

Flow sensor type 210 for liquid media

Flow range
0.5 ... 150 l/min

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

Temperature measurement
-40 ... +125 °C



The flow sensor type 210 is based on the Kármán vortex trail principle. In comparison to the OEM flow sensor (type 200), the type 210 is available with an increased range of power supply and output signals all with and without temperature measurement. With no moving parts the flow sensor is not sensitive to debris, has marginal pressure loss and high accuracy.

- Flow measuring with voltage, current or frequency output
- Temperature non-sensitive measuring principle
- Excellent media resistance (measuring element not in contact with the media)
- CE conformity
- Wide application temperature range
- Marginal loss of pressure
- Measuring element not sensitive to debris
- Direct temperature measurement in the medium
- Drinking water approval
KTW, W270, WRAS, ACS

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
		Analogue output
		Signal delay < 2 s
		Response time < 500 ms

Temperature measurement (> 8 DN)

Measuring principle	Resistance	PT1000
	Measuring range	-40 ... +125 °C
PT1000	Accuracy	class B DIN EN 60751
		@ T = 0 °C ± 0.3 K
		@ T ≠ 0 °C ± 0.3 K ± 0.005 * ΔT
0 ... 10 V	Measuring range	-25 ... +125 °C
	Accuracy	± 0.5 K ± 0.005 * ΔT
	Calculation temperature	T (°C) = ±150 °C / 10 V * U _{OUT,T} - 25 °C
Temperature influences	Self-heating at temperature sensor	1 K/mW
	Conduction resistance to connector	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
Max. pressure and medium temperature		(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:	$P_{\text{abs outlet}} / P_{\text{difference}} > 5.5$

Materials in contact with medium (FDA-conform)

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

Electrical overview

		Frequency output	Voltage output	Current output
Power supply	U _{IN}	4.75 ... 33 VDC	11.5 ... 33 VDC	8 ... 33 VDC
Output flow (Q)	Frequency square pulse signal U _{OUT_Q} or I _{OUT}	< 0.5 ... > U _{IN} - 0.5 V	–	–
Output temperature (T)	Resistant signal R _{OUT_PT1000}	–	0 ... 10 V	4 ... 20 mA
Electrical connection and protection class	Voltage signal U _{OUT_T}	–	PT1000 class B DIN EN 60751	–
Load against GND or IIN		M12x1 (IP 65)	0 ... 10 V	–
Current consumption load free (I _{IN})		< 1 mA / < 100 nF	M12x1 (IP 65)	M12x1 (IP 65)
Electrical reliability		< 2 mA	< 6 mA / < 100 nF ¹⁾	< (U _{IN} - 8 V) / 20 mA
			< 5 mA	–
		Short circuit, reverse voltage and external voltage protected within the admissible supply voltage.		

Weight

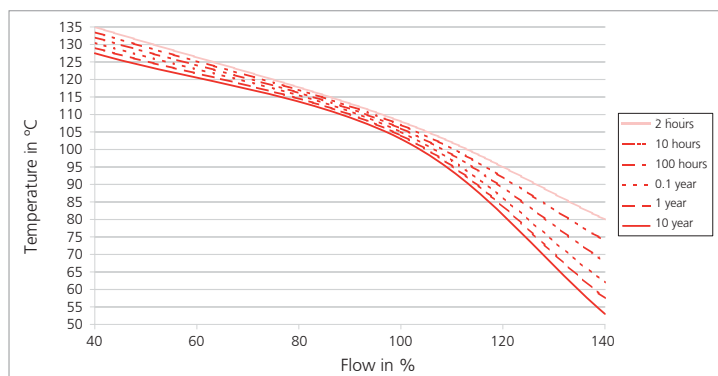
DN 6 / 8	~ 47 g
DN 10	~ 57 g
DN 15	~ 68 g
DN 20	~ 92 g
DN 25	~ 100 g

Test / Admissions

Electromagnetic compatibility	CE conformity acc. to EN 61326-2-3 WRAS
Drinking water approval	Plastic parts with KTW and W270 approval 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 20x
DN 20	Blister 20x	Blister 20x	Blister 15x
DN25	–	Blister 15x	Blister 15x

Minimum life span on high flow rate and high temperature



¹⁾ against GND only

Nominal diameters dependent variables

Nominal diameters	Tube connection	Measuring range	Quantity per pulse @ 50% fs	Flow range	Frequency range	Q ₀	K _f	K _U	K _I	Pressure drop ^{1), 2)}
DN 6	K	0.5 ... 10 l/min	0.386 ml	0.074 ... 1.474 m/s	28 ... 427 Hz	-0.14	0.0238	1.0	0.625	240 * Q ²
	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	1.5	0.938	85.00 * Q ²
	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	3.2	2.000	22.50 * Q ²
	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	4.0	2.500	22.50 * Q ²
	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	5.0	3.125	6.70 * Q ²
	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	8.5	5.313	2.50 * Q ²
	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	15	9.375	0.92 * Q ²
	G		12.251 ml		12 ... 204 Hz		0.7370			

Characteristic line formula frequency output

$$Q_V = K_f * f + Q_0$$

Characteristic line formula voltage output

$$Q_V = K_U * U_{OUT}$$

Characteristic line formula current output

$$Q_V = K_I * (I_{OUT} - 4 \text{ mA})$$

Formula quantity per pulse [litres/pulse]

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

Legend

Q _V	Volume flow rate	[l/min]
Q ₀	Axis intercept	[l/min]
K _f	Coefficient frequency output	[(l/min) / f]
K _U	Coefficient voltage output	[(l/min) / V]
K _I	Coefficient current output	[(l/min) / mA]
f	Frequency	[Hz]
U _{OUT}	Voltage	[V]
I _{OUT}	Current	[mA]
quantity/pulse	Quantity per pulse	litres/pulse

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

¹⁾ incl. 3xDi inlet and outlet side

²⁾ Pv in Pa; Q in l/min

Order code selection table			1	2	3	4	5	6	7
			210.	X	X	X	X	X	X
Version	Flow		9				4		
	Flow and temperature (PT1000)		8				5		
	Flow and temperature (0 ... 10 V)		6			3	5		
Nominal diameters and flow range	DN 6	0.5 ... 10 l/min.	9	0	6				K,G
	DN 8	0.9 ... 15 l/min.		0	8				
	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
Output / power supply	Frequency output (Square pulse signal)	4.75 ... 33 VDC	8,9			2			
	Analogue signal 0 ... 10 V	11.5 ... 33 VDC				3			
	Analogue signal 4 ... 20 mA	8 ... 33 VDC	8,9			4			
Electrical connection	Connector M12x1	2- or 3-pole (condensation protection)	9				4		
		4- or 5-pole (condensation protection)	8,6				5		
Sealing material	EPDM	Ethylene propylene rubber (peroxidically cross-linked)						1	
	FPM ¹⁾	Fluoro elastomer						2	
Tube connection		connection copper tube (max. DN 20)							N
	Plastic PA6T / 6I	outside thread K (see dimension diagram)							K
		outside thread G (see dimension diagram)							G

Accessories ²⁾

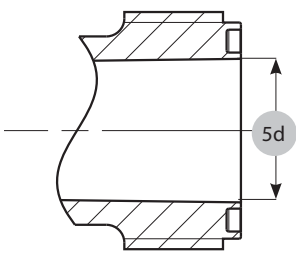
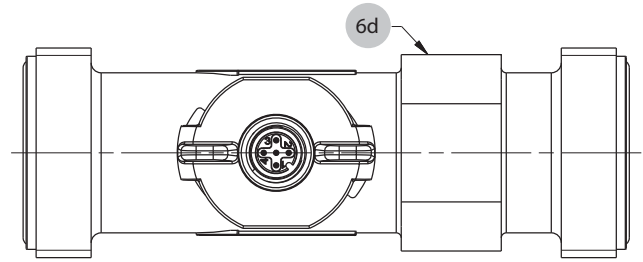
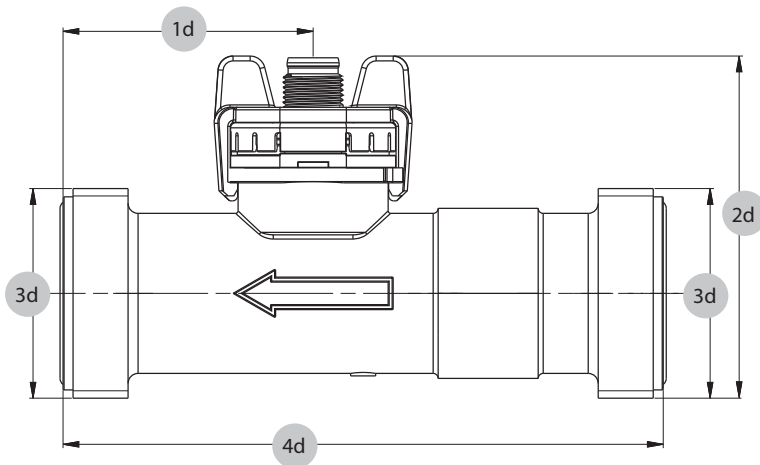
				Order number
Connection kit ³⁾ DN 8, 10 with copper tube				113775
Connection kit ³⁾ DN 8, 10 with adapter Rp $\frac{3}{4}$				Stainless steel 1.4305/AISI 303 113776
Connection kit ³⁾ DN 15 with copper tube				113777
Connection kit ³⁾ DN 15 with adapter Rp $\frac{1}{2}$				Stainless steel 1.4305/AISI 303 113778
Connection kit ³⁾ DN 20 with copper tube				113779
Connection kit ³⁾ DN 20 with adapter Rp $\frac{3}{4}$				Stainless steel 1.4305/AISI 303 113780
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
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 \varnothing 13.95 x 2.62 Copper tube and adapter 112124
O-Ring for DN 15				EPDM \varnothing 17.86 x 2.62 Copper tube and adapter 112265
O-Ring for DN 20				EPDM \varnothing 21.89 x 2.62 Copper tube and adapter 112723
O-Ring for DN 25				EPDM \varnothing 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 for DN 8 und DN 10				Rp $\frac{3}{4}$ Stainless steel 1.4305/AISI 303 112655
Adapter for DN 15				Rp $\frac{1}{2}$ Stainless steel 1.4305/AISI 303 112660
Adapter for DN 20				Rp $\frac{3}{4}$ Stainless steel 1.4305/AISI 303 112661

¹⁾ No drinking water approval

²⁾ Accessories supplied loose

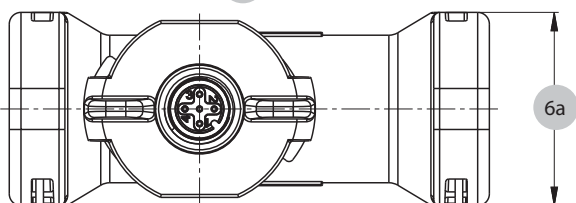
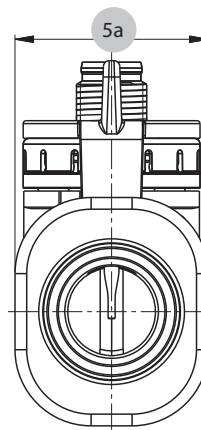
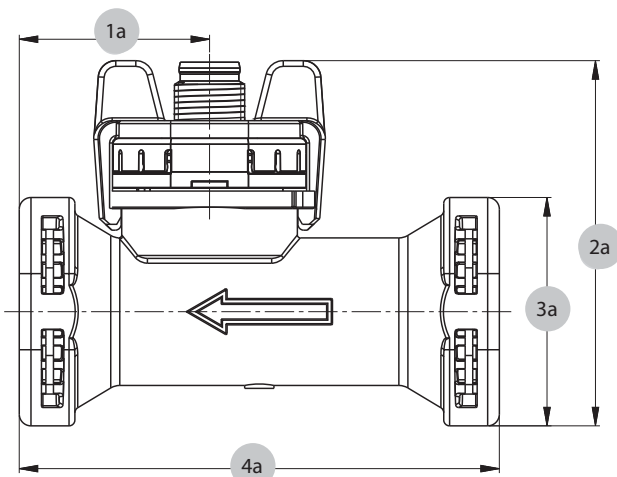
³⁾ Connection set includes: 2x Clip, 2x Copper tubes or Adapter and 2x O-Ring

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



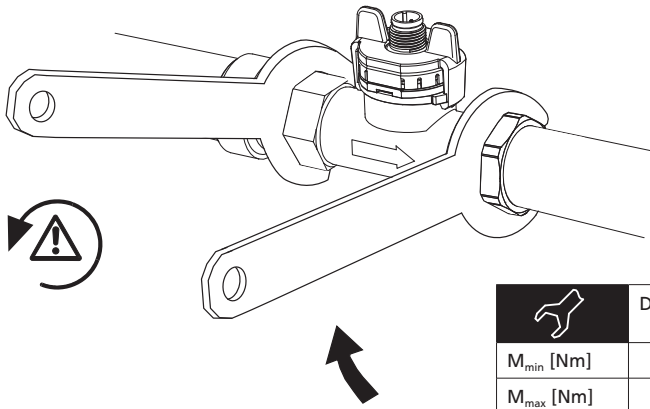
		1d	2d	3d	4d	5d	6d
DN6	K	43.7	53.0	G ½	77	11.5	12
DN6	G	48.2	55.7	G ¾	86	11.5	12
DN8	K	43.7	53.0	G ½	77	11.5	12
DN8	G	48.2	55.7	G ¾	86	11.5	12
DN10	K	35.0	51.3	G ½	81	11.5	19
DN10	G	39.5	54.1	G ¾	90	11.5	19
DN15	K	36.6	56.1	G ¾	87	16	22
DN15	G	41.6	59.5	G 1	97	16	22
DN20	K	36.6	61.5	G 1	105	20	27
DN20	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

Dimension diagram DN 8, 10, 15, 20



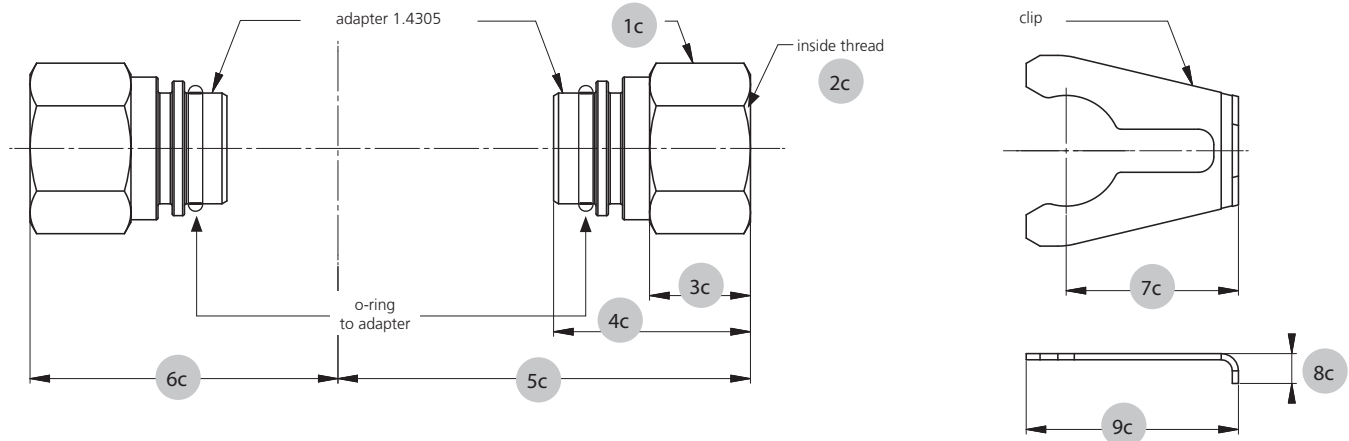
	1a	2a	3a	4a	5a	6a
DN8	29.5	59.0	32.9	72	30.2	28.9
DN10	32.5	57.3	32.9	77	30.2	28.9
DN15	32.5	62.4	39.0	82	30.2	33.0
DN20	39.3	66.3	43.0	105	30.2	37.4

Admissible locking torque



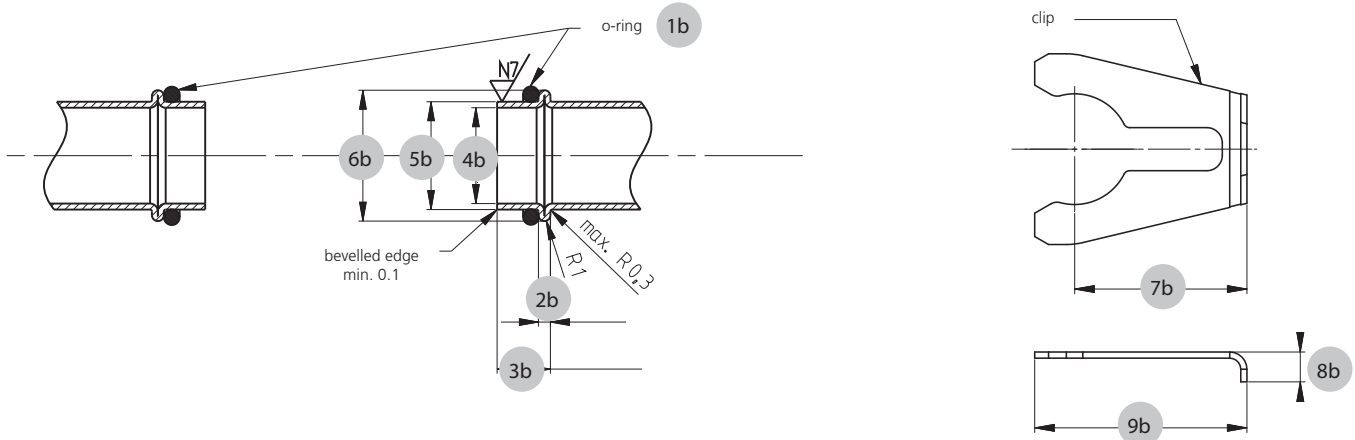
	DN6/8/10 G ½	DN6/8/10 G ¾	DN15 G ¾	DN15 G1	DN20 G1	DN20 G1 ¼	DN25 G1 ¼	DN25 G1 ½
M_{min} [Nm]	1	1	1	2	2	2.5	2.5	2.5
M_{max} [Nm]	12	12	12	12	12	15	15	15

Accessories DN 8, 10, 15, 20



	1c	2c	3c	4c	5c	6c	7c	8c	9c
DN8	22	Rp ¾ DIN 2999 length min. 9	14.0	29	57.65	44.65	24.5	7.3	30.8
DN10	22	Rp ¾ DIN 2999 length min. 9	14.0	29	59.65	47.55	24.5	7.3	30.8
DN15	24	Rp ½ DIN 2999 length min. 11.5	16.4	32	67.05	50.05	28.0	7.6	34.5
DN20	30	Rp ¼ DIN 2999 length min. 13	18.5	38	82.25	58.85	28.0	8.7	34.5

Geometry of customer's connection tube DN 8, 10, 15, 20

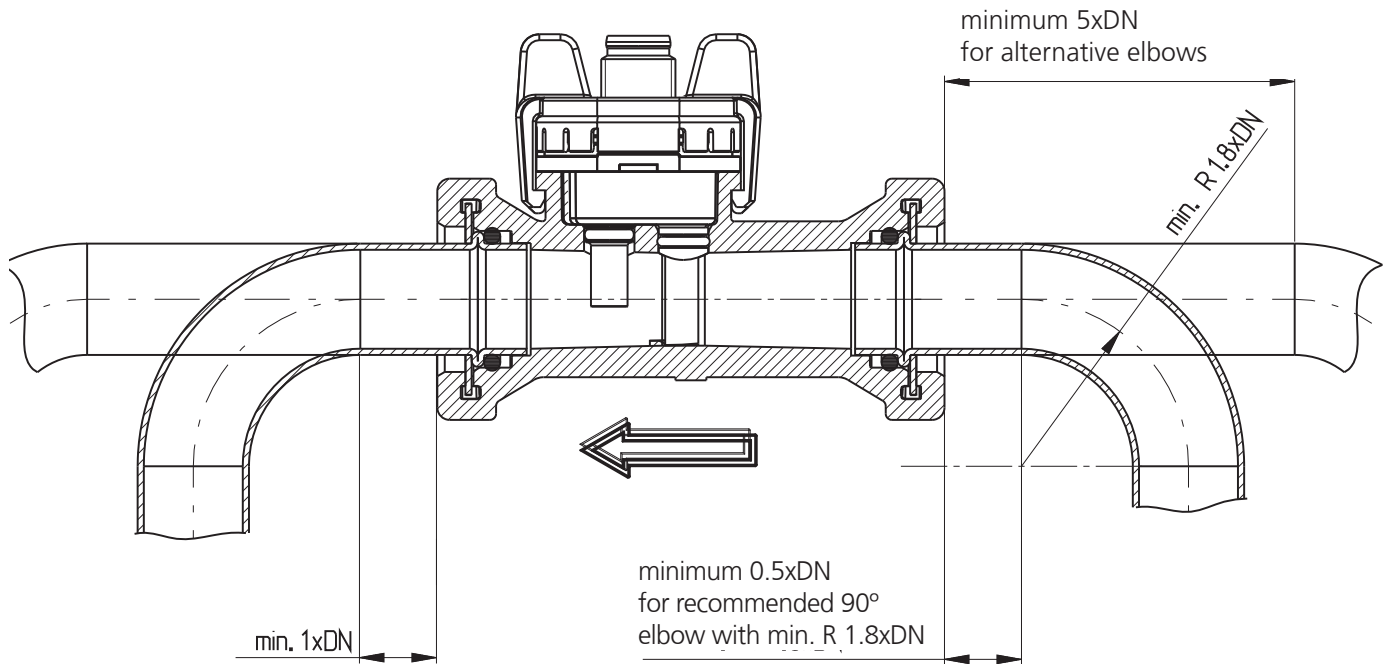


	1b	2b	3b	4b	5b	6b	7b	8b	9b
DN8	∅ 13.95x2.62	2 ± 0.2	8.9 ± 0.2	∅ 13 ± 0.2	∅ 15.00 ± 0.08	∅ 18.88 ± 0.1	24.5	7.3	30.8
DN10	∅ 13.95x2.62	2 ± 0.2	8.9 ± 0.2	∅ 13 ± 0.2	∅ 15.00 ± 0.08	∅ 18.88 ± 0.1	24.5	7.3	30.8
DN15	∅ 17.86x2.62	2 ± 0.2	8.9 ± 0.3	∅ 16 ± 0.2	∅ 18.00 ^{+0.08} _{-0.06}	∅ 21.85 ± 0.1	28.0	7.6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

Tube mounting instructions

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

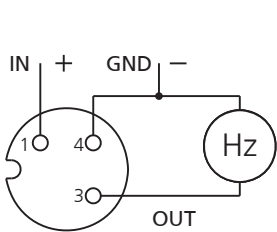
- Only diameter changes from large to small are allowed.
- Avoid repeated elbows in the same level at entryside



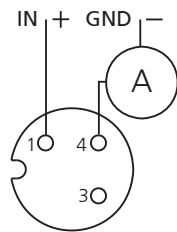
Electrical connection

Connector M12x1 without temperature measurement

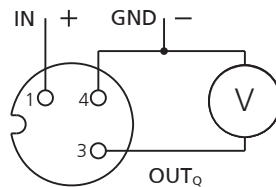
1



Frequency output



current output

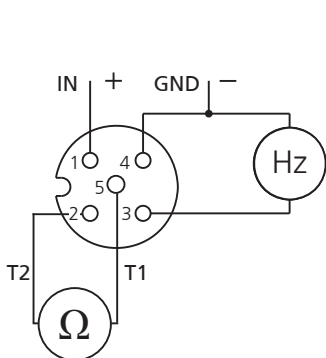


voltage output

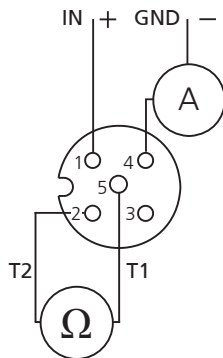
Pin	Colour
1	brown
3	blue
4	black
1	brown
2	white
3	blue
4	black
5	gray

Connector M12x1 with temperature measurement

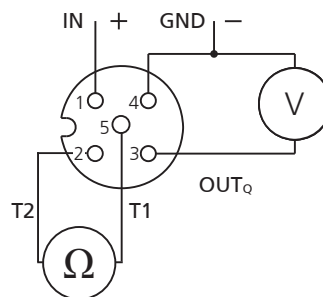
2



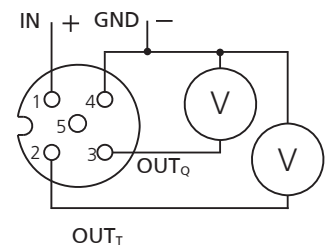
frequency output with PT1000



current output with PT1000



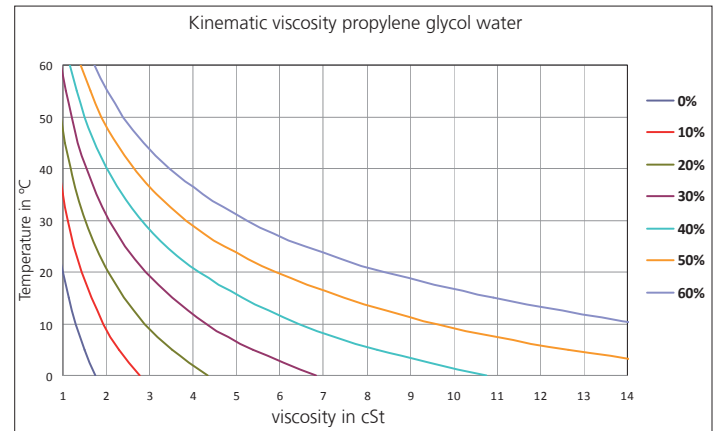
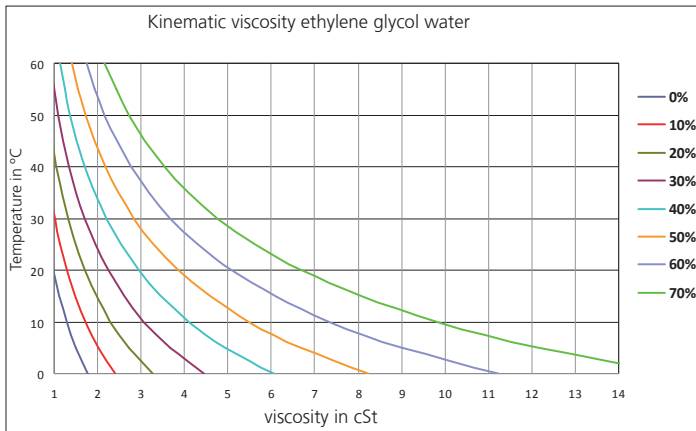
voltage output with PT1000



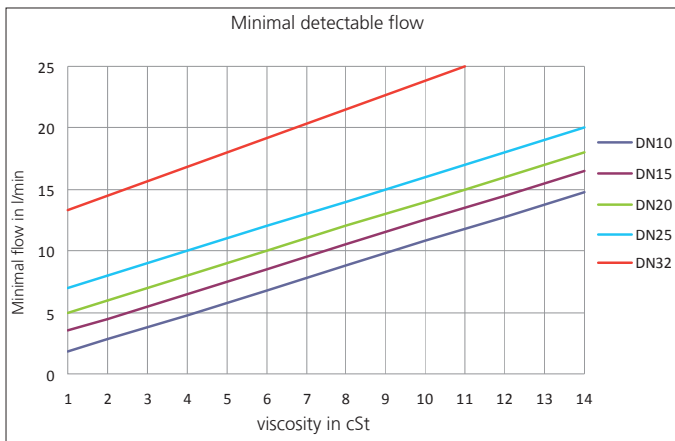
voltage output with temperature output 0 ... 10 V

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 (ν = viscosity in cSt).

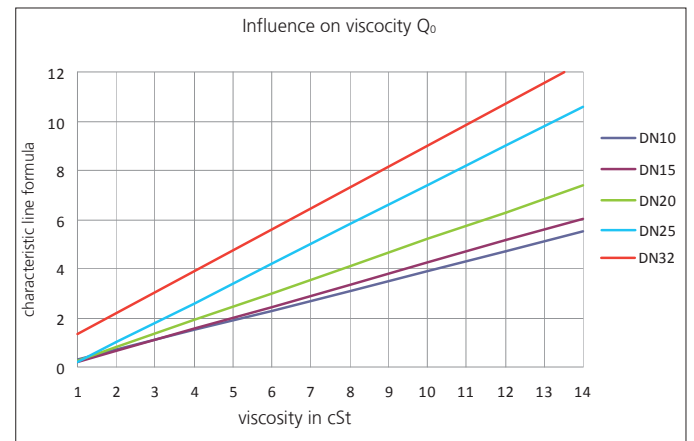
Definition of viscosity of glycol-water-compound



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: $Q_{min} = \nu + 0.8$
- DN15: $Q_{min} = \nu + 2.5$
- DN20: $Q_{min} = \nu + 4$
- DN25: $Q_{min} = \nu + 8$

Formula characteristic line for $Q \geq Q_{min}$ in l/min
< DN 10 not possible

- Frequency output:
- DN10: $Q = K_f * f - 0.40\nu + 0.20$
 - DN15: $Q = K_f * f - 0.45\nu + 0.25$
 - DN20: $Q = K_f * f - 0.55\nu + 0.25$
 - DN25: $Q = K_f * f - 0.80\nu + 0.60$

Voltage output 0 ... 10 V

- DN10: $Q = K_U * U_{Out} - 0.40\nu + 0.40$
- DN15: $Q = K_U * U_{Out} - 0.45\nu + 0.45$
- DN20: $Q = K_U * U_{Out} - 0.55\nu + 0.55$
- DN25: $Q = K_U * U_{Out} - 0.80\nu + 0.80$

Current output 4 ... 20 mA (I in mA)

- DN10: $Q = K_I * (I - 4 \text{ mA}) - 0.40\nu + 0.40$
- DN15: $Q = K_I * (I - 4 \text{ mA}) - 0.45\nu + 0.45$
- DN20: $Q = K_I * (I - 4 \text{ mA}) - 0.55\nu + 0.55$
- DN25: $Q = K_I * (I - 4 \text{ mA}) - 0.80\nu + 0.80$

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