Huba Control

FOR FINE PRESSURE AND FLOW MEASUREMENT

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 enhanced power supply and output signals and is available 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, pulse or frequency output
- 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
- 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.	Frequency output (unfiltered)		Signal delay	< 100 ms
				Response time	< 5 ms
		Frequency output (filtered)	Analogue output	Signal delay	< 2 s
				Response time	< 500 ms

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
		Ambient (2x 4 ... 20 mA)	-15 ... +65 °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:	$P_{abs\ outlet} / P_{difference} > 5.5$	

Materials in contact with medium (FDA-conform)

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

Electrical connection	**Protection standard**
Connector M12x1	IP 65

Weight

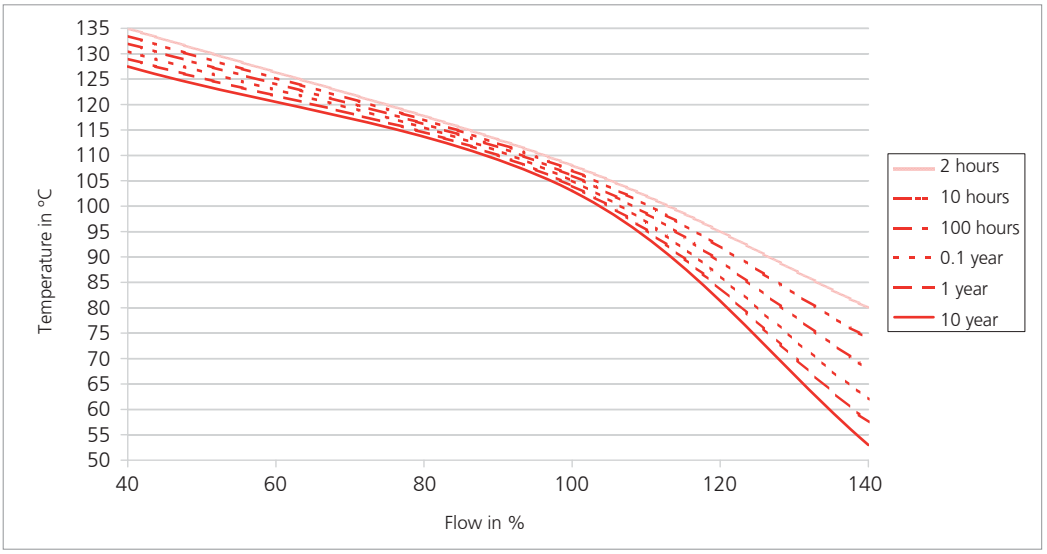
DN 6 / 8	~ 47 g
DN 10	~ 57 g
DN 15	~ 68 g
DN 20	~ 92 g
DN 25	~ 100 g

Test / Admissions

Electromagnetic compatibility	CE conformity acc. EN 61326-2-3
Drinking water approval	WRAS
	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
DN 25	–	Blister 20x	Blister 15x

Minimum life span on high flow rate and high temperature



Analogue output - Electrical overview

Temperature measurement (≥ 8 DN)

Measuring principle	Resistance			PT1000
PT1000	Measuring range			-40 ... +125 °C
	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			$T(°C) = \frac{\pm 150\ °C}{10\ V} * U_{OUT\_T} - 25\ °C$
4 ... 20 mA	Measuring range			-25 ... +125 °C
	Accuracy			± 0.5 K ± 0.005 * ΔT
	Calculation temperature			$T(°C) = \frac{I_{OUT\_T} - 4\ mA}{16\ mA} * 150\ °C - 25\ °C$

Electronic		Voltage output	Current output	Dual power output
Power supply		11.5 ... 33 VDC	8 ... 33 VDC	10 ... 33 VDC
Output flow (Q)	anaogue signal	0 ... 10 V	4 ... 20 mA	4 ... 20 mA
Output temperature (T)	signal	0 ... 10 V	–	4 ... 20 mA
Load agianst GND or IN		< 6 mA / < 100 nF [1]	< (U_{IN} - 8 V) / 20 mA	< (U_{IN} - 10 V) / 20 mA
Current consumption load free (I_{IN})		< 5 mA	–	–
Electrical reliability	Short circuit, reverse voltage and external voltage protected within the admissible supply voltage.			

Analogue output - Nominal diameters dependent variables

DN	Measuring range [l/min]	Flow range [m/s]	Pressure drop [2),3)]	$K_U \left[\frac{L}{V * min}\right]$	$K_I \left[\frac{L}{mA * min}\right]$
6	0.5 ... 10	0.074 ... 1.474	$240.00*Q^2$	1.0	0.625
8	0.9 ... 15	0.133 ... 2.210	$85.00*Q^2$	1.5	0.938
10	1.8 ... 32	0.265 ... 4.716	$22.50*Q^2$	3.2	2.000
10	2.0 ... 40	0.295 ... 5.895	$22.50*Q^2$	4.0	2.500
15	3.5 ... 50	0.290 ... 4.145	$6.70*Q^2$	5.0	3.125
20	5.0 ... 85	0.265 ... 4.509	$2.50*Q^2$	8.5	5.313
25	9.0 ... 150	0.283 ... 4.709	$0.92*Q^2$	15.0	9.375

Characteristic line formula current output
$Q_V = K_I * (I_{OUT} - 4\ mA)$

Characteristic line formula voltage output
$Q_V = K_U * U_{OUT}$

Legend

Q_V	Volume flow rate	[l/min]
K_U	Coefficient voltage output	[(l/min) / V]
K_I	Coefficient current output	[(l/min) / mA]
U_{OUT}	Voltage	[V]
I_{OUT}	Current	[mA]

Analogue output - Order code selection table

				210.	1 X	2 X	3 X	4 X	5 X	6 X	7 X
Version	Flow				9			3,4	4		
	Flow and temperature (PT1000)				8			3,4	5		
	Flow and temperature (2x 0 ... 10 V)				6			3	5		
	Flow and temperature (2x 4 ... 20 mA)				5			5	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	Analogue output 0 ... 10 V		11.5 ... 33 VDC		9,8,6			3			
	Analogue output 4 ... 20 mA		8 ... 33 VDC		9,8			4			
	Analogue output 4 ... 20 mA		10 ... 33 VDC		5			5			
Electrical connection	Connector M12x1	3-pole	(with condensation protection)		9			3,4	4		
		5-pole	(with condensation protection)		8,6,5				5		
Sealing material	EPDM	Ethylene propylene rubber (peroxidically cross-linked)								1	
	FPM [4)]	Fluoro elastomer								2	
Tube connection	Plastic PA6T / 6I	connection copper tube (max. DN 20)									N
		outside thread K (see dimension diagram)									K
		outside thread G (see dimension diagram)									G

[1)] against GND only
[2)] incl. 3xDi inlet and outlet side
[3)] Pv in Pa; Q in l/min
[4)] No drinking water approval

Frequency output (filtered) and pulse output - Electrical overview

Temperature measurement (> 8 DN)

Measuring principle	Resistance			PT1000 class B DIN EN 60751
PT1000	Measuring range			-40 ... +125 °C
	Accuracy	Class B DIN EN 60751	@ T = 0 °C	± 0.3 K
			@ T ≠ 0 °C	± 0.3 K ± 0.005 * ΔT
Temperature influences		Self-heating at temperature sensor		1 K/mW
		Conduction resistance to connector		0.8 Ω

Electronic

Power Supply		4.75 ... 33 VDC
Output flow (Q)	Level height (open collector)	< 0.5 ... > U_{IN} - 0.5 V
Output temperature (T)	Resistant signal	PT1000 class B DIN EN 60751
Load agianst GND or IN		> 1 kΩ / < 10 kΩ
Current consumption load free (I_{IN})		< 3 mA
Electrical reliability	Short circuit, reverse voltage and external voltage protected within the admissible supply voltage.	

Frequency output (filtered) and pulse output - Nominal diameters dependent variables

DN	Measuring range [l/min]	Flow range [m/s]	Pressure drop [1),2)]	K_{ff} [(l/min) / Hz] at 0 ... 1000 Hz	Quantity per pulse K_I [ml] (pulse)	Pulse (pulse output) [1/l]
6	0.5 ... 10	0.074 ... 1.474	240.00*Q^2	0.01	0.20	5000
8	0.9 ... 15	0.133 ... 2.210	85.00*Q^2	0.015	0.20	5000
10	1.8 ... 32	0.265 ... 4.716	22.50*Q^2	0.032	0.50	2000
10	2.0 ... 40	0.295 ... 5.895	22.50*Q^2	0.04	0.50	2000
15	3.5 ... 50	0.290 ... 4.145	6.70*Q^2	0.05	1.00	1000
20	5.0 ... 85	0.265 ... 4.509	2.50*Q^2	0.085	1.00	1000
25	9.0 ... 150	0.283 ... 4.709	0.92*Q^2	0.15	1.25	800

Characteristic line formula frequency output filtered *(0 ... 1000 Hz, other frequency on request)*

$Q_V = K_{ff} * f$

Pulse

$l/min = \frac{pulse}{s} * K_I * \frac{60}{1000}$

Legend

Q_V	Volume flow rate	[l/min]
K_{ff}	Coefficient frequency output filtered	[(l/min) / f]
f	Frequency	[Hz]

Frequency output (filtered) and pulse output - Order code selection table

210.

				1	2	3	4	5	6	7
				X	X	X	X	X	X	X
Version	Flow			9				4		
	Flow and temperature (PT1000)			8				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 (filtered)		4.75 ... 33 VDC				6			
	Pulse output		4.75 ... 33 VDC				7			
Electrical connection	Connector M12x1	3-pole	(with condensation protection)	9				4		
		5-pole	(with condensation protection)	8				5		
Sealing material	EPDM	Ethylene propylene rubber (peroxidically cross-linked)							1	
	FPM [3)]	Fluoro elastomer							2	
Tube connection	Plastic PA6T / 6I	connection copper tube (max. DN 20)								N
		outside thread K (see dimension diagram)								K
		outside thread G (see dimension diagram)								G

[1)] incl. 3xDi inlet and outlet side [2)] Pv in Pa; Q in l/min [3)] No drinking water approval

Frequency output (unfiltered) - Electrical overview

Temperature measurement (> 8 DN)

Measuring principle	Resistance			PT1000 class B DIN EN 60751
PT1000	Measuring range			-40 ... +125 °C
	Accuracy	Class B DIN EN 60751	@ T = 0 °C	± 0.3 K
			@ T ≠ 0 °C	± 0.3 K ± 0.005 * ΔT
Temperature influences		Self-heating at temperature sensor		1 K/mW
		Conduction resistance to connector		0.8 Ω

Electronic

Power Supply			4.75 ... 33 VDC
Output flow (Q)		Level height (push-pull)	< 0.5 ... > U_{IN} - 0.5 V
Output temperature (T)		Resistant signal	PT1000 class B DIN EN 60751
Load agianst GND or IN			< 1 mA / < 100 nF
Current consumption load free (I_{IN})			< 2 mA
Electrical reliability	Short circuit, reverse voltage and external voltage protected within the admissible supply voltage.		

Frequency output (unfiltered) - Nominal diameters dependent variables

DN	Tube connection	Measuring range [l/min]	Flow range [m/s]	Pressure drop [1),2)]	Quantity per pulse @50% fs [ml]	Frequency range unfiltered [Hz]	Q_0 [l/min]	K_f [(l/min) / f]
6	K	0.5 ... 10	0.074 ... 1.474	240.00*Q^2	0.386	27 ... 426	-0.14	0.0238
	G							
8	K	0.9 ... 15	0.133 ... 2.210	85.00*Q^2	0.628	30 ... 384	-0.3	0.0398
	G				0.631	30 ... 388		0.0394
	N				0.614	31 ... 399		0.0383
10	K	1.8 ... 32	0.265 ... 4.716	22.50*Q^2	1.399	24 ... 379	-0.2	0.0850
	G				1.370	24 ... 387		0.0832
	N				1.384	24 ... 383		0.0841
10	K	2.0 ... 40	0.295 ... 5.895	22.50*Q^2	1.403	26 ... 473	-0.2	0.0850
	G				1.373	26 ... 483		0.0832
	N				1.388	26 ... 478		0.0841
15	K	3.5 ... 50	0.290 ... 4.145	6.70*Q^2	3.047	20 ... 272	-0.2	0.1843
	G				3.016	20 ... 275		0.1824
	N				3.077	20 ... 270		0.1861
20	K	5.0 ... 85	0.265 ... 4.509	2.50*Q^2	6.213	14 ... 227	-0.3	0.3754
	G				6.125	14 ... 230		0.3701
	N				6.208	14 ... 227		0.3751
25	K	9.0 ... 150	0.283 ... 4.709	0.92*Q^2	12.412	12 ... 201	-0.2	0.7467
	G				12.251	12 ... 204		0.7370

Characteristic line formula frequency output unfiltered

$Q_V = K_f * f + Q_0$

Formula quantity per pulse [litres/pulse]

$$\frac{\text{Quantity}}{\text{Pulse}} = \frac{K_f * Q_V}{60 * (Q_V - Q_0)}$$

Legend

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

Frequency output (unfiltered) - Order code selection table

				1	2	3	4	5	6	7
			210.	X	X	X	X	X	X	X
Version	Flow			9				4		
	Flow and temperature (PT1000)			8				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 (unfiltered)		4.75 ... 33 VDC				2			
Electrical connection	Connector M12x1	3-pole	(with condensation protection)	9				4		
		5-pole	(with condensation protection)	8				5		
Sealing material	EPDM	Ethylene propylene rubber (peroxidically cross-linked)							1	
	FPM [3)]	Fluoro elastomer							2	
Tube connection	Plastic PA6T / 6I	connection copper tube (max. DN 20)								N
		outside thread K (see dimension diagram)								K
		outside thread G (see dimension diagram)								G

[1)] incl. 3xDi inlet and outlet side [2)] Pv in Pa; Q in l/min [3)] No drinking water approval

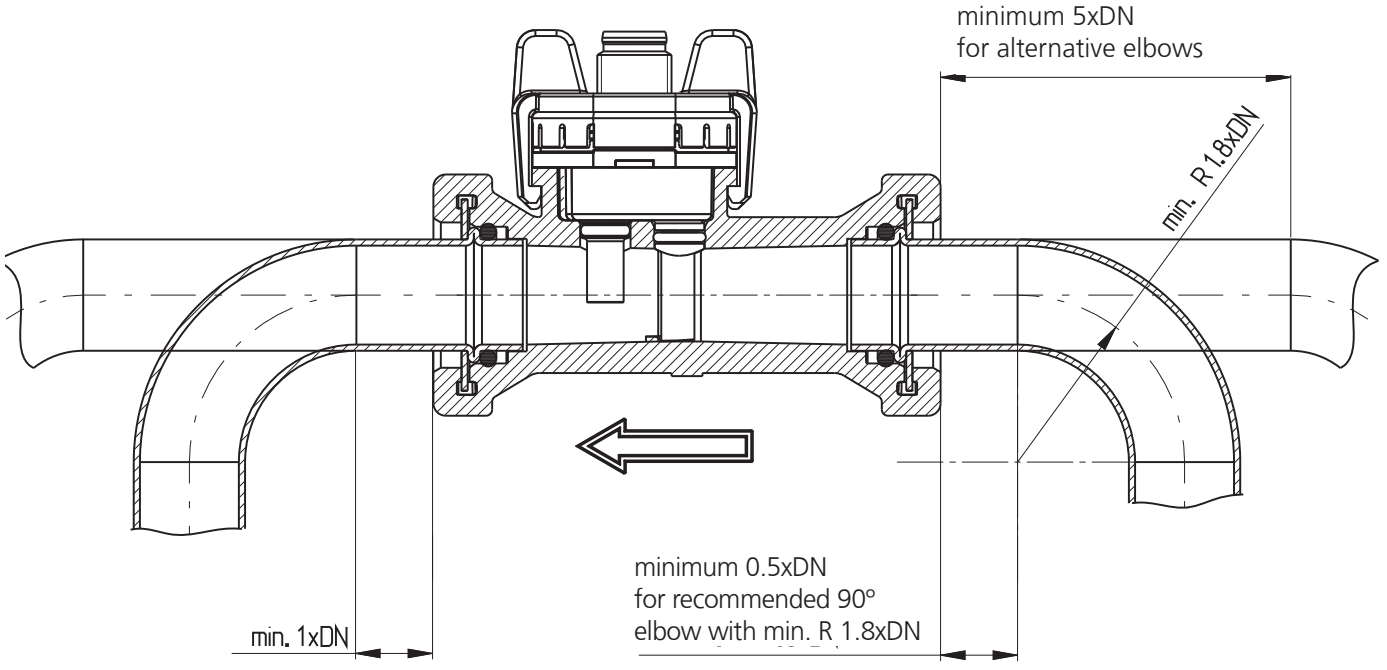
Accessories *(supplied loose)*

				Order number
Connection kit [1] DN 8, 10 with copper tube				113775
Connection kit [1] DN 8, 10 with adapter Rp ⅜	Stainless steel 1.4305/AISI 303			113776
Connection kit [1] DN 15 with copper tube				113777
Connection kit [1] DN 15 with adapter Rp ½	Stainless steel 1.4305/AISI 303			113778
Connection kit [1] DN 20 with copper tube				113779
Connection kit [1] DN 20 with adapter Rp ¾	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	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 for DN 8 und DN 10	Rp ⅜		Stainless steel 1.4305/AISI 303	112655
Adapter for DN 15	Rp ½		Stainless steel 1.4305/AISI 303	112660
Adapter for DN 20	Rp ¾		Stainless steel 1.4305/AISI 303	112661

Tube mounting instructions

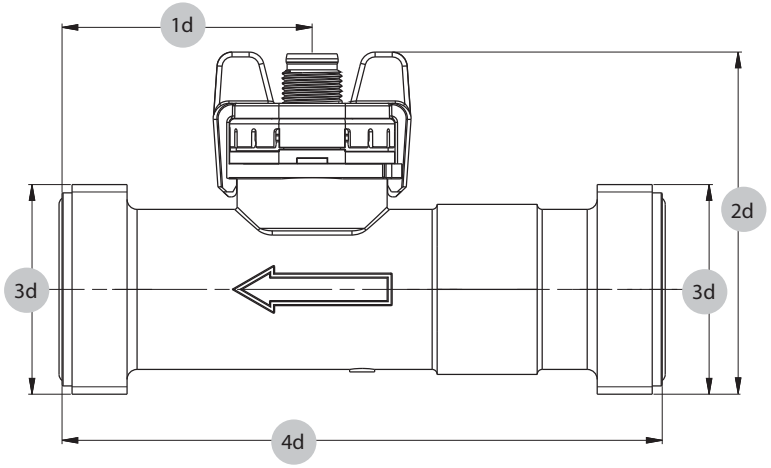
Consider the following to ensure the correct function of the sensor.

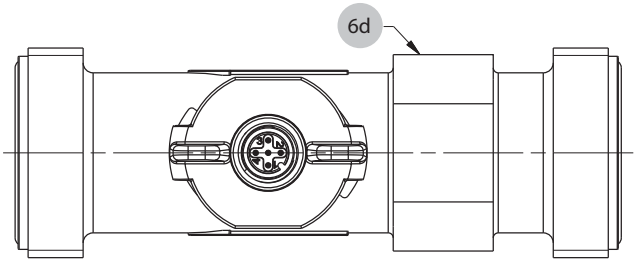
- Only diameter changes from large to small are allowed.
- Avoid repeated elbows in the same level at entryside

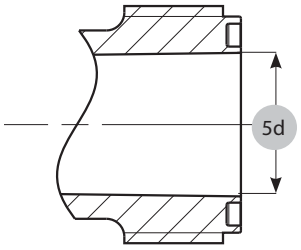


[1] Connection set includes: 2x Clip, 2x Copper tubes or Adapter and 2x O-Ring

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

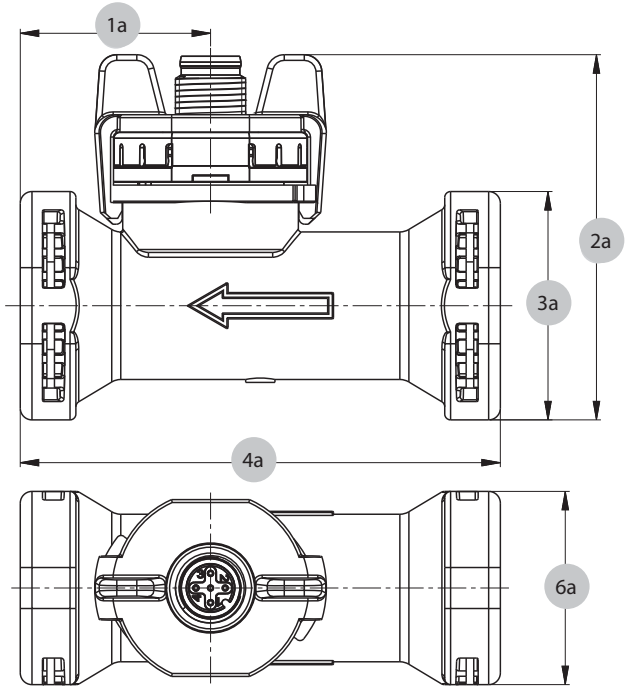


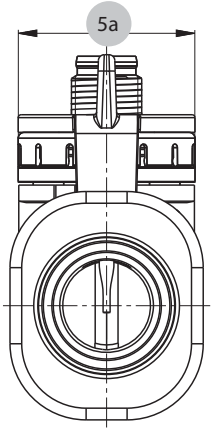




		1d	2d	3d	4d	5d	6d
DN6	K	43.7	53.0	G ½	77	11.5	12
DN6	G	48.2	55.7	G ¾	86	11.5	12
DN8	K	43.7	53.0	G ½	77	11.5	12
DN8	G	48.2	55.7	G ¾	86	11.5	12
DN10	K	35.0	51.3	G ½	81	11.5	19
DN10	G	39.5	54.1	G ¾	90	11.5	19
DN15	K	36.6	56.1	G ¾	87	16	22
DN15	G	41.6	59.5	G 1	97	16	22
DN20	K	36.6	61.5	G 1	105	20	27
DN20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

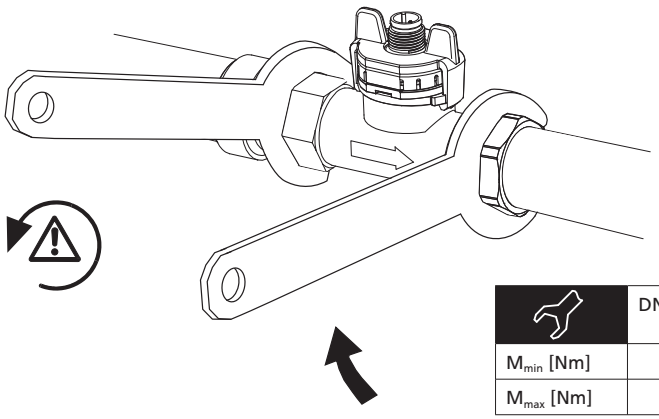
Dimension diagram DN 8, 10, 15, 20





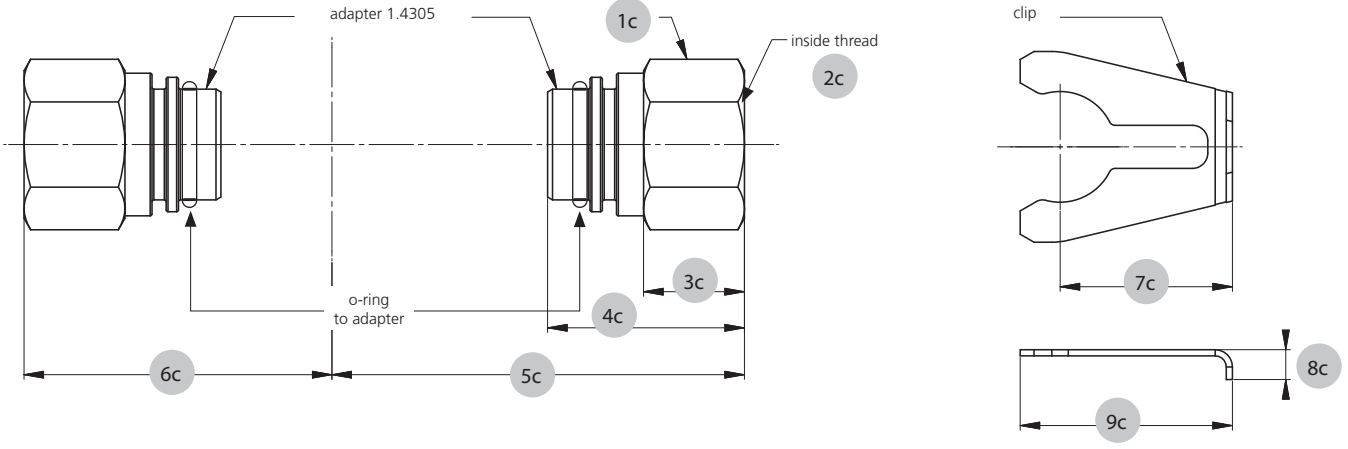
	1a	2a	3a	4a	5a	6a
DN8	29.5	59.0	32.9	72	30.2	28.9
DN10	32.5	57.3	32.9	77	30.2	28.9
DN15	32.5	62.4	39.0	82	30.2	33.0
DN20	39.3	66.3	43.0	105	30.2	37.4

Admissible locking torque



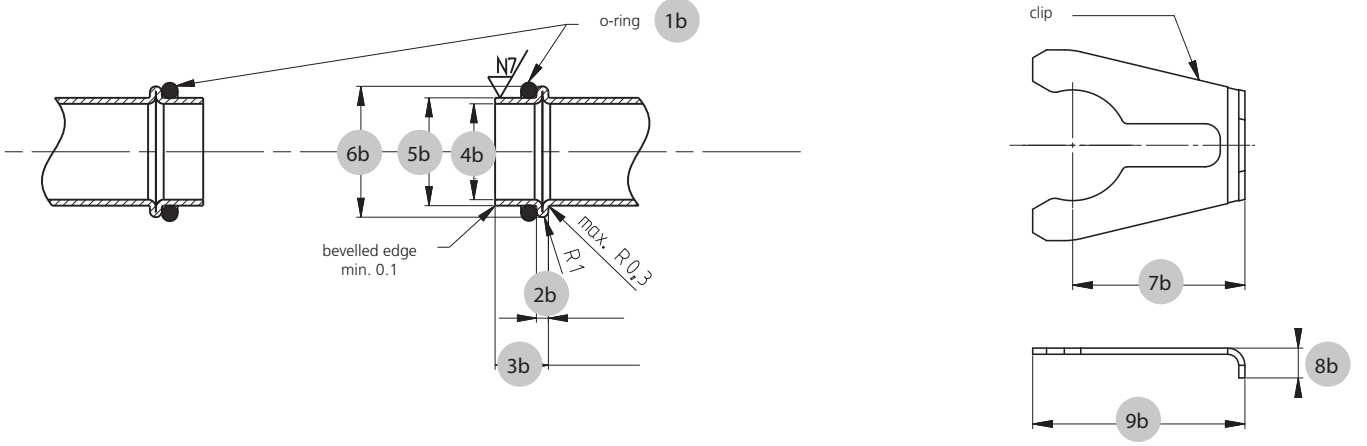
	DN6/8/10 G ½	DN6/8/10 G ¾	DN15 G ¾	DN15 G1	DN20 G1	DN20 G1 ¼	DN25 G1 ¼	DN25 G1 ½
M_{min} [Nm]	1	1	1	2	2	2.5	2.5	2.5
M_{max} [Nm]	12	12	12	12	12	15	15	15

Accessories DN 8, 10, 15, 20



	1c	2c	3c	4c	5c	6c	7c	8c	9c
DN8	22	Rp ⅜ DIN 2999 lenght min. 9	14.0	29	57.65	44.65	24.5	7.3	30.8
DN10	22	Rp ⅜ DIN 2999 lenght 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 ¾ DIN 2999 lenght min. 13	18.5	38	82.25	58.85	28.0	8.7	34.5

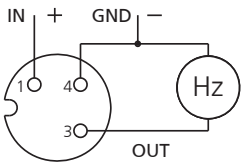
Geometry of customers connection tube DN 8, 10, 15, 20



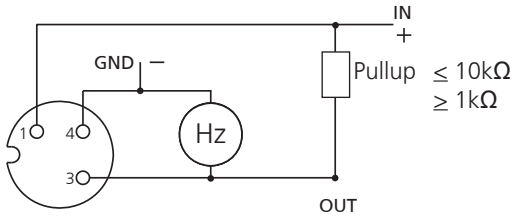
	1b	2b	3b	4b	5b	6b	7b	8b	9b
DN8	ø 13.95x2.62	2 ± 0.2	8.9 ± 0.2	ø 13 ± 0.2	ø 15.00 ± 0.08	ø 18.88 ± 0.1	24.5	7.3	30.8
DN10	ø 13.95x2.62	2 ± 0.2	8.9 ± 0.2	ø 13 ±0.2	ø 15.00 ± 0.08	ø 18.88 ± 0.1	24.5	7.3	30.8
DN15	ø 17.86x2.62	2 ± 0.2	8.9 ± 0.3	ø 16 ± 0.2	ø 18.00 $^{+0.08}_{-0.06}$	ø 21.85 ± 0.1	28.0	7.6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

Electrical connection

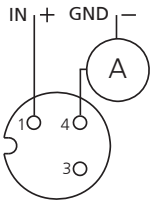
Connector M12x1 without temperature measurement 1



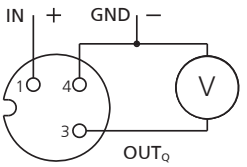
Frequency output
unfiltered



Frequency output filtered
Pulse output

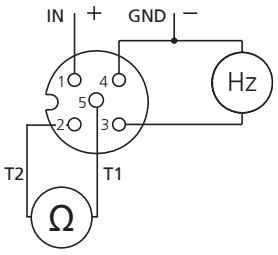


Current output

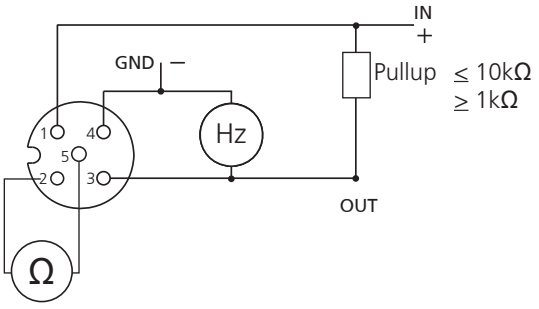


Voltage output

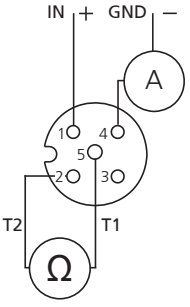
Connector M12x1 with temperature measurement 2



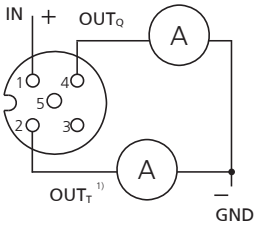
frequency output with
temperature measurement
PT1000



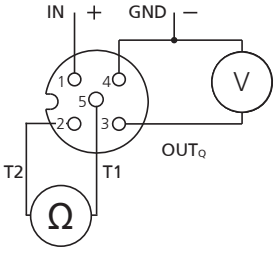
Frequency output filtered
Pulse output



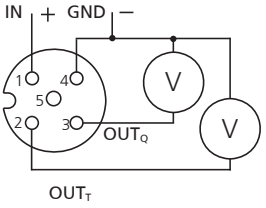
Current output
with temperature
measurement
PT1000



Current output with
temperature measu-
rement 4 ... 20 mA



Voltage output with
temperature measurement
PT1000



Voltage output with temperature
measurement 0 ...10 V

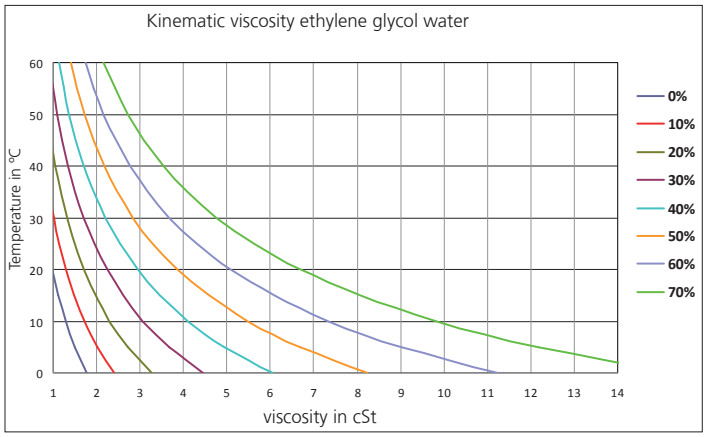
Pin		Colour
1	1	brown
3		blue
4		black
1	2	brown
2		white
3		blue
4		black
5		gray

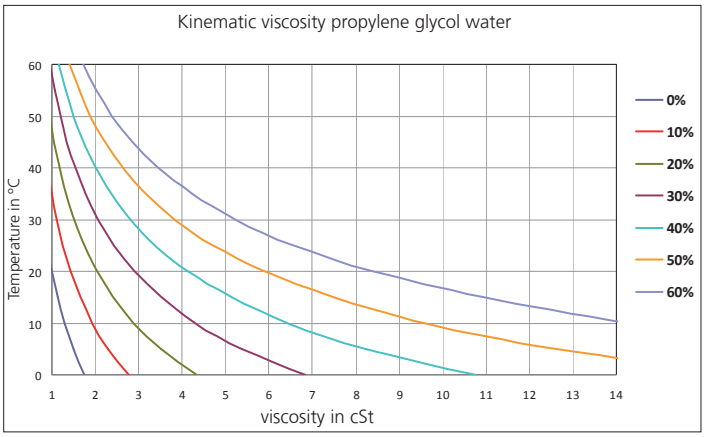
[1] «OUT T» is only in operation if «OUT Q» is connected

Influence of glycol

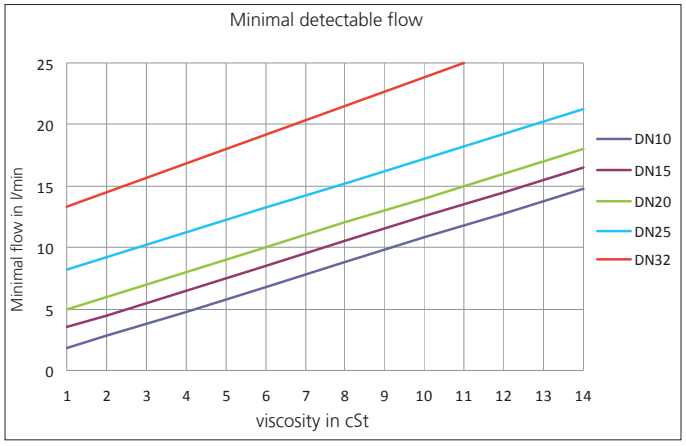
With the following definitions we are able to correct the influence of media with higher viscosity than water (= media viscosity > 1.8 cST) in order to reach a measuring accuracy of 3% fs in the range of 1.8 - 4 cST and of 4% in the range of 4 - 14 cSt (υ = viscosity in cSt).

Definition of viscosity of glycol-water-compound

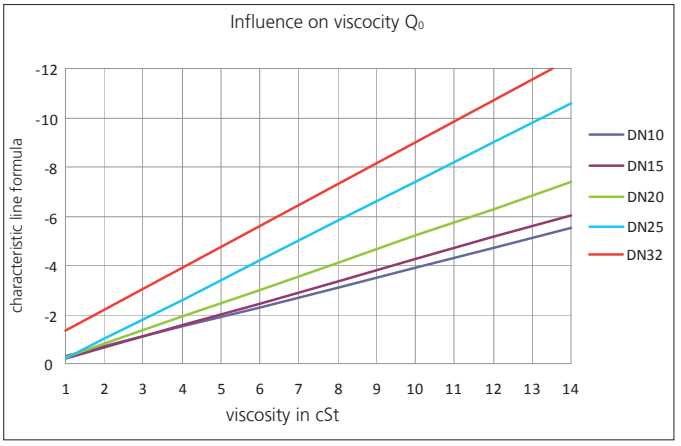




Definition of respond threshold Q_{min}



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

Formula characteristic line for $Q \geq Q_{min}$ in l/min
< DN 10 not possible
Frequency output (unfiltered):
DN10: $Q = K_f * f - 0.40\upsilon + 0.20$
DN15: $Q = K_f * f - 0.45\upsilon + 0.25$
DN20: $Q = K_f * f - 0.55\upsilon + 0.25$
DN25: $Q = K_f * f - 0.80\upsilon + 0.60$

Frequency output (filtered):
DN10: $Q = 0.032 * f - 0.40\upsilon + 0.40$
DN15: $Q = 0.050 * f - 0.45\upsilon + 0.45$
DN20: $Q = 0.080 * f - 0.55\upsilon + 0.55$
DN25: $Q = 0.150 * f - 0.80\upsilon + 0.80$

Impulse output:
DN10: $Q = 0.030 * \#Pulse/s - 0.40\upsilon + 0.40$
DN15: $Q = 0.060 * \#Pulse/s - 0.45\upsilon + 0.45$
DN20: $Q = 0.060 * \#Pulse/s - 0.55\upsilon + 0.55$
DN25: $Q = 0.075 * \#Pulse/s - 0.80\upsilon + 0.80$

Voltage output 0 ...10 V:
DN10: $Q = 3.2 * U_{out} - 0.40\upsilon + 0.40$
DN15: $Q = 5.0 * U_{out} - 0.45\upsilon + 0.45$
DN20: $Q = 8.5 * U_{out} - 0.55\upsilon + 0.55$
DN25: $Q = 15.0 * U_{out} - 0.80\upsilon + 0.80$

Current output 4 ... 20 mA (I in mA):
DN10: $Q = 2.000 * (I - 4\ mA) - 0.40\upsilon + 0.40$
DN15: $Q = 3.125 * (I - 4\ mA) - 0.45\upsilon + 0.45$
DN20: $Q = 5.313 * (I - 4\ mA) - 0.55\upsilon + 0.55$
DN25: $Q = 9.375 * (I - 4\ mA) - 0.80\upsilon + 0.80$

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