OPTIFLUX 7300 Technical Datasheet

Electromagnetic flowmeter with non wetted electrodes and ceramic liner

- No insulation of electrodes
- Stable measurement in noisy applications
- Improved safety and hygiene with absolute leak tight design

KROHNE

CONTENTS

1.1 Non wetted electrodes with high-tech ceramic liner

The OPTIFLUX 7300 combines the advantages of non wetted capacitive electrodes, a ceramic liner and the IFC 300 signal converter. This electromagnetic flowmeter can be used for noisy applications, low conductivities, mediums tending to form an insulating film, applications with high vibrations, and oxidizing, abrasive and toxic mediums.

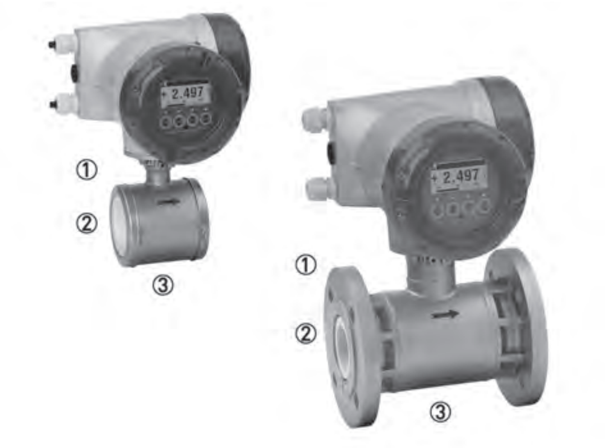
Instead of conventional electrodes that have a direct contact with the process liquid, OPTIFLUX 7300 has a non-contacting capacitive signal pick-up. The electrodes are designed as large-area capacitor plates, mounted behind the ceramic liner.

Because the electrodes have no contact with the medium, unwanted catalytic action with metallic parts is eliminated. A second benefit is that the insulation of electrodes no longer forms a risk. In case of a medium that tends to form a non conductive surface coating on the tube wall, the signal pick up between medium and electrodes will not be interrupted.

The smooth and pore free ceramic tube construction does not leak and is CIP / SIP resistant, making it highly suitable for hygienic applications in for example the food & beverage and pharmaceutical industry. It is very hard, non permeable and has an extreme and broad chemical resistance, fulfilling requirements of the chemical industry.

The construction of the OPTIFLUX 7300 offers an absolute leak tight solution, because leakage through the liner and leakage along the electrodes is not possible.

The IFC 300 signal converter includes as standard extensive diagnostics of the process and meter and powerful filter settings for stable flow measurements.



① Stainless steel flow sensor housing
② Ceramic liner
③ Capacitor plates for signal pick up behind the liner

ceramic durability

Ceramic durability

By implementing oxide ceramic sensors into OPTIFLUX and BATCHFLUX electromagnetic flowmeters as well as ceramic diaphragms into OPTIBAR pressure devices, KROHNE is using a superior material that is permanently resistant to corrosive and abrasive media and also immune to temperature shocks.

Highlights

- Ceramic liner with non wetted electrodes
- Excellent chemical and abrasion resistance
- Increased safety and hygiene with absolutely leak tight design
- No metals in contact with the medium
- No insulation of the electrodes
- No wear or corrosion of the electrodes
- Stable flow measurement
- Low conductivities to 0.05 μS/cm
- Fully vacuum resistant
- Insensitive for temperature shocks
- Sterile and hygienic; conformity to FDA requirements
- Excellent long term stability and accuracy
- Alternative for mass flowmeter (for the price of an electromagnetic flowmeter)

Industries

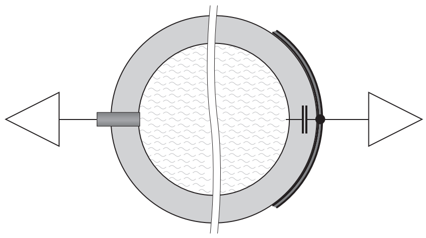
- Chemical
- Food & beverage
- Pharmaceutical
- Pulp & Paper
- Wastewater
- Machine building
- Primaries

Applications

- Toxic, aggressive and abrasive mediums
- Emulsions: latex, emulsion paints
- Adhesives
- Organic mass production
- Low conductive mediums: (bio-) alcohols, spirits, glycols, glycerine
- Abrasive slurries
- Water mixed with oil or metallic particles
- Fibrous products
- Oil-based products: vegetable oils
- Dairy products: fat creams, milk, cheese, yoghurt with fruit particles
- Cement

1.2 Features

Non wetted, capacitive electrodes

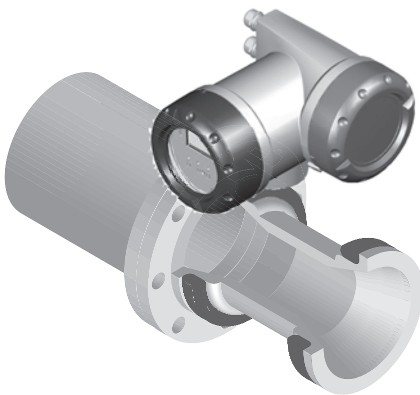


The electrodes are designed as large-area capacitor plates, fitted onto the outside of the ceramic tube. The non-wetted signal pick-up offers major benefits over a classic wetted electrode design:

- No metals in contact with the medium
- No risk of insulation of electrodes
- No leakage
- No wear or corrosion of electrodes
- Minimum conductivity of the medium down to 0.05 μS/cm
- More stable flow indication with inhomogeneous media.

With non wetted capacitive electrodes noise is significantly reduced because there is no electromechanical interaction or particles hitting electrodes.

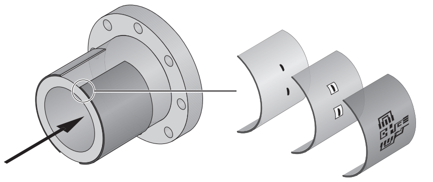
Ceramic liner with conical design



The ceramic liner of the OPTIFLUX 7300 has an excellent abrasion resistance, is extremely hard, dimensionally stable and has a low thermal expansion coefficient. The chemical resistance is excellent and broad. It is also smooth, pore-free and non-permeable.

These features result in the following advantages:
- High wear resistance, and therefore very suitable for abrasive fluids
- Full vacuum resistance
- Very suitable for aggressive media
- Exceptional long term stability
- High measurement accuracy also under unfavourable measurement conditions
- No crevices, no gaps, no bacteria growth
- No leaching of the ceramic into the medium
- Suitable for CIP /SIP

All electronic parts rigidly fixed to the ceramic tube



With OPTIFLUX 7300 noise is not only reduced by capacitive electrodes but also by the rigid construction of the electronic parts.

All electronic parts are fully integrated with the ceramic tube using LTCC (Low Temperature Co-fired Ceramic) technology. The capacitive electrodes, shielding and pre-amplifiers are sintered in three layers of LTCC tape on the ceramic tube. This results in a very rigid and fixed construction, eliminating relative movements of these parts. This is also known as microphonic effects. The use of non-piezo electric materials avoids piezo-electric noise that can be induced when using plastic insulation materials.

The benefits of the highly rigid design are a high noise and vibration immunity.

1.3 Measuring principle

An electrically conductive fluid flows inside an electrically insulated pipe through a magnetic field. This magnetic field is generated by a current, flowing through a pair of field coils.
Inside of the fluid, a voltage U is generated:
U = v * k * B * D

in which:
v = mean flow velocity
k = factor correcting for geometry
B = magnetic field strength
D = inner diameter of flowmeter

The signal voltage U is picked off by electrodes and is proportional to the mean flow velocity v and thus the flow rate Q. A signal converter is used to amplify the signal voltage, filter it and convert it into signals for totalizing, recording and output processing.

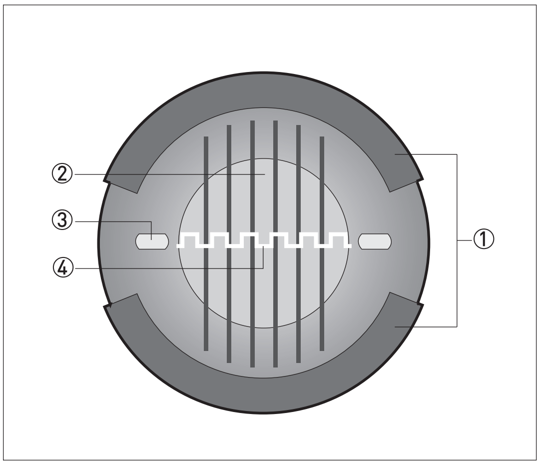


Figure 1-1: Measuring principle

① Field coils
② Magnetic field
③ Electrodes (capacitive)
④ Induced voltage (proportional to flow velocity)

2.1 Technical data

- *The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.*
- *Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Downloadcenter).*

Measuring system

Measuring principle	Farady's law of induction
Application range	Continuous measurement of the volumetric flow rate of electrically conductive liquids.
Measured value	
Primary measured value	Flow velocity
Secondary measured value	Volume flow, mass flow

Design

Features	Sandwich / flanged version with optimized flow tube
Modular construction	The measurement system consists of a flow sensor and a signal converter. It is available as compact version only. More information about the signal converter can be found in the documentation of the signal converter.
Compact version	With IFC 300 C / CAP converter: OPTIFLUX 7300 C
Nominal diameter	DN25, 40, 50, 80, 100 / 1", 1½", 2", 3" and 4".
Signal converter	
Outputs / inputs	Current (incl. HART®), pulse, frequency and/or status output, limit switch and/or control input, current input (depends on the I/O version)
Counters	2 (optional 3) internal counters with a max. of 8 counter places (e.g. for counting volume and/or mass units)
Verification	Intergrated verification, diagnostic functions: measuring device, process, measured value, empty pipe detection, stabilization.
Communication interfaces	Foundation Fieldbus, Profibus PA and DP, Modbus, HART®
User interface	
Display	LC Display, backlit white
	Size: 128 x 64 pixel, corresponds to 59 x 31 mm / 2.32" x 1.22"
	Display can be turned in steps of 90°
	Ambient temperature below -25°C / -13°F, may effect the readability of the display.
Operating elements	4 optical keys for operator control of the signal converter without opening the housing.
	Infrared interface for reading and writing all parameters with IR interface (option) without opening the housing.
Remote control	PACTware® (incl. Device Type Manager (DTM))
	HART® Hand Held Communicator from Emerson Process
	AMS® from Emerson Process
	PDM® from Siemens
	All DTMs and drivers are available free of charge from the manufacturer's website.
Display functions	

Operating menu	Setting the parameters using 2 measured value pages, 1 status page, 1 graphics page (measured values and graphics are freely adjustable).
Language display texts (as language package)	Standard: English, French, German, Dutch, Portuguese, Swedish, Spanish, Italian
	Eastern Europe: English, Slovenian, Czech, Hungarian
	Northern Europe: English, Danish, Polish
	China: English, Chinese
	Russia: English, Russian
Units	Metric, British and US units selectable as required from lists for volume / mass flow and counting, flow velocity, temperature.

Measuring accuracy

Reference conditions	Flow conditions: similar to EN 29104
	Flow velocity: > 1 m/s / > 3 ft/s
	Valve closing time variation: < 1 ms
	Wet calibrated on EN 17025 accredited calibration rig by direct volume comparison.
Maximum measuring error	v ≤ 1 m/s: ± 5 mm/s
	v ≥ 1 m/s: ± 0.5% of measured value
	Related to volume flow.
	These values are related to the pulse / frequency output.
	The additional typical measuring deviation for the current output is ± 10 µA.
Repeatability	± 0.1% of MV, minimum 1 mm/s
Long term stability	± 0.1% of MV
Special calibration	On request

Operating conditions

Temperature		
Process temperature	-40...100°C / -40...+212°F (up to 120°C / 248°F for up to 30 min.)	
	For Ex versions different temperature ranges are applicable. Please see the relevant Ex documentation for details.	
Maximum temperature change (shock)	Rising: 125°C / 257°F (in 10 min.); 120°C / 248°F (sudden change)	
	Falling: 100°C / 212°F (in 10 min.); 80°C / 176°F (sudden change)	
Ambient temperature	Non-Ex: -40..+65°C / -40...+149°F	
	Ex: -40...+60°C / -40...+140°F	
Storage temperature	-50...+70°C / -58...+158°F	
Measurement range	-12...+12 m/s / -40...+40 ft/s	
Pressure		
	OPTIFLUX 7300 C - SW	**OPTIFLUX 7300 C - FL**
Ambient pressure	Atmospheric	Atmospheric
Nominal flange pressure		
EN 1092-1	**Standard:**	**Standard:**
	DN100: PN 16	DN100: PN 16
	DN25...80: PN 40	DN25...80: PN 40
Option:	DN100: PN 25	-
ASME B16.5	**Standard:**	**Standard:**
	1...4": 150 lb	1...4": 150 lb
Option:	1...3": 300 lb	1...3": 300 lb
	4": 300 lb Max. pressure is 30 bar / 435 psig	
Vacuum load	0 mbar / 0 psig	0 mbar / 0 psig
Chemical properties		
Physical condition	Liquids	
Electrical conductivity	0.05 µS/cm	
	Demineralised cold water: ≥ 1 µS/cm	
Permissible gas content (volume)	≤ 5%	
Permissible solid content	≤ 70%	

Installation conditions

Installation	Take care that the flow sensor is always fully filled.
	For detailed information; refer to *Installation* on page 23.
Flow direction	Forward and reverse
	Arrow on flow sensor indicates positive flow direction.
Inlet run	≥ 5 DN (without disturbing flow, after a single 90° bend)
	≥ 10 DN (after a double bend 2 x 90°)
	≥ 10 DN (behind a control valve)
Outlet run	≥ 2 DN
Dimensions and weights	For detailed information; refer to *Dimensions and weights* on page 19.

Materials

	OPTIFLUX 7300 C - SW	OPTIFLUX 7300 C - FL
Sensor housing	Stainless steel AISI 304 / 1.4306	Stainless steel AISI 316 / 1.4408
Measuring tube	Ceramic	Ceramic
Flange	-	Stainless steel AISI 316 / 1.4408
Measuring electrodes	Non wetted, capacitive	Non wetted, capacitive
Grounding rings	Stainless steel, Hastelloy® C, Titanium, Tantalum	-
	Other materials on request.	-
Stud bolts and nuts	Standard: steel	-
	Option: stainless steel, rubber, centering sleeves	-
Gaskets	Gylon®, PTFE-PF 29, Chemotherm®	PTFE sealing rings, PTFE white. Option: filled PTFE, blue (L-type).
	Other materials on request.	-
Signal converter housing	Standard: die-cast aluminium; standard coating	
	Option: stainless steel 316 L / 1.4408	

Process connections

	OPTIFLUX 7300 C - SW	OPTIFLUX 7300 C - FL
EN 1092-1	**Standard**	
	DN100 in PN 16	DN100 in PN 16
	DN25...80 in PN 40	DN25...80 in PN 40
Option	DN100 in PN 25	-
ASME	**Standard**	
	1...4" in 150 lb	1...4" in 150 lb
Option	1...3" in 300 lb	1"-2"-3" in 300 lb
	4" in 300 lb Max. pressure is 30 bar / 435 psig	

Electrical connection

General	Electrical connection is carried out in conformity with the VDE 0100 directive "Regulations for electrical power installations with line voltages up to 1000 V" or equivalent national regulations.
Voltage	**Standard**
	100...230 VAC (-15% / +10%), 50/60 Hz
	Options
	24 VDC (-55% / +30%)
	24 VAC/DC (AC: -15% / +10%, 50/60 Hz; DC: -25% / +30%)
Power consumption	AC: 22 VA
	DC: 12 W
Cable entries	Standard: M20 x 1.5 (8...12 mm)
	Option: ½" NPT, PF ½

Inputs and outputs

General	All outputs are electrically isolated from each other and from all other circuits.		
	All operating data and output values van be adjusted.		
Description of the used abbreviations	U_{ext} = external voltage R_L = load + resistance U_o = terminal voltage I_{nom}= nominal current **Safety limit values (Ex i):** U_i = max. input voltage I_I = max. input current P_I = max. input power rating C_I = max. input capacity L_I = max. input inductivity		
Current output			
Output data	Volume flow, mass flow, diagnostics value, flow velocity, coil temperature.		
Settings	**Without HART®**		
	Q = 0%: 0...20 mA		
	Q = 100%: 10...21.5 mA		
	Error identifications: 10...21.5 mA		
	With HART®		
	Q = 0%: 4...20 mA		
	Q = 100%: 10...21.5 mA		
	Error identifications: 3.5...22 mA		
Operating Data	**Basic I/Os**	**Modular I/Os**	**Ex i**
Active	$U_{int, nom}$ = 24 VDC I ≤ 22 mA R_L ≤ 1 kΩ		$U_{int, nom}$ = 20 VDC I ≤ 22 mA R_L ≤ 450 Ω
			U_0 = 21 V I_0 = 90 mA P_0 = 0.5 W C_0 = 90 nF / L_0 = 2 mH C_0 = 110 nF / L_0 = 0.5 mH
Passive	U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≥ 1.8 V $R_L \leq (U_{ext} - U_0) / I_{max}$		U_{ext} ≤ 32 VDC I ≤ 22 mA U_0 ≥ 4 V $R_L \leq (U_{ext} - U_0) / I_{max}$
			U_i = 30 V I_i = 100 mA P_i = 1 W C_i = 10 nF L_i ~ 0 mH

HART®			
Description	HART® protocol via active and passive current output.		
	HART® version: V5		
	Universal HART® parameter: completely integrated		
Load	≥ 250 Ω at HART® test point.		
	Note maximum load for current output!		
Multidrop operation	Yes, current output = 4 mA		
	Multidrop address adjustable in operation menu 1...15		
Device driver	Available for FC 375, AMS, PDM, FDT/DTM		
Registration (HART® Communication Foundation)	Yes		
Pulse or frequency output			
Output data	Pulse output: volume flow, mass flow		
	Frequency output: volume flow, mass flow, diagnostic value, flow velocity, coil temperature		
Function	Adjustable as pulse or frequency output.		
Pulse rate/frequency	0.01...10000 pulses/s or Hz		
Settings	Pulses per volume or mass unit or max. frequency for 100% flow		
	Pulse width: adjustable as automatic, symmetric of fixed (0.05...2000 ms).		
Operating data	**Basic I/Os**	**Modular I/Os**	**Ex i**
Active		U_{nom} = 24 VDC	
		f_{max} in operating menu set to $f_{max} \leq$ 100 Hz: I ≤ 20 mA open: I ≤ 0.05 mA closed: $U_{0, nom}$ = 24 V at I = 20 mA	
		f_{max} in operating menu set to 100 Hz < $f_{max} \leq$ 10 kHz: I ≤ 20 mA open: I ≤ 0.05 mA closed: $U_{0, nom}$ = 22.5 V at I = 1 mA $U_{0, nom}$ = 21.5 V at I = 10 mA $U_{0, nom}$ = 19 V at I = 20 mA	

Passive	$U_{ext} \leq 32$ VDC		
	f_{max} in operating menu set to $f_{max} \leq 100$ Hz: $I \leq 100$ mA $R_{L, max} = 47$ kΩ $R_{L, min} = (U_{ext} - U_0) / I_{max}$ open: $I \leq 0.05$ mA at $U_{ext} = 32$ VDC closed: $U_{0, max} = 0.2$ V at $I \leq 10$ mA $U_{0, max} = 2$ V at $I \leq 100$ mA		
	f_{max} in operating menu set to 100 Hz < $f_{max} \leq 10$ kHz: $I \leq 20$ mA $R_{L, max} = 47$ kΩ $R_{L, min} = (U_{ext} - U_0) / I_{max}$ open: $I \leq 0.05$ mA at $U_{ext} = 32$ VDC closed: $U_{0, max} = 1.5$ V at $I \leq 1$ mA $U_{0, max} = 2.5$ V at $I \leq 10$ mA $U_{0, max} = 5.0$ V at $I \leq 20$ mA		
NAMUR	-	Passive to EN 60947-5-6 open: $I_{nom} = 0.6$ mA closed: $I_{nom} = 3.8$ mA	Passive to EN 60947-5-6 open: $I_{nom} = 0.43$ mA closed: $I_{nom} = 4.5$ mA
			$U_i = 30$ V $I_i = 100$ mA $P_i = 1$ W $C_i = 10$ nF $L_i \sim 0$ mH

<table>
<tr><td colspan="4">Low flow cut-off</td></tr>
<tr><td>Function</td><td colspan="3">Switching point and hysteresis separately adjustable for each output, counter and the display.</td></tr>
<tr><td rowspan="2">Switching point</td><td colspan="3">Set in increments of 0.1</td></tr>
<tr><td colspan="3">0....20% (current output, frequency output) or
0...± 9.999 m/s (pulse output)</td></tr>
<tr><td rowspan="2">Hysteresis</td><td colspan="3">Set in increments of 0.1</td></tr>
<tr><td colspan="3">0...5% (current output, frequency output) or 0...5 m/s (pulse output)</td></tr>
<tr><td colspan="4">Time constant</td></tr>
<tr><td>Function</td><td colspan="3">The time constant corresponds to the elapsed time until 67% of the end value has been reached according to a step function.</td></tr>
<tr><td rowspan="2">Settings</td><td colspan="3">Set in increments of 0.1</td></tr>
<tr><td colspan="3">0...100 s</td></tr>
<tr><td colspan="4">Status output / limit switch</td></tr>
<tr><td rowspan="3">Functions and settings</td><td colspan="3">Adjustable as automatic measuring range conversion, display of flow direction, counter overflow, error, switching point or empty pipe detection.</td></tr>
<tr><td colspan="3">Valve control with activated dosing function</td></tr>
<tr><td colspan="3">Status and/or control: ON or OFF</td></tr>
<tr><td>Operating data</td><td>Basic I/Os</td><td>Modular I/Os</td><td>Ex i</td></tr>
<tr><td>Active</td><td>-</td><td>U_{int} = 24 VDC

I ≤ 20 mA

open:
I ≤ 0.05 mA

closed:
$U_{0, nom}$ = 24 V
at I = 20 mA</td><td>-</td></tr>
<tr><td>Passive</td><td colspan="2">U_{ext} ≤ 32 VDC

I ≤ 100 mA

$R_{L, max}$ = 47 kΩ
$R_{L, min} = (U_{ext} - U_0) / I_{max}$

open:
I ≤ 0.05 mA at U_{ext} = 32 VDC

closed:
$U_{0, max}$ = 0.2 Vat I ≤ 10 mA
$U_{0, max}$ = 2 Vat I ≤ 100 mA</td><td>-</td></tr>
<tr><td rowspan="2">NAMUR</td><td rowspan="2">-</td><td rowspan="2">Passive to
EN 60947-5-6

open:
I_{nom} = 0.6 mA

closed:
I_{nom} = 3.8 mA</td><td>Passive to
EN 60947-5-6

open:
I_{nom} = 0.43 mA

closed:
I_{nom} = 4.5 mA</td></tr>
<tr><td>U_i = 30 V
I_i = 100 mA
P_i = 1 W
C_i =10 nF
L_i = 0 mH</td></tr>
</table>

Control input			
Function	Hold output values (e.g. when cleaning), set value of outputs to "zero", counter and error reset, range conversion.		
	Start of dosing when dosing function is activated.		
Operating data	**Basic I/Os**	**Modular I/Os**	**Ex i**
Active	-	U_{int} = 24 VDC Ext. contact open: $U_{0, nom}$ = 22 V Ext. contact closed: I_{nom} = 4 mA Contact closed (on): $U_0 \geq 12$ V with I_{nom} = 1.9 mA Contact open (off): $U_0 \leq 10$ V with I_{nom} = 1.9 mA	-
Passive	$8 V \leq U_{ext} \leq 32$ VDC I_{max} = 6.5 mA at $U_{ext} \leq 24$ VDC I_{max} = 8.2 mA at $U_{ext} \leq 32$ VDC Contact closed (on): $U_0 \geq 8$ V with I_{nom} = 2.8 mA Contact open (off): $U_0 \leq 2.5$ V with I_{nom} = 0.4 mA	$3 V \leq U_{ext} \leq 32$ VDC I_{max} = 9.5 mA at $U_{ext} \leq 24$ V I_{max} = 9.5 mA at $U_{ext} \leq 32$ V Contact closed (on): $U_0 \geq 3$ V with I_{nom} = 1.9 mA Contact open (off): $U_0 \leq 2.5$ V with I_{nom} = 1.9 mA	$U_{ext} \leq 32$ VDC $I \leq 6$ mA at U_{ext} = 24 V $I \leq 6.6$ mA at U_{ext} = 32 V On: $U_0 \geq 5.5$ V or $I \geq 4$ mA Off: $U_0 \leq 3.5$ V or $I \leq 0.5$ mA
			U_i = 30 V I_i = 100 mA P_i = 1 W C_i = 10 nF L_i = 0 mH
NAMUR	-	Active to EN 60947-5-6 Terminals open: $U_{0, nom}$ = 8.7 V Contact closed (on): $U_{0, nom}$ = 6.3 V with I_{nom} > 1.9 mA Contact open (off): $U_{0, nom}$ = 6.3 V with I_{nom} < 1.9 mA Detection of cable break: $U_0 \geq 8.1$ V with $I \leq 0.1$ mA Detection of cable short circuit: $U_0 \leq 1.2$ V with $I \geq 6.7$ mA	-

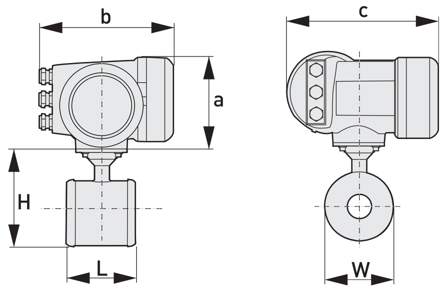
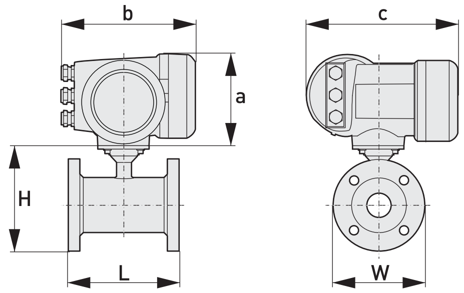
Current input			
Function	The following values can be delivered from the measuring sensor to the current input: temperature, pressure and current.		
Operating data	**Basic I/Os**	**Modular I/Os**	**Ex i**
Active	-	$U_{int,\,nom}$ = 24 VDC I ≤ 22 mA I_{max} ≤ 26 mA (electronically limited) $U_{0,\,min}$ = 19 V at I ≤ 22 mA No HART®	$U_{int,\,nom}$ = 20 VDC I ≤ 22 mA $U_{0,\,min}$ = 14 V at I ≤ 22 mA No HART®
			U_0 = 24.5 V I_0 = 99 mA P_0 = 0.6 W C_0 = 75 nF / L_0 = 0.5 mH No HART®
Passive	-	U_{ext} ≤ 32 VDC I ≤ 22 mA I_{max} ≤ 26 mA (electronically limited) $U_{0,\,max}$ = 5 V at I ≤ 22 mA No HART®	U_{ext} ≤ 32 VDC I ≤ 22 mA $U_{0,\,max}$ = 4 V at I ≤ 22 mA No HART®
			U_i = 30 V I_i = 100 mA P_i = 1 W C_i = 10 nF L_i = 0 mH No HART®
PROFIBUS DP			
Description	Galvanically isolated acc. to IEC 61158		
	Profile version: 3.01		
	Automatic data transmission rate recognition (max. 12 MBaud)		
	Bus address adjustable via local display at the measuring device.		
Function blocks	5 x analogue input, 3 x totalizer		
Output data	Volume flow, mass flow, volume counter 1 + 2, mass counter, velocity, coil temperature		
PROFIBUS PA			
Description	Galvanically isolated acc. to IEC 61158		
	Profile version: 3.01		
	Current consumption: 10.5 mA		
	Permissible bus voltage: 9...32 V; in Ex application: 9...24 V		
	Bus interface with integrated reverse polarity protection.		
	Typical error current FDE (Fault Disconnection Electronic): 4.3 mA		
	Bus address adjustable via local display at the measuring device.		
Function blocks	5 x analogue input, 3 x totalizer		
Output data	Volume flow, mass flow, volume counter 1 + 2, mass counter, velocity, coil temperature		

FOUNDATION Fieldbus	
Description	Galvanically isolated acc. to IEC 61158
	Current consumption: 10.5 mA
	Permissible bus voltage: 9...32 V; in Ex application: 9...24 V
	Bus interface with integrated reverse polarity protection.
	Link Master function (LM) supported
	Tested with Interoperable Test Kit (ITK) version 5.1
Function blocks	3 x analogue input, 2x integrator
Output data	Volume flow, mass flow, volume counter 1 + 2, mass counter, velocity, coil temperature
Modbus	
Description	Modbus RTU, Master / Slave, RS485
Address range	1...247
Supported function codes	03, 04, 16
Broadcast	Supported with function code 16
Supported Baudrate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Baud

Approvals and certifications

CE	
This device fulfills the statutory requirements of the EU directives. The manufacturer certifies successful testing of the product by applying the CE mark.	
	For full information of the EU directive & standards and the approved certifications; please refer to the EU Declaration of Conformity or the website of the manufacturer.
Other approvals and standards	
Non-Ex	Standard
Hazardous areas	
ATEX	Please check the relevant Ex documentation for details.
	KEMA 10ATEX0105 X
	For gas: zone 1 and 2, gas group IIC, temperature class T6...T4
	For dust: zone 21 and 22, maximum surface temperature T115°C
NEPSI	GYJ18.1099X
Protection category acc. to IEC 60529	IP66/67, NEMA 4/4X/6
Hygiene	Ceramic measuring tube is conform FDA regulations.
Shock test	IEC 60068-2-27
	30 g for 18 ms
Vibration resistance	IEC 60068-2-64
	f = 20...2000 Hz, rms = 4.5 g, t = 30 min

2.2 Dimensions and weights

Sandwich version		a = 155 mm / 6.1" b = 230 mm / 9.1" ① c = 260 mm / 10.2" Total height = H + a
Flanged version		a = 155 mm / 6.1" b = 230 mm / 9.1" ① c = 260 mm / 10.2" Total height = H + a

① The value may vary depending on the used cable glands.

- *All data given in the following tables are based on standard versions of the flow sensor only.*
- *Especially for smaller nominal sizes of the flow sensor, the signal converter can be bigger than the sensor.*
- *Note that for other pressure ratings than mentioned, the dimensions may be different.*
- *For full information on signal converter dimensions see relevant documentation.*

Sandwich version

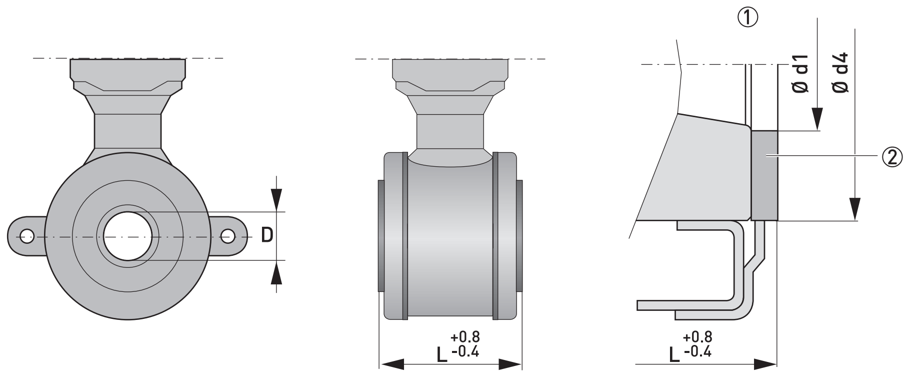


Figure 2-1: Construction details DN25...100 / 1...4"

① Situation without grounding rings
② Gasket

Nominal size	Dimensions [mm]						Approx. weight [kg]
DN	L	H	W	D	Ød1	Ød4	
25	58 ①	116	68	20	26	46	1.6
40	83 ①	131	83	30	39	62	2.4
50	103 ①	149	101	40	51	74	2.9
80	153 ①	181	133	60	80	106	6.4
100	203 ①	206	158	80	101	133	8.8

① Total fitting length of flowmeter without rings: dimension L only.

The table below is valid for 150 and 300 lb.

Nominal size	Dimensions [inches]						Approx. weight [lb]
ASME	L	H	W	D	Ød1	Ød4	
1"	2.28 ①	4.57	2.68	0.79	1.02	1.81	3.53
1½"	3.27 ①	5.16	3.27	1.18	1.54	2.44	5.29
2"	4.06 ①	5.87	3.98	1.57	2.01	2.91	6.39
3"	6.02 ①	7.13	5.24	2.36	3.15	4.17	14.11
4"	7.99 ①	8.11	6.22	3.15	3.98	5.24	19.40

① Total fitting length of flowmeter without rings: dimension L only.

Flanged version

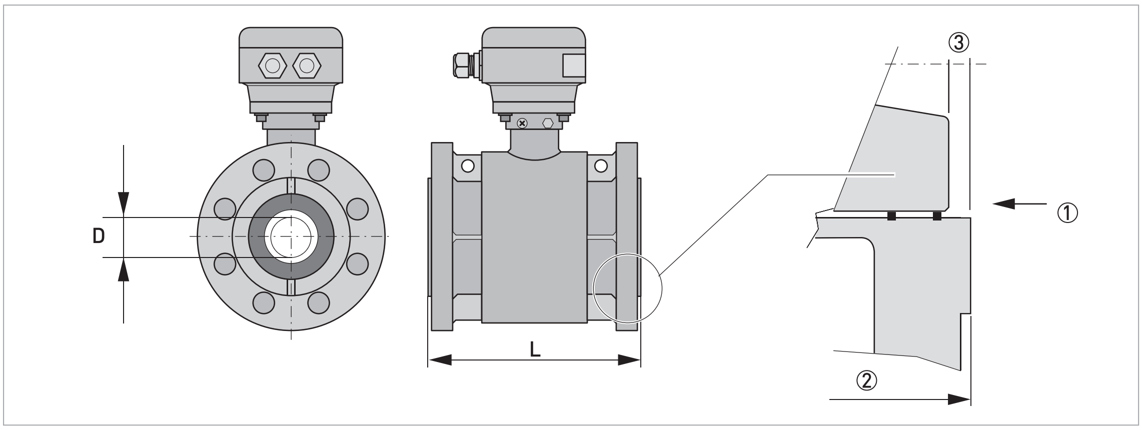


Figure 2-2: Construction details DN25...100 / 1...4"

① Detail ceramics, flange and gaskets, see options in following illustration
② Length tolerances (see table on following pages)

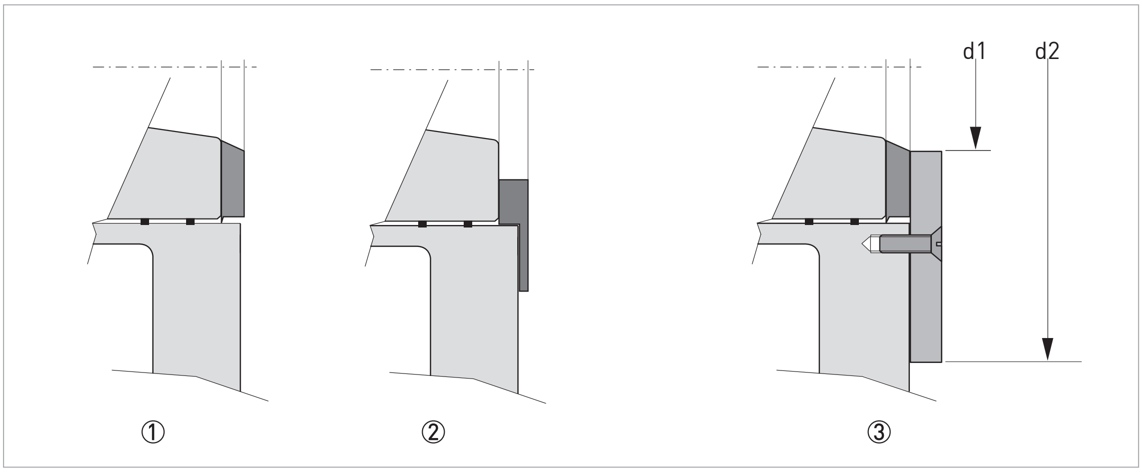


Figure 2-3: Details of gasket options

① Sealing ring: PTFE (white)
Optional: conductive PTFE (grey) / Gylon 3504 (blue)
② Sealing ring for rounded counter flanges: filled PTFE (blue)
③ DN25...100 / 1...4"; optional spacer ring with gasket

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Nominal size	Dimensions [mm]					Approx. weight [kg]
DN	L	H	W	D	Ød1	
25	150	143	115	20	26	4
40	150	168	150	30	39	6
50	200	184	165	40	51	9
80	200	217	200	60	80	15
100	250	242	220	80	101	21

ASME B 16.5 150 lb

Nominal size	Dimensions [inches]					Approx. weight [lb]
inch	L	H	W	D	Ød1	
1"	5.91	5.47	4.25	0.79	1.02	8.8
1½"	5.91	6.18	5.00	1.18	1.54	13.2
2"	7.87	6.89	6.00	1.57	2.01	19.8
3"	7.87	8.39	7.50	2.36	3.15	33.1
4"	9.84	9.65	9.00	3.15	3.98	46.3

ASME B 16.5 300 lb

Nominal size	Dimensions [inches]					Approx. weight [lb]
inch	L	H	W	D	Ød1	
1"	5.91	5.91	4.92	0.79	1.02	8.8
2"	7.87	7.20	6.50	1.57	2.01	22.9
3"	7.87	8.86	8.27	2.36	3.15	40.6

3.1 Intended use

Responsibility for the use of the measuring devices with regard to suitability, intended use and corrosion resistance of the used materials against the measured fluid lies solely with the operator.

The manufacturer is not liable for any damage resulting from improper use or use for other than the intended purpose.

This electromagnetic flowmeter is designed exclusively to measure the flow of electrically conductive, liquid media.

3.2 General notes on installation

Inspect the packaging carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

Do a check of the packing list to make sure that you have all the elements given in the order.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2.1 Vibrations

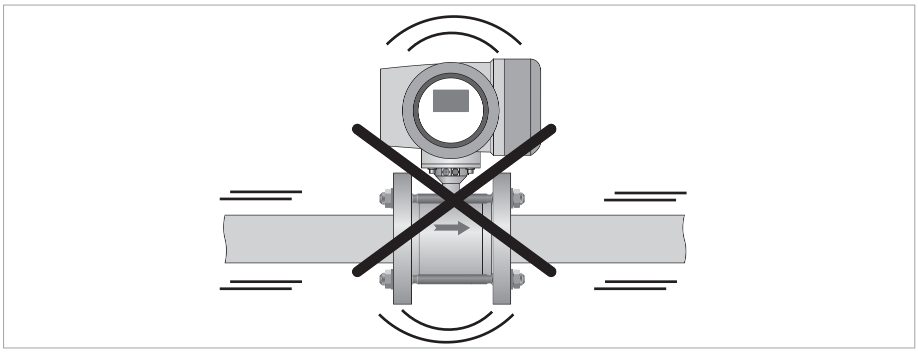

Figure 3-1: Avoid vibrations

3.2.2 Magnetic field

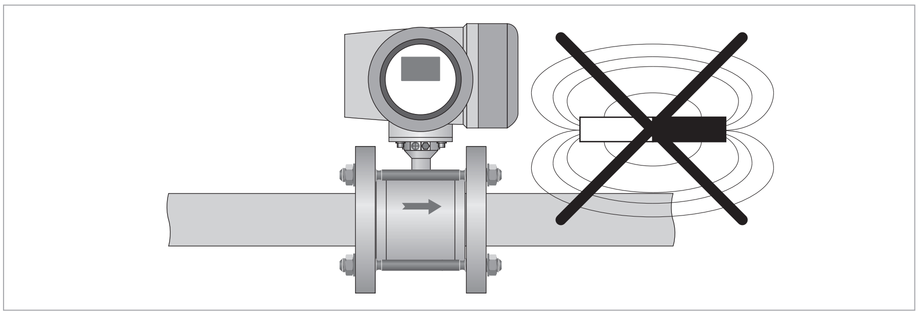

Figure 3-2: Avoid magnetic fields

3.3 Installation conditions

Support the pipeline on both side of the flowmeter. Make sure the M12 connector is on the flow inlet side.

3.3.1 Inlet and outlet

Use straight inlet and outlet pipe sections to prevent flow distortion or swirl, caused by bends and T-sections.

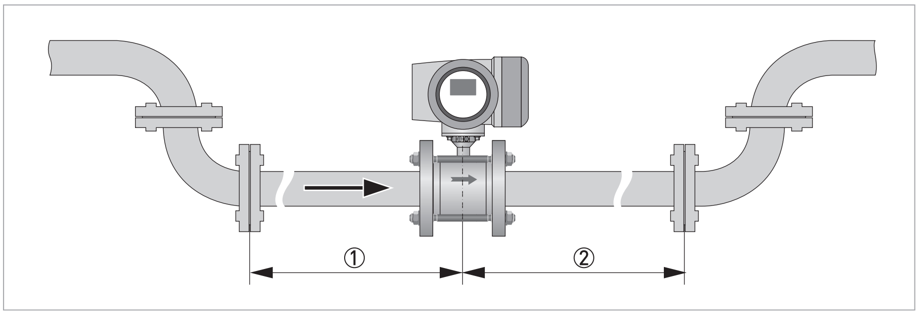

Figure 3-3: Recommended inlet and outlet sections

① Refer to chapter "Bends in 2 or 3 dimensions"
② ≥ 2 DN

3.3.2 Bends in 2 or 3 dimensions

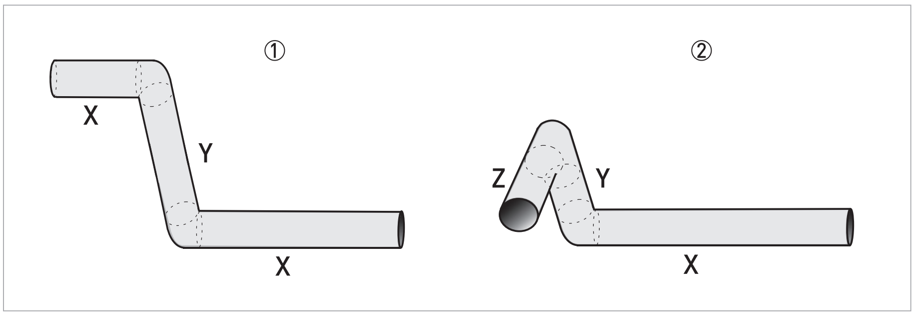

Figure 3-4: 2 and/or 3 dimensional bends upstream of the flowmeter

① 2 dimensions = X/Y
② 3 dimensions = X/Y/Z
Inlet length: using bends in 2 dimensions: ≥ 5 DN; when having bends in 3 dimensions: ≥ 10 DN

*2 dimensional bends occur in a vertical **or** horizontal plane (X/Y) only, while 3 dimensional bends occur in both vertical **and** horizontal plane (X/Y/Z).*

3.3.3 T-section

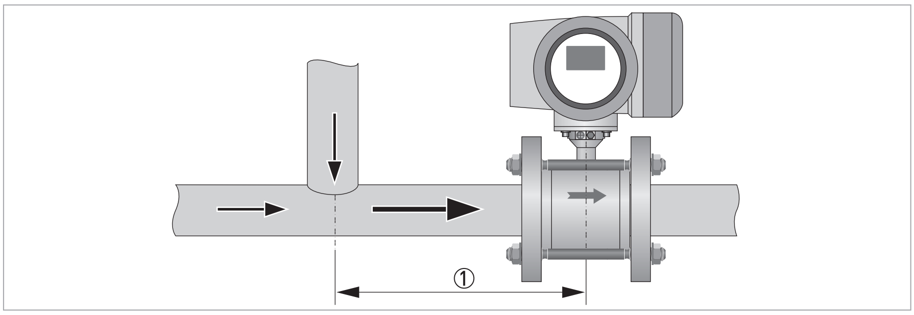

Figure 3-5: Distance after T-sections

① ≥ 10 DN

3.3.4 Bends

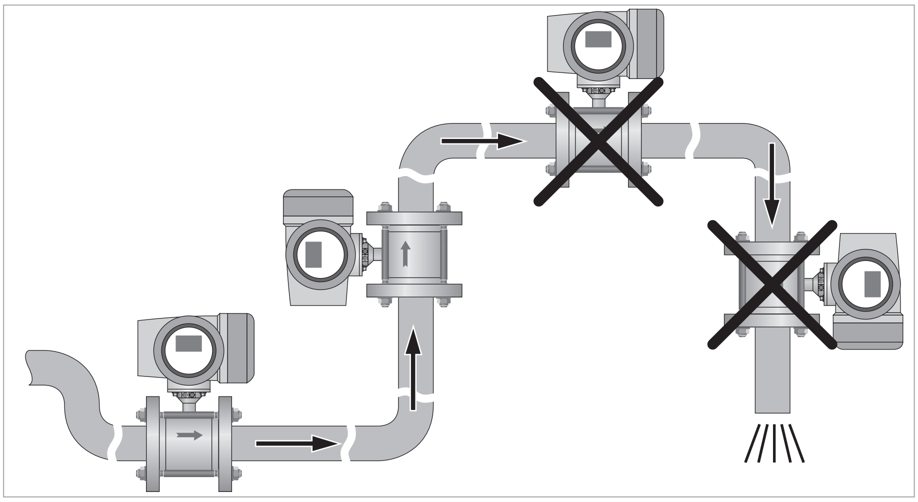

Figure 3-6: Installation in bending pipes (90°)

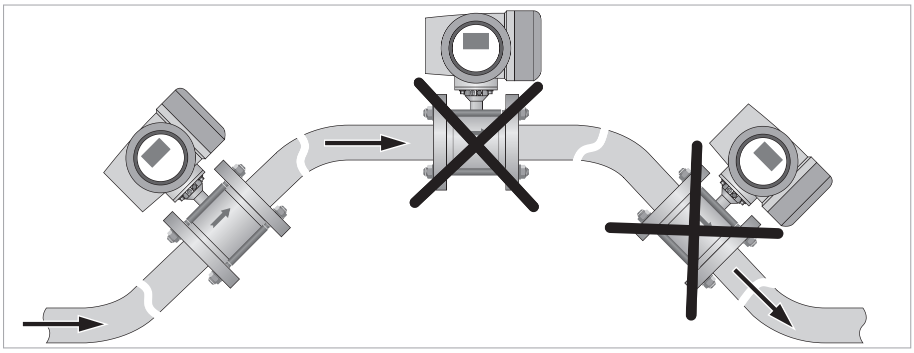

Figure 3-7: Installation in bending pipes (45°)

Avoid draining or partial filling of the flow sensor

3.3.5 Open discharge

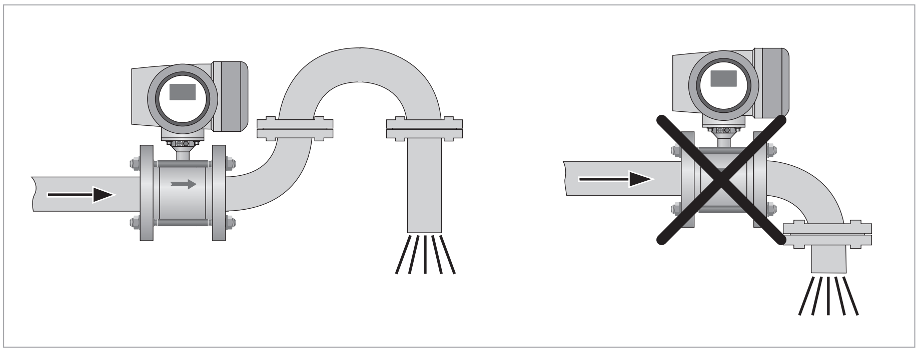

Figure 3-8: Installation before an open discharge

3.3.6 Control valve

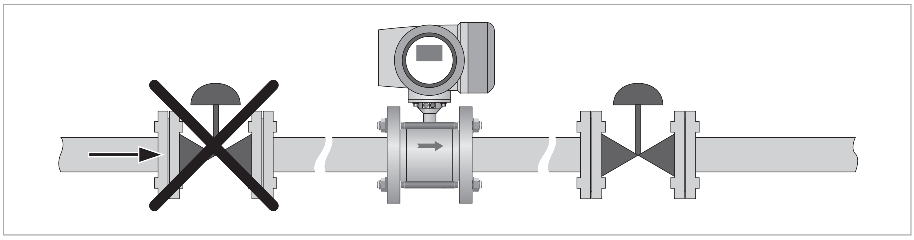

Figure 3-9: Installation before control valve

3.3.7 Pump

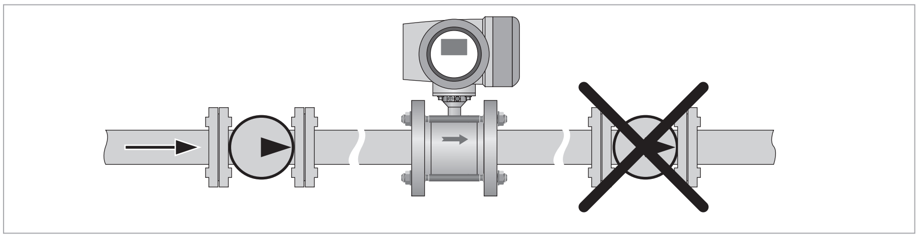

Figure 3-10: Installation after pump

3.3.8 Temperatures

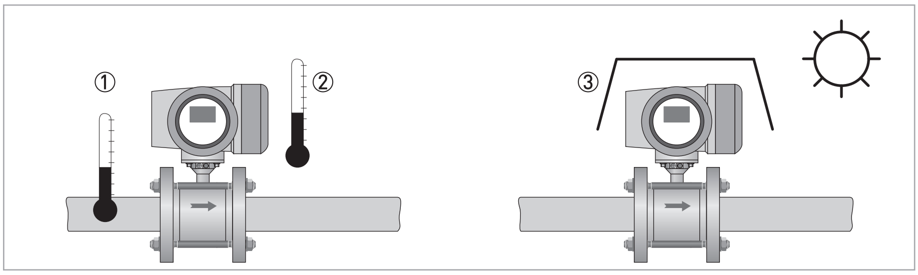

Figure 3-13: Temperatures

① Process temperature
② Ambient temperature
③ Sunshade

Protect the device from direct sunlight.

3.3.9 Air venting

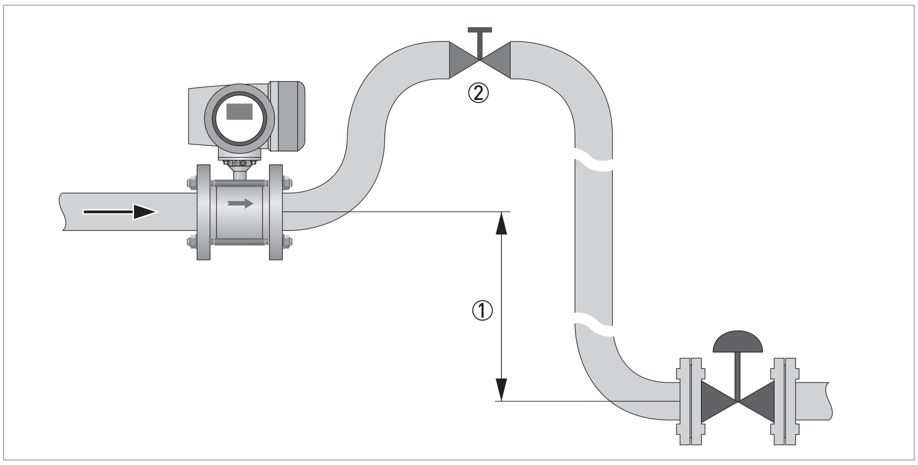

Figure 3-12: Air venting

① ≥ 5 m
② Air ventilation point

3.3.10 Flange deviation

Max. permissible deviation of pipe flange faces:
L_{max} - L_{min} ≤ 0.5 mm / 0.02"

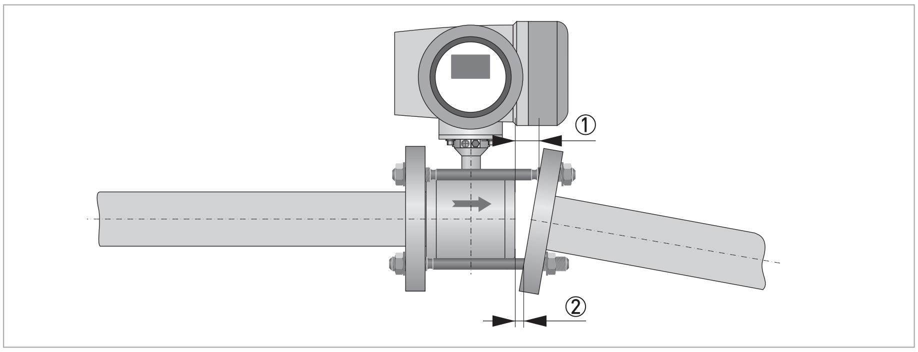

Figure 3-11: Flange deviation

① L_{max}
② L_{min}

3.3.11 Mounting position

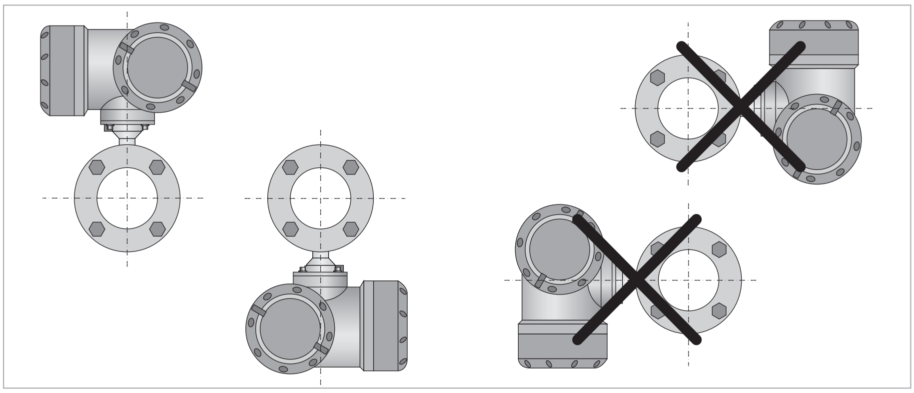

Figure 3-14: Mounting position

3.4 Mounting

3.5 Torques and pressures sandwich versions

- *Use stainless steel A2 / 6.9 class bolts.*
- *Make sure the connecting flanges are of type raised face (RF).*

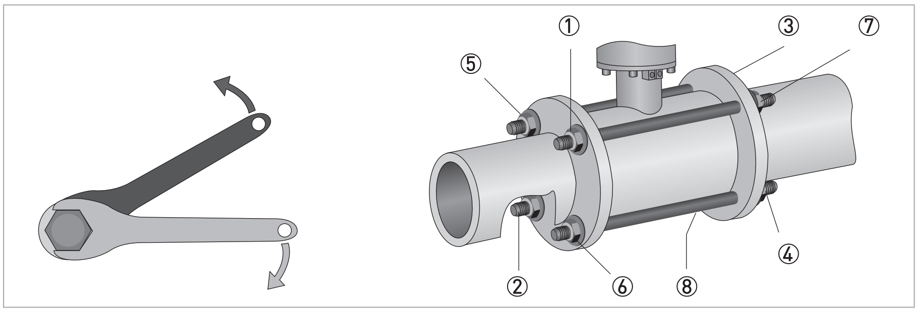

Figure 3-15: Tighten the bolts in fixed order, see picture.

Max. torque:

- Step 1: approx. 50% of max. torque
- Step 2: approx. 80% of max. torque
- Step 3: 100% of max. torque given in tables

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Nominal size DN [mm]	Pressure rating	Max. allowable operating pressure [bar]
25...80	PN 40	40
100	PN 16	16
100	PN 25	25

ASME B 16.5

Nominal size [inch]	Pressure rating	Max. allowable operating pressure [psig]
1...4"	150 lb	230
1...3"	300 lb	580

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Nominal size DN [mm]	Counter flanges & bolts		Max. allowable torque			
			Gasket: Filled PTFE / PTFE / PF29		Gasket: Graphite	
	Rating	Size	Nm	ft-lb	Nm	ft-lb
25	PN 40	M12 x 141	22	16	32	24
40	PN 40	M16 x 176	47	35	66	49
50	PN 40	M16 x 203	58	43	82	60
80	PN 40	M16 x 261	48	35	69	51
100	PN 16	M16 x 303	75	55	106	78
100	PN 25	M20 x 176	94	69	133	98

ASME B 16.5 (150 lb)

Nominal size DN [inch]	Counter flanges & bolts		Max. allowable torque			
			Gasket: Filled PTFE / PTFE / PF29		Gasket: Graphite	
	Rating	Size	Nm	ftlb	Nm	ftlb
1"	150 lb	1/2"UNC x 142	24	18	33	24
1 ½"	150 lb	1/2"UNC x 174	38	28	54	40
2"	150 lb	5/8"UNC x 215	58	43	83	61
3"	150 lb	5/8"UNC x 268	98	72	138	102
4"	150 lb	5/8"UNC x 318	75	55	108	80

ASME B 16.5 (300 lb)

Nominal size DN [inch]	Counter flanges & bolts		Max. allowable torque			
			Gasket: Filled PTFE / PTFE / PF29		Gasket: Graphite	
	Rating	Size	Nm	ftlb	Nm	ftlb
1"	300 lb	1"	20	15	28	21
1 ½"	300 lb	1 ½"	43	32	61	45
2"	300 lb	2"	61	45	87	64
3"	300 lb	3"	58	43	83	61
4"	300 lb	4"	85	63	112	90

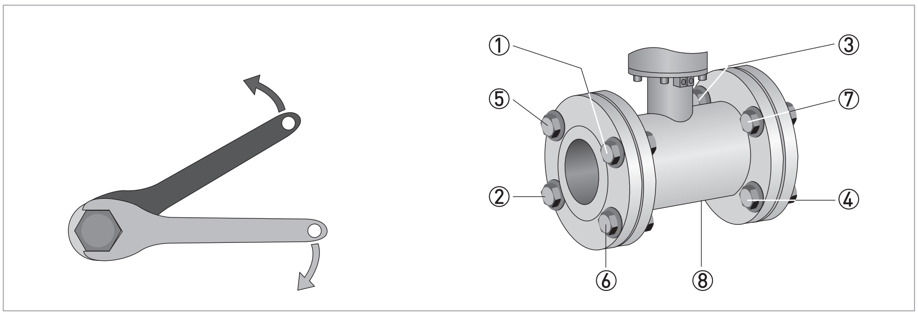
3.6 Torques and pressures flanged versions

Use stainless steel A2 / 6.9 class bolts.

Please take care to use the proper gasket to prevent damaging the liner of the flowmeter. In general, the use of spiral wound gaskets is not advised, as it could severely damage the liner of the flowmeter.

Tighten the bolts in fixed order, see picture:

- Step 1: by hand
- Step 2: approx. 25% of max. torque
- Step 3: approx. 50% of max. torque
- Step 4: approx. 80% of max. torque
- Step 5: 100% of max. torque given in table



Diameters DN80 and DN100 have 8 holes per flange, please continue in the same way to tighten the other bolts.

With the instrument, 4 PTFE sealing rings are included (2 to be used with installation, 2 as spare).
No other gaskets are required.

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Nominal size DN [mm]	Counter flanges		Recommended torque [Nm]	
	Rating	Bolts	Min.	Max.
25	PN 40	4 x M 12	50	70
40	PN 40	4 x M 16	100	175
50	PN 40	4 x M 16	100	175
80	PN 40	8 x M 16	100	175
100	PN 16	8 x M 16	100	175

ASME B 16.5 (150 lb)

Nominal size DN [inch]	Counter flanges		Recommended torque [ftlb]	
	Rating	Bolts	Min.	Max.
1"	150	4 x ½"	40	80
1½"	150	4 x ½"	60	80
2"	150	4 x 5/8"	80	160
3"	150	4 x 5/8"	100	160
4"	150	8 x 5/8"	100	160

ASME B 16.5 (300 lb)

Nominal size DN [inch]	Counter flanges		Recommended torque [ftlb]	
	Rating	Bolts	Min.	Max.
1"	300	4 x ¾"	40	180
1½"	300	4 x ¾"	60	180
2"	300	8 x 5/8"	80	96
3"	300	8 x ¾"	100	180

4.1 Safety instructions

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

Observe the national regulations for electrical installations!

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Grounding

The device must be grounded in accordance with regulations in order to protect personnel against electric shocks.

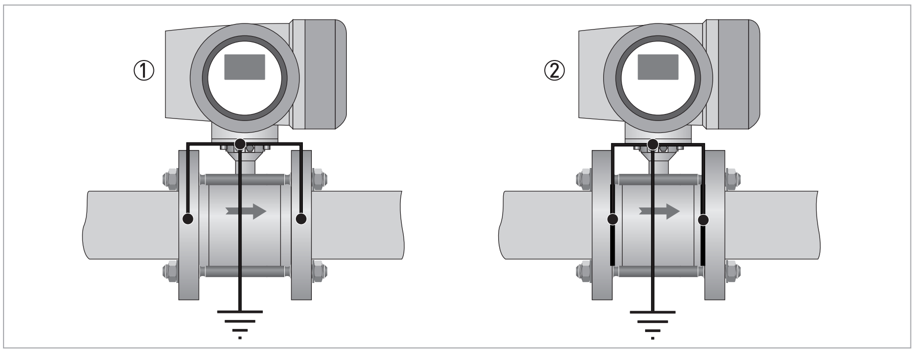

Figure 4-1: Grounding

① Metal pipelines, not internally coated. Grounding without grounding rings.
② Metal pipelines with internal coating and non-conductive pipelines. Grounding with grounding rings.

Figure 4-2: Grounding ring number 1

Grounding ring number 1 (for type VN19):

- 3 mm / 0.12" thick (tantalum: 0.5 mm / 0.02")

4.3 Connection diagrams

For the connection diagrams and more information on connection of the sensor, please refer to the documentation of the applicable signal converter.

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