OPTISWIRL 4200 Technical Datasheet

Vortex flowmeter

- Integrated pressure and temperature compensation
- Gross and net heat measurement for hot water and steam
- Stable measurements even under demanding process conditions with advanced technology for signal filtering (AVFD)

HART COMMUNICATION PROTOCOL

KROHNE

1.1 The all-in-one solution

Vortex flowmeters are suitable for a wide range of media. This is particularly true of the **OPTISWIRL 4200**. Its capability to master even fluctuating pressures and temperatures turns it into an ideal all-rounder for the measurement of energy carriers in auxiliary and supply processes.

Already the basic version of the **OPTISWIRL 4200** is equipped with a temperature compensation for saturated steam applications. With the optional pressure sensor the flowmeter has an integrated density compensation available, which even allows an exact measurement of gases and superheated steam with varying process conditions. The additional integrated gross and net heat measurement makes this flowmeter to be a reliable partner for advanced energy management systems.

With the innovative AVFD (Advanced Vortex Frequency Detection) the **OPTISWIRL 4200** 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.

This vortex flowmeter was designed for the safety-related applications from the very beginning. It was developed according to the standard IEC 61508 edition 2. The certification is effected within the scope of a full assessment by TUEV Sued. Thereby the flowmeter can be used for continuous volume flow measurement in safety-related applications with classification SIL 2.

Highlights

- Development according to IEC 61508, edition 2
- Advanced technology for signal filtering - AVFD (Advanced Vortex Frequency Detection)
- Integrated pressure and temperature compensation
- Temperature compensation for saturated steam included as standard
- Integrated gross and net heat calculation for steam and hot water
- Comprehensive communication options
- 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
- Power plants
- Food & Beverage
- Pharmaceuticals
- Iron, Steel and Metals
- Pulp & Paper
- Water
- Automotive industry

Applications

- Measurement of saturated steam and superheated steam
- Steam boiler monitoring
- Heat metering of steam and hot water
- Measurement of consumption of industrial gases
- Measurement of consumption in compressed air systems
- Monitoring of compressor output
- Evaluation of free air delivery (FAD)
- SIP and CIP processes in the food, beverage and pharmaceutical industries
- Safety-related measurement in SIL applications (SIL 2)

1.2 Options and variants

1. The universal device with temperature compensation for saturated steam integrated as standard

The **OPTISWIRL 4200 C** as compact flowmeter in a flange version is suitable for universal use in measuring liquids, gases and vapours.

The temperature compensation for saturated steam is integrated as standard, thus enabling direct compensation of the density; the mass and energy can also be measured.

The advanced signal filter technology AVFD (Advanced Vortex Frequency Detection) complements the high accurate measurement.

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

The **OPTISWIRL 4200 C** as a compact flowmeter in a sandwich version is suitable for universal use in the measurement of liquids, gases and vapours.

The temperature compensation for saturated steam is integrated as standard.

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 one-of-a-kind 2-wire device with integrated pressure and temperature compensation

The **OPTISWIRL 4200** as a flange or sandwich flowmeter is optinally available with integrated pressure and temperature compensation for gases, wet gases, gas mixtures or steam.

The advantage of this unique design couldn't be clearer:

- No additional cost-intensive installation of pressure and temperature sensors
- No additional cabling work
- No faulty measurement results, because pressure, temperature and volume flow can be read at a single point
- Direct measurement of mass and/or energy

4. Vortex flowmeter with shut-off valve for the pressure measurement

As an option, the **OPTISWIRL 4200** can be supplied with a shut-off valve to allow the pressure sensor to be exchanged without interrupting the process.

What is more, the pressure sensor can be shut off for the purpose of pressure or leak testing of the pipeline.

Using the built-in two-way valve, the pressure sensor can also be calibrated and tested at a later time.

5. Dual measurement for twofold reliability

The **OPTISWIRL 4200** is optionally available as a dual version.

This is a genuine redundant system with two independent flow sensors and two signal converters. This provides twofold functional reliability and availability of the measurement.

This variant is ideally suited for measurements in multi-product pipelines. In such pipelines, two different products are moved through one after the other.

One signal converter can be programmed for one product, and the other signal converter for the other product.

6. The OPTISWIRL 4200 F as remote version

The **OPTISWIRL 4200** 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.

Additionally to the flow rates, measurements of the integrated pressure and temperature sensors can be displayed.

7. OPTISWIRL 4200 F1R / F2R with integrated nominal diameter reduction

The **OPTISWIRL 4200 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

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.

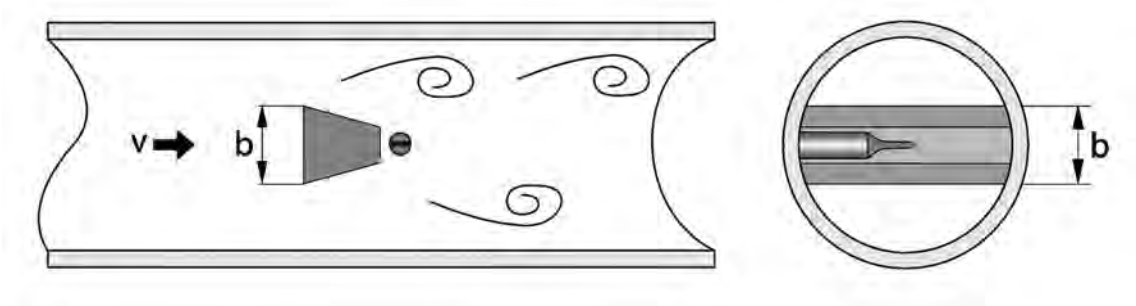


Figure 1-1: Functional principle

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
	Remote version (in preparation) Cable length: ≤ 50 m / 164 ft

Flow sensor

Standard	Flange version (with integrated temperature measurement), flow sensor: F
	Sandwich version (with integrated temperature measurement), flow sensor: S
Option	Basic device with additional pressure measurement
	Basic device with additional pressure measurement and shut-off valve for pressure sensor
	Dual measuring device in both flange and sandwich version (redundant measurement)
	Dual measuring device with additional pressure measurement
	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	German, English, French; 22 further languages (in preparation)

Measuring accuracy

Reference condition

Reference conditions	Water at +20°C / +68°F
	Air at +20°C / +68°F and 1.013 bara / 14.7 psia

Maximum measuring error

Volume flow (liquid)	±0.75% of measured value (Re ≥ 20000)
	±2.0% of measured value (10000 < Re < 20000)
Volume flow (gases and steam)	±1.0% of measured value (Re ≥ 20000) ①
	±2.0% of measured value (10000 < Re < 20000) ①
Mass flow (gases and steam)	±1.5% of measured value (Re ≥ 20000)
	±2.5% of measured value (10000 < Re < 20000)
Mass flow (liquid / water)	±1.5% of measured value (Re ≥ 20000)
	±2.5% of measured value (10000 < Re < 20000)
Normalised volume flow (gas)	±1.5% of measured value (Re ≥ 20000)
	±2.5% of measured value (10000 < Re < 20000)
Repeatability (volume flow)	±0.1% of measured value
The maximum error of measurement refers to measurement at an operating pressure >65% of the full scale value of the applied pressure sensor.	

Operating conditions

Temperature

Medium temperature	-40…+240°C / -40…+465°F
Ambient temperature	Non-Ex: -40…+85°C / -40…+185°F
	Ex: -40...+65°C / -40...+140°F
Storage temperature	-40...+85°C / -40...+185°F

Pressure

Medium pressure	Max. 100 bar / 1450 psi (higher pressures on request)
Ambient pressure	Atmosphere

Media properties

Density	Taken into consideration when sizing.
Viscosity	< 10 cP
Reynold's number	> 10000

Recommended flow velocities

Liquids	0.25…7 m/s / 0.82…23 ft/s (optional up to 10 m/s / 32.8 ft/s taking cavitation into account)
Gases and steam	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
For further information refer to *Intended use* on page 28.	

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 x DN without disturbing flow, after pipe narrowing, after a single 90° bend
	≥ 30 x DN after a double bend 2x90°
	≥ 40 x DN after a double three-dimensional bend 2x90°
	≥ 50 x DN after control valves
	≥ 2 DN before flow straightener; ≥ 8 DN after flow straightener
Outlet section	≥ 5 x DN

Materials

Flow sensor and process connections	Standard: 1.4404/316L
	Option: Hastelloy® C-22 on request
Electronics housing	Aluminium die-cast, two-layer coating (epoxy/polyester)
	Option: die-cast aluminium with finish for advanced requirements
Pressure sensor gasket	Standard: FPM
	Option: FFKM
Measuring tube gasket (Pick-up)	Standard: 1.4435/316L
	Option: Hastelloy® C-276
	Selection depends on flow sensor material / medium.

Process connections of flange version

DIN EN 1092-1	DN15...300 - PN16...100 (higher pressures on request)
ASME B16.5	½...12" - 150...600 lb (higher pressures on request)
JIS B 2220	DN15...300 - JIS 10...20 K (higher pressures on request)
For detailed information on combination flange/pressure rating, refer to section "Dimensions and weights".	

Process connections of sandwich version

DIN	DN15...100 - PN100 (higher pressures on request)
ASME	½...4" - 600 lb (higher pressures on request)
JIS	DN15...100 - 10...20 K (higher pressures on request)

Electrical connections

Power supply	Non-Ex: 12...36 VDC
	Ex: 12...30 VDC

Inputs and outputs

General	All inputs and outputs are electrically isolated from one another.
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, gross/net power, free air delivery, density, temperature (internal sensor), pressure, 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_{ext} - 12 VDC) / 22 mA)

HART®

	HART® protocol via passive current output
HART® revision	Burst mode Catch device
Manufacturer ID	00069 (0x45)
Device type code	00205 (0xCD)
System requirements	Load min. 250 Ω
Multidrop operation	4 mA

Binary output

Function	Pulse, frequency, status, limit switch
Type	Passive Proximity sensor acc. to DIN EN 60947-5-6 (NAMUR sensor) or pulse output signal acc. to VDI/VDE 2188 (category 2)
Temperature coefficient	50 ppm/K
Residual current	< 0.2 mA at 32 V (R_i = 180 kΩ)
Pulse width	0.5...2000 ms

Pulse output

Output data	Volume, mass, norm. volume, gross/net energy
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 V
	Ex: 24 VDC as NAMUR or open < 1 mA, maximum 30 V, closed 120 mA, U < 2 V

Frequency output

Output data	Volume flow, mass flow, norm. volume flow, gross/net power, free air delivery, density, temperature (internal sensor or via external input), pressure, vortex frequency, flow velocity, spec. enthalpy, spec. heat capacity, Reynolds number
Max. frequency	1000 Hz

Status output

Output data	Status acc. to NE 107 (F, S, C), flow totalizer overflow, energy totalizer overflow, fluid type (in steam applications)

Limit switch

Output data	Volume flow, mass flow, norm. volume flow, volume, mass, norm. volume, gross/net power, gross/net energy, free air delivery, density, temperature (internal sensor or via external input), pressure, vortex frequency, flow velocity, spec. enthalpy, spec. heat capacity, Reynolds number

Current input

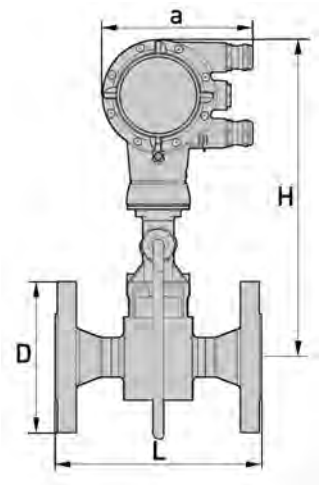
Type	4...20 mA (passive)
Resolution	6 µA
Linearity / accuracy	0.1% (of read value)
Temperature coefficient	100 ppm/K (typically), 200 ppm/K (max.)
Voltage drop	10 V

Approvals and certificates

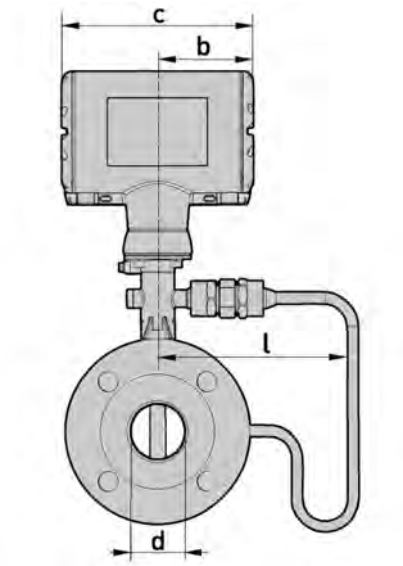
ATEX	ATEX II2 G - Ex ia IIC T6...T2 Gb ATEX II2 G - Ex d ia IIC T6...T2 Gb ATEX II3 G - Ex nA IIC T6...T2 Gc ATEX II2 D - Ex tb IIIC T70°C Db
IECEx	IECEx - Ex ia IIC T6...T2 Gb IECEx - Ex d ia IIC T6...T2 Gb IECEx - Ex nA IIC T6...T2 Gc IECEx - Ex tb IIIC T70°C Db
QPS (USA & Canada)	QPS IS Class I Div 1 (in preparation) QPS XP Class I Div 1 (in preparation) QPS NI Class I Div 2 (in preparation) QPS DIP Class II, III Div 1 (in preparation)

2.2 Dimensions and weights

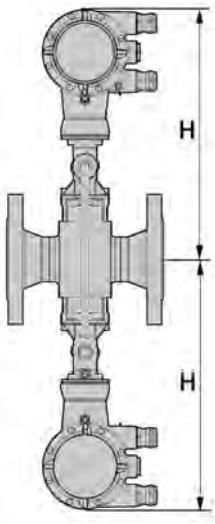
2.2.1 Flange versions



a = 148.5 mm / 5.85"



b = 85.8 mm / 3.38"
c = 171.5 mm / 6.76"



Option:
Version with two signal converter

Dimensions of flange version EN 1092-1 [mm]

Nominal size DN	Pressure rating PN	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
15	40	17.3	95	200	358.8	-	-	169.3	-	-
15	100	17.3	105	200	358.8	-	-	169.3	-	-
25	40	28.5	115	200	358.4	358.8	-	169.3	169.3	-
25	100	28.5	140	200	358.4	358.8	-	169.3	169.3	-
40	40	43.1	150	200	362.3	358.4	358.8	169.5	169.3	169.3
40	100	42.5	170	200	362.3	358.4	358.8	169.5	169.3	169.3
50	16	54.5	165	200	368.3	362.3	358.4	169.3	169.5	169.3
50	40	54.5	165	200	368.3	362.3	358.4	169.3	169.5	169.3
50	63	54.5	180	200	368.3	368.3	362.3	169.3	169.5	169.5
50	100	53.9	195	200	368.3	368.3	362.3	169.3	169.5	169.5
80	16	82.5	200	200	380.3	368.3	368.3	169.3	169.5	169.5
80	40	82.5	200	200	380.3	368.3	368.3	169.3	169.5	169.5
80	63	81.7	215	200	380.3	380.3	368.3	169.3	169.5	169.5
80	100	80.9	230	200	380.3	380.3	368.3	169.3	169.5	169.5
100	16	107	220	250	396.8	380.3	380.3	171.5	169.3	169.5
100	40	107	235	250	396.8	380.3	380.3	171.5	169.3	169.5
100	63	106	250	250	396.8	396.8	380.3	171.5	169.3	169.5
100	100	104	265	250	396.8	396.8	380.3	171.5	169.3	169.5

Nominal size DN	Pressure rating PN	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
150	16	159	285	300	416.3	396.8	396.8	191.5	171.5	169.3
150	40	159	300	300	416.3	396.8	396.8	191.5	171.5	169.3
150	63	157	345	300	416.3	416.3	396.8	191.5	171.5	169.3
150	100	154	355	300	416.3	416.3	396.8	191.5	171.5	169.3
200	10	207	340	300	442.1	416.3	416.3	202.8	191.5	171.5
200	16	207	340	300	442.1	416.3	416.3	202.8	191.5	171.5
200	25	207	360	300	442.1	442.1	416.3	202.8	191.5	171.5
200	40	207	375	300	442.1	442.1	416.3	202.8	191.5	171.5
250	10	260	395	380	468.8	442.1	442.1	229.5	202.8	191.5
250	16	260	405	380	468.8	442.1	442.1	229.5	202.8	191.5
250	25	259	425	380	468.8	468.8	442.1	229.5	202.8	191.5
250	40	259	450	380	468.8	468.8	442.1	229.5	202.8	191.5
300	10	310	445	450	492.8	468.8	468.8	255	229.5	202.8
300	16	310	460	450	492.8	468.8	468.8	255	229.5	202.8
300	25	308	485	450	492.8	492.8	468.8	255	229.5	202.8
300	40	308	515	450	492.8	492.8	468.8	255	229.5	202.8

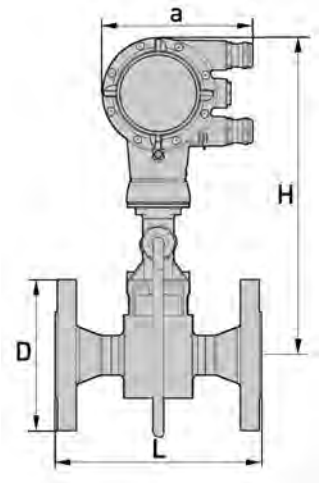
① F1R - single reduction
② F2R - double reduction

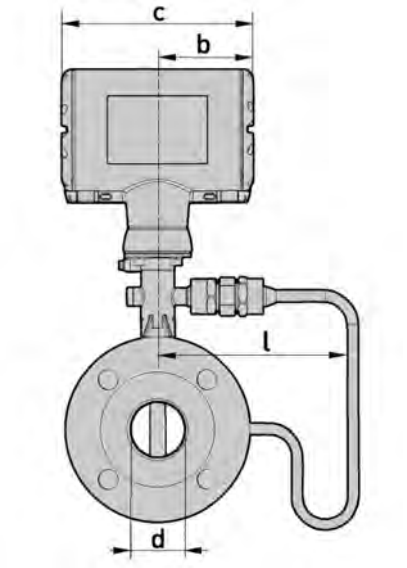
Weight of flange version EN 1092-1 [kg]

Nominal size DN	Pressure rating PN	with	without	F1R ① with	F1R ① without	F2R ② with	F2R ② without
		Pressure sensor		Pressure sensor		Pressure sensor	
15	40	6.1	5.5	-	-	-	-
15	100	7.1	6.5	-	-	-	-
25	40	7.9	7.3	7.2	6.6	-	-
25	100	9.9	9.3	9.7	9.1	-	-
40	40	10.8	10.2	9.7	9.1	8.9	8.3
40	100	14.8	14.2	13.3	12.7	12.5	11.9
50	16	12.7	12.1	11.4	10.8	10.6	10.0
50	40	12.9	12.3	11.9	11.3	11.2	10.6
50	63	16.9	16.3	15.0	14.4	14.3	13.7
50	100	18.4	17.8	17.2	16.6	16.6	16.0
80	16	17.4	16.8	15.6	15.0	14.2	13.6
80	40	19.4	18.8	17.1	16.5	15.8	15.2
80	63	23.4	22.8	20.3	19.7	19.0	18.4
80	100	27.4	26.8	24.0	23.4	22.8	22.2
100	16	22.0	21.4	21.5	20.9	18.7	18.1
100	40	25.0	24.4	24.9	24.3	22.1	21.5
100	63	30.0	29.4	30.1	29.5	27.4	26.8
100	100	36.0	35.4	36.7	36.1	34.0	33.4
150	16	35.8	35.2	33.9	33.3	32.3	31.7
150	40	41.8	41.2	41.4	40.8	40.2	39.6
150	63	59.8	59.2	58.3	57.7	59.0	58.4
150	100	67.8	67.2	69.2	68.6	70.8	70.2
200	10	38.4	37.8	40.7	40.1	43.1	42.5
200	16	38.4	37.8	40.3	39.7	44.3	43.7
200	25	47.4	46.8	49.5	48.9	50.8	50.2
200	40	55.4	54.8	58.0	57.4	58.5	57.9
250	10	58.0	57.4	63.1	62.5	59.8	59.2
250	16	59.0	58.4	64.7	64.1	61.5	60.9
250	25	75.0	74.4	78.5	77.9	76.8	76.2
250	40	93.0	92.4	96.3	95.7	96.1	95.5
300	10	76.3	75.7	81.1	80.5	85.8	85.2
300	16	82.8	82.2	87.6	87.0	92.9	92.3
300	25	99.3	98.7	105.1	104.5	113.0	112.4
300	40	128.1	127.5	132.0	131.4	143.2	142.6
Weight specifications for version with two signal converters + 3.2 kg / 7.05 lb							

① F1R - single reduction
② F2R - double reduction

Dimensions of flange version ASME B16.5





a = 148.5 mm / 5.85"

b = 85.8 mm / 3.38"
c = 171.5 mm / 6.76"

Dimensions of flange version ASME B16.5 [mm]

Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
½	150	16	90	200	358.8	-	-	169.3	-	-
½	300	16	95	200	358.8	-	-	169.3	-	-
½	600	14	95	200	358.8	-	-	169.3	-	-
1	150	27	110	200	358.4	358.8	-	169.3	169.3	-
1	300	27	125	200	358.4	358.8	-	169.3	169.3	-
1	600	24	125	200	358.4	358.8	-	169.3	169.3	-
1½	150	41	125	200	362.3	358.4	358.8	169.5	169.3	169.3
1½	300	41	155	200	362.3	358.4	358.8	169.5	169.3	169.3
1½	600	38	155	200	362.3	358.4	358.8	169.5	169.3	169.3
2	150	53	150	200	368.3	362.3	358.4	169.5	169.5	169.3
2	300	53	165	200	368.3	362.3	358.4	169.5	169.5	169.3
2	600	49	165	200	368.3	362.3	358.4	169.5	169.5	169.3
3	150	78	190	200	380.3	368.3	362.3	169.3	169.5	169.5
3	300	78	210	200	380.3	368.3	362.3	169.3	169.5	169.5
3	600	74	210	200	380.3	368.3	362.3	169.3	169.5	169.5
4	150	102	230	250	396.8	380.3	368.3	171.5	169.3	169.5
4	300	102	255	250	396.8	380.3	368.3	171.5	169.3	169.5
4	600	97	275	250	396.8	380.3	368.3	171.5	169.3	169.5
6	150	154	280	300	416.3	396.8	380.3	191.5	171.1	169.3
6	300	154	320	300	416.3	396.8	380.3	191.5	171.1	169.3
6	600	146	355	300	416.3	396.8	380.3	191.5	171.1	169.3

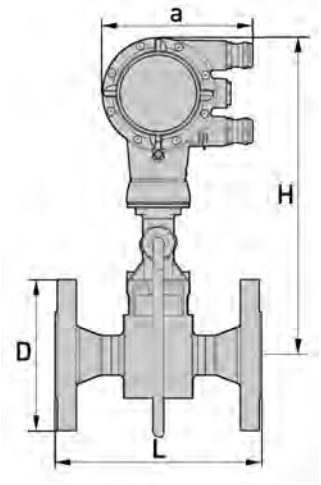
Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
8	150	203	345	300	442.1	416.3	396.8	202.8	191.5	171.5
8	300	203	380	300	442.1	416.3	396.8	202.8	191.5	171.5
10	150	255	405	380	468.8	442.1	416.3	229.5	202.8	191.5
10	300	255	455	380	468.8	442.1	416.3	229.5	202.8	191.5
12	150	305	485	450	492.8	468.8	442.1	255.0	229.5	202.8
12	300	305	520	450	492.8	468.8	442.1	255.0	229.5	202.8

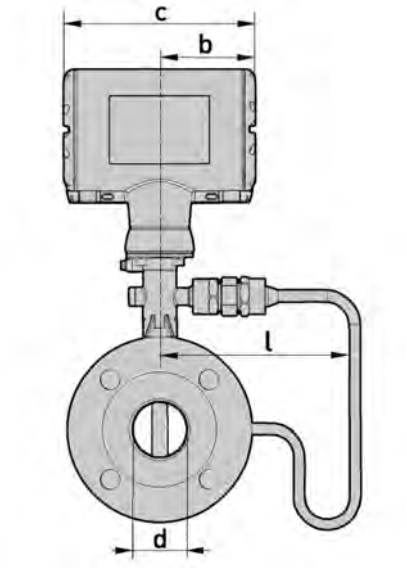
① F1R - single reduction
② F2R - double reduction

Weight of flange version ASME B16.5 [kg]

Nominal size DN	Pressure rating Class	with	without	F1R with	F1R without	F2R with	F2R without
		Pressure sensor		Pressure sensor		Pressure sensor	
½	150	5.1	4.5	-	-	-	-
½	300	5.5	4.9	-	-	-	-
½	600	5.7	5.1	-	-	-	-
1	150	6.8	6.2	6.6	6.0	-	-
1	300	7.8	7.2	7.6	7.0	-	-
1	600	8.1	7.5	7.9	7.3	-	-
1½	150	8.9	8.3	8.6	8.0	7.7	7.1
1½	300	11.0	10.4	10.9	10.3	10.0	9.4
1½	600	12.0	11.4	11.8	11.2	11.0	10.4
2	150	11.6	11.0	11.0	10.4	10.3	9.7
2	300	13.0	12.4	12.6	12.0	11.9	11.3
2	600	14.5	13.9	14.0	13.4	13.4	12.8
3	150	20.4	19.8	16.9	16.3	15.6	15.0
3	300	23.4	22.8	20.4	19.8	19.2	18.6
3	600	24.4	23.8	22.9	22.3	21.8	21.2
4	150	24.0	23.4	25.3	24.7	22.7	22.1
4	300	32.0	31.4	33.9	33.3	31.2	30.6
4	600	41.0	40.4	44.1	43.5	41.2	40.6
6	150	36.8	36.2	37.8	37.2	36.9	36.3
6	300	51.8	51.2	56.1	55.5	55.8	55.2
6	600	76.8	76.2	79.8	79.2	82.6	82.0
8	150	50.6	50.0	48.8	48.2	52.5	51.9
8	300	75.4	74.8	72.2	71.6	78.1	77.5
10	150	75.0	74.4	75.2	74.6	73.9	73.3
10	300	107.0	106.4	112.4	111.8	113.5	112.9
12	150	107.0	106.4	109.8	109.2	120.4	119.8
12	300	152.0	151.4	165.4	155.8	171.7	171.1

Dimensions of flange version ASME B16.5 [inch]





a = 135 mm / 5.32"

b = 108 mm / 4.26"
c = 184 mm / 7.25"

Dimensions of flange version ASME B16.5 [inch]

Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
½	150	0.63	3.5	7.9	14.2	-	-	6.67	-	-
½	300	0.63	3.7	7.9	14.2	-	-	6.67	-	-
½	600	0.40	3.7	7.9	14.2	-	-	6.67	-	-
1	150	1.1	4.3	7.9	14.1	14.1	-	6.67	6.67	-
1	300	1.1	4.9	7.9	14.1	14.1	-	6.67	6.67	-
1	600	1.0	4.9	7.9	14.1	14.1	-	6.67	6.67	-
1½	150	1.6	4.9	7.9	14.3	14.1	14.1	6.67	6.67	6.67
1½	300	1.6	6.1	7.9	14.3	14.1	14.1	6.67	6.67	6.67
1½	600	1.5	6.1	7.9	14.3	14.1	14.1	6.67	6.67	6.67
2	150	2.1	5.9	7.9	14.5	14.3	14.1	6.67	6.67	6.67
2	300	2.1	6.5	7.9	14.5	14.3	14.1	6.67	6.67	6.67
2	600	1.9	6.5	7.9	14.5	14.3	14.1	6.67	6.67	6.67
3	150	3.1	7.5	7.9	15.0	14.5	14.3	6.67	6.67	6.67
3	300	3.1	8.3	7.9	15.0	14.5	14.3	6.67	6.67	6.67
3	600	2.9	8.3	7.9	15.0	14.5	14.3	6.67	6.67	6.67
4	150	4.0	9.1	9.8	15.7	15.0	14.5	6.76	6.67	6.67
4	300	4.0	10	9.8	15.7	15.0	14.5	6.76	6.67	6.67
4	600	3.8	11	9.8	15.7	15.0	14.5	6.76	6.67	6.67
6	150	6.1	11	12	16.4	15.6	15.0	7.54	6.76	6.67
6	300	6.1	13	12	16.4	15.6	15.0	7.54	6.76	6.67
6	600	5.8	14	12	16.4	15.6	15.0	7.54	6.76	6.67

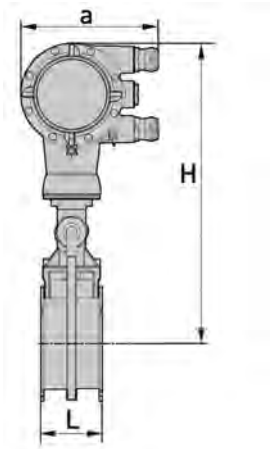
Nominal size DN	Pressure rating Class	d	D	L	H	H F1R ①	H F2R ②	l	l F1R ①	l F2R ②
8	150	8.0	14	12	17.4	16.4	15.6	8.0	7.54	6.76
8	300	8.0	15	12	17.4	16.4	15.6	8.0	7.54	6.76
10	150	10	16	15	18.5	17.4	16.4	9.04	8.0	7.54
10	300	10	18	15	18.5	17.4	16.4	9.04	8.0	7.54
12	150	12	19	18	19.4	18.5	17.4	10.0	9.04	8.0
12	300	12	21	18	19.4	18.5	17.4	10.0	9.04	8.0

① F1R - single reduction
② F2R - double reduction

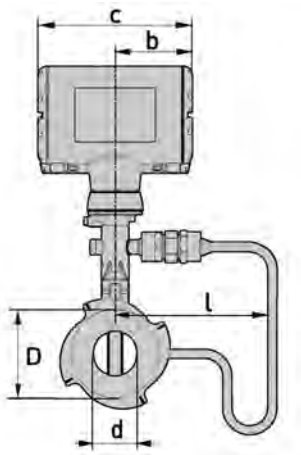
Weight of flange version ASME B16.5 [lb]

Nominal size DN	Pressure rating Class	with	without	F1R with	F1R without	F2R with	F2R without
		Pressure sensor		Pressure sensor		Pressure sensor	
½	150	11	9.9	-	-	-	-
½	300	12	11	-	-	-	-
½	600	13	11	-	-	-	-
1	150	15	14	14.6	13.2	-	-
1	300	17	16	16.8	15.4	-	-
1	600	18	17	17.4	16.1	-	-
1½	150	20	18	19.0	17.6	17.0	15.7
1½	300	24.3	22.9	24.0	22.7	22.1	20.7
1½	600	26.5	25.1	26.0	24.7	24.1	22.9
2	150	25.6	24.3	24.3	22.9	22.7	21.4
2	300	28.7	27.3	27.8	26.5	26.2	24.9
2	600	32.0	30.7	30.9	29.6	29.6	28.2
3	150	45.0	43.7	37.3	36.0	34.4	33.1
3	300	51.6	50.3	45.0	43.7	42.3	41.0
3	600	53.8	52.5	50.5	49.2	48.1	46.8
4	150	52.9	51.6	55.8	54.5	50.1	48.7
4	300	70.6	69.3	74.8	73.4	68.8	67.5
4	600	90.4	89.1	97.3	95.9	91.0	89.5
6	150	81.2	79.8	83.4	82.0	81.4	80.0
6	300	114.2	112.9	123.7	122.4	123.1	121.7
6	600	169.4	168.1	176	174.7	182.2	181.0
8	150	111.6	110.3	107.6	106.3	115.8	114.5
8	300	166.3	165.0	159.2	157.9	172.2	171.0
10	150	165.4	164.1	165.9	164.5	163.0	161.7
10	300	236.0	234.7	247.9	246.6	250.3	249.0
12	150	236.0	234.7	242.2	240.8	265.5	264.2
12	300	335.2	333.9	364.8	343.6	378.7	377.4

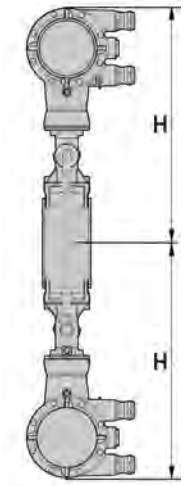
2.2.2 Sandwich version



a = 133 mm / 5.24"



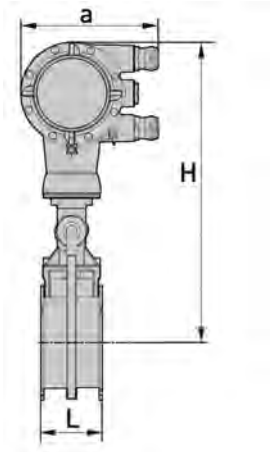
b = 105 mm / 4.13"
c = 179 mm / 7.05"



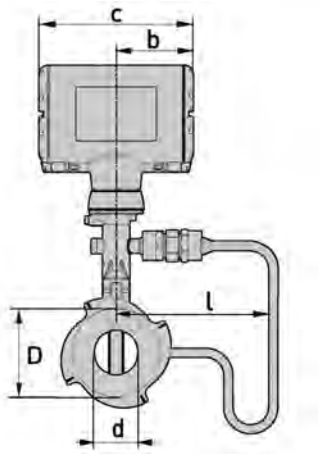
Dimension H x 2
Specified weight: + 2.8 kg / 6.2 lb

Sandwich version EN

Nominal size	Pressure rating	Dimensions [mm]					Weight [kg]	
DN	PN	d	D	L	H	l	with	without
							Pressure sensor	
15	100	16	45	65	265	174.25	4.1	3.5
25	100	24	65	65	265	174.25	4.9	4.3
40	100	38	82	65	270	174.5	5.5	4.9
50	100	50	102	65	275	174.5	6.6	6
80	100	74	135	65	290	174.25	8.8	8.2
100	100	97	158	65	310	176.5	10.1	9.5



a = 135 mm / 5.32"

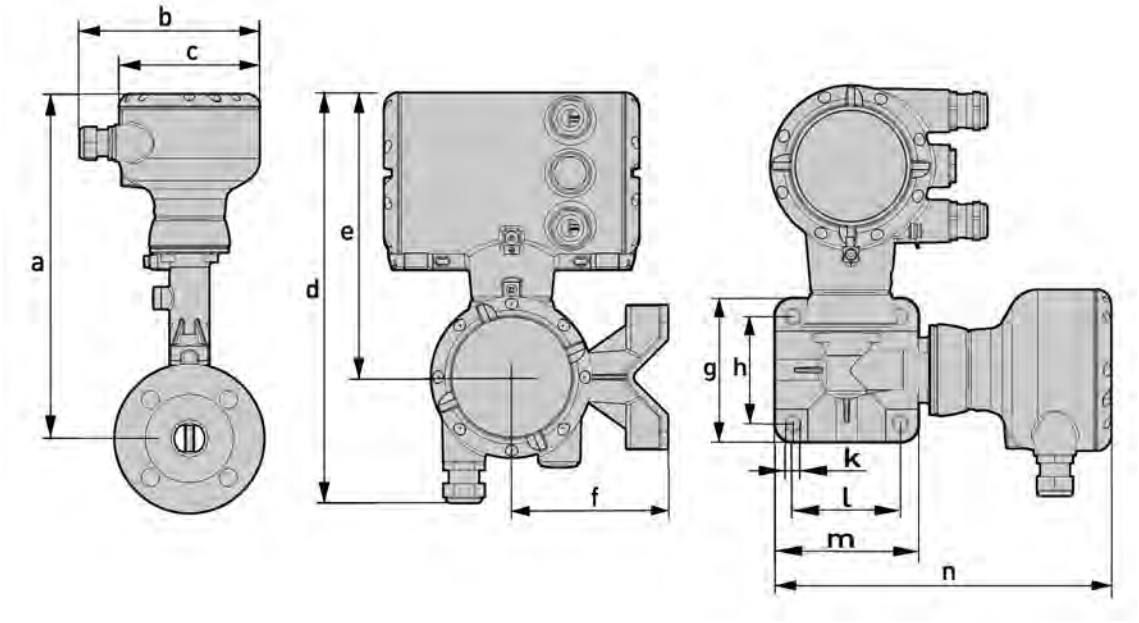


b = 108 mm / 4.26"
c = 184 mm / 7.25"

Sandwich version ASME

Nominal size	Pressure rating	Dimensions [inch]					Weight [lb]	
NPS	Class	d	D	L	H	l	with	without
							Pressure sensor	
½	150	0.63	1.77	2.56	10.43	6.82	9.04	7.72
½	300	0.63	1.77	2.56	10.43	6.82	9.04	7.72
½	600	0.55	1.77	2.56	10.43	6.82	9.04	7.72
1	150	0.94	2.56	2.56	10.43	6.82	10.8	9.48
1	300	0.94	2.56	2.56	10.43	6.82	10.8	9.48
1	600	0.94	2.56	2.56	10.43	6.82	10.8	9.48
1½	150	1.5	3.23	2.56	10.63	6.87	12.13	10.8
1½	300	1.5	3.23	2.56	10.63	6.87	12.13	10.8
1½	600	1.5	3.23	2.56	10.63	6.87	12.13	10.8
2	150	1.97	4.02	2.56	10.83	6.87	14.55	13.23
2	300	1.97	4.02	2.56	10.83	6.87	14.55	13.23
2	600	1.97	4.02	2.56	10.83	6.87	14.55	13.23
3	150	2.91	5.31	2.56	11.42	6.82	19.4	18.08
3	300	2.91	5.31	2.56	11.42	6.82	19.4	18.08
3	600	2.91	5.31	2.56	11.42	6.82	19.4	18.08
4	150	3.82	6.22	2.56	12.21	6.95	22.27	20.94
4	300	3.82	6.22	2.56	12.21	6.95	22.27	20.94
4	600	3.82	6.22	2.56	12.21	6.95	22.27	20.94

2.2.3 Dimensions of remote version



Dimension a

	Flange & sandwich version						Flange version			
DN ▸	15	25	40	50	80	100	150	200	250	300
NPS ▸	½	1	1½	2	3	4	6	8	10	12
[mm] ▸	315.7	315.2	319.2	235.2	337.2	353.7	373.2	398.9	425.7	449.7
["] ▸	12.5	12.4	12.6	12.8	13.3	14.0	14.7	15.7	16.8	17.7

Dimension a F1/2R

	Flange version									
DN ▸	15	25	40	50	80	100	150	200	250	300
NPS ▸	½	1	1½	2	3	4	6	8	10	12
F1R ① [mm] ▸	-	315.7	315.2	319.2	325.2	337.2	353.7	373.2	398.9	425.7
F1R ① ["] ▸	-	12.4	12.4	12.6	12.8	13.3	13.9	14.7	15.7	16.8
F2R ② [mm] ▸	-	-	315.7	315.2	319.2	325.2	337.2	353.7	373.2	398.9
F2R ② ["] ▸	-	-	12.4	12.4	12.6	12.8	13.3	13.9	14.7	15.7

① F1R - single reduction - ② F2R - double reduction

Dimensions b...n

	b	c	d	e	f	g	h	j	k	l	m	n
[mm]	139	108	276	191	105	97	72	108	9	72	97	226
["]	5.46	4.25	10.9	7.53	4.14	3.82	2.84	4.25	0.35	2.84	3.82	8.90

2.3 Flow tables

Measuring ranges

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

Water

15	3/8	0.36	5.07	95.61	1339
25	1	0.81	11.40	215	3012
40	1½	2.04	28.58	539	7550
50	2	3.53	49.48	934	13072
80	3	7.74	108.3	2045	28632
100	4	13.30	186.2	3514	49196
150	6	30.13	421.89	7961	111454
200	8	56.61	792.5	14954	209356
250	10	90.49	1267	23905	334681
300	12	131.4	1840	34720	486077
Values based on water at +20°C / +68°F					

Air

15	3/8	4.34	32.57	1147	8605
25	1	9.77	114.0	2581	30117
40	1½	24.50	326.6	6472	86288
50	2	42.41	565.5	11204	149390
80	3	92.90	1239	24542	327224
100	4	159.6	2128	42168	562245
150	6	361.6	4822	95532	1273761
200	8	679.3	9057	179448	2392635
250	10	1086	14478	286870	3824929
300	12	1577	21028	416638	5555167
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					

Measuring range saturated steam: 1...7 barg

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	3/8	5.07	36.94	7.41	78.8	8.62	106.6	9.73	135.7
25	1	11.42	129.3	16.68	275.8	19.40	373.0	21.88	474.9
40	1½	28.63	370.4	41.87	790.3	48.62	1069	54.86	1361
50	2	49.56	641.3	72.39	1368	84.18	1850	94.98	2356
80	3	108.6	1405	158.6	2997	184.4	4053	208.1	5160
100	4	186.5	2414	272.4	5149	316.8	6964	357.5	8866
150	6	422.6	5468	617.2	11666	717.8	15777	809.9	20086
200	8	793.7	10271	1159	21913	1348	29636	1521	37730
250	10	1269	16420	1853	35031	2155	47376	2432	60316
300	12	1843	23848	2692	50877	3130	68807	3532	87601

Measuring range saturated steam: 10.5...20 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	3/8	12.77	191.6	16.48	247.2	20.20	303.1	22.87	343.1
25	1	26.01	670.6	29.54	857.0	32.71	954.8	34.80	1020
40	1½	66.19	1877	74.05	2148	81.99	2394	87.24	2556
50	2	112.9	3250	128.2	3720	142.0	4144	151.0	4426
80	3	247.2	7119	280.8	8148	310.9	9077	330.8	9694
100	4	424.8	12232	482.5	13999	534.2	15597	568.5	16657
150	6	962.4	27712	1093	31715	1210	35334	1288	37737
200	8	1808	52054	2053	59574	2273	66371	2419	70884
250	10	2890	83215	3282	95237	3634	106102	3867	113318
300	12	4197	120858	4767	138318	5279	154099	5617	164578

Measuring range saturated steam: 15...100 psig

Gauge pressure [psig]		15		50		75		100	
Density [lb/ft³]		0.0721		0.1496		0.2033		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	3/8	11.09	81.44	16.42	173.7	19.05	235.0	21.59	299.2
25	1	24.95	285.0	36.95	608.1	42.86	822.4	48.58	1047
40	1½	62.55	816.7	92.63	1742	107.5	2356	121.8	3000
50	2	108.3	1414	160.4	3016	186.0	4079	210.9	5194
80	3	237.2	3097	351.3	6607	407.5	8935	461.9	11376
100	4	407.6	5321	603.6	11352	700.1	15353	793.6	19547
150	6	923.3	12055	1367	25719	1586	34782	1798	44283
200	8	1734	22645	2569	48310	2979	65335	3377	83180
250	10	2773	36200	4106	77230	4763	104447	5399	132974
300	12	4027	52576	5964	112165	6918	151694	7841	193127

Measuring range saturated steam: 150...300 psig

Gauge pressure [psig]		150		200		250		300	
Density [lb/ft³]		0.3626		0.4682		0.5727		0.6781	
Temperature [°F]		365.9		387.9		406.0		421.7	
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	3/8	28.16	422.4	36.33	544.9	44.54	668.1	50.43	756.4
25	1	57.70	1479	65.50	1900	72.61	2119	75.64	2216
40	1½	144.7	4164	164.2	4763	182.0	5312	189.6	5555
50	2	250.4	7209	284.3	8246	315.2	9197	328.3	96.18
80	3	548.6	15790	622.7	18062	690.3	20145	719.1	21067
100	4	942.5	27131	1070	31035	1186	34614	1236	36198
150	6	2135	61464	2424	70309	2687	78419	2799	82006
200	8	4011	115455	4553	132068	5048	147302	5258	154041
250	10	6412	184569	7279	211127	8069	235481	8406	246254
300	12	9313	268060	10571	306632	11720	342002	12209	357649

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 CISPR11:2009. 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 and SIP applications in the food industry

- The flow sensors are made from stainless steel 316 L (1.4404) or Hastelloy® C22.
- 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, TS and PT (PED 97/23/EC).
- External forces and moments, caused e.g. by pipe stresses, have not been taken into account.

Primarily, volumetric flow and temperature are measured, with pressure measurement as an option. From these parameters 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}: 0.25 m/s	0.8 ft/s	$V_{min}\,[m/s] = 0.5 \times \sqrt{\frac{998}{\rho}} \quad \rho\left[\frac{kg}{m^3}\right]$	①
		V_{max}: 10 m/s	32 ft/s	$V_{max}\,[m/s] = 7 \times \left(\frac{998}{\rho}\right)^{0.47} \quad \rho\left[\frac{kg}{m^3}\right]$	②
Gases and steam:	DN15	V_{min}: 3 m/s	10 ft/s	$V_{min}\,[m/s] = 6 \times \sqrt{\frac{1.204}{\rho}} \quad \rho\left[\frac{kg}{m^3}\right]$	①
		V_{max}: 45 m/s	147 ft/s	$V_{max}\,[m/s] = 7 \times \left(\frac{998}{\rho}\right)^{0.47} \quad \rho\left[\frac{kg}{m^3}\right]$	②
	DN15C	V_{min}: 3 m/s	10 ft/s	$V_{min}\,[m/s] = 12 \times \sqrt{\frac{1.204}{\rho}} \quad \rho\left[\frac{kg}{m^3}\right]$	①
		V_{max}: 55 m/s	180 ft/s	$V_{max}\,[m/s] = 7 \times \left(\frac{998}{\rho}\right)^{0.47} \quad \rho\left[\frac{kg}{m^3}\right]$	②
	DN25	V_{min}: 2 m/s	6.6 ft/s	$V_{min}\,[m/s] = 6 \times \sqrt{\frac{1.204}{\rho}} \quad \rho\left[\frac{kg}{m^3}\right]$	①
		V_{max}: 70 m/s	229 ft/s	$V_{max}\,[m/s] = 7 \times \left(\frac{998}{\rho}\right)^{0.47} \quad \rho\left[\frac{kg}{m^3}\right]$	②
	DN25C	V_{min}: 2 m/s	6.6 ft/s	$V_{min}\,[m/s] = 12 \times \sqrt{\frac{1.204}{\rho}} \quad \rho\left[\frac{kg}{m^3}\right]$	①
		V_{max}: 80 m/s	262 ft/s	$V_{max}\,[m/s] = 7 \times \left(\frac{998}{\rho}\right)^{0.47} \quad \rho\left[\frac{kg}{m^3}\right]$	②
	DN40... DN300	V_{min}: 2 m/s	6.6 ft/s	$V_{min}\,[m/s] = 6 \times \sqrt{\frac{1.204}{\rho}} \quad \rho\left[\frac{kg}{m^3}\right]$	①
		V_{max}: 80 m/s	262 ft/s	$V_{max}\,[m/s] = 7 \times \left(\frac{998}{\rho}\right)^{0.47} \quad \rho\left[\frac{kg}{m^3}\right]$	②

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 vibration will 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.*
- *Do not lay signal cables directly next to cables for the power supply.*

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.

Sunshades

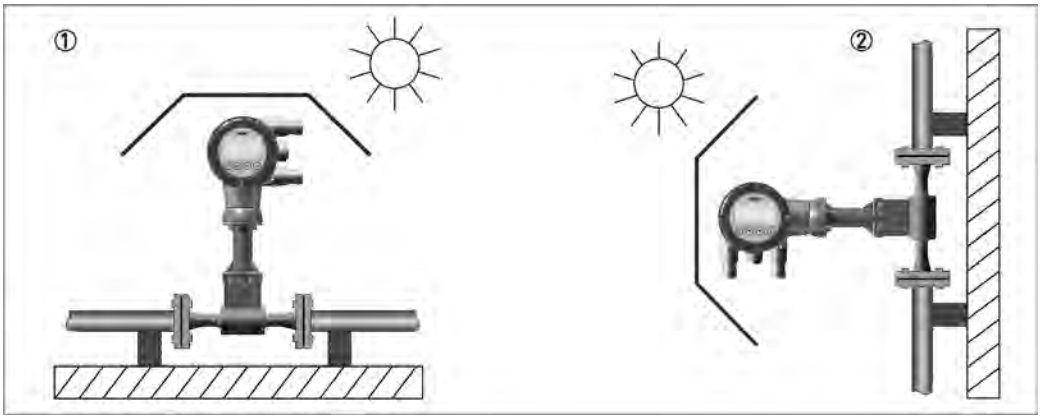


Figure 3-1: Installation recommendations

① Horizontal mounting
② Vertical mounting

The meter MUST be protected from strong sunlight.
A sunshade is available from the manufacturer as an option.

3.2.1 Prohibited installation when measuring liquids

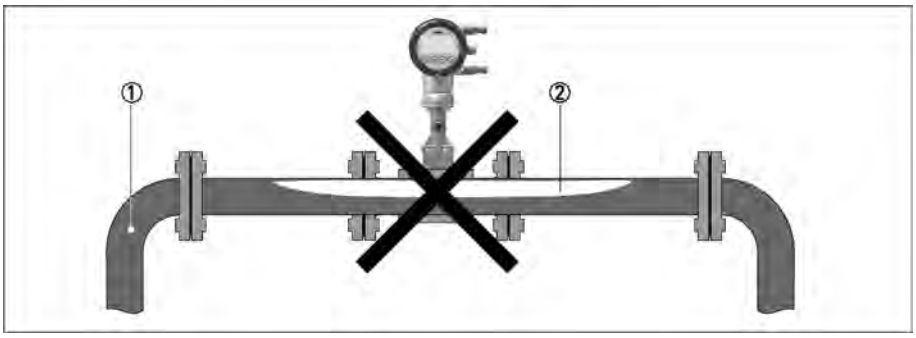


Figure 3-2: Upper pipe bend

Prohibited: Installing the device in an upper pipe bend ①, because there is a risk of gas bubbles ② forming. Gas bubbles can lead to pressure surges and inaccurate measurement.

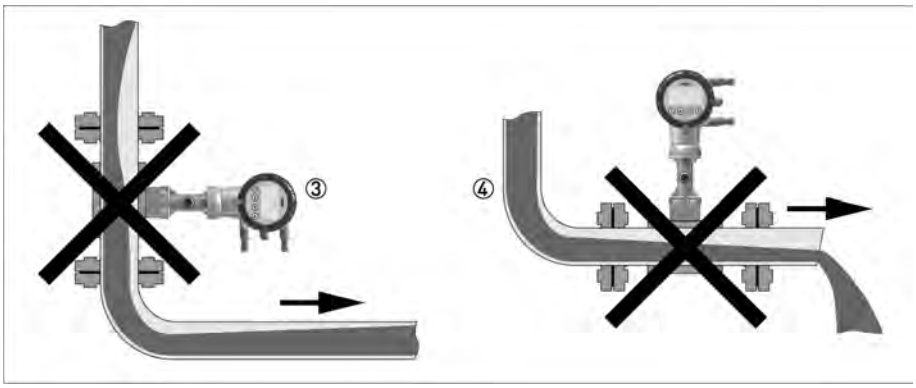
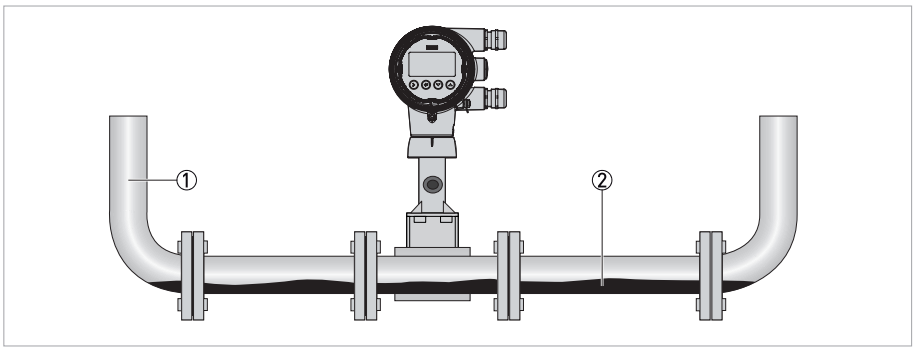


Figure 3-3: Downstream pipe and outlet

Installing the device in a downstream pipe ③ or upstream pipe of an outlet ④. There is the risk of partially filled pipes leading to inaccurate measurements.

3.2.2 Prohibited installation when measuring steam and gases



① Lower pipe bends
② Condensate

Prohibited: Installing the device in a lower pipe bend ①, because there is a risk of condensate forming ②.
Condensate can lead to cavitation and inaccurate measurement. Under certain circumstances the device can be destroyed and the measured product 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.

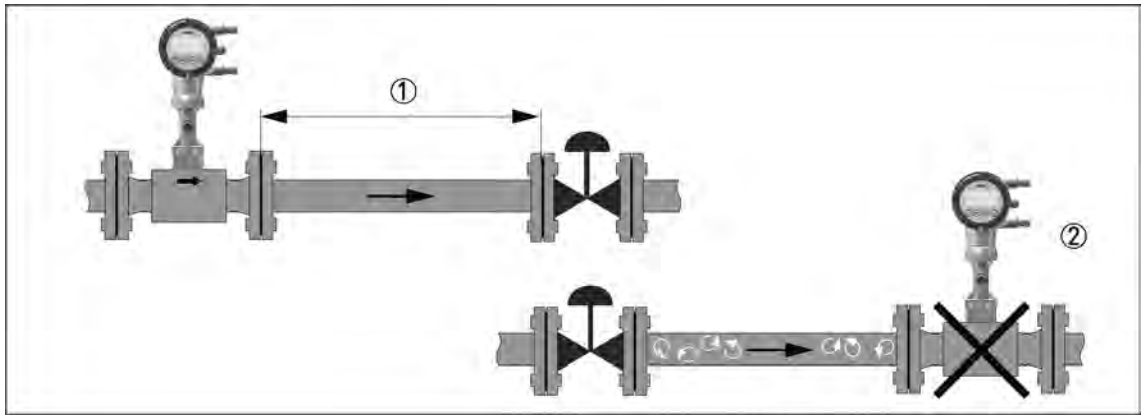


Figure 3-4: Pipeline with control valve

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

3.2.4 Preferred mounting position

Preferred mounting position

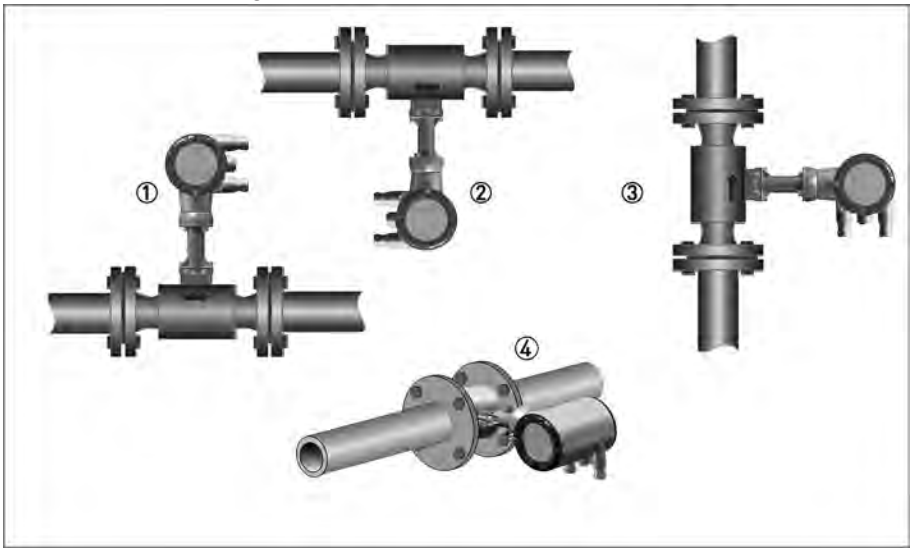


Figure 3-5: Mountig position

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 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

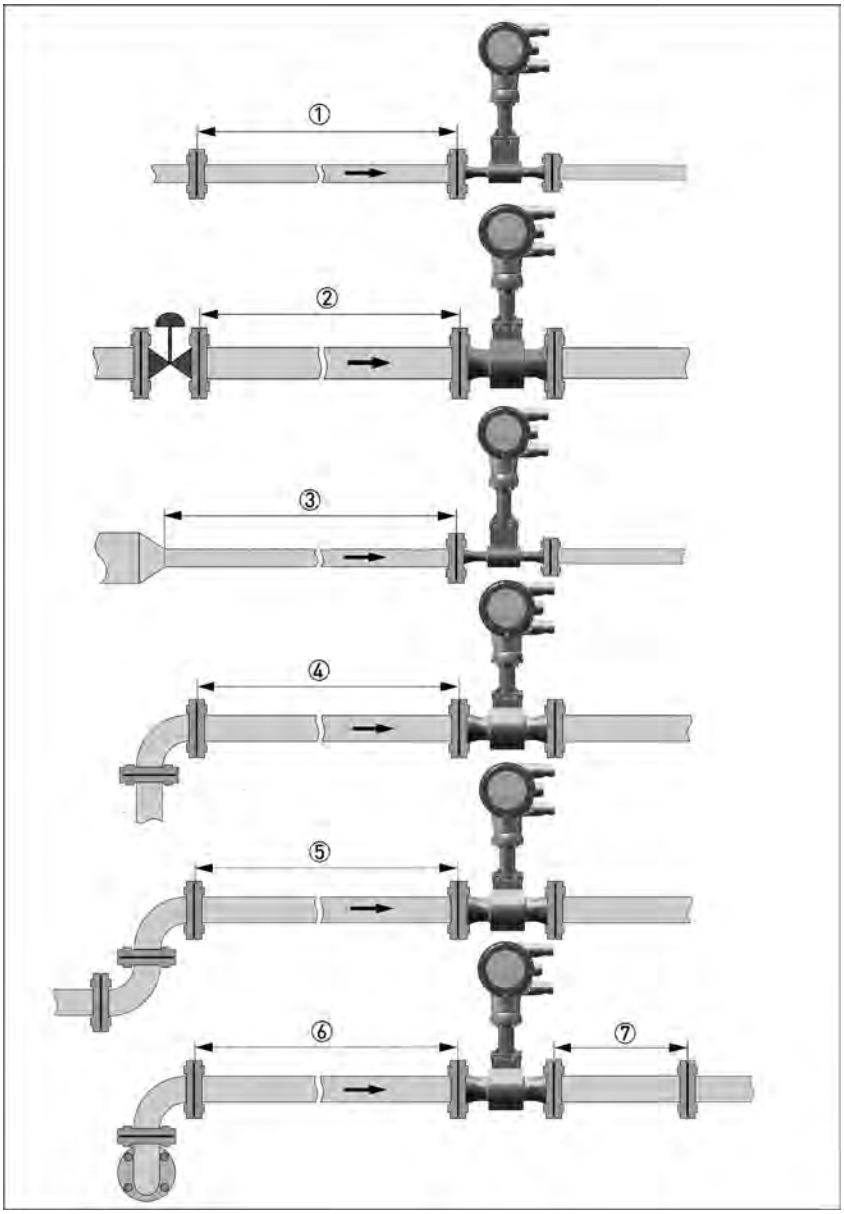


Figure 3-6: Inlet sections

① General inlet section without disturbing flow ≥ 15 DN
② Behind a control valve ≥ 50 DN
③ After a pipe diameter reduction ≥ 20 DN
④ After a single bend 90° ≥ 20 DN
⑤ After a double bend 2x90° ≥ 30 DN
⑥ After a double three-dimensional bend 2x90° ≥ 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

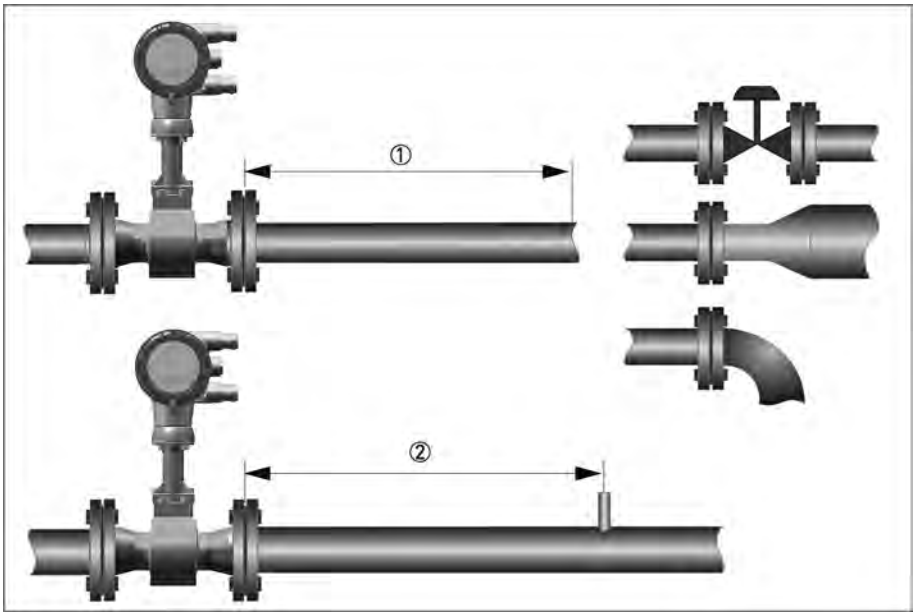


Figure 3-7: Minimum outlet sections

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 measuring device has an internal temperature sensor. 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.

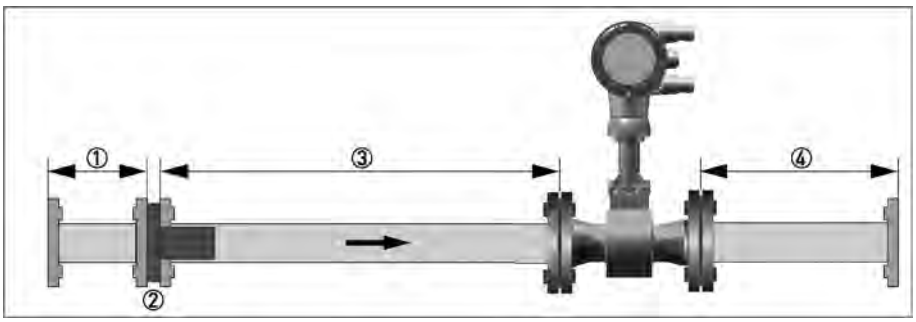


Figure 3-8: Flow straightener

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 ③ may only extend to the maximum height ① shown below.

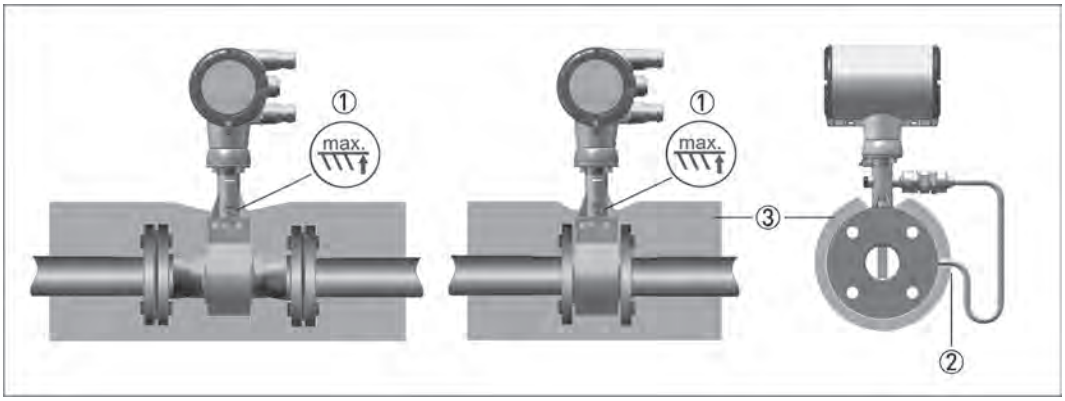


Figure 3-9: Installation heat insulation

① Max. height of the insulation up to the marking on the neck of the flow sensor
② Max. thickness of the insulation up to the bend of the pressure pipe
③ Insulation

The heat insulation ③ may only extend as far as the bend of the pressure sensing line ②.

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!

When using the binary output M1...M4 as pulse output and frequencies above 100 Hz, shielded cables are to be used in order to reduce effects from electrical interferences (EMC).

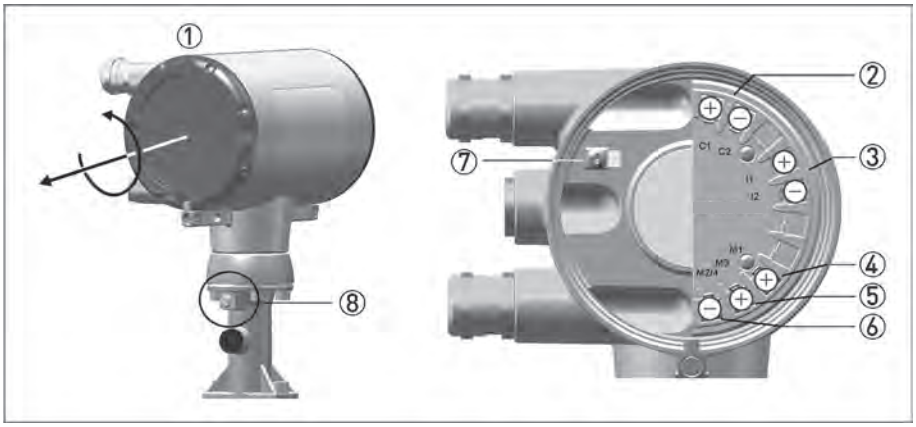


Figure 4-1: Connecting the signal converter

① Open the housing cover of the electrical terminal compartment using the key
② Signal converter supply and 4...20 mA loop
③ 4...20 mA current input, - external transmitter, optional
④ Terminal M1 binary (high current)
⑤ Terminal M3 binary (NAMUR)
⑥ Terminal M2/4 binary, common minus connection
⑦ Ground terminal in housing
⑧ Ground terminal on connection piece between flow sensor and signal converter

Both grounding terminals 7 and 8 are equally effective from a technical point of view.

Steps for connecting the signal converter:

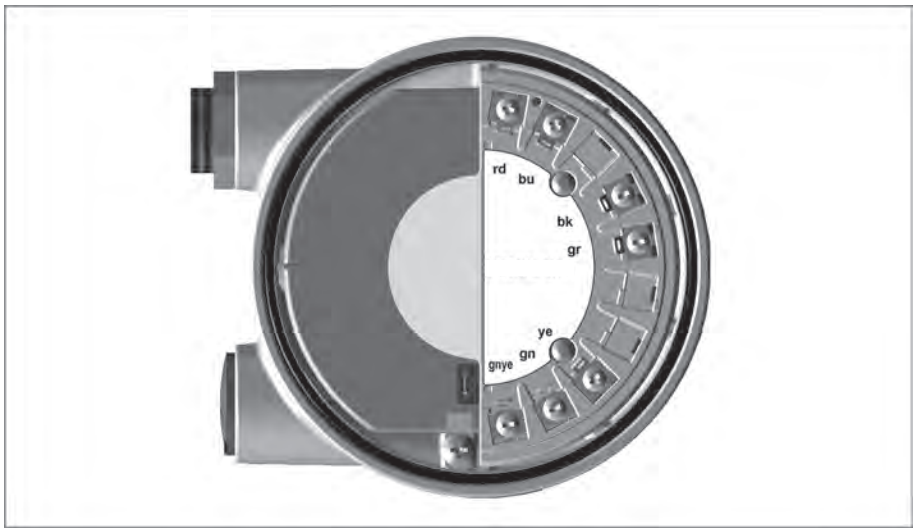
- Unscrew the housing cover ① of the electrical terminal compartment.
- Feed the connection cable through the cable entry in the housing.
- Connect the cable according to the terminal diagrams below.
- Connect the grounding to the terminal ⑦. Alternatively use the ground terminal ⑧ on the connection 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 inputs and outputs are passive and always require an additional power supply.

4.3 Connection of remote version



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

Connection cable strand colour

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

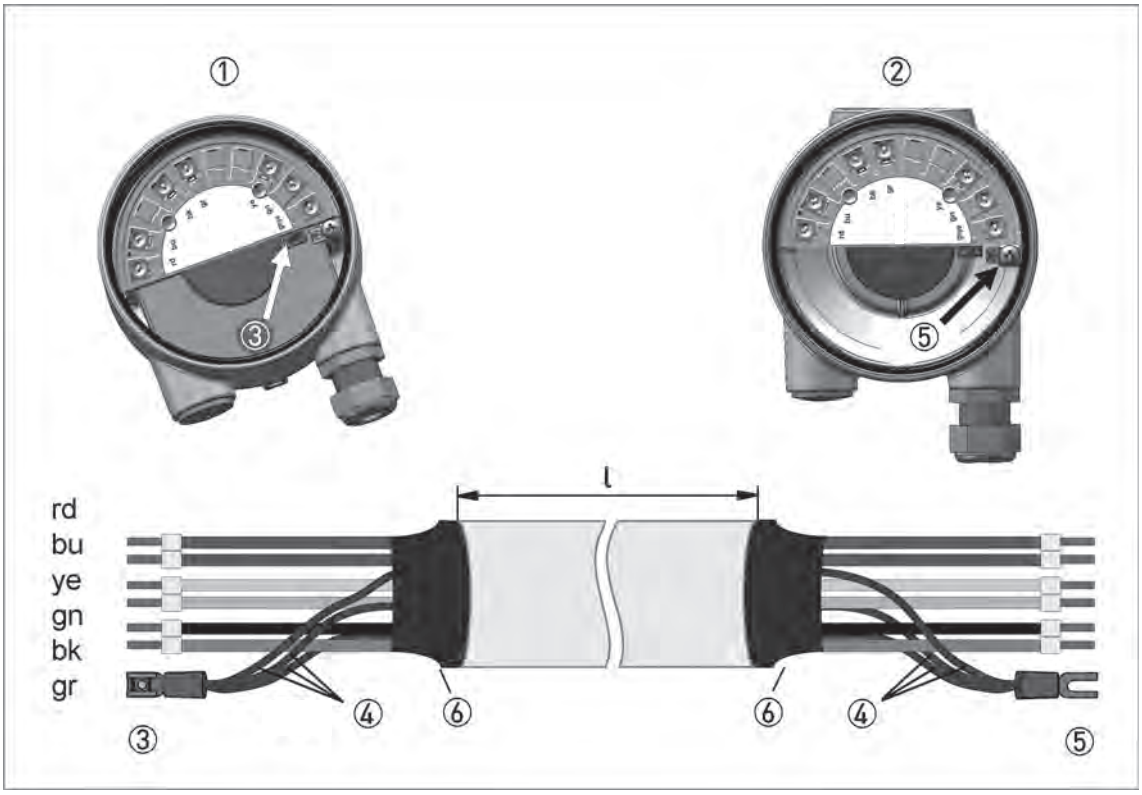


Figure 4-2: Connection of remote version

① Terminal connection of flow sensor
② Terminal connection of signal converter
③ Terminal end pair shielding of flow sensor
④ Filler wire pair shielding (protected with heat shrink tubing)
⑤ Fork clamp pair shielding on signal converter side
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. The exterior shielding of the cable must not be connected to any terminal.

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

Then please fax 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	_ Remote 5 m / 16.4 ft cable length	_ Remote 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 II3 G - Ex nA IIC T6 _ ATEX II2 D - Ex tb IIIC T70°C Db	_ QPS IS US/C _ QPS XP US/C _ QPS DIP US/C _ QPS NI US/C
		_ IECEx - Ex ia IIC T6 _ IECEx - Ex d ia IIC T6 _ IECEx - Ex nA 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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