



Vortex flow sensor

## OEM Flow sensor for liquid media

### Type 200

The flow sensor Type 200 is based on the Karman Vortex principle. You can choose between various versions. The Type 200 is available with or without temperature measurement. With no moving parts the flow sensor is not sensitive to debris, has marginal pressure loss and high accuracy.



## Flow range

0.5 ... 150 l/min

## Nominal diameters

DN 6 / 8 / 10 / 15 / 20 / 25

## Temperature measurement

-40 ... +125 °C

- + Low cost product with high levels of accuracy
- + Temperature non-sensitive measuring principle
- + Excellent media resistance (measuring element not in contact with the media)
- + Wide application temperature range
- + Marginal loss of pressure
- + Measuring element not sensitive to debris
- + Direct temperature measurement in the medium with PT1000 or NTC
- + Drinking water approval KTW, W270, ACS, WRAS

## Technical overview

### Flow measurement

Measuring principle	Vortex		Piezoelectric sensor element
Measuring range			0.5 ... 150 l/min
Nominal diameters			DN 6 / 8 / 10 / 15 / 20 / 25
Accuracy at < 50% fs (water)			< 1% fs
Accuracy at > 50% fs (water)			< 2% measuring value
Response time	Immediately Therefore suitable for spigot use.	Signal delay	< 100 ms
		Response time	< 5 ms

### Temperature measurement (≥ DN 8)

Measuring principle	Resistance		PT1000 NTC
	Measuring range		-40 ... +125 °C
PT1000	Accuracy	Class B DIN EN 60751	@ T = 0 °C @ T ≠ 0 °C
	Measuring range		± 0.3 K ± 0.3 K ± 0.005 * ΔT -40 ... +125 °C
NTC	Accuracy	NTC 10 kOhm @ 25 °C β = 4050	@ T = +25 °C @ T < +25 °C @ T > +25 °C
			± 0.7 K ± 0.7 K ± 0.025 * ΔT ± 0.7 K ± 0.050 * ΔT
Temperature influences	Self-heating at temperature sensor Conduction resistance to connector		1 K/mW 0.8 Ohm

### Operating conditions

Medium	Suitable for heating circuit water with the usual additives Drinking water		Other medium on request
Temperature		Media	< +125 °C
		Ambient	-15 ... +85 °C
		Storage	-30 ... +85 °C
		(for lifetime)	12 bar at +40 °C
		(for lifetime)	6 bar at +100 °C
		(for 600 hours)	4 bar at +125 °C
		(for 2 hours)	4 bar at +140 °C
		(max. test pressure)	18 bar at +40 °C
Cavitation	The following equation is valid to prevent cavitation:		$P_{abs.outlet} / P_{difference} > 5.5$

### Materials in contact with medium

Sensor paddle	ETFE
Case with damming body	PA6T/6I (40% GF)
Sealing material	FPM EPDM (perox.)

### Electrical overview

Power supply	$U_{IN}$	5 VDC ± 5%
Output flow (Q)	Frequency Square pulse signal	$U_{OUT.Q.Frequency}$ < 0.1 ... > 4.75 V
Output temperature (T)	Resistant signal	$R_{OUT.PT1000}$ $R_{OUT.NTC}$ PT1000 class B DIN EN 60751 NTC 10 kOhm @ 25 °C; β = 4050
Electrical connection and protection class	Connector RAST 2.5 / 2.54 Connector M12x1	IP 20 IP 65
Load against GND or IN		> 10 kOhm / < 10 nF
Current consumption $I_{in}$ load free	standard enhanced EMC protection	< 6 mA < 10 mA

### Weight

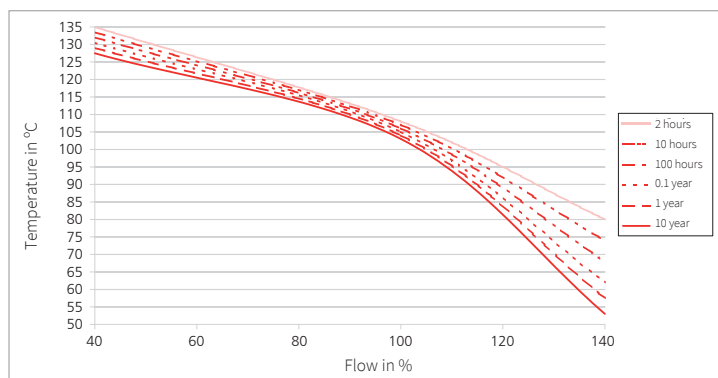
DN 6 / 8	~ 47 g
DN 10	~ 57 g
DN 15	~ 68 g
DN 20	~ 92 g
DN 25	~ 100 g

### Test / Admissions

Electromagnetic compatibility	acc. to EN 61326-2-3 (no protection at surge)
Drinking water approval	Plastic parts with KTW and W270 approval WRAS ACS

Packaging (multiple packaging)	Connection copper tube	Outside thread K	Outside thread G
DN 6	-	Blister 30x	Blister 30x
DN 8 / 10	Blister 30x	Blister 30x	Blister 30x
DN 15	Blister 30x	Blister 30x	Blister 30x
DN 20	Blister 20x	Blister 20x	Blister 15x
DN 25	-	Blister 20x	Blister 15x

## Minimum life span on high flow rate and high temperature



## Nominal diameters dependent variables

Nominal diameters	Tube connection	Measuring range	Quantity per pulse @ 50% fs	Flow rate	Frequency range	$Q_0$	$K_f$	Pressure drop <sup>1), 2)</sup>
DN 6	K	0.5 ... 10 l/min	0.386 ml	0.074 ... 1.474 m/s	27 ... 426 Hz	-0.14	0.0238	240 * Q <sup>2</sup>
	G							
DN 8	K	0.9 ... 15 l/min	0.638 ml	0.133 ... 2.210 m/s	30 ... 384 Hz	-0.3	0.0398	85.00 * Q <sup>2</sup>
	G		0.631 ml		30 ... 388 Hz		0.0394	
	N		0.614 ml		31 ... 399 Hz		0.0383	
DN 10	K	1.8 ... 32 l/min	1.399 ml	0.265 ... 4.716 m/s	24 ... 379 Hz	-0.2	0.0850	22.50 * Q <sup>2</sup>
	G		1.370 ml		24 ... 387 Hz		0.0832	
	N		1.384 ml		24 ... 383 Hz		0.0841	
DN 10	K	2.0 ... 40 l/min	1.403 ml	0.295 ... 5.895 m/s	26 ... 473 Hz	-0.2	0.0850	22.50 * Q <sup>2</sup>
	G		1.373 ml		26 ... 483 Hz		0.0832	
	N		1.388 ml		26 ... 478 Hz		0.0841	
DN 15	K	3.5 ... 50 l/min	3.047 ml	0.290 ... 4.145 m/s	20 ... 272 Hz	-0.2	0.1843	6.70 * Q <sup>2</sup>
	G		3.016 ml		20 ... 275 Hz		0.1824	
	N		3.077 ml		20 ... 270 Hz		0.1861	
DN 20	K	5.0 ... 85 l/min	6.213 ml	0.265 ... 4.509 m/s	14 ... 227 Hz	-0.3	0.3754	2.50 * Q <sup>2</sup>
	G		6.125 ml		14 ... 230 Hz		0.3701	
	N		6.208 ml		14 ... 227 Hz		0.3751	
DN 25	K	9.0 ... 150 l/min	12.412 ml	0.283 ... 4.709 m/s	12 ... 201 Hz	-0.2	0.7467	0.92 * Q <sup>2</sup>
	G		12.251 ml		12 ... 204 Hz		0.7370	

### Characteristic line formula frequency output

$$Q_v = K_f * f + Q_0$$

### Formula quantity per pulse [litres/pulse]

$$\frac{\text{quantity}}{\text{pulse}} = \frac{Q_v * K_f}{60 * (Q_v - Q_0)}$$

(Influence of viscosity for media other than water - see page 8)

### Legend

$Q_v$	Volume flow rate	[l/min]
$Q_0$	Axis intercept	[l/min]
$K_f$	Coefficient frequency output	[(l/min) / f]
$f$	Frequency	[Hz]
$\frac{\text{quantity}}{\text{pulse}}$	Quantity per pulse	$\frac{\text{litres}}{\text{pulse}}$

<sup>1)</sup> incl. 3xDi inlet and outlet side

<sup>2)</sup> Pv in Pa; Q in l/min

				1	2	3	4	5	6	7	
<b>Order code selection table</b>				200.	X	X	X	X	X	X	
<b>Version</b>	Flow			9							
	Flow and temperature (PT1000)			8			1				
	Flow and temperature (NTC)			7			1				
<b>Nominal diameters / flow range</b>	DN 6	0.5 ... 10 l/min.		9	0	6	1			K,G	
	DN 8	0.9 ... 15 l/min.			0	8	1				
	DN 10	1.8 ... 32 l/min.			1	0					
	DN 10	2.0 ... 40 l/min.			1	1					
	DN 15	3.5 ... 50 l/min.			1	5					
	DN 20	5.0 ... 85 l/min.			2	0					
	DN 25	9.0 ... 150 l/min.			2	5				K,G	
<b>Output / power supply</b>	Frequency output, 0 ... 5 VDC (Square pulse signal)		5 VDC	standard	9			0			
	Frequency output, 0 ... 5 VDC (Square pulse signal)		5 VDC	enhanced EMC protection				1			
<b>Electrical connection</b>	3-pole connector		RAST 2.5		9				0		
	2x3-pole connector		RAST 2.5		7,8			1	1		
	3-pole connector		RAST 2.5 (condensation protection)		9				2		
	2x3-pole connector		RAST 2.5 (condensation protection)		7,8			1	3		
	3-pole circular connector		M12x1 (condensation protection)		9			1	4		
	5-pole circular connector		M12x1 (condensation protection)		7,8			1	5		
<b>Sealing material</b>	EPDM		Ethylene propylene rubber (peroxidically cross-linked)							1	
	FPM <sup>1)</sup>		Fluoro elastomer							2	
<b>Tube connection</b>	Plastic PA6T/6I		connection copper tube (max. DN 20)							N	
			outside thread K (see dimension diagram)								K
			outside thread G (see dimension diagram)								

<b>Accessories</b> <i>(supplied loose)</i>				<b>Order number</b>	
Connection kit <sup>2)</sup> DN 8, 10 with copper tube				113775	
Connection kit <sup>2)</sup> DN 8, 10 with adapter Rp 3/8		Stainless steel 1.4305/AISI 303		113776	
Connection kit <sup>2)</sup> DN 15 with copper tube				113777	
Connection kit <sup>2)</sup> DN 15 with adapter Rp 1/2		Stainless steel 1.4305/AISI 303		113778	
Connection kit <sup>2)</sup> DN 20 with copper tube				113779	
Connection kit <sup>2)</sup> DN 20 with adapter Rp 3/4		Stainless steel 1.4305/AISI 303		113780	
Connector RAST 2.5 with cable		3-pole	30 cm	111668	
Connector RAST 2.5 with cable		3-pole	110 cm	101817	
Straight-wire box for connector M12x1 with cable		3-pole	200 cm	114605	
Corner-wire box for connector M12x1 with cable		3-pole	200 cm	114604	
Connector RAST 2.54 with cable		2x3 pole	110 cm (with temperature)	114629	
Straight-wire box for connector M12x1 with cable		5-pole	200 cm (with temperature)	114564	
Corner-wire box for connector M12x1 with cable		5-pole	200 cm (with temperature)	114563	
Straight-wire box for connector M12x1 screwing terminal			5-pole	115024	
Clip for DN 8,10				112116	
Clip for DN 15				110941	
Clip for DN 20				112122	
O-Ring for DN 8, DN 10		EPDM	ø 13.95 x 2.62	Copper tube and adapter	112124
O-Ring for DN 15		EPDM	ø 17.86 x 2.62	Copper tube and adapter	112265
O-Ring for DN 20		EPDM	ø 21.89 x 2.62	Copper tube and adapter	112723
O-Ring for DN 25		EPDM	ø 31 x 3	(as a replacement, already assembled)	112792
Connection copper tube for DN 8, 10		L=150 mm			112121
Connection copper tube for DN 15		L=150 mm			112211
Connection copper tube for DN 20		L=150 mm			112306
Adapter (inside thread) for DN 8 und DN 10		Rp 3/8	Stainless steel 1.4305/AISI 303		112655
Adapter (inside thread) for DN 15		Rp 1/2	Stainless steel 1.4305/AISI 303		112660
Adapter (inside thread) for DN 20		Rp 3/4	Stainless steel 1.4305/AISI 303		112661

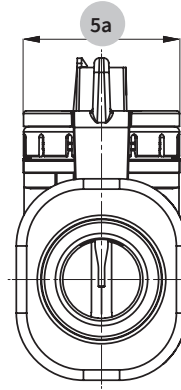
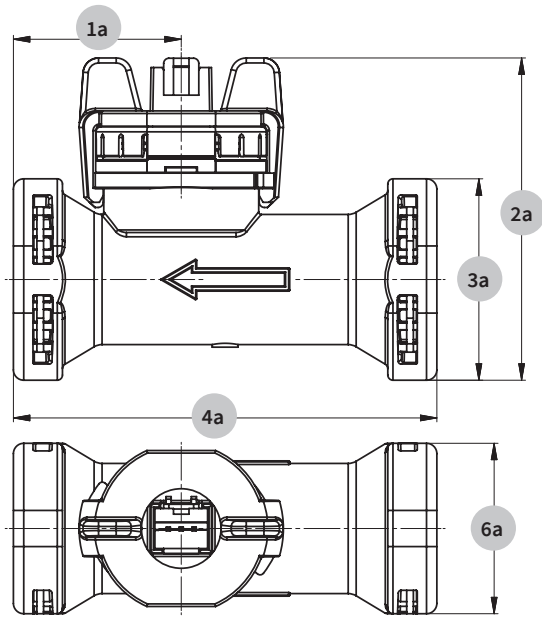
AMP connector <sup>3)</sup>	Manufacturers order number	Colour	for flexible wire
	3-829868-3	grey	7 x 0.20 mm = 0.22 mm <sup>2</sup> 12 x 0.20 mm = 0.35 mm <sup>2</sup>
	1-966194-3	beige	7 x 0.25 mm = 0.35 mm <sup>2</sup>

<sup>1)</sup> No drinking water approval

<sup>2)</sup> Connection set includes: 2x Clip, 2x Copper tube or Adapter and 2x O-Ring

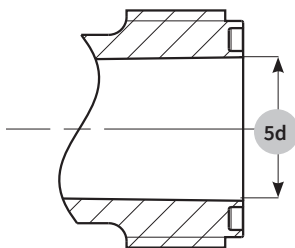
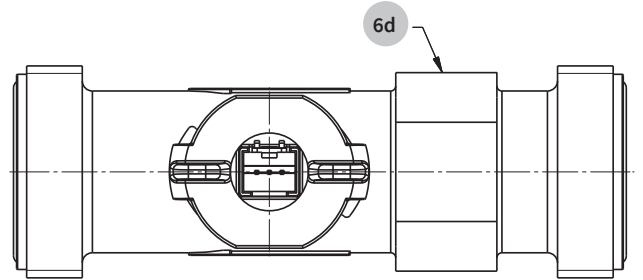
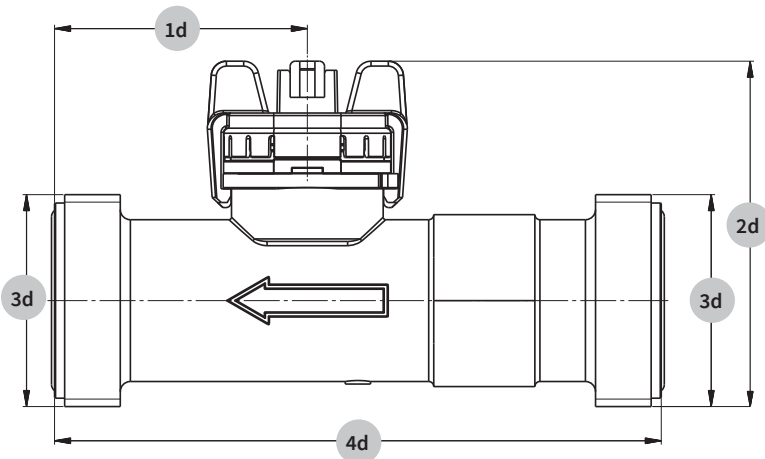
<sup>3)</sup> To order separately directly from the manufacturer. Find further information in the manufacturers specification no. 114.18049

Dimension diagram DN 8, 10, 15, 20



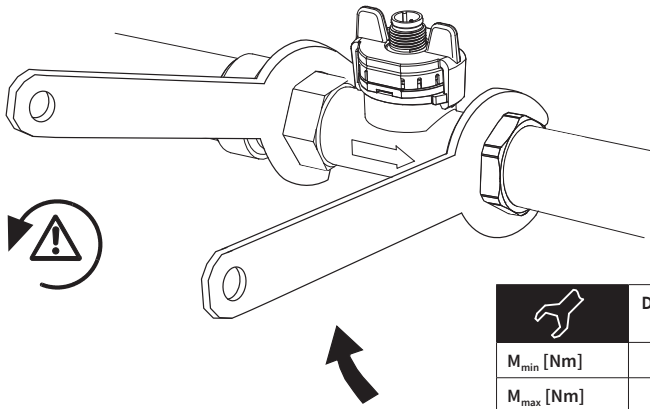
	1a	2a	3a	4a	5a	6a
DN8	29.5	59.0	32.9	72	30.2	28.9
DN10	32.5	57.3	32.9	77	30.2	28.9
DN15	32.5	62.4	39.0	82	30.2	33.0
DN20	39.3	66.3	43.0	105	30.2	37.4

Dimension diagram DN 6, 8, 10, 15, 20, 25



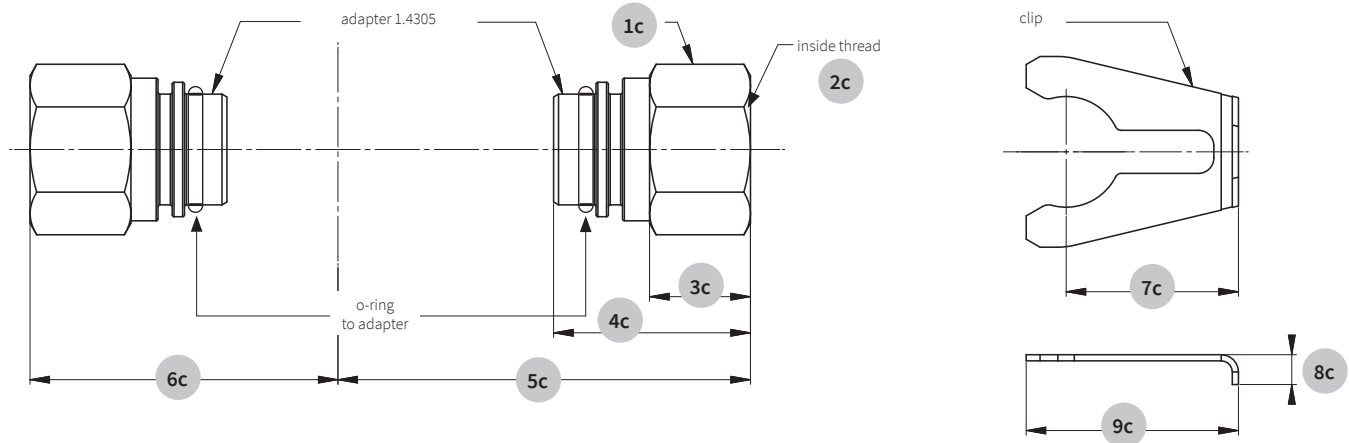
		1d	2d	3d	4d	5d	6d
DN6	K	43.7	53.0	G ½	77	11.5	12
DN6	G	48.2	55.7	G ¾	86	11.5	12
DN8	K	43.7	53.0	G ½	77	11.5	12
DN8	G	48.2	55.7	G ¾	86	11.5	12
DN10	K	35.0	51.3	G ½	81	11.5	19
DN10	G	39.5	54.1	G ¾	90	11.5	19
DN15	K	36.6	56.1	G ¾	87	16	22
DN15	G	41.6	59.5	G 1	97	16	22
DN20	K	36.6	61.5	G 1	105	20	27
DN20	G	42.6	65.8	G 1¼	117	20	27
DN25	K	50.0	68.3	G 1¼	120	26	34
DN25	G	56.0	71.3	G 1½	132	26	34

## Admissible locking torque



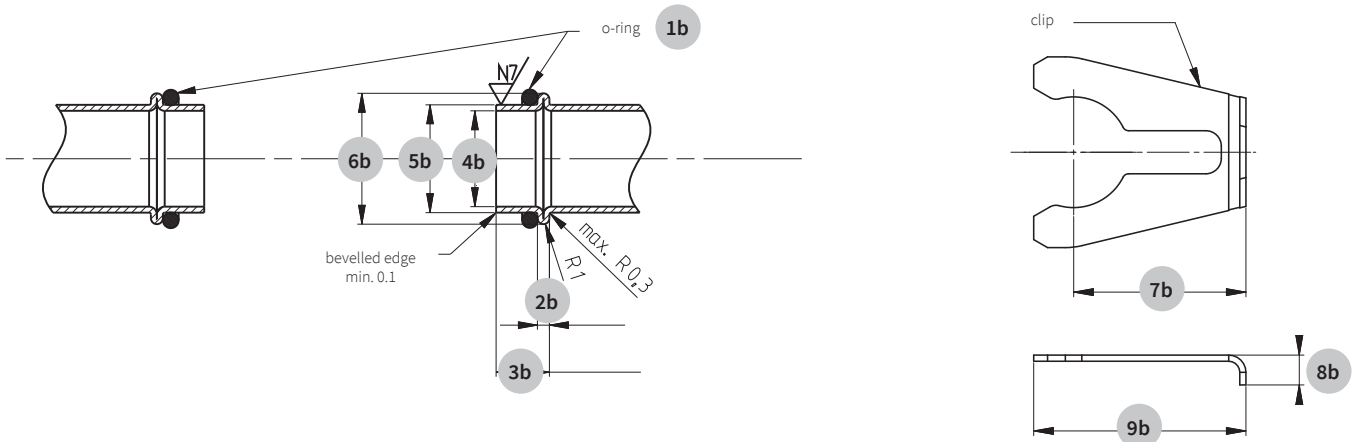
	DN6/8/10 G 1/2	DN6/8/10 G 3/4	DN15 G 3/4	DN15 G1	DN20 G1	DN20 G1 1/4	DN25 G1 1/4	DN25 G1 1/2
$M_{min}$ [Nm]	1	1	1	2	2	2.5	2.5	2.5
$M_{max}$ [Nm]	12	12	12	12	12	15	15	15

## Accessories DN 8, 10, 15, 20



	1c	2c	3c	4c	5c	6c	7c	8c	9c
DN8	22	Rp 3/8 DIN 2999 length min. 9	14.0	29	57.65	44.65	24.5	7.3	30.8
DN10	22	Rp 3/8 DIN 2999 length min. 9	14.0	29	59.65	47.55	24.5	7.3	30.8
DN15	24	Rp 1/2 DIN 2999 length min. 11.5	16.4	32	67.05	50.05	28.0	7.6	34.5
DN20	30	Rp 3/4 DIN 2999 length min. 13	18.5	38	82.25	58.85	28.0	8.7	34.5

## Geometry of customers connection tube DN 8, 10, 15, 20

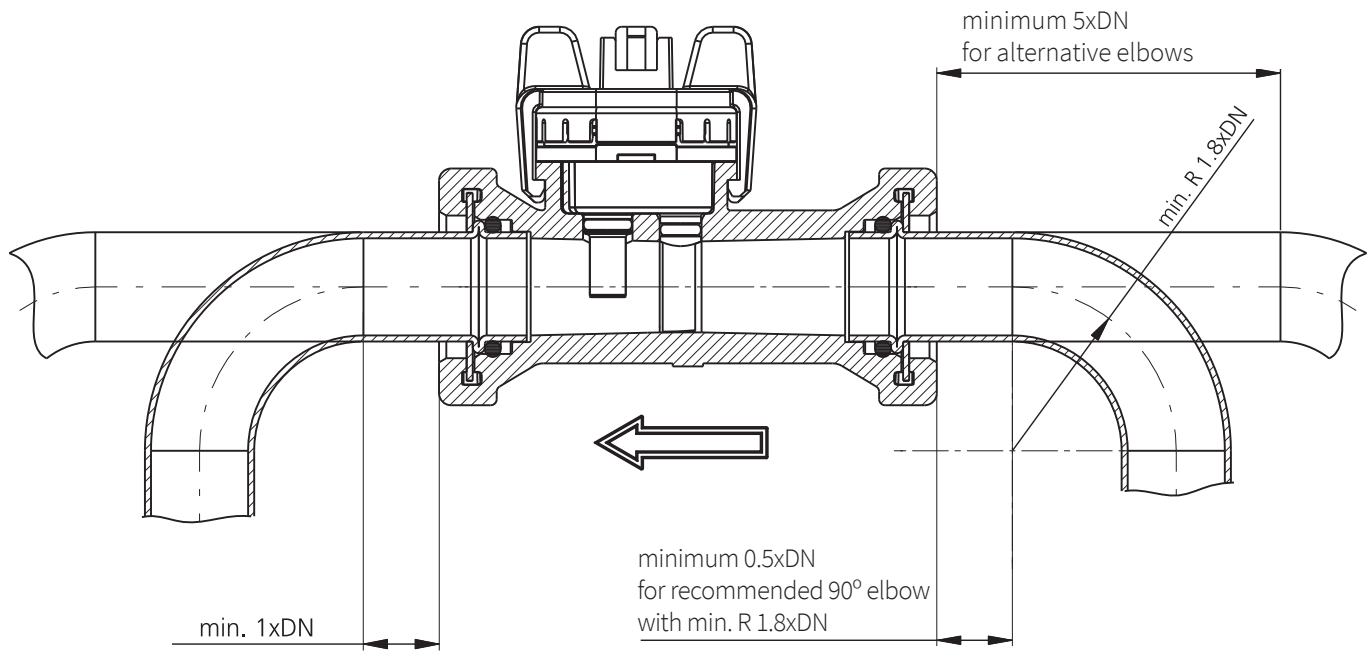


	1b	2b	3b	4b	5b	6b	7b	8b	9b
DN8	∅ 13.95x2.62	2 ± 0.2	8.9 ± 0.2	∅ 13 ± 0.2	∅ 15.00 ± 0.08	∅ 18.88 ± 0.1	24.5	7.3	30.8
DN10	∅ 13.95x2.62	2 ± 0.2	8.9 ± 0.2	∅ 13 ± 0.2	∅ 15.00 ± 0.08	∅ 18.88 ± 0.1	24.5	7.3	30.8
DN15	∅ 17.86x2.62	2 ± 0.2	8.9 ± 0.3	∅ 16 ± 0.2	∅ 18.00 <sup>+0.08</sup> <sub>-0.06</sub>	∅ 21.85 ± 0.1	28.0	7.6	34.5
DN20	∅ 21.89x2.62	2 ± 0.2	12.9 ± 0.3	∅ 20 ± 0.2	∅ 22.00 <sup>+0.08</sup> <sub>-0.06</sub>	∅ 25.85 ± 0.1	28.0	8.7	34.5

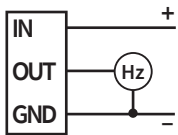
## Tube mounting instructions

Consider the following to ensure the correct function of the sensor.

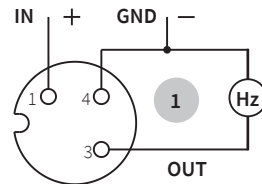
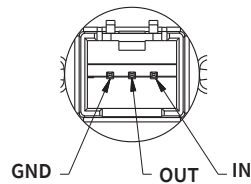
- Only diameter changes from large to small are allowed.
- Avoid repeated elbows in the same level at entryside



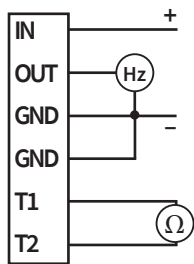
## Electrical connections



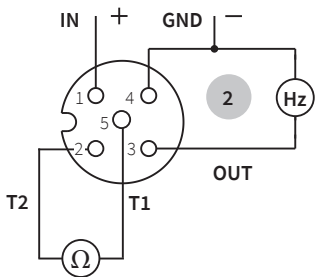
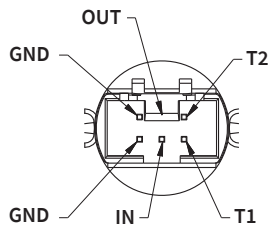
RAST 2.5 without temperature output



Connector M12x1 without temperature output



Connector 2x3-poles with temperature output



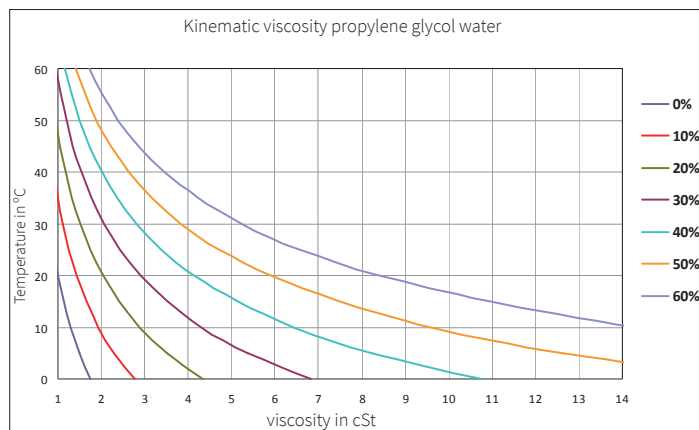
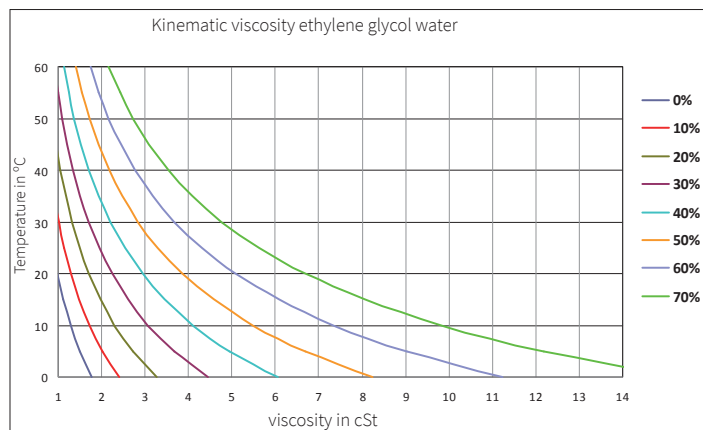
Connector M12x1 with temperature output

Pin	Colour
1	brown
3	blue
4	black
1	brown
2	white
3	blue
4	black
5	gray

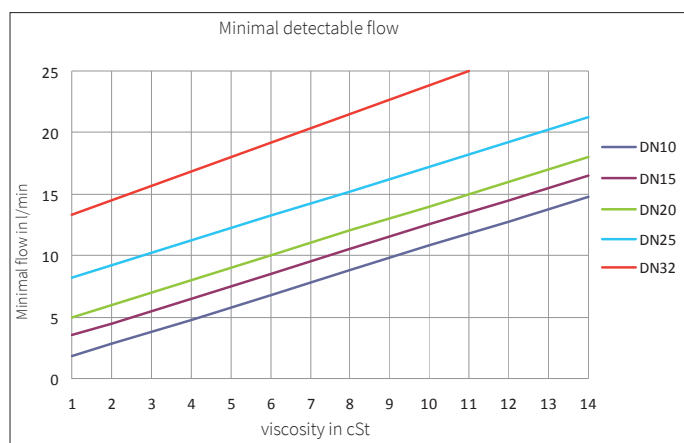
## Influence of glycol

With the following definitions we are able to correct the influence of media with higher viscosity than water (= media viscosity > 1.8 cSt) in order to reach a measuring accuracy of 3% fs in the range of 1.8 - 4 cSt and of 4% in the range of 4 - 14 cSt ( $\nu$  = viscosity in cSt).

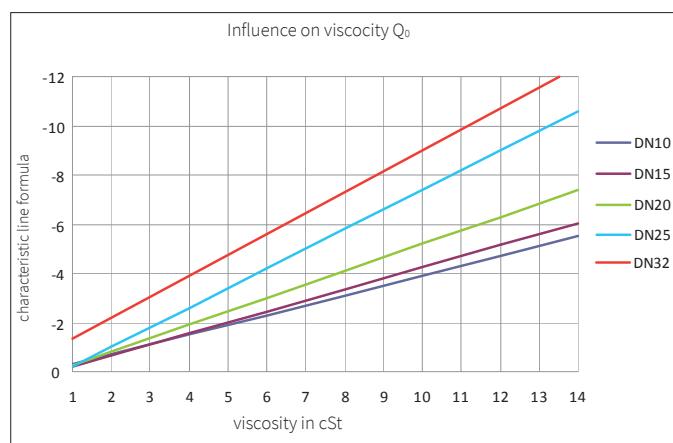
### Definition of viscosity of glycol-water-compound



### Definition of respond threshold $Q_{min}$



### Definition of characteristic line formula $Q_v = k_f * f + Q_0$



#### Formula respond threshold $Q_{min}$ in l/min

< DN 10 not possible

DN10:  $Q_{min} = \mathbf{u} + 0.8$

DN15:  $Q_{min} = \mathbf{u} + 2.5$

DN20:  $Q_{min} = \mathbf{u} + 4.0$

DN25:  $Q_{min} = \mathbf{u} + 8.0$

#### Formula characteristic line for $Q \geq Q_{min}$ in l/min

< DN 10 not possible

Frequency output:

DN10:  $Q = K_f * f - 0.40\mathbf{u} + 0.20$

DN15:  $Q = K_f * f - 0.45\mathbf{u} + 0.25$

DN20:  $Q = K_f * f - 0.55\mathbf{u} + 0.25$

DN25:  $Q = K_f * f - 0.80\mathbf{u} + 0.60$

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