

CLARK

210 Series Vortex Flow Transmitter

Frequency & Analog Output , 1/4" to 1.0" Pipe Sizes, Rugged PPA Construction

DESCRIPTION

In comparison to the OEM flow sensor type 200, the type 210 is available with an increased range of power supply and output signals all with and without temperature measurement.

With no moving parts the flow sensor is not sensitive to debris, has marginal pressure loss and high accuracy.

Versions with a 1000 Ohm RTD temperature sensor built-in to the bluff are available.

SPECIFICATIONS

Medium: Suitable for water & water glycol based heat exchange systems with the usual additives and other fluids compatible with the materials of construction (consult factory). For media with viscosity greater than 2 millipascal seconds (2 centipoise), higher flow rates are required to form vortices raising the minimum measurable flow rate value.

Flow ranges: From 0.24 to 39.6 GPM (0.9 ... 150 litres per minute). See Table 3.

Temperature measurement: Optional PT1000 RTD imbedded in flow sensor bluff
 Measure range -40°F to +302°F (-40 to > +150 °C)
 1000.00 Ohm @ 32°F (0 °C)
 1573.25 Ohm @ 302°F (150 °C)

Temperature: Ambient: 5° to 185°F (-15 to + 85 °C)
 In storage: -22° to 185°F (-30 to + 85 °C)

Max. pressures and medium temperature:

Table 1

psi	bar	°F	°C	Duration
174	12	104	40	Lifetime
87	6	212	100	Lifetime
58	4	257	125	600 hours
58	4	284	140	2 hours

Max. test pressure: 261 psi/18 bar at 104°F/40 °C

Loss of pressure / cavitation: A minimum inlet pressure of 10.2 psi (0.7 bars) is required to avoid cavitation issues at maximum flow.

Wetted materials:

Sensor vane: ETFE

Sealing material: EPDM

Flow sensor and bluff:

ASTM- PPA, Polyphthalamide
 ISO-PA6T/6I, Grivory 40%GF

Power/Output Options:

Table 2

	Square Pulse Frequency Output	Voltage Output	Current Output
Power (U _{in})	4.75-33 VDC	11.5-33 VDC	8-33 VDC
Signal	<0.5...>U _{in} -0.5 V	0-10 V	4-20 mA
Load Against GND	<1 mA/<100 nF	<6 mA/<100 nF	<(U _{in} -8 V)/20 mA
Current Consumption	<2 mA	<5 mA	-



Features

- Low cost product with high levels of accuracy
- Temperature insensitive measuring principle
- Excellent media resistance (measuring element not in contact with the media)
- Minimal pressure loss
- Measuring element not sensitive to debris
- Direct temperature measurement in the medium

Response time: A high accuracy of flow rate is detected within 100 ms.

Electrical connection: 3-pole connector (without temperature output), RAST 2.5 (AMP DUO PLUG 2.5™ is recommended mating connector.) M12x1, 5-pole circular receptacle provided for temperature output option. See accessories for cable assembly offerings

Polarity reversal protection: Short circuit, reverse voltage and external voltage protected within the admissible supply voltage.

Protection class: IP20, IP65 (M12x1 only)

Mounting position: In principle universal. We recommend that, when the sensor is mounted in horizontal pipe runs that the electrical connection/sensor assembly be mounted off vertical (3 o'clock or 9 o'clock best).

Piping connection fittings: See tables 6, 7 & 8 for standard selection of types & sizes. Special fittings can be produced by Clark or the customer.

Accuracy:

Accuracy specifications are valid for media with a viscosity <2 centipoise (2 millipascal seconds):

For water in temperature range 41 to 212°F (5 to 100°C) or for water with maximum 20% glycol at ≥77°F (≥25°C)

Up to 50% fs: ≤ 1% fs

From 50% fs: ≤ 2% of measured value

Temperature measurement accuracy:

PT 1000 for DIN EN 60751 Class B
 ± 0.8°F @ 68° (± 0.45 °C @ 20 °C)
 ± 1.4°F @ 190°F (± 0.75 °C @ 90 °C)

Packaging:

Packaged singly (standard) or in multiple blister packs
 Blister packs:
 DN 8, 10 and 15 Blister packs each containing 30 pcs
 DN 20 and 25 Blister packs each containing 20 pcs

Table 3- Model Size Selection

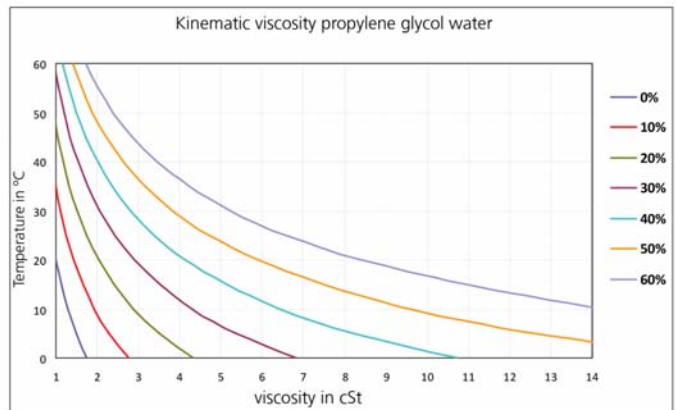
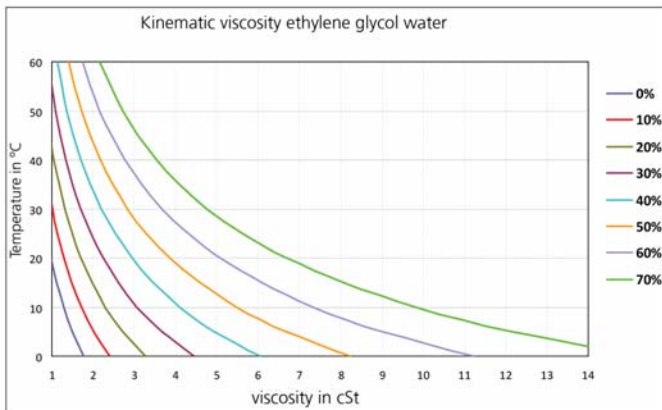
Size	Pipe Size	Full Scale Range (Gal/min)	Full Scale Range (l/min)	Approximate Frequency Range (Hz)	Calibration Factor/Formulas Q= volume flow in LPM f=Hz	Approx. Weight (Without End Fittings)
DN8	1/4"	0.238 to 3.96	0.9 to 15.0	31 to 399	Q= 0.0383*f-0.3	0.1 lbs (47g)
DN10	3/8"	0.476 to 8.45	1.8 to 32.0	24 to 383	Q= 0.0841*f-0.2	0.13 lbs (57 g)
DN15	1/2"	0.925 to 13.20	3.5 to 50.0	20 to 270	Q= 0.1861*f-0.2	0.15 lbs (68 g)
DN20	3/4"	1.32 to 22.50	5.0 to 85.0	14 to 227	Q= 0.3751*f-0.3	0.20 lbs (92 g)
DN25	1"	2.38 to 39.6	9.0 to 150.0	12 to 204	Q= 0.7370*f-0.2	0.22 lbs (100 g)

Characteristic line Formulas:

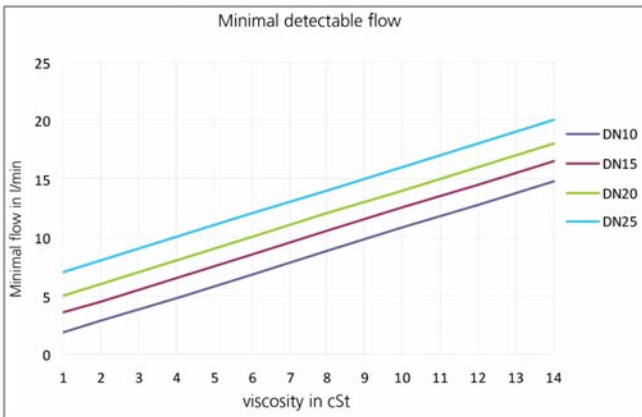
Frequency Output- $Q_v = K_f * f + Q_0$
 Quantity per Pulse (liters/pulse)- Quantity/Pulse= $Q_v * K_f / 60 * (Q_v - Q_0)$
 Current Output- $Q_v = K_i * (I_{out} - 4 \text{ mA})$
 Voltage Output- $Q_v = K_u * U_{out}$

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)/f]
f	Frequency	[Hz]
U_{out}	Voltage	[V]
I_{out}	Current	[mA]
Qty/Pulse	Quantity per Pulse	liters/pulse

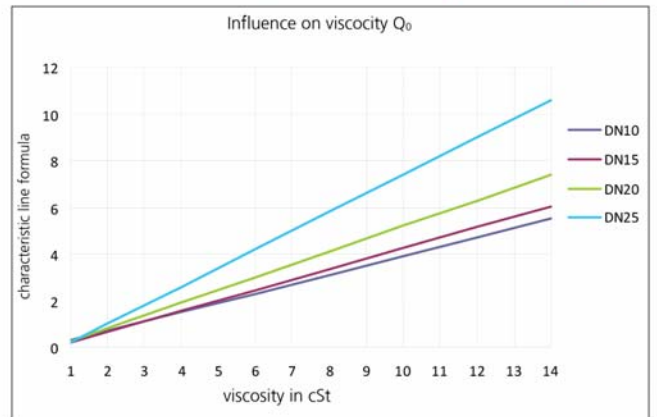
Influence of Glycol: Following definitions correct the influence of media with higher viscosity than water (media viscosity (v) > 1.8 cSt. Corrections result in measuring accuracy of 3% FS in range of 1.8-4 cSt & 4% FS in the range of 4-14 cSt.



Definition of respond threshold Q_{min}



Definition of characteristic line formula $Q = k * f - Q_0$



Response threshold Q_{min} (minimum flow in l/min)

DN 10: $Q_{min} = v + 0.8$
 DN 15: $Q_{min} = v + 2.5$
 DN 20: $Q_{min} = v + 4$
 DN 25: $Q_{min} = v + 6$

(Multiply liters x 0.264 to convert to gallons)

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

Frequency output:
 DN10: $Q = 0.0832 * f - 0.40v + 0.20$
 DN15: $Q = 0.1843 * f - 0.45v + 0.25$
 DN20: $Q = 0.3754 * f - 0.55v + 0.25$
 DN25: $Q = 0.7467 * f - 0.80v + 0.60$
 Voltage output 0 ... 10 V
 DN10: $Q = 3.2 * U_{out} - 0.40v + 0.40$
 DN15: $Q = 5.0 * U_{out} - 0.45v + 0.45$
 DN20: $Q = 8.5 * U_{out} - 0.55v + 0.55$
 DN25: $Q = 15.0 * U_{out} - 0.80v + 0.80$

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

DIMENSIONS DN 8, 10, 15, 20

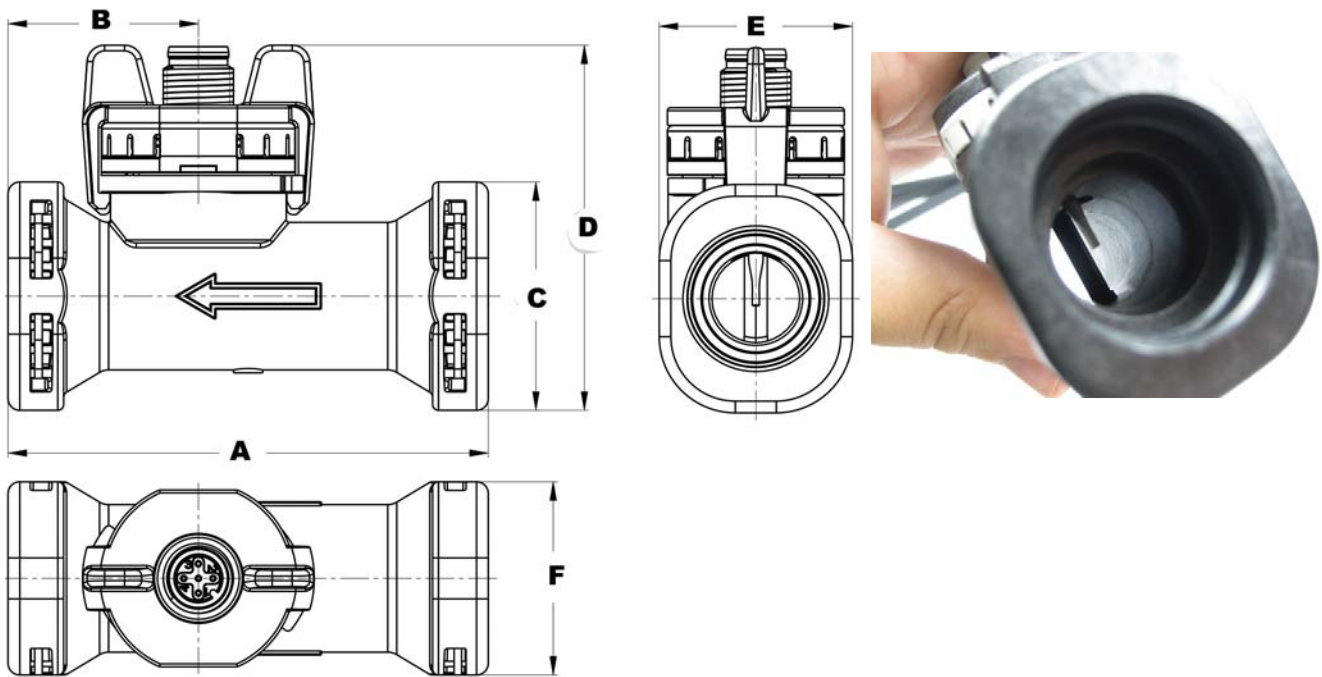


Table 4

Dimensions do not include fittings- see following tables for standard fitting offerings

Size	A inches(mm)	B inches(mm)	C inches(mm)	D inches(mm)	E inches(mm)	f inches(mm)
DN8	2.83 (72)	1.16 (29.5)	1.30 (32.9)	2.32 (59)	1.19 (30.2)	1.14 (28.9)
DN10	3.03 (77)	1.28 (32.5)	1.30 (32.9)	2.26 (57.3)	1.19 (30.2)	1.14(28.9)
DN15	3.23 (82)	1.28 (32.5)	1.54 (39)	2.46 (62.4)	1.19 (30.2)	1.30 (33)
DN20	4.13 (105)	1.55 (39.3)	1.19 (43)	2.61 (66.3)	1.19 (30.2)	1.47 (37.4)

DIMENSIONS DN 25

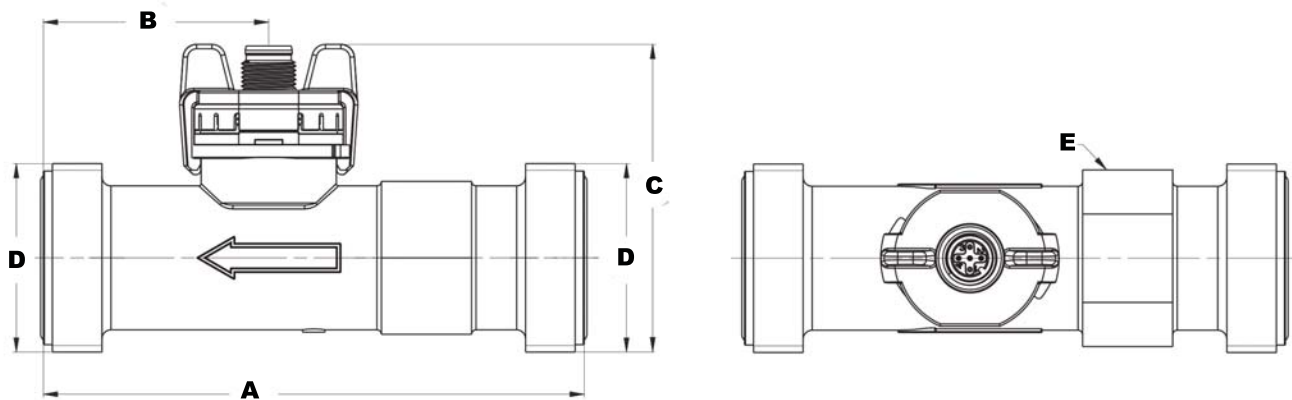


Table 5

Size	A inches(mm)	B inches(mm)	C inches(mm)	D *BSPP Male Pipe Thread	E Wrench Flat	F inches(mm)
DN25	120 (4.72)	1.97 (50)	2.69 (68.3)	G1 1/4	34 mm	1.02 (26)

Minimum Locking Torque- 2.5 Nm Maximum Locking Torque- 15 Nm

PIPING CONNECTIONS

The 210 series offers great flexibility with respect to piping connections. Inserting and removing fittings for pipe sizes to 3/4" is easy. A clip secures the end fitting to the flow sensor and an o-ring provides the seal. OEM clients may wish to produce fittings according to their own design needs.

The 1" size (DN25) has metric G1 1/4 male threads molded integral to the sensor body and is supplied with two EPDM sealing o-rings. 1" NPT 303 SS and polypropylene adaptors are available (see Table 7).

THREADED ADAPTERS

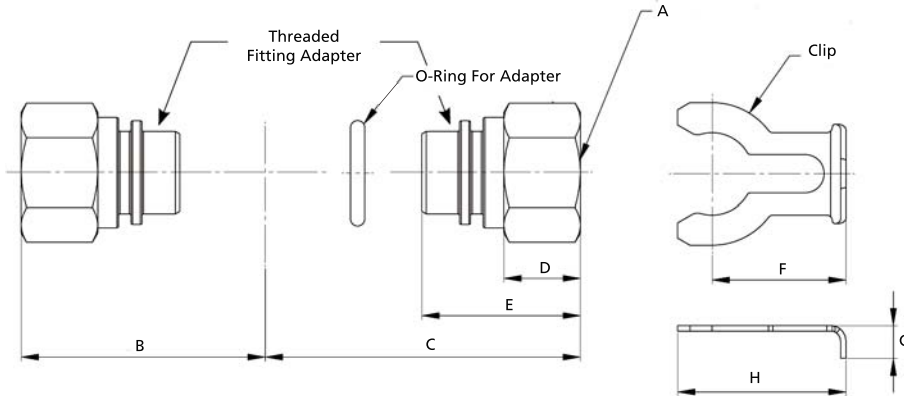


Table 6: Stainless Threaded Adapters (1/4"-3/4" NPT) & Clip Table

Size	Clip Part Number	O-Ring Part Number (Material)	Threaded Adapter Part Number	*Material	A	B inches (mm)	C inches (mm)	**D inches (mm)	E inches (mm)	F inches (mm)	g inches (mm)	H inches (mm)
DN8	C810	R810E (EPDM)	ADS1/4	303 SS	1/4" NPT	1.76 (44.65)	2.27 (57.65)	0.551 (14)	1.14(29)	0.965 (24.5)	0.236 (6)	1.21 (30.8)
DN10	C810	R810E (EPDM)	ADS3/8	303 SS	3/8" NPT	1.87 (47.55)	2.35 (59.65)	0.551 (14)	1.142 (29)	0.965 (24.5)	0.236 (6)	1.21 (30.8)
DN15	C15	R15E (EPDM)	ADS1/2	303 SS	1/2" NPT	1.97 (50.05)	2.64 (67.05)	0.646 (16.4)	1.260 (32)	1.1 (28)	0.191 (4.85)	1.36 (34.5)
DN20	C20	R20E (EPDM)	ADS3/4	303 SS	3/4" NPT	2.32 (58.85)	3.36 (85.25)	0.731(18.6)	1.499 (37.8)	1.1 (28)	0.315 (8)	1.36 (34.5)

*Contact us for other materials or details on how to make your own fittings

**The overall length of the flow sensor is increased by approximately twice this value

Table 7: Brass Solder Adapters

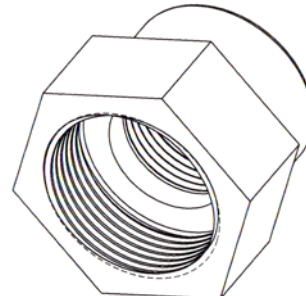
Size	Clip Part Number	O-Ring Part Number (Material)	Adapter Part Number	Material	Standard Tubing Size (For Use With Type K & Type L Copper Tubing)
DN8	C810	R810E (EPDM)	SADB1/4	360 Brass	1/4"
DN10	C810	R810E (EPDM)	SADB3/8	360 Brass	3/8"
DN15	C15	R15E (EPDM)	SADB1/2	360 Brass	1/2"
DN20	C20	R20E (EPDM)	SADB3/4	360Brass	3/4"



Table 8: DN25 BSP to NPT Adapters

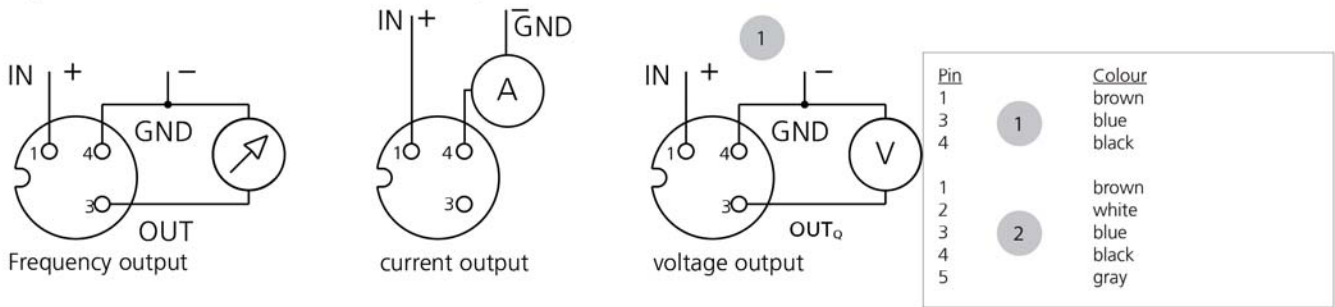
*Model	Description	Material
ADSG1NPT	Adapter G1-1/4 to 1" NPT Female	303 Stainless Steel
ADPG1NPT	Adapter G1-1/4 to 1" NPT Female	Polypropylene

* Two R25E EPDM sealing o-rings are supplied with model DN25

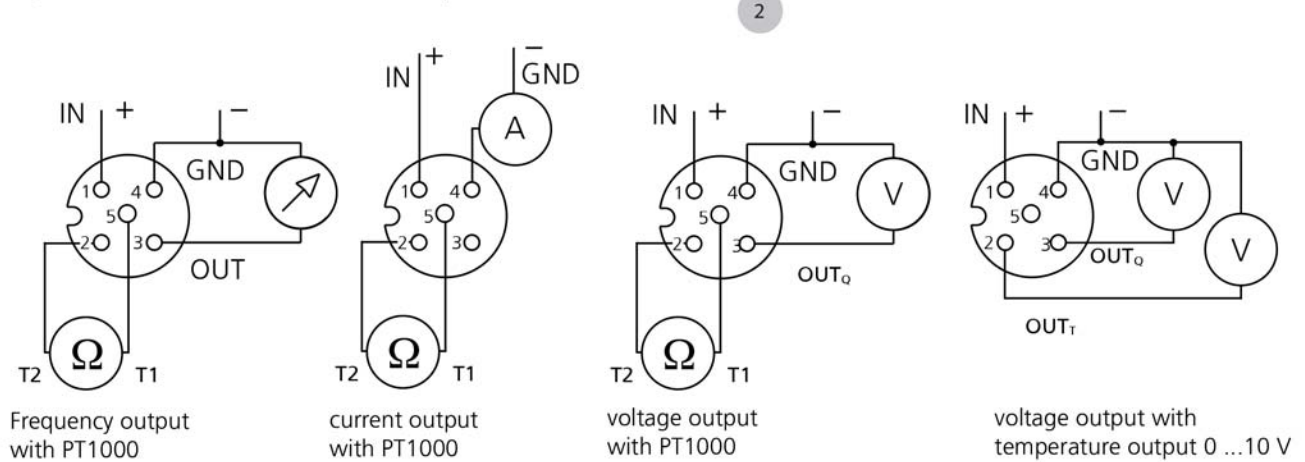


WIRING

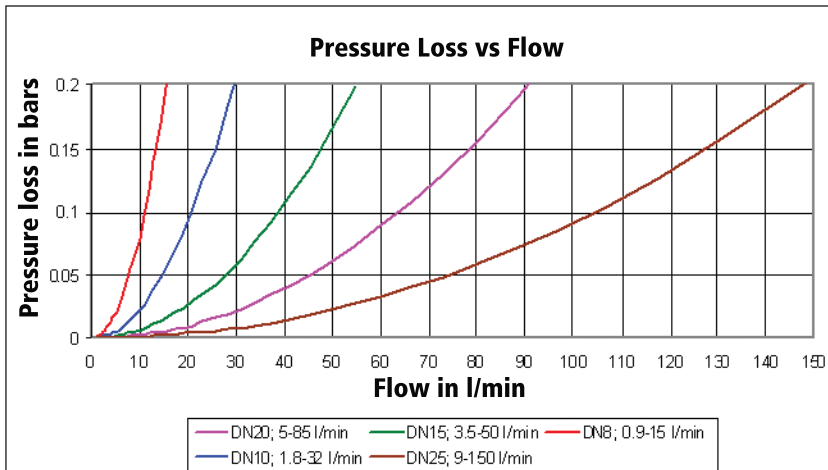
3-pole circular connection M12x1 without temperature measurement



5-pole circular connection M12x1 with temperature measurement



PRESSURE LOSS



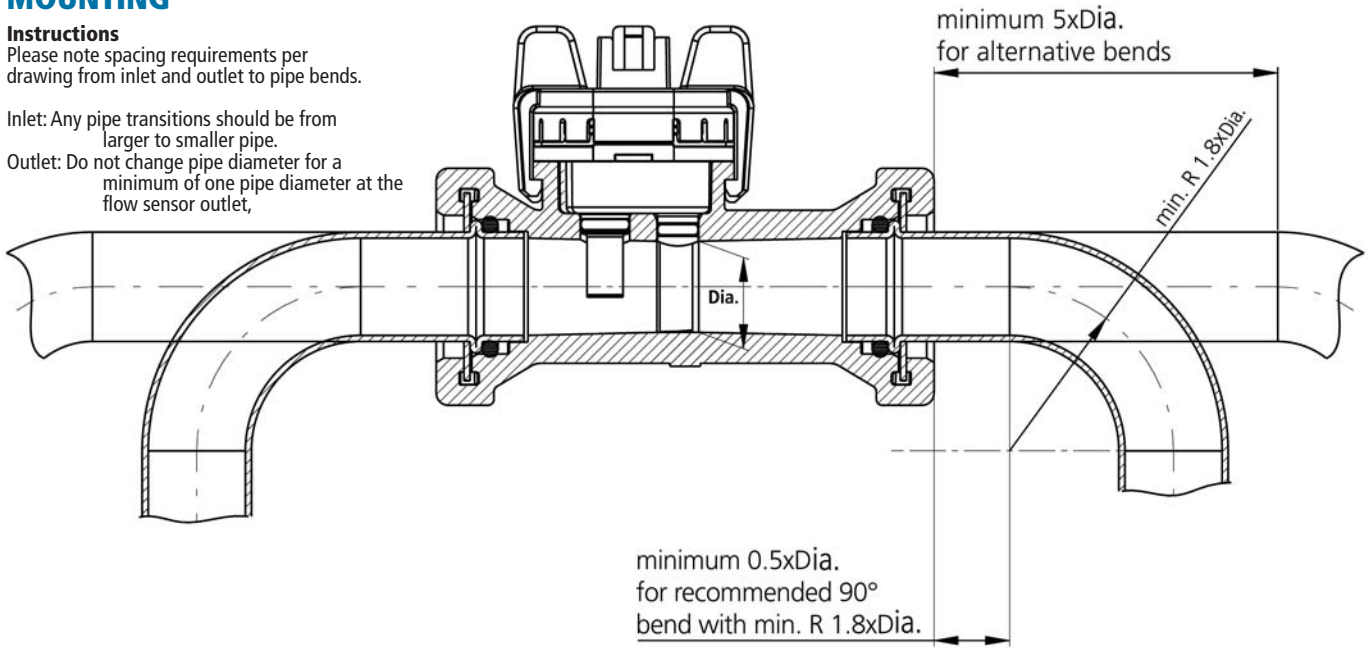
MOUNTING

Instructions

Please note spacing requirements per drawing from inlet and outlet to pipe bends.

Inlet: Any pipe transitions should be from larger to smaller pipe.

Outlet: Do not change pipe diameter for a minimum of one pipe diameter at the flow sensor outlet,



ORDERING INFORMATION

1) Order flow sensor model from table 9 -ABCDEF

Example: 21091044

2) Order End Connection adapters, O-rings and adapter clips (table 10)

A Model	B Version	C Size	D Output	E Electrical Connection	F Seal Material
210	9=Flow 8=Flow & Temperature (1000 Ohm RTD)	08=DN8 10=DN10 15=DN15 20=DN20	2=Frequency 3= 0-10V 4= 4-20 mA	4= 2 or 3 Pole M12X1 5= 4 or 5 Pole M12X1	DN8 to DN20- Order Separately from Table 10
		25=DN25			1=EPDM (Included with DN25)

Size	Connection Adapter (Two Required)	O-rings (Two Required)	Adapter Clips (Two Required)
DN8	Select from Table 6 or Table 7	Select from Table 6 or Table 7	Select from Table 6 or Table 7
DN10			
DN15			
DN20			
DN25	Select from Table 8	Two R25E o-rings supplied standard with flow sensor, adapter clips not used on this model	

Part Number	Description
Electrical	
114604	M12x1 straight circular connector, 3 pole plug with 78.7" (200 cm) cable
114564 (Replaces ECM125)	M12x1 straight circular connector, 5 pole plug with 78.7" (200 cm) cable
Fitting Clips	
C810	For DN8 and DN10
C15	For DN15
C20	For DN20
O-Rings	
R810E	EPDM, AS568-113
R15E	EPDM, AS568-909
R20E	EPDM, AS568-118
R25E	EPDM, 31 mm dia. x 3 mm wall

Part Number	Description
Connection Adapter Fittings- Threaded	
ADS1/4	Model DN8 Stainless Steel Adapter, 1/4" NPT Female
ADS3/8	Model DN10 Stainless Steel Adapter, 3/8" NPT Female
ADS1/2	Model DN15 Stainless Steel Adapter, 1/2" NPT Female
ADS3/4	Model DN20 Stainless Steel Adapter, 3/4" NPT Female
ADSG1NPT	Stainless Steel Adapter G1-1/4 to 1" NPT Female
ADPG1NPT	Polypropylene Adapter G1-1/4 to 1" NPT Female
Connection Adapter Fittings- Soldered	
SADB1/4	Model DN8 to 1/4" copper tubing
SADB3/8	Model DN10 to 3/8" copper tubing
SADB1/2	Model DN15 to 1/2" copper tubing
SADB3/4	Model DN20 to 3/4" copper tubing