

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 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		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.	Signal delay < 100 ms
		Response time < 5 ms
	Frequency output	Signal delay < 2 s
	Analogue output	Response time < 500 ms

Temperature measurement

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	$T(^{\circ}\text{C}) = \frac{\pm 150^{\circ}\text{C}}{10\text{ V}} * U_{\text{OUT,T}} - 25^{\circ}\text{C}$
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	Red brass / PA6T/6I (40% GF)
Sealing material	EPDM (perox.) (for drinking water) 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	Frequency square pulse signal	$U_{\text{OUT,Q,frequency}}$	< 0.5 ... > $U_{\text{IN}} - 0.5\text{ V}$	–
Flow (Q)	Analogue signal	$U_{\text{OUT,Q}}$ OR I_{OUT}	–	0 ... 10 V
Output	Resistant signal	$R_{\text{OUT,PT1000}}$	PT1000 class B DIN EN 60751	4 ... 20 mA
temperature (T)	Voltage signal	$U_{\text{OUT,T}}$	0 ... 10 V	–
Electrical connection and protection class		M12x1 (IP 65)	M12x1 (IP 65)	M12x1 (IP 65)
Load against GND or IN		< 1 mA / < 100 nF	< 6 mA / < 100 nF ¹⁾	< ($U_{\text{IN}} - 8\text{ V}$) / 20 mA
Current consumption load free (I_{IN})		< 2mA	< 5 mA	–
Electrical reliability	Short circuit, reverse voltage and external voltage protected within the admissible supply voltage.			

Weight

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

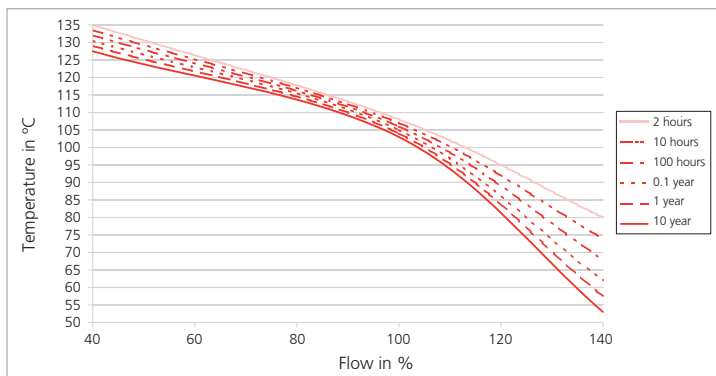
Test / Admissions

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

Packaging

Single packaging

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 10	L	1.8 ... 32 l/min	1.378 ml	0.265 ... 4.716 m/s	24 ... 385 Hz	-0.2	0.0858	3.2	2.000	22.50 * Q ²
DN 10	L	2.0 ... 40 l/min	1.381 ml	0.295 ... 5.895 m/s	26 ... 480 Hz	-0.2	0.0858	4.0	2.000	22.50 * Q ²
DN 15	A	3.5 ... 50 l/min	2.998 ml	0.290 ... 4.145 m/s	20 ... 277 Hz	-0.2	0.1813	5.0	3.125	6.70 * Q ²
	L		2.975 ml		21 ... 279 Hz		0.1799			
DN 20	A	5.0 ... 85 l/min	6.109 ml	0.265 ... 4.509 m/s	14 ... 231 Hz	-0.2	0.3691	8.5	5.313	2.50 * Q ²
	L		6.057 ml		14 ... 233 Hz		0.3660			
DN 25	A	9.0 ... 150 l/min	12.114 ml	0.283 ... 4.709 m/s	13 ... 206 Hz	-0.2	0.7288	15	9.375	0.92 * Q ²
	L		12.143 ml				0.7305			

Characteristic line formula
frequency output
 $Q_V = K_f * f + Q_0$

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

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

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

Formula quantity per pulse [litres/pulse]
quantity
pulse = $\frac{Q_V * K_f}{60 * (Q_V - Q_0)}$

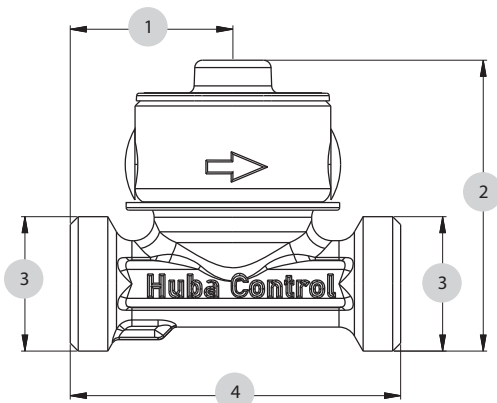
(Influence of viscosity for media other than water - see page 5)

Order code selection table		1	2	3	4	5	6	7
		230. X X X X X X X						
Version	Flow	9				4		
	Flow and temperature (PT1000)	8				5		
	Flow and temperature (0 ... 10 V)	6				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 and 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 ³⁾ Fluoro elastomer						2	
Red brass body	Red brass armature outside thread A (see dimension diagram)							A
	L (see dimension diagram)							L

Accessories ⁴⁾

				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 ¾	65
DN15	A	40	59.22	G ¾	75
DN15	L	40	62.65	G 1	75
DN20	A	49	64.62	G 1	86
DN20	L	49	68.95	G 1¼	86
DN25	A	70	71.45	G 1¼	109
DN25	L	70	74.40	G 1½	109

¹⁾ incl. 3xDi inlet and outlet side

²⁾ Pv in Pa; Q in l/min

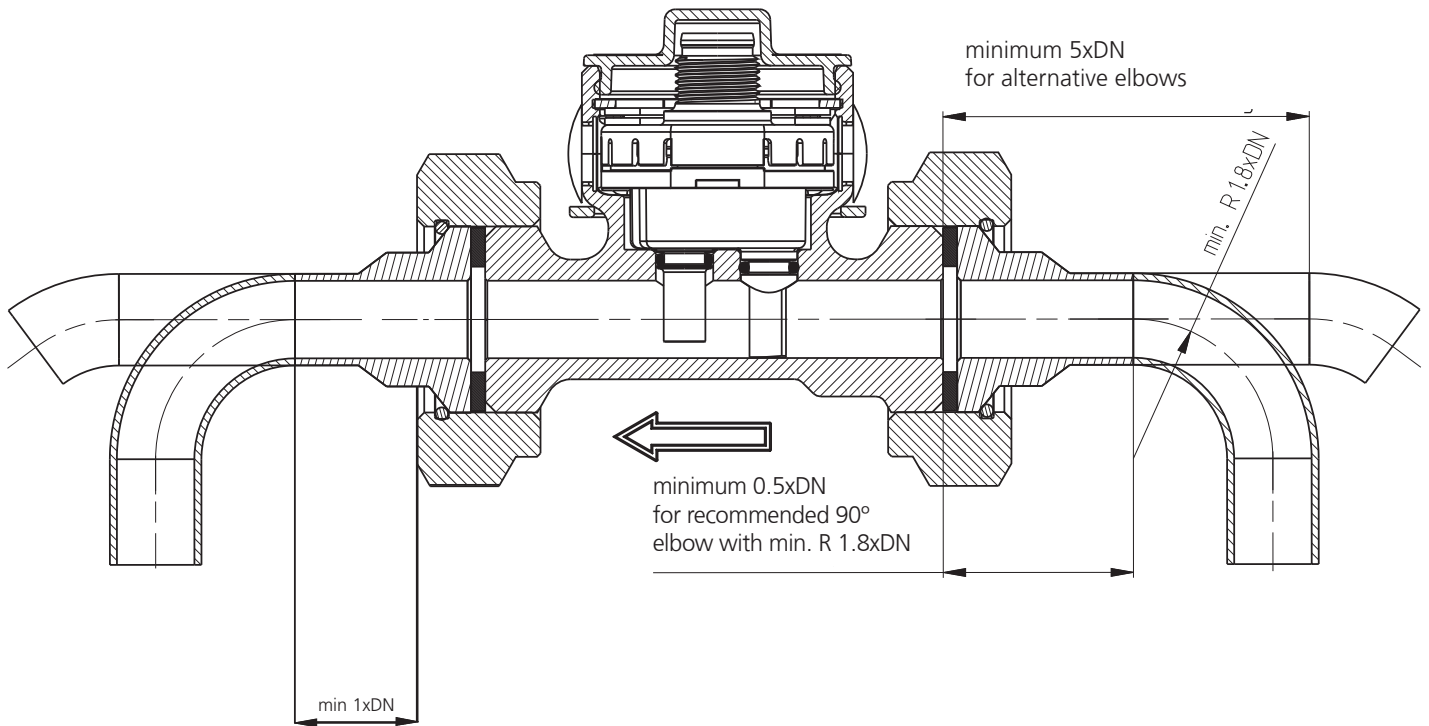
³⁾ No drinking water approval

⁴⁾ Accessories supplied loose

Tube mounting instructions

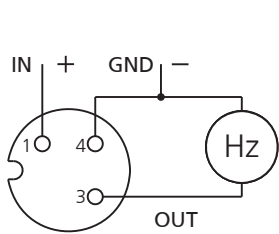
Consider the following to ensure the correct function of the sensor.

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

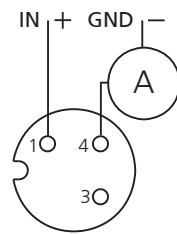


Electrical connection

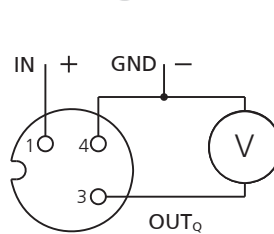
Connector M12x1 without temperature measurement



Frequency output



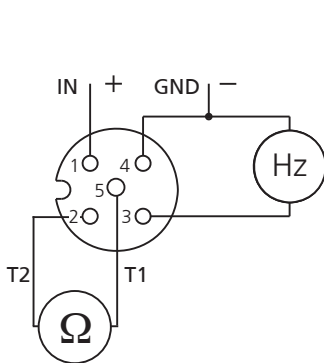
current output



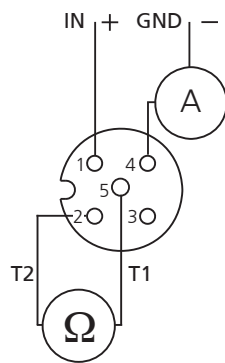
voltage output

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

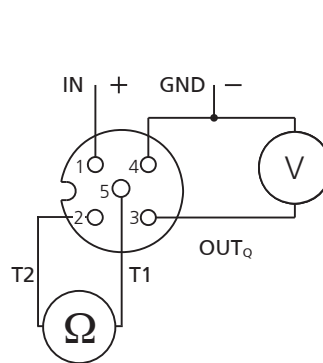
Connector M12x1 with temperature measurement



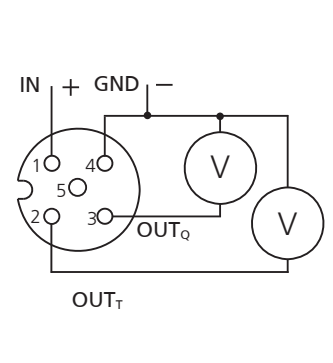
Frequency output with PT1000



current output with PT1000



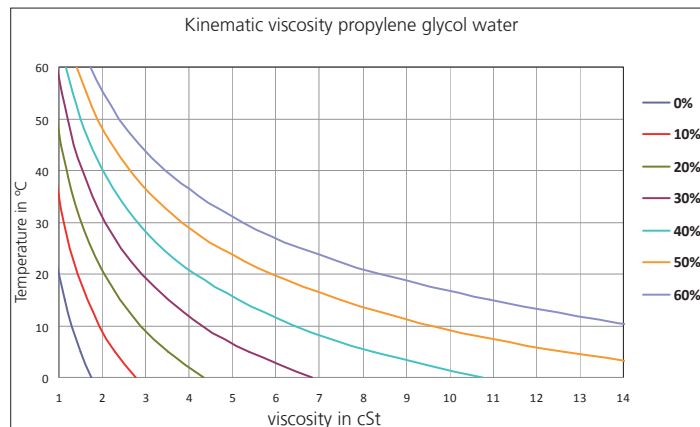
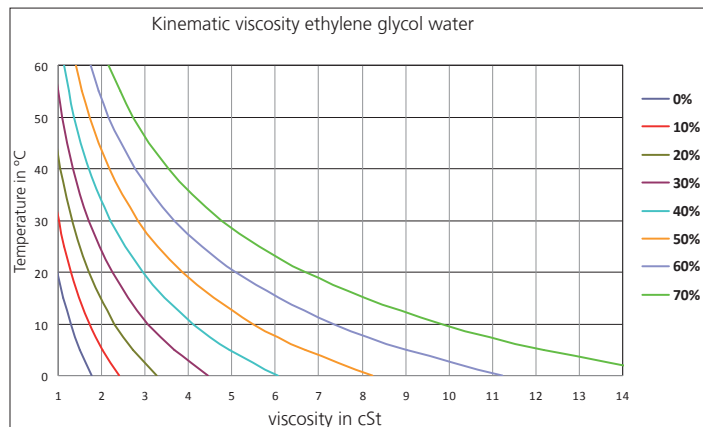
voltage output with PT1000



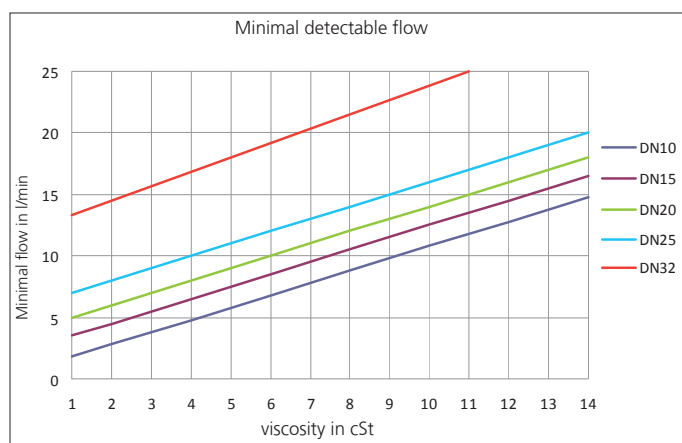
voltage output with temperature output 0 ...10 V

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).

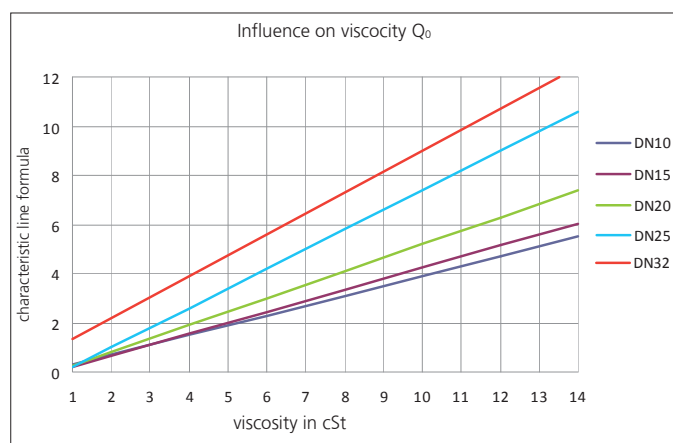
Definition of viscosity of glycol-water-compound



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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