



FioSonic

Ultrasonic Flow Meter

For custody transfer

Ultrasonic Gas Flow Meter

FioSonic is the natural evolution of the Pietro Fiorentini know-how and experience in the gas industry. With its multi path-chordal technology, FioSonic provides real time diagnostics, high accuracy, redundancy, for fiscal gas flow measurement.

Classification and Area of Application

The main applications of the FioSonic Ultrasonic Flow Meter are:

- Onshore and offshore applications
- Power plants, refineries and chemical industry
- Natural gas production, transportation, distribution and storage
- Fiscal metering
- Process control
- Process gases
- Dry, wet, corrosive and abrasive gases
- Gas such as sour gas or biogas with H₂S

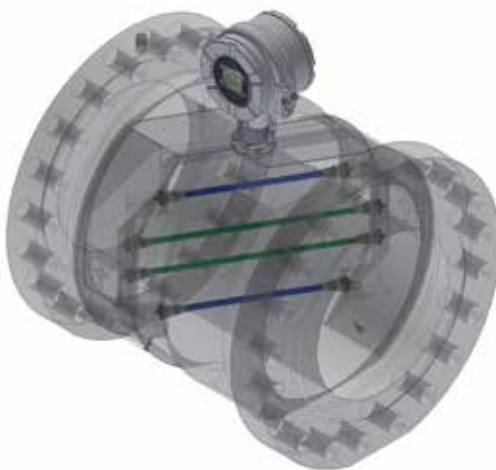


Fig.1

Fiosonic - Ultrasonic Gas Flow Meter

Fiosonic (FSN-4P)

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

The **Fiosonic** has four paths as standard. It has been tested to meet the international standards for custody transfer metering including AGA-9 and OIMLR137 (class 0.5).

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 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 remedial action is taken.

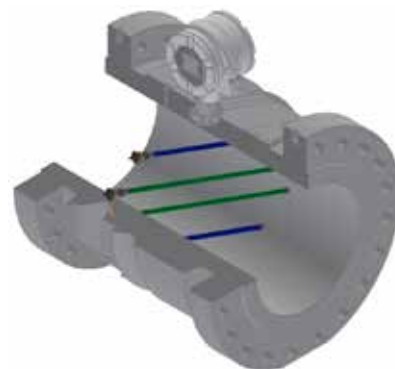


Fig.2

Fiosonic - FSN-4P (4 path)

Fiosonic BX

The **Fiosonic BX** dual gas meter consists of two redundant fully independent systems integrated in one single standard meter body, providing space and cost saving solution.

The main measurement is performed by the main 4-path (FSN-4P) while the secondary could be done as follows:

- Three path system measurement (with different path layout) with enhanced diagnostics, enabling the user to perform condition-based maintenance (three path only AGA 9 compliant)
- Additional four path meter (FSN-4P), if the requirement demands for Two fiscal measurements (both meter OIML class 0.5)

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

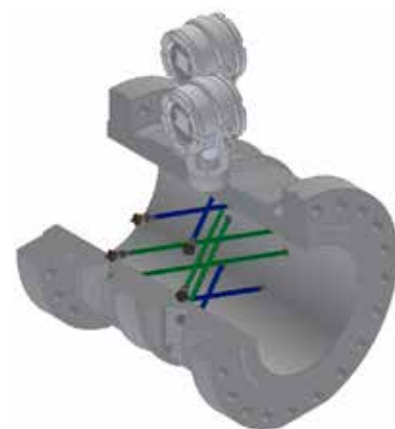


Fig.3

Fiosonic BX - 2 x FSN-4P

Technical Data

Principle of operation	Broadband continuous wave – transit time
Sizes	150, 300, 600 and 900lbs; 3 – 30", other sizes on request
Flange type	ANSI, DIN, others on request
Pressure ranges	Up to 153 bar
Ambient temperature	-40 to +60°C (-40 to +140°F)
Process temperature	-30 to +80°C (-22 to +176°F)
Typical uncertainty	0.5% (Qt – Qmax) factory calibration
	1% (Qmin – Qt) factory calibration
	0.2% (Qt – Qmax) flow calibration
	0.5% (Qmin – Qt) flow calibration
Metrology	AGA-9 compliant
	ISO 17089
	OIML R137-1&2
	MID 2014/32/EU
Repeatability	0.1%
Turndown	100:1
Meter body materials	Carbon steel ASTM A350-LF2 Cl.1
	Other materials on request
Transducers	All metal Titanium, retractable version available as option
Pressure port	¼" NPT female, others on request
Electronic enclosure material	Epoxy painted, low copper aluminum alloy
Electronic enclosure cable entry	M20x1.5 female
	1/2" NPT female
Power supply	Main power: 14 - 28.8V, 670mW max
	I/O option board power: 10.8 - 28.8V, 225mW max
User interface	128x128 dot matrix LC Display, 4 keys
Interface ports	1x USB (not intrinsically safe)
	1x HF / LF pulse output
Optional interface ports	I/O Option Board
	1x RS485, two wire, externally powered
	2x Digital, software configurable (HF, LF, status)
	1 x 4-20mA loop powered output (pending)
	PT Option board
	Pressure and temperature sensors
	4-20mA/HART Option Board
	1 x 4-20mA loop powered output (HART pending)
Communication protocols	MODBUS (RS485 and USB)
Hazardous area certification	ATEX II 1 G Ex ia IIC T4 Ga
	IECEx Ex ia IIC T4 Ga
Ingress Protection	IP66, NEMA 4X

Flowranges Metric MID ranges

Nominal Size	*Schedule	Internal diameter [mm]	Flow [m ³ /hr]			Turndown
			Q _{max}	Q _t	Q _{min}	
3" / DN80"	40	77.9	610	61	7	88
	80	73.7	540	54	7	78
4" / DN100	40	102.3	1000	100	12	84
	80	97.2	900	90	11	82
6" / DN150	40	154.1	2020	202	21	97
	80	146.3	1820	182	19	96
8" / DN200	40	202.7	3490	349	35	100
	80	193.7	3190	319	32	100
10" / DN250	40	254.5	5500	550	55	100
	80	238.2	4900	490	49	100
12" / DN300	STD	304.7	7900	790	79	100
	80	389.0	7100	710	71	100
14" / DN350	STD	366.5	9700	970	97	100
	80	317.5	8600	860	86	100
16" / DN400	STD	387.3	12800	1280	128	100
	80	363.5	11300	1130	113	100
18" / DN450	STD	437.9	16300	1630	163	100
	80	409.3	14300	1430	143	100
20" / DN500	XS	482.6	19800	1980	198	100
	80	455.6	17700	1770	177	100
24" / DN600	XS	584.6	28100	2810	290	97
	80	547.7	24600	2460	255	97
30" / DN750	30	730.2	42300	4230	453	94
	wt = 35	692.0	38000	3800	407	94

Tab.1

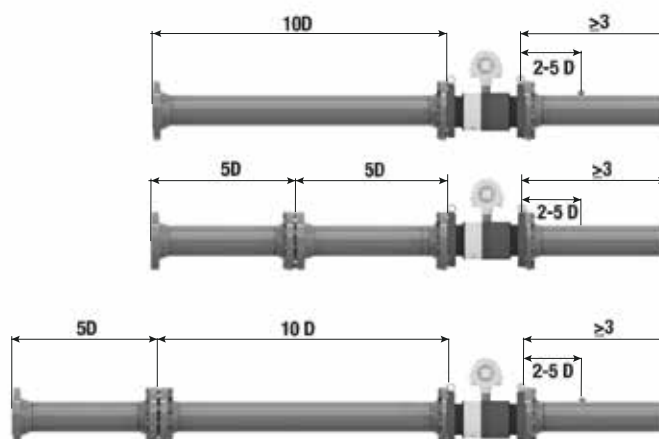
* According to inlet/outlet pipe schedule

Configurations

According to **AGA 9** only

According to **MID**, with **PTB** flow conditioner

According to **MID**, with **NOVA 50E** flow conditioner



Transducers

Titanium transducers - rugged and efficient

The very efficient design of the ultrasonic transducers allows 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 metal for the harshest conditions. Transducers are available up to 153barg versions. Transducers Extraction Tool, intended for transducers removal under pressure (Max 100barg), available as option on sizes above DN14'.

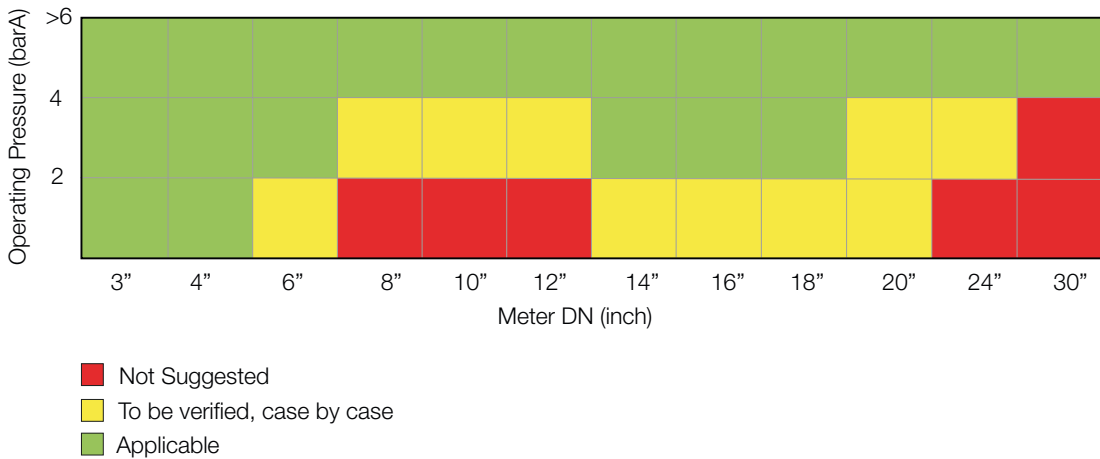


Fig.4

Fiosonic - Ultrasonic Transducers

Fiosonic Suggested Application Range

The minimum working pressures in the Fiosonic meter series differ by model size. The below table shows the Fiosonic gas Flow Meter minimum working pressure vs. Sizes, for preliminary application self-analysis.



BCW

Broadband Continuous Wave signal processing

Most ultrasonic flowmeters 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 flowmeter 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 the receive signal that is precise and resistant to signal noise and interference in difficult applications.

Extending the transmitted power over a long period rather than a few short pulses means that much lower transmit voltages are used, resulting in safety and low power. In addition, other ultrasonic flowmeters can only communicate on one acoustic path at a time.

The Broadband Continuous Wave system, using codes that do not interfere, can transmit on two or more paths at the same time. Simultaneous transmission means a faster response time and better performance in fluctuating or pulsating flow.

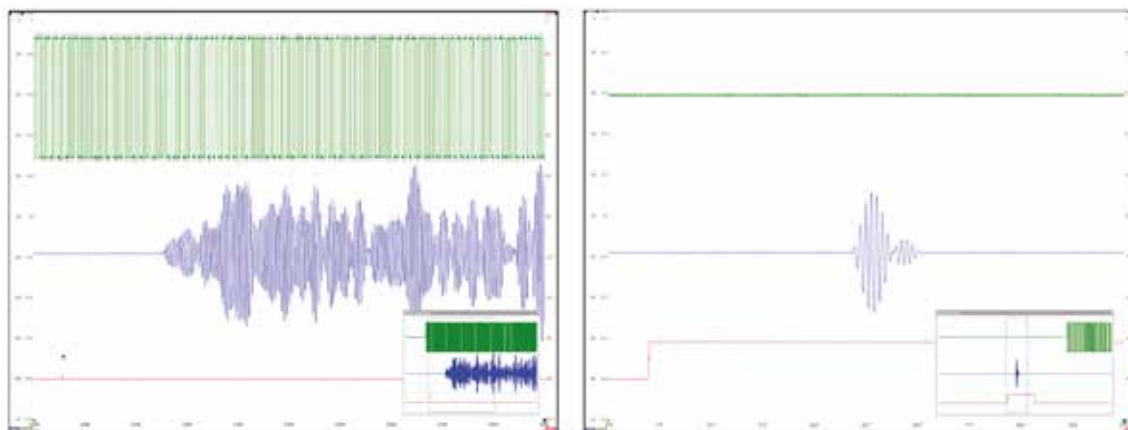


Fig.5

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

Diagnostics and Condition Monitoring

The Fiosonic Series flowmeters provide extensive diagnostic information both on the graphic display screen and remotely via the PF Instruments Manager PC interface.

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

Path Performance

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 flowmeter calculates Profile and Symmetry Factors which can be used for condition monitoring of the measurement and the gas flow. In addition, the Fiosonic flowmeter 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 velocity of sound, signal-to-noise ratio and signal strength are available to the user as well.

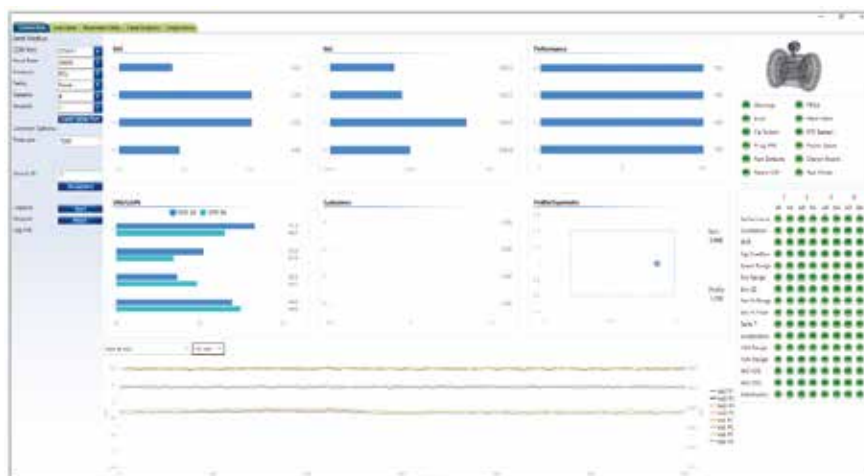


Fig.6 Fiosonic - Diagnostic Information

Data logging and trending

User selectable flow data or diagnostics may be logged and displayed graphically. Historical trending of data may provide an early indication of a potential problem or maintenance requirement.

For example a gradual drop in gain (AGC) may indicate fouling in a transducer port.

Status indicators

Indicator lights, or “traffic lights” provide a very quick indication of a warning (yellow) or error condition (red) at the system and individual path level.

A New Frontier in Ultrasonic Flowmeter Technology

The unique combination of cutting-edge signal processing and superior acoustics delivers the solution for your most demanding flowmetering applications in an economical and compact package.

Intrinsically safe

The Fiosonic Series are Intrinsically Safe (ATEX/IECEx Intrinsically safe for zone 0). Installation is simple and economical as no special precautions are required for wiring and housing.

The versatile keypad and display can be accessed in a hazardous area without special precautions, so start-up and diagnostic monitoring is quick and simple.

Field wiring may also be accessed without the need to shut down the meter and lose measurement data.

The low energy levels inherent in intrinsically safe design result in low operating power (<1 watt) making the Fiosonic Series ideal for solar or battery power applications.

Difficult applications

The titanium ultrasonic sensors are remarkably efficient and coupled with the Broadband Continuous Wave processing can reliably measure the most challenging applications such as wet and dirty gases, varying gas compositions and attenuating gases. The combination of the efficient transducers and the Broadband Continuous Wave processing is also resistant to acoustic noise such as valve noise, which has been the bane of other ultrasonic meters.

Accurate and fast response

The Fiosonic Series have three or four paths as standard. This results in a stable, accurate flow reading over the full range of flow, pressures and gas composition.

The Broadband Continuous Wave signal processing allows more than one path to be interrogated simultaneously avoiding the slow response that is the hallmark of other multi-path meters.

A New Frontier in Ultrasonic flowmeter Technology

Simplified design

With only a single circuit board having all circuits on-board the Fiosonic Series is extremely simple by design. The two optional expansion boards are fitted directly on the main board.



Fig.7

Fiosonic - On-board electronics

Environment Protections

The Fiosonic Series epoxy coated aluminium alloy electronic housing, rated to IP66 and NEMA 4X, is designed to be used outdoor in almost any environment.

The ambient operating temperature covers the range -40°C (-40°F) to $+60^{\circ}\text{C}$ ($+140^{\circ}\text{F}$). The ultrasonic sensors have all titanium wetted surfaces and are designed for process gas temperature from -30°C (-22°F) to $+80^{\circ}\text{C}$ ($+176^{\circ}\text{F}$).

VERSATILE CONNECTIVITY

The Fiosonic Series allow smooth interface with all market available flow computer, enabling meter diagnostic, verification, logging and trending.

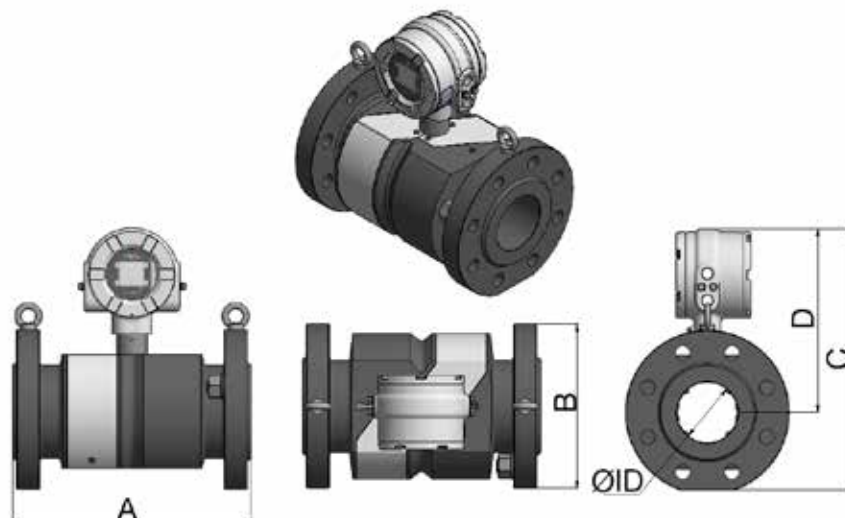
Versatile I/O

The Fiosonic Series comes standard with the Pulse/Frequency output and a USB port for commissioning and field service. Optional I/O Boards can provide an isolated RS485 and two additional isolated Pulse-Frequency outputs and 4-20mA/HART.

Pressure and temperature

For applications requiring integrated volume conversion the Fiosonic Series 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.

Dimensions and weights - metric



Nominal Size	Rating	A-Length [mm]	B-Width [mm]	C-Height [mm]	Weight [Kg]
3" / DN80"	150	300	190	430	45
	300	350	210	430	45
	600	350	210	430	50
4" / DN100	150	350	230	470	70
	300	350	255	470	75
	600	400	275	500	95
6" / DN150	150	350	280	500	80
	300	400	320	530	120
	600	400	355	570	140
8" / DN200	150	400	345	570	120
	300	500	380	590	210
	600	500	420	620	225
10" / DN250	300	550	445	660	280
	600	550	510	690	330
12" / DN300	300	600	520	730	320
	600	600	560	750	400
14" / DN350	300	650	585	780	440
	600	650	605	780	455
16" / DN400	300	700	650	740	660
	600	700	690	760	700
18" / DN450	600	900	745	950	1000
20" / DN500	600	1000	815	1000	1200
24" / DN600	600	1100	940	1050	1560
30" / DN750	600	1300	1130	1270	2500

Tab.3

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

