

Technical Information

Proline Promag L 400

Electromagnetic flowmeter



Weight-optimized sensor with a state-of-the-art transmitter for Water & Wastewater

Application

- The measuring principle is virtually independent of pressure, density, temperature and viscosity
- Fully suitable for standard applications in the water and wastewater industry

Device properties

- Up to 30 % less sensor weight
- Nominal diameter: DN 25 to 2400 (1 to 90")
- Maximum reduced installation length to DVGW/ISO
- Transmitter housing made of durable polycarbonate or aluminum
- WLAN access
- Integrated data logger: measured values monitoring

Your benefits

- Reduced installation costs – flexible mounting by one-of-a-kind lap-joint flange concept (DN < 350/14")
- Energy-saving flow measurement – no pressure loss due to cross-section constriction
- Maintenance-free – no moving parts
- Safe operation – no need to open the device due to display with touch control, background lighting
- Time-saving local operation without additional software and hardware – integrated web server
- Integrated verification – Heartbeat Technology

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Document information

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 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.

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

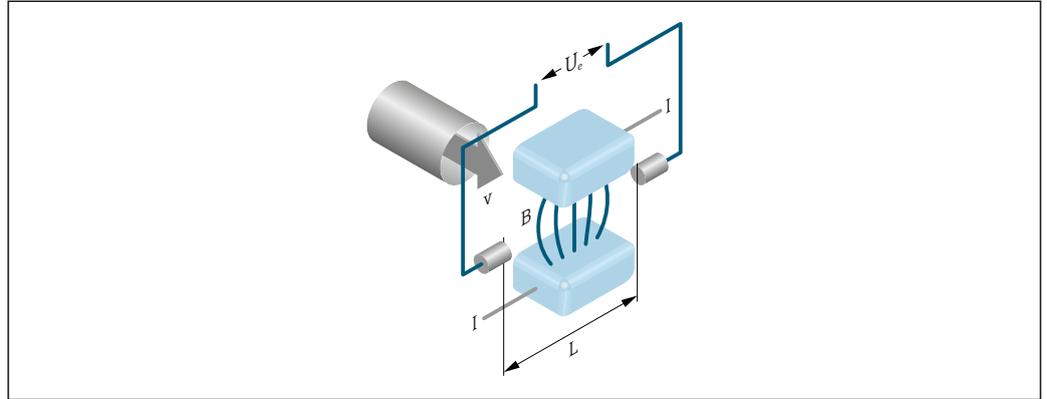
Symbols in graphics

Symbol	Meaning
1, 2, 3,...	Item numbers
	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.



U_e 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 $Q = A \cdot v$

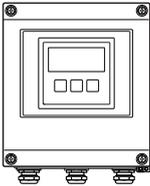
Measuring system

The device consists of a transmitter and a sensor.

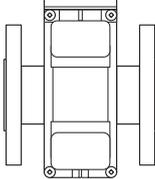
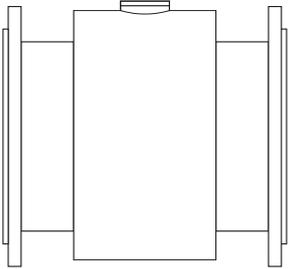
Two device versions are available:

- Compact version – transmitter and sensor form a mechanical unit.
- Remote version - transmitter and sensor are mounted in separate locations.

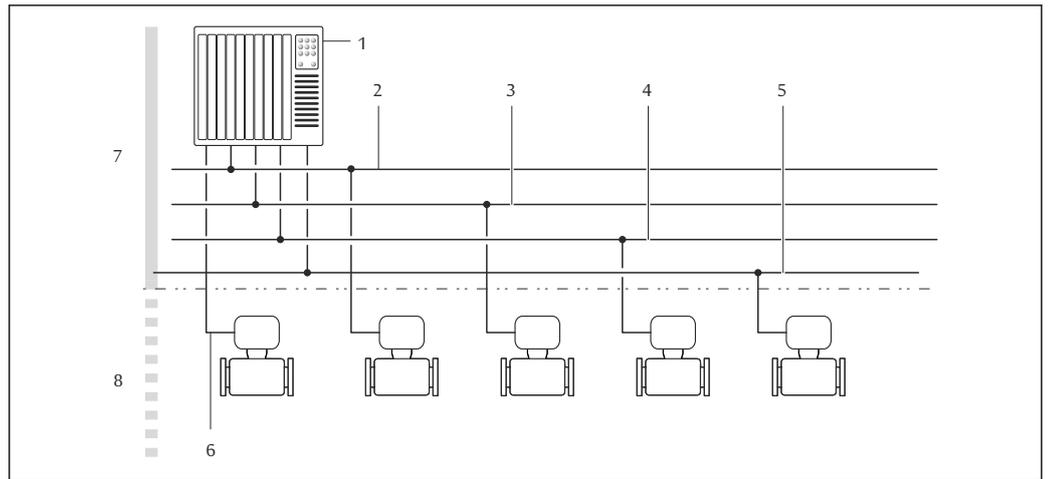
Transmitter

<p>Promag 400</p>  <p style="text-align: right; font-size: small;">A0017117</p>	<p>Device versions and materials</p> <ul style="list-style-type: none"> ■ Compact version: compact housing <ul style="list-style-type: none"> - Polycarbonate plastic - Aluminum, AlSi10Mg, coated ■ Remote version: wall-mount housing <ul style="list-style-type: none"> - Polycarbonate plastic - Aluminum, AlSi10Mg, coated <p>Configuration:</p> <ul style="list-style-type: none"> ■ External operation via four-line, illuminated local display with touch control and guided menus ("Make-it-run" wizards) for applications ■ Via operating tools (e.g. FieldCare) ■ Via Web browser (e.g. Microsoft Internet Explorer) ■ Also for device version with EtherNet/IP output: <ul style="list-style-type: none"> - Via Add-on Profile Level 3 for automation system from Rockwell Automation - Via Electronic Data Sheet (EDS) ■ Also for device version with PROFIBUS DP output: <ul style="list-style-type: none"> - Via PDM driver for Siemens automation system
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Sensor

<p>Promag L</p> <p><i>Lap joint flange, lap joint flange, stamped plate: DN 25 to 300 (1 to 12")</i></p>  <p style="text-align: right; font-size: small;">A0017040</p>	<ul style="list-style-type: none"> ■ Nominal diameter range: DN 25 to 2400 (1 to 90") ■ Materials: <ul style="list-style-type: none"> - Sensor housing: aluminum, AlSi10Mg, coated; carbon steel with protective varnish - Sensor connection housing: aluminum, AlSi10Mg, coated - Sensor connection housing polycarbonate for DN 350 to 2400 mm (13.8 to 94.5 in) for IP68 option - Measuring tubes: <ul style="list-style-type: none"> DN 25 to 300 (1 to 12"): stainless steel, 1.4301/1.4306/304L DN 350 to 1200 (14 to 48"): stainless steel, 1.4301/1.4307/202/304 DN 1350 to 2400 (54 to 90"): stainless steel, 1.4301/1.4307 - Liner: hard rubber, polyurethane, PTFE - Electrodes: stainless steel, 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022) - Process connections: <ul style="list-style-type: none"> Stainless steel, 1.4301/1.4306/1.4404//1.4571/F316L Carbon steel, A105/A181/A515(70)/FE410WB/P250GH/P235GH/P265GH/S235JRG2/S235JR+N/S275JR - Seals: as per DIN EN 1514-1 - Ground disks: stainless steel, 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022)
<p><i>Fixed flange: DN 350 to 2400 (14 to 90")</i></p>  <p style="text-align: right; font-size: small;">A0017041</p>	

Equipment 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.

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.

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). 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.

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 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.

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 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 .

Access via Web server

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

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

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



Additional information: "Description of Device Parameters" document pertaining to the device .

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 $\mu\text{S/cm}$ for liquids in general

Flow characteristic values in SI units

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.3/10 m/s) [m ³ /h]	Factory settings		
[mm]	[in]		Full scale value current output (v ~ 2.5 m/s) [m ³ /h]	Pulse value (~ 2 pulse/s) [m ³]	Low flow cut off (v ~ 0.04 m/s) [m ³ /h]
25	1	9 to 300 dm ³ /min	75 dm ³ /min	0.5 dm ³	1 dm ³ /min
32	–	15 to 500 dm ³ /min	125 dm ³ /min	1.0 dm ³	2 dm ³ /min
40	1 ½	25 to 700 dm ³ /min	200 dm ³ /min	1.5 dm ³	3 dm ³ /min
50	2	35 to 1 100 dm ³ /min	300 dm ³ /min	2.5 dm ³	5 dm ³ /min
65	–	60 to 2 000 dm ³ /min	500 dm ³ /min	5 dm ³	8 dm ³ /min
80	3	90 to 3 000 dm ³ /min	750 dm ³ /min	5 dm ³	12 dm ³ /min
100	4	145 to 4 700 dm ³ /min	1 200 dm ³ /min	10 dm ³	20 dm ³ /min
125	–	220 to 7 500 dm ³ /min	1 850 dm ³ /min	15 dm ³	30 dm ³ /min
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	2 850 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
–	84	3 700 to 125 000	31 000	4.5	500
2 200	–	4 100 to 136 000	34 000	4.5	540
–	90	4 300 to 143 000	36 000	5	570
2 400	–	4 800 to 162 000	40 000	5.5	650

Flow characteristic values in US units

Nominal diameter		Recommended flow min./max. full scale value (v ~ 0.3/10 m/s)	Factory settings		
[in]	[mm]		Full scale value current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulse/s)	Low flow cut off (v ~ 0.04 m/s)
		[gal/min]	[gal/min]	[gal]	[gal/min]
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
–	65	16 to 500	130	1	2
3	80	24 to 800	200	2	2.5
4	100	40 to 1250	300	2	4
8	200	155 to 4850	1200	10	15
10	250	250 to 7500	1500	15	30
12	300	350 to 10600	2400	25	45
14	350	500 to 15000	3600	30	60
15	375	600 to 19000	4800	50	60
16	400	600 to 19000	4800	50	60
18	450	800 to 24000	6000	50	90
20	500	1000 to 30000	7500	75	120
24	600	1400 to 44000	10500	100	180
28	700	1900 to 60000	13500	125	210
30	750	2150 to 67000	16500	150	270
32	800	2450 to 80000	19500	200	300
36	900	3100 to 100000	24000	225	360
40	1000	3800 to 125000	30000	250	480
42	–	4200 to 135000	33000	250	600
48	1200	5500 to 175000	42000	400	600
54	–	9 to 300 Mgal/d	75 Mgal/d	0.0005 Mgal/d	1.3 Mgal/d
–	1400	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
–	1600	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	1800	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
–	2000	20 to 700 Mgal/d	175 Mgal/d	0.0010 Mgal/d	2.9 Mgal/d
84	–	24 to 800 Mgal/d	190 Mgal/d	0.0011 Mgal/d	3.2 Mgal/d
–	2200	26 to 870 Mgal/d	210 Mgal/d	0.0012 Mgal/d	3.4 Mgal/d
90	–	27 to 910 Mgal/d	220 Mgal/d	0.0013 Mgal/d	3.6 Mgal/d
–	2400	31 to 1030 Mgal/d	245 Mgal/d	0.0014 Mgal/d	4.1 Mgal/d



To calculate the measuring range, use the *Applicator* sizing tool → 86

Recommended measuring range

"Flow limit" section → 42

Operable flow range

Over 1000 : 1

Input signal

External measured values

 Various pressure transmitters and temperature measuring devices can be ordered from Endress +Hauser: see "Accessories" section → 86

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

Digital communication

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

- PROFIBUS DP
- Modbus RS485
- EtherNet/IP

Status input

Maximum input values	<ul style="list-style-type: none"> ▪ DC 30 V ▪ 6 mA
Response time	Adjustable: 5 to 200 ms
Input signal level	<ul style="list-style-type: none"> ▪ Low signal: DC -3 to +5 V ▪ High signal: DC 12 to 30 V
Assignable functions	<ul style="list-style-type: none"> ▪ Off ▪ Reset totalizers 1-3 separately ▪ Reset all totalizers ▪ Flow override

Output

Output signal

Current output

Current output	Can be set as: <ul style="list-style-type: none"> ▪ 4-20 mA NAMUR ▪ 4-20 mA US ▪ 4-20 mA HART ▪ 0-20 mA
Maximum output values	<ul style="list-style-type: none"> ▪ DC 24 V (no flow) ▪ 22.5 mA
Load	0 to 700 Ω
Resolution	0.5 µA
Damping	Adjustable: 0.07 to 999 s
Assignable measured variables	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Flow velocity ▪ Conductivity ▪ Electronic temperature

Pulse/frequency/switch output

Function	<ul style="list-style-type: none"> ▪ With the order code for "Output; Input", option H: output 2 can be set as a pulse or frequency output ▪ With the order code for "Output; Input", option I: output 2 and 3 can be set as a pulse, frequency or switch output
Version	Passive, open collector
Maximum input values	<ul style="list-style-type: none"> ▪ DC 30 V ▪ 250 mA
Voltage drop	For 25 mA: ≤ DC 2 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	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow
Frequency output	
Output frequency	Adjustable: 0 to 12 500 Hz
Damping	Adjustable: 0 to 999 s
Pulse/pause ratio	1:1
Assignable measured variables	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Conductivity ▪ Flow velocity ▪ Electronic temperature
Switch output	
Switching behavior	Binary, conductive or non-conductive
Switching delay	Adjustable: 0 to 100 s
Number of switching cycles	Unlimited
Assignable functions	<ul style="list-style-type: none"> ▪ Off ▪ On ▪ Diagnostic behavior ▪ Limit value: <ul style="list-style-type: none"> - Off - Volume flow - Mass flow - Conductivity - Flow velocity - Totalizer 1-3 - Electronic temperature ▪ Flow direction monitoring ▪ Status <ul style="list-style-type: none"> - 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
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Signal on alarm

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

Current output 4 to 20 mA

4 to 20 mA

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

Failure mode	Choose from: <ul style="list-style-type: none"> ▪ Maximum alarm: 22 mA ▪ Freely definable value between: 0 to 22.5 mA
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HART current output

Device diagnostics	Device condition can be read out via HART Command 48
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Pulse/frequency/switch output

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

PROFIBUS DP

Status and alarm messages	Diagnostics in accordance with PROFIBUS PA Profile 3.02
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Modbus RS485

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

Device diagnostics	Device condition can be read out in Input Assembly
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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
 - PROFIBUS DP
 - Modbus RS485
 - EtherNet/IP
- Via service interface

Plain text display	With information on cause and remedial measures
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Additional information on remote operation → 76

Web server

Plain text display	With information on cause and remedial measures
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Light emitting diodes (LED)

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

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

Galvanic isolation

The following connections are galvanically isolated from each other:

- Inputs
- Outputs
- Power supply

Protocol-specific data**HART**

Manufacturer ID	0x11
Device type ID	0x69

HART protocol revision	7
Device description files (DTM, DD)	Information and files under: www.endress.com
HART load	Min. 250 Ω
Dynamic variables	<p>Read out the dynamic variables: HART command 3 The measured variables can be freely assigned to the dynamic variables.</p> <p>Measured variables for PV (primary dynamic variable)</p> <ul style="list-style-type: none"> ▪ Off ▪ Volume flow ▪ Mass flow ▪ Conductivity ▪ Flow velocity ▪ Electronic temperature <p>Measured variables for SV, TV, QV (secondary, tertiary and quaternary dynamic variable)</p> <ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Conductivity ▪ Flow velocity ▪ Electronic temperature ▪ Totalizer 1 ▪ Totalizer 2 ▪ Totalizer 3
Device variables	<p>Read out the device variables: HART command 9 The device variables are permanently assigned.</p> <p>A maximum of 8 device variables can be transmitted:</p> <ul style="list-style-type: none"> ▪ 0 = volume flow ▪ 1 = mass flow ▪ 2 = conductivity ▪ 3 = flow velocity ▪ 4 = electronic temperature ▪ 5 = totalizer 1 ▪ 6 = totalizer 2 ▪ 7 = totalizer 3

PROFIBUS DP

Manufacturer ID	0x11
Ident number	0x1562
Profile version	3.02
Device description files (GSD, DTM, DD)	Information and files under: <ul style="list-style-type: none"> ▪ www.endress.com ▪ www.profibus.org
Output values (from measuring device to automation system)	<p>Analog input 1 to 4</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow ▪ Flow velocity ▪ Conductivity ▪ Electronic temperature <p>Digital input 1 to 2</p> <ul style="list-style-type: none"> ▪ Empty pipe detection ▪ Low flow cut off ▪ Verification status <p>Totalizer 1 to 3</p> <ul style="list-style-type: none"> ▪ Mass flow ▪ Volume flow

Input values (from automation system to measuring device)	Analog output 1 (fixed assignment) External density Digital output 1 to 2 (fixed assignment) <ul style="list-style-type: none"> ▪ Digital output 1: switch positive zero return on/off ▪ Digital output 2: start verification Totalizer 1 to 3 <ul style="list-style-type: none"> ▪ Totalize ▪ Reset and hold ▪ Preset and hold ▪ Stop ▪ Operating mode configuration: <ul style="list-style-type: none"> - Net flow total - Forward flow total - Reverse flow total
Supported functions	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 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	<ul style="list-style-type: none"> ▪ 03: Read holding register ▪ 04: Read input register ▪ 06: Write single registers ▪ 08: Diagnostics ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Broadcast messages	Supported by the following function codes: <ul style="list-style-type: none"> ▪ 06: Write single registers ▪ 16: Write multiple registers ▪ 23: Read/write multiple registers
Supported baud rate	<ul style="list-style-type: none"> ▪ 1 200 BAUD ▪ 2 400 BAUD ▪ 4 800 BAUD ▪ 9 600 BAUD ▪ 19 200 BAUD ▪ 38 400 BAUD ▪ 57 600 BAUD ▪ 115 200 BAUD
Data transfer mode	<ul style="list-style-type: none"> ▪ ASCII ▪ RTU
Data access	Each device parameter can be accessed via Modbus RS485.  For Modbus register information

EtherNet/IP

Protocol	<ul style="list-style-type: none"> ■ The CIP Networks Library Volume 1: Common Industrial Protocol ■ The CIP Networks Library Volume 2: EtherNet/IP Adaptation of CIP 		
Communication type	<ul style="list-style-type: none"> ■ 10Base-T ■ 100Base-TX 		
Device profile	Generic device (product type: 0x2B)		
Manufacturer ID	0x49E		
Device type ID	0x1067		
Baud rates	Automatic 10 ₁₀₀ Mbit with half-duplex and full-duplex detection		
Polarity	Auto-polarity for automatic correction of crossed Tx/D and Rx/D pairs		
Supported CIP connections	Max. 3 connections		
Explicit connections	Max. 6 connections		
I/O connections	Max. 6 connections (scanner)		
Configuration options for measuring device	<ul style="list-style-type: none"> ■ DIP switches on the electronics module for IP addressing ■ Manufacturer-specific software (FieldCare) ■ Custom Add-on Profile for Rockwell Automation control systems ■ Web browser ■ Electronic Data Sheet (EDS) integrated in the measuring device 		
Configuration of the EtherNet interface	<ul style="list-style-type: none"> ■ Speed: 10 MBit, 100 MBit, auto (factory setting) ■ Duplex: half-duplex, full-duplex, auto (factory setting) 		
Configuration of the device address	<ul style="list-style-type: none"> ■ DIP switches on the electronics module for IP addressing (last octet) ■ DHCP ■ Manufacturer-specific software (FieldCare) ■ Custom Add-on Profile 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:	0x64	32

Input Assembly	<ul style="list-style-type: none"> ▪ Current device diagnostics ▪ Volume flow ▪ Mass flow ▪ Conductivity ▪ 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:	0x65	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x68	398
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88
Input only Multicast		Instance	Size [byte]
	Instance configuration:	0x69	-
	O → T configuration:	0xC7	-
	T → O configuration:	0x65	88
Configurable Input Assembly	<ul style="list-style-type: none"> ▪ Volume flow ▪ Mass flow ▪ Electronic temperature ▪ Conductivity ▪ Totalizer 1 to 3 ▪ Flow velocity ▪ Volume flow unit ▪ Mass flow unit ▪ Temperature unit ▪ Conductivity unit ▪ Unit totalizer 1-3 ▪ Flow velocity unit ▪ Verification result ▪ Verification status <p> The range of options increases if the measuring device has one or more application packages.</p>		
Fix Output			
Output Assembly	<ul style="list-style-type: none"> ▪ Activation of reset totalizers 1-3 ▪ Activation of reference density compensation ▪ Reset totalizers 1-3 ▪ External density ▪ Density unit ▪ Activation verification ▪ Start verification 		

Configuration	
Configuration Assembly	<p>Only the most common configurations are listed below.</p> <ul style="list-style-type: none"> ■ Software write protection ■ Mass flow unit ■ Mass unit ■ Volume flow unit ■ Volume unit ■ Density unit ■ Conductivity ■ Temperature unit ■ Totalizer 1-3: <ul style="list-style-type: none"> - Assignment - Unit - Operating mode - Failure mode ■ Alarm delay

Power supply

Terminal assignment

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

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
Terminals	Terminals	<ul style="list-style-type: none"> ■ Option A: coupling M20x1 ■ Option B: thread M20x1 ■ Option C: thread G ½" ■ Option D: thread NPT ½"

Supply voltage

Order code for "Power supply"	Terminal numbers	
	1 (L+/L)	2 (L-/N)
Option L (wide range power unit)	AC100 to 240 V	
	AC/DC24 V	

Signal transmission 0-20 mA/4-20 mA HART and additional outputs and inputs

Order code for "Output" and "Input"	Terminal numbers							
	Output 1		Output 2		Output 3		Input	
	26 (+)	27 (-)	24 (+)	25 (-)	22 (+)	23 (-)	20 (+)	21 (-)
Option H	<ul style="list-style-type: none"> ■ 4-20 mA HART (active) ■ 0-20 mA (active) 		Pulse/frequency output (passive)		Switch output (passive)			-
Option I	<ul style="list-style-type: none"> ■ 4-20 mA HART (active) ■ 0-20 mA (active) 		Pulse/frequency/switch output (passive)		Pulse/frequency/switch output (passive)			Status input

Transmitter: PROFIBUS DP

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
Terminals	Terminals	<ul style="list-style-type: none"> ▪ Option A: coupling M20x1 ▪ Option B: thread M20x1 ▪ Option C: thread G ½" ▪ Option D: thread NPT ½"

Supply voltage

Order code for "Power supply"	Terminal numbers	
	1 (L+/L)	2 (L-/N)
Option L (wide range power unit)	AC100 to 240 V	
	AC/DC24 V	

PROFIBUS DP signal transmission

Order code for "Output" and "Input"	Terminal numbers	
	26 (RxD/TxD-P)	27 (RxD/TxD-N)
Option L	B	A
Order code for "Output": Option L: PROFIBUS DP, for use in non-hazardous areas and Zone 2/div. 2		

Transmitter: Modbus RS485

The sensor can be ordered with terminals.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
Terminals	Terminals	<ul style="list-style-type: none"> ▪ Option A: coupling M20x1 ▪ Option B: thread M20x1 ▪ Option C: thread G ½" ▪ Option D: thread NPT ½"

Supply voltage

Order code for "Power supply"	Terminal numbers	
	1 (L+/L)	2 (L-/N)
Option L (wide range power unit)	AC100 to 240 V	
	AC/DC24 V	

Signal transmission Modbus RS485

Order code for "Output" and "Input"	Terminal numbers	
	26 (+)	27 (-)
Option M	B	A

Transmitter: EtherNet/IP

The sensor can be ordered with terminals or a device plug.

Connection methods available		Possible options for order code "Electrical connection"
Outputs	Power supply	
Terminals	Terminals	<ul style="list-style-type: none"> ■ Option A: coupling M20x1 ■ Option B: thread M20x1 ■ Option C: thread G 1/2" ■ Option D: thread NPT 1/2"
Device plug	Terminals	<ul style="list-style-type: none"> ■ Option L: plug M12x1 + thread NPT 1/2" ■ Option N: plug M12x1 + coupling M20 ■ Option P: plug M12x1 + thread G 1/2" ■ Option U: plug M12x1 + thread M20

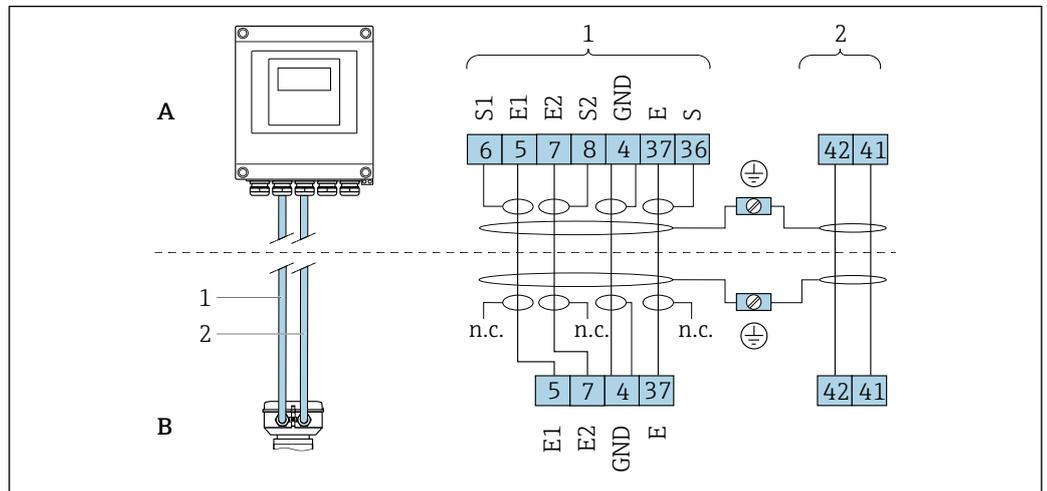
Supply voltage

Order code for "Power supply"	Terminal numbers	
	1 (L+/L)	2 (L-/N)
Option L (wide range power unit)	AC100 to 240 V	
	AC/DC24 V	

EtherNet/IP signal transmission

Order code for "Output"	Connection via
Option N	EtherNet/IP connector

Remote version



2 Remote version terminal assignment

- A Transmitter wall-mount housing
- B Sensor connection housing
- 1 Electrode cable
- 2 Coil current cable
- n.c. Not connected, insulated cable shields

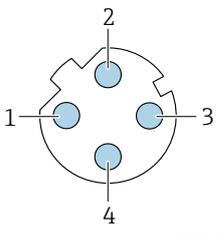
Terminal No. and cable colors: 6/5 = brown; 7/8 = white; 4 = green; 36/37 = yellow

Pin assignment, device plug

Order codes for the M12x1 connectors, see the "Order code for electrical connection" column: EtherNet/IP → 21

EtherNet/IP

Device plug for signal transmission (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**

Order code for "Power supply"	Terminal voltage	Frequency range
Option L	AC100 to 240 V	50/ 60 Hz, ±4 Hz
	AC/DC24 V	50/ 60 Hz, ±4 Hz

Power consumption

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

Current consumption**Transmitter**

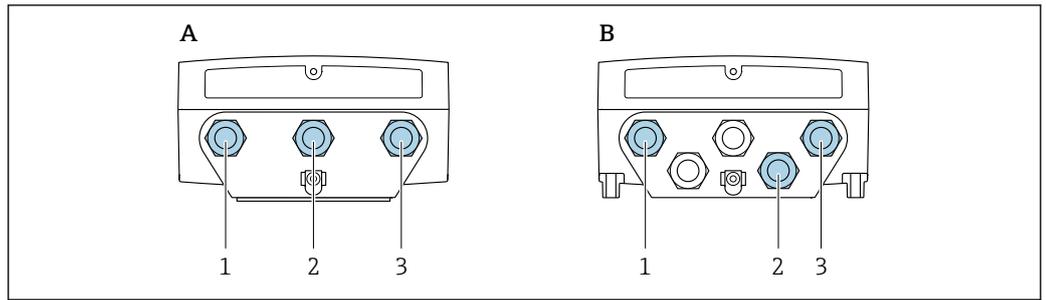
Order code for "Power supply"	Maximum Current consumption	Maximum switch-on current
Option L: AC 100 to 240 V	145 mA	25 A (< 5 ms)
Option L: AC/DC 24 V	350 mA	27 A (< 5 ms)

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

Connecting the transmitter



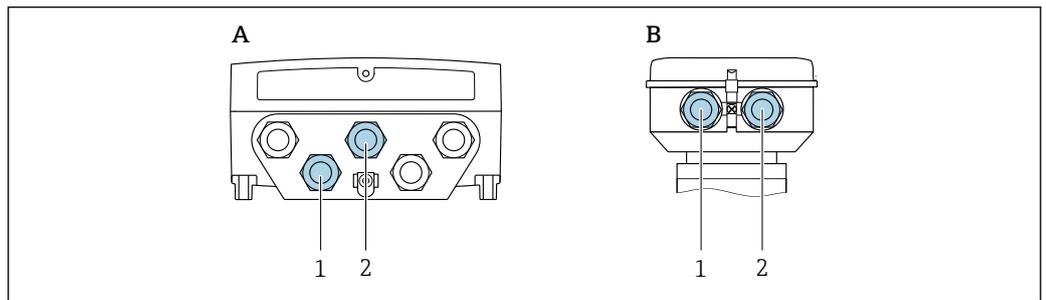
A0032041

3 Supply voltage and signal transmission connection

- A Compact version
- B Remote version wall-mount housing
- 1 Cable entry for supply voltage
- 2 Cable entry for signal transmission
- 3 Cable entry for signal transmission

Remote version connection

Connecting cable



A0032042

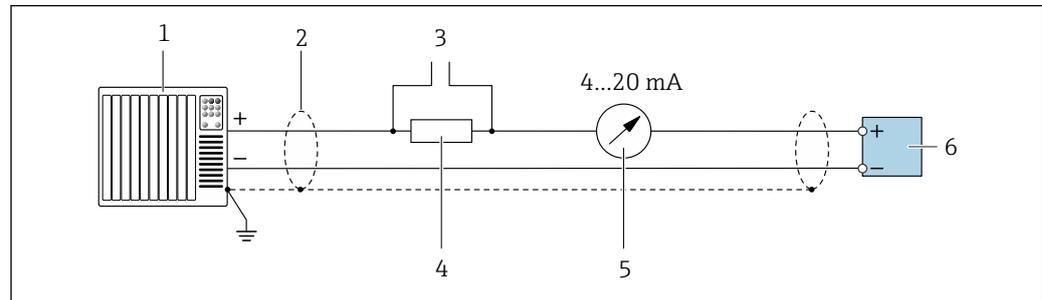
4 Connecting cable connection: electrode and coil current cable

- A Transmitter wall-mount housing
- B Sensor connection housing
- 1 Electrode cable
- 2 Coil current cable

- Fix the cable run or route it in an armored conduit.
Cable movements can influence the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between sensor and transmitter .

Connection examples

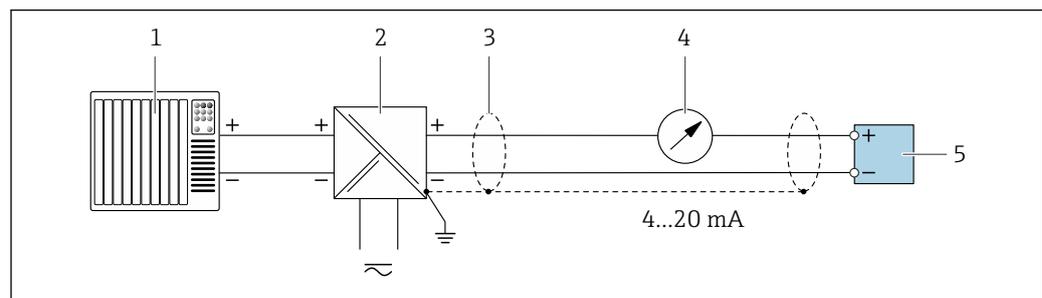
Current output 4 to 20 mA HART



A0029055

5 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 → 29
- 3 Connection for HART operating devices → 76
- 4 Resistor for HART communication ($\geq 250 \Omega$); observe maximum load → 11
- 5 Analog display unit: observe maximum load → 11
- 6 Transmitter

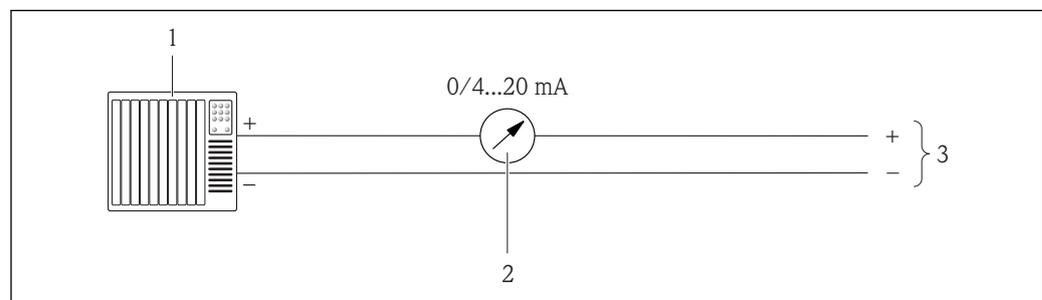


A0028762

6 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 → 29
- 4 Analog display unit: observe maximum load → 11
- 5 Transmitter

Current output 4-20 mA

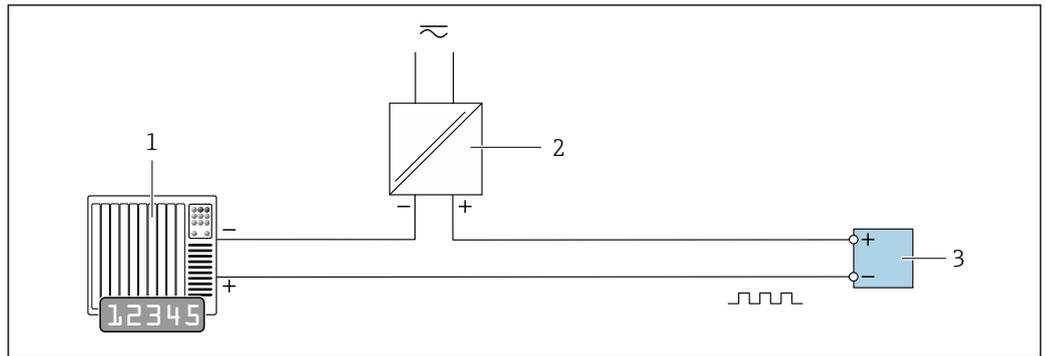


A0017162

7 Connection example for 0-20 mA current output (active) and 4-20 mA current output (active)

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

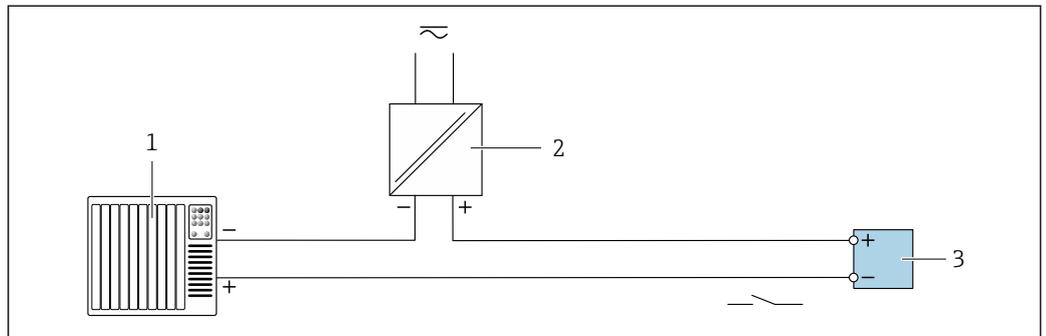
Pulse/frequency output



A0028761

- 8 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 → 12

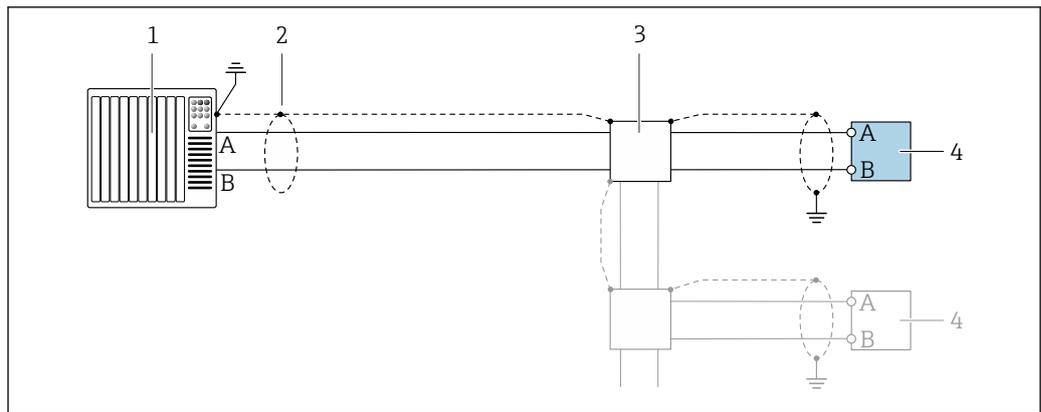
Switch output



A0028760

- 9 Connection example for switch output (passive)
- 1 Automation system with switch input (e.g. PLC)
 - 2 Power supply
 - 3 Transmitter: Observe input values → 12

PROFIBUS DP



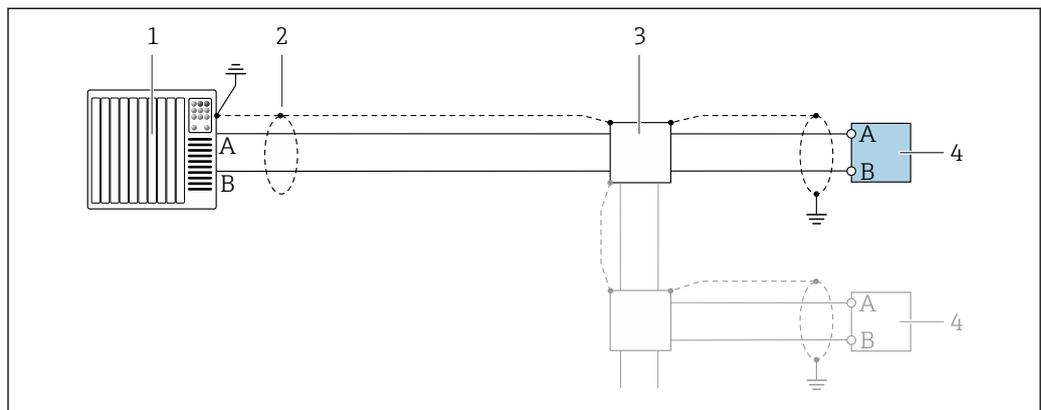
A0028765

10 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 Transmitter

i 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

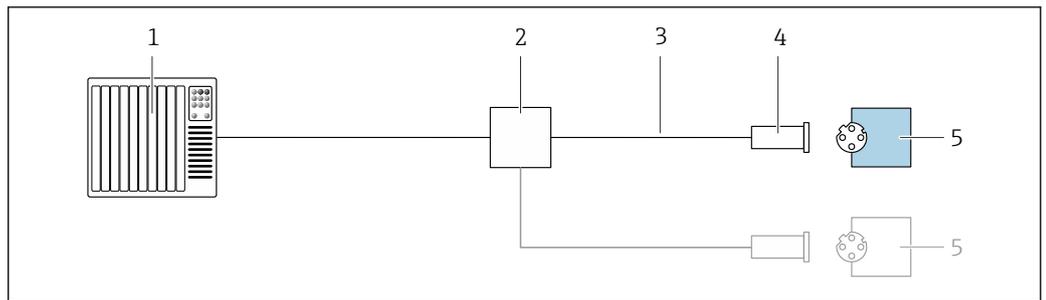


A0028765

11 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

EtherNet/IP

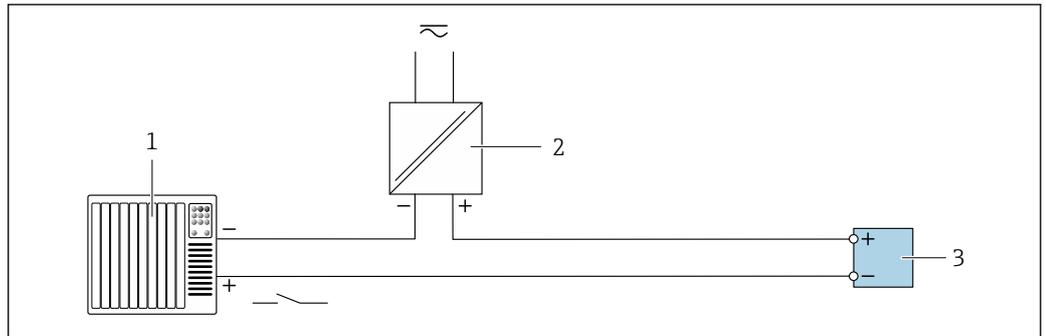


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12 Connection example for EtherNet/IP

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

Status input



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13 Connection example for status input

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

Potential equalization

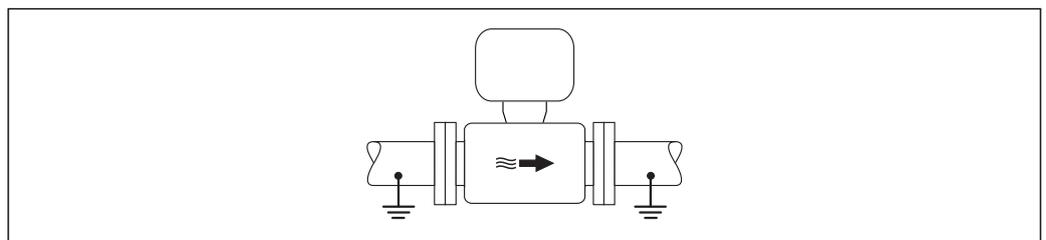
Requirements

Please consider the following to ensure correct measurement:

- Same electrical potential for the fluid and sensor
- Remote version: same electrical potential for the sensor and transmitter
- Company-internal grounding concepts
- Pipe material and grounding

Connection example, standard scenario

Metal, grounded pipe



A0016315

14 Potential equalization via measuring tube

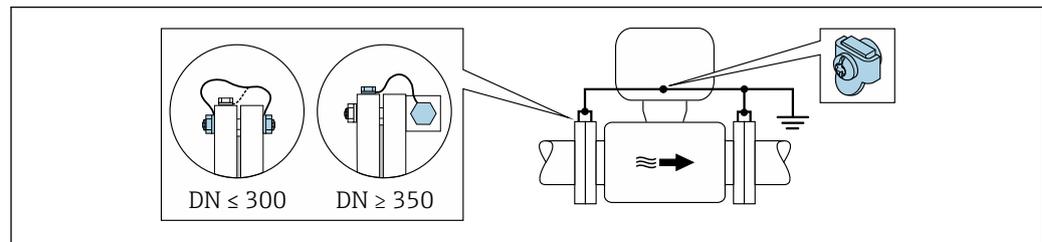
Connection example in special situations

Unlined and ungrounded metal pipe

This connection method also applies in situations where:

- The customary potential equalization is not used
- Equalizing currents are present

Ground cable	Copper wire, at least 6 mm ² (0.0093 in ²)
---------------------	---



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.

i For remote device versions, the ground terminal in the example always refers to the sensor and **not** to the transmitter.

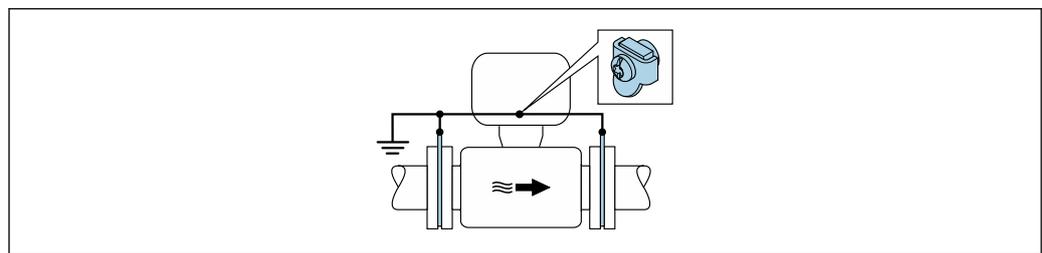
i You can order the necessary ground cable from Endress+Hauser: → 84.

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 mm ² (0.0093 in ²)
---------------------	---



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.

i For remote device versions, the ground terminal in the example always refers to the sensor and **not** to the transmitter.

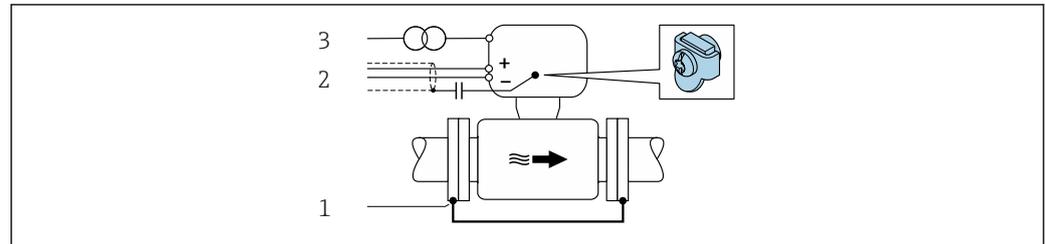
i The ground cable and ground disks can be ordered from Endress+Hauser → 84.

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 mm ² (0.0093 in ²)
---------------------	---



- 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.

i For remote device versions, the ground terminal in the example always refers to the sensor and **not** to the transmitter.

i You can order the necessary ground cable from Endress+Hauser: → [84](#).

Terminals

Transmitter

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

Sensor connection housing

Spring terminals for wire cross-sections 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entries

Cable entry thread

- M20 x 1.5
- Via adapter:
 - NPT ½"
 - G ½"

Cable gland

- For standard cable: M20 × 1.5 with cable ϕ 6 to 12 mm (0.24 to 0.47 in)
- For reinforced cable: M20 × 1.5 with cable ϕ 9.5 to 16 mm (0.37 to 0.63 in)

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

Cable specification

Permitted temperature range

Minimum requirement: cable temperature range \geq ambient temperature +20 K

Power supply cable

Standard installation cable is sufficient.

Signal cable

Current output 0/4 to 20 mA

Standard installation cable is sufficient.

Current output 4 to 20 mA HART

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

Pulse/frequency/switch output

Standard installation cable is sufficient.

Status input

Standard installation cable is sufficient.

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 mm ² (22 AWG)
Cable type	Twisted pairs
Loop resistance	\leq 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.

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	\leq 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.

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

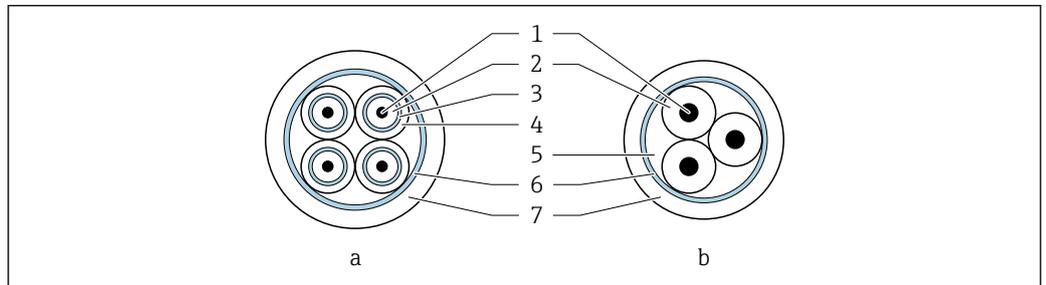
Connecting cable for remote version*Electrode cable*

Standard cable	3 \times 0.38 mm ² (20 AWG) with common, braided copper shield (ϕ ~9.5 mm (0.37 in)) and individual shielded cores
Cable for empty pipe detection (EPD)	4 \times 0.38 mm ² (20 AWG) with common, braided copper shield (ϕ ~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)
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 (ϕ ~9 mm (0.35 in))
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)
Test voltage for cable insulation	≤ AC 1433 V r.m.s. 50/60 Hz or ≥ DC 2026 V



17 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

i Reinforced connecting cables with an additional, reinforcing metal braid can be ordered from Endress+Hauser .

Operation in zones of severe electrical interference

The measuring system meets the general safety requirements → 82 and EMC specifications → 39.

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.

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 (7.3 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

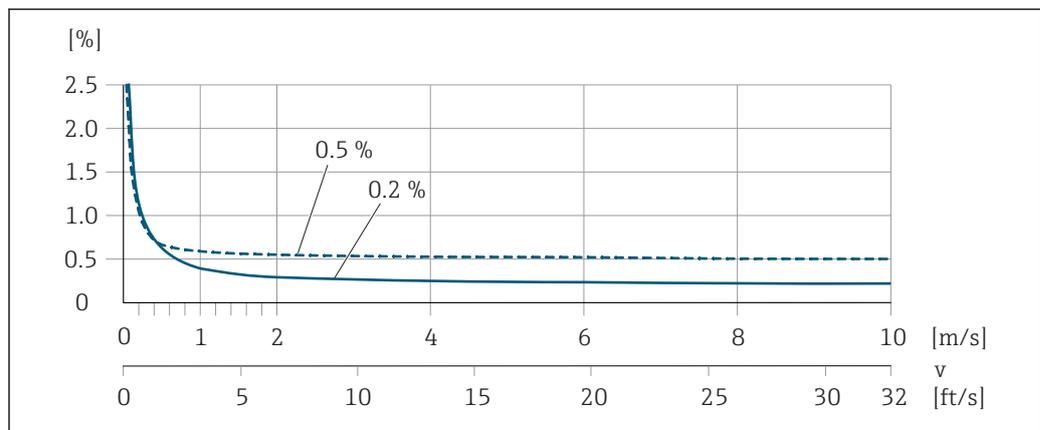
o.r. = of reading

Volume flow

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



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



A0032069

18 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	Max. $\pm 5 \mu\text{A}$
----------	--------------------------

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. $\pm 0.1\%$ o.r. ± 0.5 mm/s (0.02 in/s)

Electrical conductivity

Max. $\pm 5\%$ o.r.

Influence of ambient temperature

Current output

o.r. = of reading

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

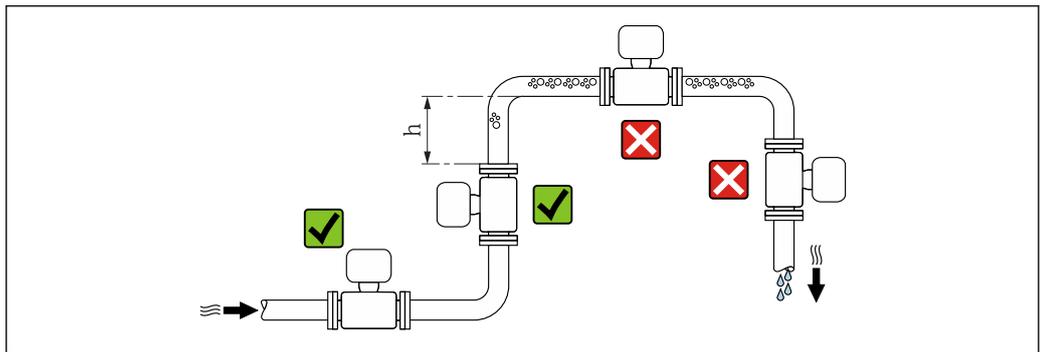
Pulse/frequency output

Temperature coefficient	No additional effect. Included in accuracy.
--------------------------------	---

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: $h \geq 2 \times DN$

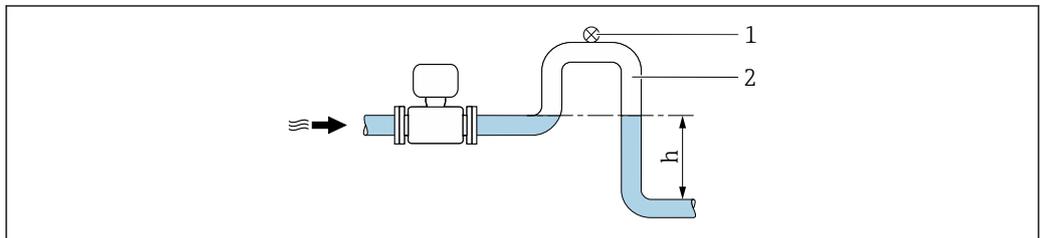
To prevent measuring errors arising from accumulation of gas bubbles in the measuring tube, avoid the following mounting locations in the pipe:

- 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 $h \geq 5$ 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



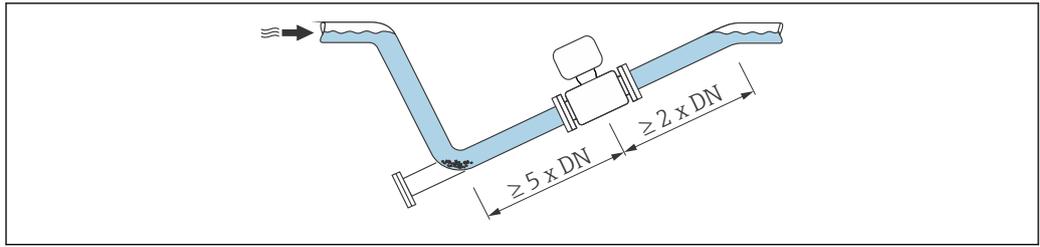
A0028981

 19 Installation in a down pipe

- 1 Vent valve
- 2 Pipe siphon
- h Length of down pipe

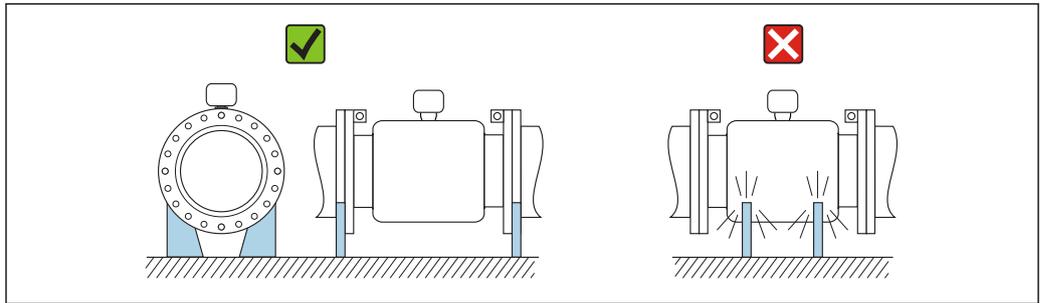
Installation in partially filled pipes

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.



A0029257

For heavy sensors DN \geq 350 (14")



A0016276

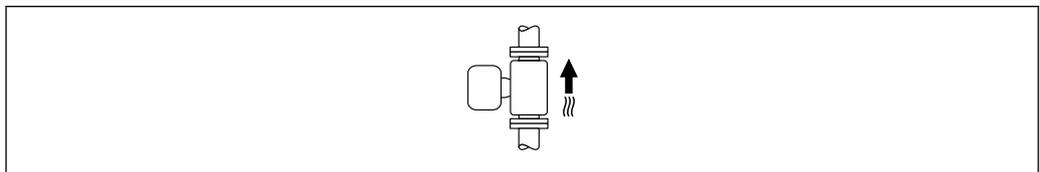
Orientation

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).

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.

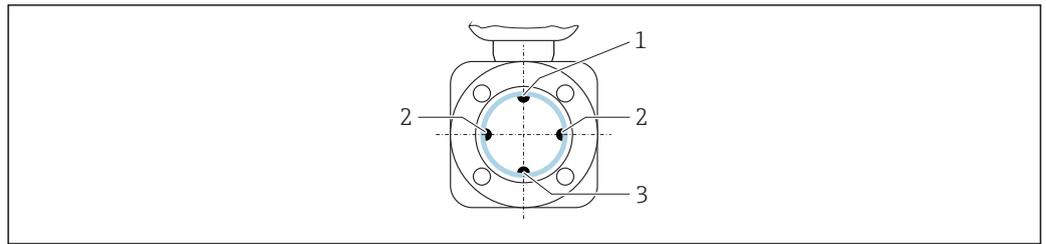
Vertical



A0015591

Optimum for self-emptying pipe systems and for use in conjunction with empty pipe detection.

Horizontal



A0029344

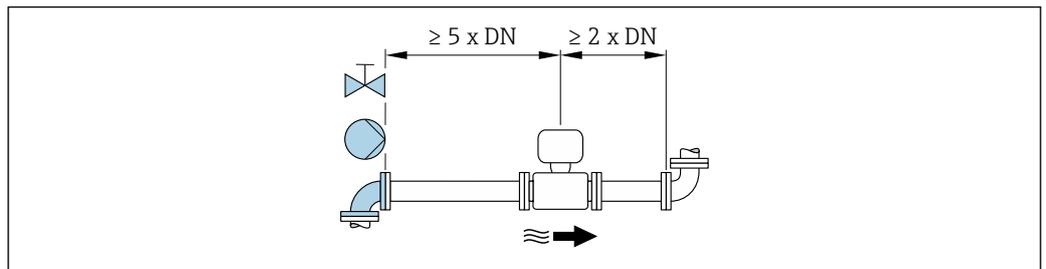
- 1 EPD electrode for empty pipe detection
- 2 Measuring electrodes for signal detection
- 3 Reference electrode for potential equalization

- i** 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

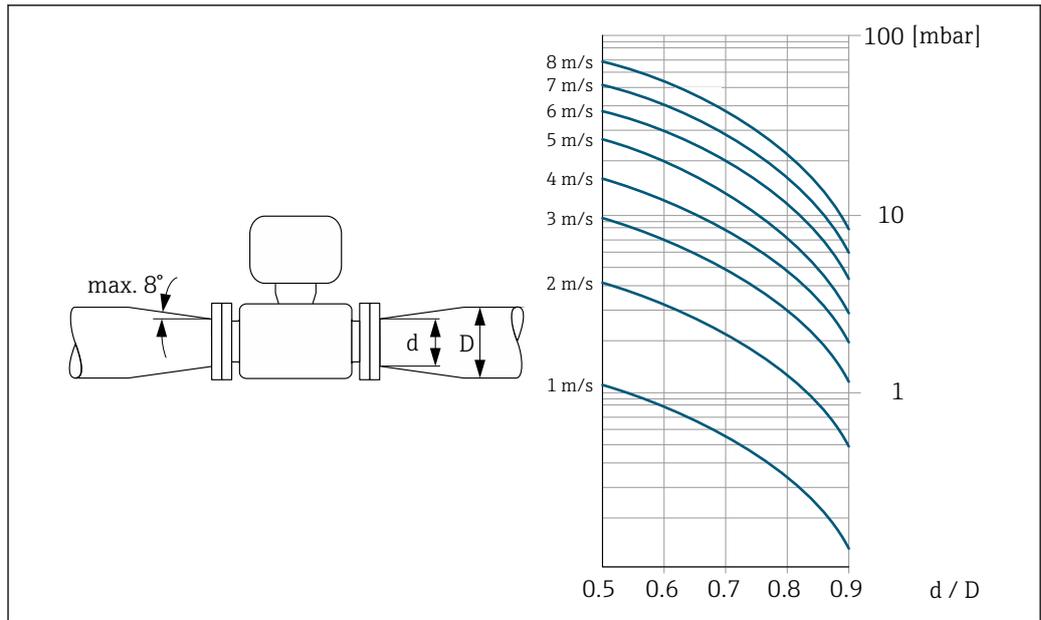
Adapters

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.

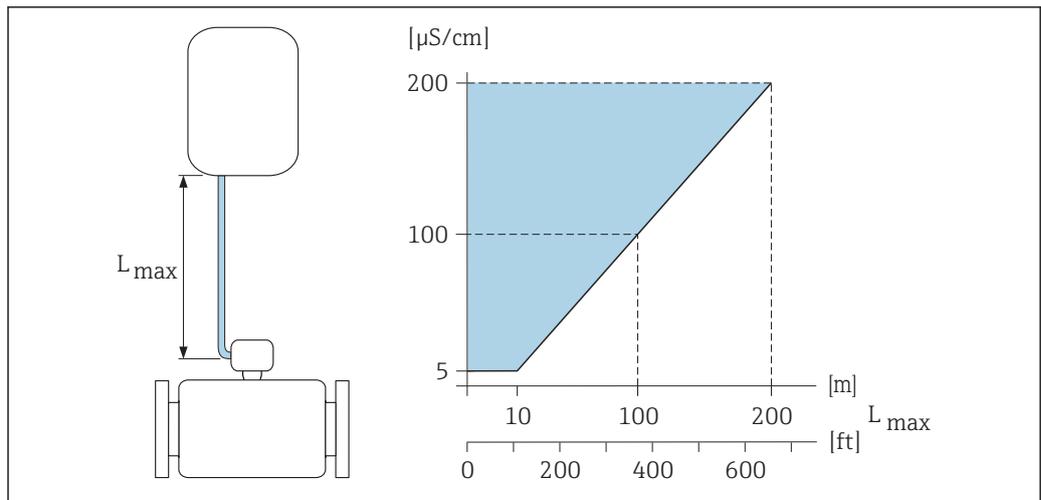
- i** The nomogram only applies to liquids with a viscosity similar to that of water.



A0029002

Length of connecting cable

To ensure correct measuring results when using the remote version, observe the maximum permitted length of the connecting cable L_{max} . This length is determined by the conductivity of the fluid.
 If measuring liquids in general: $5 \mu\text{S/cm}$



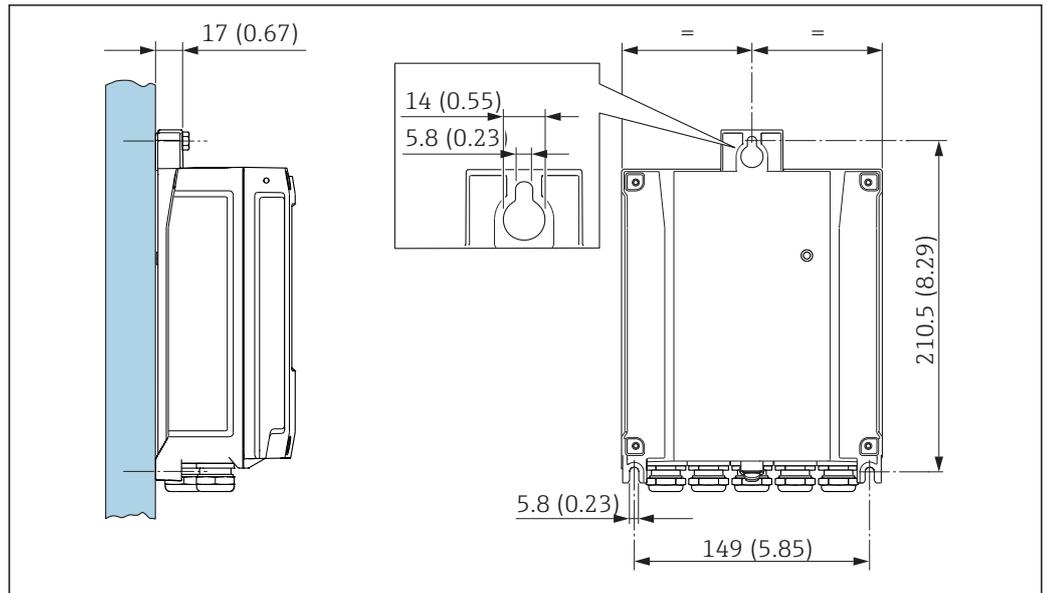
A0016539

20 Permitted length of connecting cable for remote version

Colored area = permitted range
 L_{max} = length of connecting cable in [m] ([ft])
 $[\mu\text{S/cm}]$ = fluid conductivity

Installing the wall-mount housing

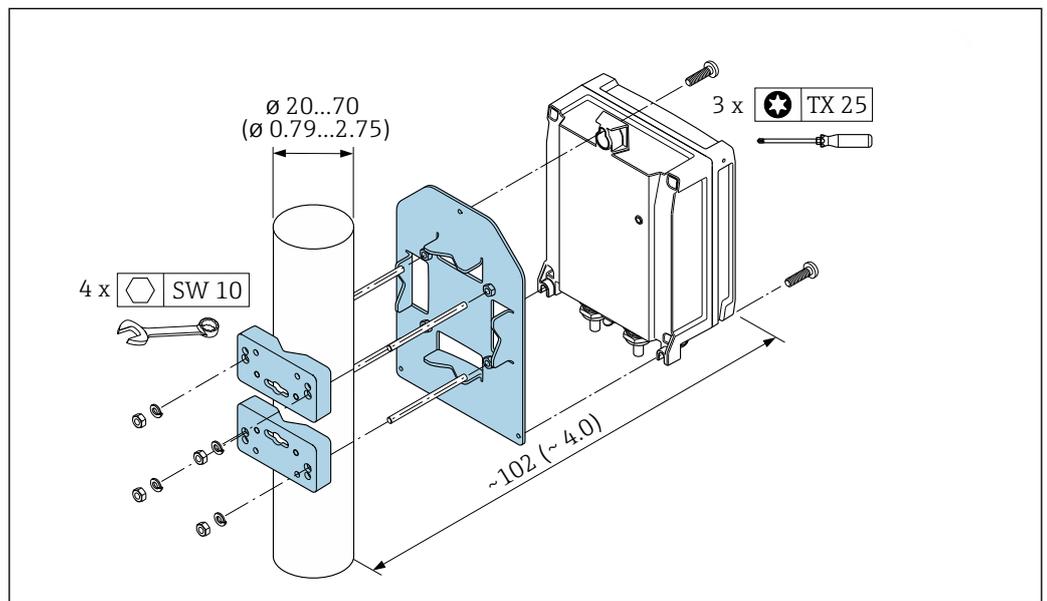
Wall mounting



A0020523

21 Engineering unit mm (in)

Post mounting



A0029051

22 Engineering unit mm (in)

Special mounting instructions

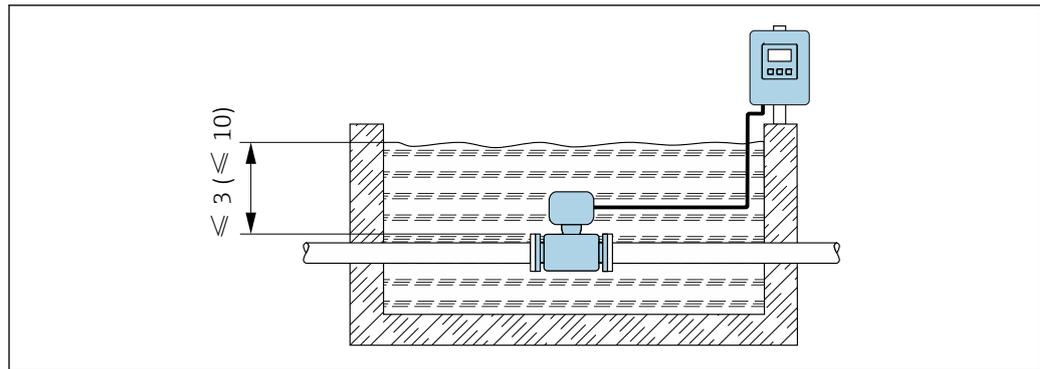
Display protection

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

Temporary immersion in water

A remote version with IP67 protection, Type 6 is optionally available for temporary immersion in water for up to 168 hours at ≤ 3 m (10 ft) or in exceptional cases for use for up to 48 hours at ≤ 10 m (30 ft).

Compared with the standard degree of protection IP67, Type 4X enclosure, the version IP67, Type 6 enclosure has been designed to withstand short-term or temporary flooding.



A0029320

23 Engineering unit in m(ft)

i Replacement of cable gland on connection housing → 29

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	<ul style="list-style-type: none"> ▪ 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) <p>Mount the transmitter separately from the sensor if both the ambient and fluid temperatures are high.</p>
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.
- If the compact version of the device is insulated at low temperatures, the insulation must also include the device neck.
- Protect the display against impact.
- Protect the display from abrasion by sand in desert areas.

i You can order a display guard from Endress+Hauser : → 84

Temperature tables

i Observe the interdependencies between the permitted ambient and fluid temperatures when operating the device in hazardous areas.

b For detailed information on the temperature tables, see the separate document entitled "Safety Instructions" (XA) for the device.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors. → 38

- 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.

Atmosphere	<p>If a plastic transmitter housing is permanently exposed to certain steam and air mixtures, this can damage the housing.</p> <p> If you are unsure, please contact your Endress+Hauser Sales Center for clarification.</p>
Degree of protection	<p>Transmitter</p> <ul style="list-style-type: none"> ▪ As standard: IP66/67, type 4X enclosure ▪ When housing is open: IP20, type 1 enclosure <p>Sensor</p> <ul style="list-style-type: none"> ▪ As standard: IP66/67, type 4X enclosure ▪ Optionally available for remote version: <ul style="list-style-type: none"> – IP67, type 4X enclosure. Suitable for temporary immersion in water for up to 168 hours at depths ≤ 3 m (10 ft) or up to 48 hours at depths ≤ 10 m (30 ft). – IP68, type 6P enclosure (for DN ≤ 300 (12") only possible in conjunction with stainless steel flanges) <p>Not suitable for use in corrosive atmospheres/liquids or in buried applications if special precautions are not taken.</p>
Vibration resistance	<p>Compact version</p> <ul style="list-style-type: none"> ▪ Vibration, sinusoidal according to IEC 60068-2-6 <ul style="list-style-type: none"> – 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 <ul style="list-style-type: none"> – 10 to 200 Hz, 0.003 g²/Hz – 200 to 2 000 Hz, 0.001 g²/Hz – Total: 1.54 g rms <p>Remote version</p> <ul style="list-style-type: none"> ▪ Vibration, sinusoidal according to IEC 60068-2-6 <ul style="list-style-type: none"> – 2 to 8.4 Hz, 7.5 mm peak – 8.4 to 2 000 Hz, 2 g peak ▪ Vibration broad-band random, according to IEC 60068-2-64 <ul style="list-style-type: none"> – 10 to 200 Hz, 0.01 g²/Hz – 200 to 2 000 Hz, 0.003 g²/Hz – Total: 1.54 g rms
Shock resistance	<p>Shock, half-sine according to IEC 60068-2-27 6 ms 50 g</p>
Impact resistance	<p>Rough handling shocks according to IEC 60068-2-31</p>
Mechanical load	<ul style="list-style-type: none"> ▪ 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)	<ul style="list-style-type: none"> ▪ 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 <p> 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.</p> <p> For details, refer to the Declaration of Conformity.</p>

Process

Medium temperature range	<ul style="list-style-type: none"> ▪ 0 to +80 °C (+32 to +176 °F) for hard rubber, DN 350 to 2400 (14 to 90") ▪ -20 to +50 °C (-4 to +122 °F) for polyurethane, DN 25 to 1200 (1 to 48") ▪ -20 to +90 °C (-4 to +194 °F) for PTFE, DN 25 to 300 (1 to 12")
---------------------------------	---

Conductivity

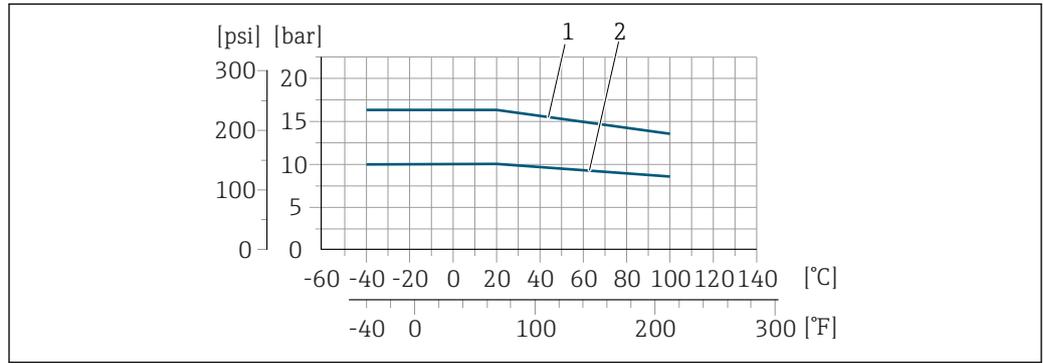
≥ 5 µS/cm for liquids in general. Stronger filter damping is required for very low conductivity values.

i Note that in the case of the remote version, the requisite minimum conductivity also depends on the cable length → 36.

Pressure-temperature ratings

The following pressure/temperature diagrams apply to all pressure-bearing parts of the device and not just the process connection.

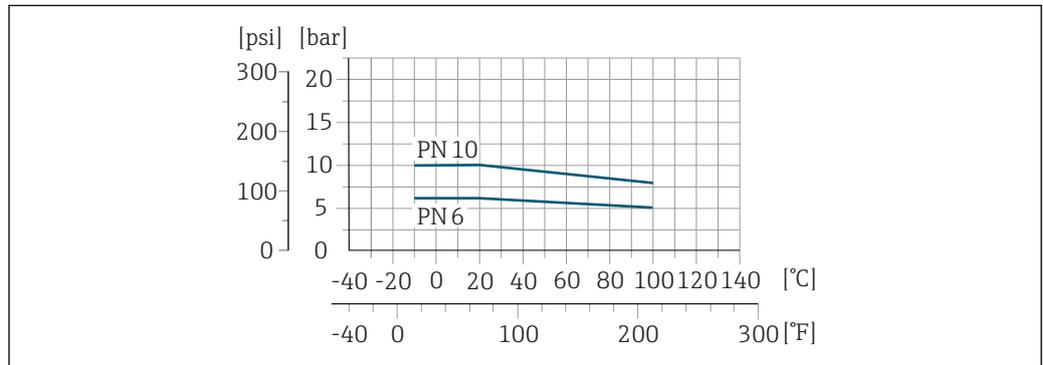
Process connection: lap joint flange/lap joint flange, stamped plate according to EN 1092-1 (DIN 2501) and ASME B16.5; DN 25 to 300 (1 to 12")



24 Process connection material: stainless steel (min. -40 °C (-40 °F)), carbon steel (min. -10 °C (+14 °F))

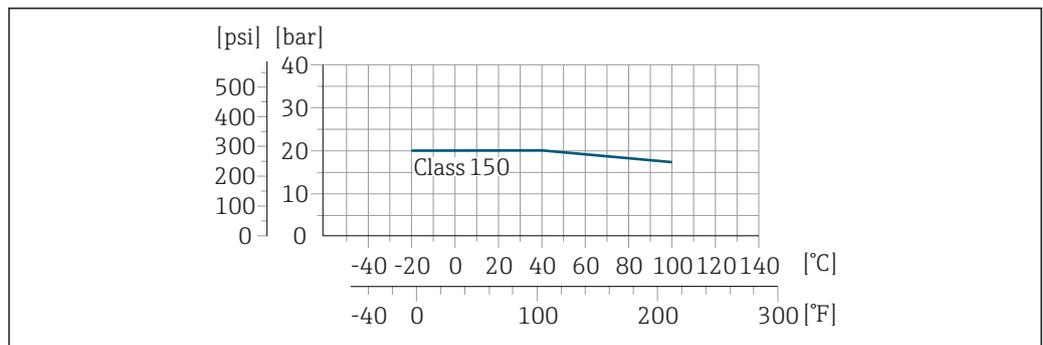
- 1 Lap joint flange PN16/ Class150
- 2 Lap joint flange, stamped plate PN10, lap joint flange PN10

Process connection: fixed flange according to EN 1092-1 (DIN 2501)



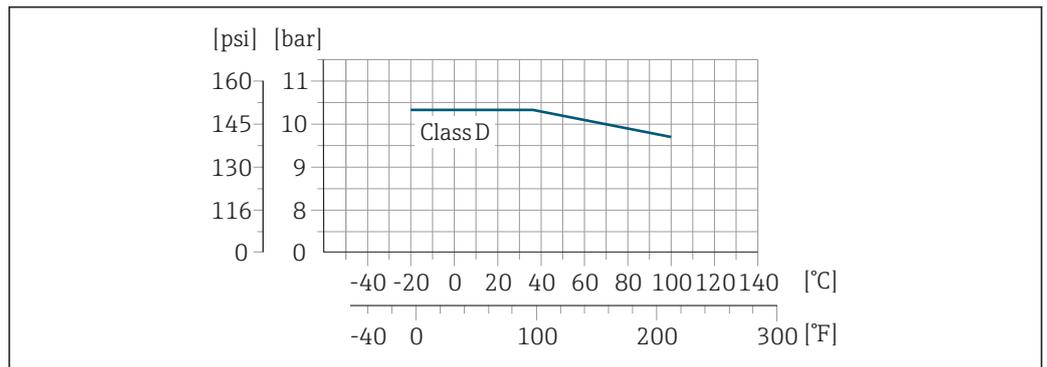
25 Process connection material: stainless steel, 1.4306/1.4404/1.4571/F316L; carbon steel, A105/FE410WB/S235JRG2

Process connection: fixed flange according to ASME B16.5



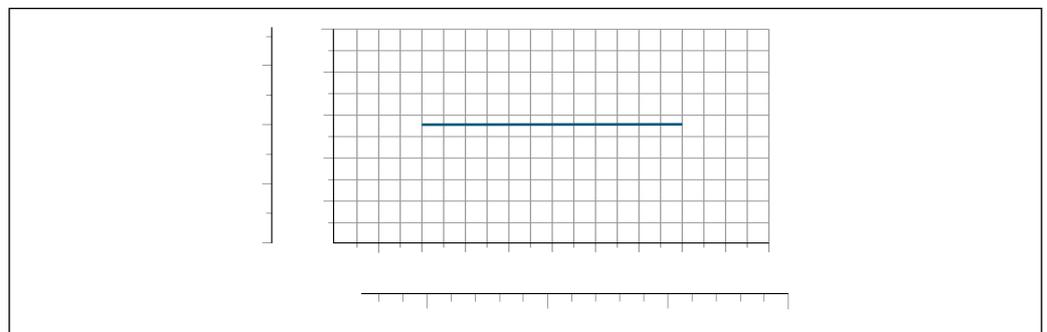
26 Process connection material: stainless steel, F316L similar to 1.4404; carbon steel, A105/A515(70)

Process connection: fixed flange according to AWWA C207



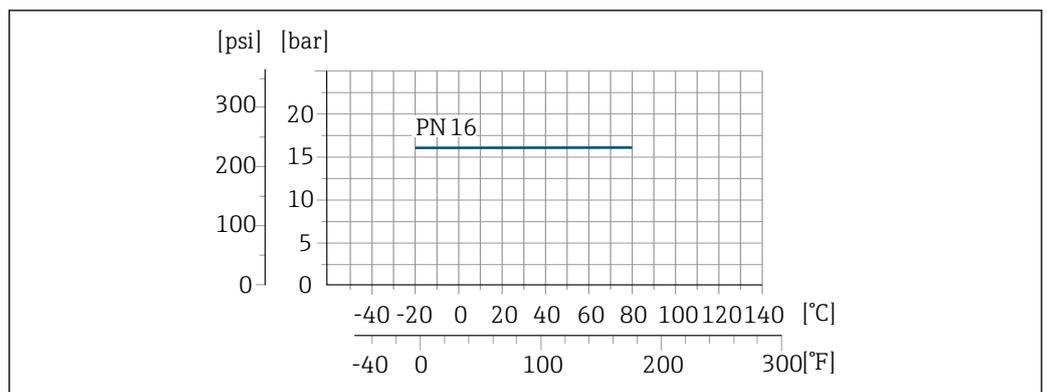
27 Process connection material: carbon steel, A105/A181/P265GH/S275JR

Process connection: fixed flange according to AS 2129



28 Process connection material: A105/FE410WB/P235GH/P265GH/S235JRG2

Process connection: fixed flange according to AS 4087



29 Process connection material: A105/P265GH/S275JR

Pressure tightness

Liner: hard rubber, polyurethane

Nominal diameter		Liner	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)
350...2400	14...90	Hard rubber	0 (0)	0 (0)	0 (0)
25...1200	1...48	Polyurethane	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)	+90 °C (+194 °F)
25	1	0 (0)	0 (0)
40	2	0 (0)	0 (0)
50	2	0 (0)	0 (0)
65	2 ½	0 (0)	40 (0.58)
80	3	0 (0)	40 (0.58)
100	4	0 (0)	135 (2.0)
125	5	135 (2.0)	240 (3.5)
150	6	135 (2.0)	240 (3.5)
200	8	200 (2.9)	290 (4.2)
250	10	330 (4.8)	400 (5.8)
300	12	400 (5.8)	500 (7.3)

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:

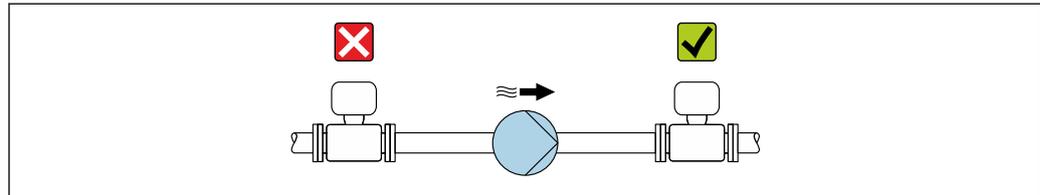
- $v < 2$ m/s (6.56 ft/s): for abrasive fluids (e.g. potter's clay, lime milk, ore slurry)
- $v > 2$ m/s (6.56 ft/s): for fluids producing buildup (e.g. wastewater sludge)

i A necessary increase in the flow velocity can be achieved by reducing the sensor nominal diameter.

i For an overview of the full scale values for the measuring range, see the "Measuring range" section →  8

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 →  35

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.

i Furthermore, install pulse dampers if reciprocating, diaphragm or peristaltic pumps are used.

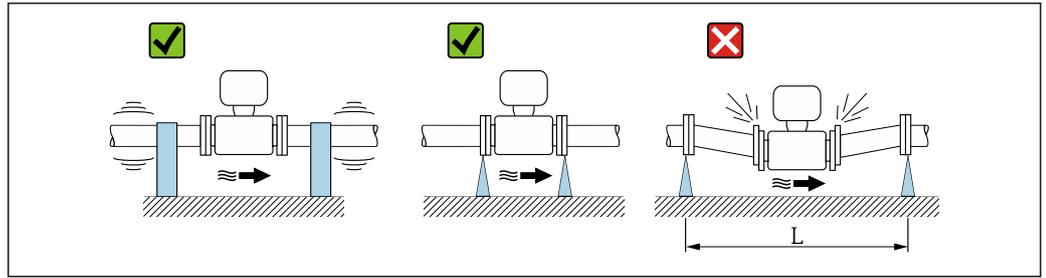
- For information on the liner's resistance to partial vacuum →  41
- For information on the shock resistance of the measuring system
- For information on the vibration resistance of the measuring system

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



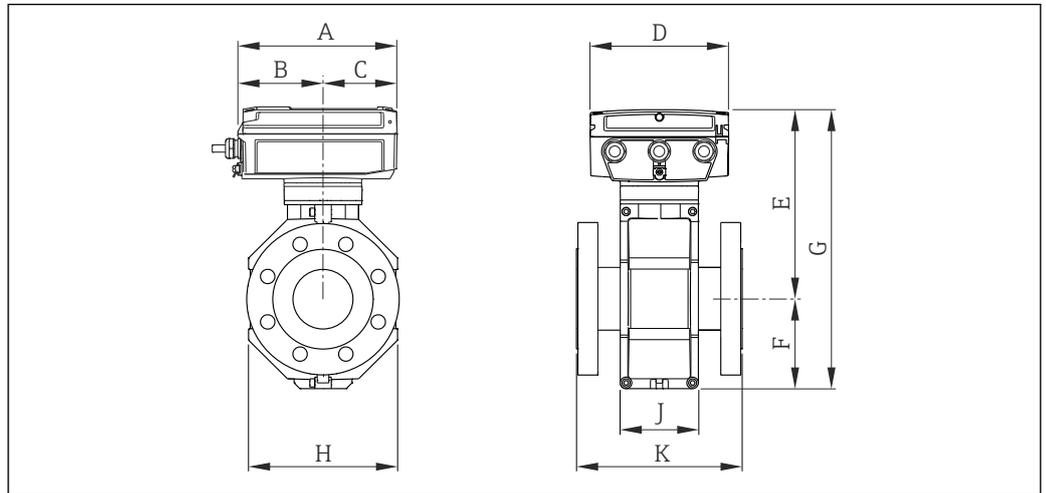
30 Measures to avoid device vibrations ($L > 10\text{ m}$ (33 ft))

Mechanical construction

Dimensions in SI units

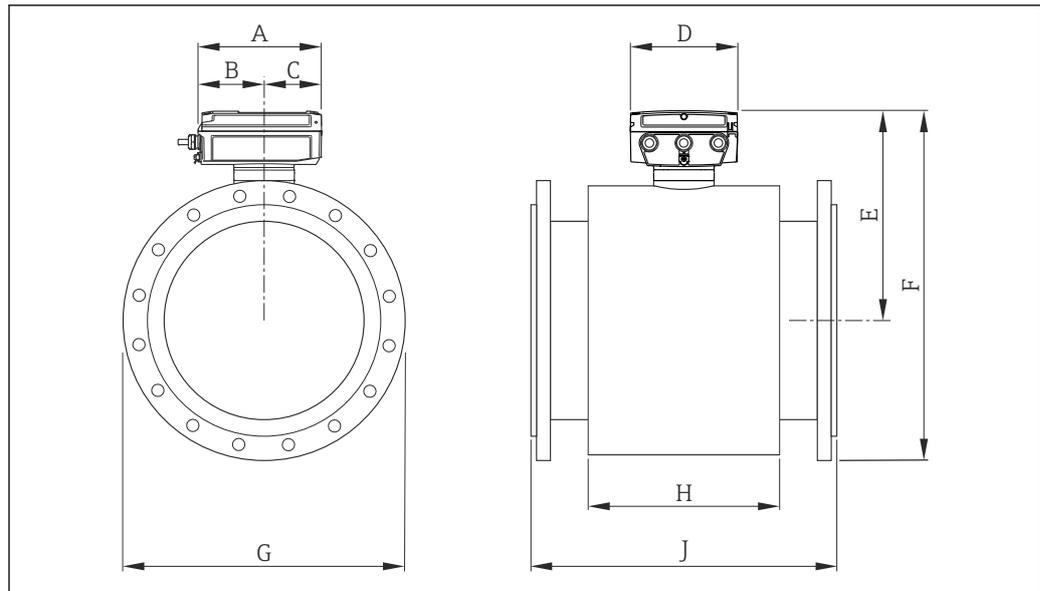
Compact version

Order code for "Housing", option M "Compact, polycarbonate" or option A "Compact, aluminum, coated"



DN	A	B	C	D	E	F	G	H	J	K ¹⁾
[mm]										
25	193	103	90	167	222	84	306	120	94	200
32	193	103	90	167	222	84	306	120	94	200
40	193	103	90	167	222	84	306	120	94	200
50	193	103	90	167	222	84	306	120	94	200
65	193	103	90	167	247	109	356	180	94	200
80	193	103	90	167	247	109	356	180	94	200
100	193	103	90	167	247	109	356	180	94	250
125	193	103	90	167	287	150	437	260	140	250
150	193	103	90	167	287	150	437	260	140	300
200	193	103	90	167	312	180	492	324	156	350
250	193	103	90	167	337	205	542	400	166	450
300	193	103	90	167	362	230	592	460	166	500

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.

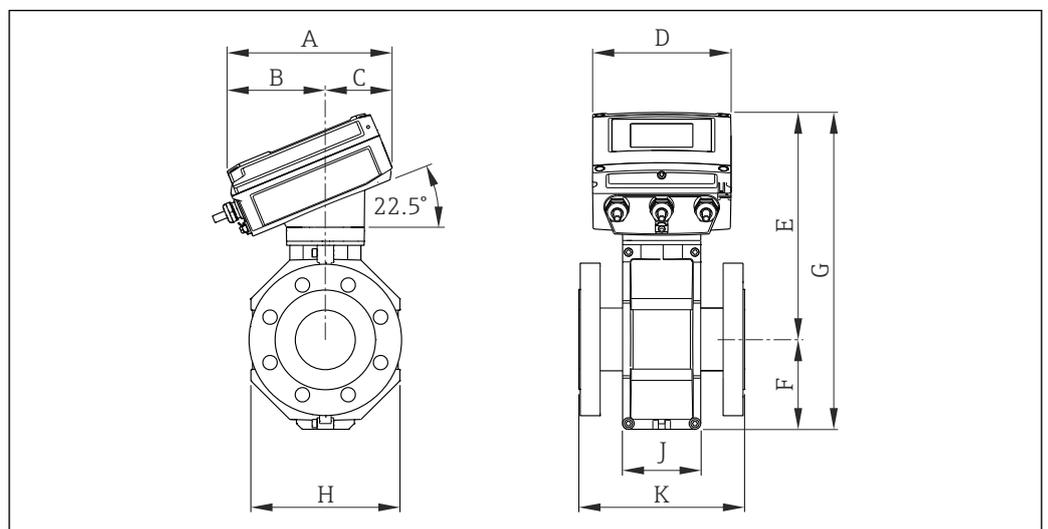


A0017153

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	H [mm]	J [mm]
350	193	103	90	167	386	290	550
375	193	103	90	167	412	290	600
400	193	103	90	167	412	290	600
450	193	103	90	167	440	290	600
500	193	103	90	167	465	290	600
600	193	103	90	167	506	290	600
700	193	103	90	167	571	424	700
750	193	103	90	167	608	454	750
800	193	103	90	167	627	500	800
900	193	103	90	167	677	580	900
1000	193	103	90	167	727	660	1000
1050	193	103	90	167	763	755	1050
1200	193	103	90	167	841	828	1200
1350	193	103	90	167	953	1008	1350
1400	193	103	90	167	953	1008	1400
1500	193	103	90	167	1053	1147	1500
1600	193	103	90	167	1053	1147	1600
1650	193	103	90	167	1104	1284	1650
1800	193	103	90	167	1161	1379	1800
2000	193	103	90	167	1272	1569	2000
2150	193	103	90	167	1372	1711	2150
2200	193	103	90	167	1372	1711	2200
2300	193	103	90	167	1477	1859	2300
2400	193	103	90	167	1477	1859	2400

DN [mm]	Dimension F					Dimension G				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]
350	631	638	702	653	648	490	505	520	533	525
375	-	-	-	-	687	-	-	-	-	550
400	682	694	760	710	702	540	565	580	597	580
450	737	747	823	757	760	595	615	640	635	640
500	787	800	926	814	817	645	670	715	699	705
600	883	896	1026	912	918	755	780	840	813	825
700	1001	1018	1145	1034	1026	860	895	910	927	910
750	-	-	-	1100	1106	-	-	-	984	995
800	1115	1135	1240	1157	1157	975	1015	1025	1060	1060
900	1215	1235	1240	1261	1265	1075	1115	1125	1168	1175
1000	1315	1342	1355	1372	1355	1175	1230	1255	1289	1255
1050	-	-	-	1436	-	-	-	-	1346	-
1200	1544	1569	1584	1597	1586	1405	1455	1485	1511	1490
1350	-	-	-	1795	-	-	-	-	1683	-
1400	1768	1791	1796	-	-	1630	1675	1685	-	-
1500	-	-	-	1980	-	-	-	-	1854	-
1600	1968	2011	2019	-	-	1830	1915	1930	-	-
1650	-	-	-	2120	-	-	-	-	2032	-
1800	2183	2218	2226	2259	-	2045	2115	2130	2197	-
2000	2404	2434	2444	2453	-	2265	2325	2345	2362	-
2150	-	-	-	2639	-	-	-	-	2534	-
2200	2609	2647	-	-	-	2475	2550	-	-	-
2300	-	-	-	2829	-	-	-	-	2705	-
2400	2819	2857	-	-	-	2685	2760	-	-	-

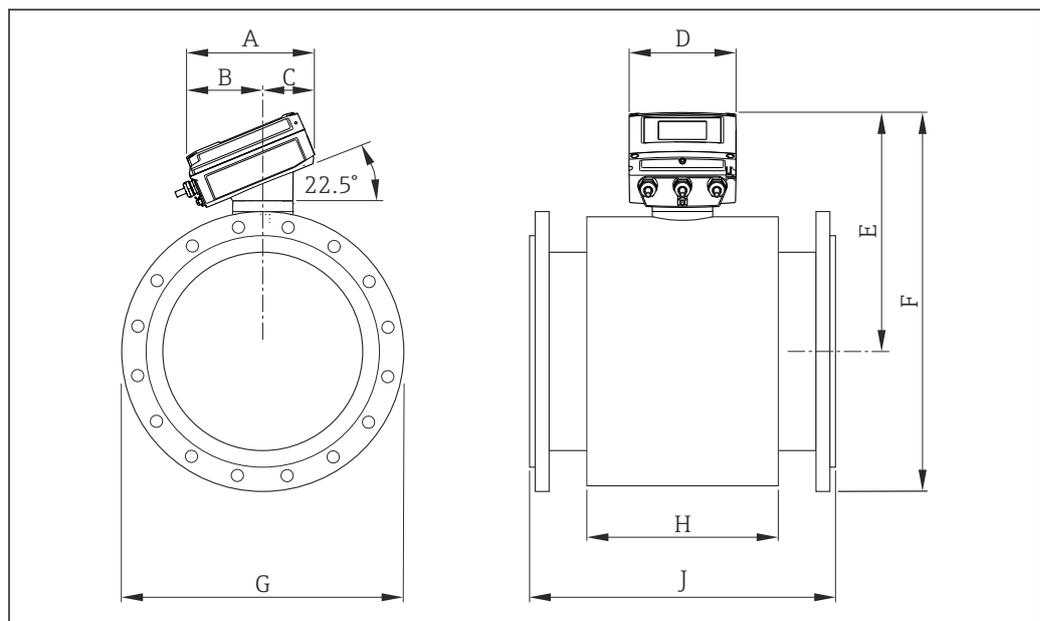
Order code for "Housing", option Q "Compact, polycarbonate, inclined" or option R "Compact, aluminum, coated, inclined"



A0020353

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	J [mm]	K ¹⁾ [mm]
25	199	119	80	167	267	84	351	120	94	200
32	199	119	80	167	267	84	351	120	94	200
40	199	119	80	167	267	84	351	120	94	200
50	199	119	80	167	267	84	351	120	94	200
65	199	119	80	167	292	109	401	180	94	200
80	199	119	80	167	292	109	401	180	94	200
100	199	119	80	167	292	109	401	180	94	250
125	199	119	80	167	332	150	482	260	140	250
150	199	119	80	167	332	150	482	260	140	300
200	199	119	80	167	357	180	537	324	156	350
250	199	119	80	167	382	205	587	400	166	450
300	199	119	80	167	407	230	637	460	166	500

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



A0020393

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	H [mm]	J [mm]
350	199	119	80	167	431	290	550
375	199	119	80	167	457	290	600
400	199	119	80	167	457	290	600
450	199	119	80	167	485	290	600
500	199	119	80	167	510	290	600
600	199	119	80	167	551	290	600
700	199	119	80	167	616	424	700
750	199	119	80	167	653	454	750
800	199	119	80	167	672	500	800

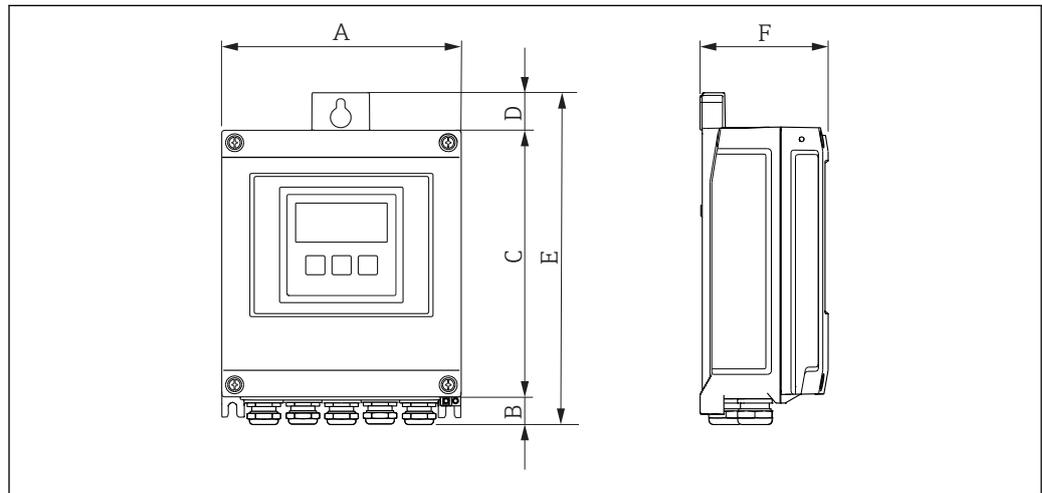
DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	H [mm]	J [mm]
900	199	119	80	167	722	580	900
1000	199	119	80	167	772	660	1000
1050	199	119	80	167	808	755	1050
1200	199	119	80	167	886	828	1200
1350	199	119	80	167	998	1008	1350
1400	199	119	80	167	953	1008	1400
1500	199	119	80	167	1098	1147	1500
1600	199	119	80	167	1098	1147	1600
1650	199	119	80	167	1149	1284	1650
1800	199	119	80	167	1206	1379	1800
2000	199	119	80	167	1317	1569	2000
2150	199	119	80	167	1417	1711	2150
2200	199	119	80	167	1417	1711	2200
2300	199	119	80	167	1522	1859	2300
2400	199	119	80	167	1522	1859	2400

DN [mm]	Dimension F					Dimension G				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]
350	676	683	618	698	693	490	505	520	533	525
375	-	-	-	-	732	-	-	-	-	550
400	727	739	672	755	747	540	565	580	597	580
450	782	792	732	802	805	595	615	640	635	640
500	832	845	795	859	862	645	670	715	699	705
600	928	941	898	957	963	755	780	840	813	825
700	1046	1063	1008	1079	1071	860	895	910	927	910
750	-	-	-	1145	1151	-	-	-	984	995
800	1160	1180	1112	1202	1202	975	1015	1025	1060	1060
900	1260	1280	1212	1306	1310	1075	1115	1125	1168	1175
1000	1360	1387	1327	1417	1400	1175	1230	1225	1289	1255
1050	-	-	-	1481	-	-	-	-	1346	-
1200	1589	1614	1556	1642	1631	1405	1455	1255	1511	1490
1350	-	-	-	1840	-	-	-	-	1683	-
1400	1813	1836	1768	-	-	1630	1675	1685	-	-
1500	-	-	-	2025	-	-	-	-	1854	-
1600	2013	2056	1991	-	-	1830	1915	1930	-	-
1650	-	-	-	2165	-	-	-	-	2032	-
1800	2228	2263	2198	2304	-	2045	2115	2130	2197	-
2000	2449	2479	2416	2498	-	2265	2325	2345	2362	-
2150	-	-	-	2684	-	-	-	-	2534	-

DN [mm]	Dimension F					Dimension G				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]
2200	2654	2692	-	-	-	2475	2550	-	-	-
2300	-	-	-	2874	-	-	-	-	2705	-
2400	2864	2902	-	-	-	2685	2760	-	-	-

Transmitter remote version

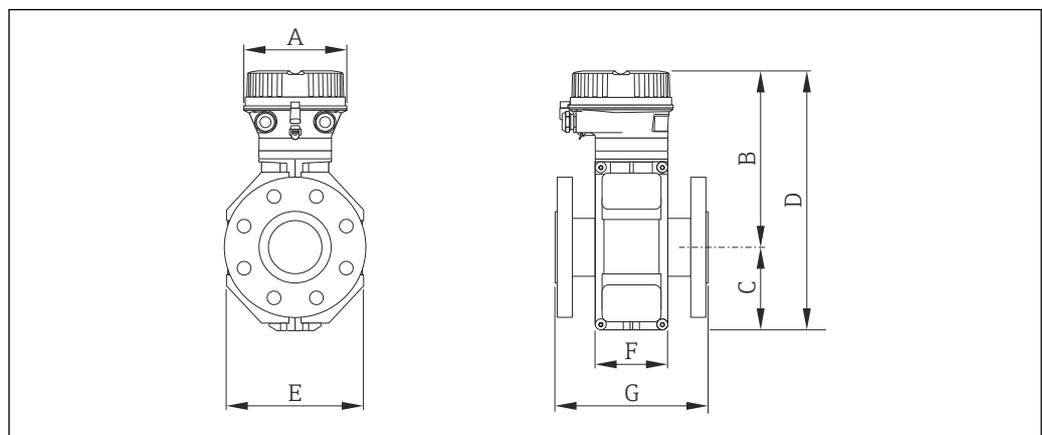
Order code for "Housing", option N "Remote, polycarbonate" or option P "Remote, aluminum coated"



A0020522

A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
167	21	187	24	232	80

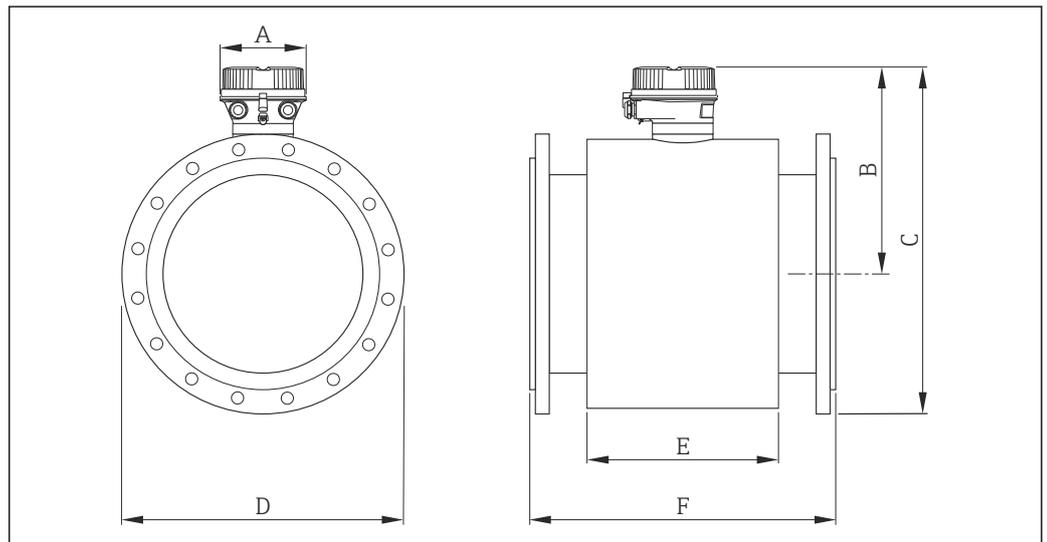
Sensor remote version



A0017282

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G ¹⁾ [mm]
25	136	207	84	291	120	94	200
32	136	207	84	291	120	94	200
40	136	207	84	291	120	94	200
50	136	207	84	291	120	94	200
65	136	232	109	341	180	94	200
80	136	232	109	341	180	94	200
100	136	232	109	341	180	94	250
125	136	272	150	422	260	140	250
150	136	272	150	422	260	140	300
200	136	297	180	477	324	156	350
250	136	322	205	527	400	156	450
300	136	347	230	577	460	166	500

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



A0017284

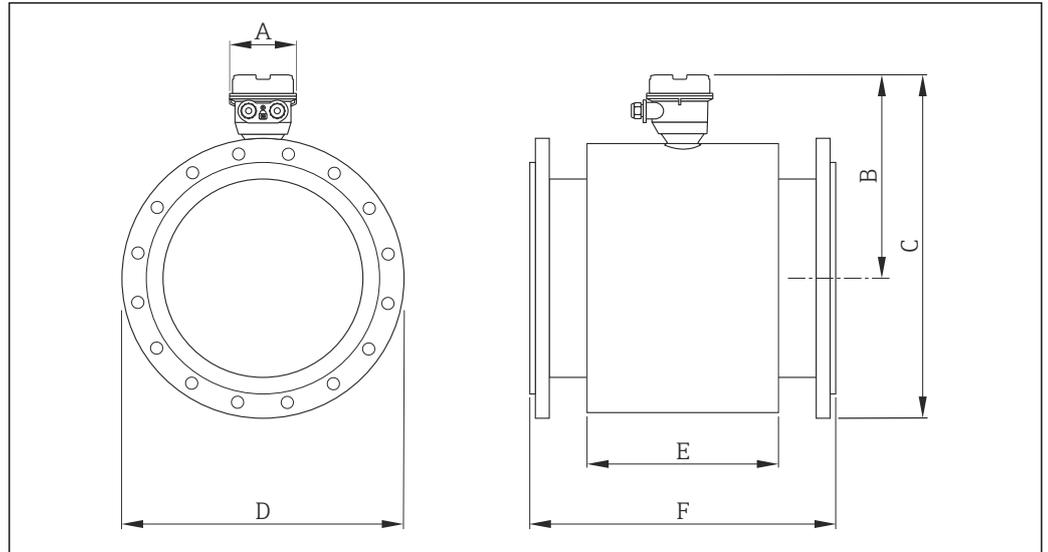
DN [mm]	A [mm]	B [mm]	E [mm]	F [mm]
350	136	358	290	550
375	136	384	290	600
400	136	384	290	600
450	136	412	290	600
500	136	437	290	600
600	136	478	290	600
700	136	543	424	700
750	136	579	454	750
800	136	599	500	800
900	136	649	580	900
1000	136	699	660	1000

DN [mm]	A [mm]	B [mm]	E [mm]	F [mm]
1050	136	735	755	1050
1200	136	813	828	1200
1350	136	925	1008	1350
1400	136	925	1008	1400
1500	136	1025	1147	1500
1600	136	1025	1147	1600
1650	136	1076	1284	1650
1800	136	1133	1379	1800
2000	136	1244	1569	2000
2150	136	1344	1711	2150
2200	136	1344	1711	2200
2300	136	1449	1859	2300
2400	136	1449	1859	2400

DN [mm]	Dimension C					Dimension D				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]
350	603	610	616	625	620	490	505	520	533	525
375	-	-	-	-	659	-	-	-	-	550
400	654	666	672	682	674	540	565	580	597	580
450	709	719	729	729	732	595	615	640	635	640
500	759	772	791	786	789	645	670	715	699	705
600	855	868	903	884	890	755	780	840	813	825
700	973	990	1009	1006	998	860	895	910	927	910
750	-	-	-	1072	1078	-	-	-	984	995
800	1087	1107	1123	1129	1129	975	1015	1025	1060	1060
900	1187	1207	1223	1233	1237	1075	1115	1125	1168	1175
1000	1287	1314	1338	1344	1327	1175	1230	1225	1289	1255
1050	-	-	-	1408	-	-	-	-	1346	-
1200	1516	1541	1567	1569	1558	1405	1455	1255	1511	1490
1350	-	-	-	1767	-	-	-	-	1683	-
1400	1740	1763	1779	-	-	1630	1675	1685	-	-
1500	-	-	-	1952	-	-	-	-	1854	-
1600	1940	1983	2002	-	-	1830	1915	1930	-	-
1650	-	-	-	2092	-	-	-	-	2032	-
1800	2155	2190	2209	2231	-	2045	2115	2130	2197	-
2000	2376	2406	2427	2425	-	2265	2325	2345	2362	-
2150	-	-	-	2611	-	-	-	-	2534	-
2200	2581	2619	-	-	-	2475	2550	-	-	-

DN [mm]	Dimension C					Dimension D				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]	PN 6 [mm]	PN 10 [mm]	PN 16 [mm]	AWWA [mm]	[mm]
2300	-	-	-	2801	-	-	-	-	2705	-
2400	2791	2829	-	-	-	2685	2760	-	-	-

Order code for "Sensor option", option CK "IP68, Type 6P, waterproof"



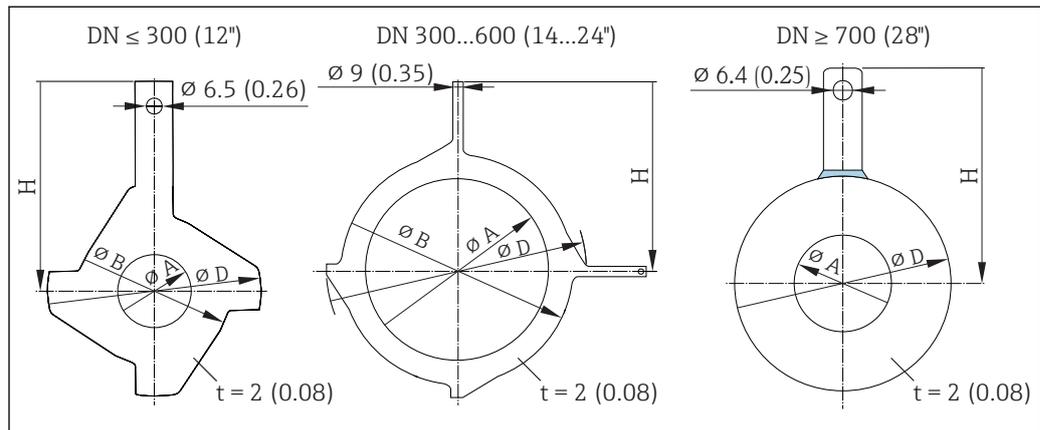
A0020436

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
350	112	364	617	520	290	550
375	112	390	-	-	290	600
400	112	390	673	580	290	600
450	112	418	730	640	290	600
500	112	443	792	715	290	600
600	112	484	904	840	290	600
700	112	549	1010	910	424	700
750	112	585	-	-	454	750
800	112	605	1224	1025	500	800
900	112	655	1224	1125	580	900
1000	112	705	1339	1225	660	1000
1050	112	741	-	-	755	1050
1200	112	819	1568	1255	828	1200
1350	112	931	-	-	1008	1350
1400	112	931	1780	1685	1008	1400
1500	112	1031	-	-	1147	1500
1600	112	1031	2003	1930	1147	1600
1650	112	1082	-	-	1284	1650

DN [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]
1800	112	1139	2210	2130	1379	1800
2000	112	1250	2428	2345	1569	2000

Accessories

Ground disks for flange connections



A0015442

31 Engineering unit mm (in)

DN [mm]	Pressure rating	A [mm]	B [mm]	D [mm]	H [mm]
25	1)	26	62	77.5	87.5
32	1)	35	80	87.5	94.5
40	1)	41	82	101	103
50	1)	52	101	115.5	108
65	1)	68	121	131.5	118
80	1)	80	131	154.5	135
100	1)	104	156	186.5	153
125	1)	130	187	206.5	160
150	1)	158	217	256	184
200	1)	206	267	288	205
250	1)	260	328	359	240
300	1)	312	375	413	273
350	DIN, PN 6	343	433	479	365
350	DIN, PN 10	343	400	479	365
350	ASME, Class 150	343	400	479	365
400	DIN, PN 6	393	470	542	395
400	DIN, PN 10	393	469	542	395
400	ASME, Class 150	393	469	542	395
450	DIN, PN 6	439	525	583	417
450	DIN, PN 10	439	535	583	417

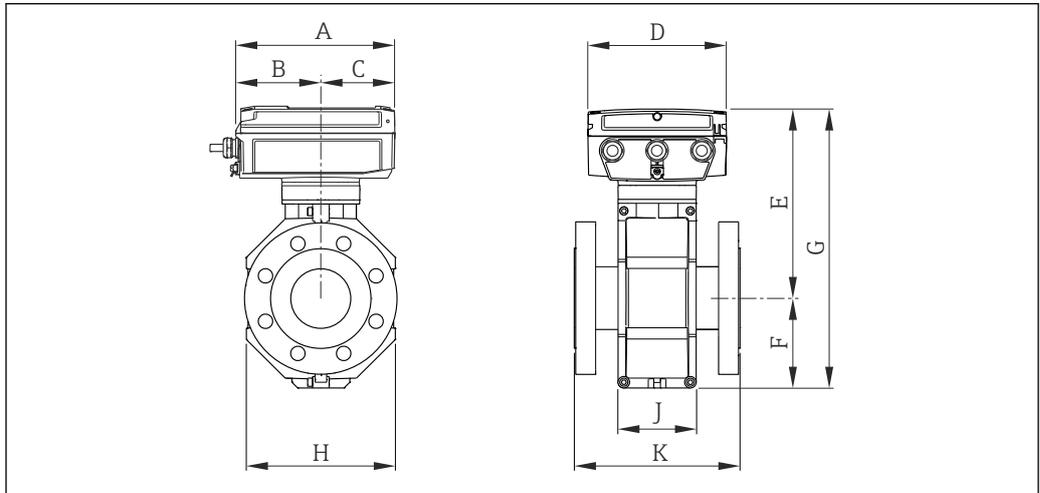
DN [mm]	Pressure rating	A [mm]	B [mm]	D [mm]	H [mm]
450	ASME, Class 150	439	535	583	417
500	DIN, PN 6	493	575	650	460
500	DIN, PN 10	493	588	650	460
500	ASME, Class 150	493	588	650	460
600	DIN, PN 6	593	676	766	522
600	DIN, PN 10	593	688	766	522
600	ASME, Class 150	593	688	766	522
700	DIN, PN 6	697	-	786	460
700	DIN, PN 10	693	-	813	480
700	AS, PN 16	687	-	807	490
700	AWWA, Class D	693	-	832	494
750	AWWA, Class D	743	-	833	523
800	DIN, PN 6	799	-	893	520
800	DIN, PN 10	795	-	920	540
800	AS, PN 16	789	-	914	550
800	AWWA, Class D	795	-	940	561
900	DIN, PN 6	897	-	993	570
900	DIN, PN 10	893	-	1020	590
900	AS, PN 16	886	-	1014	595
900	AWWA, Class D	893	-	1048	615
1000	DIN, PN 6	999	-	1093	620
1000	DIN, PN 10	995	-	1127	650
1000	AS, PN 16	988	-	1131	660
1000	AWWA, Class D	995	-	1163	675
1050	AWWA, Class D	1044	-	1220	704
1200	DIN, PN 6	1203	-	1310	733

- 1) Ground disks can be used for all the flange standards/pressure ratings which can be supplied in the standard version.

Dimensions in US units

Compact version

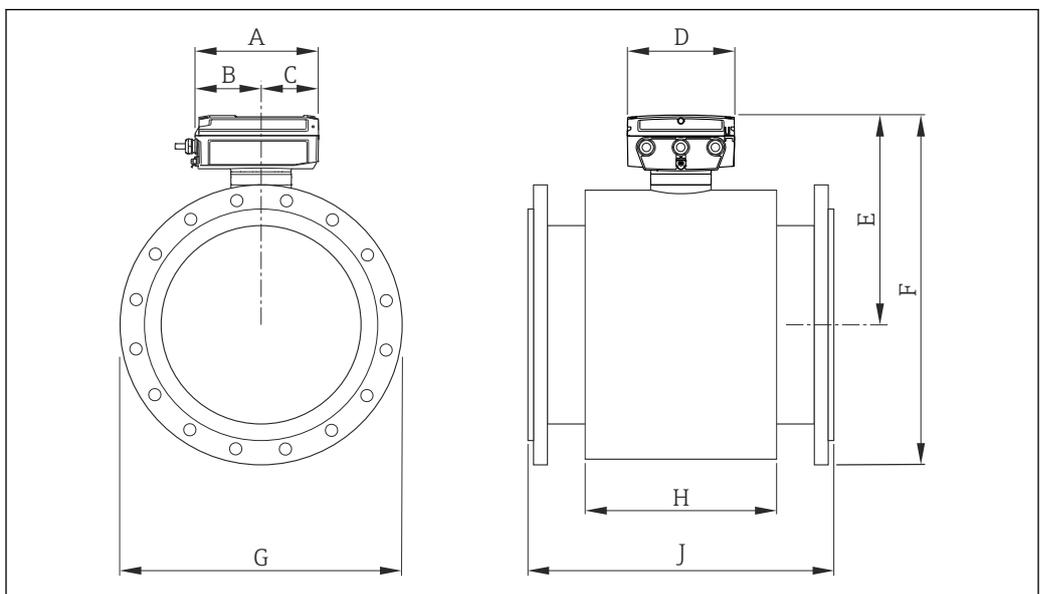
Order code for "Housing", option M "Compact, polycarbonate" or option A "Compact, aluminum, coated"



A0020352

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	J [in]	K ¹⁾ [in]
1	7.60	4.06	3.54	6.57	8.74	3.31	12.1	4.72	3.70	7.87
1 ½	7.60	4.06	3.54	6.57	8.74	3.31	12.1	4.72	3.70	7.87
2	7.60	4.06	3.54	6.57	8.74	3.31	12.1	4.72	3.70	7.87
3	7.60	4.06	3.54	6.57	9.72	4.29	14.0	7.09	3.70	7.87
4	7.60	4.06	3.54	6.57	9.72	4.29	14.0	7.09	3.70	9.84
6	7.60	4.06	3.54	6.57	11.3	5.91	17.2	10.2	5.51	11.8
8	7.60	4.06	3.54	6.57	12.3	7.09	19.4	12.8	6.14	13.8
10	7.60	4.06	3.54	6.57	13.3	8.07	21.3	15.8	6.54	17.7
12	7.60	4.06	3.54	6.57	14.3	9.06	23.3	18.1	6.54	19.7

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



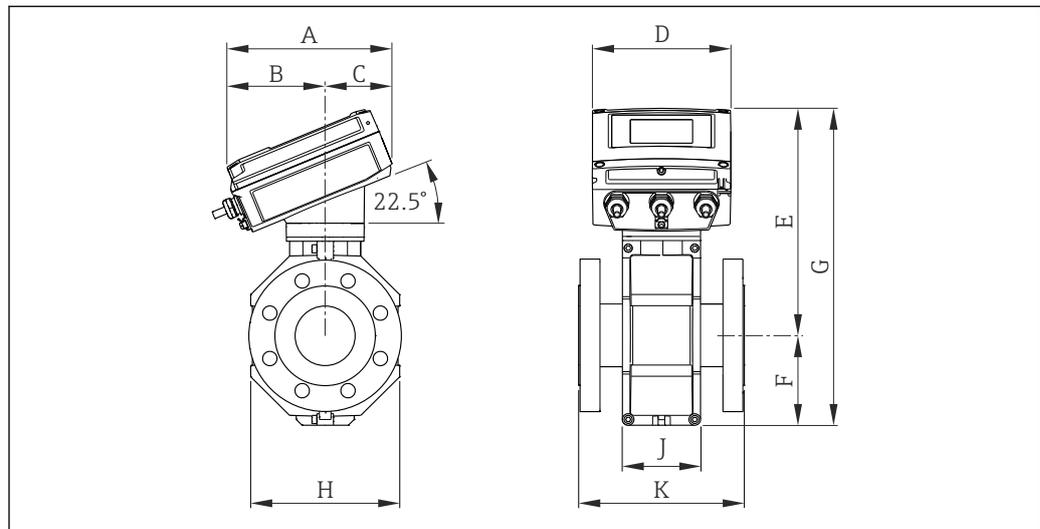
A0017153

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	H [in]	J [in]
14	7.60	4.06	3.54	6.57	15.2	11.4	21.6
15	7.60	4.06	3.54	6.57	16.2	11.4	23.6
16	7.60	4.06	3.54	6.57	16.2	11.4	23.6
18	7.60	4.06	3.54	6.57	17.3	11.4	23.6
20	7.60	4.06	3.54	6.57	18.3	11.4	23.6
24	7.60	4.06	3.54	6.57	19.9	11.4	23.6
28	7.60	4.06	3.54	6.57	22.5	16.7	27.6
30	7.60	4.06	3.54	6.57	23.9	17.9	29.5
32	7.60	4.06	3.54	6.57	24.7	19.7	31.5
36	7.60	4.06	3.54	6.57	26.6	22.8	35.4
40	7.60	4.06	3.54	6.57	28.6	26.0	39.4
42	7.60	4.06	3.54	6.57	30.0	29.7	41.3
48	7.60	4.06	3.54	6.57	33.1	32.6	47.2
54	7.60	4.06	3.54	6.57	37.5	39.7	53.1
60	7.60	4.06	3.54	6.57	41.4	45.2	59.0
66	7.60	4.06	3.54	6.57	43.4	50.6	64.9
72	7.60	4.06	3.54	6.57	45.7	54.3	70.8
78	7.60	4.06	3.54	6.57	50.1	61.8	78.7
84	7.60	4.06	3.54	6.57	54.0	67.4	84.6
90	7.60	4.06	3.54	6.57	58.1	73.2	90.5

DN [in]	Dimension F					Dimension G				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]
14	24.8	25.1	27.6	25.7	25.5	19.3	19.9	20.5	21.0	20.7
15	-	-	-	-	27	-	-	-	-	21.7
16	26.8	27.3	30.0	27.0	27.6	21.3	22.2	22.8	23.5	22.8
18	29.0	29.4	32.4	29.8	29.9	23.4	24.2	25.2	25.0	25.2
20	31.0	31.5	36.5	32.0	32.1	25.4	26.4	28.1	27.5	27.8
24	34.7	35.3	40.4	35.9	36.1	29.7	30.7	33.1	32.0	32.5
28	39.4	40.1	45.1	40.7	40.4	33.9	35.2	35.8	36.5	35.8
30	-	-	-	43.3	43.5	-	-	-	38.7	39.2
32	43.9	44.7	48.8	45.5	45.5	38.4	40.0	40.4	41.7	41.7
36	47.8	48.6	48.8	49.6	49.8	42.3	43.9	44.3	46.0	46.3
40	51.7	52.8	53.4	54.0	53.3	46.3	48.4	49.4	50.7	49.4
42	-	-	-	56.5	-	-	-	-	53.0	-
48	60.8	61.7	62.4	62.9	62.4	55.3	57.3	58.5	59.5	58.7
54	-	-	-	70.6	-	-	-	-	66.3	-
60	-	-	-	77.9	-	-	-	-	73.0	-
66	-	-	-	83.4	-	-	-	-	80.0	-

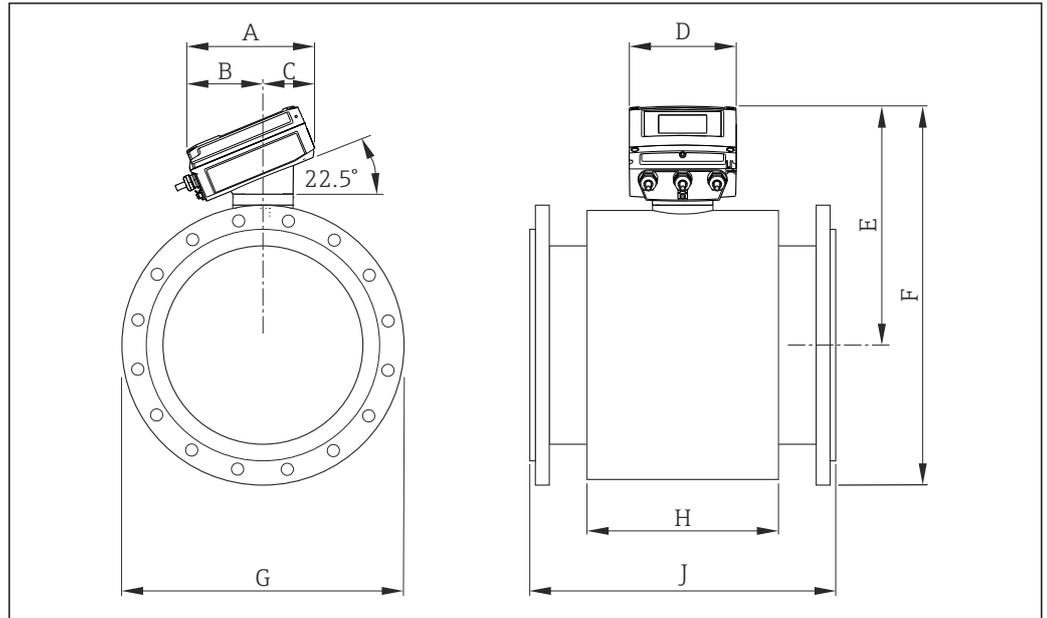
DN [in]	Dimension F					Dimension G				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]
72	85.9	87.3	87.6	88.9	-	80.5	83.3	83.9	86.5	-
78	94.6	95.8	96.2	96.6	-	89.2	91.5	92.3	93.0	-
84	-	-	-	104.0	-	-	-	-	99.8	-
90	-	-	-	111.0	-	-	-	-	-	-

Order code for "Housing", option Q "Compact, polycarbonate, inclined" or option R "Compact, aluminum, coated, inclined"



DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G [in]	H [in]	J [in]	K ¹⁾ [in]
1	7.83	4.69	3.15	6.57	10.5	3.31	13.8	4.72	3.70	7.87
1 ½	7.83	4.69	3.15	6.57	10.5	3.31	13.8	4.72	3.70	7.87
2	7.83	4.69	3.15	6.57	10.5	3.31	13.8	4.72	3.70	7.87
3	7.83	4.69	3.15	6.57	11.5	4.29	15.8	7.09	3.70	7.87
4	7.83	4.69	3.15	6.57	11.5	4.29	15.8	7.09	3.70	9.84
6	7.83	4.69	3.15	6.57	13.1	5.91	19.0	10.2	5.51	11.8
8	7.83	4.69	3.15	6.57	14.1	7.09	21.1	12.8	6.14	13.8
10	7.83	4.69	3.15	6.57	15.0	8.07	23.1	15.8	6.54	17.7
12	7.83	4.69	3.15	6.57	16.0	9.06	25.1	18.1	6.54	19.7

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



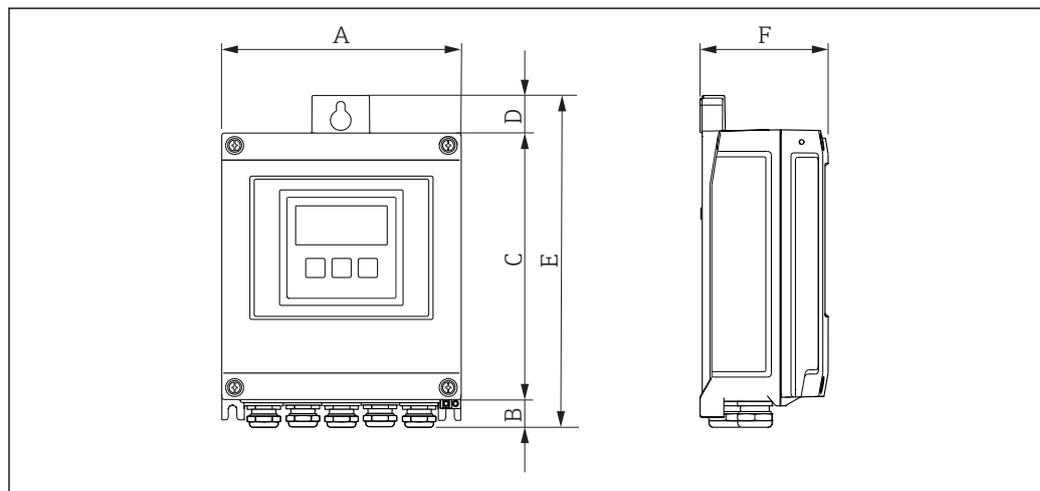
A0020393

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	H [in]	J [in]
14	7.83	4.69	3.15	6.57	17.0	11.4	21.6
15	7.83	4.69	3.15	6.57	18.0	11.4	23.6
16	7.83	4.69	3.15	6.57	18.0	11.4	23.6
18	7.83	4.69	3.15	6.57	19.1	11.4	23.6
20	7.83	4.69	3.15	6.57	20.1	11.4	23.6
24	7.83	4.69	3.15	6.57	21.7	11.4	23.6
28	7.83	4.69	3.15	6.57	24.3	16.7	27.6
30	7.83	4.69	3.15	6.57	25.7	17.9	29.5
32	7.83	4.69	3.15	6.57	26.5	19.7	31.5
36	7.83	4.69	3.15	6.57	28.4	22.8	35.4
40	7.83	4.69	3.15	6.57	30.4	26.0	39.4
42	7.83	4.69	3.15	6.57	31.8	29.7	41.3
48	7.83	4.69	3.15	6.57	34.9	32.6	47.2
54	7.83	4.69	3.15	6.57	39.3	39.7	53.1
60	7.83	4.69	3.15	6.57	43.2	45.2	59.0
66	7.83	4.69	3.15	6.57	45.2	50.6	64.9
72	7.83	4.69	3.15	6.57	47.5	54.3	70.8
78	7.83	4.69	3.15	6.57	51.9	61.8	78.7
84	7.83	4.69	3.15	6.57	55.8	67.4	84.6
90	7.83	4.69	3.15	6.57	59.9	73.2	90.5

DN [in]	Dimension F					Dimension G				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]
14	26.6	26.9	24.3	27.5	27.3	19.3	19.9	20.5	21.0	20.7
15	-	-	-	-	28.8	-	-	-	-	21.7
16	28.6	29.1	26.5	28.8	29.4	21.3	22.2	22.8	23.5	22.8
18	30.8	31.2	28.8	31.6	31.7	23.4	24.2	25.2	25.0	25.2
20	32.8	33.3	31.3	33.8	33.9	25.4	26.4	28.1	27.5	27.8
24	36.5	37.1	35.4	37.7	37.9	29.7	30.7	33.1	32.0	32.5
28	41.2	41.9	39.7	42.5	42.2	33.9	35.2	35.8	36.5	35.8
30	-	-	-	45.1	45.3	-	-	-	38.7	39.2
32	45.7	46.5	43.8	47.3	47.3	38.4	40.0	40.4	41.7	41.7
36	49.6	50.4	47.7	51.4	49.8	42.3	43.9	44.3	46.0	46.3
40	53.5	54.6	52.2	55.8	55.1	46.3	48.4	48.2	50.7	49.4
42	-	-	-	58.3	-	-	-	-	53.0	-
48	62.6	63.5	61.3	64.7	64.2	55.3	57.3	49.4	59.5	58.7
54	-	-	-	72.4	-	-	-	-	66.3	-
60	-	-	-	79.7	-	-	-	-	73.0	-
66	-	-	-	85.2	-	-	-	-	80.0	-
72	87.7	89.1	86.5	90.7	-	80.5	83.3	83.9	86.5	-
78	96.4	97.6	95.1	98.4	-	89.2	91.5	92.3	93.0	-
84	-	-	-	105.8	-	-	-	-	99.8	-
90	-	-	-	112.8	-	-	-	-	-	-

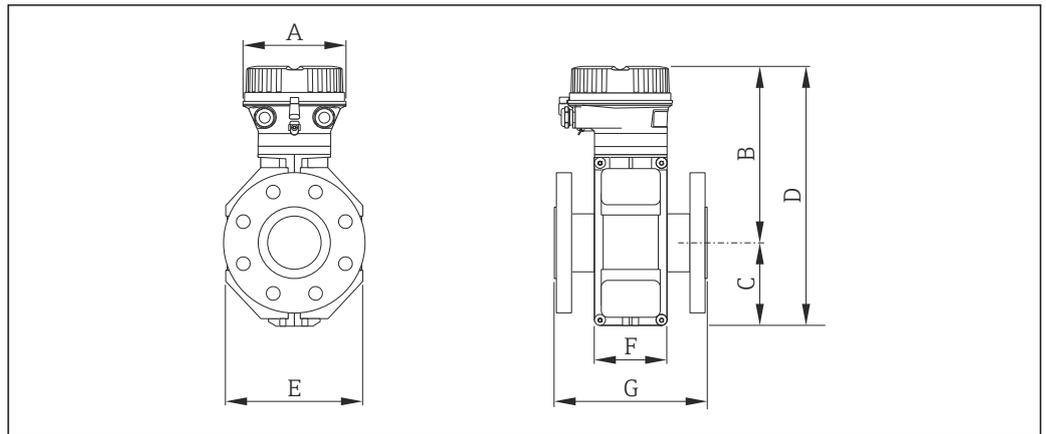
Transmitter remote version

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



A [in]	B [in]	C [in]	D [in]	E [in]	F [in]
6.57	0.83	7.36	0.94	9.13	3.15

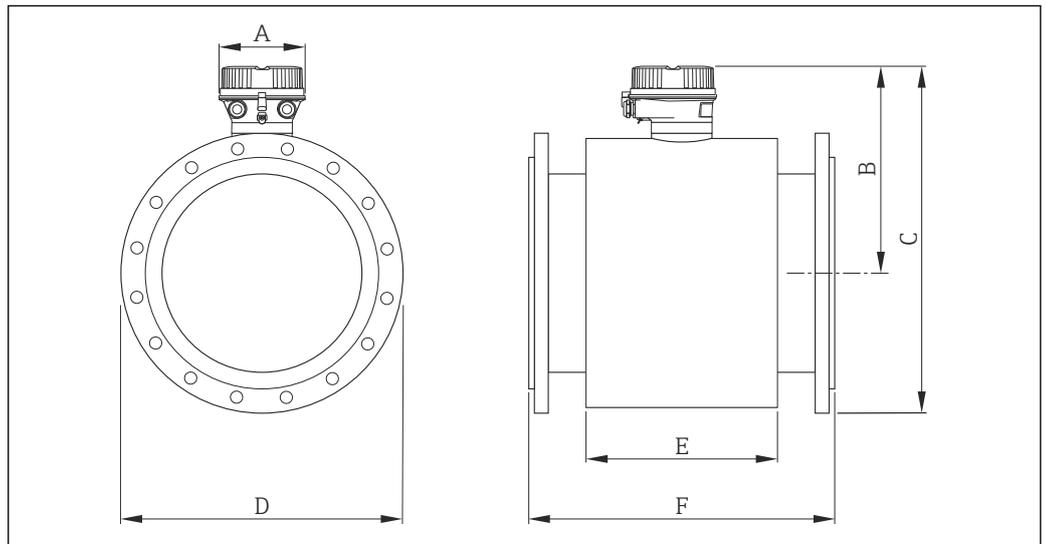
Sensor remote version



A0017282

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]	G ¹⁾ [in]
1	5.35	8.15	3.31	11.5	4.72	3.70	7.87
1 ½	5.35	8.15	3.31	11.5	4.72	3.70	7.87
2	5.35	8.15	3.31	11.5	4.72	3.70	7.87
3	5.35	9.13	4.29	13.4	7.09	3.70	7.87
4	5.35	9.13	4.29	13.4	7.09	3.70	9.84
6	5.35	10.7	5.91	16.6	10.2	5.51	11.8
8	5.35	11.7	7.09	18.8	12.8	6.14	13.8
10	5.35	12.7	8.07	20.8	15.8	6.14	17.7
12	5.35	13.7	9.06	22.8	18.1	6.54	19.7

1) The length is independent of the selected pressure rating. Length in accordance with DVGW/ISO.



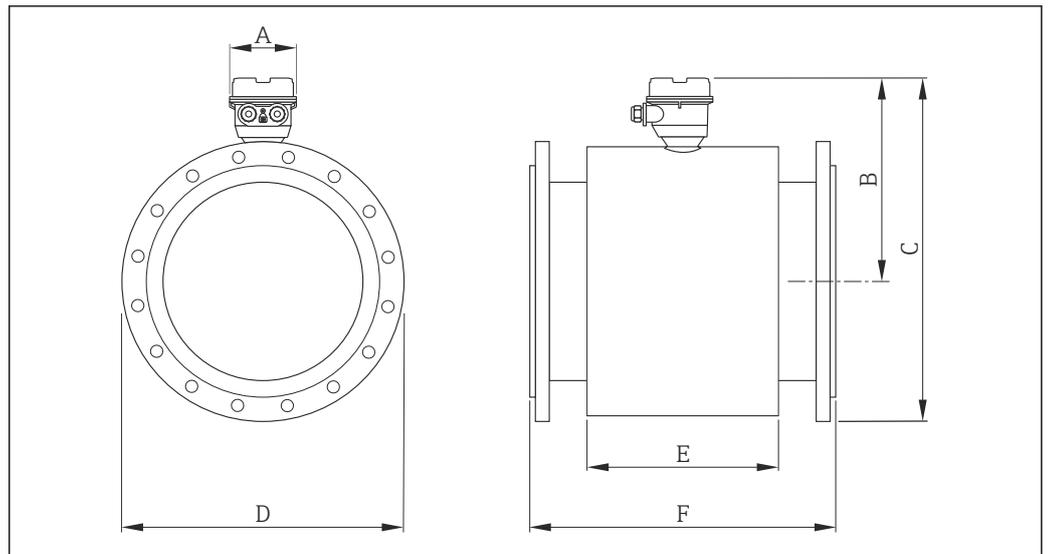
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DN [in]	A [in]	B [in]	E [in]	F [in]
14	5.35	14.1	11.4	21.6
15	5.35	15.1	11.4	23.6
16	5.35	15.1	11.4	23.6
18	5.35	16.2	11.4	23.6
20	5.35	17.2	11.4	23.6
24	5.35	18.8	11.4	23.6
28	5.35	21.6	16.7	27.6
30	5.35	23.0	17.9	29.5
32	5.35	23.6	19.7	31.5
36	5.35	25.6	22.8	35.4
40	5.35	27.5	26.0	39.4
42	5.35	28.9	29.7	41.3
48	5.35	32.0	32.6	47.2
54	5.35	36.4	39.6	53.1
60	5.35	40.4	45.2	59.0
66	5.35	42.4	50.6	64.9
72	5.35	44.6	54.2	70.8
78	5.35	49.0	61.8	78.7
84	5.35	52.9	67.4	84.6
90	5.35	57.1	73.2	90.5

DN [in]	Dimension C					Dimension D				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]
14	23.7	24.0	24.3	24.6	24.4	19.3	19.9	20.5	21.0	20.7
15	-	-	-	-	25.9	-	-	-	-	21.7
16	25.8	26.2	26.5	26.9	26.5	21.3	22.2	22.8	23.5	22.8
18	27.9	28.3	28.7	28.7	28.8	23.4	24.2	25.2	25.0	25.2
20	29.9	30.4	31.1	30.9	31.1	25.4	26.4	28.1	27.5	27.8
24	33.7	34.2	35.6	34.8	35.0	29.7	30.7	33.1	32.0	32.5
28	38.5	39.2	39.7	39.8	39.5	33.9	35.2	35.8	36.5	35.8
30	-	-	-	42.4	42.4	-	-	-	38.7	39.2
32	43.0	43.8	44.2	44.6	44.6	38.4	40.0	40.4	41.7	41.7
36	46.9	47.7	48.2	48.7	48.9	42.3	43.9	44.3	46.0	46.3
40	50.8	51.9	52.7	53.1	52.4	46.3	48.4	48.2	50.7	49.4
42	-	-	-	55.6	-	-	-	-	53.0	-
48	59.9	60.8	61.7	62.0	61.5	55.3	57.3	49.4	59.5	58.7
54	-	-	-	69.6	-	-	-	-	66.3	-
60	-	-	-	76.9	-	-	-	-	73.0	-
66	-	-	-	82.4	-	-	-	-	80.0	-

DN [in]	Dimension C					Dimension D				
	EN (DIN)			ASME	AS	EN (DIN)			ASME	AS
	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]	PN 6 [in]	PN 10 [in]	PN 16 [in]	AWWA [in]	[in]
72	84.9	86.3	87.0	87.9	-	80.5	83.3	83.9	86.5	-
78	93.6	94.7	95.6	95.5	-	89.2	91.5	92.3	93.0	-
84	-	-	-	102.8	-	-	-	-	99.8	-
90	-	-	-	110.3	-	-	-	-	106.5	-

Order code for "Sensor option", option CK "IP68, Type 6P, waterproof"



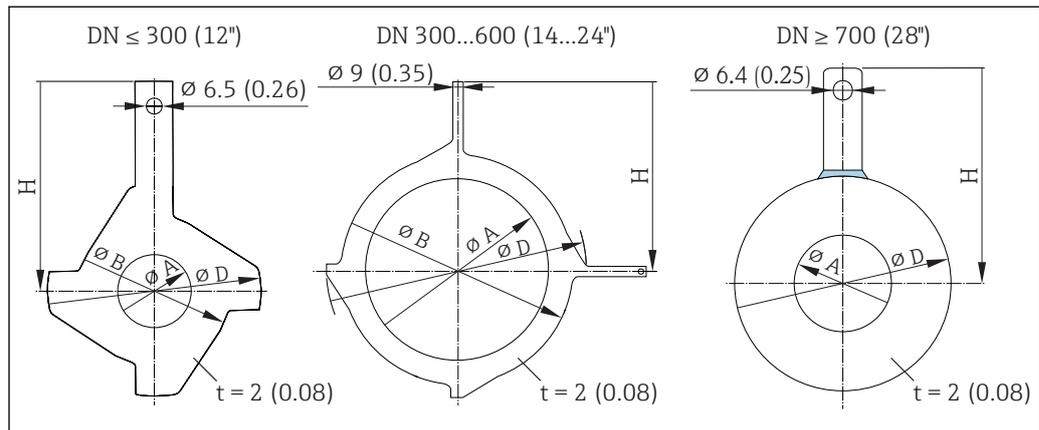
A0020436

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]
14	4.41	14.3	24.3	20.5	11.4	21.6
15	4.41	15.4	-	-	11.4	23.6
16	4.41	15.4	26.5	22.8	11.4	23.6
18	4.41	16.5	28.7	25.2	11.4	23.6
20	4.41	17.4	31.2	28.1	11.4	23.6
24	4.41	19.1	35.6	33.1	11.4	23.6
28	4.41	21.6	39.8	35.8	16.7	27.6
30	4.41	23.0	-	-	17.9	29.5
32	4.41	23.8	44.2	40.4	19.7	31.5
36	4.41	25.8	48.2	44.3	22.8	35.4
40	4.41	27.8	52.7	48.2	26.0	39.4
42	4.41	29.2	-	-	29.7	41.3
48	4.41	32.2	61.7	49.4	32.6	47.2
54	4.41	36.7	-	-	39.6	53.1
60	4.41	40.6	-	-	45.2	59.0
66	4.41	42.6	-	-	50.6	64.9

DN [in]	A [in]	B [in]	C [in]	D [in]	E [in]	F [in]
72	4.41	44.8	87.0	83.9	54.2	70.8
78	4.41	49.2	95.6	92.3	61.8	78.7

Accessories

Ground disks for flange connections



A0015442

32 Engineering unit mm (in)

DN [in]	Pressure rating	A [in]	B [in]	D [in]	H [in]
1	¹⁾	1.02	2.44	3.05	3.44
1 ¼	¹⁾	1.38	3.15	3.44	3.72
1 ½	¹⁾	1.61	3.23	3.98	4.06
2	¹⁾	2.05	3.98	4.55	4.25
2 ½	¹⁾	2.68	4.76	5.18	4.65
3	¹⁾	3.15	5.16	6.08	5.31
4	¹⁾	4.09	6.14	7.34	6.02
5	¹⁾	5.12	7.36	8.13	6.30
6	¹⁾	6.22	8.54	10.1	7.24
8	¹⁾	8.11	10.5	11.3	8.07
10	¹⁾	10.2	12.9	14.1	9.45
12	¹⁾	12.3	14.8	16.3	10.8
14	DIN, PN 6	13.5	16.5	18.9	14.4
14	DIN, PN 10	13.5	15.8	18.9	14.4
14	ASME, Class 150	13.5	15.8	18.9	14.4
16	DIN, PN 6	15.5	18.5	21.3	15.6
16	DIN, PN 10	15.5	18.5	21.3	15.6
16	ASME, Class 150	15.5	18.5	21.3	15.6
18	DIN, PN 6	17.3	20.7	23.0	16.4
18	DIN, PN 10	17.3	21.1	23.0	16.4

DN [in]	Pressure rating	A [in]	B [in]	D [in]	H [in]
18	ASME, Class 150	17.3	21.1	23.0	16.4
20	DIN, PN 6	19.4	23.3	25.6	18.1
20	DIN, PN 10	19.4	23.2	25.6	18.1
20	ASME, Class 150	19.4	23.2	25.6	18.1
24	DIN, PN 6	23.4	27.3	30.2	20.6
24	DIN, PN 10	23.4	27.1	30.2	20.6
24	ASME, Class 150	23.4	27.1	30.2	20.6
28	DIN, PN 6	27.4	-	30.9	18.1
28	DIN, PN 10	27.3	-	32.0	18.9
28	AS, PN 16	27.1	-	31.8	19.3
28	AWWA, Class D	27.3	-	32.8	19.5
30	AWWA, Class D	29.3	-	32.8	20.6
32	DIN, PN 6	31.5	-	35.2	20.5
32	DIN, PN 10	31.3	-	36.2	21.3
32	AS, PN 16	31.1	-	36.0	21.7
32	AWWA, Class D	31.3	-	37.0	22.1
36	DIN, PN 6	35.3	-	39.1	22.4
36	DIN, PN 10	35.2	-	40.2	23.2
36	AS, PN 16	34.9	-	39.9	23.4
36	AWWA, Class D	35.2	-	41.3	24.2
40	DIN, PN 6	39.3	-	43.0	24.4
40	DIN, PN 10	39.2	-	44.4	25.6
40	AS, PN 16	38.9	-	44.5	26.0
40	AWWA, Class D	39.2	-	45.8	26.6
42	AWWA, Class D	41.1	-	48.0	27.7
48	DIN, PN 6	47.4	-	51.6	28.9

- 1) Ground disks can be used for all the flange standards/pressure ratings which can be supplied in the standard version.

Weight

Compact version

Weight data:

- Including the transmitter
 - Order code for "Housing", option M, Q: 1.3 kg (2.9 lb)
 - Order code for "Housing", option A, R: 2.0 kg (4.4 lb)
- Excluding packaging material

Weight in SI units

Lap joint flange; fixed flange DN \geq 350

EN 1092-1 (DIN 2501)			
DN [mm]	Order code for "Housing", option M, Q Polycarbonate plastic ¹⁾		
	Weight [kg]		
	PN 6	PN 10	PN 16
25	-	-	6.8
32	-	-	7.5
40	-	-	8.5
50	-	-	9
65	-	-	10
80	-	-	12
100	-	-	14
125	-	-	20
150	-	-	24
200	-	43	44.4
250	-	63	70.2
300	-	68	85.3
350	77	88	103
400	89	104	121
450	99	112	138
500	114	132	178
600	155	162	223
700	190	240	287
800	240	315	349
900	308	393	440
1000	359	468	562
1200	529	717	839
1400	784	1114	1200
1600	1058	1624	1840
1800	1484	2107	2353
2000	1877	2630	2925
2200	2512	3422	-
2400	2996	4094	-

1) Values for aluminum transmitter, AlSi10Mg, coated: + 0.7 kg

AS 2129, Table E		
DN [mm]	Weight [kg]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AlSi10Mg, coated
350	99	99.7
400	120	120.7

AS 2129, Table E		
DN [mm]	Weight [kg]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AlSi10Mg, coated
450	143	143.7
500	182	182.7
600	260	260.7
700	346	346.7
750	433	433.7
800	493	493.7
900	690	690.7
1000	761	761.7
1200	1237	1237.7

AS 4087, PN 16		
DN [mm]	Weight [kg]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AlSi10Mg, coated
350	99	99.7
375	105	105.7
400	120	120.7
450	133	133.7
500	182	182.7
600	260	260.7
700	367	367.7
750	445	445.7
800	503	503.7
900	702	702.7
1000	759	759.7
1200	1219	1219.7

Lap joint flange, stamped plate

EN 1092-1 (DIN 2501), PN 10		
DN [mm]	Weight [kg]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AlSi10Mg, coated
25	5.3	6.0
32	5.1	5.8
40	5.8	6.5
50	5	5.7
65	6	6.7
80	7	7.7
100	9	9.7
125	13	13.7

EN 1092-1 (DIN 2501), PN 10		
DN [mm]	Weight [kg]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AISi10Mg, coated
150	17	17.7
200	35	35.7
250	54	54.7
300	55	55.7

Weight in US units

Lap joint flange; fixed flange DN ≥ 14 "

ASME B16.5, Class 150		
DN [in]	Weight [lbs]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AISi10Mg, coated
1	11.6	13.2
1 ½	12.8	14.3
2	20	21.5
3	26	27.5
4	31	32.5
6	53	54.5
8	95	96.5
10	139	140.5
12	150	151.5
14	302	303.5
16	370	371.5
18	421	422.5
20	503	504.5
24	666	667.5

AWWA C207, Class D		
DN [in]	Weight [lbs]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AISi10Mg, coated
28	586	587.5
30	701	702.5
32	844	845.5
36	1036	1037.5
40	1294	1295.5
42	1477	1478.5
48	1987	1988.5
54	2807	2808.5
60	3515	3516.5
66	4699	4700.5

AWWA C207, Class D		
DN [in]	Weight [lbs]	
	Order code for "Housing", option M, Q Polycarbonate plastic	Order code for "Housing", option A, R Aluminum, AlSi10Mg, coated
72	5 662	5 663.5
78	6 864	6 865.5
84	8 280	8 281.5
90	10 577	10 578.5

Transmitter remote version

Wall-mount housing

Depends on the material of the wall-mount housing:

- Polycarbonate plastic: 1.3 kg (2.9 lb)
- Aluminum, AlSi10Mg, coated: 2.0 kg (4.4 lb)

Sensor remote version

Weight data:

- Including sensor connection housing
- Excluding the connecting cable
- Excluding packaging material

Weight in SI units

Lap joint flange; fixed flange DN ≥ 350

EN 1092-1 (DIN 2501)			
DN [mm]	Weight [kg]		
	PN 6	PN 10	PN 16
25	-	-	6.8
32	-	-	7.5
40	-	-	8.5
50	-	-	6
65	-	-	7
80	-	-	9
100	-	-	11
125	-	-	16
150	-	-	20
200	-	40	44.4
250	-	60	70.2
300	-	65	85.3
350	73	84	101
400	85	100	119
450	95	108	136
500	110	128	176
600	158	158	221
700	187	237	285
800	237	312	347
900	305	390	438

EN 1092-1 (DIN 2501)			
DN [mm]	Weight [kg]		
	PN 6	PN 10	PN 16
1000	356	465	560
1200	526	714	837
1400	781	1 111	1 197
1600	1055	1 621	1 838
1800	1 415	2 104	2 350
2000	1 874	2 627	2 922
2200	2 509	3 419	-
2400	2 993	4 091	-

AS 2129, Table E	
DN [mm]	Weight [kg]
350	95
400	116
450	139
500	178
600	256
700	343
750	430
800	490
900	687
1000	758
1200	1 234

AS 4087, PN 16	
DN [mm]	Weight [kg]
350	95
375	101
400	116
450	129
500	178
600	256
700	364
750	442
800	500
900	699
1000	756
1200	1 216

Lap joint flange, stamped plate

EN 1092-1 (DIN 2501), PN 10	
DN [mm]	[kg]
25	6.0
32	5.8
40	6.5
50	3
65	4
80	5
100	7
125	11
150	15
200	33
250	52
300	53

Weight in US units

Lap joint flange; fixed flange DN ≥ 14"

ASME B16.5, Class 150	
DN [in]	Weight [lbs]
1	13.2
1 ½	14.3
2	13
3	20
4	24
6	44
8	88
10	132
12	143
14	293
15	-
16	361
18	412
20	494
24	657

AWWA C207, Class D	
DN [in]	Weight [lbs]
28	580
30	695

AWWA C207, Class D	
DN [in]	Weight [lbs]
32	838
36	1030
40	1288
42	1471
48	1980
54	2800
60	3508
66	4692
72	5656
78	6858
84	8273
90	10571

Measuring tube specification

Nominal diameter		Pressure rating			Measuring tube internal diameter					
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	Hard rubber		Polyurethane		PTFE	
[mm]	[in]				[mm]	[in]	[mm]	[in]	[mm]	[in]
25	1	PN 10/16	Class 150	-	-	-	23.7	0.9	25.3	1.0
32	1 ¼	PN 10/16	Class 150	-	-	-	32.4	1.3	34.0	1.3
40	1 ½	PN 10/16	Class 150	-	-	-	38.3	1.5	39.9	1.6
50	2	PN 10/16	Class 150	-	-	-	50.3	2.0	51.7	2.0
65 ¹⁾	2 ½	PN 10/16	Class 150	-	-	-	66.1	2.6	67.7	2.7
80	3	PN 10/16	Class 150	-	-	-	78.9	3.1	79.9	3.1
100	4	PN 10/16	Class 150	-	-	-	104.3	4.1	103.8	4.1
125	5	PN 10/16	Class 150	-	-	-	129.7	5.1	129.1	5.1
150	6	PN 10/16	Class 150	-	-	-	158.3	6.2	156.3	6.2
200	8	PN 10/16	Class 150	-	-	-	206.7	8.1	202.1	8.0
250	10	PN 10/16	Class 150	-	-	-	260.6	10.3	256.2	10.1
300	12	PN 10/16	-	-	-	-	311.5	12.3	305.5	12.0
300	12	-	Class 150	-	-	-	309.9	12.2	303.9	12.0
350	14	PN 6	-	-	341	13.4	344	13.5	-	-
350	14	PN 10	-	-	341	13.4	344	13.5	-	-
350	14	-	-	Table E, PN 16	339	13.3	342	13.4	-	-
350	14	-	Class 150	-	339	13.3	342	13.4	-	-
375	15	PN 10	-	-	391	15.4	-	-	-	-
375	15	-	-	PN 16	389	15.3	392	15.4	-	-
400	16	PN 6	-	-	391	15.4	394	13.5	-	-
400	16	PN 10	-	-	442	17.4	394	13.5	-	-
400	16	-	-	Table E, PN 16	389	15.3	392	13.4	-	-
400	16	-	Class 150	-	389	15.3	392	13.4	-	-
450	18	PN 6	-	-	442	17.4	445	17.5	-	-

Nominal diameter		Pressure rating			Measuring tube internal diameter					
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	Hard rubber		Polyurethane		PTFE	
[mm]	[in]				[mm]	[in]	[mm]	[in]	[mm]	[in]
450	18	PN 10	-	-	493	19.4	445	17.5	-	-
450	18	-	-	Table E, PN 16	440	17.3	443	17.4	-	-
450	18	-	Class 150	-	438	17.2	441	17.3	-	-
500	20	PN 6	-	-	493	19.4	496	19.5	-	-
500	20	PN 10	-	-	595	23.4	496	19.5	-	-
500	20	-	-	Table E, PN 16	489	19.2	492	19.3	-	-
500	20	-	Class 150	-	489	19.2	492	19.3	-	-
600	24	PN 6	-	-	595	23.4	598	23.5	-	-
600	24	PN 10	-	-	590	23.2	598	23.5	-	-
600	24	-	-	Table E, PN 16	591	23.2	594	23.4	-	-
600	24	-	Class 150	-	589	23.1	592	23.3	-	-
700	28	PN 6	-	-	696	27.4	699	27.5	-	-
700	28	PN 10	-	-	694	27.3	697	27.4	-	-
700	28	-	-	Table E, PN 16	690	27.2	693	27.3	-	-
700	28	-	Class D	-	694	27.3	697	27.4	-	-
750	30	PN 6	-	-	-	-	699	27.5	-	-
750	30	PN 10	-	-	-	-	697	27.4	-	-
750	30	-	-	Table E, PN 16	741	29.2	744	29.3	-	-
750	30	-	Class D	-	743	29.3	746	29.4	-	-
800	32	PN 6	-	-	798	31.4	801	31.5	-	-
800	32	PN 10	-	-	796	31.3	799	31.5	-	-
800	32	-	-	Table E, PN 16	792	31.2	795	31.3	-	-
800	32	-	Class D	-	794	31.3	797	31.4	-	-
900	36	PN 6	-	-	897	35.3	900	35.4	-	-
900	36	PN 10	-	-	895	35.2	898	35.4	-	-
900	36	-	-	Table E, PN 16	889	35.0	892	35.1	-	-
900	36	-	Class D	-	895	35.2	898	35.4	-	-
1000	40	PN 6	-	-	999	39.3	1002	39.4	-	-
1000	40	PN 10	-	-	997	39.3	1000	39.4	-	-
1000	40	-	-	Table E, PN 16	991	39.0	994	39.1	-	-
1000	40	-	Class D	-	995	39.1	998	39.3	-	-
1050	42	PN 6	-	-	-	-	-	-	-	-
1050	42	PN 10	-	-	-	-	-	-	-	-
1050	42	-	-	Table E, PN 16	-	-	-	-	-	-
1050	42	-	Class D	-	1046	41.2	1049	41.3	-	-
1200	48	PN 6	-	-	1203	47.4	1206	47.5	-	-
1200	48	PN 10	-	-	1199	47.2	1202	47.3	-	-
1200	48	-	-	Table E, PN 16	1191	46.9	1194	47.0	-	-
1200	48	-	Class D	-	1195	47.0	1198	47.2	-	-
-	54	-	Class D	-	1345	53.8	-	-	-	-

Nominal diameter		Pressure rating			Measuring tube internal diameter					
		EN (DIN)	ASME AWWA	AS 2129 AS 4087	Hard rubber		Polyurethane		PTFE	
[mm]	[in]				[mm]	[in]	[mm]	[in]	[mm]	[in]
1400	-	PN 6	-	-	1402	56.1	-	-	-	-
1400	-	PN 10	-	-	1394	55.78	-	-	-	-
-	60	-	Class D	-	1498	59.9	-	-	-	-
1600	-	PN 6	-	-	1600	64.0	-	-	-	-
1600	-	PN 10	-	-	1590	63.6	-	-	-	-
-	66	-	Class D	-	1646	65.8	1198	47.2	-	-
1800	72	PN 6	-	-	1800	72.0	1206	47.5	-	-
1800	72	PN 10	-	-	1790	71.6	1202	47.3	-	-
1800	72	-	Class D	-	1790	71.6	1198	47.2	-	-
2000	78	PN 6	-	-	1998	79.9	-	-	-	-
2000	78	PN 10	-	-	1990	79.6	-	-	-	-
2000	78	-	Class D	-	1986	79.4	-	-	-	-
-	84	-	Class D	-	2099	84.0	-	-	-	-
2200	-	PN 6	-	-	2194	87.8	-	-	-	-
2200	-	PN 10	-	-	2186	87.4	-	-	-	-
-	90	-	Class D	-	2246	89.8	-	-	-	-
2400	-	PN 6	-	-	2394	95.8	-	-	-	-
2400	-	PN 10	-	-	2386	95.4	-	-	-	-

1) Designed acc. to EN 1092-1 (not to DIN 2501)

Materials

Transmitter housing

Compact version, standard

- Order code for "Housing", option **A** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **M**: polycarbonate plastic
- Window material:
 - For order code for "Housing", option **A**: glass
 - For order code for "Housing", option **M**: plastic

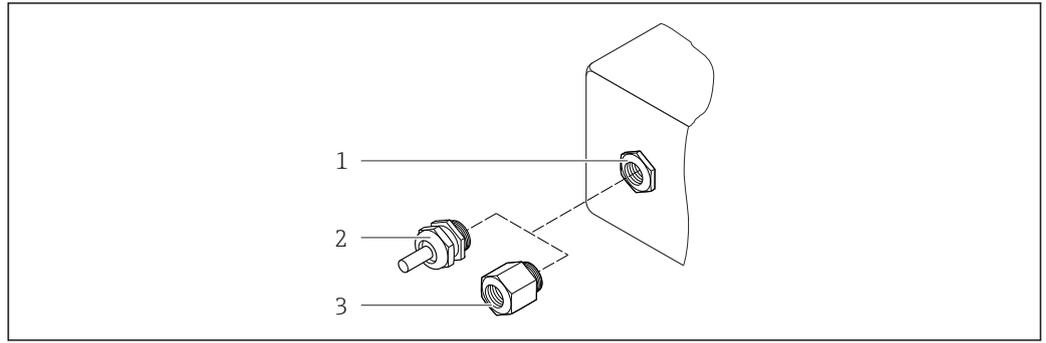
Compact version, inclined

- Order code for "Housing", option **R** "Compact, aluminum coated":
Aluminum, AlSi10Mg, coated
- Order code for "Housing", option **Q**: polycarbonate plastic
- Window material:
 - For order code for "Housing", option **R**: glass
 - For order code for "Housing", option **Q**: plastic

Remote version (wall-mount housing)

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

Cable entries/cable glands



33 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"

Compact and remote versions and sensor connection housing

Cable entry/cable gland	Material
Cable gland M20 × 1.5	Plastic
Remote version: cable gland M20 × 1.5 <ul style="list-style-type: none"> ▪ Option CK "IP68, Type 6P, waterproof" ▪ Option of reinforced connecting cable 	<ul style="list-style-type: none"> ▪ Sensor connection housing: Nickel-plated brass ▪ Transmitter wall-mount housing: Plastic
Adapter for cable entry with internal thread G ½" or NPT ½"	Nickel-plated brass

Device plug

Electrical connection	Material
Plug M12x1	<ul style="list-style-type: none"> ▪ Socket: Stainless steel, 1.4404 (316L) ▪ Contact housing: Polyamide ▪ Contacts: Gold-plated brass

Connecting cable for remote version

- Electrode and coil current cable
- Standard cable: PVC cable with copper shield
 - Reinforced cable: PVC cable with copper shield and additional steel wire braided jacket

Sensor housing

- DN 25 to 300 (1 to 12"): aluminum, AlSi10Mg, coated
- DN 350 to 2400 (14 to 90"): carbon steel with protective varnish

Sensor connection housing

- Aluminum, AlSi10Mg, coated
- Option for order code for "Sensor option", option **CK**: Polycarbonate for DN 350 to 2 400 mm (13.8 to 94.5 in) for option IP68

Measuring tubes

- DN 25 to 300 (1 to 12"): stainless steel, 1.4301/1.4306/304L
- DN 350 to 1200 (14 to 48"): stainless steel, 1.4301/1.4307/202/304
- DN 1350 to 2400 (54 to 90"): stainless steel, 1.4301/1.4307

Liner

- DN 25 to 300 (1 to 12"): PTFE
- DN 25 to 1200 (1 to 48"): polyurethane
- DN 350 to 2400 (14 to 90"): hard rubber

Electrodes

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)

Process connections*EN 1092-1 (DIN 2501)*

DN 25 to 300:

- Fixed flange:
 - Stainless steel, 1.4306/1.4404/1.4571/F316L
 - Carbon steel, A105/FE410WB/S235JRG2
- Lap joint flange, stamped plate:
 - Stainless steel, 1.4301 similar to 304
 - Carbon steel, S235JRG2 similar to 1.0038 (S235JR+AR)
- DN 350 to 600:
 - Carbon steel, A105/FE410WB/P250GH/S235JRG2/S235JR+N
- DN 700 to 1200:
 - Carbon steel, A105/P250GH/S235JRG2/S235JR+N
- DN 1350 to 2400:
 - Carbon steel, P250GH/S235JRG2/S235JR+N

ASME B16.5

DN 25 to 300 (1 to 12"):

Fixed flange:

- Stainless steel, F316L similar to 1.4404
- Carbon steel, A105 similar to 1.0432

DN 350 to 600 (14 to 24"):

Carbon steel, A105/A515 Grade 70

AWWA C207

- DN 48":
 - Carbon steel, A105/A181/FE410WB/P265GH/S275JR
- DN 54 to 90":
 - Carbon steel, A105/A181/P265GH/S275JR

AS 2129

Carbon steel, A105/FE410WB/P235GH/P265GH/S235JRG2

AS 4087

Carbon steel, A105/P265GH/S275JRG2

Seals

In accordance with DIN EN 1514-1

Accessories*Display protection*

Stainless steel, 1.4301 (304L)

Ground disks

- Stainless steel, 1.4435 (316L)
- Alloy C22, 2.4602 (UNS N06022)

Fitted electrodes	Measurement, reference and empty pipe detection electrodes available as standard with: <ul style="list-style-type: none"> ■ 1.4435 (316L) ■ Alloy C22, 2.4602 (UNS N06022)
Process connections	<ul style="list-style-type: none"> ■ EN 1092-1 (DIN 2501) <ul style="list-style-type: none"> – DN ≤ 300: lap joint flange (PN 10/16), lap joint flange, stamped plate (PN 10) = form A – DN ≥ 350: fixed flange (PN 6/10) = flat face ■ ASME B16.5 <ul style="list-style-type: none"> – DN ≤ 300 (12"): lap joint flange (Class 150) – DN ≥ 350 (14"): fixed flange (Class 150) ■ AWWA C207 <ul style="list-style-type: none"> DN 48 to 90": fixed flange (Class D) ■ AS 2129 <ul style="list-style-type: none"> DN 350 to 1200: fixed flange (Table E) ■ AS 4087 <ul style="list-style-type: none"> DN 350 to 1200: fixed flange (PN 16) <p> All carbon steel lap joint flanges are supplied with a hot-dip galvanized finish.</p> <p> For information on the different materials used in the process connections →  74</p>
Surface roughness	Electrodes with 1.4435 (316L); Alloy C22, 2.4602 (UNS N06022): ≤ 0.3 to 0.5 μm (11.8 to 19.7 μin) (All data relate to parts in contact with fluid)

Operability

Operating concept	<p>Operator-oriented menu structure for user-specific tasks</p> <ul style="list-style-type: none"> ■ Commissioning ■ Operation ■ Diagnostics ■ Expert level <p>Fast and safe commissioning</p> <ul style="list-style-type: none"> ■ Guided menus ("Make-it-run" wizards) for applications ■ Menu guidance with brief explanations of the individual parameter functions ■ Device access via Web server ■ Optional: WLAN access to device via mobile handheld terminal <p>Reliable operation</p> <ul style="list-style-type: none"> ■ Operation in local language ■ Uniform operating philosophy applied to device and operating tools ■ If replacing electronic modules, transfer the device configuration via the integrated memory (integrated HistoROM) which contains the process and measuring device data and the event logbook. No need to reconfigure. <p>Efficient diagnostics increase measurement availability</p> <ul style="list-style-type: none"> ■ 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
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Languages	Can be operated in the following languages: <ul style="list-style-type: none"> ■ Via local operation: <ul style="list-style-type: none"> English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish ■ Via "FieldCare", "DeviceCare" operating tool: <ul style="list-style-type: none"> English, German, French, Spanish, Italian, Chinese, Japanese ■ Via Web browser (only available for device versions with HART, PROFIBUS DP and EtherNet/IP): <ul style="list-style-type: none"> English, German, French, Spanish, Italian, Dutch, Portuguese, Polish, Russian, Turkish, Chinese, Japanese, Bahasa (Indonesian), Vietnamese, Czech, Swedish
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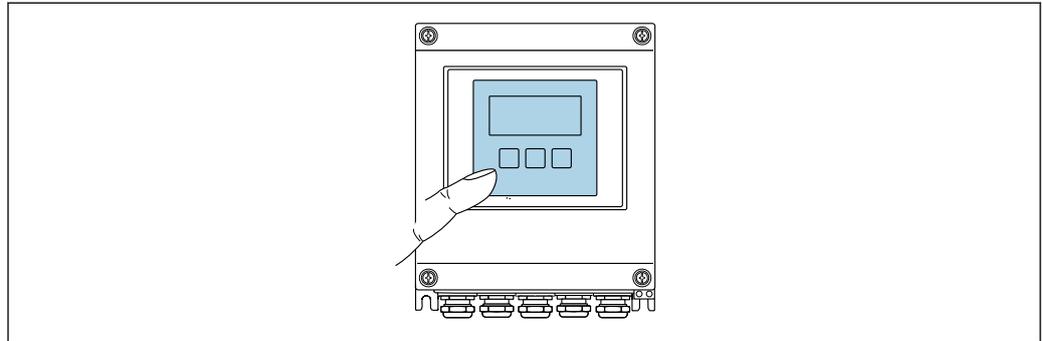
Local display

Via display module

Two display modules are available:

- Standard:
4-line, illuminated, graphic display; touch control
- Optionally via order code for "Display", option **W1** "WLAN display":
4-line, illuminated, graphic display; touch control + WLAN

 Information about WLAN interface →  78



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 34 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.

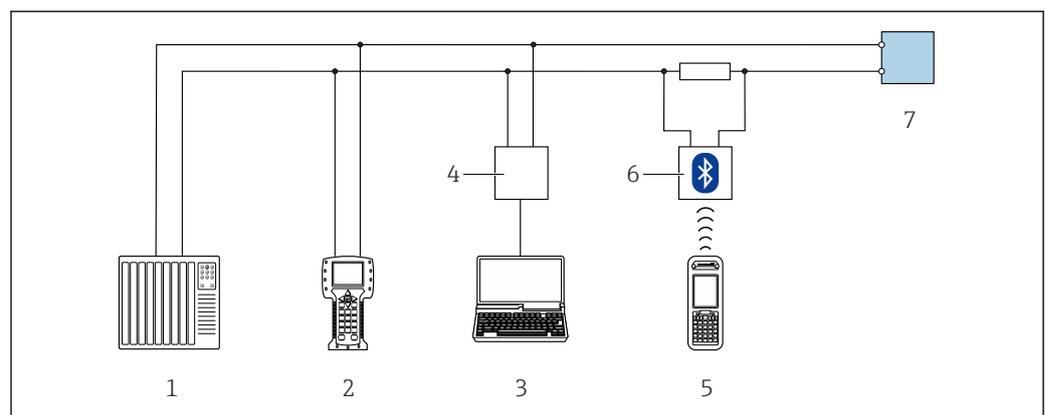
Operating elements

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

Remote operation

Via HART protocol

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



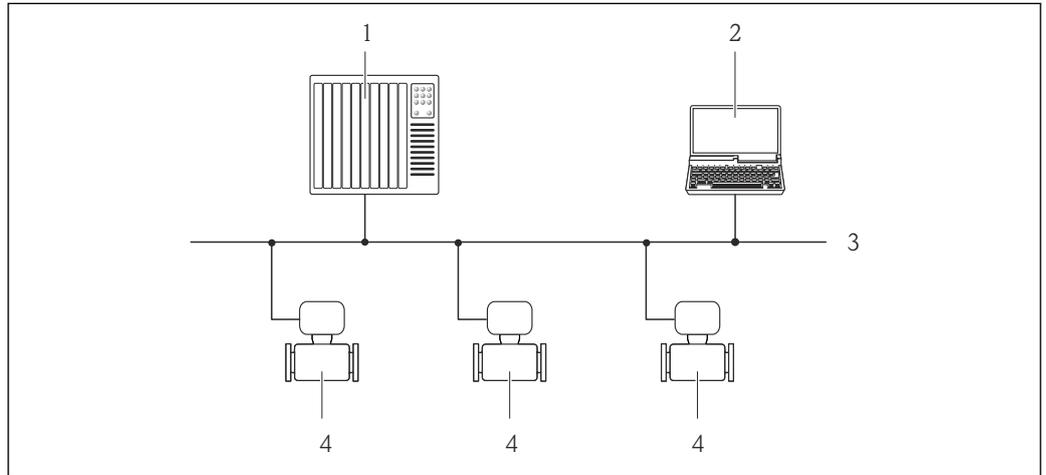
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 35 Options for remote operation via HART protocol

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

Via PROFIBUS DP network

This communication interface is available in device versions with PROFIBUS DP.



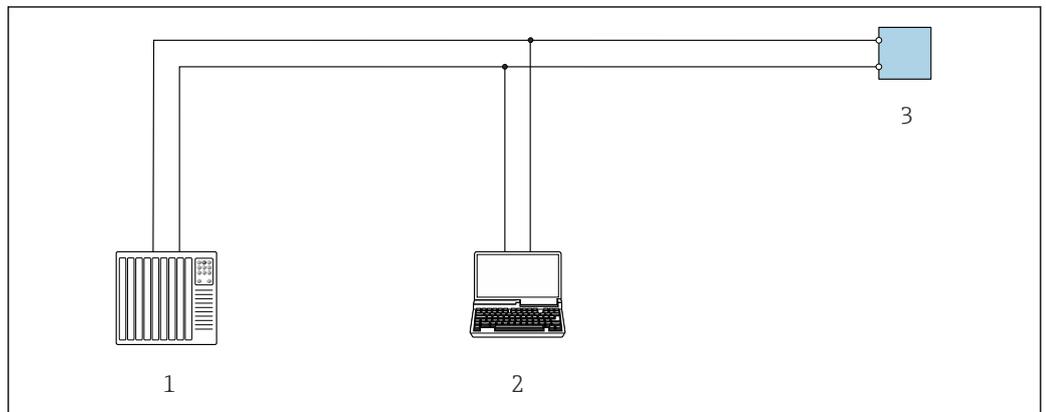
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36 Options for remote operation via PROFIBUS DP network

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

Via Modbus RS485 protocol

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



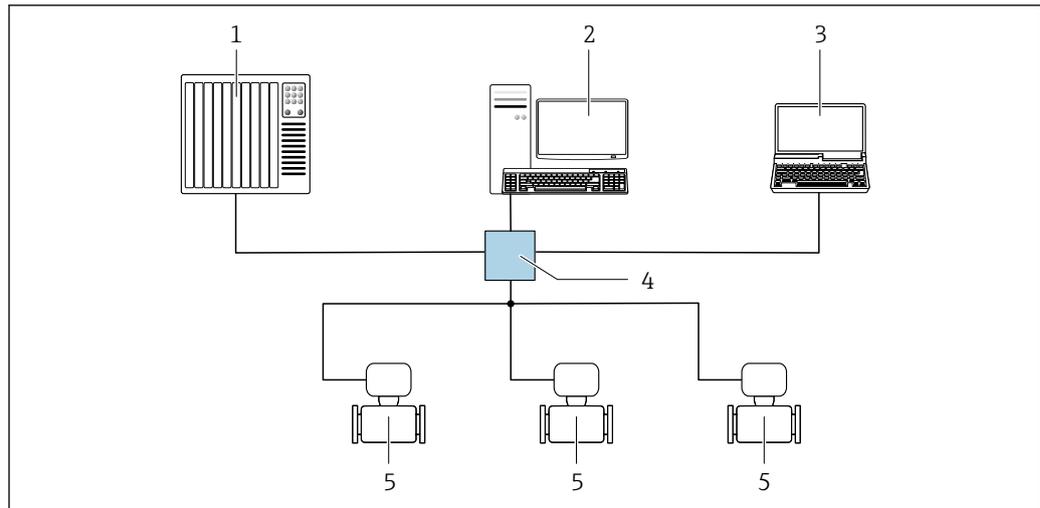
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37 Options for remote operation via Modbus-RS485 protocol (active)

- 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-based fieldbus

This communication interface is available in device versions with EtherNet/IP.



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38 Options for remote operation via Ethernet-based fieldbus

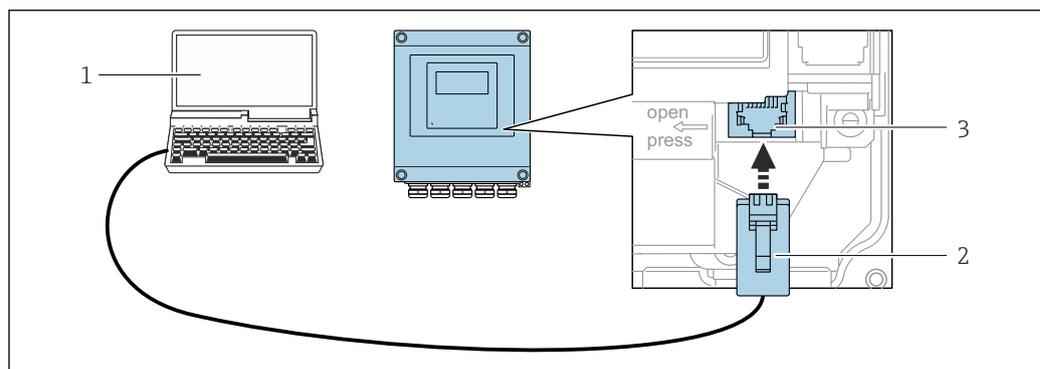
- 1 Automation system, e.g. "RSLogix" (Rockwell Automation)
- 2 Workstation for measuring device operation: with Custom Add-On Profile for "RSLogix 5000" (Rockwell Automation) or with Electronic Data Sheet (EDS)
- 3 Computer with Web browser (e.g. Internet Explorer) for accessing the integrated device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

Service interface

Via service interface (CDI-RJ45)

This communication interface is present in the following device version:

- Order code for "Output", option **H**: 4-20/0-20 mA HART, pulse/frequency/switch output
- Order code for "Output", option **I**: 4-20/0-20 mA HART, pulse/frequency/switch output, status input
- Order code for "Output", option **L**: PROFIBUS DP
- Order code for "Output", option **N**: EtherNet/IP
- Order code for "Output", option **M**: Modbus RS485



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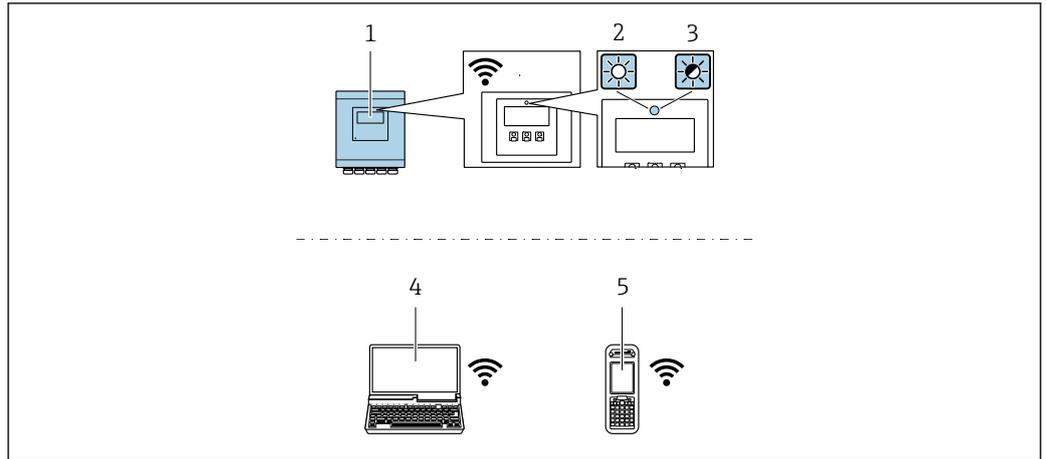
39 Connection via service interface (CDI-RJ45)

- 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 plug
- 3 Service interface (CDI-RJ45) of the measuring device with access to the integrated Web server

Via WLAN interface

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

- Order code for "Display", option **W1** "WLAN display":
4-line, illuminated, graphic display; touch control + WLAN



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

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)

Supported operating tools

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

Supported operating tools	Operating unit	Interface	Additional information
Web browser	Notebook, PC or tablet with Web browser	<ul style="list-style-type: none"> ▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Ethernet-based fieldbus (EtherNet/IP) 	Special Documentation for the device
DeviceCare SFE100	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> ▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol 	→ 86

Supported operating tools	Operating unit	Interface	Additional information
FieldCare SFE500	Notebook, PC or tablet with Microsoft Windows system	<ul style="list-style-type: none"> ▪ CDI-RJ45 service interface ▪ WLAN interface ▪ Fieldbus protocol 	→  86
Device Xpert	Field Xpert SFX 100/350/370	HART and FOUNDATION Fieldbus fieldbus protocol	Operating Instructions BAO1202S 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 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", option **W1** "WLAN display": 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:

- 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
- Download driver for system integration

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	<ul style="list-style-type: none"> ▪ Device firmware package ▪ Driver for system integration e.g.: <ul style="list-style-type: none"> - DD for HART - GSD for PROFIBUS DP - EDS for EtherNet/IP 	<ul style="list-style-type: none"> ▪ Event history, such as diagnostic events ▪ Measured value memory ("Extended HistoROM" order option) ▪ Current parameter data record (used by firmware at run time) ▪ Maximum indicators (min/max values) ▪ Totalizer values 	<ul style="list-style-type: none"> ▪ 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

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.

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	<p>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.</p> <p> The separate Ex documentation (XA) containing all the relevant explosion protection data is available from your Endress+Hauser sales center.</p> <p>ATEX, IECEx</p> <p>Currently, the following versions for use in hazardous areas are available:</p>
Drinking water approval	<ul style="list-style-type: none"> ▪ ACS ▪ KTW/W270 ▪ NSF 61 ▪ WRAS BS 6920
HART certification	<p>HART interface</p> <p>The measuring device is certified and registered by the FieldComm Group. The measuring system meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ▪ Certified according to HART 7 ▪ The device can also be operated with certified devices of other manufacturers (interoperability)
Certification PROFIBUS	<p>PROFIBUS interface</p> <p>The measuring device is certified and registered by the PROFIBUS User Organization (PNO). The measuring system meets all the requirements of the following specifications:</p> <ul style="list-style-type: none"> ▪ 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	<p>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:</p> <ul style="list-style-type: none"> ▪ 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)
Radio approval	<p>Europe: RED 2014/53/EU</p> <p>United States of America: CFR Title 47, FCC Part 15.247</p> <p>Canada: RSS-247 Issue 1</p> <p>Japan: Article 2 clause 1 item 19</p> <p> Additional country-specific approvals on request.</p>
Other standards and guidelines	<ul style="list-style-type: none"> ▪ 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). ▪ 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 -> 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

Product generation index

Release date	Product root	Modification
01.07.2012	5L4B	Original
01.11.2016	5L4C	<ul style="list-style-type: none"> ■ Web server: current version ■ Logbook: current concept, including Parameter Change ■ Upload/download: current concept ■ Heartbeat Technology: new hardware, diagnostics, events ■ Security concept: encrypted password transmission ■ WLAN



More information is available from your Sales Center or at:

www.service.endress.com → Downloads

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.

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 ₃ O 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).

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

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

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
Display protection	Is used to protect the display against impact or scoring from sand in desert areas.  For details, see Special Documentation SD00333F	
Connecting cable for remote version	Coil current and electrode cables, various lengths, reinforced cables available on request.	
Ground cable	Set, consisting of two ground cables for potential equalization.	
Post mounting kit	Post mounting kit for transmitter.	

Compact → Remote conversion kit	For converting a compact device version to a remote device version.
Promag 50/53 → Promag 400 conversion kit	For converting a Promag with transmitter 50/53 to a Promag 400.

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 the "Technical Information" document TI405C/07
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 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

Service-specific accessories

Accessories	Description
Applicator	<p>Software for selecting and sizing Endress+Hauser measuring devices:</p> <ul style="list-style-type: none"> Choice of measuring devices for industrial requirements Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, flow velocity and accuracy. Graphic illustration of the calculation results Determination of the partial order code, administration, documentation and access to all project-related data and parameters over the entire life cycle of a project. <p>Applicator is available:</p> <ul style="list-style-type: none"> Via the Internet: https://wapps.endress.com/applicator As a downloadable DVD for local PC installation.
W@M	<p>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.</p> <p>W@M Life Cycle Management is an open and flexible information platform with online and on-site tools. Instant access for your staff to current, in-depth data shortens your plant's engineering time, speeds up procurement processes and increases plant uptime.</p> <p>Combined with the right services, W@M Life Cycle Management boosts productivity in every phase. For more information, visit www.endress.com/lifecyclemanagement</p>
FieldCare	<p>FDT-based plant asset management tool from Endress+Hauser. It can configure all smart field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.</p> <p> For details, see Operating Instructions BA00027S and BA00059S</p>
DeviceCare	<p>Tool for connecting and configuring Endress+Hauser field devices.</p> <p> For details, see Innovation brochure IN01047S</p>
Commubox FXA291	<p>Connects Endress+Hauser field devices with a CDI interface (= Endress+Hauser Common Data Interface) and the USB port of a computer or laptop.</p> <p> For details, see "Technical Information" TI00405C</p>

System components

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

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

Brief Operating Instructions, HART

Part 1 of 2: Sensor

Measuring device	Documentation code
Promag L 400	KA01265D

Part 2 of 2: Transmitter

Measuring device	Documentation code
	HART
Promag 400	KA01263D

Brief Operating Instructions, PROFIBUS DP, Modbus RS485, EtherNet/IP

Measuring device	Documentation code
Promag D 400	KA01112D
Promag L 400	KA01113D
Promag W 400	KA01114D

Operating Instructions

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Promag L 400	BA01062D	BA01233D	BA01230D	BA01213D

Description of device parameters

Measuring device	Documentation code			
	HART	PROFIBUS DP	Modbus RS485	EtherNet/IP
Promag 400	GP01043D	GP01044D	GP01045D	GP01046D

Supplementary device-dependent documentation

Special Documentation

HART protocol

Content	Documentation code
Websserver	SD01811D
Heartbeat Technology	SD01847D

PROFIBUS DP, Modbus RS485 and EtherNet/IP communication protocol

Content	Documentation code
Websserver	SD01458D
Heartbeat Technology	SD01183D

Installation Instructions

Contents	Documentation code
Installation Instructions for spare part sets	Specified for each individual accessory

Registered trademarks

HART®

Registered trademark of the FieldComm Group, Austin, Texas, 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®, DeviceCare®, Field Xpert™, HistoROM®, Heartbeat Technology™

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