

Flow sensor type 230 for liquid media

Flow range
1.8 ... 150 l/min

Nominal diameters
DN 10 / 15 / 20 / 25

Temperature measurement
-40 ... +125 °C



The flow sensor type 230 is based on the Kármán vortex trail. You can choose between various versions as integrated temperature measurement.

The type 230 has a rugged construction of red brass. 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, WRAS, ACS

Technical Overview

Flow measurement

Measuring principle	Vortex		Piezoelectric sensor element	
Measuring range			1.8 ... 150 l/min	
Nominal diameters			DN 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 (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
	(for lifetime)	12 bar at +40 °C
Max. pressure and medium temperature	(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	Red brass / PA6T/6I (40% GF)
Sealing material	EPDM (perox.) (for drinking water)
	FPM

Electrical connection

Connector M12x1	Protection standard
	IP 65

Weight

	with thread A	with thread L
DN 10	-	~ 230 g
DN 15	~ 240 g	~ 310 g
DN 20	~ 340 g	~ 440 g
DN 25	~ 510 g	~ 600 g

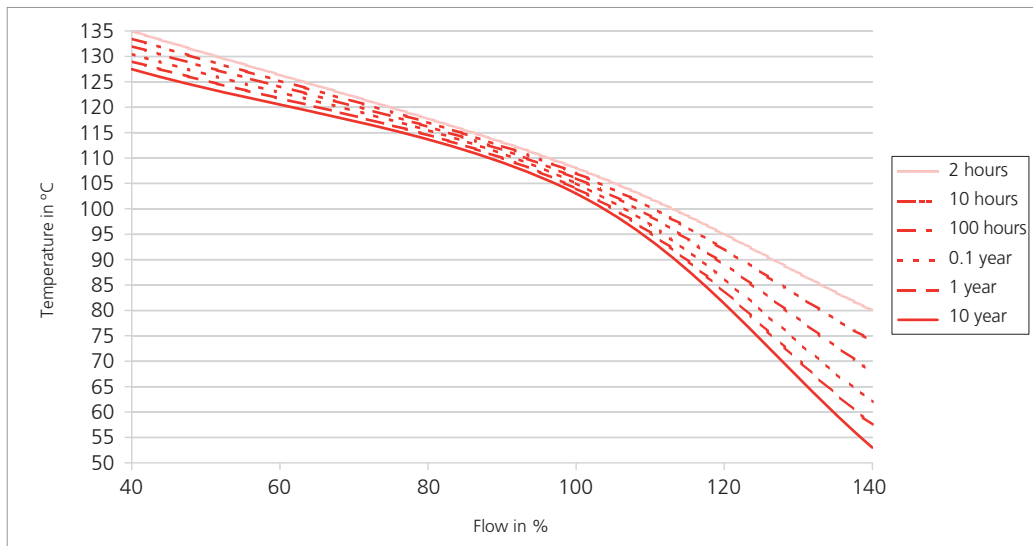
Test / Admissions

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

Packaging

Single packaging	
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Minimum life span on high flow rate and high temperature



Analogue output - Electrical overview

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
	Measuring range		-25 ... +125 °C
0 ... 10 V	Accuracy		± 0.5 K ± 0.005 * ΔT
	Calculation temperature		T (°C) = $\frac{I_{OUT,T} - 4 \text{ mA}}{16 \text{ mA}} * U_{OUT,T} - 25 \text{ °C}$
	Measuring range		-25 ... +125 °C
4 ... 20 mA	Accuracy		± 0.5 K ± 0.005 * ΔT
	Calculation temperature		T (°C) = $\frac{I_{OUT,T} - 4 \text{ mA}}{16 \text{ mA}} * U_{OUT,T} - 25 \text{ °C}$
Electronic			
Power supply	Output flow (Q)	Voltage output	Current output
10 ... 33 VDC	anaogue signal	11.5 ... 33 VDC	8 ... 33 VDC
4 ... 20 mA	signal	0 ... 10 V	4 ... 20 mA
4 ... 20 mA		0 ... 10 V	4 ... 20 mA
Load against GND or IN		< 6 mA / < 100 nF ¹⁾	< (U _{IN} - 8 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 [$\frac{L}{V * min}$]	K _I [$\frac{L}{mA * min}$]
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
 $Q_V = K_I * (I_{OUT} - 4 \text{ mA})$

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
		230. 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 10		1	0				L
	DN 10		1	1				L
	DN 15		1	5				
	DN 20		2	0				
	DN 25		2	5				
Output / power supply	Analogue output 0 ... 10 V	9,8,6			3			
	Analogue output 4 ... 20 mA	9,8			4			
	Analogue output 4 ... 20 mA	5			5			
Electrical connection	Connector M12x1		9		3,4	4		
			8,6,5			5		
Sealing material	EPDM						1	
	FPM ⁴⁾						2	
Red brass body	Red brass armature outside thread							A
								L

¹⁾ against GND only

²⁾ incl. 3xDi inlet and outlet side

³⁾ P_v 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 @ T ≠ 0 °C	± 0.3 K ± 0.3 K ± 0.005 * ΔT
Temperature influences		Self-heating at temperature sensor Conduction resistance to connector		1 K/mW 0.8 Ω

Electronic

Power Supply				4.75 ... 33 VDC
Output flow (Q)			Level height (open collector)	< 0.5 ... > U _N - 0.5 V
Output temperature (T)			Resistant signal	PT1000 class B DIN EN 60751
Load against 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]
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

230. 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 10 1.8 ... 32 l/min.		1	0				L
	DN 10 2.0 ... 40 l/min.		1	1				L
	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				
Output / power supply	Frequency output (filtered)					6		
	Pulse output					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
Red brass body	Red brass armature outside thread A (see dimension diagram)							A
	L (see dimension diagram)							L

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

Measuring principle	Resistance	PT1000 class B DIN EN 60751		
	Measuring range	-40 ... +125 °C		
PT1000	Accuracy	Class B DIN EN 60751	@ T = 0 °C @ T ≠ 0 °C	± 0.3 K ± 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 against 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]
10	L	1.8 ... 32	0.265 ... 4.716	22.50 * Q ²	1.378	24 ... 385	-0.2	0.0858
10	L	2.0 ... 40	0.295 ... 5.895	22.50 * Q ²	1.381	26 ... 480	-0.2	0.0858
15	A	3.5 ... 50	0.290 ... 4.145	6.70 * Q ²	2.998	20 ... 277	-0.2	0.1813
	L				2.975	21 ... 279		0.1799
20	A	5.0 ... 85	0.265 ... 4.509	2.50 * Q ²	6.109	14 ... 231	-0.2	0.3691
	L				6.057	14 ... 233		0.3660
25	A	9.0 ... 150	0.283 ... 4.709	0.92 * Q ²	12.114	13 ... 206	-0.2	0.7288
	L				12.143			0.7305

Characteristic line formula frequency output unfiltered

$$Q_v = K_f * f + Q_0$$

Formula quantity per pulse [litres/pulse]

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

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]
Quantity per Pulse	Quantity per pulse	litres pulse

Frequency output (unfiltered) - Order code selection table

230. 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 10 1.8 ... 32 l/min.		1	0				L
	DN 10 2.0 ... 40 l/min.		1	1				L
	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				
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	
Red brass body	Red brass armature outside thread A (see dimension diagram)							A
	L (see dimension diagram)							L

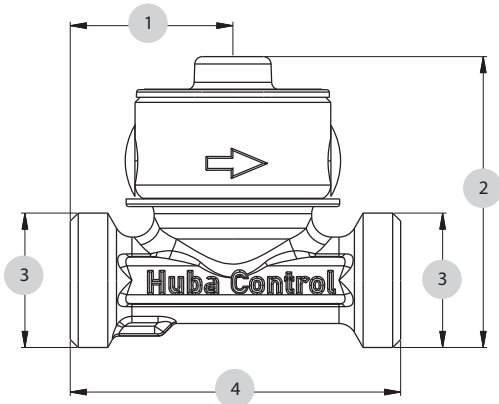
¹⁾ incl. 3xDi inlet and outlet side

²⁾ Pv in Pa; Q in l/min

³⁾ No drinking water approval

Accessories (Accessories supplied loose)				Order number
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				115024

Dimension diagram DN 10, 15, 20, 25

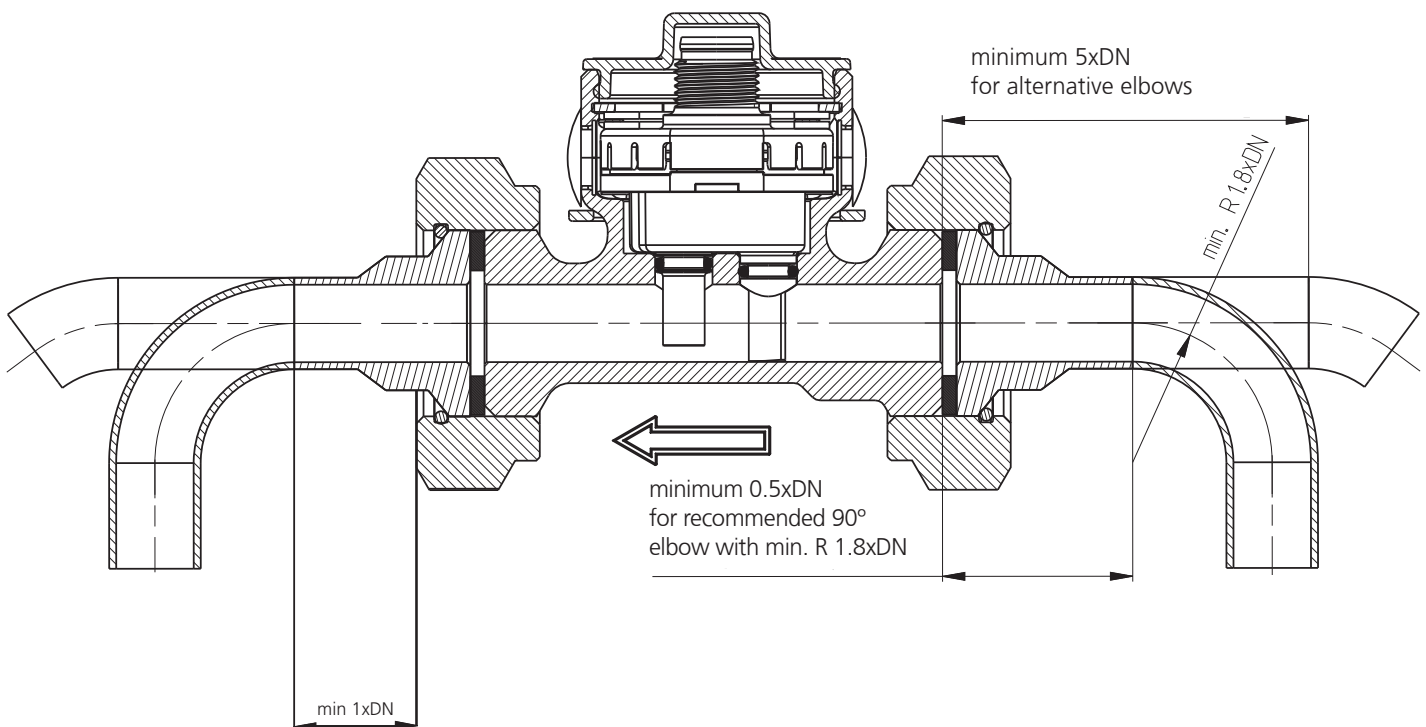


		1	2	3	4
DN10	L	32	57.22	G 3/4	65
DN15	A	40	59.22	G 3/4	75
DN15	L	40	62.65	G 1	75
DN20	A	49	64.62	G 1	86
DN20	L	49	68.95	G 1 1/4	86
DN25	A	70	71.45	G 1 1/4	109
DN25	L	70	74.40	G 1 1/2	109

Tube mounting instructions

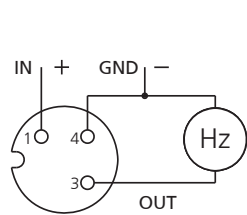
Consider the following to ensure the correct function of the sensor.

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

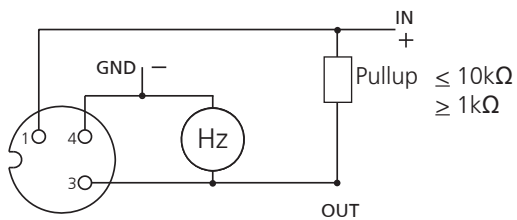


Connector M12x1 without temperature measurement

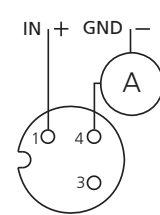
1



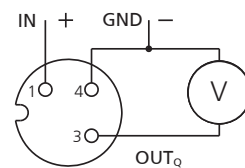
Frequency output unfiltered



Frequency output filtered
Pulse output



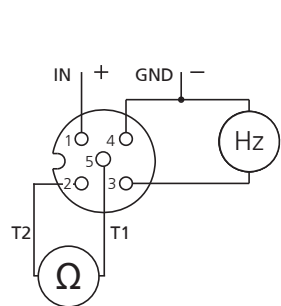
Current output



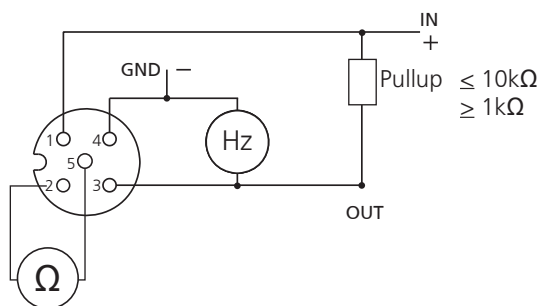
Voltage output

Connector M12x1 with temperature measurement

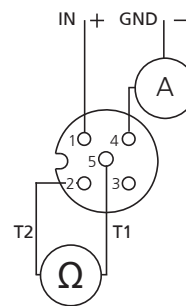
2



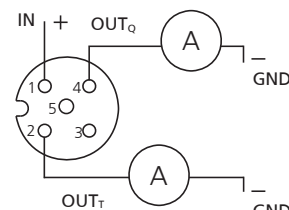
frequency output with temperature measurement
PT1000



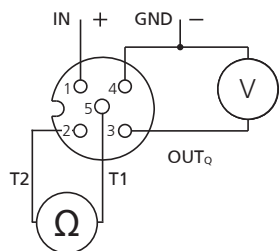
Frequency output filtered
Pulse output



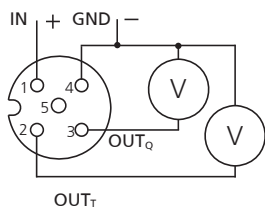
Current output with temperature measurement
PT1000



Current output with temperature measurement
4 ... 20 mA



Voltage output with temperature measurement
PT1000

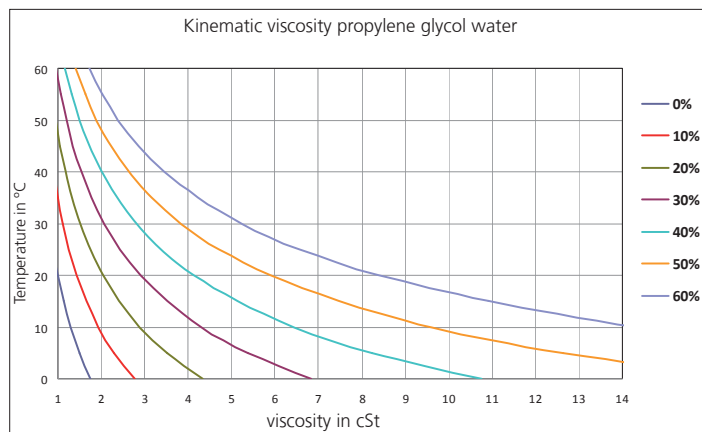
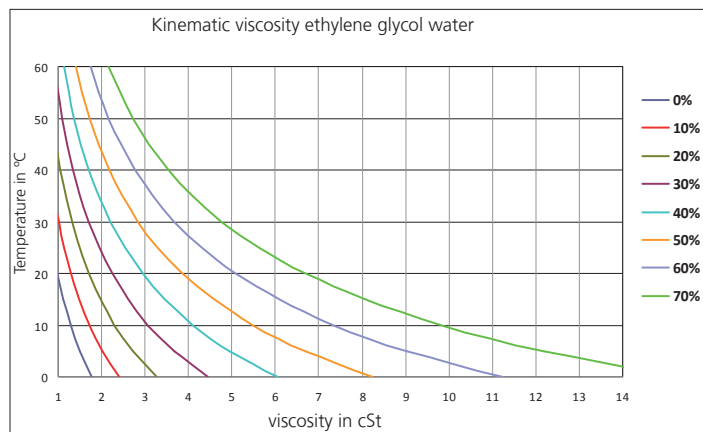


Voltage output with temperature measurement
0 ... 10 V

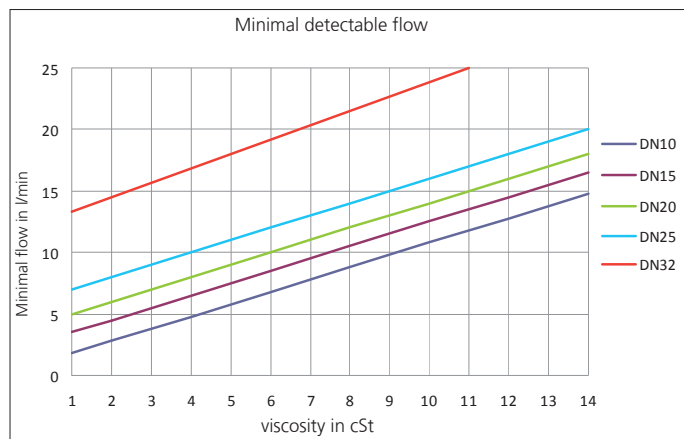
Pin	Colour
1	brown
3	blue
4	black
1	
1	brown
2	white
3	blue
4	black
5	gray
2	

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).

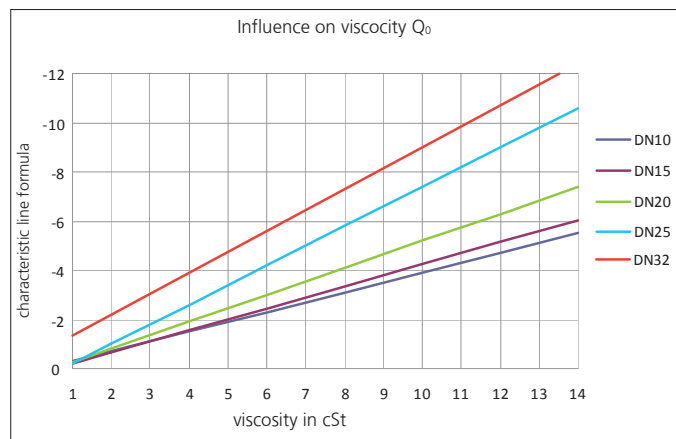
Definition of viscosity of glycol-water-compound



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 (unfiltered):
 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: $Q = K_f * f - 0.80\nu + 0.60$

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

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

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

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

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