Flow sensor type 236 for liquid media

Flow range
0.9 ... 240 l/min

Nominal diameters
DN 8 / 10 / 15 / 20 / 25 / 32

Temperature measurement
-40 ... +125 °C

The type 236 is based on the type 210 but incorporates a brass housing. The Vortex Sensor type 236 has a rugged construction of brass connection. This flow sensor is available with a larger variety concerning power supply and outputs.

You can choose between various versions as integrated 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 WRAS, ACS

Technical Overview

Flow measurement

Measuring principle		Vortex	Piezoelectric sensor element	
Measuring range			0.9 ... 240 l/min	
Nominal diameters			DN 8 / 10 / 15 / 20 / 25 / 32	
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 (unfiltered) 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	Red brass / PA6T/6I (40% GF)
Sealing material	EPDM (perox.) (for drinking water) FPM

Electrical connection | Protection standard

Connector M12x1	IP 65

Weight

|	with thread K	with thread M	with thread G
DN 8 with condensation protection	~ 160 g	-	~ 206 g
DN 10 with condensation protection	~ 200 g	~ 241 g	~ 307 g
DN 15 with condensation protection	~ 250 g	-	~ 310 g
DN 20 with condensation protection	~ 378 g	-	~ 490 g
DN 25 with condensation protection	~ 303 g	-	~ 707 g
DN 32 with condensation protection	-	-	~ 696 g

Test / Admissions

Electromagnetic compatibility	CE conformity acc. to EN 61326-2-3
Drinking water approval	WRAS, ACS Plastic parts with KTW and W270 approval

Packaging

Single packaging
Multiple packaging

Minimum life span on high flow rate and high temperature
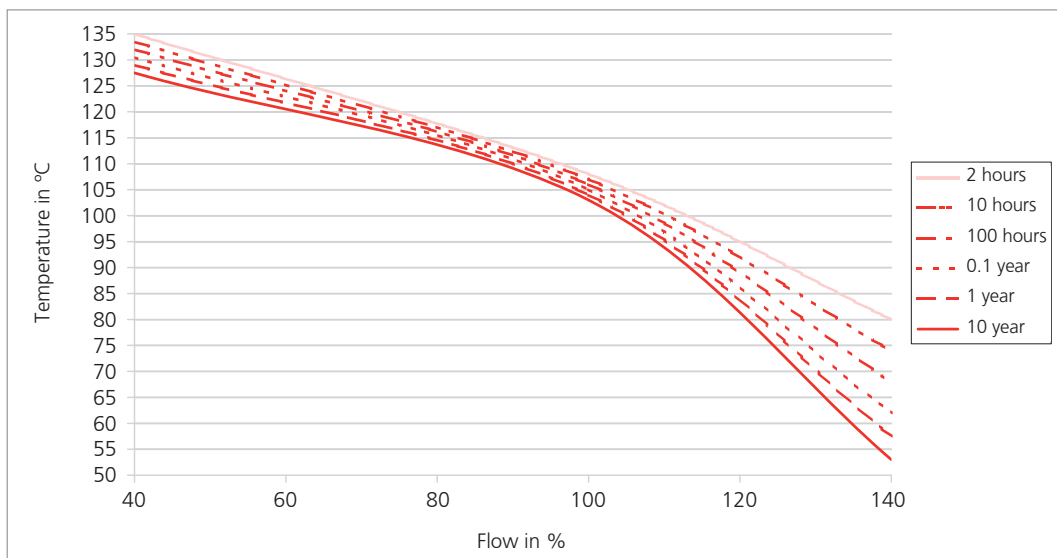
Analogue output - Electrical overview

Temperature measurement

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)]	$K_U \left[\frac{L}{V*min}\right]$	$K_I \left[\frac{L}{mA*min}\right]$
8	0.9 ... 15	0.133 ... 2.210	85.00 * Q²	1.5	0.938
10	1.8 ... 32	0.265 ... 4.716	22.50 * Q²	3.2	2.000
10	2.0 ... 40	0.295 ... 5.895	22.50 * Q²	4.0	2.500
15	3.5 ... 50	0.290 ... 4.145	6.70 * Q²	5.0	3.125
20	5.0 ... 85	0.265 ... 4.509	2.50 * Q²	8.5	5.313
25	9.0 ... 150	0.283 ... 4.709	0.92 * Q²	15.0	9.375
32	14 ... 240	0.290 ... 4.974	0.25 * Q²	24.0	15.000

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

				1	2	3	4	5	6	7
			236.	X	X	X	X	X	X	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 8	0.9 ... 15 l/min.			0	8				K,G
	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				K,G
	DN 20	5.0 ... 85 l/min.			2	0				K,G
	DN 25	9.0 ... 150 l/min.			2	5				K,G
	DN 32	14.0 ... 240 l/min.			3	2				K
Ouput / 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-polet (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	Brass with outside thread	K (DN 8, 10 - G ½; DN 15 - G ¾; DN 20 - G 1; DN 25 - G 1 ¼; DN 32 - G 1 ½)								K
		M (DN 10 - G ¾)								M
		G (DN 8 - G ¾ ; DN 10 - G 1; DN 15 - G 1; DN 20 - G 1 ¼; DN 25 - G 1 ½)								G

[1)] against GND only   [2)] incl. 3 xDi 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

Measuring principle	Resistance			PT1000 class B DIN EN 60751
	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
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]
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
32	14 ... 240	0.290 ... 4.974	0.25 * Q^2	0.24	2.00	500

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

$$Q_V = K_{ff} * f$$

Pulse

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

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

236. **X X X X X X X**

			1	2	3	4	5	6	7
Version	Flow		9				4		
	Flow and temperature (PT1000)		8				5		
Nominal diameters and flow range	DN 8	0.9 ... 15 l/min.		0	8				K,G
	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				K,G
	DN 20	5.0 ... 85 l/min.		2	0				K,G
	DN 25	9.0 ... 150 l/min.		2	5				K,G
	DN 32	14.0 ... 240 l/min.		3	2				K
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	Brass with outside thread	K (DN 8, 10 - G ½; DN 15 - G ¾; DN 20 - G 1; DN 25 - G 1 ¼; DN 32 - G 1 ½)							K
		M (DN 10 - G ¾)							M
		G (DN 8 - G ¾ ; DN 10 - G 1; DN 15 - G 1; DN 20 - G 1 ¼; DN 25 - G 1 ½)							G

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

Frequency output (unfiltered) - Electrical overview

Temperature measurement

Measuring principle	Resistance			PT1000 class B DIN EN 60751
	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
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]
8	K,G	0.9 ... 15	0.133 ...2.210	85.00 * Q^2	0.586	20 ... 416	-0.2	0.0356
10	K	1.8 ... 32	0.265 ... 4.716	22.50 * Q^2	1.416	23 ... 374	-0.2	0.0860
	G,M				1.386	24 ... 380		0.0847
10	K	2.0 ... 40	0.295 ... 5.895	22.50 * Q^2	1.419	26 ... 467	-0.2	0.0860
	G,M				1.386	26 ... 479		0.0840
15	K	3.5 ... 50	0.290 ... 4.145	6.70 * Q^2	3.036	20 ... 273	-0.2	0.1836
	G				2.993	20 ... 277		0.1810
20	K	5.0 ... 85	0.265 ... 4.509	2.50 * Q^2	6.173	14 ... 229	-0.2	0.3730
	G				6.140	14 ... 230		0.3710
25	K	9.0 ... 150	0.283 ... 4.709	0.92 * Q^2	12.201	13 ... 205	-0.2	0.7340
	G				12.134	13 ... 206		0.7300
32	K	14 ... 240	0.290 ... 4.974	0.25 * Q^2	27.513	9 ... 145	-1.47	1.6710

Characteristic line formula frequency output unfiltered

$$Q_V = K_f * f + Q_0$$

Formula quantity per pulse [litres/pulse]

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

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]
$\frac{Quantity}{Pulse}$	Quantity per pulse	$\frac{litres}{pulse}$

Frequency output (unfiltered) - Order code selection table

236. X X X X X X X

|				1	2	3	4	5	6	7
Version	Flow			9				4		
	Flow and temperature (PT1000)			8				5		
Nominal diameters and flow range	DN 8	0.9 ... 15 l/min.			0	8				K,G
	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				K,G
	DN 20	5.0 ... 85 l/min.			2	0				K,G
	DN 25	9.0 ... 150 l/min.			2	5				K,G
	DN 32	14.0 ... 240 l/min.			3	2				K
Output / power supply	Frequency output (unfiltered)	4.75 ... 33 VDC					2			
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 [3)]	Fluoro elastomer							2	
Tube connection	Brass with outside thread	K (DN 8, 10 - G ½; DN 15 - G ¾; DN 20 - G 1; DN 25 - G 1 ¼; DN 32 - G 1 ½)								K
		M (DN 10 - G ¾)								M
		G (DN 8 - G ¾ ; DN 10 - G 1; DN 15 - G 1; DN 20 - G 1 ¼; DN 25 - G 1 ½)								G

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

| 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

Dimension diagram
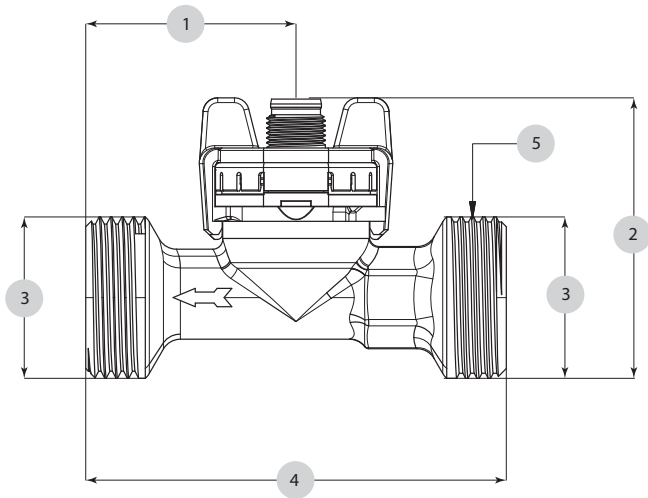
	1	2	3	4	5
DN 8 K	33.3	52.9	G ½	77	🔧 15
DN 8 G	33.3	55.7	G ¾	77	🔧 15
DN10 K	43	51.1	G ½	86	🔧 19
DN 10 M	43	54.1	G ¾	86	🔧 19
DN 10 G	43	57.3	G 1	86	🔧 19
DN 15 K	41	55.9	G ¾	87	🔧 22
DN 15 G	41	59.3	G 1	87	🔧 22
DN 20 K	40.6	61.6	G 1	105	🔧 27
DN 20 G	40.6	65.6	G 1 ¼	105	🔧 27
DN 25 K	50	68.1	G 1 ¼	120	🔧 34
DN 25 G	50	71.1	G 1 ½	120	🔧 34
DN 32 K	50	74.9	G 1 ½	134	🔧 41

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
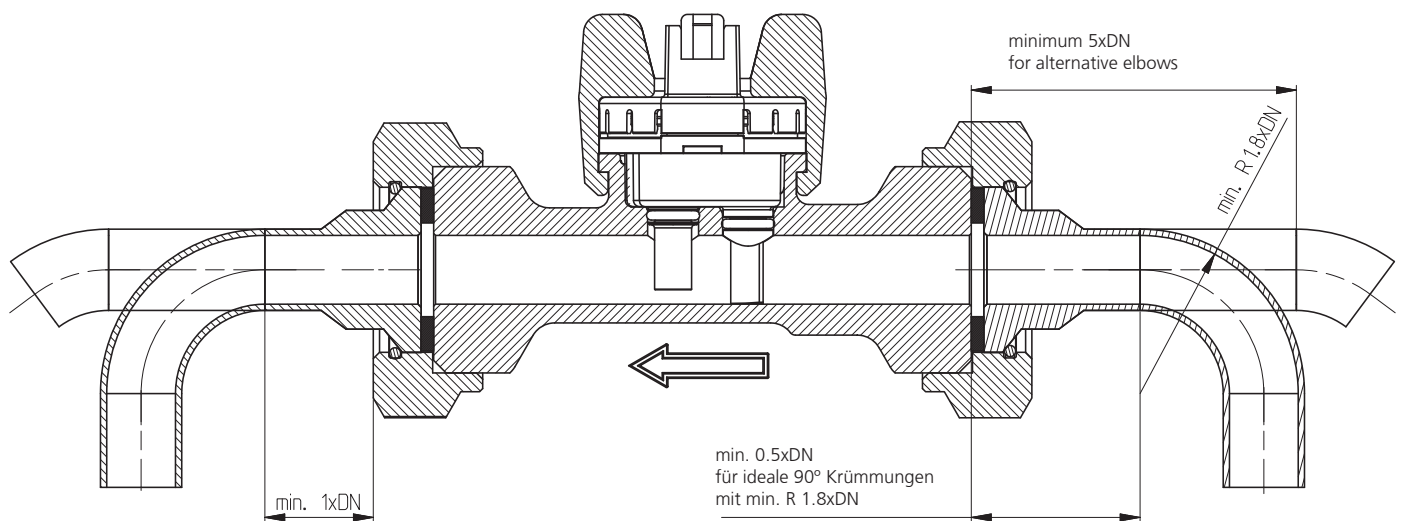
Connector M12x1 without temperature measurement ①
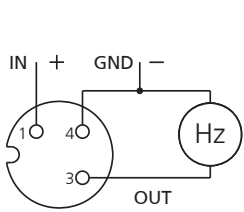
Frequency output
unfiltered
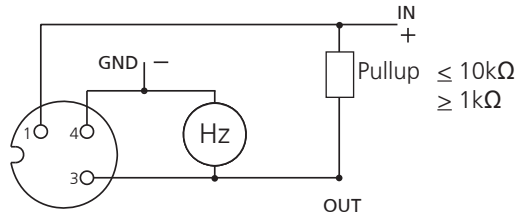
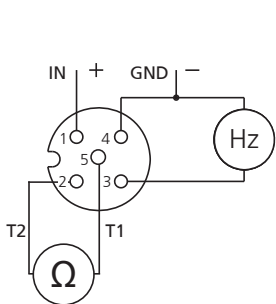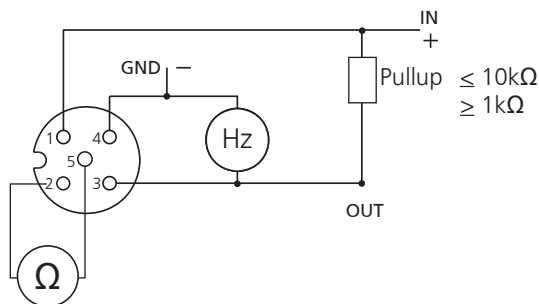Frequency output filtered
Pulse output
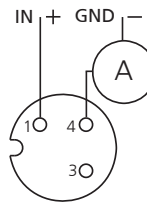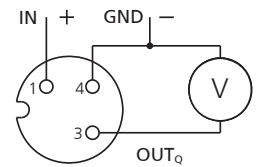
Current output

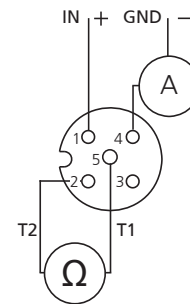Voltage output
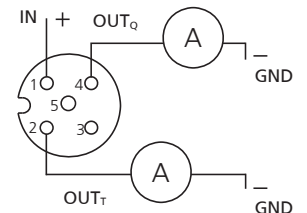
Connector M12x1 with temperature measurement ②

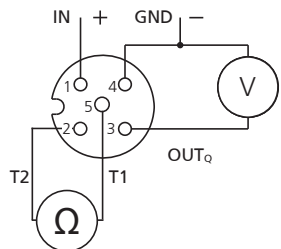frequency output with
temperature measurement
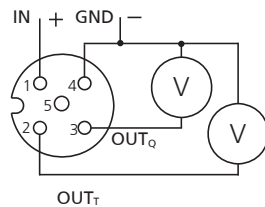PT1000

Frequency output filtered
Pulse output

Current output
with temperature
measurement
PT1000

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

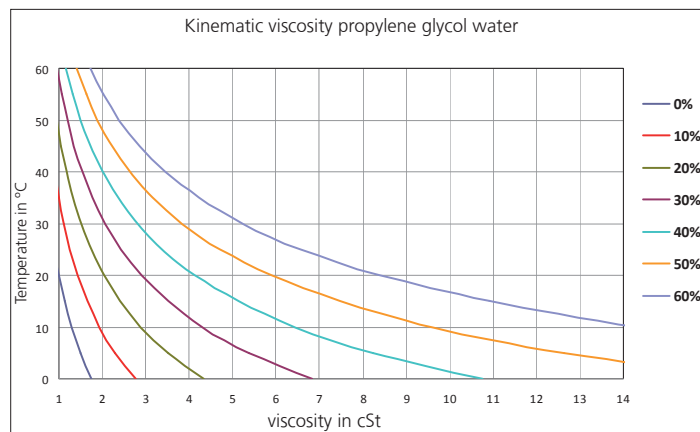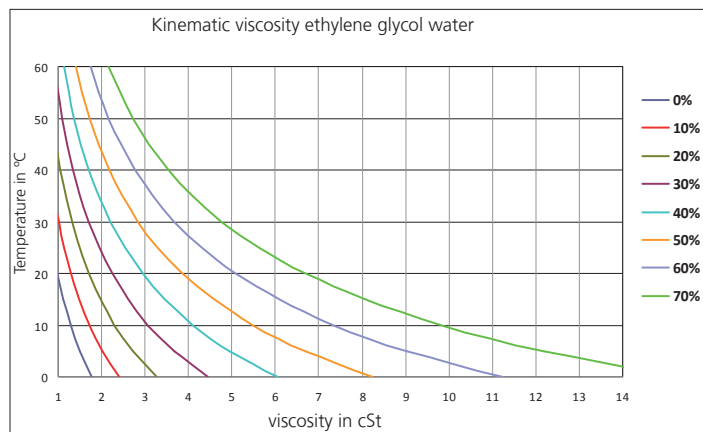Voltage output with
temperature measurement
PT1000

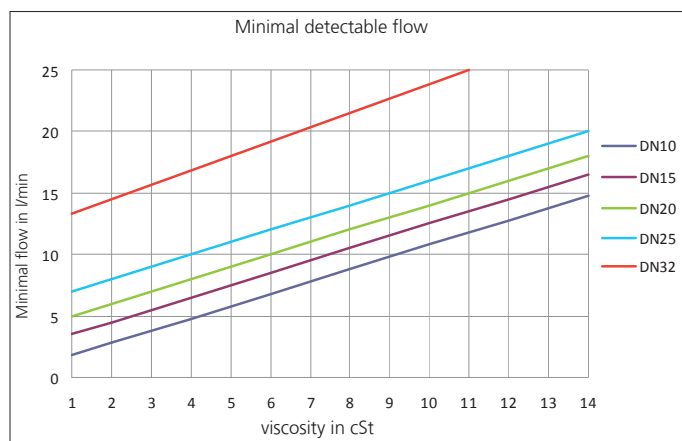Voltage output with temperature
measurement 0 ...10 V

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

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).
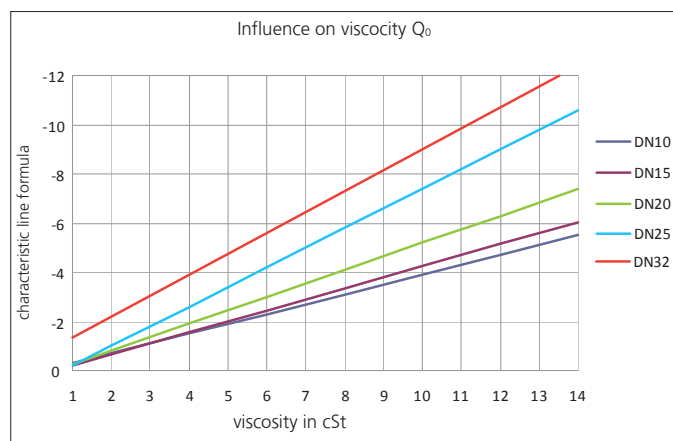
Definition of viscosity of glycol-water-compound

Kinematic viscosity ethylene glycol water

Legend: 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%

Kinematic viscosity propylene glycol water

Legend: 0%, 10%, 20%, 30%, 40%, 50%, 60%

Definition of respond threshold Q_{min} Definition of characteristic line formula $Q_V = k_f * f + Q_0$

Minimal detectable flow

Legend: DN10, DN15, DN20, DN25, DN32

Influence on viscocity Q_0

Legend: DN10, DN15, DN20, DN25, DN32

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: $Q_{min} = \upsilon + 4.0$
DN25: $Q_{min} = \upsilon + 8.0$
DN32: $Q_{min} = \upsilon + 13.0$

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: $Q = K_f * f - 0.80\upsilon + 0.60$
DN32: $Q = K_f * f - 0.85\upsilon + 0.55$

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: $Q = 0.150 * f - 0.80\upsilon + 0.80$
DN32: $Q = 0.240 * f - 0.85\upsilon + 0.55$

Impulse output:
DN10: $Q = 0.030 * \text{\#Pulse/s} - 0.40\upsilon + 0.40$
DN15: $Q = 0.060 * \text{\#Pulse/s} - 0.45\upsilon + 0.45$
DN20: $Q = 0.060 * \text{\#Pulse/s} - 0.55\upsilon + 0.55$
DN25: $Q = 0.075 * \text{\#Pulse/s} - 0.80\upsilon + 0.80$
DN32: $Q = 0.120 * \text{\#Pulse/s} - 0.85\upsilon + 0.55$

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: $Q = 15.0 * U_{out} - 0.80\upsilon + 0.80$
DN32: $Q = 24.0 * U_{out} - 0.80\upsilon + 0.80$

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: $Q = 9.375 * (I - 4\,mA) - 0.80\upsilon + 0.80$
DN32: $Q = 15.000 * (I - 4\,mA) - 0.80\upsilon + 0.80$

Huba Control

FOR FINE PRESSURE AND FLOW MEASUREMENT

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