FLEXIM

PIOX® S

Mass flow measurement without media contact

Flow rate – Concentration – Density

Acids

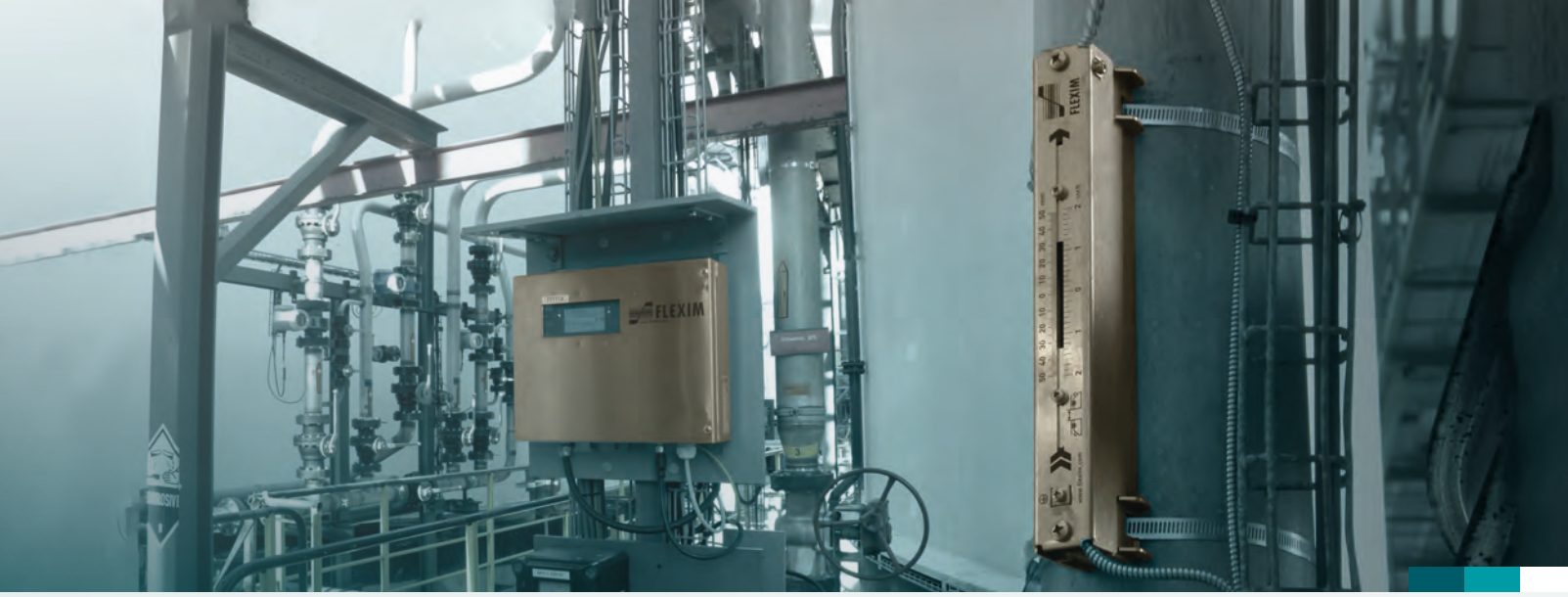
Caustics

Salts

Solvents

Organic media

Inorganic media



PIOX® S – Measurement from the safe side

PIOX® S determines mass flow rate, concentration, density and other parameters by means of clamp-on ultrasonic transducers mounted on the outside of the pipe. The non-invasive acoustic technology is the system of choice when substances and processes place highest demands on safety and reliability.

Precise and reliable

- → Permanently stable measurement without any drift
- → Accurate measurements at the lowest and highest flow velocities
- → Independent of entrained solids or gas
- → Continuous monitoring of measurement quality

Durable and long term stability

- → No media contact, therefore no risk of corrosion
- → No moving parts, no vibrations, no material fatigue
- → No pressure limitations
- → For harsh industrial environments

Safe and available

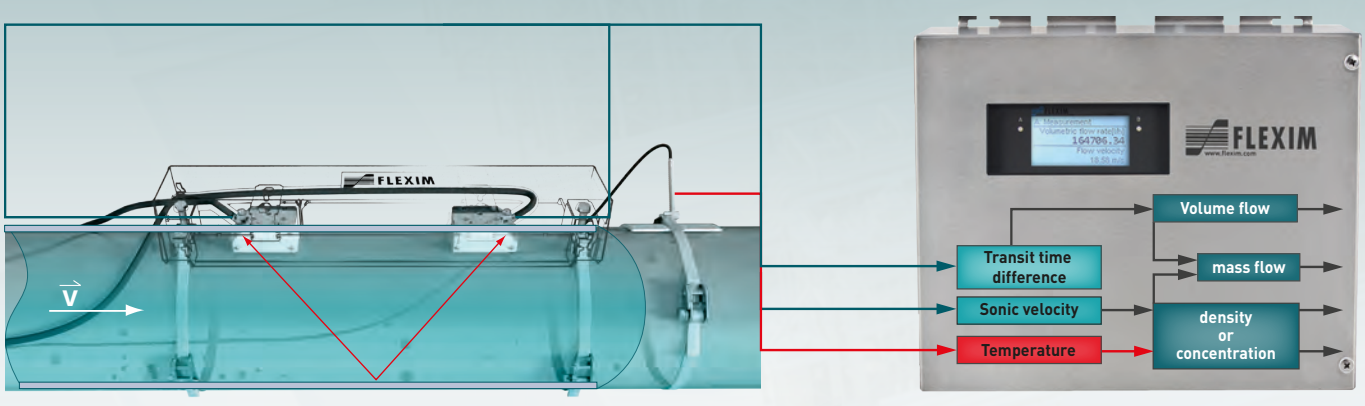
- → Mounting of the measurement system outside of the pipe, no need for pipe modifications
- → Maintenance-free measurement system
- → No leakage risk

Cost-effective and economical

- → No plant shutdown for commissioning
- → No special materials or bypass solutions required
- → No early failure of measuring system
- → Simultaneous determination of mass flow as well as concentration and density

Indestructible as a matter of principle

PIOX® S measures the acoustic velocity, thereby determining the density and concentration of the medium inside the pipe. By simultaneously recording the volume flow rate, PIOX® S automatically calculates the mass flow rate.



Unlimited applications

For virtually all pipe sizes and materials – regardless of whether it's steel, plastic, glass or special materials with coatings.

For temperatures up to 400 °C.

For almost all acids, caustics and a wide range of other toxic media.

For hazardous areas – transducers and transmitters are available in ATEX, IEC and FM-certified variants.

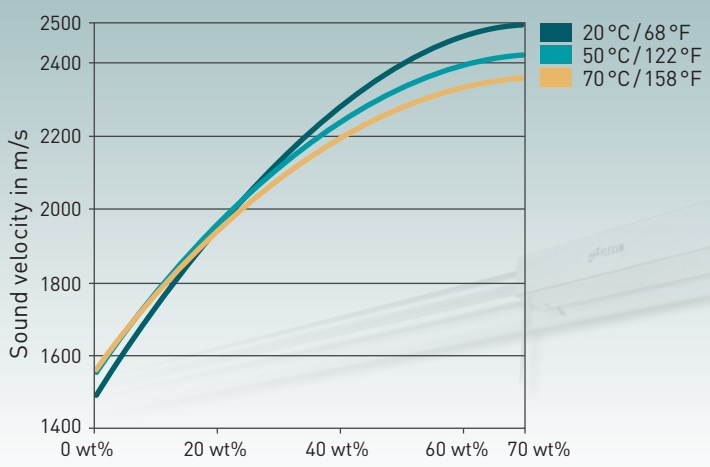
For 100% plant availability – the measurement point can be set up during ongoing operation.

Proven measurement:

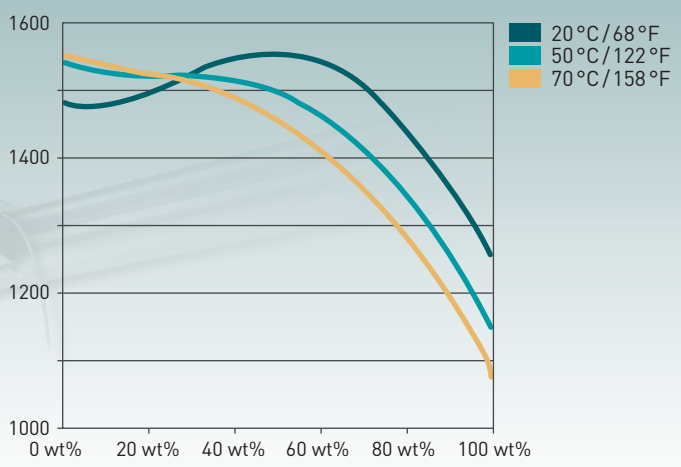
- Nitric acid
- Sulphuric acid
- Hydrofluoric acid
- Phosphoric acid
- Sodium / Potassium hydroxide solution
- Ammonia
- Ammonium nitrate
- Salt solutions
- Alcohols, Glycols
- Caprolactam
- and many other media

In a large number of binary media systems, the acoustic velocity is in a fixed proportion to concentration and density. PIOX® S includes an extensive database of substances, thereby allowing for accurate and reliable density, concentration and mass flow determination in real time for a variety of acids, caustics and other chemical media.

Caustic Soda (NaOH)



Nitric Acid (HNO_3)



PIOX® S stands its ground where others fail

Concentration and mass flow measurement of sodium hydroxide

Chlor-alkali electrolysis is one of the central processes of the chemical industry. It provides the basic substances chlorine, sodium hydroxide and hydrogen.

At a major German chemical site, sodium hydroxide produced during chlor-alkali electrolysis is evaporated in a multi-stage distillation process. The Coriolis meter that was installed for concentration measurement was subject to enormous wear by the corrosive medium and did not achieve a satisfactory service life. Replacing the inline instrument is extremely time-consuming and requires a shutdown lasting several days for the shut-off and emptying of the pipeline.

Non-invasive measurement with PIOX® S proved to be the better solution. PIOX® S remains stable over the long term and without any measurement drift as proven by regular control measurements in the laboratory. Continuous accurate concentration measurement allows the system to run optimally at all times and ensures compliance with the specified quality. The PIOX® S simultaneously measures the mass flow.

Advantages:

- → No wear and corrosion on the measurement system
- → Highly durable and long term stable measurement without any measurement drift and maintenance-free
- → No need for expensive special materials or bypass solutions

Concentration and mass flow measurement of nitric acid

One of Europe's largest fertiliser manufacturers uses PIOX® S in its nitric acid bottling plants. The nitric acid is traded in two different concentrations: 68 % and 60 %. If the lower concentration is required, the 68% nitric acid must be diluted by adding water. Compliance with the required concentration must be monitored by means of measuring technology.

The ideal solution for this measuring task is PIOX® S: Since the clamp-on ultrasonic transducers are simply mounted on the outside of the pipe, there is no direct contact with the aggressive medium. Thus there is no risk of corrosion or acid leakage, as it was in the case with previously installed Coriolis meters. Replacing an inline meter often requires an expensive process shut-down for emptying and cleaning of the pipe. Furthermore, simultaneous measurement of volume flow and density allows for the output of mass flow and thus the complete monitoring of the filling process.

Advantages:

- → No risk of corrosion or leakage
- → Simultaneous measurement of concentration and mass flow
- → Non-invasive measurement, no process shut-downs necessary

PIOX® S – mass flow, density and concentration measurement without media contact

PIOX® S includes an extensive and continuously growing database for the non-invasive determination of mass flow and concentration of liquid media:

Medium name	Medium formula	Typical sound speed values	Medium name	Medium formula	Typical sound speed values
Acetic acid	$C_2H_4O_2$	1169 m/s	Hydrochloric acid	HCl	1521 m/s
Aceton	C_3H_6O	1182 m/s	Hydrofluoric acid	HF	1051 m/s
Ammonia	NH_3	1794 m/s	Hydrogen peroxide	H_2O_2	1483 m/s
Ammonium nitrate	NH_4NO_3	2173 m/s	Isopropyl alcohol	C_3H_8O	1157 m/s
Ammonium sulfate	$(NH_4)_2SO_4$	1727 m/s	Lithium bromide	LiBr	1620 m/s
Calcium chloride	$CaCl_2$	1703 m/s	MDEA	$CH_3N-(CH_2CH_2OH)_2$	1628 m/s
Caprolactam	$C_6H_{11}NO$	1598 m/s	Methanol	CH_3OH	1127 m/s
Caustic potash	KOH	1948 m/s	Nitric acid	HNO_3	1501 m/s
Caustic soda	NaOH	2375 m/s	NMP	C_5H_9NO	1560 m/s
Diethylene glycol	$C_4H_{10}O_3$	1578 m/s	Oleum	SO_3	1267 m/s
DMAC	C_4H_9NO	1474 m/s	Phosphoric acid	H_3PO_4	1646 m/s
DMF	C_3H_7NO	1476 m/s	Potassium chloride	KCl	1517 m/s
Ethanol	C_2H_5OH	1145 m/s	Propylene glycol	$C_3H_8O_3$	1515 m/s
Ethylene glycol	$C_2H_6O_2$	1668 m/s	Sodium carbonate	Na_2CO_3	1561 m/s
Ferric chloride	$FeCl_3$	1712 m/s	Sodium chloride	NaCl	1767 m/s
Ferric sulfate	$Fe_2(SO_4)_3$	1472 m/s	Sodium hypochlorite	NaClO	1807 m/s
Ferrous chloride	$FeCl_2$	1497 m/s	Sodium sulfate	Na_2SO_4	1537 m/s
Ferrous sulfate	$FeSO_4$	1496 m/s	Sodium sulfide	Na_2S	1591 m/s
Formalin	CH_2O	1608 m/s	Sulfuric acid	H_2SO_4	1308 m/s
Formic acid	CH_2O_2	1286 m/s	Triethylene glycol	$C_6H1_4O_4$	1612 m/s
Glycerol	$C_3H_8O_3$	1927 m/s	Urea	CH_4N_2O	1625 m/s

The media listed here are available as standard data sets for PIOX® S. Alternative media sets can be analysed for proposal upon customer request.

PIOX® S 721
Aluminium

PIOX® S 721
Stainless Steel

PIOX® S 831

Technical Data

	S 721	S 831
Measurement principle	Transit time difference principle	
Measurement functions Physical quantities Totalizers Diagnostic functions	Volumetric flow rate, mass flow rate, flow velocity, sound speed, density Volume, mass fraction Signal amplitude, SNR, SCNR, standard deviation of amplitude and transit times	
Measuring Ranges Flow velocity Sound speed Pipe diameter Pipe surface temperature Ambient temperature	0.01 ... 25 m/s 500 ... 3000 m/s 10 ... 6500 mm -40 ... +200 °C (+600 °C with WaveInjector®) -40 ... +60 °C	
Uncertainty[1] Mass flow rate Volumetric flow rate Sound speed / density / mass fraction	± 1.2 % of reading (as function of volumetric flow rate and density) ± 1 % of reading Defined by field calibration	
Repeatability[1] Flow velocity Mass flow rate Volume flow rate Sound speed Density Mass fraction	± 0.005 m/s ± 0.25 % of reading (as function of volumetric flow rate and density) ± 0.15 % of reading ± 0.5 m/s ± 1 kg/m³ ± 0.1 wt%	
Transmitter Number of measuring channels	1 or 2	
Explosion protection	ATEX/IECEx Zone 2 or FM Class I Div 2	ATEX/IECEx Zone 1
Power supply Outputs	100 ... 230 V AC / 50 ... 60 Hz 20 ... 32 V DC 4 ... 20 mA active 4 ... 20 mA HART active/passive pulse, frequency, binary	
Process inputs	Maximum 4, available are: temperature (Pt 100/1000), current, voltage, binary or temperature, density	Pt100/Pt1000 (Ex-ia), 4 ... 20 mA active current input
Digital communication	Modbus RTU, HART, Profibus PA, Foundation Fieldbus	
Housing material	Aluminum or stainless steel 316L	Aluminum
Transducers Explosion protection Temperature range (pipe wall)	ATEX/IECEx Zone 1/2 FM Class I Div 1 or 2 -40 ... +240 °C / WI: -200 ... +600 °C	

[1] Values are approximations for typical applications under reference conditions. Contact us for detailed values for your specific application.

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