



Vortex flow sensor

OEM Flow sensor for liquid media Type 235

The type 235 is based on the type 200 but incorporates a brass housing. The flow sensor type 235 is based on the Kármán vortex trail. 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 range

0.9 ... 240 l/min

Nominal diameters

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

Temperature measurement

-40 ... +125 °C

- + Low cost product with high levels of accuracy
- + 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 with PT1000 or NTC
- + Drinking water approval ACS, WRAS

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 ¹⁾ (water)			< 1% fs
Accuracy at > 50% fs (water)			< 2% measuring value
Response time	Immediately	Signal delay	< 100 ms
	Therefore suitable for spigot use.	Response time	< 5 ms

Temperature measurement

Measuring principle	Resistance		PT1000 NTC
PT1000	Measuring range		-40 ... +125 °C
	Accuracy	Class B DIN EN 60751	±0.3 °C ± 0.005 · ΔT _{0°C}
	Measuring range		-40 ... +125 °C
NTC	Accuracy	NTC 10 kOhm @ 25 °C β = 4050	@ T > +25 °C ±0.7 °C ± 0.025 · ΔT _{25 °C} @ T < +25 °C ±0.7 °C ± 0.025 · ΔT _{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 (non freezing)	-15 ... +125 °C
	Ambient	-15 ... +85 °C
	Storage	-30 ... +85 °C
	(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

Sensor paddle	ETFE
Case with damming body	Brass (CuZn21Si3P), PA6T/6I (40% fibreglass)
Sealing material	EPDM (perox.) (for drinking water) FPM

Electrical overview

Power supply		U _{IN}	5 VDC ±5%
Output flow (Q)	Frequency Square pulse signal	U _{OUT_Q_Frequency}	< 0.1 ... > 4.75 V
Output temperature (T)	Resistant signal	R _{OUT_PT1000}	PT1000 class B DIN EN 60751
		R _{OUT_NTC}	NTC 10 kOhm @ 25 °C; β = 4050
Electrical connection and protection class		Connector RAST 2.5 / 2.54	IP 20
Load against GND or IN		Connector M12x1	IP 65
Current consumption I _m load free		Version OEM	< 6 mA
		Version standard	< 10 mA

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	222 g	-	288 g
DN 20 with condensation protection	356 g	-	469 g
DN 25 with condensation protection	576 g	-	681 g
DN 32 with condensation protection	691 g	-	-

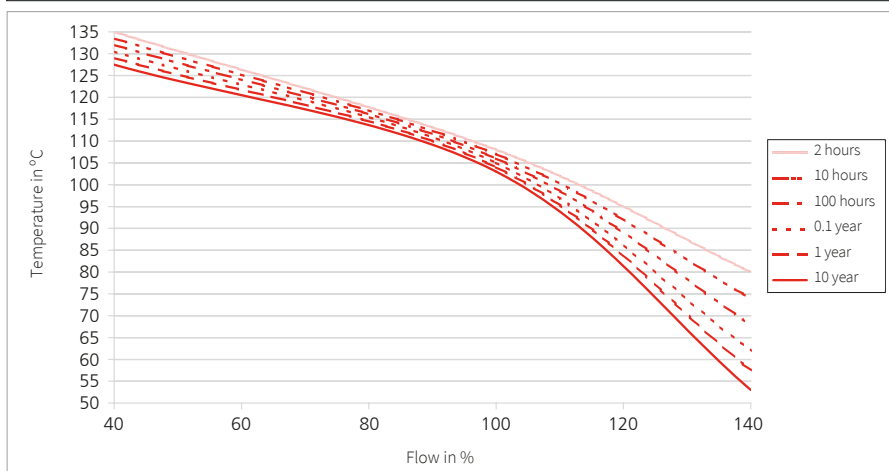
Test / Admissions

Electromagnetic compatibility	acc. to EN 61326-2-3 (no protection at surge)
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



¹⁾ fs = Fullscale

Nominal diameters dependent variables

Nominal diameters	Tube connection	Measuring range [l/min]	Quantity per pulse @ 50% fs [ml]	Flow rate [m/s]	Frequency range [Hz]	Q ₀ [l/min]	K _f [(l/min)/ Hz]	Pressure drop P _v in [Pa] ^{1),2)}
DN 8	K, G	0.9 ... 15	0.578	0.133 ... 2.210	31 ... 427	-0.2	0.0356	85.00 * Q ²
DN 10	K	1.8 ... 32	1.416	0.265 ... 4.716	23 ... 374	-0.2	0.0860	22.50 * Q ²
	G, M		1.383		24 ... 380		0.0840	
DN 10	K	2.0 ... 40	1.419	0.295 ... 5.895	26 ... 467	-0.2	0.0860	22.50 * Q ²
	G, M		1.386		26 ... 479		0.0840	
DN 15	K	3.5 ... 50	3.036	0.290 ... 4.145	20 ... 273	-0.2	0.1836	6.70 * Q ²
	G		2.993		20 ... 277		0.1810	
DN 20	K	5.0 ... 85	6.173	0.265 ... 4.509	14 ... 229	-0.3	0.3730	2.50 * Q ²
	G		6.140		14 ... 230		0.3710	
DN 25	K	9.0 ... 150	12.201	0.283 ... 4.709	13 ... 205	-0.2	0.7340	0.92 * Q ²
	G		12.134		13 ... 206		0.7300	
DN 32	K	14 ... 240	27.513	0.290 ... 4.974	9 ... 145	-1.47	1.6710	0.25 * Q ²

Characteristic line formula frequency output

$$Q_v = K_f \cdot f + Q_0$$

Formula quantity per pulse [litres/pulse]

$$\frac{\text{quantity}}{\text{pulse}} = \frac{Q_v \cdot K_v}{60 \cdot (Q_v - Q_0)}$$

Legend

Q _v	Volume flow rate	[l/min]
P _v	Pressure drop	[Pa]
Q ₀	Axis intercept	[l/min]
K _f	Coefficient frequency output	[(l/min) / f]
f	Frequency	[Hz]

Order code selection table

		1	2	3	4	5	6	7
		235. X X X X X X X						
Version	Flow	9						
	Flow and temperature (PT1000)	8			1			
	Flow and temperature (NTC)	7			1			
Nominal diameters and flow range	DN 8 0.9 ... 15 l/min		0	8	1			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, 0 ... 5 VDC (Square pulse signal) OEM	9			0			
	Frequency output, 0 ... 5 VDC (Square pulse signal) Standard				1			
Electrical connection	3-pole connector RAST 2.5	9			0			
	2x3-pole connector RAST 2.5	7,8			1	1		
	3-pole connector RAST 2.5 (condensation protection)	9				2		
	2x3-pole connector RAST 2.5 (condensation protection)	7,8			1	3		
	3-pole circular connector M12x1 (condensation protection)	9			1	4		
5-pole circular connector M12x1 (condensation protection)	7,8			1	5			
Sealing material	EPDM Ethylene propylene rubber (peroxidically cross-linked)						1	
	FKM Fluoro elastomer						2	
Tube connection	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

Accessories (supplied loose)

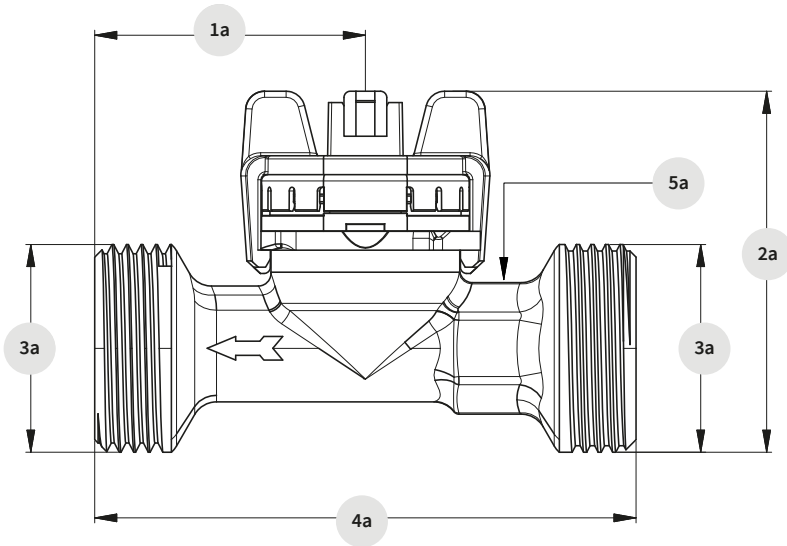
Order number

Connector RAST 2.5 with cable	3-pole	30 cm	111668
Connector RAST 2.5 with cable	3-pole	110 cm	101817
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
Connector RAST 2.5 with cable	2x3 pole	110 cm (with temperature)	114629
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

¹⁾ incl. 3x DN inlet and outlet side

²⁾ Q in l/min

Dimension diagram

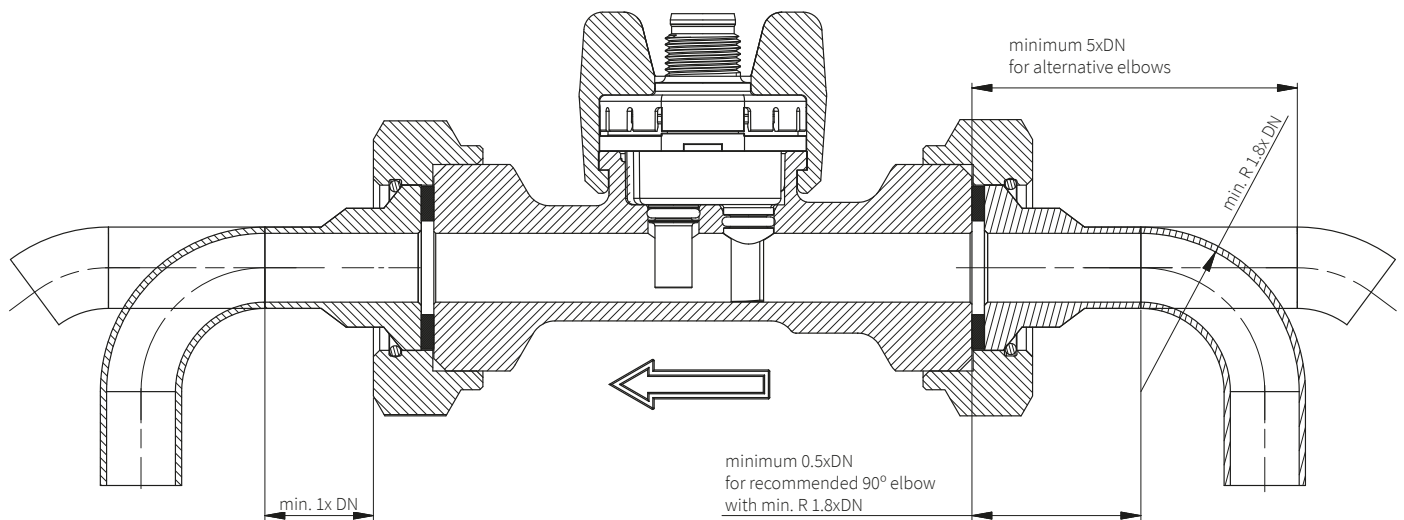


	1a [mm]	2a [mm]	3a	4a [mm]	5a
DN 8 K	33.3	52.9	G ½	77	15
DN 8 G	33.3	55.7	G ¾	77	15
DN 10 K	43	51.1	G ½	86	19
DN 10 M	43	54.1	G ¾	86	19
DN 10 G	43	57.3	G 1	86	19
DN 15 K	41	55.9	G ¾	87	22
DN 15 G	41	59.3	G 1	87	22
DN 20 K	40.6	61.3	G 1	105	27
DN 20 G	40.6	65.6	G 1 ¼	105	27
DN 25 K	50	68.1	G 1 ¼	120	34
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

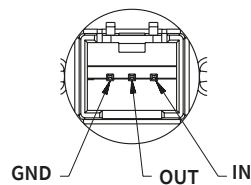
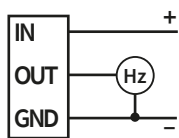
Consider the following to ensure the correct function of the sensor.

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

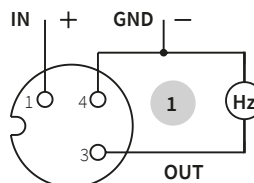


Electrical connections

RAST 2.5 without temperature output

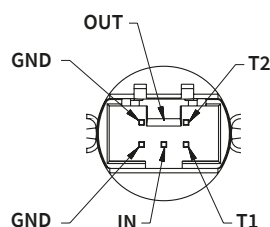
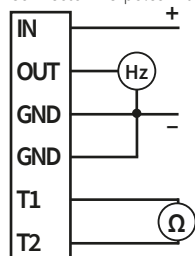


Connector M12x1 without temperature output

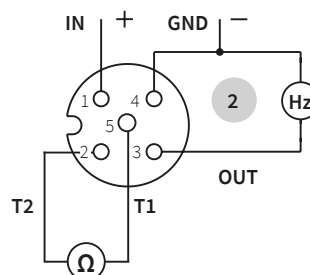


Pin	Colour
1	brown
3	blue
4	black
1	brown
2	white
3	blue
4	black
5	gray

Connector 2x3-poles with temperature output



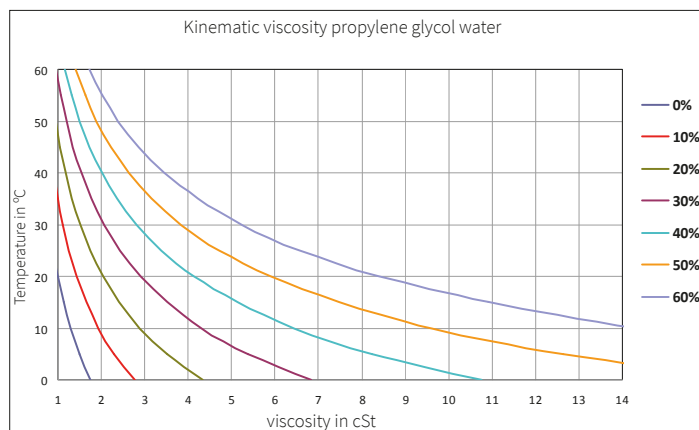
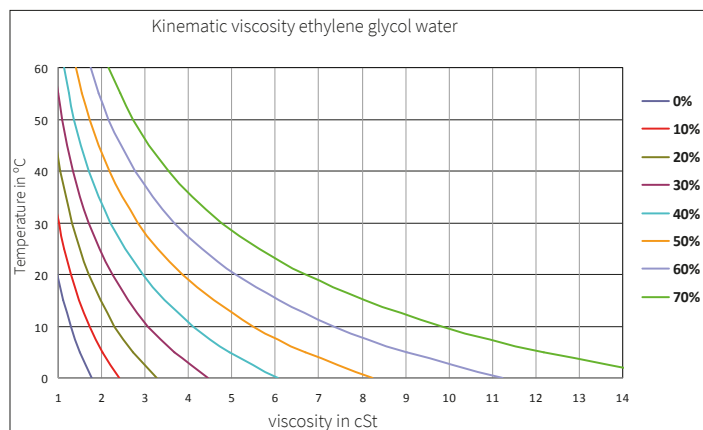
Connector M12x1 with temperature output



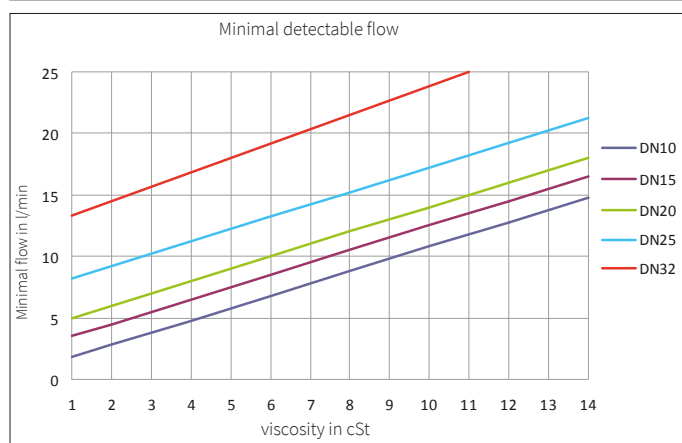
Influence of glycol

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 (ν = viscosity in cSt).

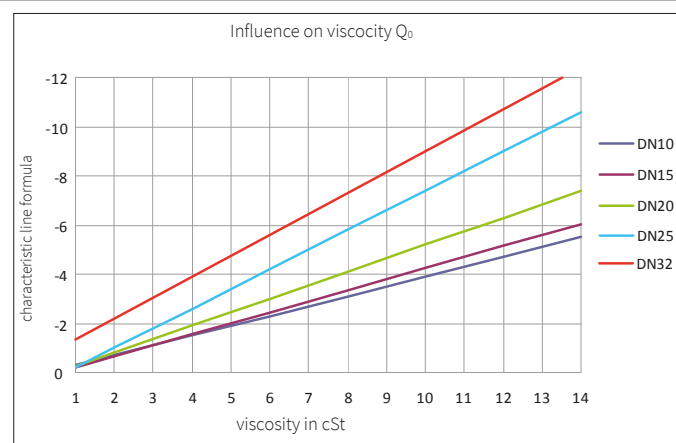
Definition of viscosity of glycol-water-compound



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

< DN10 not possible

DN10: $Q_{min} = \nu + 0.8$

DN15: $Q_{min} = \nu + 2.5$

DN20: $Q_{min} = \nu + 4.0$

DN25: $Q_{min} = \nu + 8.0$

DN32: $Q_{min} = \nu + 13.0$

Formula characteristic line for $Q \geq Q_{min}$ in l/min

< DN10 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: $Q = K_f * f - 0.80\nu + 0.60$

DN32: $Q = K_f * f - 0.85\nu - 0.55$

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