



OPTISWIRL 2100 Technical Datasheet

Vortex flowmeter

- Economical Vortex flowmeter for standard applications
- Easy to use and reliable
- Stable measurements even under demanding process conditions with advanced technology for signal filtering (AVFD)



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1.1 The economical solution

Vortex flowmeters are suitable for a wide range of media. This also applies to the OPTISWIRL 2100.

The OPTISWIRL 2100 uses the same durable sensor technology as the OPTISWIRL 4200. Due to the widely installed base of the OPTISWIRL 4200, the long-term reliability of the flow sensor has been proven.

With the innovative AVFD (Advanced Vortex Frequency Detection) the OPTISWIRL 2100 is fitted with an up-to-date signal filter. It analyses the measured signal and eliminates interferences and perturbations. Thereby, stable measurements can even be realised under demanding process conditions.



Figure 1-1: Device versions

- ① Compact flange version
- ② Compact sandwich version
- ③ Remote signal converter
- ④ Remote flow sensor

Highlights

- Advanced technology for signal filtering - AVFD (Advanced Vortex Frequency Detection)
- Remote version with field housing converter with cable length up to 50 m / 164 ft
- Integrated reduction of nominal size
- Measurement of conductive and non-conductive liquids, gases and steam

Industries

- Chemicals
- Oil & Gas
- Food & Beverage
- Pharmaceuticals
- Iron, Steel and Metals
- Pulp & Paper
- Water

Applications

- Measurement of saturated steam and superheated steam
- Measurement of consumption of industrial gases
- Measurement of consumption in compressed air systems
- SIP and CIP processes in the food, beverage and pharmaceutical industries

1.2 Options and variants

1. The economical device for standard applications



The **OPTISWIRL 2100 C** as compact flowmeter in a flange version is suitable for universal use in measuring liquids, gases and vapours.

2. The easy to install sandwich version with optimised centering rings



The **OPTISWIRL 2100 C** as a compact flowmeter in a sandwich version is suitable for universal use in the measurement of liquids, gases and vapours.

The flowmeter is provided with additional optimised centering rings. The vortex flowmeter can be aligned centrically by turning the centering rings, eliminating any offset between the flowmeter and the pipeline.

3. The OPTISWIRL 2100 F as remote version



The **OPTISWIRL 2100** is also available as a remote version with field housing converter.

This feature allows separating the signal converter from the flow sensor up to a distance of 50 m / 164 ft, in case the flow sensor is mounted in inaccessible areas.

The remote mounted signal converter allows easy operation and reading of values at eye level.

4. OPTISWIRL 2100 F1R / F2R with integrated nominal diameter reduction



The **OPTISWIRL 2100 F1R / F2R** with integrated nominal diameter reduction up to two nominal diameter sizes assures best results in accuracy and optimal measuring ranges even in pipelines with large diameters, which have been designed for a low pressure loss.

By forgoing complex pipeline reduction installations, space and cost saving installations can be realized. At the same time the number of potential leakages is reduced to a minimum.

1.3 Devices with integrated nominal diameter reduction

The device versions F1R and F2R offer an integrated nominal diameter reduction up to two nominal diameter sizes to assure best results in accuracy and optimum measuring ranges; even in pipelines with large diameters, which have been designed for a low pressure loss.

Nominal diameter of flow sensor	Nominal size of process connections									
	DN15	DN25	DN40	DN50	DN80	DN100	DN150	DN200	DN250	DN300
DN15	StV ①	F1R	F2R	-	-	-	-	-	-	-
DN25	-	StV ①	F1R	F2R	-	-	-	-	-	-
DN40	-	-	StV ①	F1R	F2R	-	-	-	-	-
DN50	-	-	-	StV ①	F1R	F2R	-	-	-	-
DN80	-	-	-	-	StV ①	F1R	F2R	-	-	-
DN100	-	-	-	-	-	StV ①	F1R	F2R	-	-
DN150	-	-	-	-	-	-	StV ①	F1R	F2R	-
DN200	-	-	-	-	-	-	-	StV ①	F1R	F2R
DN250	-	-	-	-	-	-	-	-	StV ①	F1R
DN300	-	-	-	-	-	-	-	-	-	StV ①

Table 1-1: Integrated nominal diameter reduction

① Standard version

1.4 Functional principle

Vortex flowmeters are used to measure the flow of gases, vapours and liquids at completely filled pipes.

The measuring principle is based on the Karman vortex street. The measuring tube contains a bluff body at which vortex shedding occurs and which is detected by a sensor unit located behind. The frequency f of the vortex shedding is proportional to the flow velocity v . The non-dimensional Stouhal number S describes the relationship between vortex frequency f , width b of the bluff body and the average flow velocity v :

$$f = \frac{S \cdot v}{b}$$

The vortex frequency is recorded at the flow sensor and evaluated at the signal converter.

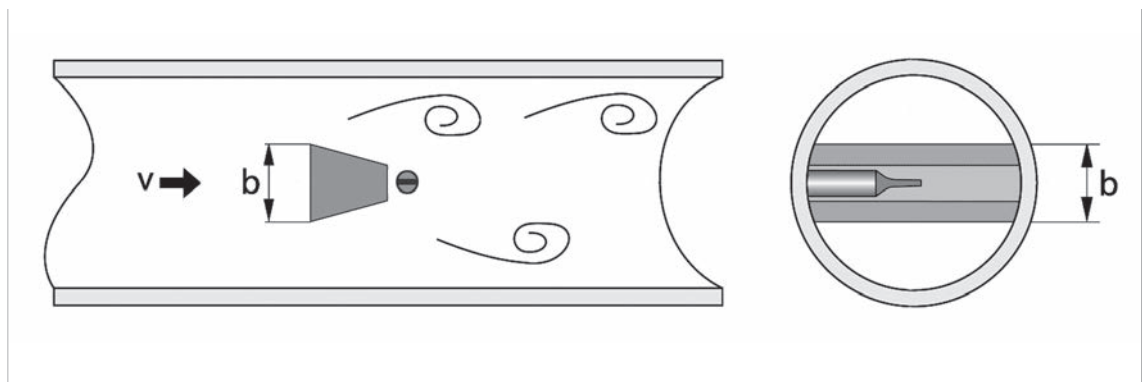


Figure 1-2: Functional principle

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

Application range	Flow measurement of liquids, gases and vapours
Function / Measuring principle	Karman vortex street
Measurement	
Primary measured value	Number of separated vortices
Secondary measured value	Operating and standard volume flow and mass flow
Signal converter	
Versions	Compact version
	Remote version
Weather protection cover	Optional available cover to protect the signal converter housing against intense solar radiation or vandalism
Flow sensor	
Standard	Flange version, flow sensor: F
	Sandwich version, flow sensor: S
Option	Flange version with single reduction of nominal diameter, flow sensor: F1R
	Flange version with double reduction of nominal diameter, flow sensor: F2R
Display and user interface	
Local display	Graphic display
Interface and display languages	Available display languages: German, English, French, Italian, Spanish, Chinese, Czech, Polish, Turkish
Communication interfaces	HART®

Measuring accuracy

Reference conditions	
Reference conditions	Water at +20°C / +68°F
	Air at +20°C / +68°F and 1.013 bara / 14.7 psia
Maximum measuring error	
Flow rate (liquid)	±1% of measured value ($Re \geq 20000$) with calibration
	±5% of measured value ($Re \geq 20000$) without calibration
	±3% of measured value ($10000 < Re < 20000$) with calibration
	±7% of measured value ($10000 < Re < 20000$) without calibration
Flow rate (gases and steam)	±2% of measured value ($Re \geq 20000$) with calibration
	±5% of measured value ($Re \geq 20000$) without calibration
	±3% of measured value ($10000 < Re < 20000$) with calibration
	±7% of measured value ($10000 < Re < 20000$) without calibration
Repeatability (volume flow)	±0.1% of measured value

Operating conditions

Temperature	
Medium temperature	-40...+240°C / -40...+465°F
Ambient temperature ②	Non-Ex: -40...+85°C / -40...+185°F
	Ex: -40...+65°C / -40...+140°F
Storage temperature	-40...+85°C / -40...+185°F
② Decreasing display contrast outside of the temperature range of 0...+60°C / +32...+140°F.	
Pressure	
Medium pressure	Max. 100 bar / 1450 psi
Ambient pressure	Atmosphere: altitude up to 4000 m / 13123 ft above sea level
Media properties	
Density	Taken into consideration when sizing.
Viscosity	< 10 cP
Reynold's number	> 10000
Other conditions	
Use	Indoor / Outdoor
Humidity	Annual average $\leq 90\%$ RH (no condensation)

Recommended flow velocities	
Liquids ③	0.3...7 m/s / 0.98...23 ft/s (optional up to 10 m/s / 32.8 ft/s taking cavitation into account)
Gases and steam ③	2.0...80 m/s / 6.6...262.5 ft/s
	DN15: 3.0...45 m/s / 9.8...148 ft/s; DN25: 2.0...70 m/s / 6.6...230 ft/s
③ These values represent the absolute limits of flow velocities. For more detailed information for your specific application refer to <i>Intended use</i> on page 23.	
Other conditions	
Ingress protection	Compact version: IP66/67
	Remote version: signal converter housing: IP66/67; flow sensor housing: IP66/67

Installation conditions

Inlet section	≥ 15 DN without disturbing flow
	≥ 20 DN after a pipe diameter reduction
	≥ 20 DN after a single bend 90°
	≥ 30 DN after a double bend 2 x 90°
	≥ 40 DN after a double three-dimensional bend 2 x 90°
	≥ 50 DN after a control valve
	≥ 2 DN before a flow straightener; ≥ 8 DN after a flow straightener
Outlet section	≥ 5 x DN

Materials

Flanges and process connections	Steel A105
Flow sensor body	Die-cast stainless steel 1.4408/CF8M
Electronics housing	Die-cast aluminium, two-layer coating (epoxy/polyester)
Measuring tube (Pick-up gasket)	Stainless steel 1.4435 / 316L

Process connections

Flange version	
DIN EN 1092-1	DN15...100, PN16...100 DN150...300, PN16...40
ASME B16.5	NPS1/2...4, 150...600 lb NPS6...12, 150...300 lb
JIS B2220	DN15...300, 10...20 K
For detailed information on combination flange/pressure rating, refer to section "Dimensions and weights".	
Sandwich version	
DIN	DN15...100, PN100
ASME	NPS1/2...4, 600 lb
JIS	DN15...100, 10...20 K

Electrical connections

Power supply (current output version)	The power supply has to be able to supply a minimum of 22 mA.
	Non-Ex: 12...36 VDC
	Ex i: 12...30 VDC
	Ex d: 12...32 VDC
Connection terminals	For wire cross-sections 0.5...2.5 mm ²
	Fastening torque: 0.6 N
Cable entries	Standard: M20.5
	Option: 1/2 NPT and G1/2 adapters
Connecting cable	Only for remote versions.
	Cable length: ≤ 50 m / 164 ft

Outputs

General	All inputs and outputs are electrically isolated from each other and from all other circuits.
Time constant	The time constant corresponds to 63% of the elapsed time of a processor procedure. 0...100 seconds (rounded up to 0.1 seconds)
Current output	
Type	4...20 mA HART® (passive)
Output data	Volume flow, mass flow, norm. volume flow, vortex frequency, flow velocity
Resolution	5 µA
Linearity / accuracy	0.1% (of read value)
Temperature coefficient	50 ppm/K (typically), 100 ppm/K (max.)
Error signal	According to NE 43
Description of abbreviations	U_{ext} = external voltage; R_L = load + resistance
Load	Minimum 0 Ω; maximum $R_L = ((U_{\text{ext}} - 12 \text{ VDC}) / 22 \text{ mA})$
HART®	
General	HART® protocol via passive current output
HART® revision	HART® 7
	Burst mode
System requirements	Load min. 250 Ω
Multidrop operation	4 mA

Pulse output	
Type	Passive
Temperature coefficient	50 ppm/K
Residual current	< 0.2 mA at 32 V ($R_i = 180 \text{ k}\Omega$)
Pulse width	0.5...2000 ms
Output data	Volume, mass, norm. volume
Pulse rate	Max. 1000 pulses/s
Power supply	Non-Ex: 24 VDC as NAMUR or open < 1 mA, maximum 36 V, closed 120 mA, $U < 2 \text{ V}$ Ex: 24 VDC as NAMUR or open < 1 mA, maximum 30 V, closed 120 mA, $U < 2 \text{ V}$

Approvals and certificates

Declaration of conformity	This device fulfils the statutory requirements of the relevant directives and regulations. The manufacturer certifies successful testing of the product by applying the conformity mark on the device. For further information on directives, regulations, standards and certifications, please refer to the declaration of conformity which you can download from the manufacturer's website.
Standard version	Non-Ex
Hazardous areas	
ATEX	ATEX II2 G - Ex ia IIC T6...T2 Gb ATEX II2 G - Ex d ia IIC T6...T2 Gb ATEX II2 D - Ex tb IIIC T70°C Db
IECEx	IECEx - Ex ia IIC T6...T2 Gb IECEx - Ex d ia IIC T6...T2 Gb IECEx - Ex tb IIIC T70°C Db
QPS (USA & Canada)	QPS IS Class I Div 1 QPS XP Class I Div 1 QPS DIP Class II, III Div 1
Other standards and approvals	
QPS (USA & Canada)	QPS Ordinary Locations
Mechanical stress tests: Stationary vibration and shock	The signal converter was tested according to IEC 60721-3-4 Class 4M4. The flow sensor was tested according to IEC 60721-3-4 Class 4M4 and IEC 61298-3 - Low vibration. Sine vibration test - endurance (IEC 61298-3 - Low vibration, IEC 60068-2-6) - Frequency range: 10...1000 Hz - Amplitude: 10.0...58.1 Hz: $\pm 0.15 \text{ mm}$; 58.1...1000.0 Hz: 20 m/s^2 Sine vibration test - class 4M4 (IEC 60721-3-4 Class 4M4, IEC 60068-2-6) - Frequency range: 5...200 Hz - Amplitude: 5.00...8.51 Hz: $\pm 3.5 \text{ mm}$; 8.51...200.0 Hz: 10 m/s^2 Mechanical shock test (IEC 60721-3-4 Class 4M4, IEC 60068-2-27) - Shock pulse: Half-sine - Shock acceleration: 15g - Shock duration: 6 ms
NAMUR	NE 06, NE 21, NE 23, NE 32, NE 43, NE 53, NE 107
Further approvals on request.	

Table 2-1: Technical data

2.2 Dimensions and weights

2.2.1 Flange versions

Flange version EN 1092-1

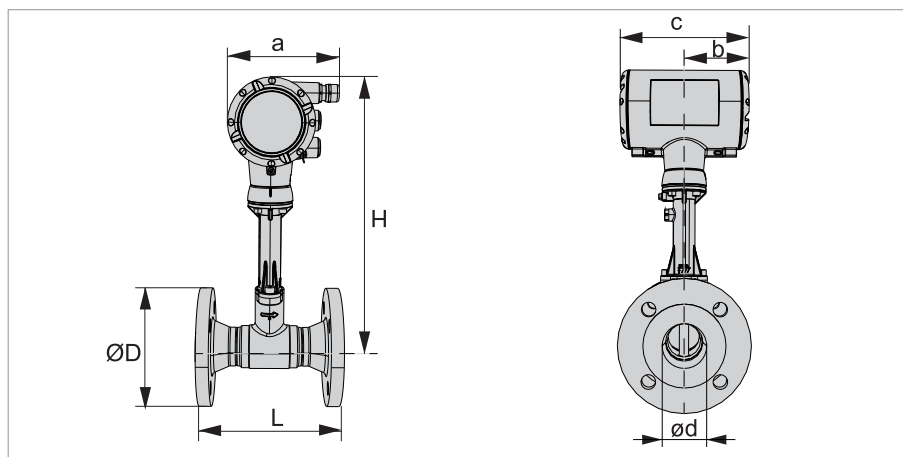


Figure 2-1: Front and side view of flange version

a = 148.5 mm / 5.85"

b = 85.8 mm / 3.38"

c = 171.5 mm / 6.75"

F1R - single reduction

F2R - double reduction

Nominal size	Pressure rating	Dimensions [mm]						Weight [kg]		
DN	PN	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
15	40	17.3	95	200	358.2	-	-	5.3	-	-
15	100	17.3	105	200	358.2	-	-	6.1	-	-
25	40	28.5	115	200	358.2	358.2	-	6.4	6.5	-
25	100	28.5	140	200	358.2	358.2	-	9.0	9.0	-
40	40	43.1	150	200	363.3	358.2	358.2	8.4	8.2	8.2
40	100	42.5	170	200	363.3	358.2	358.2	12.1	11.9	11.8
50	16	54.5	165	200	367.3	363.3	358.2	9.5	9.2	9.2
50	40	54.5	165	200	367.3	363.3	358.2	10.1	9.7	9.8
50	63	54.5	180	200	367.3	363.3	358.2	13.5	12.9	12.8
50	100	53.9	195	200	367.3	363.3	358.2	15.8	15.2	15.1
80	16	82.5	200	200	393.8	367.3	363.3	13.5	12.8	12.1
80	40	82.5	200	200	393.8	367.3	363.3	14.9	14.2	13.5
80	63	81.7	215	200	393.8	367.3	363.3	15.3	17.8	16.9
80	100	80.9	230	200	393.8	367.3	363.3	22.4	21.5	20.7
100	16	107.1	220	250	407.3	393.8	367.3	17.5	17.1	15.7
100	40	107.1	235	250	407.3	393.8	367.3	21.1	20.7	19.2

Nominal size	Pressure rating	Dimensions [mm]						Weight [kg]		
DN	PN	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
100	63	106.3	250	250	407.3	393.8	367.3	27.6	27.0	25.0
100	100	104.3	265	250	407.3	393.8	367.3	35.8	33.3	31.6
150	16	159.3	285	300	416.3	407.3	393.8	26.6	29.0	27.4
150	40	159.3	300	300	416.3	407.3	393.8	34.0	37.3	35.4
200	10	206.5	340	300	442.1	416.3	407.3	39.1	37.4	34.6
200	16	206.5	340	300	442.1	416.3	407.3	38.7	37.0	35.0
200	25	206.5	360	300	442.1	416.3	407.3	47.6	47.8	46.4
200	40	206.5	375	300	442.1	416.3	407.3	54.6	55.1	54.1
250	10	260.4	395	380	468.8	442.1	416.3	59.6	61.7	54.8
250	16	260.4	405	380	468.8	442.1	416.3	61.2	63.3	56.5
250	25	258.8	425	380	468.8	442.1	416.3	72.7	76.0	71.8
250	40	258.8	450	380	468.8	442.1	416.3	91.6	94.2	90.7
300	10	309.7	445	450	492.8	468.8	442.1	80.8	81.8	83.3
300	16	309.7	460	450	492.8	468.8	442.1	87.2	88.3	90.4
300	25	307.9	485	450	492.8	468.8	442.1	103.4	104.5	108.6
300	40	307.9	515	450	492.8	468.8	442.1	131.7	132.2	141.6

Table 2-2: Dimensions and weight of flange version EN 1092-1 in mm and kg

Nominal size	Pressure rating	Dimensions [inch]						Weight [lb]		
DN	PN	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
15	40	0.7	3.7	7.9	14.1	-	-	11.7	-	-
15	100	0.7	4.1	7.9	14.1	-	-	13.4	-	-
25	40	1.1	4.5	7.9	14.1	14.1	-	14.1	14.3	-
25	100	1.1	5.5	7.9	14.1	14.1	-	19.8	19.8	-
40	40	1.7	5.9	7.9	14.3	14.1	14.1	18.5	18.1	18.1
40	100	1.67	6.7	7.9	14.3	14.1	14.1	26.7	26.2	26.0
50	16	2.14	6.5	7.9	14.5	14.3	14.1	20.9	20.3	20.3
50	40	2.14	6.5	7.9	14.5	14.3	14.1	22.3	21.4	21.6
50	63	2.14	7.1	7.9	14.5	14.3	14.1	29.8	28.4	28.2
50	100	2.12	7.3	7.9	14.5	14.3	14.1	34.8	33.5	33.3
80	16	3.25	7.9	7.9	15.5	14.5	14.3	29.8	28.2	26.7
80	40	3.25	7.9	7.9	15.5	14.5	14.3	32.8	31.3	29.8
80	63	3.2	8.5	7.9	15.5	14.5	14.3	33.7	39.2	37.2
80	100	3.18	9.1	7.9	15.5	14.5	14.3	49.4	47.4	45.6
100	16	4.2	8.7	9.8	16.0	15.5	14.5	38.6	37.7	34.6
100	40	4.2	9.3	9.8	16.0	15.5	14.5	46.5	45.6	42.3

Nominal size	Pressure rating	Dimensions [inch]						Weight [lb]		
DN	PN	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
100	63	4.18	9.8	9.8	16.0	15.5	14.5	60.8	59.5	55.1
100	100	4.1	10.4	9.8	16.0	15.5	14.5	78.9	73.4	69.7
150	16	6.3	11.2	11.8	16.4	16.0	15.5	58.6	63.9	60.4
150	40	6.3	11.8	11.8	16.4	16.0	15.5	75.0	82.2	78.0
200	10	8.1	13.4	11.8	17.4	16.4	16.0	86.2	82.5	76.3
200	16	8.1	13.4	11.8	17.4	16.4	16.0	85.3	81.6	77.2
200	25	8.1	14.2	11.8	17.4	16.4	16.0	104.9	105.4	102.3
200	40	8.1	14.8	11.8	17.4	16.4	16.0	120.4	121.5	119.3
250	10	10.3	15.6	15.0	18.5	17.4	16.4	131.4	136.0	120.8
250	16	10.3	15.9	15.0	18.5	17.4	16.4	134.9	139.6	124.6
250	25	10.2	16.7	15.0	18.5	17.4	16.4	160.3	167.6	158.3
250	40	10.2	17.7	15.0	18.5	17.4	16.4	201.9	207.7	200.0
300	10	12.2	17.5	17.7	19.4	18.5	17.4	178.1	180.3	183.6
300	16	12.2	18.1	17.7	19.4	18.5	17.4	192.2	194.7	199.3
300	25	12.1	19.1	17.7	19.4	18.5	17.4	228.0	230.4	239.4
300	40	12.1	20.3	17.7	19.4	18.5	17.4	290.3	291.4	312.2

Table 2-3: Dimensions and weight of flange version EN 1092-1 in inch and lb

Flange version ASME B16.5

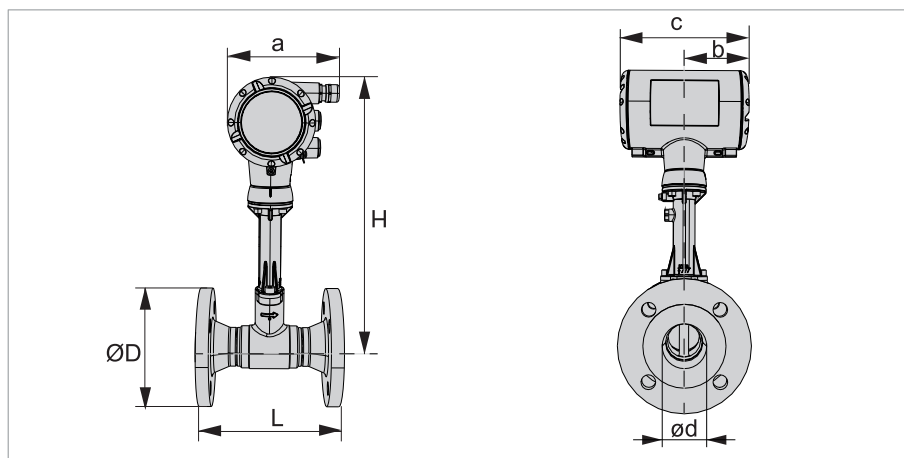


Figure 2-2: Front and side view of flange version

a = 148.5 mm / 5.85"

b = 85.8 mm / 3.38"

c = 171.5 mm / 6.75"

Nominal size	Pressure rating	Dimensions [mm]						Weight [kg]		
NPS	Class	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
1/2	150	15.8	90	200	358.2	-	-	4.7	-	-
1/2	300	15.8	95	200	358.2	-	-	5.2	-	-
1/2	600	15.8	95	200	358.2	-	-	5.3	-	-
1	150	26.6	110	200	358.2	358.2	-	5.8	5.8	-
1	300	26.6	125	200	358.2	358.2	-	6.8	6.9	-
1	600	24.3	125	200	358.2	358.2	-	7.2	7.2	-
1 1/2	150	40.9	125	200	363.3	358.2	358.2	7.2	7.1	7.0
1 1/2	300	40.9	155	200	363.3	358.2	358.2	9.5	9.4	9.3
1 1/2	600	38.1	155	200	363.3	358.2	358.2	10.5	10.4	10.4
2	150	52.5	150	200	367.3	363.3	358.2	9.2	9.1	8.8
2	300	52.5	165	200	367.3	363.3	358.2	10.8	10.7	10.4
2	600	49.2	165	200	367.3	363.3	358.2	12.5	12.3	12.0
3	150	77.9	190	200	393.8	367.3	363.3	14.7	14.1	13.7
3	300	77.9	210	200	393.8	367.3	363.3	18.0	17.7	17.4
3	600	74.0	210	200	393.8	367.3	363.3	21.0	20.6	20.3
4	150	102.3	230	250	407.3	393.8	367.3	20.9	21.0	19.9
4	300	102.3	255	250	407.3	393.8	367.3	29.4	29.6	28.5
4	600	97.2	275	250	407.3	393.8	367.3	40.9	40.8	39.8
6	150	154.1	280	300	416.3	407.3	393.8	29.9	33.3	32.1
6	300	154.1	320	300	416.3	407.3	393.8	47.4	52.2	51.1
8	150	202.7	345	300	442.1	416.3	407.3	45.6	45.7	45.5
8	300	202.7	380	300	442.1	416.3	407.3	66.2	69.4	71.6

Nominal size	Pressure rating	Dimensions [mm]						Weight [kg]		
NPS	Class	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
10	150	254.6	405	380	468.8	442.1	416.3	68.2	73.8	69.1
10	300	254.6	455	380	468.8	442.1	416.3	106.3	111.4	111.2
12	150	304.8	485	450	492.8	468.8	442.1	110.7	111.0	118.0
12	300	304.8	520	450	492.8	468.8	442.1	154.8	153.6	170.5

Table 2-4: Dimensions and weight of flange version ASME B16.5 in mm and kg

Nominal size	Pressure rating	Dimensions [inch]						Weight [lb]		
NPS	Class	d	D	L	H	H F1R	H F2R	Std.	F1R	F2R
1/2	150	0.6	3.5	7.9	14.1	-	-	10.4	-	-
1/2	300	0.6	3.7	7.9	14.1	-	-	11.5	-	-
1/2	600	0.6	3.7	7.9	14.1	-	-	11.7	-	-
1	150	1.0	4.3	7.9	14.1	14.1	-	12.8	12.8	-
1	300	1.0	4.9	7.9	14.1	14.1	-	15.0	15.2	-
1	600	0.96	4.9	7.9	14.1	14.1	-	15.9	15.9	-
1 1/2	150	1.6	4.9	7.9	14.3	14.1	14.1	15.9	15.7	15.4
1 1/2	300	1.6	6.1	7.9	14.3	14.1	14.1	20.9	20.7	20.5
1 1/2	600	1.5	6.1	7.9	14.3	14.1	14.1	23.1	22.9	22.9
2	150	2.1	5.9	7.9	14.5	14.3	14.1	20.3	20.1	19.4
2	300	2.1	6.5	7.9	14.5	14.3	14.1	23.8	23.6	22.9
2	600	1.9	6.5	7.9	14.5	14.3	14.1	27.6	27.1	26.5
3	150	3.1	7.5	7.9	15.5	14.5	14.3	32.4	31.1	30.2
3	300	3.1	8.3	7.9	15.5	14.5	14.3	39.7	39.0	38.4
3	600	2.9	8.3	7.9	15.5	14.5	14.3	46.3	45.4	44.8
4	150	4.0	9.1	9.8	16.0	15.5	14.5	46.1	46.3	43.9
4	300	4.0	10.0	9.8	16.0	15.5	14.5	64.8	65.3	62.8
4	600	3.8	10.8	9.8	16.0	15.5	14.5	90.2	89.9	87.7
6	150	6.1	11.0	11.8	16.4	16.0	15.5	65.9	73.4	70.8
6	300	6.1	12.6	11.8	16.4	16.0	15.5	104.5	115.1	112.7
8	150	8.0	13.6	11.8	17.4	16.4	16.0	100.5	100.8	100.3
8	300	8.0	14.2	11.8	17.4	16.4	16.0	145.9	153.0	157.9
10	150	10.1	15.9	15.0	18.5	17.4	16.4	150.4	162.7	152.3
10	300	10.1	17.5	15.0	18.5	17.4	16.4	234.4	245.6	245.2
12	150	12	19.1	17.7	19.4	18.5	17.4	244.1	244.7	260.1
12	300	12	20.5	17.7	19.4	18.5	17.4	341.3	338.6	375.9

Table 2-5: Dimensions and weight of flange version ASME B16.5 in inch and lb

2.2.2 Sandwich versions

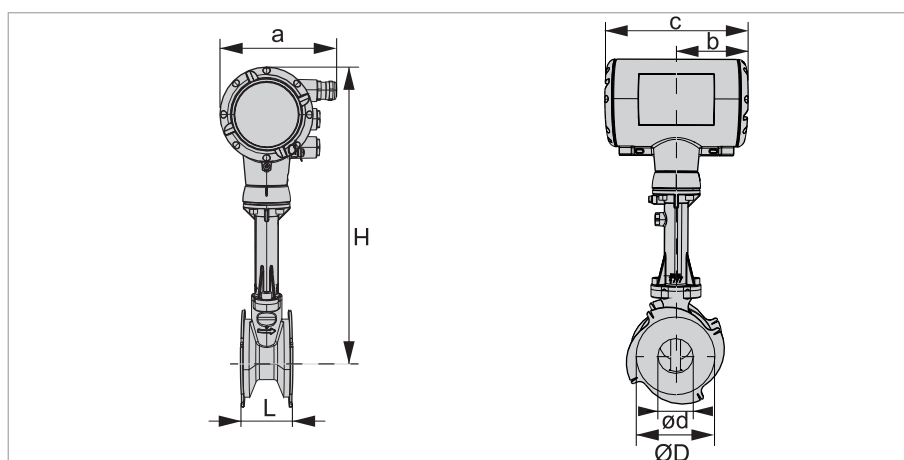


Figure 2-3: Front and side view of sandwich version

a = 148.5 mm / 5.85"

b = 85.8 mm / 3.38"

c = 171.5 mm / 6.75"

Nominal size	Pressure rating	Dimensions [mm]				Weight [kg]
DN	PN	d	D	L	H	
15	100	16	41	65	358.2	3.9
25	100	24	61	65	358.2	4.2
40	100	36	78	65	363.3	4.6
50	100	44	98	65	367.3	5.2
80	100	73	131	65	393.8	6.7
100	100	90	154	65	407.3	7.9

Table 2-6: Dimensions and weight of sandwich version in mm and kg

Nominal size	Pressure rating	Dimensions [inch]				Weight [lb]
DN	PN	d	D	L	H	
15	100	0.6	1.6	2.6	14.1	8.6
25	100	0.9	2.4	2.6	14.1	9.3
40	100	1.4	3.1	2.6	14.3	10.1
50	100	1.7	3.8	2.6	14.5	11.5
80	100	2.9	5.2	2.6	15.5	14.8
100	100	3.5	6.1	2.6	16.0	17.4

Table 2-7: Dimensions and weight of sandwich version in inch and lb

2.2.3 Remote versions

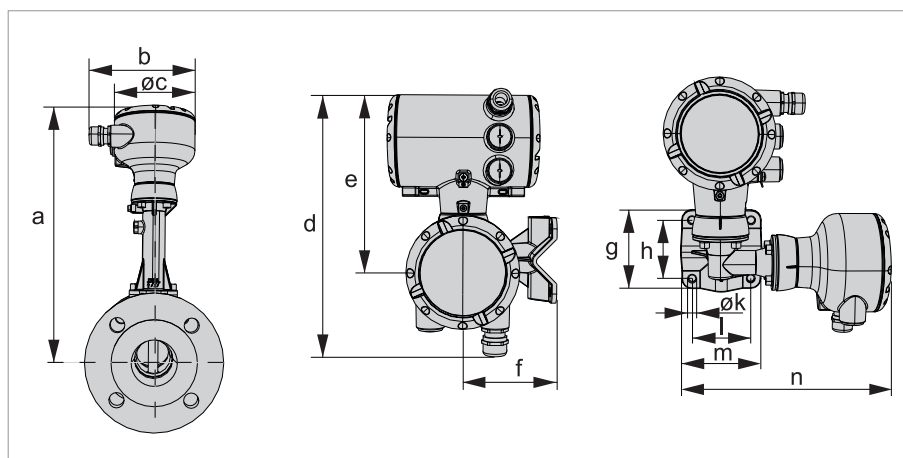


Figure 2-4: Front and side view of remote version

Dimension a

	Flange & sandwich version						Flange version			
DN	15	25	40	50	80	100	150	200	250	300
NPS	1/2	1	1 1/2	2	3	4	6	8	10	12
[mm]	314.6	314.6	319.7	323.7	350.2	363.7	372.7	398.5	425.2	449.2
["]	12.4	12.4	12.6	12.7	13.8	14.3	14.7	15.7	16.7	17.7

Table 2-8: Dimension a in mm and inch

Dimension a F1/2R

	Flange version									
DN	15	25	40	50	80	100	150	200	250	300
NPS	1/2	1	1 1/2	2	3	4	6	8	10	12
F1R [mm]	-	314.6	314.6	319.7	323.7	350.2	363.7	372.7	398.5	425.2
["]	-	12.4	12.4	12.6	12.7	13.8	14.3	14.7	15.7	16.7
F2R [mm]	-	-	314.6	314.6	319.7	323.7	350.2	363.7	372.7	398.95
["]	-	-	12.4	12.4	12.6	12.7	13.8	14.3	14.7	15.7

Table 2-9: Dimension a for F1R and F2R in mm and inch

Dimensions b...n

	b	c	d	e	f	g	h	j	k	l	m	n
[mm]	138.5	108.0	275.6	191.2	105.0	97.0	72.0	108.0	9.0	72.0	97.0	226.0
["]	5.46	4.25	10.9	7.53	4.14	3.82	2.84	4.25	0.35	2.84	3.82	8.90

Table 2-10: Dimensions b...n in mm and inch

2.3 Flow tables

Nominal size		Q _{min}	Q _{max}	Q _{min}	Q _{max}
DN - EN 1092-1	NPS - ASME B16.5	[m ³ /h]		[gph]	

Water

15	1/2	0.36	5.04	95.61	1283
15C	1/2	0.36	5.04	95.61	1283
25	1	0.81	11.34	215	3012
25C	1	0.81	11.34	215	3012
40	1 1/2	1.83	25.52	486.02	6256
50	2	2.74	38.13	727.70	10127
80	3	7.53	104.90	2000	27860
100	4	11.45	159.50	3041	42361
150	6	30.13	419.80	7961	111492
200	8	56.55	787.70	15019	209200
250	10	90.49	1261	23905	334901
300	12	123.03	1714	32675	455210
Values based on water at +20°C / +68°F					

Air

15	1/2	4.34	32.4	1147	8605
15C	1/2	8.69	39.6	2297	10517
25	1	9.77	113.4	2582	30117
25C	1	19.54	129.6	5164	34420
40	1 1/2	21.99	291.7	5812	77471
50	2	32.84	435.7	8679	115715
80	3	90.40	1199	23891	318434
100	4	137.41	1823	36316	484158
150	6	361.6	4797	95532	1274003
200	8	678.58	9003	179339	2391047
250	10	1086	14406	286870	3825993
300	12	1476	19586	390176	5201715
Values based on air at +20°C / +68°F and 1.013 bara / 14.7 psia and density 1.204 kg/m ³ / 0.0751 lb/ft ³					

Table 2-11: Measuring ranges for water and air

Gauge pressure [barg]		1		3.5		5.2		7	
Density [kg/m³]		1.134		2.419		3.272		4.166	
Temperature [°C]		120.4		148.0		160.2		170.5	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[kg/h]		[kg/h]		[kg/h]		[kg/h]	
15	1/2	5.87	36.79	7.41	78.41	8.62	106.0	9.73	135.0
25	1	11.43	128.7	16.68	274.4	19.4	371.1	21.89	472.5
40	1 1/2	25.71	331.1	37.53	705.7	43.64	954.4	49.24	1215
50	2	38.4	494.6	56.06	1054	65.2	1425	73.56	1815
80	3	105.7	1361	154.4	2901	179.5	3924	202.5	4996
100	4	160.7	2069	234.6	4410	272.8	5965	307.8	7594
150	6	422.8	5446	617.3	11607	717.8	15698	809.9	19985
200	8	793.4	10220	1159	21781	13487	29458	1520	37503
250	10	1270	16355	1854	33855	2156	47139	2432	60014
300	12	1727	22236	2520	47388	2931	64089	3307	81594

Table 2-12: Measuring range for saturated steam: 1...7 barg

Gauge pressure [barg]		10.5		14		17.5		20	
Density [kg/m³]		5.883		7.588		9.304		10.53	
Temperature [°C]		186.1		198.3		208.5		214.9	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[kg/h]		[kg/h]		[kg/h]		[kg/h]	[kg/h]
15	1/2	12.78	190.6	16.49	246.0	20.21	301.5	22.87	341.3
25	1	26.01	667.2	29.55	853.0	32.71	950.0	34.8	1014
40	1 1/2	58.52	1676	66.48	1919	73.6	2137	78.29	2282
50	2	87.41	2504	99.31	2867	110.0	3193	117.0	3409
80	3	240.6	6893	273.4	7891	302.6	8789	322.0	9385
100	4	365.8	10477	415.5	11995	460.0	13360	489.4	14266
150	6	962.4	27572	1094	31567	1211	35158	1288	37542
200	8	1808	51741	2052	59237	2272	65975	2417	70450
250	10	2890	82797	3284	94792	3635	105576	3867	112736
300	12	3930	112569	4464	128877	4942	143538	5258	153273

Table 2-13: Measuring range for saturated steam: 10.5...20 barg

Gauge pressure [psig]		15		50		75		100	
Density [lb/ft³]		0.0722		0.1494		0.2034		0.2564	
Temperature [°F]		249.8		297.7		320.0		337.8	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[lb/h]		[lb/h]		[lb/h]		[lb/h]	[lb/h]
15	1/2	12.32	82.42	16.26	171.1	18.97	232.8	21.31	293.8
25	1	25.40	288.4	36.59	598.8	42.58	814.9	47.95	1028
40	1 1/2	57.14	741.8	82.32	1540	96.03	2095	107.9	2644
50	2	85.35	1108	123.0	2300	143.5	3130	161.2	3951
80	3	235.0	3050	338.5	6332	394.9	8616	443.6	10875
100	4	357.1	4636	514.5	9625	600.2	13097	674.3	16531
150	6	939.7	12056	1354	25329	1580	34467	1775	43503
200	8	1764	22531	2541	47530	2964	64679	3330	81634
250	10	2822	36638	4066	76060	4743	103501	5329	130634
300	12	3837	49812	5528	103409	6448	140717	7244	177606

Table 2-14: Measuring range for saturated steam: 15...100 psig

Gauge pressure [psig]		150		200		250		300	
Density [lb/ft³]		0.3624		0.4676		0.5728		0.6784	
Temperature [°F]		365.9		387.8		406.0		421.8	
Flow rate		min.	max.	min.	max.	min.	max.	min.	max.
DN EN 1092-1	NPS ASME B16.5	[lb/h]		[lb/h]		[lb/h]		[lb/h]	[lb/h]
15	1/2	27.80	414.4	35.87	535.3	43.94	655.7	52.04	776.6
25	1	56.97	1452	64.71	1867	71.62	2079	78.06	2274
40	1 1/2	128.2	3670	145.6	4201	162.3	4768	175.67	5117
50	2	191.5	5483	217.5	6276	240.8	6989	262.4	7645
80	3	527.1	15093	598.7	17276	662.7	19239	722.2	21044
100	4	801.1	22942	910	26260	1008	29243	1098	31986
150	6	2109	60375	2395	69107	2651	76989	2889	84176
200	8	3956	113296	4494	129681	4974	144410	5421	157958
250	10	6331	181300	7191	207519	7959	231089	8675	252769
300	12	8607	246491	9777	282138	10821	314183	11794	343658

Table 2-15: Measuring range for saturated steam: 150...300 psig

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.

This device is a Group 1, Class A device as specified within CISPR11. It is intended for use in industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

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

The vortex flowmeters are used for flow measurement of gases, vapours and liquids.

The devices are particularly suitable for the measurement of:

- Clean liquids with low viscosity (< 10 cP)
- Hydrocarbons with low viscosity (< 10 cP)
- Water
- Chemicals with low corrosiveness
- Saturated steam
- Superheated steam, including CIP (Cleaning in Place) and SIP (Sterilising in Place) applications in the food industry

Note the following:

- In your project planning, please observe the data given in the corrosion tables.
- The pressure-bearing parts have been designed and rated for stationary operation taking into account the maximum pressure and temperature.
- Observe the data indicated on the nameplate for PS (stated pressures), TS (stated temperatures) and PT (test pressure).
- External forces and moments, caused e.g. by pipe stresses, have not been taken into account.

Primarily, volumetric flow is measured. A fixed density can be programmed to the measuring device. From this parameter the measuring device calculates the mass flow or standard volumetric flow using pre-programmed density data and then exports the measured values via various communication interfaces.

The devices are rated for the following flow velocities:

Liquids: DN15...DN300		$V_{\min}$: 0.3 m/s	0.98 ft/s	$V_{\min} [\text{m/s}] = 0.5 \times \sqrt{\frac{998}{\rho}} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	①
		$V_{\max}$: 10 m/s	32 ft/s	$V_{\max} [\text{m/s}] = 7 \times \left(\frac{998}{\rho} \right)^{0.47} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	②
Gases and steam:	DN15	$V_{\min}$: 3 m/s	10 ft/s	$V_{\min} [\text{m/s}] = 6 \times \sqrt{\frac{1.204}{\rho}} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	①
		$V_{\max}$: 45 m/s	147 ft/s	$V_{\max} [\text{m/s}] = 7 \times \left(\frac{998}{\rho} \right)^{0.47} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	②
	DN15C	$V_{\min}$: 3 m/s	10 ft/s	$V_{\min} [\text{m/s}] = 12 \times \sqrt{\frac{1.204}{\rho}} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	①
		$V_{\max}$: 55 m/s	180 ft/s	$V_{\max} [\text{m/s}] = 7 \times \left(\frac{998}{\rho} \right)^{0.47} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	②
	DN25	$V_{\min}$: 2 m/s	6.6 ft/s	$V_{\min} [\text{m/s}] = 6 \times \sqrt{\frac{1.204}{\rho}} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	①
		$V_{\max}$: 70 m/s	229 ft/s	$V_{\max} [\text{m/s}] = 7 \times \left(\frac{998}{\rho} \right)^{0.47} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	②
	DN25C	$V_{\min}$: 2 m/s	6.6 ft/s	$V_{\min} [\text{m/s}] = 12 \times \sqrt{\frac{1.204}{\rho}} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	①
		$V_{\max}$: 80 m/s	262 ft/s	$V_{\max} [\text{m/s}] = 7 \times \left(\frac{998}{\rho} \right)^{0.47} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	②
	DN40... DN300	$V_{\min}$: 2 m/s	6.6 ft/s	$V_{\min} [\text{m/s}] = 6 \times \sqrt{\frac{1.204}{\rho}} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	①
		$V_{\max}$: 80 m/s	262 ft/s	$V_{\max} [\text{m/s}] = 7 \times \left(\frac{998}{\rho} \right)^{0.47} \quad \rho \left[\frac{\text{kg}}{\text{m}^3} \right]$	②

Table 3-1: Flow velocities

① Use the larger value, according to the amount.

② Use the smaller value, according to the amount.

DN15C and DN25C have a robust flow sensor (signal pick-up) for harsh measuring conditions and higher maximum velocity compared to the standard version.

3.2 Installation conditions

For accurate volumetric flow measurement the measuring device needs a completely filled pipe and a fully developed flow profile.

Any vibrations may distort the measuring result. That is why any vibrations in the pipeline must be prevented through suitable measures.

Procedures to carry out before installing the device:

- *Nominal diameter of connection pipe flange = nominal flange diameter of pipe!*
- *Use flanges with smooth holes, e.g. welding neck flanges.*
- *Align carefully the holes of the connecting flange and the flowmeter flange.*
- *Check the compatibility of the gasket material with the process product.*
- *Make sure that the gaskets are arranged concentrically. The flange gaskets must not project into the pipe cross-section.*
- *The flanges have to be concentric.*
- *There must not be any pipe bends, valves, flaps or other internals in the immediate inlet run.*
- *Devices in sandwich version may only be installed using centering rings.*
- *Never install the device directly behind piston compressors or rotary piston meters.*
- *The device must not be heated by radiated heat (e.g. exposure to the sun) to an electronics housing surface temperature above the maximum permissible ambient temperature. If it is necessary to prevent damage from heat sources, a heat protection (e.g. sun shade) has to be installed.*
- *Do not lay signal cables directly next to cables for the power supply.*
- *At product temperatures or ambient temperatures $>+65^{\circ}\text{C}$ / $+149^{\circ}\text{F}$, a connection cable and cable glands with a minimum service temperature of $+80^{\circ}\text{C}$ / $+176^{\circ}\text{F}$ must be used.*

If there is a risk of water hammers in steam networks, appropriate condensate separators must be installed. Suitable measures must be taken to avoid water cavitation if it is a possible risk.

3.2.1 Installation when measuring liquids

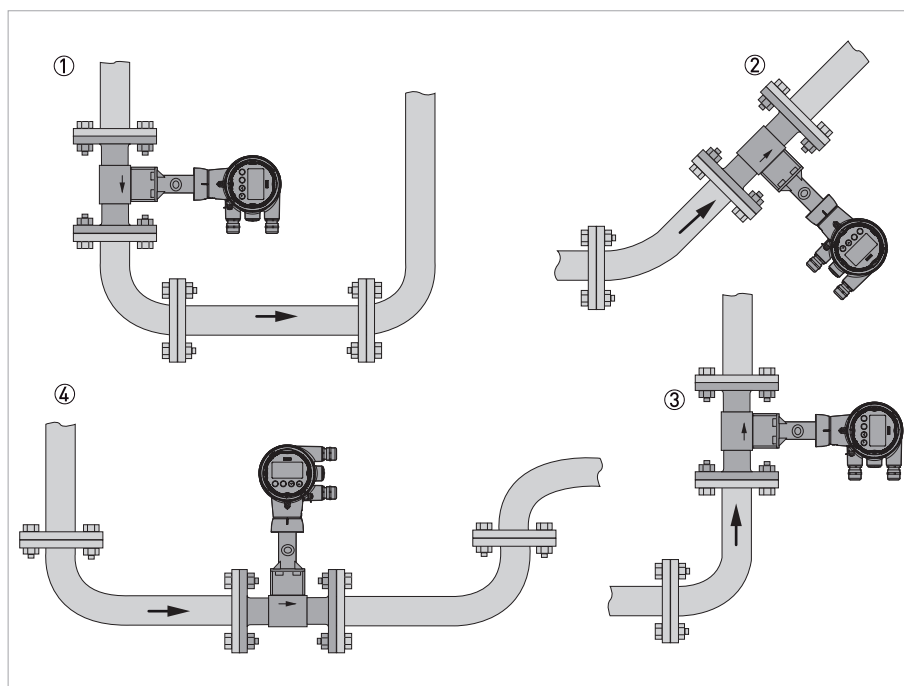


Figure 3-1: Recommended installation

- ① If the device is installed in a downpipe, a standpipe must be installed immediately after it
- ② Installing the device in an inclined standpipe
- ③ Installing the device in a vertical standpipe
- ④ Installing the device in the lower pipe bend

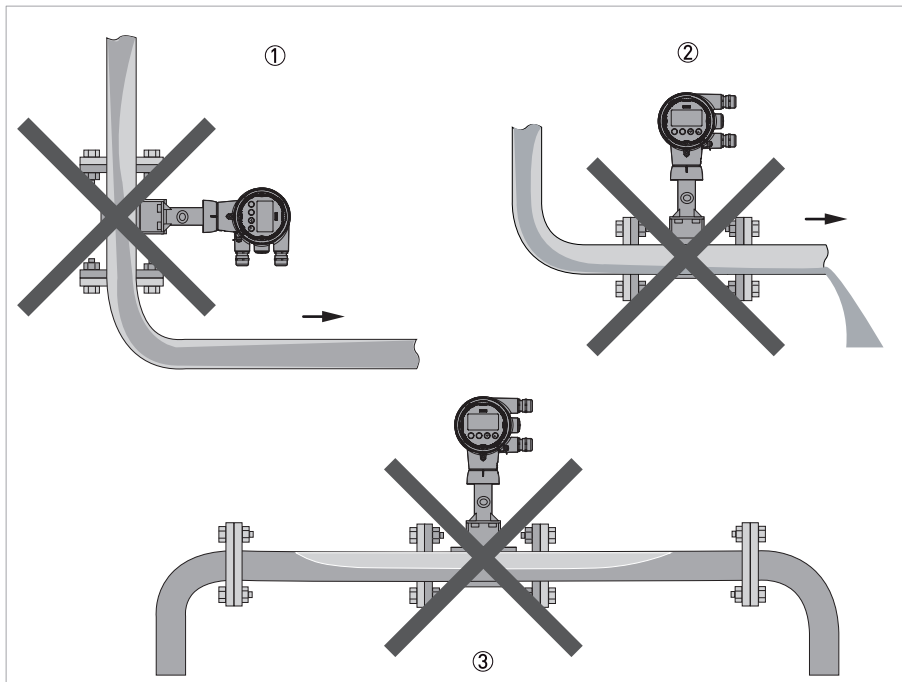


Figure 3-2: Not recommended installation

- ① Installing the device in a downstream pipe
- ② Installing the device in front of an outlet
- ③ Installing the device in an upper pipe bend due to risk of gas bubbles forming

- *Installing the device in a downstream pipe ① or upstream pipe of an outlet ②, there is a risk of partially filled pipes leading to inaccurate measurements.*
- *Installing the device in an upper pipe bend ③, there is a risk of gas bubbles forming. Gas bubbles can lead to pressure surges and inaccurate measurement.*

3.2.2 Installation when measuring steam and gases

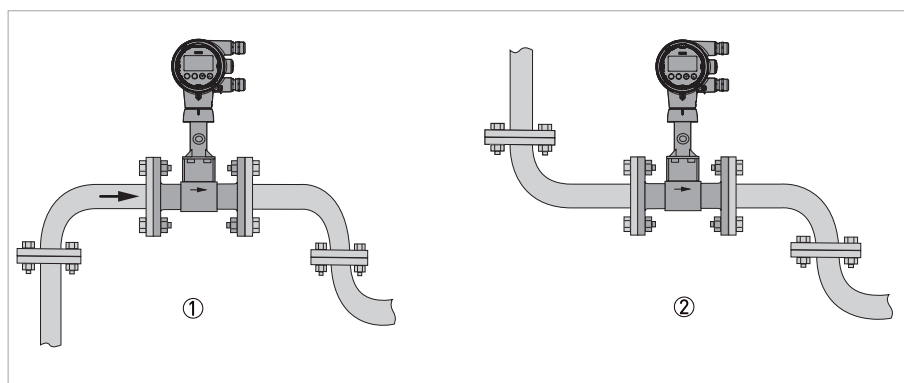


Figure 3-3: Recommended installation

- ① Installing the device in an upper pipe bend
- ② If the device is installed in a downpipe, a downpipe must be installed immediately after it

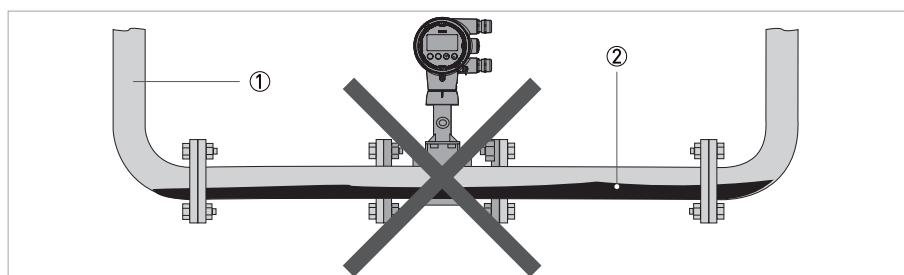


Figure 3-4: Not recommended installation

- ① Lower pipe bends
- ② Condensate

Installing the device in a lower pipe bend: there is a risk of condensate forming. Condensate can lead to cavitation and inaccurate measurement. Under certain circumstances the device can be destroyed and the measured medium can leak.

3.2.3 Pipelines with control valve

To ensure smooth and correct measurement, the manufacturer recommends not installing the measuring device downstream from a control valve. This would run the risk of vortex formation, which would distort the measuring result.

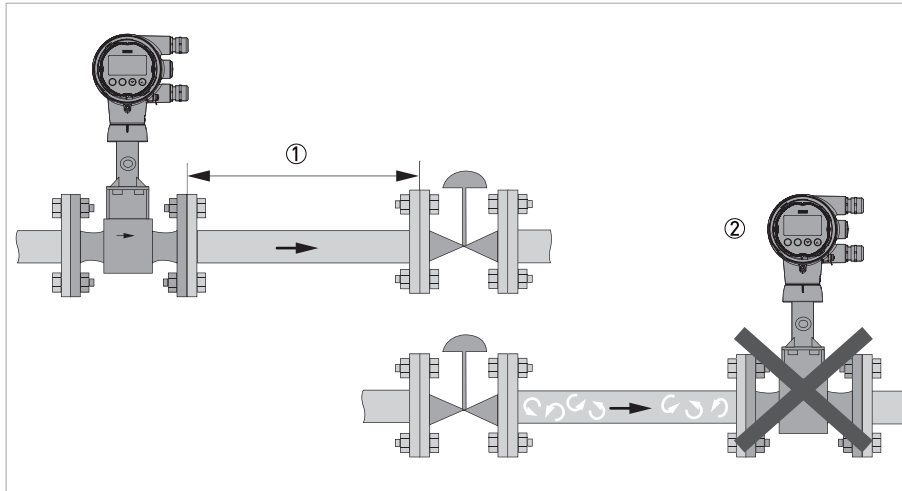


Figure 3-5: Pipelines with control valve

- ① Recommended: installing the device before the control valve at a distance of ≥ 5 DN
- ② Not recommended: installing the device directly downstream of control valves, due to vortex formation

3.2.4 Preferred mounting position

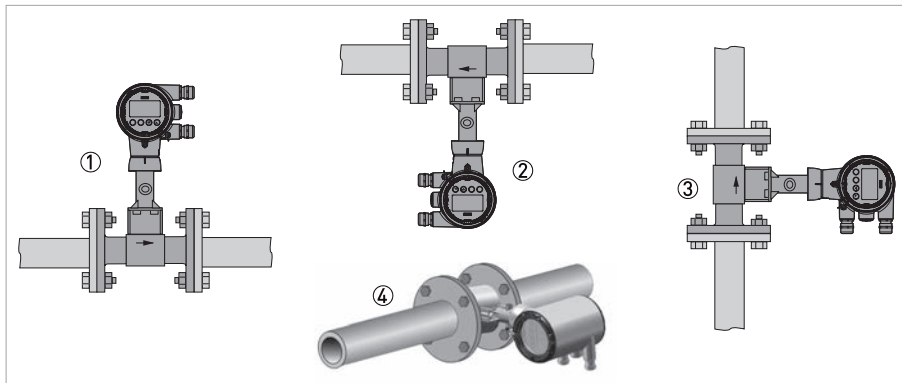


Figure 3-6: Preferred mounting position

- ① Above a horizontal pipe
- ② Underneath a horizontal pipe (not permitted with lines at risk of condensate forming)
- ③ On a vertical pipe
- ④ Horizontal pipeline with signal converter orientation of 90° to the side

Depending on the installation position, you may have to rotate the display and/or the connection housing.

3.3 Minimum inlet sections

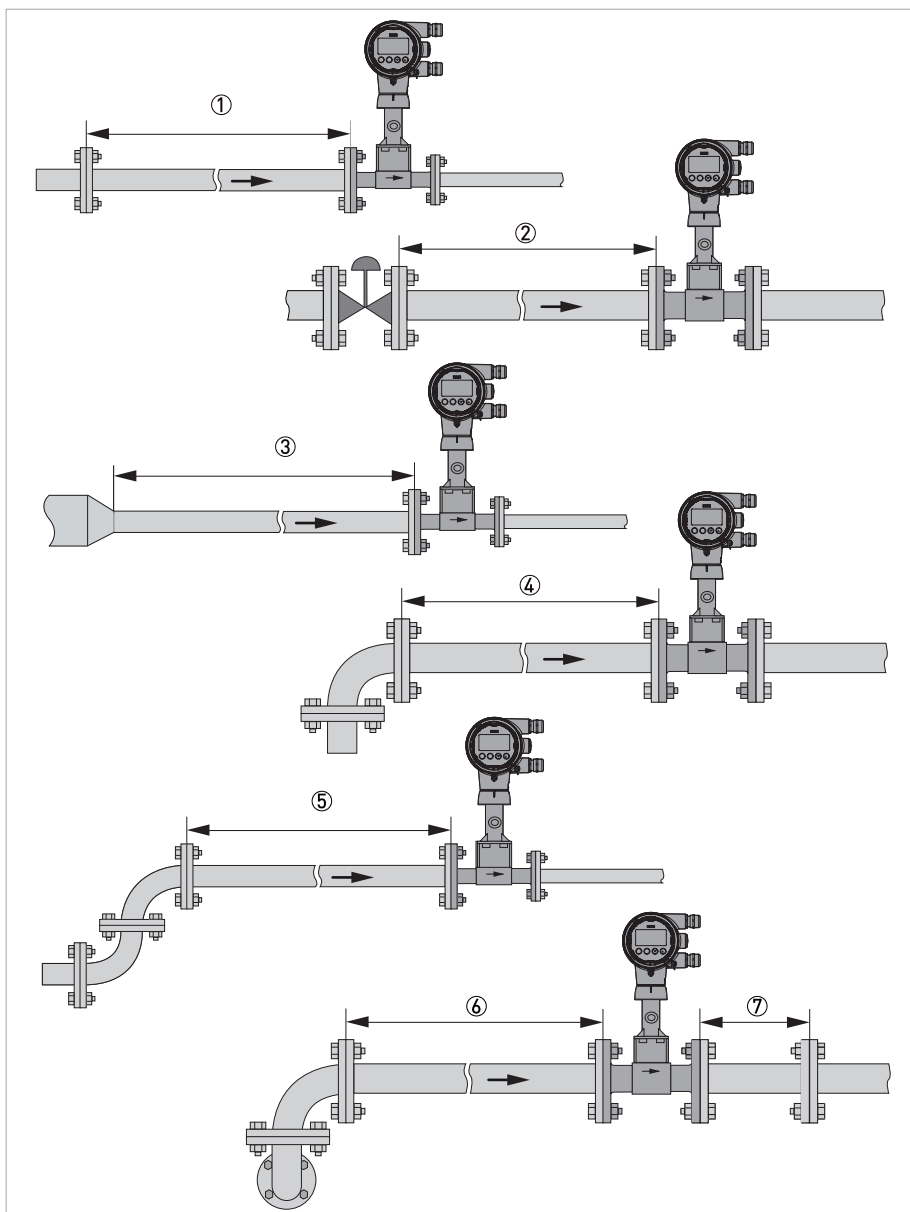


Figure 3-7: Minimum inlet sections

- ① General inlet section without disturbing flow ≥ 15 DN
- ② After a control valve ≥ 50 DN
- ③ After a pipe diameter reduction ≥ 20 DN
- ④ After a single bend $90^\circ \geq 20$ DN
- ⑤ After a double bend $2 \times 90^\circ \geq 30$ DN
- ⑥ After a double three-dimensional bend $2 \times 90^\circ \geq 40$ DN
- ⑦ Outlet section > 5 DN

The nominal diameter of the flange is significant for the determination of the minimum inlet and outlet sections for the nominal diameter reduced versions of vortex flowmeter versions F1R and F2R.

3.4 Minimum outlet sections

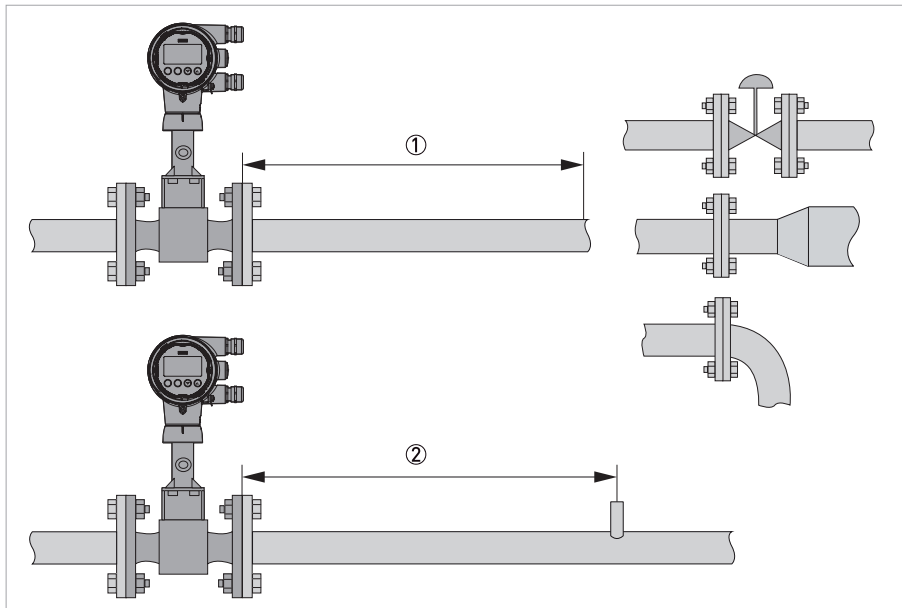


Figure 3-8: Minimum outlet sections

- ① Upstream of pipe expanders, pipe bends, control valves, etc. ≥ 5 DN
- ② Upstream of measuring points ≥ 5 DN

*The interior of the pipe at the metering points must be free of burrs and other flow impediments.
The distance from external temperature measuring points must be ≥ 5 DN.
Use flow sensors that are as short as possible to avoid disturbances of the flow profile.*

3.5 Flow straightener

If, due to the type of installation, the required inlet sections are not available, the manufacturer recommends using flow straighteners. Flow straighteners are installed between two flanges upstream of the device and shorten the required inlet section.

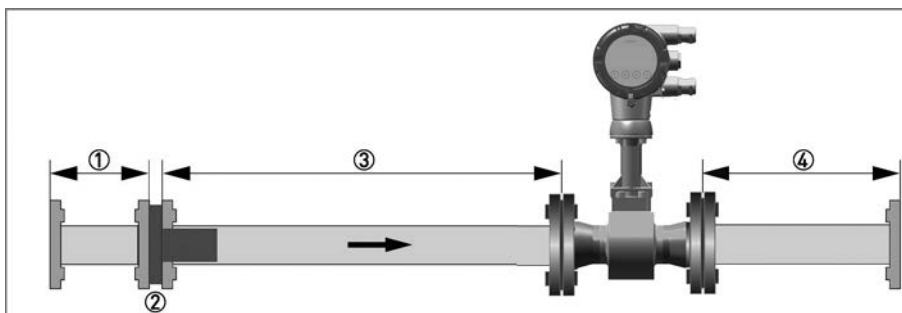


Figure 3-9: Flow straightener

- ① Straight inlet section upstream of straightener ≥ 2 DN
- ② Flow straightener
- ③ Straight pipe run between flow straightener and device ≥ 8 DN
- ④ Minimum straight outlet section ≥ 5 DN

3.6 Heat insulation

For applications with medium temperatures above +160°C / +320°F an insulation of the pipeline in accordance to the insulation guideline is suggested. Avoid higher electronic temperatures than +80°C / +176°F.

The area above the signal converter support must not be heat-insulated.

The heat insulation ② may only extend to the maximum height ① shown below.

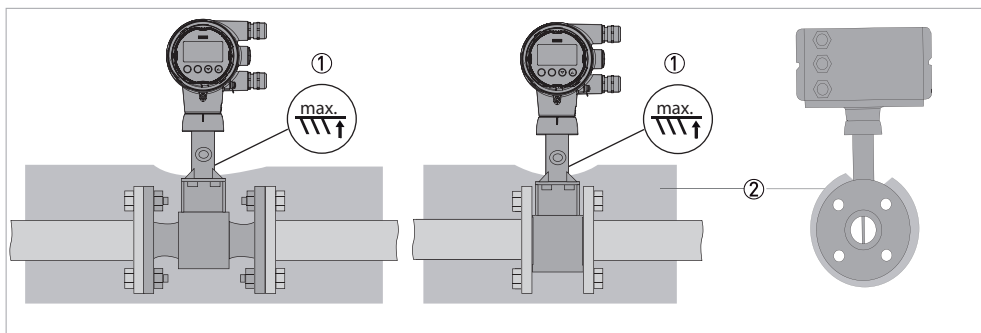


Figure 3-10: Mounting of the heat insulation

- ① Max. height of the insulation up to the marking on the neck of the flow sensor
- ② Insulation

4.1 Connecting the signal converter

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

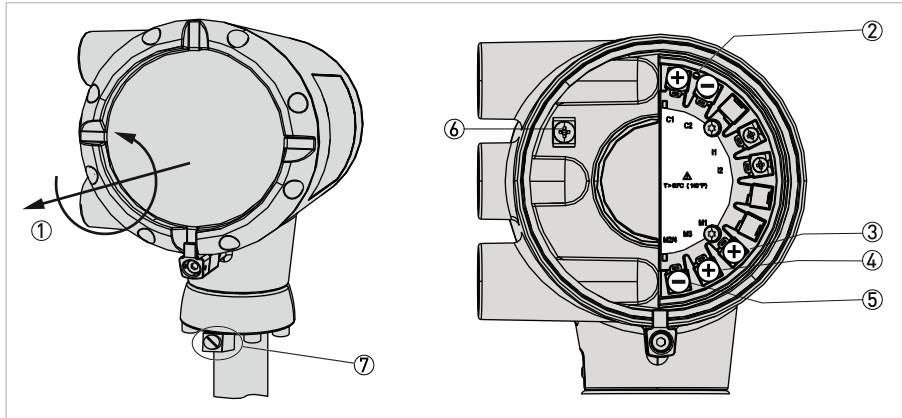


Figure 4-1: Connecting the signal converter

- ① Open the housing cover of the electrical terminal compartment using the key
- ② Signal converter supply and 4...20 mA loop
- ③ Terminal M1 pulse (high current)
- ④ Terminal M3 pulse (NAMUR)
- ⑤ Terminal M2/4 pulse, common minus connection
- ⑥ Ground terminal in housing
- ⑦ Ground terminal on connection piece between flow sensor and signal converter

Both grounding terminals ⑥ and ⑦ are equally effective from a technical point of view.

Steps for connecting the signal converter:

- Unscrew the housing cover ① of the electrical terminal compartment.
- Feed the connection cable through the cable entry in the housing.
- Connect the cable according to the terminal diagrams below.
- Connect the grounding to the terminal ⑥. Alternatively use the ground terminal ⑦ on the connection piece between the flow sensor and the signal converter.
- Tighten the cable glands.
- Turn the housing cover and gasket back onto the housing and tighten it by hand.

Ensure that the housing gasket is properly fitted, clean and undamaged.

4.2 Electrical connections

The signal converter is a 2-wire device with 4...20 mA as output signal. All other outputs are passive and always require an additional power supply.

4.3 Connection of remote version

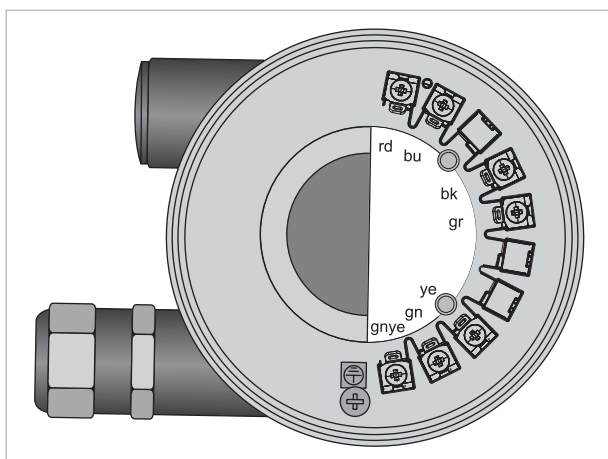


Figure 4-2: Connection terminals of remote version

The connection terminals in the connection box of the flow sensor and the wall bracket are identical in construction.

Terminals	Strand colour
rd	red
bu	blue
bk	black
gr	grey
ye	yellow
gn	green
gnye	Shielding

Table 4-1: Connection cable strand colour

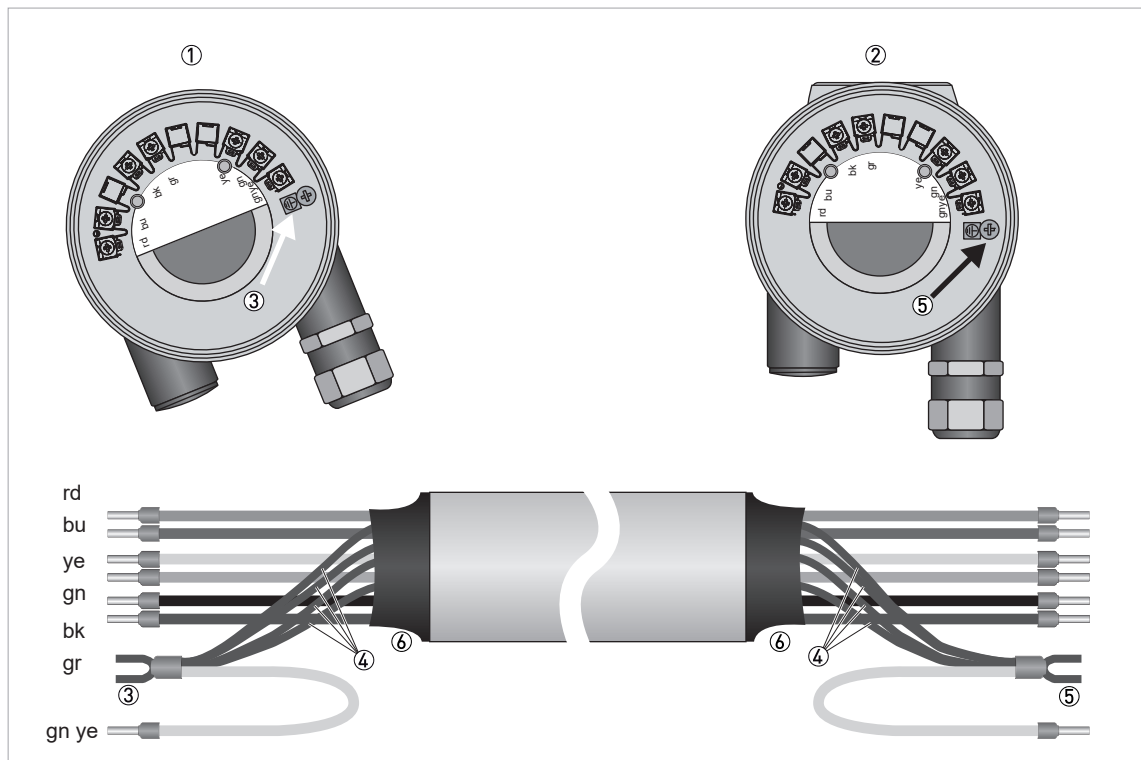


Figure 4-3: Connection of remote version

- ① Connection terminal flow sensor
- ② Connection terminal signal converter
- ③ Connection shielding flow sensor
- ④ Shielding (drain wire and overall shield)
- ⑤ Connection shielding signal converter
- ⑥ Heat shrink tubing

The maximum cable length is 50 m / 164 ft.

The cable can be shortened easily. All wires must be connected afterwards.

Please ensure that the shielding ④ has been properly connected to both terminals ③ and ⑤.

Please provide us with the missing information so that we can be of help to you as quickly as possible.

Then please send this page to the appropriate sales associate. We will then contact you as soon as possible.

Device data

Nominal connection size:			
Pressure rating:			
Raised face:			
Material of pipeline:			
Connection type:	☐ Flange	☐ Sandwich	
Design:	☐ Compact version	☐ Remote version with 5 m / 16.4 ft cable length	☐ Remote version with 50 m / 164 ft cable length
Display:	☐ With	☐ Without	
Approval:	☐ No Ex	☐ ATEX II2 G - Ex ia IIC T6 ☐ ATEX II2 G - Ex d ia IIC T6 ☐ ATEX II2 D - Ex tb IIIC T70°C Db	☐ QPS IS US/C ☐ QPS XP US/C ☐ QPS DIP US/C
		☐ IECEx - Ex ia IIC T6 ☐ IECEx - Ex d ia IIC T6 ☐ IECEx - Ex tb IIIC T70°C Db	

Rating data

Product:	
Operating pressure:	
Rated pressure:	
Operating temperature:	
Rated temperature:	
Operating density:	
Viscosity:	
Measuring range:	
Comments:	

Contact data

Company:	
Contact person:	
Telephone number:	
Fax number:	
E-mail:	







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