 = corrected volume flow
- 3 = flow velocity
- 4 = conductivity
- 5 = corrected conductivity
- 6 = temperature
- 7 = electronic temperature

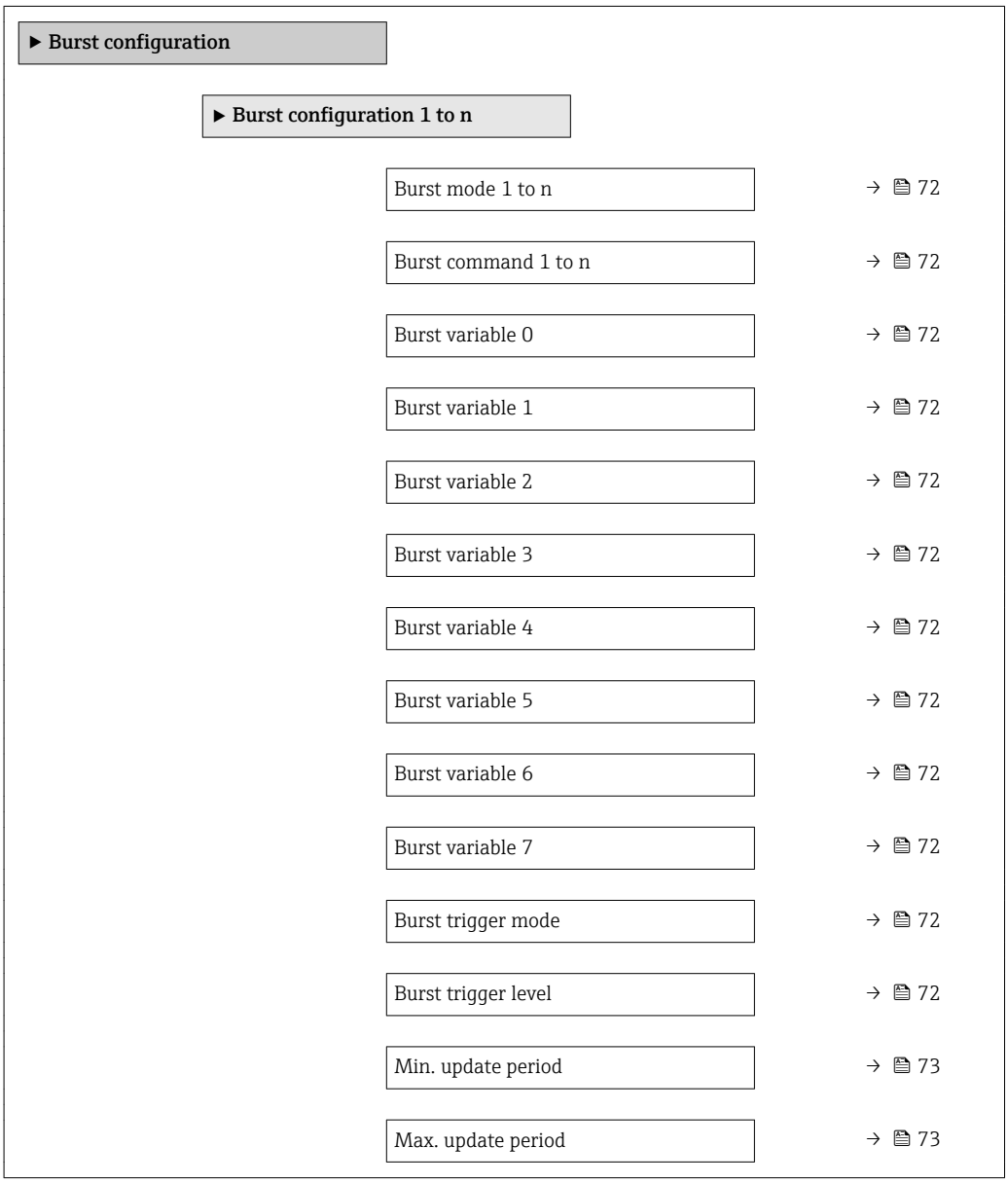
1) Visibility depends on order options or device settings
2) Visibility depends on order options or device settings

- 8 = totalizer 1
- 9 = totalizer 2
- 10 = totalizer 3

9.3 Other settings

9.3.1 Burst mode functionality in accordance with HART 7 Specification

Navigation
"Expert" menu → Communication → HART output → Burst configuration → Burst configuration 1 to n



Parameter overview with brief description

Parameter	Description	Selection / User entry	Factory setting
Burst mode 1 to n	Activate the HART burst mode for burst message X.	▪ Off ▪ On	Off
Burst command 1 to n	Select the HART command that is sent to the HART master.	▪ Command 1 ▪ Command 2 ▪ Command 3 ▪ Command 9 ▪ Command 33 ▪ Command 48	Command 2
Burst variable 0	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Density ▪ Temperature * ▪ HART input ▪ Percent of range ▪ Measured current ▪ Primary variable (PV) ▪ Secondary variable (SV) ▪ Tertiary variable (TV) ▪ Quaternary variable (QV) ▪ Not used	Volume flow
Burst variable 1	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 2	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 3	For HART command 9 and 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 4	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 5	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 6	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst variable 7	For HART command 33, assign a HART device variable or process variable to burst variable.	See the **Burst variable 0** parameter.	Not used
Burst trigger mode	Select the event that triggers burst message X.	▪ Continuous ▪ Window ▪ Rising ▪ Falling ▪ On change	Continuous
Burst trigger level	Enter the burst trigger value. Together with the option selected in the **Burst trigger mode** parameter the burst trigger value determines the time of burst message X.	Positive floating-point number	–

Parameter	Description	Selection / User entry	Factory setting
Min. update period	Enter the minimum time span between two burst responses of one burst message.	Positive integer	1 000 ms
Max. update period	Enter the maximum time span between two burst responses of one burst message.	Positive integer	2 000 ms

* Visibility depends on order options or device settings

10 Commissioning

10.1 Function check

Before commissioning the measuring device:

▶ Make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist → 30
- "Post-connection check" checklist → 42

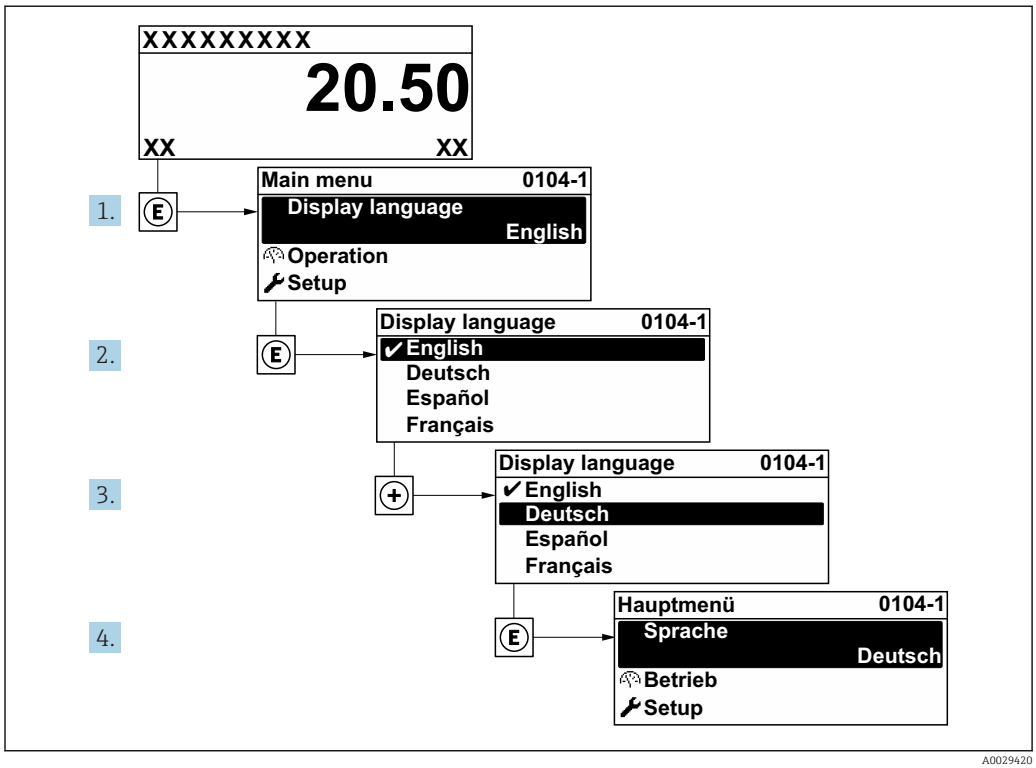
10.2 Switching on the measuring device

▶ After a successful function check, switch on the measuring device.
  ↳ After a successful startup, the local display switches automatically from the startup display to the operational display.

If nothing appears on the local display or a diagnostic message is displayed, refer to the section on "Diagnostics and troubleshooting" → 125.

10.3 Setting the operating language

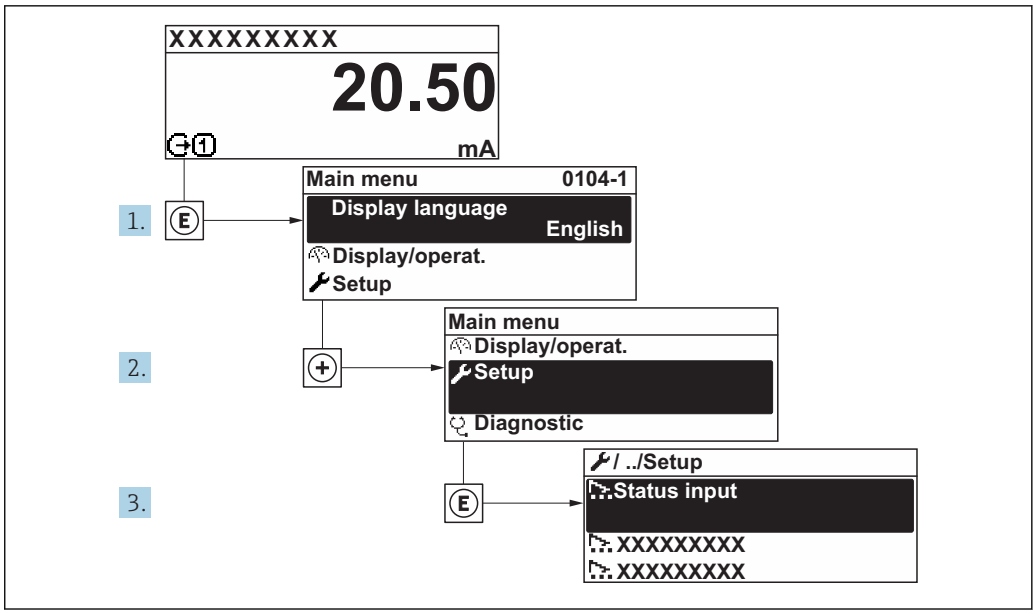
Factory setting: English or ordered local language



25 *Taking the example of the local display*

10.4 Configuring the measuring device

- The **Setup** menuwith its guided wizards contains all the parameters needed for standard operation.
- Navigation to the **Setup** menu



26 *Taking the example of the local display*

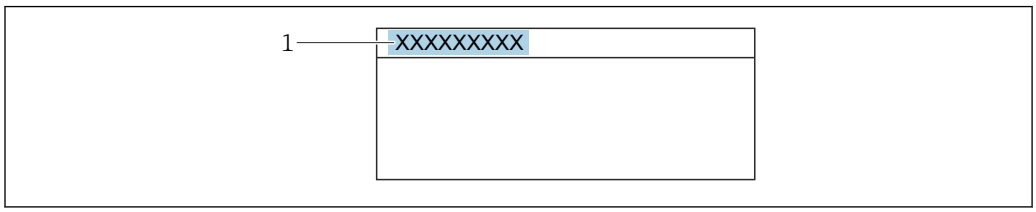
Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Setup

Device tag	→ 76
▶ System units	→ 76
▶ I/O configuration	→ 78
▶ Current input 1 to n	→ 79
▶ Status input 1 to n	→ 78
▶ Current output 1 to n	→ 80
▶ Pulse/frequency/switch output 1 to n	→ 83
▶ Relay output 1 to n	→ 94
▶ Double pulse output	→ 96
▶ Display	→ 89
▶ Low flow cut off	→ 91
▶ Empty pipe detection	→ 92
▶ Advanced setup	→ 98

10.4.1 Defining the tag name

To enable fast identification of the measuring point within the system, you can enter a unique designation using the **Device tag** parameter and thus change the factory setting.



27 *Header of the operational display with tag name*

1 Tag name

Enter the tag name in the "FieldCare" operating tool → 67

Navigation
"Setup" menu → Device tag

Parameter overview with brief description

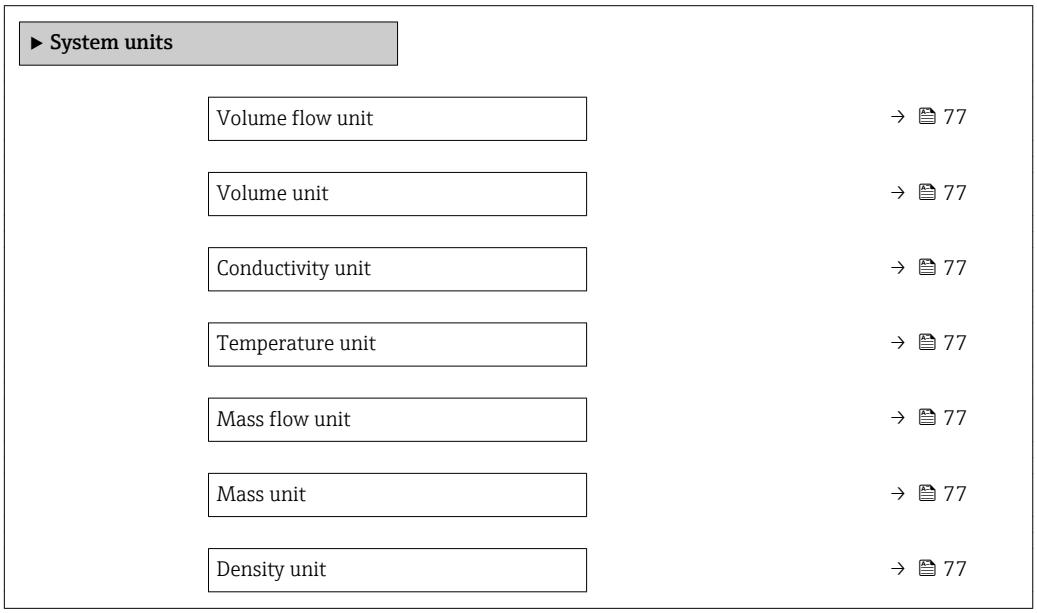
Parameter	Description	User entry	Factory setting
Device tag	Enter the name for the measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag

10.4.2 Setting the system units

In the **System units** submenu the units of all the measured values can be set.

Depending on the device version, not all submenus and parameters are available in every device. The selection can vary depending on the order code.

Navigation
"Setup" menu → System units



Corrected volume flow unit	→ 77
Corrected volume unit	→ 77

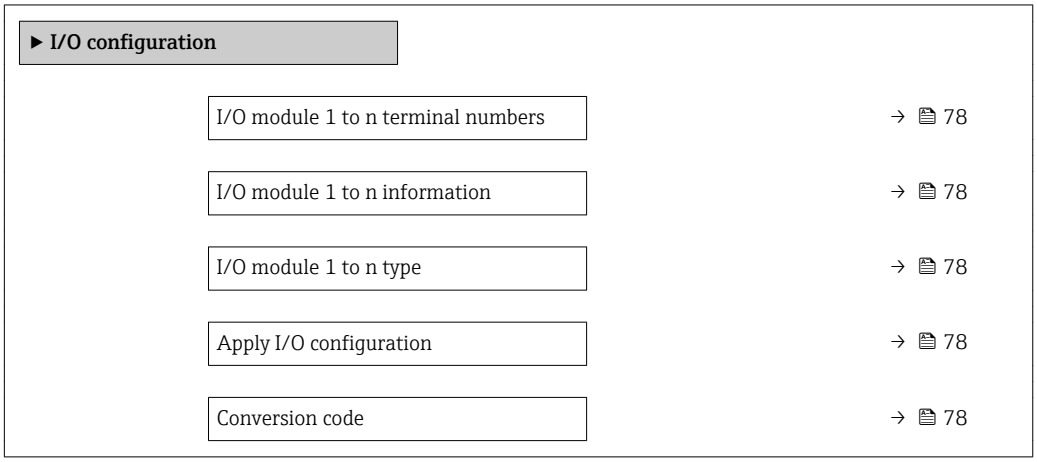
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection	Factory setting
Volume flow unit	–	Select volume flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ l/h ▪ gal/min (us)
Volume unit	–	Select volume unit.	Unit choose list	Country-specific: ▪ m^3 ▪ gal (us)
Conductivity unit	The **On** option is selected in the **Conductivity measurement** parameter parameter.	Select conductivity unit. *Effect* The selected unit applies for: ▪ Current output ▪ Frequency output ▪ Switch output ▪ Simulation process variable	Unit choose list	µS/cm
Temperature unit	–	Select temperature unit. *Result* The selected unit applies for: ▪ **Temperature** parameter ▪ **Maximum value** parameter ▪ **Minimum value** parameter ▪ **External temperature** parameter ▪ **Maximum value** parameter ▪ **Minimum value** parameter	Unit choose list	Country-specific: ▪ °C ▪ °F
Mass flow unit	–	Select mass flow unit. *Result* The selected unit applies for: ▪ Output ▪ Low flow cut off ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/h ▪ lb/min
Mass unit	–	Select mass unit.	Unit choose list	Country-specific: ▪ kg ▪ lb
Density unit	–	Select density unit. *Result* The selected unit applies for: ▪ Output ▪ Simulation process variable	Unit choose list	Country-specific: ▪ kg/l ▪ lb/ft^3
Corrected volume flow unit	–	Select corrected volume flow unit. *Result* The selected unit applies for: **Corrected volume flow** parameter (→ 116)	Unit choose list	Country-specific: ▪ Nl/h ▪ Sft^3/h
Corrected volume unit	–	Select corrected volume unit.	Unit choose list	Country-specific: ▪ Nm^3 ▪ Sft^3

10.4.3 Displaying the I/O configuration

The **I/O configuration** submenu guides the user systematically through all the parameters in which the configuration of the I/O modules is displayed.

Navigation
"Setup" menu → I/O configuration



Parameter overview with brief description

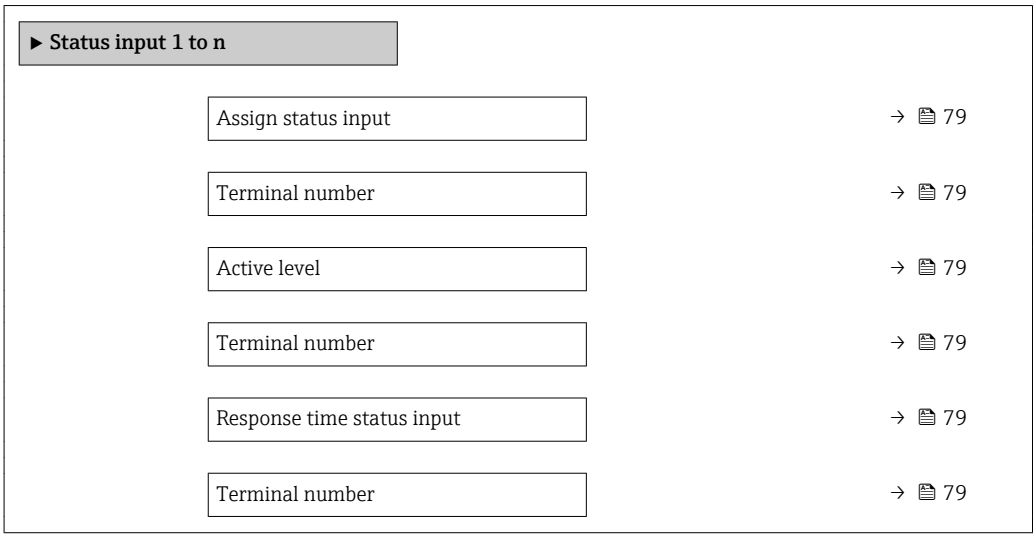
Parameter	Description	User interface / Selection / User entry	Factory setting
I/O module 1 to n terminal numbers	Shows the terminal numbers used by the I/O module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
I/O module 1 to n information	Shows information of the plugged I/O module.	▪ Not plugged ▪ Invalid ▪ Not configurable ▪ Configurable ▪ Fieldbus	–
I/O module 1 to n type	Shows the I/O module type.	▪ Off ▪ Current output * ▪ Current input * ▪ Status input * ▪ Pulse/frequency/switch output *	Off
Apply I/O configuration	Apply parameterization of the freely configurable I/O module.	▪ No ▪ Yes	No
Conversion code	Enter the code in order to change the I/O configuration.	Positive integer	0

* Visibility depends on order options or device settings

10.4.4 Configuring the status input

The **Status input** submenu guides the user systematically through all the parameters that have to be set for configuring the status input.

Navigation
"Setup" menu → Status input



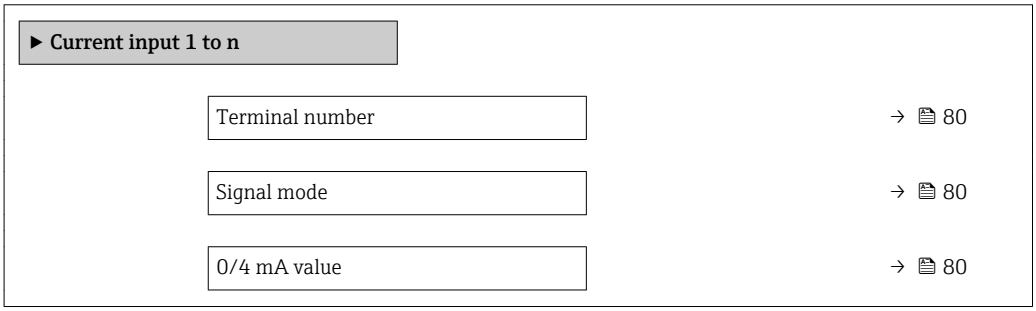
Parameter overview with brief description

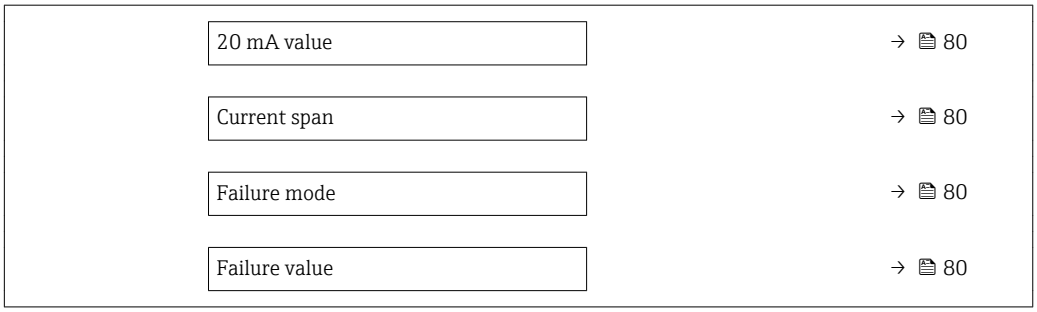
Parameter	Description	User interface / Selection / User entry	Factory setting
Terminal number	Shows the terminal numbers used by the status input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Assign status input	Select function for the status input.	▪ Off ▪ Reset totalizer 1 ▪ Reset totalizer 2 ▪ Reset totalizer 3 ▪ Reset all totalizers ▪ Flow override	Off
Active level	Define input signal level at which the assigned function is triggered.	▪ High ▪ Low	High
Response time status input	Define the minimum amount of time the input signal level must be present before the selected function is triggered.	5 to 200 ms	50 ms

10.4.5 Configuring the current input

The **"Current input" wizard** guides the user systematically through all the parameters that have to be set for configuring the current input.

Navigation
"Setup" menu → Current input





Parameter overview with brief description

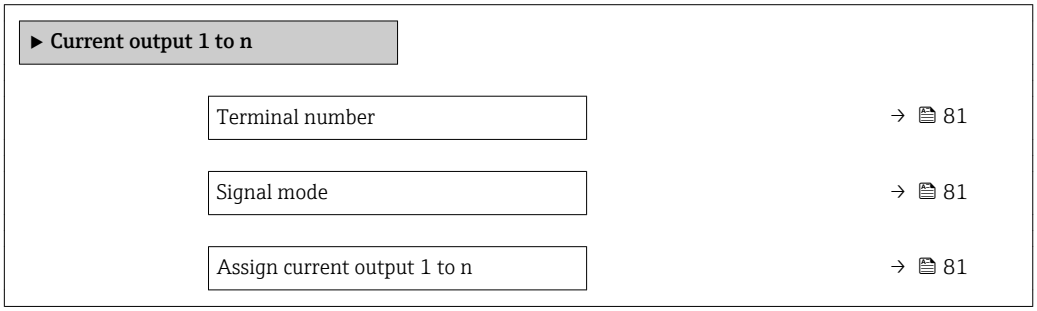
Parameter	Prerequisite	Description	User interface / Selection / User entry	Factory setting
Terminal number	–	Shows the terminal numbers used by the current input module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	The measuring device is **not** approved for use in the hazardous area with type of protection Ex-i.	Select the signal mode for the current input.	▪ Passive ▪ Active	Passive
0/4 mA value	–	Enter 4 mA value.	Signed floating-point number	0
20 mA value	–	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 0...20 mA	Country-specific: ▪ 4...20 mA NAMUR ▪ 4...20 mA US
Failure mode	–	Define input behavior in alarm condition.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

10.4.6 Configuring the current output

The **Current output** wizard guides you systematically through all the parameters that have to be set for configuring the current output.

Navigation

"Setup" menu → Current output



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Assign current output 1 to n	–	Select process variable for current output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Volume flow
Terminal number	–	Shows the terminal numbers used by the current output module.	▪ Not used ▪ 26-27 (I/O 1) ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Current span	–	Select current range for process value output and upper/lower level for alarm signal.	▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA ▪ Fixed current	Country-specific: ▪ 4...20 mA NAMUR ▪ 4...20 mA US
Signal mode	–	Select the signal mode for the current output.	▪ Passive ▪ Active	Passive
0/4 mA value	One of the following options is selected in the **Current span** parameter (→ 81): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Enter 4 mA value.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
20 mA value	One of the following options is selected in the **Current span** parameter (→ 81): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Enter 20 mA value.	Signed floating-point number	Depends on country and nominal diameter
Fixed current	In the **Current span** parameter (→ 81), the **Fixed current** option is selected.	Defines the fixed output current.	0 to 22.5 mA	22.5 mA

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Failure mode	One of the following options is selected in the **Assign current output** parameter (→ 🖹 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature One of the following options is selected in the **Current span** parameter (→ 🖹 81): ▪ 4...20 mA NAMUR ▪ 4...20 mA US ▪ 4...20 mA ▪ 0...20 mA	Define output behavior in alarm condition.	▪ Min. ▪ Max. ▪ Last valid value ▪ Actual value ▪ Defined value	Max.
Failure current	In the **Failure mode** parameter, the **Defined value** option is selected.	Enter current output value in alarm condition.	0 to 22.5 mA	22.5 mA

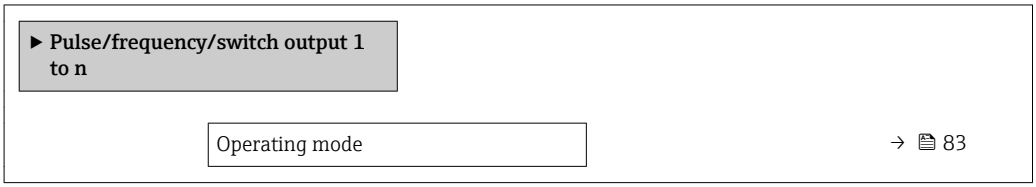
* Visibility depends on order options or device settings

10.4.7 Configuring the pulse/frequency/switch output

The **Pulse/frequency/switch output** wizard guides you systematically through all the parameters that can be set for configuring the selected output type.

Navigation

"Setup" menu → Advanced setup → Pulse/frequency/switch output



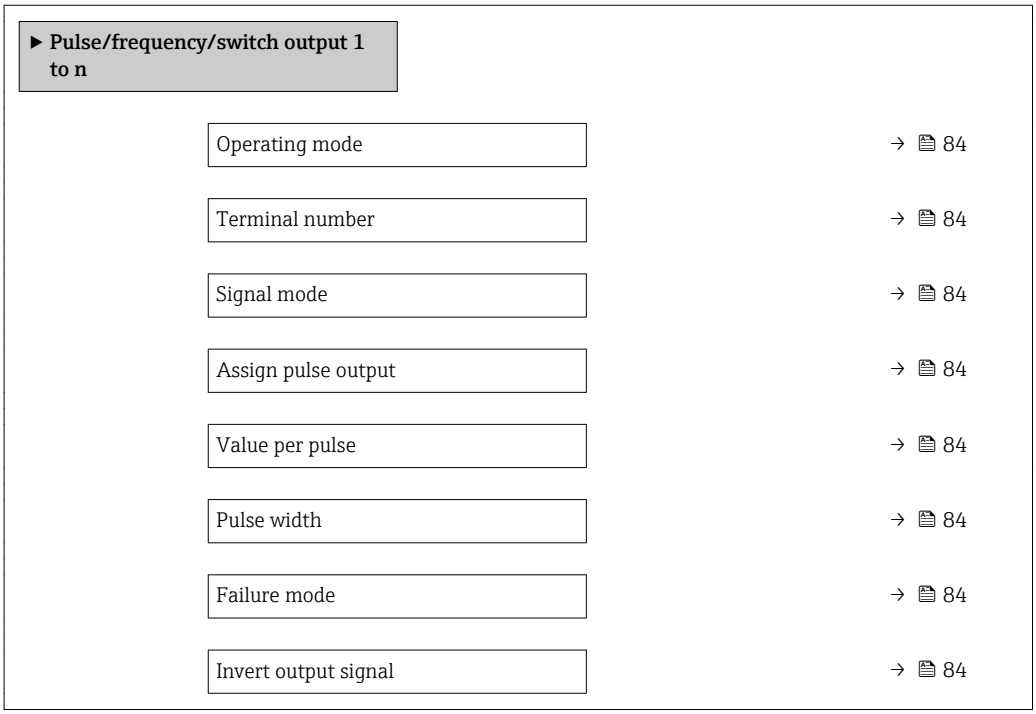
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Operating mode	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse

Configuring the pulse output

Navigation

"Setup" menu → Pulse/frequency/switch output



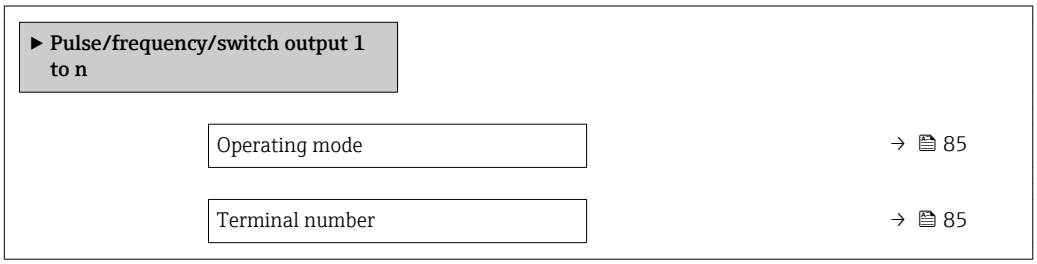
Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive
Assign pulse output 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Off
Value per pulse	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 84): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 84): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Define time width of the output pulse.	0.05 to 2 000 ms	100 ms
Failure mode	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 84): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

Configuring the frequency output

Navigation

"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

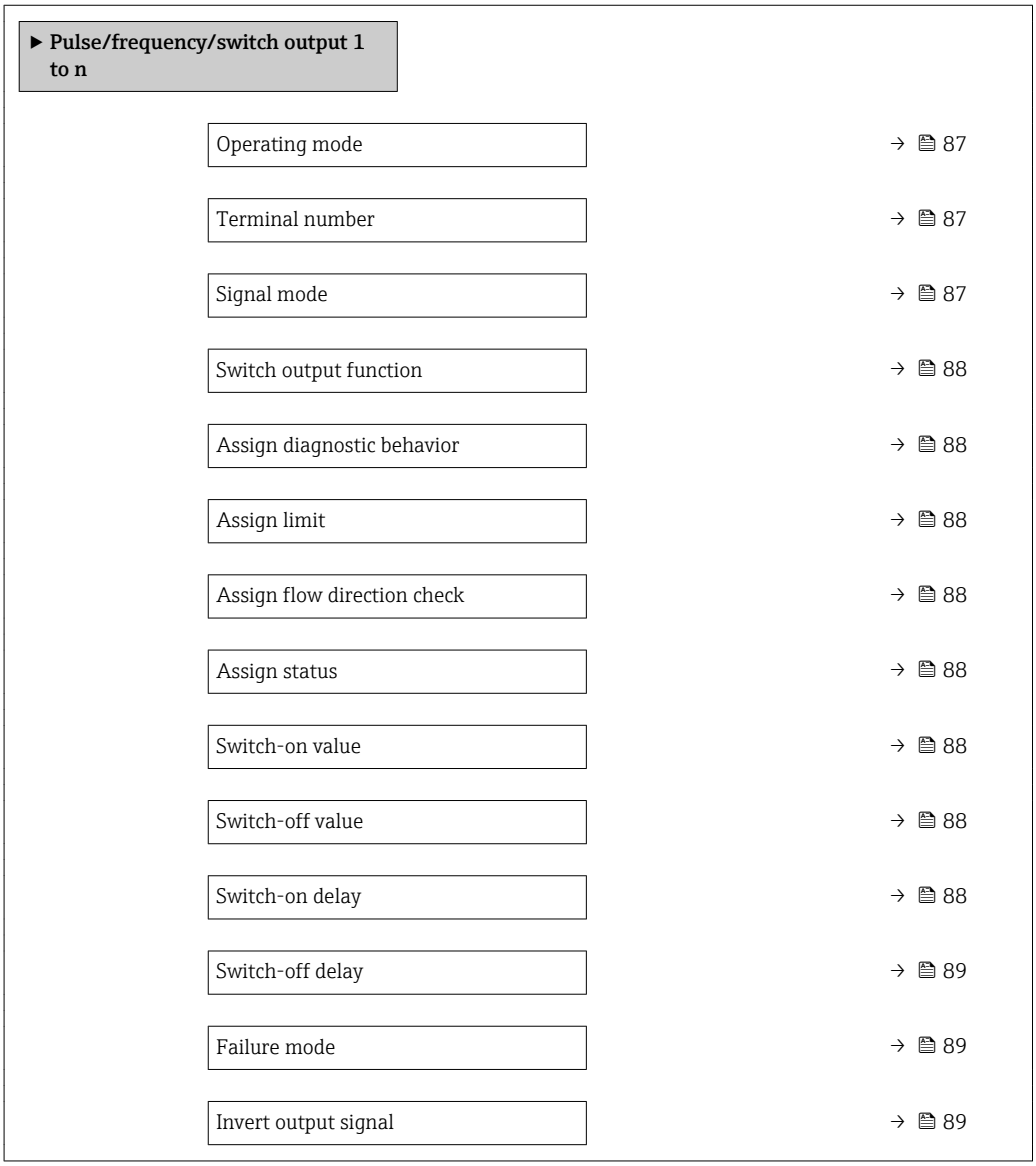
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive
Assign frequency output	In the **Operating mode** parameter (→ 83), the **Frequency** option is selected.	Select process variable for frequency output.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Off
Minimum frequency value	One of the following options is selected in the **Assign current output** parameter (→ 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Enter minimum frequency.	0.0 to 10 000.0 Hz	0.0 Hz

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Maximum frequency value	One of the following options is selected in the **Assign current output** parameter (→ 🖹 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Enter maximum frequency.	0.0 to 10 000.0 Hz	10 000.0 Hz
Measuring value at minimum frequency	One of the following options is selected in the **Assign current output** parameter (→ 🖹 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Enter measured value for minmum frequency.	Signed floating-point number	Depends on country and nominal diameter
Measuring value at maximum frequency	One of the following options is selected in the **Assign current output** parameter (→ 🖹 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Enter measured value for maximum frequency.	Signed floating-point number	Depends on country and nominal diameter
Failure mode	One of the following options is selected in the **Assign current output** parameter (→ 🖹 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Define output behavior in alarm condition.	▪ Actual value ▪ Defined value ▪ 0 Hz	0 Hz
Failure frequency	One of the following options is selected in the **Assign current output** parameter (→ 🖹 81): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature	Enter frequency output value in alarm condition.	0.0 to 12 500.0 Hz	0.0 Hz
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

Configuring the switch output

Navigation
"Setup" menu → Pulse/frequency/switch output



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Operating mode	–	Define the output as a pulse, frequency or switch output.	▪ Pulse ▪ Frequency ▪ Switch	Pulse
Terminal number	–	Shows the terminal numbers used by the PFS output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Signal mode	–	Select the signal mode for the PFS output.	▪ Passive ▪ Active	Passive

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch output function	In the **Operating mode** parameter the **Switch** option is selected.	Select function for switch output.	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Status	Off
Assign diagnostic behavior	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign limit	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Temperature * ▪ Electronic temperature	Volume flow
Assign flow direction check	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Flow direction check** option is selected in the **Switch output function** parameter.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign status	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Status** option is selected in the **Switch output function** parameter.	Select device status for switch output.	▪ Empty pipe detection ▪ Low flow cut off	Empty pipe detection
Switch-on value	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
Switch-off value	▪ In the **Operating mode** parameter, the **Switch** option is selected. ▪ In the **Switch output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
Switch-on delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s

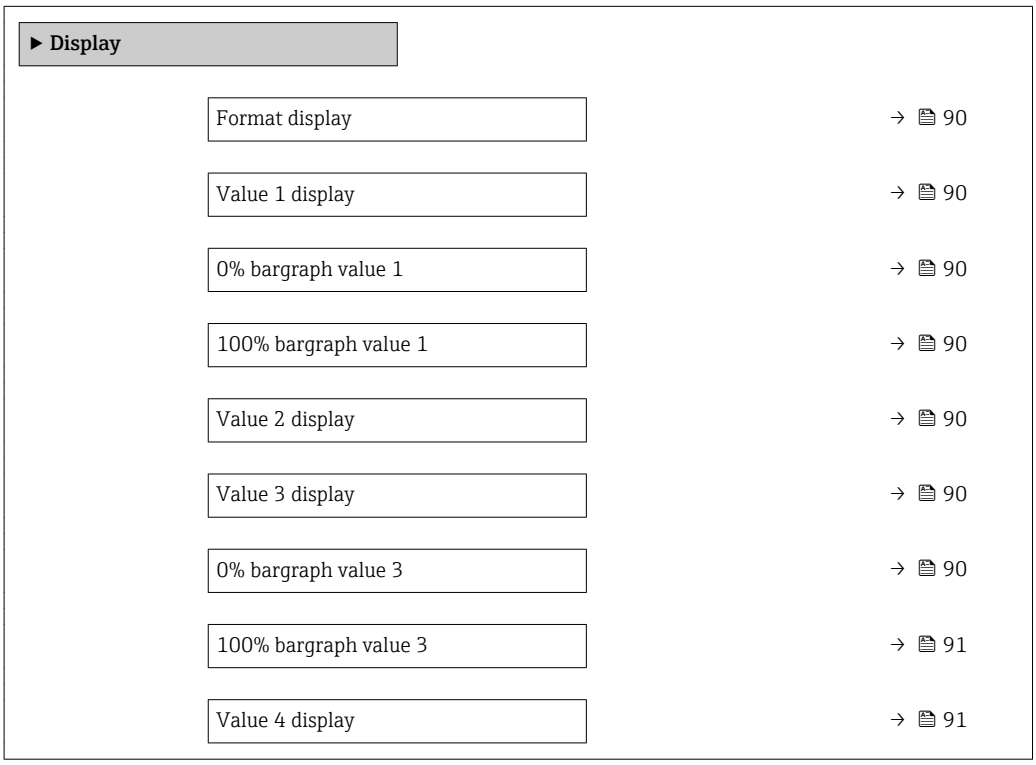
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch-off delay	▪ The **Switch** option is selected in the **Operating mode** parameter. ▪ The **Limit** option is selected in the **Switch output function** parameter.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open
Invert output signal	–	Invert the output signal.	▪ No ▪ Yes	No

* Visibility depends on order options or device settings

10.4.8 Configuring the local display

The **Display** wizard guides you systematically through all the parameters that can configured for configuring the local display.

Navigation
"Setup" menu → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 * ▪ Custody transfer counter *	None
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 90)	None
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 🖹 90)	None

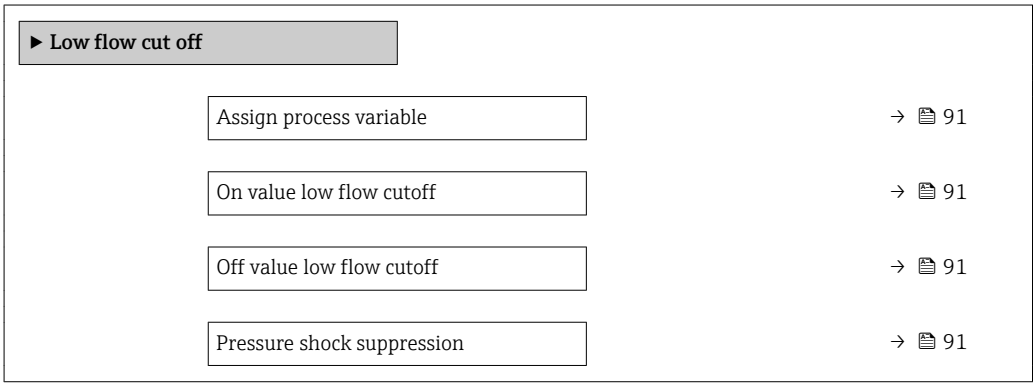
* Visibility depends on order options or device settings

10.4.9 Configuring the low flow cut off

The **Low flow cut off** wizard systematically guides the user through all the parameters that must be set to configure low flow cut off.

Navigation

"Setup" menu → Low flow cut off



Parameter overview with brief description

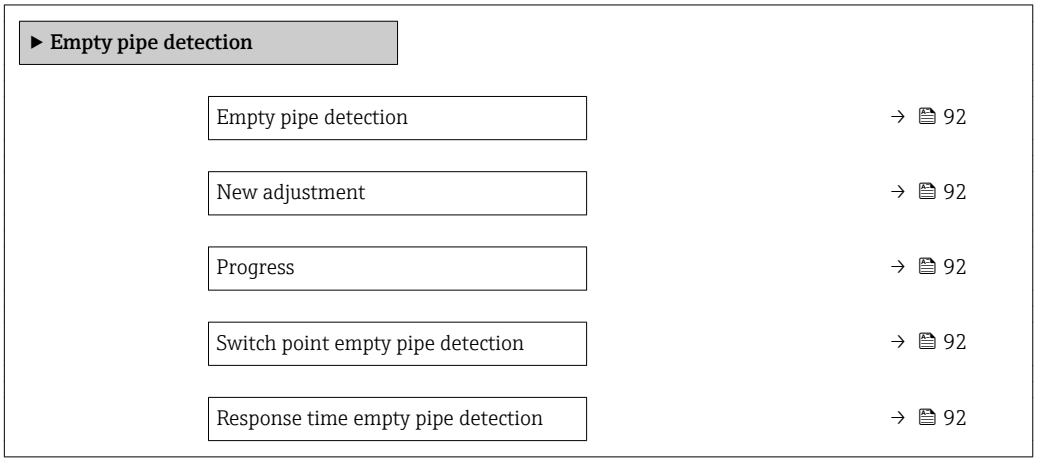
Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Assign process variable	–	Select process variable for low flow cut off.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
On value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 91): ▪ Volume flow ▪ Mass flow	Enter on value for low flow cut off.	Positive floating-point number	Depends on country and nominal diameter
Off value low flow cutoff	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 91): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Enter off value for low flow cut off.	0 to 100.0 %	50 %
Pressure shock suppression	One of the following options is selected in the **Assign process variable** parameter (→ 🖹 91): ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Enter time frame for signal suppression (= active pressure shock suppression).	0 to 100 s	0 s

10.4.10 Configuring empty pipe detection

The **Empty pipe detection** submenu contains parameters that must be configured for the configuration of empty pipe detection.

Navigation

"Setup" menu → Empty pipe detection



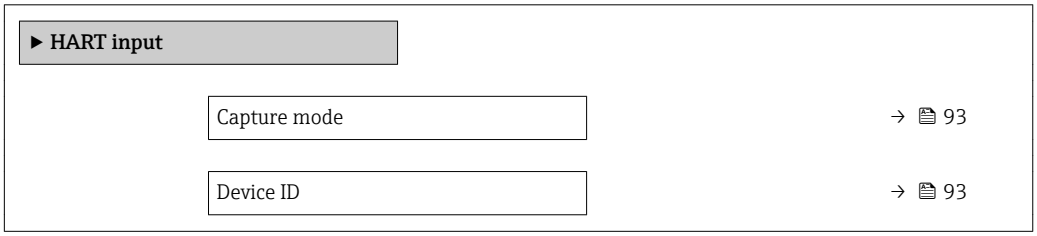
Parameter overview with brief description

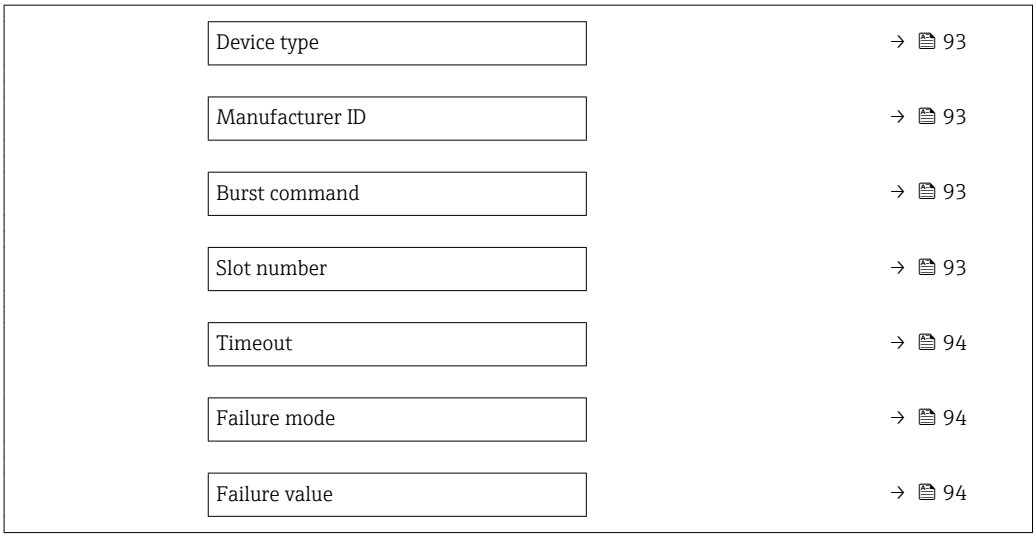
Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Empty pipe detection	–	Switch empty pipe detection on and off.	▪ Off ▪ On	Off
New adjustment	The **On** option is selected in the **Empty pipe detection** parameter.	Select type of adjustment.	▪ Cancel ▪ Empty pipe adjust ▪ Full pipe adjust	Cancel
Progress	The **On** option is selected in the **Empty pipe detection** parameter.	Shows the progress.	▪ Ok ▪ Busy ▪ Not ok	–
Switch point empty pipe detection	The **On** option is selected in the **Empty pipe detection** parameter.	Enter hysteresis in %, below this value the measuring tube will detected as empty.	0 to 100 %	10 %
Response time empty pipe detection	In the **Empty pipe detection** parameter (→ 92), the **On** option is selected.	Enter the time before diagnostic message S862 "Pipe empty" is displayed for empty pipe detection.	0 to 100 s	1 s

10.4.11 Configuring the HART input

Navigation

"Setup" menu → HART input





"Configuration" submenu

Navigation
"Expert" menu → Communication → HART input → Configuration

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Capture mode	–	Select capture mode via burst or master communication.	▪ Off ▪ Burst network ▪ Master network	Off
Device ID	The **Master network** option is selected in the **Capture mode** parameter.	Enter device ID of external device.	6-digit value: ▪ Via local operation: enter as hexadecimal or decimal number ▪ Via operating tool: enter as decimal number	0
Device type	In the **Capture mode** parameter, the **Master network** option is selected.	Enter device type of external device.	2-digit hexadecimal number	0x00
Manufacturer ID	The **Master network** option is selected in the **Capture mode** parameter.	Enter manufacture ID of external device.	2-digit value: ▪ Via local operation: enter as hexadecimal or decimal number ▪ Via operating tool: enter as decimal number	0
Burst command	The **Burst network** option or the **Master network** option are selected in the **Capture mode** parameter.	Select command to read in external process variable.	▪ Command 1 ▪ Command 3 ▪ Command 9 ▪ Command 33	Command 1
Slot number	The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter.	Define position of external process variable in burst command.	1 to 8	1

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Timeout	The **Burst network** option or the **Master network** option is selected in the **Capture mode** parameter.	Enter deadline for process variable of external device. If the waiting time is exceeded, the diagnostic message ⊗**F410 Data transfer** is displayed.	1 to 120 s	5 s
Failure mode	In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected.	Define behavior if external process variable is missed.	▪ Alarm ▪ Last valid value ▪ Defined value	Alarm
Failure value	The following conditions are met: ▪ In the **Capture mode** parameter, the **Burst network** option or **Master network** option is selected. ▪ In the **Failure mode** parameter, the **Defined value** option is selected.	Enter value to be used by the device if input value from external device is missing.	Signed floating-point number	0

"Input" submenu

Navigation
"Expert" menu → Communication → HART input → Input

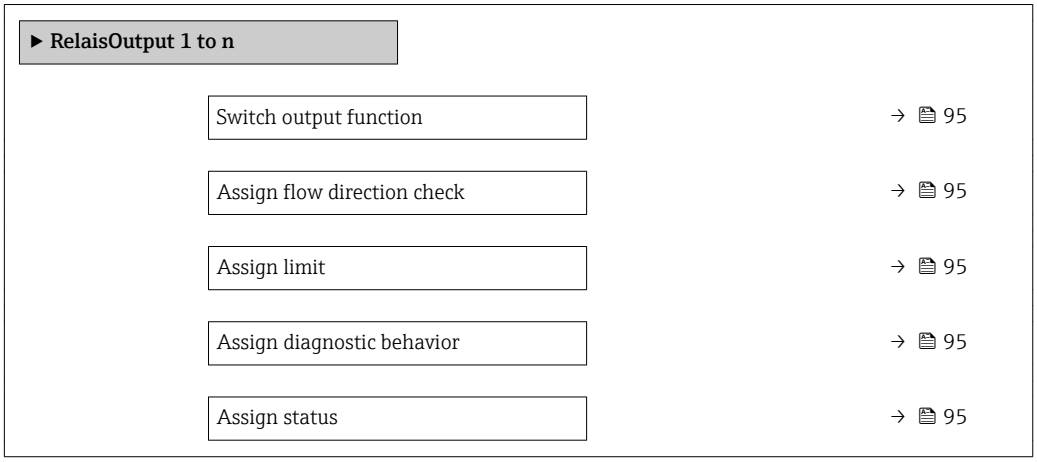
Parameter overview with brief description

Parameter	Description	User interface
Value		Signed floating-point number
Status		▪ Manual/Fixed ▪ Good ▪ Poor accuracy ▪ Bad

10.4.12 Configuring the relay output

The **Relay output** wizard guides the user systematically through all the parameters that have to be set for configuring the relay output.

Navigation
"Setup" menu → Relay output 1 to n



	Switch-off value	→ 95
	Switch-on value	→ 95
	Failure mode	→ 96

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Relay output function	–	Select the function for the relay output.	▪ Closed ▪ Open ▪ Diagnostic behavior ▪ Limit ▪ Flow direction check ▪ Digital Output	Closed
Terminal number	–	Shows the terminal numbers used by the relay output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Assign flow direction check	In the **Relay output function** parameter, the **Flow direction check** option is selected.	Select process variable for flow direction monitoring.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Assign limit	In the **Relay output function** parameter, the **Limit** option is selected.	Select process variable for limit function.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Temperature * ▪ Electronic temperature	Volume flow
Assign diagnostic behavior	In the **Relay output function** parameter, the **Diagnostic behavior** option is selected.	Select diagnostic behavior for switch output.	▪ Alarm ▪ Alarm or warning ▪ Warning	Alarm
Assign status	In the **Relay output function** parameter, the **Digital Output** option is selected.	Select device status for switch output.	▪ Partially filled pipe detection ▪ Low flow cut off	Partially filled pipe detection
Switch-off value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-off point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal(us)/min
Switch-off delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-off of status output.	0.0 to 100.0 s	0.0 s
Switch-on value	In the **Relay output function** parameter, the **Limit** option is selected.	Enter measured value for the switch-on point.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal(us)/min

Parameter	Prerequisite	Description	Selection / User interface / User entry	Factory setting
Switch-on delay	In the **Relay output function** parameter, the **Limit** option is selected.	Define delay for the switch-on of status output.	0.0 to 100.0 s	0.0 s
Failure mode	–	Define output behavior in alarm condition.	▪ Actual status ▪ Open ▪ Closed	Open

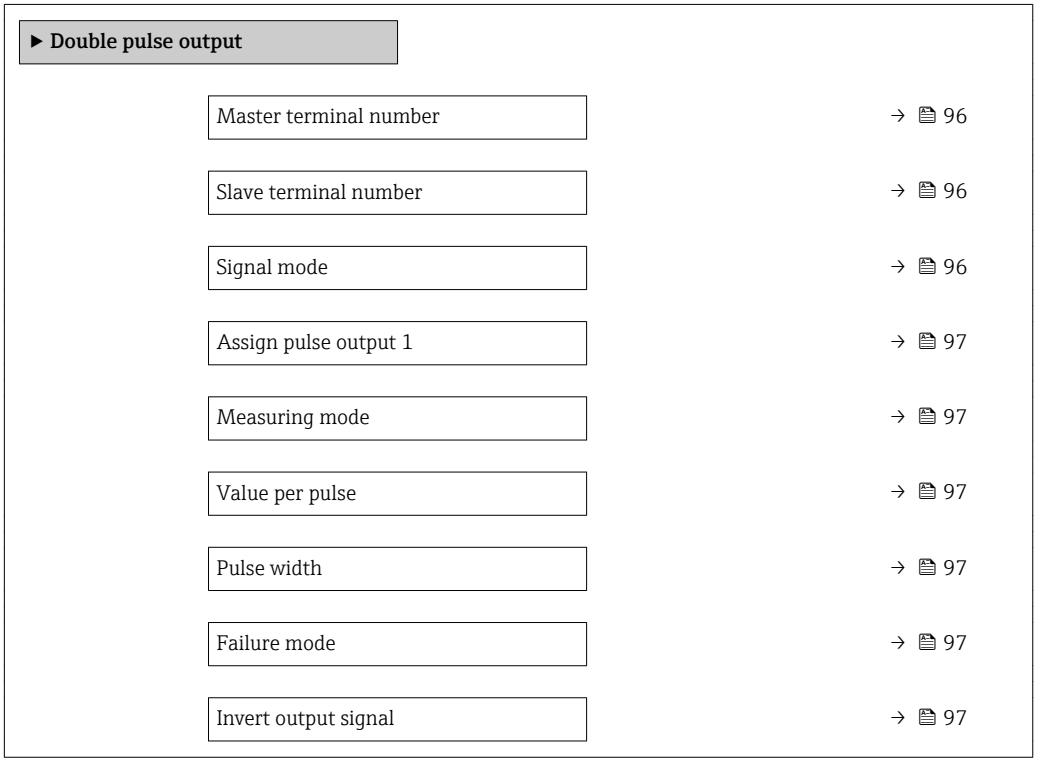
* Visibility depends on order options or device settings

10.4.13 Configuring the double pulse output

The **Double pulse output** submenu guides the user systematically through all the parameters that have to be set for configuring the double pulse output.

Navigation

"Setup" menu → Double pulse output



Parameter overview with brief description

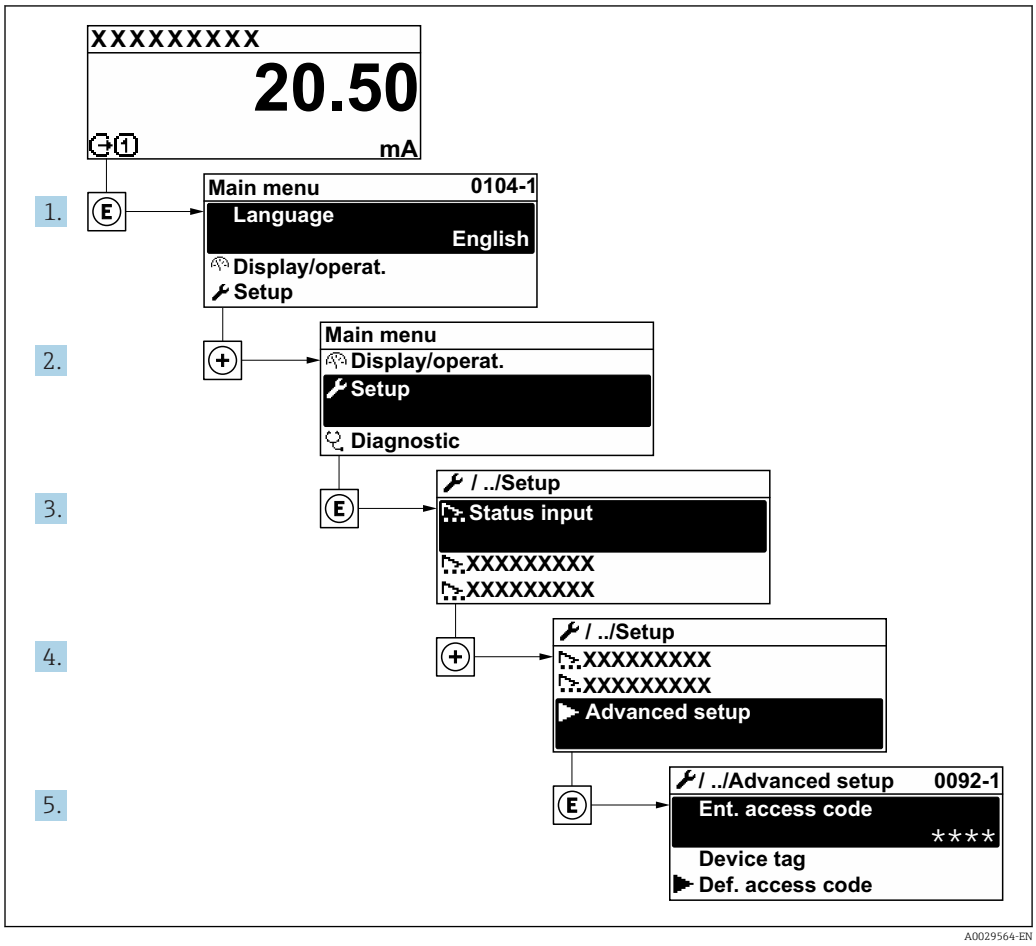
Parameter	Description	Selection / User interface / User entry	Factory setting
Signal mode	Select the signal mode for the double pulse output.	▪ Passive ▪ Active ▪ Passive NAMUR	Passive
Master terminal number	Shows the terminal numbers used by the master of the double pulse output module.	▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–
Slave terminal number		▪ Not used ▪ 24-25 (I/O 2) ▪ 22-23 (I/O 3)	–

Parameter	Description	Selection / User interface / User entry	Factory setting
Assign pulse output 1	Select process variable for pulse output.	▪ Off ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Off
Measuring mode	Select measuring mode for pulse output.	▪ Forward flow ▪ Forward/Reverse flow ▪ Reverse flow ▪ Reverse flow compensation	Forward flow
Value per pulse	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Pulse width	Define time width of the output pulse.	0.5 to 2 000 ms	0.5 ms
Failure mode	Define output behavior in alarm condition.	▪ Actual value ▪ No pulses	No pulses
Invert output signal	Invert the output signal.	▪ No ▪ Yes	No

10.5 Advanced settings

The **Advanced setup** submenu together with its submenus contains parameters for specific settings.

Navigation to the "Advanced setup" submenu

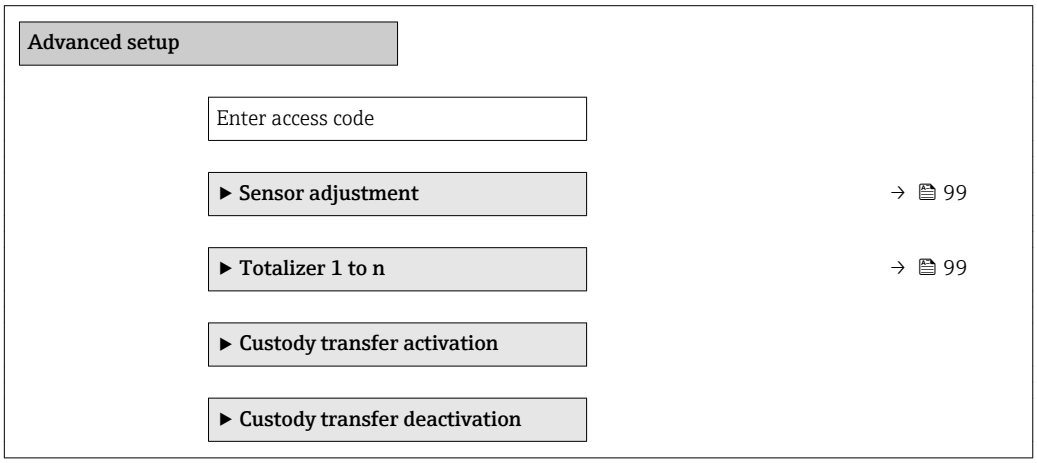


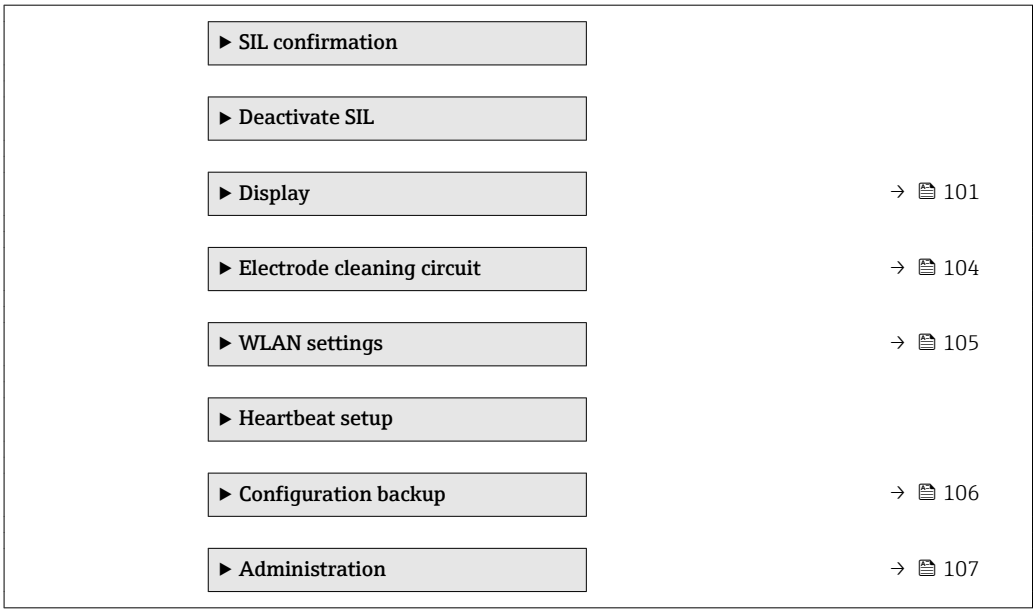
A0029564-EN

The number of submenus can vary depending on the device version. Some submenus are not dealt with in the Operating Instructions. These submenus and the parameters they contain are explained in the Special Documentation for the device.

Navigation

"Setup" menu → Advanced setup



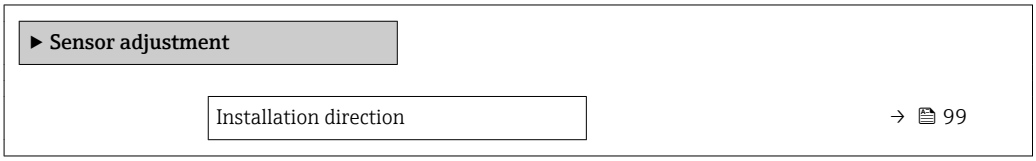


10.5.1 Carrying out a sensor adjustment

The **Sensor adjustment** submenu contains parameters that pertain to the functionality of the sensor.

Navigation

"Setup" menu → Advanced setup → Sensor adjustment



Parameter overview with brief description

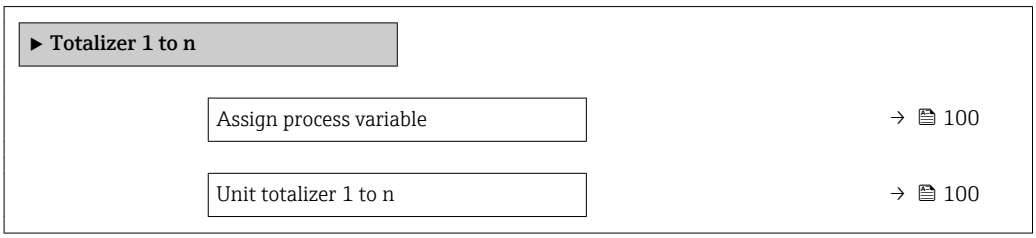
Parameter	Description	Selection	Factory setting
Installation direction	Set sign of flow direction to match the direction of the arrow on the sensor.	▪ Flow in arrow direction ▪ Flow against arrow direction	Flow in arrow direction

10.5.2 Configuring the totalizer

In the **"Totalizer 1 to n" submenu** the individual totalizer can be configured.

Navigation

"Setup" menu → Advanced setup → Totalizer 1 to n



Totalizer operation mode	→ 100
Failure mode	→ 100

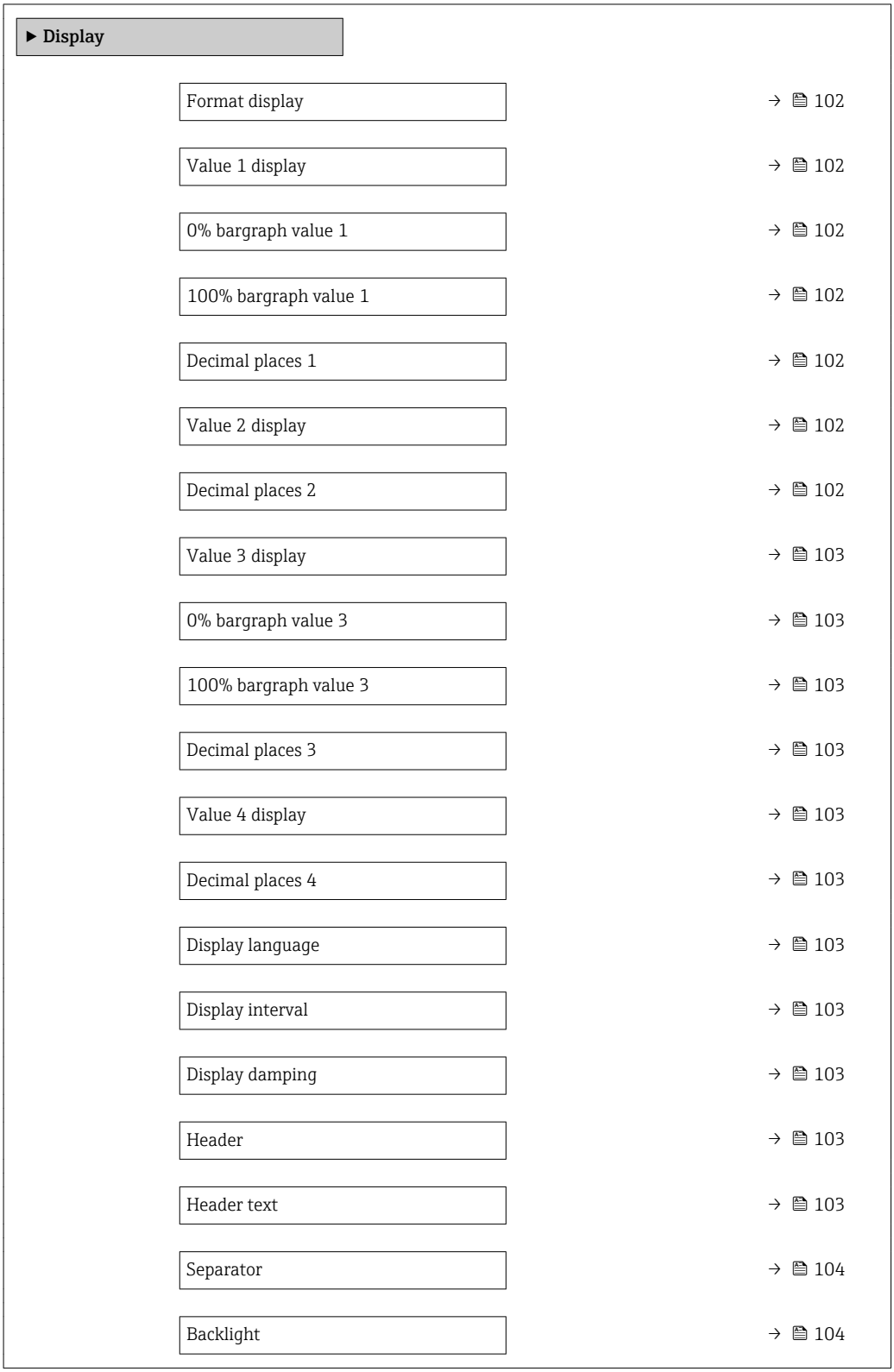
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Assign process variable	Select process variable for totalizer.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow	Volume flow
Unit totalizer 1 to n	Select process variable totalizer unit.	Unit choose list	l
Totalizer operation mode	Select totalizer calculation mode.	▪ Net flow total ▪ Forward flow total ▪ Reverse flow total	Net flow total
Failure mode	Define totalizer behavior in alarm condition.	▪ Stop ▪ Actual value ▪ Last valid value	Stop

10.5.3 Carrying out additional display configurations

In the **Display** submenu you can set all the parameters associated with the configuration of the local display.

Navigation
"Setup" menu → Advanced setup → Display



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Format display	A local display is provided.	Select how measured values are shown on the display.	▪ 1 value, max. size ▪ 1 bargraph + 1 value ▪ 2 values ▪ 1 value large + 2 values ▪ 4 values	1 value, max. size
Value 1 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 *	Volume flow
0% bargraph value 1	A local display is provided.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 1	A local display is provided.	Enter 100% value for bar graph display.	Signed floating-point number	Depends on country and nominal diameter
Decimal places 1	A measured value is specified in the **Value 1 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 2 display	A local display is provided.	Select the measured value that is shown on the local display.	▪ None ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature * ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3 ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Current output 4 * ▪ Custody transfer counter *	None
Decimal places 2	A measured value is specified in the **Value 2 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Value 3 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 90)	None
0% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 0% value for bar graph display.	Signed floating-point number	Country-specific: ▪ 0 l/h ▪ 0 gal/min (us)
100% bargraph value 3	A selection was made in the **Value 3 display** parameter.	Enter 100% value for bar graph display.	Signed floating-point number	0
Decimal places 3	A measured value is specified in the **Value 3 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Value 4 display	A local display is provided.	Select the measured value that is shown on the local display.	For the picklist, see the **Value 2 display** parameter (→ 90)	None
Decimal places 4	A measured value is specified in the **Value 4 display** parameter.	Select the number of decimal places for the display value.	▪ x ▪ x.x ▪ x.xx ▪ x.xxx ▪ x.xxxx	x.xx
Display language	A local display is provided.	Set display language.	▪ English ▪ Deutsch * ▪ Français * ▪ Español * ▪ Italiano * ▪ Nederlands * ▪ Portuguesa * ▪ Polski * ▪ русский язык (Russian) * ▪ Svenska * ▪ Türkçe * ▪ 中文 (Chinese) * ▪ 日本語 (Japanese) * ▪ 한국어 (Korean) * ▪ العَرَبِيّة (Arabic) * ▪ Bahasa Indonesia * ▪ ภาษาไทย (Thai) * ▪ tiếng Việt (Vietnamese) * ▪ čeština (Czech) *	English (alternatively, the ordered language is preset in the device)
Display interval	A local display is provided.	Set time measured values are shown on display if display alternates between values.	1 to 10 s	5 s
Display damping	A local display is provided.	Set display reaction time to fluctuations in the measured value.	0.0 to 999.9 s	0.0 s
Header	A local display is provided.	Select header contents on local display.	▪ Device tag ▪ Free text	Device tag
Header text	In the **Header** parameter, the **Free text** option is selected.	Enter display header text.	Max. 12 characters such as letters, numbers or special characters (e.g. @, %, /)	----------

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Separator	A local display is provided.	Select decimal separator for displaying numerical values.	▪ . (point) ▪ , (comma)	. (point)
Backlight	One of the following conditions is met: ▪ Order code for "Display; operation", option **F** "4-line, illum.; touch control" ▪ Order code for "Display; operation", option **G** "4-line, illum.; touch control +WLAN" ▪ Order code for "Display; operation", option **O** "remote 4-line display, illum; 10m/ 30ft cable; touch control"	Switch the local display backlight on and off.	▪ Disable ▪ Enable	Enable

* Visibility depends on order options or device settings

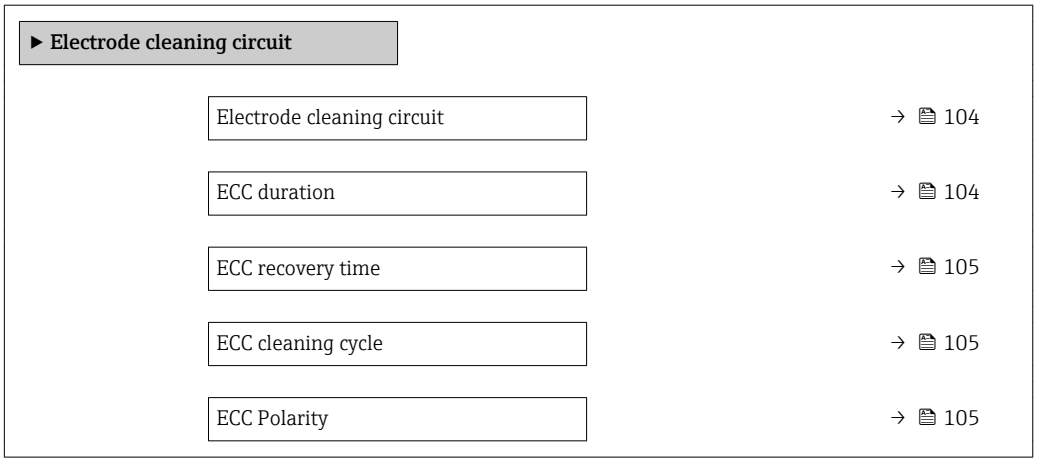
10.5.4 Performing electrode cleaning

The **Electrode cleaning circuit** submenu contains parameters that must be configured for the configuration of electrode cleaning.

The submenu is only available if the device was ordered with electrode cleaning.

Navigation

"Setup" menu → Advanced setup → Electrode cleaning circuit



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Electrode cleaning circuit	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enable the cyclic electrode cleaning circuit.	▪ Off ▪ On	Off
ECC duration	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enter the duration of electrode cleaning in seconds.	0.01 to 30 s	2 s

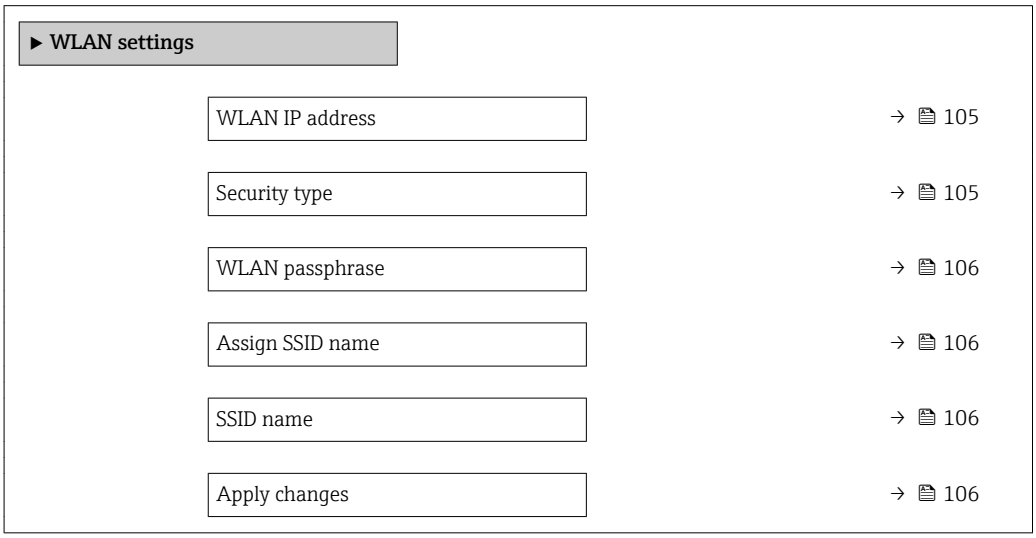
Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
ECC recovery time	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Define recovery time after electrode cleaning. During this time the current output values will be held at last valid value.	1 to 600 s	60 s
ECC cleaning cycle	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Enter the pause duration between electrode cleaning cycles.	0.5 to 168 h	0.5 h
ECC Polarity	For the following order code: "Application package", option **EC** "ECC electrode cleaning"	Select the polarity of the electrode cleaning circuit.	▪ Positive ▪ Negative	Depends on the electrode material: ▪ Platinum: **Negative** option ▪ Tantalum, Alloy C22, stainless steel: **Positive** option

10.5.5 WLAN configuration

The **WLAN Settings** submenu guides the user systematically through all the parameters that have to be set for the WLAN configuration.

Navigation

"Setup" menu → Advanced setup → WLAN Settings



Parameter overview with brief description

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
WLAN IP address	–	Enter IP address of the device WLAN interface.	4 octet: 0 to 255 (in the particular octet)	192.168.1.212
Security type	–	Select the security type of the WLAN interface.	▪ Unsecured ▪ WPA2-PSK	WPA2-PSK

Parameter	Prerequisite	Description	User entry / Selection	Factory setting
WLAN passphrase	In the **Security type** parameter, the **WPA2-PSK** option is selected.	Enter the network key (8 to 32 characters). The network key supplied with the device should be changed during commissioning for security reasons.	8 to 32-digit character string comprising numbers, letters and special characters	Serial number of the measuring device (e.g. L100A802000)
Assign SSID name	–	Select which name will be used for SSID: device tag or user-defined name.	▪ Device tag ▪ User-defined	User-defined
SSID name	In the **Assign SSID name** parameter, the **User-defined** option is selected.	Enter the user-defined SSID name (max. 32 characters). The user-defined SSID name may only be assigned once. If the SSID name is assigned more than once, the devices can interfere with one another.	Max. 32-digit character string comprising numbers, letters and special characters	EH_device designation_last 7 digits of the serial number (e.g. EH_Promag_300_A802000)
Apply changes	–	Use changed WLAN settings.	▪ Cancel ▪ Ok	Cancel

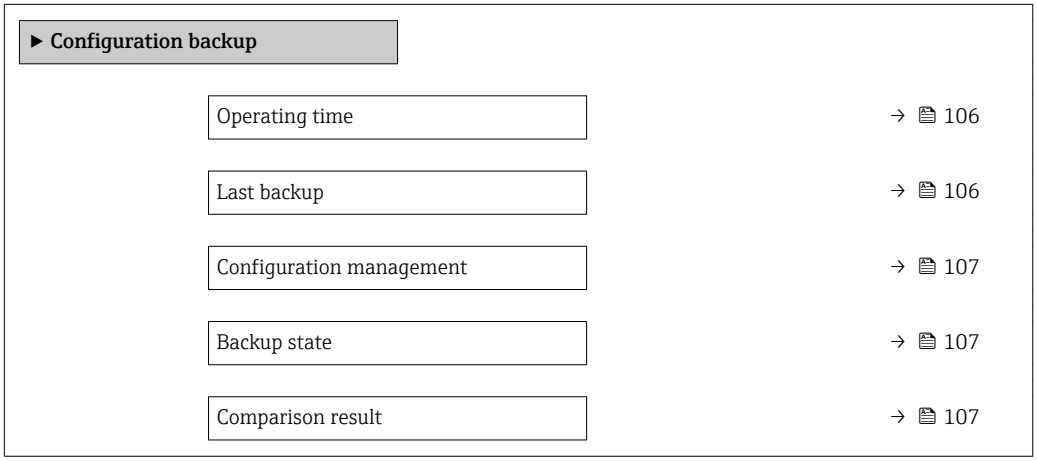
10.5.6 Configuration management

After commissioning, you can save the current device configurationor restore the previous device configuration.

You can do so using the **Configuration management** parameter and the related options found in the **Configuration backup** submenu.

Navigation

"Setup" menu → Advanced setup → Configuration backup



Parameter overview with brief description

Parameter	Description	User interface / Selection	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Last backup	Shows when the last data backup was saved to embedded HistoROM.	Days (d), hours (h), minutes (m) and seconds (s)	–

Parameter	Description	User interface / Selection	Factory setting
Configuration management	Select action for managing the device data in the embedded HistoROM.	▪ Cancel ▪ Execute backup ▪ Restore ▪ Compare ▪ Clear backup data	Cancel
Backup state	Shows the current status of data saving or restoring.	▪ None ▪ Backup in progress ▪ Restoring in progress ▪ Delete in progress ▪ Compare in progress ▪ Restoring failed ▪ Backup failed	None
Comparison result	Comparison of current device data with embedded HistoROM.	▪ Settings identical ▪ Settings not identical ▪ No backup available ▪ Backup settings corrupt ▪ Check not done ▪ Dataset incompatible	Check not done

Function scope of the "Configuration management" parameter

Options	Description
Cancel	No action is executed and the user exits the parameter.
Execute backup	A backup copy of the current device configuration is saved from the integrated HistoROM to the memory of the device. The backup copy includes the transmitter data of the device.
Restore	The last backup copy of the device configuration is restored from the device memory to the device's integrated HistoROM. The backup copy includes the transmitter data of the device.
Compare	The device configuration saved in the device memory is compared with the current device configuration of the integrated HistoROM.
Clear backup data	The backup copy of the device configuration is deleted from the memory of the device.

Integrated HistoROM
A HistoROM is a "non-volatile" device memory in the form of an EEPROM.

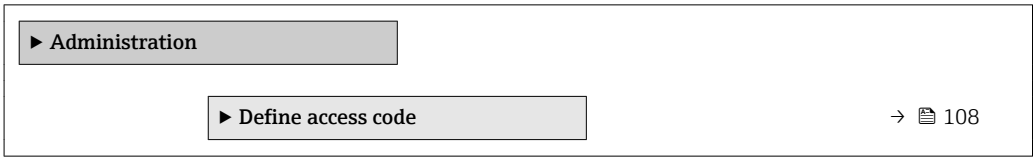
While this action is in progress, the configuration cannot be edited via the local display and a message on the processing status appears on the display.

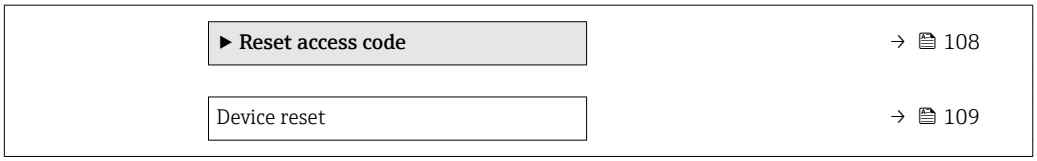
10.5.7 Using parameters for device administration

The **Administration** submenu systematically guides the user through all the parameters that can be used for device administration purposes.

Navigation

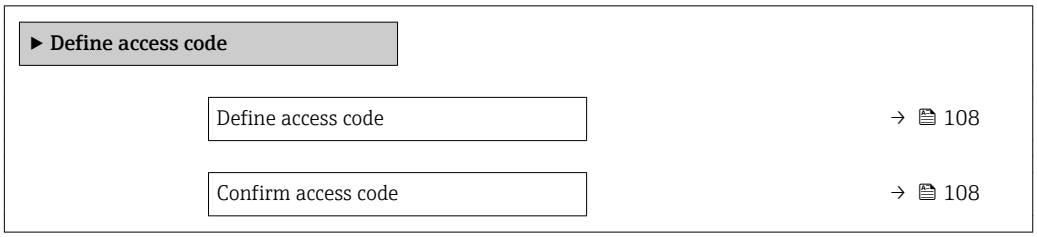
"Setup" menu → Advanced setup → Administration





Using the parameter to define the access code

Navigation
"Setup" menu → Advanced setup → Administration → Define access code

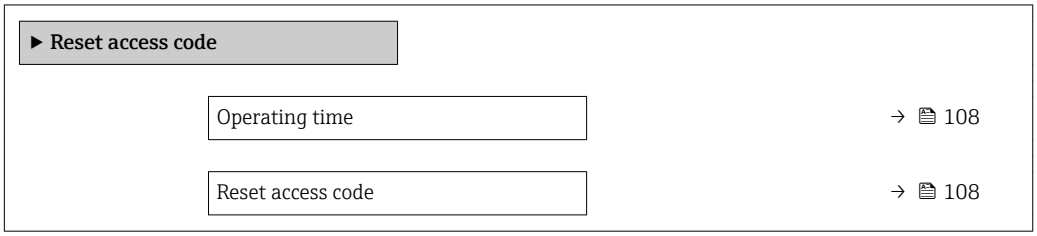


Parameter overview with brief description

Parameter	Description	User entry
Define access code	Restrict write-access to parameters to protect the configuration of the device against unintentional changes.	Max. 16-digit character string comprising numbers, letters and special characters
Confirm access code	Confirm the entered access code.	Max. 16-digit character string comprising numbers, letters and special characters

Using the parameter to reset the access code

Navigation
"Setup" menu → Advanced setup → Administration → Reset access code



Parameter overview with brief description

Parameter	Description	User interface / User entry	Factory setting
Operating time	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)	–
Reset access code	Reset access code to factory settings. For a reset code, contact your Endress+Hauser service organization. The reset code can only be entered via: ▪ Web browser ▪ DeviceCare, FieldCare (via service interface CDI-RJ45) ▪ Fieldbus	Character string comprising numbers, letters and special characters	0x00

Using the parameter to reset the device

Navigation
"Setup" menu → Advanced setup → Administration

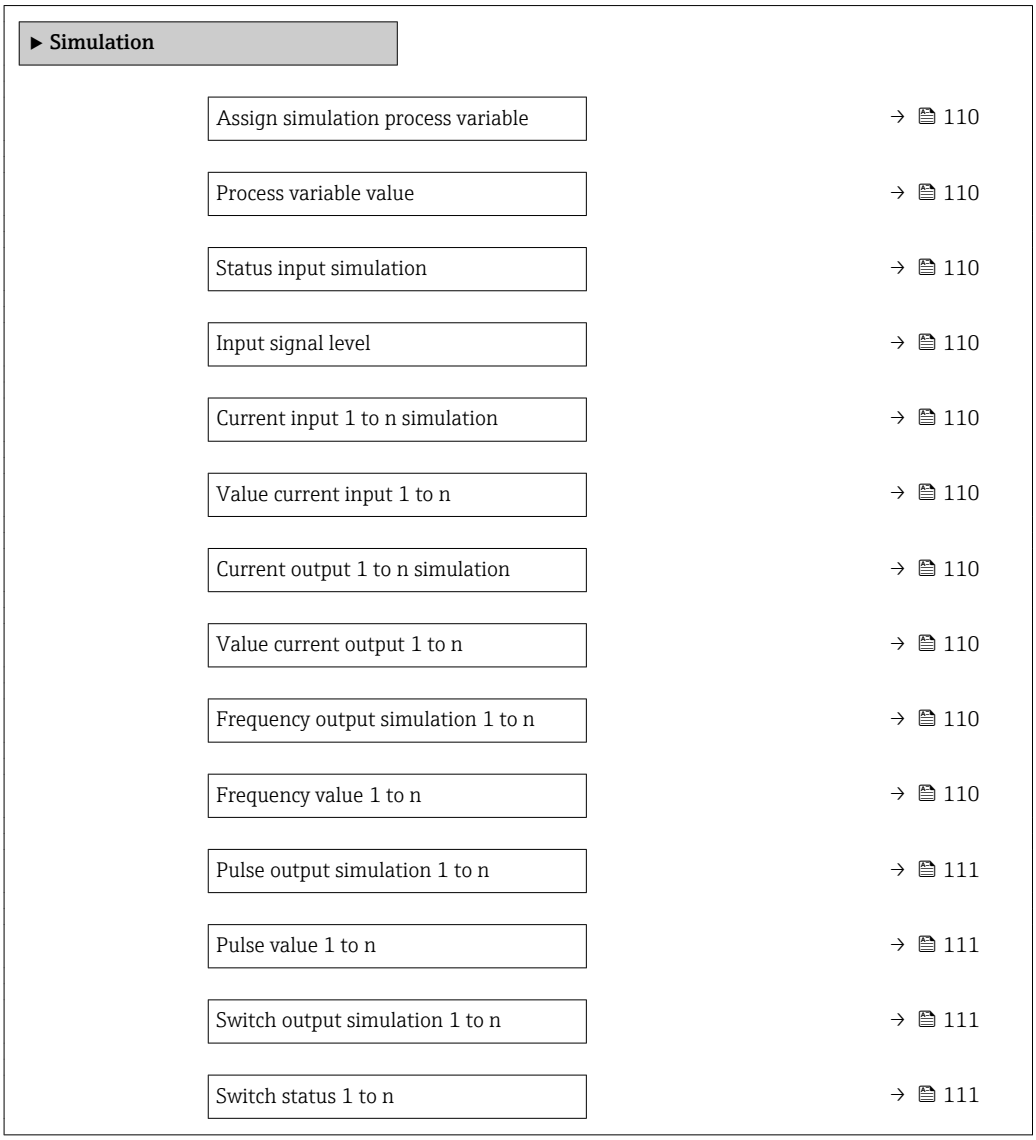
Parameter overview with brief description

Parameter	Description	Selection	Factory setting
Device reset	Reset the device configuration - either entirely or in part - to a defined state.	▪ Cancel ▪ To delivery settings ▪ Restart device ▪ Restore S-DAT backup	Cancel

10.6 Simulation

The **Simulation** submenu enables you to simulate, without a real flow situation, various process variables in the process and the device alarm mode and to verify downstream signal chains (switching valves or closed-control loops).

Navigation
"Diagnostics" menu → Simulation



Relay output 1 to n simulation	→ 111
Switch status 1 to n	→ 111
Pulse output simulation	→ 111
Pulse value	→ 111
Device alarm simulation	→ 111
Diagnostic event category	→ 111
Diagnostic event simulation	→ 111

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign simulation process variable	–	Select a process variable for the simulation process that is activated.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Temperature *	Off
Process variable value	–	Enter the simulation value for the selected process variable.	Depends on the process variable selected	0
Status input simulation	–	Switch simulation of the status input on and off.	▪ Off ▪ On	Off
Input signal level	In the **Status input simulation** parameter, the **On** option is selected.	Select the signal level for the simulation of the status input.	▪ High ▪ Low	High
Current input 1 to n simulation	–	Switch simulation of the current input on and off.	▪ Off ▪ On	Off
Value current input 1 to n	In the **Current input 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	0 to 22.5 mA	0 mA
Current output 1 to n simulation	–	Switch the simulation of the current output on and off.	▪ Off ▪ On	Off
Value current output 1 to n	In the **Current output 1 to n simulation** parameter, the **On** option is selected.	Enter the current value for simulation.	3.59 to 22.5 mA	3.59 mA
Frequency output simulation 1 to n	In the **Operating mode** parameter, the **Frequency** option is selected.	Switch the simulation of the frequency output on and off.	▪ Off ▪ On	Off
Frequency value 1 to n	In the **Frequency output simulation 1 to n** parameter, the **On** option is selected.	Enter the frequency value for the simulation.	0.0 to 12 500.0 Hz	0.0 Hz

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Pulse output simulation 1 to n	In the **Operating mode** parameter, the **Pulse** option is selected.	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter (→ 84) defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off
Pulse value 1 to n	In the **Pulse output simulation 1 to n** parameter, the **Down-counting value** option is selected.	Enter the number of pulses for simulation.	0 to 65 535	0
Switch output simulation 1 to n	In the **Operating mode** parameter, the **Switch** option is selected.	Switch the simulation of the switch output on and off.	▪ Off ▪ On	Off
Switch status 1 to n	–	Select the status of the status output for the simulation.	▪ Open ▪ Closed	Open
Relay output 1 to n simulation	–	Switch simulation of the relay output on and off.	▪ Off ▪ On	Off
Switch status 1 to n	In the **Switch output simulation 1 to n** parameter, the **On** option is selected.	Select status of the relay output for the simulation.	▪ Open ▪ Closed	Open
Pulse output simulation	–	Set and switch off the pulse output simulation. For **Fixed value** option: **Pulse width** parameter defines the pulse width of the pulses output.	▪ Off ▪ Fixed value ▪ Down-counting value	Off
Pulse value	In the **Pulse output simulation** parameter, the **Down-counting value** option is selected.	Set and switch off the pulse output simulation.	0 to 65 535	0
Device alarm simulation	–	Switch the device alarm on and off.	▪ Off ▪ On	Off
Diagnostic event category	–	Select a diagnostic event category.	▪ Sensor ▪ Electronics ▪ Configuration ▪ Process	Process
Diagnostic event simulation	–	Select a diagnostic event to simulate this event.	▪ Off ▪ Diagnostic event picklist (depends on the category selected)	Off
Logging interval	–	Define the logging interval tlog for data logging. This value defines the time interval between the individual data points in the memory.	1.0 to 3 600.0 s	–

* Visibility depends on order options or device settings

10.7 Protecting settings from unauthorized access

The following write protection options exist in order to protect the configuration of the measuring device from unintentional modification:
- Protect access to parameters via access code → 112
- Protect access to local operation via key locking → 56
- Protect access to measuring device via write protection switch → 113

10.7.1 Write protection via access code

The effects of the user-specific access code are as follows:
- Via local operation, the parameters for the measuring device configuration are write-protected and their values can no longer be changed.
- Device access is protected via the Web browser, as are the parameters for the measuring device configuration.
- Device access is protected via FieldCare or DeviceCare (via CDI-RJ45 service interface), as are the parameters for the measuring device configuration.

Defining the access code via local display

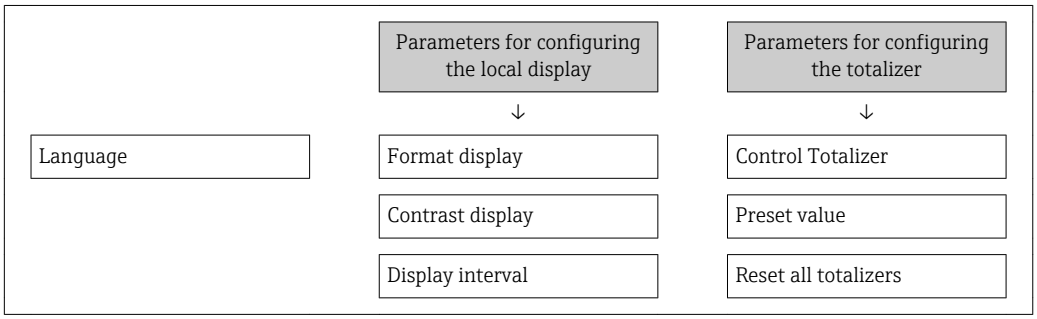
1. Navigate to the **Define access code** parameter (→ 108).
2. Define a max. 16-digit character string comprising numbers, letters and special characters as the access code.
3. Enter the access code again in the **Confirm access code** parameter (→ 108) to confirm the code.
   ↳ The -symbol appears in front of all write-protected parameters.

The device automatically locks the write-protected parameters again if a key is not pressed for 10 minutes in the navigation and editing view. The device locks the write-protected parameters automatically after 60 s if the user skips back to the operational display mode from the navigation and editing view.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 56.
- The user role with which the user is currently logged on via the local display is indicated by the → 56 **Access status** parameter. Navigation path: Operation → Access status

Parameters which can always be modified via the local display

Certain parameters that do not affect the measurement are excepted from parameter write protection via the local display. Despite the user-specific access code, they can always be modified, even if the other parameters are locked.



Defining the access code via the Web browser

1. Navigate to the **Define access code** parameter (→ 108).
2. Max. Define a max. 4-digit numeric code as an access code.

3. Enter the access code again in the **Confirm access code** parameter (→ 108) to confirm the code.
   ↳ The Web browser switches to the login page.

If no action is performed for 10 minutes, the Web browser automatically returns to the login page.

- If parameter write protection is activated via an access code, it can also only be deactivated via this access code → 56.
- The user role with which the user is currently logged on via Web browser is indicated by the **Access status** parameter. Navigation path: Operation → Access status

Resetting the access code

If you misplace the user-specific access code, it is possible to reset the code to the factory setting. A reset code must be entered for this purpose. The user-specific access code can then be defined again afterwards.

Via Web browser, FieldCare, DeviceCare (via CDI-RJ45 service interface), fieldbus

For a reset code, contact your Endress+Hauser service organization.

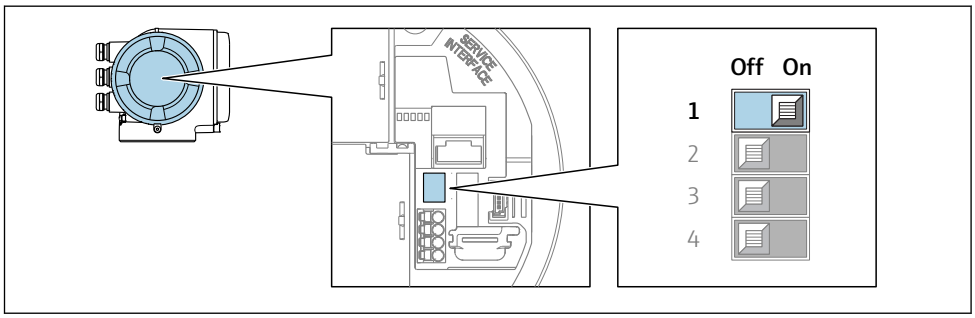
1. Navigate to the **Reset access code** parameter (→ 108).
2. Enter the reset code.
   ↳ The access code has been reset to the factory setting **0000**. It can be redefined → 112.

10.7.2 Write protection via write protection switch

Unlike parameter write protection via a user-specific access code, this allows write access to the entire operating menu - except for the **"Contrast display" parameter** - to be locked.

The parameter values are now read only and cannot be edited any more (exception **"Contrast display" parameter**):
- Via local display
- Via HART protocol

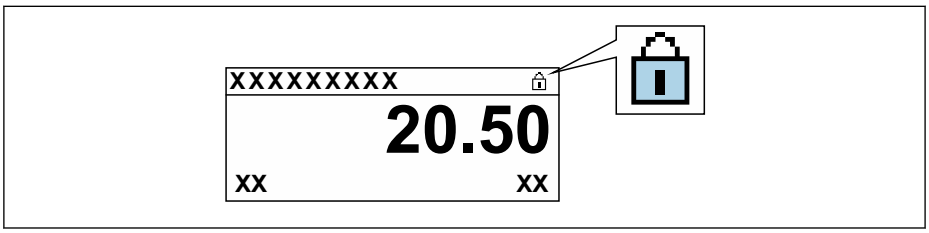
1.



A0029630

Setting the write protection (WP) switch on the main electronics module to the **ON** position enables hardware write protection.

↳ In the **Locking status** parameter the **Hardware locked** option is displayed → 115. In addition, on the local display the 🔒-symbol appears in front of the parameters in the header of the operational display and in the navigation view.



A0029425

2. Setting the write protection (WP) switch on the main electronics module to the **OFF** position (factory setting) disables hardware write protection.

↳ No option is displayed in the **Locking status** parameter → 115. On the local display, the 🔒-symbol disappears from in front of the parameters in the header of the operational display and in the navigation view.

11 Operation

11.1 Reading the device locking status

Device active write protection: **Locking status** parameter

Operation → Locking status

Function scope of the "Locking status" parameter

Options	Description
None	The access status displayed in the **Access status** parameter applies → 📄 56. Only appears on local display.
Hardware locked	The DIP switch for hardware locking is activated on the PCB board. This locks write access to the parameters (e.g. via local display or operating tool).
SIL locked	The SIL mode is enabled. This locks write access to the parameters (e.g. via local display or operating tool).
CT active - all parameters	The DIP switch for custody transfer mode is activated on the PCB board. This locks write access to all the parameters (e.g. via local display or operating tool). For detailed information on custody transfer mode, see the Special Documentation for the device
CT active - defined parameters	The DIP switch for custody transfer mode is activated on the PCB board. This locks write access to the defined parameters (e.g. via local display or operating tool). For detailed information on custody transfer mode, see the Special Documentation for the device
Temporarily locked	Write access to the parameters is temporarily locked on account of internal processes running in the device (e.g. data upload/download, reset etc.). Once the internal processing has been completed, the parameters can be changed once again.

11.2 Adjusting the operating language

Detailed information:
- To configure the operating language → 📄 74
- For information on the operating languages supported by the measuring device → 📄 168

11.3 Configuring the display

Detailed information:
- On the basic settings for the local display → 📄 89
- On the advanced settings for the local display → 📄 101

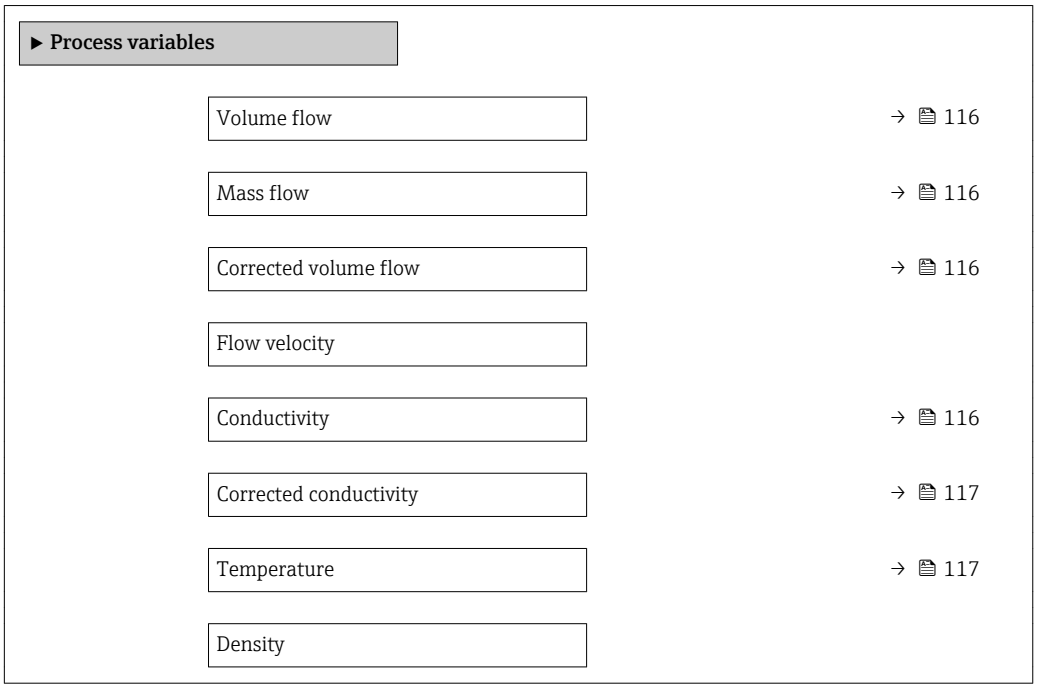
11.4 Reading measured values

With the **Measured values** submenu, it is possible to read all the measured values.

11.4.1 Process variables

The **Measured variables** submenu contains all the parameters needed to display the current measured values for each process variable.

Navigation
"Diagnostics" menu → Measured values → Process variables



Parameter overview with brief description

Parameter	Prerequisite	Description	User interface
Volume flow	–	Displays the volume flow currently measured. *Dependency* The unit is taken from the **Volume flow unit** parameter (→ 77).	Signed floating-point number
Mass flow	–	Displays the mass flow currently calculated. *Dependency* The unit is taken from the **Mass flow unit** parameter (→ 77).	Signed floating-point number
Conductivity	–	Displays the conductivity currently measured. *Dependency* The unit is taken from the **Conductivity unit** parameter (→ 77).	Signed floating-point number
Corrected volume flow	–	Displays the corrected volume flow currently calculated. *Dependency* The unit is taken from the **Corrected volume flow unit** parameter (→ 77).	Signed floating-point number

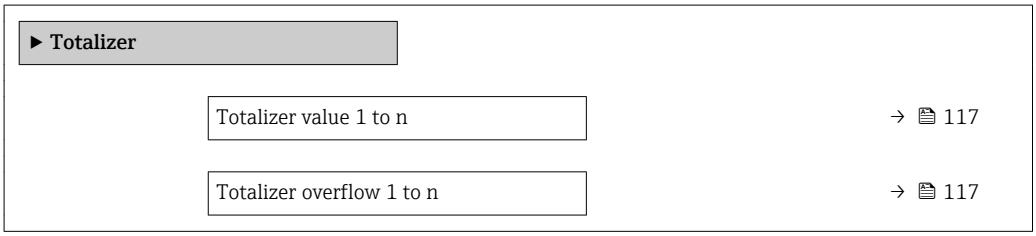
Parameter	Prerequisite	Description	User interface
Temperature	One of the following conditions is met: ▪ Order code for "Sensor option", option **CI** "Medium temperature measurement" or ▪ The temperature is read into the flowmeter from an external device.	Displays the temperature currently calculated. *Dependency* The unit is taken from the **Temperature unit** parameter (→ 🖹 77).	Positive floating-point number
Corrected conductivity	One of the following conditions is met: ▪ Order code for "Sensor option", option **CI** "Medium temperature measurement" or ▪ The temperature is read into the flowmeter from an external device.	Displays the conductivity currently corrected. *Dependency* The unit is taken from the **Conductivity unit** parameter (→ 🖹 77).	Positive floating-point number

11.4.2 "Totalizer" submenu

The **Totalizer** submenu contains all the parameters needed to display the current measured values for every totalizer.

Navigation

"Diagnostics" menu → Measured values → Totalizer



Parameter overview with brief description

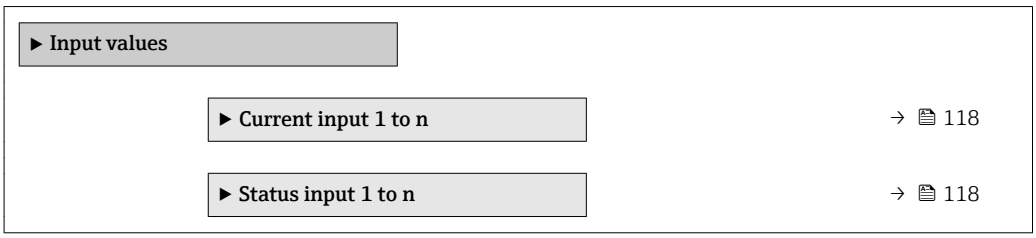
Parameter	Prerequisite	Description	User interface
Totalizer value 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 🖹 100) of the **Totalizer 1 to n** submenu.	Displays the current totalizer counter value.	Signed floating-point number
Totalizer overflow 1 to n	A process variable is selected in the **Assign process variable** parameter (→ 🖹 100) of the **Totalizer 1 to n** submenu.	Displays the current totalizer overflow.	Integer with sign

11.4.3 "Input values" submenu

The **Input values** submenu guides you systematically to the individual input values.

Navigation

"Diagnostics" menu → Measured values → Input values

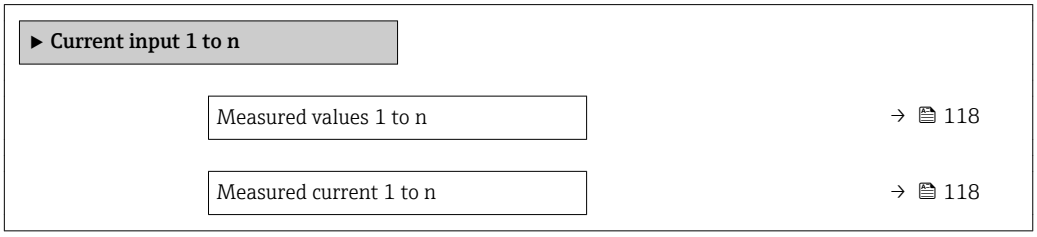


Input values of current input

The **Current input 1 to n** submenu contains all the parameters needed to display the current measured values for every current input.

Navigation

"Diagnostics" menu → Measured values → Input values → Current input 1 to n



Parameter overview with brief description

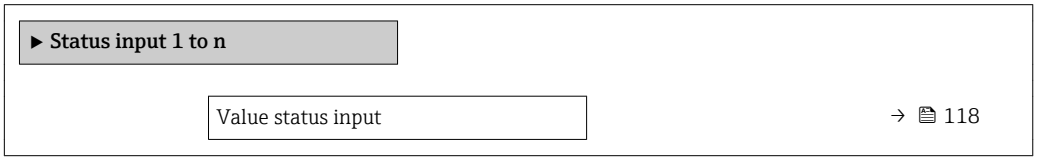
Parameter	Description	User interface
Measured values 1 to n	Displays the current input value.	Signed floating-point number
Measured current 1 to n	Displays the current value of the current input.	0 to 22.5 mA

Input values of status input

The **Status input 1 to n** submenu contains all the parameters needed to display the current measured values for every status input.

Navigation

"Diagnostics" menu → Measured values → Input values → Status input 1 to n



Parameter overview with brief description

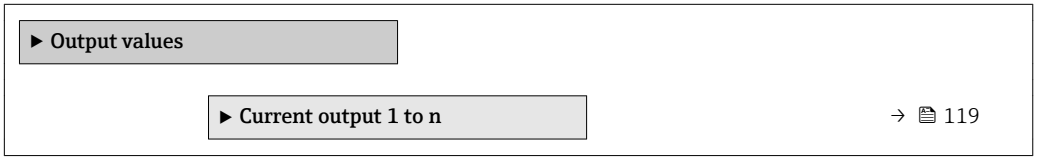
Parameter	Description	User interface
Value status input	Shows the current input signal level.	▪ High ▪ Low

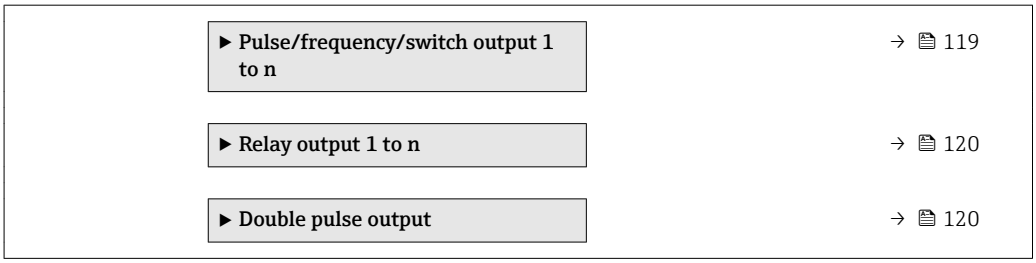
11.4.4 Output values

The **Output values** submenu contains all the parameters needed to display the current measured values for every output.

Navigation

"Diagnostics" menu → Measured values → Output values



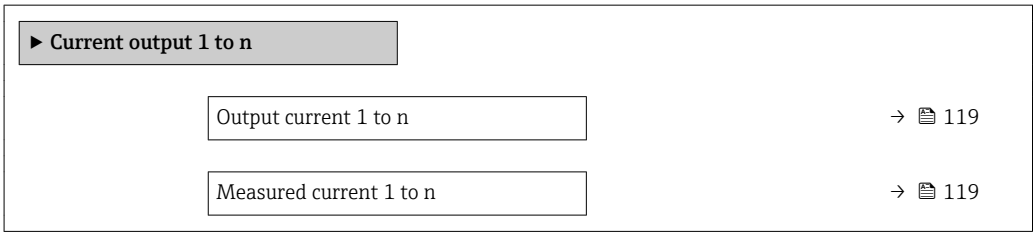


Output values of current output

The **Value current output** submenu contains all the parameters needed to display the current measured values for every current output.

Navigation

"Diagnostics" menu → Measured values → Output values → Value current output 1 to n



Parameter overview with brief description

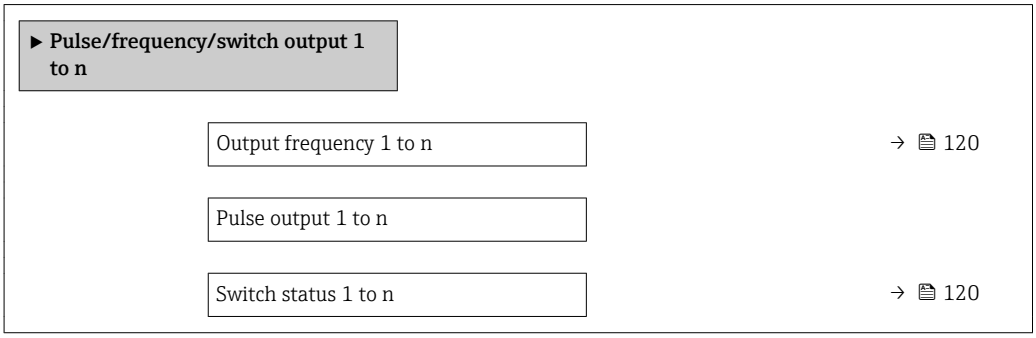
Parameter	Description	User interface
Output current 1	Displays the current value currently calculated for the current output.	3.59 to 22.5 mA
Measured current	Displays the current value currently measured for the current output.	0 to 30 mA

Output values for pulse/frequency/switch output

The **Pulse/frequency/switch output 1 to n** submenu contains all the parameters needed to display the current measured values for every pulse/frequency/switch output.

Navigation

"Diagnostics" menu → Measured values → Output values → Pulse/frequency/switch output 1 to n



Parameter overview with brief description

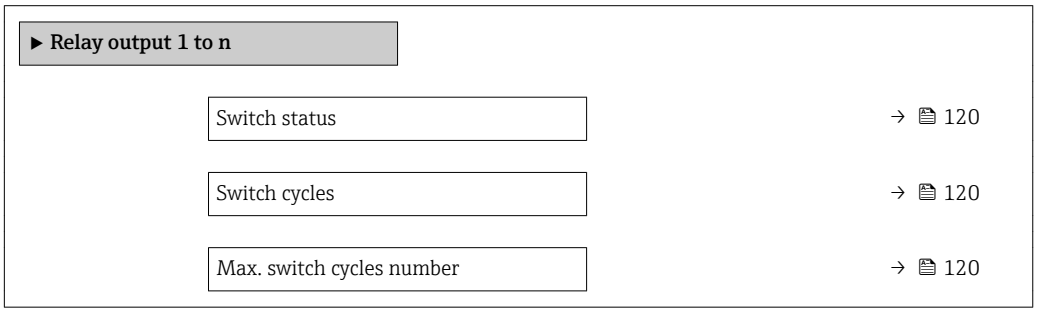
Parameter	Prerequisite	Description	User interface / User entry	Factory setting
Output frequency	In the **Operating mode** parameter, the **Frequency** option is selected.	Displays the value currently measured for the frequency output.	0.0 to 12 500.0 Hz	–
Value per pulse	In the **Operating mode** parameter, the **Pulse** option is selected and one of the following options is selected in the **Assign pulse output** parameter (→ 🖹 84): ▪ Mass flow ▪ Volume flow ▪ Corrected volume flow	Enter measured value at which a pulse is output.	Signed floating-point number	Depends on country and nominal diameter
Switch status	The **Switch** option is selected in the **Operating mode** parameter.	Displays the current switch output status.	▪ Open ▪ Closed	–

Output values for relay output

The **Relay output 1 to n** submenu contains all the parameters needed to display the current measured values for every relay output.

Navigation

"Diagnostics" menu → Measured values → Output values → Relay output 1 to n



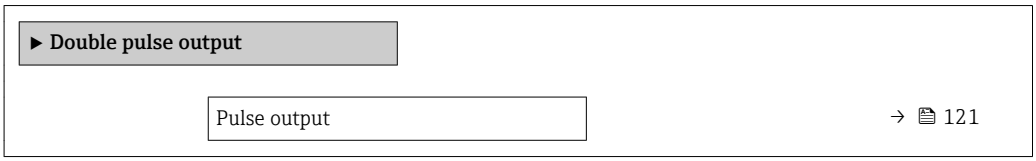
Parameter overview with brief description

Parameter	Description	User interface
Switch status	Shows the current relay switch status.	▪ Open ▪ Closed
Switch cycles	Shows number of all performed switch cycles.	Positive integer
Max. switch cycles number	Shows the maximal number of guaranteed switch cycles.	Positive integer

Output values for double pulse output

The **Double pulse output** submenu contains all the parameters needed to display the current measured values for every double pulse output.

Navigation
"Diagnostics" menu → Measured values → Output values → Double pulse output



Parameter overview with brief description

Parameter	Description	User interface
Pulse output	Shows the currently output pulse frequency.	Positive floating-point number

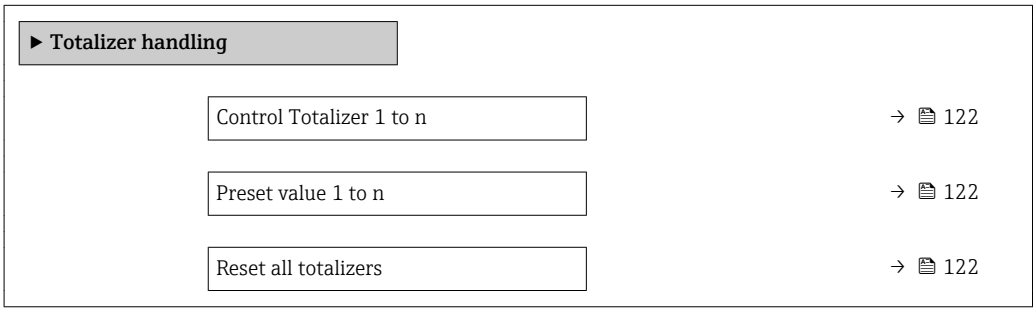
11.5 Adapting the measuring device to the process conditions

The following are available for this purpose:
- Basic settings using the**Setup** menu (→ 74)
- Advanced settings using the**Advanced setup** submenu (→ 98)

11.6 Performing a totalizer reset

The totalizers are reset in the **Operation** submenu:
- Control Totalizer
- Reset all totalizers

Navigation
"Operation" menu → Totalizer handling



Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry	Factory setting
Control Totalizer 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 100)**Totalizer 1 to n** submenu: Volume flow	Control totalizer value.	▪ Totalize ▪ Reset + hold ▪ Preset + hold ▪ Reset + totalize ▪ Preset + totalize ▪ Hold	Totalize
Preset value 1 to n	One of the following options is selected in the **Assign process variable** parameter (→ 100)**Totalizer 1 to n** submenu: Volume flow	Specify start value for totalizer. *Dependency* The unit of the selected process variable is specified for the totalizer in the **Unit totalizer** parameter (→ 100).	Signed floating-point number	0 l
Reset all totalizers	–	Reset all totalizers to 0 and start.	▪ Cancel ▪ Reset + totalize	Cancel

11.6.1 Function scope of the "Control Totalizer" parameter

Options	Description
Totalize	The totalizer is started or continues running.
Reset + hold	The totaling process is stopped and the totalizer is reset to 0.
Preset + hold	The totaling process is stopped and the totalizer is set to its defined start value from the **Preset value** parameter.
Reset + totalize	The totalizer is reset to 0 and the totaling process is restarted.
Preset + totalize	The totalizer is set to the defined start value from the **Preset value** parameter and the totaling process is restarted.
Hold	Totalizing is stopped.

11.6.2 Function scope of the "Reset all totalizers" parameter

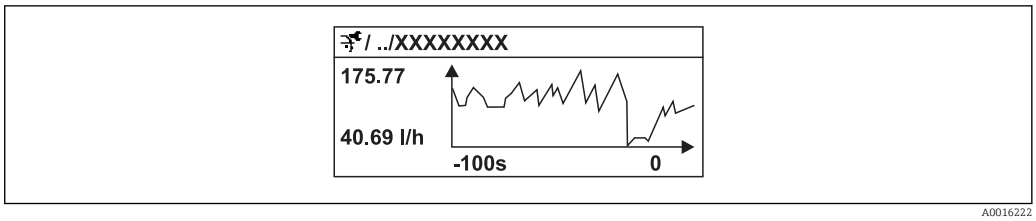
Options	Description
Cancel	No action is executed and the user exits the parameter.
Reset + totalize	Resets all totalizers to 0 and restarts the totaling process. This deletes all the flow values previously totalized.

11.7 Showing data logging

The **Extended HistoROM** application package must be enabled in the device (order option) for the **Data logging** submenu to appear. This contains all the parameters for the measured value history.

Data logging is also available via:
- Plant Asset Management Tool FieldCare → 66.
- Web browser→ 57

Function range
- A total of 1000 measured values can be stored
- 4 logging channels
- Adjustable logging interval for data logging
- Display of the measured value trend for each logging channel in the form of a chart



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28 *Chart of a measured value trend*

- x-axis: depending on the number of channels selected displays 250 to 1000 measured values of a process variable.
- y-axis: displays the approximate measured value span and constantly adapts this to the ongoing measurement.

If the length of the logging interval or the assignment of the process variables to the channels is changed, the content of the data logging is deleted.

Navigation

"Diagnostics" menu → Data logging

▶ Data logging	
Assign channel 1...4	→ 124
Logging interval	→ 124
Clear logging data	→ 124
Data logging	→ 124
Logging delay	→ 124
Data logging control	→ 124
Data logging status	→ 124
Entire logging duration	→ 124

Parameter overview with brief description

Parameter	Prerequisite	Description	Selection / User entry / User interface	Factory setting
Assign channel 1 to n	The **Extended HistoROM** application package is available.	Assign process variable to logging channel.	▪ Off ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity * ▪ Corrected conductivity * ▪ Electronic temperature ▪ Current output 1 ▪ Current output 2 * ▪ Current output 3 * ▪ Temperature *	Off
Logging interval	The **Extended HistoROM** application package is available.	Define the logging interval for data logging. This value defines the time interval between the individual data points in the memory.	0.1 to 999.0 s	1.0 s
Clear logging data	The **Extended HistoROM** application package is available.	Clear the entire logging data.	▪ Cancel ▪ Clear data	Cancel
Data logging	–	Select the data logging method.	▪ Overwriting ▪ Not overwriting	Overwriting
Logging delay	In the **Data logging** parameter, the **Not overwriting** option is selected.	Enter the time delay for measured value logging.	0 to 999 h	0 h
Data logging control	In the **Data logging** parameter, the **Not overwriting** option is selected.	Start and stop measured value logging.	▪ None ▪ Delete + start ▪ Stop	None
Data logging status	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the measured value logging status.	▪ Done ▪ Delay active ▪ Active ▪ Stopped	Done
Entire logging duration	In the **Data logging** parameter, the **Not overwriting** option is selected.	Displays the total logging duration.	Positive floating-point number	0 s

* Visibility depends on order options or device settings

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Error	Possible causes	Solution
Local display dark and no output signals	Supply voltage does not match the value indicated on the nameplate.	Apply the correct supply voltage → 33.
Local display dark and no output signals	The polarity of the supply voltage is wrong.	Correct the polarity.
Local display dark and no output signals	No contact between connecting cables and terminals.	Check the connection of the cables and correct if necessary.
Local display dark and no output signals	Terminals are not plugged into the I/O electronics module correctly. Terminals are not plugged into the main electronics module correctly.	Check terminals.
Local display dark and no output signals	I/O electronics module is defective. Main electronics module is defective.	Order spare part → 147.
Local display is dark, but signal output is within the valid range	Display is set too bright or too dark.	▪ Set the display brighter by simultaneously pressing ⊞ + Ⓔ. ▪ Set the display darker by simultaneously pressing ⊟ + Ⓔ.
Local display is dark, but signal output is within the valid range	The cable of the display module is not plugged in correctly.	Insert the plug correctly into the main electronics module and display module.
Local display is dark, but signal output is within the valid range	Display module is defective.	Order spare part → 147.
Backlighting of local display is red	Diagnostic event with "Alarm" diagnostic behavior has occurred.	Take remedial measures
Text on local display appears in a foreign language and cannot be understood.	Incorrect operating language is configured.	1. Press ⊟ + ⊞ for 2 s ("home position"). 2. Press Ⓔ. 3. Set the desired language in the **Display language** parameter (→ 103).
Message on local display: "Communication Error" "Check Electronics"	Communication between the display module and the electronics is interrupted.	▪ Check the cable and the connector between the main electronics module and display module. ▪ Order spare part → 147.

For output signals

Error	Possible causes	Solution
Signal output outside the valid range	Main electronics module is defective.	Order spare part → 147.
Signal output outside the valid current range (< 3.6 mA or > 22 mA)	Main electronics module is defective. I/O electronics module is defective.	Order spare part → 147.

Error	Possible causes	Solution
Device shows correct value on local display, but signal output is incorrect, though in the valid range.	Configuration error	Check and correct the parameter configuration.
Device measures incorrectly.	Configuration error or device is operated outside the application.	1. Check and correct parameter configuration. 2. Observe limit values specified in the "Technical Data".

For access

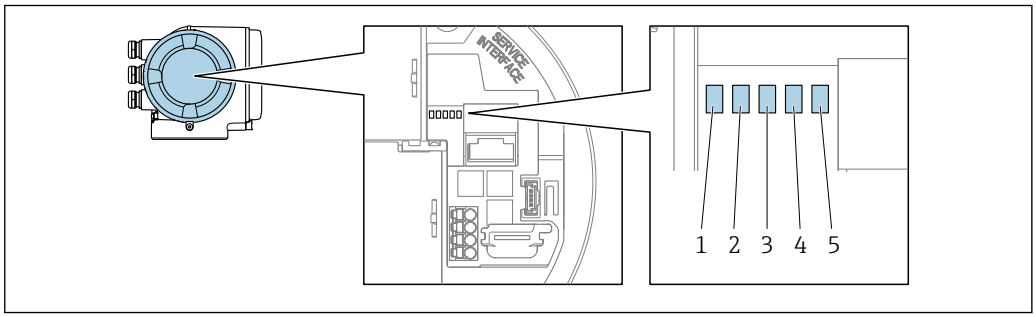
Error	Possible causes	Solution
No write access to parameters	Hardware write protection enabled	Set the write protection switch on main electronics module to the **Off** position → 🖹 113.
No write access to parameters	Current user role has limited access authorization	1. Check user role → 🖹 56. 2. Enter correct customer-specific access code → 🖹 56.
No connection via HART protocol	Communication resistor missing or incorrectly installed.	Install the communication resistor (250 Ω) correctly. Observe the maximum load → 🖹 155.
No connection via HART protocol	Commubox ▪ Connected incorrectly ▪ Configured incorrectly ▪ Drivers not installed correctly ▪ USB interface on computer configured incorrectly	Observe the documentation for the Commubox. FXA195 HART: Document "Technical Information" TI00404F
Not connecting to Web server	Web server disabled	Using the "FieldCare" or "DeviceCare" operating tool, check whether the web server of the measuring device is enabled, and enable it if necessary → 🖹 62.
	Incorrect setting for the Ethernet interface of the computer	1. Check the properties of the Internet protocol (TCP/IP) → 🖹 59. 2. Check the network settings with the IT manager.
Not connecting to Web server	Incorrect IP address	Check the IP address: 192.168.1.212 → 🖹 59
Not connecting to Web server	Incorrect WLAN access data	▪ Check WLAN network status. ▪ Log on to the device again using WLAN access data. ▪ Verify that WLAN is enabled on the measuring device and operating device → 🖹 59.
	WLAN communication disabled	–
Not connecting to web server, FieldCare or DeviceCare	No WLAN network available	▪ Check if WLAN reception is present: LED on display module is lit blue ▪ Check if WLAN connection is enabled: LED on display module flashes blue ▪ Switch on instrument function.
Network connection not present or unstable	WLAN network is weak.	▪ Operating device is outside of reception range: Check network status on operating device. ▪ To improve network performance, use an external WLAN antenna.

Error	Possible causes	Solution
	Parallel WLAN and Ethernet communication	▪ Check network settings. ▪ Temporarily enable only the WLAN as an interface.
Web browser frozen and operation no longer possible	Data transfer active	Wait until data transfer or current action is finished.
	Connection lost	1. Check cable connection and power supply. 2. Refresh the Web browser and restart if necessary.
Content of Web browser incomplete or difficult to read	Not using optimum version of Web server.	1. Use the correct Web browser version . 2. Clear the Web browser cache and restart the Web browser.
	Unsuitable view settings.	Change the font size/display ratio of the Web browser.
No or incomplete display of contents in the Web browser	▪ JavaScript not enabled ▪ JavaScript cannot be enabled	1. Enable JavaScript. 2. Enter http://XXX.XXX.X.XXX/basic.html as the IP address.
Operation with FieldCare or DeviceCare via CDI-RJ45 service interface (port 8000)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.
Flashing of firmware with FieldCare or DeviceCare via CDI-RJ45 service interface (via port 8000 or TFTP ports)	Firewall of computer or network is preventing communication	Depending on the settings of the firewall used on the computer or in the network, the firewall must be adapted or disabled to allow FieldCare/DeviceCare access.

12.2 Diagnostic information via light emitting diodes

12.2.1 Transmitter

Different LEDs in the transmitter provide information on the device status.



A0029629

1 *Supply voltage*
2 *Device status*
3 *Not used*
4 *Communication*
5 *Service interface (CDI) active*

LED	Color	Meaning
1 Supply voltage	Green	Supply voltage is ok
	Off	Supply voltage is off or too low
2 Device status	Red	Error

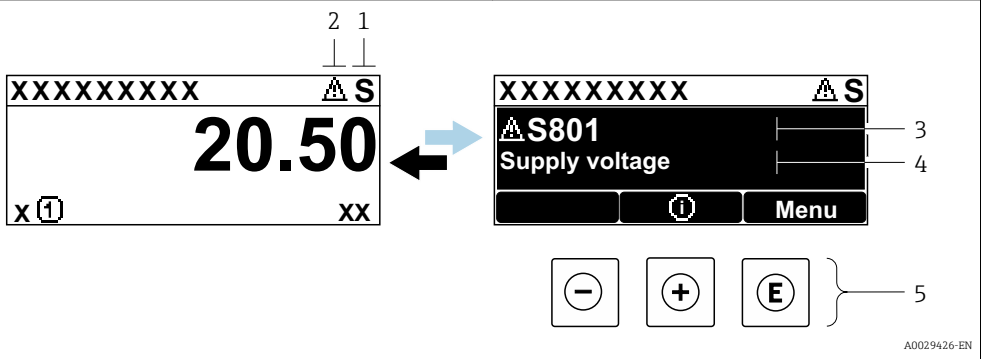
LED	Color	Meaning
	Flashing red	Warning
3 Not used	–	–
4 Communication	White	Communication active
5 Service interface (CDI)	Yellow	Connection established
	Flashing yellow	Communication active
	Off	No connection

12.3 Diagnostic information on local display

12.3.1 Diagnostic message

Faults detected by the self-monitoring system of the measuring device are displayed as a diagnostic message in alternation with the operational display.

Operational display in alarm condition	Diagnostic message



1 *Status signal*
2 *Diagnostic behavior*
3 *Diagnostic behavior with diagnostic code*
4 *Short text*
5 *Operating elements*

If two or more diagnostic events are pending simultaneously, only the message of the diagnostic event with the highest priority is shown.

Other diagnostic events that have occurred can be displayed in the **Diagnostics** menu:
- Via parameter
- Via submenus → 140

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

The status signals are categorized according to VDI/VDE 2650 and NAMUR Recommendation NE 107: F = Failure, C = Function Check, S = Out of Specification, M = Maintenance Required

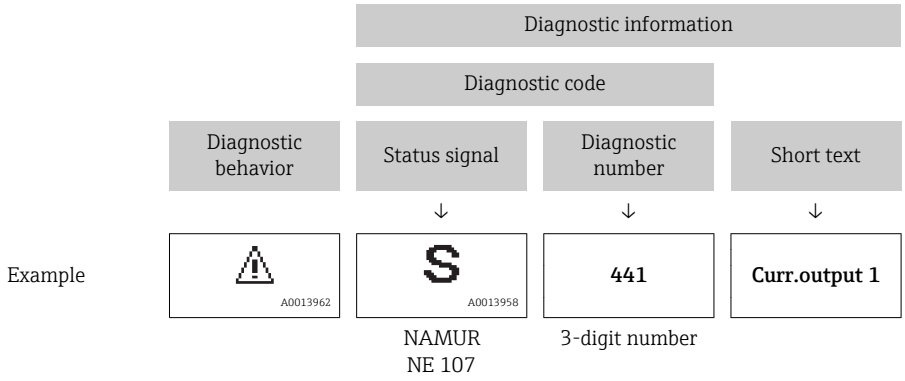
Symbol	Meaning
F	**Failure** A device error has occurred. The measured value is no longer valid.
C	**Function check** The device is in service mode (e.g. during a simulation).
S	**Out of specification** The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
M	**Maintenance required** Maintenance is required. The measured value remains valid.

Diagnostic behavior

Symbol	Meaning
	**Alarm** ▪ Measurement is interrupted. ▪ Signal outputs and totalizers assume the defined alarm condition. ▪ A diagnostic message is generated.
	**Warning** Measurement is resumed. The signal outputs and totalizers are not affected. A diagnostic message is generated.

Diagnostic information

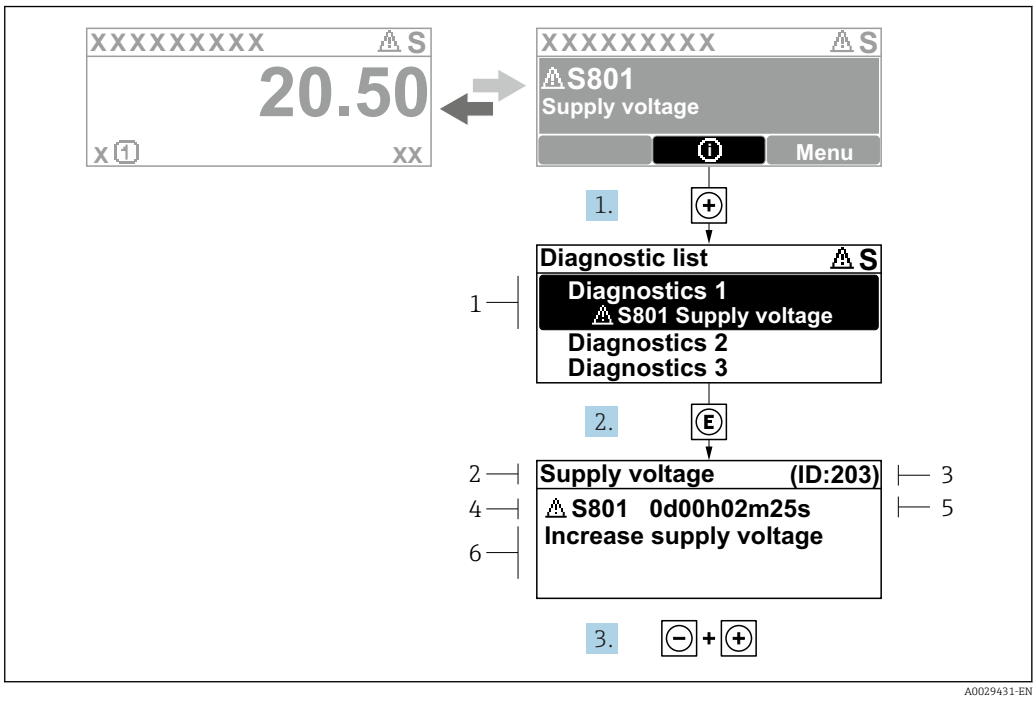
The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



Operating elements

Key	Meaning
	**Plus key** *In a menu, submenu* Opens the message about remedy information.
	**Enter key** *In a menu, submenu* Opens the operating menu.

12.3.2 Calling up remedial measures



29 *Message for remedial measures*

1 *Diagnostic information*
2 *Short text*
3 *Service ID*
4 *Diagnostic behavior with diagnostic code*
5 *Operation time of occurrence*
6 *Remedial measures*

The user is in the diagnostic message.

1. Press ⊞ (ⓘ symbol).
   ↳ The **Diagnostic list** submenu opens.
2. Select the desired diagnostic event with ⊞ or ⊟ and press Ⓔ .
   ↳ The message for the remedial measures for the selected diagnostic event opens.
3. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

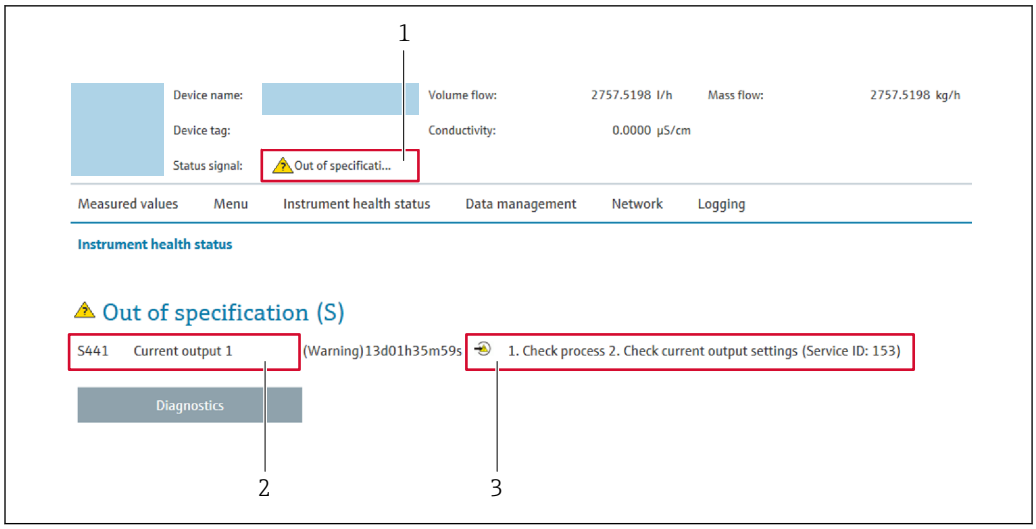
The user is in the **Diagnostics** menu at an entry for a diagnostics event, e.g. in the **Diagnostic list** submenu or **Previous diagnostics** parameter.

1. Press Ⓔ.
   ↳ The message for the remedial measures for the selected diagnostic event opens.
2. Press ⊟ + ⊞ simultaneously.
   ↳ The message for the remedial measures closes.

12.4 Diagnostic information in the Web browser

12.4.1 Diagnostic options

Any faults detected by the measuring device are displayed in the Web browser on the home page once the user has logged on.



1 *Status area with status signal*
2 *Diagnostic information→ 130*
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter
- Via submenu → 140

Status signals

The status signals provide information on the state and reliability of the device by categorizing the cause of the diagnostic information (diagnostic event).

Symbol	Meaning
	Failure A device error has occurred. The measured value is no longer valid.
	Function check The device is in service mode (e.g. during a simulation).
	Out of specification The device is operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
	Maintenance required Maintenance is required. The measured value is still valid.

The status signals are categorized in accordance with VDI/VDE 2650 and NAMUR Recommendation NE 107.

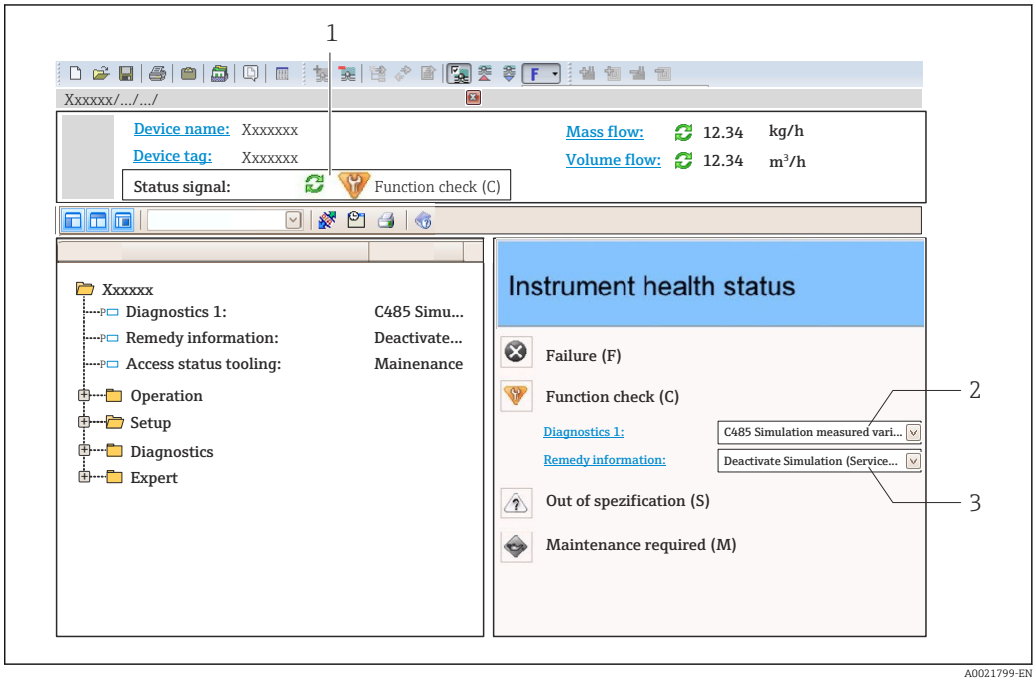
12.4.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly. These measures are displayed in red along with the diagnostic event and the related diagnostic information.

12.5 Diagnostic information in DeviceCare or FieldCare

12.5.1 Diagnostic options

Any faults detected by the measuring device are displayed on the home page of the operating tool once the connection has been established.

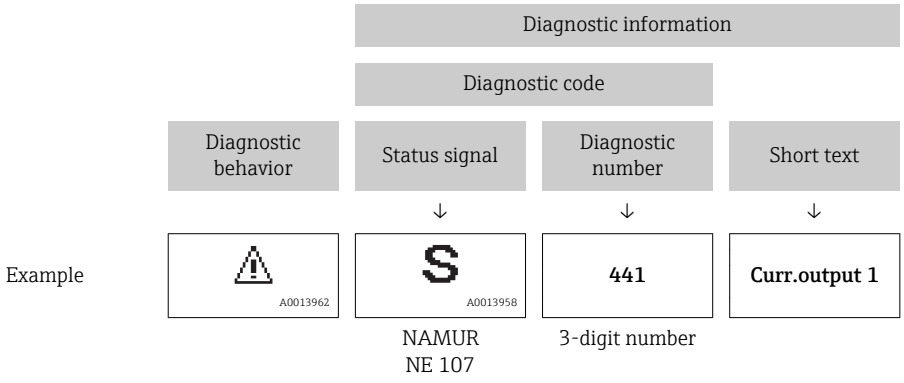


1 *Status area with status signal* → 🖹 *129*
2 *Diagnostic information* → 🖹 *130*
3 *Remedy information with Service ID*

In addition, diagnostic events which have occurred can be shown in the **Diagnostics** menu:
- Via parameter
- Via submenu → 🖹 140

Diagnostic information

The fault can be identified using the diagnostic information. The short text helps you by providing information about the fault. In addition, the corresponding symbol for the diagnostic behavior is displayed in front of the diagnostic information on the local display.



12.5.2 Calling up remedy information

Remedy information is provided for every diagnostic event to ensure that problems can be rectified quickly:

- On the home page
  Remedy information is displayed in a separate field below the diagnostics information.
- In the **Diagnostics** menu
  Remedy information can be called up in the working area of the user interface.

The user is in the **Diagnostics** menu.

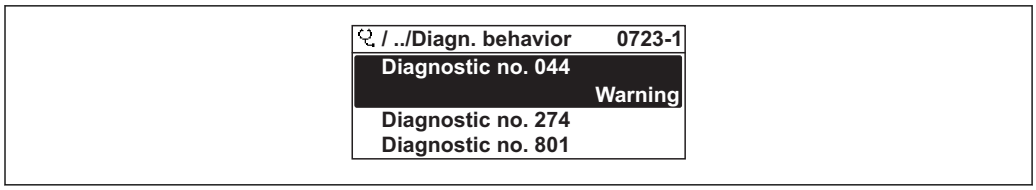
1. Call up the desired parameter.
2. On the right in the working area, mouse over the parameter.
   ↳ A tool tip with remedy information for the diagnostic event appears.

12.6 Adapting the diagnostic information

12.6.1 Adapting the diagnostic behavior

Each item of diagnostic information is assigned a specific diagnostic behavior at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic behavior** submenu.

Expert → System → Diagnostic handling → Diagnostic behavior



30 Taking the example of the local display

You can assign the following options to the diagnostic number as the diagnostic behavior:

Options	Description
Alarm	The device stops measurement. The signal outputs and totalizers assume the defined alarm condition. A diagnostic message is generated. The background lighting changes to red.
Warning	The device continues to measure. The signal outputs and totalizers are not affected. A diagnostic message is generated.
Logbook entry only	The device continues to measure. The diagnostic message is displayed only in the **Event logbook** submenu (**Event list** submenu) and is not displayed in alternation with the operational display.
Off	The diagnostic event is ignored, and no diagnostic message is generated or entered.

12.6.2 Adapting the status signal

Each item of diagnostic information is assigned a specific status signal at the factory. The user can change this assignment for specific diagnostic information in the **Diagnostic event category** submenu.

Expert → Communication → Diagnostic event category

Available status signals

Configuration as per HART 7 Specification (Condensed Status), in accordance with NAMUR NE107.

Symbol	Meaning
F A0013956	**Failure** A device error is present. The measured value is no longer valid.
C A0013959	**Function check** The device is in service mode (e.g. during a simulation).
S A0013958	**Out of specification** The device is being operated: ▪ Outside its technical specification limits (e.g. outside the process temperature range) ▪ Outside of the configuration carried out by the user (e.g. maximum flow in parameter **20 mA value**)
M A0013957	**Maintenance required** Maintenance is required. The measured value is still valid.
N A0023076	Has no effect on the condensed status.

12.7 Overview of diagnostic information

The amount of diagnostic information and the number of measured variables affected increase if the measuring device has one or more application packages.

In the case of some items of diagnostic information, the status signal and the diagnostic behavior can be changed. Change the diagnostic information → 134

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
Diagnostic of sensor				
043	Sensor short circuit	1. Check sensor cable and sensor 2. Execute Heartbeat Verification 3. Replace sensor cable or sensor	S	Warning [1]
082	Data storage	1. Check module connections 2. Contact service	F	Alarm
083	Memory content	1. Restart device 2. Restore HistoROM S-DAT backup ('Device reset' parameter) 3. Replace HistoROM S-DAT	F	Alarm
170	Coil resistance	Check ambient and process temperature	F	Alarm
180	Temperature sensor defective	1. Check sensor connections 2. Replace sensor cable or sensor 3. Turn off temperature measurement	F	Warning
181	Sensor connection	1. Check sensor cable and sensor 2. Execute Heartbeat Verification 3. Replace sensor cable or sensor	F	Alarm
Diagnostic of electronic				
201	Device failure	1. Restart device 2. Contact service	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
242	Software incompatible	1. Check software 2. Flash or change main electronics module	F	Alarm
252	Modules incompatible	1. Check electronic modules 2. Change electronic modules	F	Alarm
262	Sensor electronic connection faulty	1. Check or replace connection cable between sensor electronic module (ISEM) and main electronics 2. Check or replace ISEM or main electronics	F	Alarm
270	Main electronic failure	Change main electronic module	F	Alarm
271	Main electronic failure	1. Restart device 2. Change main electronic module	F	Alarm
272	Main electronic failure	1. Restart device 2. Contact service	F	Alarm
273	Main electronic failure	Change electronic	F	Alarm
275	I/O module 1 to n defective	Change I/O module	F	Alarm
276	I/O module 1 to n faulty	1. Restart device 2. Change I/O module	F	Alarm
283	Memory content	1. Reset device 2. Contact service	F	Alarm
302	Device verification active	Device verification active, please wait.	C	Warning
311	Electronic failure	1. Do not reset device 2. Contact service	M	Warning
332	Writing in embedded HistoROM failed	Replace user interface board Ex d/XP: replace transmitter	F	Alarm
361	I/O module 1 to n faulty	1. Restart device 2. Check electronic modules 3. Change I/O Modul or main electronics	F	Alarm
372	Sensor electronic (ISEM) faulty	1. Restart device 2. Check if failure recurs 3. Replace sensor electronic module (ISEM)	F	Alarm
373	Sensor electronic (ISEM) faulty	1. Transfer data or reset device 2. Contact service	F	Alarm
375	I/O- 1 to n communication failed	1. Restart device 2. Check if failure recurs 3. Replace module rack inclusive electronic modules	F	Alarm
376	Sensor electronic (ISEM) faulty	1. Replace sensor electronic module (ISEM) 2. Turn off diagnostic message	F	Warning [1)]
377	Sensor electronic (ISEM) faulty	1. Check sensor cable and sensor 2. Perform Heartbeat Verification 3. Replace sensor cable or sensor	F	Warning [1)]
382	Data storage	1. Insert T-DAT 2. Replace T-DAT	F	Alarm
383	Memory content	1. Restart device 2. Delete T-DAT via 'Reset device' parameter 3. Replace T-DAT	F	Alarm

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
387	Embedded HistoROM failed	Contact service organization	F	Alarm
512	Sensor electronic (ISEM) faulty	1. Check ECC recovery time 2. Turn off ECC	F	Alarm
Diagnostic of configuration				
303	I/O 1 to n configuration changed	1. Apply I/O module configuration (parameter 'Apply I/O configuration') 2. Afterwards reload device description and check wiring	M	Warning
330	Flash file invalid	1. Update firmware of device 2. Restart device	M	Warning
331	Firmware update failed	1. Update firmware of device 2. Restart device	F	Warning
410	Data transfer	1. Check connection 2. Retry data transfer	F	Alarm
412	Processing download	Download active, please wait	C	Warning
431	Trim 1 to n	Carry out trim	C	Warning
437	Configuration incompatible	1. Restart device 2. Contact service	F	Alarm
438	Dataset	1. Check data set file 2. Check device configuration 3. Up- and download new configuration	M	Warning
441	Current output 1 to n	1. Check process 2. Check current output settings	S	Warning [1)]
442	Frequency output 1 to n	1. Check process 2. Check frequency output settings	S	Warning [1)]
443	Pulse output 1 to n	1. Check process 2. Check pulse output settings	S	Warning [1)]
444	Current input 1 to n	1. Check process 2. Check current input settings	S	Warning [1)]
453	Flow override	Deactivate flow override	C	Warning
484	Failure mode simulation	Deactivate simulation	C	Alarm
485	Measured variable simulation	Deactivate simulation	C	Warning
486	Current input 1 to n simulation	Deactivate simulation	C	Warning
491	Current output 1 to n simulation	Deactivate simulation	C	Warning
492	Simulation frequency output 1 to n	Deactivate simulation frequency output	C	Warning
493	Simulation pulse output 1 to n	Deactivate simulation pulse output	C	Warning
494	Switch output simulation 1 to n	Deactivate simulation switch output	C	Warning
495	Diagnostic event simulation	Deactivate simulation	C	Warning
496	Status input simulation	Deactivate simulation status input	C	Warning

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
502	CT activation/ deactivation failed	Follow the sequence of the custody transfer activation/deactivation: First authorized user login, then set the DIP switch on the main electonic module	C	Warning
511	Sensor electronic (ISEM) faulty	1. Check measuring period and integration time 2. Check sensor properties	C	Alarm
520	I/O 1 to n hardware configuration invalid	1. Check I/O hardware configuration 2. Replace wrong I/O module 3. Plug the module of double pulse output on correct slot	F	Alarm
530	Electrode cleaning is running	Turn off ECC	C	Warning
531	Empty pipe detection	Execute EPD adjustment	S	Warning [1]
537	Configuration	1. Check IP addresses in network 2. Change IP address	F	Warning
540	Custody transfer mode failed	1. Deactivate custody transfer mode 2. Reactivate custody transfer mode	F	Alarm
543	Double pulse output	1. Check process 2. Check pulse output settings	S	Warning [1]
593	Double pulse output simulation	Deactivate simulation pulse output	C	Warning
594	Relay output simulation	Deactivate simulation switch output	C	Warning
599	Custody transfer logbook full	1. Deactivate custody transfer mode 2. Clear custody transfer logbook (all 30 entries) 3. Activate custody transfer mode	F	Warning
Diagnostic of process				
803	Current loop	1. Check wiring 2. Change I/O module	F	Alarm
832	Electronic temperature too high	Reduce ambient temperature	S	Warning [1]
833	Electronic temperature too low	Increase ambient temperature	S	Warning [1]
834	Process temperature too high	Reduce process temperature	S	Warning [1]
835	Process temperature too low	Increase process temperature	S	Warning [1]
842	Process limit	Low flow cut off active! 1. Check low flow cut off configuration	S	Warning
882	Input signal	1. Check input configuration 2. Check external device or process conditions	F	Alarm
937	EMC interference	1. Eliminate external magnetic field near sensor 2. Turn off diagnostic message	S	Warning [1]

Diagnostic number	Short text	Remedy instructions	Status signal [from the factory]	Diagnostic behavior [from the factory]
938	EMC interference	1. Check ambient conditions regarding EMC influence 2. Turn off diagnostic message	F	Alarm [1]
962	Empty pipe	1. Perform full pipe adjustment 2. Perform empty pipe adjustment 3. Turn off empty pipe detection	S	Warning [1]

1) Diagnostic behavior can be changed.

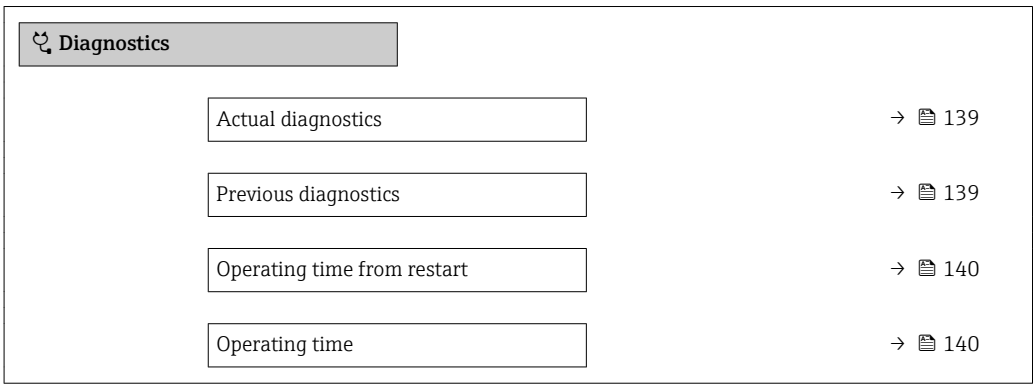
12.8 Pending diagnostic events

The **Diagnostics** menu allows the user to view the current diagnostic event and the previous diagnostic event separately.

To call up the measures to rectify a diagnostic event:
- Via local display → 131
- Via Web browser → 132
- Via "FieldCare" operating tool → 134
- Via "DeviceCare" operating tool → 134

Other pending diagnostic events can be displayed in the **Diagnostic list** submenu → 140

Navigation
"Diagnostics" menu



Parameter overview with brief description

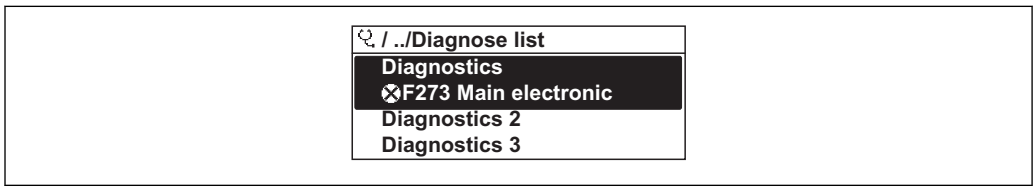
Parameter	Prerequisite	Description	User interface
Actual diagnostics	A diagnostic event has occurred.	Shows the current occured diagnostic event along with its diagnostic information. If two or more messages occur simultaneously, the message with the highest priority is shown on the display.	Symbol for diagnostic behavior, diagnostic code and short message.
Previous diagnostics	Two diagnostic events have already occurred.	Shows the diagnostic event that occurred prior to the current diagnostic event along with its diagnostic information.	Symbol for diagnostic behavior, diagnostic code and short message.

Parameter	Prerequisite	Description	User interface
Operating time from restart	–	Shows the time the device has been in operation since the last device restart.	Days (d), hours (h), minutes (m) and seconds (s)
Operating time	–	Indicates how long the device has been in operation.	Days (d), hours (h), minutes (m) and seconds (s)

12.9 Diagnostic list

Up to 5 currently pending diagnostic events can be displayed in the **Diagnostic list** submenu along with the associated diagnostic information. If more than 5 diagnostic events are pending, the events with the highest priority are shown on the display.

Navigation path
Diagnostics → Diagnostic list



31 Taking the example of the local display

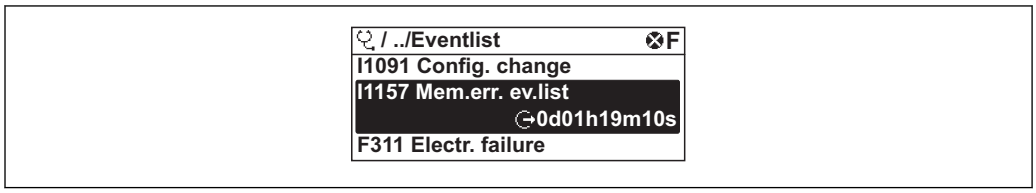
To call up the measures to rectify a diagnostic event:
- Via local display → 131
- Via Web browser → 132
- Via "FieldCare" operating tool → 134
- Via "DeviceCare" operating tool → 134

12.10 Event logbook

12.10.1 Event history

A chronological overview of the event messages that have occurred is provided in the **Events list** submenu.

Navigation path
Diagnostics menu → **Event logbook** submenu → Event list



32 Taking the example of the local display

- Max. 20 event messages can be displayed in chronological order.
- If the **Extended HistoROM** application package (order option) is enabled in the device, the event list can contain up to 100 entries .

The event history includes entries for:
- Diagnostic events → 135
- Information events → 141

In addition to the operation time of its occurrence, each event is also assigned a symbol that indicates whether the event has occurred or is ended:
- Diagnostic event
  - ⊕: Occurrence of the event
  - ⊖: End of the event
- Information event
  ⊕: Occurrence of the event

To call up the measures to rectify a diagnostic event:
- Via local display → 131
- Via Web browser → 132
- Via "FieldCare" operating tool → 134
- Via "DeviceCare" operating tool → 134

For filtering the displayed event messages → 141

12.10.2 Filtering the event logbook

Using the **Filter options** parameter you can define which category of event message is displayed in the **Events list** submenu.

Navigation path
Diagnostics → Event logbook → Filter options

Filter categories
- All
- Failure (F)
- Function check (C)
- Out of specification (S)
- Maintenance required (M)
- Information (I)

12.10.3 Overview of information events

Unlike a diagnostic event, an information event is displayed in the event logbook only and not in the diagnostic list.

Info number	Info name
I1000	--------(Device ok)
I1079	Sensor changed
I1089	Power on
I1090	Configuration reset
I1091	Configuration changed
I1092	Embedded HistoROM deleted
I1137	Electronic changed
I1151	History reset
I1155	Reset electronic temperature
I1156	Memory error trend
I1157	Memory error event list
I1184	Display connected
I1256	Display: access status changed
I1264	Safety sequence aborted
I1278	I/O module reset detected
I1335	Firmware changed

Info number	Info name
I1351	Empty pipe detection adjustment failure
I1353	Empty pipe detection adjustment ok
I1361	Web server login failed
I1397	Fieldbus: access status changed
I1398	CDI: access status changed
I1443	Coating thickness not determined
I1444	Device verification passed
I1445	Device verification failed
I1450	Monitoring off
I1451	Monitoring on
I1457	Measured error verification failed
I1459	I/O module verification failed
I1461	Sensor verification failed
I1462	Sensor electronic module verific. failed
I1512	Download started
I1513	Download finished
I1514	Upload started
I1515	Upload finished
I1517	Custody transfer active
I1518	Custody transfer inactive
I1554	Safety sequence started
I1555	Safety sequence confirmed
I1556	Safety mode off
I1618	I/O module replaced
I1619	I/O module replaced
I1621	I/O module replaced
I1622	Calibration changed
I1624	Reset all totalizers
I1625	Write protection activated
I1626	Write protection deactivated
I1627	Web server login successful
I1628	Display login successful
I1629	CDI login successful
I1631	Web server access changed
I1632	Display login failed
I1633	CDI login failed
I1634	Parameter factory reset
I1635	Parameter delivery reset
I1639	Max. switch cycles number reached
I1643	Custody transfer logbook cleared
I1649	Hardware write protection activated
I1650	Hardware write protection deactivated
I1651	Custody transfer parameter changed

Info number	Info name
I1712	New flash file received
I1725	Sensor electronic module (ISEM) changed
I1726	Configuration backup failed

12.11 Resetting the measuring device

Using the**Device reset** parameter (→ 109) it is possible to reset the entire device configuration or some of the configuration to a defined state.

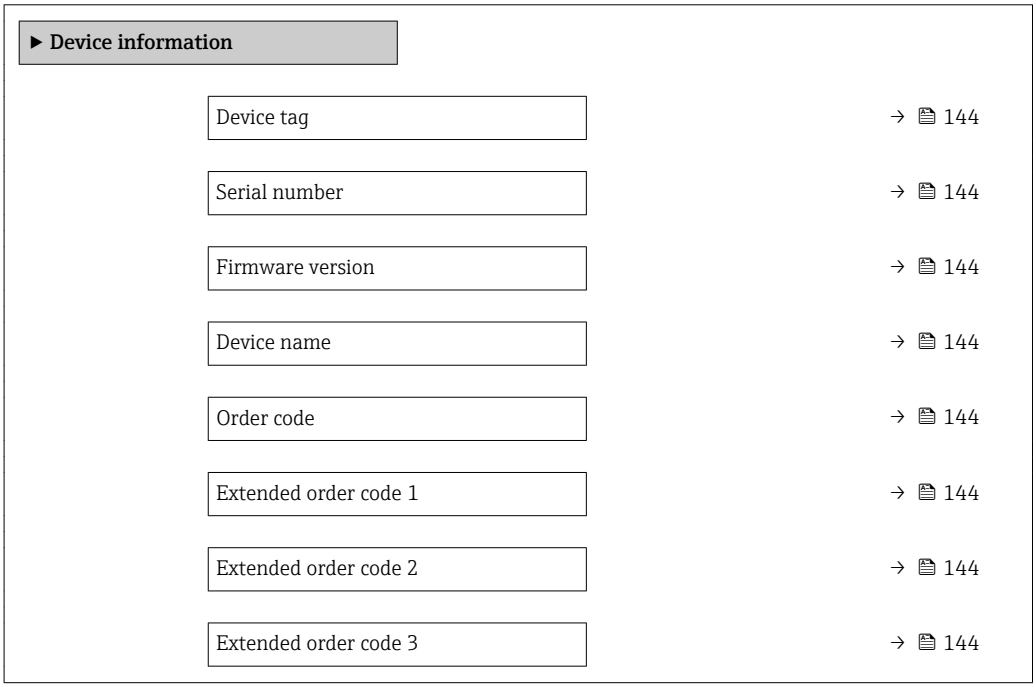
12.11.1 Function scope of the "Device reset" parameter

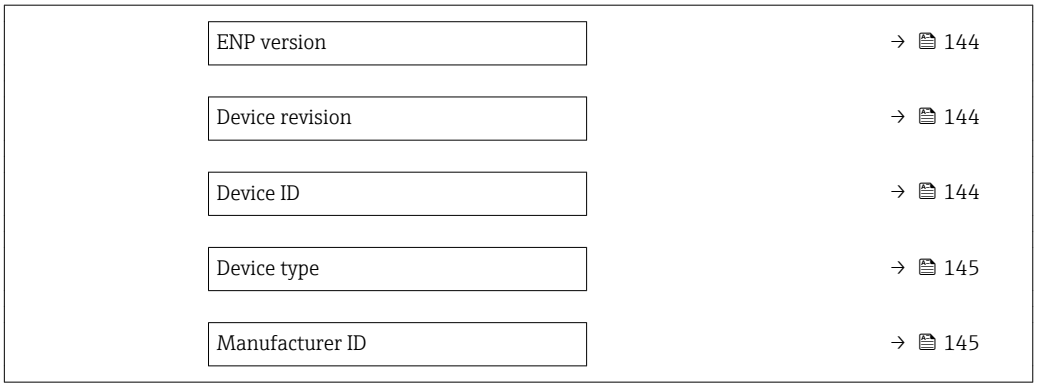
Options	Description
Cancel	No action is executed and the user exits the parameter.
To delivery settings	Every parameter for which a customer-specific default setting was ordered is reset to this customer-specific value. All other parameters are reset to the factory setting.
Restart device	The restart resets every parameter whose data are in the volatile memory (RAM) to the factory setting (e.g. measured value data). The device configuration remains unchanged.
Restore S-DAT backup	Restore the data that are saved on the S-DAT. The data record is restored from the electronics memory to the S-DAT.

12.12 Device information

The **Device information** submenu contains all parameters that display different information for device identification.

Navigation
"Diagnostics" menu → Device information





Parameter overview with brief description

Parameter	Description	User interface	Factory setting
Device tag	Shows name of measuring point.	Max. 32 characters, such as letters, numbers or special characters (e.g. @, %, /).	Promag300/500
Serial number	Shows the serial number of the measuring device.	A maximum of 11-digit character string comprising letters and numbers.	–
Firmware version	Shows the device firmware version installed.	Character string in the format xx.yy.zz	–
Device name	Shows the name of the transmitter. The name can be found on the nameplate of the transmitter.	Promag300/500	–
Order code	Shows the device order code. The order code can be found on the nameplate of the sensor and transmitter in the "Order code" field.	Character string composed of letters, numbers and certain punctuation marks (e.g. /).	–
Extended order code 1	Shows the 1st part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 2	Shows the 2nd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
Extended order code 3	Shows the 3rd part of the extended order code. The extended order code can also be found on the nameplate of the sensor and transmitter in the "Ext. ord. cd." field.	Character string	–
ENP version	Shows the version of the electronic nameplate (ENP).	Character string	2.02.00
Device revision	Shows the device revision with which the device is registered with the HART Communication Foundation.	2-digit hexadecimal number	1
Device ID	Shows the device ID for identifying the device in a HART network.	6-digit hexadecimal number	–

Parameter	Description	User interface	Factory setting
Device type	Shows the device type with which the measuring device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x3A (for Promag 300)
Manufacturer ID	Shows the manufacturer ID device is registered with the HART Communication Foundation.	2-digit hexadecimal number	0x11 (for Endress+Hauser)

12.13 Firmware history

Release date	Firmware version	Order code for "Firmware version"	Firmware changes	Documentation type	Documentation
08.2016	01.00.zz	Option **76**	Original firmware	Operating Instructions	BA01392D/06/EN/01.16

It is possible to flash the firmware to the current version or the previous version using the service interface.

For the compatibility of the firmware version with the previous version, the installed device description files and operating tools, observe the information about the device in the "Manufacturer's information" document.

The manufacturer's information is available:
- In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads
- Specify the following details:
  - Product root: e.g. 5H3B
  - Text search: Manufacturer's information
  - Media type: Documentation – Technical Documentation

13 Maintenance

13.1 Maintenance tasks

No special maintenance work is required.

13.1.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing or the seals.

13.1.2 Interior cleaning

Cleaning with pigs

It is essential to take the internal diameters of the measuring tube and process connection into account when cleaning with pigs. All the dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document.

13.1.3 Replacing seals

The sensor's seals (particularly aseptic molded seals) must be replaced periodically.

The interval between changes depends on the frequency of the cleaning cycles, the cleaning temperature and the medium temperature.

Replacement seals (accessory) → 174

13.2 Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

List of some of the measuring and testing equipment: → 149

13.3 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14 Repairs

14.1 General notes

14.1.1 Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to other certified devices by Endress+Hauser Service or at the factory.

14.1.2 Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:
- ▶ Use only original Endress+Hauser spare parts.
- ▶ Carry out the repair according to the Installation Instructions.
- ▶ Observe the applicable standards, federal/national regulations, Ex documentation (XA) and certificates.
- ▶ Document every repair and each conversion and enter them into the *W@M* life cycle management database.

14.2 Spare parts

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

Measuring device serial number:
- Is located on the nameplate of the device.
- Can be read out via the **Serial number** parameter (→ 144) in the **Device information** submenu.

14.3 Endress+Hauser services

Endress+Hauser offers a wide range of services.

Your Endress+Hauser Sales Center can provide detailed information on the services.

14.4 Return

The measuring device must be returned if it is need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at http://www.endress.com/support/return-material

14.5 Disposal

14.5.1 Removing the measuring device

1. Switch off the device.

⚠ WARNING

Danger to persons from process conditions.

- Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids.

2. Carry out the mounting and connection steps from the "Mounting the measuring device" and "Connecting the measuring device" sections in reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring device

⚠ WARNING

Danger to personnel and environment from fluids that are hazardous to health.

- Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

15 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.

15.1 Device-specific accessories

15.1.1 For the transmitter

Accessories	Description
Promag 300 transmitter	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 EA01150
Remote display and operating module DKX001	The remote display and operating module DKX001 is available as an optional extra: Order code for "Display; operation", option **O** "Separate backlit, 4-line display; 10 m (30 ft) Cable; touch control" The remote display and operating module DKX001 can also be ordered separately and subsequently as an accessory without a measuring device . Further information on display and operating module DKX001→ 169. For details, see Special Documentation SD01763D
WLAN antenna Wide range	External WLAN antenna for a range of up to 50 m (165 ft). Further information on the WLAN interface → 64.
Protective cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. For details, see Installation Instructions EA01160

15.1.2 For the sensor

Accessories	Description
Adapter set	Adapter connections for installing Promag H instead of a Promag 30/33 A or Promag 30/33 H (DN 25) device. Consists of: ▪ 2 process connections ▪ Screws ▪ Seals
Seal set	For the regular replacement of seals for the sensor.
Spacer	If replacing a DN 80/100 sensor in an existing installation, a spacer is needed if the new sensor is shorter.
Welding jig	Welding nipple as process connection: welding jig for installation in pipe.
Grounding rings	Are used to ground the fluid in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

Mounting kit	Consists of: ▪ 2 process connections ▪ Screws ▪ Seals
Wall mounting kit	Wall mounting kit for measuring device (only DN 2 to 25 (1/12 to 1"))

15.2 Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. For details, see "Technical Information" TI00404F
HART Loop Converter HMX50	Is used to evaluate and convert dynamic HART process variables to analog current signals or limit values. For details, see "Technical Information" TI00429F and Operating Instructions BA00371F
Fieldgate FXA320	Gateway for the remote monitoring of connected 4 to 20 mA measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. For details, see "Technical Information" TI00025S and Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area**. For details, see Operating Instructions BA01202S
Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices in the **non-Ex area** and the **Ex area**. For details, see Operating Instructions BA01202S

15.3 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://wapps.endress.com/applicator ▪ As a downloadable DVD for local PC installation.

W@M	W@M Life Cycle Management 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. 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. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement
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. For details, see Operating Instructions BA00027S and BA00059S
DeviceCare	Tool for connecting and configuring Endress+Hauser field devices. For details, see Innovation brochure IN01047S

15.4 System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all 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. For details, see "Technical Information" TI00133R and Operating Instructions BA00247R

16 Technical data

16.1 Application

Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are sufficiently resistant.

16.2 Function and system design

Measuring principle

Electromagnetic flow measurement on the basis of *Faraday's law of magnetic induction*.

Measuring system

The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

For information on the structure of the device → 14

16.3 Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Temperature (DN 15 to 150 (½ to 6"))
- Electrical conductivity

Calculated measured variables

- Mass flow
- Corrected volume flow
- Corrected electrical conductivity

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Flow characteristic values in SI units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
2	1/12	0.06 to 1.8	0.5	0.005	0.01
4	1/8	0.25 to 7	2	0.025	0.05
8	3/8	1 to 30	8	0.1	0.1
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
40	1 ½	25 to 700	200	1.5	3

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1200	10	20
125	5	220 to 7 500	1850	15	30
150	6	20 to 600 m³/h	150 m³/h	0.03 m³	2.5 m³/h

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
1/12	2	0.015 to 0.5	0.1	0.001	0.002
1/8	4	0.07 to 2	0.5	0.005	0.008
3/8	8	0.25 to 8	2	0.02	0.025
½	15	1 to 27	6	0.05	0.1
1	25	2.5 to 80	18	0.2	0.25
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
5	125	60 to 1 950	450	5	7
6	150	90 to 2 650	600	5	12

Recommended measuring range

"Flow limit" section → 164

Operable flow range

Over 1000 : 1

Input signal

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device:

- Fluid temperature to increase the accuracy of the electrical conductivity (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress+Hauser: see "Accessories" section → 151

It is recommended to read in external measured values to calculate the following measured variables:
Corrected volume flow

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 → 154.

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 µA
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	▪ Pressure ▪ Temperature ▪ Density

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Adjustable: 5 to 200 ms
Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ Off ▪ Reset the individual totalizers separately ▪ Reset all totalizers ▪ Flow override

16.4 Output

Output signal

HART current output

Current output	4 to 20 mA HART
Current span	Can be set to: 4 to 20 mA (active/passive)
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Current output 0/4 to 20 mA

Current output	0/4 to 20 mA
Maximum output values	22.5 mA
Current span	Can be set to: ▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
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	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: ▪ 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	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume 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	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature
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	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ 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
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)
Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow cut off

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:

Current output 0/4 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 ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value (f_{max} 2 to 12 500 Hz)
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: ▪ 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
- Via service interface

Plain text display	With information on cause and remedial measures

Web server

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 Diagnostic information via light emitting diodes

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).

Protocol-specific data

Manufacturer ID	0x11
Device type ID	0x3C
HART protocol revision	7
Device description files (DTM, DD)	Information and files under: 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 ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature **Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)** ▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Corrected conductivity ▪ Temperature ▪ Electronic 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 = corrected volume flow ▪ 3 = flow velocity ▪ 4 = conductivity ▪ 5 = corrected conductivity ▪ 6 = temperature ▪ 7 = electronic temperature ▪ 8 = totalizer 1 ▪ 9 = totalizer 2 ▪ 10 = totalizer 3

16.5 Power supply

Terminal assignment

→ 33

Supply voltage

Order code for "Power supply"	terminal voltage		Frequency range
Option **D**	DC 24 V	±20%	–
Option **E**	AC100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz
Option **I**	DC 24 V	±20%	–
	AC100 to 240 V	−15…+10%	50/60 Hz, ±4 Hz

Power consumption

Transmitter

Max. 10 W (active power)

Current consumption

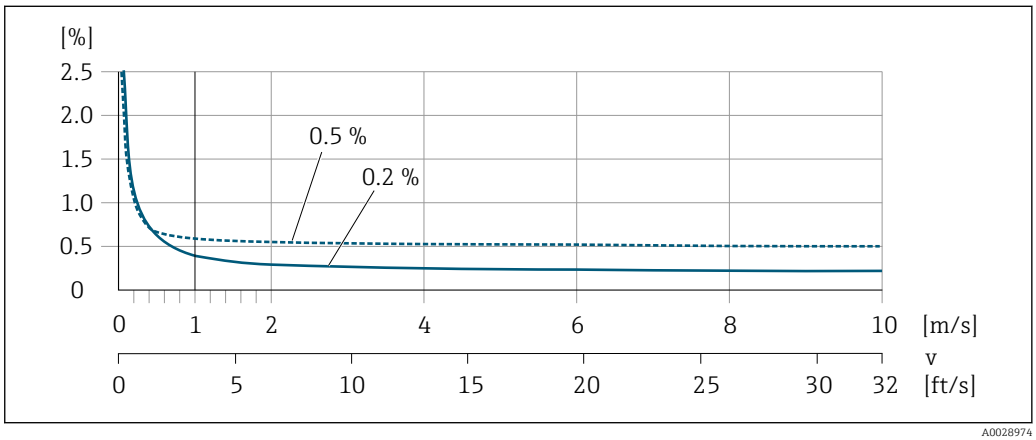
Transmitter

- 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. ▪ Configuration is retained in the plug-in memory (HistoROM DAT). ▪ Error messages (incl. total operated hours) are stored.
Electrical connection	→ 33
Potential equalization	→ 36
Terminals	**Transmitter** Spring terminals for conductor cross-section 0.2 to 2.5 mm² (24 to 12 AWG)
Cable entries	▪ Cable gland: M20 × 1.5 with cable Ø 6 to 12 mm (0.24 to 0.47 in) ▪ Thread for cable entry: – NPT ½" – G ½" – M20
Cable specification	→ 31

16.6 Performance characteristics

Reference operating conditions	▪ Error limits following DIN EN 29104, in future ISO 20456 ▪ Water, typically +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi) ▪ Data as indicated in the calibration protocol ▪ Accuracy based on accredited calibration rigs according to ISO 17025
Maximum measured error	**Error limits under reference operating conditions** o.r. = of reading **Volume flow** ▪ ±0.5 % o.r. ± 1 mm/s (0.04 in/s) ▪ Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s) Fluctuations in the supply voltage do not have any effect within the specified range.



33 *Maximum measured error in % o.r.*

Temperature
±3 °C (±5.4 °F)

Electrical conductivity
Max. measured error not specified.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±5 µA

Pulse/frequency output

o.r. = of reading

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

Repeatability

o.r. = of reading

Volume flow
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Temperature
±0.5 °C (±0.9 °F)

Electrical conductivity
- Max. ±5 % o.r.
- Max. ±1 % o.r. for DN 15 to 150 in conjunction with stainless steel process connections, 1.4404 (F316L)

Temperature measurement response time

T_{90} < 15 s

Influence of ambient temperature

Current output

o.r. = of reading

Temperature coefficient	Max. 1 µA/°C

Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

16.7 Installation

"Mounting requirements" → 22

16.8 Environment

Ambient temperature range

→ 24

Temperature tables

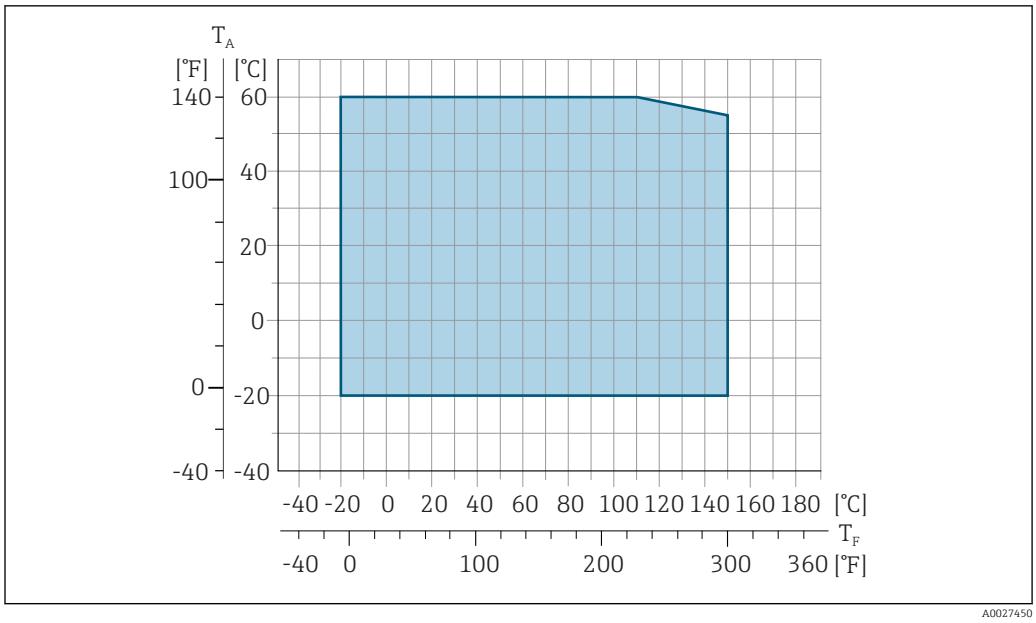
Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

Storage temperature	−50 to +80 °C (−58 to +176 °F) ▪ Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures. ▪ Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner. ▪ If protection caps or protective covers are mounted these should never be removed before installing the measuring device.
Degree of protection	**Transmitter and sensor** ▪ As standard: IP66/67, type 4X enclosure ▪ With the order code for "Sensor options", option **CM**: IP69K can also be ordered ▪ When housing is open: IP20, type 1 enclosure ▪ Display module: IP20, type 1 enclosure **External WLAN antenna** IP67
Vibration resistance	▪ Vibration, sinusoidal according to IEC 60068-2-6 – 2 to 8.4 Hz, 3.5 mm peak – 8.4 to 2 000 Hz, 1 g peak ▪ Vibration broad-band random, according to IEC 60068-2-64 – 10 to 200 Hz, 0.003 g^2/Hz – 200 to 2 000 Hz, 0.001 g^2/Hz – Total: 1.54 g rms
Shock resistance	Shock, half-sine according to IEC 60068-2-27 6 ms 30 g
Impact resistance	Rough handling shocks according to IEC 60068-2-31
Mechanical load	▪ Protect the transmitter housing against mechanical effects, such as shock or impact. ▪ Never use the transmitter housing as a ladder or climbing aid.
Interior cleaning	▪ Cleaning in place (CIP) ▪ Sterilization in place (SIP)
Electromagnetic compatibility (EMC)	As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21) For details, refer to the Declaration of Conformity.

16.9 Process

Medium temperature range	−20 to +150 °C (−4 to +302 °F)



T_A *Ambient temperature range*
T_F *Fluid temperature*

Conductivity

≥ 5 µS/cm for liquids in general. Stronger filter damping is required for very low conductivity values.

Pressure-temperature ratings

An overview of the pressure-temperature ratings for the process connections is provided in the "Technical Information" document

Pressure tightness

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for fluid temperatures:				
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)	+150 °C (+302 °F)
2 to 150	1/12 to 6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:
- v < 2 m/s (6.56 ft/s): for low conductivity values
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. milk with a high fat content)

A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

For an overview of the full scale values for the measuring range, see the "Measuring range" section → 152

Pressure loss

- No pressure loss occurs as of nominal diameter DN 8 (3/8") if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 25

System pressure

→ 24

Vibrations → 24

16.10 Mechanical construction

Design, dimensions

For the dimensions and installation lengths of the device, see the "Technical Information" document, "Mechanical construction" section

Weight

- Including the transmitter
- Weight specifications apply to standard pressure ratings and without packaging material.

Transmitter version for the hazardous area: +2 kg (+4.4 lbs)

Nominal diameter		Weight	
[mm]	[in]	[kg]	[lbs]
2	1/12	4.7	10.4
4	1/8	4.7	10.4
8	3/8	4.7	10.4
15	½	4.6	10.1
25	1	5.5	12.1
40	1 ½	6.8	15.0
50	2	7.3	16.1
65	–	8.1	17.9
80	3	8.7	19.2
100	4	10.0	22.1
125	5	15.4	34.0
150	6	17.8	39.3

Measuring tube specification

Nominal diameter		Pressure rating [1]	Process connection internal diameter	
		EN (DIN)	PFA	
[mm]	[in]	[bar]	[mm]	[in]
2	1/12	PN 16/40	2.25	0.09
4	1/8	PN 16/40	4.5	0.18
8	3/8	PN 16/40	9.0	0.35
15	½	PN 16/40	16.0	0.63
–	1	PN 16/40	22.6	0.89
25	–	PN 16/40	26.0	1.02

1) Depending on process connection and seals used

Materials

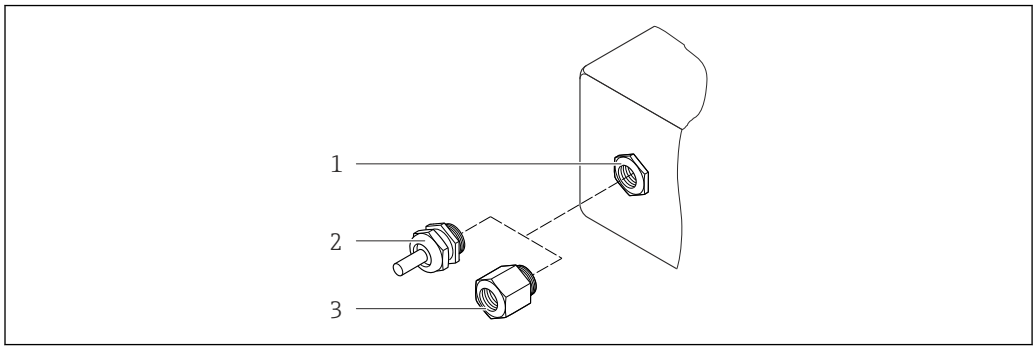
Transmitter housing

Order code for "Housing":
Option **A** "Aluminum, coated": aluminum, AlSi10Mg, coated

Window material

Order code for "Housing":
Option **A** "Aluminum, coated": glass

Cable entries/cable glands



34 *Possible cable entries/cable glands*

1 *Cable entry with M20 × 1.5 internal thread*
2 *Cable gland M20 × 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*

Order code for "Housing", option A "Aluminum, coated"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Plastic/nickel-plated brass
Adapter for cable entry with internal thread G ½"	Nickel-plated brass
Adapter for cable entry with internal thread NPT ½"	
Device plug coupling	Plug M12 × 1 ▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Sensor housing

Stainless steel 1.4301 (304)

Measuring tubes

Stainless steel 1.4301 (304)

Liner

PFA (USP Class VI, FDA 21 CFR 177.1550, 3A)

Process connections

- Stainless steel, 1.4404 (F316L)
- PVDF
- PVC adhesive sleeve

Electrodes

Standard: 1.4435 (316L)

Seals

- O-ring seal, DN 2 to 25 (1/12 to 1"): EPDM, FKM, Kalrez
- Aseptic molded seal, DN 2 to 150 (1/12 to 6"): EPDM [3], FKM, silicone [3]

3) USP Class VI, FDA 21 CFR 177.2600, 3A

Accessories

Protective cover

Stainless steel, 1.4404 (316L)

External WLAN antenna

- WLAN antenna:
  ASA plastic (acrylic ester-styrene-acrylonitrile) and nickel-plated brass
- Adapter:
  Stainless steel and copper

Grounding rings

- Standard: 1.4435 (316L)
- Optional: Alloy C22, tantalum

Wall mounting kit

Stainless steel 1.4301 (304)

Spacer

1.4435 (F316L)

Fitted electrodes

- 2 measuring electrodes for signal detection
- 1 empty pipe detection electrode for empty pipe detection/temperature measurement (only DN 15 to 150 (½ to 6"))

Process connections

With O-ring seal
- Welding nipple (DIN EN ISO 1127, ODT/SMS, ISO 2037)
- Flange (EN (DIN), ASME, JIS)
- Flange from PVDF (EN (DIN), ASME, JIS)
- External thread
- Internal thread
- Hose connection
- PVC adhesive sleeve

With aseptic molded seal:
- Coupling (DIN 11851, DIN 11864-1, ISO 2853, SMS 1145)
- Flange DIN 11864-2

For information on the different materials used in the process connections → 166

Surface roughness

Stainless steel electrodes, 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum:
≤ 0.3 to 0.5 µm (11.8 to 19.7 µin)
(All data relate to parts in contact with fluid)

Liner with PFA:
≤ 0.4 µm (15.7 µin)
(All data relate to parts in contact with fluid)

Stainless steel process connections:
- With O-ring seal: ≤ 1.6 µm (63 µin)
- With aseptic seal: ≤ 0.8 µm (31.5 µin)
  Optional: ≤ 0.38 µm (15 µin)
  (All data relate to parts in contact with fluid)

16.11 Operability

Languages

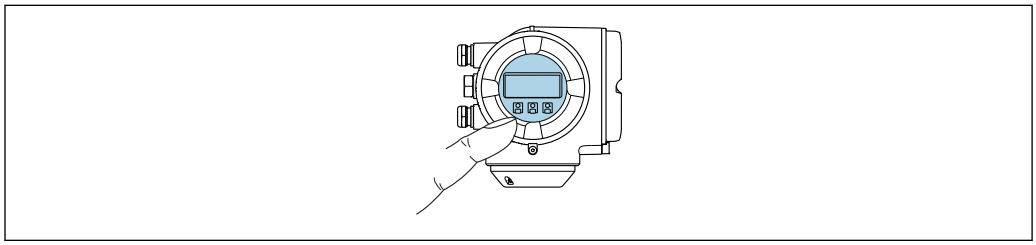
Can be operated in the following languages:
- Via local operation
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via Web browser
  English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Korean, Arabic, Bahasa (Indonesian), Thai, Vietnamese, Czech, Swedish
- Via "FieldCare", "DeviceCare" operating tool: English, German, French, Spanish, Italian, Chinese, Japanese

Local operation

Via display module

Two display modules are available:
- Order code for "Display; operation", option **F** "4-line, backlit, graphic display; touch control"
- Order code for "Display; operation", option **G** "4-line, backlit, graphic display; touch control + WLAN"

Information about WLAN interface → 64



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35 *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
- 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.

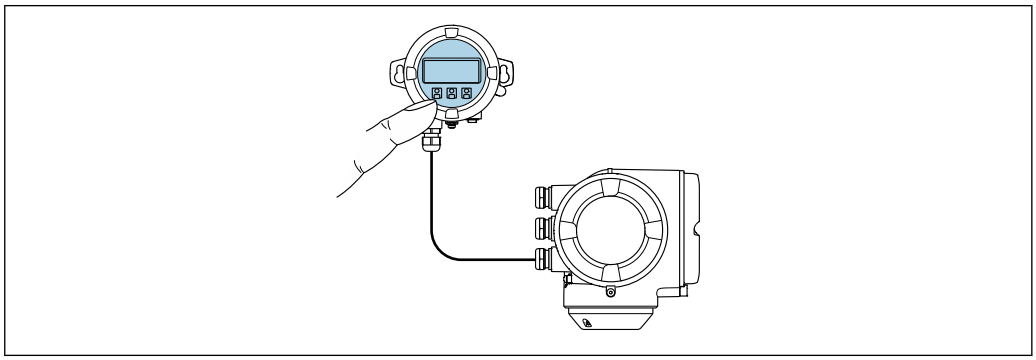
Operating elements

- External operation via touch control (3 optical keys) without opening the housing: ⊞, ⊟, Ⓔ
- Operating elements also accessible in various hazardous areas

Via remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra:
Order code for "Display; operation", option **O** "Separate backlit, 4-line display; 10 m (30 ft) Cable; touch control"

Another device version, e.g. other housing material, other cable length etc., can be ordered via the separate product structure DKX001. The measuring device is ordered with:
Order code for "Display; operation", option **M** "None, prepared for remote display"



36 *Operation via remote display and operating module DKX001*

Display and operating elements

The display and operating elements correspond to those of the display module → 168.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is used. Display or operation at the transmitter is not possible in this case.
- The remote display and operating module DKX001 can also be ordered separately and subsequently as an accessory without a measuring device → 149.
- If ordered subsequently: The remote display and operating module DKX001 cannot be connected at the same time as the existing display or operation unit. Only one display or operation unit may be connected to the transmitter at any one time.

Material

The housing material of the display and operating module DKX001 corresponds to the selected material of the transmitter housing.

Transmitter housing		Remote display and operating module
Order code for "Housing"	Material	Material
Option **A** "Aluminum, coated"	AlSi10Mg, coated	AlSi10Mg, coated

Cable entry

Corresponds to the choice of transmitter housing, order code for "Electrical connection".

Connecting cable

→ 32

Dimensions

For the dimensions, see the "Technical Information" document, "Mechanical construction" section.

Service interface → 64

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 the device → 176
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 150
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 150
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus 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:

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

The associated device description files are available at: 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 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 measuring device data can be managed and the network parameters can be configured. The WLAN connection requires a device that acts as an access point to enable communication via a computer or mobile handheld terminal.

Supported functions
Data exchange between the operating unit (such as a notebook for example) and the measuring device:
– Uploading 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, create documentation of 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

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:

	Device memory	T-DAT	S-DAT
Available data	▪ Event history, such as diagnostic events ▪ Parameter data record backup ▪ Device firmware package ▪ Driver for system integration e.g.: DD for HART	▪ Measured value memory ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Maximum indicators (min/max values) ▪ Totalizer values	▪ Sensor data: diameter etc. ▪ Serial number ▪ User-specific access code (to use the "Maintenance" user role) ▪ Calibration data ▪ 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	Can be plugged into 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

Manual

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

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

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 1000 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
- Use the recorded measured value data in the integrated device simulation function in the **Diagnostics** submenu (→ 🖹 139).

Service logbook

Manual
- Create up to 20 user-specific events with a date and customized text in a separate logbook for documentation of the measuring point
- Use for calibration or service operations, for example, or for maintenance or revision work that has been performed

16.12 Certificates and approvals

CE mark	The measuring system is in conformity with the statutory 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.
C-Tick symbol	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 "Safety Instructions" (XA) document. Reference is made to this document on the nameplate.
Sanitary compatibility	▪ 3A approval and EHEDG-certified ▪ Seals → FDA-compliant (apart from Kalrez seals)
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 (multichannel architecture with homogeneous redundancy) and is independently evaluated and certified by the TÜV 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 → 175

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

Europe:
RED 2014/53/EU

United States of America:
CFR Title 47, FCC Part 15.247

Canada:
RSS-247 Issue 1

Japan:
Article 2 clause 1 item 19

Additional country-specific approvals on request.

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
- ETSI EN 300 328
  Guidelines for 2.4 GHz radio components.
- EN 301489
  Electromagnetic compatibility and radio spectrum matters (ERM).

16.13 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.

Diagnostics functions

Package	Description
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.

Heartbeat Technology

Package	Description
Heartbeat Verification +Monitoring	**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 process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets. **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.

Cleaning

Package	Description
Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to AVOID build up of highly conductive matter and thin layers (typical of magnetite).

16.14 Accessories

Overview of accessories available for order → 149

16.15 Supplementary documentation

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

Standard documentation

Brief Operating Instructions

Part 1 of 2: Sensor

Measuring device	Documentation code
Proline Promag	KA01216D

Part 2 of 2: Transmitter

Measuring device	Documentation code
Proline 300	KA01226D

Technical Information

Measuring device	Documentation code
Promag H 300	TI01223D

Description of device parameters

Measuring device	Documentation code
Promag 300	GP01051D

Supplementary device-dependent documentation

Safety Instructions

Contents	Documentation code
ATEX/IECEx Ex d/Ex de	XA01414D
ATEX/IECEx Ex ec	XA01514D
cCSAus XP	XA01515D
cCSAus Ex d/ Ex de	XA01516D
cCSAus Ex nA	XA01517D
INMETRO Ex d/Ex de	XA01518D
INMETRO Ex ec	XA01519D
NEPSI Ex d/Ex de	XA01520D
NEPSI Ex nA	XA01521D

Remote display and operating module DKX001

Contents	Documentation code
ATEX/IECEx Ex i	XA01494D
ATEX/IECEx Ex ec	XA01498D

Contents	Documentation code
cCSAus IS	XA01499D
cCSAus Ex nA	XA01513D
INMETRO Ex i	XA01500D
INMETRO Ex ec	XA01501D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Functional Safety Manual	SD01740D
Remote display and operating module DKX001	SD01763D
Heartbeat Technology	SD01640D
Web server	SD01654D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Overview of accessories available for order → 149

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www.addresses.endress.com

Technical Information
Proline Promag P 300

Electromagnetic flowmeter

The flowmeter for highest medium temperatures with a compact, easily accessible transmitter

Application

- The bidirectional measuring principle is virtually independent of pressure, density, temperature and viscosity
- Dedicated to chemical and process applications with corrosive liquids and high medium temperatures

Device properties

- Nominal diameter: max. DN 600 (24")
- All common Ex approvals
- Liner made of PTFE or PFA
- Compact dual-compartment housing with up to 3 I/Os
- Backlit display with touch control and WLAN access
- Remote display available

Your benefits

- Versatile applications – wide variety of wetted materials
- Energy-saving flow measurement – no pressure loss due to cross-section constriction
- Maintenance-free – no moving parts
- Full access to process and diagnostic information – numerous, freely combinable I/Os and fieldbuses
- Reduced complexity and variety – freely configurable I/O functionality
- Integrated verification – Heartbeat Technology

Endress+Hauser
People for Process Automation

Table of contents

About this document

Symbols used

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: ▪ Inner ground terminal: Connects the protectiv 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.

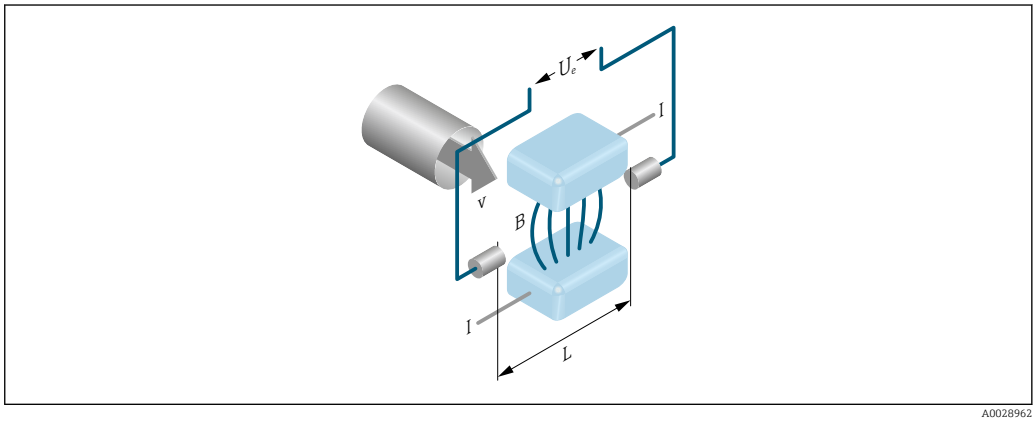
Symbols in graphics

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

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.



A0028962

Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
I *Current*
v *Flow velocity*

In the electromagnetic measuring principle, the flowing medium is the moving conductor. The voltage induced (U_e) is proportional to the flow velocity (v) and is supplied to the amplifier by means of two measuring electrodes. The flow volume (Q) is calculated via the pipe cross-section (A). The DC magnetic field is created through a switched direct current of alternating polarity.

Formulae for calculation

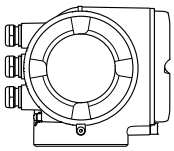
- Induced voltage $U_e = B \cdot L \cdot v$
- Volume flow $Q = A \cdot v$

Measuring system

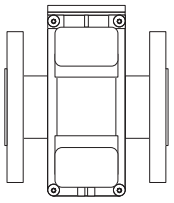
The device consists of a transmitter and a sensor.

The device is available as a compact version:
The transmitter and sensor form a mechanical unit.

Transmitter

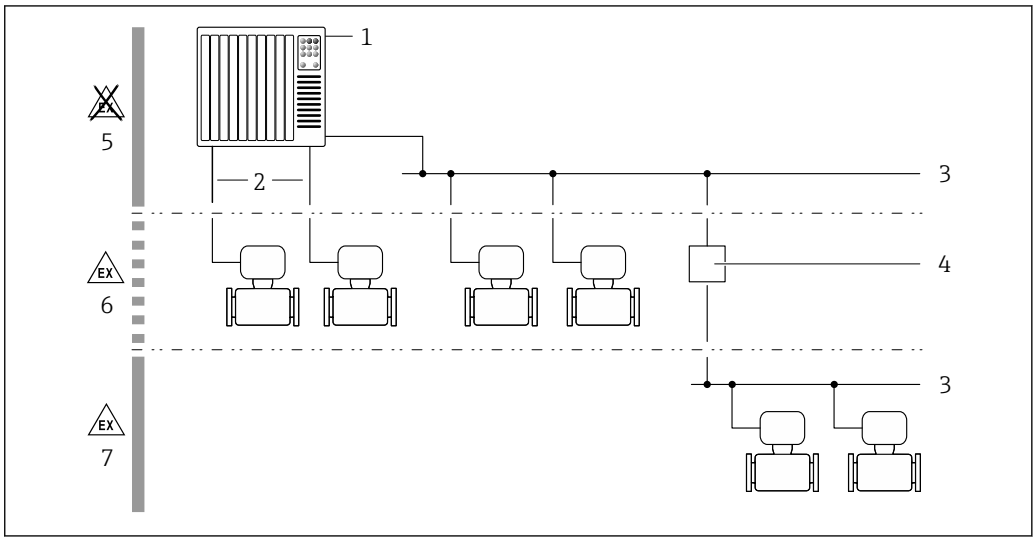
Promag 300  A0026708	Device versions and materials: ▪ Transmitter housing Aluminum, coated: aluminum, AlSi10Mg, coated ▪ Material of window in transmitter housing: Aluminum, coated: glass Configuration: ▪ External operation via 4-line, backlit, graphic local display with touch control and guided menus ("Make-it-run" wizards) for application-specific commissioning. ▪ Via service interface or WLAN interface: – Operating tools (e.g. FieldCare, DeviceCare, SmartBlue app) – Web server (access via Web browser, e.g. Microsoft Internet Explorer, Microsoft Edge)

Sensor

Promag P  A0017703	Nominal diameter range: DN 15 to 600 (½ to 24") Materials: ▪ Sensor housing: – Aluminum, AlSi10Mg, coated – DN 15 to 300 (½ to 12"): aluminum, AlSi10Mg, coated – DN 350 to 600 (14 to 24"): carbon steel with protective varnish ▪ Measuring tubes [1]: stainless steel, 1.4301/1.4306 ▪ Liner: PFA, PTFE ▪ Electrodes: stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium ▪ Process connections: stainless steel, 1.4404 [2]/1.4571/F316L [2]; carbon steel, A105/FE410WB [2]/HII/S235JRG2/S275JR ▪ Seals: as per DIN EN 1514-1 ▪ Ground disks: stainless steel, 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022); tantalum; titanium

1) For flanges made of carbon steel with Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))
2) With Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))

Equipment architecture



1 *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 *Segment 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 → 🖹 8	Not enabled.	On an individual basis following risk assessment.
Access code (also applies for Web server login or FieldCare connection) → 🖹 8	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) → 🖹 8	Serial number	Assign a customized access code during commissioning.
WLAN mode	Access Point	On an individual basis following risk assessment.
Web server→ 🖹 8	Enabled.	On an individual basis following risk assessment.
CDI-RJ45 service interface → 🖹 9	–	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. For device versions with the EtherNet/IP and PROFINET communication protocols, the connection can also be established via the terminal connection for signal transmission with EtherNet/IP or PROFINET (RJ45 connector).

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 → 92

Access via OPC-UA

The "OPC UA Server" application package is available in the device version with the HART communication protocol → 89.

The device can communicate with OPC UA clients using the "OPC UA Server" application package.

The OPC UA server integrated in the device can be accessed via the WLAN access point using the WLAN interface - which can be ordered as an optional extra - or the service interface (CDI- RJ45) via Ethernet network. Access rights and authorization as per separate configuration.

The following Security Modes are supported as per the OPC UA Specification (IEC 62541):
- None
- Basic128Rsa15 – signed
- Basic128Rsa15 – signed and encrypted

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.

The device can be integrated in a ring topology. The device is integrated via the terminal connection for signal transmission (output 1) and the connection to the service interface (CDI-RJ45) → 78.

Input

Measured variable

Direct measured variables

- Volume flow (proportional to induced voltage)
- Electrical conductivity

Calculated measured variables

- Mass flow
- Corrected volume flow

Measuring range

Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Flow characteristic values in SI units: DN 15 to 125 (½ to 4")

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[dm³/min]	[dm³/min]	[dm³]	[dm³/min]
15	½	4 to 100	25	0.2	0.5
25	1	9 to 300	75	0.5	1
32	–	15 to 500	125	1	2
40	1 ½	25 to 700	200	1.5	3
50	2	35 to 1 100	300	2.5	5
65	–	60 to 2 000	500	5	8
80	3	90 to 3 000	750	5	12
100	4	145 to 4 700	1200	10	20
125	–	220 to 7 500	1850	15	30

Flow characteristic values in SI units: DN 150 to 600 (6 to 24")

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[mm]	[in]	[m³/h]	[m³/h]	[m³]	[m³/h]
150	6	20 to 600	150	0.03	2.5
200	8	35 to 1 100	300	0.05	5
250	10	55 to 1 700	500	0.05	7.5
300	12	80 to 2 400	750	0.1	10
350	14	110 to 3 300	1 000	0.1	15
400	16	140 to 4 200	1 200	0.15	20
450	18	180 to 5 400	1 500	0.25	25
500	20	220 to 6 600	2 000	0.25	30
600	24	310 to 9 600	2 500	0.3	40

Flow characteristic values in US units

Nominal diameter		Recommended flow	Factory settings		
		min./max. full scale value (v ~ 0.3/10 m/s)	Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
[in]	[mm]	[gal/min]	[gal/min]	[gal]	[gal/min]
½	15	1.0 to 27	6	0.1	0.15
1	25	2.5 to 80	18	0.2	0.25
1 ½	40	7 to 190	50	0.5	0.75
2	50	10 to 300	75	0.5	1.25
3	80	24 to 800	200	2	2.5
4	100	40 to 1 250	300	2	4
6	150	90 to 2 650	600	5	12
8	200	155 to 4 850	1200	10	15
10	250	250 to 7 500	1500	15	30
12	300	350 to 10 600	2400	25	45
14	350	500 to 15 000	3600	30	60
16	400	600 to 19 000	4800	50	60
18	450	800 to 24 000	6000	50	90
20	500	1 000 to 30 000	7500	75	120
24	600	1 400 to 44 000	10500	100	180

To calculate the measuring range, use the *Applicator* sizing tool → 91

Recommended measuring range

"Flow limit" section → 53

Operable flow range

Over 1000 : 1

Input signal

Input and output versions

→ 12

External measured values

To increase the accuracy of certain measured variables or to calculate the corrected volume flow, the automation system can continuously write different measured values to the measuring device:
- Medium temperature to increase the accuracy of the electrical conductivity (e.g. iTEMP)
- Reference density for calculating the corrected volume flow

Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section → 91

It is recommended to read in external measured values to calculate the corrected volume flow.

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 → 11.

Digital communication

The measured values can be written from the automation system to the measuring via:
- FOUNDATION Fieldbus
- PROFIBUS DP
- PROFIBUS PA
- Modbus RS485
- EtherNet/IP
- PROFINET

Current input 0/4 to 20 mA

Current input	0/4 to 20 mA (active/passive)
Current span	▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive)
Resolution	1 µA
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	▪ Pressure ▪ Temperature ▪ Density

Status input

Maximum input values	▪ DC −3 to 30 V ▪ If status input is active (ON): R_i >3 kΩ
Response time	Adjustable: 5 to 200 ms
Input signal level	▪ Low signal: DC −3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	▪ 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 table 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.

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	↓	**CA**								
FOUNDATION Fieldbus		↓	**SA**							
FOUNDATION Fieldbus Ex i			↓	**TA**						
PROFIBUS DP				↓	**LA**					
PROFIBUS PA					↓	**GA**				
PROFIBUS PA Ex i						↓	**HA**			
Modbus RS485							↓	**MA**		
EtherNet/IP 2-port switch integrated								↓	**NA**	
PROFINET 2-port switch integrated									↓	**RA**
Order code for "Output; input 2" (021) →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not assigned	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Current output 0/4 to 20 mA	**B**		**B**		**B**	**B**		**B**	**B**	**B**
Current output 0/4 to 20 mA (Ex i)		**C**		**C**			**C**			
User configurable input/output [1]	**D**		**D**		**D**	**D**		**D**	**D**	**D**
Pulse/frequency/switch output	**E**		**E**		**E**	**E**		**E**	**E**	**E**
Double pulse output [2]	**F**							**F**		
Pulse/frequency/switch output (Ex i)		**G**		**G**			**G**			
Relay output	**H**		**H**		**H**	**H**		**H**	**H**	**H**
Current input 0/4 to 20 mA	**I**		**I**		**I**	**I**		**I**	**I**	**I**
Status input	**J**		**J**		**J**	**J**		**J**	**J**	**J**
Order code for "Output; input 3" (022) →	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
Not assigned	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Current output 0/4 to 20 mA	**B**				**B**			**B**	**B**	**B**
Current output 0/4 to 20 mA (Ex i)		**C**								
User configurable input/output	**D**				**D**			**D**	**D**	**D**
Pulse/frequency/switch output	**E**				**E**			**E**	**E**	**E**
Double pulse output (slave)	**F**							**F**		
Pulse/frequency/switch output (Ex i)		**G**								
Relay output	**H**				**H**			**H**	**H**	**H**
Current input 0/4 to 20 mA	**I**				**I**			**I**	**I**	**I**
Status input	**J**				**J**			**J**	**J**	**J**

1) A specific input or output can be assigned to a user configurable input/output → 16.
2) If double pulse output (F) is selected for output/input 2 (021), only the double pulse output (F) option is available for selection for output/input 3 (022).

Output signal

HART current output

Current output	4 to 20 mA HART
Current span	Can be set to: 4 to 20 mA (active/passive) Ex-i, passive
Open-circuit voltage	DC 28.8 V (active)
Maximum input voltage	DC 30 V (passive)
Load	250 to 700 Ω
Resolution	0.38 µA
Damping	Configurable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Electronic temperature

PROFIBUS PA

PROFIBUS PA	In accordance with EN 50170 Volume 2, IEC 61158-2 (MBP), galvanically isolated
Data transmission	31.25 kbit/s
Current consumption	10 mA 16 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

PROFIBUS DP

Signal encoding	NRZ code
Data transfer	9.6 kBaud...12 MBaud

EtherNet/IP

Standards	In accordance with IEEE 802.3

PROFINET

Standards	In accordance with IEEE 802.3

FOUNDATION Fieldbus

FOUNDATION Fieldbus	H1, IEC 61158-2, galvanically isolated
Data transfer	31.25 kbit/s
Current consumption	10 mA
Permitted supply voltage	9 to 32 V
Bus connection	With integrated reverse polarity protection

Modbus RS485

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

Current output 0/4 to 20 mA

Current output	0/4 to 20 mA
Maximum output values	22.5 mA
Current span	Can be set to: ▪ 4 to 20 mA (active) ▪ 0/4 to 20 mA (passive) Ex-i, passive
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	Adjustable: 0.07 to 999 s
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Pulse/frequency/switch output

Function	Can be set to pulse, frequency or switch output
Version	Open collector Can be set to: ▪ Active ▪ Passive Ex-i, 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	Adjustable: 0.05 to 2 000 ms
Maximum pulse rate	10 000 Impulse/s
Pulse value	Adjustable
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume 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	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature
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	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow

Double pulse output

Function	Double pulse
Version	Open collector Can be set to: ▪ 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
Output frequency	Adjustable: 0 to 1 000 Hz
Damping	Adjustable: 0 to 999 s

Pulse/pause ratio	1:1
Assignable measured variables	▪ Volume flow ▪ Mass flow ▪ Corrected volume flow ▪ Flow velocity ▪ Conductivity ▪ Corrected conductivity ▪ Temperature ▪ Electronic temperature

Relay output

Function	Switch output
Version	Relay output, galvanically isolated
Switching behavior	Can be set to: ▪ NO (normally open), factory setting ▪ NC (normally closed)
Maximum switching capacity (passive)	▪ DC 30 V, 0.1 A ▪ AC 30 V, 0.5 A
Assignable functions	▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: – Off – Volume flow – Mass flow – Corrected volume flow – Flow velocity – Conductivity – Corrected conductivity – Totalizer 1-3 – Temperature – Electronic temperature ▪ Flow direction monitoring ▪ Status – Empty pipe detection – Low flow

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

PROFIBUS PA

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
Error current FDE (Fault Disconnection Electronic)	0 mA

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02

EtherNet/IP

Device diagnostics	Device condition can be read out in Input Assembly

PROFINET

Device diagnostics	According to "Application Layer protocol for decentralized periphery", Version 2.3

FOUNDATION Fieldbus

Status and alarm messages	Diagnostics in accordance with FF-891
Error current FDE (Fault Disconnection Electronic)	0 mA

Modbus RS485

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

Current output 0/4 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 ▪ Freely definable value between: 3.59 to 22.5 mA ▪ Actual value ▪ Last valid value

0 to 20 mA

Failure mode	Choose from: ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 20.5 mA

Pulse/frequency/switch output

Pulse output	
Failure mode	Choose from: ▪ Actual value ▪ No pulses
Frequency output	
Failure mode	Choose from: ▪ Actual value ▪ 0 Hz ▪ Defined value (f_{max} 2 to 12 500 Hz)
Switch output	
Failure mode	Choose from: ▪ Current status ▪ Open ▪ Closed

Relay output

Failure mode	Choose from: ▪ 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
  - FOUNDATION Fieldbus
  - PROFIBUS PA
  - PROFIBUS DP
  - Modbus RS485
  - EtherNet/IP
  - PROFINET
- Via service interface
  - CDI-RJ45 service interface
  - WLAN interface

Plain text display	With information on cause and remedial measures

Additional information on remote operation → 75

Web server

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 ▪ EtherNet/IP network available ▪ EtherNet/IP connection established ▪ PROFINET network available ▪ PROFINET connection established ▪ PROFINET blinking feature

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 **GA**	PROFIBUS PA	U_N = 30 V_{DC} U_M = 250 V_{AC}	
Option **LA**	PROFIBUS DP	U_N = 30 V_{DC} U_M = 250 V_{AC}	
Option **MA**	Modbus RS485	U_N = 30 V_{DC} U_M = 250 V_{AC}	
Option **SA**	FOUNDATION Fieldbus	U_N = 30 V_{DC} U_M = 250 V_{AC}	
Option **NA**	EtherNet/IP	U_N = 30 V_{DC} U_M = 250 V_{AC}	
Option **RA**	PROFINET	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**	Double pulse output	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	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 C_i = 0	
Option **HA**	PROFIBUS PA Ex i	**Ex ia** [1] U_i = 30 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF	**Ex ic** [2] U_i = 32 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF
Option **TA**	FOUNDATION Fieldbus Ex i	**Ex ia** [1] U_i = 30 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF	**Ex ic** [2] U_i = 32 V I_i = 570 mA P_i = 8.5 W L_i = 10 µH C_i = 5 nF

1) Only available for the Zone 1; Class I, Division 1 version
2) Only available for the Zone 2; Class I, Division 2 version transmitter

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	U_i = 30 V I_i = 100 mA P_i = 1.25 W L_i = 0 C_i = 0			
Option **G**	Pulse/frequency/switch output Ex i	U_i = 30 V I_i = 100 mA P_i = 1.25 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).

Protocol-specific data

HART

Manufacturer ID	0x11
Device type ID	0x3C
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 → 🖹 92. ▪ Measured variables via HART protocol ▪ Burst Mode functionality

PROFIBUS PA

Manufacturer ID	0x11
Ident number	0x156C
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com ▪ www.profibus.org
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur
Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Local display ▪ Via operating tools (e.g. FieldCare)
Compatibility with earlier model	If the device is replaced, the measuring device Promag 300 supports the compatibility of the cyclic data with previous models. It is not necessary to adjust the engineering parameters of the PROFIBUS network with the Promag 300 GSD file. Earlier models: ▪ Promag 50 PROFIBUS PA – ID No.: 1525 (hex) – Extended GSD file: EH3x1525.gsd – Standard GSD file: EH3_1525.gsd ▪ Promag 53 PROFIBUS PA – ID No.: 1527 (hex) – Extended GSD file: EH3x1527.gsd – Standard GSD file: EH3_1527.gsd Description of the function scope of compatibility: Operating Instructions → 92.
System integration	Information regarding system integration: Operating Instructions → 92. ▪ Cyclic data transmission ▪ Block model ▪ Description of the modules

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1570
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com On the product page for the device: Documents/Software → Device drivers ▪ www.profibus.org
Supported functions	▪ Identification & Maintenance Simplest device identification on the part of the control system and nameplate ▪ PROFIBUS upload/download Reading and writing parameters is up to ten times faster with PROFIBUS upload/download ▪ Condensed status Simplest and self-explanatory diagnostic information by categorizing diagnostic messages that occur

Configuration of the device address	▪ DIP switches on the I/O electronics module ▪ Via operating tools (e.g. FieldCare)
System integration	Information regarding system integration: Operating Instructions → 92. ▪ Cyclic data transmission ▪ Block model ▪ Description of the modules

EtherNet/IP

Protocol	▪ The CIP Networks Library Volume 1: Common Industrial Protocol ▪ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP
Communication type	▪ 10Base-T ▪ 100Base-TX
Device profile	Generic device (product type: 0x2B)
Manufacturer ID	0x11
Device type ID	0x103C
Baud rates	Automatic $^{10}/_{100}$ Mbit with half-duplex and full-duplex detection
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs
Supported CIP connections	Max. 3 connections
Explicit connections	Max. 6 connections
I/O connections	Max. 6 connections (scanner)
Configuration options for measuring device	▪ DIP switches on the electronics module for IP addressing ▪ Manufacturer-specific software (FieldCare) ▪ Add-on Profile Level 3 for Rockwell Automation control systems ▪ Web browser ▪ Electronic Data Sheet (EDS) integrated in the measuring device
Configuration of the EtherNet interface	▪ Speed: 10 MBit, 100 MBit, auto (factory setting) ▪ Duplex: half-duplex, full-duplex, auto (factory setting)
Configuration of the device address	▪ DIP switches on the electronics module for IP addressing (last octet) ▪ DHCP ▪ Manufacturer-specific software (FieldCare) ▪ Add-on Profile Level 3 for Rockwell Automation control systems ▪ Web browser ▪ EtherNet/IP tools, e.g. RSLinx (Rockwell Automation)
Device Level Ring (DLR)	Yes
System integration	Information regarding system integration: Operating Instructions → 92. ▪ Cyclic data transmission ▪ Block model ▪ Input and output groups

PROFINET

Protocol	"Application layer protocol for decentral device periphery and distributed automation", version 2.3
Communication type	100 MBit/s
Conformity class	Conformance Class B
Netload Class	Netload Class II
Baud rates	Automatic 100 Mbit/s with full-duplex detection
Cycle times	From 8 ms
Polarity	Auto-polarity for automatic correction of crossed TxD and RxD pairs

Media Redundancy Protocol (MRP)	Yes
Device profile	Application interface identifier 0xF600 Generic device
Manufacturer ID	0x11
Device type ID	0x843C
Device description files (GSD, DTM, DD)	Information and files under: ▪ www.endress.com On the product page for the device: Documents/Software → Device drivers ▪ www.profibus.org
Supported connections	▪ 1 x AR (IO Controller AR) ▪ 1 x AR (IO-Supervisor Device AR connection allowed) ▪ 1 x Input CR (Communication Relation) ▪ 1 x Output CR (Communication Relation) ▪ 1 x Alarm CR (Communication Relation)
Configuration options for measuring device	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ Manufacturer-specific software (FieldCare, DeviceCare) ▪ Web browser ▪ Device master file (GSD), can be read out via the integrated Web server of the measuring device
Configuration of the device name	▪ DIP switches on the electronics module, for device name assignment (last part) ▪ DCP protocol ▪ Process Device Manager (PDM) ▪ Integrated Web server
Supported functions	▪ Identification & Maintenance Simple device identification via: – Control system – Nameplate ▪ Measured value status The process variables are communicated with a measured value status ▪ Blinking feature via the onsite display for simple device identification and assignment ▪ Device operation via operating tools (e.g. FieldCare, DeviceCare, SIMATIC PDM)
System integration	Information regarding system integration: Operating Instructions → 92. ▪ Cyclic data transmission ▪ Overview and description of the modules ▪ Status coding ▪ Startup configuration ▪ Factory setting:

FOUNDATION Fieldbus

Manufacturer ID	0x452B48 (hex)
Ident number	0x103C (hex)
Device revision	1
DD revision	Information and files under: ▪ www.endress.com ▪ www.fieldbus.org
CFF revision	
Interoperability Test Kit (ITK)	Version 6.2.0
ITK Test Campaign Number	Information: ▪ www.endress.com ▪ www.fieldbus.org
Link Master capability (LAS)	Yes
Choice of "Link Master" and "Basic Device"	Yes Factory setting: Basic Device

Node address	Factory setting: 247 (0xF7)
Supported functions	The following methods are supported: ▪ Restart ▪ ENP Restart ▪ Diagnostic ▪ Set to OOS ▪ Set to AUTO ▪ Read trend data ▪ Read event logbook
Virtual Communication Relationships (VCRs)	
Number of VCRs	44
Number of link objects in VFD	50
Permanent entries	1
Client VCRs	0
Server VCRs	10
Source VCRs	43
Sink VCRs	0
Subscriber VCRs	43
Publisher VCRs	43
Device Link Capabilities	
Slot time	4
Min. delay between PDU	8
Max. response delay	16
System integration	Information regarding system integration: Operating Instructions → 92. ▪ Cyclic data transmission ▪ Description of the modules ▪ Execution times ▪ Methods

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 transfer mode	▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485. For Modbus register information
Compatibility with earlier model	If the device is replaced, the measuring device Promag 300 supports the compatibility of the Modbus registers for the process variables and the diagnostic information with the previous model Promag 53. It is not necessary to change the engineering parameters in the automation system. Description of the function scope of compatibility: Operating Instructions → 92.
System integration	Information on system integration: Operating Instructions → 92. ▪ 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 (–)
		The terminal assignment depends on the specific device version ordered → 12.					

FOUNDATION Fieldbus

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (A)	27 (B)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered → 12.					

PROFIBUS PA

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (B)	27 (A)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered → 12.					

PROFIBUS DP

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (B)	27 (A)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered → 12.					

Modbus RS485

Supply voltage		Input/output 1		Input/output 2		Input/output 3	
1 (+)	2 (–)	26 (B)	27 (A)	24 (+)	25 (–)	22 (+)	23 (–)
		The terminal assignment depends on the specific device version ordered → 12.					

PROFINET

Supply voltage		Input/output 1	Input/output 2		Input/output 3	
1 (+)	2 (–)	PROFINET (RJ45 connector)	24 (+)	25 (–)	22 (+)	23 (–)
			The terminal assignment depends on the specific device version ordered → 12.			

EtherNet/IP

Supply voltage		Input/output 1	Input/output 2		Input/output 3	
1 (+)	2 (–)	EtherNet/IP (RJ45 connector)	24 (+)	25 (–)	22 (+)	23 (–)
			The terminal assignment depends on the specific device version ordered → 12.			

Terminal assignment of the remote display and operating module → 31.

Device plugs available

Device plugs may not be used in hazardous areas!

Device plugs for fieldbus systems:
Order code for "Input; output 1"
- Option **SA** "FOUNDATION Fieldbus" → 26
- Option **GA** "PROFIBUS PA" → 26
- Option **RA** "PROFINET" → 27
- Option **NA** "EtherNet/IP" → 27

Device plug for connecting to the service interface:
Order code for "Accessory mounted"
option **NB**, adapter RJ45 M12 (service interface) → 28

Order code for "Input; output 1", option SA "FOUNDATION Fieldbus"

Order code for "Electrical connection"	Cable entry/connection → 30	
	2	3
M, 3, 4, 5	7/8" connector	–

Order code for "Input; output 1", option GA "PROFIBUS PA"

Order code for "Electrical connection"	Cable entry/connection → 30	
	2	3
L, N, P, U	Connector M12 × 1	–

Order code for "Input; output 1", option RA "PROFINET"

Order code for "Electrical connection"	Cable entry/connection → 30	
	2	3
L, N, P, U	Connector M12 × 1	–
R [1) 2)], S [1) 2)], T [1) 2)], V [1) 2)]	Connector M12 × 1	Connector M12 × 1

1) Cannot be combined with an external WLAN antenna (order code for "Enclosed accessories", option P8) of an RJ45 M12 adapter for the service interface (order code for "Accessories mounted", option NB) or of the remote display and operating module DKX001.
2) Suitable for integrating the device in a ring topology.

Order code for "Input; output 1", option NA "EtherNet/IP"

Order code for "Electrical connection"	Cable entry/connection → 30	
	2	3
L, N, P, U	Connector M12 × 1	–
R [1) 2)], S [1) 2)], T [1) 2)], V [1) 2)]	Connector M12 × 1	Connector M12 × 1

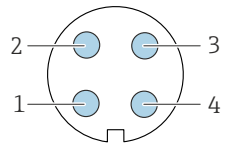
1) Cannot be combined with an external WLAN antenna (order code for "Enclosed accessories", option P8) of an RJ45 M12 adapter for the service interface (order code for "Accessories mounted", option NB) or of the remote display and operating module DKX001
2) Suitable for integrating the device in a ring topology.

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

Order code "Accessory mounted"	Cable entry/coupling → 30	
	Cable entry 2	Cable entry 3
NB	Plug M12 × 1	–

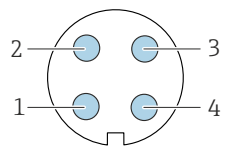
Pin assignment, device plug

FOUNDATION Fieldbus



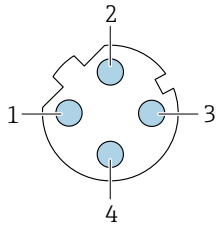
Pin	Assignment		Coding	Plug/socket
1	+	Signal +	A	Plug
2	-	Signal –		
3		Grounding		
4		Not assigned		

PROFIBUS PA



Pin	Assignment		Coding	Plug/socket
1	+	PROFIBUS PA +	A	Plug
2		Grounding		
3	-	PROFIBUS PA –		
4		Not assigned		

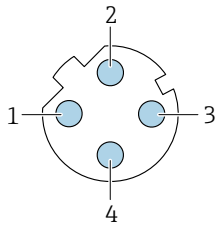
PROFINET



Pin		Assignment
1	+	TD +
2	+	RD +
3	-	TD –
4	-	RD –
Coding		**Plug/socket**
D		Socket

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q
- When using the device in a hazardous location, use a suitably certified plug.

EtherNet/IP

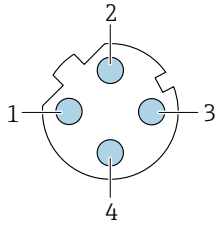


Pin		Assignment
1	+	Tx
2	+	Rx
3	-	Tx
4	-	Rx
Coding		**Plug/socket**
D		Socket

Recommended plug:
- Binder, series 763, part no. 99 3729 810 04
- Phoenix, part no. 1543223 SACC-M12MSD-4Q
- When using the device in a hazardous location, use a suitably certified plug.

Service interface

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



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
- When using the device in a hazardous location, use a suitably certified plug.

Supply voltage

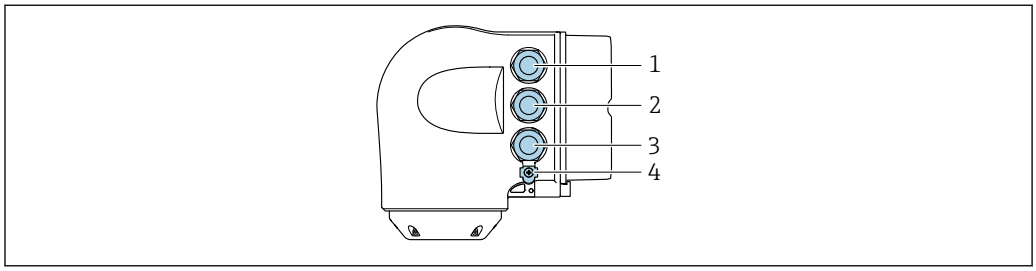
Order code for "Power supply"	terminal voltage		Frequency range
Option **D**	DC24 V	±20%	–
Option **E**	AC100 to 240 V	–15…+10%	50/60 Hz, ±4 Hz
Option **I**	DC24 V	±20%	–
	AC100 to 240 V	–15…+10%	50/60 Hz, ±4 Hz

Power consumption	**Transmitter** Max. 10 W (active power)
Current consumption	**Transmitter** ▪ Max. 400 mA (24 V) ▪ Max. 200 mA (110 V, 50/60 Hz; 230 V, 50/60 Hz)
Power supply failure	Depending on the device version, the configuration is retained in the device memoryor in the pluggable data memory (HistoROM DAT).

Electrical connection

Connecting the transmitter

- Terminal assignment→ 25
- Device plugs available→ 26



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 via service interface (CDI-RJ45); Optional: terminal connection for external WLAN antenna or connection for remote display and operating module DKX001*
4 *Protective ground (PE)*

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

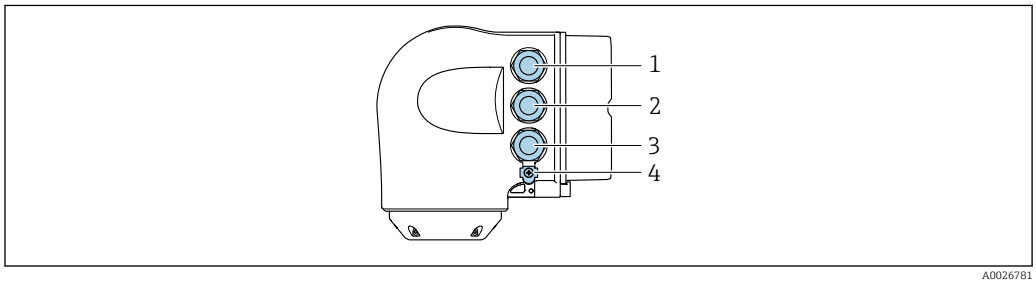
The adapter connects the service interface (CDI-RJ45) to an M12 connector mounted in the cable entry. Therefore the connection to the service interface can be established via an M12 connector without opening the device.

Network connection via service interface (CDI-RJ45) → 80

Connecting in a ring topology

Device versions with EtherNet/IP and PROFINET communication protocols can be integrated into a ring topology. The device is integrated via the terminal connection for signal transmission (output 1) and the connection to the service interface (CDI-RJ45).

Integrate the transmitter into a ring topology:
- EtherNet/IP → 78
- PROFINET → 79



A0026781

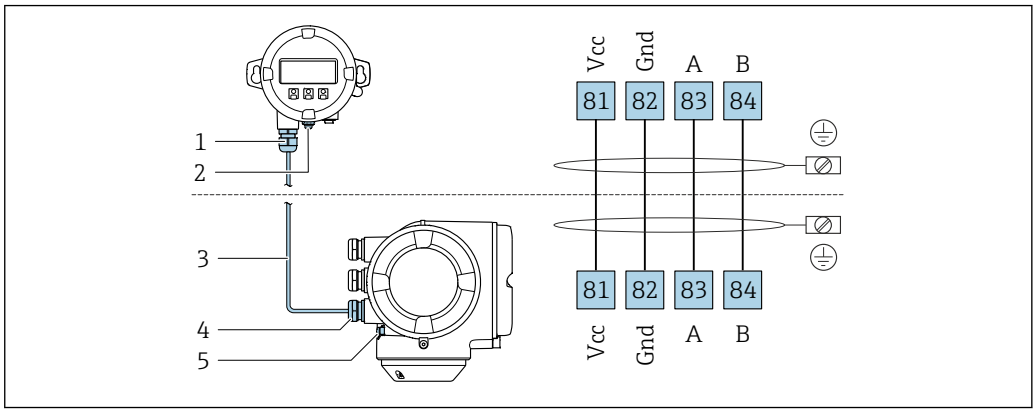
1 *Terminal connection for supply voltage*
2 *Terminal connection for signal transmission: PROFINET or EtherNet/IP (RJ45 connector)*
3 *Connection to service interface (CDI-RJ45)*
4 *Protective earth (PE)*

If the device has additional input/outputs, these are routed via the cable entry for the connection to the service interface (CDI-RJ45).

Connecting the remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra → 89.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.

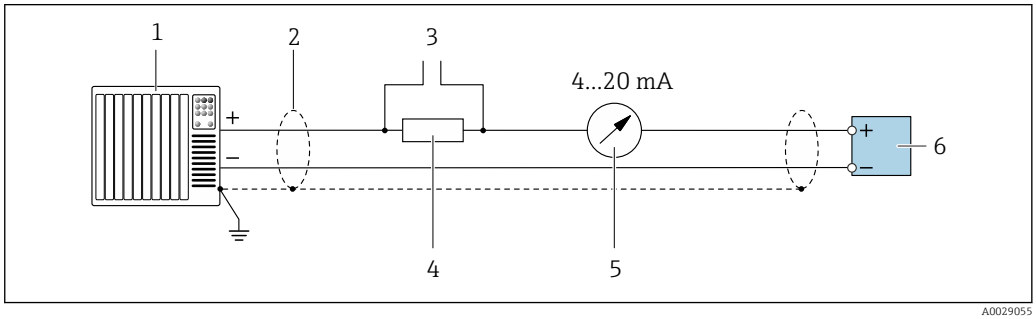


A0027518

1 *Remote display and operating module DKX001*
2 *Protective earth (PE)*
3 *Connecting cable*
4 *Measuring device*
5 *Protective earth (PE)*

Connection examples

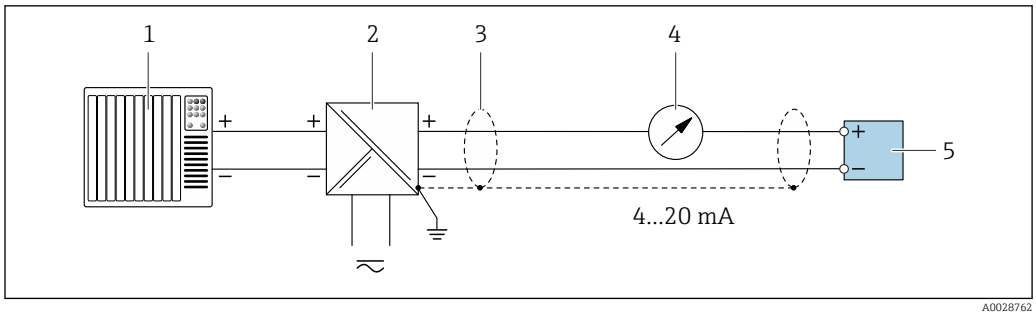
Current output 4 to 20 mA HART



A0029055

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

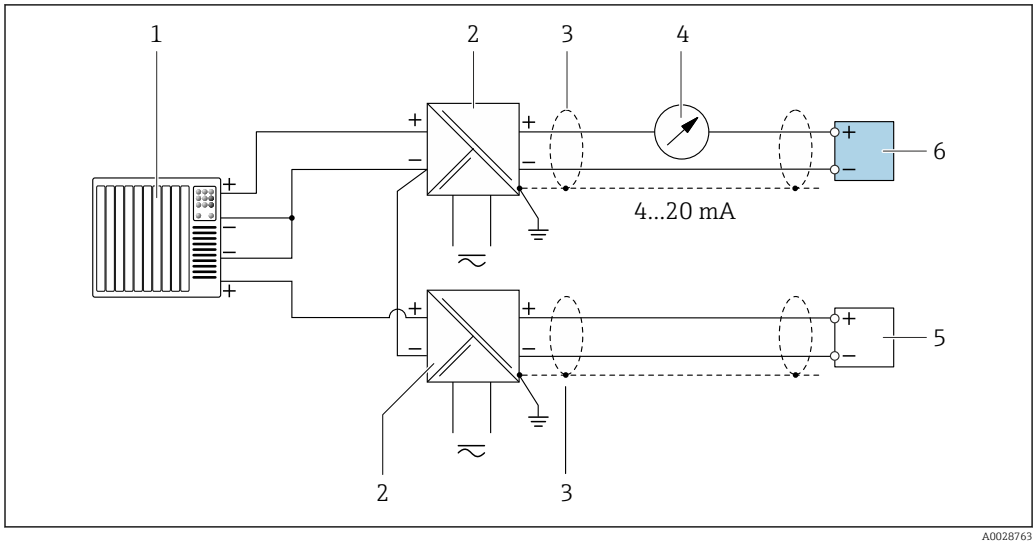
1 *Automation system with current input (e.g. PLC)*
2 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 41*
3 *Connection for HART operating devices → 75*
4 *Resistor for HART communication (≥ 250 Ω): observe maximum load → 13*
5 *Analog display unit: observe maximum load → 13*
6 *Transmitter*



3 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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications → 41*
4 *Analog display unit: observe maximum load → 13*
5 *Transmitter*

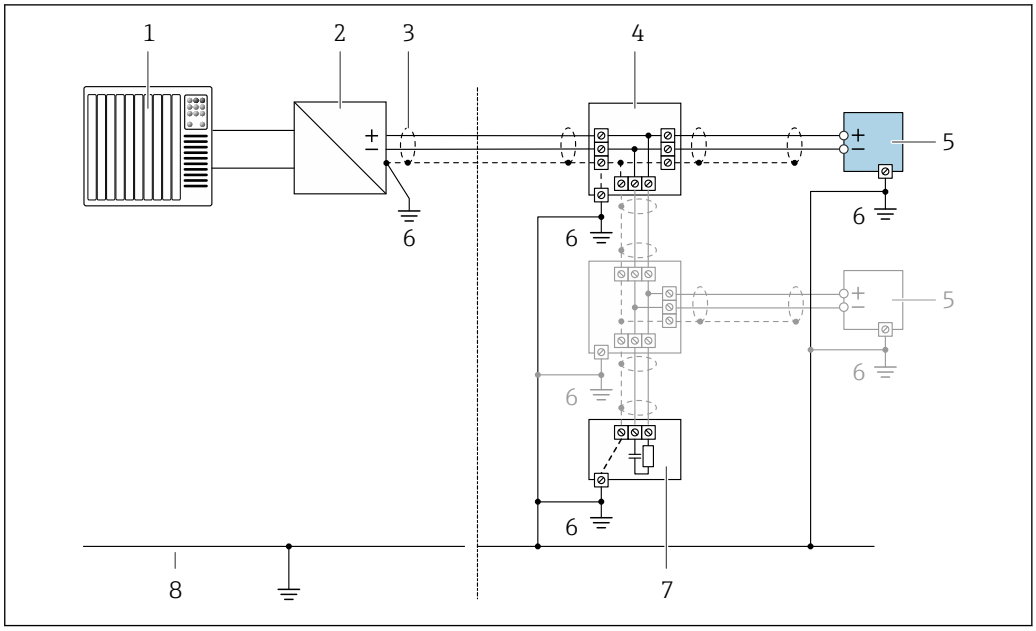
HART input



4 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: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *Analog display unit: observe maximum load*
5 *Pressure transmitter (e.g. Cerabar M, Cerabar S): see requirements*
6 *Transmitter*

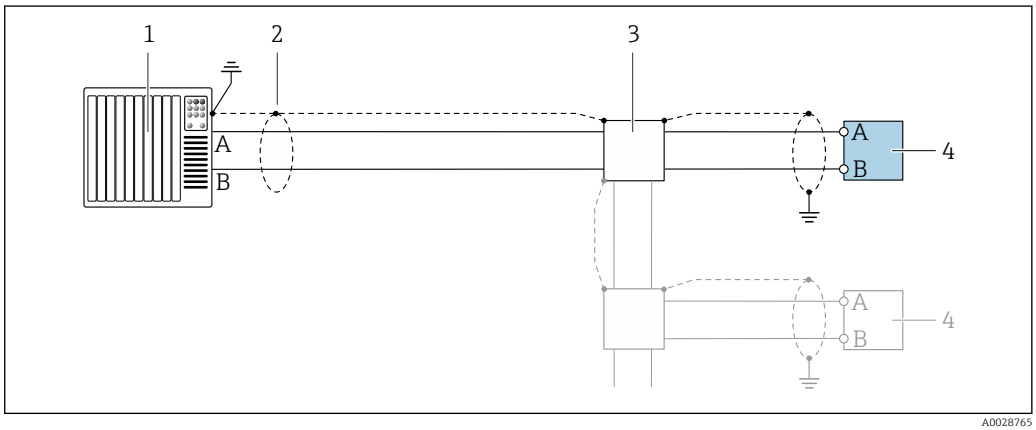
PROFIBUS PA



5 *Connection example for PROFIBUS PA*

1 *Control system (e.g. PLC)*
2 *PROFIBUS PA segment coupler*
3 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
4 *T-box*
5 *Measuring device*
6 *Local grounding*
7 *Bus terminator*
8 *Potential matching line*

PROFIBUS DP

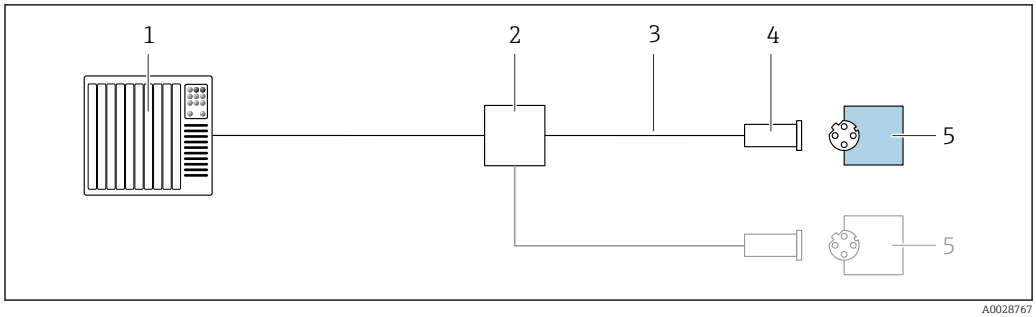


6 *Connection example for PROFIBUS DP, non-hazardous area and Zone 2/Div. 2*

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

If baud rates > 1.5 MBaud an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

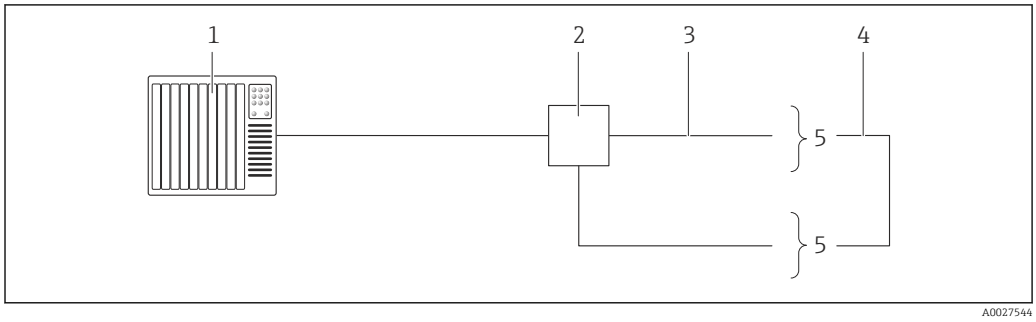
EtherNet/IP



7 Connection example for EtherNet/IP

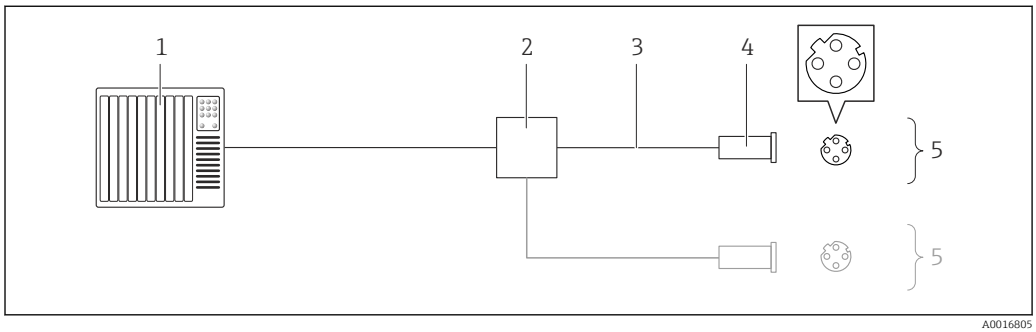
1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications*
4 *Device plug*
5 *Transmitter*

EtherNet/IP: DLR (Device Level Ring)



1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications* → *41*
4 *Connecting cable between the two transmitters*
5 *Transmitter*

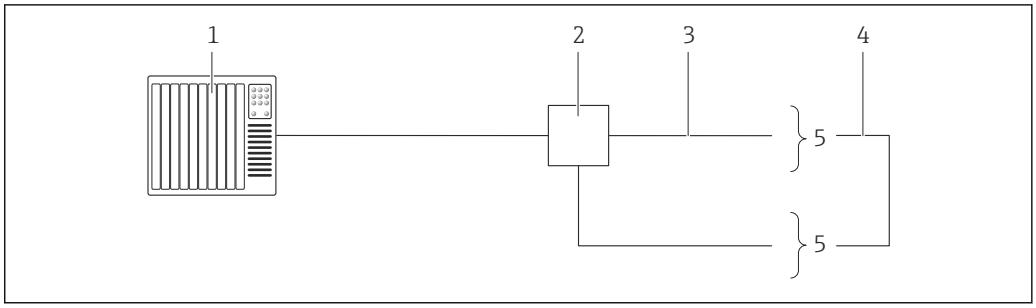
PROFINET



8 Connection example for PROFINET

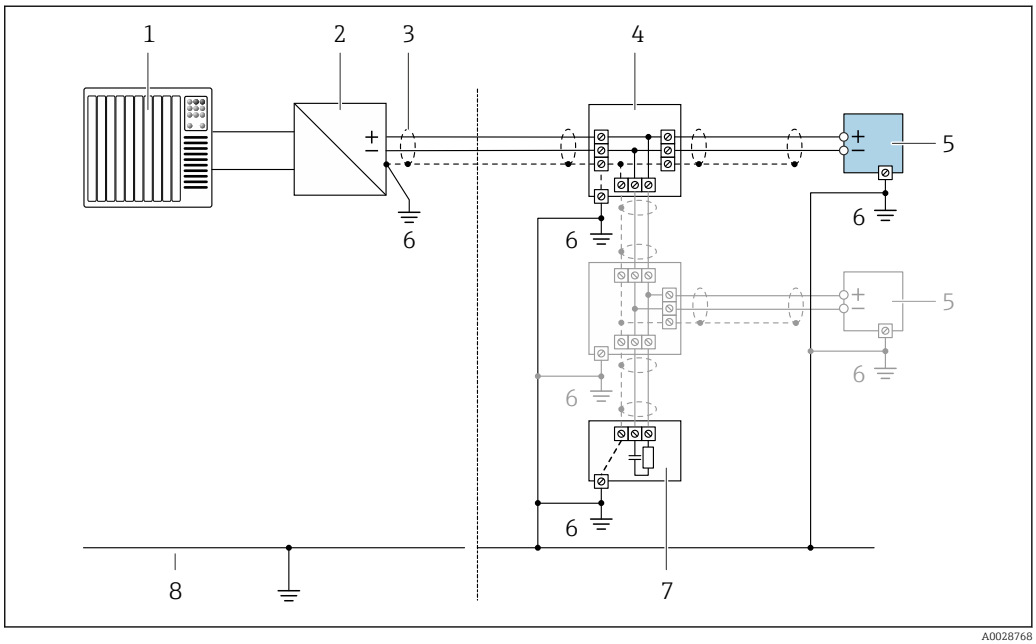
1 *Control system (e.g. PLC)*
2 *Ethernet switch*
3 *Observe cable specifications*
4 *Device plug*
5 *Transmitter*

PROFINET: MRP (Media Redundancy Protocol)



1 Control system (e.g. PLC)
2 Ethernet switch
3 Observe cable specifications → 41
4 Connecting cable between the two transmitters
5 Transmitter

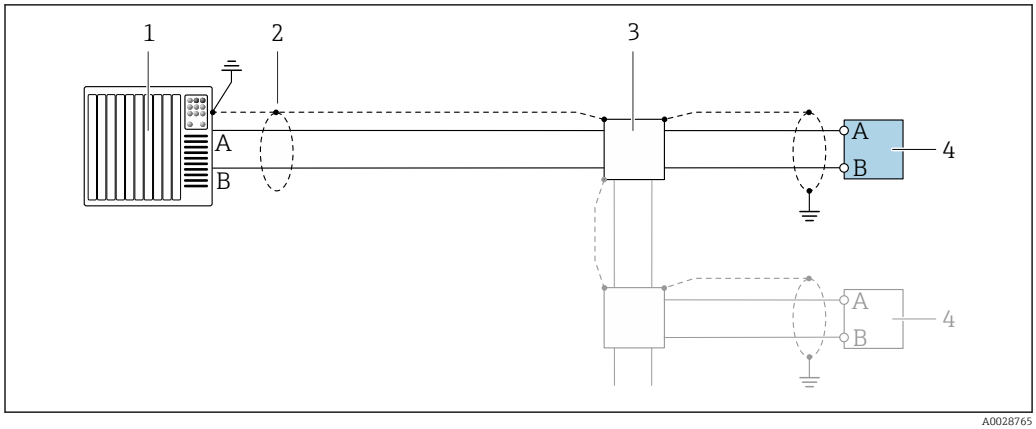
FOUNDATION Fieldbus



9 Connection example for FOUNDATION Fieldbus

1 Control system (e.g. PLC)
2 Power Conditioner (FOUNDATION Fieldbus)
3 Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications
4 T-box
5 Measuring device
6 Local grounding
7 Bus terminator
8 Potential matching line

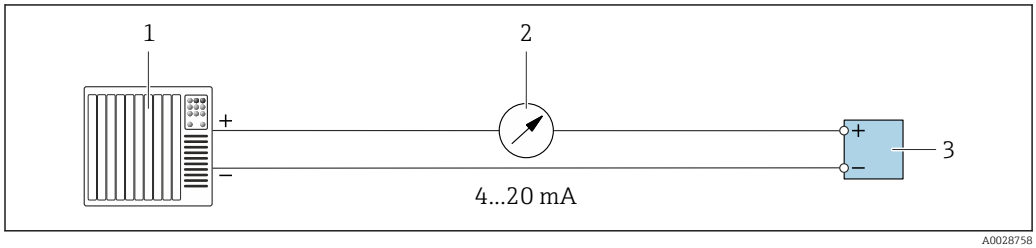
Modbus RS485



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

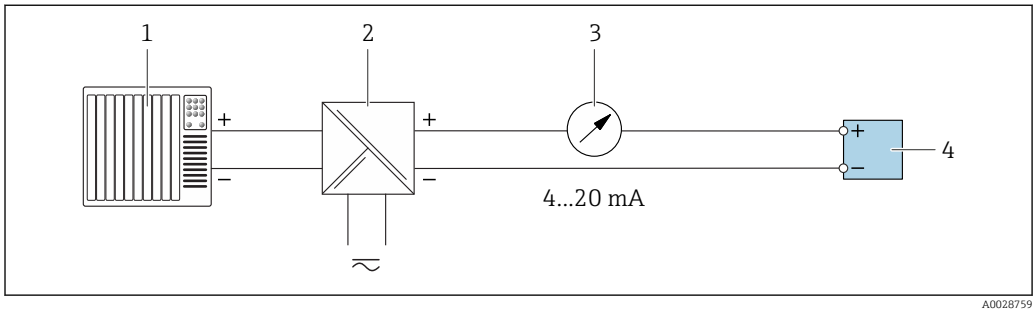
1 *Control system (e.g. PLC)*
2 *Cable shield: the cable shield must be grounded at both ends to comply with EMC requirements; observe cable specifications*
3 *Distribution box*
4 *Transmitter*

Current output 4-20 mA



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

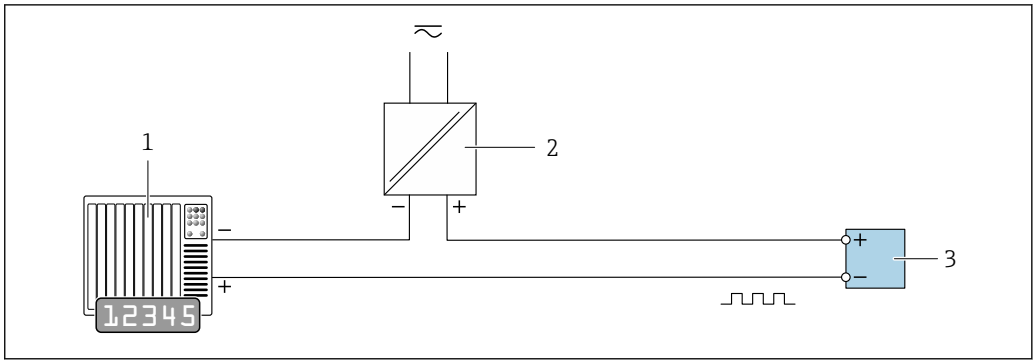
1 *Automation system with current input (e.g. PLC)*
2 *Analog display unit: observe maximum load*
3 *Transmitter*



12 *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*
4 *Transmitter*

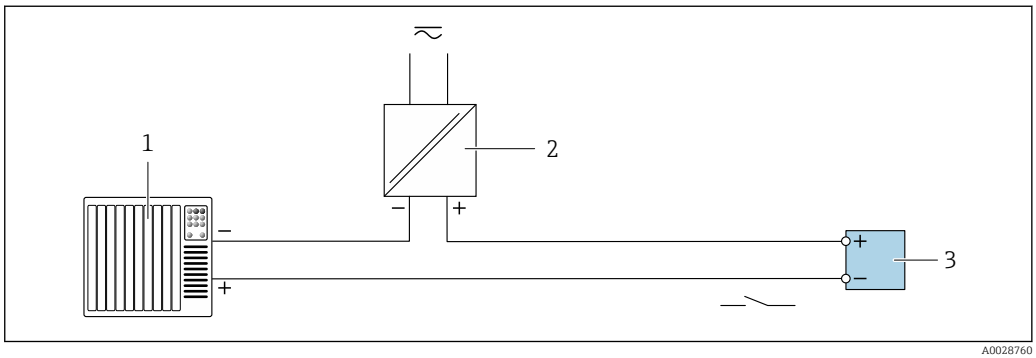
Pulse/frequency output



13 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 → 14

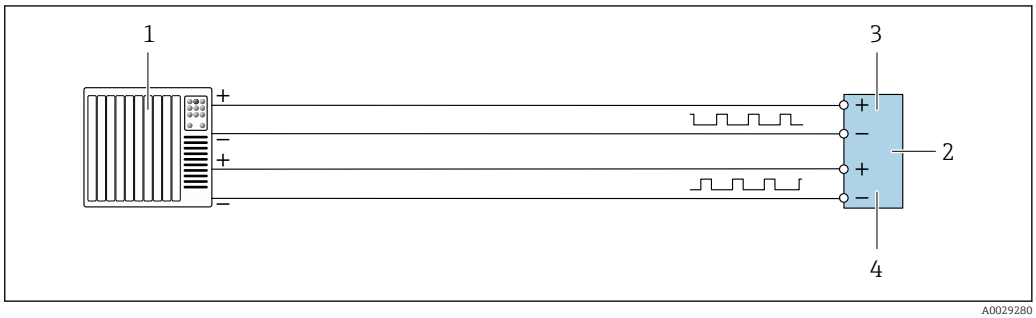
Switch output



14 Connection example for switch output (passive)

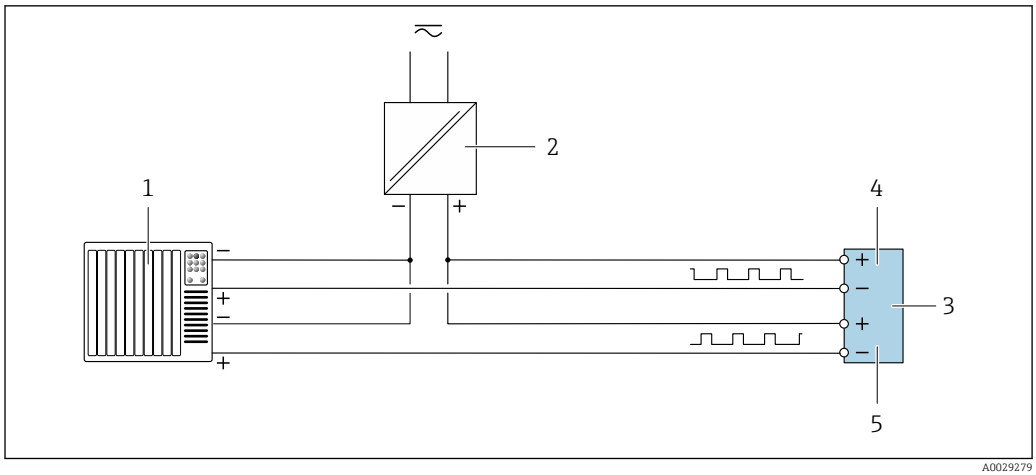
1 Automation system with switch input (e.g. PLC)
2 Power supply
3 Transmitter: Observe input values → 14

Double pulse output



15 Connection example for double pulse output (active)

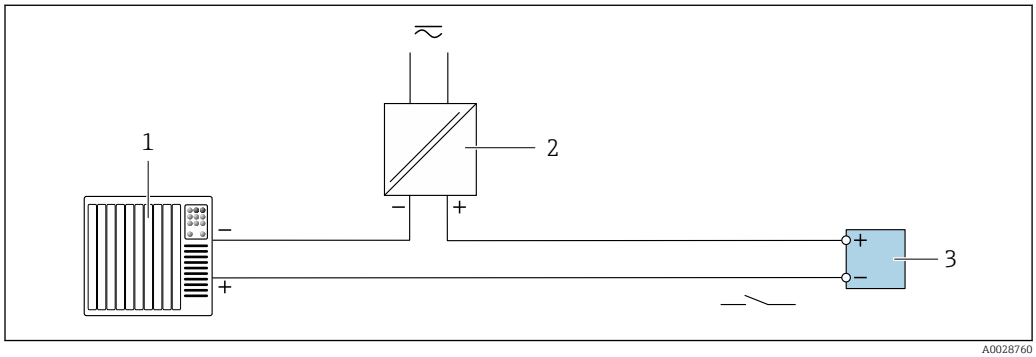
1 Automation system with double pulse input (e.g. PLC)
2 Transmitter: Observe input values → 15
3 Double pulse output
4 Double pulse output (slave), phase-shifted



16 *Connection example for double pulse output (passive)*

1 *Automation system with double pulse input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 15*
4 *Double pulse output*
5 *Double pulse output (slave), phase-shifted*

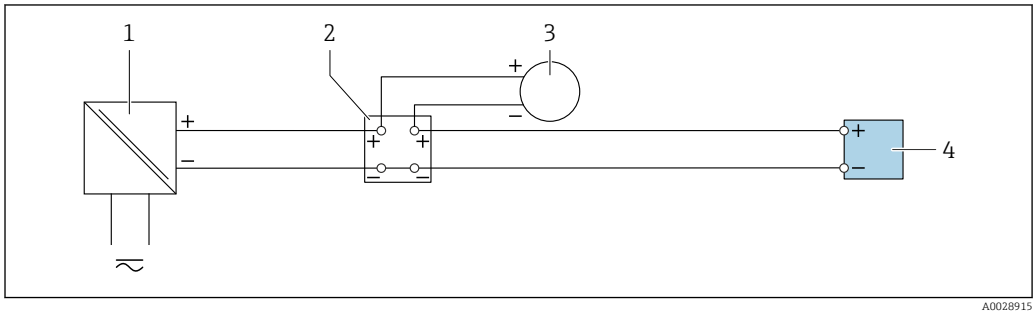
Relay output



17 *Connection example for relay output (passive)*

1 *Automation system with relay input (e.g. PLC)*
2 *Power supply*
3 *Transmitter: Observe input values → 16*

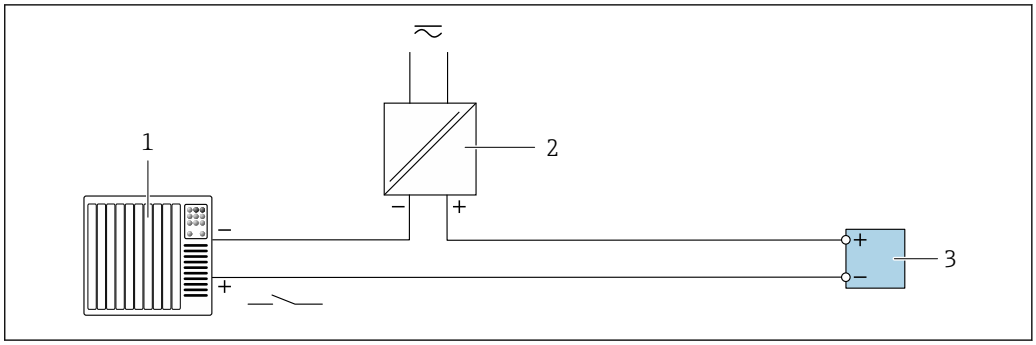
Current input



18 *Connection example for 4 to 20 mA current input*

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

Status input



19 *Connection example for status input*

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

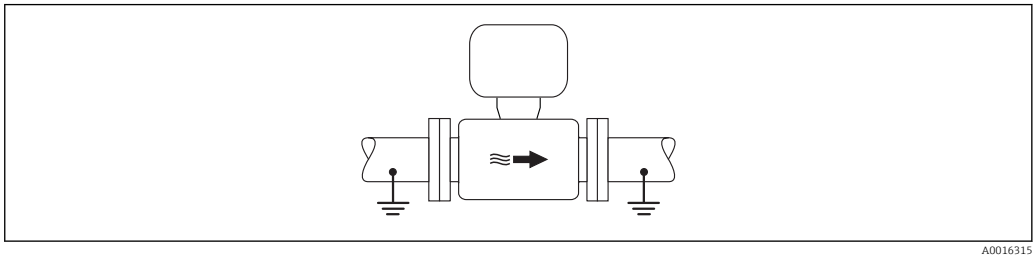
Potential equalization

Requirements

Please consider the following to ensure correct measurement:
- Same electrical potential for the fluid and sensor
- Company-internal grounding concepts
- Pipe material and grounding

Connection example, standard scenario

Metal, grounded pipe



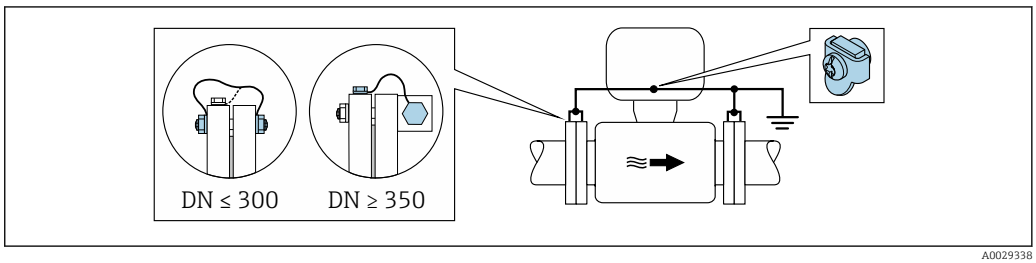
20 *Potential equalization via measuring tube*

Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm^2 (0.0093 in^2)



21 *Potential equalization via ground terminal and pipe flanges*

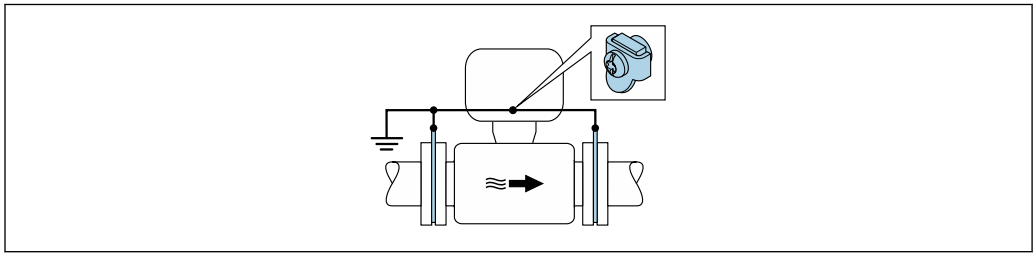
Note the following when installing:
- Connect both sensor flanges to the pipe flange via a ground cable and ground them.
- Connect the connection housing of the transmitter or sensor to ground potential by means of the ground terminal provided for the purpose. To mount the ground cable:
  - If DN ≤ 300 (12"): Mount the ground cable directly on the conductive flange coating of the sensor with the flange screws.
  - If DN ≥ 350 (14"): Mount the ground cable directly on the metal transport bracket.

You can order the necessary ground cable from Endress+Hauser: → 89.

Plastic pipe or pipe with insulating liner

This connection method also applies in situations where:
- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



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22 *Potential equalization via ground terminal and ground disks*

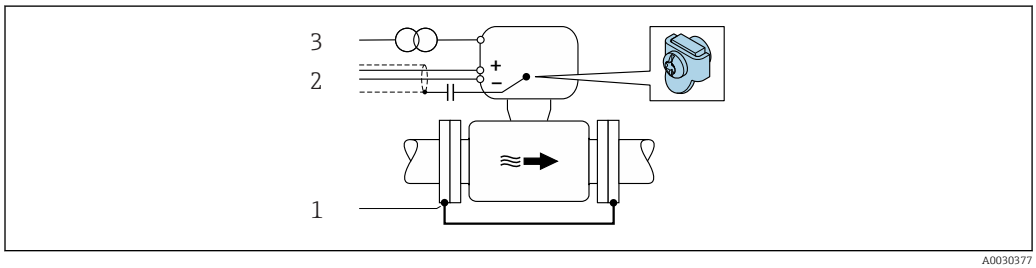
Note the following when installing:
The ground disks must be connected to the ground terminal via the ground cable and be connected to ground potential.

The ground cable and ground disks can be ordered from Endress+Hauser .

Pipe with a cathodic protection unit

This connection method is only used if the following two conditions are met:
- Metal pipe without liner or pipe with electrically conductive liner
- Cathodic protection is integrated in the personal protection equipment

Ground cable	Copper wire, at least 6 mm² (0.0093 in²)



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1 *Connection of the two flanges of the pipe via a ground cable*
2 *Signal line shielding via a capacitor*
3 *Measuring device connected to power supply such that it is floating in relation to the protective ground (isolation transformer)*

Note the following when installing:
The sensor is installed in the pipe in a way that provides electrical insulation.

You can order the necessary ground cable from Endress+Hauser: → 89.

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 Ø 6 to 12 mm (0.24 to 0.47 in) ▪ Thread for cable entry: – NPT ½" – G ½" – 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** Standard installation cable is sufficient. **Signal cable** *Current output 4 to 20 mA HART* A shielded cable is recommended. Observe grounding concept of the plant. *PROFIBUS PA* Twisted, shielded two-wire cable. Cable type A is recommended . For further information on planning and installing PROFIBUS networks see: ▪ Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S) ▪ PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline" ▪ IEC 61158-2 (MBP) *PROFIBUS DP* The IEC 61158 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.

For further information on planning and installing PROFIBUS networks see:
▪ Operating Instructions "PROFIBUS DP/PA: Guidelines for planning and commissioning" (BA00034S)
▪ PNO Directive 2.092 "PROFIBUS PA User and Installation Guideline"
▪ IEC 61158-2 (MBP)

EtherNet/IP

The standard ANSI/TIA/EIA-568-B.2 Annex specifies CAT 5 as the minimum category for a cable used for EtherNet/IP. CAT 5e and CAT 6 are recommended.

For more information on planning and installing EtherNet/IP networks, please refer to the "Media Planning and Installation Manual. EtherNet/IP" of ODVA Organization

PROFINET

Standard IEC 61156-6 specifies CAT 5 as the minimum category for a cable used for PROFINET. CAT 5e and CAT 6 are recommended.

For more information on planning and installing PROFINET networks, see: "PROFINET Cabling and Interconnection Technology", Guideline for PROFINET

FOUNDATION Fieldbus

Twisted, shielded two-wire cable.

For further information on planning and installing FOUNDATION Fieldbus networks see:

- Operating Instructions for "FOUNDATION Fieldbus Overview" (BA00013S)
- FOUNDATION Fieldbus Guideline
- IEC 61158-2 (MBP)

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.

Double pulse output

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 for transmitter - remote display and operating module DKX001

Standard cable

A standard cable can be used as the connecting cable.

Standard cable	4 cores (2 pairs); pair-stranded with common shield
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	Maximum 1 000 nF for Zone 1; Class I, Division 1
L/R	Maximum 24 µH/Ω for Zone 1; Class I, Division 1
Cable length	Maximum 300 m (1 000 ft), see the following table

Cross-section	**Cable length for use in:** ▪ **Non-hazardous area** ▪ **Hazardous area: Zone 2; Class I, Division 2** ▪ **Hazardous area: Zone 1; Class I, Division 1**
0.34 mm² (22 AWG)	80 m (270 ft)
0.50 mm² (20 AWG)	120 m (400 ft)
0.75 mm² (18 AWG)	180 m (600 ft)
1.00 mm² (17 AWG)	240 m (800 ft)
1.50 mm² (15 AWG)	300 m (1 000 ft)

Optionally available connecting cable

Standard cable	2 × 2 × 0.34 mm² (22 AWG) PVC cable [1] with common shield (2 pairs, pair-stranded)
Flame resistance	According to DIN EN 60332-1-2
Oil-resistance	According to DIN EN 60811-2-1
Shielding	Tin-plated copper-braid, optical cover ≥ 85 %
Capacitance: core/shield	≤200 pF/m
L/R	≤24 µH/Ω
Available cable length	10 m (35 ft)
Operating temperature	When mounted in a fixed position: −50 to +105 °C (−58 to +221 °F); when cable can move freely: −25 to +105 °C (−13 to +221 °F)

1) UV radiation can impair the cable outer sheath. Protect the cable from direct sunshine where possible.

Performance characteristics

Reference operating conditions

- Error limits following DIN EN 29104, in future ISO 20456
- Water, typically: +15 to +45 °C (+59 to +113 °F); 0.5 to 7 bar (73 to 101 psi)
- Data as indicated in the calibration protocol
- Accuracy based on accredited calibration rigs according to ISO 17025

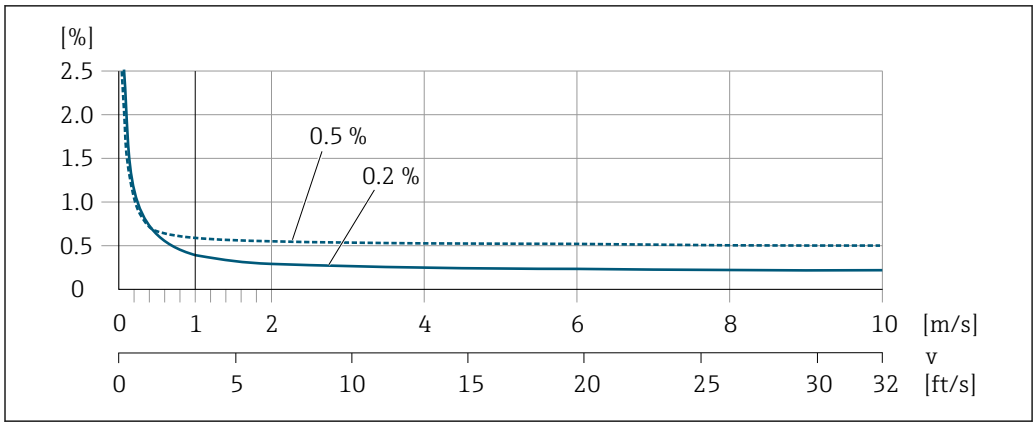
Maximum measured error

Error limits under reference operating conditions

o.r. = of reading

Volume flow
- ±0.5 % o.r. ± 1 mm/s (0.04 in/s)
- Optional: ±0.2 % o.r. ± 2 mm/s (0.08 in/s)

Fluctuations in the supply voltage do not have any effect within the specified range.



23 *Maximum measured error in % o.r.*

Electrical conductivity
Max. measured error not specified.

Accuracy of outputs

The outputs have the following base accuracy specifications.

Current output

Accuracy	±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

Volume flow
Max. ±0.1 % o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity
Max. ±5 % o.r.

Influence of ambient temperature

Current output

Temperature coefficient	Max. 1 µA/°C

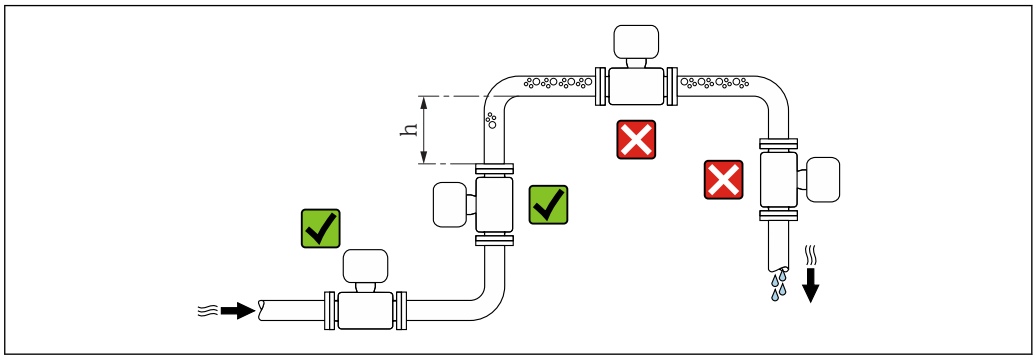
Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.

Installation

No special measures such as supports etc. are necessary. External forces are absorbed by the construction of the device.

Mounting location

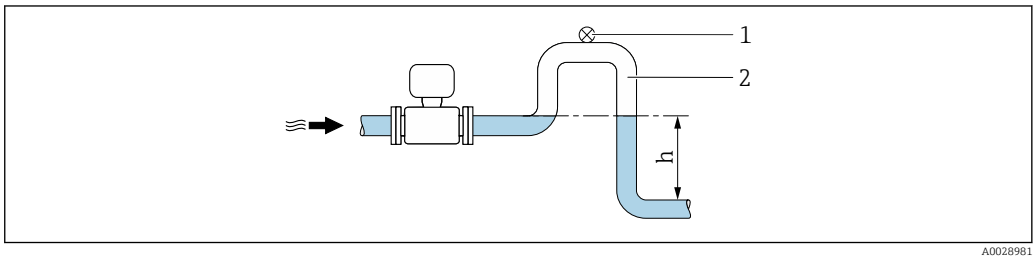


A0029343

Preferably install the sensor in an ascending pipe, and ensure a sufficient distance to the next pipe elbow: h ≥ 2 × DN

Installation in down pipes

Install a siphon with a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime.



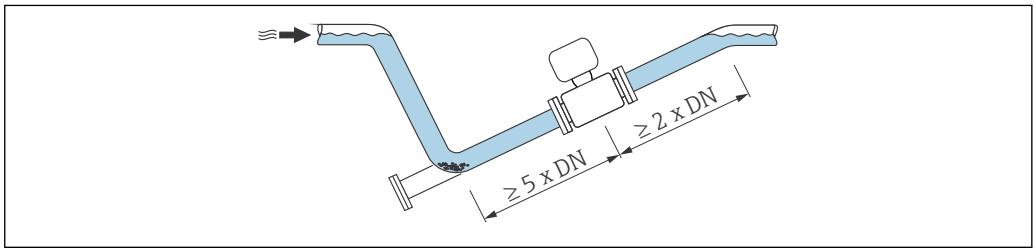
A0028981

24 *Installation in a down pipe*

1 Vent valve
2 Pipe siphon
h Length of down pipe

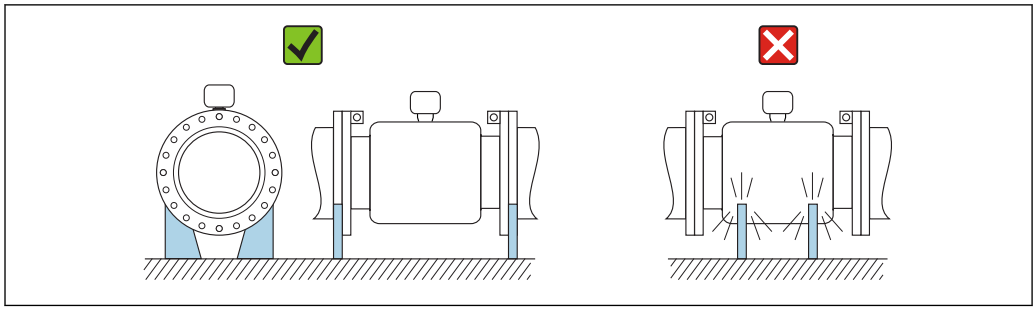
Installation in partially filled pipes

A partially filled pipe with a gradient necessitates a drain-type configuration.



A0029257

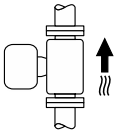
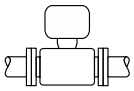
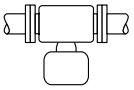
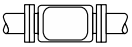
For heavy sensors DN ≥ 350 (14")



A0016276

Orientation

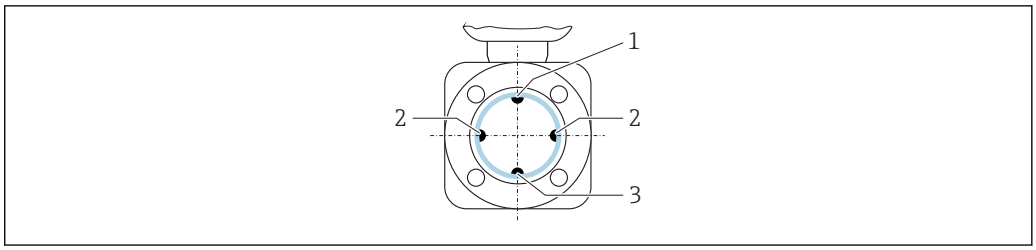
The direction of the arrow on the sensor nameplate helps you to install the sensor according to the flow direction (direction of medium flow through the piping).

Orientation			Recommendation
A	Vertical orientation	 A0015591	✓✓
B	Horizontal orientation, transmitter at top	 A0015589	✓✓ 1)
C	Horizontal orientation, transmitter at bottom	 A0015590	✓✓ 2) 3)
D	Horizontal orientation, transmitter at side	 A0015592	✗

1) Applications with low process temperatures may decrease the ambient temperature. To maintain the minimum ambient temperature for the transmitter, this orientation is recommended.
2) Applications with high process temperatures may increase the ambient temperature. To maintain the maximum ambient temperature for the transmitter, this orientation is recommended.
3) To prevent the electronics module from overheating in the case of a sharp rise in temperature (e.g. CIP or SIP processes), install the device with the transmitter component pointing downwards.

Horizontal

- Ideally, the measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
- Empty pipe detection only works if the transmitter housing is pointing upwards as otherwise there is no guarantee that the empty pipe detection function will actually respond to a partially filled or empty measuring tube.



A0029344

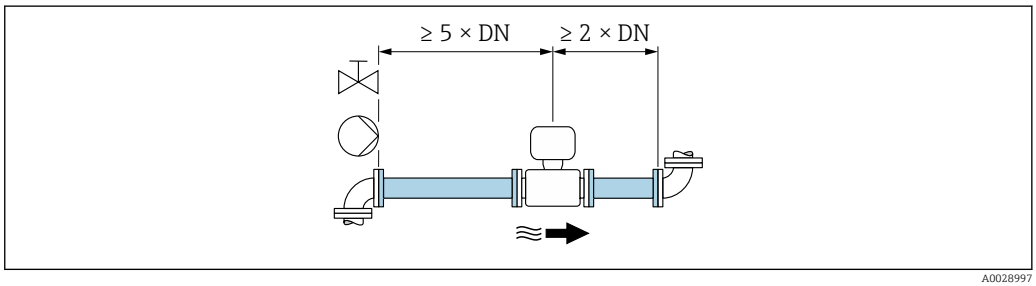
1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

Measuring devices with tantalum or platinum electrodes can be ordered without an EPD electrode. In this case, empty pipe detection is performed via the measuring electrodes.

Inlet and outlet runs

If possible, install the sensor upstream from fittings such as valves, T-pieces or elbows.

Observe the following inlet and outlet runs to comply with accuracy specifications:



A0028997

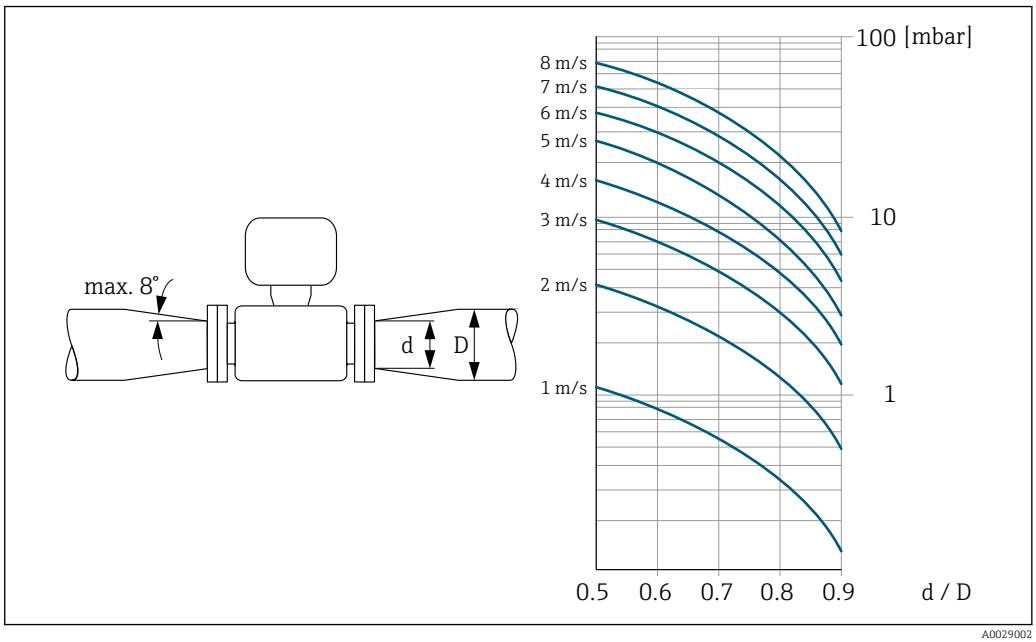
Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids.

The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders:

- Calculate the ratio of the diameters d/D.
- From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

The nomogram only applies to liquids with a viscosity similar to that of water.



A0029002

Environment

Ambient temperature range

Transmitter	Standard: −40 to +60 °C (−40 to +140 °F)
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	▪ Process connection material, carbon steel: −10 to +60 °C (+14 to +140 °F) ▪ Process connection material, stainless steel: −40 to +60 °C (−40 to +140 °F)
Liner	Do not exceed or fall below the permitted temperature range of the liner .

If operating outdoors:
- Install the measuring device in a shady location.
- Avoid direct sunlight, particularly in warm climatic regions.
- Avoid direct exposure to weather conditions.

You can order a weather protection cover from Endress+Hauser. → 89.

Storage temperature

The storage temperature corresponds to the operating temperature range of the transmitter and the sensor → 48.

- Protect the measuring device against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus or bacteria infestation can damage the liner.
- If protection caps or protective covers are mounted these should never be removed before installing the measuring device.

Degree of protection

Measuring device
- As standard: IP66/67, type 4X enclosure
- When housing is open: IP20, type 1 enclosure
- Display module: IP20, type 1 enclosure

External WLAN antenna
IP67

Vibration resistance

- Oscillation, sinusoidal, following IEC 60068-2-6
  - 2 to 8.4 Hz, 3.5 mm peak
  - 8.4 to 2 000 Hz, 1 g peak
- Oscillation, broadband noise following IEC 60068-2-64
  - 10 to 200 Hz, 0.003 g^2/Hz
  - 200 to 2 000 Hz, 0.001 g^2/Hz
  - Total: 1.54 g rms

Shock resistance

Shock, half-sine according to IEC 60068-2-27
6 ms 50 g

Shock resistance

Shock due to rough handling following IEC 60068-2-31

Mechanical load

- Protect the transmitter housing against mechanical effects, such as shock or impact.
- Never use the transmitter housing as a ladder or climbing aid.

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation 21 (NE 21)
- Device version with PROFIBUS DP: Complies with emission limits for industry as per EN 50170 Volume 2, IEC 61784

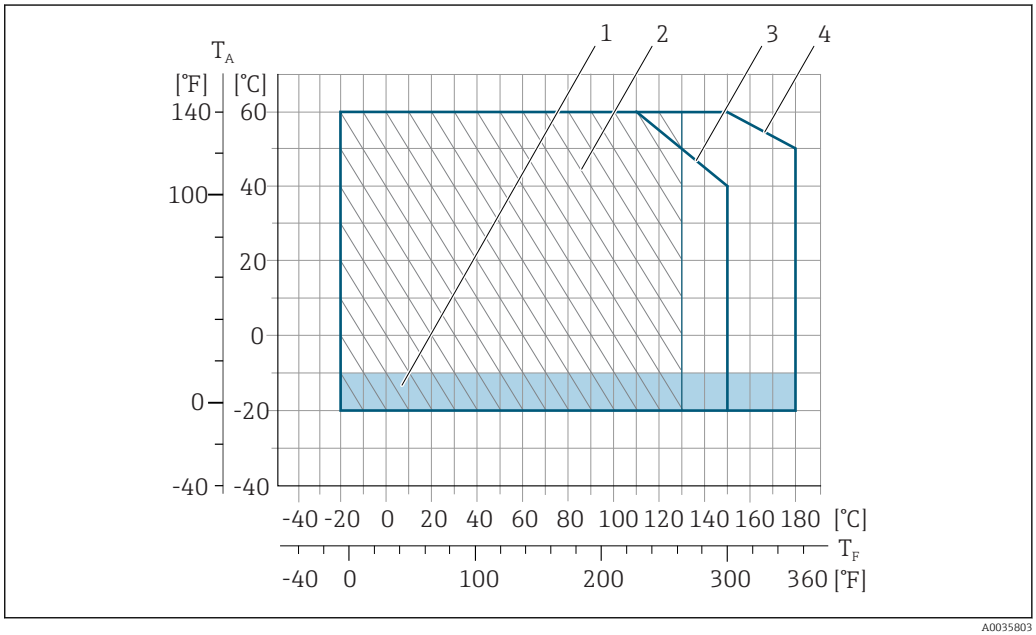
The following applies for PROFIBUS DP: If baud rates > 1.5 MBaud, an EMC cable entry must be used and the cable shield must continue as far as the terminal wherever possible.

Details are provided in the Declaration of Conformity.

Process

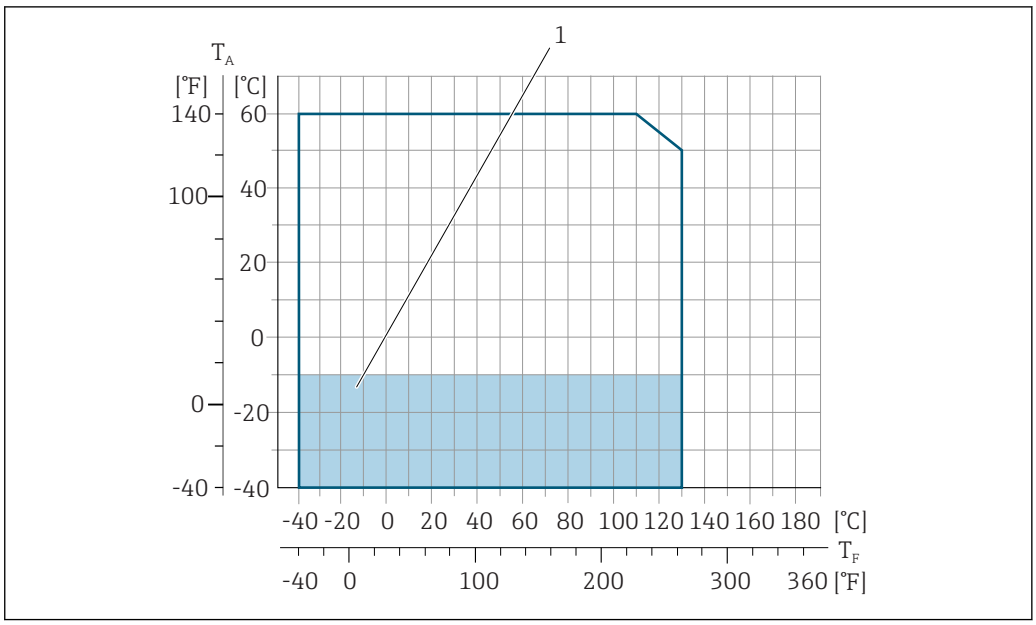
Medium temperature range

- −20 to +150 °C (−4 to +302 °F) for PFA, DN 25 to 200 (1 to 8")
- −20 to +180 °C (−4 to +356 °F) for PFA high-temperature, DN 25 to 200 (1 to 8")
- −40 to +130 °C (−40 to +266 °F) for PTFE, DN 15 to 600 (½ to 24")



25 PFA

T_A *Ambient temperature range*
T_F *Fluid temperature*
1 *Colored area: the ambient temperature range −10 to −20 °C (+14 to −4 °F) applies to stainless flanges only*
2 *Hatched area: harsh environment only for fluid temperature range −20 to +130 °C (−4 to +266 °F)*
3 *−20 to +150 °C (−4 to +302 °F) for PFA, DN 25 to 200 (1 to 8")*
4 *−20 to +180 °C (−4 to +356 °F) for PFA high-temperature, DN 25 to 200 (1 to 8")*

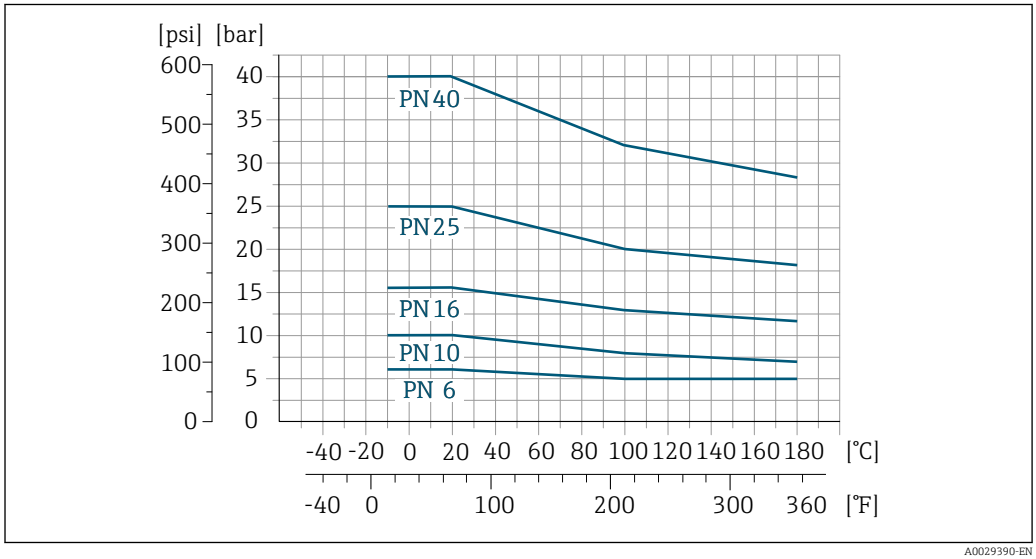


26 PTFE

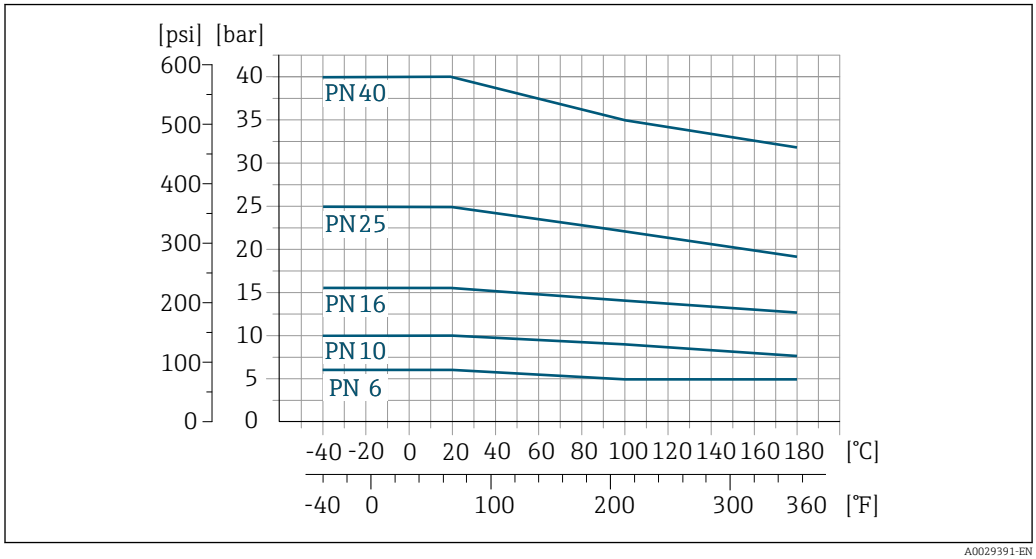
T_A *Ambient temperature range*
T_F *Fluid temperature*
1 *Colored area: the ambient temperature range of −10 to −40 °C (+14 to −40 °F) applies to stainless flanges only*

Conductivity	≥ 5 µS/cm for liquids in general. Stronger filter damping is required for very low conductivity values.
Pressure-temperature ratings	The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection. The diagrams show the maximum permissible medium pressure depending on the specific medium temperature.

Process connection: flange according to EN 1092-1 (DIN 2501)

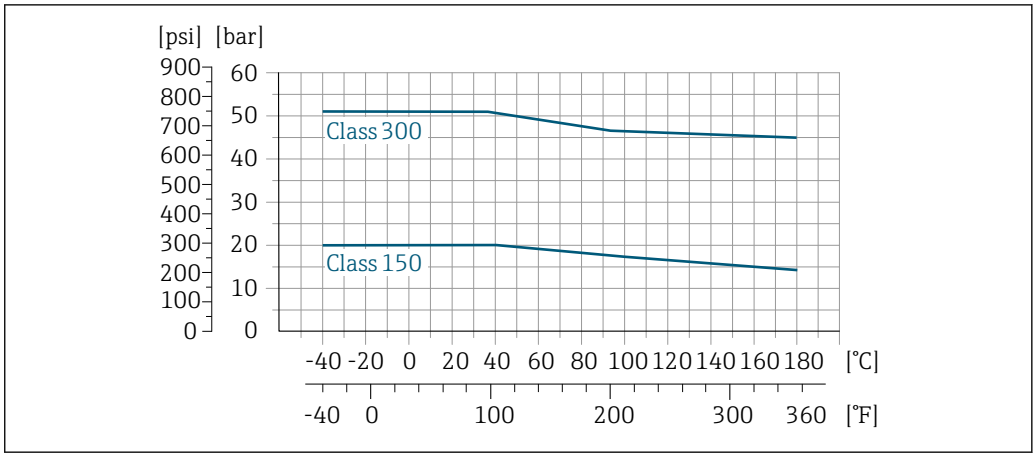


27 *Process connection material: carbon steel, FE410WB/S235JRG2; Alloy C22, 2.4602 (UNS N06022)*

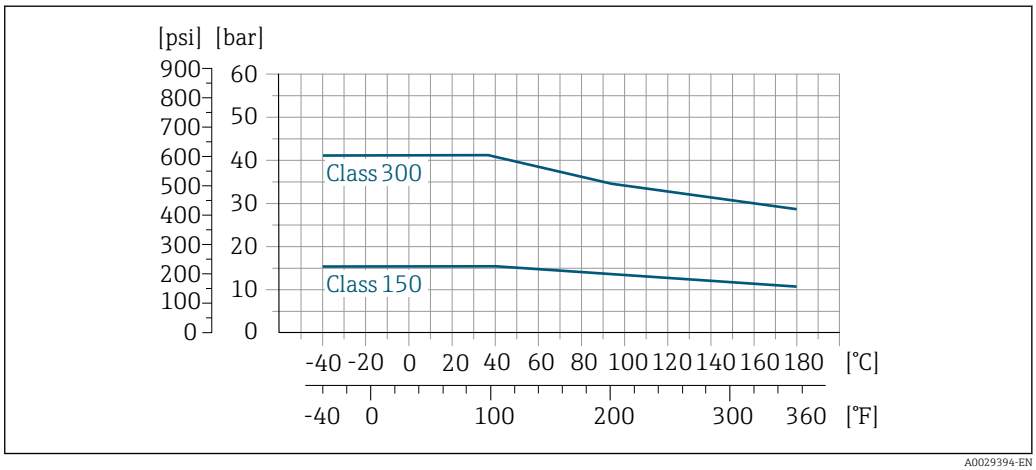


28 *Process connection material: stainless steel, 1.4571 (F316L)*

Process connection: flange according to ASME B16.5

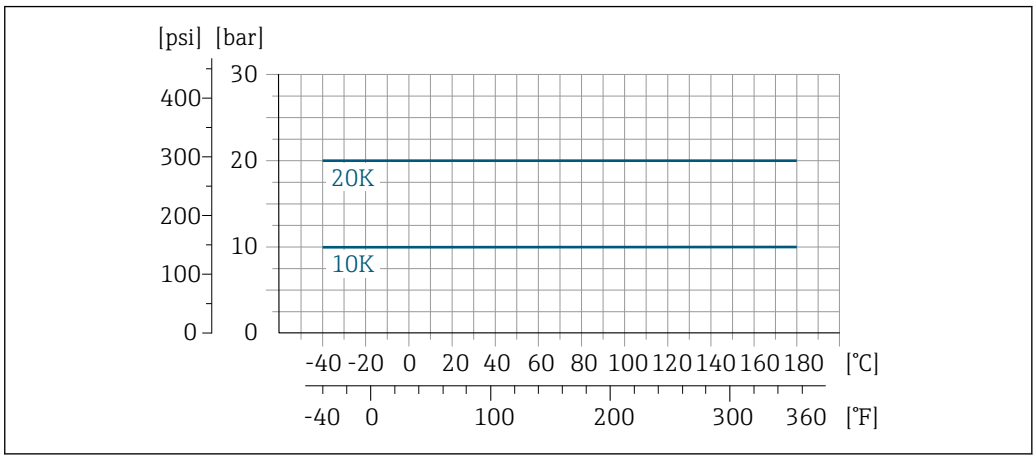


29 *Process connection material: carbon steel, A105*



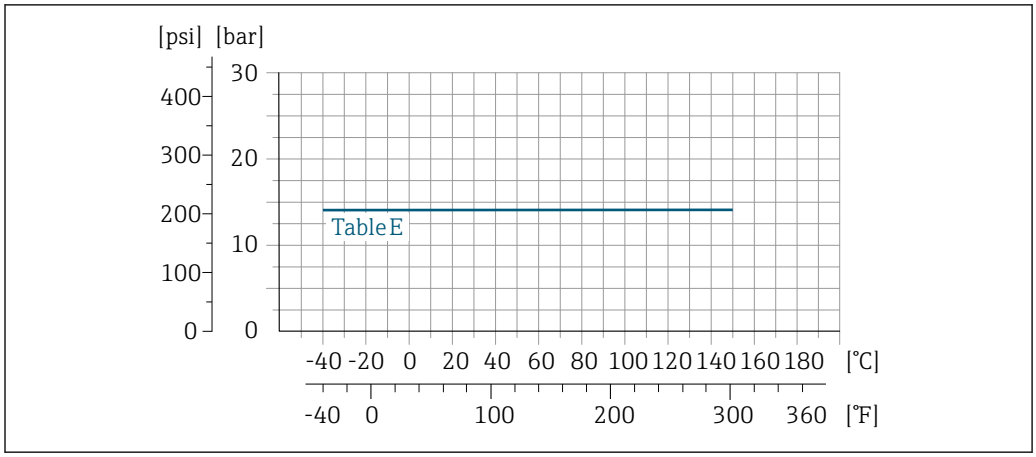
30 *Process connection material: stainless steel, F316L*

Process connection: flange according to JIS B2220



31 *Process connection material: stainless steel, 1.0425 (F316L); carbon steel, S235JRG2/HII*

Process connection: flange according to AS 2129 (Table E) or AS 4087 (PN 16)



32 *Process connection material: carbon steel, A105/S235JRG2/S275JR*

Pressure tightness

"–" = no specifications possible

Liner: PFA

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:		
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 to +180 °C (+212 to +356 °F)
25	1	0 (0)	0 (0)	0 (0)
32	–	0 (0)	0 (0)	0 (0)
40	1 ½	0 (0)	0 (0)	0 (0)
50	2	0 (0)	0 (0)	0 (0)
65	–	0 (0)	0 (0)	0 (0)
80	3	0 (0)	0 (0)	0 (0)
100	4	0 (0)	0 (0)	0 (0)
125	–	0 (0)	0 (0)	0 (0)
150	6	0 (0)	0 (0)	0 (0)
200	8	0 (0)	0 (0)	0 (0)

Liner: PTFE

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
15	½	0 (0)	0 (0)	0 (0)	100 (1.45)
25	1	0 (0)	0 (0)	0 (0)	100 (1.45)
32	–	0 (0)	0 (0)	0 (0)	100 (1.45)
40	1 ½	0 (0)	0 (0)	0 (0)	100 (1.45)
50	2	0 (0)	0 (0)	0 (0)	100 (1.45)
65	–	0 (0)	–	40 (0.58)	130 (1.89)
80	3	0 (0)	–	40 (0.58)	130 (1.89)
100	4	0 (0)	–	135 (1.96)	170 (2.47)
125	–	135 (1.96)	–	240 (3.48)	385 (5.58)
150	6	135 (1.96)	–	240 (3.48)	385 (5.58)
200	8	200 (2.90)	–	290 (4.21)	410 (5.95)

Nominal diameter		Limit values for absolute pressure in [mbar] ([psi]) for medium temperatures:			
[mm]	[in]	+25 °C (+77 °F)	+80 °C (+176 °F)	+100 °C (+212 °F)	+130 °C (+266 °F)
250	10	330 (4.79)	–	400 (5.80)	530 (7.69)
300	12	400 (5.80)	–	500 (7.25)	630 (9.14)
350	14	470 (6.82)	–	600 (8.70)	730 (10.6)
400	16	540 (7.83)	–	670 (9.72)	800 (11.6)
450	18	No negative pressure permitted!			
500	20				
600	24				

Flow limit

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 to 3 m/s (6.56 to 9.84 ft/s). Also match the velocity of flow (v) to the physical properties of the fluid:

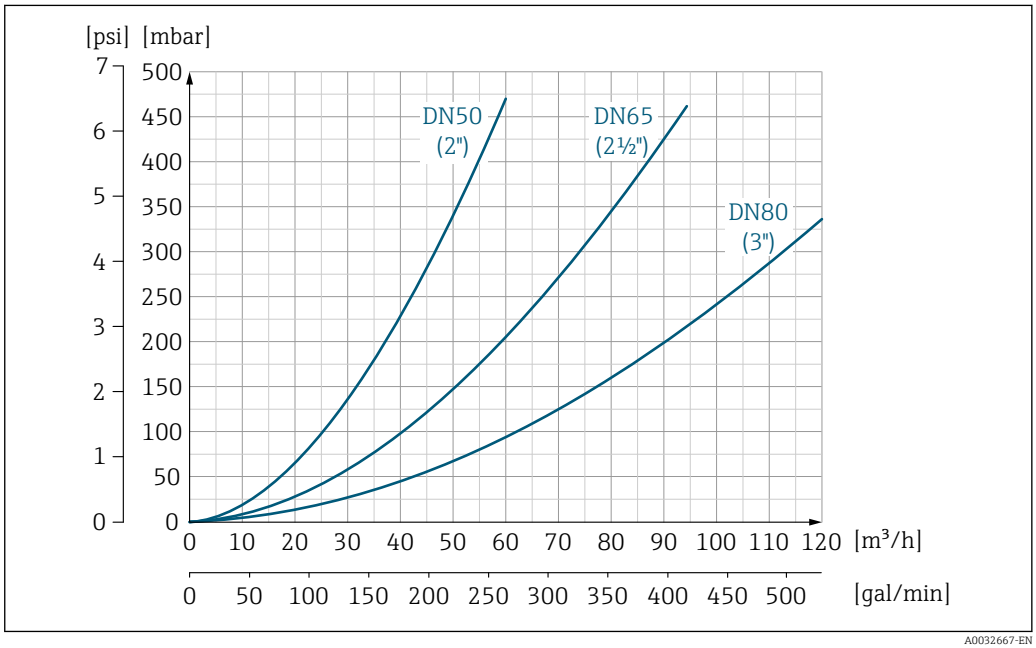
- v < 2 m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- v > 2 m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludge)

A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

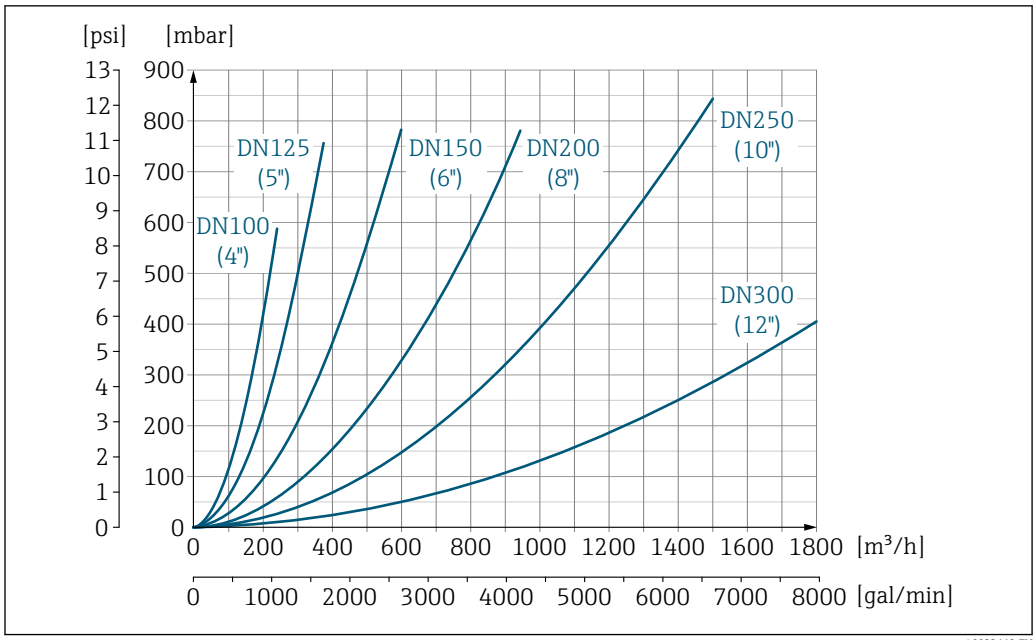
For an overview of the full scale values for the measuring range, see the "Measuring range" section → 9

Pressure loss

- No pressure loss occurs if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 47

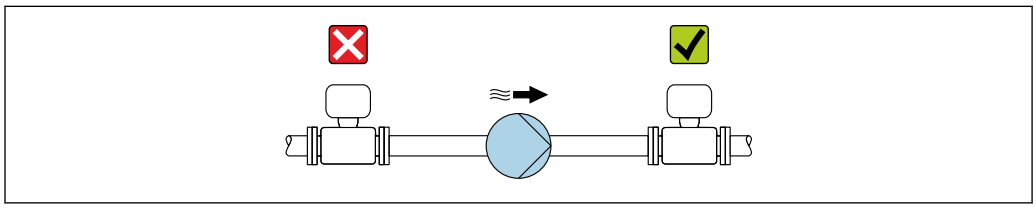


33 *Pressure loss DN 50 to 80 (2 to 3") in the case of order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"*



34 *Pressure loss DN 100 to 300 (4 to 12") in the case of order code for "Design", option C "Insertion length short ISO/DVGW to DN300, without inlet/outlet runs, constricted meas.tube"*

System pressure



Never install the sensor on the pump suction side in order to avoid the risk of low pressure, and thus damage to the liner.

Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

- Information on the liner's resistance to partial vacuum → 52
- Information on the shock resistance of the measuring system → 48
- Information on the vibration resistance of the measuring system → 48

Thermal insulation

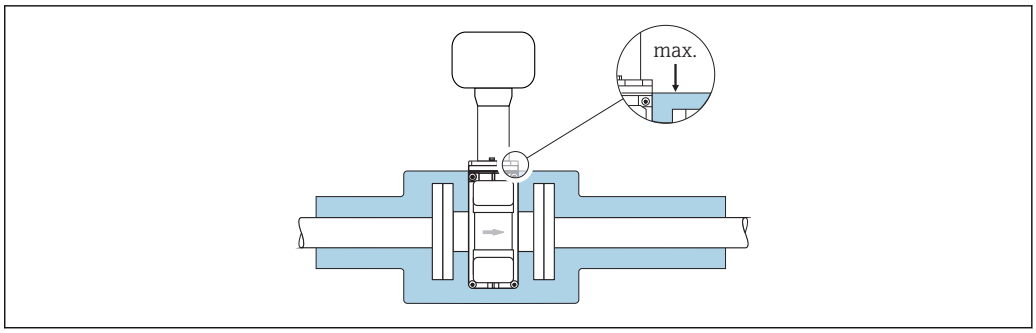
If process fluids are very hot, it is necessary to insulate pipes in order to reduce energy loss and to prevent individuals from accidentally coming into contact with hot pipes. Please observe the applicable standards and guidelines for insulating pipes.

A housing support/an extended neck is used for heat dissipation:
- Devices with the order code for "Lining", option **B** "PFA high-temperature" always come with a housing support.
- In the case of all other devices, a housing support can be ordered via the order code for "Sensor option", option **CG** "Sensor extended neck".

WARNING

Electronics overheating on account of thermal insulation!

► The housing support is used for heat dissipation and must be completely free (i.e. uncovered). At the very maximum, the sensor insulation may extend as far as the upper edge of the two sensor half-shells.



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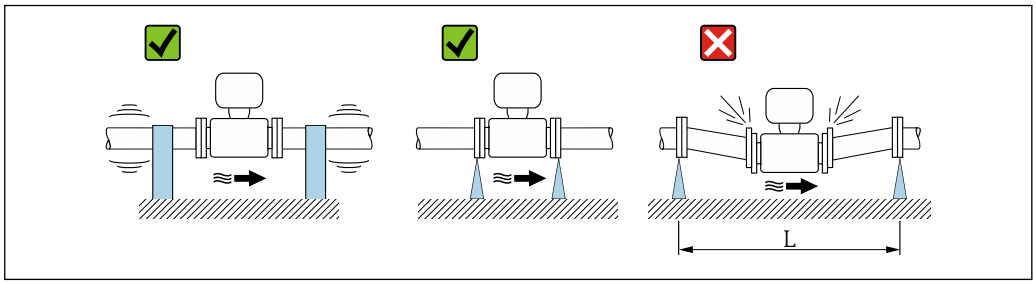
Vibrations



A0029004

35 *Measures to avoid device vibrations (L > 10 m (33 ft))*

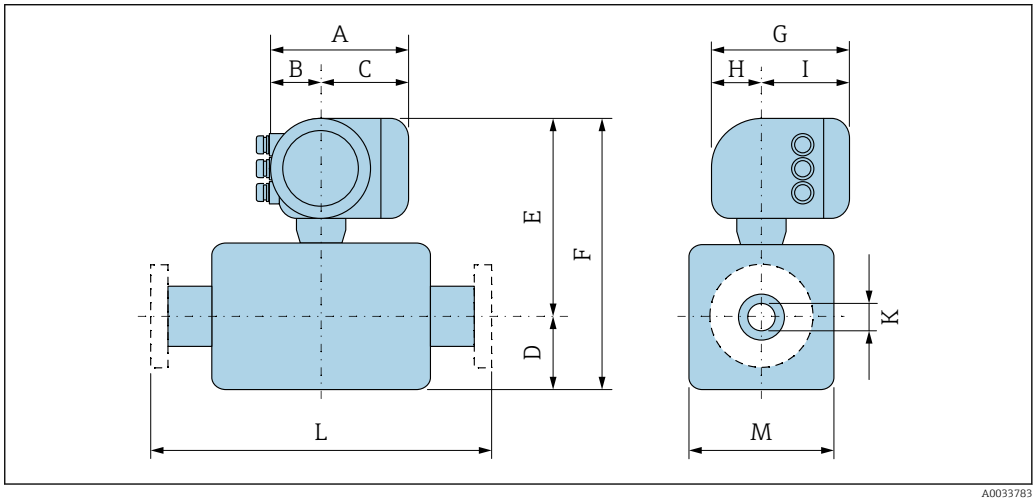
In the event of very strong vibrations, the pipe and sensor must be supported and fixed.

- Information on the shock resistance of the measuring system → 48
- Information on the vibration resistance of the measuring system → 48

Mechanical construction

Dimensions in SI units

Compact version



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Order code for "Housing", option A "Aluminum, coated"

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [mm]	E [2] [mm]	F [2] [mm]	G [3] [mm]	H [mm]	I [3] [mm]	K [mm]	L [mm]	M [mm]
15	169	68	101	84	271	355	200	59	141	[4]	[5]	120
25	169	68	101	84	271	355	200	59	141	[4]	[5]	120
32	169	68	101	84	271	355	200	59	141	[4]	[5]	120

DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [mm]	E [2] [mm]	F [2] [mm]	G [3] [mm]	H [mm]	I [3] [mm]	K [mm]	L [mm]	M [mm]
40	169	68	101	84	271	355	200	59	141	[4]	[5]	120
50	169	68	101	84	271	355	200	59	141	[4]	[5]	120
65	169	68	101	109	296	405	200	59	141	[4]	[5]	180
80	169	68	101	109	296	405	200	59	141	[4]	[5]	180
100	169	68	101	109	296	405	200	59	141	[4]	[5]	180
125	169	68	101	150	336	486	200	59	141	[4]	[5]	260
150	169	68	101	150	336	486	200	59	141	[4]	[5]	260
200	169	68	101	180	361	541	200	59	141	[4]	[5]	324
250	169	68	101	205	386	591	200	59	141	[4]	[5]	400
300	169	68	101	230	411	641	200	59	141	[4]	[5]	460
350	169	68	101	282	469	751	200	59	141	[4]	[5]	564
400	169	68	101	308	496	804	200	59	141	[4]	[5]	616
450	169	68	101	333	521	854	200	59	141	[4]	[5]	666
500	169	68	101	359	546	905	200	59	141	[4]	[5]	717
600	169	68	101	411	594	1005	200	59	141	[4]	[5]	821

1) Depending on the cable gland used: values up to + 30 mm
2) With order code for "Sensor option", option CG "Sensor extended neck for insulation" or order code for "Liner", option B "PFA high temperature": values + 110 mm
3) For version without local display: values − 30 mm
4) Depends on the liner
5) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water).→ 🖹 58

Order code for "Housing", option A "Aluminum, coated"; Ex d

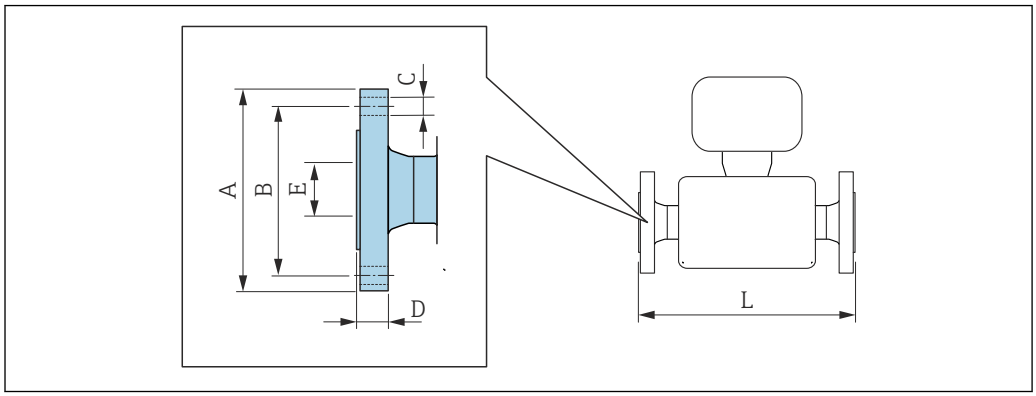
DN [mm]	A [1] [mm]	B [1] [mm]	C [mm]	D [mm]	E [2] [mm]	F [2] [mm]	G [3] [mm]	H [mm]	I [3] [mm]	K [mm]	L [mm]	M [mm]
15	188	85	103	84	301	385	206	58	148	[4]	[5]	120
25	188	85	103	84	301	385	206	58	148	[4]	[5]	120
32	188	85	103	84	301	385	206	58	148	[4]	[5]	120
40	188	85	103	84	301	385	206	58	148	[4]	[5]	120
50	188	85	103	84	301	385	206	58	148	[4]	[5]	120
65	188	85	103	109	326	435	206	58	148	[4]	[5]	180
80	188	85	103	109	326	435	206	58	148	[4]	[5]	180
100	188	85	103	109	326	435	206	58	148	[4]	[5]	180
125	188	85	103	150	366	516	206	58	148	[4]	[5]	260
150	188	85	103	150	366	516	206	58	148	[4]	[5]	260
200	188	85	103	180	391	571	206	58	148	[4]	[5]	324
250	188	85	103	205	416	621	206	58	148	[4]	[5]	400
300	188	85	103	230	441	671	206	58	148	[4]	[5]	460
350	188	85	103	282	499	781	206	58	148	[4]	[5]	564
400	188	85	103	308	526	834	206	58	148	[4]	[5]	616
450	188	85	103	333	551	884	206	58	148	[4]	[5]	666

DN [mm]	A [1)] [mm]	B [1)] [mm]	C [mm]	D [mm]	E [2)] [mm]	F [2)] [mm]	G [3)] [mm]	H [mm]	I [3)] [mm]	K [mm]	L [mm]	M [mm]
500	188	85	103	359	576	935	206	58	148	4)	5)	717
600	188	85	103	411	624	1035	206	58	148	4)	5)	821

1) Depending on the cable gland used: values up to + 30 mm
2) With order code for "Sensor option", option CG "Sensor extended neck for insulation" or order code for "Liner", option B "PFA high temperature": values + 110 mm
3) For version without local display: values − 30 mm
4) Depends on the liner
5) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water).→ 🖹 58

Flange connections

Flange



A0015621

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 10 **P245GH (1.0352):** *order code for "Process connection", option* **D2K** **1.4404 (F316/F316L):** *order code for "Process connection", option* **D2S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
200	340	295	8 × Ø22	26	220.9	350
250	395	350	12 × Ø22	28	275.5	450
300	445	400	12 × Ø22	28	326.5	500
350	505	460	16 × Ø22	26	346	550
400	565	515	16 × Ø26	26	396	600
450	615	565	20 × Ø26	28	447	650
500	670	620	20 × Ø26	28	498	650
600	780	725	20 × Ø30	30	600	780
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 16 **P245GH (1.0352):** *order code for "Process connection", option* **D3K** **1.4404 (F316/F316L):** *order code for "Process connection", option* **D3S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
65	185	145	8 × Ø18	20	77.1	200
80	200	160	8 × Ø18	20	89.9	200
100	220	180	8 × Ø18	22	115.3	250
125	250	210	8 × Ø18	24	141.3	250
150	285	240	8 × Ø22	24	170.2	300
200	340	295	12 × Ø22	26	220.9	350
250	405	355	12 × Ø26	32	275.7	450
300	460	410	12 × Ø26	32	326.5	500
350	520	470	16 × Ø26	30	346	550
400	580	525	16 × Ø30	32	396	600
500	715	650	20 × Ø33	36	498	650

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 16 P245GH (1.0352): *order code for "Process connection", option* **D3K** 1.4404 (F316/F316L): *order code for "Process connection", option* **D3S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
600	840	770	20 × Ø36	40	600	780
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 25 P245GH (1.0352): *order code for "Process connection", option* **D4K** 1.4404 (F316/F316L): *order code for "Process connection", option* **D4S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
200	360	310	12 × Ø26	32	220.9	350
250	425	370	12 × Ø30	36	275.7	450
300	485	430	16 × Ø30	40	326.5	500
350	555	490	16 × Ø33	38	346	550
400	620	550	16 × Ø36	40	396	600
500	730	660	20 × Ø36	48	498	650
600	845	770	20 × Ø39	48	600	780
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange in accordance with EN 1092-1 (DIN 2501 / DIN 2512N): PN 40 P245GH (1.0352): *order code for "Process connection", option* **D5K** 1.4404 (F316/F316L): *order code for "Process connection", option* **D5S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
15	95	65	4 × Ø14	14	22.2	200
25	115	85	4 × Ø14	16	34.2	200
32	140	100	4 × Ø18	18	43	200
40	150	110	4 × Ø18	18	49.1	200
50	165	125	4 × Ø18	20	61.3	200
65	185	145	8 × Ø18	24	77.1	200
80	200	160	8 × Ø18	26	89.9	200
100	235	190	8 × Ø22	26	115.3	250
125	270	220	8 × Ø26	28	141.3	250
150	300	250	8 × Ø26	30	170.2	300
Surface roughness (flange): EN 1092-1 Form B1 (DIN 2526 Form C), Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange according to ASME B16.5, Class 150
A 105: *order code for "Process connection", option* **A1K**
1.4404 (F316/F316L): *order code for "Process connection", option* **A1S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [1)] [mm]
15	88.9	60.5	4 × Ø16	9.6	22.3	200
25	108	79.2	4 × Ø16	12.6	34.2	200
40	127	98.6	4 × Ø16	15.9	49.1	200
50	152.4	120.7	4 × Ø19.1	17.5	61.3	200
80	190.5	152.4	4 × Ø19.1	22.3	89.9	200
100	228.6	190.5	8 × Ø19.1	22.3	115.3	250
150	279.4	241.3	8 × Ø22.4	23.8	170.2	300
200	342.9	298.5	8 × Ø22.4	26.8	220.9	350
250	406.4	362	12 × Ø25.4	29.6	275.7	450
300	482.6	431.8	12 × Ø25.4	30.2	326.5	500
350	535	476.3	12 × Ø28.6	35.4	346	550
400	595	539.8	16 × Ø28.6	37	396	600
450	635	577.9	16 × Ø31.8	40.1	447	650
500	700	635	20 × Ø31.8	43.3	498	650
600	815	749.3	20 × Ø34.9	48.1	600	780
Surface roughness (flange): Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange according to ASME B16.5, Class 300
A 105: *order code for "Process connection", option* **A2K**
1.4404 (F316/F316L): *order code for "Process connection", option* **A2S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [1)] [mm]
15	95.3	66.5	4 × Ø16	12.6	22.3	200
25	123.9	88.9	4 × Ø19.1	15.9	34.2	200
40	155.4	114.3	4 × Ø22.4	19	49.1	200
50	165.1	127	8 × Ø19.1	20.8	61.3	200
80	209.6	168.1	8 × Ø22.4	26.8	89.9	200
100	254	200.2	8 × Ø22.4	30.2	115.3	250
150	317.5	269.7	12 × Ø22.4	35	170.2	300
Surface roughness (flange): Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange according to JIS B2220, 10K
A 105/A350LF2: *order code for "Process connection", option* **N3K**
1.4404 (F316L): *order code for "Process connection", option* **N3S**

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	L [1)] [mm]
50	155	120	4 × Ø19	16	61.1	200
65	175	140	4 × Ø19	18	77.1	200
80	185	150	8 × Ø19	18	90	200

Flange according to JIS B2220, 10K **A 105/A350LF2:** *order code for "Process connection", option* **N3K** **1.4404 (F316L):** *order code for "Process connection", option* **N3S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
100	210	175	8 × Ø19	18	115.4	250
125	250	210	8 × Ø23	20	141.2	250
150	280	240	8 × Ø23	22	169	300
200	330	290	12 × Ø23	22	220	350
250	400	355	12 × Ø25	24	274	450
300	445	400	16 × Ø25	24	325	500
Surface roughness (flange): Ra 6.3 to 12.5 µm						

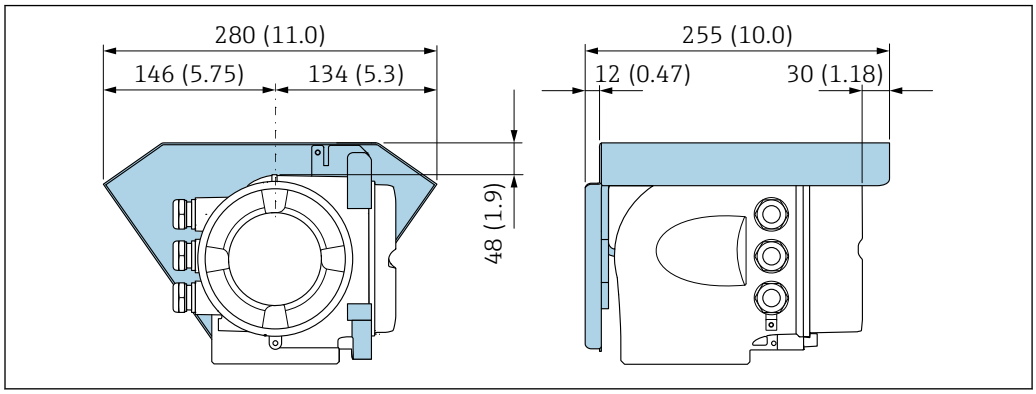
1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Flange according to JIS B2220, 20K **A 105/A350LF2:** *order code for "Process connection", option* **N4K** **1.4404 (F316L):** *order code for "Process connection", option* **N4S**						
DN [mm]	**A [mm]**	**B [mm]**	**C [mm]**	**D [mm]**	**E [mm]**	**L [1] [mm]**
15	95	70	4 × Ø15	14	22.2	200
25	125	90	4 × Ø19	16	34.5	200
32	135	100	4 × Ø19	18	43.2	200
40	140	105	4 × Ø19	18	49.1	200
50	155	120	8 × Ø19	18	61.1	200
65	175	140	8 × Ø19	20	77.1	200
80	200	160	8 × Ø23	22	90	200
100	225	185	8 × Ø23	24	115.4	250
125	270	225	8 × Ø25	26	141.2	250
150	305	260	12 × Ø25	28	169	300
200	350	305	12 × Ø25	30	220	350
250	430	380	12 × Ø27	34	274	450
300	480	430	16 × Ø27	36	325	500
Surface roughness (flange): Ra 6.3 to 12.5 µm						

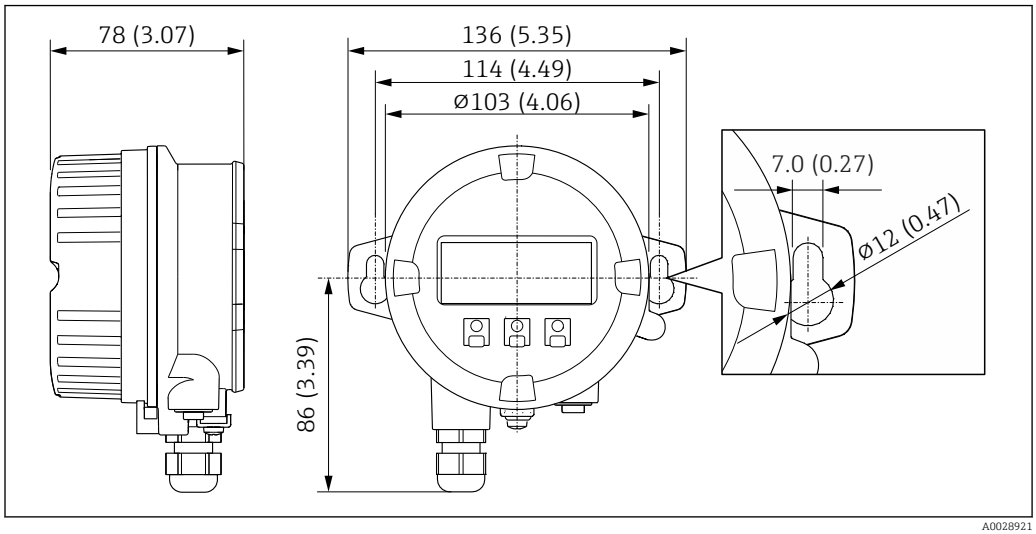
1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Accessories

Protective cover



Remote display and operating module DKX001

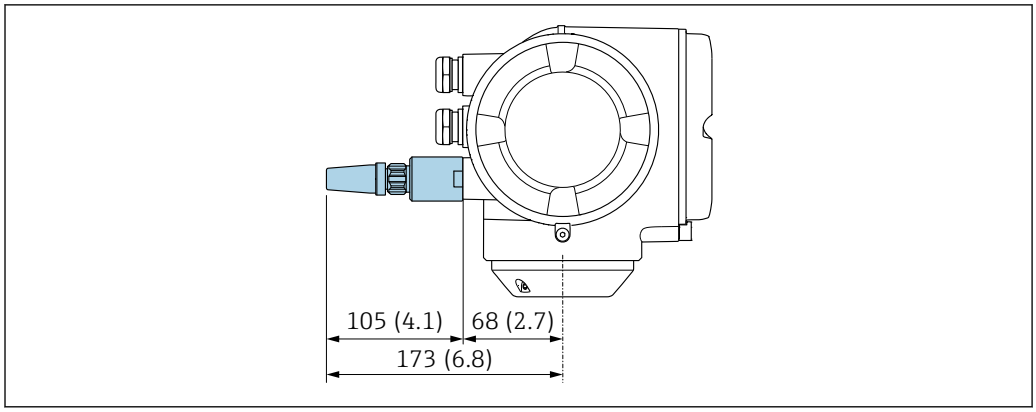


36 *Engineering unit mm (in)*

External WLAN antenna

The external WLAN antenna is not suitable for use in hygienic applications.

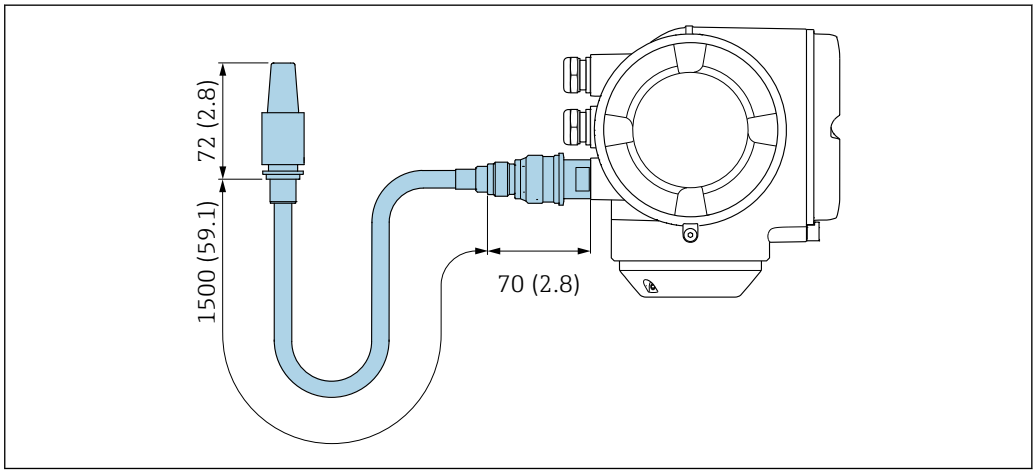
External WLAN antenna mounted on device



37 *Engineering unit mm (in)*

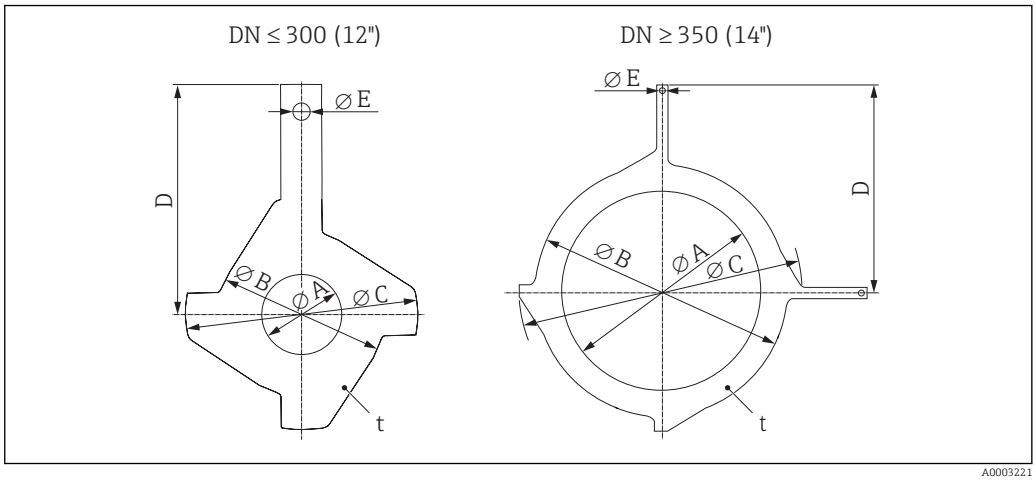
External WLAN antenna mounted with cable

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



38 *Engineering unit mm (in)*

Ground disk for flange connection



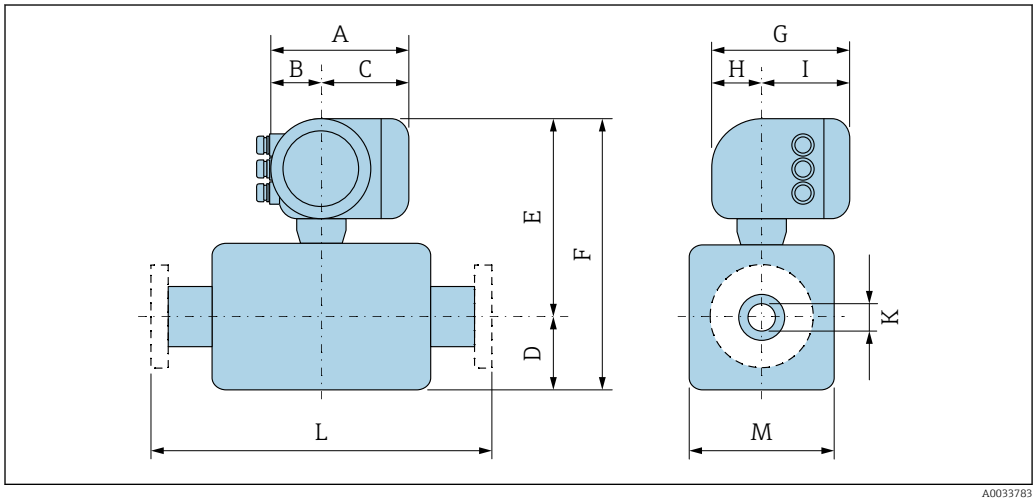
DN [1] EN (DIN), JIS, AS [2] [mm]	A PFA, PTFE [mm]	B [mm]	C [mm]	D [mm]	E [mm]	t [mm]
15	16	43	61.5	73	6.5	2
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5	6.5	2
40	41	82	101	103	6.5	2
50	52	101	115.5	108	6.5	2
65	68	121	131.5	118	6.5	2
80	80	131	154.5	135	6.5	2
100	104	156	186.5	153	6.5	2
125	130	187	206.5	160	6.5	2
150	158	217	256	184	6.5	2
200	206	267	288	205	6.5	2

DN [1] EN (DIN), JIS, AS [2] [mm]	A PFA, PTFE [mm]	B [mm]	C [mm]	D [mm]	E [mm]	t [mm]
250	260	328	359	240	6.5	2
300 [3]	312	375	413	273	6.5	2
300 [4]	310	375	404	268	6.5	2
350 [3]	343	433	479	365	9.0	2
400 [3]	393	480	542	395	9.0	2
450 [3]	439	538	583	417	9.0	2
500 [3]	493	592	650	460	9.0	2
600 [3]	593	693	766	522	9.0	2

1) Ground disks DN 15 to 250 (½ to 10") can be used for all available flange standards/pressure ratings.
2) For flanges to AS, only DN 25 and DN 50 are available.
3) PN 10/16
4) PN 25, JIS 10K/20K

Dimensions in US units

Compact version



A0033783

Order code for "Housing", option A "Aluminum, coated"

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [in]	E [2] [in]	F [2] [in]	G [3] [in]	H [in]	I [3] [in]	K [in]	L [in]	M [in]
½	6.65	2.68	3.98	3.31	10.67	13.98	7.87	2.32	5.55	[4]	[5]	4.72
1	6.65	2.68	3.98	3.31	10.67	13.98	7.87	2.32	5.55	[4]	[5]	4.72
1 ¼	6.65	2.68	3.98	3.31	10.67	13.98	7.87	2.32	5.55	[4]	[5]	4.72
1 ½	6.65	2.68	3.98	3.31	10.67	13.98	7.87	2.32	5.55	[4]	[5]	4.72
2	6.65	2.68	3.98	3.31	10.67	13.98	7.87	2.32	5.55	[4]	[5]	4.72
2 ½	6.65	2.68	3.98	4.29	11.65	15.94	7.87	2.32	5.55	[4]	[5]	7.09
3	6.65	2.68	3.98	4.29	11.65	15.94	7.87	2.32	5.55	[4]	[5]	7.09
4	6.65	2.68	3.98	4.29	11.65	15.94	7.87	2.32	5.55	[4]	[5]	7.09
5	6.65	2.68	3.98	5.91	13.23	19.13	7.87	2.32	5.55	[4]	[5]	10.2
6	6.65	2.68	3.98	5.91	13.23	19.13	7.87	2.32	5.55	[4]	[5]	10.2
8	6.65	2.68	3.98	7.09	14.21	21.3	7.87	2.32	5.55	[4]	[5]	12.8
10	6.65	2.68	3.98	8.07	15.2	23.27	7.87	2.32	5.55	[4]	[5]	15.8

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [in]	E [2] [in]	F [2] [in]	G [3] [in]	H [in]	I [3] [in]	K [in]	L [in]	M [in]
12	6.65	2.68	3.98	9.06	16.18	25.24	7.87	2.32	5.55	4)	5)	18.1
14	6.65	2.68	3.98	11.1	18.46	29.57	7.87	2.32	5.55	4)	5)	22.2
16	6.65	2.68	3.98	12.13	19.53	31.65	7.87	2.32	5.55	4)	5)	24.3
18	6.65	2.68	3.98	13.11	20.51	33.62	7.87	2.32	5.55	4)	5)	26.2
20	6.65	2.68	3.98	14.13	21.5	35.63	7.87	2.32	5.55	4)	5)	28.2
24	6.65	2.68	3.98	16.18	23.39	39.57	7.87	2.32	5.55	4)	5)	32.3

1) Depending on the cable gland used: values up to +1.18 in
2) With order code for "Sensor option", option CG "Sensor extended neck for insulation" or order code for "Liner", option B "PFA high temperature": values + 4.33 in
3) For version without local display: values − 1.18 in
4) Depends on the liner
5) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water).→ 66

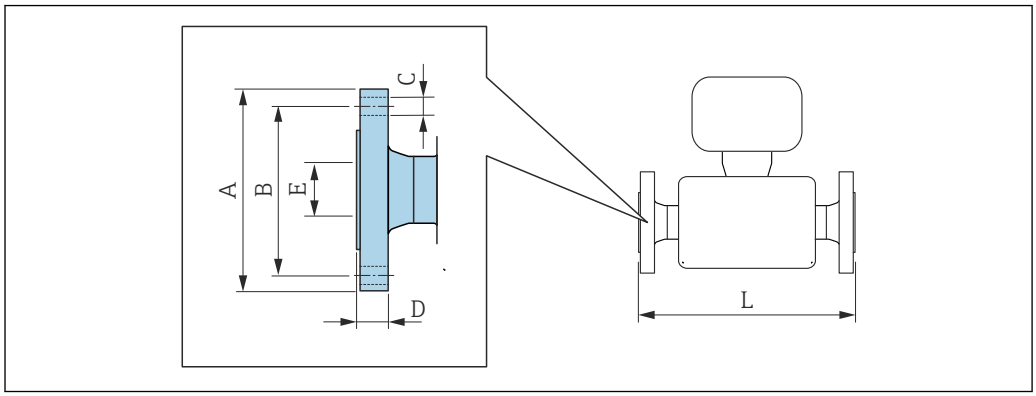
Order code for "Housing", option A "Aluminum, coated"; Ex d

DN [in]	A [1] [in]	B [1] [in]	C [in]	D [in]	E [2] [in]	F [2] [in]	G [3] [in]	H [in]	I [3] [in]	K [in]	L [in]	M [in]
½	7.4	3.35	4.06	3.31	11.85	15.16	8.11	2.28	5.83	4)	5)	4.72
1	7.4	3.35	4.06	3.31	11.85	15.16	8.11	2.28	5.83	4)	5)	4.72
1 ¼	7.4	3.35	4.06	3.31	11.85	15.16	8.11	2.28	5.83	4)	5)	4.72
1 ½	7.4	3.35	4.06	3.31	11.85	15.16	8.11	2.28	5.83	4)	5)	4.72
2	7.4	3.35	4.06	3.31	11.85	15.16	8.11	2.28	5.83	4)	5)	4.72
2 ½	7.4	3.35	4.06	4.29	12.83	17.13	8.11	2.28	5.83	4)	5)	7.09
3	7.4	3.35	4.06	4.29	12.83	17.13	8.11	2.28	5.83	4)	5)	7.09
4	7.4	3.35	4.06	4.29	12.83	17.13	8.11	2.28	5.83	4)	5)	7.09
5	7.4	3.35	4.06	5.91	14.41	20.31	8.11	2.28	5.83	4)	5)	10.2
6	7.4	3.35	4.06	5.91	14.41	20.31	8.11	2.28	5.83	4)	5)	10.2
8	7.4	3.35	4.06	7.09	15.39	22.48	8.11	2.28	5.83	4)	5)	12.8
10	7.4	3.35	4.06	8.07	16.38	24.45	8.11	2.28	5.83	4)	5)	15.8
12	7.4	3.35	4.06	9.06	17.36	26.42	8.11	2.28	5.83	4)	5)	18.1
14	7.4	3.35	4.06	11.1	19.65	30.75	8.11	2.28	5.83	4)	5)	22.2
16	7.4	3.35	4.06	12.13	20.71	32.83	8.11	2.28	5.83	4)	5)	24.3
18	7.4	3.35	4.06	13.11	21.69	34.8	8.11	2.28	5.83	4)	5)	26.2
20	7.4	3.35	4.06	14.13	22.68	36.81	8.11	2.28	5.83	4)	5)	28.2
24	7.4	3.35	4.06	16.18	24.57	40.75	8.11	2.28	5.83	4)	5)	32.3

1) Depending on the cable gland used: values up to +1.18 in
2) With order code for "Sensor option", option CG "Sensor extended neck for insulation" or order code for "Liner", option B "PFA high temperature": values + 4.33 in
3) For version without local display: values − 1.18 in
4) Depends on the liner
5) Total length is independent of the process connections. Length according to DVGW (German Technical and Scientific Association for Gas and Water).→ 66

Flange connections

Flange



A0015621

Flange according to ASME B16.5, Class 150 **A 105:** *order code for "Process connection", option* **A1K** **1.4404 (F316/F316L):** *order code for "Process connection", option* **A1S**						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [1] [in]**
½	3.5	2.38	4 × Ø0.63	0.38	0.88	7.87
1	4.25	3.12	4 × Ø0.63	0.5	1.35	7.87
1 ½	5	3.88	4 × Ø0.63	0.63	1.93	7.87
2	6	4.75	4 × Ø0.75	0.69	2.41	7.87
3	7.5	6	4 × Ø0.75	0.88	3.54	7.87
4	9	7.5	8 × Ø0.75	0.88	4.54	9.84
6	11	9.5	8 × Ø0.88	0.94	6.7	11.8
8	13.5	11.75	8 × Ø0.88	1.06	8.7	13.8
10	16	14.25	12 × Ø1	1.17	10.85	17.7
12	19	17	12 × Ø1	1.19	12.85	19.7
14	21.06	18.75	12 × Ø1.13	1.39	13.62	21.7
16	23.43	21.25	16 × Ø1.13	1.46	15.59	23.6
18	25	22.75	16 × Ø1.25	1.58	17.6	25.6
20	27.56	25	20 × Ø1.25	1.7	19.61	25.6
24	32.09	29.5	20 × Ø1.37	1.89	23.62	30.7
Surface roughness (flange): Ra 6.3 to 12.5 µm						

1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

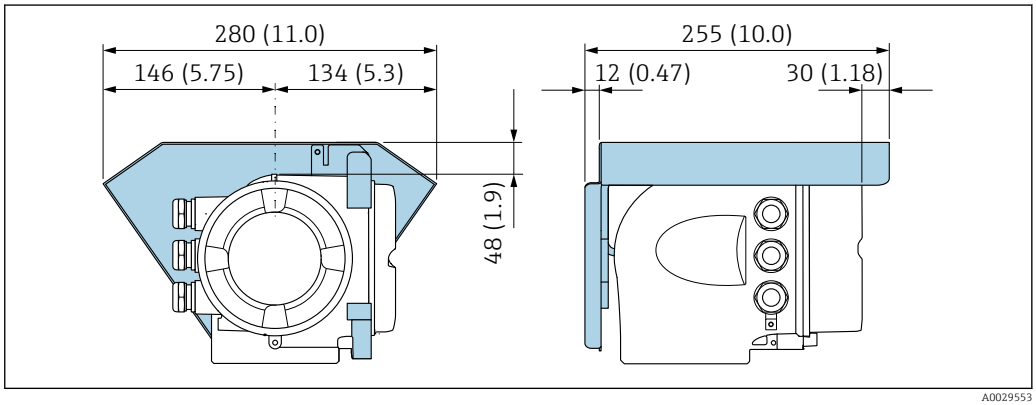
Flange according to ASME B16.5, Class 300 **A 105:** *order code for "Process connection", option* **A2K** **1.4404 (F316/F316L):** *order code for "Process connection", option* **A2S**						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [1] [in]**
½	3.75	2.62	4 × Ø0.63	0.5	0.88	7.87
1	4.88	3.5	4 × Ø0.75	0.63	1.35	7.87
1 ½	6.12	4.5	4 × Ø0.88	0.75	1.93	7.87
2	6.5	5	8 × Ø0.75	0.82	2.41	7.87

Flange according to ASME B16.5, Class 300 **A 105:** *order code for "Process connection", option* **A2K** **1.4404 (F316/F316L):** *order code for "Process connection", option* **A2S**						
DN [in]	**A [in]**	**B [in]**	**C [in]**	**D [in]**	**E [in]**	**L [1] [in]**
3	8.25	6.62	8 × Ø0.88	1.06	3.54	7.87
4	10	7.88	8 × Ø0.88	1.19	4.54	9.84
6	12.5	10.62	12 × Ø0.88	1.38	6.7	11.8
Surface roughness (flange): Ra 6.3 to 12.5 µm						

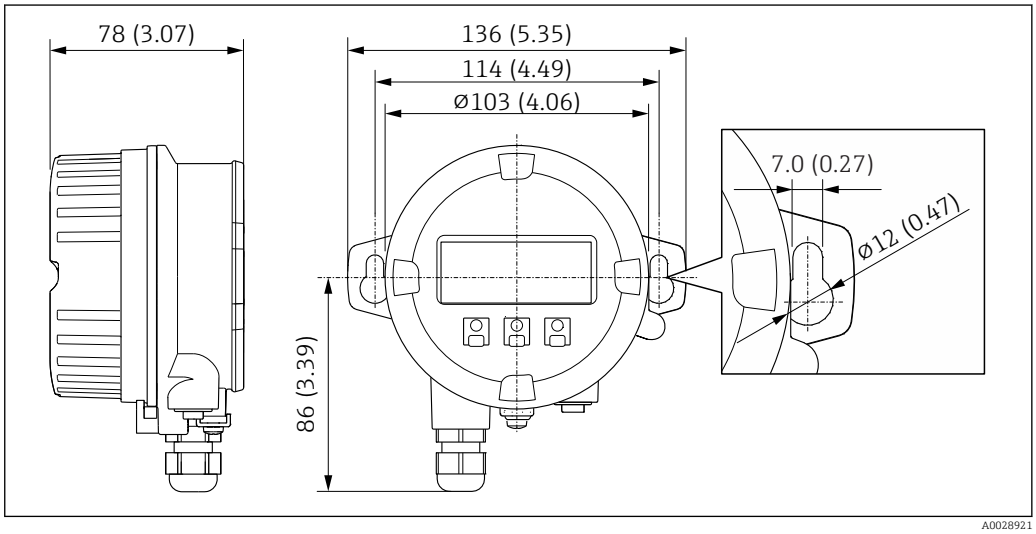
1) Length according to DVGW (German Technical and Scientific Association for Gas and Water).

Accessories

Protective cover



Remote display and operating module DKX001

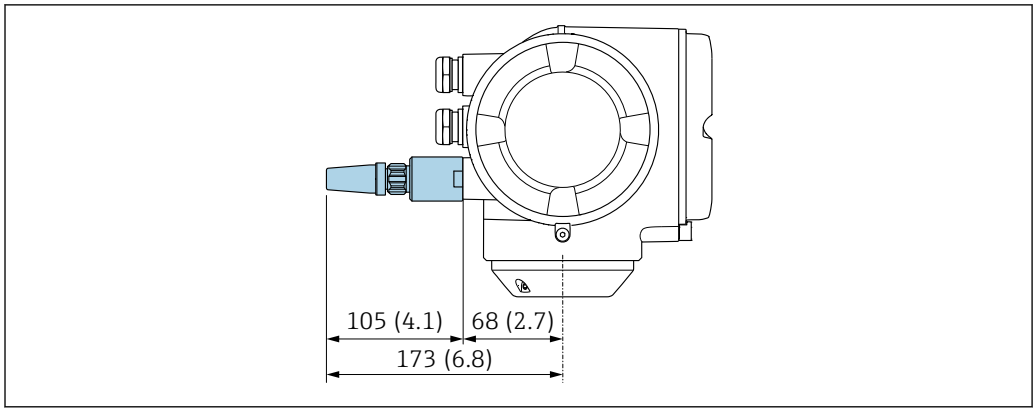


39 *Engineering unit mm (in)*

External WLAN antenna

The external WLAN antenna is not suitable for use in hygienic applications.

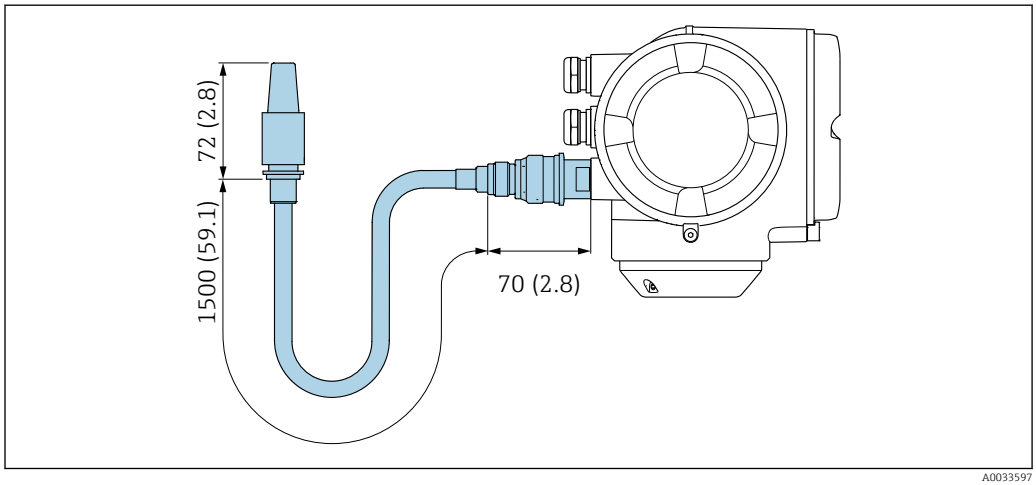
External WLAN antenna mounted on device



40 Engineering unit mm (in)

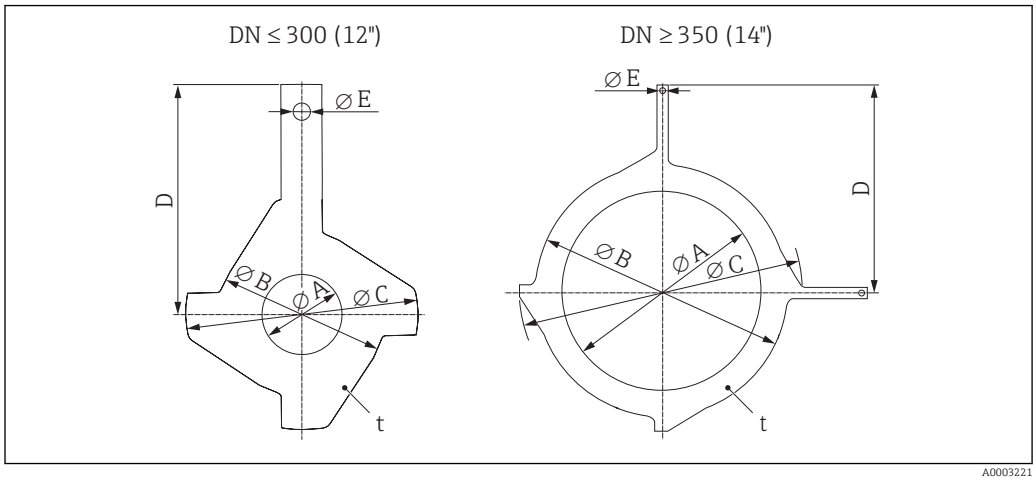
External WLAN antenna mounted with cable

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



41 Engineering unit mm (in)

Ground disk for flange connection



DN [1] ASME [in]	A PFA, PTFE [in]	B [in]	C [in]	D [in]	E [in]	t [in]
½	0.63	1.69	2.42	2.87	0.26	0.08
1	1.02	2.44	3.05	3.44	0.26	0.08
1 ½	1.61	3.23	3.98	4.06	0.26	0.08
2	2.05	3.98	4.55	4.25	0.26	0.08
3	3.15	5.16	6.08	5.31	0.26	0.08
4	4.09	6.14	7.34	6.02	0.26	0.08
6	6.22	8.54	10.08	7.24	0.26	0.08
8	8.11	10.51	11.34	8.07	0.26	0.08
10	10.24	12.91	14.13	9.45	0.26	0.08
12	12.28	14.76	16.26	10.75	0.26	0.08
14	13.50	17.05	18.86	14.37	0.35	0.08
16	15.47	18.90	21.34	15.55	0.35	0.08
18	17.28	21.18	22.95	16.42	0.35	0.08
20	19.41	23.31	25.59	18.11	0.35	0.08
24	23.35	27.28	30.16	20.55	0.35	0.08

1) Ground disks can be used for all available pressure ratings.

Weight

All values (weight exclusive of packaging material) refer to devices for standard pressure ratings. Weight specifications including transmitter as per order code for "Housing", option A "Aluminum, coated".

Different values due to different transmitter versions:
Transmitter version for the hazardous area
(Order code for "Housing", option A "Aluminum, coated"; Ex d): +2 kg (+4.4 lbs)

Weight in SI units

Nominal diameter		EN (DIN), AS [1]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
15	½	PN 40	7.2	Class 150	7.2	10K	4.5
25	1	PN 40	8.0	Class 150	8.0	10K	5.3
32	–	PN 40	8.7	Class 150	–	10K	5.3
40	1 ½	PN 40	10.1	Class 150	10.1	10K	6.3
50	2	PN 40	11.3	Class 150	11.3	10K	7.3
65	–	PN 16	12.7	Class 150	–	10K	9.1
80	3	PN 16	14.7	Class 150	14.7	10K	10.5
100	4	PN 16	16.7	Class 150	16.7	10K	12.7
125	–	PN 16	22.2	Class 150	–	10K	19
150	6	PN 16	26.2	Class 150	26.2	10K	22.5
200	8	PN 10	45.7	Class 150	45.7	10K	39.9
250	10	PN 10	65.7	Class 150	75.7	10K	67.4
300	12	PN 10	70.7	Class 150	111	10K	70.3
350	14	PN 10	105.7	Class 150	176	10K	79
400	16	PN 10	120.7	Class 150	206	10K	100

Nominal diameter		EN (DIN), AS [1)]		ASME		JIS	
[mm]	[in]	Pressure rating	[kg]	Pressure rating	[kg]	Pressure rating	[kg]
450	18	PN 10	161.7	Class 150	256	10K	128
500	20	PN 10	156.7	Class 150	286	10K	142
600	24	PN 10	208.7	Class 150	406	10K	188

1) For flanges to AS, only DN 25 and 50 are available.

Weight in US units

Nominal diameter		ASME	
[mm]	[in]	Pressure rating	[lbs]
15	½	Class 150	15.9
25	1	Class 150	17.6
40	1 ½	Class 150	22.3
50	2	Class 150	24.9
80	3	Class 150	32.4
100	4	Class 150	36.8
150	6	Class 150	57.7
200	8	Class 150	101
250	10	Class 150	167
300	12	Class 150	244
350	14	Class 150	387
400	16	Class 150	454
450	18	Class 150	564
500	20	Class 150	630
600	24	Class 150	895

Measuring tube specification

Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
15	½	PN 40	Class 150	–	–	20K	–	–	15	0.59
25	1	PN 40	Class 150	Table E	–	20K	23	0.91	26	1.02
32	–	PN 40	–	–	–	20K	32	1.26	35	1.38
40	1 ½	PN 40	Class 150	–	–	20K	36	1.42	41	1.61
50	2	PN 40	Class 150	Table E	PN 16	10K	48	1.89	52	2.05
65	–	PN 16	–	–	–	10K	63	2.48	67	2.64
80	3	PN 16	Class 150	–	–	10K	75	2.95	80	3.15
100	4	PN 16	Class 150	–	–	10K	101	3.98	104	4.09
125	–	PN 16	–	–	–	10K	126	4.96	129	5.08
150	6	PN 16	Class 150	–	–	10K	154	6.06	156	6.14
200	8	PN 10	Class 150	–	–	10K	201	7.91	202	7.95
250	10	PN 10	Class 150	–	–	10K	–	–	256	10.1
300	12	PN 10	Class 150	–	–	10K	–	–	306	12.0

Nominal diameter		Pressure rating					Process connection internal diameter			
		EN (DIN)	ASME	AS 2129	AS 4087	JIS	PFA		PTFE	
[mm]	[in]	[bar]	[psi]	[bar]	[bar]	[bar]	[mm]	[in]	[mm]	[in]
350	14	PN 10	Class 150	–	–	10K	–	–	337	13.3
400	16	PN 10	Class 150	–	–	10K	–	–	387	15.2
450	18	PN 10	Class 150	–	–	10K	–	–	432	17.0
500	20	PN 10	Class 150	–	–	10K	–	–	487	19.2
600	24	PN 10	Class 150	–	–	10K	–	–	593	23.3

Materials

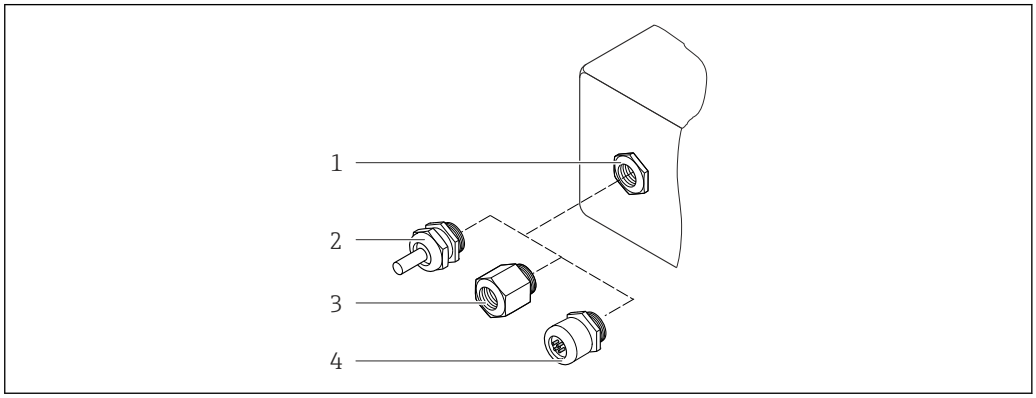
Transmitter housing

Order code for "Housing":
Option **A** "Aluminum, coated": aluminum, AlSi10Mg, coated

Window material

Order code for "Housing":
Option **A** "Aluminum, coated": glass

Cable entries/cable glands



42 *Possible cable entries/cable glands*

1 *Female thread M20 × 1.5*
2 *Cable gland M20 × 1.5*
3 *Adapter for cable entry with internal thread G ½" or NPT ½"*
4 *Device plugs*

Order code for "Housing", option A "Aluminum, coated"

The various cable entries are suitable for hazardous and non-hazardous areas.

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Plastic/nickel-plated brass
Adapter for cable entry with internal thread G ½"	Nickel-plated brass
Adapter for cable entry with internal thread NPT ½"	
Device plug	Plug M12 × 1 ▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Device plug

Electrical connection	Material
Plug M12x1	▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Sensor housing

- DN 15 to 300 (½ to 12"): coated aluminum AlSi10Mg
- DN 350 to 600 (14 to 24"): carbon steel with protective varnish

Measuring tubes

Stainless steel, 1.4301/304/1.4306/304L
For flanges made of carbon with Al/Zn protective coating (DN 15 to 300 (½ to 12")) or protective varnish (DN 350 to 600 (14 to 24"))

Liner

- PFA
- PTFE

Process connections

EN 1092-1 (DIN 2501)
Stainless steel, 1.4571 (F316L); carbon steel, E250C [1]/S235JRG2/P245GH

ASME B16.5
Stainless steel, F316L; carbon steel, A105 [1]

JIS B2220
Stainless steel, 1.0425 (F316L) [1]; carbon steel, A105/A350 LF2

AS 2129 Table E
- DN 25 (1"): carbon steel, A105/S235JRG2
- DN 40 (1 ½"): carbon steel, A105/S275JR

AS 4087 PN 16
Carbon steel, A105/S275JR

Electrodes

Stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium

Seals

As per DIN EN 1514-1, form IBC

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

Ground disks

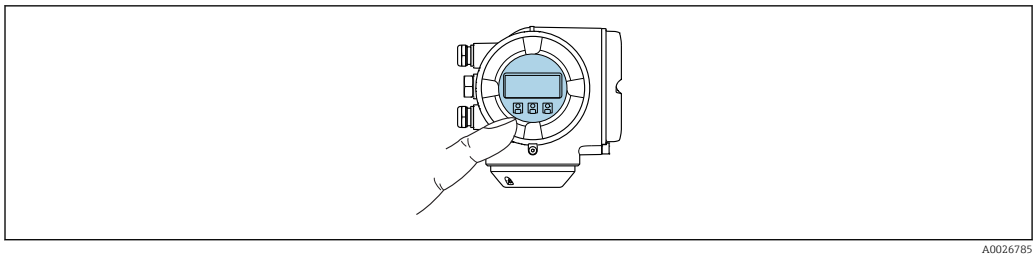
Stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); tantalum; titanium

1) DN 15 to 300 (½ to 12") with Al/Zn protective coating; DN 350 to 600 (14 to 24") with protective varnish

Fitted electrodes	Measuring electrodes, reference electrodes and electrodes for empty pipe detection: ▪ Standard: stainless steel, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); tantalum, titanium ▪ Optional: only platinum measuring electrodes
Process connections	▪ ASME B16.5 ▪ JIS B2220 ▪ AS 2129 Table E ▪ AS 4087 PN 16 For information on the different materials used in the process connections → 72
Surface roughness	Stainless steel electrodes, 1.4435 (F316L); Alloy C22, 2.4602 (UNS N06022); platinum; tantalum; titanium: ≤ 0.3 to 0.5 µm (11.8 to 19.7 µin) (All data relate to parts in contact with fluid) Liner with PFA: ≤ 0.4 µm (15.7 µin) (All data relate to parts in contact with fluid)

Operability

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 ▪ Device access via Web server or SmartBlue app → 91 ▪ WLAN access to the device via mobile handheld terminal, tablet or smart phone **Reliable operation** ▪ Operation in local language → 73 ▪ 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
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** Two display modules are available: ▪ 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 → 80



A0026785

43 *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
- 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.

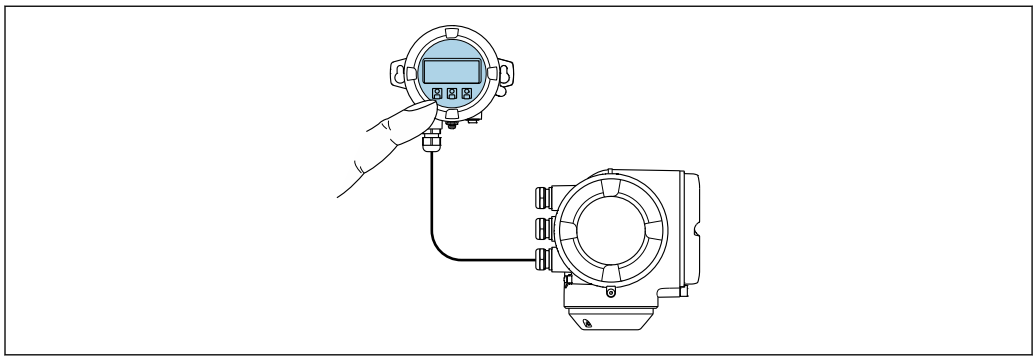
Operating elements

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

Via remote display and operating module DKX001

The remote display and operating module DKX001 is available as an optional extra → 89.

- The measuring device is always supplied with a dummy cover when the remote display and operating module DKX001 is ordered directly with the measuring device. Display or operation at the transmitter is not possible in this case.
- If ordered subsequently, the remote display and operating module DKX001 may not be connected at the same time as the existing measuring device display module. Only one display or operation unit may be connected to the transmitter at any one time.



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44 *Operation via remote display and operating module DKX001*

Display and operating elements

The display and operating elements correspond to those of the display module → 73.

Material

The housing material of the display and operating module DKX001 depends on the choice of transmitter housing material.

Transmitter housing		Remote display and operating module
Order code for "Housing"	Material	Material
Option **A** "Aluminum, coated"	AlSi10Mg, coated	AlSi10Mg, coated

Cable entry

Corresponds to the choice of transmitter housing, order code for "Electrical connection".

Connecting cable

→ 43

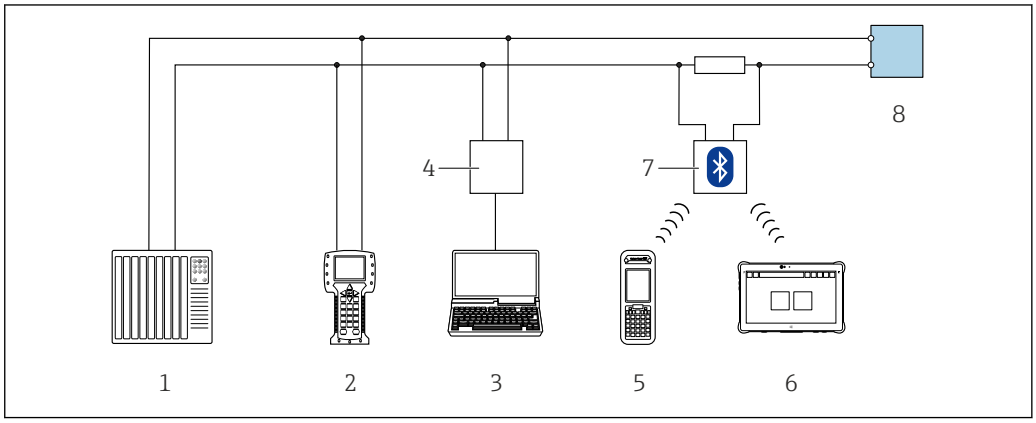
Dimensions

→ 62

Remote operation

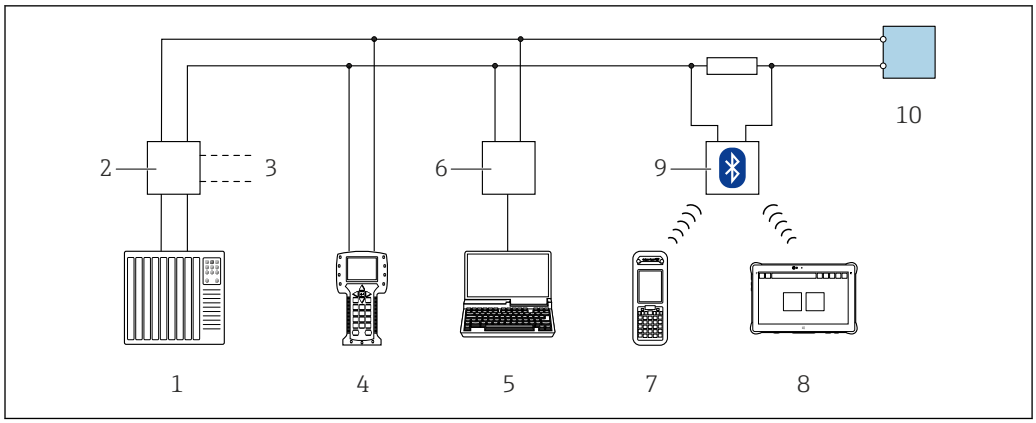
Via HART protocol

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



45 *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*

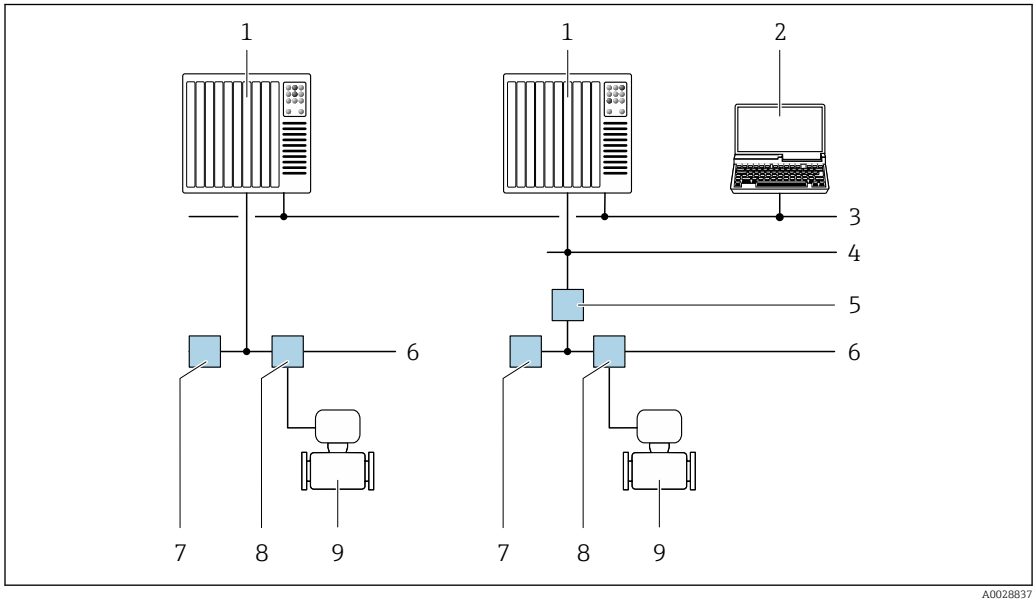


46 *Options for remote operation via HART protocol (passive)*

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 FOUNDATION Fieldbus network

This communication interface is available in device versions with FOUNDATION Fieldbus.

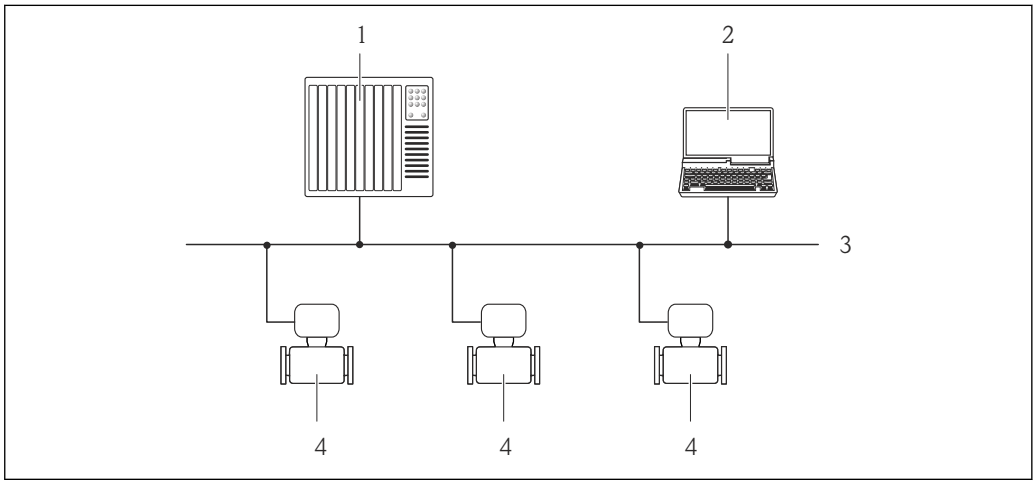


47 *Options for remote operation via FOUNDATION Fieldbus network*

1 *Automation system*
2 *Computer with FOUNDATION Fieldbus network card*
3 *Industry network*
4 *High Speed Ethernet FF-HSE network*
5 *Segment coupler FF-HSE/FF-H1*
6 *FOUNDATION Fieldbus FF-H1 network*
7 *Power supply FF-H1 network*
8 *T-box*
9 *Measuring device*

Via PROFIBUS DP network

This communication interface is available in device versions with PROFIBUS DP.

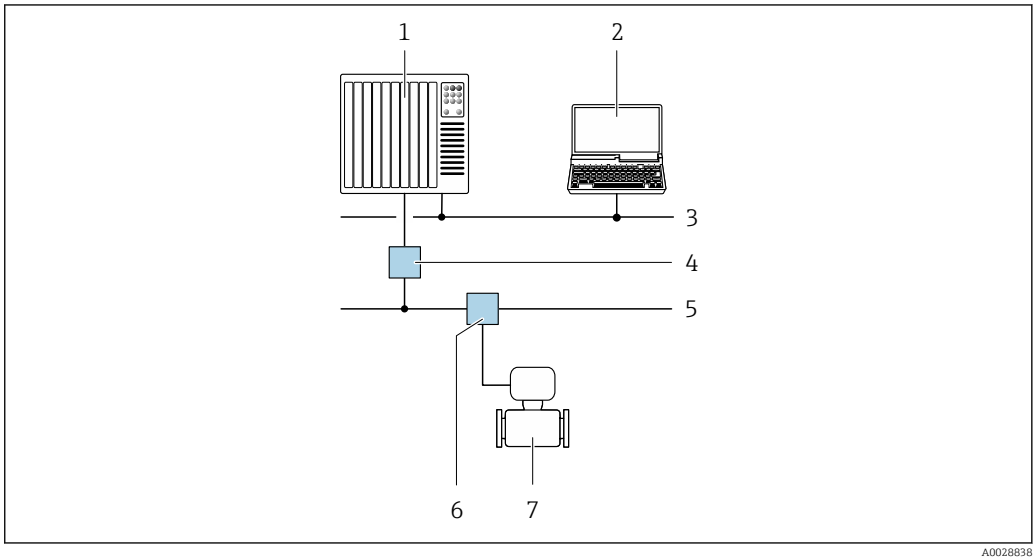


48 *Options for remote operation via PROFIBUS DP network*

1 *Automation system*
2 *Computer with PROFIBUS network card*
3 *PROFIBUS DP network*
4 *Measuring device*

Via PROFIBUS PA network

This communication interface is available in device versions with PROFIBUS PA.

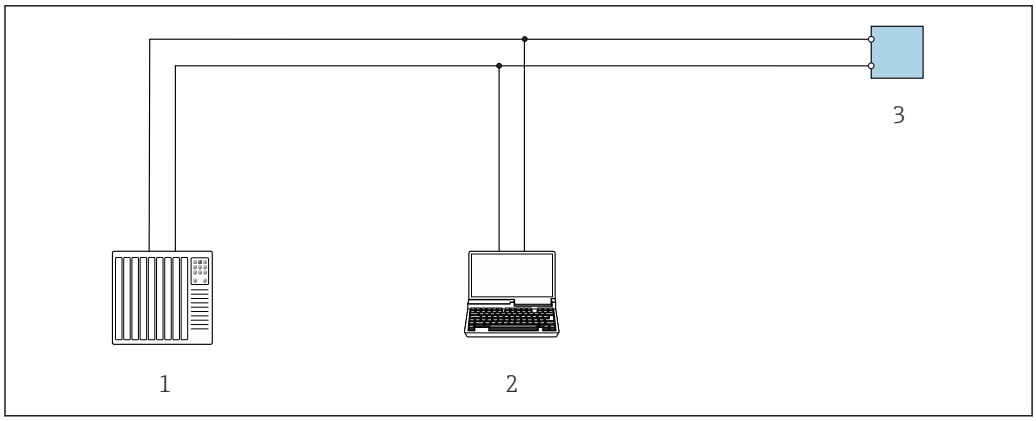


49 *Options for remote operation via PROFIBUS PA network*

1 *Automation system*
2 *Computer with PROFIBUS network card*
3 *PROFIBUS DP network*
4 *Segment coupler PROFIBUS DP/PA*
5 *PROFIBUS PA network*
6 *T-box*
7 *Measuring device*

Via Modbus RS485 protocol

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



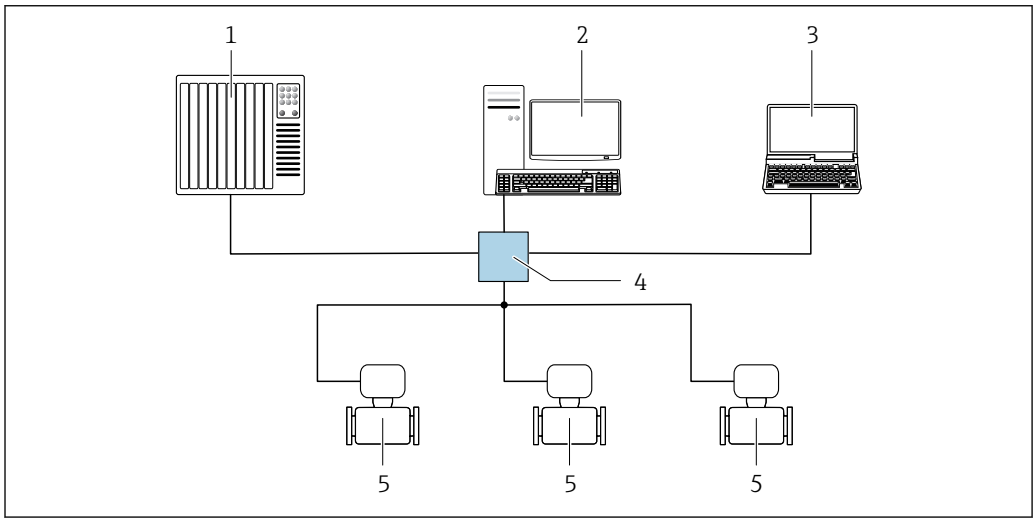
50 *Options for remote operation via Modbus-RS485 protocol (active)*

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*

Via EtherNet/IP network

This communication interface is available in device versions with EtherNet/IP.

Star topology

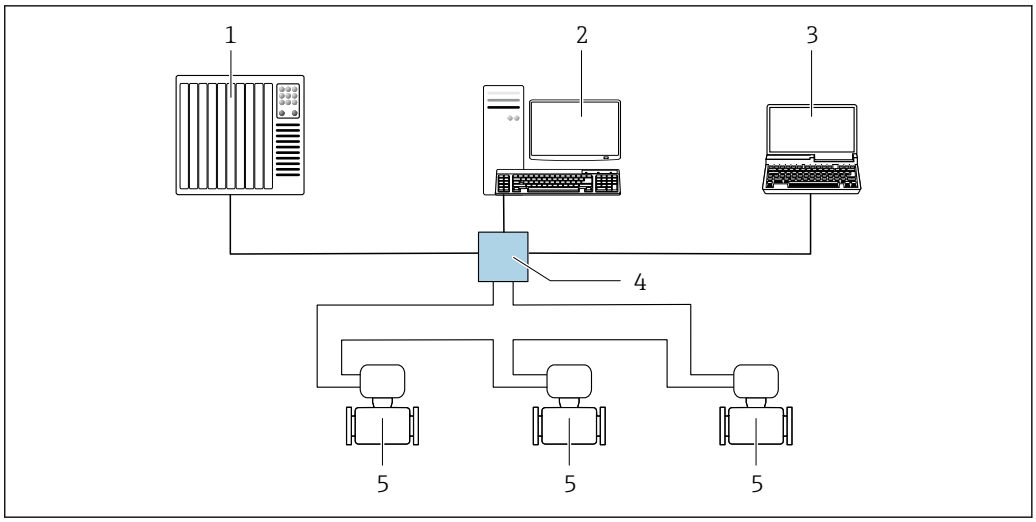


51 *Options for remote operation via EtherNet/IP network: star topology*

1 *Automation system, e.g. "RSLogix" (Rockwell Automation)*
2 *Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)*
3 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare) with COM DTM "CDI Communication TCP/IP"*
4 *Ethernet switch*
5 *Measuring device*

Ring topology

The device is integrated via the terminal connection for signal transmission (output 1) and the service interface (CDI-RJ45).



52 *Options for remote operation via EtherNet/IP network: ring topology*

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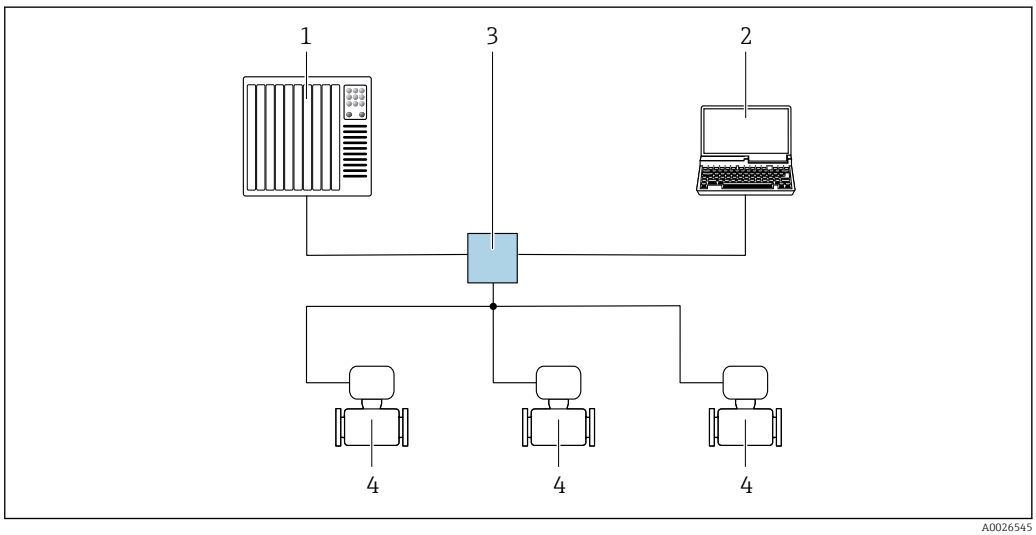
4 *Ethernet switch*
5 *Measuring device*

Via PROFINET network

This communication interface is available in device versions with PROFINET.

Star topology

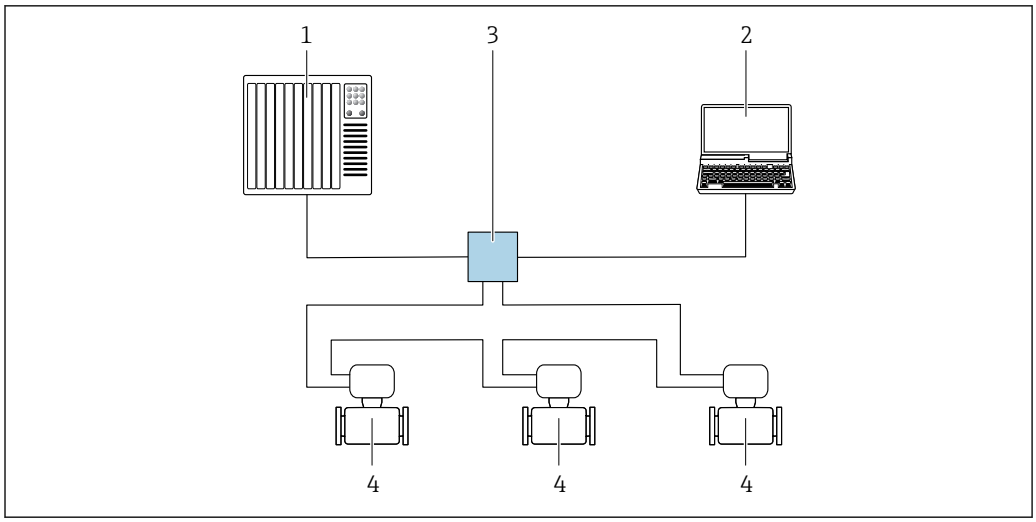


53 *Options for remote operation via PROFINET network: star topology*

1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
3 *Switch, e.g. Scalance X204 (Siemens)*
4 *Measuring device*

Ring topology

This communication interface is available in device versions with PROFINET.



54 *Options for remote operation via PROFINET network: ring topology*

1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device Web server or computer with operating tool (e.g. FieldCare, DeviceCare, SIMATIC PDM) with COM DTM "CDI Communication TCP/IP"*
3 *Switch, e.g. Scalance X204 (Siemens)*
4 *Measuring device*

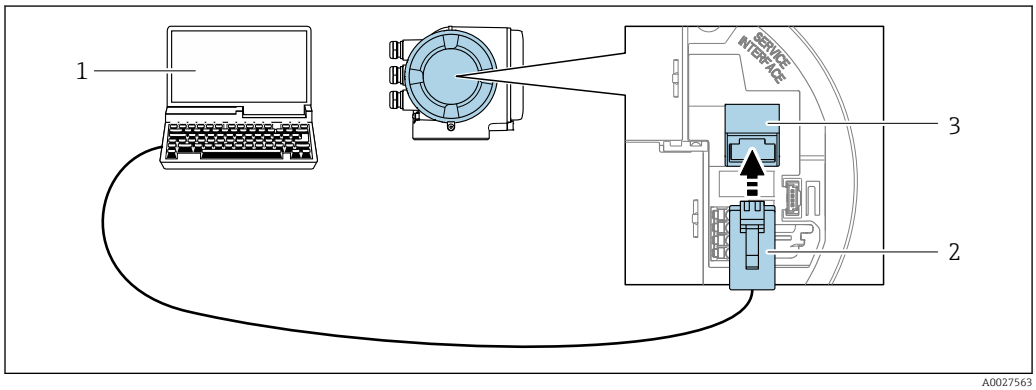
Service interface

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.

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.

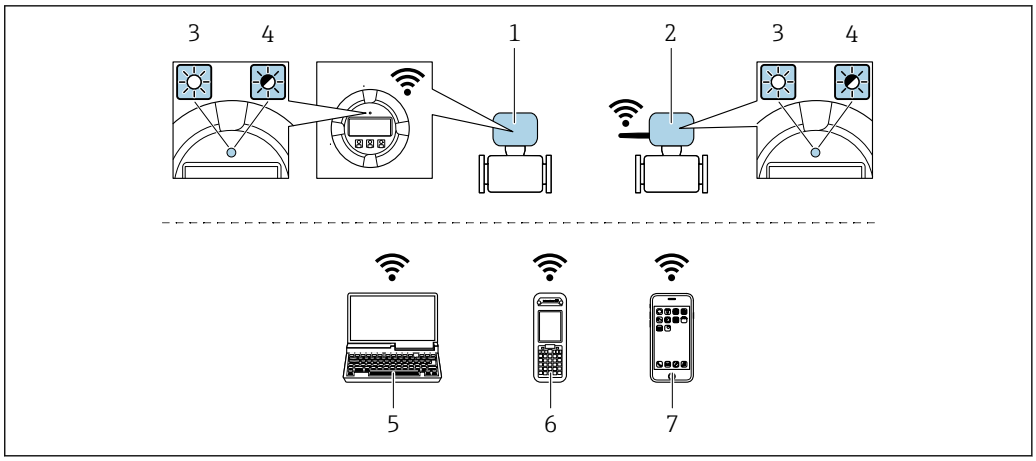


55 *Connection via service interface (CDI-RJ45)*

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, graphic display; touch control + WLAN"



A0034570

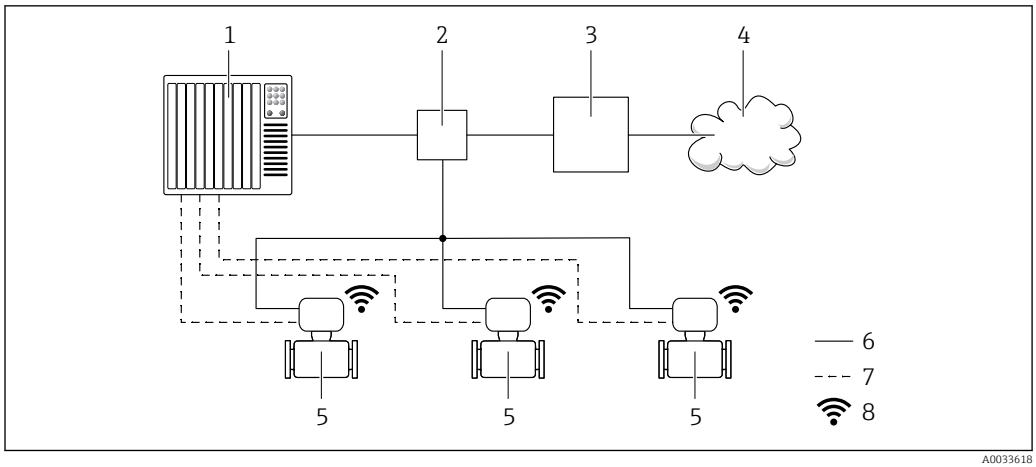
1 *Transmitter with integrated WLAN antenna*
2 *Transmitter with external WLAN antenna*
3 *LED lit constantly: WLAN reception is enabled on measuring device*
4 *LED flashing: WLAN connection established between operating unit and measuring device*
5 *Computer with WLAN interface and Web browser (e.g. 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) ▪ 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	▪ Internal antenna ▪ External antenna (optional) In the event of poor transmission/reception conditions at the place of installation. Available as an accessory → 🖹 89. Only one antenna active in each case!
Max. range	50 m (164 ft)
Materials: External WLAN antenna	▪ 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

Network integration

With the optional OPC-UA-Server application package, the device can be integrated into an Ethernet network via the service interface (CDI-RJ45 and WLAN) and communicate with OPC-UA clients. If the device is used in this way, IT security must be considered.

For permanent access to device data and for device configuration via the Web server, the device is incorporated directly in a network via the service interface (CDI-RJ45). In this way, the device can be accessed any time from the control station. The measured values are processed separately via the inputs and outputs through the automation system.



A0033618

1 *Automation system, e.g. Simatic S7 (Siemens)*
2 *Ethernet switch*
3 *Edge Gateway*
4 *Cloud*
5 *Measuring device*
6 *Ethernet network*
7 *Measured values via inputs and outputs*
8 *Optional WLAN interface*

The optional WLAN interface is available on the following device version:
Order code for "Display; operation", option **G** "4-line, illuminated, graphic display; touch control + WLAN"

Special Documentation for the OPC-UA-Server application package → 93.

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 ▪ Ethernet-based fieldbus (EtherNet/IP, PROFINET)	Special Documentation for device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 91

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol	→ 🖹 91
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus 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) by Rockwell Automation → www.rockwellautomation.com
- Process Device Manager (PDM) by Siemens → www.siemens.com
- Asset Management Solutions (AMS) by Emerson → www.emersonprocess.com
- FieldCommunicator 375/475 by Emerson → www.emersonprocess.com
- Field Device Manager (FDM) by Honeywell → www.honeywellprocess.com
- FieldMate by Yokogawa → www.yokogawa.com
- PACTWare → www.pactware.com

The associated device description files are available at: 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 → 🖹 88)

Web server special documentation → 🖹 93

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:

	Device memory	T-DAT	S-DAT
Available data	▪ Event logbook such as diagnostic events for example ▪ Parameter data record backup ▪ Device firmware package ▪ Driver for system integration for exporting via Web server, e.g: – GSD for PROFIBUS DP – GSD for PROFIBUS PA – GSDML for PROFINET – EDS for EtherNet/IP – DD for FOUNDATION Fieldbus	▪ Measured value logging ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Peakhold indicator (min/max values) ▪ Totalizer values	▪ Sensor data: nominal diameter etc. ▪ Serial number ▪ Calibration data ▪ 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)
- Transmission of the drivers for system integration via Web server, e.g.:
  – GSD for PROFIBUS DP
  – GSD for PROFIBUS PA
  – GSDML for PROFINET
  – EDS for EtherNet/IP
  – DD for FOUNDATION Fieldbus

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.

C-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.

ATEX, IECEx

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

Ex db eb

Category	Type of protection
II2G	Ex db eb ia IIC T6...T1 Gb

Ex tb

Category	Type of protection
II2D	Ex tb IIIC Txxx Db

Ex ec

Category	Type of protection
II3G	Ex ec ic IIC T5...T1 Gc

cCSAus

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

IS (Ex i) and XP (Ex d)
Class I, II, III Division 1 Groups A-G

NI (Ex nA)
Class I Division 2 Groups A - D

Ex de
Class I, Zone 1 AEx/ Ex de ia IIC T6...T1 Gb

Ex nA
Class I, Zone 2 AEx/Ex nA ic IIC T5...T1 Gc

Ex tb
Zone 21 AEx/ Ex tb IIIC T** °C Db

Pharmaceutical compatibility

- FDA
- USP Class VI
- TSE/BSE Certificate of Suitability

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 (multichannel architecture with homogeneous redundancy) and is independently evaluated and certified by the TÜV 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 → 92

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)

FOUNDATION Fieldbus certification

FOUNDATION Fieldbus interface

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

- Certified in accordance with FOUNDATION Fieldbus H1
- Interoperability Test Kit (ITK), revision version 6.2.0 (certificate available on request)
- Physical Layer Conformance Test
- The device can also be operated with certified devices of other manufacturers (interoperability)

Certification PROFIBUS

PROFIBUS interface

The measuring device is certified and registered by the PNO (PROFIBUS User Organization Organization). The measuring system meets all the requirements of the following specifications:

- Certified in accordance with PROFIBUS PA Profile 3.02
- The device can also be operated with certified devices of other manufacturers (interoperability)

EtherNet/IP certification

The measuring device is certified and registered by the ODVA (Open Device Vendor Association). The measuring system meets all the requirements of the following specifications:

- Certified in accordance with the ODVA Conformance Test
- EtherNet/IP Performance Test
- EtherNet/IP PlugFest compliance
- The device can also be operated with certified devices of other manufacturers (interoperability)

Certification PROFINET

PROFINET interface

The measuring device is certified and registered by the PNO (PROFIBUS User Organization Organization). The measuring system meets all the requirements of the following specifications:

- Certified according to:
  - Test specification for PROFINET devices
  - PROFINET Security Level 2 – Netload Class
- The device can also be operated with certified devices of other manufacturers (interoperability)

Radio approval

The measuring device has radio approval.

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

Pressure Equipment Directive

The devices can be ordered with or without a PED approval. If a device with a PED approval is required, this must be explicitly stated in the order. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.

- With the identification PED/G1/x (x = category) on the sensor nameplate, Endress+Hauser confirms conformity with the "Essential Safety Requirements" specified in Appendix I of the Pressure Equipment Directive 2014/68/EU.
- Devices bearing this marking (PED) are suitable for the following types of medium: Media in Group 1 and 2 with a vapor pressure greater than, or smaller and equal to0.5 bar (7.3 psi)
- Devices not bearing this marking (PED) are designed and manufactured according to good engineering practice. They meet the requirements of Article 4 paragraph 3 of the Pressure Equipment Directive 2014/68/EU. The range of application is indicated in tables 6 to 9 in Annex II of the Pressure Equipment Directive 2014/68/EU.

Measuring instrument approval

The measuring device is qualified to OIML R117 and has an OIML Certificate of Conformity (optional).

Additional certification

PWIS-free

PWIS = paint-wetting impairment substances

Order code for "Service":
- Option **HC**: PWIS-free (version A)
- Option **HD**: PWIS-free (version B)
- Option **HE**: PWIS-free (version C)

For more information on PWIS-free certification, see "Test specification" document TS01028D

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
- 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 the following sources:
- 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.

Diagnostics functions

Package	Description
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.

Heartbeat Technology

Package	Description
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 process influences (such as corrosion, abrasion, buildup etc.) have on the measuring performance over time. ▪ Schedule servicing in time. ▪ Monitor the process or product quality, e.g. gas pockets.

Cleaning

Package	Description
Electrode cleaning circuit (ECC)	The electrode cleaning circuit (ECC) function has been developed to have a solution for applications where magnetite (Fe_3O_4) deposits frequently occur (e.g. hot water). Since magnetite is highly conductive this build up leads to measuring errors and ultimately to the loss of signal. The application package is designed to AVOID build up of highly conductive matter and thin layers (typical of magnetite).

OPC-UA server

Package	Description
OPC-UA-Server	The application package provides the user with an integrated OPC-UA server for comprehensive instrument services for IoT and SCADA applications. Special Documentation for the "OPC-UA-Server" application package → 93.

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
Proline 300 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Output ▪ Input ▪ Display/operation ▪ Housing ▪ Software Order code: 5X3BXX Installation Instructions EA01150
Remote display and operating module DKX001	▪ If ordered directly with the measuring device: Order code for "Display; operation", option O "Separate 4-line display, illum.; 10 m (30 ft)Cable; touch control". ▪ If ordered separately: – Measuring device: order code for "Display; operation", option M "None, prepared for separate display". – DKX001: Via the separate product structure DKX001. ▪ If ordered subsequently: DKX001: Via the separate product structure DKX001. **Mounting bracket for DKX001** ▪ Ordered directly with the DKX001: Order code for "Enclosed accessories", option RA "Mounting bracket, 1"/2" pipe". ▪ If ordered subsequently: order number: 71340960 **Connecting cable (replacement cable)** Via the separate product structure: DKX002 Further information on display and operating module DKX001→ 74. Special Documentation SD01763D

External WLAN antenna	External WLAN antenna with 1.5 m (59.1 in) connecting cable and two angle brackets. Order code for "Enclosed accessories", option P8 "Wireless antenna wide area". ▪ The external WLAN antenna is not suitable for use in hygienic applications. ▪ Further information on the WLAN interface → 🖹 80. Order number: 71351317 Installation Instructions EA01238D
Protective cover	Is used to protect the measuring device from the effects of the weather: e.g. rainwater, excess heating from direct sunlight. Order number: 71343505 Installation Instructions EA01160
Ground cable	Set, consisting of two ground cables for potential equalization.

For the sensor

Accessories	Description
Ground disks	Are used to ground the medium in lined measuring tubes to ensure proper measurement. For details, see Installation Instructions EA00070D

Communication-specific accessories

Accessories	Description
Commubox FXA195 HART	For intrinsically safe HART communication with FieldCare via the USB interface. Technical Information TI00404F
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
Fieldgate FXA320	Gateway for the remote monitoring of connected 4-20 mA measuring devices via a Web browser. Technical Information TI00025S Operating Instructions BA00053S
Fieldgate FXA520	Gateway for the remote diagnostics and remote configuration of connected HART measuring devices via a Web browser. Technical Information TI00025S Operating Instructions BA00051S
Field Xpert SFX350	Field Xpert SFX350 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices and can be used in non-hazardous areas. Operating Instructions BA01202S

Field Xpert SFX370	Field Xpert SFX370 is a mobile computer for commissioning and maintenance. It enables efficient device configuration and diagnostics for HART and FOUNDATION Fieldbus devices and can be used in the non-hazardous area and in the hazardous area. Operating Instructions BA01202S
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

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.
W@M	W@M Life Cycle Management 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. 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. Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement
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

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

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 Promag P	KA01290D

Brief Operating Instructions for transmitter

Measuring device	Documentation code						
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485	EtherNet/IP	PROFINET
Proline 300	KA01308D	KA01294D	KA01227D	KA01385D	KA01310D	KA01338D	KA01340D

Operating Instructions

Measuring device	Documentation code						
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485	EtherNet/IP	PROFINET
Promag P 300	BA01393D	BA01478D	BA01397D	BA01853D	BA01395D	BA01717D	BA01719D

Description of Device Parameters

Measuring device	Documentation code						
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485	EtherNet/IP	PROFINET
Promag 300	GP01051D	GP01098D	GP01052D	GP01135D	GP01053D	GP01113D	GP01112D

Device-dependent additional documentation

Safety instructions

Safety instructions for electrical equipment for hazardous areas.

Contents	Documentation code
ATEX/IECEx Ex d/Ex de	XA01414D
ATEX/IECEx Ex ec	XA01514D
cCSAus XP	XA01515D
cCSAus Ex d/ Ex de	XA01516D
cCSAus Ex nA	XA01517D
INMETRO Ex d/Ex de	XA01518D
INMETRO Ex ec	XA01519D
NEPSI Ex d/Ex de	XA01520D
NEPSI Ex nA	XA01521D

Remote display and operating module DKX001

Contents	Documentation code
ATEX/IECEx Ex i	XA01494D
ATEX/IECEx Ex ec	XA01498D
cCSAus IS	XA01499D
cCSAus Ex nA	XA01513D
INMETRO Ex i	XA01500D
INMETRO Ex ec	XA01501D
NEPSI Ex i	XA01502D
NEPSI Ex nA	XA01503D

Special Documentation

Contents	Documentation code
Information on the Pressure Equipment Directive	SD01614D
Functional Safety Manual	SD01740D
Radio approvals for WLAN interface for A309/A310 display module	SD01793D
Remote display and operating module DKX001	SD01763D
OPC-UA Server [1)]	SD02043D

1) This Special Documentation is only available for device versions with a HART output.

Contents	Documentation code						
	HART	FOUNDATION Fieldbus	PROFIBUS PA	PROFIBUS DP	Modbus RS485	PROFINET	EtherNet/IP
Heartbeat Technology	SD01640D	SD01742D	SD01744D	SD02206D	SD01743D	SD01986D	SD01980D
Web server	SD01654D	SD01657D	SD01656D	SD02235D	SD01655D	SD01977D	SD01976D

Installation Instructions

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

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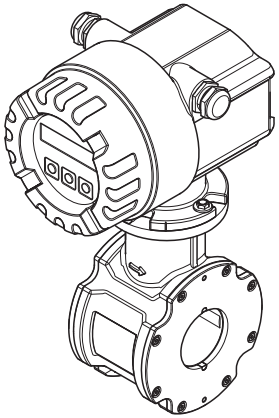
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Brief Operating Instructions

Proline Promag 10D

Electromagnetic flow measuring system

HART



These Brief Operating Instructions are **not** intended to replace the Operating Instructions provided in the scope of supply.
Detailed information is provided in the Operating Instructions and the additional documentation on the CD-ROM supplied.

The complete device documentation consists of:
- These Brief Operating Instructions
- Depending on the device version:
  - Operating Instructions and the Description of Device Functions
  - Approvals and safety certificates
  - Special safety instructions in accordance with the approvals for the device (e.g. explosion protection, pressure equipment directive etc.)
  - Additional device-specific information

KA00036D/06/EN/13.15
71299364

Endress+Hauser

Table of contents

1 Safety instructions

1.1 Designated use

- The measuring device is to be used only for measuring the flow of conductive liquids in closed pipes. Most liquids can be measured as of a minimum conductivity of 50 µS/cm.
- Any use other than that described here compromises the safety of persons and the entire measuring system and is, therefore, not permitted.
- The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

- The measuring device must only be installed, connected, commissioned and maintained by qualified and authorized specialists (e.g. electrical technicians) in full compliance with the instructions in these Brief Operating Instructions, the applicable norms, legal regulations and certificates (depending on the application).
- The specialists must have read and understood these Brief Operating Instructions and must follow the instructions they contain. If you are unclear on anything in these Brief Operating Instructions, you must read the Operating Instructions (on the CD-ROM). The Operating Instructions provide detailed information on the measuring device.
- The measuring device should only be installed in the pipe in a de-energized state free from outside loads or strain.
- The measuring device may only be modified if such work is expressly permitted in the Operating Instructions (on the CD-ROM).
- Repairs may only be performed if a genuine spare parts kit is available and this repair work is expressly permitted.
- If performing welding work on the piping, the welding unit may not be grounded by means of the measuring device.

1.3 Operational safety

- The measuring device is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. Relevant regulations and European standards have been observed.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.
- The information on the warning notices, nameplates and connection diagrams affixed to the device must be observed. These contain important data on the permitted operating conditions, the range of application of the device and information on the materials used.
- If the device is not used at atmospheric temperatures, compliance with the relevant marginal conditions as specified in the device documentation supplied (on CD-ROM) is mandatory.
- All parts of the device must be included in the potential equalization of the system.

- Cables, certified cable glands and certified dummy plugs must be suitable to withstand the prevailing operating conditions, such as the temperature range of the process. Housing apertures that are not used must be sealed with dummy plugs.
- The device should only be used for fluids to which all the wetted parts of the device are sufficiently resistant. With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of wetted materials.
  However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance.
  For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application. The user is responsible for the choice of suitable wetted materials in the process.
- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- Hazardous areas:
  Measuring devices for use in hazardous areas are labeled accordingly on the nameplate. Relevant national regulations must be observed when operating the device in hazardous areas.
- Hygienic applications:
  Measuring devices for hygienic applications have their own special labeling. Relevant national regulations must be observed when using these devices.
- Pressure devices:
  Measuring devices for use in systems that need to be monitored are labeled accordingly on the nameplate. Relevant national regulations must be observed when using these devices. The documentation on the CD-ROM for pressure devices in systems that need to be monitored is an integral part of the entire device documentation. The installation regulations, connection data and safety instructions provided in the Ex documentation must be observed.
- Endress+Hauser will be happy to assist in clarifying any questions on approvals, their application and implementation.

1.4 Safety conventions

⚠ Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

☝ Caution!
“Caution” indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

✎ Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

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2 Installation

2.1 Installation conditions

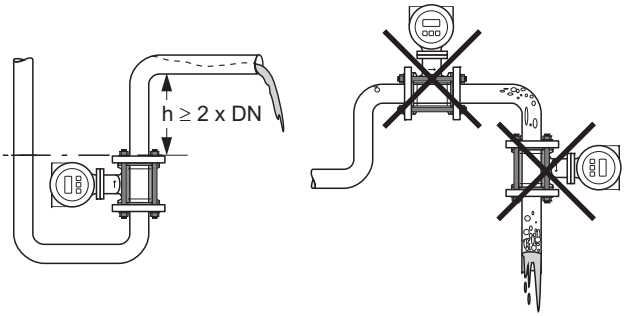
2.1.1 Dimensions

For the dimensions of the measuring device, → see the associated Technical Information on the CD-ROM.

Mounting location

The sensor should preferably be installed in an ascending pipe. Ensure the sensor is an adequate distance (≥ 2 x DN) away from the next pipe bend.

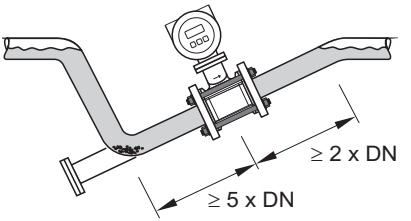
✎ Note!
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors. For this reason, the following mounting locations should be **avoided**:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline. Risk of pipe not filling correctly!



a0010747

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.



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Installation in a partially filled pipe

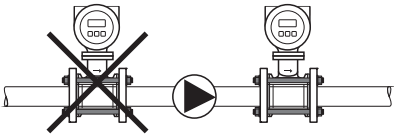
Installation with pumps

The sensor should only be installed on the pump pressure side.

Note!

- The sensor should **never** be installed on the pump suction side in order to avoid the risk of low pressure, and thus damage to the measuring tube.
- Pulsation dampers may be needed if the sensor is installed downstream from piston pumps, piston diaphragm pumps or hose pumps.

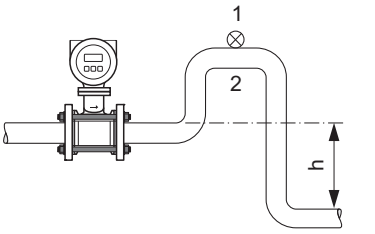
For information on the measuring tube's pressure tightness and the device's resistance to vibration and shock → see the related Technical Information on the CD-ROM.



a0010748

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes longer than 5 meters (16 ft). This precaution is to avoid low pressure and the consequent risk of damage to the measuring tube. This measure also prevents the system losing prime, which could cause air pockets. For information on the measuring tube's pressure tightness → see the related Technical Information on the CD-ROM.



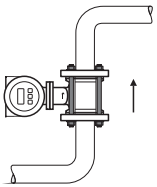
a0010750

Measures for installation in a down pipe (h > 5 m/16 ft)

1. Vent valve
2. Siphon

Orientation

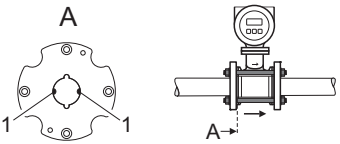
Vertical orientation



a0010709

Measures for installation in a down pipe (h > 5 m/16 ft)
Vertical orientation is generally preferred. Vertical orientation helps avoid gas and air accumulations and deposits in the measuring tube.

Horizontal orientation



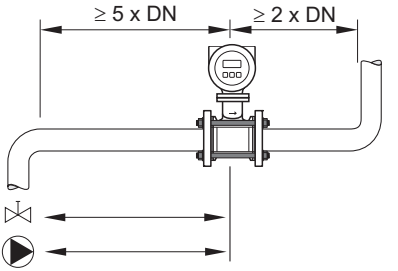
a0010710

The measuring electrode axis should be horizontal in the case of horizontal orientations. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.
1 = Measuring electrodes for signal detection

Inlet and outlet run

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc.

The following inlet and outlet runs must be observed in order to meet accuracy specifications:
- Inlet run ≥ 5 × DN
- Outlet run ≥ 2 × DN



a0010751

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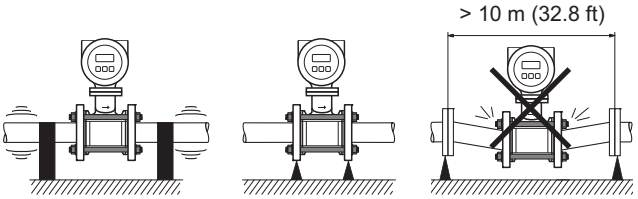
روبروی پالایشگاه نفت پارس، پلاک ۱۲

2.1.2 Vibrations

Secure the piping and the sensor if vibration is severe.

☝.Caution!
If vibrations are too severe (>2 g/2 h per day; 10 to 100 Hz), we recommend the sensor and transmitter be mounted separately. For information on the permitted shock and vibration resistance → see the Technical Information on the CD-ROM.



a0010752-ae

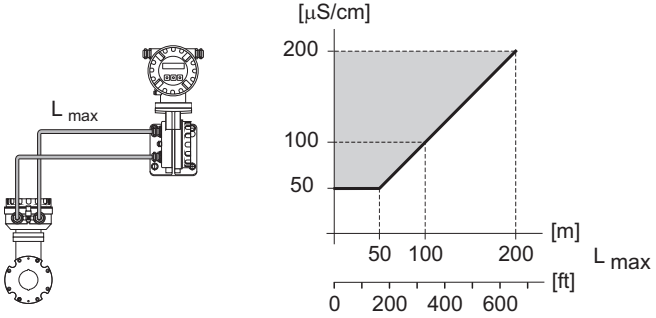
2.1.3 Length of connecting cable

Note the following when mounting the remote version:

- Fix cable run or lay in armored conduit.

  ✎. Note!
  Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.

- Route the cable well clear of electrical machines and switching elements.
- If necessary, establish potential equalization between the sensor and transmitter.
- The permitted length of the connection cable L_{max} (area shaded gray in the graphic) depends on the conductivity of the fluid. A minimum conductivity of 50 µS/cm is needed for all fluids.



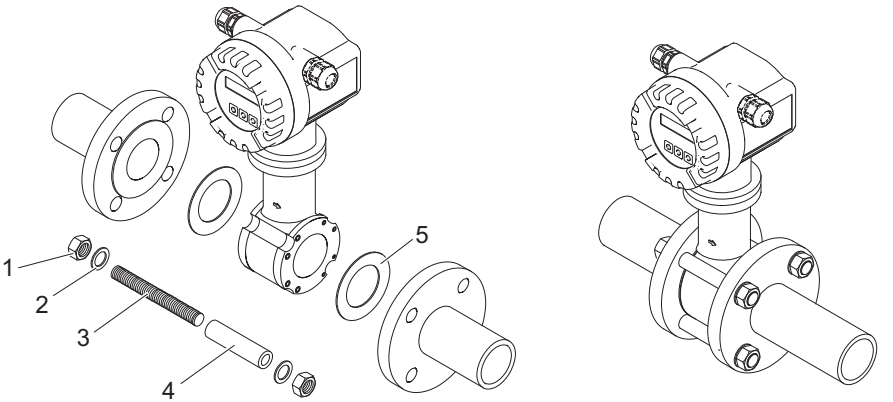
a0010754-ae

2.2 Installing the sensor

2.2.1 Mounting kit

The sensor is installed between the pipe flanges with a mounting kit. The device is centered using recesses on the sensor.

Note!
A mounting kit consisting of nuts (1), washers (2), mounting bolts (3) and seals (5) can be ordered separately. Centering sleeves (4) are provided with the device if they are required for the installation.



a0010714

Seals

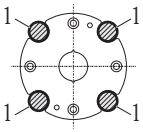
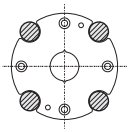
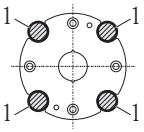
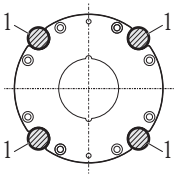
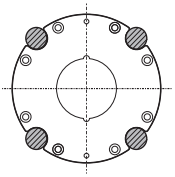
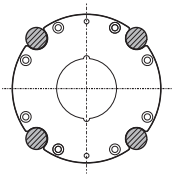
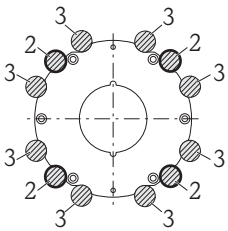
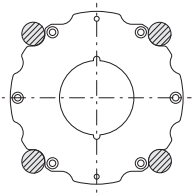
When installing the sensor, make sure that the seals used do not project into the pipe cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

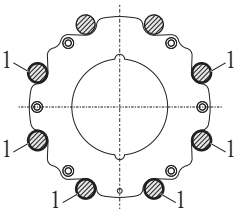
Note!
Use seals with a hardness rating of 70° Shore.

Arrangement of the mounting bolts and centering sleeves

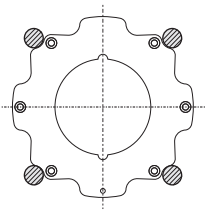
The device is centered using recesses on the sensor. The arrangement of the mounting bolts and the use of the centering sleeves supplied depend on the nominal diameter and pressure rating of the device.

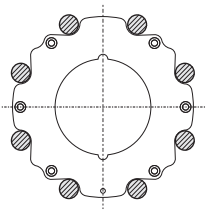
	Pressure rating		
	EN (DIN)	ANSI	JIS
DN 25 to 40 (1" to 1 ½")	 A0010896	 A0010824	 A0010896
DN 50 (2")	 A0010897	 A0010825	 A0010825
DN 65	 A0012170	—	 A0012171

DN 80 (3")

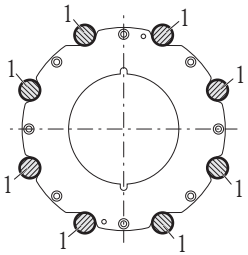


A0010898

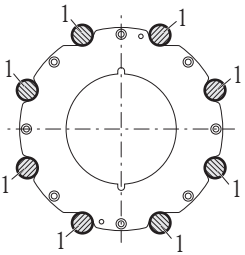

A0010827


A0010826

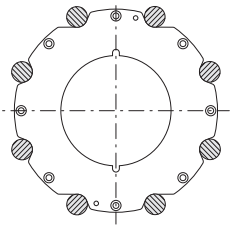
DN 100 (4")



A0012168



A0012168


A0012169

1 = Mounting bolts with centering sleeves
2 = EN (DIN) flanges: 4-hole → with centering sleeves
3 = EN (DIN) flanges: 8-hole → without centering sleeves

Tightening torques

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

The tightening torques apply to situations where an EPDM soft material flat seal (e.g. 70 Shore) is used.

Tightening torques, mounting bolts and centering sleeves for EN (DIN) PN 16

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque [Nm] with a process flange with a	
			smooth seal face	raised face
25	4 × M12 × 145	54	19	19
40	4 × M16 × 170	68	33	33
50	4 × M16 × 185	82	41	41
65[1)]	4 × M16 × 200	92	44	44

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque [Nm] with a process flange with a	
			smooth seal face	raised face
65[2)]	8 × M16 × 200	– [3)]	29	29
80	8 × M16 × 225	116	36	36
100	8 × M16 × 260	147	40	40

[1)] EN (DIN) flanges: 4-hole → with centering sleeves
[2)] EN (DIN) flanges: 8-hole → without centering sleeves
[3)] A centering sleeve is not required. The device is centered directly via the sensor housing.

Tightening torques, mounting bolts and centering sleeves for JIS 10 K

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque [Nm] with a process flange with a	
			smooth seal face	raised face
25	4 × M16 × 170	54	24	24
40	4 × M16 × 170	68	32	25
50	4 × M16 × 185	– *	38	30
65	4 × M16 × 200	– *	42	42
80	8 × M16 × 225	– *	36	28
100	8 × M16 × 260	– *	39	37

* A centering sleeve is not required. The device is centered directly via the sensor housing.

Tightening torques, mounting bolts and centering sleeves for ANSI Class 150

Nominal diameter [inch]	Mounting bolts [inch]	Centering sleeve length [inch]	Tightening torque [lbf · ft] with a process flange with a	
			smooth seal face	raised face
1"	4 × UNC 1/2" × 5.70"	– *	14	7
1 ½"	4 × UNC 1/2" × 6.50"	– *	21	14
2"	4 × UNC 5/8" × 7.50"	– *	30	27
3"	4 × UNC 5/8" × 9.25"	– *	31	31
4"	8 × UNC 5/8" × 10,4"	5,79	28	28

* A centering sleeve is not required. The device is centered directly via the sensor housing.

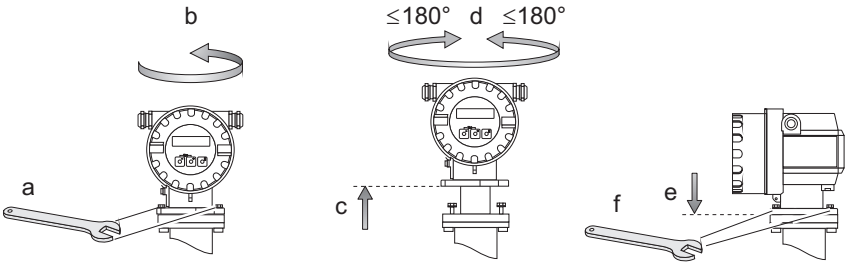
2.3 Installing the transmitter housing

2.3.1 Turning the transmitter housing

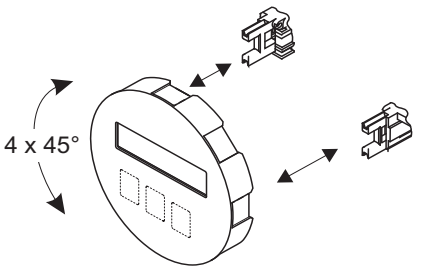
Turning the aluminum field housing

Caution!

- Raising the transmitter housing (Step c):
  Raise the transmitter housing max. 10 mm (0.39 inch) above the securing screws
- Turning the transmitter housing (Step d):
  Turn the transmitter housing max. 180° clockwise or counterclockwise



2.3.2 Turning the onsite display



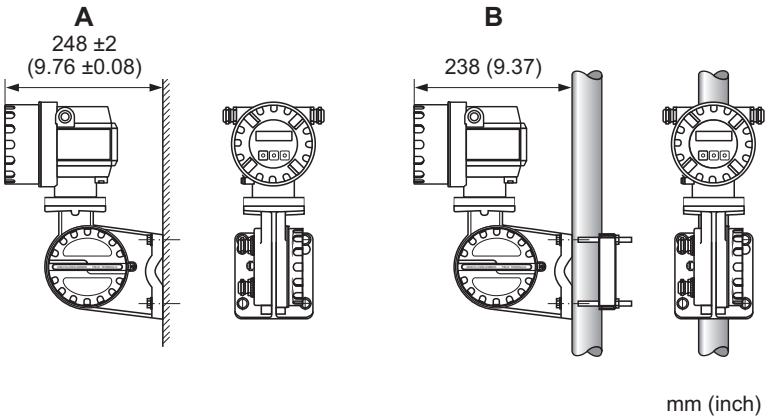
a. Unscrew cover of the electronics compartment from the transmitter housing.
b. Remove the display module from the transmitter retaining rails.
c. Turn the display to the desired position (max. 4 x 45° in each direction).
d. Fit the display back onto the retaining rails.
e. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

2.3.3 Mounting the transmitter (remote version)

Caution!

- The ambient temperature range –20 to +60°C (–4 to +140°F) may not be exceeded at the mounting location. Avoid direct sunlight.
- If the device is mounted to a warm pipe, make sure that the housing temperature does not exceed +60 °C (+140 °F), which is the maximum permissible temperature.

The transmitter can be mounted directly on a wall (A) or a pipe (B).



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2.4 Post-installation check

- Is the measuring device damaged (visual inspection)?
- Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, minimum fluid conductivity, measuring range, etc.?
- Does the arrow on the sensor nameplate match the actual direction of flow through the pipe?
- Is the position of the measuring electrode plane correct?
- Is the position of the empty pipe detection electrode correct?
- Were all screws tightened to the specified torques when the sensor was installed?
- Were the correct seals used (type, material, installation)?
- Are the measuring point number and labeling correct (visual inspection)?
- Were the inlet and outlet runs respected?
- Is the measuring device protected against moisture and direct sunlight?
- Is the sensor adequately protected against vibration (attachment, support)? Acceleration up to 2 g by analogy with IEC 600 68-2-8

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3 Wiring

⚠ Warning!
Risk of electric shock! Components carry dangerous voltages.
- Never mount or wire the measuring device while it is connected to the power supply.
- Before connecting the power supply, check the safety equipment.
- Route the power supply and signal cables so they are securely seated.
- Seal the cable entries and covers tight.

☝ Caution!
Risk of damaging the electronic components!
- Connect the power supply in accordance with the connection data on the nameplate.
- Connect the signal cable in accordance with the connection data in the Operating Instructions.

In addition, for the remote version:

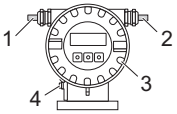
☝ Caution!
Risk of damaging the electronic components!
- Only connect sensors and transmitters with the same serial number.
- Observe the cable specifications of the connecting cable → Operating Instructions on the CD-ROM.

✎ Note!
Install the connecting cable securely to prevent movement.

3.1 Connecting the various housing types

Wire the unit using the terminal assignment diagram inside the cover.

3.1.1 Compact version



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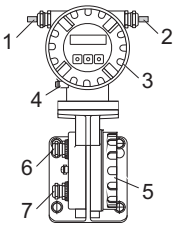
Transmitter connection:

1 Signal cable
2 Power supply cable
3 Electronics compartment cover (connection diagram on the cover of the connection compartment)
4 Ground terminal for potential equalization

3.1.2 Remote version (transmitter)



A0010757

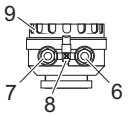
Transmitter connection:

1 Signal cable
2 Power supply cable
3 Electronics compartment cover (connection diagram on the cover of the connection compartment)
4 Ground terminal for potential equalization

Connecting the connecting cable (∅ it 19):

5 Connection compartment cover (connection diagram on the inside)
6 Coil current cable
7 Signal cable

3.1.3 Remote version (sensor)



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Transmitter connection:

9 Connection compartment cover (connection diagram on the inside)

Connecting the connecting cable (∅ it 19):

6 Coil current cable
7 Signal cable
8 Ground terminal for potential equalization

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3.2 Connecting the remote version connecting cable

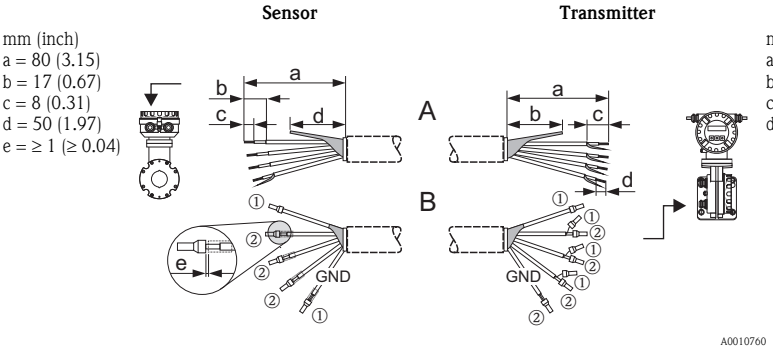
3.2.1 Connecting cable

Connecting cable termination

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Fit the fine-wire cores with cable end ferrules (Detail B).

Signal cable termination

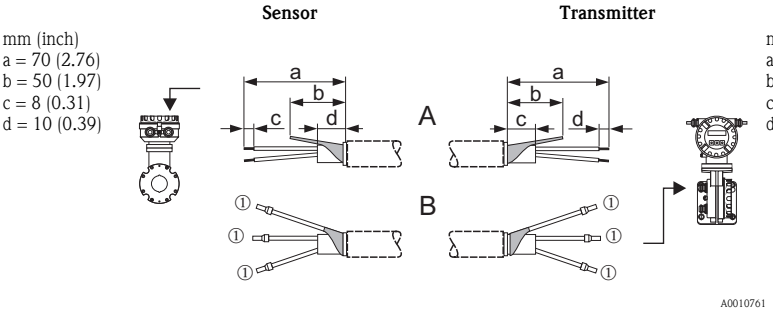
Make sure that the cable end ferrules do not touch the wire shields on the sensor side! Minimum distance = 1 mm (0.04"), exception "GND" = green cable.



① = Cable end ferrules, red, ∅ 1.0 mm (0.04"); ② = Cable end ferrules, white, ∅ 0.5 mm (0.02")

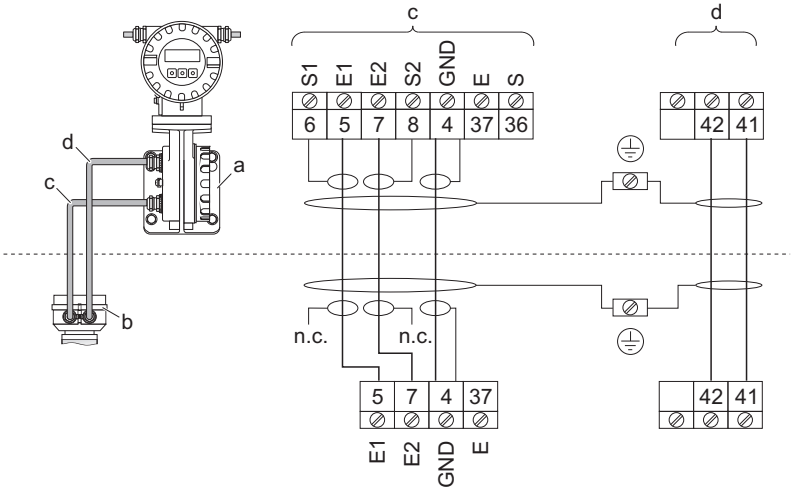
Coil current cable termination

Insulate one core of the three-core cable at the level of the core reinforcement; you only require two cores for the connection.



① = Cable end ferrules, red, ∅ 1.0 mm (0.04"); ② = Cable end ferrules, white, ∅ 0.5 mm (0.02")

3.2.2 Connecting cable connection



a Wall-mount housing connection compartment
b Sensor connection housing
c Signal cable
d Coil current cable

n.c. = not connected, isolated cable shields

Cable colors/numbers for terminals:
5/6 = brown
7/8 = white
4 = green

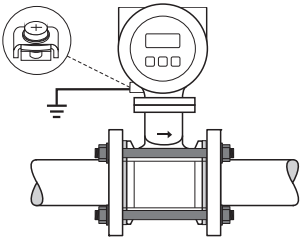
3.3 Potential equalization

Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the two ground disks of the sensor.

The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes, cathodic protection etc.

Standard situation
Potential equalization takes place via the ground terminal of the transmitter when using the device in the following pipes:
- Metal, grounded pipe
- Plastic pipe
- Pipe with insulating lining

✎ Note!
When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.



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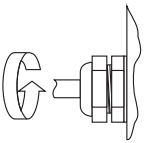
✎ Note!
Potential equalization for other areas of application → Operating Instructions on the CD-ROM.

3.4 Degree of protection

The devices meet all the requirements for IP 67.

After mounting in the field or service work, the following points have to be observed to ensure that IP 67 protection is retained:

- Install the measuring device in such a way that the cable entries do not point upwards.
- Do not remove the seal from the cable entry.
- Remove all unused cable entries and plug them with suitable/certified drain plugs.
- Use cable entries and drain plugs with a long-term operating temperature range in accordance with the temperature specified on the nameplate.



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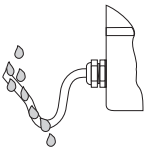
Tighten the cable entries correctly.



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The cables must loop down before they enter the cable entries ("water trap").

3.5 Post-connection check

- Are cables or the device damaged (visual inspection)?
- Does the supply voltage match the information on the nameplate?
- Do the cables used comply with the necessary specifications?
- Do the mounted cables have adequate strain relief and are they routed securely?
- Is the cable type route completely isolated? Without loops and crossovers?
- Are all screw terminals firmly tightened?
- Have all the measures for grounding and potential equalization been correctly implemented?
- Are all cable entries installed, firmly tightened and correctly sealed?
- Cable routed as a “water trap” in loops?
- Are all the housing covers installed and securely tightened?

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4 Commissioning

4.1 Switching on the measuring device

On completion of the installation (successful post-installation check), wiring (successful post-connection check) and after making the necessary hardware settings, where applicable, the permitted power supply (see nameplate) can be switched on for the measuring device.

When the power supply is switched on, the measuring device performs a number of power-up checks and device self-checks. As this procedure progresses the following messages can appear on the onsite display:

Display examples:

PROMAG 10 **V XX.XX.XX**	Startup message

The measuring device starts operating as soon as the startup procedure is complete. Various measured values and/or status variables appear on the display.

✎ Note!
If an error occurs during startup, this is indicated by an error message.

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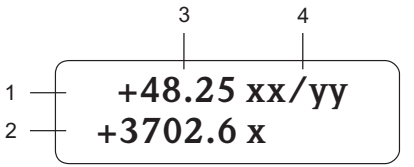
4.2 Operation

4.2.1 Display elements

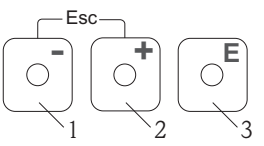


A0007557

Display lines/fields

1. Main line for primary measured values
2. Additional line for additional measured variables/status variables
3. Current measured values
4. Engineering units/time units

4.2.2 Operating elements



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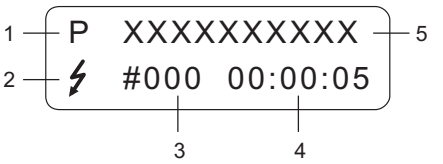
Operating keys

1. (–) Minus key for entering, selecting
2. (+) Plus key for entering, selecting
3. Enter key for calling the function matrix, saving

When the +/– keys are pressed simultaneously (Esc):

- Exit the function matrix step-by-step:
- > 3 sec. = cancel data input and return to the measured value display

4.2.3 Displaying error messages



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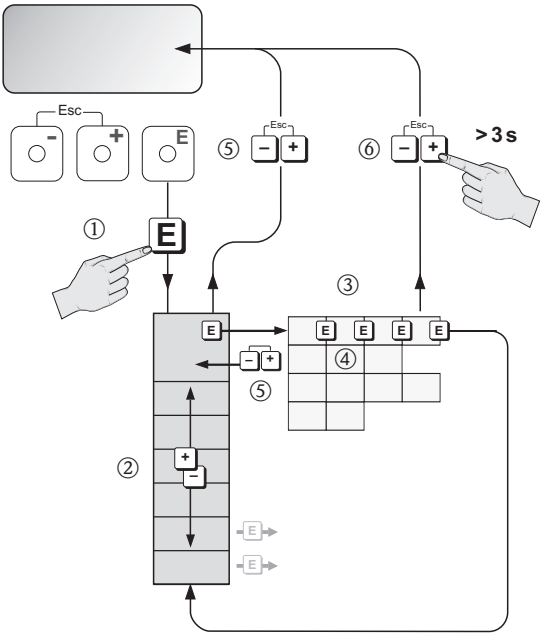
1. Type of error:
   P = Process error, S = System error
2. Error message type:
   ϟ = Fault message, ! = Notice message
3. Error number
4. Duration of the last error that occurred:
   Hours: Minutes: Seconds
5. Error designation
   List of all error messages, see associated Operating Instructions on the CD-ROM

4.3 Navigating within the function matrix



1. E → Enter the function matrix (starting with measured value display)
2. ↕ → Select the group (e.g. OPERATION)
   E → Confirm selection
3. ↕ → Select function (e.g. LANGUAGE)
4. ↕ → Enter code **10** (only for the first time you access the function matrix)
   E → Confirm entry

   ↕ → Change function/selection (e.g. ENGLISH)
   E → Confirm selection
5. ↕ → Return to measured value display step by step
6. ↕ > 3 s → Return immediately to measured value display

4.4 Device functions to be configured during commissioning

Check the values and settings of the device functions **not** marked gray in the following function matrix (UNIT VOL. FLOW, UNIT VOLUME, LANGUAGE, CURRENT RANGE etc.) and adapt them to your application.

A complete description of all the device functions is provided in the Operating Instructions on the CD-ROM.

Group	Device functions					
SYSTEM UNITS	UNIT VOL. FLOW	UNIT VOLUME	FORMAT DATE/TIME			
OPERATION	LANGUAGE	ACCESS CODE	DEFINE PRIVATE CODE			
USER INTERFACE	FORMAT	CONTRAST LCD	TEST DISPLAY			
TOTALIZER	SUM	OVERFLOW	RESET TOTALIZER			
CURRENT OUTPUT	CURRENT RANGE	VALUE 20 mA	TIME CONSTANT			
PULSE/ STATUS OUTP.	OPERATING MODE	PULSE VALUE	PULSE WIDTH	OUTPUT SIGNAL		
		ASSIGN STATUS	SWITCH-ON POINT	SWITCH-OFF POINT		
COMMUNICATION	TAG NAME	TAG DESCR.	BUS ADDRESS	HART WRITE PROTECT.	MANUFACTURER ID	DEVICE ID
PROCESS PARAM.	LOW FLOW CUT OFF	EPD	EPD ADJ.			
SYSTEM PARAM.	INSTALL. DIRECTION	MEASURING MODE	POS. ZERO RET.	SYSTEM DAMP.		
SENSOR DATA	CALIBRAT. DATE	K-FACTOR	ZERO POINT	NOMINAL DIAMETER	MEASURING PERIOD	EPD ELECTRODE
SUPERVISION	FAILSAFE MODE	ALARM DELAY	SYSTEM RESET	SELF CHECKING		
SIMULAT. SYSTEM	SIM. FAILSAFE	SIM. MEASURAND	VALUE SIM. MEASURAND			
SENSOR VERSION	SERIAL NUMBER	SENSOR TYPE				
AMPLIFIER VERS.	SW REV.					

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4.5 Troubleshooting

A complete description of all the error messages is provided in the Operating Instructions on the CD-ROM.

✎ Note!
The output signals (e.g. pulse, frequency) of the measuring device must correspond to the higher-order controller.

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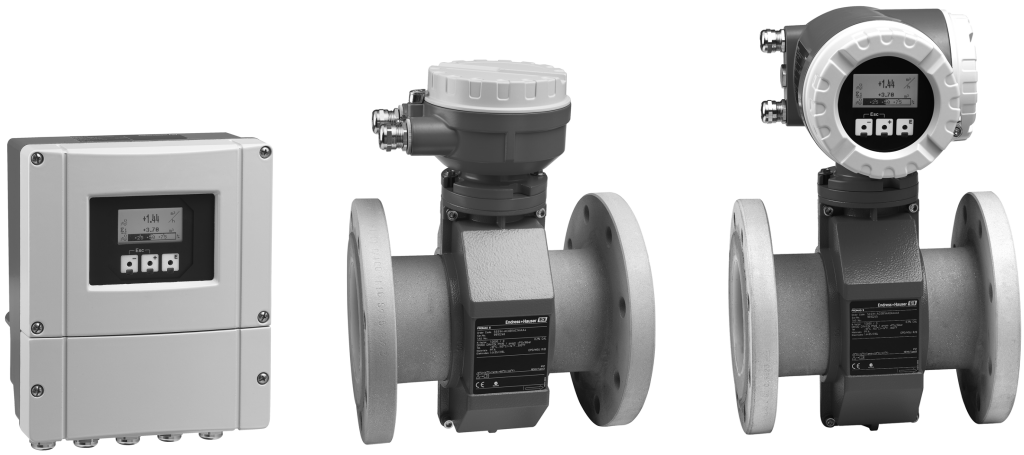
Technical Information

Proline Promag 55S

Electromagnetic Flow Measuring System
Flow rate measurement of liquids with solids content or inhomogeneous liquids



Application
Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 5 µS/cm – in particular fluids with solids, and fluids which are abrasive, inhomogeneous or tend to build-up, for example:

- Chemical/mechanical pulps, paper pulp or wood pulp with solids contents up to 15 Vol.-%
- Fruit mashes, fruit concentrates and final products (salad dressings, soups with vegetable pieces)
- Slurries containing high amounts of sand or stone with an abrasive effect, e.g. ore slurry or mortar
- Chemically inhomogeneous fluids (e.g. additives)
- Thick wastewater sludges

- Flow measurement up to 9600 m^3/h (42267 gal/min)
- Can be used up to +180 °C (+356 °F) and max. 40 bar (580 psi)
- Fitting lengths as per DVGW/ISO

Application-specific linings and electrodes:
- Natural rubber, hard rubber, polyurethane, PTFE or PFA linings
- Flat, bullet nose, neck, bow or brush electrodes

Approvals for hazardous area:
- ATEX, FM, CSA

Connection to process control system:
- HART, PROFIBUS PA, FOUNDATION Fieldbus

Your benefits
Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The **Proline transmitter concept** comprises of:
- High degree of efficiency due to the modular device and operating concept
- Software options for: electrode cleaning, advanced diagnostics, calculation of mass flow and solids content

The robust **Promag S sensors** offer:
- Universal devices, even for difficult fluids
- Excellent accuracy and repeatability
- High resistance to abrasion thanks to industry-optimized linings and measuring electrodes
- Optimum operational safety due to advanced, permanent self-diagnosis
- Simple installation and commissioning
- Insensitive to vibration
- No pressure loss

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Endress+Hauser
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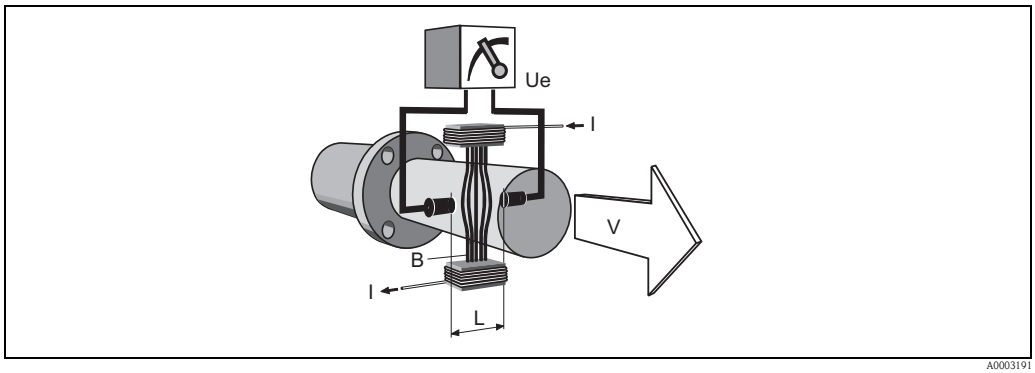
Table of contents

Function and system design

Measuring principle

Faraday's law of induction states that a voltage is induced in a conductor moving in a magnetic field.
In electromagnetic measuring, the flowing medium corresponds to the moving conductor. The induced voltage is proportional to the flow velocity and is detected by two measuring electrodes and transmitted to the amplifier. Flow volume is computed on the basis of the pipe's diameter. The constant magnetic field is generated by a switched direct current of alternating polarity.



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$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

Ue *induced voltage*
B *magnetic induction (magnetic field)*
L *electrode gap*
v *flow velocity*
Q *volume flow*
A *pipe cross-section*
I *current strength*

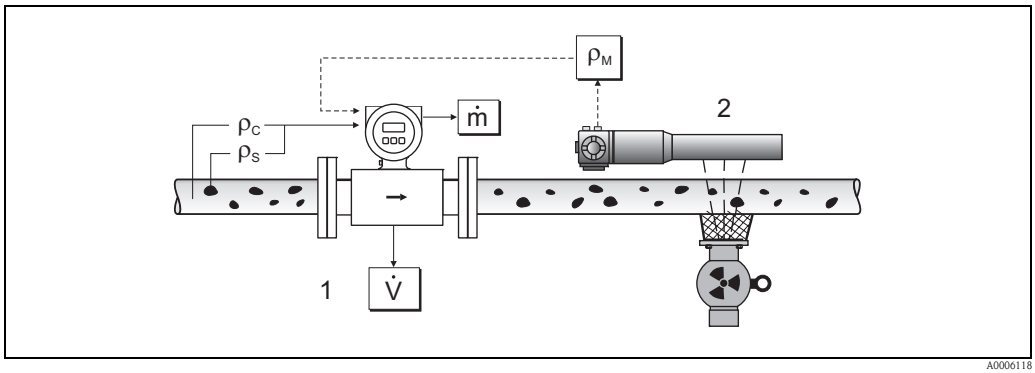
Measuring system

The flow measuring system consists of the following components:
- Promag 55 transmitter
- Promag S sensor (DN 15 to 600 / ½ to 24")

Two versions are available:
- Compact version: Transmitter and sensor form a single mechanical unit.
- Remote version: Transmitter and sensor are installed separately.

Measurement of solids flow rates

In combination with a density meter, e.g. with "Gammapilot M" from Endress+Hauser, Promag 55S also determines the throughput of solids in mass, volume or percentage rates.
The following order specifications are required for this: order option for software function "Solids content flow" (F-CHIP) and order option for a current input.



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Solids content flow measurement (m) with the aid of a density and flow measuring device. If the solid density (ρ_S) and the density of the carrier liquid (ρ_C) are also known, they can be used to calculate the solids flow.

1 *Flow measuring device (Promag 55S) → volume flow (V). The solid density (ρ_S) and the density of the transport liquid (ρ_C) must be entered in the transmitter.*
2 *Density measuring device (e.g. "Gammapilot M") → total fluid density (ρ_M) (transport liquid and solids)*

Input

Measured variable

- Flow rate (proportional to induced voltage)
- Conductivity (without temperature compensation)

Measuring range

- Flow rate: Typical v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified measuring accuracy
- Conductivity s = 5 to 2000 µ/cm
  not for sensors without reference electrode (Promag S with brush electrodes)

Operable flow range

Over 1000 : 1

Input signal

Status input (auxiliary input):

U = 3 to 30 V DC, Ri = 5 kΩ, galvanically isolated
Configurable for: totalizer(s) reset, positive zero return, error-message reset

Current input:

active/passive selectable, galvanically isolated, full scale value adjustable, resolution: 3 µA,
temperature coefficient: typically 0.005% o.f.s./°C (0.003% o.f.s./°F)

- active: 4 to 20 mA, $R_i \leq 150\ \Omega$, U_{out} = 24 V DC, short-circuit proof
- passive: 0/4 to 20 mA, $R_i \leq 150\ \Omega$, U_{max} = 30 V DC

Output

Output signal

Current output:
active/passive selectable, galvanically isolated, time constant selectable (0.01 to 100 s),
full scale value adjustable, temperature coefficient: typically 0.005% o.f.s./°C (0.003 % o.f.s./°F),
resolution: 0.5 µA

- active: 0/4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
- passive: 4 to 20 mA; supply voltage V_S: 18 to 30 V DC; $R_i \geq 150\ \Omega$

Pulse/frequency output:
active/passive selectable (Ex i version passive only), galvanically isolated

- active: 24 V DC, 25 mA (max. 250 mA over 20 ms), $R_L > 100\ \Omega$
- passive: open collector, 30 V DC, 250 mA
- Frequency output: end frequency 2 to 10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 10 s
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05 to 2000 ms)

PROFIBUS PA interface:

- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- Profile version 3.0
- Current consumption: 11 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Function blocks: 2 × analog input, 3 × totalizer
- Output data: volume flow, calculated mass flow, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), totalizer control, value for local display
- Cyclic data transmission compatible with previous model Promag 35S
- Bus address adjustable via miniature switches or local display (optional) at the measuring device

FOUNDATION Fieldbus interface:
- FOUNDATION Fieldbus H1
- Transmission technology (Physical Layer): IEC 61158-2 (MBP), galvanically isolated
- ITK version 5.0
- Current consumption: 12 mA
- Inrush current: < 12 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA
- Permissible supply voltage: 9 to 32 V
- Bus connection with integrated reverse polarity protection
- Function blocks:
  - 5 × Analog Input (execution time: 18 ms each)
  - 1 × PID (25 ms)
  - 1 × Digital Output (18 ms)
  - 1 × Signal Characterizer (20 ms)
  - 1 × Input Selector (20 ms)
  - 1 × Arithmetic (20 ms)
  - 1 × Integrator (18 ms)
- Total VCRs: 48
- Total link objects in VFD: 40
- Output data: volume flow, calculated mass flow, temperature, totalizer 1 to 3
- Input data: positive zero return (ON/OFF), reset totalizer
- Link Master (LM) functionality is supported

Signal on alarm

Current output:
Failsafe mode selectable (e.g. according to NAMUR recommendation NE 43)

Pulse/frequency output:
Failsafe mode selectable

Relay output:
"de-energized" in the event of a fault or power supply failure

Load

See "output signal"

Low flow cut off

Switch points for low flow cut off freely selectable.

Galvanic isolation

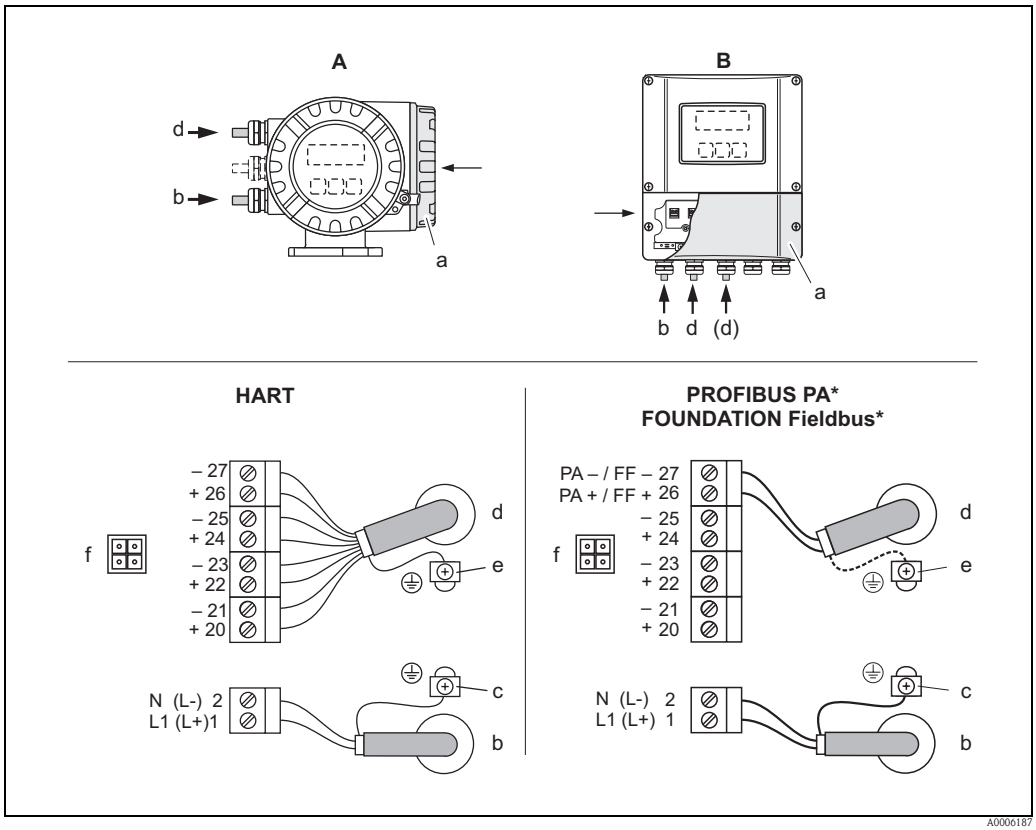
All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

Switching output

Relay output:
Normally closed (NC or break) or normally open (NO or make) contacts available
(default: relay 1 = NO, relay 2 = NC),
max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated.
Configurable for: error messages, empty pipe detection (EPD), direction of flow, limit values.

Power supply

Electrical connection measuring unit



Connecting the transmitter, cable cross-section max. 2.5 mm² (14 AWG)

A View A (field housing)
B View B (wall-mount housing)

**)* Fixed communication boards
a Connection compartment cover
b Cable for power supply: 20 to 260 V AC / 20 to 64 V DC
- Terminal No. 1: L1 for AC, L+ for DC
- Terminal No. 2: N for AC, L– for DC

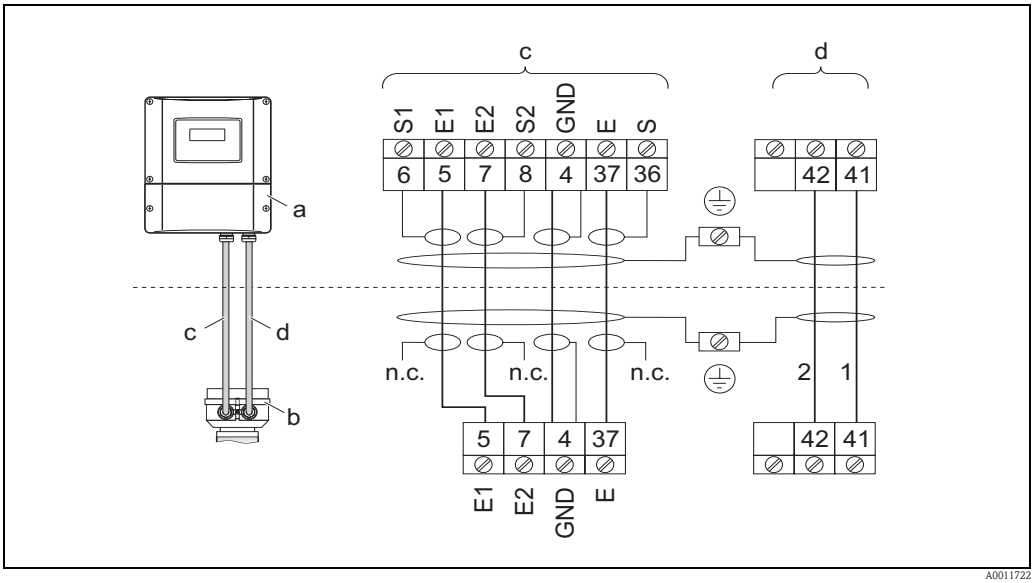
c Ground terminal for protective conductor
d Signal cable: see "Electrical connection terminal assignment"
Fieldbus cable:
- Terminal No. 26: PA + / FF + (with polarity protection)
- Terminal No. 27: PA – / FF – (with polarity protection)

e Ground terminal for signal cable shield / Fieldbus cable
f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

Electrical connection terminal assignment

Order version	Terminal No. (inputs / outputs			
	20 (+) / 21 (–)	22 (+) / 23 (–)	24 (+) / 25 (–)	26 (+) / 27 (–)
Fixed communication boards (fixed assignment)				
55***-**********A	–	–	Frequency output	Current output HART
55***-**********B	Relay output 2	Relay output 1	Frequency output	Current output HART
55***-**********H				PROFIBUS PA
55***-**********K				FOUNDATION Fieldbus
Flexible communication boards				
55***-**********C	Relay output 2	Relay output 1	Frequency output	Current output HART
55***-**********D	Status input	Relay output	Frequency output	Current output HART
55***-**********L	Status input	Relay output 2	Relay output 1	Current output HART
55***-**********M	Status input	Frequency output 2	Frequency output 1	Current output HART
55***-**********2	Relay output	Current output 2	Frequency output	Current output 1 HART
55***-**********3	Current input	Current output 2	Frequency output	Current output 1 HART
55***-**********4	Current input	Relay output	Frequency output	Current output HART
55***-**********5	Status input	Current input	Frequency output	Current output HART

Electrical connection remote version



Connecting the remote version

a Connection compartment, wall-mount housing
b Cover of connection housing, sensor
c Signal cable
d Coil current cable
n.c. unconnected, insulated cable shields
Terminal no. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow

Electrical connections

20 to 260 V AC, 45 to 65 Hz
20 to 64 V DC

Cable entries

Power-supply and signal cables (inputs/outputs):
- Cable gland M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Cable entries for thread ½" NPT, G ½"

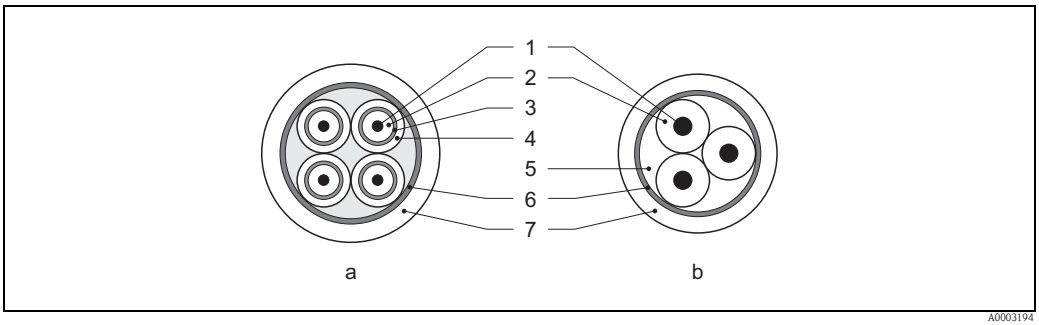
Fieldbus cable:
- Fieldbus connector for PROFIBUS PA, M12 × 1 / PG 13.5 plus adapter PG 13.5 / M20.5
- Fieldbus connector for FOUNDATION Fieldbus, 7/8-16 UNC × M20

Connecting cable for remote version:
- Cable gland M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Cable entries for thread ½" NPT, G ½"

Cable specifications (remote version)

Coil cable
- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤37 Ω/km (≤0.011 Ω/ft)
- Capacitance: core/core, shield grounded: ≤120 pF/m (≤37 pF/ft)
- Operating temperature:
  – Cable not permanently routed: –20 to +80 °C (–4 to +176 °F)
  – Cable permanently routed: –40 to +80 °C (–40 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)

Signal cable
- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individually shielded cores
- With Empty Pipe Detection (EPD): 4 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance: core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature:
  – Cable not permanently routed: –20 to +80 °C (–4 to +176 °F)
  – Cable permanently routed: –40 to +80 °C (–40 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)



A0003194

a *Signal cable*
b *Coil current cable*

1 *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

As an option, Endress+Hauser can also deliver reinforced connecting cables with an additional, reinforcing metal braid. We recommend such cables for the following cases:
- Directly buried cable
- Cables endangered by rodents
- Device operation which should comply with the IP 68 (NEMA 6P) standard of protection

Operation in zones of severe electrical interference
The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR recommendation NE 21.

Caution!
Grounding of the shield is by means of the ground terminals provided for the purpose inside the connection housing. Keep the stripped and twisted lengths of cable shield to the terminals as short as possible.

Power consumption

AC: < 45 VA at 260 V AC; < 32 VA at 110 V AC (incl. sensor)
DC: < 19 W (including sensor)

Switch-on current:
- max. 2.00 A (< 700 ms) at 20 V AC
- max. 2.28 A (< 5 ms) at 110 V AC
- max. 5.5 A (< 5 ms) at 260 V AC

Power supply failure

Lasting min. 1 power cycle:
- EEPROM or HistoROM/T-DAT saves measuring system data if power supply fails
- HistoROM/S-DAT: exchangeable data storage device which stores sensor characteristic data (nominal diameter, serial number, calibration factor, zero point etc.)

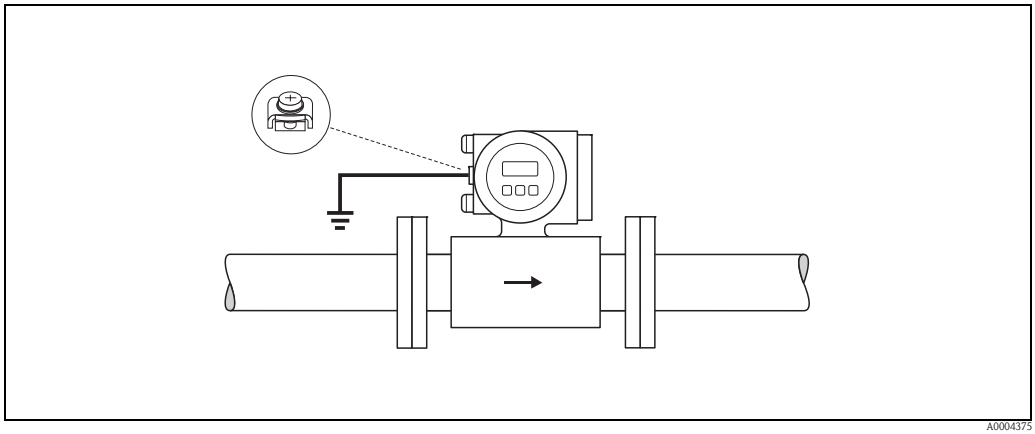
Potential equalization

Standard case

Perfect measurement is only ensured when the medium and the sensor have the same electrical potential. Most Promag sensors have a reference electrode installed as standard, which guarantees the required potential equalization. This usually means that additional potential equalization measures are unnecessary.

Promag S:
- Reference electrode is standard for electrode materials 1.4435/316L, Alloy C-22, tantalum, titanium Gr. 2, Duplex 1.4462, tungsten carbide coating (for electrodes made of 1.4435)
- Reference electrode is optional for electrode material platinum
- Reference electrode not present in measuring tubes with a natural rubber lining in conjunction with brush electrodes

Note!
For installation in metal pipes, it is advisable to connect the ground terminal of the transmitter housing to the piping. Also, observe company-internal grounding guidelines.


A0004375

Potential equalization by means of the transmitter's ground terminal

Caution!
- For sensors without reference electrodes or without metal process connections, carry out potential equalization as per the instructions for special cases described below. These special measures are particularly important when standard grounding practice cannot be ensured or extremely strong matching currents are expected.
- Sensors with brush electrodes do not have a reference electrode. For this reason, ground disks must be installed if necessary to ensure sufficient potential equalization to the fluid. This applies in particular to isolating lined pipes which are not grounded → 10.

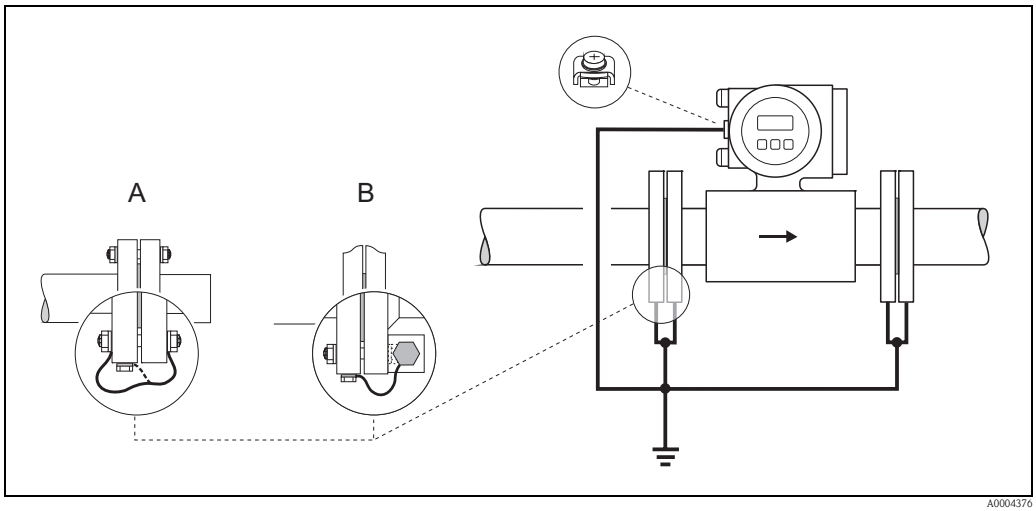
Special cases

Metal, ungrounded piping

In order to prevent outside influences on measurement, it is necessary to use ground cables to connect each sensor flange to its corresponding pipe flange and ground the flanges. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose (see diagram).
The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser → 45.

- DN ≤ 300 (12"): The ground cable is in direct connection with the conductive flange coating and is secured by the flange screws (A).
- DN ≥ 350 (14"): The ground cable connects directly to the metal transport bracket (B).

Caution!
Also, observe company-internal grounding guidelines.

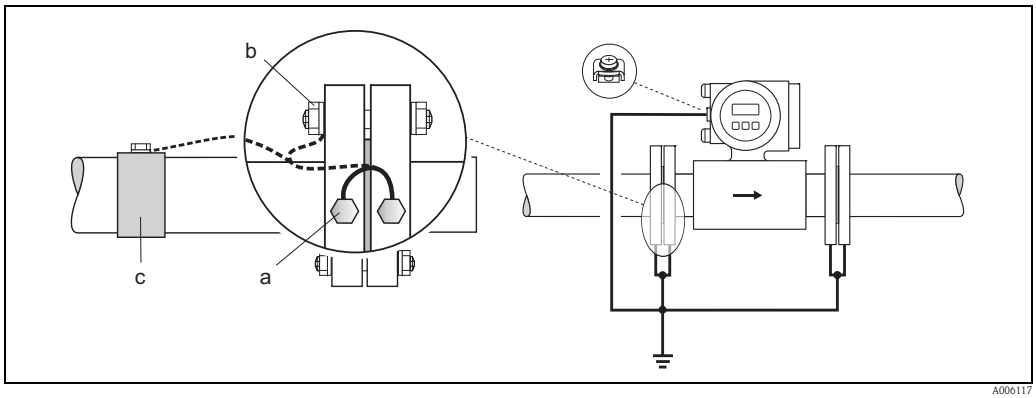


Potential equalization with equalizing currents in ungrounded, metal pipes (ground cable: copper wire, at least 6 mm² /10 AWG)

A Installing ground cable at DN ≤ 300 (12")
B Installing ground cable at DN ≥ 350 (14")

Pre-installed ground cable for DN ≤ 300 (12") (order option)
Ground cables which are preinstalled on the sensor flange, are also available. These ground cables can be mounted and connected electrically to the piping in different ways:

- Using a screw on the side of the pipe flange (a)
- Using the flange screws (b)
- Using a pipe clip installed around the pipe (c)

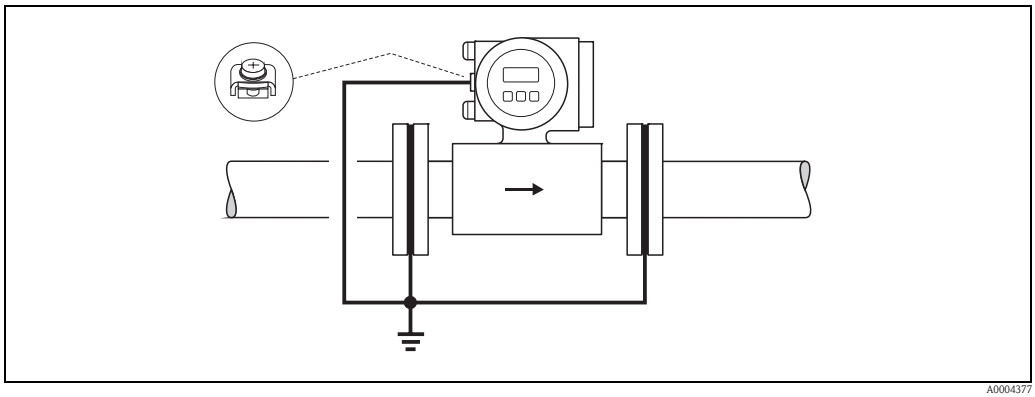


Possibilities for connecting and mounting pre-installed ground cables (ground cable: copper wire at least 6 mm² /10 AWG)

Plastic pipes and isolating lined pipes

Normally, potential is matched using the reference electrodes in the measuring tube. However, in exceptional cases it is possible that, due to the grounding plan of a system, matching currents flow over the reference electrodes. This can lead to destruction of the sensor, e.g. through electro-chemical decomposition of the electrodes. In such cases, e.g. for fiberglass or PVC pipings, it is therefore **essential** that you use additional ground disks for potential equalization. This applies also to two-phase or two-component flow, where the fluid is not well mixed or its constituents are not mixable.

Caution!
- Risk of damage by electrochemical corrosion. Note the electrochemical insulation rating, if the ground disks and measuring electrodes are made of different materials.
- Also, observe company-internal grounding guidelines.



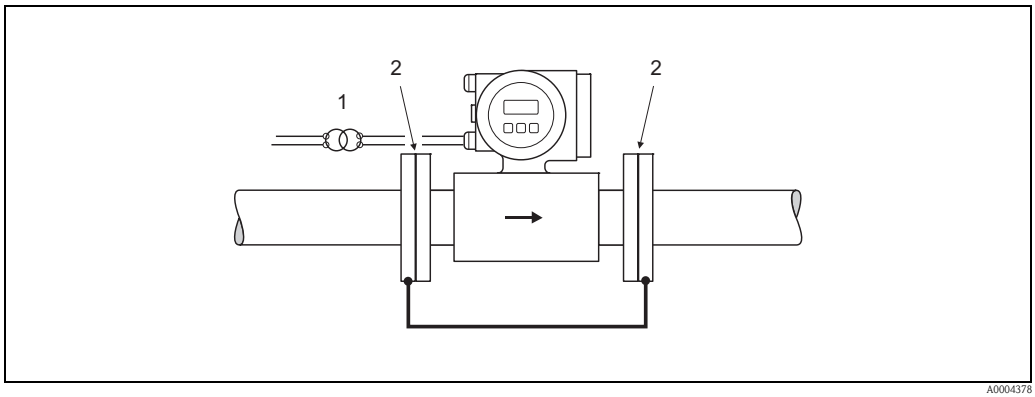
A0004377

Potential equalization/ground disks in the case of plastic pipes or isolating lined pipes (ground cable: copper wire at least 6 mm^2 / 10 AWG)

Plastic pipes and isolating lined pipes

In such cases, install the measuring instrument without potential in the piping:
- When installing the measuring device, make sure that there is an electrical connection between the two piping runs (copper wire, at least 6 mm^2 / 10 AWG).
- When using ground disks in plastic or isolating lined pipes, ensure that they are electrically connected with each other (copper wire at least 6 mm^2 / 10 AWG).
- Make sure that the mounting material used does not establish a conductive connection between the pipe and the measuring device and that the mounting material withstands the torques applied when the threaded fasteners are tightened during installation.
- Check the galvanic isolation using an insulation tester (protection against contact).
- Also comply with the regulations applicable to potential-free installation.

Note!
For the remote version, both the sensor and the transmitter must be installed so that they are potential-free.



A0004378

Potential equalization and cathodic protection (connecting cable: copper wire at least 6 mm^2 / 10 AWG)

1 Isolation transformer power supply
2 Electrically insulated

Performance characteristics

Reference conditions

To DIN EN 29104 and VDI/VDE 2641:
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
- Ambient temperature: +22 °C ± 2 K (+72 °F ± 2 K)
- Warm-up time: 30 minutes

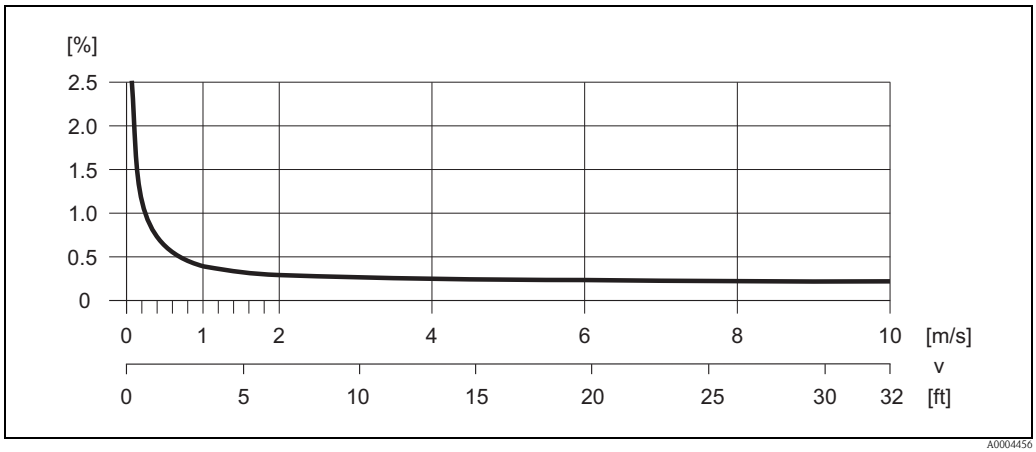
Installation:
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- Sensor centered relative to the pipe.

Maximum measured error

Pulse output:
- Standard: ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s)
- With brush electrodes (Option): ±0.5% o.r. ± 2 mm/s (±0.5% o.r. ± 0.08 in/s)
  (o.r. = of reading)

Current output:
in addition typically ±5 µA

Note!
Supply-voltage fluctuations have no effect within the specified range.



Max. measured error in % of reading

Conductivity

- Max. measuring error not specified
- Without temperature compensation (cell constant is a factory setting)

Repeatability

Volume flow

- Standard: max. ±0.1% o.r. ± 0.5 mm/s (±0.1% o.r. ± 0.02 in/s)
- With brush electrodes (Option): max. ±0.2% o.r. ± 0.5 mm/s (±0.2% o.r. ± 0.02 in/s)
  (o.r. = of reading)

Conductivity

- Max. ±5% o.r.
  (o.r. = of reading)

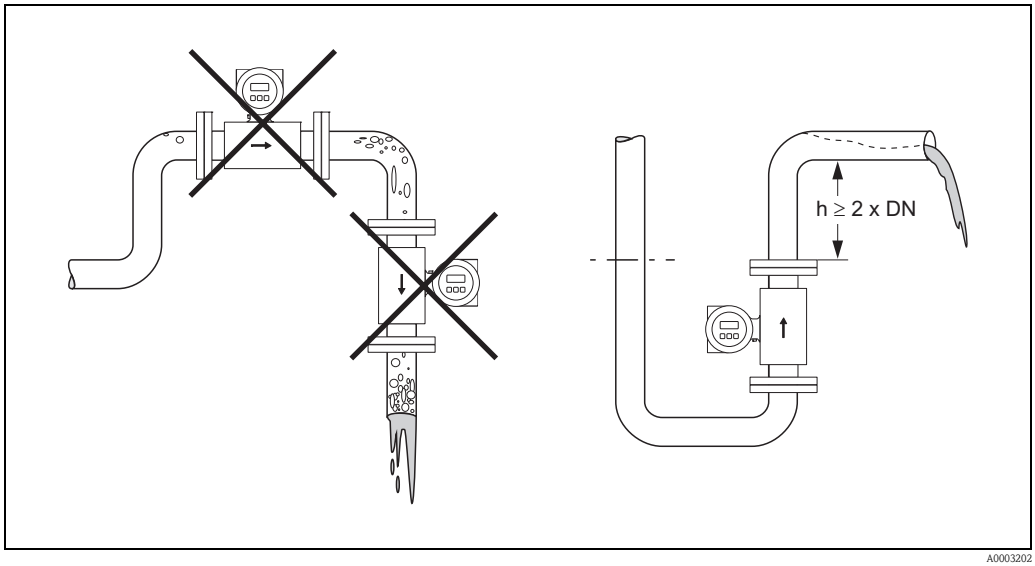
Operating conditions: Installation

Installation instructions

Location

The accumulation of air or gas bubbles in the measuring tube could result in an increase in measuring errors.
Avoid the following locations:

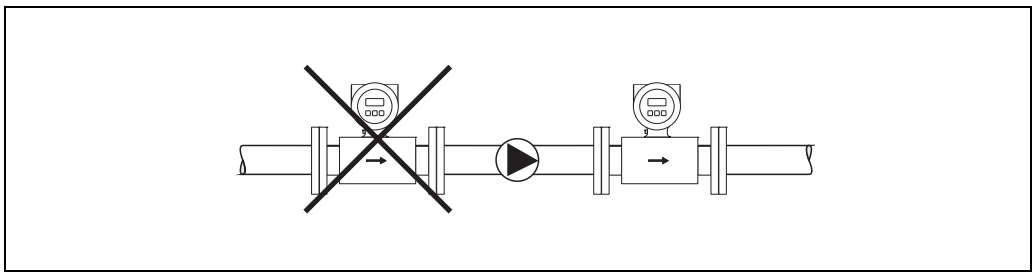
- At the highest point of a pipeline. Risk of air accumulating.
- Directly upstream from a free pipe outlet in a vertical pipeline.



A0003202

Installing pumps

Do not install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the lining's resistance to partial vacuum → 21.
It might be necessary to install pulse dampers in systems incorporating reciprocating, diaphragm or peristaltic pumps. Information on the measuring system's resistance to vibration and shock → 19.

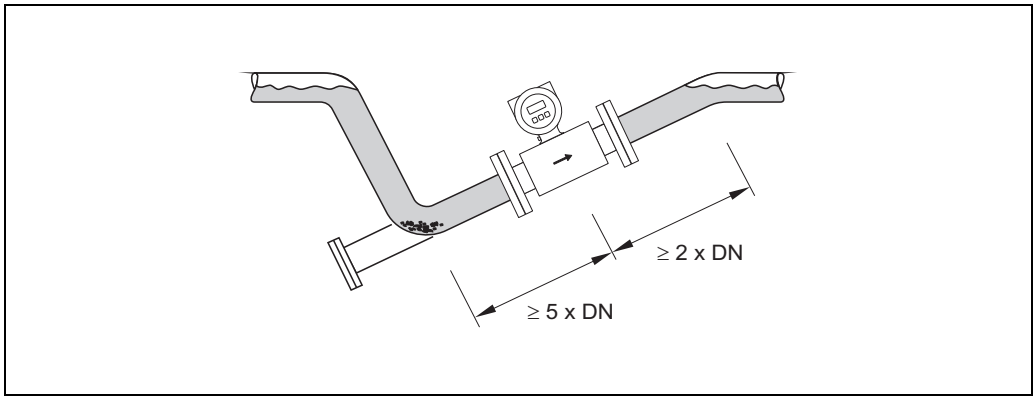


A0003203

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration. The Empty Pipe Detection function offers additional protection by detecting empty or partially filled pipes.

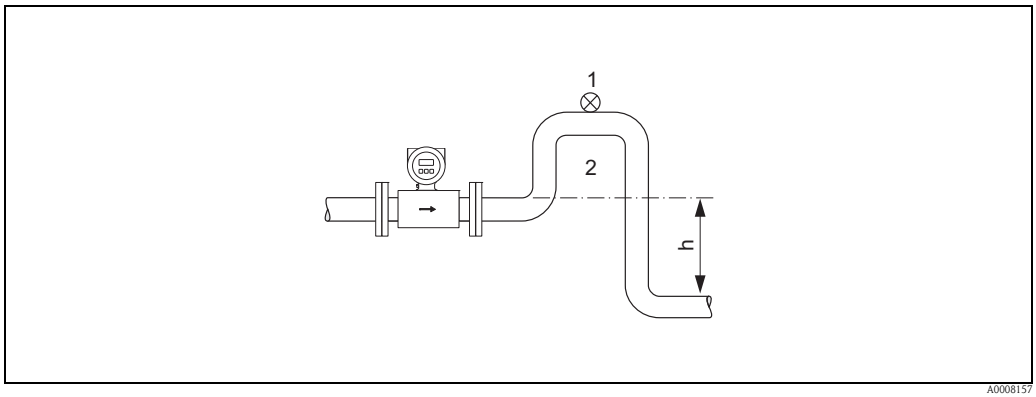
Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



A0003204

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16,4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the system losing prime, which could cause air inclusions.
Information on the lining's resistance to partial vacuum → 21.



A0008157

Measures for installation in a down pipe

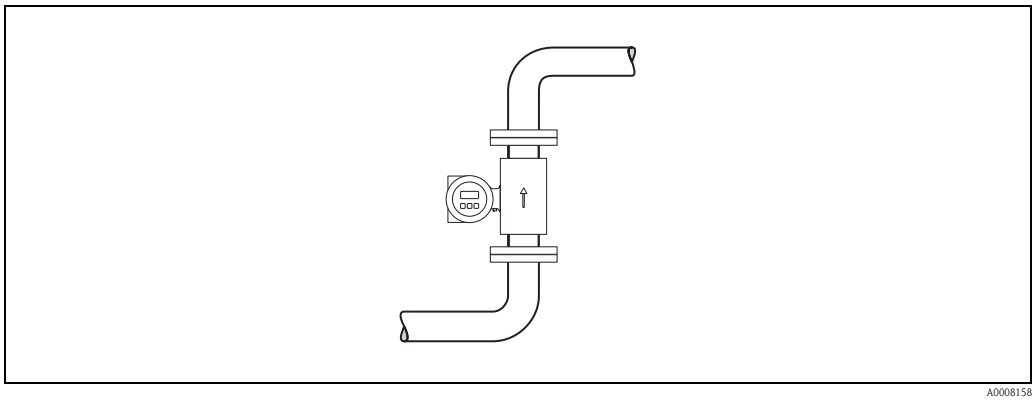
1 Vent valve
2 Siphon
h Vertical height of the down pipe regarding the sensor

Orientation

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube. Promag, nevertheless, supplies a range of functions and accessories for correct measuring of problematic fluids:
- Electrode Cleaning Circuit (ECC) for applications with fluids producing build-up, e.g. electrically conductive deposits → "Description of Device Functions" manual.
- Empty Pipe Detection (EPD) ensures the detection of partially filled measuring tubes, e.g. in the case of degassing fluids.

Vertical orientation

A vertical orientation is ideal in the following cases:
- For self-emptying piping systems and when using empty pipe detection.
- For sludge containing sand or stones and where the solids cause sedimentation.

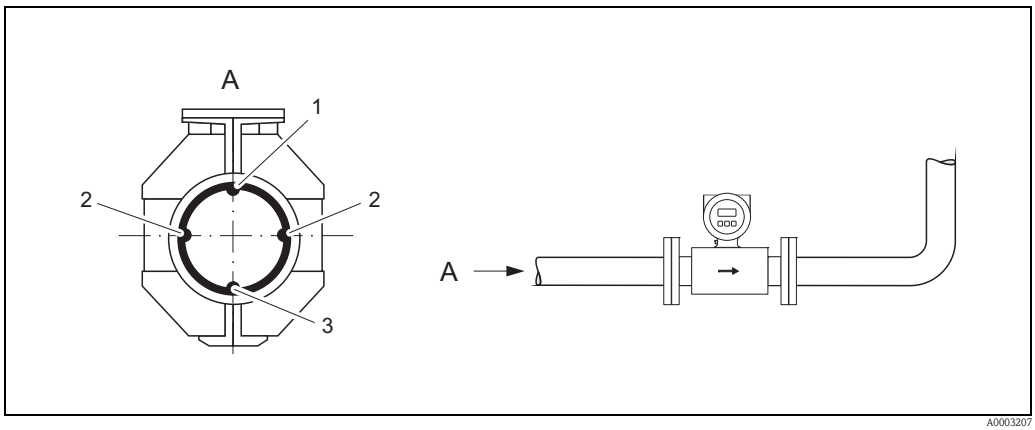


A0008158

Horizontal orientation

The measuring electrode plane should be horizontal. This prevents brief insulation of the two electrodes by entrained air bubbles.

Caution!
Empty Pipe Detection functions correctly with the measuring device installed horizontally only when the transmitter housing is facing upward (see diagram). Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled or empty.



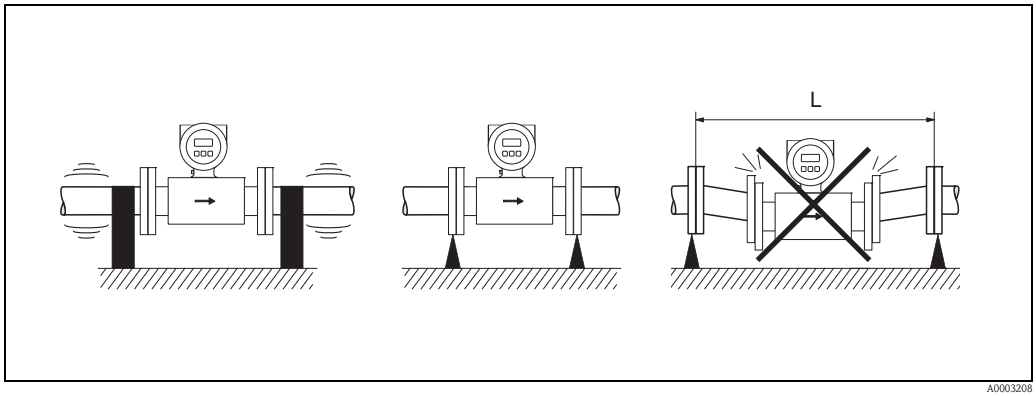
A0003207

1 EPD electrode for empty pipe detection (not available for "measuring electrode only" option)
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization (not available for "measuring electrode only" option)

Vibrations

Secure and fix both the piping and the sensor if the vibrations are severe.

Caution!
It is advisable to install sensor and transmitter separately if vibration is excessively severe. Information on the permitted resistance to vibration and shock → 19.

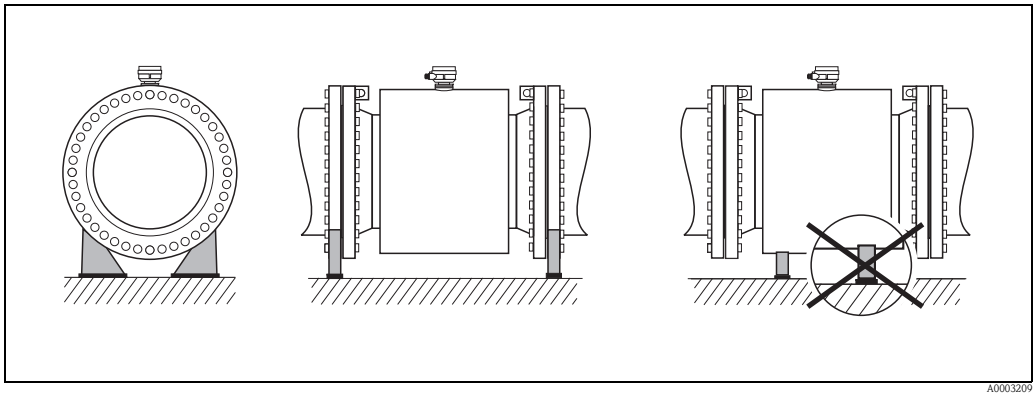


Measures to prevent vibration of the measuring device (L > 10 m / 33 ft)

Foundations, supports

If the nominal diameter is DN ≥ 350 (14"), mount the sensor on a foundation of adequate load-bearing strength.

Caution!
Risk of damage.
Do not support the weight of the sensor on the metal casing: the casing would buckle and damage the internal magnetic coils.



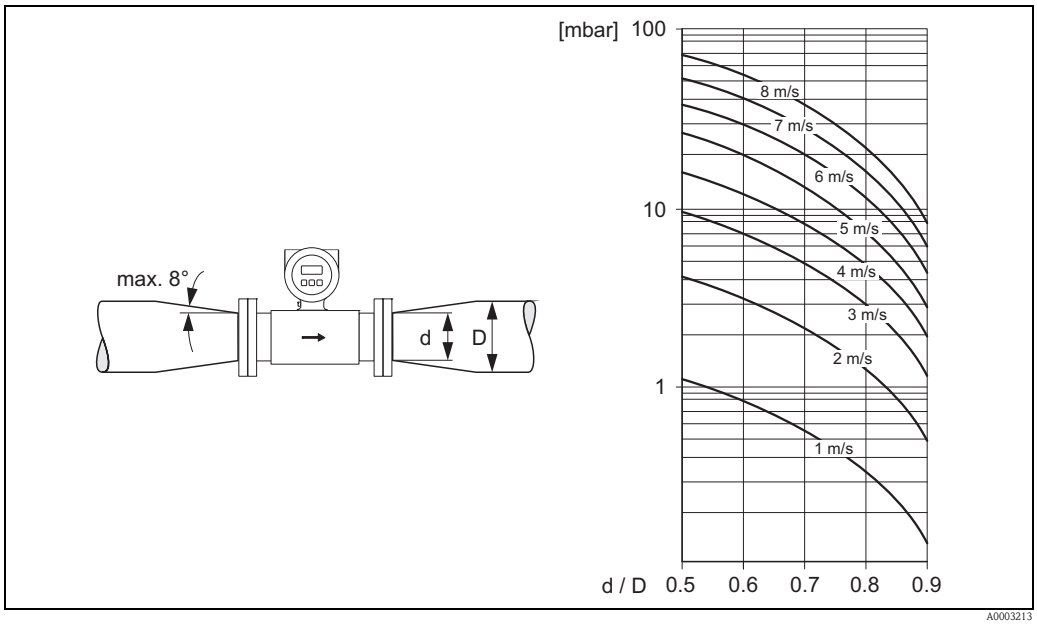
Correct support for large nominal diameters (DN≥ 350 / 14")

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by cross-section reduction.

Note!
The nomogram applies to fluids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram, read off the pressure loss as a function of fluid velocity (*downstream* from the reduction) and the d/D ratio.



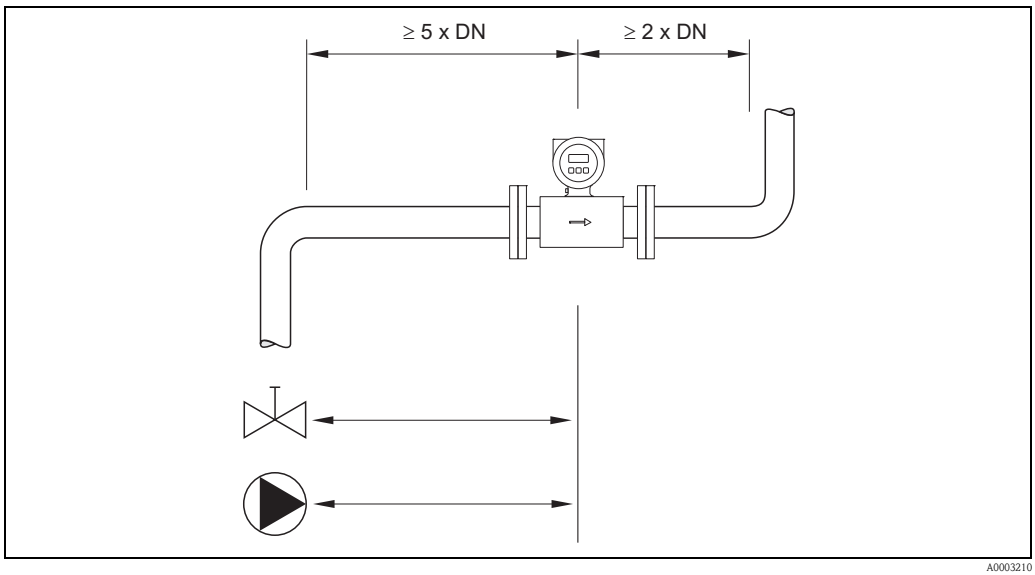
Pressure loss due to adapters (for pressure losses in US units, please contact Endress+Hauser)

Inlet and outlet runs

If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows etc.

Compliance with the following requirements for the inlet and outlet runs is necessary in order to ensure measuring accuracy.

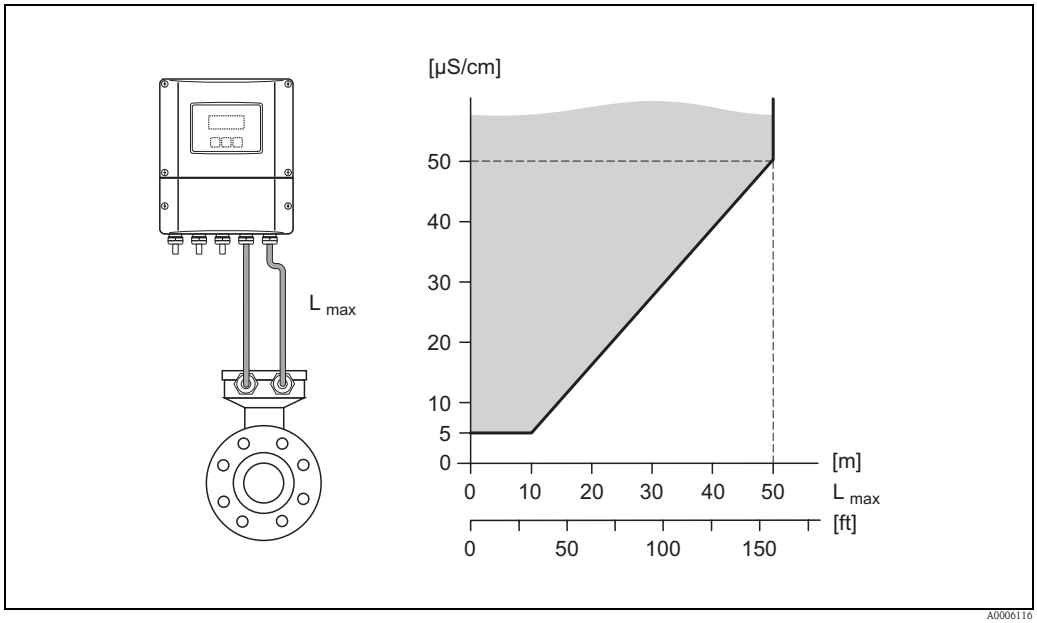
- Inlet run ≥ 5 × DN
- Outlet run ≥ 2 × DN



Length of connecting cable

In order to ensure measuring accuracy, comply with the following instructions when installing the remote version:

- Secure the cable run or route the cable in an armored conduit. Movement of the cable can falsify the measuring signal, particularly if the fluid conductivity is low.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between sensor and transmitter, if necessary.
- The permissible cable length L_{max} depends on the fluid conductivity (see Figure).



Permitted lengths for connecting cable in remote version, as a function of the conductivity of the fluid

Gray shaded area = permissible area
L_{max} = Length of connecting cable

Operating conditions: Environment

Ambient temperature

Transmitter:
- Standard:
  - Compact version: –20 to +50 °C (–4 to +122 °F)
  - Remote version: –20 to +60 °C (–4 to +140 °F)
- Optional:
  - Compact version: –40 to +50 °C (–40 to +122 °F)
  - Remote version: –40 to +60 °C (–40 to +140 °F)

Note!
At ambient temperatures below –20 °C (–4 °F), the readability of the display may be impaired.

Sensor:
- Flange material carbon steel: –10 to +60 °C (+14 to +140 °F)
- Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)

Caution!
Do not exceed the min. and max. temperatures for the lining of the measuring tube (→ "Medium temperature range").

Note the following points:
- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- If both fluid and ambient temperatures are high, install the transmitter at a remote location from the sensor (→ "Medium temperature range").

Storage temperature

The storage temperature corresponds to the operating temperature range of the transmitter and sensor.

Degree of protection

- Standard: IP 67 (NEMA 4X) for transmitter and sensor
- Optional: IP 68 (NEMA 6P) for remote version of Promag S sensor

Shock and vibration resistance

Acceleration up to 2 g by analogy with IEC 600 68-2-6

(High temperature version: no data available)

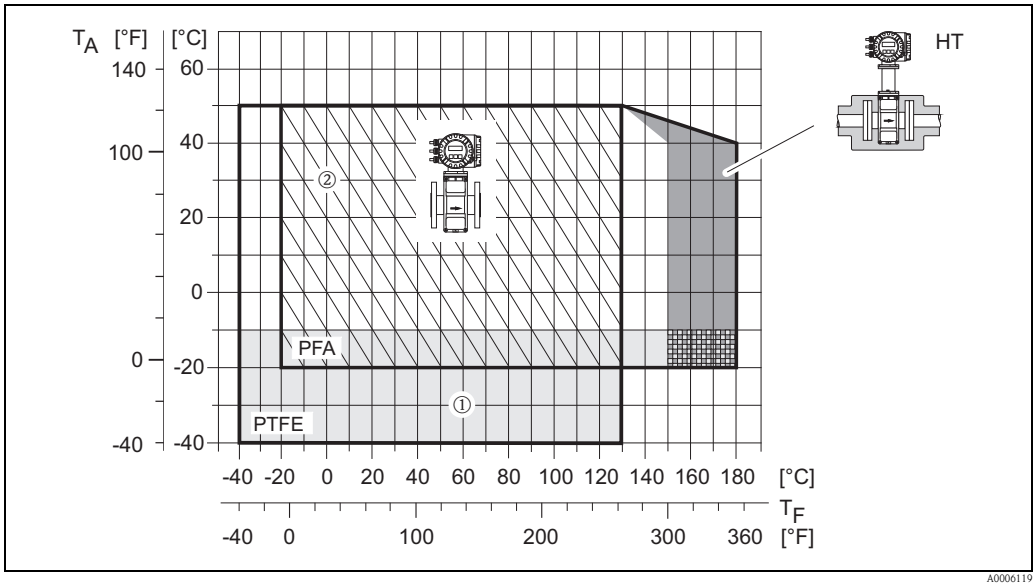
Electromagnetic compatibility (EMC)

According to IEC/EN 61326 and NAMUR recommendation NE 21

Operating conditions: Process

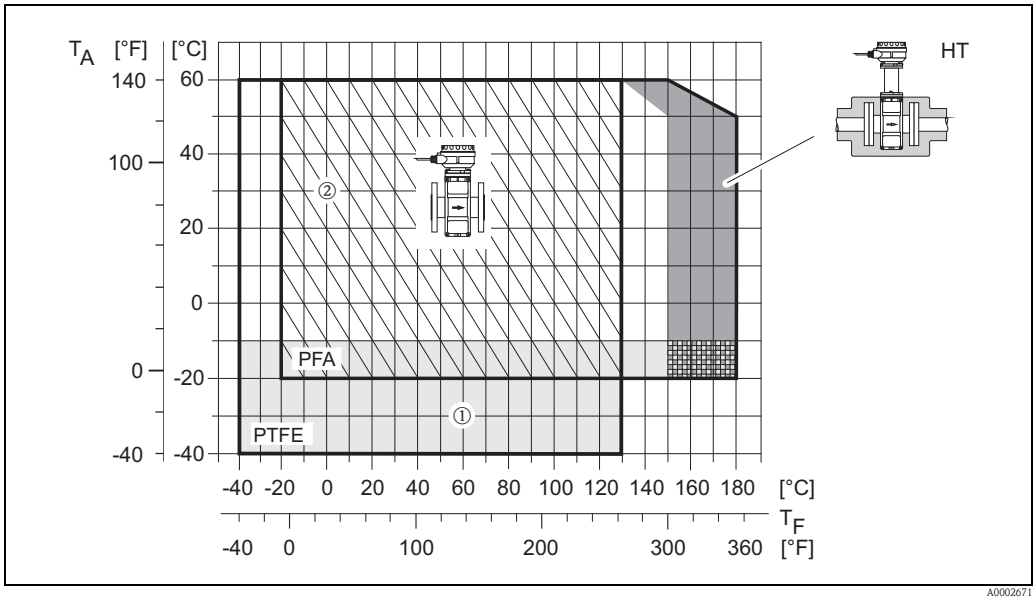
Medium temperature range

The permitted temperature depends on the lining of the measuring tube:
- 0 to +60 °C (+32 to +140 °F) for natural rubber (DN 65 to 600 / 2½ to 24")
- 0 to +80 °C (+32 to +176 °F) for hard rubber (DN 65 to 600 / 2½ to 24")
- –20 to +50 °C (–4 to +122 °F) for polyurethane (DN 25 to 600 / 1 to 24")
- –20 to +180 °C (–4 to +356 °F) for PFA (DN 25 to 200 / 1 to 8"), restrictions → see diagrams
- –40 to +130 °C (–40 to +266 °F) for PTFE (DN 15 to 600 / ½ to 24"), restrictions → see diagrams



Promag S compact versions (with PFA or PTFE lining)

T_A *Ambient temperature*
T_F *Fluid temperature*
HT High temperature version with insulation
① *Gray shaded area → temperature range from –10 to –40 °C (–14 to –40 °F) applies only to stainless steel flanges*



Promag S remote versions (with PFA or PTFE lining)

T_A *Ambient temperature*
T_F *Fluid temperature*
HT High temperature version with insulation
① *Gray shaded area → temperature range from –10 to –40 °C (–14 to –40 °F) applies only to stainless steel flanges*

Conductivity

Minimum conductivity:
- ≥ 5 µS/cm for all liquids (incl. demineralized water)

Note!
In the remote version, the required minimum conductivity is also influenced by the length of the cable → 🖹 18.

Limiting medium pressure range (nominal pressure)

- EN 1092-1 (DIN 2501): PN 10 (DN 200 to 600 / 8 to 24"), PN 16 (DN 65 to 600 / 2½ to 24"), PN 25 (DN 200 to 600 / 8 to 24"), PN 40 (DN 15 to 150 / ½ to 6")
- ANSI B16.5: Class 150 (DN ½ to 24"), Class 300 (DN ½ to 6")
- JIS B2220: 10K (DN 50 to 300 / 2 to 12"), 20K (DN 15 to 300 / ½ to 12")
- AS 2129: Table E (DN 25 / 1", DN 50 / 2")
- AS 4087: Cl. 14 (DN 50 / 2")

Pressure tightness (lining)

Pressure tightness in SI units [mbar]

Promag S Nominal diameter [mm]	Measuring tube lining	Resistance of measuring tube lining to partial vacuum (SI units) Limit values for abs. pressure [mbar] at various fluid temperatures						
		25 °C	50 °C	80 °C	100 °C	130 °C	150 °C	180 °C
25 to 600	Polyurethane	0	0	-	-	-	-	-
65 to 600	Natural rubber	0	0	-	-	-	-	-
65 to 600	Hard rubber	0	0	0	-	-	-	-

Promag S Nominal diameter [mm]	Measuring tube lining	Resistance of measuring tube lining to partial vacuum (SI units) Limit values for abs. pressure [mbar] at various fluid temperatures					
		25 °C	80 °C	100 °C	130 °C	150 °C	180 °C
15	PTFE	0	0	0	100	–	–
25	PTFE / PFA	0/0	0/0	0/0	100/0	–/0	–/0
32	PTFE / PFA	0/0	0/0	0/0	100/0	–/0	–/0
40	PTFE / PFA	0/0	0/0	0/0	100/0	–/0	–/0
50	PTFE / PFA	0/0	0/0	0/0	100/0	–/0	–/0
65	PTFE / PFA	0/0	*	40/0	130/0	–/0	–/0
80	PTFE / PFA	0/0	*	40/0	130/0	–/0	–/0
100	PTFE / PFA	0/0	*	135/0	170/0	–/0	–/0
125	PTFE / PFA	135/0	*	240/0	385/0	–/0	–/0
150	PTFE / PFA	135/0	*	240/0	385/0	–/0	–/0
200	PTFE / PFA	200/0	*	290/0	410/0	–/0	–/0
250	PTFE	330	*	400	530	–	–
300	PTFE	400	*	500	630	–	–
350	PTFE	470	*	600	730	–	–
400	PTFE	540	*	670	800	–	–
450	PTFE	Partial vacuum is impermissible!					
500	PTFE						
600	PTFE						

* No value can be quoted.

Pressure tightness in US units [psi = pounds/inch^2]

Promag S Nominal diameter [inch]	Measuring tube lining	Resistance of measuring tube lining to partial vacuum (US units) Limit values for abs. pressure [psi] at various fluid temperatures						
		77 °F	122 °F	176 °F	212 °F	266 °F	302 °F	356 °F
1 to 24"	Polyurethane	0	0	-	-	-	-	-
3 to 24"	Natural rubber	0	0	-	-	-	-	-
3 to 24"	Hard rubber	0	0	0	-	-	-	-

Promag S Nominal diameter [inch]	Measuring tube lining	Resistance of measuring tube lining to partial vacuum (US units) Limit values for abs. pressure [psi] at various fluid temperatures					
		77 °F	176 °F	212 °F	266 °F	302 °F	356 °F
½"	PTFE	0	0	0	1.5	–	–
1"	PTFE / PFA	0/0	0/0	0/0	1.5/0	–/0	–/0
–	PTFE / PFA	0/0	0/0	0/0	1.5/0	–/0	–/0
1½"	PTFE / PFA	0/0	0/0	0/0	1.5/0	–/0	–/0
2"	PTFE / PFA	0/0	0/0	0/0	1.5/0	–/0	–/0
–	PTFE / PFA	0/0	*	0.6/0	1.9/0	–/0	–/0
3"	PTFE / PFA	0/0	*	0.6/0	1.9/0	–/0	–/0
4"	PTFE / PFA	0/0	*	2.0/0	2.5/0	–/0	–/0
–	PTFE / PFA	2.0/0	*	3.5/0	5.6/0	–/0	–/0
6"	PTFE / PFA	2.0/0	*	3.5/0	5.6/0	–/0	–/0
8"	PTFE / PFA	2.9/0	*	4.2/0	5.9/0	–/0	–/0
10"	PTFE	4.8	*	5.8	7.7	–	–
12"	PTFE	5.8	*	7.3	9.1	–	–
14"	PTFE	6.8	*	8.7	10.6	–	–
16"	PTFE	7.8	*	9.7	11.6	–	–
18"	PTFE	Partial vacuum is impermissible!					
20"	PTFE						
24"	PTFE						
* No value can be quoted.							

Nominal diameter and flow rate

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum flow velocity is between 2 and 3 m/s (6 to 10 ft/s). The flow velocity (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (< 6 ft/s): for abrasive fluids where solids do not cause sedimentation (e.g. lime milk)
- v > 2 m/s (> 6 ft/s): for fluids producing build-up (e.g. wastewater sludge)
- v > 2 m/s (> 6 ft/s): for abrasive sludge with a high sand or stone content and where the solids easily cause sedimentation (e.g. ore slurry)

Note!
Flow velocity can be increased, if necessary, by reducing the nominal diameter of the sensor through the use of adapters → 17.

Flow rate characteristic values - Promag S (SI units)

Nominal diameter	Recommended flow rate	Factory settings		
[mm]	min./max. full scale value (v ≈ 0.3 or 10 m/s)	Full scale value (v ≈ 2.5 m/s)	Pulse value (≈ 2 pulse/s)	Low flow cut off (v ≈ 0.04 m/s)
15	4 to 100 dm^3/min	25 dm^3/min	0.20 dm^3	0.5 dm^3/min
25	9 to 300 dm^3/min	75 dm^3/min	0.50 dm^3	1 dm^3/min
32	15 to 500 dm^3/min	125 dm^3/min	1.00 dm^3	2 dm^3/min
40	25 to 700 dm^3/min	200 dm^3/min	1.50 dm^3	3 dm^3/min
50	35 to 1100 dm^3/min	300 dm^3/min	2.50 dm^3	5 dm^3/min
65	60 to 2000 dm^3/min	500 dm^3/min	5.00 dm^3	8 dm^3/min
80	90 to 3000 dm^3/min	750 dm^3/min	5.00 dm^3	12 dm^3/min
100	145 to 4700 dm^3/min	1200 dm^3/min	10.00 dm^3	20 dm^3/min
125	220 to 7500 dm^3/min	1850 dm^3/min	15.00 dm^3	30 dm^3/min
150	20 to 600 m^3/h	150 m^3/h	0.025 m^3	2.5 m^3/h
200	35 tof 1100 m^3/h	300 m^3/h	0.05 m^3	5.0 m^3/h
250	55 to 1700 m^3/h	500 m^3/h	0.05 m^3	7.5 m^3/h
300	80 to 2400 m^3/h	750 m^3/h	0.10 m^3	10 m^3/h
350	110 to 3300 m^3/h	1000 m^3/h	0.10 m^3	15 m^3/h
400	140 to 4200 m^3/h	1200 m^3/h	0.15 m^3	20 m^3/h
450	180 to 5400 m^3/h	1500 m^3/h	0.25 m^3	25 m^3/h
500	220 to 6600 m^3/h	2000 m^3/h	0.25 m^3	30 m^3/h
600	310 to 9600 m^3/h	2500 m^3/h	0.30 m^3	40 m^3/h

Flow rate characteristic values - Promag S (US units)				
Nominal diameter	**Recommended flow rate**	**Factory settings**		
[inch]	min./max. full scale value (v ≈ 1.0 or 33 ft/s)	Full scale value (v ≈ 8.2 ft/s)	Pulse value (≈ 2 pulse/s)	Low flow cut off (v ≈ 0.1 ft/s)
½"	1.0 to 27 gal/min	6 gal/min	0.05 gal	0.10 gal/min
1"	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
1¼"	4 to 130 gal/min	30 gal/min	0.20 gal	0.50 gal/min
1½"	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
2½"	16 to 500 gal/min	130 gal/min	1 gal	2.0 gal/min
3"	24 to 800 gal/min	200 gal/min	2 gal	2.5 gal/min
4"	40 to 1250 gal/min	300 gal/min	2 gal	4.0 gal/min
5"	60 to 1950 gal/min	450 gal/min	5 gal	7.0 gal/min
6"	90 to 2650 gal/min	600 gal/min	5 gal	12 gal/min
8"	155 to 4850 gal/min	1200 gal/min	10 gal	15 gal/min
10"	250 to 7500 gal/min	1500 gal/min	15 gal	30 gal/min
12"	350 to 10600 gal/min	2400 gal/min	25 gal	45 gal/min
14"	500 to 15000 gal/min	3600 gal/min	30 gal	60 gal/min
16"	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
18"	800 to 24000 gal/min	6000 gal/min	50 gal	90 gal/min
20"	1000 to 30000 gal/min	7500 gal/min	75 gal	120 gal/min
24"	1400 to 44000 gal/min	10500 gal/min	100 gal	180 gal/min

Pressure loss

- No pressure loss if the sensor is installed in a pipe of the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 → 17.

Measuring tube specifications

Measuring tube specifications - Promag S (SI units)

Nominal diameter		Pressure rating					Inside diameter of measuring tube			
[mm]	[inch]	EN (DIN) [bar]	AS 2129	AS 4087	ANSI [lbs]	JIS	with PFA [mm]	with PTFE [mm]	PU[1)] [mm]	HR[1)] [mm]
15	½"	PN 40	–	–	Cl 150	20K	–	15	–	–
25	1"	PN 40	Table E	–	Cl 150	20K	23	26	24	–
32	–	PN 40	–	–	–	20K	32	35	32	–
40	1½"	PN 40	–	–	Cl 150	20K	36	41	38	–
50	2"	PN 40	Table E	Cl.14	Cl 150	10K	48	52	50	–
65	–	PN 16	–	–	–	10K	63	67	66	66
80	3"	PN 16	–	–	Cl 150	10K	75	80	79	79
100	4"	PN 16	–	–	Cl 150	10K	101	104	102	102
125	–	PN 16	–	–	–	10K	126	129	127	127
150	6"	PN 16	–	–	Cl 150	10K	154	156	156	156
200	8"	PN 10	–	–	Cl 150	10K	201	202	204	204
250	10"	PN 10	–	–	Cl 150	10K	–	256	258	258
300	12"	PN 10	–	–	Cl 150	10K	–	306	309	309
350	14"	PN 10	–	–	Cl 150	–	–	337	342	342
400	16"	PN 10	–	–	Cl 150	–	–	387	392	392
450	18"	PN 10	–	–	Cl 150	–	–	432	437	437
500	20"	PN 10	–	–	Cl 150	–	–	487	492	492
600	24"	PN 10	–	–	Cl 150	–	–	593	594	594

[1)] Abbreviations (lining): PU = Polyurethane, HR = Hard rubber

Measuring tube specifications - Promag S (US units)

Nominal diameter		Pressure rating					Inside diameter of measuring tube			
[inch]	[mm]	EN (DIN) [bar]	AS 2129	AS 4087	ANSI [lbs]	JIS	with PFA [inch]	with PTFE [inch]	PU[1] [inch]	HR[1] [inch]
½"	15	PN 40	–	–	Cl 150	20K	–	0.59	–	–
1"	25	PN 40	Table E	–	Cl 150	20K	0.91	1.02	0.94	–
–	32	PN 40	–	–	–	20K	1.26	1.34	1.26	–
1½"	40	PN 40	–	–	Cl 150	20K	1.42	1.61	1.50	–
2"	50	PN 40	Table E	Cl.14	Cl 150	10K	1.89	2.05	1.97	–
–	65	PN 16	–	–	–	10K	2.48	2.64	2.60	2.60
3"	80	PN 16	–	–	Cl 150	10K	2.95	3.15	3.11	3.11
4"	100	PN 16	–	–	Cl 150	10K	3.98	4.09	4.02	4.02
–	125	PN 16	–	–	–	10K	4.96	5.08	5.00	5.00
6"	150	PN 16	–	–	Cl 150	10K	6.06	6.14	6.14	6.14
8"	200	PN 10	–	–	Cl 150	10K	7.91	7.92	8.03	8.03
10"	250	PN 10	–	–	Cl 150	10K	–	10.08	10.16	10.16
12"	300	PN 10	–	–	Cl 150	10K	–	12.05	12.17	12.17
14"	350	PN 10	–	–	Cl 150	–	–	13.27	13.46	13.46
16"	400	PN 10	–	–	Cl 150	–	–	15.24	15.43	15.43
18"	450	PN 10	–	–	Cl 150	–	–	17.01	17.20	17.20
20"	500	PN 10	–	–	Cl 150	–	–	19.17	19.37	19.37
24"	600	PN 10	–	–	Cl 150	–	–	23.35	23.39	23.39

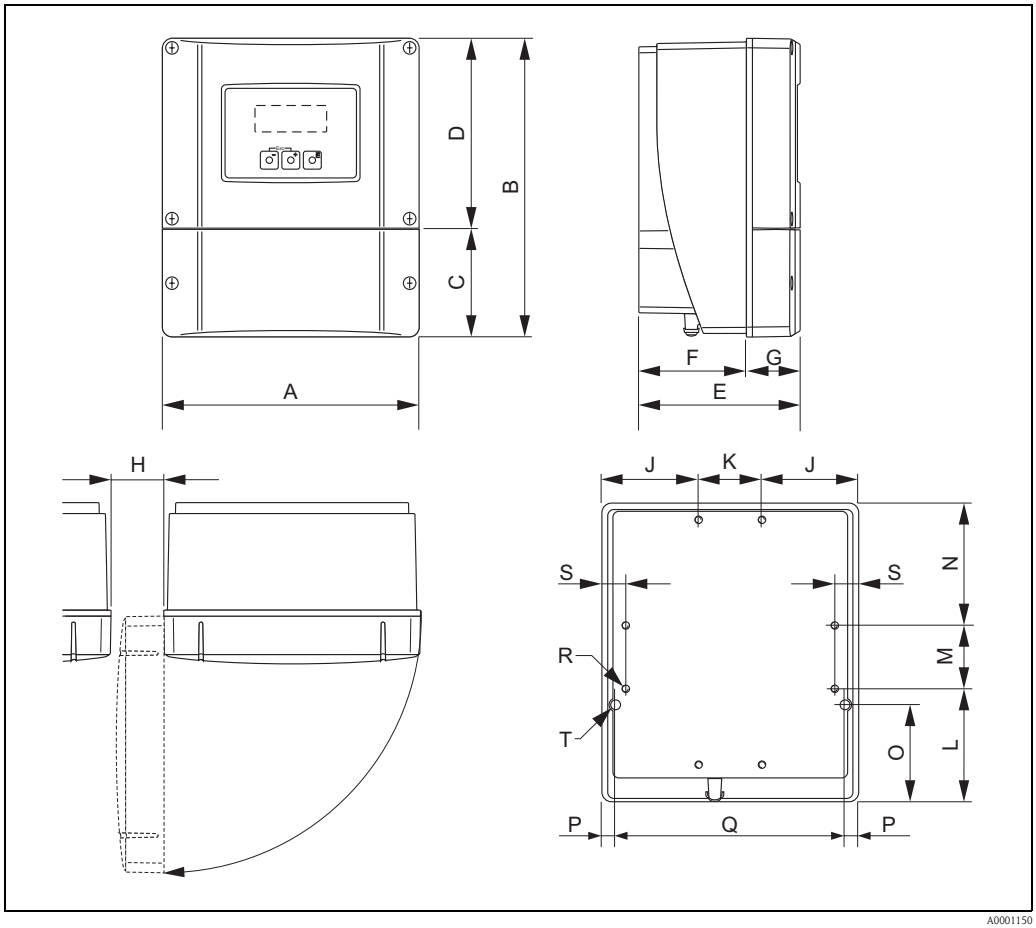
[1] Abbreviations (lining): PU = Polyurethane, HR = Hard rubber

Nominal diameter			Inside diameter of measuring tube with natural rubber		Thickness of lining material natural rubber	
[inch]	[mm]		[inch]	[mm]	[inch]	[mm]
2½"	65	PN 16/150 lbs	2.05	52	0.39	10
3"	80		2.56	65	0.39	10
4"	100		3.58	91	0.39	10
5"	125		4.57	116	0.39	10
6"	150		5.59	142	0.47	12
8"	200		6.30	190	0.47	12
10"	250	PN 10	9.61	244	0.47	12
12"	300		11.50	292	0.51	13
14"	350		12.68	322	0.55	14
16"	400		14.53	369	0.63	16
18"	450		16.42	417	0.55	14
20"	500		18.35	466	0.67	17
24"	600		22.13	562	0.79	20
10"	250	150 lbs	9.57	243	0.47	12
12"	300		11.46	291	0.47	12
14"	350		12.60	320	0.51	13
16"	400		14.49	368	0.55	14
18"	450		16.42	417	0.55	14
20"	500		18.31	465	0.63	16
24"	600		22.17	563	0.63	16

Mechanical construction

Design, dimensions

Transmitter wall-mount housing (non hazardous area and II3G / zone 2)



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Dimensions (SI units)

A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
215	250	90.5	159.5	135	90	45	> 50	81	53	95	53	102	81.5	11.5	192	8 × M5

All dimensions in [mm]

Dimensions (US units)

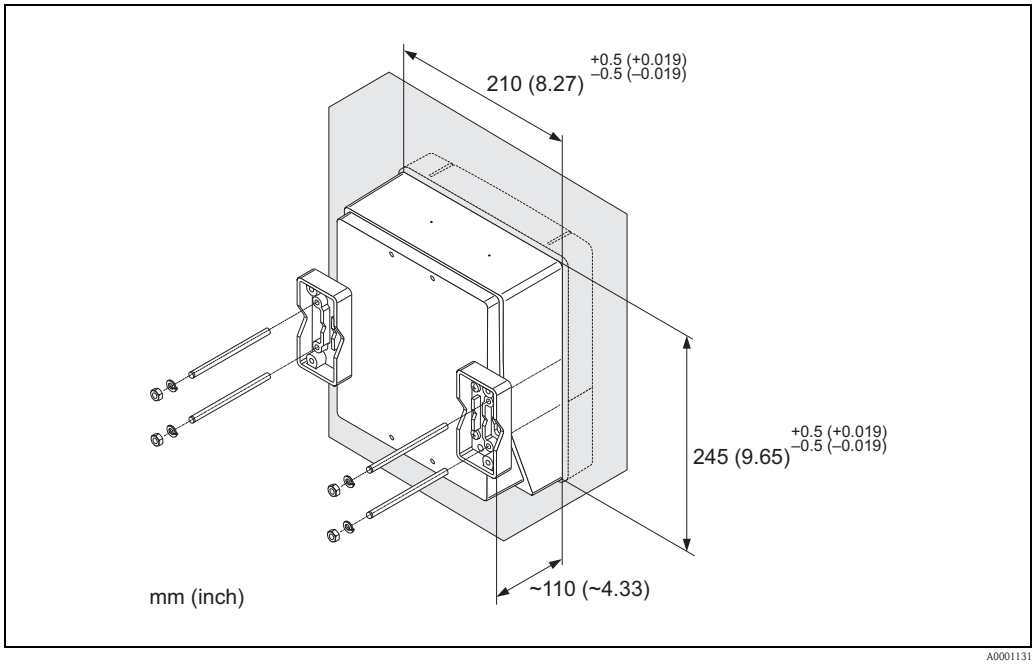
A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R
8.46	9.84	3.56	6.28	5.32	3.54	1.77	> 1.97	3.19	2.09	3.74	2.09	4.02	3.21	0.45	7.56	8 × M5

All dimensions in [inch]

There is a separate mounting kit for the wall-mounted housing. It can be ordered from Endress+Hauser as an accessory. The following installation variants are possible:

- Panel-mounted installation
- Pipe mounting

Installation in control panel



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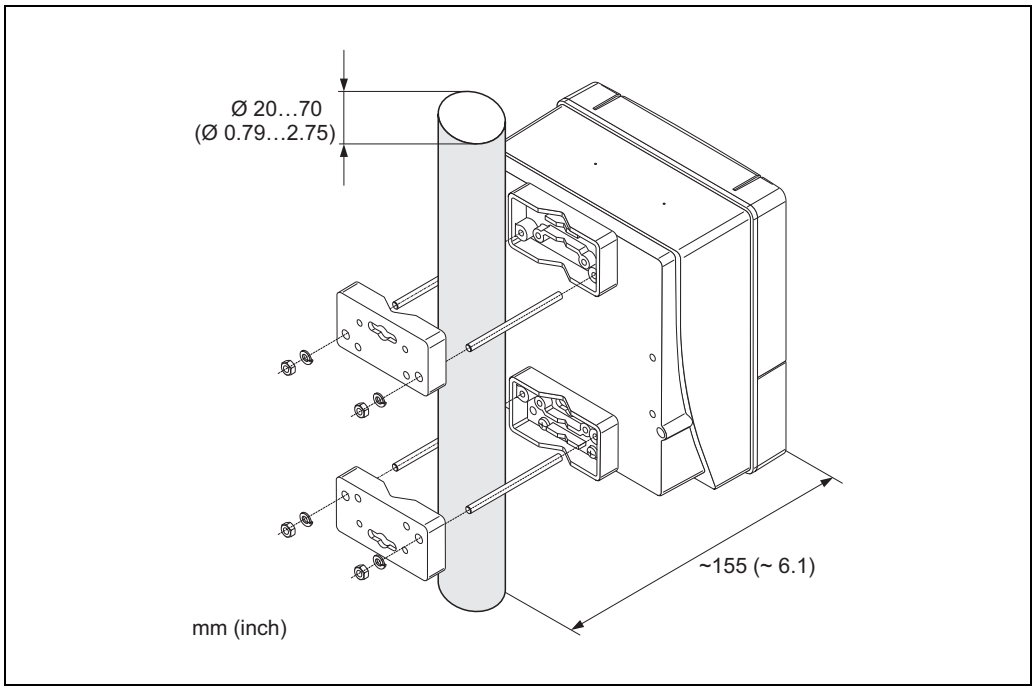
Pipe mounting



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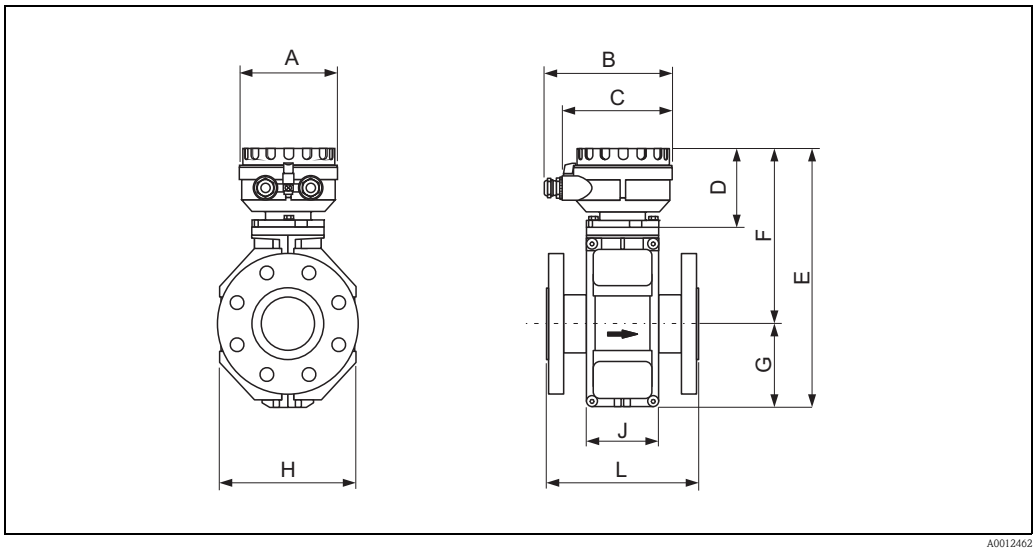
Sensor, remote version DN ≤ 300 (12")



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Dimensions (SI units)

DN EN (DIN) / JIS / AS[1)]	A	B	C	D	E	F	G	H	J	L
15	129	163	143	102	286	202	84	120	94	200
25					286	202	84	120	94	200
32					286	202	84	120	94	200
40					286	202	84	120	94	200
50					286	202	84	120	94	200
65					336	227	109	180	94	200
80					336	227	109	180	94	200
100					336	227	109	180	94	250
125					417	267	150	260	140	250
150					417	267	150	260	140	300
200					472	292	180	324	156	350
250					522	317	205	400	156	450
300					572	342	230	460	166	500

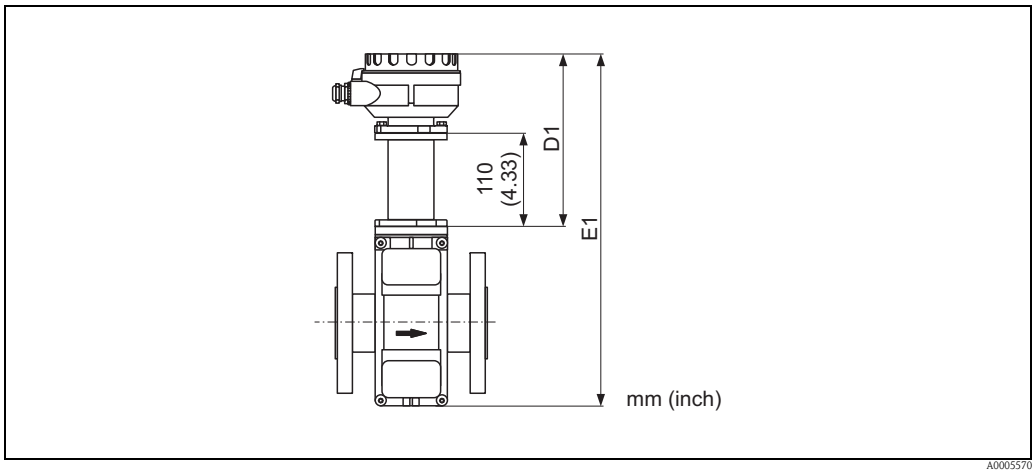
The fitting length (L) is always the same, regardless of the pressure rating.
[1)] Only DN 25 and DN 50 are available for flanges according to AS.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	A	B	C	D	E	F	G	H	J	L
½"	5.08	6.42	5.63	4.02	11.3	7.95	3.31	4.72	3.70	7.87
1"					11.3	7.95	3.31	4.72	3.70	7.87
1½"					11.3	7.95	3.31	4.72	3.70	7.87
2"					11.3	7.95	3.31	4.72	3.70	7.87
3"					13.2	8.94	4.29	7.09	3.70	7.87
4"					13.2	8.94	4.29	7.09	3.70	9.84
6"					16.4	10.5	5.91	10.2	5.51	11.8
8"					18.6	11.5	7.08	12.8	6.14	13.8
10"					20.6	12.5	8.07	15.8	6.14	17.7
12"					22.5	13.5	9.06	18.1	6.54	19.7

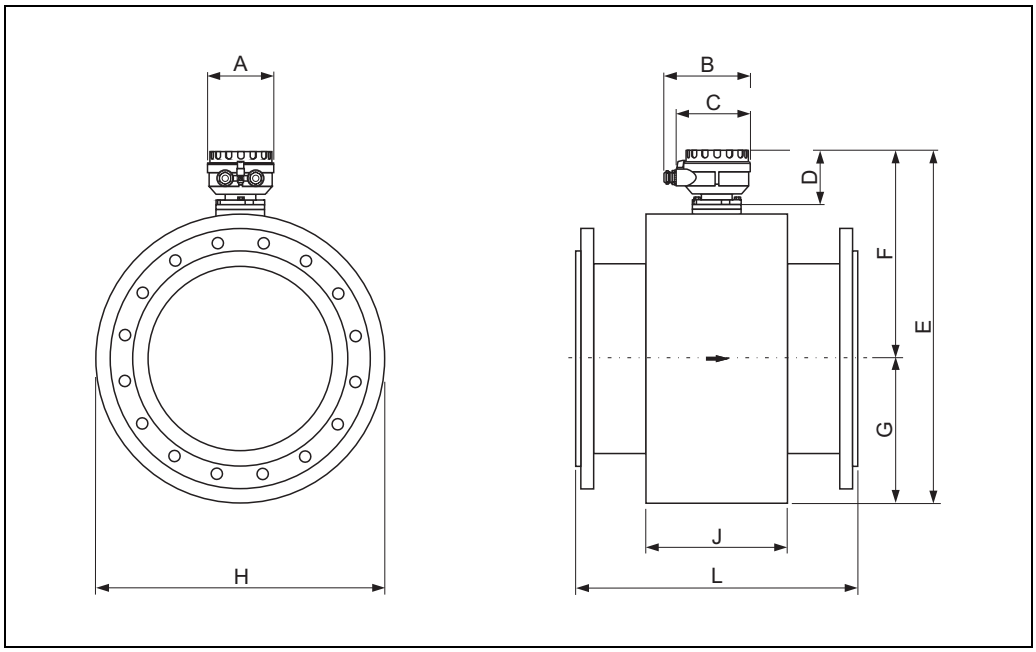
The fitting length (L) is always the same, regardless of the pressure rating.
All dimensions in [inch]

High temperature version DN≤ 300 (12")



Measurement D1, E1 = Measurement D, E of the standard remote version plus 110 mm (4.33")

Sensor, remote version DN ≥ 300 (12")



Dimensions (SI units)

DN EN (DIN)	A	B	C	D	E	F	G	H	J	L
350	129	163	143	102	683.5	401.5	282.0	564	276	550
400					735.5	427.5	308.0	616	276	600
450					785.5	452.5	333.0	666	292	650
500					836.5	478.0	358.5	717	292	650
600					940.5	530.0	410.5	821	402	780

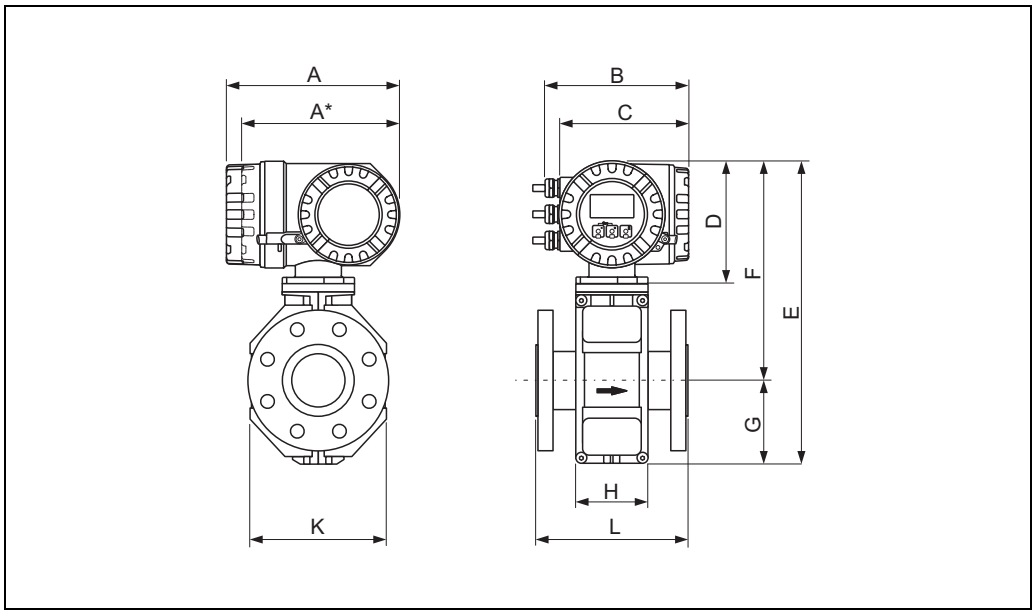
The fitting length (L) is always the same, regardless of the pressure rating.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	A	B	C	D	E	F	G	H	J	L
14"	5.08	6.42	5.63	4.02	26.9	15.8	11.1	22.2	10.9	21.7
16"					29.0	16.8	12.1	24.3	10.9	23.6
18"					30.9	17.8	13.1	26.2	11.5	25.6
20"					32.9	18.8	14.1	28.2	11.5	25.6
24"					37.0	20.9	16.2	32.3	15.8	30.7

The fitting length (L) is always the same, regardless of the pressure rating.
All dimensions in [inch]

Compact version DN ≤ 300 (12")



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Dimensions (SI units)

DN EN (DIN) / JIS / AS[1)]	A	A*	B	C	D	E	F	G	H	K	L
15	227	207	187	168	160	341	257	84	94	120	200
25						341	257	84	94	120	200
32						341	257	84	94	120	200
40						341	257	84	94	120	200
50						341	257	84	94	120	200
65						391	282	109	94	180	200
80						391	282	109	94	180	200
100						391	282	109	94	180	250
125						472	322	150	140	260	250
150						472	322	150	140	260	300
200						527	347	180	156	324	350
250						577	372	205	156	400	450
300						627	397	230	166	460	500

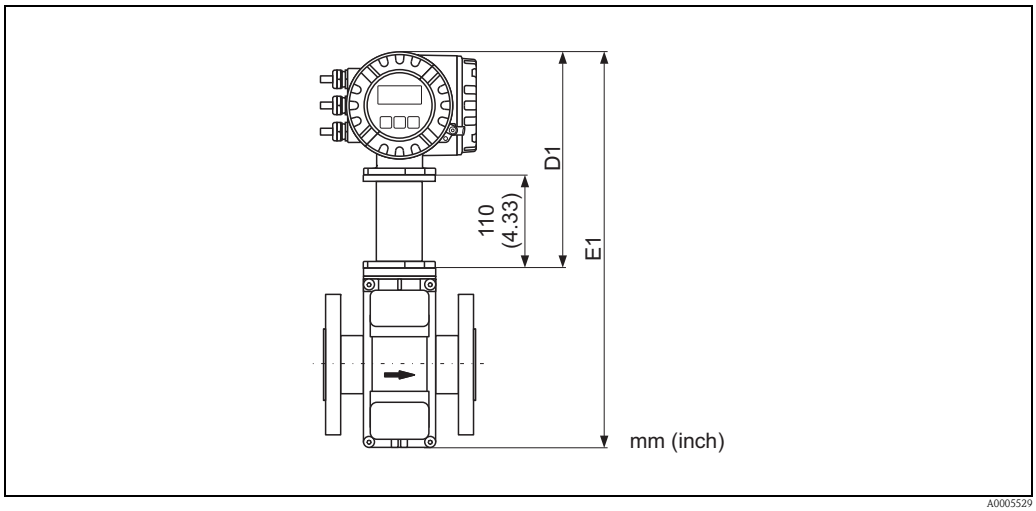
The fitting length (L) is always the same, regardless of the pressure rating.
[1)] Only DN 25 and DN 50 are available for flanges according to AS.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	A	A*	B	C	D	E	F	G	H	K	L
½"	8.94	8.15	7.36	6.61	6.30	13.4	10.1	3.31	3.70	4.72	7.87
1"						13.4	10.1	3.31	3.70	4.72	7.87
1½"						13.4	10.1	3.31	3.70	4.72	7.87
2"						13.4	10.1	3.31	3.70	4.72	7.87
3"						15.4	11.1	4.29	3.70	7.09	7.87
4"						15.4	11.1	4.29	3.70	7.09	9.84
6"						18.6	12.7	5.91	5.51	10.2	11.8
8"						20.8	13.7	7.09	6.14	12.8	13.8
10"						22.7	14.7	8.07	6.14	15.8	17.7
12"						24.7	15.6	9.06	6.54	18.1	19.7

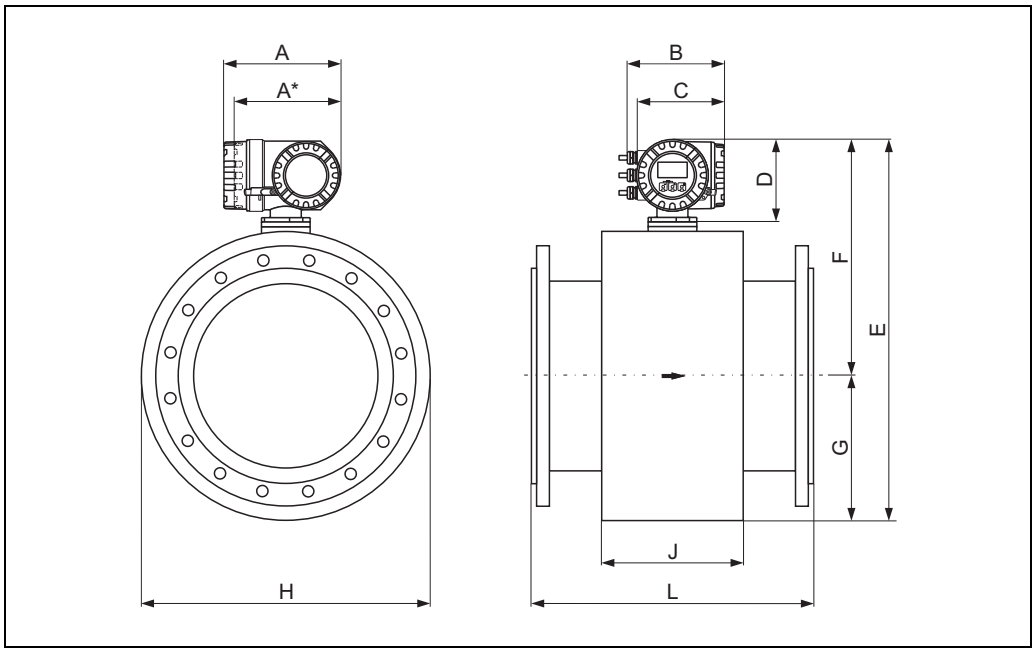
The fitting length (L) is always the same, regardless of the pressure rating.
All dimensions in [inch]

High temperature version DN ≤ 300 (12")



Measurement D1, E1 = Measurement D, E of the standard compact version plus 110 mm (4.33")

Compact version DN ≥ 300 (12")



Dimensions (SI units)

DN EN (DIN)	A	A*	B	C	D	E	F	G	H	J	L
350	227	207	187	168	160	738.5	456.5	282.0	564	276	550
400						790.5	482.5	308.0	616	276	600
450						840.5	507.5	333.0	666	292	650
500						891.5	533.0	358.5	717	292	650
600						995.5	585.0	410.5	821	402	780

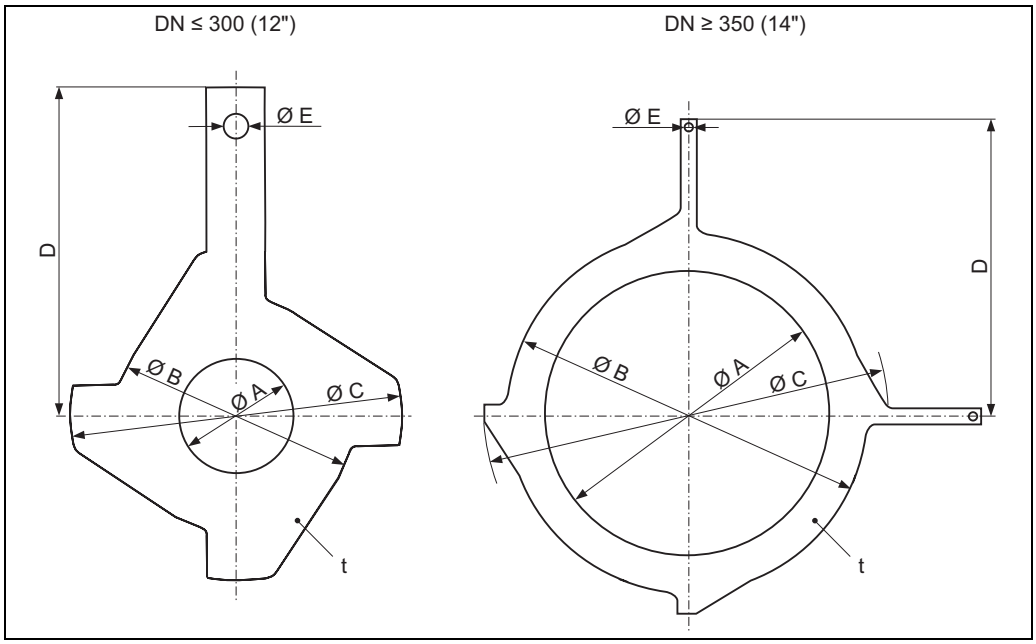
The fitting length (L) is always the same, regardless of the pressure rating.
All dimensions in [mm]

Dimensions (US units)

DN ANSI	A	A*	B	C	D	E	F	G	H	J	L
14"	8.94	8.15	7.36	6.61	6.30	29.1	18.0	11.1	22.2	10.9	21.7
16"						31.1	19.0	12.1	24.3	10.9	23.6
18"						33.1	20.0	13.1	26.2	11.5	25.6
20"						35.1	21.0	14.1	28.2	11.5	25.6
24"						39.2	23.0	16.2	32.3	15.8	30.7

The fitting length (L) is always the same, regardless of the pressure rating.
All dimensions in [inch]

Ground disk for flange connections



Dimensions (SI units)

DN[1]	A		B	C	D	E	t
EN (DIN) / JIS / AS[4]	PTFE, PFA, PU, HR[5]	NR[5]					
15	16	–	43	61.5	73	6.5	2
25	26	–	62	77.5	87.5		
32	35	–	80	87.5	94.5		
40	41	–	82	101	103		
50	52	–	101	115.5	108		
65	68	53	121	131.5	118		
80	80	66	131	154.5	135		
100	104	91.5	156	186.5	153		
125	130	117	187	206.5	160		
150	158	143.5	217	256	184		
200	206	192	267	288	205		
250	260	245	328	359	240		
300[2]	312	294.5	375	413	273		
300[3]	310	–	375	404	268		
350[2]	343	323.5	433	479	365	9.0	
400[2]	393	371	480	542	395		
450[2]	439	420	538	583	417		
500[2]	493	469	592	650	460		
600[2]	593	566	693	766	522		

[1] Ground disks at DN 15 to 250 can be used for all flange standards/nominal pressures available as standard.
[2] PN 10/16, Cl 150
[3] PN 25, JIS 10K/20K
[4] Only DN 25 and DN 50 are available for flanges according to AS.
[5] Abbreviations (lining): PU = Polyurethane, HR = Hard rubber, NR = Natural rubber
All dimensions in [mm]

Dimensions (US units)

DN[1] ANSI	A PTFE, PFA, PU, HR[2]	A NR[2]	B	C	D	E	t
½"	0.63	–	1.69	2.42	2.87	0.26	0.08
1"	1.02	–	2.44	3.05	3.44		
1½"	1.61	–	3.23	3.98	4.06		
2"	2.05	–	3.98	4.55	4.25		
3"	3.15	2.60	5.16	6.08	5.31		
4"	4.09	3.60	6.14	7.34	6.02		
6"	6.22	5.65	8.54	10.08	7.24		
8"	8.11	7.56	10.5	11.3	8.07		
10"	10.2	9.65	12.9	14.1	9.45		
12"	12.3	11.6	14.8	16.3	10.8		
14"	13.5	12.7	17.1	18.9	14.4	0.35	
16"	15.45	14.6	18.9	21.3	15.6		
18"	17.3	16.5	21.2	23.0	16.4		
20"	19.4	18.5	23.3	25.6	18.1		
24"	23.4	22.3	27.3	30.1	20.6		

[1] Ground disks can be used for all pressure ratings.
[2] Abbreviations (lining): PU = Polyurethane, HR = Hard rubber, NR = Natural rubber
All dimensions in [inch]

Weight

Weight in [kg]

Nominal diameter		Compact version						Remote version (without cable)						
								Sensor						Transmitter
[mm]	[inch]	EN (DIN) / AS*		JIS		ANSI		EN (DIN) / AS*		JIS		ANSI		(Wall-mount housing)
15	½"	PN 40	6.5	10K	6.5	Class 150	6.5	PN 40	4.5	10K	4.5	Class 150	4.5	6.0
25	1"		7.3		7.3		7.3		5.3		5.3		5.3	
32	–		8.0		7.3		–		6.0		5.3		–	
40	1½"		9.4		8.3		9.4		7.4		6.3		7.4	
50	2"		10.6		9.3		10.6		8.6		7.3		8.6	
65	–	PN 16	12.0		11.1		–	PN 16	10.0		9.1		–	
80	3"		14.0		12.5		14.0		12.0		10.5		12.0	
100	4"		16.0		14.7		16.0		14.0		12.7		14.0	
125	–		21.5		21.0		–		19.5		19.0		–	
150	6"		25.5		24.5		25.5		23.5		22.5		23.5	
200	8"	PN 10	45		41.9		45	PN 10	43		39.9		43	
250	10"		65		69.4		75		63		67.4		73	
300	12"		70		72.3		110		68		70.3		108	
350	14"		115				175		113				173	
400	16"		135				205		133				203	
450	18"		175				255		173				253	
500	20"		175				285		173				283	
600	24"		235				405		233				403	

Transmitter (Compact version): 3.4 kg
High temperature version: +1.5 kg
(Weight data valid for standard pressure ratings and without packaging material)
* Only DN 25 and DN 50 are available for flanges according to AS.

Weight in [lbs]

Nominal diameter		Compact version						Remote version (without cable)						
								Sensor						Transmitter
[mm]	[inch]	EN (DIN) / AS*		JIS		ANSI		EN (DIN) / AS*		JIS		ANSI		(Wall-mount housing)
15	½"	PN 40	14	10K	14	Class 150	14	PN 40	10	10K	10	Class 150	10	13
25	1"		16		16		16		12		12		12	
32	–		18		16		–		13		12		–	
40	1½"		21		18		21		16		14		16	
50	2"		23		21		23		19		16		19	
65	–	PN 16	26		24		–	PN 16	22		20		–	
80	3"		31		28		31		26		23		26	
100	4"		35		32		35		31		28		31	
125	–		47		46		–		43		42		–	
150	6"		56		54		56		52		50		52	
200	8"	PN 10	99		92		99	PN 10	95		88		95	
250	10"		143		153		165		139		149		161	
300	12"		154		159		243		150		155		238	
350	14"		254				386		249				381	
400	16"		298				452		293				448	
450	18"		386				562		381				558	
500	20"		386				628		381				624	
600	24"		518				893		514				889	

Transmitter (Compact version): 3.4 kg
High temperature version: +1.5 kg
(Weight data valid for standard pressure ratings and without packaging material)
* Only DN 25 and DN 50 are available for flanges according to AS.

Materials

Transmitter housing:
- Compact and remote version: Powder-coated die-cast aluminum

Sensor housing:
- DN 15 to 300 (½ to 12"): Powder-coated die-cast aluminum
- DN 350 to 600 (14 to 24"): Painted steel

Measuring tube:
- DN < 350 (14"): Stainless steel 1.4301 (SS 304) or 1.4306/304L. For flanges of carbon steel with Al/Zn protective coating.
- DN > 300 (12"): Stainless steel 1.4301/304. For flanges of carbon steel with protective paint finish.

Flange:
- EN 1092-1 (DIN 2501): 316L / 1.4571 (SS 316Ti); RSt37-2 (S235JRG2) / C22 / FE 410W B (DN < 350 (14"): with Al/Zn protective coating; DN > 300 (12") with protective paint finish)
- ANSI: A105; F316L (DN < 350 (14") with Al/Zn protective coating; DN > 300 (12") with protective paint finish)
- JIS: RSt37-2 (S235JRG2) / HII / 1.0425 / 316L (DN < 350 (14") with Al/Zn protective coating; DN > 300 (12") with protective paint finish)
- AS 2129:
  - DN 25 (1"): A105 or RSt37-2 (S235JRG2), with Al/Zn protective coating
  - DN 50 (2"): A105 or St44-2 (S275JR), with Al/Zn protective coating
- AS 4087:
  - DN 50 (2"): A105 or St44-2 (S275JR), with Al/Zn protective coating

Ground disks: 1.4435/316L or Alloy C-22

Electrodes:
- 1.4435, platinum, Alloy C-22, tantalum, titanium Gr. 2, tungsten carbide coating (for electrodes made from 1.4435)
- 1.4310/302 (for brush electrodes), Duplex 1.4462, Alloy X750 (for brush electrodes)

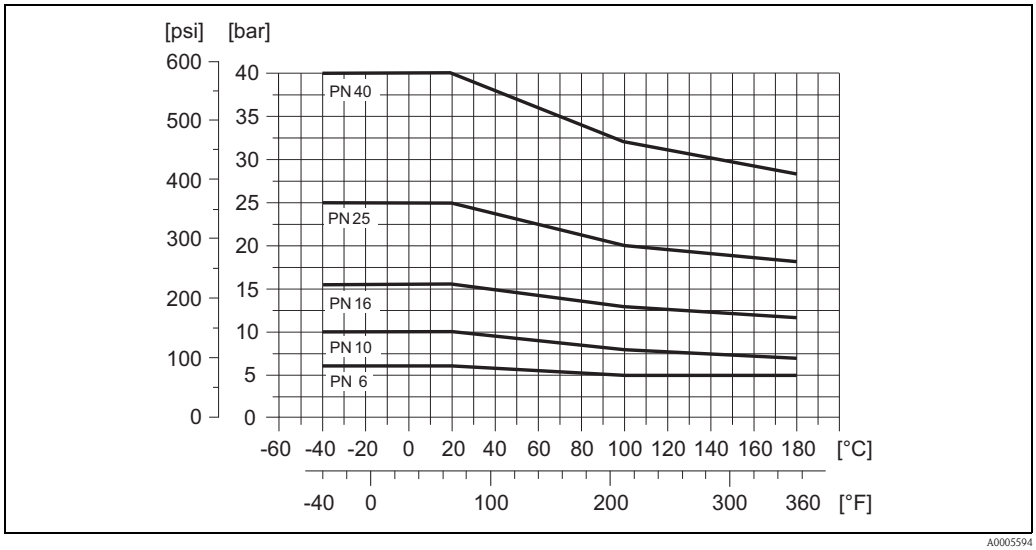
Seals: according to DIN EN 1514-1

Material load diagrams

Caution!
The following diagrams contain material load curves (reference curves) for various process connections relating to the fluid temperature. But the maximal permissible fluid temperature always depends on the lining material of the sensor and/or the sealing material.

Flange connection to EN 1092-1 (DIN 2501)

Flange material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



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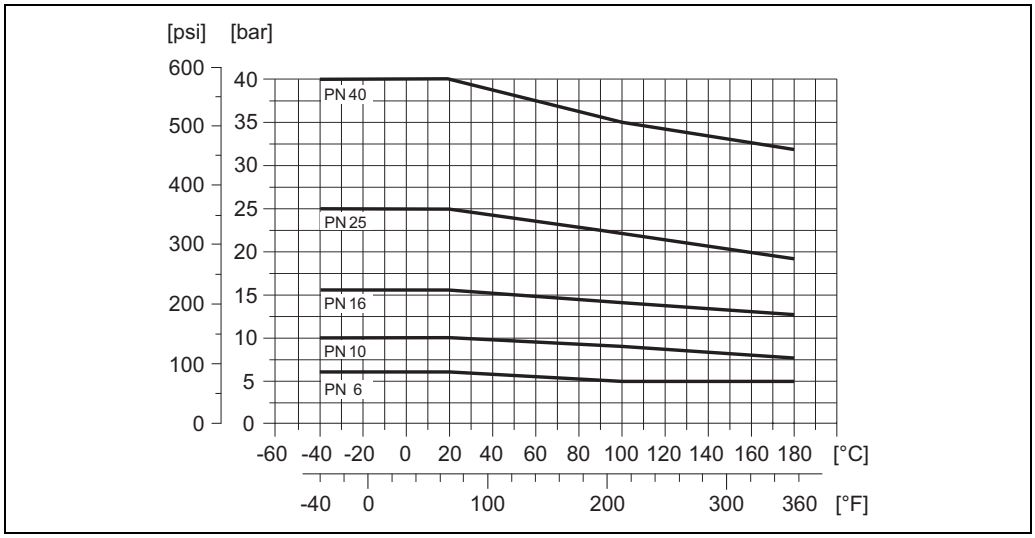
Flange connection to EN 1092-1 (DIN 2501)

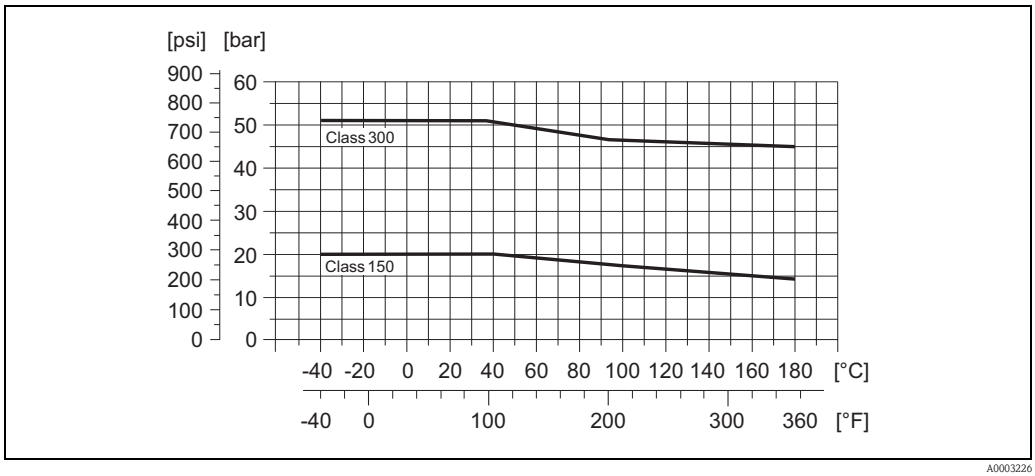
Flange material: 316L / 1.4571



A0005304

Flange connection to ANSI B16.5

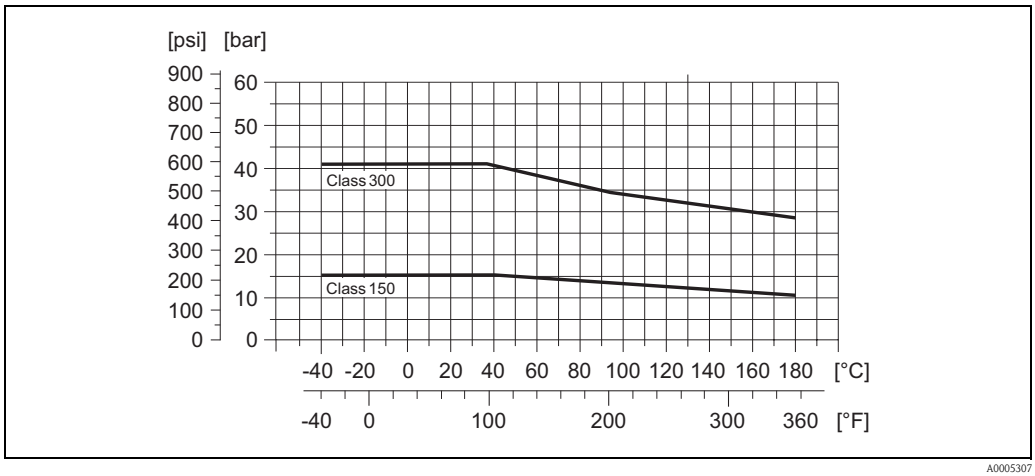
Flange material: A105



A0003226

Flange connection to ANSI B16.5

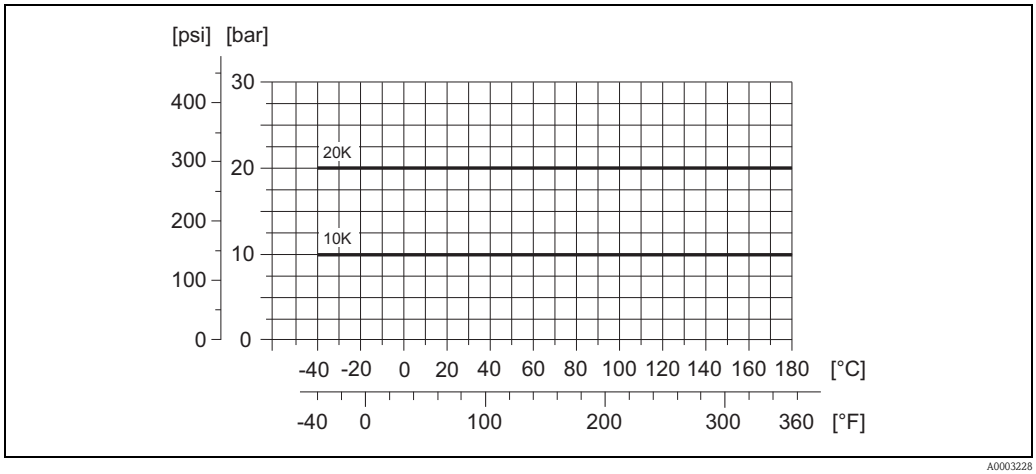
Flange material: F316L



A0005307

Flange connection to JIS B2220

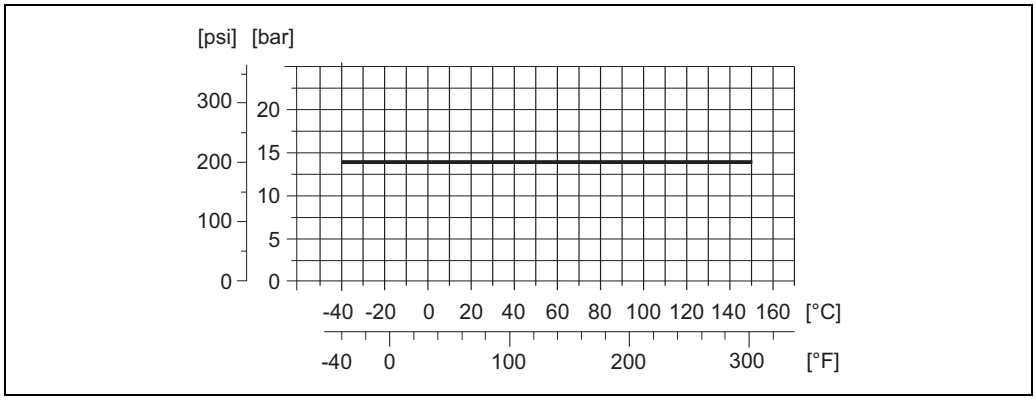
Flange material: RSt37-2 (S235JRG2) / H II / 1.0425



A0003228

Flange connection to AS 2129 Table E or AS 4087 Cl. 14

Flange material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



A0005595

Fitted electrodes

Comes as standard:
- 2 measuring electrodes for signal detection
- 1 EPD electrode for empty pipe detection
- 1 Reference electrode for potential equalization

Optionally available for measuring electrodes made of platinum:
- 1 EPD electrode for empty pipe detection
- 1 Reference electrode for potential equalization

For measuring tube with natural rubber lining in combination with brush electrodes:
- 2 brush electrodes for signal detection

Process connections

Flange connection:
- EN 1092-1 (DIN 2501)
  - DN < 300 (12"): Form A
  - DN > 300 (12"): Form B
  - DN 65 (2½") PN 16 and DN 600 (24") PN 16 exclusively according to EN 1092-1
- ANSI
- JIS
- AS

Surface roughness

- Lining with PFA: ≤ 0.4 µm (16 µin)
- Electrodes: 0.3 to 0.5 µm (12 to 20 µin)

All data relate to wetted parts.

Human interface

Display elements

- Liquid-crystal display: illuminated, four lines with 16 characters per line
- Custom configurations for presenting different measured values and status variables
- 3 totalizers
- At ambient temperatures below –20 °C (–4 °F), the readability of the display may be impaired.

Operating elements

- Onsite operation with three optical sensor keys (⊟/⊞/ⓔ)
- Application-specific Quick Setup menus for straightforward commissioning

Language groups

Language groups available for operation in different countries:

- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch, Portuguese
- Eastern Europe/Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish, Czech
- South and East Asia (SEA):
  English, Japanese, Indonesian
- China (CN):
  English, Chinese

Note!
You can change the language group via the operating program "FieldCare".

Language groups

via HART protocol

Certificates and approvals

CE mark

The measuring system described in these Operating Instructions therefore complies with the legal requirements of the EU Directives. Endress+Hauser confirms this by affixing the CE mark to it and by issuing the CE declaration of conformity.

C-tick mark

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

Ex certification

Information on the currently available Ex-rated versions (ATEX, FM, CSA etc.) is available on request from your Endress+Hauser sales outlet. All information relevant to explosion protection is available in separate documents that you can order as necessary.

Sanitary compatibility

No applicable approvals or certification

Pressure measuring device approval

All measuring devices, including those with a nominal diameter smaller than or equal to DN 25, correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. For nominal diameters greater than DN 25 (depending on the fluid and process pressure), there are additional optional approvals according to category II/III.

FOUNDATION Fieldbus certification

The flow device has successfully passed all the test procedures carried out and is certified and registered by the Fieldbus Foundation. The device thus meets all the requirements of the following specifications:

- Certified to FOUNDATION Fieldbus Specification
- The device meets all the specifications of the FOUNDATION Fieldbus H1
- Interoperability Test Kit (ITK), revision status 5.0 (device certification number: on request)
- The device can also be operated with certified devices of other manufacturers
- Physical Layer Conformance Test of the Fieldbus Foundation

PROFIBUS PA certification

The flowmeter has successfully passed all the test procedures carried out and is certified and registered by the PNO (PROFIBUS User Organization). The device thus meets all the requirements of the following specifications:

- Certified in accordance with PROFIBUS Profile Version 3.0 (device certification number: available on request)
- The measuring device can also be operated with certified devices of other manufacturers (interoperability)

Other standards, guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010-1
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures
- IEC/EN 61326
  "Emission in accordance with requirements for class A".
  Electromagnetic compatibility (EMC requirements).
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 (No. 1010.1-92)
  Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category I.
- NAMUR NE 21
  Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- 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.

Accessories

Various accessories are available for the transmitter and the sensor. These can be ordered separately from Endress+Hauser.

Note!
For detailed information on specific order codes, please contact the Endress+Hauser service organization.

Supplementary documentation

- Flow Measurement (FA005D/06/en)
- Operating Instructions Promag 55 (BA119D/06/en, BA120D/06/en)
- Operating Instructions Promag 55 PROFIBUS PA (BA124D/06/en, BA125D/06/en)
- Operating Instructions Promag 53 FOUNDATION Fieldbus (BA126D/06/en, BA127D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA

Ordering information

Note!
Endress+Hauser reserves the right to change or modify product, specifications, and ordering information at any time without notice. Please consult Endress+Hauser or your local representative for the most recent information.

Registered trademarks

HART®
Registered trademark of HART Communication Foundation, Austin, USA

PROFIBUS®
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FOUNDATION™ Fieldbus
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HistoROM™, S-DAT®, T-DAT®, F-CHIP®, FieldCare®, Fieldcheck®, Applicator®
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People for Process Automation

TI071D/06/en/10.09
71104953
FM+SGML6.0/ProMoDo

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promag 10W

Electromagnetic Flow Measuring System
Flow measurement of liquids in water or wastewater applications

Application
Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 50 µS/cm:

- Drinking water
- Wastewater
- Sewage sludge

- Flow measurement up to 110000 m³/h (484315 gal/min)
- Fluid temperature up to +80 °C (176 °F)
- Process pressures up to 40 bar (580 psi)
- Lengths in accordance with DVGW/ISO

Application-specific lining materials:
- Polyurethane
- Hard rubber

Lined measuring pipes with materials approved for drinking water:
- KTW
- WRAS
- NSF
- ACS

Your benefits
Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:
- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:
- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

TI093D/06/en/11.09
71105946

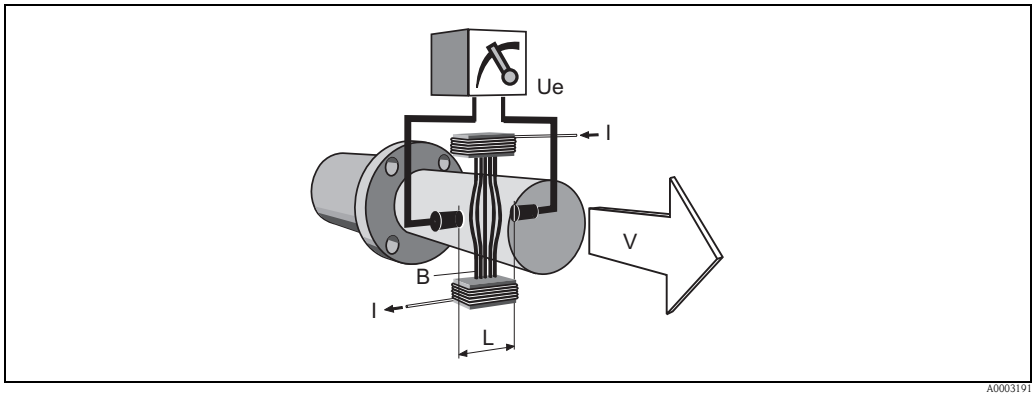
Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.
In the electromagnetic measuring principle, the flowing medium is the moving conductor.
The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated by means of the pipe cross-sectional area.
The DC magnetic field is created through a switched direct current of alternating polarity.



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$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
v *Flow velocity*
Q *Volume flow*
A *Pipe cross-section*
I *Current strength*

Measuring system

The measuring system consists of a transmitter and a sensor.
Two versions are available:
- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:
- Promag 10 (key operation, two-line, unilluminated display)

Sensor:
- Promag W
  DN 25 to 2000 (1 to 78")

Input

Measured variable	Flow velocity (proportional to induced voltage)
Measuring ranges	Typically v = 0.01 to 10 m/s (0.033 to 33 ft/s) with the specified accuracy
Operable flow range	Over 1000 : 1

Output

Output signal

Current output

- Galvanically isolated
- Active: 4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
- Full scale value adjustable
- Temperature coefficient: typ. 2 µA/°C, resolution: 1.5 µA

Pulse/status output

- Galvanically isolated
- Passive: 30 V DC / 250 mA
- Open collector
- Can be configured as:
  - Pulse output
    Pulse value and pulse polarity can be selected, max. pulse width adjustable (5 to 2000 ms), pulse frequency max. 100 Hz
  - Status output
    For example, can be configured for error messages, empty pipe detection, flow recognition, limit value

Signal on alarm

Current output

Failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43)

Pulse output

Failsafe mode can be selected

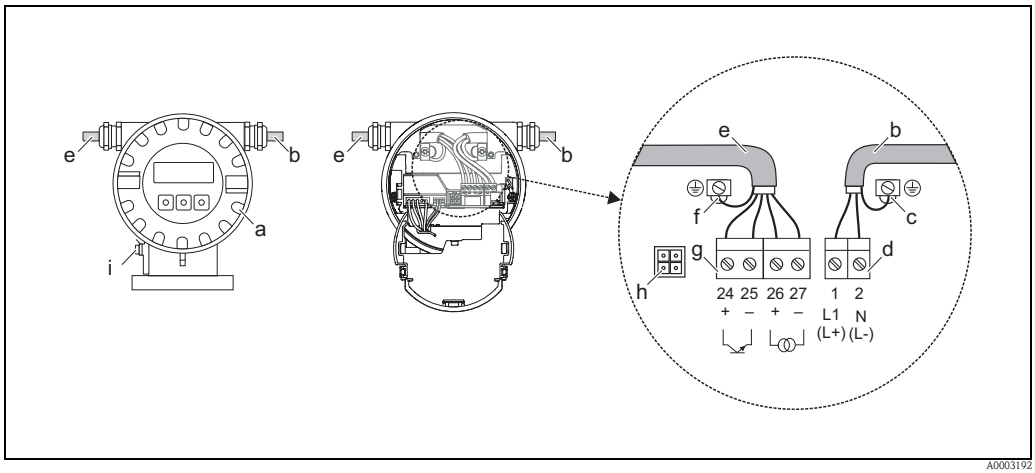
Status output

"Not conductive" in the event of fault or power supply failure

Load	See "Output signal"
Low flow	Low flow cutoff, switch-on point can be selected as required
Galvanic isolation	All circuits for inputs, outputs and power supply are galvanically isolated from each other.

Power supply

Electrical connection, measuring unit



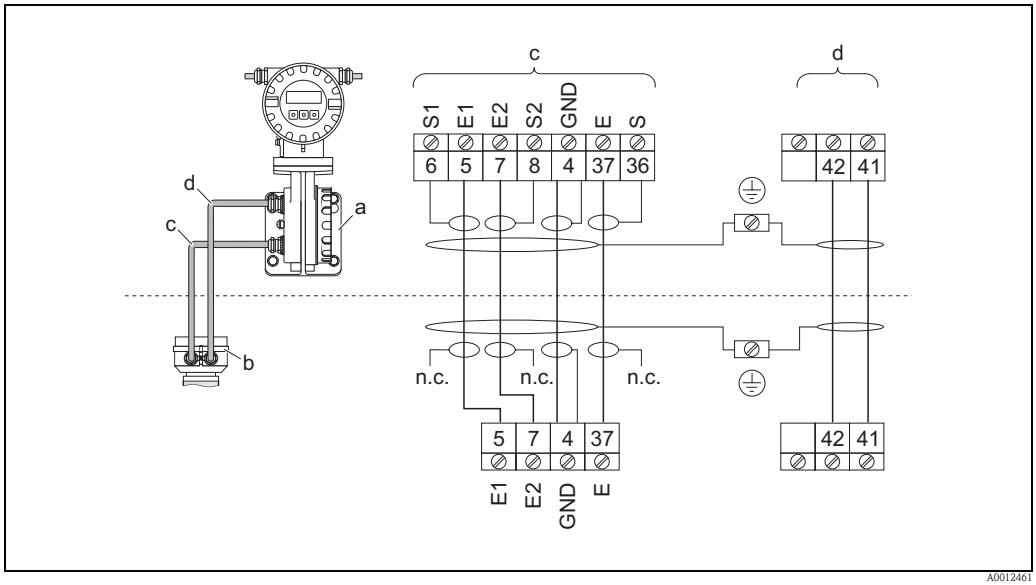
Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)

a *Electronics compartment cover*
b *Power supply cable*
c *Ground terminal for power supply cable*
d *Terminal connector for power supply cable*
e *Signal cable*
f *Ground terminal for signal cable*
g *Terminal connector for signal cable*
h *Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)*
i *Ground terminal for potential equalization*

Electrical connection, terminal assignment

Order version	Terminal No.					
	24 (+)	25 (–)	26 (+)	27 (–)	1 (L1/L+)	2 (N/L–)
10***-**********A	Pulse/status output		HART current output		Power supply	
Functional values	See “Output signal”				See “Supply voltage”	

Electrical connection, remote version



Connecting the remote version

a Wall-mount housing connection compartment
b Sensor connection housing cover
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields

Cable colors/numbers for terminals:
5/6 = brown; 7/8 = white; 4 = green; 37/36 = yellow

Supply voltage (power supply)

- 85 to 250 V AC, 45 to 65 Hz
- 20 to 28 V AC, 45 to 65 Hz, 11 to 40 V DC

Cable entry

Power supply and signal cables (inputs/outputs):

- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:

- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

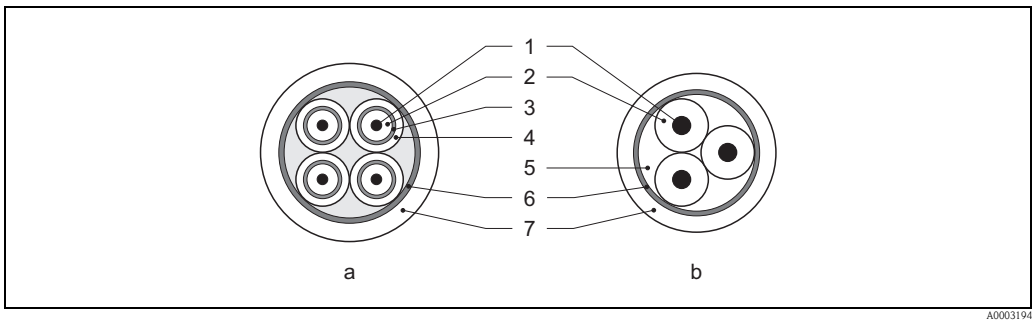
Remote version cable specifications

Coil cable

- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤ 37 Ω/km (≤ 0.011 Ω/ft)
- Capacitance core/core, shield grounded: ≤ 120 pF/m (≤37 pF/ft)
- Operating temperature: –20 to +80 °C (–4 to +176 °F)
- Cable cross-section: max. 2.5 mm² (16 AWG)
- Test voltage for cable insulation: ≥ 1433 V AC r.m.s. 50/60 Hz or ≥ 2026 V DC

Signal cable

- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature: –20 to +80 °C (–4 to +176 °F)
- Cable cross-section: max. 2.5 mm² (16 AWG)



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a *Signal cable*
b *Coil current cable*

1 *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

Operation in zones of severe electrical interference

The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendation NE 21.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

Power consumption

Power consumption
- 85 to 250 V AC: < 12 VA (incl. sensor)
- 20 to 28 V AC: < 8 VA (incl. sensor)
- 11 to 40 V DC: < 6 W (incl. sensor)

Switch-on current
- Max. 16 A (< 5 ms) for 250 V AC
- Max. 5.5 A (< 5 ms) for 28 V AC
- Max. 3.3 A (< 5 ms) for 24 V DC

Power supply failure

Lasting min. ½ cycle frequency: EEPROM saves measuring system data

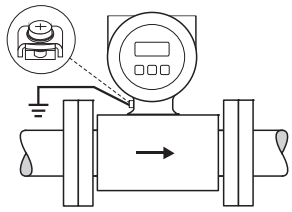
Potential equalization

Warning!
The measuring system must be included in the potential equalization.

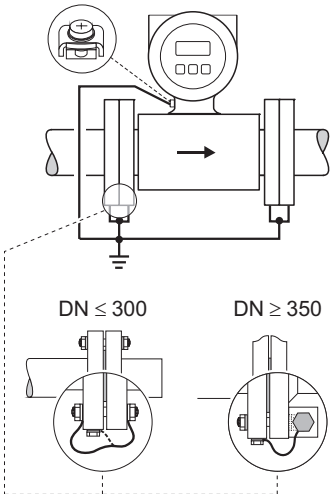
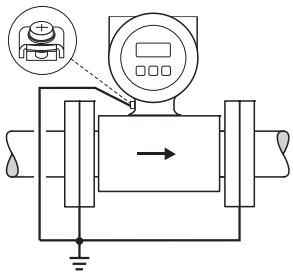
Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

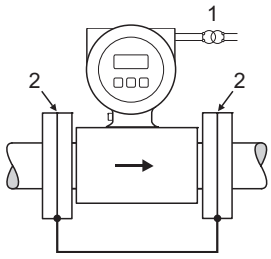
The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes (see table)

Standard situation

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal, grounded pipe Potential equalization takes place via the ground terminal of the transmitter. Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 A0010831 *Via the ground terminal of the transmitter*

Special situations

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal pipe that is not grounded This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, at least 6 mm² / 0.0093 in²) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose. Ground cable installation depends on the nominal diameter: ■ DN ≤ 300 (12"): The ground cable is mounted directly on the conductive flange coating with the flange screws. ■ DN ≥ 350 (14"): The ground cable is mounted directly on the metal transport bracket. Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 A0010832 *Via the ground terminal of the transmitter and the flanges of the pipe*
When using the measuring device in a: ■ Plastic pipe ■ Pipe with insulating lining This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, at least 6 mm² / 0.0093 in²). When installing the ground disks, please comply with the enclosed Installation Instructions.	 A0010833 *Via the ground terminal of the transmitter and the optionally available ground disks*

Operating conditions	Potential equalization
When using the measuring device in a: ■ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, at least 6 mm² / 0.0093 in²). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ■ The applicable regulations regarding potential-free installation must be observed. ■ There should be **no** electrically conductive connection between the pipe and the device. ■ The mounting material must withstand the applicable torques.	 A0010834 *Potential equalization and cathodic protection* *1 Power supply isolation transformer* *2 Electrically isolated*

Performance characteristics

Reference operating conditions

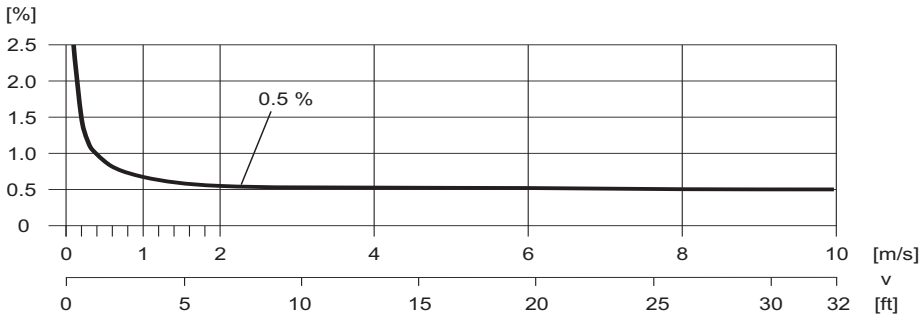
As per DIN EN 29104 and VDI/VDE 2641:
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
- Ambient temperature: +22 °C ±2 K (+72 °F ± 2 K)
- Warm-up period: 30 minutes

Installation conditions:
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

- Current output: also typically ± 5 µA
- Pulse output: ±0.5% o.r. ± 2 mm/s (±0.5% o.r. ± 0.08 in/s) (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.



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Max. measured error in % of reading

Repeatability

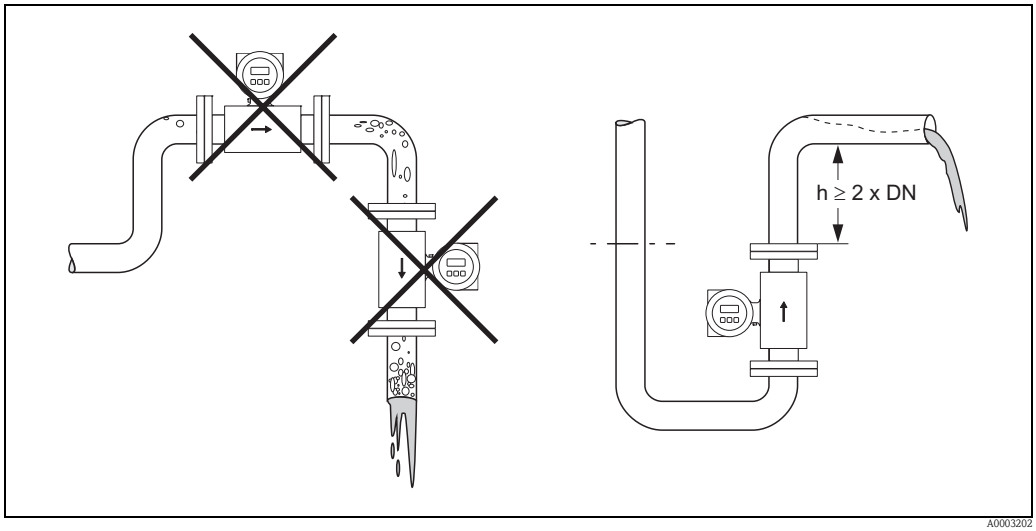
Max. ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

Operating conditions: Installations

Installation instructions

Mounting location

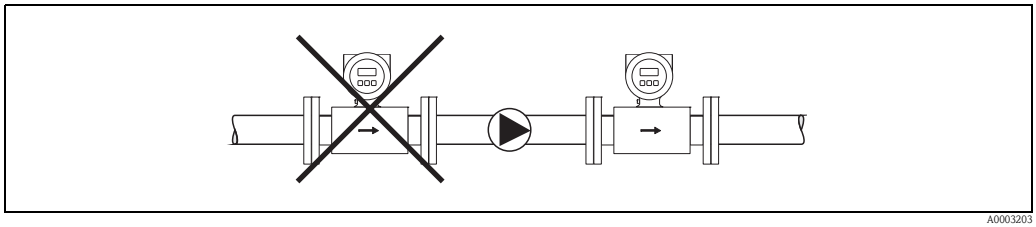
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



Mounting location

Installation of pumps

Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".
Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 16, Section "Shock and vibration resistance".

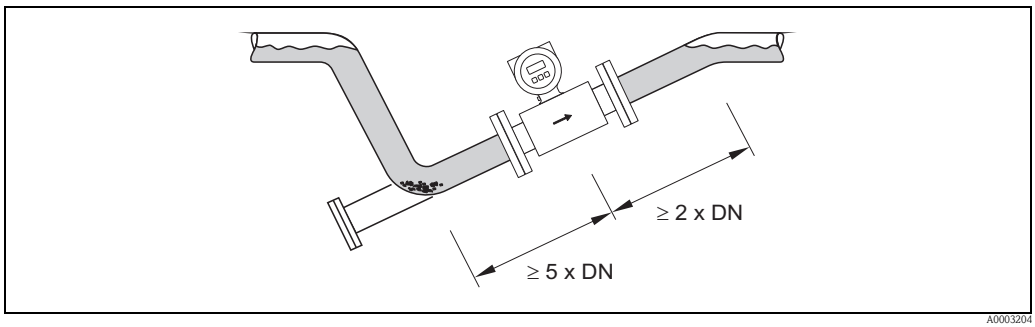


Installation of pumps

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

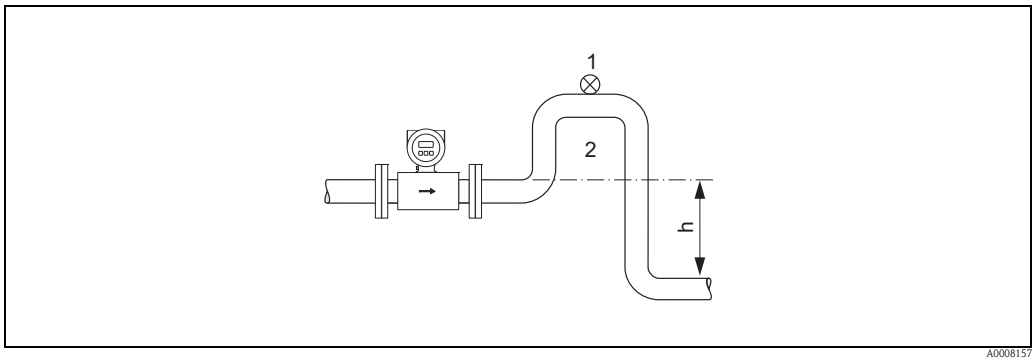
Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



Installation with partially filled pipes

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".



Installation measures for vertical pipes

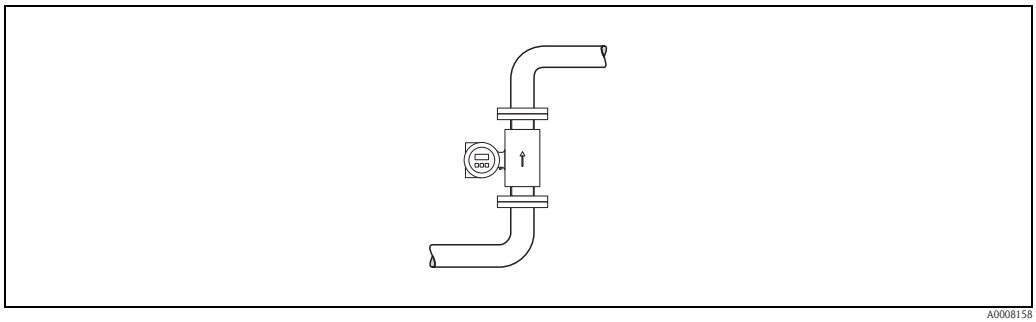
1 Vent valve
2 Pipe siphon
h Length of the down pipe

Orientation

An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, the measuring device also offers the additional function of empty pipe detection (EPD) for detecting partially filled measuring tubes or if outgassing fluids or fluctuating operating pressures are present.

Vertical orientation

This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



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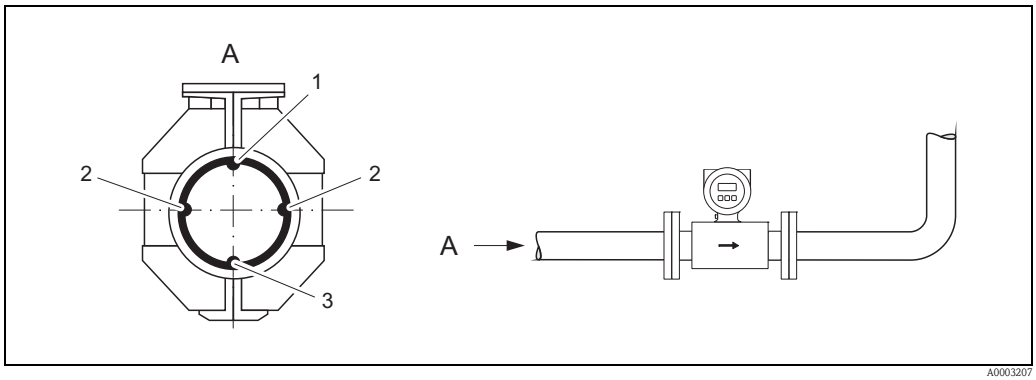
Vertical orientation

Horizontal orientation

The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!

Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.



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Horizontal orientation

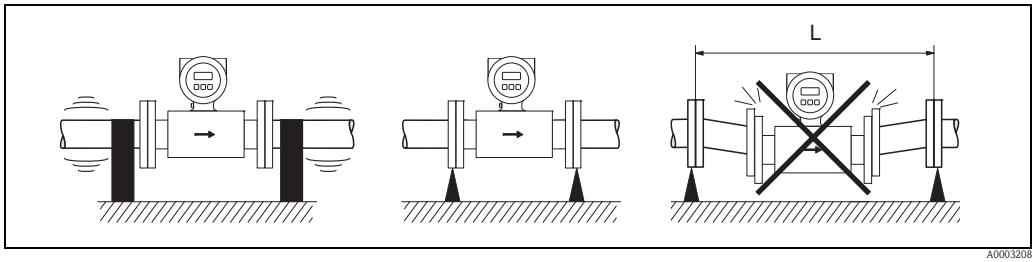
1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!

If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 16, Section "Shock and vibration resistance".



Measures to prevent vibration of the measuring device

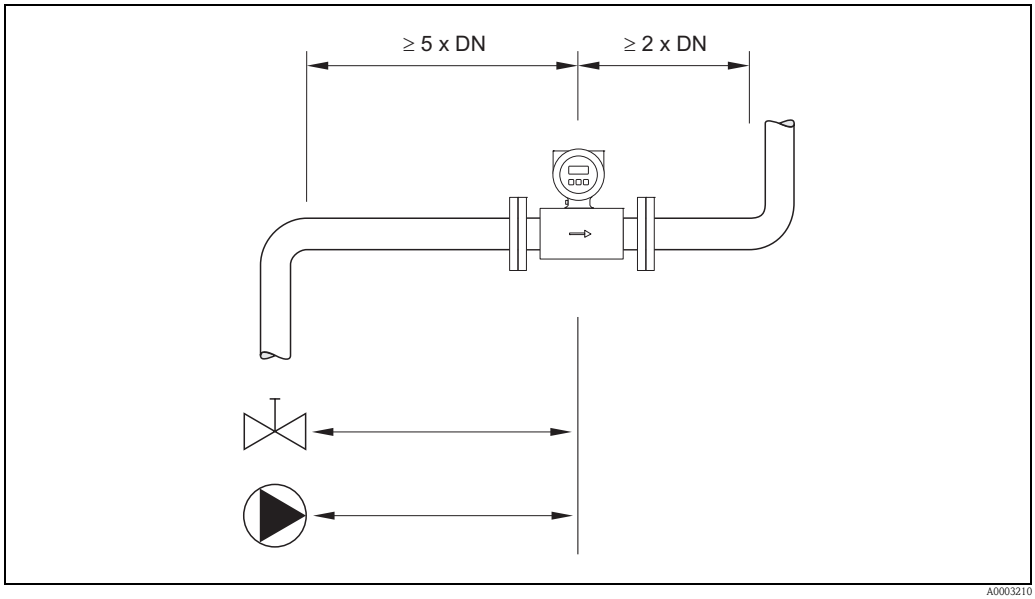
L > 10 m (33 ft)

Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

Note the following inlet and outlet runs to comply with measuring accuracy specifications:

- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN



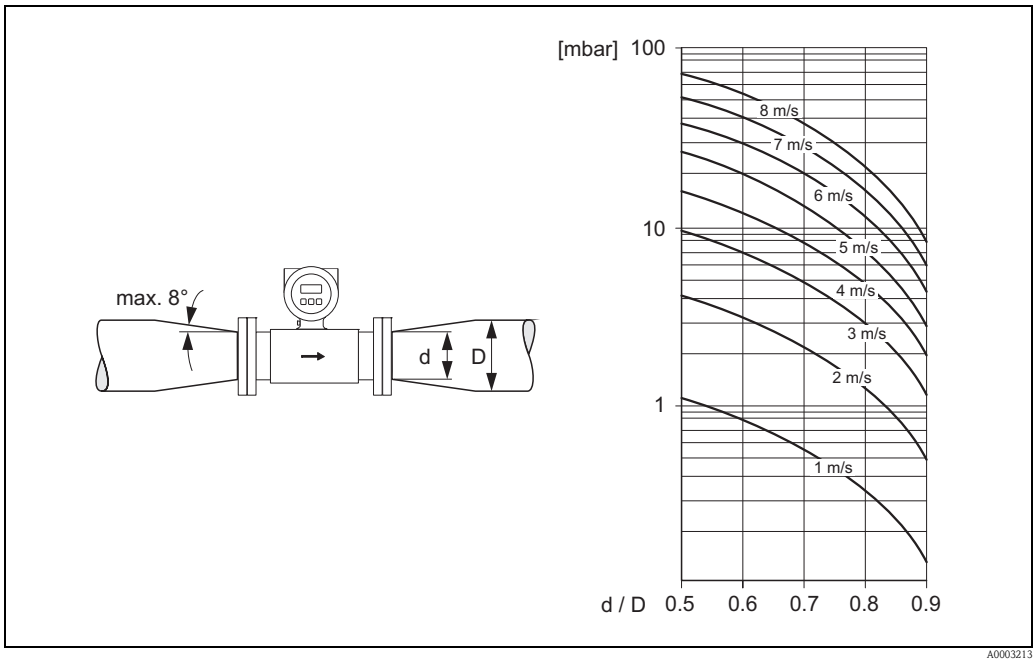
Inlet and outlet run

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

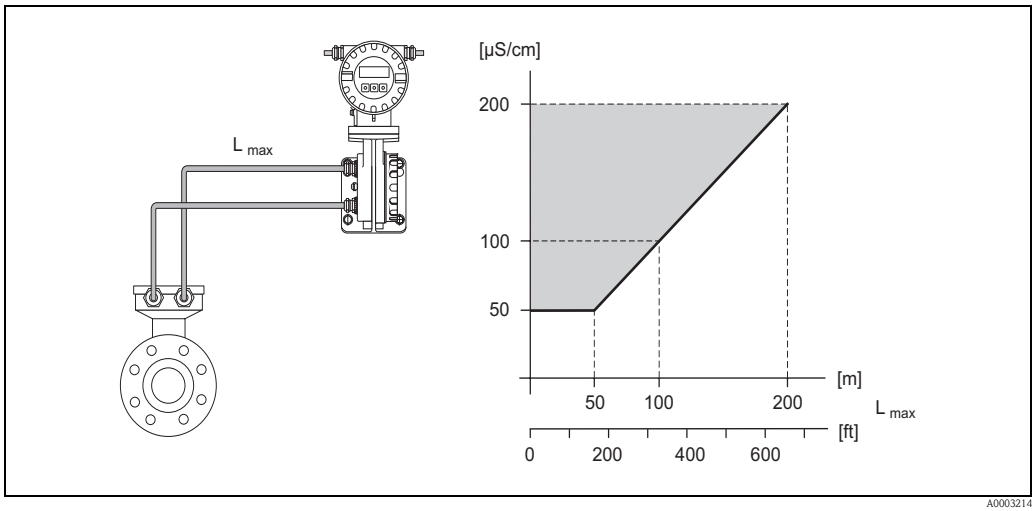


Pressure loss due to adapters

Length of connecting cable

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length L_{max} is determined by the fluid conductivity. A minimum conductivity of 50 µS/cm is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).



Permitted length of connecting cable for remote version
Area marked in gray = permitted range; L_{max} = length of connecting cable in [m] ([ft]); fluid conductivity in [µS/cm]

Operating conditions: Environment

Ambient temperature range

Transmitter
- –20 to +60 °C (–4 to +140 °F)

Sensor
- Flange material carbon steel: –10 to +60 °C (+14 to +140 °F)
- Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)

Caution!
The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ 17, Section "Medium temperature range").

Please note the following points:
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

Degree of protection
- Standard: IP 67 (NEMA 4X) for transmitter and sensor.
- Optional: IP 68 (NEMA 6P) for sensor for remote version.
- For information regarding applications where the device is buried directly in the soil or is installed in a flooded wastewater basin please contact your local Endress+Hauser Sales Center.

Shock and vibration resistance

Acceleration up to 2 g following IEC 600 68-2-6

Electromagnetic compatibility (EMC)
- As per IEC/EN 61326 as well as NAMUR Recommendation NE 21
- Emission: to limit value for industry EN 55011

Operating conditions: Process

Medium temperature range

The permitted temperature depends on the measuring tube lining:
- Polyurethane: –20 to +50 °C (-4 to +122 °F) (DN 25 to 1200 / 1 to 48")
- Hard rubber: 0 to +80 °C (+32 to +176 °F) (DN 50 to 2000 / 2 to 78")

Conductivity

The minimum conductivity is: ≥ 50 µS/cm

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 15, Section "Length of connecting cable").

Medium pressure range (nominal pressure)

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 2000 / 14 to 78")
  - PN 10 (DN 200 to 2000 / 8 to 78")
  - PN 16 (DN 65 to 2000 / 3 to 78")
  - PN 25 (DN 200 to 1000 / 8 to 40")
  - PN 40 (DN 25 to 150 / 1 to 6")
- ANSI B 16.5
  - Class 150 (DN 25 to 600 / 1 to 24")
  - Class 300 (DN 25 to 150 / 1 to 6")
- AWWA
  - Class D (DN 700 to 2000 / 28 to 78")
- JIS B2220
  - 10 K (DN 50 to 300 / 2 to 12")
  - 20 K (DN 25 to 300 / 1 to 12")
- AS 2129
  - Table E (DN 80, 100, 150 to 1200 / 3", 4", 6 to 48")
- AS 4087
  - PN 16 (DN 80, 100, 150 to 1200 / 3", 4", 6 to 48")

Pressure tightness

Measuring tube lining: Polyurethane

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:			
		25 °C (77 °F)		50 °C (122 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]
25 to 1200	1 to 48"	0	0	0	0

Measuring tube lining: Hard rubber

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:					
		25 °C (77 °F)		70 °C (158 °F)		80 °C (176 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]	[mbar]	[psi]
50 to 2000	2 to 78"	0	0	0	0	0	0

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.
The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.5 ft/s): for abrasive fluids such as potter's clay, lime milk, ore slurry etc.
- v > 2 m/s (6.5 ft/s): for fluids causing build-up such as wastewater sludges etc.

Flow characteristic values (SI units)

Diameter		Recommended flow	Factory settings		
[mm]	[inch]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value Current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow (v ~ 0.04 m/s)
25	1"	9 to 300 dm³/min	75 dm³/min	0.50 dm³	1 dm³/min
32	–	15 to 500 dm³/min	125 dm³/min	1.00 dm³	2 dm³/min
40	1½"	25 to 700 dm³/min	200 dm³/min	1.50 dm³	3 dm³/min
50	2"	35 to 1100 dm³/min	300 dm³/min	2.50 dm³	5 dm³/min
65	–	60 to 2000 dm³/min	500 dm³/min	5.00 dm³	8 dm³/min
80	3"	90 to 3000 dm³/min	750 dm³/min	5.00 dm³	12 dm³/min
100	4"	145 to 4700 dm³/min	1200 dm³/min	10.00 dm³	20 dm³/min
125	–	220 to 7500 dm³/min	1850 dm³/min	15.00 dm³	30 dm³/min
150	6"	20 to 600 m³/h	150 m³/h	0.025 m³	2.5 m³/h
200	8"	35 to 1100 m³/h	300 m³/h	0.05 m³	5.0 m³/h
250	10"	55 to 1700 m³/h	500 m³/h	0.05 m³	7.5 m³/h
300	12"	80 to 2400 m³/h	750 m³/h	0.10 m³	10 m³/h
350	14"	110 to 3300 m³/h	1000 m³/h	0.10 m³	15 m³/h
375	15"	140 to 4200 m³/h	1200 m³/h	0.15 m³	20 m³/h
400	16"	140 to 4200 m³/h	1200 m³/h	0.15 m³	20 m³/h
450	18"	180 to 5400 m³/h	1500 m³/h	0.25 m³	25 m³/h
500	20"	220 to 6600 m³/h	2000 m³/h	0.25 m³	30 m³/h
600	24"	310 to 9600 m³/h	2500 m³/h	0.30 m³	40 m³/h
700	28"	420 to 13500 m³/h	3500 m³/h	0.50 m³	50 m³/h
–	30"	480 to 15000 m³/h	4000 m³/h	0.50 m³	60 m³/h
800	32"	550 to 18000 m³/h	4500 m³/h	0.75 m³	75 m³/h
900	36"	690 to 22500 m³/h	6000 m³/h	0.75 m³	100 m³/h
1000	40"	850 to 28000 m³/h	7000 m³/h	1.00 m³	125 m³/h
–	42"	950 to 30000 m³/h	8000 m³/h	1.00 m³	125 m³/h
1200	48"	1250 to 40000 m³/h	10000 m³/h	1.50 m³	150 m³/h
–	54"	1550 to 50000 m³/h	13000 m³/h	1.50 m³	200 m³/h
1400	–	1700 to 55000 m³/h	14000 m³/h	2.00 m³	225 m³/h
–	60"	1950 to 60000 m³/h	16000 m³/h	2.00 m³	250 m³/h
1600	–	2200 to 70000 m³/h	18000 m³/h	2.50 m³	300 m³/h
–	66"	2500 to 80000 m³/h	20500 m³/h	2.50 m³	325 m³/h
1800	72"	2800 to 90000 m³/h	23000 m³/h	3.00 m³	350 m³/h
–	78"	3300 to 100000 m³/h	28500 m³/h	3.50 m³	450 m³/h
2000	–	3400 to 110000 m³/h	28500 m³/h	3.50 m³	450 m³/h

Flow characteristic values (US units)					
Diameter		Recommended flow rate	Factory settings		
[inch]	[mm]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value Current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow (v ~ 0.04 m/s)
1"	25	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
–	32	4 to 130 gal/min	30 gal/min	0.20 gal	0.50 gal/min
1½"	40	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	50	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
–	65	16 to 500 gal/min	130 gal/min	1 gal	2.0 gal/min
3"	80	24 to 800 gal/min	200 gal/min	2 gal	2.5 gal/min
4"	100	40 to 1250 gal/min	300 gal/min	2 gal	4.0 gal/min
–	125	60 to 1950 gal/min	450 gal/min	5 gal	7.0 gal/min
6"	150	90 to 2650 gal/min	600 gal/min	5 gal	12 gal/min
8"	200	155 to 4850 gal/min	1200 gal/min	10 gal	15 gal/min
10"	250	250 to 7500 gal/min	1500 gal/min	15 gal	30 gal/min
12"	300	350 to 10600 gal/min	2400 gal/min	25 gal	45 gal/min
14"	350	500 to 15000 gal/min	3600 gal/min	30 gal	60 gal/min
15"	375	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
16"	400	600 to 19000 gal/min	4800 gal/min	50 gal	60 gal/min
18"	450	800 to 24000 gal/min	6000 gal/min	50 gal	90 gal/min
20"	500	1000 to 30000 gal/min	7500 gal/min	75 gal	120 gal/min
24"	600	1400 to 44000 gal/min	10500 gal/min	100 gal	180 gal/min
28"	700	1900 to 60000 gal/min	13500 gal/min	125 gal	210 gal/min
30"	–	2150 to 67000 gal/min	16500 gal/min	150 gal	270 gal/min
32"	800	2450 to 80000 gal/min	19500 gal/min	200 gal	300 gal/min
36"	900	3100 to 100000 gal/min	24000 gal/min	225 gal	360 gal/min
40"	1000	3800 to 125000 gal/min	30000 gal/min	250 gal	480 gal/min
42"	–	4200 to 135000 gal/min	33000 gal/min	250 gal	600 gal/min
48"	1200	5500 to 175000 gal/min	42000 gal/min	400 gal	600 gal/min
54"	–	9 to 300 Mgal/min	75 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1400	10 to 340 Mgal/min	85 Mgal/min	0.0005 Mgal	1.3 Mgal/min
60"	–	12 to 380 Mgal/min	95 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1600	13 to 450 Mgal/min	110 Mgal/min	0.0008 Mgal	1.7 Mgal/min
66"	–	14 to 500 Mgal/min	120 Mgal/min	0.0008 Mgal	2.2 Mgal/min
72"	1800	16 to 570 Mgal/min	140 Mgal/min	0.0008 Mgal	2.6 Mgal/min
78"	–	18 to 650 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min
–	2000	20 to 700 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min

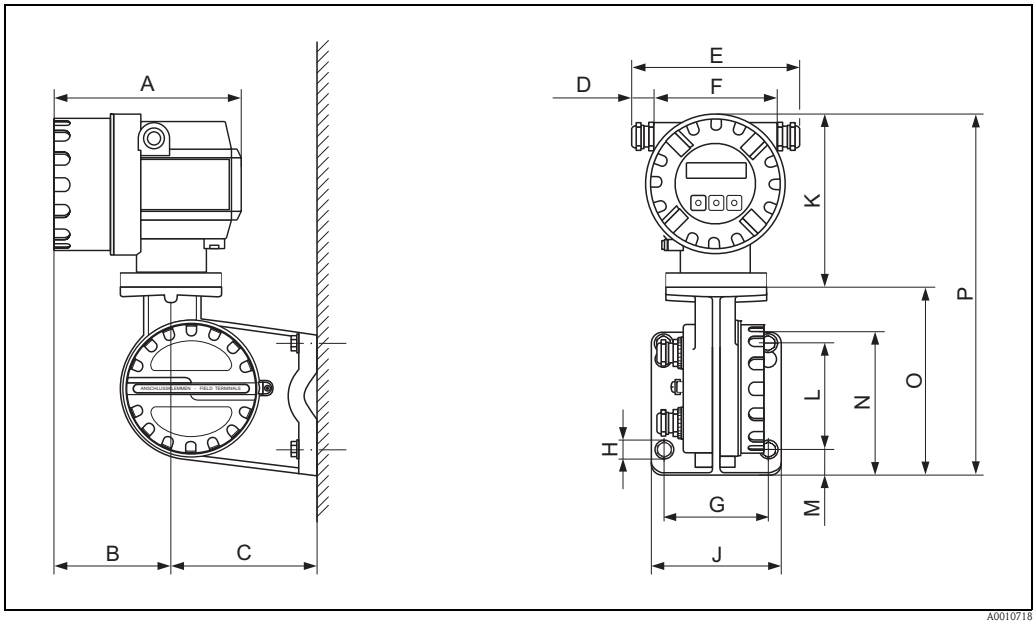
Pressure loss

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 14, Section "Adapters").

Mechanical construction

Design, dimensions

Transmitter, remote version



Transmitter dimensions, remote version

Dimensions in SI units

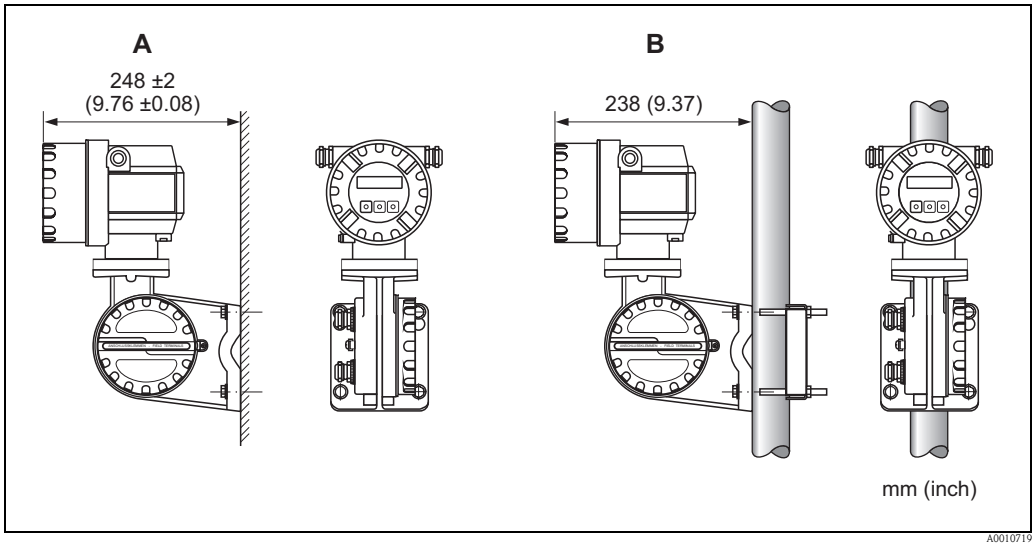
A	B	C	D	E	F	G	Ø H
178	113	135	20 to 30	161 to 181	113	100	8.6 (M8)
J	K	L	M	N	O	P	
123	150	100	25	133	177.5	327.5	

All dimensions in [mm]

Dimensions in US units

A	B	C	D	E	F	G	Ø H
7.00	4.45	5.31	0.79 to 1.81	6.34 to 7.13	4.45	3.94	0.34 (M8)
J	K	L	M	N	O	P	
4.84	5.90	3.94	0.98	5.24	6.99	12.89	

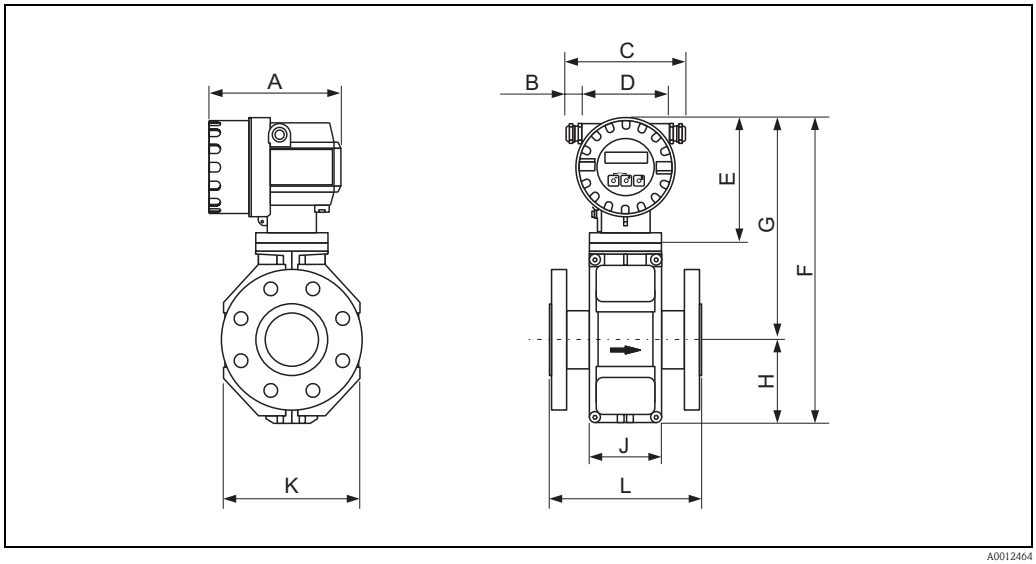
All dimensions in [inch]



Transmitter mounting, remote version

A Direct wall mounting
B Pipe mounting

Compact version DN ≤ 300 (12")



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Dimensions in SI units

DN EN (DIN) / JIS / AS [2]	L [1]	A	B	C	D	E	F	G	H	J	K
25	200	178	20 to 30	161 to 181	113	150	341	257	84	94	120
32	200						341	257	84	94	120
40	200						341	257	84	94	120
50	200						341	257	84	94	120
65	200						391	282	109	94	180
80	200						391	282	109	94	180
100	250						391	282	109	94	180
125	250						472	322	150	140	260
150	300						472	322	150	140	260
200	350						527	347	180	156	324
250	450						577	372	205	166	400
300	500						627	397	230	166	460

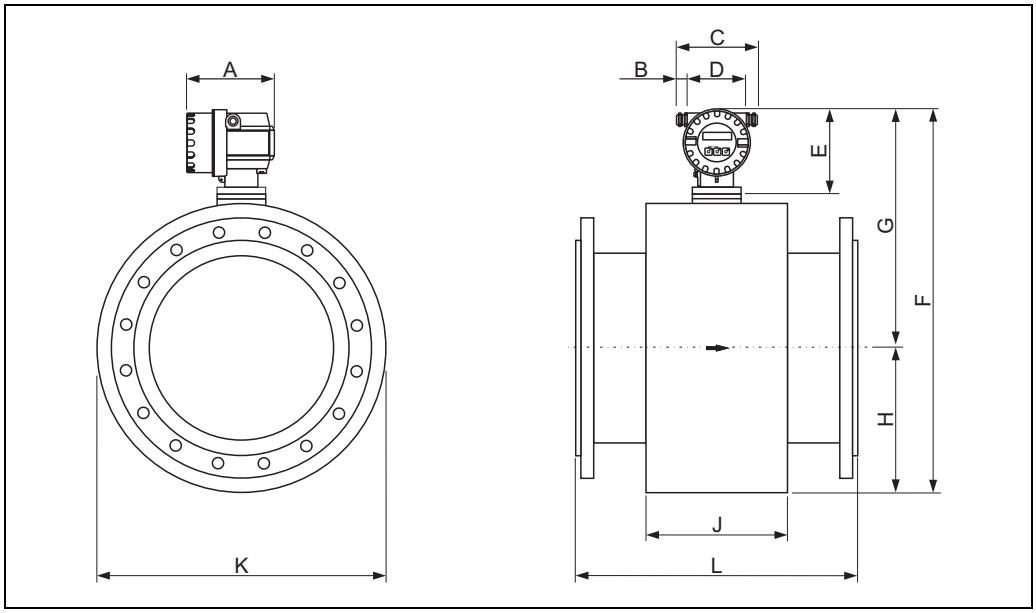
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions in US units

DN ANSI	L [1)]	A	B	C	D	E	F	G	H	J	K
1"	7.87	7.01	0.79 to 1.18	6.34 to 7.13	4.45	5.91	13.4	10.1	3.31	3.70	4.72
1½"	7.87						13.4	10.1	3.31	3.70	4.72
2"	7.87						13.4	10.1	3.31	3.70	4.72
3"	7.87						15.4	11.1	4.29	3.70	7.09
4"	9.84						15.4	11.1	4.29	3.70	7.09
6"	11.8						18.6	12.7	5.91	5.51	10.2
8"	13.8						20.8	13.7	7.09	6.14	12.8
10"	17.7						22.7	14.7	8.07	6.14	15.8
12"	19.7						24.7	15.6	9.06	6.54	18.1

[1)] The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Compact version DN ≥ 350 (14")



A0003218

Dimensions in SI units

DN EN (DIN) / AS [2]	L [1]	A	B	C	D	E	F	G	H	J	K
350	550	178	20 to 30	161 to 181	113	150	738.5	456.5	282.0	276	564
375	600						790.5	482.5	308.0	276	616
400	600						790.5	482.5	308.0	276	616
450	650						840.5	507.5	333.0	292	666
500	650						891.5	533.0	358.5	292	717
600	780						995.5	585.0	410.5	402	821
700	910						1198.5	686.5	512.0	589	1024
750	975						1198.5	686.5	512.0	626	1024
800	1040						1241.5	708.5	533.5	647	1067
900	1170						1394.5	784.5	610.0	785	1220
1000	1300						1546.5	860.5	686.0	862	1372
1050	1365						1598.5	886.5	712.0	912	1424
1200	1560						1796.5	985.5	811.0	992	1622
1350	1755						1998.5	1086.5	912.0	1252	1824
1400	1820						2148.5	1161.5	987.0	1252	1974
1500	1950						2196.5	1185.5	1011.0	1392	2022
1600	2080						2286.5	1230.5	1056.0	1482	2112
1650	2145						2360.5	1267.5	1093.0	1482	2186
1800	2340						2550.5	1362.5	1188.0	1632	2376
2000	2600						2650.5	1412.5	1238.0	1732	2476

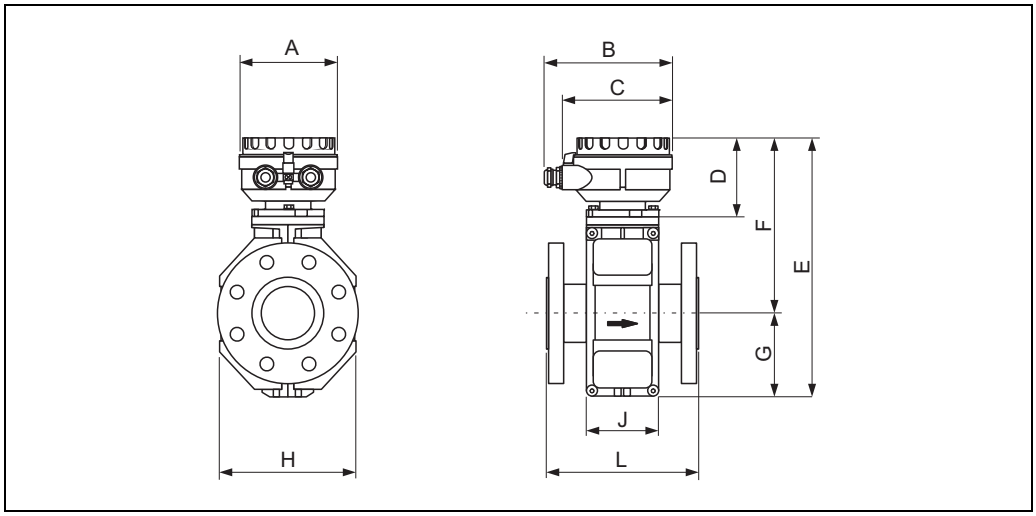
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

Dimensions in US units

DN ANSI / AWWA [2]	L [1]	A	B	C	D	E	F	G	H	J	K
14"	21.6	7.01	0.79 to 1.18	6.34 to 7.13	4.45	5.91	29.1	17.9	11.1	10.9	22.2
15"	23.6						31.1	18.9	12.1	10.9	24.2
16"	23.6						31.1	18.9	12.1	10.9	24.2
18"	25.6						33.1	19.9	13.1	11.5	26.2
20"	25.6						35.1	20.9	14.1	11.5	28.2
24"	30.7						39.2	23.0	16.2	15.8	32.3
28"	35.8						47.2	27.0	20.1	23.2	40.3
30"	38.4						47.2	27.0	20.1	24.6	40.3
32"	40.9						48.9	27.9	21.0	25.5	42.0
36"	46.0						54.9	30.9	24.0	30.9	48.0
40"	51.2						60.9	33.9	27.0	33.9	54.0
42"	53.7						62.9	34.9	28.0	35.9	56.0
48"	61.4						71.7	38.8	31.9	39.0	63.8
54"	69.1						78.7	42.8	35.9	42.3	71.8
56"	71.7						84.6	45.7	38.9	49.3	77.7
60"	76.8						86.5	46.7	39.8	54.8	79.6
64"	81.9						90.0	48.4	41.6	58.4	83.2
66"	84.4						92.9	49.9	43.0	58.4	86.0
72"	92.1						100.4	53.6	46.8	64.2	93.5
78"	102.3						104.3	55.6	48.7	68.2	97.5

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Flanges ≤ DN 600 only to ANSI available, ≥ DN 700 only to AWWA available.
All dimensions in [inch]

Sensor, remote version DN ≤ 300 (12")



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Dimensions in SI units

DN EN (DIN) / JIS / AS [2]	L [1]	A	B	C	D	E	F	G	H	J
25	200	129	163	143	102	286	202	84	120	94
32	200	129	163	143	102	286	202	84	120	94
40	200	129	163	143	102	286	202	84	120	94
50	200	129	163	143	102	286	202	84	120	94
65	200	129	163	143	102	336	227	109	180	94
80	200	129	163	143	102	336	227	109	180	94
100	250	129	163	143	102	336	227	109	180	94
125	250	129	163	143	102	417	267	150	260	140
150	300	129	163	143	102	417	267	150	260	140
200	350	129	163	143	102	472	292	180	324	156
250	450	129	163	143	102	522	317	205	400	166
300	500	129	163	143	102	572	342	230	460	166

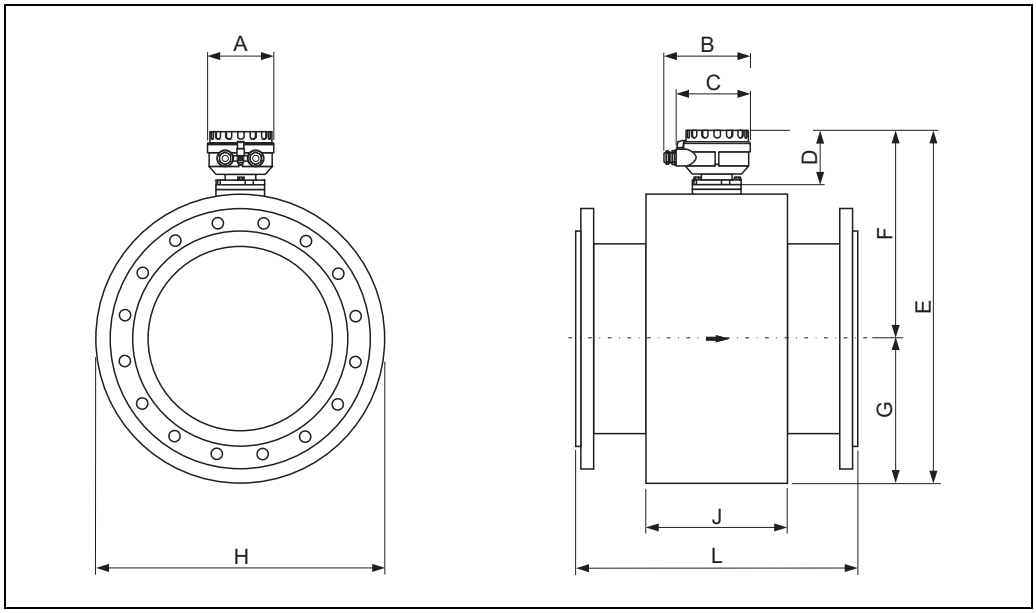
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only the nominal diameters DN 80, 100 and 150 to 300 are available.
All dimensions in [mm]

Dimensions in US units

DN ANSI	L [1)]	A	B	C	D	E	F	G	H	J
1"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
1½"	7.87					11.3	7.95	3.32	4.72	3.70
2"	7.87					11.3	7.95	3.32	4.72	3.70
3"	7.87					13.2	8.94	4.30	7.10	3.70
4"	9.84					13.2	8.94	4.30	7.10	3.70
6"	11.8					16.4	10.5	5.91	10.2	5.51
8"	13.8					18.6	11.5	7.10	12.8	6.14
10"	17.7					20.6	12.5	8.08	15.8	6.14
12"	19.7					22.5	13.5	9.06	18.1	6.54

[1)] The length is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Sensor, remote version DN ≥ 350 (14")



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Dimensions in SI units

DN EN (DIN) / AS [2]	L [1]	A	B	C	D	E	F	G	H	J
350	550	129	163	143	102	683.5	401.5	282.0	564	276
375	600					735.5	427.5	308.0	616	276
400	600					735.5	427.5	308.0	616	276
450	650					785.5	452.5	333.0	666	292
500	650					836.5	478.0	358.5	717	292
600	780					940.5	530.0	410.5	821	402
700	910					1143.5	631.5	512.0	1024	589
750	975					1143.5	631.5	512.0	1024	626
800	1040					1186.5	653.0	533.5	1067	647
900	1170					1339.5	729.5	610.0	1220	785
1000	1300					1491.5	805.5	686.0	1372	862
1050	1365					1543.5	831.5	712.0	1424	912
1200	1560					1741.5	930.5	811.0	1622	992
1350	1755					1943.5	1031.5	912.0	1824	1252
1400	1820					2093.5	1106.5	987.0	1974	1252
1500	1950					2141.5	1130.5	1011.0	2022	1392
1600	2080					2231.5	1175.5	1056.0	2112	1482
1650	2145					2305.5	1212.5	1093.0	2186	1482
1800	2340					2495.5	1307.5	1188.0	2376	1632
2000	2600					2595.5	1357.5	1238.0	2476	1732

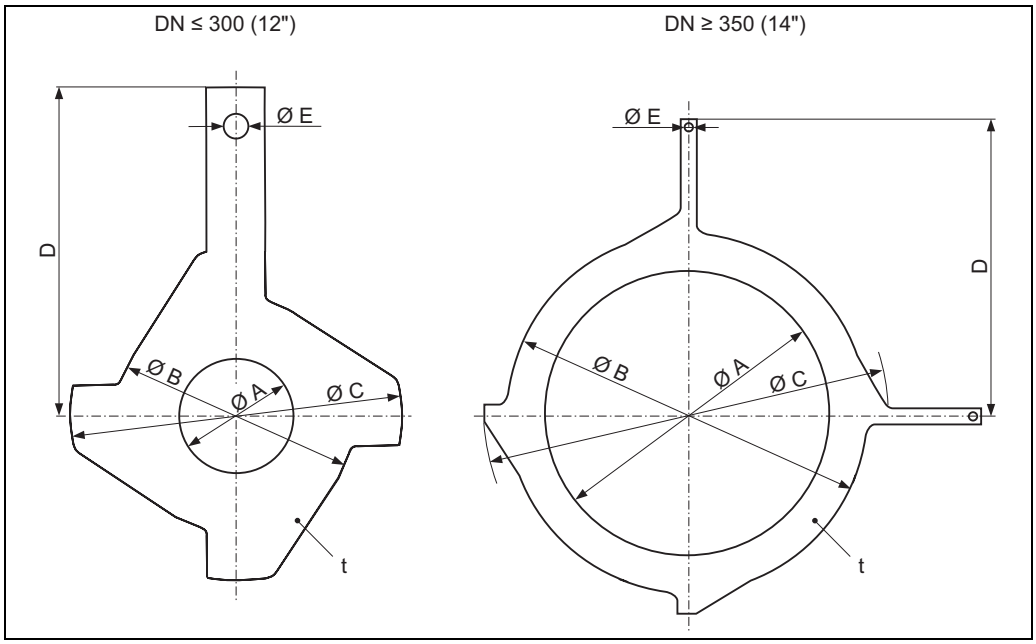
[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] For flanges to AS, only DN 350, 400, 500 and 600 are available.
All dimensions in [mm]

Dimensions in US units

DN ANSI / AWWA [2]	L [1]	A	B	C	D	E	F	G	H	J
14"	21.6	5.08	6.42	5.63	4.02	29.1	15.8	11.1	22.2	10.9
15"	23.6					31.1	16.8	12.1	24.2	10.9
16"	23.6					31.1	16.8	12.1	24.2	10.9
18"	25.6					33.1	17.8	13.1	26.2	11.5
20"	25.6					35.1	18.8	14.1	28.2	11.5
24"	30.7					39.2	20.9	16.2	32.3	15.8
28"	35.8					45.0	24.9	20.1	40.3	23.2
30"	38.4					45.0	24.9	20.1	40.3	24.6
32"	40.9					46.7	25.7	21.0	42.0	25.5
36"	46.0					52.7	28.7	24.0	48.0	30.9
40"	51.2					58.7	31.7	27.0	54.0	33.9
42"	53.7					60.7	32.7	28.0	56.0	35.9
48"	61.4					68.5	36.6	31.9	63.8	39.0
54"	69.1					76.5	40.6	35.9	71.8	42.3
56"	71.7					82.4	43.6	38.9	77.7	49.3
60"	76.8					84.3	44.5	39.8	79.6	54.8
64"	81.9					87.9	46.3	41.6	83.2	58.4
66"	84.4					90.8	47.7	43.0	86.0	58.4
72"	92.1					98.2	51.5	46.8	93.5	64.2
78"	102.3					102.2	53.4	48.7	97.5	68.2

[1] The length is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Flanges ≤ DN 600 only to ANSI available, ≥ DN 700 only to AWWA available.
All dimensions in [inch]

Ground disk for flange connections



Dimensions (SI units)

DN [1] EN (DIN) / JIS / AS [2]	A	B	C	D	E	t
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5		
40	41	82	101	103		
50	52	101	115.5	108		
65	68	121	131.5	118		
80	80	131	154.5	135		
100	104	156	186.5	153		
125	130	187	206.5	160		
150	158	217	256	184		
200	206	267	288	205		
250	260	328	359	240		
300 [3]	312	375	413	273		
300 [4]	310	375	404	268		
350 [3]	343	433	479	365	9.0	
375 [3]	393	480	542	395		
400 [3]	393	480	542	395		
450 [3]	439	538	583	417		
500 [3]	493	592	650	460		
600 [3]	593	693	766	522		

[1] Ground disks can be used for all flange standards/pressure ratings that can be delivered, except for DN ≥ 300.
[2] Only DN 32, 40, 65 and 125 are available for flanges according to AS.
[3] PN 10/16
[4] PN 25, JIS 10K/20K
All dimensions in [mm]

Dimensions (US units)

DN [1] ANSI	A	B	C	D	E	t
1"	1.02	2.44	3.05	3.44	0.26	0.08
1½"	1.61	3.23	3.98	4.06		
2"	2.05	3.98	4.55	4.25		
3"	3.15	5.16	6.08	5.31		
4"	4.09	6.14	7.34	6.02		
6"	6.22	8.54	10.08	7.24		
8"	8.11	10.5	11.3	8.07		
10"	10.2	12.9	14.1	9.45		
12"	12.3	14.8	16.3	10.8		
14"	13.5	17.1	18.9	14.4	0.35	
15"	15.45	18.9	21.3	15.6		
16"	15.45	18.9	21.3	15.6		
18"	17.3	21.2	23.0	16.4		
20"	19.4	23.3	25.6	18.1		
24"	23.4	27.3	30.1	20.6		

[1] Ground disks can be used for all flange standards/pressure ratings.
All dimensions in [inch]

Weight

Weight in SI units

Weight data in kg

Diameter		Compact version						Remote version (without cable)						
								Sensor						Transmitter
[mm]	[inch]	EN (DIN) / AS [1]		JIS		ANSI / AWWA		EN (DIN) / AS [1]		JIS		ANSI / AWWA		Wall housing
25	1"	PN 40	5.7	10K	5.7	Class 150	5.7	PN 40	5.3	10K	5.3	Class 150	5.3	3.1
32	–		6.4		5.7		–		6.0		5.3		–	
40	1½"		7.8		6.7		7.8		7.4		6.3		7.4	
50	2"		9.0		7.7		9.0		8.6		7.3		8.6	
65	–	PN 16	10.4		9.5		–	PN 16	10.0		9.1		–	
80	3"		12.4		10.9		12.4		12.0		10.5		12.0	
100	4"		14.4		13.1		14.4		14.0		12.7		14.0	
125	–		19.9		19.4		–		19.5		19.0		–	
150	6"		23.9		22.9		23.9		23.5		22.5		23.5	
200	8"	PN 10	43.4		40.3		43.3	PN 10	43		39.9		43	
250	10"		63.4		67.8		73.4		63		67.4		73	
300	12"		68.4		70.7		108.4		68		70.3		108	
350	14"	PN 6	105				175	PN 6	103				173	
375	15"		120				–		118				–	
400	16"		120				205		118				203	
450	18"		161				255		159				253	
500	20"		156				285		154				283	
600	24"		208				405		206				403	
700	28"		304			Class D	400		302			Class D	398	
–	30"		–				460		–				458	
800	32"		357				550		355				548	
900	36"		485				800		483				798	
1000	40"		589				900		587				898	
–	42"		–				1100		–				1098	
1200	48"		850				1400		848				1398	
–	54"		–				2200		–				2198	
1400	–		1300				–		1298				–	
–	60"		–				2700		–				2698	
1600	–		1700				–		1698				–	
–	66"		–				3700		–				3698	
1800	72"		2200				4100		2198				4098	
–	78"		–				4600		–				4598	
2000	–		2800				–		2798				–	

[1] For flanges to AS, only DN 80, 100, 150 to 400, 500 and 600 are available.

- Transmitter (compact version): 1.8 kg
- Weight data valid for standard pressure ratings and without packaging material

Weight in US units (only ANSI/AWWA)

Weight data in lbs					
Diameter		Compact version		Remote version (without cable)	
				Sensor	Transmitter
[mm]	[inch]		ANSI /AWWA	ANSI / AWWA	Wall housing
25	1"	Class 150	12.6	Class 150	11.7	6.8
40	1½"		17.2		16.3	
50	2"		19.9		19.0	
80	3"		27.3		26.5	
100	4"		31.8		30.9	
150	6"		52.7		51.8	
200	8"		95.5		94.8	
250	10"		162.1		161.0	
300	12"		239.0		238.1	
350	14"		380.1		381.5	
400	16"		448.5		447.6	
450	18"		558.8		557.9	
500	20"		624.9		624.0	
600	24"		889.5		888.6	
700	28"	Class D	878.5	Class D	877.6	
–	30"		1010.8		1009.9	
800	32"		1209.2		1208.3	
900	36"		1760.5		1759.6	
1000	40"		1981.0		1980.1	
–	42"		2422.0		2421.1	
1200	48"		3083.5		3082.6	
–	54"		4847.5		4846.6	
–	60"		5950.0		5949.1	
–	66"		8155.0		8154.1	
1800	72"		9037.0		9036.1	
–	78"		10139.0		10139.0	

- Transmitter (compact version): 4.0 lbs
- Weight data valid for standard pressure ratings and without packaging material

Measuring tube specifications

Diameter		Pressure rating						Internal diameter			
		EN (DIN)	AS 2129	AS 4087	ANSI	AWWA	JIS	Hard rubber		Polyurethane	
[mm]	[inch]	[bar]			[lbs]			[mm]	[inch]	[mm]	[inch]
25	1"	PN 40	–	–	Cl. 150	–	20 K	–	–	24	0.94
32	–	PN 40	–	–	–	–	20 K	–	–	32	1.26
40	1½"	PN 40	–	–	Cl. 150	–	20 K	–	–	38	1.50
50	2"	PN 40	Table E	PN 16	Cl. 150	–	10 K	50	1.97	50	1.97
65	–	PN 16	–	–	–	–	10 K	66	2.60	66	2.60
80	3"	PN 16	Table E	PN 16	Cl. 150	–	10 K	79	3.11	79	3.11
100	4"	PN 16	Table E	PN 16	Cl. 150	–	10 K	102	4.02	102	4.02
125	–	PN 16	–	–	–	–	10 K	127	5.00	127	5.00
150	6"	PN 16	Table E	PN 16	Cl. 150	–	10 K	156	6.14	156	6.14
200	8"	PN 10	Table E	PN 16	Cl. 150	–	10 K	204	8.03	204	8.03
250	10"	PN 10	Table E	PN 16	Cl. 150	–	10 K	258	10.2	258	10.2
300	12"	PN 10	Table E	PN 16	Cl. 150	–	10 K	309	12.2	309	12.2
350	14"	PN 6	Table E	PN 16	Cl. 150	–	–	342	13.5	342	13.5
375	15"	–	–	PN 16	–	–	–	392	15.4	–	–
400	16"	PN 6	Table E	PN 16	Cl. 150	–	–	392	15.4	392	15.4
450	18"	PN 6	–	–	Cl. 150	–	–	437	17.2	437	17.2
500	20"	PN 6	Table E	PN 16	Cl. 150	–	–	492	19.4	492	19.4
600	24"	PN 6	Table E	PN 16	Cl. 150	–	–	594	23.4	594	23.4
700	28"	PN 6	–	–	–	Class D	–	692	27.2	692	27.2
–	30"	–	–	–	–	Class D	–	742	29.2	742	29.2
800	32"	PN 6	–	–	–	Class D	–	794	31.3	794	31.3
900	36"	PN 6	–	–	–	Class D	–	891	35.1	891	35.1
1000	40"	PN 6	–	–	–	Class D	–	994	39.1	994	39.1
–	42"	–	–	–	–	Class D	–	1043	41.1	1043	41.1
1200	48"	PN 6	–	–	–	Class D	–	1197	47.1	1197	47.1
–	54"		–	–	–	Class D	–	1339	52.7	–	–
1400	–	PN 6	–	–	–	–	–	1402	55.2	–	–
–	60"	–	–	–	–	Class D	–	1492	58.7	–	–
1600	–	PN 6	–	–	–	–	–	1600	63.0	–	–
–	66"	–	–	–	–	Class D	–	1638	64.5	–	–
1800	72"	PN 6	–	–	–	Class D	–	1786	70.3	–	–
2000	78"	PN 6	–	–	–	Class D	–	1989	78.3	–	–

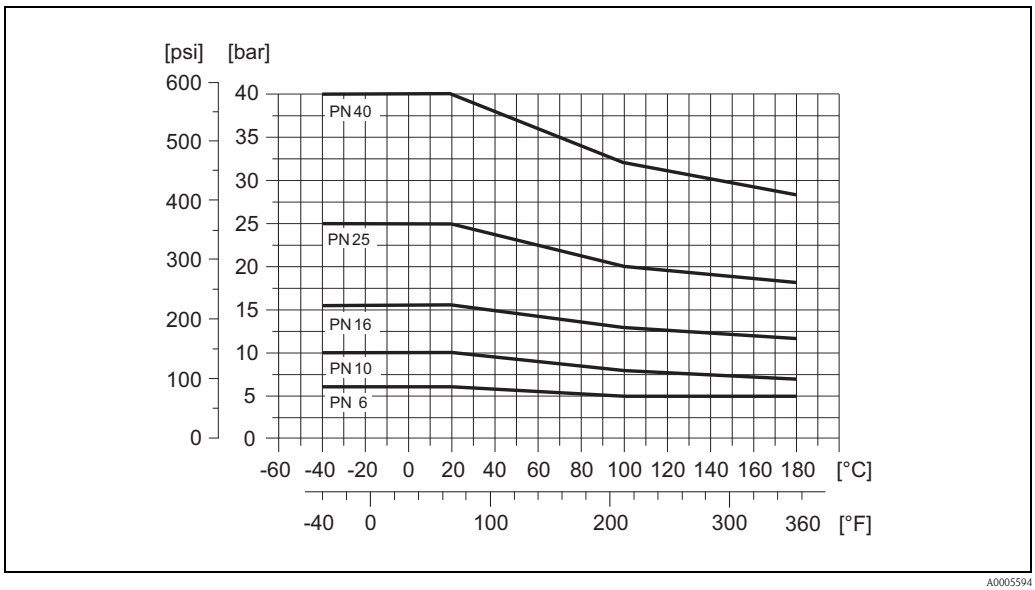
Material

- Housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  - DN 350 to 2000 (14 to 78"): with protective lacquering
- Measuring tube
  - DN ≤ 300 (12"): stainless steel 1.4301 or 1.4306/304L;
    (Flange material: carbon steel with Al/Zn protective coating)
  - DN ≥ 350 (14"): stainless steel 1.4301 or 1.4306/304L;
    (Flange material: carbon steel with protective lacquering)
- Electrodes: 1.4435/316L, Alloy C-22
- Flanges
  - EN 1092-1 (DIN2501): RSt37-2 (S235JRG2); C22, Fe 410W B
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - ANSI: A105
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AWWA: 1.0425 (with protective lacquering)
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AS 2129
    - (DN 25, 80, 100, 150…1200 / 1", 3", 4", 6…48"): A105 or RSt37-2 (S235JRG2)
    - (DN 50, 80, 350, 400, 500 / 2", 3", 14", 16", 20"): A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR)
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

Material load diagram

Caution!
The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature. However, the maximum medium temperatures permitted always depend on the lining material of the sensor and/or the sealing material.

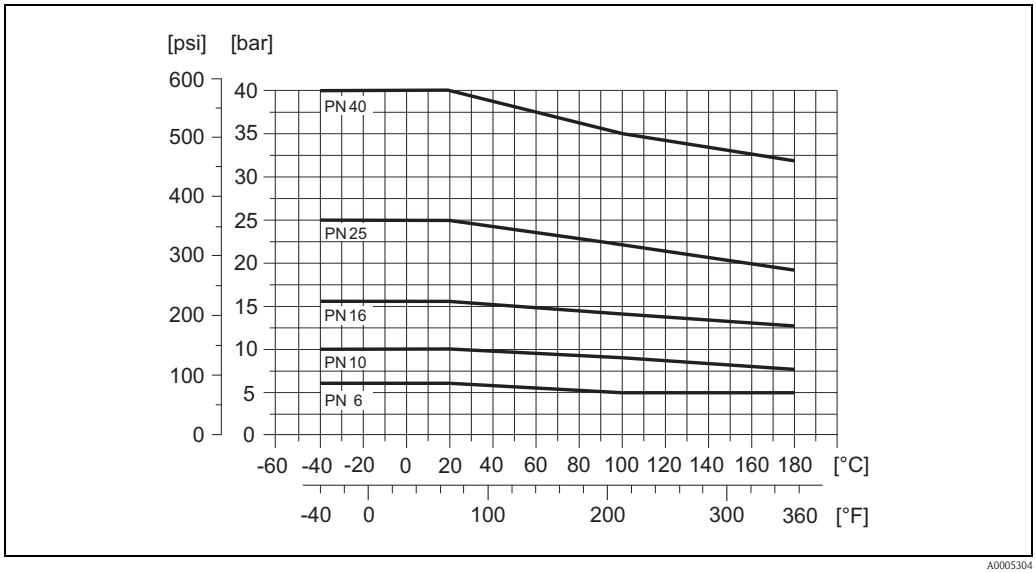
Flange connection to EN 1092-1 (DIN 2501)
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



A0005594

Flanschanschluss nach EN 1092-1 (DIN 2501)

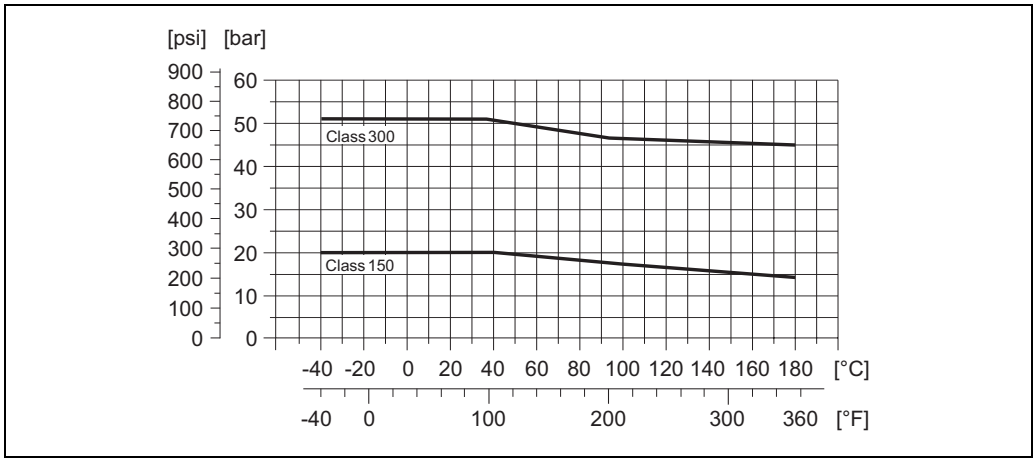
Werkstoff: 316L / 1.4571



A0005304

Flange connection to ANSI B16.5

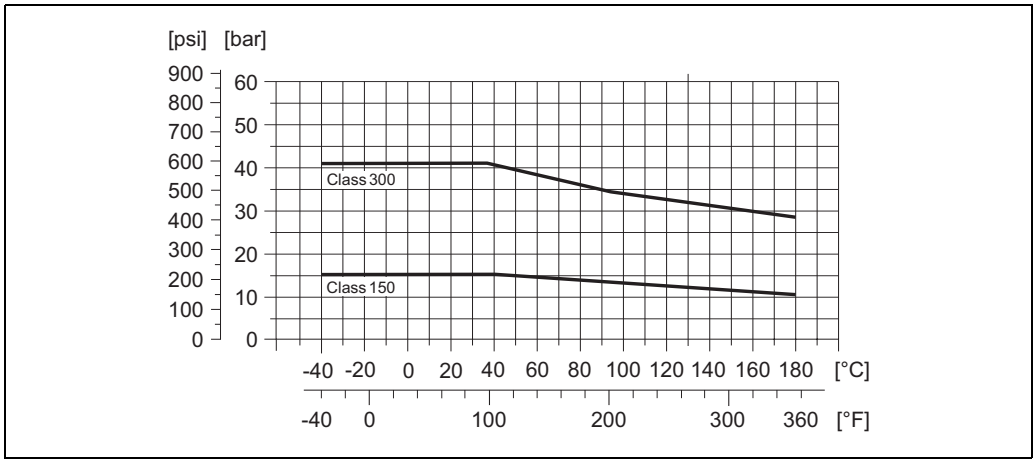
Material: A 105



A0003226

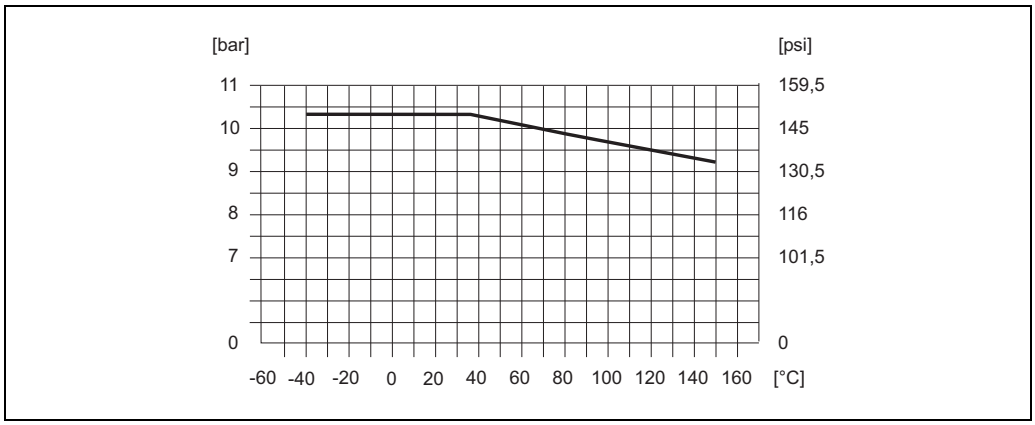
Flanschanschluss nach ANSI B16.5

Werkstoff: F316L



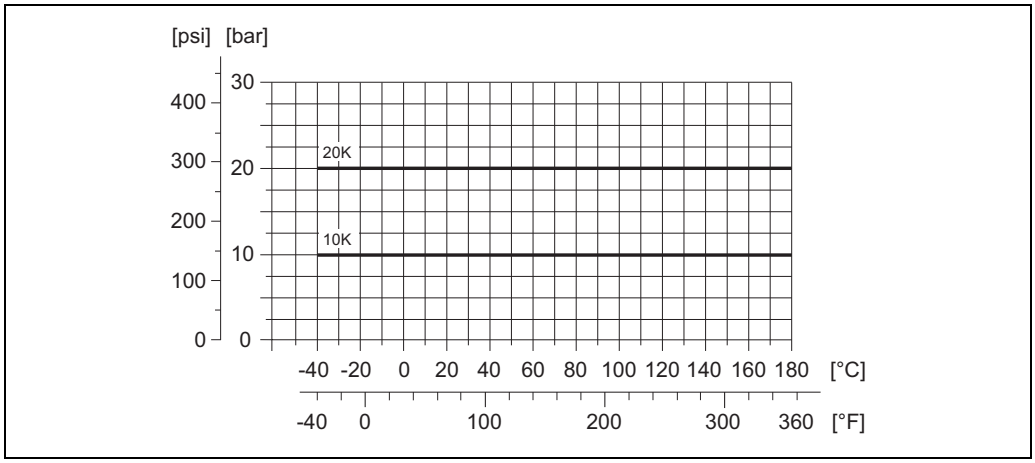
A0005307

Flange connection to AWWA C207, Class D
Material: 1.0425



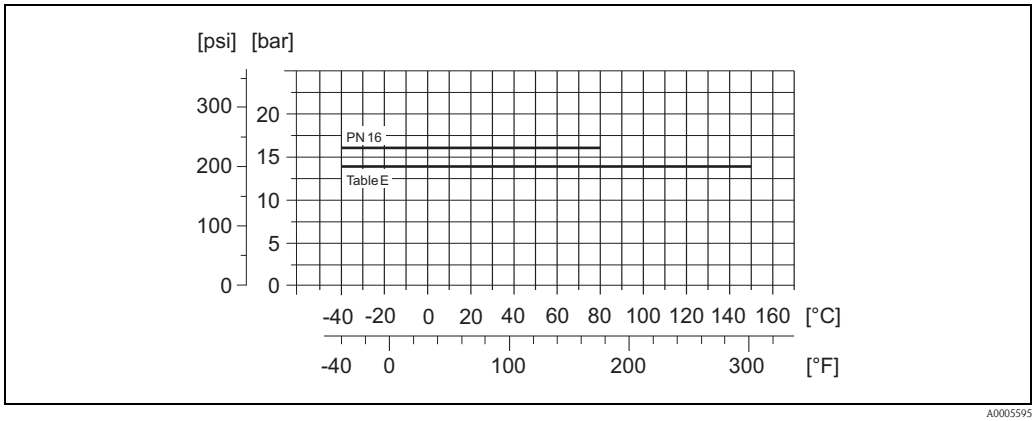
A0005592

Flange connection to JIS B2220
Material: RSt37-2 (S235JRG2) / HII / 1.0425 / 316L



A0003228

Flange connection to AS 2129 Table E or AS 4087 PN 16
Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



A0005595

Fitted electrodes

Measuring electrodes, reference electrodes and empty pipe detection electrodes available as standard with:
- 1.4435
- Alloy C-22

Process connections	Flange connection: ■ EN 1092-1 (DIN 2501), DN ≤ 300 (12") form A, DN ≥ 350 (14") form B (Dimensions to DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 exclusively to EN 10921) ■ ANSI B16.5 ■ AWWA C 207, Class D ■ JIS B2220 ■ AS 2129 Table E ■ AS 4087 PN 16
Surface roughness	Electrodes with 1.4435 (AISI 316L), Alloy C-22: ≤ 0.3 to 0.5 µm (12 to 20 µin) (All data refer to parts in contact with medium)

Human interface

Display elements	■ Liquid crystal display: unilluminated, two-line, 16 characters per line ■ Display (operating mode) preconfigured: volume flow and totalizer status ■ 1 totalizer
Operating elements	Local operation via three keys (−, +, E)
Remote operation	Operation via HART protocol and FieldCare

Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-tick mark	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	Information about currently available Ex versions (FM, CSA etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.
Other standards and guidelines	■ EN 60529 Degrees of protection by housing (IP code). ■ EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ■ IEC/EN 61326 “Emission in accordance with requirements for Class A”. Electromagnetic compatibility (EMC requirements). ■ ANSI/ISA-S82.01 Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment – General Requirements. Pollution degree 2, Installation Category II. ■ CAN/CSA-C22.2 No. 1010.1-92 Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II.
Pressure measuring device approval	Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the medium and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters.

Ordering information

Your Endress +Hauser service organization can provide detailed ordering information and information on the order codes on request.

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

Documentation

- System Information Promag 10 (SI042D/06)
- Operating Instructions Promag 10 (BA082D/06)

Registered trademarks

KALREZ® and VITON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

FieldCare®, Fieldcheck®, Field Xpert™, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

Instruments International

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Endress+Hauser
People for Process Automation

TI093D/06/en/11.09
71105946
FM+SGML6.0 ProMoDo

Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Proline Promag 10P

Electromagnetic Flow Measuring System
Flow measurement of liquids in chemical or process applications

Application
Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 50 µS/cm:

- Acid, alkalis
- Paints
- Pastes
- Water, wastewater etc.

- Flow measurement up to 9600 m^3/h (42268 gal/min)
- Fluid temperature up to +130 °C (266 °F)
- Process pressures up to 40 bar (580 psi)
- Lengths in accordance with DVGW/ISO

Application-specific lining material:
- PTFE

Your benefits
Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:
- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:
- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

TI094D/06/en/11.09
71106267

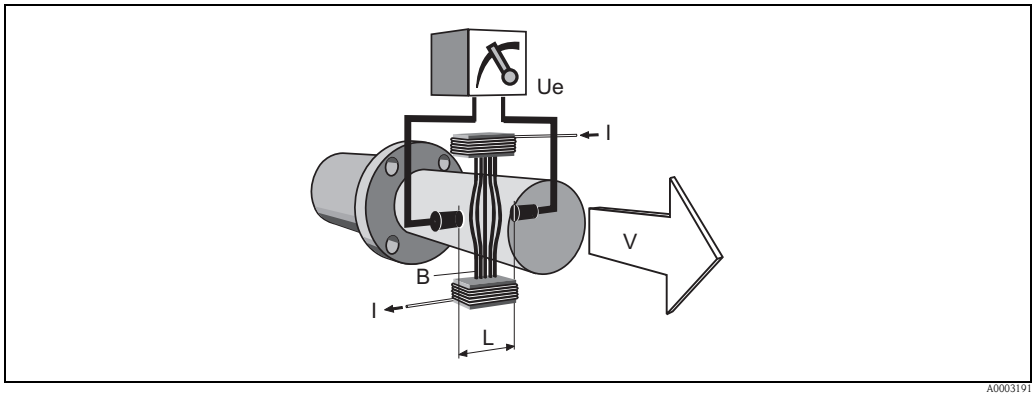
Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Measuring principle

Following *Faraday's law of magnetic induction*, a voltage is induced in a conductor moving through a magnetic field.
In the electromagnetic measuring principle, the flowing medium is the moving conductor.
The voltage induced is proportional to the flow velocity and is supplied to the amplifier by means of two measuring electrodes. The flow volume is calculated by means of the pipe cross-sectional area.
The DC magnetic field is created through a switched direct current of alternating polarity.



A0003191

$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

Ue *Induced voltage*
B *Magnetic induction (magnetic field)*
L *Electrode spacing*
v *Flow velocity*
Q *Volume flow*
A *Pipe cross-section*
I *Current strength*

Measuring system

The measuring system consists of a transmitter and a sensor.
Two versions are available:
- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:
- Promag 10 (key operation, two-line, unilluminated display)

Sensor:
- Promag P (DN 25 to 600 / 1 to 24")

Input

Measured variable

Flow velocity (proportional to induced voltage)

Measuring ranges

Measuring ranges for liquids
Typically v = 0.01 to 10 m/s (0.03 to 33 ft/s) with the specified accuracy

Operable flow range

Over 1000 : 1

Output

Output signal

Current output

- Galvanically isolated
- Active: 4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
- Full scale value adjustable
- Temperature coefficient: typ. 2 µA/°C, resolution: 1.5 µA

Pulse/status output

- Galvanically isolated
- Passive: 30 V DC/250 mA
- Open collector
- Can be configured as:
  - Pulse output: Pulse value and pulse polarity can be selected, max. pulse width adjustable (5 to 2000 ms), pulse frequency max. 100 Hz
  - Status output: for example, can be configured for error messages, empty pipe detection, flow recognition, limit value

Signal on alarm

- Current output → Failsafe mode can be selected
- Pulse output → Failsafe mode can be selected
- Status output → "Not conductive" in the event of fault or power supply failure

Load

See "output signal"

Low flow cutoff

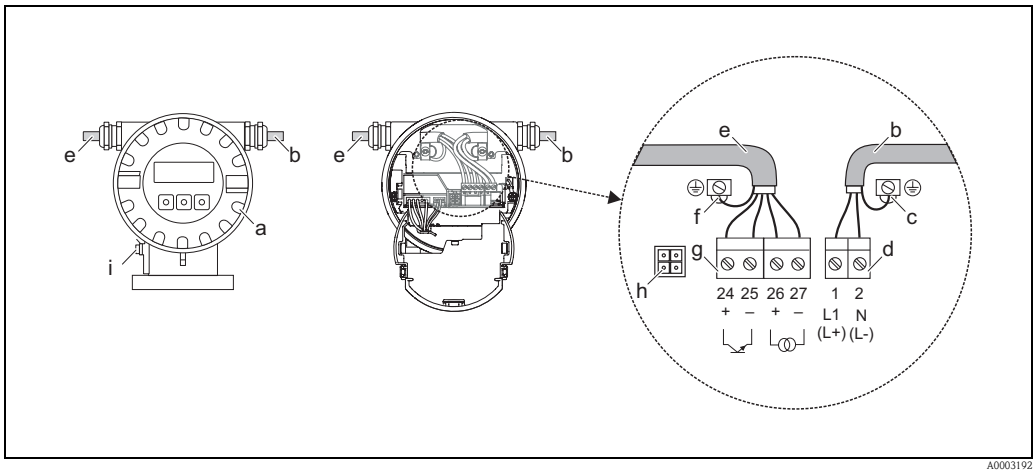
Switch-on points for low flow are selectable.

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other

Power supply

Electrical connection, measuring unit



A0003192

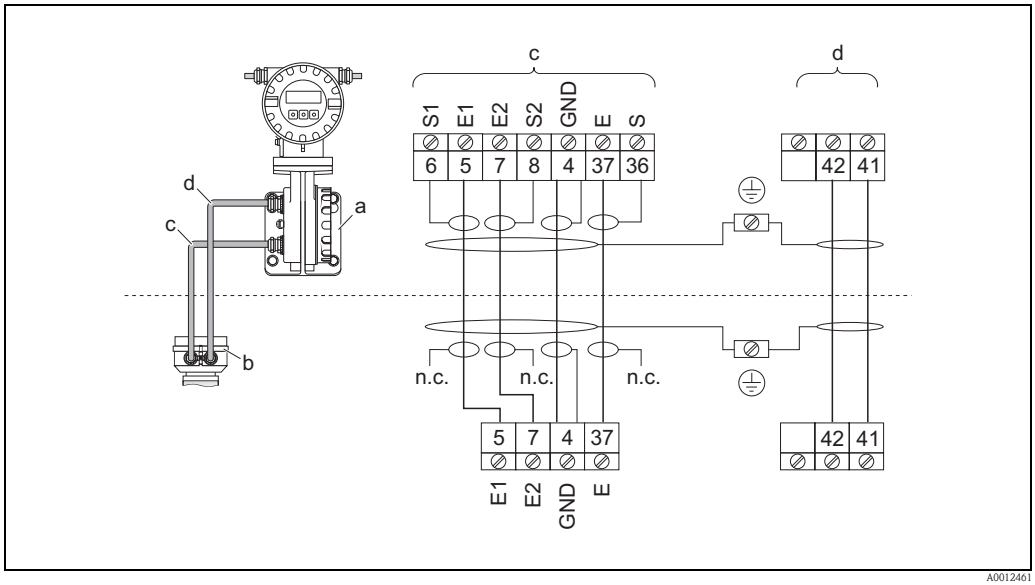
Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)

a Electronics compartment cover
b Power supply cable
c Ground terminal for power supply cable
d Terminal connector for power supply cable
e Signal cable
f Ground terminal for signal cable
g Terminal connector for signal cable
h Service connector for connecting service interface FXA 193 (Fieldcheck, FieldCare)
i Ground terminal for potential equalization

Electrical connection, terminal assignment

Order version	Terminal No.					
	24 (+)	25 (–)	26 (+)	27 (–)	1 (L1/L+)	2 (N/L–)
10***_**********A	Pulse/status output		HART current output		Power supply	
Functional values	→ 4, Section "output signal"				→ Section "Supply voltage"	

Electrical connection, remote version



Connecting the remote version

a Wall-mount housing connection compartment
b Sensor connection housing cover
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields

Terminal numbers and cable colors:
5/6 = brown, 7/8 = white, 4 = green, 37/36 = yellow

Supply voltage (power supply)

- 85 to 250 V AC, 45 to 65 Hz
- 20 to 28 V AC, 45 to 65 Hz
- 11 to 40 V DC

Cable entry

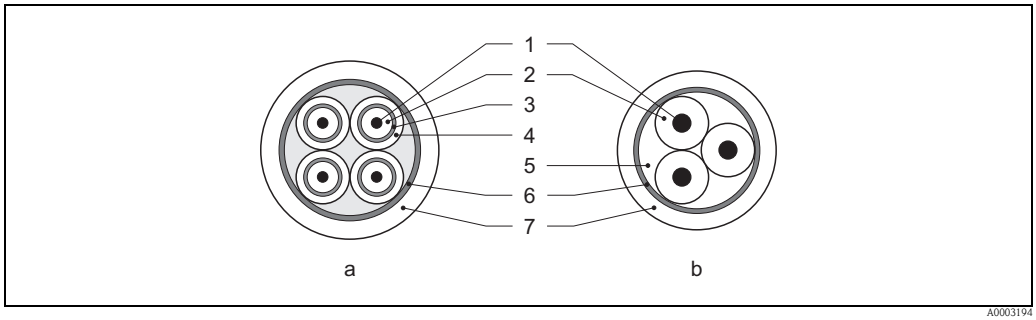
Power supply and signal cables (inputs/ outputs):
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Remote version cable specifications

Coil cable
- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤ 37 Ω/km (≤ 0.011 Ω/ft)
- Capacitance core/core, shield grounded: ≤ 120 pF/m (≤ 37 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)
- Test voltage for cable insulation: ≤ 1433 AC r.m.s. 50/60 Hz or ≥ 2026 V DC

Signal cable
- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- With empty pipe detection (EPD): 4 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)



A0003194

a *Signal cable*
b *Coil current cable*

1 *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

Operation in zones of severe electrical interference
The measuring device complies with the general safety requirements in accordance with EN 61010 and the EMC requirements of IEC/EN 61326.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

Power consumption

- 85 to 250 V AC: < 12 VA (incl. sensor)
- 20 to 28 V AC: < 8 VA (incl. sensor)
- 11 to 40 V DC: < 6 W (incl. sensor)

Switch-on current:
- Max. 16 A (< 5 ms) for 250 V AC
- Max. 5.5 A (< 5 ms) for 28 V AC
- Max. 3.3 A (< 5 ms) for 24 V DC

Power supply failure

Lasting min. ½ cycle frequency: EEPROM saves measuring system data

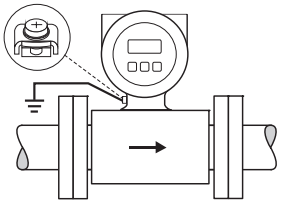
Potential equalization

Warning!
The measuring system must be included in the potential equalization.

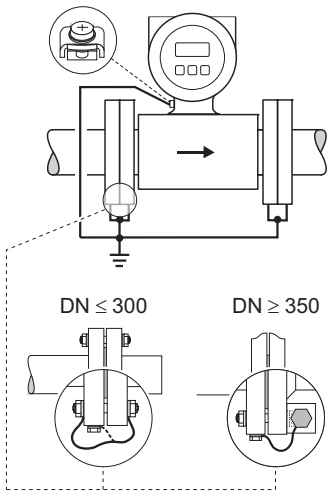
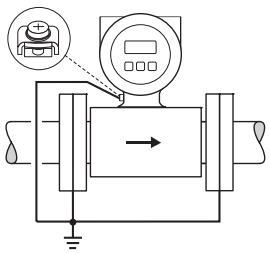
Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

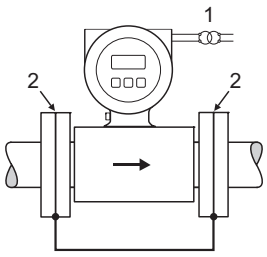
The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/ grounding of the pipes (see table)

Standard situation

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal, grounded pipe Potential equalization takes place via the ground terminal of the transmitter. Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 A0010831 *Via the ground terminal of the transmitter*

Special situations

Operating conditions	Potential equalization
When using the measuring device in a: ■ Metal pipe that is not grounded This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, at least 6 mm² / 0.0093 in²) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose. ■ DN ≤ 300 (12"): the ground cable is mounted directly on the conductive flange coating with the flange screws. ■ DN ≥ 350 (14"): the ground cable is mounted directly on the transportation metal support. Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 A0010832 *Via the ground terminal of the transmitter and the flanges of the pipe*
When using the measuring device in a: ■ Plastic pipe ■ Pipe with insulating lining This connection method also applies in situations where: ■ Customary potential equalization cannot be ensured. ■ Excessively high equalizing currents can be expected. Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, at least 6 mm² / 0.0093 in²). When installing the ground disks, please comply with the enclosed Installation Instructions.	 A0010833 *Via the ground terminal of the transmitter and the optionally available ground disks*

Operating conditions	Potential equalization
When using the measuring device in a: ■ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, at least 6 mm² / 0.0093 in²). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ■ The applicable regulations regarding potential-free installation must be observed. ■ There should be **no** electrically conductive connection between the pipe and the device. ■ The mounting material must withstand the applicable torques.	 A0010834 *Potential equalization and cathodic protection* *1 Power supply isolation transformer* *2 Electrically isolated*

Performance characteristics

Reference operating conditions

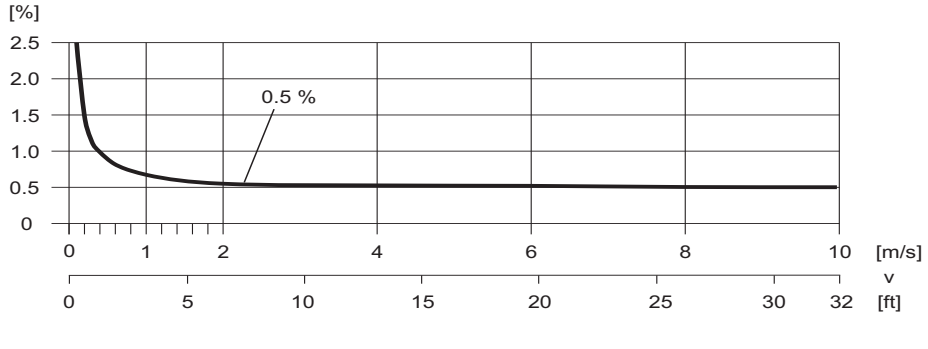
As per DIN EN 29104 and VDI/VDE 2641:
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
- Ambient temperature: +22 °C ±2 K (+72 °F ± 2 K)
- Warm-up period: 30 minutes

Installation conditions:
- Inlet run > 10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

- Current output: also typically ± 5 µA
- Pulse output: ±0.5% o.r. ± 2 mm/s (±0.5% o.r. ± 0.08 in/s) (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.



Max. measured error in % of reading

Repeatability

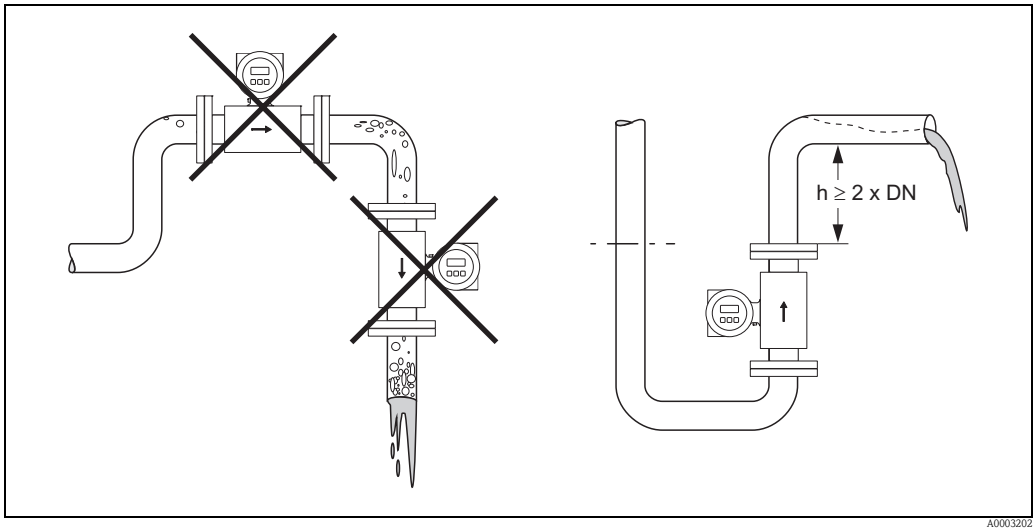
Max. ±0.2% o.r. ± 2 mm/s (±0.2% o.r. ± 0.08 in/s) (o.r. = of reading)

Operating conditions: Installations

Installation instructions

Mounting location

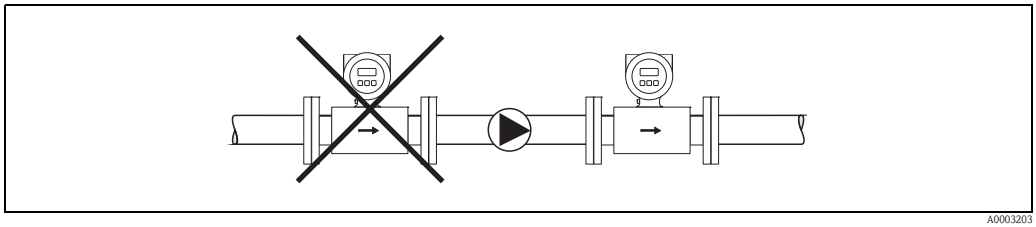
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



Mounting location

Installation of pumps

Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".
Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 15, Section "Shock and vibration resistance".

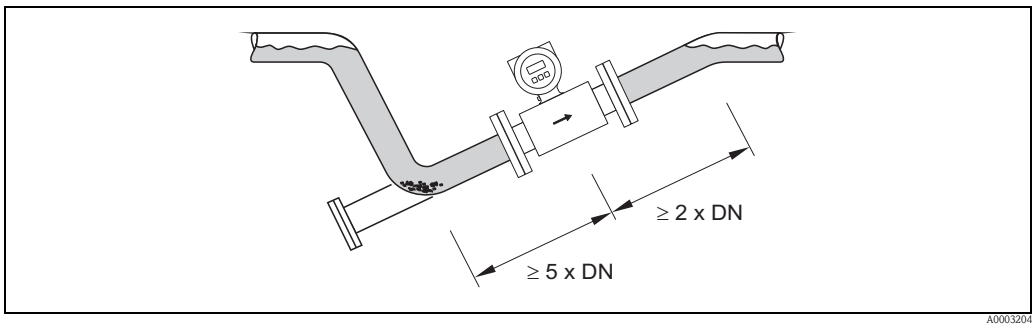


Installation of pumps

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

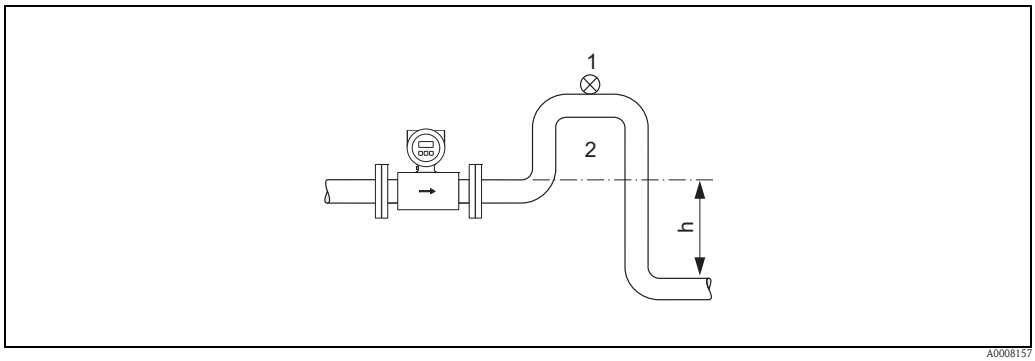
Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



Installation with partially filled pipes

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 17, Section "Pressure tightness".

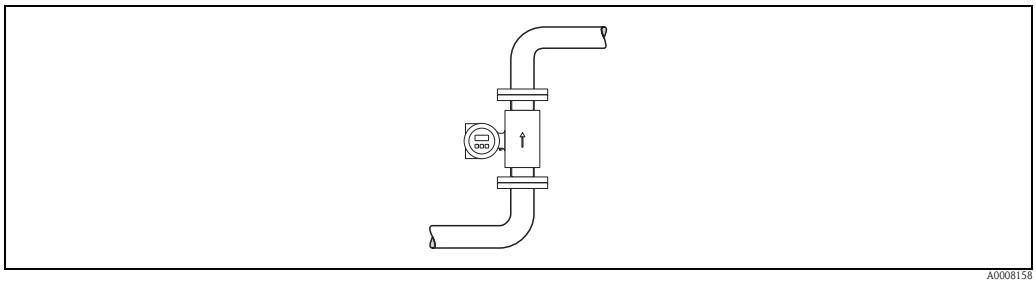


Installation measures for vertical pipes

1 Vent valve
2 Pipe siphon
h Length of the down pipe

Orientation
An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, the measuring device also offers the additional function of empty pipe detection (EPD) for detecting partially filled measuring tubes or if outgassing fluids or fluctuating operating pressures are present.

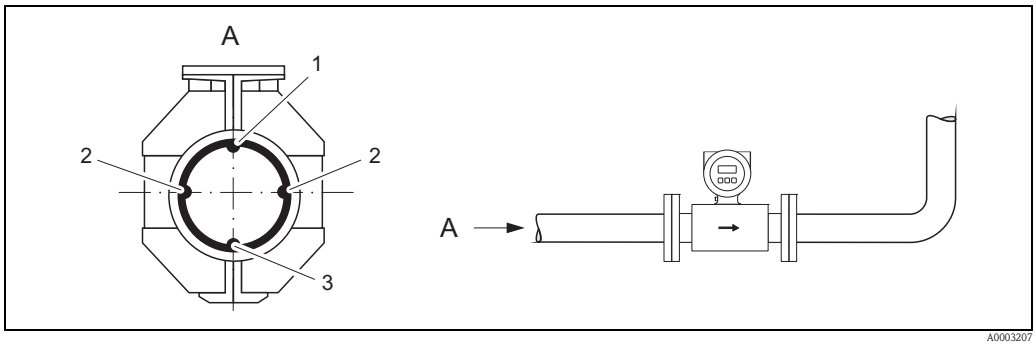
Vertical orientation
This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



Vertical orientation

Horizontal orientation
The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!
Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.

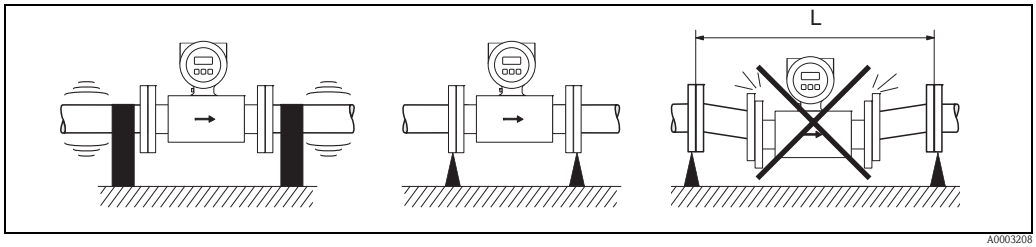


Horizontal orientation

1 EPD electrode for empty pipe detection
2 Measuring electrodes for signal detection
3 Reference electrode for potential equalization

Vibrations
Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 15, Section "Shock and vibration resistance".



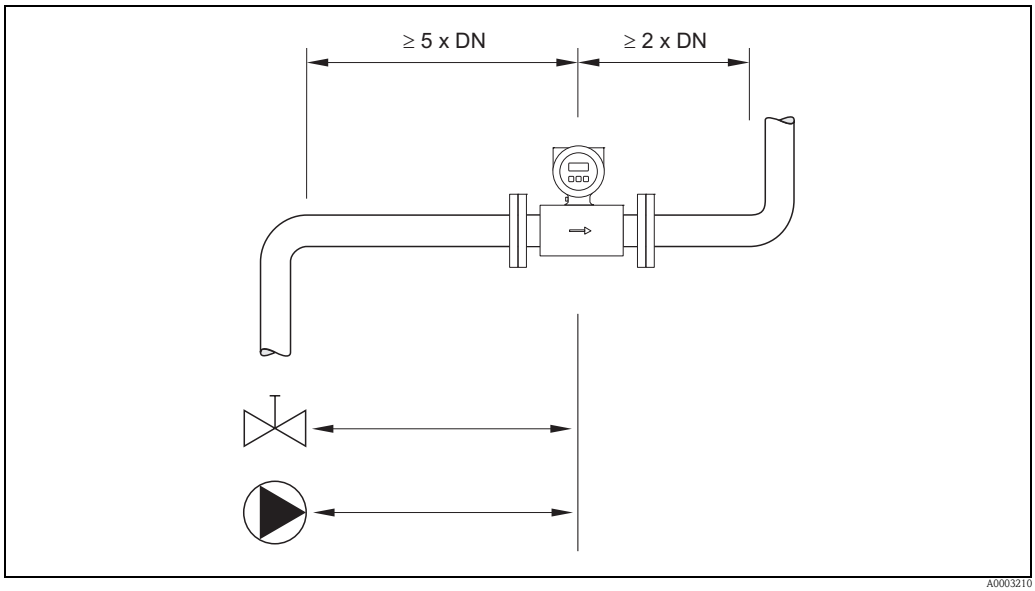
Measures to prevent vibration of the measuring device

L > 10 m (33 ft)

Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

Note the following inlet and outlet runs to comply with measuring accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN



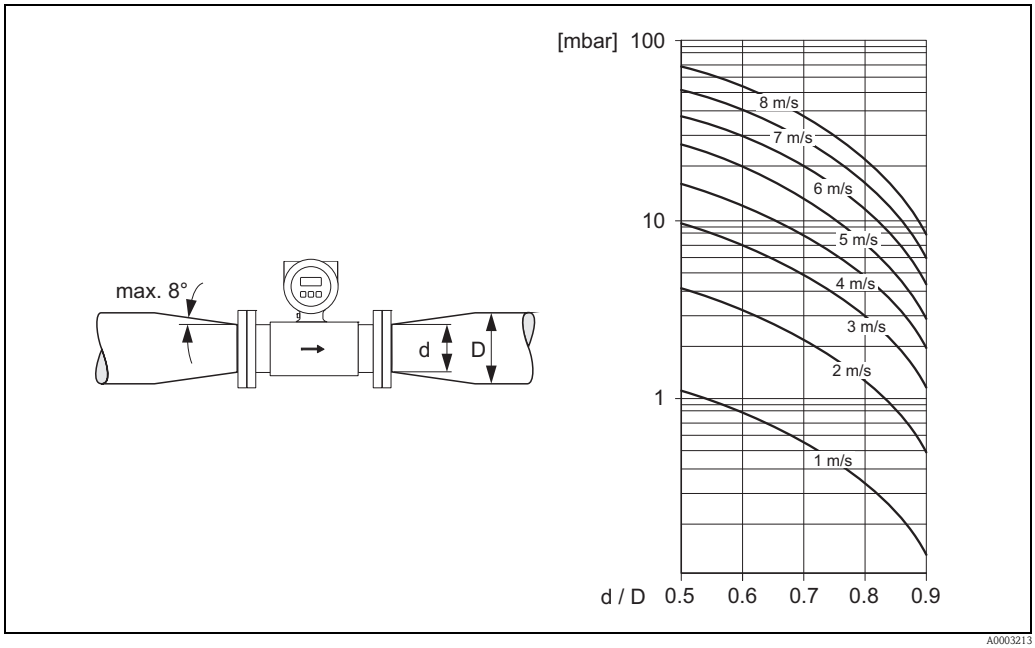
Inlet and outlet run

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (downstream from the reduction) and the d/D ratio.

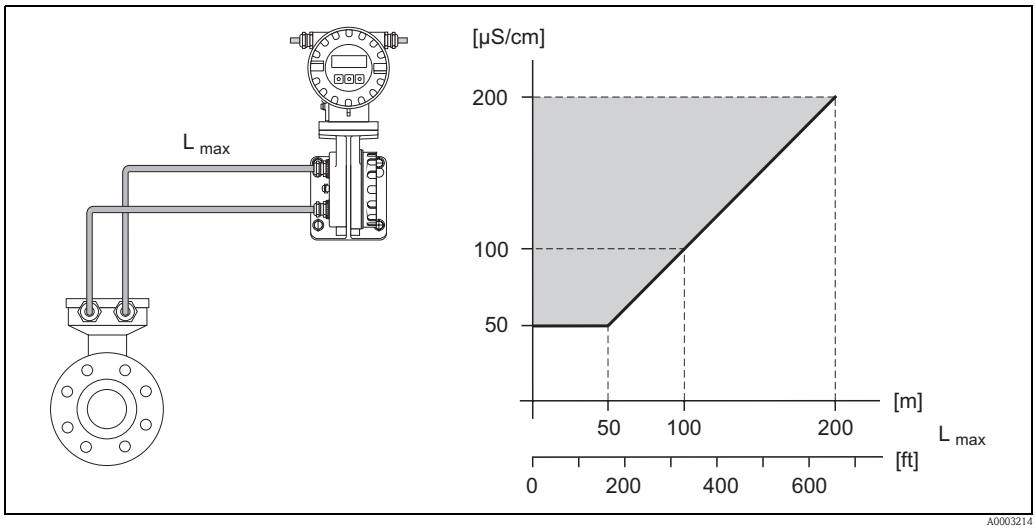


Pressure loss due to adapters

Length of connecting cable

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length L_{max} is determined by the fluid conductivity. A minimum conductivity of 50 µS/cm is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).



Permitted length of connecting cable for remote version
Area marked in gray = permitted range; L_{max} = length of connecting cable in [m] ([ft]); fluid conductivity in [µS/cm]

Operating conditions: Environment

Ambient temperature range

Transmitter
- –20 to +60 °C (–4 to +140 °F)

Sensor
- Flange material carbon steel: –10 to +60 °C (14 to +140 °F)
- Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)

Caution!
The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ 16, Section "Medium temperature range").

Please note the following points:
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

Degree of protection
- Standard: IP 67 (NEMA 4X) for transmitter and sensor.
- Optional: IP 68 (NEMA 6P) for sensor for remote version.
- For information regarding applications where the device is buried directly in the soil or is installed in a flooded wastewater basin please contact your local Endress+Hauser Sales Center.

Shock and vibration resistance

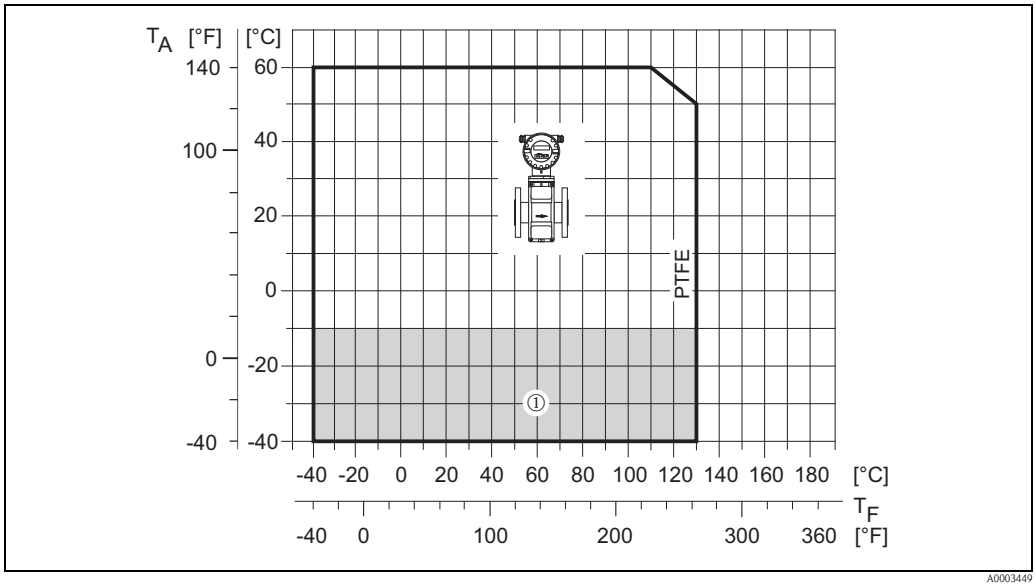
Acceleration up to 2 g following IEC 600 68-2-6

Electromagnetic compatibility (EMC)
- As per IEC/EN 61326
- Emission: to limit value for industry EN 55011

Operating conditions: Process

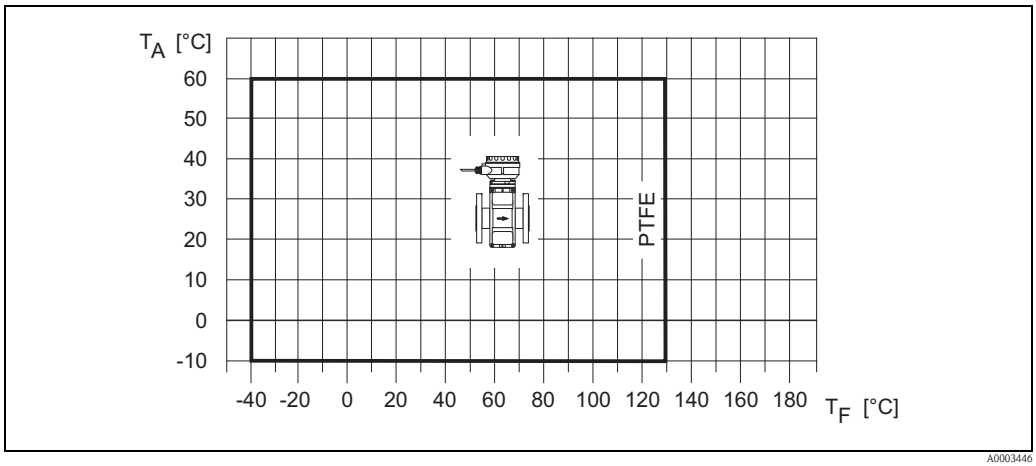
Medium temperature range

PTFE: –40 to +130 °C (–40 to +266 °F) (DN 25 to 600 / 1 to 24"), restrictions → see diagrams



Compact version (T_A = ambient temperature range, T_F = fluid temperature)

① = *gray area → temperature range from –10 to –40 °C (–14 to –40 °F) applies only to stainless steel flanges*



Remote version (T_A = ambient temperature range, T_F = fluid temperature)

Conductivity

The minimum conductivity is: ≥ 50 µS/cm

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 14, Section "Length of connecting cable").

Medium pressure range (nominal pressure)

- EN 1092-1 (DIN 2501)
  - PN 10 (DN 200 to 600 / 8 to 24")
  - PN 16 (DN 65 to 600 / 3 to 24")
  - PN 25 (DN 200 to 600 / 8 to 24")
  - PN 40 (DN 25 to 150 / 1 to 6")
- ANSI B 16.5
  - Class 150 (DN 1 to 24")
  - Class 300 (DN 1 to 6")
- JIS B2220
  - 10 K (DN 50 to 300 / 2 to 12")
  - 20 K (DN 25 to 300 / 1 to 12")
- AS 2129
  - Table E (DN 25, 50 / 1", 2")
- AS 4087
  - PN 16 (DN 50 / 2")

Pressure tightness

Measuring tube lining: PTFE

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:							
		25 °C (77 °F)		80 °C (176 °F)		100 °C (212 °F)		130 °C (266 °F)	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]	[mbar]	[psi]	[mbar]	[psi]
25	1"	0	0	0	0	0	0	100	1.45
32	–	0	0	0	0	0	0	100	1.45
40	1½"	0	0	0	0	0	0	100	1.45
50	2"	0	0	0	0	0	0	100	1.45
65	–	0	0	*	*	40	0.58	130	1.89
80	3"	0	0	*	*	40	0.58	130	1.89
100	4"	0	0	*	*	135	1.96	170	2.47
125	–	135	1.96	*	*	240	3.48	385	5.58
150	6"	135	1.96	*	*	240	3.48	385	5.58
200	8"	200	2.90	*	*	290	4.21	410	5.95
250	10"	330	4.79	*	*	400	5.80	530	7.69
300	12"	400	5.80	*	*	500	7.25	630	9.14
350	14"	470	6.82	*	*	600	8.70	730	10.6
400	16"	540	7.83	*	*	670	9.72	800	11.6
450	18"	Partial vacuum is impermissible!							
500	20"								
600	24"								

* No value can be specified.

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.
The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.5 ft/s): for abrasive fluids such as potter's clay, lime milk, ore slurry etc.
- v > 2 m/s (6.5 ft/s): for fluids causing build-up such as wastewater sludges etc.

Flow characteristic values (SI units)

Diameter		Recommended flow rate	Factory settings		
[mm]	[inch]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value, current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
25	1"	9 to 300 dm³/min	75 dm³/min	0.50 dm³	1.00 dm³/min
32	–	15 to 500 dm³/min	125 dm³/min	1.00 dm³	2.00 dm³/min
40	1½"	25 to 700 dm³/min	200 dm³/min	1.50 dm³	3.00 dm³/min
50	2"	35 to 1100 dm³/min	300 dm³/min	2.50 dm³	5.00 dm³/min
65	–	60 to 2000 dm³/min	500 dm³/min	5.00 dm³	8.00 dm³/min
80	3"	90 to 3000 dm³/min	750 dm³/min	5.00 dm³	12.0 dm³/min
100	4"	145 to 4700 dm³/min	1200 dm³/min	10.0 dm³	20.0 dm³/min
125	–	220 to 7500 dm³/min	1850 dm³/min	15.0 dm³	30.0 dm³/min
150	6"	20 to 600 m³/h	150 m³/h	0.03 m³	2.50 m³/h
200	8"	35 to 1100 m³/h	300 m³/h	0.05 m³	5.00 m³/h
250	10"	55 to 1700 m³/h	500 m³/h	0.05 m³	7.50 m³/h
300	12"	80 to 2400 m³/h	750 m³/h	0.10 m³	10.0 m³/h
350	14"	110 to 3300 m³/h	1000 m³/h	0.10 m³	15.0 m³/h
400	16"	140 to 4200 m³/h	1200 m³/h	0.15 m³	20.0 m³/h
450	18"	180 to 5400 m³/h	1500 m³/h	0.25 m³	25.0 m³/h
500	20"	220 to 6600 m³/h	2000 m³/h	0.25 m³	30.0 m³/h
600	24"	310 to 9600 m³/h	2500 m³/h	0.30 m³	40.0 m³/h

Flow characteristic values (US units)					
Diameter		**Recommended flow rate**	**Factory settings**		
[inch]	[mm]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value, current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
1"	25	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
1½"	40	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	50	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
3"	80	24 to 800 gal/min	200 gal/min	2.00 gal	2.50 gal/min
4"	100	40 to 1250 gal/min	300 gal/min	2.00 gal	4.00 gal/min
6"	150	90 to 2650 gal/min	600 gal/min	5.00 gal	12.0 gal/min
8"	200	155 to 4850 gal/min	1200 gal/min	10.0 gal	15.0 gal/min
10"	250	250 to 7500 gal/min	1500 gal/min	15.0 gal	30.0 gal/min
12"	300	350 to 10600 gal/min	2400 gal/min	25.0 gal	45.0 gal/min
14"	350	500 to 15000 gal/min	3600 gal/min	30.0 gal	60.0 gal/min
16"	400	600 to 19000 gal/min	4800 gal/min	50.0 gal	60.0 gal/min
18"	450	800 to 24000 gal/min	6000 gal/min	50.0 gal	90.0 gal/min
20"	500	1000 to 30000 gal/min	7500 gal/min	75.0 gal	120.0 gal/min
24"	600	1400 to 44000 gal/min	10500 gal/min	100.0 gal	180.0 gal/min

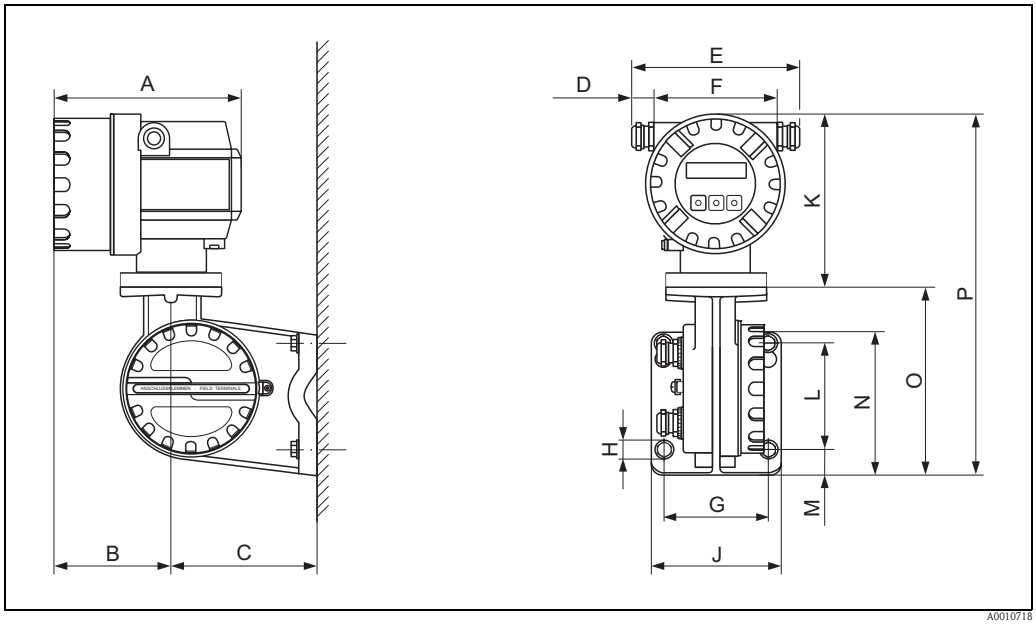
Pressure loss

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 13, Section "Adapters").

Mechanical construction

Design, dimensions

Transmitter, remote version



Transmitter dimensions, remote version

Dimensions in SI units

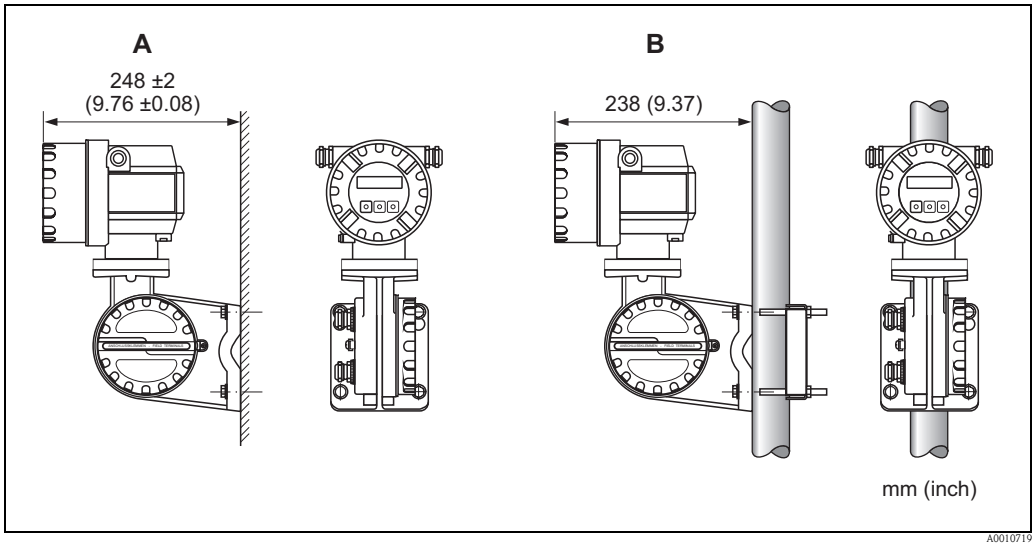
A	B	C	D	E	F	G	Ø H
178	113	135	20 to 30	161 to 181	121	100	8.6 (M8)
J	K	L	M	N	O	P	
123	150	100	25	133	177.5	327.5	

All dimensions in [mm]

Dimensions in US units

A	B	C	D	E	F	G	Ø H
7.00	4.45	5.31	0.79 to 1.81	6.34 to 7.13	4.76	3.94	0.34 (M8)
J	K	L	M	N	O	P	
4.84	5.90	3.94	0.98	5.24	6.99	12.89	

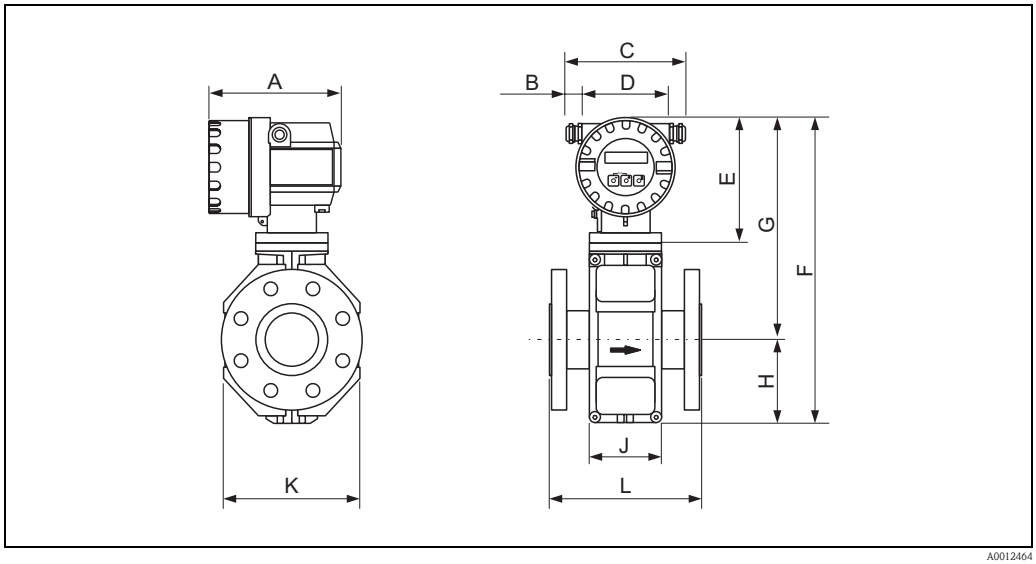
All dimensions in [inch]



Transmitter mounting, remote version

A Direct wall mounting
B Pipe mounting

Compact version



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Dimensions in SI units

DN EN (DIN) / JIS / AS [2]	L [1]	A	B	C	D	E	F	G	H	J	K
25	200	178	20 to 30	161 to 181	113	150	341	257	84	94	120
32	200						341	257	84	94	120
40	200						341	257	84	94	120
50	200						341	257	84	94	120
65	200						391	282	109	94	180
80	200						391	282	109	94	180
100	250						391	282	109	94	180
125	250						472	322	150	140	260
150	300						472	322	150	140	260
200	350						527	347	180	156	324
250	450						577	372	205	156	400
300	500						627	397	230	166	460
350	550						738.5	456.5	282	276	564
400	600						790.5	482.5	308	276	616
450	650						840.5	507.5	333	292	666
500	650						891.5	533.5	358.5	292	717
600	780						995.5	585.5	410.5	402	821

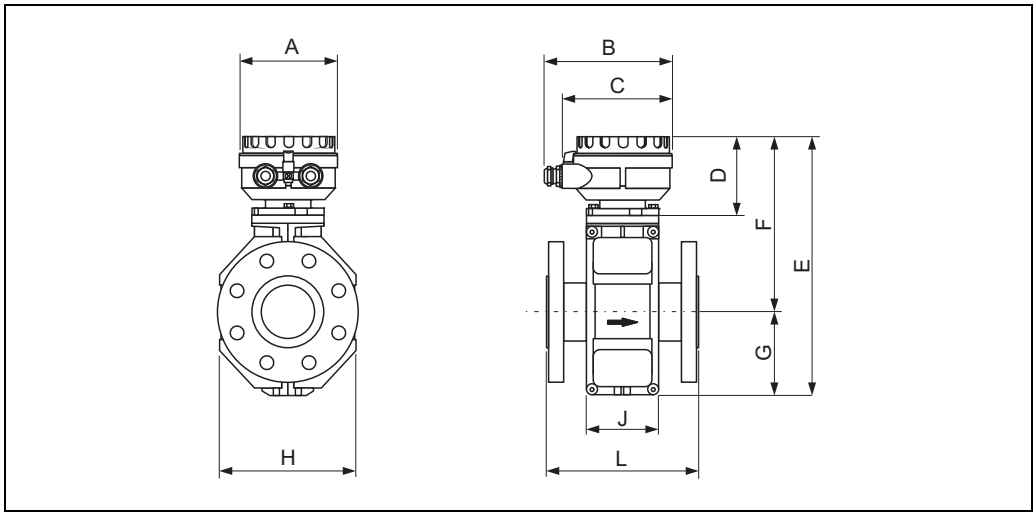
[1] The length (L) is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Only DN 80, 100 and 150 to 300 are available for flanges according to AS.
All dimensions in [mm]

Dimensions in US units

DN ANSI	L [1]	A	B	C	D	E	F	G	H	J	K
1"	7.87	7.01	0.79 to 1.81	6.34 to 7.13	4.45	5.91	13.4	10.1	3.32	3.70	4.72
1½"	7.87						13.4	10.1	3.32	3.70	4.72
2"	7.87						13.4	10.1	3.32	3.70	4.72
3"	7.87						15.4	11.1	4.30	3.70	7.10
4"	9.84						15.4	11.1	4.30	3.70	7.10
6"	11.8						18.6	12.7	5.91	5.51	10.2
8"	13.8						20.8	13.7	7.10	6.14	12.8
10"	17.7						22.7	14.7	8.08	6.14	15.8
12"	19.7						24.7	15.6	9.06	6.54	18.1
14"	21.7						29.1	18.0	11.1	10.9	22.2
16"	23.6						31.1	19.0	12.1	10.9	24.3
18"	25.6						33.1	20.0	333	11.5	26.2
20"	25.6						35.1	21.0	13.1	11.5	28.2
24"	30.7						39.2	23.1	16.2	15.8	32.3

[1] The length (L) is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Sensor, remote version



A0012462

Dimensions in SI units

DN EN (DIN) / JIS / AS [2]	L [1]	A	B	C	D	E	F	G	H	J
25	200	129	163	143	102	286	202	84	120	94
32	200					286	202	84	120	94
40	200					286	202	84	120	94
50	200					286	202	84	120	94
65	200					336	227	109	180	94
80	200					336	227	109	180	94
100	250					336	227	109	180	94
125	250					417	267	150	260	140
150	300					417	267	150	260	140
200	350					472	292	180	324	156
250	450					522	317	205	400	156
300	500					572	342	230	460	166
350	550					683.5	401.5	282	564	276
400	600					735.5	427.5	308	616	276
450	650					785.5	452.5	333	666	292
500	650					836.5	478	358.5	717	292
600	780					940.5	530	410.5	821	402

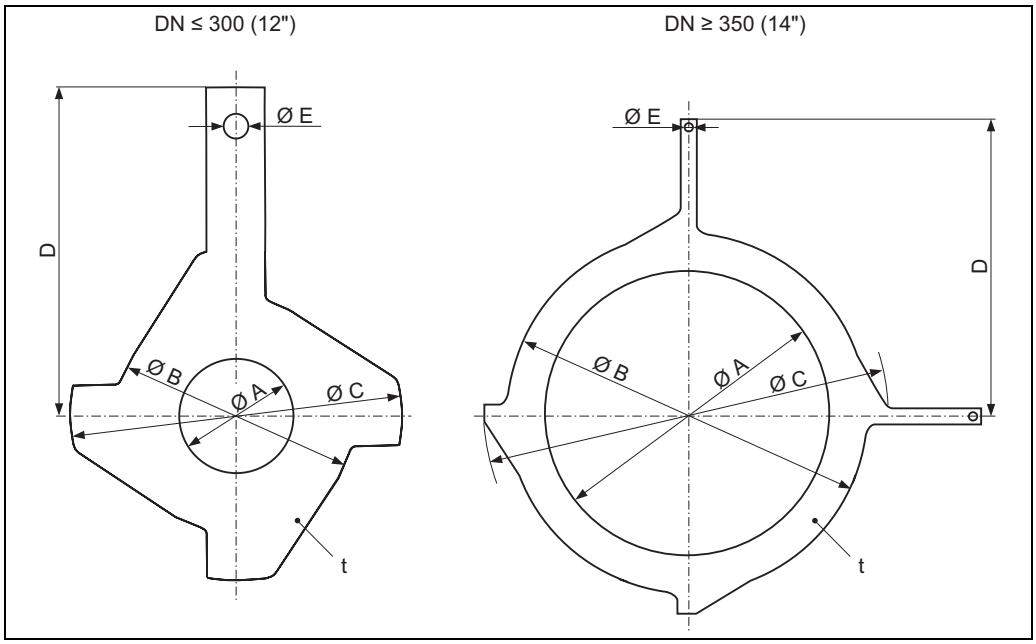
[1] The length (L) is regardless of the pressure rating selected. Fitting length to DVGW.
[2] Only DN 80, 100 and 150 to 300 are available for flanges according to AS.
All dimensions in [mm]

Dimensions in US units

DN ANSI	L [1)]	A	B	C	D	E	F	G	H	J
1"	7.87	5.08	6.42	5.63	4.02	11.3	7.95	3.32	4.72	3.70
1½"	7.87					11.3	7.95	3.32	4.72	3.70
2"	7.87					11.3	7.95	3.32	4.72	3.70
3"	7.87					13.2	8.94	4.30	7.10	3.70
4"	9.84					13.2	8.94	4.30	7.10	3.70
6"	11.8					16.4	10.5	5.91	10.2	5.51
8"	13.8					18.6	11.5	7.10	12.8	6.14
10"	17.7					20.6	12.5	8.08	15.8	6.14
12"	19.7					22.5	13.5	9.06	18.1	6.54
14"	21.7					26.9	15.8	11.1	22.2	10.9
16"	23.6					29.0	16.8	12.1	24.3	10.9
18"	25.6					30.9	17.8	333	26.2	11.5
20"	25.6					32.9	18.8	13.1	28.2	11.5
24"	30.7					37.0	20.9	16.2	32.3	15.8

[1)] The length (L) is regardless of the pressure rating selected. Fitting length to DVGW.
All dimensions in [inch]

Ground disk for flange connections



Dimensions (SI units)

DN [1] EN (DIN) / JIS / AS [2]	A	B	C	D	E	t
25	26	62	77.5	87.5	6.5	2
32	35	80	87.5	94.5		
40	41	82	101	103		
50	52	101	115.5	108		
65	68	121	131.5	118		
80	80	131	154.5	135		
100	104	156	186.5	153		
125	130	187	206.5	160		
150	158	217	256	184		
200	206	267	288	205		
250	260	328	359	240		
300 [3]	312	375	413	273		
300 [4]	310	375	404	268		
350 [3]	343	433	479	365	9.0	
375 [3]	393	480	542	395		
400 [3]	393	480	542	395		
450 [3]	439	538	583	417		
500 [3]	493	592	650	460		
600 [3]	593	693	766	522		

[1] Ground disks at DN 25 to 250 (1 to 10") can be used for all flange standards/pressure ratings.
[2] Only DN 25 and DN 50 are available for flanges according to AS.
[3] PN 10/16
[4] PN 25, JIS 10K/20K
All dimensions in [mm]

Dimensions (US units)

DN [1] ANSI	A	B	C	D	E	t
1"	1.02	2.44	3.05	3.44	0.26	0.08
1½"	1.61	3.23	3.98	4.06		
2"	2.05	3.98	4.55	4.25		
3"	3.15	5.16	6.08	5.31		
4"	4.09	6.14	7.34	6.02		
6"	6.22	8.54	10.08	7.24		
8"	8.11	10.5	11.3	8.07		
10"	10.2	12.9	14.1	9.45		
12"	12.3	14.8	16.3	10.8		
14"	13.5	17.1	18.9	14.4	0.35	
15"	15.45	18.9	21.3	15.6		
16"	15.45	18.9	21.3	15.6		
18"	17.3	21.2	23.0	16.4		
20"	19.4	23.3	25.6	18.1		
24"	23.4	27.3	30.1	20.6		

[1] Ground disks can be used for all flange standards/pressure ratings.
All dimensions in [inch]

Weight

Weight in SI units

Weight data in kg

Nominal diameter		Compact version			Remote version (without cable)			
					Sensor			Transmitter
[mm]	[inch]	EN (DIN) / AS [1]	JIS	ANSI / AWWA	EN (DIN) / AS [1]	JIS	ANSI / AWWA	Wall-mount housing
25	1"	7.3	7.3	7.3	5.3	5.3	5.3	6.0
32	–	8.0	7.3	–	6.0	5.3	–	
40	1½"	9.4	8.3	9.4	7.4	6.3	7.4	
50	2"	10.6	9.3	10.6	8.6	7.3	8.6	
65	–	12.0	11.1	–	10.0	9.1	–	
80	3"	14.0	12.5	14.0	12.0	10.5	12.0	
100	4"	16.0	14.7	16.0	14.0	12.7	14.0	
125	–	21.5	21.0	–	19.5	19.0	–	
150	6"	25.5	24.5	25.5	23.5	22.5	23.5	
200	8"	45	41.9	45	43	39.9	43	
250	10"	65	69.4	75	63	67.4	73	
300	12"	70	72.3	110	68	70.3	108	
350	14"	115		175	113		173	
400	16"	135		205	133		203	
450	18"	175		255	173		253	
500	20"	175		285	173		283	
600	24"	235		405	233		403	

PN 40 (EN (DIN) / AS); PN 16 (EN (DIN) / AS); PN 10 (EN (DIN) / AS); 10K (JIS); Class 150 (ANSI / AWWA)

[1] For flanges to AS, only DN 25 and 50 are available.

- Transmitter (compact version): 1.8 kg
- Weight data valid for standard pressure ratings and without packaging material.

Weight in US units (only ANSI / AWWA)

Weight data in lbs						
Nominal diameter		**Compact version**		**Remote version (without cable)**		
				Sensor		**Transmitter**
[mm]	[inch]		ANSI / AWWA		ANSI / AWWA	Wall-mount housing
25	1"	Class 150	16.1	Class 150	11.7	13.2
40	1½"		20.7		16.3	
50	2"		23.4		19.0	
80	3"		30.9		26.5	
100	4"		35.3		30.9	
150	6"		56.2		51.8	
200	8"		99.2		94.8	
250	10"		165.4		161.0	
300	12"		242.6		238.1	
350	14"		385.9		381.5	
400	16"		452.0		447.6	
450	18"		562.3		557.9	
500	20"		628.4		624.0	
600	24"		893.0		888.6	

- Transmitter (compact version): 3.9 lbs
- Weight data valid for standard pressure ratings and without packaging material.

Measuring tube specifications

Diameter		Pressure rating					Internal diameter			
		EN (DIN)	AS 2129	AS 4087	ANSI	JIS	PFA		PTFE	
[mm]	[inch]	[bar]			[lbs]		[mm]	[inch]	[mm]	[inch]
25	1"	PN 40	Table E	PN 16	Cl.150	20K	23	0.91	26	1.02
32	–	PN 40	Table E	–	–	20K	32	1.26	35	1.38
40	1½"	PN 40	–	–	Cl.150	20K	36	1.42	41	1.61
50	2"	PN 40	–	–	Cl.150	10K	48	1.89	52	2.05
65	–	PN 16	–	–	–	10K	63	2.48	67	2.64
80	3"	PN 16	–	–	Cl.150	10K	75	2.95	80	3.15
100	4"	PN 16	–	–	Cl.150	10K	101	3.98	104	4.09
125	–	PN 16	–	–	–	10K	126	4.96	129	5.08
150	6"	PN 16	–	–	Cl.150	10K	154	6.06	156	6.14
200	8"	PN 10	–	–	Cl.150	10K	201	7.91	202	7.95
250	10"	PN 10	–	–	Cl.150	10K	–	–	256	10.1
300	12"	PN 10	–	–	Cl.150	10K	–	–	306	12.0
350	14"	PN 10	–	–	Cl.150	–	–	–	337	13.3
400	16"	PN 10	–	–	Cl.150	–	–	–	387	15.2
450	18"	PN 10	–	–	Cl.150	–	–	–	432	17.0
500	20"	PN 10	–	–	Cl.150	–	–	–	487	19.2
600	24"	PN 10	–	–	Cl.150	–	–	23	593	23.3

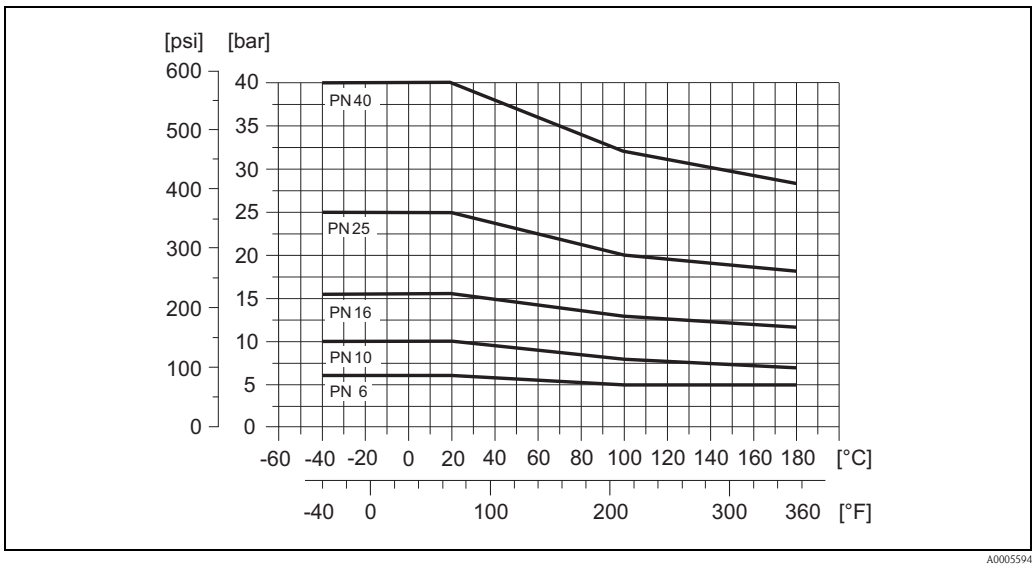
Material

- Housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300 (1 to 12"): powder-coated die-cast aluminum
  - DN 350 to 2000 (14 to 78"): with protective lacquering
- Measuring tube
  - DN ≤ 300 (12"): stainless steel 1.4301 or 1.4306/304L;
    (Flange material: carbon steel with Al/Zn protective coating)
  - DN ≥ 350 (14"): stainless steel 1.4301 or 1.4306/304L;
    (Flange material: carbon steel with protective lacquering)
- Electrodes: 1.4435/316L, Alloy C-22
- Flanges
  - EN 1092-1 (DIN2501): RSt37-2 (S235JRG2); C22, Fe 410W B
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - ANSI: A105
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
  - AS 2129
    - (DN 25, 80, 100, 150…1200 / 1", 3", 4", 6…48"): A105 or RSt37-2 (S235JRG2)
    - (DN 50, 80, 350, 400, 500 / 2", 3", 14", 16", 20"): A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR)
    (DN ≤ 300 (12"): with Al/Zn protective coating; DN ≥ 350 (14") with protective lacquering)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

Material load diagram

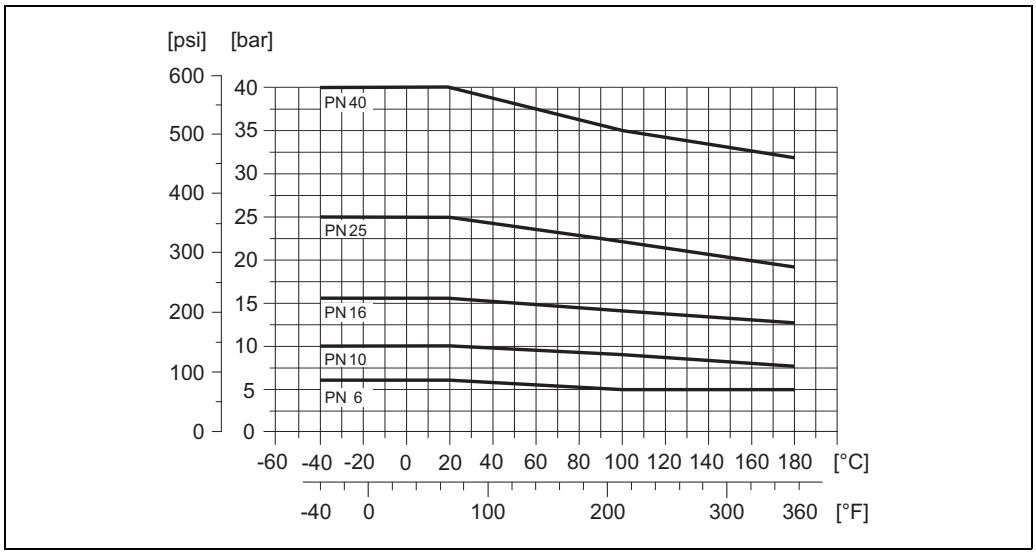
Caution!
The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature. However, the maximum medium temperatures permitted always depend on the lining material of the sensor and/or the sealing material (→ 16).

Flange connection to EN 1092-1 (DIN 2501)
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



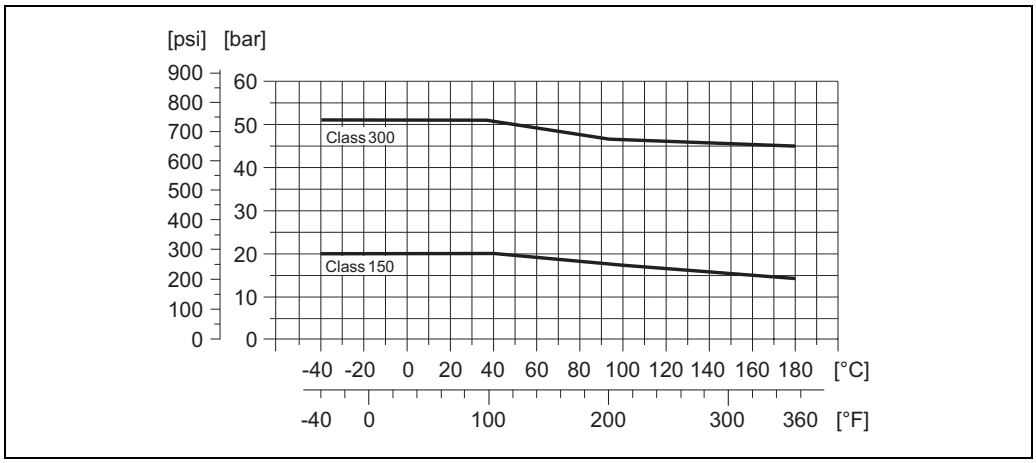
A0005594

Flange connection to EN 1092-1 (DIN 2501)
Material: 316L / 1.4571



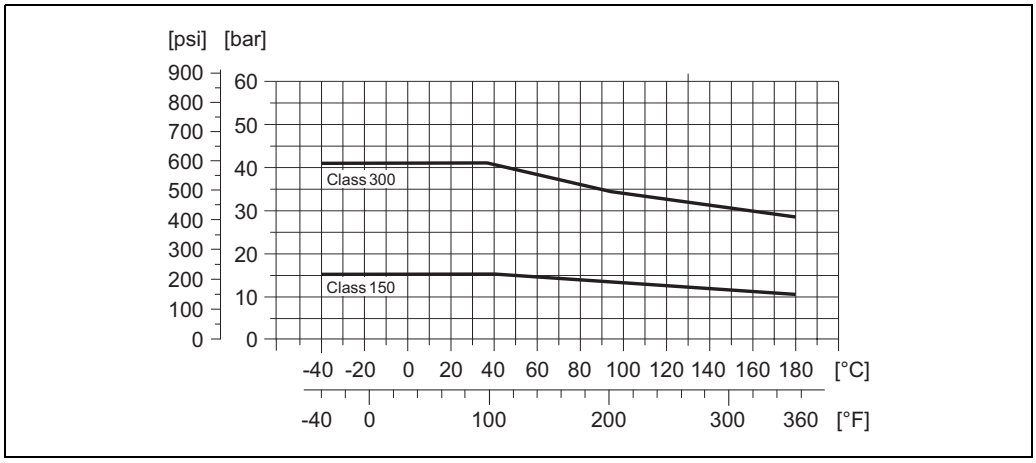
A0005304

Flange connection to ANSI B16.5
Material: A 105



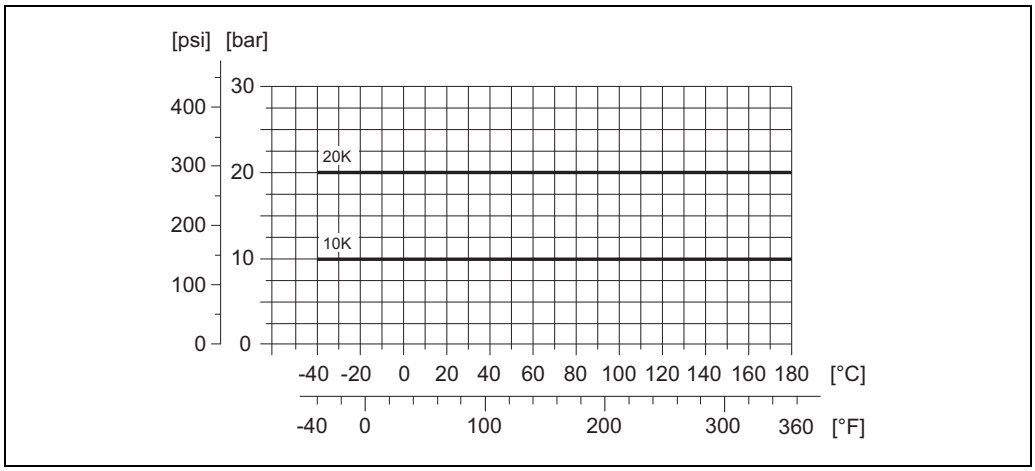
A0003226

Flange connection to ANSI B16.5
Material: F316L



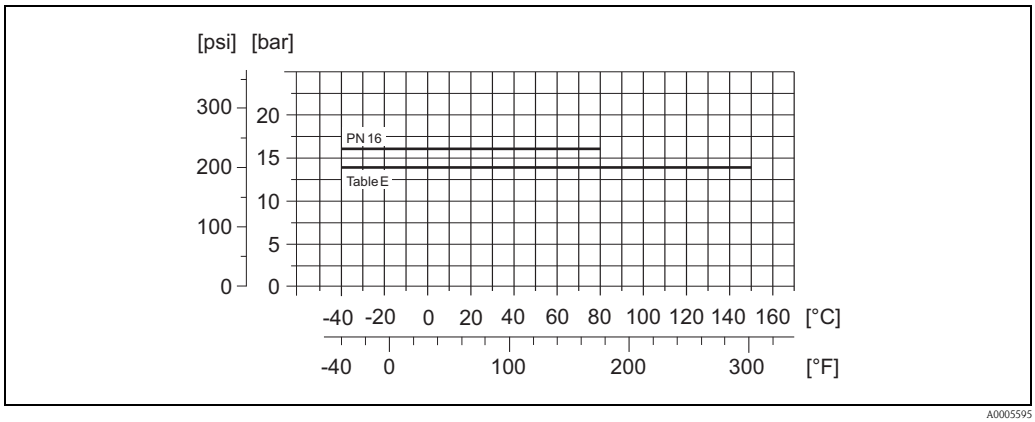
A0005307

Flange connection to JIS B2220
Material: RSt37-2 (S235JRG2) / HII / 1.0425



A0003228

Flange connection to AS 2129 Table E or AS 4087 PN 16
Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



A0005595

Fitted electrodes

Measuring electrodes, reference electrodes and empty pipe detection electrodes available as standard with:
- 1.4435
- Alloy C-22

Process connections

Flange connection:
- EN 1092-1 (DIN 2501), DN ≤ 300 (12") form A, DN ≥ 350 (14") form B
  (Dimensions to DIN 2501, DN 65 PN 16 and DN 600 (24") PN 16 exclusively to EN 1092-1)
- ANSI B16.5
- JIS B2220
- AS 2129 Table E
- AS 4087 PN 16

Surface roughness

Electrodes with 1.4435 (AISI 316L), Alloy C-22: ≤ 0.3 to 0.5 µm (≤ 11.8 to 19.7 µin)
(All data refer to parts in contact with medium)

Human interface

Display elements	■ Liquid crystal display: unilluminated, two-line, 16 characters per line ■ Display (operating mode) preconfigured: volume flow and totalizer status ■ 1 totalizer
Operating elements	Local operation via three keys (−, +, E)
Remote operation	Operation via HART protocol and FieldCare

Certificates and approvals

CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-tick mark	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA etc.) can be supplied by your Endress +Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.
Other standards and guidelines	■ EN 60529 Degrees of protection by housing (IP code) ■ EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures. ■ IEC/EN 61326 "Emission in accordance with requirements for Class A". Electromagnetic compatibility (EMC requirements) ■ ANSI/ISA-S82.01 Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment – General Requirements Pollution degree 2, Installation Category II. ■ CAN/CSA-C22.2 No. 1010.1-92 Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II
Pressure measuring device approval	Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the medium and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters.

Ordering information

Your Endress+Hauser service organization can provide detailed ordering information and information on the order codes on request.

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

Documentation

- System Information Promag 10 (SI042D/06)
- Operating Instructions Promag 10 (BA082D/06)

Registered trademarks

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FieldCare®, Fieldcheck®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

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