

# Chemical Industry Solutions

Non-Intrusive Flow - Energy Efficiency - Quality Control

Acids and Caustics

Intermediates

Process Gases and  
Compressed Air

Polymers

Solvents and Base  
Chemicals

Water and Wastewater

Thermal Energy

Media Identification  
and Phase Separation

**FLEXIM**

*when measuring matters*



The superior solution

## Non-intrusive ultrasonic flow measurement with FLUXUS® and process analytics with P10X®

Accurate - Reliable - Safe - Efficient

**FLUXUS®** measures flow rates non-intrusively with ultrasound. Clamp-on ultrasonic transducers are simply mounted on the outside of the pipe. The practical advantages are obvious: no wear and tear by the medium flowing inside the pipe, no risk of liquid leakage or fugitive gas emissions, no pressure loss and, above all, unlimited plant availability.

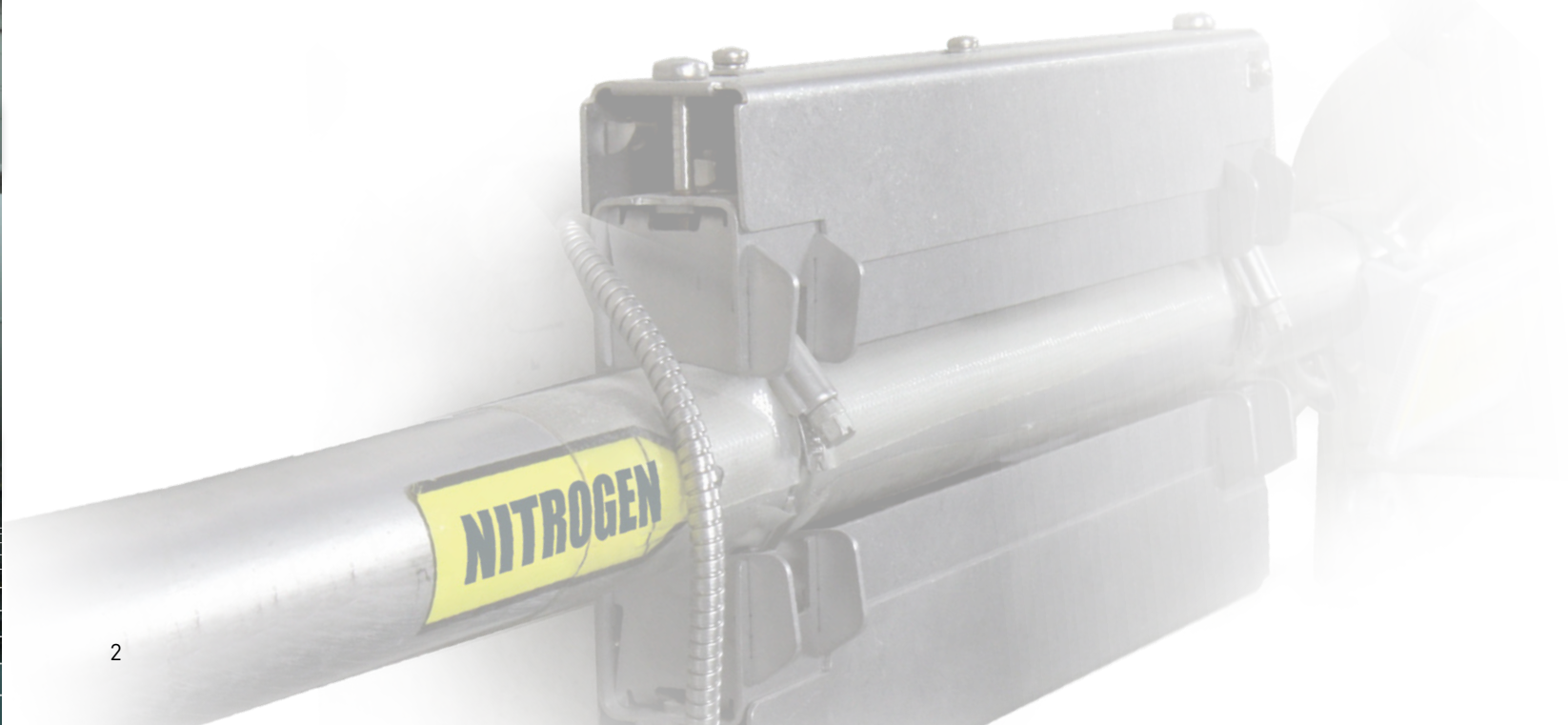
Product characteristics like concentration and density can be monitored continuously online using **P10X®** process analysers: non-intrusively with **P10X® S** clamp-on ultrasonic systems and wetted with the **P10X® R** process refractometer.

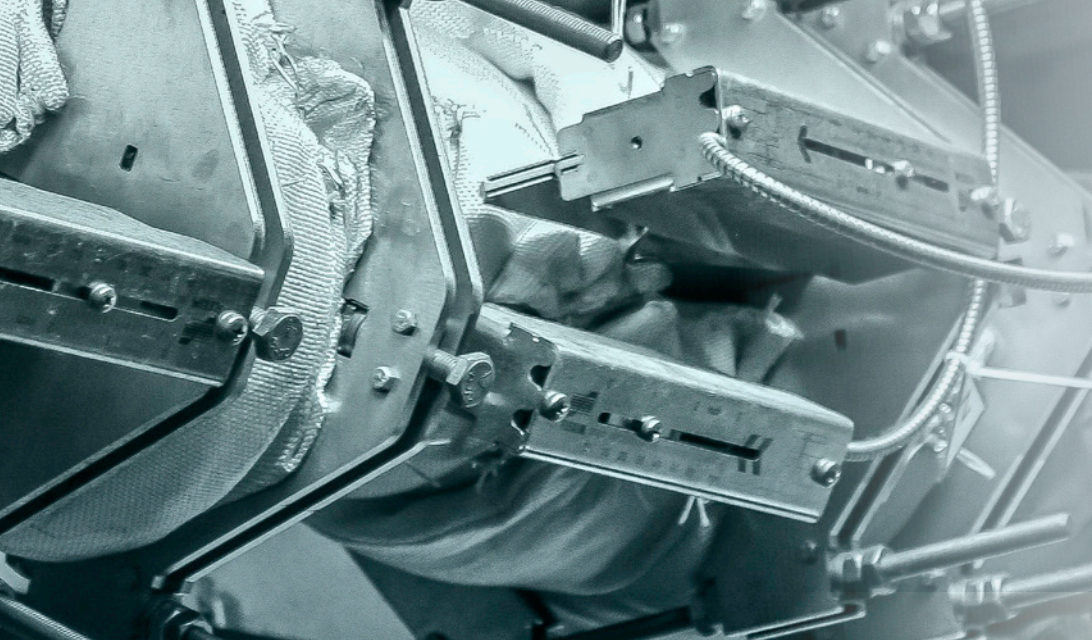
The operational conditions within chemical sites are very demanding: a wide range of organic and inorganic media - often toxic and highly corrosive - at wide temperature ranges flowing in a highly diverse range of pipe dimensions. Wetted meter technologies, such as differential pressure, Coriolis, electromagnetic or vortex meters, face well-known shortcomings - they often require frequent maintenance and process interruption for installation and cause pressure losses within the pipe, reducing the plant's availability and profitability.

### Versatile and fundamentally flexible

FLEXIM's non-intrusive ultrasonic transit-time difference measurement method is suitable for determining the volume flow rate and mass flow rate of liquids as well as gases and offers very high measuring dynamics in both flow directions. When combined with pressure and temperature measurement, it is also suitable for determining the standard volume flow rates of gases.

A wide range of ultrasonic transducers, mounting fixtures and transmitters guarantee ideal adaptation to the individual measurement task, independent of pipe material, wall thickness and measurement range - even within hazardous areas (FM Class I, Div. 1 and 2, ATEX (IECEx) Zone 1 and 2) and media temperatures from -310 °F up to 1100 °F. The FLUXUS® range of flowmeters is also SIL2 qualified.





## Unrivalled advantages of non-intrusive flow measurement with FLUXUS®:

- No process interruption for installation - virtually **maintenance-free** (no need for frequent work in hazardous areas)
- Trouble-free and highly reliable operation at extreme temperatures from as low as -310 °F up to +1100 °F - no line clogging, no wear and tear
- Certified for operation within hazardous areas (FM, ATEX, IECEx), SIL2 capable
- No potential for leaks
- No pressure losses
- Highly cost-effective due to minimal installation and maintenance costs, long life time, independent of line sizes and no need for process interruptions
- Independent of pipe material, diameter, wall thickness and internal pressure
- Accurate and repeatable measurement readings over a huge turndown ratio

### Technical facts

Temperature ranges: with Wavelnjector®:	-310 °F to +1100 °F
without Wavelnjector®:	-40 °F to +390 °F (for gases up to +210°F)
Flow velocity / flow rate:	
Liquids:	0.03 to 80 ft/s
Extremely low flows:	> 1 gal/h on 1/4 inch pipes (up to 1.5 inch pipes)
Gases:	0.03 to 115 ft/s
Repeatability:	0.15% of reading ± 0.03 ft/s
Calibrated accuracy:	
Liquids:	± 1.0% of reading ± 0.03 ft/s
Gases:	± 1% ... 3% of reading ± 0.03 ft/s
(if field calibrated):	± 0.5% of reading ± 0.03 ft/s (liquids and gases)
Pipe sizes (outer diameter):	
Transducer directly at pipe:	1/4 to 225 inches (liquids), 0.4 to 83 inches (gases)
with Wavelnjector®:	1.6 to 40 inches
Protection degree:	up to NEMA 6P / IP68
Ex approvals:	FM Class I, Div. 1 / 2, ATEX, IECEx Zone 1 and 2
SIL Qualification:	SIL2
Pressurisation:	no limitations for liquids > 45 psi for gases in steel pipes, no minimum pressure on plastic pipes required

## Unique features of FLUXUS® flowmeters:

- Engineered for the measurement of liquid and gas flow rates as well as thermal energy quantities
- Highly accurate and reliable measurement of highly viscous and sticky as well as particle-loaded liquids or wet gas
- Free of wear and tear with no maintenance required due to measurement being outside the pipe wall
- Every measurement system is pre-calibrated in-house (traceable to national standards) and delivered with a calibration certificate
- Integrated temperature compensation according to ANSI/ASME MFC-5.1-2011 regulations and digital signal processing guarantee a high zero point and flow measurement stability
- Captures even the lowest flow rates below 1 gallon per hour



# Field-Proven Clamp-On Flow Measurement of Liquids and Gases

## State-of-the-Art Ultrasonic Technology for Flow Measurement at Chemical Sites

Modern, integrated chemical plants form highly complex networks of mass and energy flows. Safety takes top priority. Continuous monitoring of all relevant process parameters is essential for fault-free operation.

Process conditions place high demands on measuring equipment. The aim is to have safe, highly available plants which efficiently convert the raw materials used without harming the environment.

### **FLUXUS® non-invasively measures liquid or gas flow rates in every environment**

Ultrasonic transducers are simply attached to the outside of the pipe. Without any pipe work, during ongoing operation. They are not subject to wear and tear and do not cause pressure loss. FM and ATEX / IECEx certified transducers and permanent as well as portable transmitters measure reliably and safely in hazardous areas.

A wide range of transducers and transmitters ensure optimum adaptation to the particular measuring task - even at very low media temperatures down to -310 °F or as hot as 1100 °F. FLUXUS® is also offered in SIL2 qualified product variants.

### **PIOX® process analyzers for media identification, concentration and density measurement**

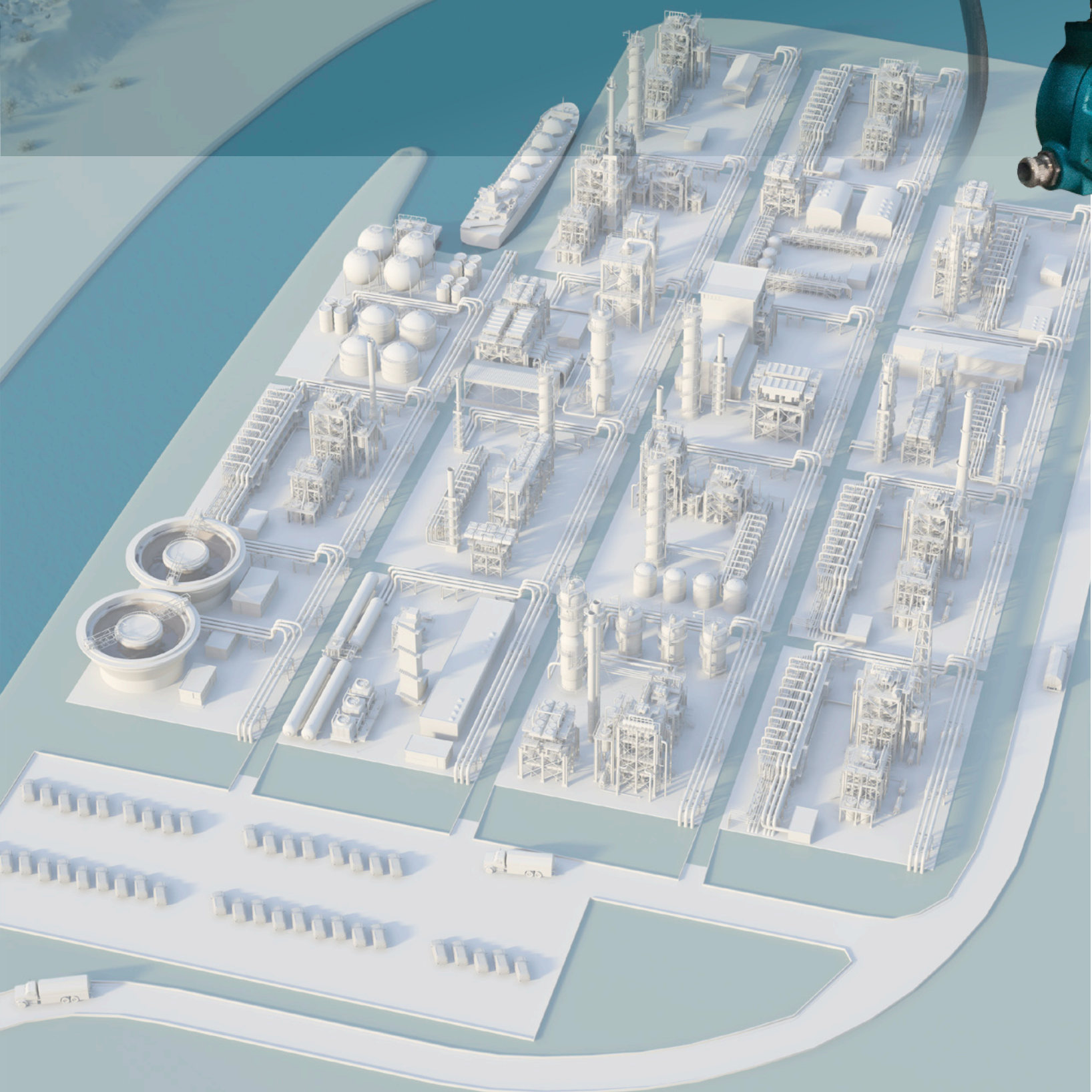
Non-intrusive online analytics and media identification with PIOX® S is the method of choice when materials and processes demand the highest levels of safety and reliability, e.g. in the case of corrosive media like acids, caustics or other toxic compounds. The inline PIOX® R ensures laboratory accuracy in the process. With its patented transmitted light principle, PIOX® R has been developed especially for challenging applications, such as the concentration measurement of highly aggressive acids and caustics in hazardous areas.



FLUXUS® F/G60X



# Flows in the Chemical Industry







## Process Gases and Compressed Air Networks

Process gases such as nitrogen, oxygen, hydrogen, natural gas as well as compressed air are used in many chemical processes. FLUXUS® enables the non-intrusive bidirectional measurement of volume or mass flow rates of gases over a huge turndown ratio. FLUXUS® flowmeters are therefore **independent of the pipe material, wall thickness and diameter, do not cause internal pressure losses and are not limited by any maximum process pressures**. Even low pressurised gas lines and compressed air networks can be precisely monitored and balanced. Another significant advantage of the non-intrusive measurement solution lies in the fact, that the system **can never be a risk for leaks** by itself and installation **does not require any process interruption**.

## Water and Wastewater Lines

It is also true in chemical plants: the most common material is water. Whether it is process water, coolant or discharged wastewater - **large quantities require large pipes. For wetted measuring technology, this means correspondingly high costs. Plant availability is equally significant. Opening a pipe usually requires a temporary plant shutdown and a corresponding loss of production**. The clamp-on FLUXUS® measuring system is mounted on the outside of the pipe and does not have the slightest effect on production.

## Acids and Caustics Production

Sulfuric, nitric, hydrochloric, hydrofluoric and other acids as well as caustics are often used as base chemicals for the production of a diverse range of intermediates, fertilizers, polymers and other specialty chemicals. Wetted measurement technologies are always affected by the problem of corrosion due to the aggressive media and are prone to subsequent failure and possible pipe leakage. Since it is mounted on the outside of the pipe wall, FLUXUS® overcomes such issues and not only provides the plant operator with **precise and reliable mass flow rates but is especially maintenance-free**. The PLOX® S ultrasonic process analyser can be used to simultaneously measure acid / caustic strength and also acts as a means for online quality control.

## Solvents and Base Chemicals

Solvents and base chemicals such as various alcohols, phenols, aldehydes, ethers, amines and others are vital for the production of polymers and specialty chemicals.

These liquids are often highly pressurised and heated (up to several hundred bar and degree Fahrenheit). Due to such challenging conditions, conventional differential pressure meters often require high maintenance efforts. FLUXUS® proves to be the superior solution. As the metering system is mounted on the outside of the pipe wall it **is completely pressure-independent and maintenance-free**. By using the patented Waveinjector® mounting fixture, even media with temperatures above 480 °F can be measured.

## Polymer Production

Ethylene and propylene are abundant gaseous feedstocks for the most common base polymers. During the polymerisation process, gases are highly compressed and heated (up to 2400 bar and 320 °F). Inline meter technologies, such as  $\Delta P$  meters, are prone to heavy wear and cause high pressure drops - leading to high operational cost and frequent plant shutdowns due to maintenance and replacement. FLUXUS® measures from outside the pipe wall, independent of the pressure and temperature inside. Also, the highly viscous polymer streams formed in the process can be **accurately measured whilst avoiding the unnecessary risk of line clogging**.

## Intermediate Chemicals

Intermediates such as MDI or TDI are known for the production of polyurethanes. Purification processes by means of distillation place strong demands on metering technology as temperatures are often above 400 °F and the medium is often highly viscous and sticky. This causes frequent maintenance intervals on any kind of inline metering technology. FLEXIM's Waveinjector® solves these issues by providing a non-invasive metering solution for high temperatures. **It is not only accurate but especially reliable, providing our customers with more than 10 years of trouble-free operations.**



## Cryogenic Applications

Cryogenic applications are common when a gaseous medium needs to change its aggregation state to a liquid or it has to act as a suitable cooling agent. For example, chlorine as well as hydrochloric acid have to be cooled down to  $-20^{\circ}\text{F}$  /  $-40^{\circ}\text{F}$  to change from a gaseous to a liquid state. Such cooling frequently causes inline meters to build up ice on the wetted sensors, leading to frequent maintenance intervals and process interruptions. A more extreme example is LNG which is carried at  $-310^{\circ}\text{F}$ . Here, the Wave-Injector® plays out its full potential, providing accurate and reliable measuring data without any pipe intrusion.

## Temporary and Check Meterings

Not every measurement point within a chemical site needs to be constantly monitored by a permanent meter. Thus, it is helpful to use FLEXIM's range of hazardous area portable liquid and gas flowmeters for **regular surveys and check metering / verification tasks**.

With the use of non-intrusive temperature probes, FLEXIM's portable flowmeters also allow **thermal energy measurements for efficiency monitoring of heat exchangers or plant wide energy audits**.

## Energy Efficiency Audits

Saving energy is one cornerstone to save on wasted costs and improve processes. The first step in doing so is to collect measurement data. FLEXIM provides non-invasive measurement technology for monitoring thermal energy consumption as well as balancing compressed air lines and complete networks - also allowing the detection of costly leaks.



FLUXUS® F/G7407.316SE



**IECEx**  
certified



PIOX®R

## Media Identification and Phase Separation

FLEXIM's ultrasonic systems measure the acoustic velocity of the medium flowing in the pipe non-intrusively. Acoustic velocity is a characteristic media property which depends on concentration and temperature.

Due to this characteristic, it is possible to **clearly differentiate various media from each other**, which is especially helpful when different media are successively passing through pipes, e.g. at tank terminals or loading stations. Another application example are phase separation processes.

## Highly Pure Media in Flexible Tubing

Where media has to be ultra pure and protected from potential contamination, FLUXUS® is the best solution. Completely non-intrusive and also suitable for mounting on flexible tubing, operators can be certain that FLUXUS® is never a potential source for leaks or contamination. With PIOX®S, the concentration and density of the medium can also be determined non-invasively.





# FLEXIM

In partnership



FLEXIM is an active leader in many areas of process instrumentation. As a worldwide pioneer in the non-intrusive flow measurement of liquids and gases, FLEXIM has been leading the way in ultrasonic clamp-on flow metering for more than 25 years. In addition to non-intrusive flow measurement, FLEXIM specializes in innovative online process analysis using ultrasonic technology and refractometry. Year after year, the Berlin-based company continues its substantial investment in research and development in order to maintain and further improve its position as an industry leader. In keeping with its core principles, FLEXIM takes customer feedback very seriously. Every generation of FLEXIM products is directly driven by customer and industry needs.

## The FLEXIM Commitment to Customer Service

FLEXIM considers itself not only a manufacturer of measuring instruments, but also a provider of technical and consulting services. These services include on-site measurements, laboratory analysis, project handling, training, commissioning, instrument rentals and consulting services. The company's focus and dedication is directed towards providing the highest quality equipment with the best support and service possible. Our aim is to set standards in all what we are doing.

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**[www.flexim.com](http://www.flexim.com)**

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**1-888-852-PIPE**

