CLARK

200 Series Vortex Flow Transmitter

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

DESCRIPTION

The series 200 vortex flow transmitters are designed with equipment manufacturers in mind and are an excellent economical choice for system flow monitoring and control.

The transmitters work on the principle of Kármáns vortex trail, named after Theodore von Kármán's mathematical description of the phenomenon. Vortex shedding flowmeters present the flow in a pipe with an obstruction/bluff in the flowmeter body. As velocity increases, alternating vortices are formed on each side of the bluff body and travel downstream.

The 200 series utilize piezoelectric sensors embedded in a ETFE vane located downstream of the bluff to detect the generated vortices. The frequency measured represents the flow velocity. A flow factor is provided to convert frequency to volume flow rate for each model size.

The minimum measured flow rate is dependent on the viscosity of the fluid.

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

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**

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 2.
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° to185°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 supply: 5 VDC (4.75 to 5.25)
Output: Square pulse frequency 0 / 5 VDC (The signal frequency depends on the nominal diameter, see order
Signal amplitude at U_{IN}=5.0 V:
Load > 10 kOhm against IN < 0.1 … 5.0 V
Current consumption: < 4 mA
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: Mechanically protected
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 5, 6 & 7 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 2- Models

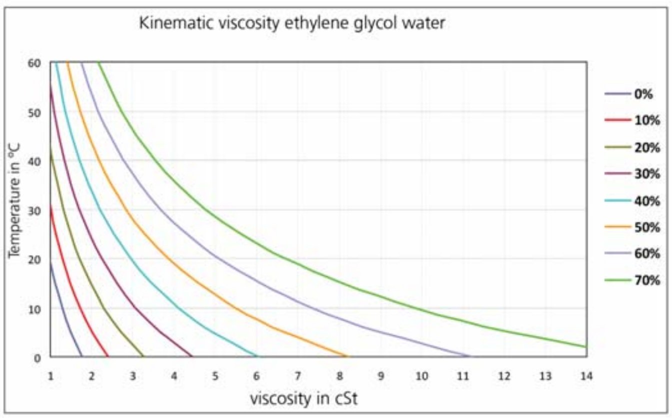
Size	Pipe Size	Full Scale Range (Gal/min)	Full Scale Range (l/min)	Approximate Frequency Range (Hz)	Calibration Factor/Formula Q= volume flow in LPM f=Hz	Approx, Weight
DN8	1/4"	0.238 to 3.96	0.9 to 15.0	31 to 399	Q= 0.0383*f-0.3	0.1 lbs (47g)
DN10	3/8"	0.476 to 8.45	1.8 to 32.0	24 to 383	Q= 0.0841*f-0.2	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)

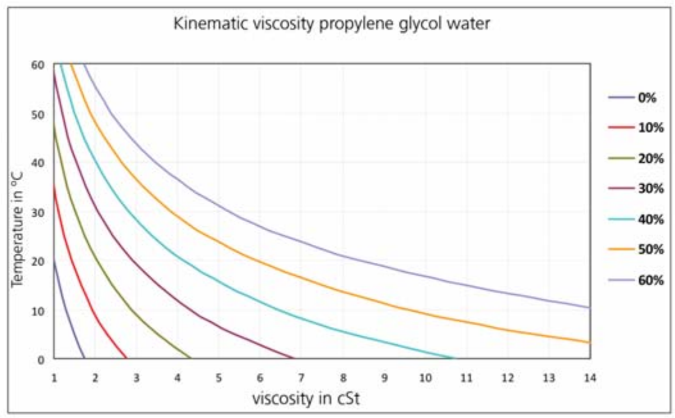
Characteristic line Formulas:

Frequency Output- $Q_v=K_f*f+Q_o$
Quantity per Pulse (liters/pulse)- Quantity/Pulse= $Q_v*Kf/60*(Q_v-Q_o)$
Current Output- $Qv=K_1*(I_{out}-4\text{ mA})$
Voltage Output- $Qv=K_u*U_{out}$

Q_v	Volume Flow Rate	[l/min]
Q_o	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

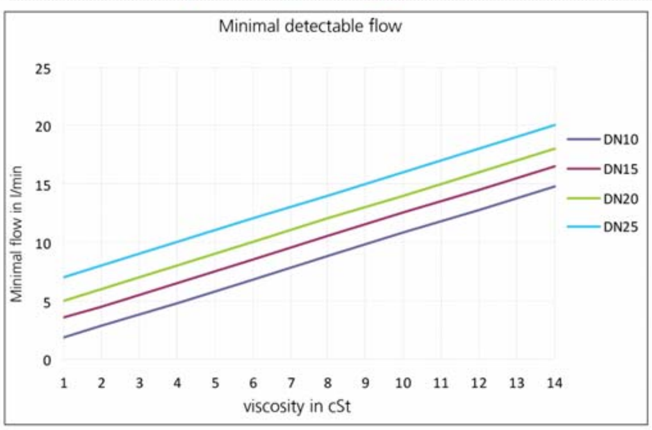
Influence of Glycol: Following definitions correct the influence of media with higher viscosity than water (media viscosity (v) > 1.8 cST. Corrections result in measuring accuracy of 3% FS in range of 1.8-4 cST & 4% FS in the range of 4-14 cST.

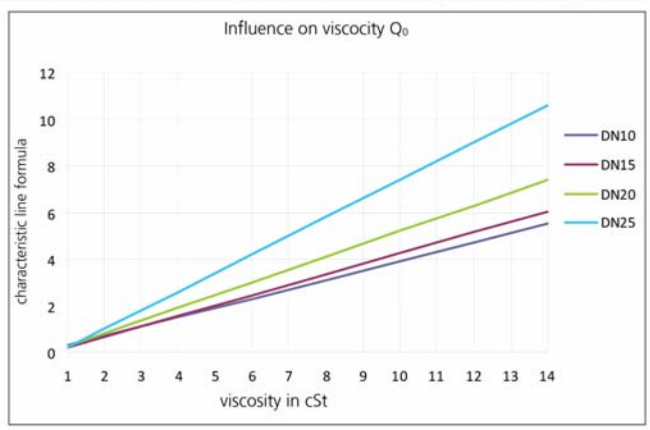




Definition of respond threshold Q_{min}

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 > Qmin 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 mA) - 0.40v + 0.40
DN15: Q = 3.125 * (I - 4 mA) - 0.45v + 0.45
DN20: Q = 5.313 * (I - 4 mA) - 0.55v + 0.55
DN25: Q = 9.375 * (I - 4 mA) - 0.80v + 0.80

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DIMENSIONS DN 8, 10, 15, 20

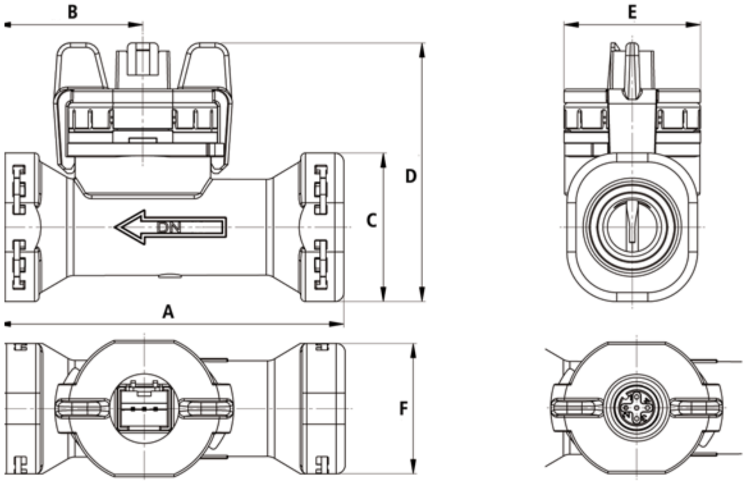


Table 3

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

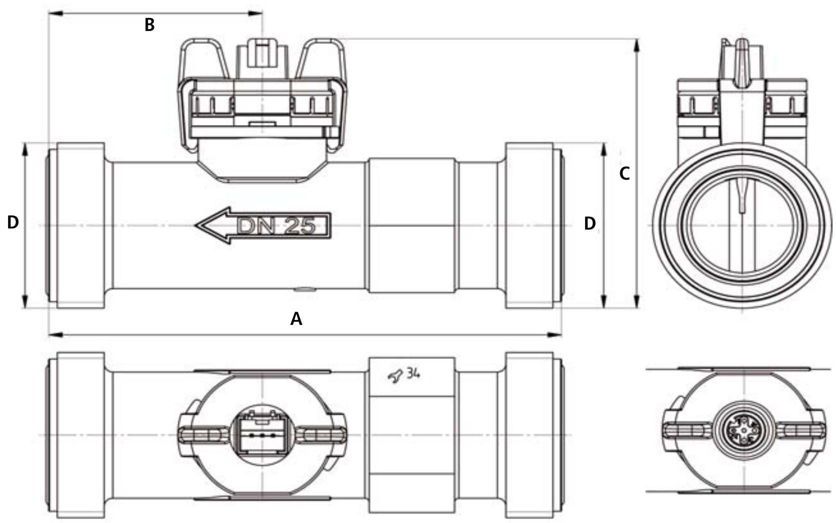


Table 4

Size	A inches(mm)	B inches(mm)	C inches(mm)	D BSPP Male Pipe Thread
DN25	120 (4.72)	1.97 (50)	2.69 (68.3)	G1 1/4

PIPING CONNECTIONS

The 200 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 model (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

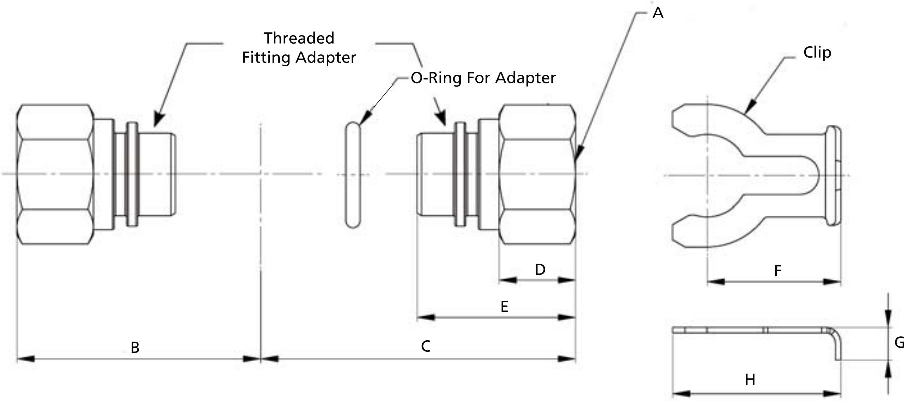


Table 5: Stainless Threaded Adapters (1/4”-3/4” NPT) & Clip Table

Sizel	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)

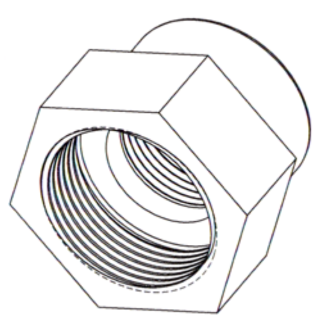
*Contact us for other materials or details on how to make your own fittings
**The overall length of the flow sensor is increased by approximately twice this value

Table 6: 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”

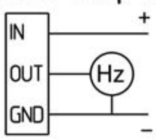
Table 7: DN25 BSP to NPT Adapters

*Size	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		

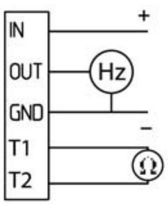


WIRING

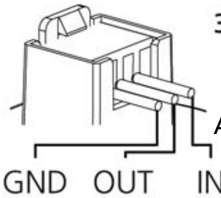
Without RTD Temp Sensor



Install a 10K Pull-up Resistor
Between “in” & “OUT”

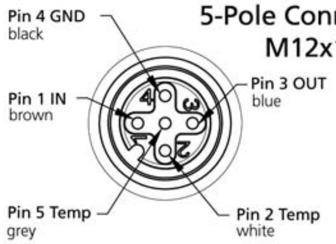


With RTD Temp Sensor

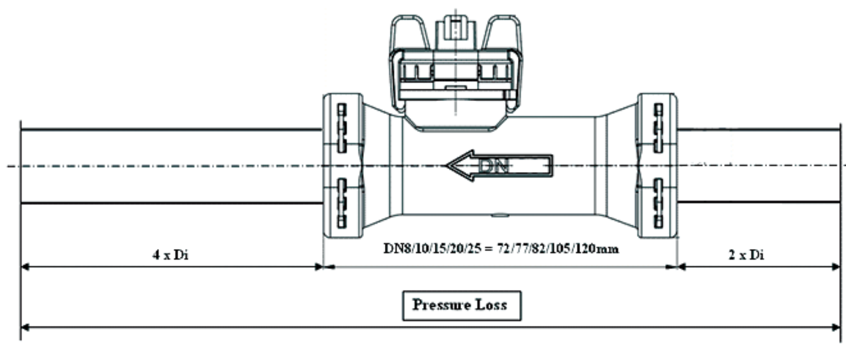


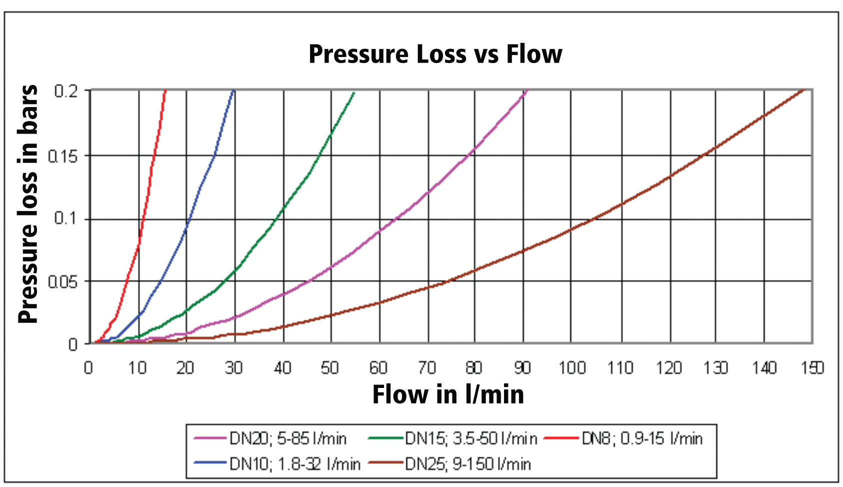
3-Pole Connector
RAST 2.5 mm
Male Connector:
Amp Duoplug 2.5

5-Pole Connector
M12x1



PRESSURE LOSS

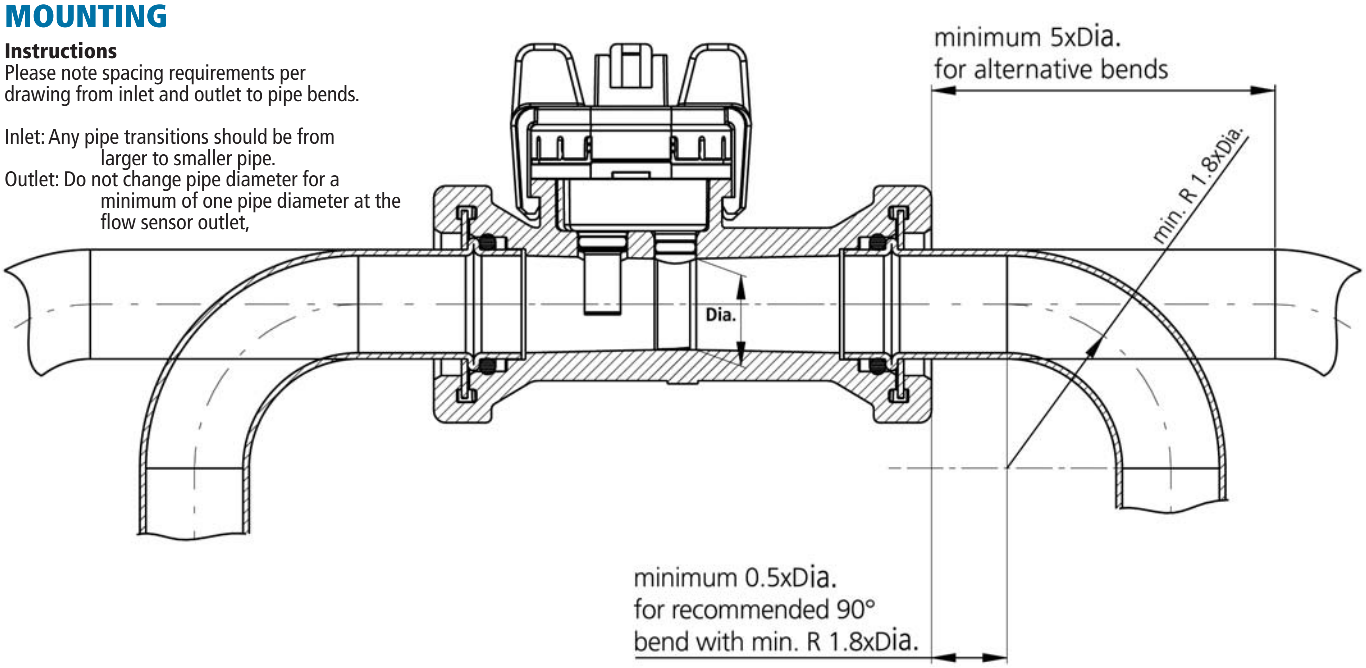




MOUNTING

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 7 -ABCDEF
Example: 20091000

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

Table 8	Flow Sensor Order Table			
A Model	**B Version**	**C Size**	**E Electrical Connection**	**F Seal Material**
200	9=Flow 8=Flow & Temperature (1000 Ohm RTD)	08=DN8 10=DN10 15=DN15 20=DN20	00=3-Pole RAST 2.5 14= 3-Pole M12X1 circular connector 15= 5-Pole M12X1 circular connector	DN8 to DN20- Order Separately from Table 9
		25=DN25		1=EPDM (Included with DN25)

Table 9	Flow Sensor End Connections Order Table		
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	

Table 10	Component Parts
Part Number	**Description**
	Electrical
111668	Amp Duoplug 2.5, 3-pole plug with 11.80" (30 cm) cable (Old Part Number ECAD2.530)
101817	Amp Duoplug 2.5, 3-pole plug with 43.3" (110 cm) cable (Old Part Number ECAD2.5110)
114605	M12x1 straight circular connector, 3-pole plug with 78.7" (200 cm) cable
114564	M12x1 straight circular connector, 5-pole plug with 78.7" (200 cm) cable (Old Part Number ECM125)
	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

Component Parts	
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 Adpter 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
	O-Rings
R810E	EPDM, AS568-113
R15E	EPDM, AS568-909
R20E	EPDM, AS568-118
R25E	EPDM, 31 mm dia. x 3 mm wall