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Technical Information

Proline Promag 10H

Electromagnetic Flow Measuring System
Flow measurement of liquids in hygienic, food or process applications

Application
Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of ≥ 50 µS/cm:

- Beverages, e.g. fruit juice, beer, wine
- Dairy products, fruit juice mixes
- Saline solutions
- Acid, alkalis etc.

- Flow measurement up to 4700 dm^3/min (1250 gal/min)
- Fluid temperature up to +150 °C (+302 °F)
- Process pressures up to 40 bar (580 psi)
- CIP-/SIP cleaning

Approvals in food sector/hygiene sector:
- 3A approval, EHEDG-tested, conform to FDA, USP Class VI

Application-specific lining material:
- PFA

Your benefits
Promag measuring devices offer you cost-effective flow measurement with a high degree of accuracy for a wide range of process conditions.

The uniform Proline transmitter concept comprises:
- High degree of reliability and measuring stability
- Uniform operating concept

The tried-and-tested Promag sensors offer:
- No pressure loss
- Not sensitive to vibrations
- Simple installation and commissioning

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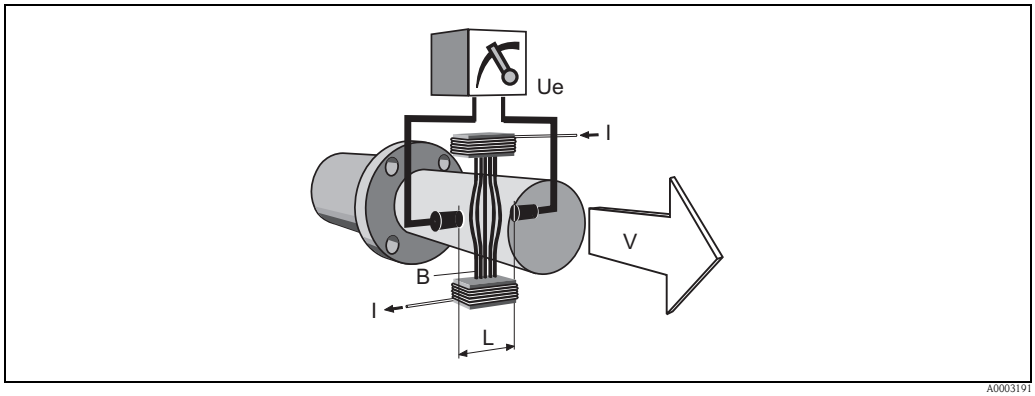
Endress+Hauser
People for Process Automation

Table of contents

Function and system design

Measuring principle

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



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$Ue = B \cdot L \cdot v$
$Q = A \cdot v$

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

Measuring system

The measuring system consists of a transmitter and a sensor.
Two versions are available:
- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:
- Promag 10 (key operation, two-line, unilluminated display)

Sensor:
- Promag H (DN 2 to 100 / 1/12 to 4")

Input

Measured variable

Flow velocity (proportional to induced voltage)

Measuring ranges

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

Operable flow range

Over 1000 : 1

Output

Output signal

Current output

- Galvanically isolated
- Active: 4 to 20 mA, $R_L < 700\ \Omega$ (for HART: $R_L \geq 250\ \Omega$)
- Full scale value adjustable
- Temperature coefficient: typ. 2 µA/°C, resolution: 1.5 µA

Pulse/status output

- Galvanically isolated
- Passive: 30 V DC/250 mA
- Open collector
- Can be configured as:
  - Pulse output: Pulse value and pulse polarity can be selected, max. pulse width adjustable (5 to 2000 ms), pulse frequency max. 100 Hz
  - Status output: for example, can be configured for error messages, empty pipe detection, flow recognition, limit value

Signal on alarm

- Current output → Failsafe mode can be selected
- Pulse output → Failsafe mode can be selected
- Status output → "Not conductive" in the event of fault or power supply failure

Load

See "output signal"

Low flow cutoff

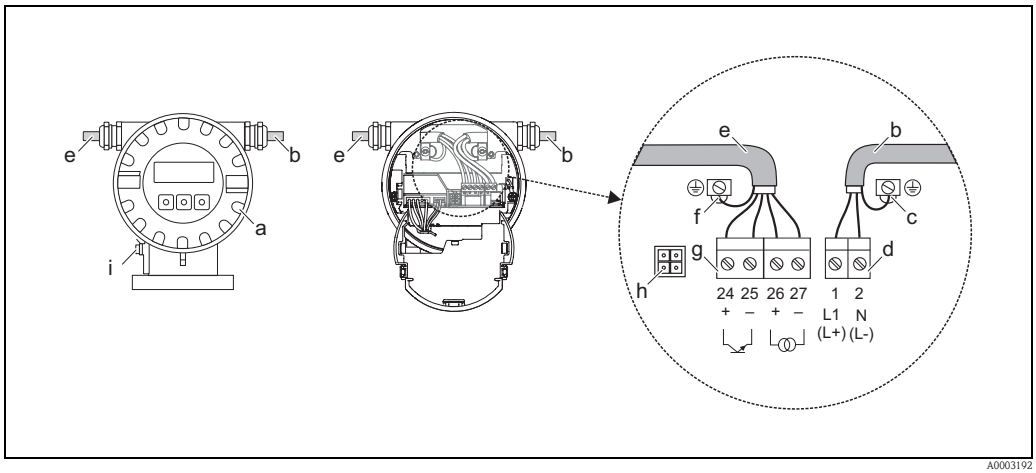
Switch-on points for low flow are selectable.

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other

Power supply

Electrical connection, measuring unit



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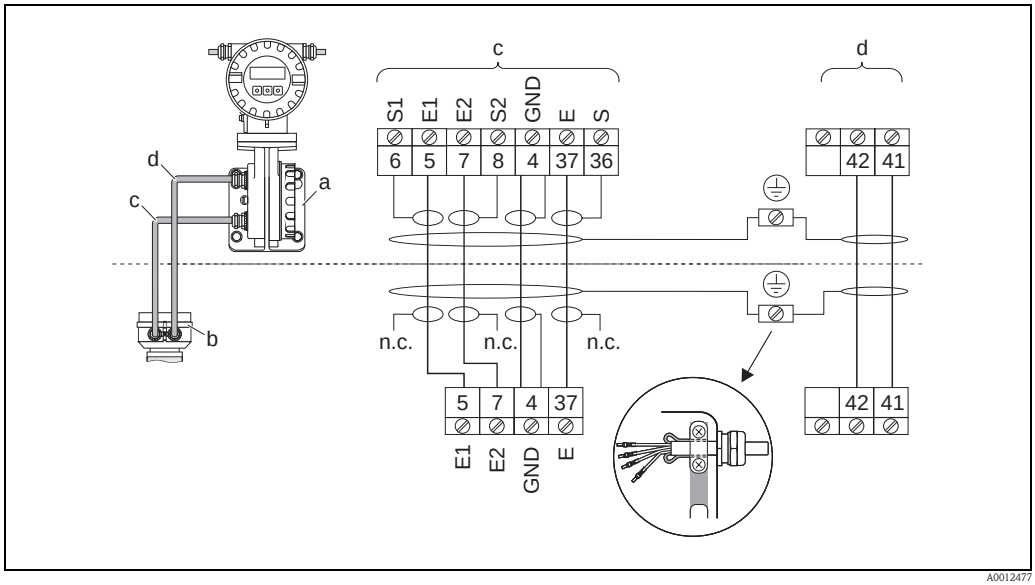
Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm² (14 AWG)

a Electronics compartment cover
b Power supply cable
c Ground terminal for power supply cable
d Terminal connector for power supply cable
e Signal cable
f Ground terminal for signal cable
g Terminal connector for signal cable
h Service connector
i Ground terminal for potential equalization

Electrical connection, terminal assignment

Order version	Terminal No.					
	24 (+)	25 (–)	26 (+)	27 (–)	1 (L1/L+)	2 (N/L–)
10***-**********A	Pulse/status output		HART current output		Power supply	
Functional values	→ 📄 4, Section "output signal"				→ Section "Supply voltage"	

Electrical connection, remote version



Connecting the remote version

a Wall-mount housing connection compartment
b Sensor connection housing cover
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields

Terminal numbers and cable colors:
5/6 = brown, 7/8 = white, 4 = green, 37/36 = yellow

Note!
Grounding the cable shielding in the sensor takes place by means of the strain relief terminal.

Supply voltage (power supply)

- 85 to 250 V AC, 45 to 65 Hz
- 20 to 28 V AC, 45 to 65 Hz
- 11 to 40 V DC

Cable entry

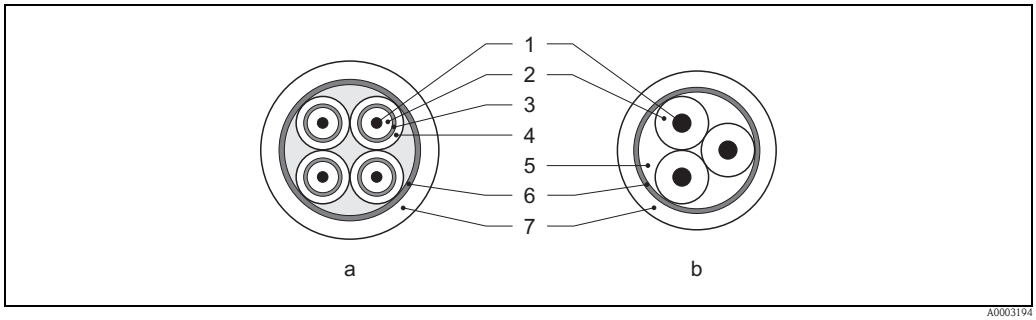
Power supply and signal cables (inputs/ outputs):
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Connecting cable for remote version:
- Cable entry M20 × 1.5 (8 to 12 mm / 0.31 to 0.47")
- Thread for cable entries, ½" NPT, G ½"

Remote version cable specifications

Coil cable
- 2 × 0.75 mm² (18 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28")
- Conductor resistance: ≤ 37 Ω/km (≤ 0.011 Ω/ft)
- Capacitance core/core, shield grounded: ≤ 120 pF/m (≤ 37 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)
- Test voltage for cable insulation: ≤ 1433 AC r.m.s. 50/60 Hz or ≥ 2026 V DC

Signal cable
- 3 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- With empty pipe detection (EPD): 4 × 0.38 mm² (20 AWG) PVC cable with common, braided copper shield (∅ ~ 7 mm / 0.28") and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km (≤ 0.015 Ω/ft)
- Capacitance core/shield: ≤ 420 pF/m (≤ 128 pF/ft)
- Operating temperature: –20 to +80 °C (–68 to +176 °F)
- Cable cross-section: max. 2.5 mm² (14 AWG)



a *Signal cable*
b *Coil current cable*

1 *Core*
2 *Core insulation*
3 *Core shield*
4 *Core jacket*
5 *Core reinforcement*
6 *Cable shield*
7 *Outer jacket*

Operation in zones of severe electrical interference
The measuring device complies with the general safety requirements in accordance with EN 61010 and the EMC requirements of IEC/EN 61326.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

Power consumption

- 85 to 250 V AC: < 12 VA (incl. sensor)
- 20 to 28 V AC: < 8 VA (incl. sensor)
- 11 to 40 V DC: < 6 W (incl. sensor)

Switch-on current:
- Max. 16 A (< 5 ms) for 250 V AC
- Max. 5.5 A (< 5 ms) for 28 V AC
- Max. 3.3 A (< 5 ms) for 24 V DC

Power supply failure

Lasting min. ½ cycle frequency: EEPROM saves measuring system data

Potential equalization

To guarantee perfect measurement, the sensor and the fluid have to be on the same electric potential. Potential equalization can take place by means of the metal, process connections in contact with the medium which are mounted directly on the sensors. As a result, further measures for potential equalization are generally not required.

Performance characteristics

Reference operating conditions

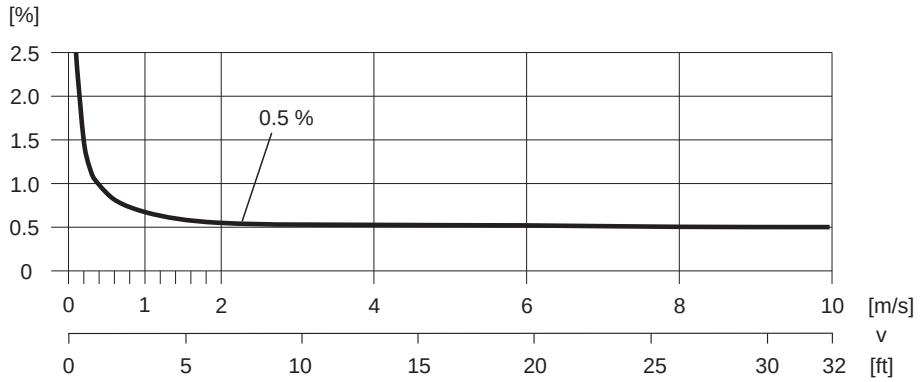
As per DIN EN 29104 and VDI/VDE 2641:
- Fluid temperature: +28 °C ± 2 K (+82 °F ± 2 K)
- Ambient temperature: +22 °C ±2 K (+72 °F ± 2 K)
- Warm-up period: 30 minutes

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

Maximum measured error

- Pulse output: ±0.5% o.r. ± 2 mm/s (o.r. = of reading)
- Current output: also typically ± 5 µA

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



Max. measured error in % of reading

Repeatability

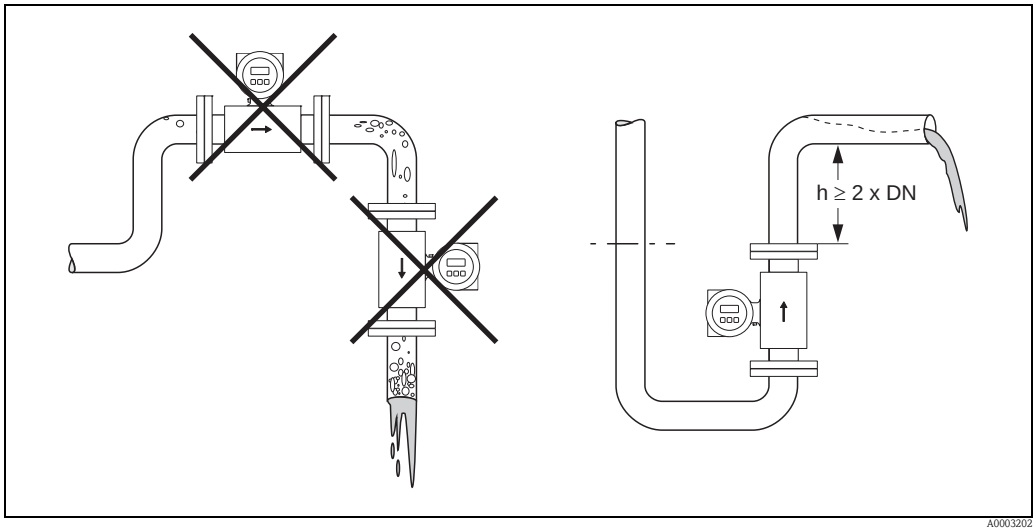
Max. ±0.2% o.r. ± 2 mm/s (o.r. = of reading)

Operating conditions: Installations

Installation instructions

Mounting location

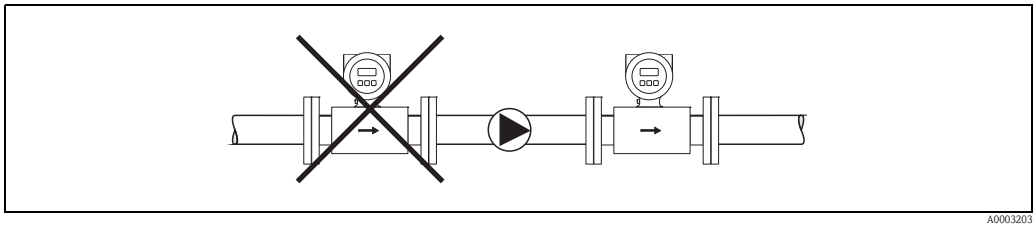
Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.
Avoid the following installation locations in the pipe:
- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.



Mounting location

Installation of pumps

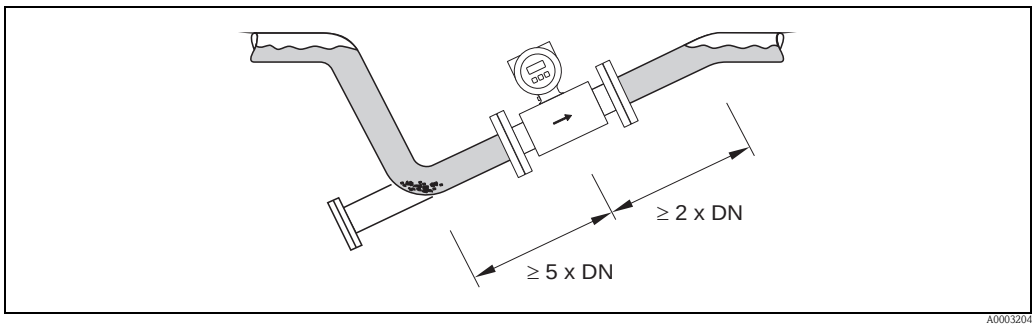
Sensors may not be installed on the pump suction side. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the pressure tightness of the measuring tube lining → 14, Section "Pressure tightness".
Pulsation dampers may be needed when using piston pumps, piston diaphragm pumps or hose pumps. Information on the shock and vibration resistance of the measuring system → 13, Section "Shock and vibration resistance".



Installation of pumps

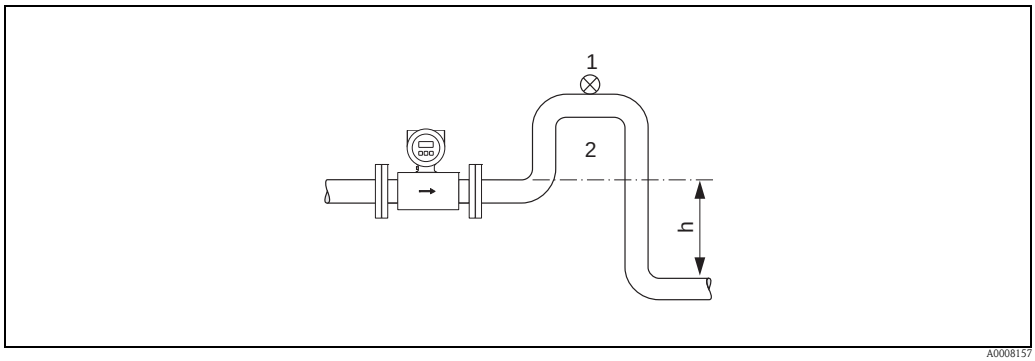
Partially filled pipes
Partially filled pipes with gradients necessitate a drain-type configuration.
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.

Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.



Installation with partially filled pipes

Down pipes
Install a siphon or a vent valve downstream of the sensor in down pipes h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. This measure also prevents the liquid current stopping in the pipe which could cause air locks. Information on the pressure tightness of the measuring tube lining → 14, Section "Pressure tightness".

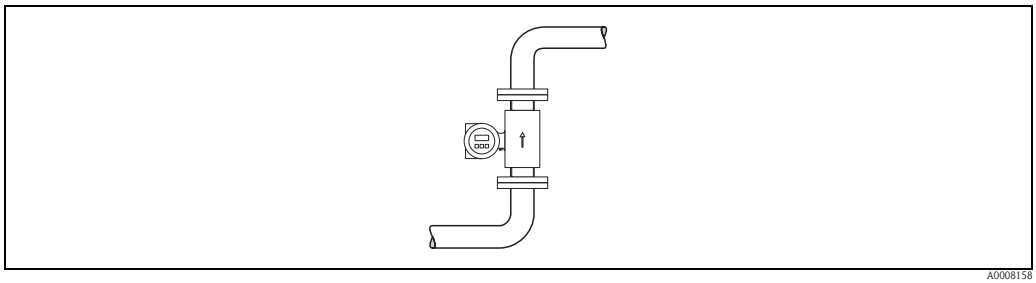


Installation measures for vertical pipes

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

Orientation
An optimum orientation helps avoid gas and air accumulations and deposits in the measuring tube. However, the measuring device also offers the additional function of empty pipe detection (EPD) for detecting partially filled measuring tubes or if outgassing fluids or fluctuating operating pressures are present.

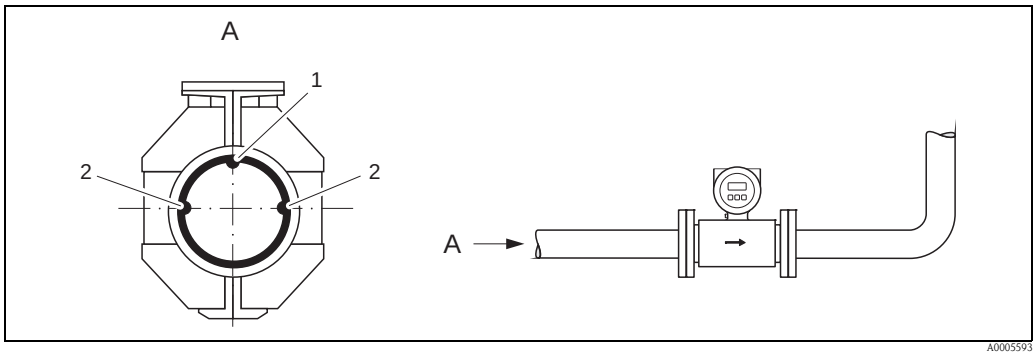
Vertical orientation
This is the ideal orientation for self-emptying piping systems and for use in conjunction with empty pipe detection.



Vertical orientation

Horizontal orientation
The measuring electrode axis should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!
Empty pipe detection only works correctly with horizontal orientation if the transmitter housing is facing upwards. Otherwise there is no guarantee that empty pipe detection will respond if the measuring tube is only partially filled or empty.

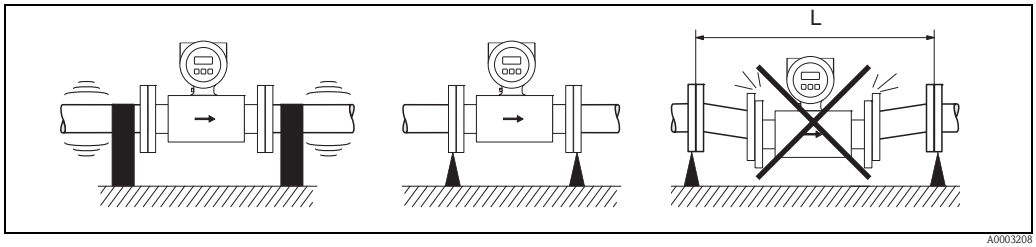


Horizontal orientation

1 EPD electrode for empty pipe detection (not for DN 2 to 15 / 1/12 to ½")
2 Measuring electrodes for signal detection

Vibrations
Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance → 13, Section "Shock and vibration resistance".



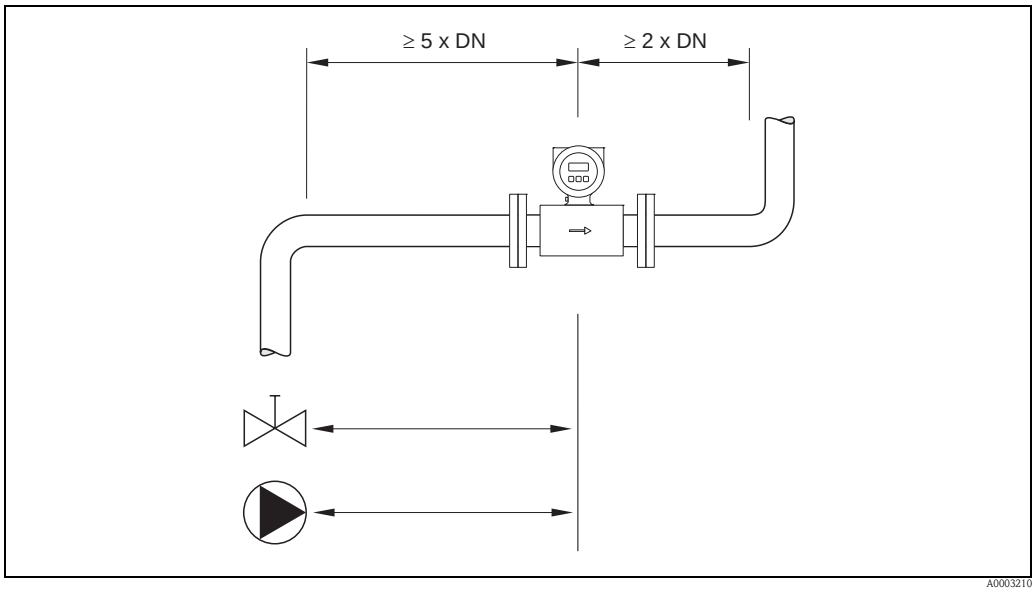
Measures to prevent vibration of the measuring device

L > 10 m (33 ft)

Inlet and outlet run

If possible, install the sensor well clear of assemblies such as valves, T-pieces, elbows etc.

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



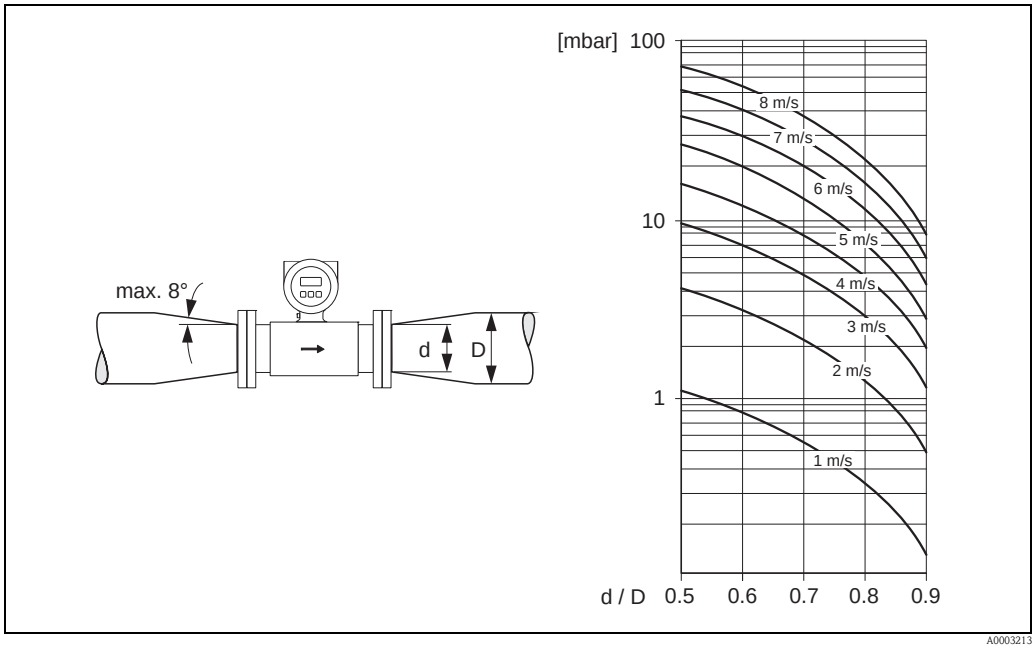
Inlet and outlet run

Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes. The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

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

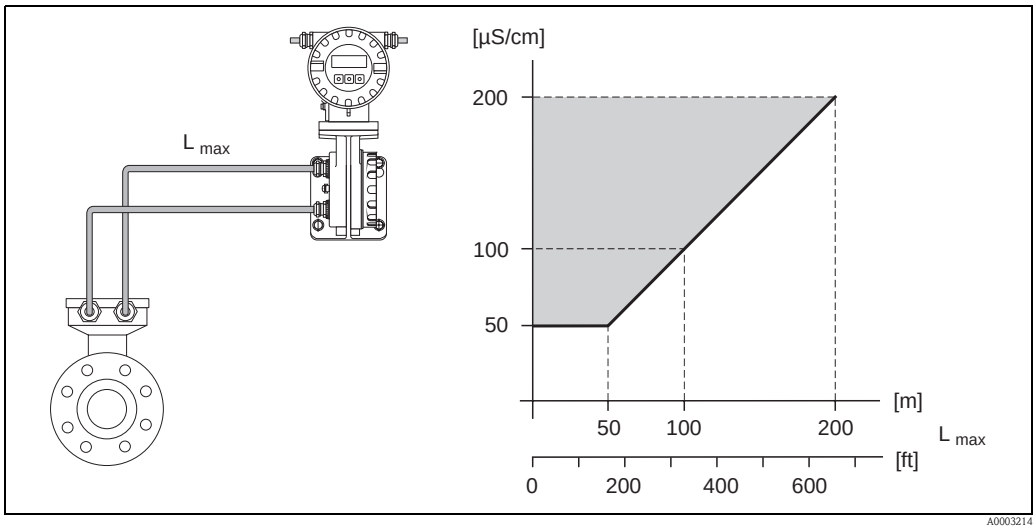


Pressure loss due to adapters

Length of connecting cable

When mounting the remote version, please note the following to achieve correct measuring results:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- If necessary, ensure potential equalization between sensor and transmitter.
- The permitted cable length L_{max} is determined by the fluid conductivity. A minimum conductivity of 50 µS/cm is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m (33 ft).



Permitted length of connecting cable for remote version
Area marked in gray = permitted range; L_{max} = length of connecting cable in [m] ([ft]); fluid conductivity in [µS/cm]

Operating conditions: Environment

Ambient temperature range

- Transmitter: –20 to +60 °C (–4 to +140 °F)

  Note!
  At ambient temperatures below –20 (–4 °F) the readability of the display may be impaired.

- Sensor: –40 to +60 °C (–40 to +140 °F)

Caution!
- The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ 14, Section "Medium temperature range").
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

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

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.
- If protecting caps or protective covers are mounted, these must not be removed before mounting the device.

Degree of protection

- Standard: IP 67 (NEMA 4X) for transmitter and sensor.

Shock and vibration resistance

Acceleration up to 2 g following IEC 600 68-2-6

CIP cleaning

possible

SIP cleaning

possible

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR recommendation NE 21
- Emission: to limit value for industry EN 55011

Operating conditions: Process

Medium temperature range

Sensor:
- DN 2 to 100 (1/12 to 4"): –20 to +150 °C (–4 to +302 °F)

Seals:
- EPDM: –20 to +150 °C (–4 to 302 °F)
- Viton: –20 to +150 °C (–4 to 302 °F)
- Kalrez: –20 to +150 °C (–4 to 302 °F)

Conductivity

The minimum conductivity is: ≥ 50 µS/cm

Note!
In the remote version, the necessary minimum conductivity also depends on the cable length (→ 🖹 12, Section "Length of connecting cable").

Medium pressure range (nominal pressure)

The permitted nominal pressure depends on the process connection and the seal:
- 40 bar (580 psi): flange, weld socket (with O-ring seal)
- 16 bar (232 psi): all other process connections

Pressure tightness

Measuring tube lining: PFA

Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at fluid temperatures:					
[mm]	[inch]	25 °C (77 °F)	80 °C (176 °F)	100 °C (212 °F)	130 °C (266 °F)	150 °C (302 °F)	180 °C (356 °F)
2 to 100	1/12 to 4"	0	0	0	0	0	0

Limiting flow

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor.
The optimum flow velocity is between 2 to 3 m/s (6.5 to 9.8 ft/s). The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- v < 2 m/s (6.5 ft/s): for small conductivities
- v > 2 m/s (6.5 ft/s): for fluids causing build-up such as high-fat milk etc.

Flow characteristic values (SI units)					
Diameter		Recommended flow rate	Factory settings		
[mm]	[inch]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value, current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
2	1/12"	0.06 to 1.8 dm³/min	0.5 dm³/min	0.005 dm³	0.01 dm³/min
4	1/8"	0.25 to 7 dm³/min	2 dm³/min	0.025 dm³	0.05 dm³/min
8	3/8"	1 to 30 dm³/min	8 dm³/min	0.10 dm³	0.1 dm³/min
15	½"	4 to 100 dm³/min	25 dm³/min	0.20 dm³	0.5 dm³/min
25	1"	9 to 300 dm³/min	75 dm³/min	0.50 dm³	1.00 dm³/min
40	1½"	25 to 700 dm³/min	200 dm³/min	1.50 dm³	3.00 dm³/min
50	2"	35 to 1100 dm³/min	300 dm³/min	2.50 dm³	5.00 dm³/min
65	–	60 to 2000 dm³/min	500 dm³/min	5.00 dm³	8.00 dm³/min
80	3"	90 to 3000 dm³/min	750 dm³/min	5.00 dm³	12.0 dm³/min
100	4"	145 to 4700 dm³/min	1200 dm³/min	10.0 dm³	20.0 dm³/min

Flow characteristic values (US units)					
Diameter		**Recommended flow rate**	**Factory settings**		
[inch]	[mm]	Min./max. full scale value (v ~ 0.3 or 10 m/s)	Full scale value, current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
1/12"	2	0.015 to 0.5 gal/min	0.1 gal/min	0.001 gal	0.002 gal/min
1/8"	4	0.07 to 2 gal/min	0.5 gal/min	0.005 gal	0.008 gal/min
3/8"	8	0.25 to 8 gal/min	2 gal/min	0.02 gal	0.025 gal/min
½"	15	1.0 to 27 gal/min	6 gal/min	0.05 gal	0.10 gal/min
1"	25	2.5 to 80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
1½"	40	7 to 190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	50	10 to 300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
3"	80	24 to 800 gal/min	200 gal/min	2.00 gal	2.50 gal/min
4"	100	40 to 1250 gal/min	300 gal/min	2.00 gal	4.00 gal/min

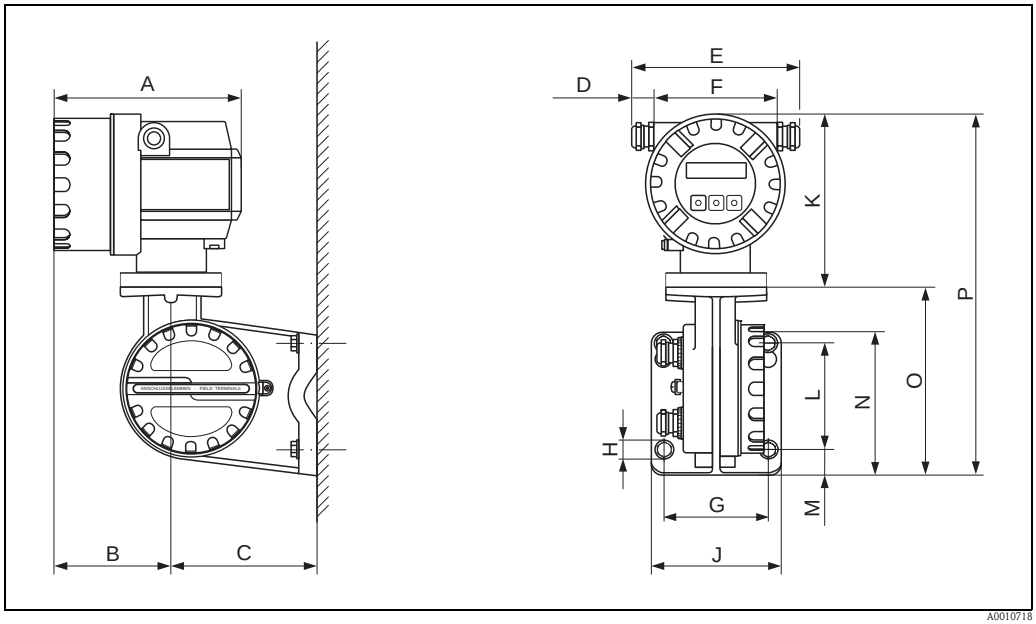
Pressure loss

- No pressure loss if the sensor is installed in a pipe with the same nominal diameter.
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (→ 🖹 11, Section "Adapters").

Mechanical construction

Design, dimensions

Transmitter, remote version



Transmitter dimensions, remote version

Dimensions in SI units

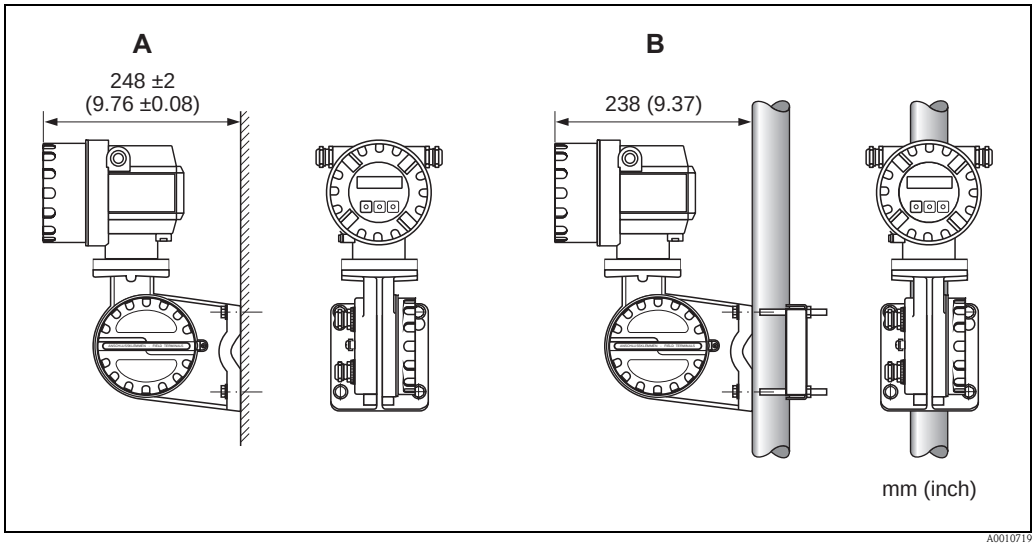
A	B	C	D	E	F	G	Ø H
178	113	135	20 to 30	161 to 181	121	100	8.6 (M8)
J	K	L	M	N	O	P	
123	150	100	25	133	177.5	327.5	

All dimensions in [mm]

Dimensions in US units

A	B	C	D	E	F	G	Ø H
7.00	4.45	5.31	0.79 to 1.81	6.34 to 7.13	4.76	3.94	0.34 (M8)
J	K	L	M	N	O	P	
4.84	5.90	3.94	0.98	5.24	6.99	12.89	

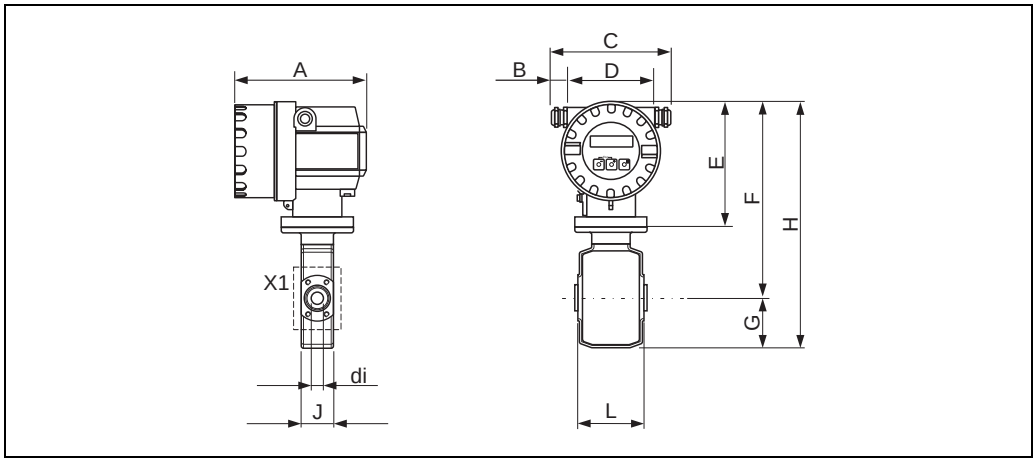
All dimensions in [inch]



Transmitter mounting, remote version

A Direct wall mounting
B Pipe mounting

Compact version DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

DN	L	A	B	C	D	E	F	G	H	J	X1	di
2	86	178	20 to 30	161 to 181	113	150	242	55	297	43	M6 × 4	2.25
4										43		4.5
8										43		9.0
15										43		16.0
25										56		26.0

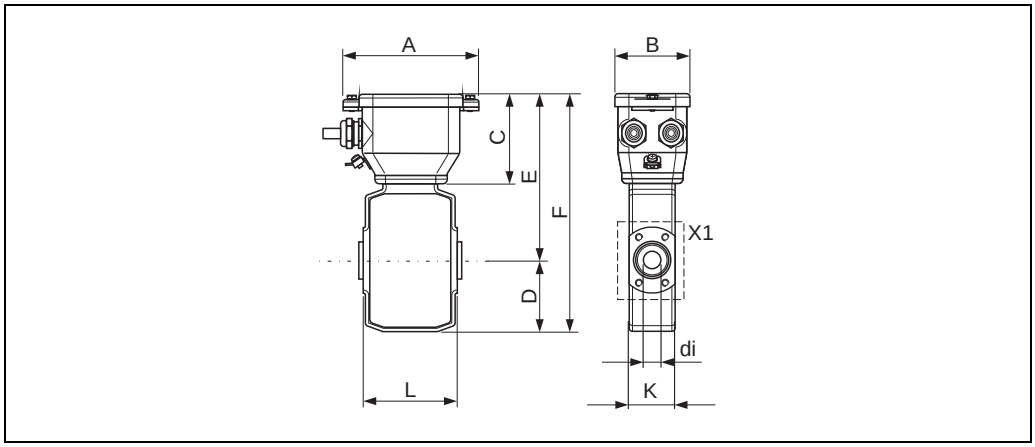
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	G	H	J	X1	di
1/12"	3.39	7.01	0.79 to 1.81	6.34 to 7.13	4.45	5.91	9.53	2.17	11.7	1.69	M6 × 4	0.09
1/8"										1.69		0.18
3/8"										1.69		0.35
½"										1.69		0.63
1"										2.20		0.89

Total length depends on the process connections.
All dimensions in [inch]

Sensor, remote version DN 2 to 25 (1/12 to 1")



Dimensions in SI units

DN	L	A	B	C	D	E	F	K	X1	di
2	86	127	70	75	55	136	191	43	M6 × 4	2.25
4								43		4.5
8								43		9.0
15								43		16.0
25								56		26.0

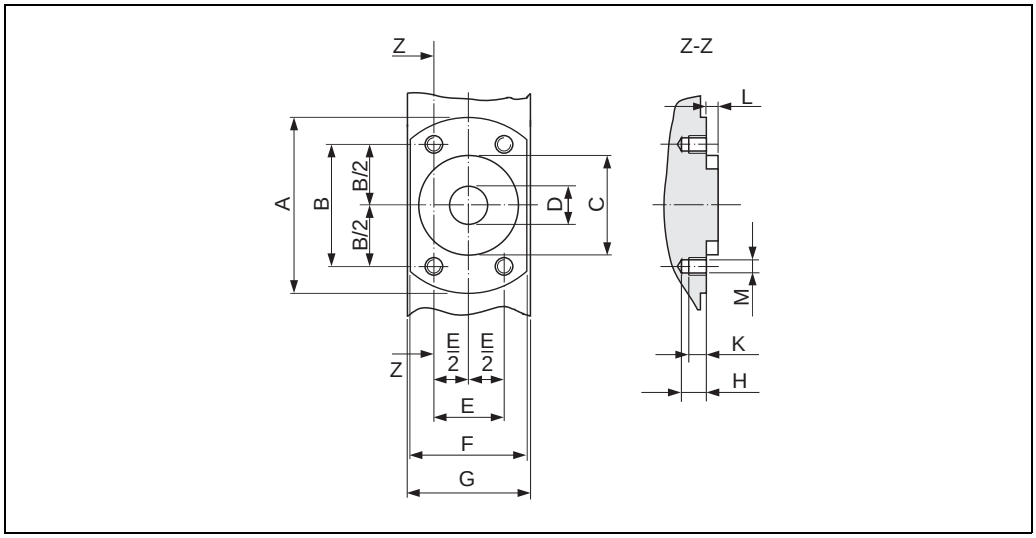
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	K	X1	di
1/12"	3.39	5.00	2.76	2.95	2.17	5.35	7.52	1.69	M6 × 4	0.09
1/8"								1.69		0.18
3/8"								1.69		0.35
½"								1.69		0.63
1"								2.20		0.89

Total length depends on the process connections.
All dimensions in [inch]

Sensor, front view (without process connections) DN 2 to 25 (1/12 to 1")



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Dimensions in SI units

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

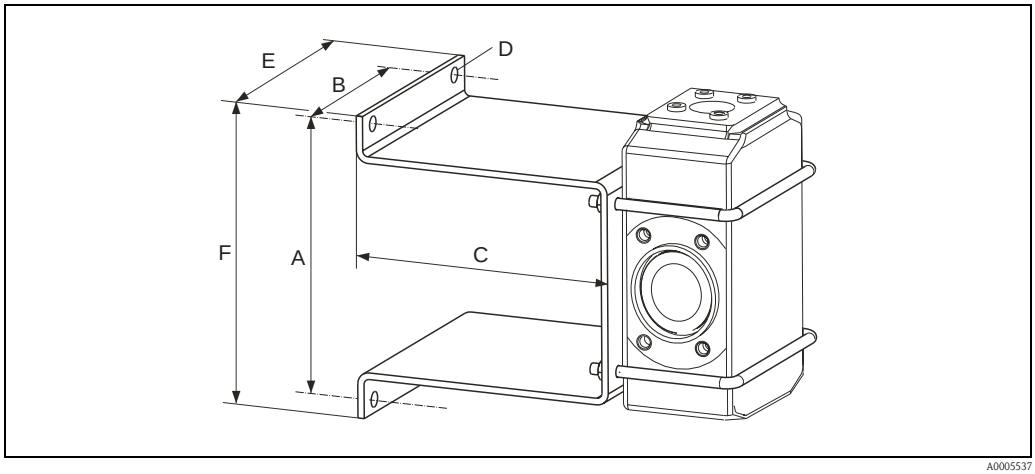
All dimensions in [mm]

Dimensions in US units

DN	A	B	C	D	E	F	G	H	K	L	M
1/12"	2.44	1.64	1.34	0.35	0.94	1.65	1.69	0.33	0.24	0.16	M6
1/8"				0.35							
3/8"				0.35							
½"				0.63							
1"	2.83	1.98	1.73	0.89	1.14	2.17	2.20				

All dimensions in [inch]

Sensor, wall mounting kit DN 2 to 25 (1/12 to 1")



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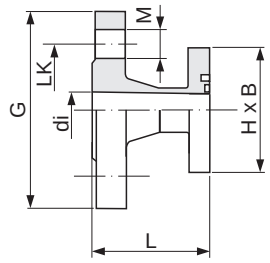
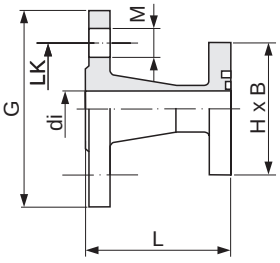
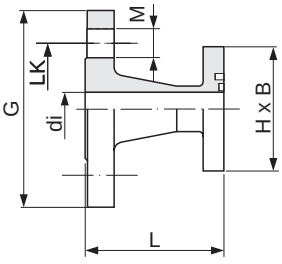
Dimensions in mm (inch)

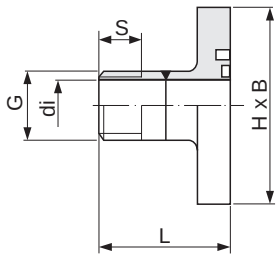
A	B	C	Ø D	E	F
125 (4.92")	88 (3.46")	120 (4.72")	7 (0.28")	110 (4.33")	140 (5.51")

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

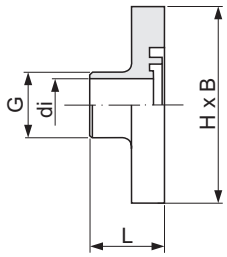
Flange	Sensor	Fits to	di	G	L	LK	M	H × B
PN 40/EN 1092-1 (DIN 2501), Form B 1.4404 / 316L 1*H**-D**********	DN [mm]	Flange[1)] [mm]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	2 to 8	DN 15	17.3	95	56.2	65	14	62 × 42
	15	DN 15	17.3	95	56.2	65	14	62 × 42
	25 (DIN)	DN 25	28.5	115	56.2	85	14	72 × 55
	[1)] EN 1092-1 (DIN 2501) ■ Fitting length = (2 × L) + 86 mm ■ Fitting length to DVGW (200 mm)							

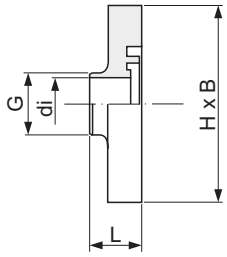
Flange	Sensor	Fits to	di	G	L	LK	M	H × B
Cl. 150/ ANSI B16.5 1.4404 / 316L 1*H**-E**********	DN [mm]	Flange ANSI B16.5 [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	2 to 8	½"	15.7	89	66.0	60.5	15.7	62 × 42
	15	½"	16.0	89	66.0	60.5	15.7	62 × 42
	25 (1" ANSI)	1"	26.7	108	71.8	79.2	15.7	72 × 55
	■ Fitting length = (2 × L) + 86 mm							

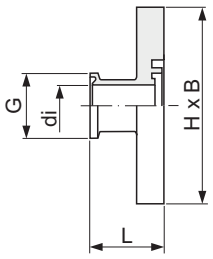
Flange	Sensor	Fits to	di	G	L	LK	M	H × B
20K / JIS B2220; 1.4404 / 316L 1*H**-F**********	DN [mm]	Flange B2220	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
	2 to 8	ND 15	15	95	67	70	15	62 × 42
	15	ND 15	16	95	67	70	15	62 × 42
	25 (DIN)	ND 25	26	125	67	90	19	72 × 55
	■ Fitting length = (2 × L) + 86 mm							

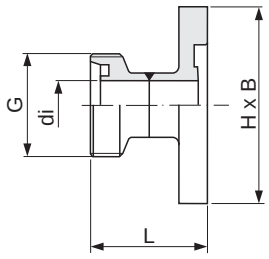
External pipe thread	Sensor	Fits to	di	G	L	S	H × B
ISO 228/ DIN 2999; 1.4404 / 316L 1*H**-K**********	DN [mm]	Internal thread [inch]	[mm]	[inch]	[mm]	[mm]	[mm]
	2 to 8	R 3/8"	10	3/8"	40	10.1	62 × 42
	15	R ½"	16	½"	40	13.2	62 × 42
	25 (1" ANSI)	R 1"	25	1"	42	16.5	72 × 55
	■ Fitting length = (2 × L) + 86 mm						

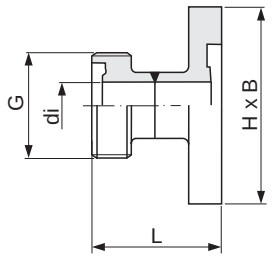
Process connections with aseptic gasket seal (DN 2 to 25 / 1/12 to 1")

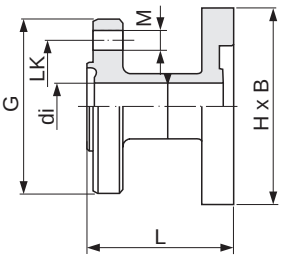
Weld nipple for DIN	Sensor	Fits to	di	G	L	H × B
1.4404 / 316L 1*H**-U**********	DN [mm]	Piping DIN 11850	[mm]	[mm]	[mm]	[mm]
 A0003870	2 to 8	14 × 2	9	14	23.3	62 × 42
	15	20 × 2	16	20	23.3	62 × 42
	25 (DIN)	30 × 2	26	30	23.3	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

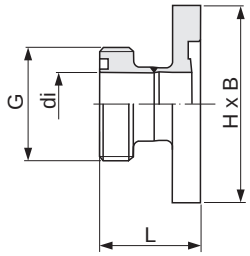
Weld nipple for ODT/SMS	Sensor	Fits to	di	G	L	H × B
1.4404 / 316L 1*H**-V**********	DN [mm]	Piping ODT/SMS	[mm]	[mm]	[mm]	[mm]
 A0003871	2 to 8	12.7 × 1.65	9.0	12.7	16.1	62 × 42
	15	19.1 × 1.65	16.0	19.1	16.1	62 × 42
	25 (1" ANSI)	24.5 × 1.65	22.6	25.4	16.1	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

Tri-Clamp for L14 AM7	Sensor	Fits to	di	G	L	H × B
1.4404 / 316L 1*H**-1**********	DN [mm]	Piping OD	[mm]	[mm]	[mm]	[mm]
 A0003872	2 to 8	Tube 12.7 × 1.65 (OD ½")	9.4	25.0	28.5	62 × 42
	15	Tube 19.1 × 1.65 (ODT ¾")	15.8	25.0	28.5	62 × 42
	25 (1" ANSI)	Tube 25.5 × 1.65 (ODT 1")	22.1	50.4	28.5	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

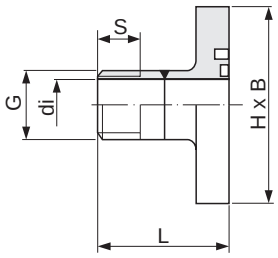
Coupling SC DIN 11851	Sensor	Fits to	di	G	L	H × B
Threaded adapter; 1.4404 / 316L 1*H**-2**********	DN [mm]	Piping DIN 11850	[mm]	[mm]	[mm]	[mm]
 A0005553	2 to 8	Tube 12 × 1 (DN 10)	10	Rd 28 × 1/8"	44	62 × 42
	15	Tube 18 × 1.5 (DN 15)	16	Rd 34 × 1/8"	44	62 × 42
	25 (DIN)	Tube 28 × 1 or 28 × 1.5 (DN 25)	26	Rd 52 × 1/6"	52	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

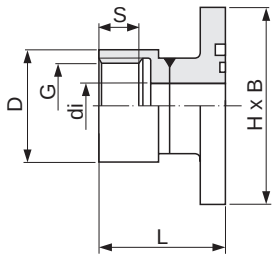
Coupling DIN 11864-1	Sensor	Fits to	di	G	L	H × B
Aseptic threaded adapter, Form A 1.4404 / 316L 1*H**-3**********	DN [mm]	Piping DIN 11850	[mm]	[mm]	[mm]	[mm]
 A0005558	2 to 8	Tube 13 × 1.5 (DN 10)	10	Rd 28 × 1/8"	42	62 × 42
	15	Tube 19 × 1.5 (DN 15)	16	Rd 34 × 1/8"	42	62 × 42
	25 (DIN)	Tube 29 × 1.5 (DN 25)	26	Rd 52 × 1/6"	49	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

Flange DIN 11864-2	Sensor	Fits to	di	G	L	LK	M	H × B
Aseptic grooved flange, Form A 1.4404 / 316L 1*H**-4**********	DN [mm]	Piping DIN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005559	2 to 8	Tube 13 × 1.5 (DN 10)	10	54	48.5	37	9	62 × 42
	15	Tube 19 × 1.5 (DN 15)	16	59	48.5	42	9	62 × 42
	25 (DIN)	Tube 29 × 1.5 (DN 25)	26	70	48.5	53	9	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

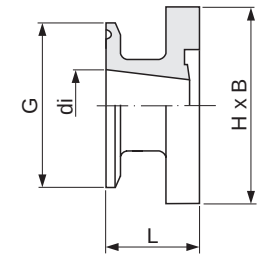
Coupling SMS 1145	Sensor	Fits to	SMS 1145	di	G	L	H × B
Threaded adapter; 1.4404 / 316L 1*H**-5**********	DN [mm]	Piping OD	Diameter [mm]	[mm]	[mm]	[mm]	[mm]
 A0005564	25 (1" ANSI)	1"	25	22.6	Rd 40 × 1/6"	30.8	72 × 55
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!						

Process connections orderable only as accessories with O-ring seal (DN 2 to 25 / 1/12 to 1")

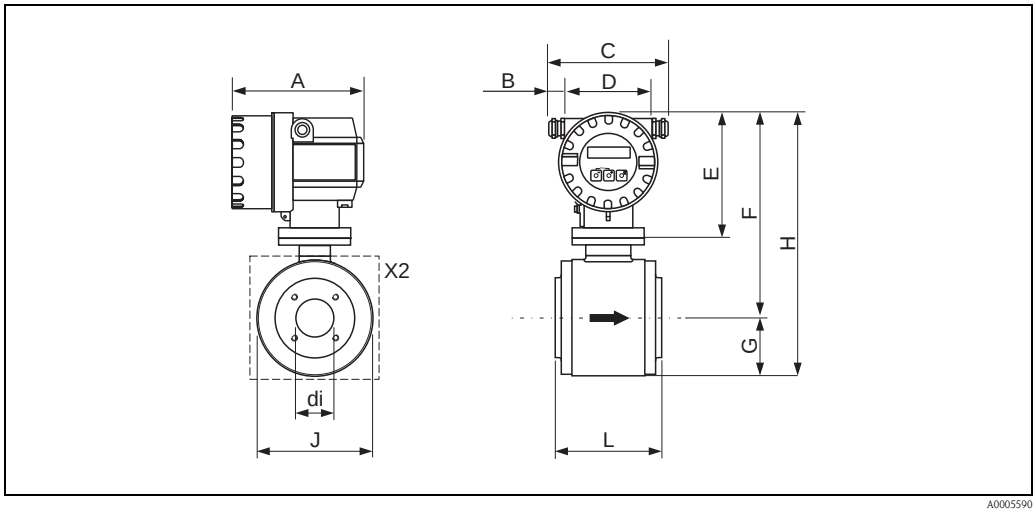
Exernal pipe thread	Sensor	Fits to	di	G	L	S	H × B
1.4404 / 316L DKH**-GD**	DN [mm]	NP internal thread	[mm]	[inch]	[mm]	[mm]	[mm]
	2 to 8	NPT 3/8"	10	3/8"	50	15.5	62 × 42
	15	NPT ½"	16	½"	50	20.0	62 × 42
	25 (1" ANSI)	NPT 1"	25	1"	55	25.0	72 × 55
	■ Fitting length = (2 × L) + 86 mm						

Internal pipe thread	Sensor	Fits to	di	G	D	L	S	H × B
1.4404 / 316L DKH**-GC**	DN [mm]	NP external thread	[mm]	[inch]	[mm]	[mm]	[mm]	[mm]
	2 to 8	NPT 3/8"	8.9	3/8"	22	45	13	62 × 42
	15	NPT ½"	16.0	½"	27	45	14	62 × 42
	25 (1" ANSI)	NPT 1"	27.2	1"	40	51	17	72 × 55
	■ Fitting length = (2 × L) + 86 mm							

Process connections orderable only as accessories with aseptic gasket seal (DN 15)

Tri-Clamp L14 AM17	Sensor	Fits to	di	G	L	H × B
1.4404 / 316L DKH**-HF**	DN [mm]	Piping OD	[mm]	[mm]	[mm]	[mm]
	15	Tube 25.4 × 1.65 (ODT 1")	22.1	50.4	28.5	62 × 42
	■ Fitting length = (2 × L) + 86 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!					

Compact version DN 40 to 100 (1½ to 4")



Dimensions in SI units

DN	L	A	B	C	D	E	F	G	H	J	X2	di
40	140	178	20 to 30	161 to 181	113	150	245	64	309	128	M8 × 4	35.3
50	140						257	77	334	153	M8 × 4	48.1
65	140						267	77	344	153	M8 × 6	59.9
80	200						282	102	384	203	M12 × 4	72.6
100	200						282	102	384	203	M12 × 6	97.5

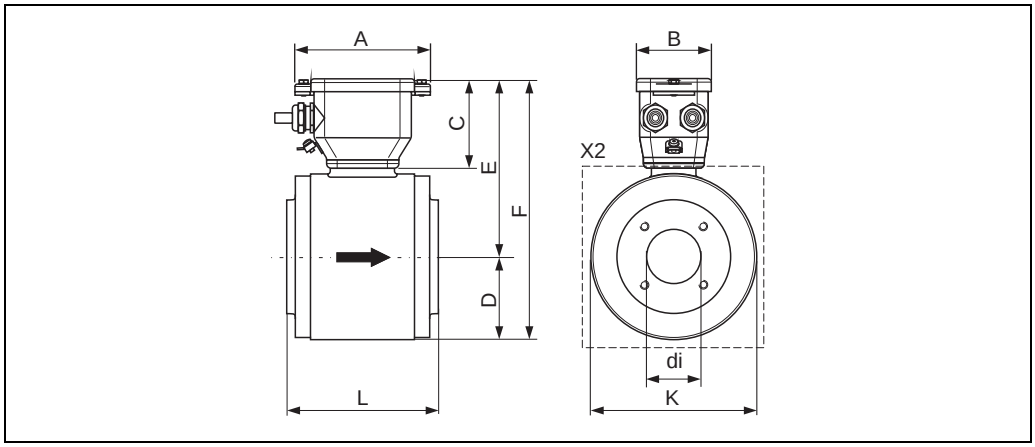
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	G	H	J	X2	di
1½"	5.51	7.01	0.79 to 1.81	6.34 to 7.13	4.45	5.91	9.65	2.52	12.2	5.04	M8 × 4	1.39
2"	5.51						10.1	3.03	13.2	6.02	M8 × 4	1.89
3"	7.87						11.1	4.02	15.1	7.99	M12 × 4	2.86
4"	7.87						11.1	4.02	15.1	7.99	M12 × 6	3.84

Total length depends on the process connections.
All dimensions in [inch]

Sensor, remote version DN 40 to 100 (1½ to 4")



A0005535

Dimensions in SI units

DN	L	A	B	C	D	E	F	K	X2	di
40	140	125	70	75	64.5	151.5	216	129	M8 × 4	35.3
50	140				77.0	164.0	241	154	M8 × 4	48.1
65	140				77.0	164.0	241	154	M8 × 6	59.9
80	200				101.5	188.5	290	203	M12 × 4	72.6
100	200				101.5	188.5	290	203	M12 × 6	97.5

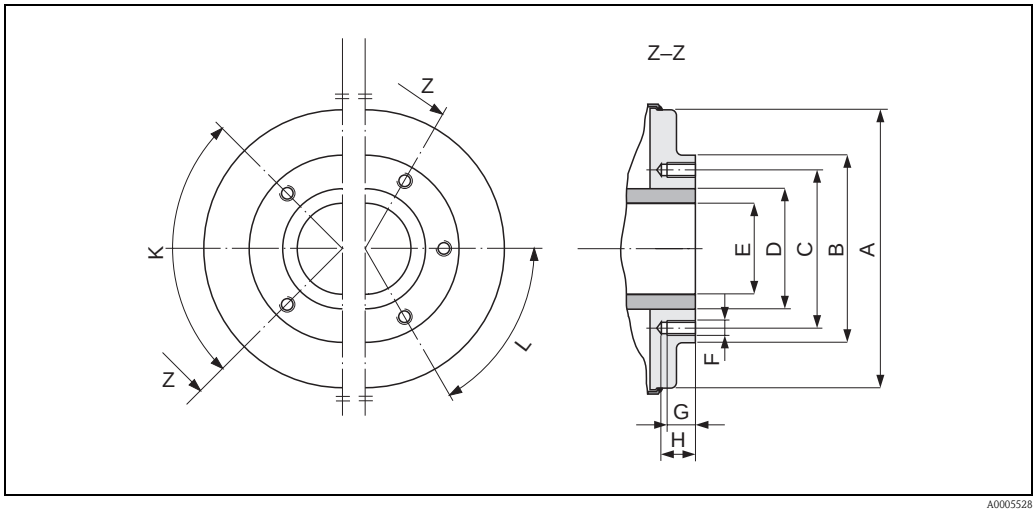
Total length depends on the process connections.
All dimensions in [mm]

Dimensions in US units

DN	L	A	B	C	D	E	F	K	X2	di
1½"	5.51	4.92	2.76	2.95	2.54	5.96	8.50	5.08	M8 × 4	1.39
2"	5.51				3.03	6.46	9.49	6.06	M8 × 4	1.89
3"	7.87				4.00	7.42	11.4	7.99	M12 × 4	2.86
4"	7.87				4.00	7.42	11.4	7.99	M12 × 6	3.84

Total length depends on the process connections.
All dimensions in [inch]

Sensor, front view (without process connections) DN 40 to 100 (1½ to 4")



A0005528

Dimensions in SI units

DN	A	B	C	D	E	F	G	H	K 90° ±0.5°	L 60° ±0.5°
									Threaded holes	
40	122	86	71.0	51.0	35.3	M 8	15	18	4	–
50	147	99	83.5	63.5	48.1	M 8	15	18	4	–
65	147	115	100.0	76.1	59.9	M 8	15	18	–	6
80	197	141	121.0	88.9	72.6	M 12	15	20	4	–
100	197	162	141.5	114.3	97.5	M 12	15	20	–	6

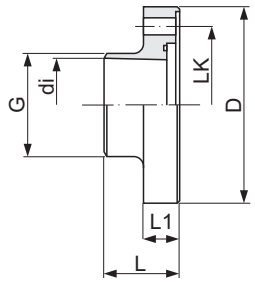
All dimensions in [mm]

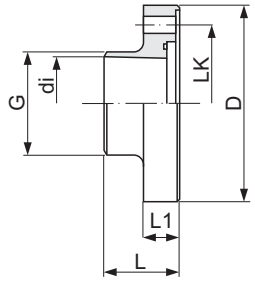
Dimensions in US units

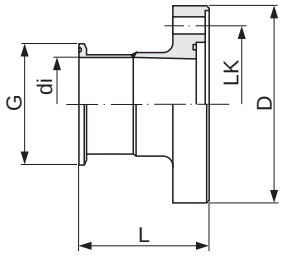
DN	A	B	C	D	E	F	G	H	K 90° ±0.5°	L 60° ±0.5°
									Threaded holes	
1½"	4.80	3.39	2.80	2.01	1.39	M 8	0.59	0.71	4	–
2"	5.79	3.90	3.29	2.50	1.89	M 8	0.59	0.71	4	–
3"	7.76	5.55	4.76	3.50	2.86	M 12	0.59	0.79	4	–
4"	7.76	6.38	5.57	4.50	3.84	M 12	0.59	0.79	–	6

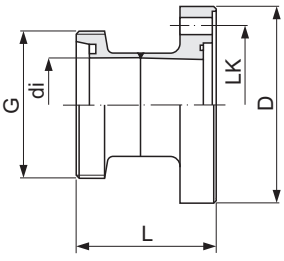
All dimensions in [inch]

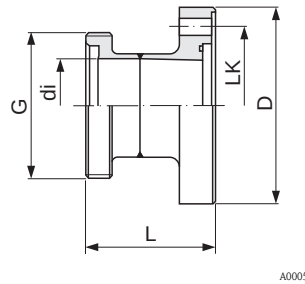
Process connections with aseptic gasket seal DN 40 to 100 (1½ to 4")

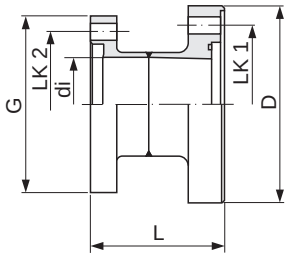
Weld nipple for DIN	Sensor	Fits to	di	G	D	L	L1	LK
1.4404 / 316L 1*H**-U**********	DN [mm]	Piping DIN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005541	40	42 × 2	38.0	43	92	42	19	71.0
	50	54 × 2	50.0	55	105	42	19	83.5
	65	70 × 2	66.0	72	121	42	21	100.0
	80	85 × 2	81.0	87	147	42	24	121.0
	100	104 × 2	100.0	106	168	42	24	141.5
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

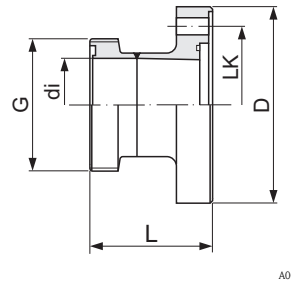
Weld nipple for ODT/SMS	Sensor	Fits to	di	G	D	L	L1	LK
1.4404 / 316L 1*H**-V**********	DN [mm]	Piping OD/SMS	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005541	40	38.1 × 1.65	35.3	40	92	42	19	71.0
	50	50.8 × 1.65	48.1	55	105	42	19	83.5
	65	63.5 × 1.65	59.9	66	121	42	21	100.0
	80	76.2 × 1.65	72.6	79	147	42	24	121.0
	100	101.6 × 1.65	97.5	104	168	42	24	141.5
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

Tri-Clamp L14 AM7	Sensor		Fits to	di	G	D	L	LK
1.4404 / 316L 1*H**-1**********	DN [mm]	DN [inch]	Piping OD	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005543	40	1½"	38.1 × 1.65	34.8	50.4	92	68.8	71.0
	50	2"	50.8 × 1.65	47.5	63.9	105	68.8	83.5
	65	–	63.5 × 1.65	60.2	77.4	121	68.8	100.0
	80	3"	76.2 × 1.65	72.9	90.9	147	68.8	121.0
	100	4"	101.6 × 1.65	97.4	118.9	168	68.8	141.5
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

Coupling SC DIN 11851	Sensor	Fits to	di	G	D	L	LK
1.4404 / 316L 1*H**-2**********	DN [mm]	Piping DN 11850	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005540	40	42 × 2	38	Rd 65 × 1/6"	92	72	71.0
	50	54 × 2	50	Rd 78 × 1/6"	105	74	83.5
	65	70 × 2	66	Rd 95 × 1/6"	121	78	100.0
	80	85 × 2	81	Rd 110 × 1/6"	147	83	121.0
	100	104 × 2	100	Rd 130 × 1/6"	168	92	141.5
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!						

Coupling DIN 11864-1	Sensor	Fits to	di	G	D	L	LK
Aseptic threaded adapter, Form A 1.4404 / 316L 1*H**-3**********	DN [mm]	Piping DN 11850	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005545	40	42 × 2	38	Rd 65 × 1/6"	92	71	71.0
	50	54 × 2	50	Rd 78 × 1/6"	105	71	83.5
	65	70 × 2	66	Rd 95 × 1/6"	121	76	100.0
	80	85 × 2	81	Rd 110 × 1/6"	147	82	121.0
	100	104 × 2	100	Rd 130 × 1/6"	168	90	141.5
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!						

Flange DIN 11864-2	Sensor	Fits to	di	G	D	L	LK 1	LK 2
Aseptic flat flange, Form A 1.4404 / 316L 1*H**-4**********	DN [mm]	Piping DN 11850	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005546	40	42 × 2	38	82	92	64	71.0	65
	50	54 × 2	50	94	105	64	83.5	77
	65	70 × 2	66	113	121	64	100.0	95
	80	85 × 2	81	133	147	98	121.0	112
	100	104 × 2	100	159	168	98	141.5	137
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

Coupling SMS 1145	Sensor	Fits to	SMS 1145	di	G	D	L	LK
Threaded adapter; 1.4404 / 316L 1*H**-5**********	DN [mm]	Piping OD	Dia- meter [mm]	[mm]	[mm]	[mm]	[mm]	[mm]
 A0005538	40	38.1 × 1.65	38.0	35.5	Rd 60 × 1/6"	92	63	71.0
	50	50.8 × 1.65	51.0	48.5	Rd 70 × 1/6"	105	65	83.5
	65	63.5 × 1.65	63.5	60.5	Rd 85 × 1/6"	121	70	100.0
	80	76.2 × 1.65	76.0	72.0	Rd 98 × 1/6"	147	75	121.0
	100	101.6 × 1.65	101.6	97.6	Rd 132 × 1/6"	168	70	141.5
	■ – Fitting length for DN 40 to 65 = (2 × L) + 136 mm – Fitting length for DN 80 to 100 = (2 × L) + 196 mm ■ If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection (di) into account!							

Weight

Nominal diameter		Compact version (DIN)		Remote version (without cable; DIN)			
				Sensor		Transmitter (wall-mount housing)	
[mm]	[inch]	[kg]	[lbs]	[kg]	[lbs]	[kg]	[lbs]
2	1/12"	3.6	8.0	2.0	4.0	3.1	7.0
4	1/8"	3.6	8.0	2.0	4.0	3.1	7.0
8	3/8"	3.6	8.0	2.0	4.0	3.1	7.0
15	½"	3.7	8.0	1.9	4.0	3.1	7.0
25	1"	3.9	9.0	2.8	6.0	3.1	7.0
40	1½"	4.9	11.0	4.5	10.0	3.1	7.0
50	2"	7.4	16.0	7.0	15.0	3.1	7.0
65	–	7.9	17.0	7.5	17.0	3.1	7.0
80	3"	17.4	38.0	17.0	37.0	3.1	7.0
100	4"	16.9	37.0	16.5	36.0	3.1	7.0

- Transmitter (compact version): 1.8 kg (3.97 lbs)
- Weight data valid for standard pressure ratings and without packaging material.

Measuring tube specifications

Nominal diameter		Pressure rating[1]	Internal diameter[2]	
		EN (DIN)	PFA	
[mm]	[inch]	[bar]	[mm]	[inch]
2	1/12"	PN 16 / PN 40	2.25	0.09
4	1/8"	PN 16 / PN 40	4.5	0.18
8	3/8"	PN 16 / PN 40	9.0	0.35
15	½"	PN 16 / PN 40	16.0	0.63
–	1"	PN 16 / PN 40	22.6	0.89
25	–	PN 16 / PN 40	26.0	1.02
40	1½"	PN 16	35.3	1.39
50	2"	PN 16	48.1	1.89
65	–	PN 16	59.9	2.36
80	3"	PN 16	72.6	2.86
100	4"	PN 16	97.5	3.84

[1] Pressure rating depends on the process connection and the seals used.
[2] Internal diameter of process connections.

Material

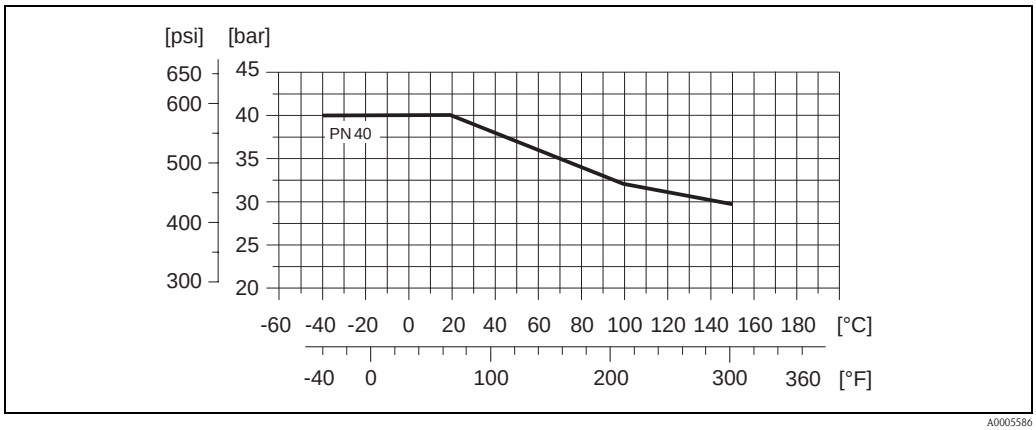
- Transmitter housing: powder-coated die-cast aluminum
- Sensor housing: 1.4301/304
- Wall mounting kit: 1.4301/304
- Measuring tube: 1.4301/304
- Lining material: PFA (USP Class VI; FDA 21 CFR 177.1550; 3A)
- Ground rings: 1.4435/316L (optional: Alloy C-22)
- Electrodes: 1.4435/316L (optional: Alloy C-22)
- Seals:
  – DN 2 to 25 (1/12 to 1"): O-Ring (EPDM, Viton, Kalrez), moulded seal (EPDM*, Viton)
  – DN 40 to 100 (1½ to 4"): moulded seal (EPDM*)

  * = USP Class VI; FDA 21 CFR 177.2600; 3A

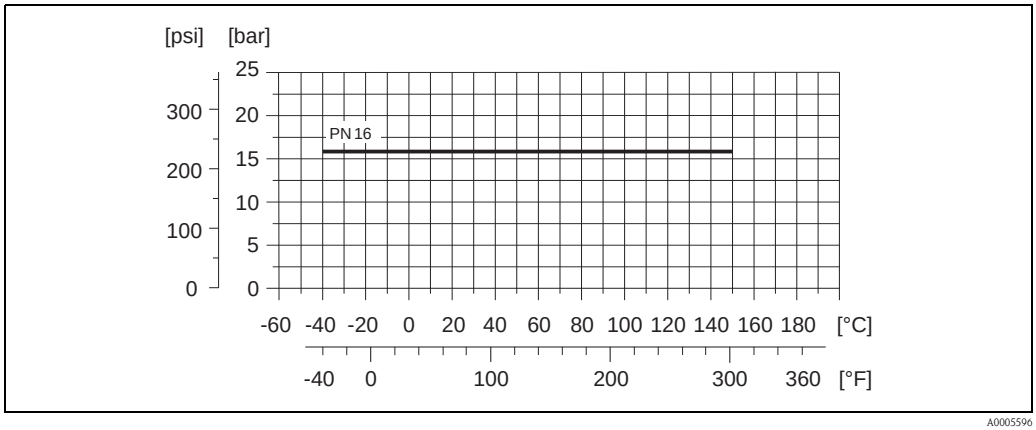
Material load diagram

Caution!
The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature.

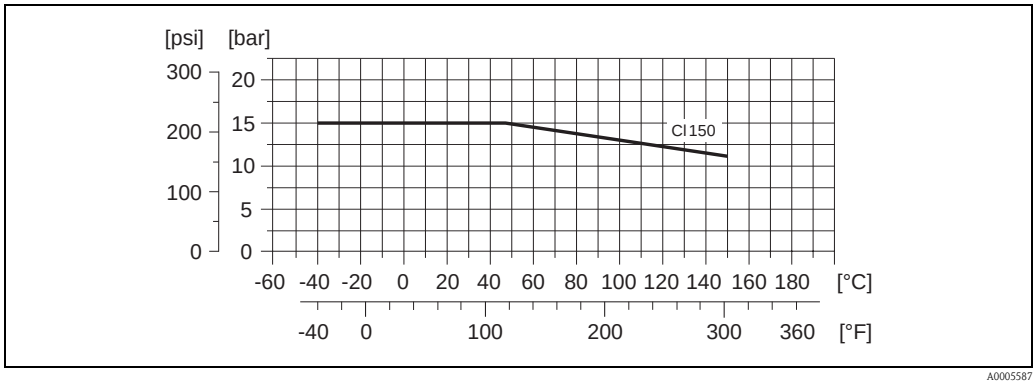
Flange connection to EN 1092-1 (DIN 2501), threaded joint to ISO 228 / DIN 2999 / NPT
Material: 1.4404 / 316L (with O-ring)



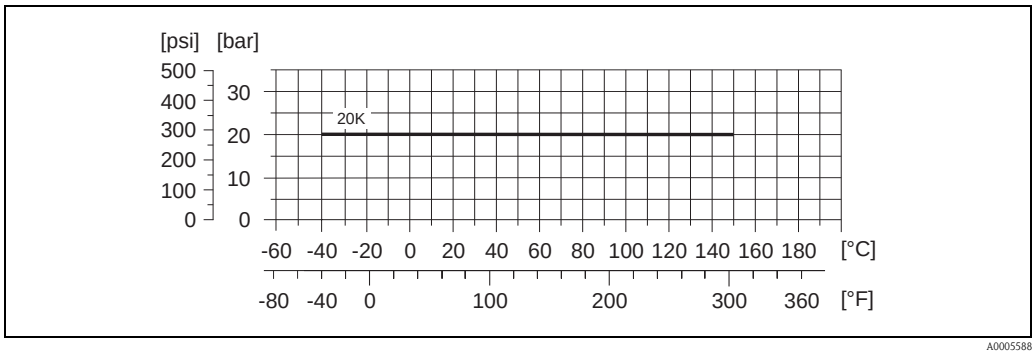
Weld socket to DIN 11850, ODT / SMS; Clamp L 14 AM7;
threaded joint DIN 11851, DIN 11864-1, SMS 1145; flange DIN 11864-2
Material: 1.4404 / 316L (with moulded seal)



Flange connection to ANSI B16.5
Material: 1.4404 / 316L



Flange connection to JIS B2220
Material: 1.4404 / 316L



Fitted electrodes

Measuring electrodes, reference electrodes and empty pipe detection electrodes
- Available as standard with: 1.4435/316L, Alloy C-22
- DN 2 to 15 (1/12 to ½"): without empty pipe detection electrode

Process connections

With O-ring:
- Flange EN (DIN), ANSI, JIS
- External thread

With gasket seals:
- Weld sockets DIN 11850, ODT/SMS
- TriClamp L14 AM7
- Threaded joint DIN 11851, DIN 11864-1, SMS 1145
- Flange DIN 11864-2

Surface roughness

(All data refer to parts in contact with medium)
- Measuring tube lining with PFA: ≤ 0.4 µm (15 µin)
- Electrodes with 1.4435/316L, Alloy C-22: ≤ 0.3 to 0.5 µm (12 to 20 µin)
- Process connection made of stainless-steel: ≤ 0.8 µm (31 µin)

Human interface

Display elements

- Liquid crystal display: unilluminated, two-line, 16 characters per line
- Display (operating mode) preconfigured: volume flow and totalizer status
- 1 totalizer

Operating elements

Local operation via three keys (⊟, ⊞, Ⓔ)

Remote operation

Operation via HART protocol and FieldCare

Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-tick mark

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

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Sanitary compatibility

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

Other standards and guidelines

- EN 60529
  Degrees of protection by housing (IP code)
- EN 61010
  Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- IEC/EN 61326
  "Emission in accordance with requirements for Class A".
  Electromagnetic compatibility (EMC requirements)
- ANSI/ISA-S82.01
  Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements Pollution degree 2, Installation Category II.
- CAN/CSA-C22.2 No. 1010.1-92
  Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category II

Pressure measuring device approval

The measuring devices can be ordered with or without PED (Pressure Equipment Directive). If a device with PED is required, this must be ordered explicitly. For devices with nominal diameters less than or equal to DN 25 (1"), this is neither possible nor necessary.

- With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.
- Devices with this identification (with PED) are suitable for the following types of fluid:
  – Fluids of Group 1 and 2 with a steam pressure of greater or less than 0.5 bar (7.3 psi)
  – Unstable gases
- Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.

Ordering information

Your Endress+Hauser service organization can provide detailed ordering information and information on the order codes on request.

Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the order codes in question.

Documentation

- System Information Promag 10 (SI042D/06)
- Operating Instructions Promag 10 (BA082D/06)

Registered trademarks

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Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

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FieldCare®, Fieldcheck®, Applicator®
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