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Temperatur



Flüssigkeits-  
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Registrierung



Systeme  
Komponenten



Services



Solutions

## Technical Information

# Proline Promag 10W

## Electromagnetic Flow Measuring System

Flow measurement of liquids in water or wastewater applications



### Application

Electromagnetic flowmeter for bidirectional measurement of liquids with a minimum conductivity of  $\geq 50 \mu\text{S}/\text{cm}$ :

- Drinking water
- Wastewater
- Sewage sludge
- Flow measurement up to 110,000 m<sup>3</sup>/h
- Fluid temperature up to +80 °C
- Process pressures up to 40 bar
- Lengths in accordance with DVGW/ISO

Application-specific lining materials:

- Polyurethane and hard rubber

Lined measuring pipes with materials approved for drinking water:

- KTW, WRAS, NSF, ACS, etc.

### 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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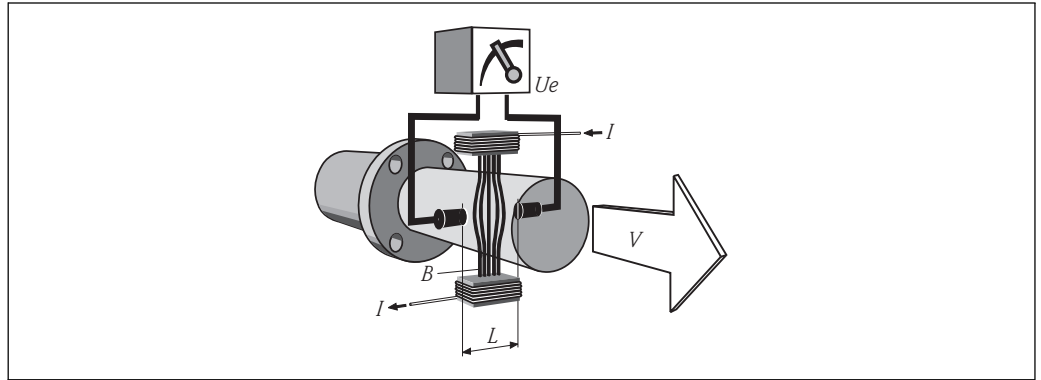
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## Function and system design

### 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.



$$U_e = B \cdot L \cdot v$$

$$Q = A \cdot v$$

- U<sub>e</sub>* Induced voltage  
*B* Magnetic induction (magnetic field)  
*L* Electrode spacing  
*v* Flow velocity  
*Q* Volume flow  
*A* Pipe cross-section  
*I* Current strength

### Measuring system

The measuring system consists of a transmitter and a sensor.

Two versions are available:

- Compact version: Transmitter and sensor form a mechanical unit.
- Remote version: Sensor is mounted separate from the transmitter.

Transmitter:

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

Sensor:

- Promag W (DN 25...2000)

## Input

### Measured variable

Flow velocity (proportional to induced voltage)

### Measuring ranges

Measuring ranges for liquids  
 Typically  $v = 0.01 \dots 10$  m/s with the specified accuracy

### Operable flow range

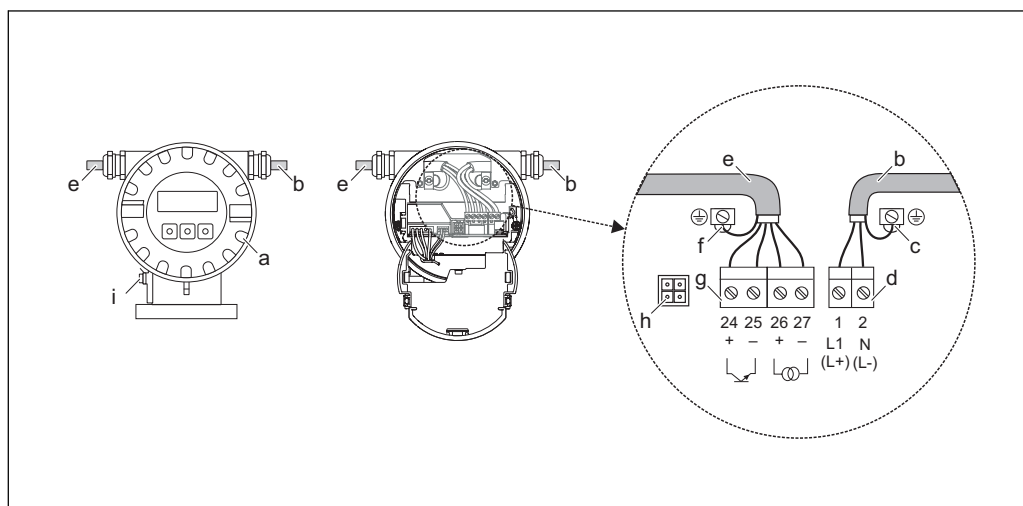
Over 1000 : 1

## Output

<b>Output signal</b>	<p><b>Current output</b></p> <ul style="list-style-type: none"> <li>■ Galvanically isolated</li> <li>■ Active: 4...20 mA, <math>R_L &lt; 700 \Omega</math> (for HART: <math>R_L \geq 250 \Omega</math>)</li> <li>■ Full scale value adjustable</li> <li>■ Temperature coefficient: typ. 2 <math>\mu\text{A}/^\circ\text{C}</math>, resolution: 1.5 <math>\mu\text{A}</math></li> </ul> <p><b>Pulse/status output</b></p> <ul style="list-style-type: none"> <li>■ Galvanically isolated</li> <li>■ Passive: 30 V DC / 250 mA</li> <li>■ Open collector</li> <li>■ Can be configured as: <ul style="list-style-type: none"> <li>– Pulse output: Pulse value and pulse polarity can be selected, max. pulse width adjustable (5...2000 ms), pulse frequency max. 100 Hz</li> <li>– Status output: for example, can be configured for error messages, empty pipe detection, flow recognition, limit value</li> </ul> </li> </ul>
<b>Signal on alarm</b>	<ul style="list-style-type: none"> <li>■ Current output → Failsafe mode can be selected</li> <li>■ Pulse output → Failsafe mode can be selected</li> <li>■ Status output → “Not conductive” in the event of fault or power supply failure</li> </ul>
<b>Load</b>	See “output signal”
<b>Low flow cut off</b>	Low flow cut off → Switch-on point can be selected as required.
<b>Galvanic isolation</b>	All circuits for inputs, outputs and power supply are galvanically isolated from each other.

## Power supply

### Electrical connection, measuring unit



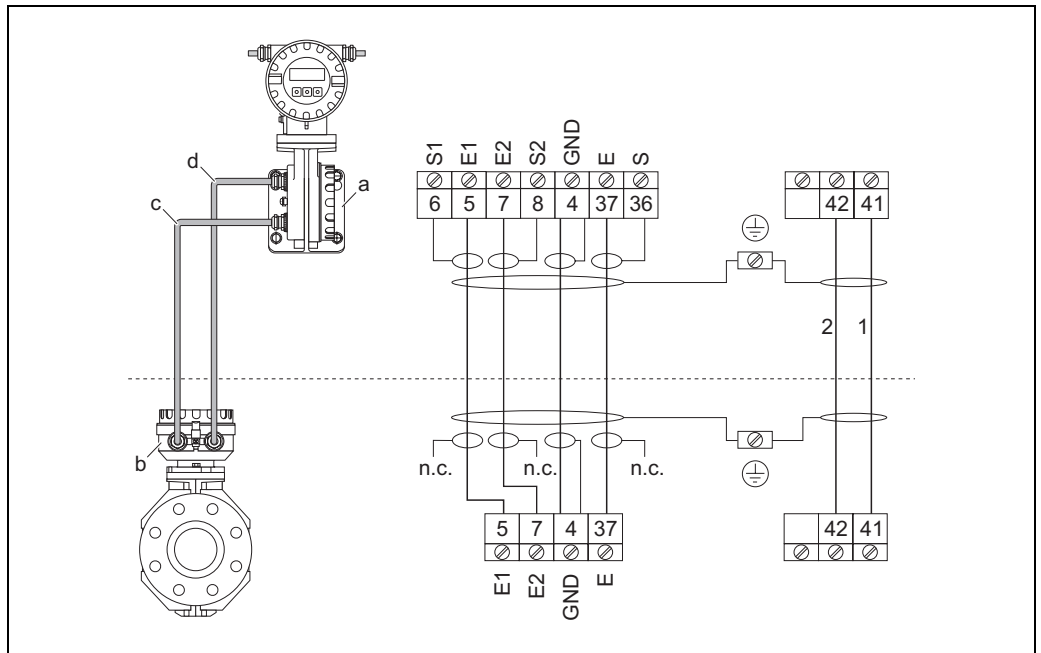
Connecting the transmitter (aluminum field housing), cable cross-section max. 2.5 mm<sup>2</sup>

- 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	See "output signal"				See "Supply voltage"	

**Electrical connection, remote version**



*Connecting the remote version*

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

*Cable colors:*

*terminal numbers 5/6 = brown; 7/8 = white; 4 = green; 37/36 = yellow*

**Supply voltage (power supply)**

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

**Cable entry**

Power supply and signal cables (inputs/outputs):

- Cable entry M20 x 1.5 (8...12 mm)
- Thread for cable entries, 1/2" NPT, G 1/2"

Connecting cable for remote version:

- Cable entry M20 x 1.5 (8...12 mm)
- Thread for cable entries, 1/2" NPT, G 1/2"

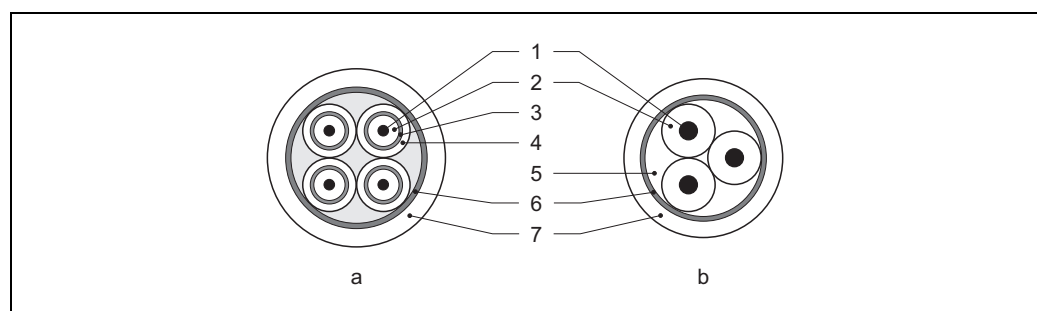
**Remote version cable specifications**

## Coil cable

- 2 x 0.75 mm<sup>2</sup> PVC cable with common, braided copper shield (Ø ~ 7 mm)
- Conductor resistance: ≤ 37 Ω/km
- Capacitance core/core, shield grounded: ≤ 120 pF/m
- Operating temperature: -20...+80 °C
- Cable cross-section: max. 2.5 mm<sup>2</sup>

## Signal cable

- 3 x 0.38 mm<sup>2</sup> PVC cable with common, braided copper shield (Ø ~ 7 mm) and individual shielded cores
- With empty pipe detection (EPD): 4 x 0.38 mm<sup>2</sup> PVC cable with common, braided copper shield (Ø ~ 7 mm) and individual shielded cores
- Conductor resistance: ≤ 50 Ω/km
- Capacitance core/shield: ≤ 420 pF/m
- Operating temperature: -20...+80 °C
- Cable cross-section: max. 2.5 mm<sup>2</sup>



- 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 EN 61326/A1 (IEC 1326).

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

## Switch-on current:

- 250 V AC → max 16 A (< 5 ms)
- 28 V AC → max. 5.5 A (< 5 ms)
- 24 V DC → max. 3.3 A (< 5 ms)

**Power supply failure**

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

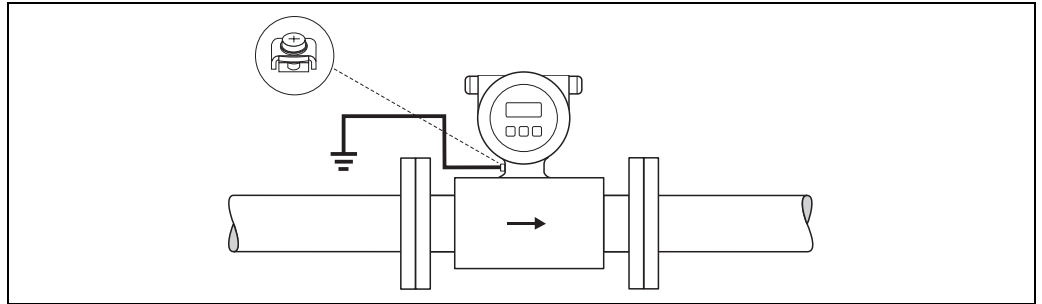
**Potential equalization**

**Standard**

Perfect measurement can only be guaranteed if the fluid and sensor are on the same electric potential. Most Promag sensors have a built-in reference electrode as standard which guarantees the necessary connection. As a result, the use of ground disks or other measures is generally not required.

Note!

When installing in metallic pipes, we recommend you connect the ground terminal of the transmitter housing with the piping. Also, observe company-internal grounding guidelines.



*Potential equalization via the ground terminal of the transmitter*

Caution!

For sensors without reference electrodes or without metallic process connections, potential equalization must be carried out as described in the following special cases. These special measures apply especially where normal grounding cannot be guaranteed or excessively strong equalizing currents are expected.

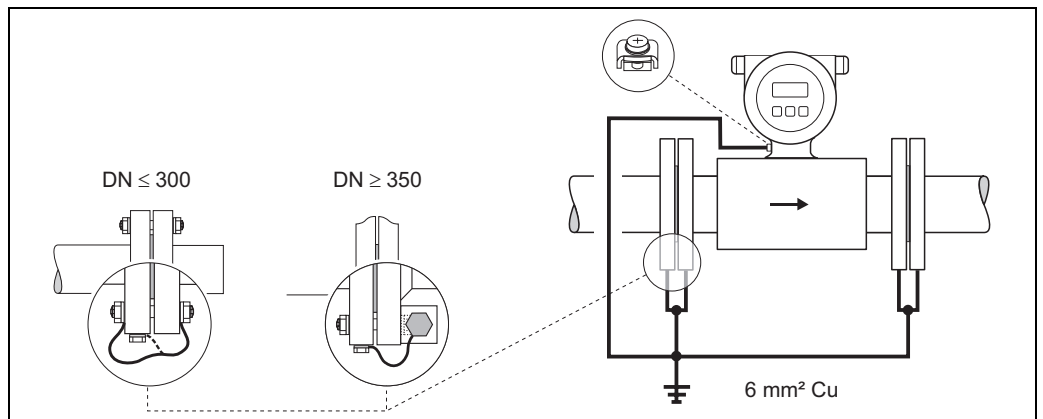
**Metallic, not grounded piping**

To prevent disturbing influences on the measurement, we recommend both sensor flanges be connected to the pipe flange via a ground cable and grounded. The transmitter or sensor terminal compartment must be set to ground potential via the ground terminal provided (see the diagram below).

Note!

The ground cable required for the flange-to-flange connection can be ordered separately from Endress+Hauser as an accessory :

- DN ≤ 300: the ground cable is mounted directly on the conductive flange coating with the flange screws.
- DN ≥ 350: the ground cable is mounted directly on the transportation metal support.



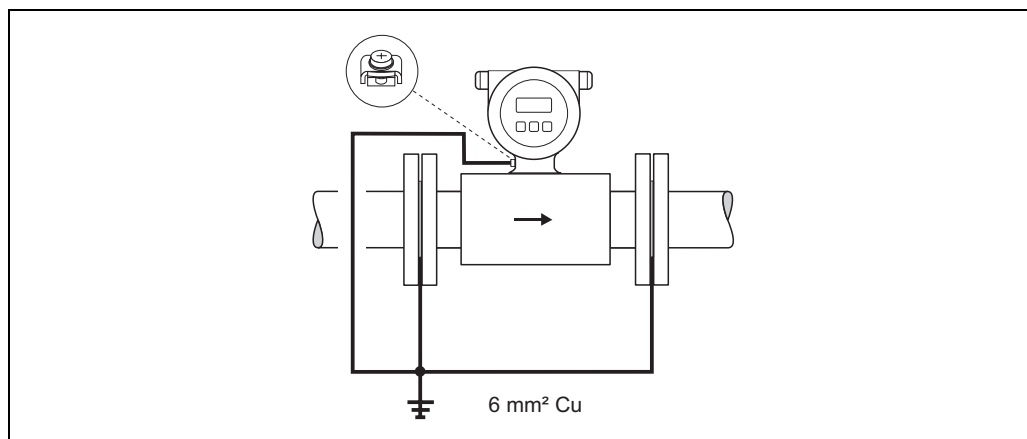
*Potential equalization in the case of equalization currents in metallic, not grounded piping*

### Plastic pipelines or pipelines with insulating lining

Normally, potential equalization takes place via the reference electrodes in the measuring tube. However, in exceptional circumstances, large equalizing currents can flow via the reference electrodes due to the grounding concept of a plant. This can destroy the sensor due to the electrochemical reduction of the electrodes, for example. In such instances, e.g. in the case of fiberglass or PVC pipelines, we recommend the additional use of ground disks for potential equalization.

Caution!

- Risk of damage by electrochemical corrosion. Please note the electrochemical series if ground disks and measuring electrodes are made of different material.
- Also, observe company-internal grounding guidelines.

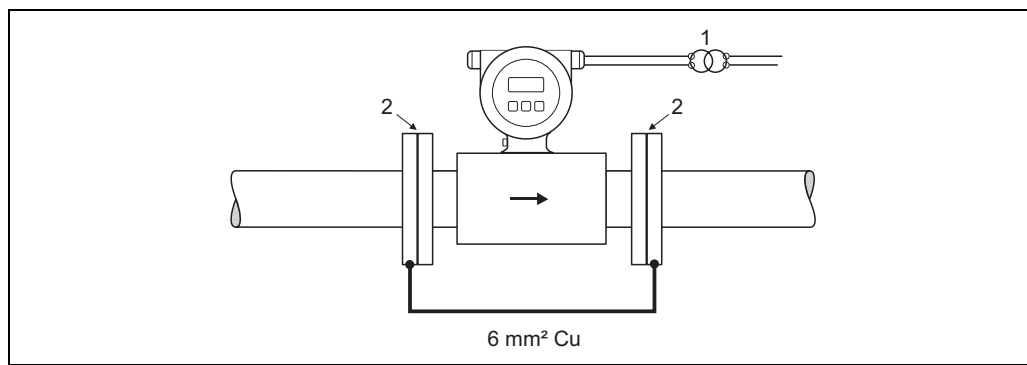


Potential equalization/ground disks for plastic or lined pipes

### Pipe with cathodic protective units

In such instances, the device is to be installed potential-free in the piping:

- During installation, ensure that the sections of the piping are electrically connected with one another (copper wire, 6 mm<sup>2</sup>).
- Make sure that no conductive connection to the device originates from the mounting material used and that the mounting material withstands the torques used during installation.
- Please also note the applicable regulations regarding potential-free installation.



Potential equalization and cathodic protection

- 1 Power supply isolation transformer
- 2 Electrically isolated



## Performance characteristics

### Reference operating conditions

As per DIN EN 29104 and VDI/VDE 2641:

- Fluid temperature:  $+28\text{ °C} \pm 2\text{ K}$
- Ambient temperature:  $+22\text{ °C} \pm 2\text{ K}$
- Warm-up period: 30 minutes

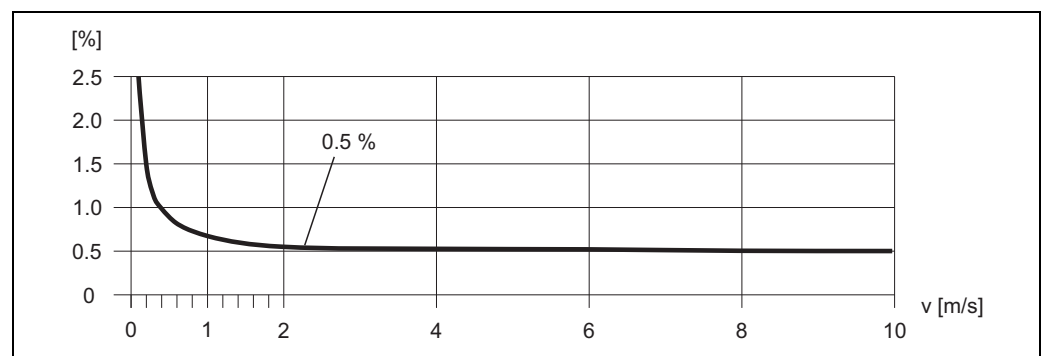
Installation:

- Inlet run  $> 10 \times \text{DN}$
- Outlet run  $> 5 \times \text{DN}$
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

### Maximum measured error

- Current output: also typically  $\pm 5\ \mu\text{A}$
- Pulse output:  $\pm 0.5\%$  o.r.  $\pm 2\text{ mm/s}$  (o.r. = of reading)

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



Max. measured error in % of reading

### Repeatability

Max.  $\pm 0.2\%$  o.r.  $\pm 2\text{ mm/s}$  (o.r. = of reading)

## Operating conditions: Installations

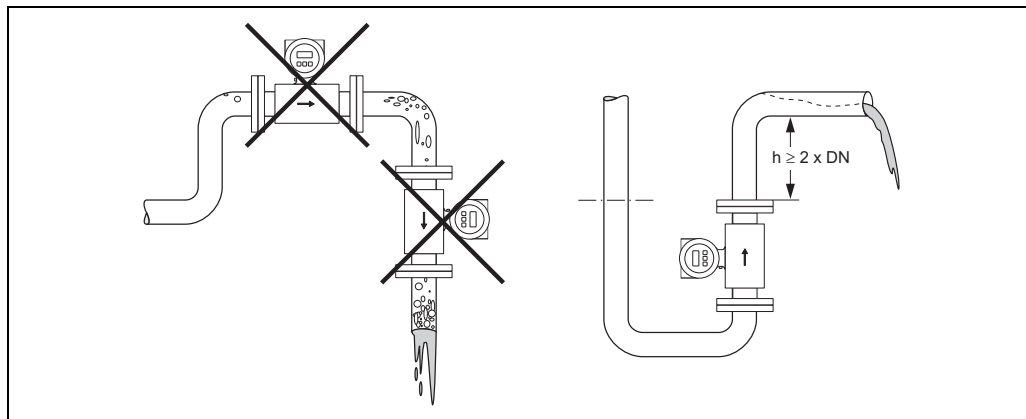
### Installation instructions

#### 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

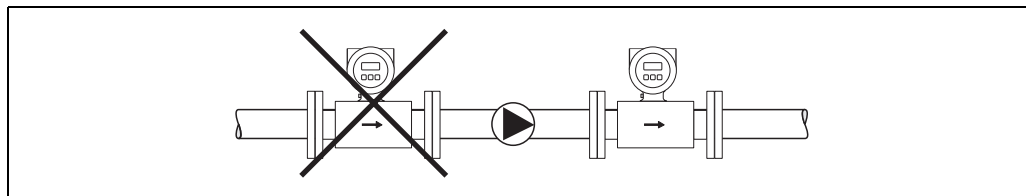
#### Installation of pumps

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 can be found in the “Pressure tightness” section in the “Operating conditions: Process” chapter.

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 can be found in the “Shock and vibration resistance” section in the “Operating conditions: Environment” chapter.

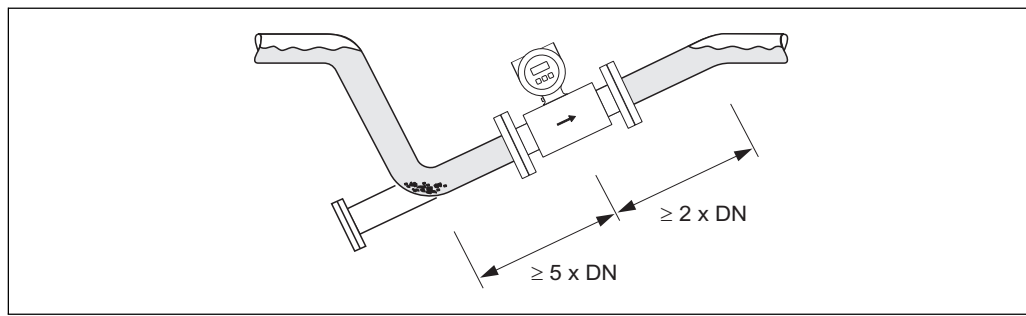


Installation of pumps

#### Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.

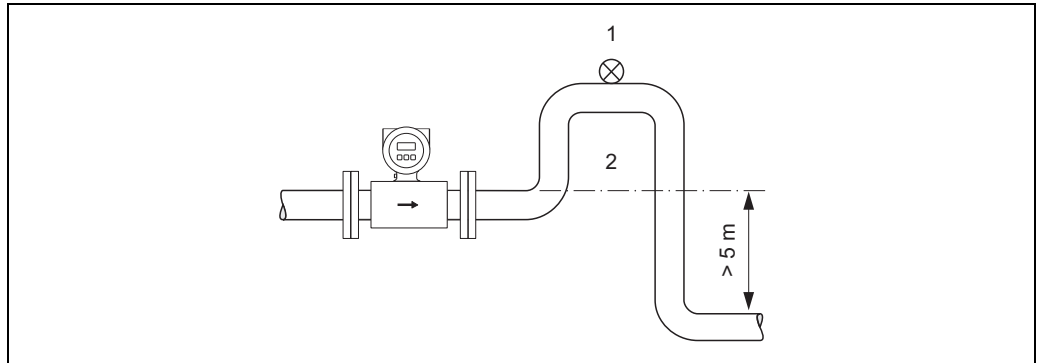
The empty pipe detection function (EPD) provides additional security in detecting empty or partially filled pipes.



Installation with partially filled pipes

### Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes longer than 5 meters. 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 can be found in the “Pressure tightness” section in the “Operating conditions: Process” chapter.



*Installation measures for vertical pipes*

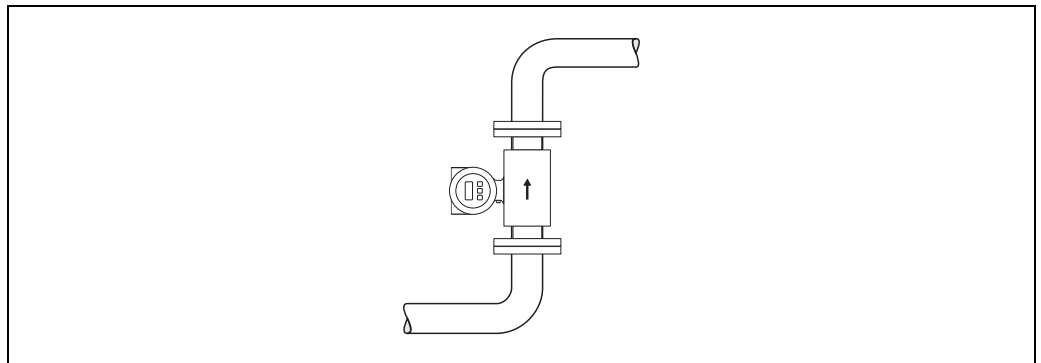
- 1 Vent valve
- 2 Pipe siphon

### Orientation

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

### Vertical orientation

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



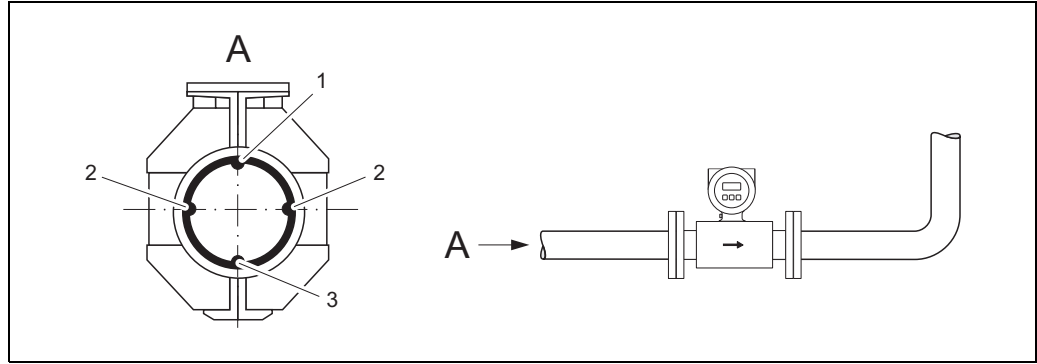
*Vertical orientation*

### Horizontal orientation

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

#### Caution!

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



#### Horizontal orientation

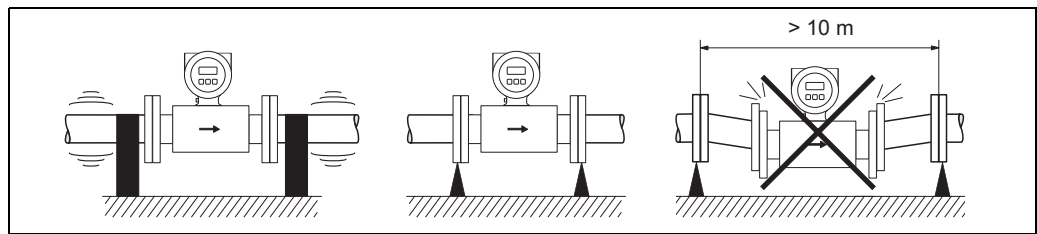
- 1 EPD electrode for empty pipe detection
- 2 Measuring electrodes for signal detection
- 3 Reference electrode for potential equalization

### Vibrations

Secure the piping and the sensor if vibration is severe.

#### Caution!

If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on the permitted shock and vibration resistance can be found in the "Shock and vibration resistance" section in the "Operating conditions: Environment" chapter.



#### Measures to prevent vibration of the measuring device

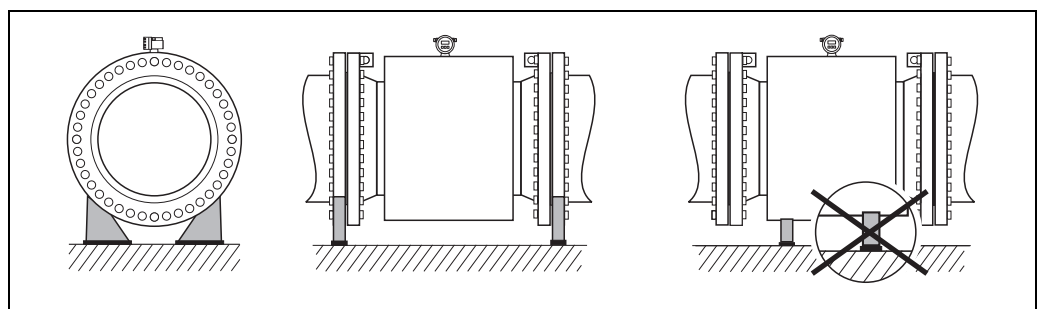
### Foundation, supports

For nominal diameters  $DN \geq 350$ , mount the sensor on a foundation of adequate load-bearing strength.

#### Caution!

Risk of damage!

Do not support the weight of the sensor at the metal casing. The casing would buckle and damage the internal magnetic coils.



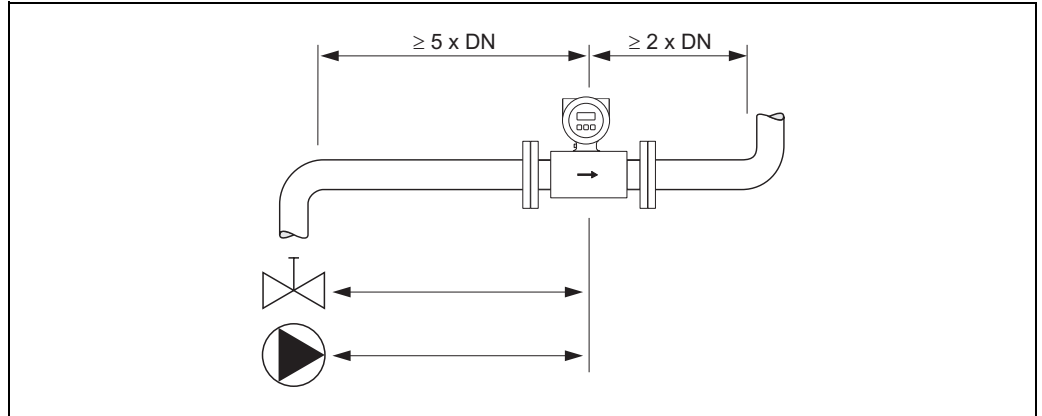
#### Support for large nominal diameters ( $DN \geq 350$ )

**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:  $\geq 5 \times \text{DN}$
- Outlet run:  $\geq 2 \times \text{DN}$



*Inlet and outlet run*

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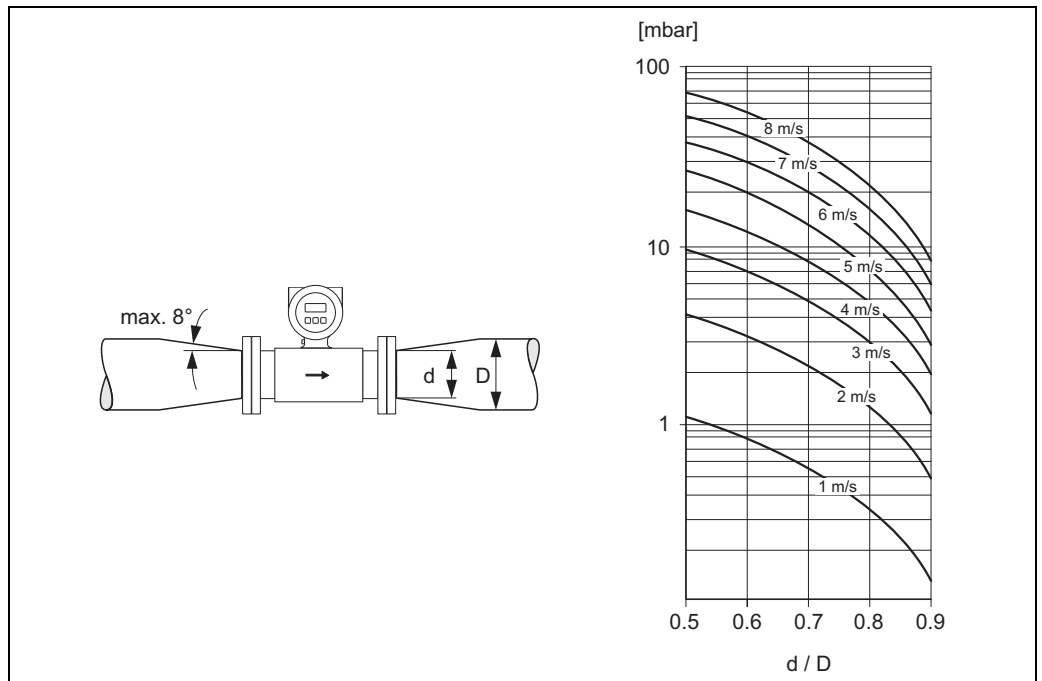
**Adapters**

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

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.



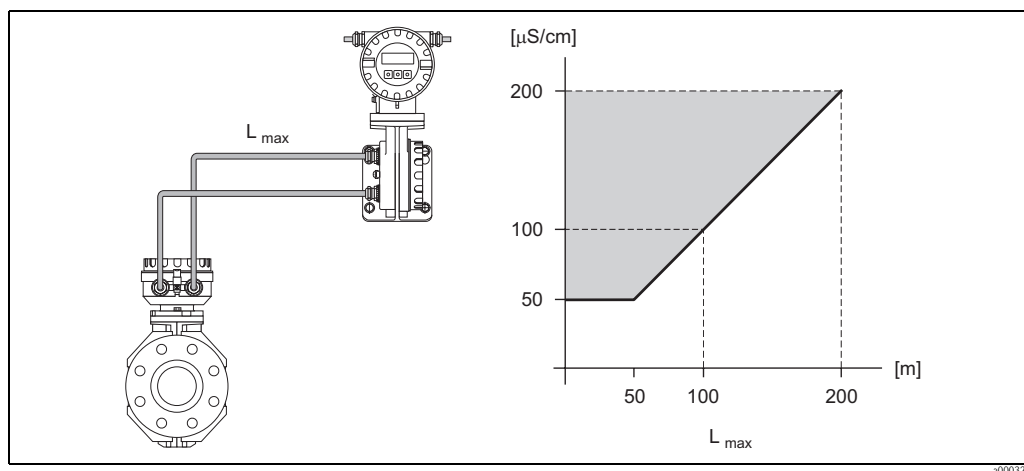
*Pressure loss due to adapters*

a0003213

**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  $50 \mu\text{S}/\text{cm}$  is needed for all fluids.
- When the empty pipe detection function is switched on (EPD), the maximum connecting cable length is 10 m.



*Permitted length of connecting cable for remote version*

*Area marked in gray = permitted range;  $L_{max}$  = length of connecting cable in [m]; fluid conductivity in  $[\mu\text{S}/\text{cm}]$*

## Operating conditions: Environment

---

### Ambient temperature range

- Sensor: -20...+60 °C
- Transmitter: -10...+60 °C

#### Caution!

The permitted temperature range of the measuring tube lining may not be undershot or overshoot (→ “Operating conditions: Process” → “Medium temperature range”).

Please note the following points:

- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
  - The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.
- 

### Storage temperature

- The temperature range for storing the device corresponds to the permitted ambient temperature range of the transmitter and the sensor (see “Ambient temperature range”).
  - 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
  - Optional: IP 68 (NEMA 6P) for sensor for remote version
- 

### Shock and vibration resistance

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

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### Electromagnetic compatibility (EMC)

- As per EN 61326
  - Emission: to limit value for industry EN 55011
-

## Operating conditions: Process

### Medium temperature range

The permitted temperature depends on the measuring tube lining:

- 0...+80 °C for hard rubber (DN 65...2000)
- -20...+50 °C for polyurethane (DN 25...1000)

### Conductivity

The minimum conductivity is:  $\geq 50 \mu\text{S}/\text{cm}$

Note!

In the remote version, the necessary minimum conductivity also depends on the cable length  
(→ "Operating conditions: Installation" → "Length of connecting cable").

### Medium pressure range (nominal pressure)

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 1200...2000)
  - PN 10 (DN 200...2000)
  - PN 16 (DN 65...2000)
  - PN 25 (DN 200...1000)
  - PN 40 (DN 25...150)
- ANSI B 16.5
  - Class 150 (DN 1"...24")
  - Class 300 (DN 1"...6")
- AWWA
  - Class D (DN 28"...78")
- JIS B2238
  - 10 K (DN 50...300)
  - 20 K (DN 25...300)
- AS 2129
  - Table E (DN 80, 100, 150...400, 500, 600)
- AS 4087
  - Cl. 14 (DN 80, 100, 150...400, 500, 600)

### Pressure tightness

Diameter		Measuring tube Material Lining	Pressure tightness, measuring tube lining						
[mm]	[inch]		Limit values for the absolute pressure [mbar] at fluid temperatures:						
			25 °C	70 °C	80 °C	100 °C	130 °C	150 °C	180 °C
25...1000	1...40"	Polyurethane	0	0	-	-	-	-	-
65...2000	3...78"	Hard rubber	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...3 m/s. The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:

- $v < 2$  m/s: for abrasive fluids such as potter's clay, lime milk, ore slurry, etc.
- $v > 2$  m/s: for fluids causing build-up such as wastewater sludges, etc.

Flow characteristic values (SI units)					
Diameter		Recommended flow Min./max. full scale value ( $v \sim 0.3$ or $10$ m/s)	Factory settings		
[mm]	[inch]		Full scale value Current output ( $v \sim 2.5$ m/s)	Pulse value ( $\sim 2$ pulses/s)	Low flow cut off ( $v \sim 0.04$ m/s)
25	1"	9...300 dm <sup>3</sup> /min	75 dm <sup>3</sup> /min	0.50 dm <sup>3</sup>	1 dm <sup>3</sup> /min
32	1 ¼"	15...500 dm <sup>3</sup> /min	125 dm <sup>3</sup> /min	1.00 dm <sup>3</sup>	2 dm <sup>3</sup> /min
40	1 ½"	25...700 dm <sup>3</sup> /min	200 dm <sup>3</sup> /min	1.50 dm <sup>3</sup>	3 dm <sup>3</sup> /min
50	2"	35...1100 dm <sup>3</sup> /min	300 dm <sup>3</sup> /min	2.50 dm <sup>3</sup>	5 dm <sup>3</sup> /min
65	2 ½"	60...2000 dm <sup>3</sup> /min	500 dm <sup>3</sup> /min	5.00 dm <sup>3</sup>	8 dm <sup>3</sup> /min
80	3"	90...3000 dm <sup>3</sup> /min	750 dm <sup>3</sup> /min	5.00 dm <sup>3</sup>	12 dm <sup>3</sup> /min
100	4"	145...4700 dm <sup>3</sup> /min	1200 dm <sup>3</sup> /min	10.00 dm <sup>3</sup>	20 dm <sup>3</sup> /min
125	5"	220...7500 dm <sup>3</sup> /min	1850 dm <sup>3</sup> /min	15.00 dm <sup>3</sup>	30 dm <sup>3</sup> /min
150	6"	20...600 m <sup>3</sup> /h	150 m <sup>3</sup> /h	0.025 m <sup>3</sup>	2.5 m <sup>3</sup> /h
200	8"	35...1100 m <sup>3</sup> /h	300 m <sup>3</sup> /h	0.05 m <sup>3</sup>	5.0 m <sup>3</sup> /h
250	10"	55...1700 m <sup>3</sup> /h	500 m <sup>3</sup> /h	0.05 m <sup>3</sup>	7.5 m <sup>3</sup> /h
300	12"	80...2400 m <sup>3</sup> /h	750 m <sup>3</sup> /h	0.10 m <sup>3</sup>	10 m <sup>3</sup> /h
350	14"	110...3300 m <sup>3</sup> /h	1000 m <sup>3</sup> /h	0.10 m <sup>3</sup>	15 m <sup>3</sup> /h
400	16"	140...4200 m <sup>3</sup> /h	1200 m <sup>3</sup> /h	0.15 m <sup>3</sup>	20 m <sup>3</sup> /h
450	18"	180...5400 m <sup>3</sup> /h	1500 m <sup>3</sup> /h	0.25 m <sup>3</sup>	25 m <sup>3</sup> /h
500	20"	220...6600 m <sup>3</sup> /h	2000 m <sup>3</sup> /h	0.25 m <sup>3</sup>	30 m <sup>3</sup> /h
600	24"	310...9600 m <sup>3</sup> /h	2500 m <sup>3</sup> /h	0.30 m <sup>3</sup>	40 m <sup>3</sup> /h
700	28"	420...13500 m <sup>3</sup> /h	3500 m <sup>3</sup> /h	0.50 m <sup>3</sup>	50 m <sup>3</sup> /h
–	30"	480...15000 m <sup>3</sup> /h	4000 m <sup>3</sup> /h	0.50 m <sup>3</sup>	60 m <sup>3</sup> /h
800	32"	550...18000 m <sup>3</sup> /h	4500 m <sup>3</sup> /h	0.75 m <sup>3</sup>	75 m <sup>3</sup> /h
900	36"	690...22500 m <sup>3</sup> /h	6000 m <sup>3</sup> /h	0.75 m <sup>3</sup>	100 m <sup>3</sup> /h
1000	40"	850...28000 m <sup>3</sup> /h	7000 m <sup>3</sup> /h	1.00 m <sup>3</sup>	125 m <sup>3</sup> /h
–	42"	950...30000 m <sup>3</sup> /h	8000 m <sup>3</sup> /h	1.00 m <sup>3</sup>	125 m <sup>3</sup> /h
1200	48"	1250...40000 m <sup>3</sup> /h	10000 m <sup>3</sup> /h	1.50 m <sup>3</sup>	150 m <sup>3</sup> /h
–	54"	1550...50000 m <sup>3</sup> /h	13000 m <sup>3</sup> /h	1.50 m <sup>3</sup>	200 m <sup>3</sup> /h
1400	–	1700...55000 m <sup>3</sup> /h	14000 m <sup>3</sup> /h	2.00 m <sup>3</sup>	225 m <sup>3</sup> /h
–	60"	1950...60000 m <sup>3</sup> /h	16000 m <sup>3</sup> /h	2.00 m <sup>3</sup>	250 m <sup>3</sup> /h
1600	–	2200...70000 m <sup>3</sup> /h	18000 m <sup>3</sup> /h	2.50 m <sup>3</sup>	300 m <sup>3</sup> /h
–	66"	2500...80000 m <sup>3</sup> /h	20500 m <sup>3</sup> /h	2.50 m <sup>3</sup>	325 m <sup>3</sup> /h
1800	72"	2800...90000 m <sup>3</sup> /h	23000 m <sup>3</sup> /h	3.00 m <sup>3</sup>	350 m <sup>3</sup> /h
–	78"	3300...100000 m <sup>3</sup> /h	28500 m <sup>3</sup> /h	3.50 m <sup>3</sup>	450 m <sup>3</sup> /h
2000	–	3400...110000 m <sup>3</sup> /h	28500 m <sup>3</sup> /h	3.50 m <sup>3</sup>	450 m <sup>3</sup> /h

Flow characteristic values (US units)					
Diameter		Recommended flow rate Min./max. full scale value (v ~ 0.3 or 10 m/s)	Factory settings		
[inch]	[mm]		Full scale value Current output (v ~ 2.5 m/s)	Pulse value (~ 2 pulses/s)	Low flow cut off (v ~ 0.04 m/s)
1"	25	2.5...80 gal/min	18 gal/min	0.20 gal	0.25 gal/min
1 ¼"	32	4...130 gal/min	30 gal/min	0.20 gal	0.50 gal/min
1 ½"	40	7...190 gal/min	50 gal/min	0.50 gal	0.75 gal/min
2"	50	10...300 gal/min	75 gal/min	0.50 gal	1.25 gal/min
2 ½"	65	16...500 gal/min	130 gal/min	1 gal	2.0 gal/min
3"	80	24...800 gal/min	200 gal/min	2 gal	2.5 gal/min
4"	100	40...1250 gal/min	300 gal/min	2 gal	4.0 gal/min
5"	125	60...1950 gal/min	450 gal/min	5 gal	7.0 gal/min
6"	150	90...2650 gal/min	600 gal/min	5 gal	12 gal/min
8"	200	155...4850 gal/min	1200 gal/min	10 gal	15 gal/min
10"	250	250...7500 gal/min	1500 gal/min	15 gal	30 gal/min
12"	300	350...10600 gal/min	2400 gal/min	25 gal	45 gal/min
14"	350	500...15000 gal/min	3600 gal/min	30 gal	60 gal/min
16"	400	600...19000 gal/min	4800 gal/min	50 gal	60 gal/min
18"	450	800...24000 gal/min	6000 gal/min	50 gal	90 gal/min
20"	500	1000...30000 gal/min	7500 gal/min	75 gal	120 gal/min
24"	600	1400...44000 gal/min	10500 gal/min	100 gal	180 gal/min
28"	700	1900...60000 gal/min	13500 gal/min	125 gal	210 gal/min
30"	–	2150...67000 gal/min	16500 gal/min	150 gal	270 gal/min
32"	800	2450...80000 gal/min	19500 gal/min	200 gal	300 gal/min
36"	900	3100...100000 gal/min	24000 gal/min	225 gal	360 gal/min
40"	1000	3800...125000 gal/min	30000 gal/min	250 gal	480 gal/min
42"	–	4200...135000 gal/min	33000 gal/min	250 gal	600 gal/min
48"	1200	5500...175000 gal/min	42000 gal/min	400 gal	600 gal/min
54"	–	9...300 Mgal/min	75 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1400	10...340 Mgal/min	85 Mgal/min	0.0005 Mgal	1.3 Mgal/min
60"	–	12...380 Mgal/min	95 Mgal/min	0.0005 Mgal	1.3 Mgal/min
–	1600	13...450 Mgal/min	110 Mgal/min	0.0008 Mgal	1.7 Mgal/min
66"	–	14...500 Mgal/min	120 Mgal/min	0.0008 Mgal	2.2 Mgal/min
72"	1800	16...570 Mgal/min	140 Mgal/min	0.0008 Mgal	2.6 Mgal/min
78"	–	18...650 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min
–	2000	20...700 Mgal/min	175 Mgal/min	0.001 Mgal	3.0 Mgal/min

#### Pressure loss

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

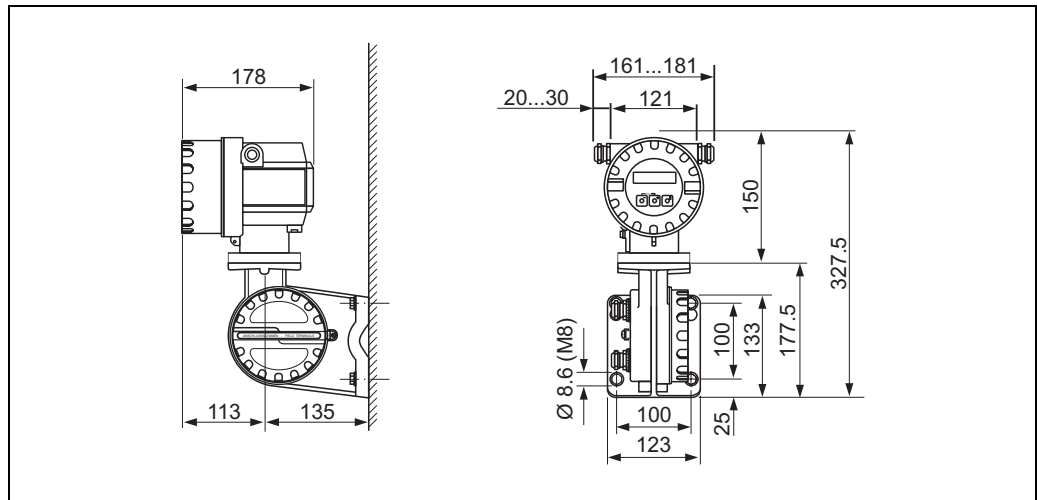
## Mechanical construction

### Measuring tube specifications

Diameter		EN (DIN) [bar]	Pressure rating					Internal diameter	
[mm]	[inch]		AS 2129	AS 4087	ANSI [lbs]	AWWA	JIS	Measuring pipe [mm]	Hard rubber
25	1"	PN 40	–	–	Cl.150	–	20K	–	24
32	–	PN 40	–	–	–	–	20K	–	32
40	1 ½"	PN 40	–	–	Cl.150	–	20K	–	38
50	2"	PN 40	–	–	Cl.150	–	10K	–	50
65	–	PN 16	–	–	–	–	10K	66	66
80	3"	PN 16	Table E	Class 14	Cl.150	–	10K	79	79
100	4"	PN 16	Table E	Class 14	Cl.150	–	10K	102	102
125	–	PN 16	–	–	–	–	10K	127	127
150	6"	PN 16	Table E	Class 14	Cl.150	–	10K	156	156
200	8"	PN 10	Table E	Class 14	Cl.150	–	10K	204	204
250	10"	PN 10	Table E	Class 14	Cl.150	–	10K	258	258
300	12"	PN 10	Table E	Class 14	Cl.150	–	10K	309	309
350	14"	PN 10	Table E	Class 14	Cl.150	–	–	342	342
400	16"	PN 10	Table E	Class 14	Cl.150	–	–	392	392
450	18"	PN 10	–	–	Cl.150	–	–	437	437
500	20"	PN 10	Table E	Class 14	Cl.150	–	–	492	492
600	24"	PN 10	Table E	Class 14	Cl.150	–	–	594	594
700	28"	PN 10	–	–	–	Class D	–	692	692
–	30"	–	–	–	–	Class D	–	742	742
800	32"	PN 10	–	–	–	Class D	–	794	794
900	36"	PN 10	–	–	–	Class D	–	891	891
1000	40"	PN 10	–	–	–	Class D	–	994	994
–	42"	–	–	–	–	Class D	–	1043	1043
1200	48"	PN 6	–	–	–	Class D	–	1197	1197
–	54"	–	–	–	–	Class D	–	1339	1339
1400	–	PN 6	–	–	–	–	–	1402	1402
–	60"	–	–	–	–	Class D	–	1492	1492
1600	–	PN 6	–	–	–	–	–	1600	1600
–	66"	–	–	–	–	Class D	–	1638	1638
1800	72"	PN 6	–	–	–	Class D	–	1786	1786
2000	78"	PN 6	–	–	–	Class D	–	1989	1989

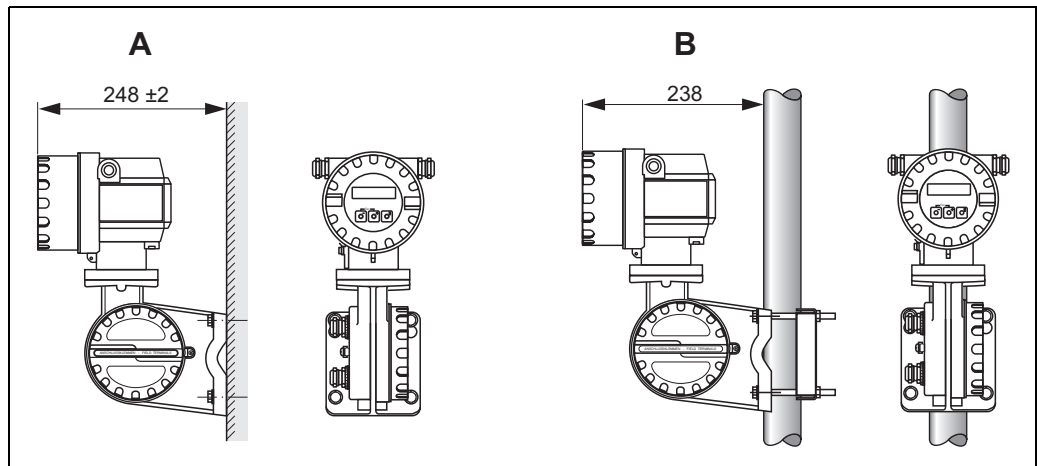
Design, dimensions

Transmitter, remote version



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Transmitter dimensions, remote version

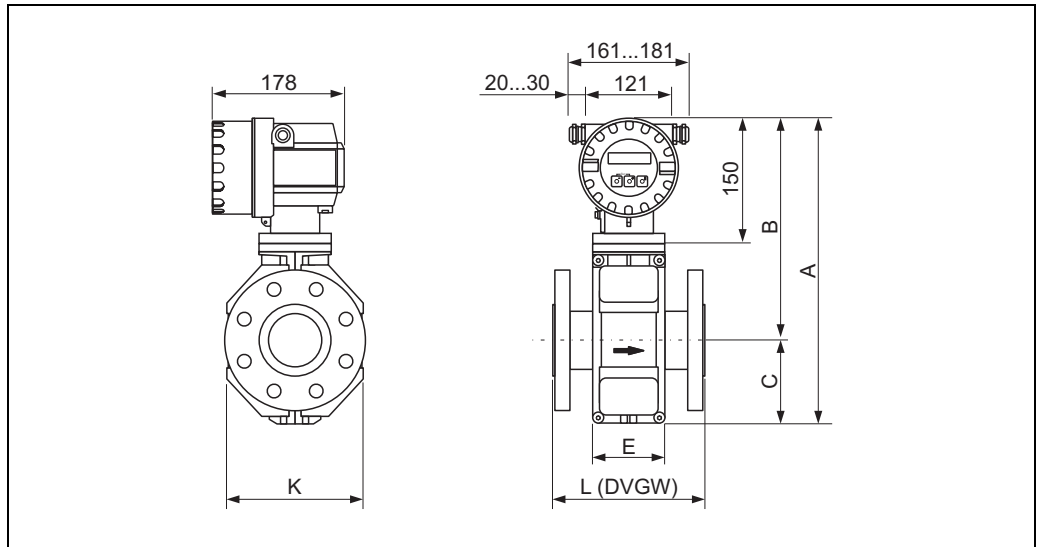


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Transmitter mounting, remote version

- A Direct wall mounting
- B Pipe mounting

Compact version DN ≤ 300



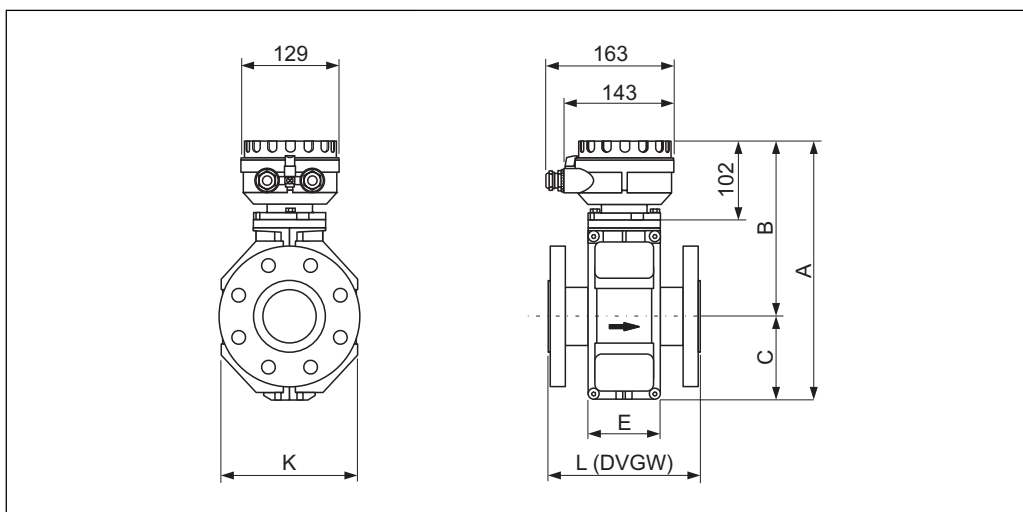
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DN		L	A	B	C	K	E
EN (DIN) / JIS / AS <sup>1)</sup> [mm]	ANSI [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1"	200	341	257	84	120	94
32	-	200	341	257	84	120	94
40	1 ½"	200	341	257	84	120	94
50	2"	200	341	257	84	120	94
65	-	200	391	282	109	180	94
80	3"	200	391	282	109	180	94
100	4"	250	391	282	109	180	94
125	-	250	472	322	150	260	140
150	6"	300	472	322	150	260	140
200	8"	350	527	347	180	324	156
250	10"	450	577	372	205	400	156
300	12"	500	627	397	230	460	166

The length (L) is always the same regardless of the pressure rating selected.

<sup>1)</sup> For flanges to AS, only the nominal diameters DN 80, 100 and 150...300 are available

Remote version DN ≤ 300



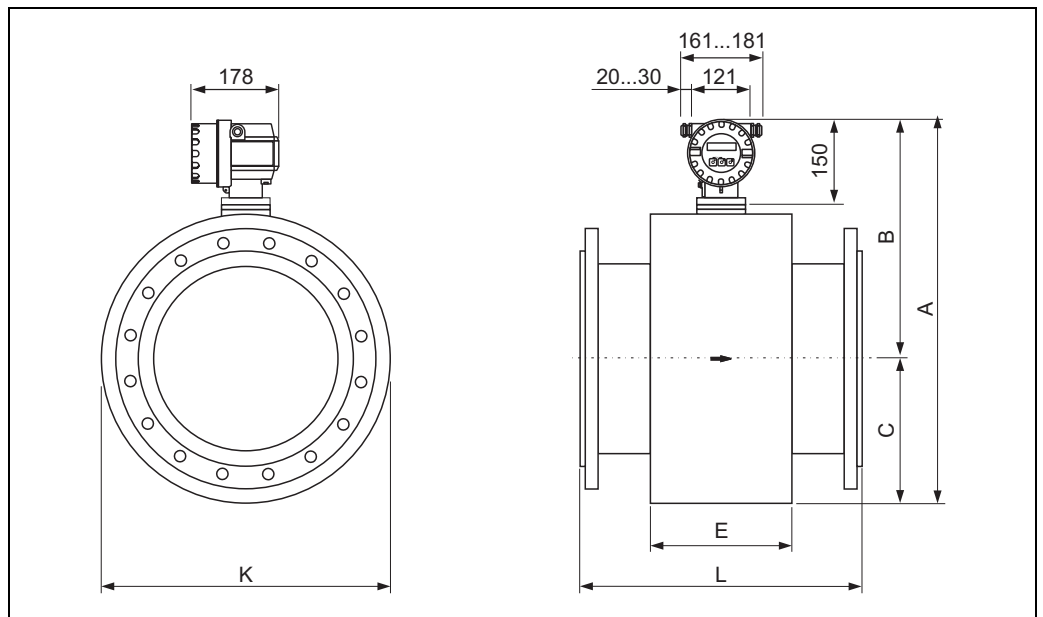
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DN		L	A	B	C	K	E
EN (DIN) / JIS / AS <sup>1)</sup> [mm]	ANSI [inch]	[mm]	[mm]	[mm]	[mm]	[mm]	[mm]
25	1"	200	286	202	84	120	94
32	-	200	286	202	84	120	94
40	1 ½"	200	286	202	84	120	94
50	2"	200	286	202	84	120	94
65	-	200	336	227	109	180	94
80	3"	200	336	227	109	180	94
100	4"	250	336	227	109	180	94
125	-	250	417	267	150	260	140
150	6"	300	417	267	150	260	140
200	8"	350	472	292	180	324	156
250	10"	450	522	317	205	400	156
300	12"	500	572	342	230	460	166

The length (L) is always the same regardless of the pressure rating selected.

<sup>1)</sup> For flanges to AS, only the nominal diameters DN 80, 100 and 150...300 are available.

Compact version DN ≥ 350



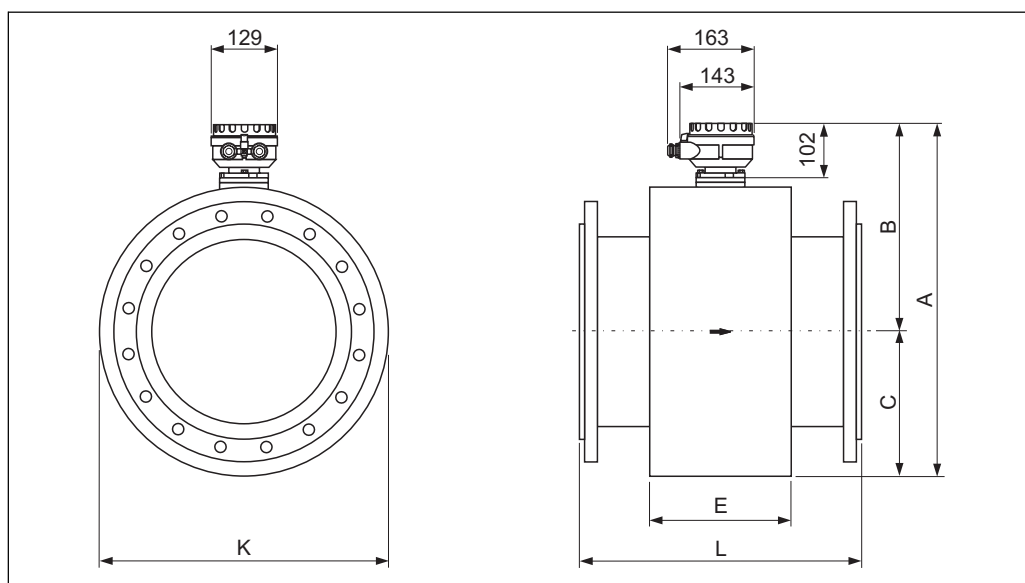
DN		L [mm]	A [mm]	B [mm]	C [mm]	K [mm]	E [mm]
EN (DIN)/AS <sup>1)</sup> [mm]	ANSI/AWWA <sup>2)</sup> [inch]						
350	14"	550	738.5	456.5	282.0	564	276
400	16"	600	790.5	482.5	308.0	616	276
450	18"	650	840.5	507.5	333.0	666	292
500	20"	650	891.5	533.0	358.5	717	292
600	24"	780	995.5	585.0	410.5	821	402
700	28"	910	1198.5	686.5	512.0	1024	589
750	30"	975	1198.5	686.5	512.0	1024	626
800	32"	1040	1241.5	708.5	533.5	1067	647
900	36"	1170	1394.5	784.5	610.0	1220	785
1000	40"	1300	1546.5	860.5	686.0	1372	862
1050	42"	1365	1598.5	886.5	712.0	1424	912
1200	48"	1560	1796.5	985.5	811.0	1622	992
1350	54"	1755	1998.5	1086.5	912.0	1824	1252
1400	56"	1820	2148.5	1161.5	987.0	1974	1252
1500	60"	1950	2196.5	1185.5	1011.0	2022	1392
1600	64"	2080	2286.5	1230.5	1056.0	2112	1482
1650	66"	2145	2360.5	1267.5	1093.0	2186	1482
1800	72"	2340	2550.5	1362.5	1188.0	2376	1632
2000	78"	2600	2650.5	1412.5	1238.0	2476	1732

The length (L) is always the same regardless of the pressure rating selected.

<sup>1)</sup> For flanges to AS, only DN 350, 400, 500 and 600 are available.

<sup>2)</sup> Flanges < DN 700 only to ANSI available, > DN 600 only to AWWA available.

## Remote version DN ≥ 350



DN		L [mm]	A [mm]	B [mm]	C [mm]	K [mm]	E [mm]
EN (DIN)/AS <sup>1)</sup> [mm]	ANSI/AWWA <sup>2)</sup> [inch]						
350	14"	550	683.5	401.5	282.0	564	276
400	16"	600	735.5	427.5	308.0	616	276
450	18"	650	785.5	452.5	333.0	666	292
500	20"	650	836.5	478.0	358.5	717	292
600	24"	780	940.5	530.0	410.5	821	402
700	28"	910	1143.5	631.5	512.0	1024	589
750	30"	975	1143.5	631.5	512.0	1024	626
800	32"	1040	1186.5	653.0	533.5	1067	647
900	36"	1170	1339.5	729.5	610.0	1220	785
1000	40"	1300	1491.5	805.5	686.0	1372	862
1050	42"	1365	1543.5	831.5	712.0	1424	912
1200	48"	1560	1741.5	930.5	811.0	1622	992
1350	54"	1755	1943.5	1031.5	912.0	1824	1252
1400	56"	1820	2093.5	1106.5	987.0	1974	1252
1500	60"	1950	2141.5	1130.5	1011.0	2022	1392
1600	64"	2080	2231.5	1175.5	1056.0	2112	1482
1650	66"	2145	2305.5	1212.5	1093.0	2186	1482
1800	72"	2340	2495.5	1307.5	1188.0	2376	1632
2000	78"	2600	2595.5	1357.5	1238.0	2476	1732

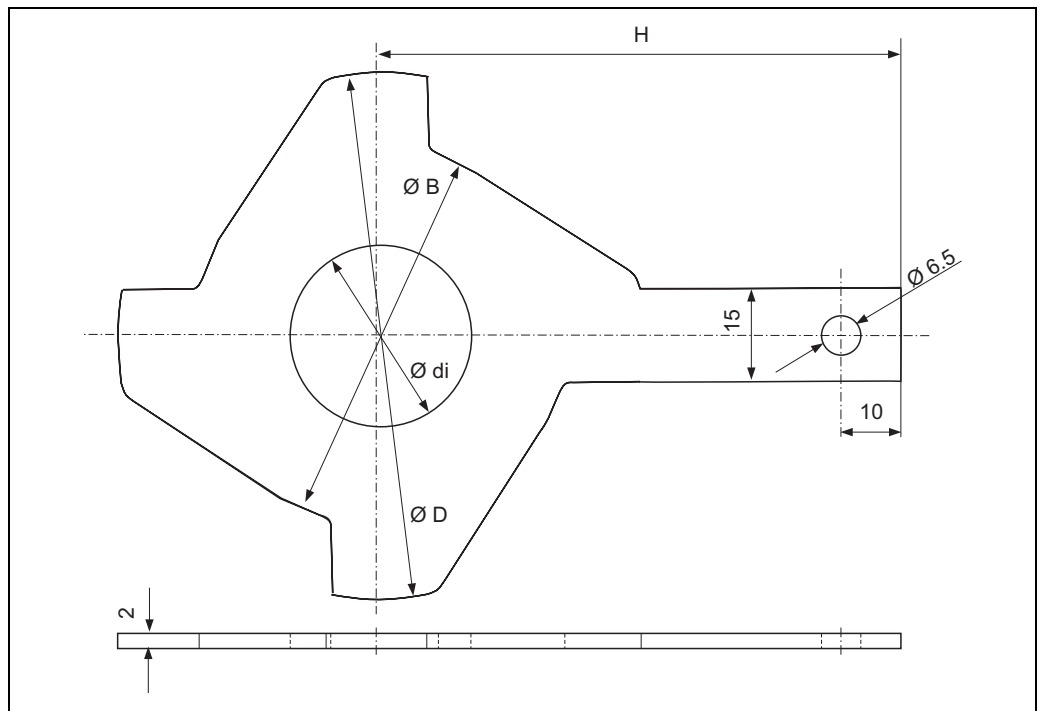
The length (L) is always the same regardless of the pressure rating selected.

<sup>1)</sup> For flanges to AS, only DN 350, 400, 500 and 600 are available.

<sup>2)</sup> Flanges < DN 700 only to ANSI available, > DN 600 only to AWWA available.



Ground disk (DN 25...300)



a0003221

DN <sup>1)</sup>		di	B	D	H
EN (DIN) / JIS / AS <sup>4)</sup> [mm]	ANSI [inch]	[mm]	[mm]	[mm]	[mm]
25	1"	26	62	77.5	87.5
32	-	35	80	87.5	94.5
40	1 ½"	41	82	101	103
50	2"	52	101	115.5	108
65	-	68	121	131.5	118
80	3"	80	131	154.5	135
100	4"	104	156	186.5	153
125	-	130	187	206.5	160
150	6"	158	217	256	184
200	8"	206	267	288	205
250	10"	260	328	359	240
300 <sup>2)</sup>	12" <sup>2)</sup>	312	375	413	273
300 <sup>3)</sup>	12" <sup>3)</sup>	310	375	404	268

<sup>1)</sup> Ground disks can be used for all flange standards/pressure ratings that can be delivered, except for DN 300.

<sup>2)</sup> PN 10/16, Cl. 150

<sup>3)</sup> PN 25, JIS 10K/20K

<sup>4)</sup> For flanges to AS, DN 32, 40, 65 and 125 are not available.

## Weight

Weight data in kg								
Diameter		Compact version			Remote version (without cable)			
		EN (DIN) / AS <sup>1)</sup>	JIS	ANSI / AWWA	Sensor		Transmitter	
[mm]	[inch]				EN (DIN) / AS <sup>1)</sup>	JIS	ANSI / AWWA	Wall housing
25	1"	5.7	5.7	5.7	5.3	5.3	5.3	3.1
32	1 ¼"	6.4	5.7	–	6.0	5.3	–	3.1
40	1 ½"	7.8	6.7	7.8	7.4	6.3	7.4	3.1
50	2"	9.0	7.7	9.0	8.6	7.3	8.6	3.1
65	2 ½"	10.4	9.5	–	10.0	9.1	–	3.1
80	3"	12.4	10.9	12.4	12.0	10.5	12.0	3.1
100	4"	14.4	13.1	14.4	14.0	12.7	14.0	3.1
125	5"	19.9	19.4	–	19.5	19.0	–	3.1
150	6"	23.9	22.9	23.9	23.5	22.5	23.5	3.1
200	8"	43.4	40.3	43.3	43	39.9	43	3.1
250	10"	63.4	67.8	73.4	63	67.4	73	3.1
300	12"	68.4	70.7	108.4	68	70.3	108	3.1
350	14"	113.4	–	172.4	113	–	173	3.1
400	16"	133.4	–	203.4	133	–	203	3.1
450	18"	173.4	–	253.4	173	–	253	3.1
500	20"	173.4	–	283.4	173	–	283	3.1
600	24"	233.4	–	403.4	233	–	403	3.1
700	28"	353.4	–	398.4	353	–	398	3.1
–	30"	–	–	458.4	–	–	458	3.1
800	32"	433.4	–	548.4	433	–	548	3.1
900	36"	573.4	–	798.4	573	–	798	3.1
1000	40"	698.4	–	898.4	698	–	898	3.1
–	42"	–	–	1098.4	–	–	1098	3.1
1200	48"	848.4	–	1398.4	848	–	1398	3.1
–	54"	–	–	2198.4	–	–	2198	3.1
1400	–	1298.4	–	–	1298	–	–	3.1
–	60"	–	–	2698.4	–	–	2698	3.1
1600	–	1698.4	–	–	1698	–	–	3.1
–	66"	–	–	3698.4	–	–	3698	3.1
1800	72"	2198.4	–	4098.4	2198	–	4098	3.1
–	78"	–	–	4598.4	–	–	4598	3.1
2000	–	2798.4	–	–	2798	–	–	3.1

<sup>1)</sup> For flanges to AS, only DN 80, 100, 150...400, 500 and 600 are available.

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

**Material**

- Housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25...300: powder-coated die-cast aluminum
  - DN 350...2000: coated steel (Amerlock 400)
- Measuring tube
  - DN < 350: stainless steel 1.4301 or 1.4306/304L;  
Flange material with Al/Zn protective coating
  - DN > 300: stainless steel 1.4301 or 1.4306/304;  
Flange material with Amerlock 400 coating
- Flanges
  - EN 1092-1 (DIN2501): RSt37-2 (S235JRG2) / C22 / Fe 410W B  
(DN < 350: with Al/Zn protective coating; DN > 300 with Amerlock 400 coating)
  - ANSI: A 105  
(DN < 350: with Al/Zn protective coating; DN > 300 with Amerlock 400 coating)
  - AWWA: 1.0425 (with Amerlock 400 coating)
  - JIS: RSt37-2 (S235JRG2) / HII / 1.0425  
(DN < 350: with Al/Zn protective coating; DN > 300 with Amerlock 400 coating)
  - AS 2129
    - (DN 25, 150, 200, 250, 300, 600) A105 or RSt37-2 (S235JRG2)
    - (DN 50, 80, 100, 350, 400, 500) A105 or St44-2 (S275JR)
  - (DN < 350: with Al/Zn protective coating; DN > 300 with Amerlock 400 coating)
  - AS 4087: A105 or St44-2 (S275JR)  
(DN < 350 with Al/Zn protective coating; DN > 300 with Amerlock 400 coating)
- Ground disks: 1.4435/316L or Alloy C-22
- Electrodes: 1.4435/316L, Alloy C-22
- Seals: to DIN EN 1514-1

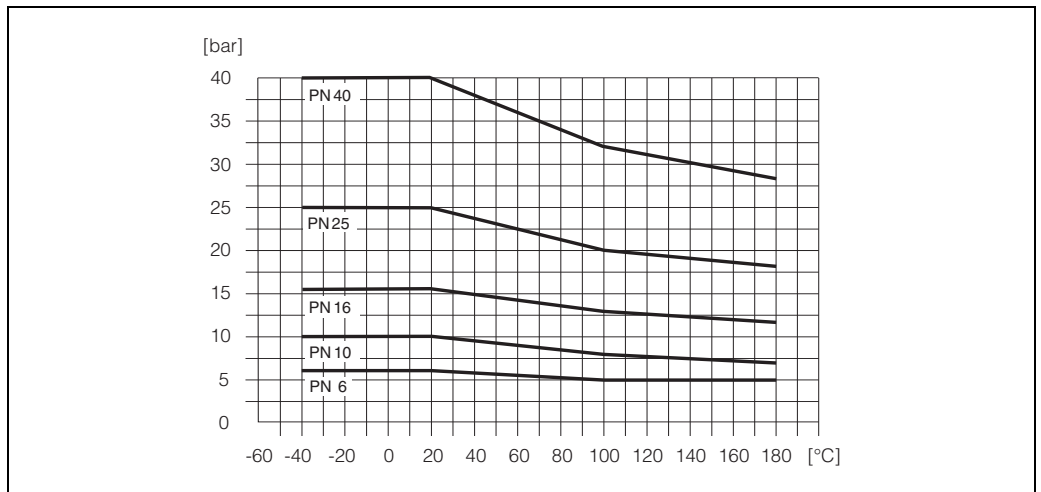
**Material load diagram**

Caution!

The following diagrams contain material load diagrams (reference curves) for flange materials with regard to the medium temperature. However, the maximum medium temperatures permitted always depend on the lining material of the sensor and/or the sealing material.

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

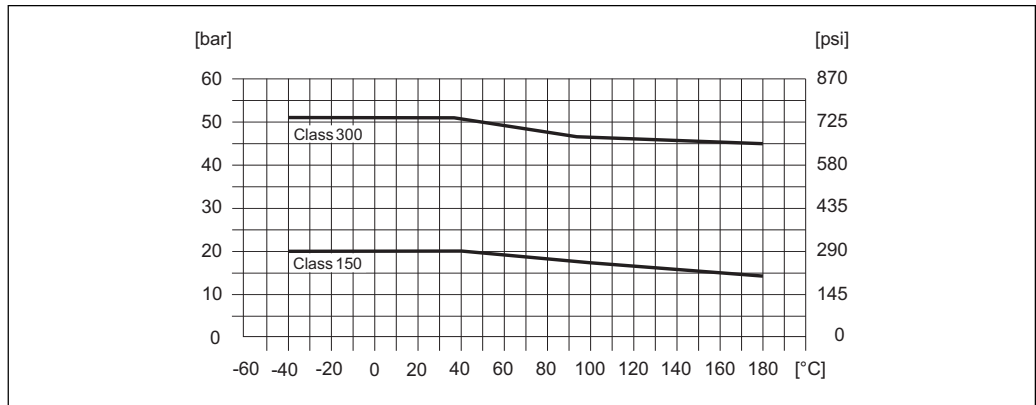
Material: RSt37-2 (S235JRG2) / C22 / Fe 410W B



F06-xxFxxxxx-05-xx-xx-xx-000

**Flange connection to ANSI B16.5**

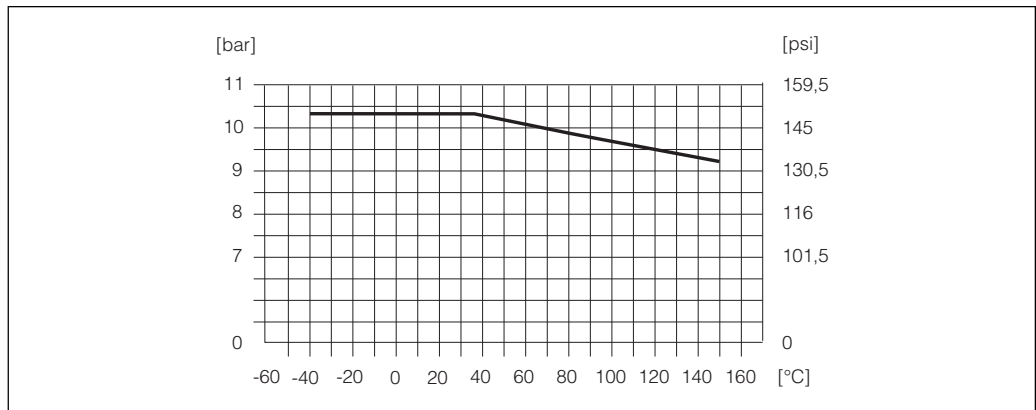
Material: A 105



a0003226

**Flange connection to AWWA C207, Class D**

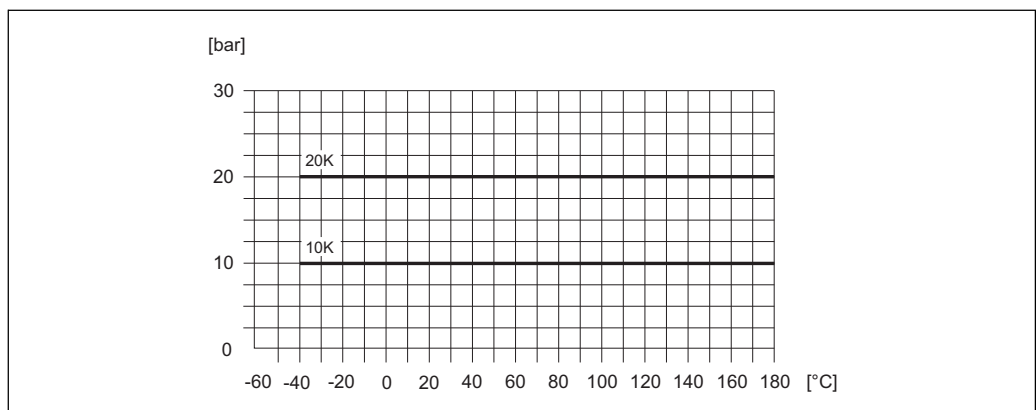
Material: 1.0425



F06-10Wxxxxx-05-xx-xx-xx-000

**Flange connection to JIS B2238**

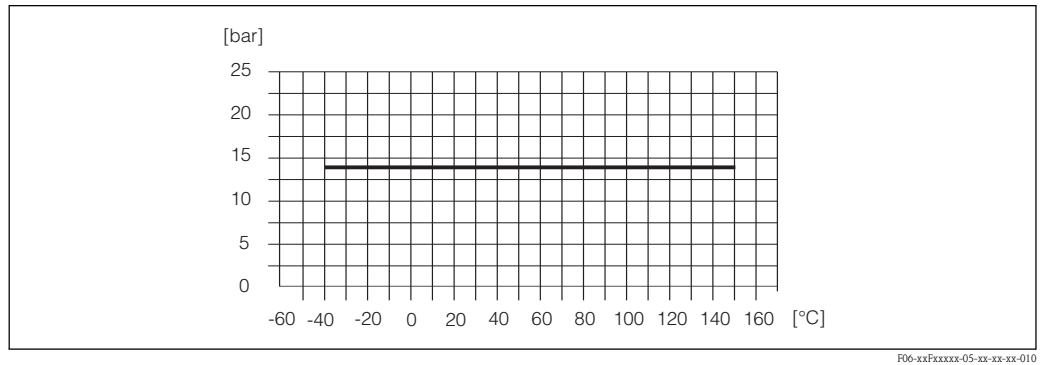
Material: RSt37-2 (S235JRG2) / HII / 1.0425



a0003228

**Flange connection to AS 2129 Table E or AS 4087 Cl. 14**

Material: A105 / RSt37-2 (S235JRG2) / St44-2 (S275JR)



F06-xxFxxxx-05-xx-xx-xx-010

**Fitted electrodes**

Measuring electrodes, reference electrodes and empty pipe detection electrodes available as standard with:

- 1.4435
- Alloy C-22

**Process connections**

Flange connection:

- EN 1092-1 (DIN 2501), < DN 350 form A, > DN 300 form B  
(Dimensions to DIN 2501, DN 65 PN 16 and DN 600 PN 16 exclusively to EN 10921)
- ANSI B16.5
- AWWA C 207, Class D
- JIS B2238
- AS 2129 Table E
- AS 4087 Cl. 14

**Surface roughness**

Electrodes with 1.4435 (AISI 316L), Alloy C-22:  $\leq 0.3...0.5 \mu\text{m}$   
(All data refer to parts in contact with medium)

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## Human interface

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<b>Display elements</b>	<ul style="list-style-type: none"> <li>■ Liquid crystal display: unilluminated, two-line, 16 characters per line</li> <li>■ Display (operating mode) preconfigured: volume flow and totalizer status</li> <li>■ 1 totalizer</li> </ul>
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<b>Operating elements</b>	Local operation via three keys (S, O, F)
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<b>Remote operation</b>	Operation via HART protocol and ToF Tool - Fieldtool Package
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## Certificates and approvals

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<b>CE mark</b>	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.
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<b>C-tick mark</b>	The measuring system meets the EMC requirements of the Australian Communications Authority (ACA)
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<b>Ex approval</b>	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.
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<b>Other standards and guidelines</b>	<ul style="list-style-type: none"> <li>■ EN 60529 Degrees of protection by housing (IP code)</li> <li>■ EN 61010 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.</li> <li>■ EN 61326/A1 (IEC 1326) "Emission in accordance with requirements for Class A". Electromagnetic compatibility (EMC requirements)</li> <li>■ ANSI/ISA-S82.01 Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category II.</li> <li>■ 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</li> </ul>
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<b>Pressure measuring device approval</b>	Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3(3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the medium and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters.
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## 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/en)
- Operating Instructions Promag 10 (BA082D/06/en)

## Registered trademarks

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

TRI-CLAMP®

Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®

Registered trademark of the HART Communication Foundation, Austin, USA

ToF Tool - Fieldtool® Package, Fieldcheck®, Applicator®

Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

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<p>Endress+Hauser Messtechnik GmbH+Co. KG Colmarer Str. 6 79576 Weil am Rhein</p> <p>Fax 0800 EHFAXEN Fax 0800 3 43 29 36 www.de.endress.com</p>	<p>Vertrieb</p> <ul style="list-style-type: none"> <li>■ Beratung</li> <li>■ Information</li> <li>■ Auftrag</li> <li>■ Bestellung</li> </ul> <p>Tel. 0800 EHVERTRIEB Tel. 0800 3 48 37 87 info@de.endress.com</p>	<p>Service</p> <ul style="list-style-type: none"> <li>■ Help-Desk</li> <li>■ Feldservice</li> <li>■ Ersatzteile/Reparatur</li> <li>■ Kalibrierung</li> </ul> <p>Tel. 0800 EHSERVICE Tel. 0800 3 47 37 84 service@de.endress.com</p>	<p>Technische Büros</p> <ul style="list-style-type: none"> <li>■ Hamburg</li> <li>■ Hannover</li> <li>■ Ratingen</li> <li>■ Frankfurt</li> <li>■ Stuttgart</li> <li>■ München</li> <li>■ Berlin</li> </ul>	<p>Endress+Hauser Ges.m.b.H. Lehnergasse 4 1230 Wien</p> <p>Tel. +43 1 88 05 60 Fax +43 1 88 05 63 35 info@at.endress.com www.at.endress.com</p>	<p>Endress+Hauser Metso AG Sternenhofstraße 21 4153 Reinach/BL 1</p> <p>Tel. +41 61 7 15 75 75 Fax +41 61 7 11 16 50 info@ch.endress.com www.ch.endress.com</p>

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