

# FioSonic

Industrial metering



**TECHNICAL BROCHURE**

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FioSonic\_technicalbrochure\_USA\_revD

**www.f Fiorentini.com**

# Who we are

We are a Global organization specialized in designing and manufacturing technologically advanced solutions for natural gas treatment, transmission and distribution systems.

We are the ideal partner for operators in the Oil & Gas sector, with a business offer that goes across the whole natural gas chain.

We are in constant evolution to meet our customers' highest expectations in terms of quality and reliability.

Our aim is to be a step ahead of the competition, with customized technologies and an after-sale service program undertaken with the highest grade of professionalism.



## Pietro Fiorentini advantages



Localised technical support



Experience since 1940

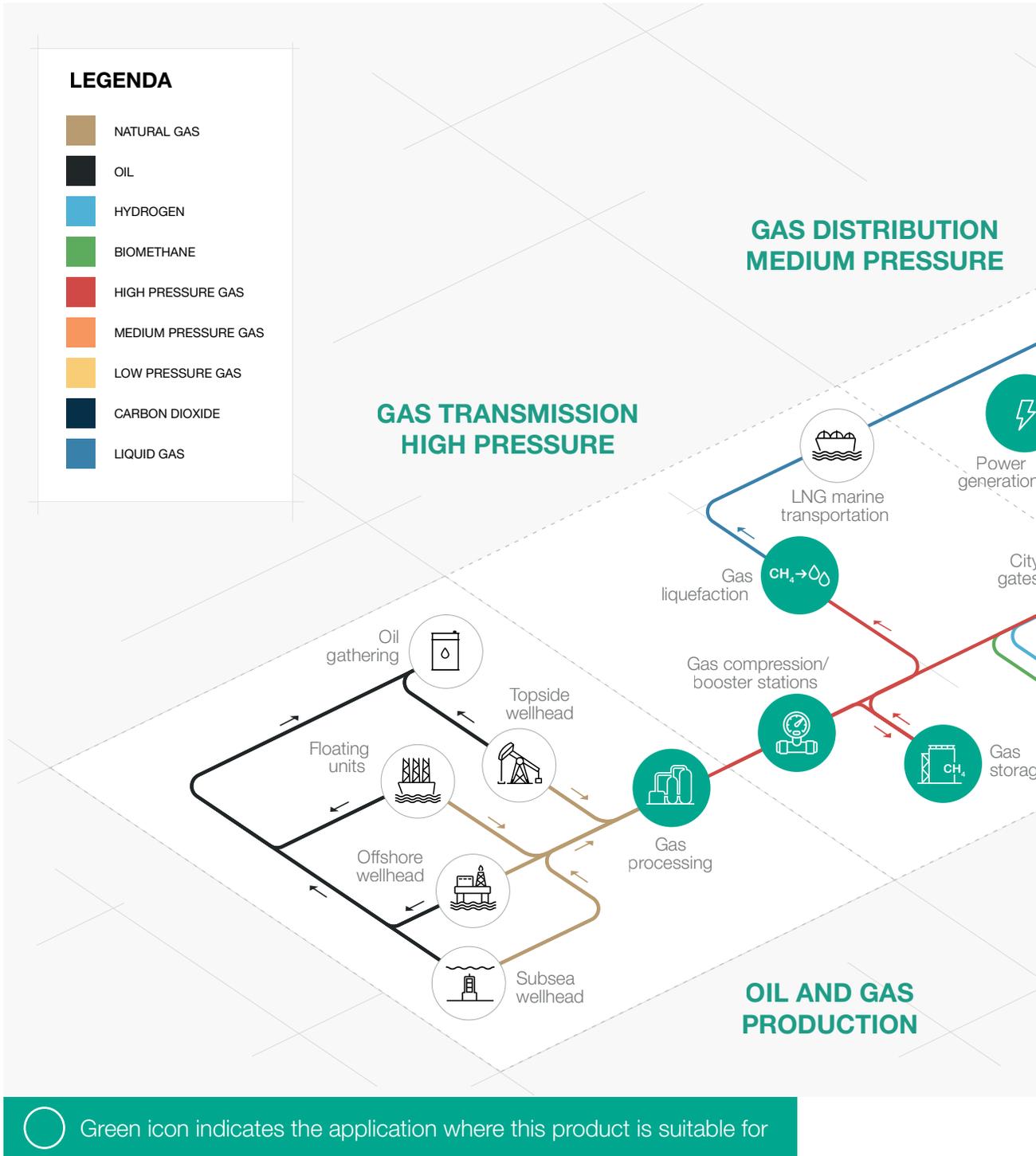


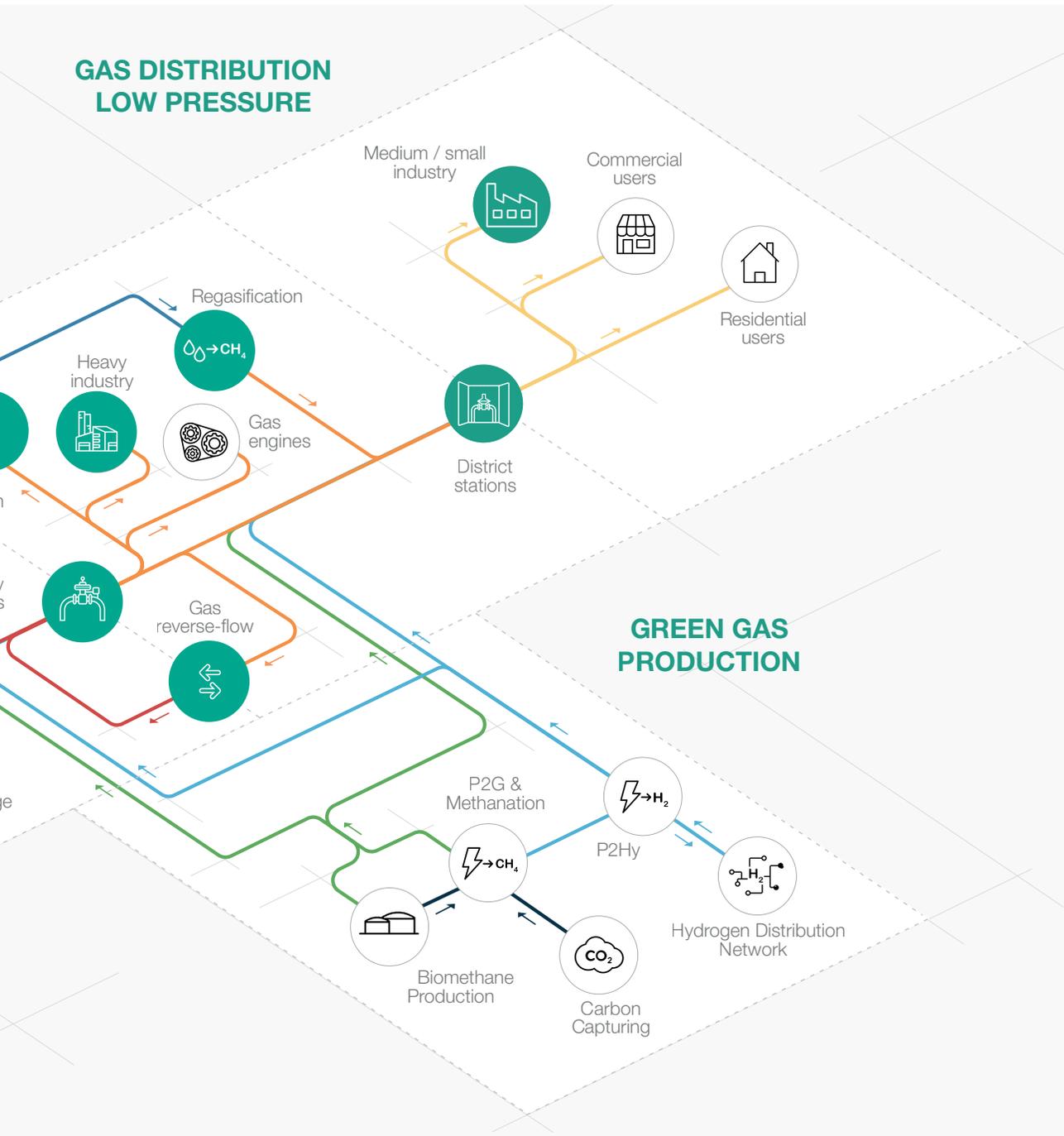
We operate in over 100 countries

# Area of Application

## LEGENDA

- NATURAL GAS
- OIL
- HYDROGEN
- BIOMETHANE
- HIGH PRESSURE GAS
- MEDIUM PRESSURE GAS
- LOW PRESSURE GAS
- CARBON DIOXIDE
- LIQUID GAS





**Figure 1** Area of Application Map

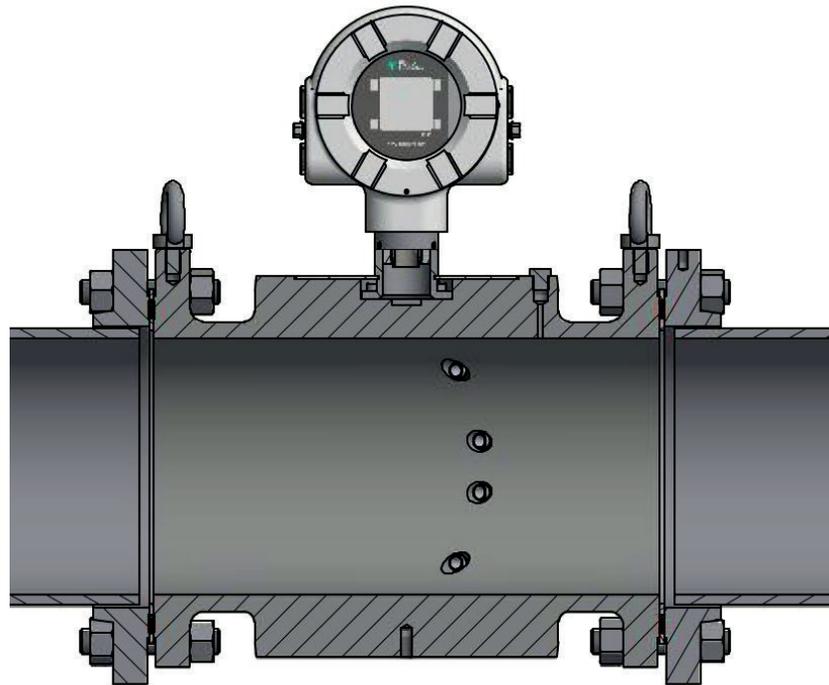


# Introduction

**FioSonic** is the natural evolution of the Pietro Fiorentini know-how and experience in the gas industry.

With its multi path-chordal ultrasonic technology FioSonic provides real time diagnostics high accuracy and redundancy for custody transfer gas flow measurement.

This device is mainly used for high-pressure transmission systems, power plants, heavy industry and for medium - low pressure natural gas distribution networks up to **1.479 psi(g)** of pipeline operating pressure.



**Figure 2** FioSonic - Ultrasonic Gas Flow Meter

# Features

**FioSonic** Series standard product has four paths.

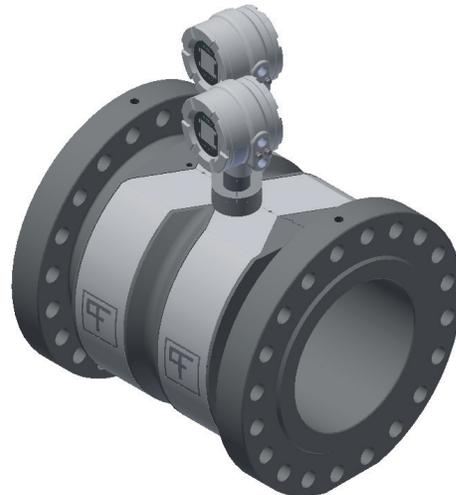
This design guarantees stable accurate flow reading over the full range of flow, pressures and gas compositions.

The BCW (Broadband Continuous Wave) signal processing allows more than one path to be interrogated simultaneously avoiding the slow response typical of first generations of ultrasonic meters.

**FioSonic** transducers frequency is from 100-250 kHz depending on the meter's size to guarantee the best performances.



**Figure 3** FioSonic



**Figure 4** FioSonic BX

## Natural Gas blended with Hydrogen

The **FioSonic** is suitable for use with Natural Gas with up to 30% of Hydrogen blending.

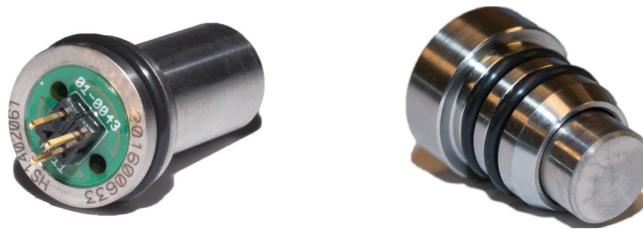


## Titanium transducers

The titanium ultrasonic sensors are remarkably efficient and coupled with the BCW (Broadband Continuous Wave) processing make the meter resistant to acoustic noise such as valve noise which has been the bane of other ultrasonic meters.

The design of the ultrasonic transducers allow them to operate at the very low transmitting voltage of 3.6V compared to tens or even hundreds of volts required by other manufacturers.

All wetted surfaces are metallic to provide the best resistance against the harshest conditions.



**Figure 5** Ultrasonic Transducers

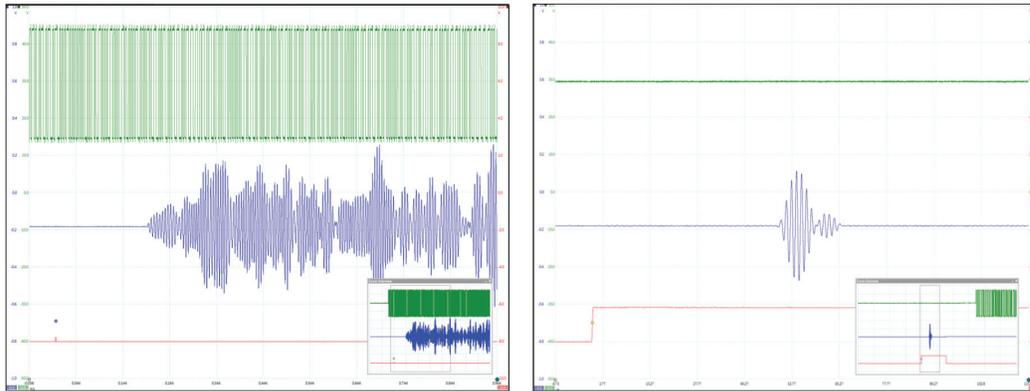
## BCW - Broadband Continuous Wave signal processing

Most ultrasonic flow meters transmit a short burst of ultrasonic energy consisting of between one and four pulses or cycles.

A few ultrasonic meters use a short code typically much less than 100 cycles.

The **FioSonic** flow meter transmits many thousands of cycles in an almost continuous stream of encoded pulses. At the receiver the signal is decoded in real time to reconstruct it in a way that is precise and resistant to signal noise and interferences.

The BCW (Broadband Continuous Wave) system allows transmission of two or more paths at the same time without interferences. Simultaneous transmission means a shorter response time and a better performance in fluctuating or pulsating flow conditions.



**Figure 6** - Left: Encoded Transmitted Signal (green) and received signal (blue)  
Right: Decoded receive signal (blue)

## Simplified design

Having all on-board electronics on a single circuit board FioSonic allow an easy and fast maintenance, and at the same time is characterized by a clean and essential design.



**Figure 7** On-board electronics



## Additional boards

### Extended I/O board

The **FioSonic** Series comes standard with the Pulse/Frequency output an USB port (for commissioning and maintenance during field operations), and a board that provides both an RS485 serial port and two isolated pulse outputs.

Optional I/O boards can instead provide a P&T input or a 4-20 mA output.

### Pressure and temperature input board

For applications requiring integrated volume conversion the FioSonic flowmeter is capable of interfacing directly with pressure and temperature sensors. The standard volume flow is calculated using the traditional volume conversion equations using fixed parameters for gas composition.

## Flow computer connectivity

**FioSonic** meter can be connected to all major flow computer brands available in the market either with pulses or serial line (Modbus protocol).

### Environmental Protection

The **FioSonic** Series epoxy coated aluminum alloy electronic housing rated to IP66/ NEMA 4X is designed to be used outdoor in almost any environment.

The ambient operating temperature covers the range **-40°F to +140°F** (-40°C to +60°C). The ultrasonic sensors have all titanium wetted surfaces and are designed for process gas temperature from **-40°F to +158°F** (-40°C to +70°C).

### Intrinsically Safe Design

The FioSonic has a fully Intrinsically Safe design (Exia) for both transducers and electronic board components.

This design increases safety and allows for easier maintenance.

### Diagnostic and performance monitoring

**FioSonic** provides extensive diagnostic information both on the graphic display screen and remotely via the FioSonic Management Software (FMS).

Flow information and diagnostics may be logged over time to show trends and enabling real time condition monitoring.

The velocity profile is a function of the upstream pipework. By calculating velocity ratios between the ultrasonic paths a good indication of the flow profile is realized. The flow meter calculates Profile and Symmetry Factors which can be used for condition monitoring of the measurement and the gas flow. In addition the FioSonic flow meter provides diagnostics for turbulence by means of the standard deviation of the instantaneous path velocity measurements.

The standard deviation provides an excellent diagnostic for turbulence fluctuations and may serve as an indicator of upstream disturbances. Additional meter diagnostics such as speed of sound signal-to-noise ratio and signal strength are available to the user as well.

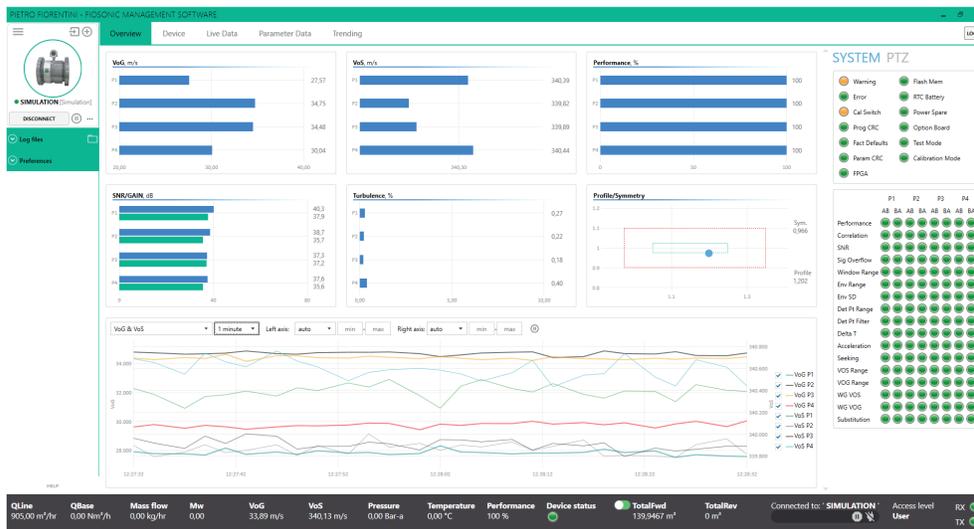


Figure 8 Diagnostic Information



## FioSonic competitive advantages

-  Titanium transducers for long durability
-  BCW (Broadband Continuous Wave)
-  Low voltage sensors
-  Easy maintenance
-  No moving parts
-  30% Hydrogen blending compatible.
-  1:160 High rangeability
-  Metallic wetted parts
-  Uni or Bi-directional Flow measurements

## Features

Features	Values
Flow rates	<b>from 318 cfh to 1.543.200 cfh</b> from 9 m <sup>3</sup> /h to 43.698 m <sup>3</sup> /h
Design pressure	<b>up to 1.479 psi(g)</b> up to 102 bar(g)
Ambient temperature range	<b>from -40°F to +140°F</b> from -40°C to +60°C
Gas temperature range	<b>from -40°F to +158°F</b> from -40°C to +70°C
Accuracy for fiscal use (OIML R137-1) or no fiscal use	<b>Class 0.5</b> Q <sub>min</sub> ≤ Q < Q <sub>t</sub> ±1% & Q <sub>t</sub> ≤ Q ≤ Q <sub>max</sub> ±0.5% <b>Class 1</b> Q <sub>min</sub> ≤ Q < Q <sub>t</sub> ±2% & Q <sub>t</sub> ≤ Q ≤ Q <sub>max</sub> ±1%
Rangeability	up to 1:100
Repeatability	better than 0.1%
Index Protection	IP 66 /NEMA 4X
Environment class	M2/E2
Power supply	14 - 29 V DC
Explosion proof protection	ATEX - Ex IIG Ex ia IIC T4 Ga IECEX - Ex ia IIC T4 Ga cQPSus - Class 1 Div.1 Gr. ABCD T4-T1(Ex ia IIC T4-T12 Ga)
Nominal dimensions DN	<b>from 3" (DN80) to 30" (DN750)</b>
Connections	ANSI 150 – ANSI300 – ANSI600 RF/RTJ flange finish according to ASME B 16.5

**Table 1** Features

## FioSonic for Custody Transfer Flow Metering: four paths for enhanced accuracy and reliability

The FioSonic model “FSN-4P” has four paths. It has been designed and certified to meet the international standards for custody transfer metering.

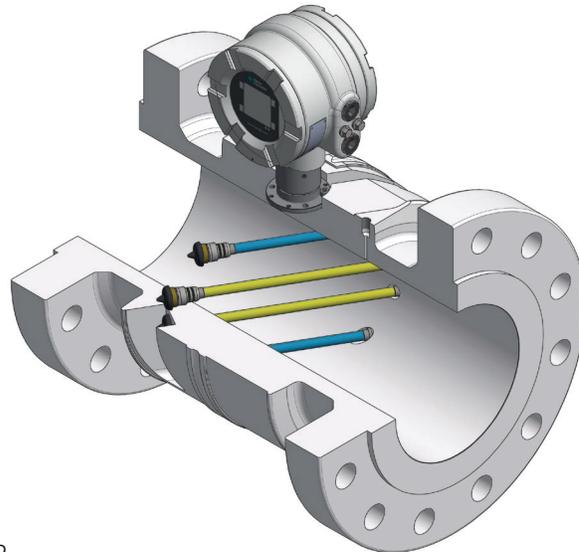
Available from **3”** (DN80) to **30”** (DN750)

The integration of the flow across the paths provides accurate measurement even with varying flow profiles caused by changes in flow velocity, gas composition and pressure or upstream pipe configuration.

Fast response is maintained by the simultaneous transmission on more than one path using BCW (Broadband Continuous Wave) processing.

The measured flow profile provides a diagnostic tool.

Should one path fail the Path Substitution Algorithm uses historical flow data to continue reliable flow measurements until the path recovers or remediation action is taken.



**Figure 9** FioSonic-FSN-4P



## FioSonic for redundant measurements applications

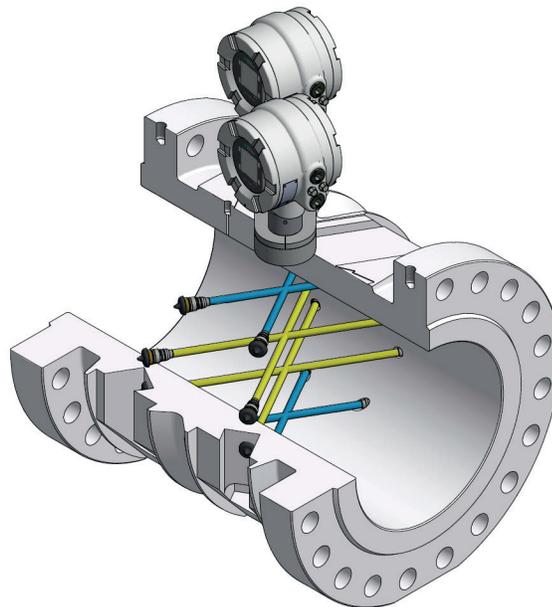
FioSonic BX model consists of two fully independent measurement systems (two electronic heads) integrated into one meter body. This solution is remarkably compact and cost effective.

Available from **8"** (DN200) to **30"** (DN750).

The meter can have 2 configurations:

- FioSonic BX model "**FSN-BX-4P-4P**" where both metering systems have 4 paths each. This solution is suitable for redundant Custody Transfer metering line.
- FioSonic BX model "**FSN-BX-4P-3P**" where 1 metering system has 4 paths and 1 has 3 paths. This solution is suitable for only 1 Custody Transfer metering line with the second simply as a check.

Each metering system works independently without any signal synchronization maintaining the full range of versatile I/O.



**Figure 10** FioSonic-BX-4P-4P

# Materials and Approvals

Part	Material
Body	Carbon steel ASTM A350 LF2 Cl.1
Electronic enclosure	Epoxy painted low copper aluminum alloy Stainless Steel 316 (on request)
Transducers	Titanium ASTM B348 Ti GR.2
Body painting	According to ISO12944-5 minimum Class C3 H (RAL9006 Grey)

**Table 2** Materials

## Construction Standards and Approvals

The **FioSonic** is designed to meet AGA report N.9 and ISO 17089-1 requirements.



AGA9



ISO17089-1

The product is certified according to European Directives 2014/68/EU (PED) as well as 2014/32/EU (MID), 2014/34/EU (ATEX), - International Organization of Legal Metrology OIML R137 – 1 - International Electrotechnical Commission IECEx – QPS Evaluation Service (Canada – USA) cQPSus.



PED



MID



ATEX



OIML  
R137-1



IECEx



cQPSus



# Working pressure sizing chart

To choose the suitable working pressure range for each FioSonic size, it is mandatory to refer to the green cells in the Table 3. The models in the red cells are not usable.

Pressure range psi(g)	DN80 3"	DN100 4"	DN150 6"	DN200 8"	DN250 10"	DN300 12"
from 0 to 14.5						
from 14.5 to 43.5						
from 43.5 to 101.5						
from 101.5 to →						

Pressure range psi(g)	DN350 14"	DN400 16"	DN450 18"	DN500 20"	DN600 24"	DN750 30"
from 0 to 14.5						
from 14.5 to 43.5						
from 43.5 to 101.5						
from 101.5 to →						

**Table 3** Working pressure sizing chart

# Capacity table

## Accuracy Class 0,5

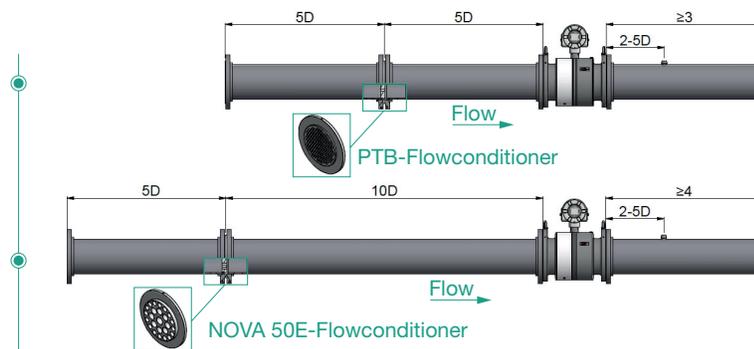
- Custody Transfer measurement with OIML R137-1 certification
- No Custody Transfer measurement

Class 0.5 FioSonic 4P Capacity table [pipe configuration 1 or 2]									
Nominal size		Pipe schedule	Capacity						
			Qmin		Qt		Q max		Turndown
Inches	DN	SCH	m3/h	cfh	m3/h	cfh	m3/h	cfh	
3"	80	STD	9	318	60	2.119	601	21.224	66
4"	100	STD	15	530	99	3.496	991	34.996	75
6"	150	STD	27	954	201	7.094	2.014	71.124	100
8"	200	STD	35	1.236	348	12.284	3.485	123.072	100
10"	250	STD	55	1.942	549	19.384	5.494	194.000	100
12"	300	STD	78	2.755	779	27.494	7.798	275.400	100
14"	350	STD	95	3.356	951	33.566	9.518	335.810	100
16"	400	STD	123	4.344	1.231	43.469	12.313	434.614	100
18"	450	STD	163	5.752	1.626	57.414	16.265	574.393	100
20"	500	STD	194	6.852	1.936	68.361	19.366	684.900	97
24"	600	STD	296	10.441	2.863	101.001	28.634	1.011.192	93
30"	750	STD	468	16.511	4.369	154.289	43.698	1.543.174	97

Table 4 Capacity and rangeability table

1 PTB flow conditioner piping configuration

2 NOVA 50E flow conditioner piping configuration





# Capacity table

## Accuracy Class 1

- - Custody Transfer measurement with OIML R137-1 certification
- No Custody Transfer measurement

**Class 1** FioSonic 4P Capacity table (spool pipes configuration 1 or 2 or 3)

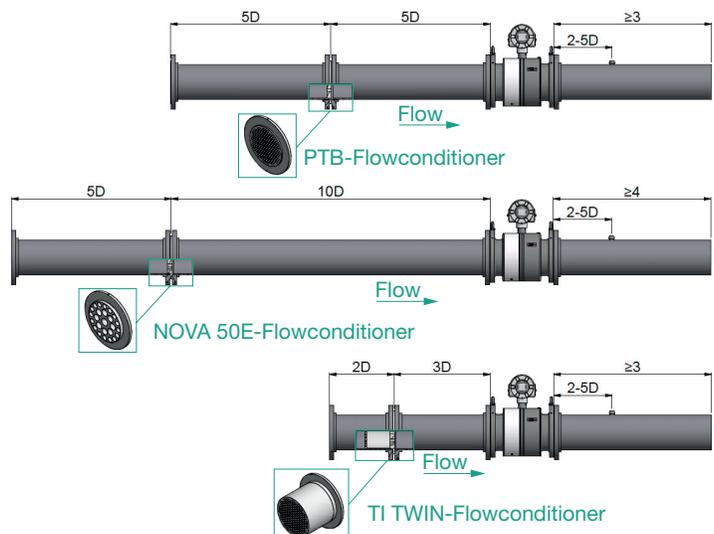
Nominal size		Pipe schedule	Capacity						
			Qmin		Qt		Q max		Turndown
Inches	DN	SCH	m3/h	cfh	m3/h	cfh	m3/h	cfh	1:X
3"	80	STD	9	318	60	2.119	601	21.224	66
4"	100	STD	15	530	99	3.496	991	34.996	66
6"	150	STD	27	954	201	7.094	2.014	71.124	75
8"	200	STD	35	1.236	348	12.284	3.485	123.072	100
10"	250	STD	55	1.942	549	19.384	5.494	194.000	100
12"	300	STD	78	2.755	779	27.494	7.798	275.400	100
14"	350	STD	95	3.356	951	33.566	9.518	335.810	100
16"	400	STD	123	4.344	1.231	43.469	12.313	434.614	100
18"	450	STD	163	5.752	1.626	57.414	16.265	574.393	100
20"	500	STD	194	6.852	1.936	68.361	19.366	684.900	100
24"	600	STD	296	10.441	2.863	101.001	28.634	1.011.192	97
30"	750	STD	468	16.511	4.369	154.289	43.698	1.543.174	93

**Table 5** Capacity and rangeability table

**1** PTB flow conditioner piping configuration

**2** NOVA 50E flow conditioner piping configuration

**3** TI TWIN flow conditioner piping configuration



# Flow Conditioner

**FioSonic** flow conditioner is selected according to target accuracy, piping configuration constrains and certification required between the below 3 models.

It is mandatory for Custody Transfer and No Custody Transfer measurements.

To choose the suitable type of flow conditioner for each FioSonic size, it's mandatory to use the models in the green cells of the following table 6.

The models in the red cells are not usable.

Flow Conditioner	DN80 3"	DN100 4"	DN150 6"	DN200 8"	DN250 10"	DN300 12"
NOVA 50E						
PTB						
TI-TWIN						

Flow Conditioner	DN350 14"	DN400 16"	DN450 18"	DN500 20"	DN600 24"	DN750 30"
Nova 50E						
PTB						
TI-TWIN						

**Table 6** Flow Conditioner table



**Figure 11** FioSonic flow conditioner



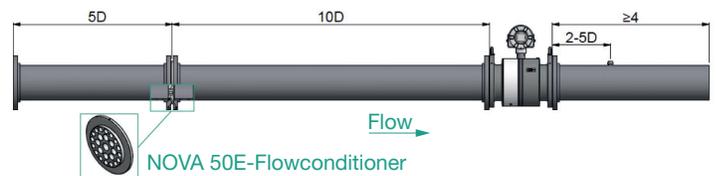
# Flow Conditioner Pipes Configuration

FioSonic flow conditioner installation require the inlet/outlet pipes configuration (spool) indicated in the figure 12.

## NOVA 50E Flow conditioner pipes configuration

Suitable for FioSonic from DN80 (3") up to DN750 (30") and certified:

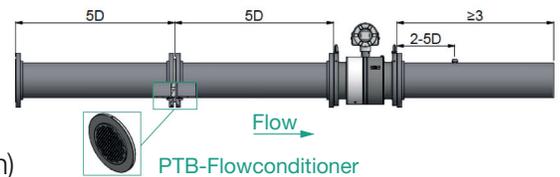
- Accuracy Class 0.5 and Class 1
- Require as minimum lengths:
- Upstream piping:  $5D + \text{NOVA50E} + 10D$
- Between flow conditioner and meter:  $10D$  (fixed length)
- Downstream piping:  $\leq 4D$



## PTB Flow conditioner pipes configuration

Suitable for FioSonic from DN80 (3") up to DN200 (8") and certified:

- Accuracy Class 0.5 and Class 1
- Require as minimum lengths:
- Upstream piping:  $5D + \text{PTB} + 5D$
- Between flow conditioner and meter:  $5D$  (fixed length)
- Downstream piping:  $\leq 3D$



## TI-TWIN Flow conditioner pipes configuration

Suitable for FioSonic from DN80 (3") up to DN150 (6") and certified

- Accuracy Class 1
- Require as minimum lengths:
- Upstream piping:  $2D + \text{TI-TWIN} + 3D$
- Between flow conditioner and meter:  $3D$  (fixed length)
- Downstream piping:  $\leq 3D$

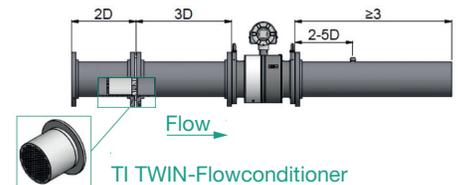


Figure 12 FioSonic flow conditioner pipes configuration

# Accessories

## For the electronic:

- Passive output board 4-20 mA (HART)
- P&T Pressure and Temperature sensors input board
- Electronic housing in Stainless Steel SS316

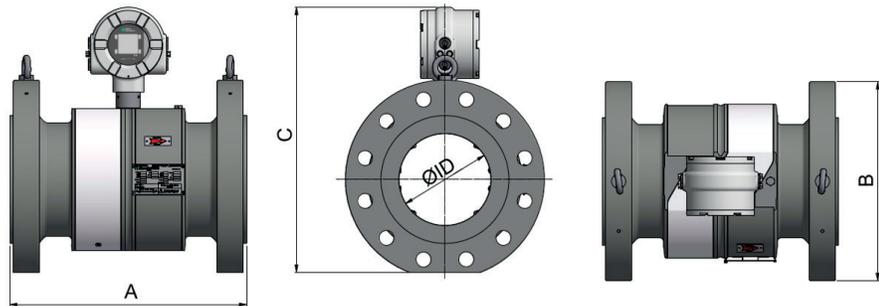
## For the meter:

- Electrical power supply panel
- Flow straightener
- Spool pipes kit
- Safety barriers / isolating repeater
- Temperature and pressure sensors



# Weights and Dimensions

## FioSonic



**Figure 13** FioSonic dimensions

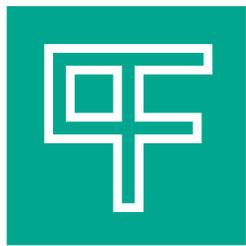
Below table shows the minimum standard FioSonic dimensions. Different dimensions can be customized according to Customer's need.

## Nominal size table

ØID Nominal Size inches   [DN]	Rating [ANSI]   PN	A-Length [mm]   inches	B-Width [mm]   inches	C-Height [mm]   inches	Weight [Kg]   lbs
3"   DN80	ANSI 150   PN 16	350   13.78	210   8.27	430   16.93	55   121
	ANSI 300	350   13.78	210   8.27	430   16.93	60   132
	ANSI 600	350   13.78	210   8.27	430   16.93	65   143
4"   DN100	ANSI 150   PN 16	400   15.75	275   10.83	500   16.69	70   154
	ANSI 300	400   15.75	275   10.83	500   16.69	80   176
	ANSI 600	400   15.75	275   10.83	500   16.69	90   198
6"   DN150	ANSI 150   PN 16	400   15.75	355   13.98	570   22.44	88   194
	ANSI 300	400   15.75	355   13.98	570   22.44	106   234
	ANSI 600	400   15.75	355   13.98	570   22.44	130   287

NOMINAL SIZE TABLE						
ØID Nominal Size inches   [DN]	Rating [ANSI]   PN	A-Length [mm]   inches	B-Width [mm]   inches	C-Height [mm]   inches	Weight [Kg]   lbs	
8"   DN200	ANSI 150   PN 16	500   <b>19.69</b>	420   <b>16.54</b>	620   <b>24.41</b>	130   <b>287</b>	
	ANSI 300	500   <b>19.69</b>	420   <b>16.54</b>	620   <b>24.41</b>	160   <b>353</b>	
	ANSI 600	500   <b>19.69</b>	420   <b>16.54</b>	620   <b>24.41</b>	195   <b>430</b>	
10" / DN250	ANSI 150   PN 16	550   <b>21.65</b>	510   <b>20.08</b>	690   <b>27.17</b>	184   <b>406</b>	
	ANSI 300	550   <b>21.65</b>	510   <b>20.08</b>	690   <b>27.17</b>	220   <b>485</b>	
	ANSI 600	550   <b>21.65</b>	510   <b>20.08</b>	690   <b>27.17</b>	295   <b>650</b>	
12"   DN300	ANSI 150   PN 16	600   <b>23.62</b>	560   <b>22.05</b>	750   <b>29.53</b>	245   <b>540</b>	
	ANSI 300	600   <b>23.62</b>	560   <b>22.05</b>	750   <b>29.53</b>	305   <b>672</b>	
	ANSI 600	600   <b>23.62</b>	560   <b>22.05</b>	750   <b>29.53</b>	393   <b>866</b>	
14"   DN350	ANSI 150   PN 16	650   <b>25.59</b>	605   <b>23.82</b>	780   <b>30.71</b>	505   <b>1113</b>	
	ANSI 300	650   <b>25.59</b>	605   <b>23.82</b>	780   <b>30.71</b>	565   <b>1246</b>	
	ANSI 600	650   <b>25.59</b>	605   <b>23.82</b>	780   <b>30.71</b>	615   <b>1356</b>	
16"   DN400	ANSI 150   PN 16	700   <b>27.56</b>	690   <b>27.17</b>	860   <b>33.86</b>	640   <b>1411</b>	
	ANSI 300	700   <b>27.56</b>	690   <b>27.17</b>	860   <b>33.86</b>	715   <b>1576</b>	
	ANSI 600	700   <b>27.56</b>	690   <b>27.17</b>	860   <b>33.86</b>	805   <b>1775</b>	
18"   DN450	ANSI 150   PN 16	900   <b>35.43</b>	745   <b>29.33</b>	950   <b>37.40</b>	760   <b>1676</b>	
	ANSI 300	900   <b>35.43</b>	745   <b>29.33</b>	950   <b>37.40</b>	875   <b>1929</b>	
	ANSI 600	900   <b>35.43</b>	745   <b>29.33</b>	950   <b>37.40</b>	1035   <b>2282</b>	
20"   DN500	ANSI 150   PN 16	1000   <b>39.37</b>	815   <b>32.09</b>	1000   <b>39.37</b>	950   <b>2094</b>	
	ANSI 300	1000   <b>39.37</b>	815   <b>32.09</b>	1000   <b>39.37</b>	1085   <b>2392</b>	
	ANSI 600	1000   <b>39.37</b>	815   <b>32.09</b>	1000   <b>39.37</b>	1315   <b>2899</b>	
24"   DN600	ANSI 150   PN 16	1100   <b>43.31</b>	940   <b>37.01</b>	1050   <b>41.34</b>	1280   <b>2822</b>	
	ANSI 300	1100   <b>43.31</b>	940   <b>37.01</b>	1050   <b>41.34</b>	1500   <b>3307</b>	
	ANSI 600	1100   <b>43.31</b>	940   <b>37.01</b>	1050   <b>41.34</b>	1800   <b>3968</b>	
30"   DN750	ANSI 150   PN 16	1300   <b>51.18</b>	1130   <b>44.49</b>	1270   <b>50.00</b>	2450   <b>5401</b>	
	ANSI 300	1300   <b>51.18</b>	1130   <b>44.49</b>	1270   <b>50.00</b>	2790   <b>6151</b>	
	ANSI 600	1300   <b>51.18</b>	1130   <b>44.49</b>	1270   <b>50.00</b>	3220   <b>7099</b>	

**Table 7** Weights and dimensions table



# Pietro Fiorentini

**TB0052USA**



The data are not binding. We reserve the right  
to make changes without prior notice.

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