

# Refinery Solutions

Non-Invasive Flow - Spent Acid Strength - Quality Control

Atmospheric and Vacuum  
Distillation Columns

Coker and Visbreaker

Cracker

Heat Transfer Lines

Gas Separation and Processing

Alkylation

Tank Storage

Mobile Flow and Energy Surveys



The superior metering solution at extreme pipe temperatures

## Non-intrusive ultrasonic flow measurement with the Wavelnjector®

Reliable - Safe - Efficient



The Wavelnjector® has been specifically engineered for high-temperature applications. Using patented technology, the Wavelnjector® thermally separates ultrasonic transducers from the hot pipe, allowing operation at process temperatures up to 400 °C and beyond.

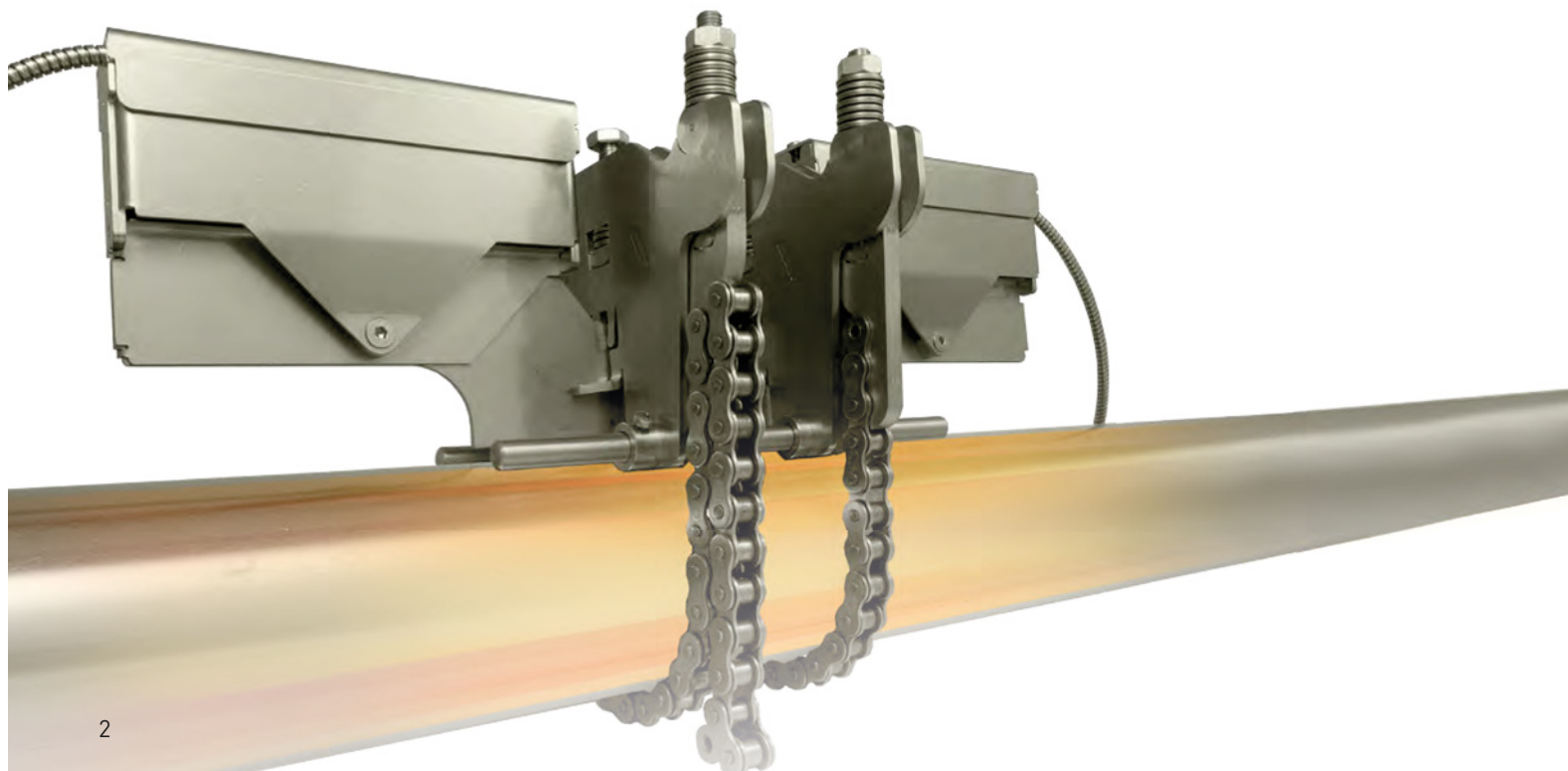
The operational conditions in refineries are very demanding: extreme temperatures, highly viscous and abrasive media in combination with very diversified application areas.

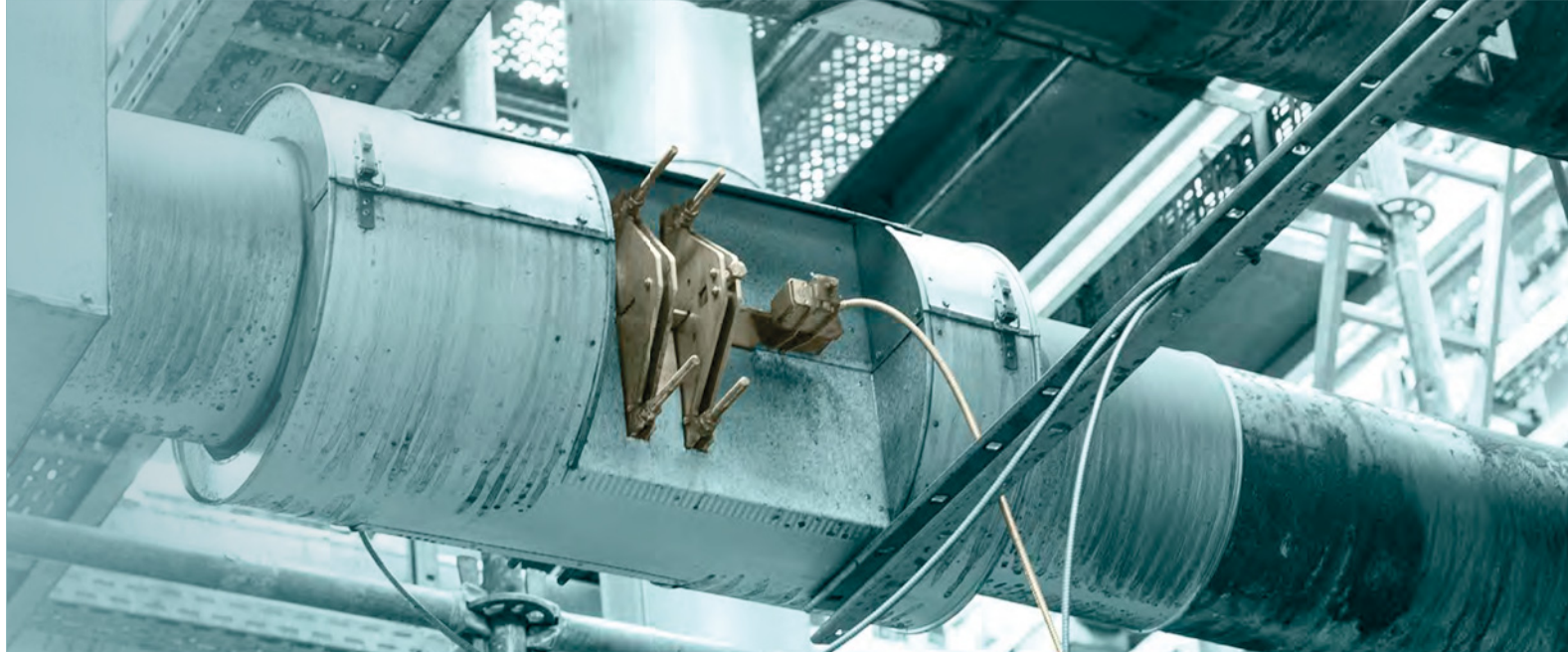
Conventional orifice / differential pressure, Coriolis and vortex meters, which are used to measure refinery flows, face well-known shortcomings - they often require frequent maintenance and process interruption for installation and cause pressure losses within the pipe reducing the plant's availability and profitability.

### Unique measuring technology

With the Wavelnjector® FLEXIM provides a metrological alternative, which offers fundamental advantages and has proven itself in numerous refinery applications worldwide. Without the need for pipe work or process interruption, the Wavelnjector® is mounted on the outer surface of the pipe. Sturdy mounting fixtures provide long-term stable measurement even on pipes with extreme vibration.

A wide range of ultrasonic transducers and transmitters guarantee the ideal adaptation to the individual measurement task, independent of pipe material, wall thickness and measurement range - even within hazardous areas (ATEX (IECEX) Zone 1 and 2, FM Class I, Div. 1 and 2).





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

- 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 up to +400 °C and beyond - no line clogging, no wear and tear
- Certified for operation within hazardous areas (ATEX, IECEx, FM)
- No leaks
- No pressure losses
- Independent of pipe material, diameter, wall thickness and internal pressure
- Accurate and repeatable measurement readings - even at the lowest flow rates (high turndown ratio)

## Technical facts

Temperature ranges: with Wavelnjector®:	-190 °C to +400 °C (up to +600 °C are applicable)
without Wavelnjector®:	-40 °C to +200 °C (for gases up to +100°C)

Flow rates:	
Liquids:	0.01 to 25 m/s
Gases:	0.01 to 35 m/s

Repeatability:	0.15% of reading ± 0.01 m/s
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Accuracy:	
Liquids:	± 1.2% of reading ± 0.01 m/s
Gases:	± 1% ... 3% of reading ± 0.01 m/s
(if field calibrated):	± 0.5% of reading ± 0.01 m/s (liquids and gases)

Pipe sizes (outer diameter):	
Transducer directly at pipe:	6 ... 6500 mm (liquids), 10 ... 1100 mm (gases)
with Wavelnjector®:	40 to 1000 mm

Protection degree:	up to IP68
Ex approvals:	ATEX (IECEx) Zone 1 and 2, FM Class I, Div. 1/2

Pressurisation:	no limitations for liquids > 5 bar for gases in steel pipes
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## 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, particle-loaded liquids or wet gas
- Free of wear and tear with no maintenance required due to measurement from 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

# Field-Proven Clamp-On Flow Measurement

## State-of-the-Art Ultrasonic Technology for Flow Measurement in Refineries

The multitude of processes in a refinery form a complex system of material and energy flows.

Everything is flowing, from incoming crude to outgoing hydrocarbon products. For the safe and efficient operation of such processes these flows need to be monitored.

Harsh process conditions can place heavy demands on flowmeters - especially at temperatures from 200 °C to significantly more than 400°C.

Furthermore, it's not only liquid hydrocarbons over a wide viscosity range, but also gases and thermal energy quantities that need to be measured accurately and reliably.

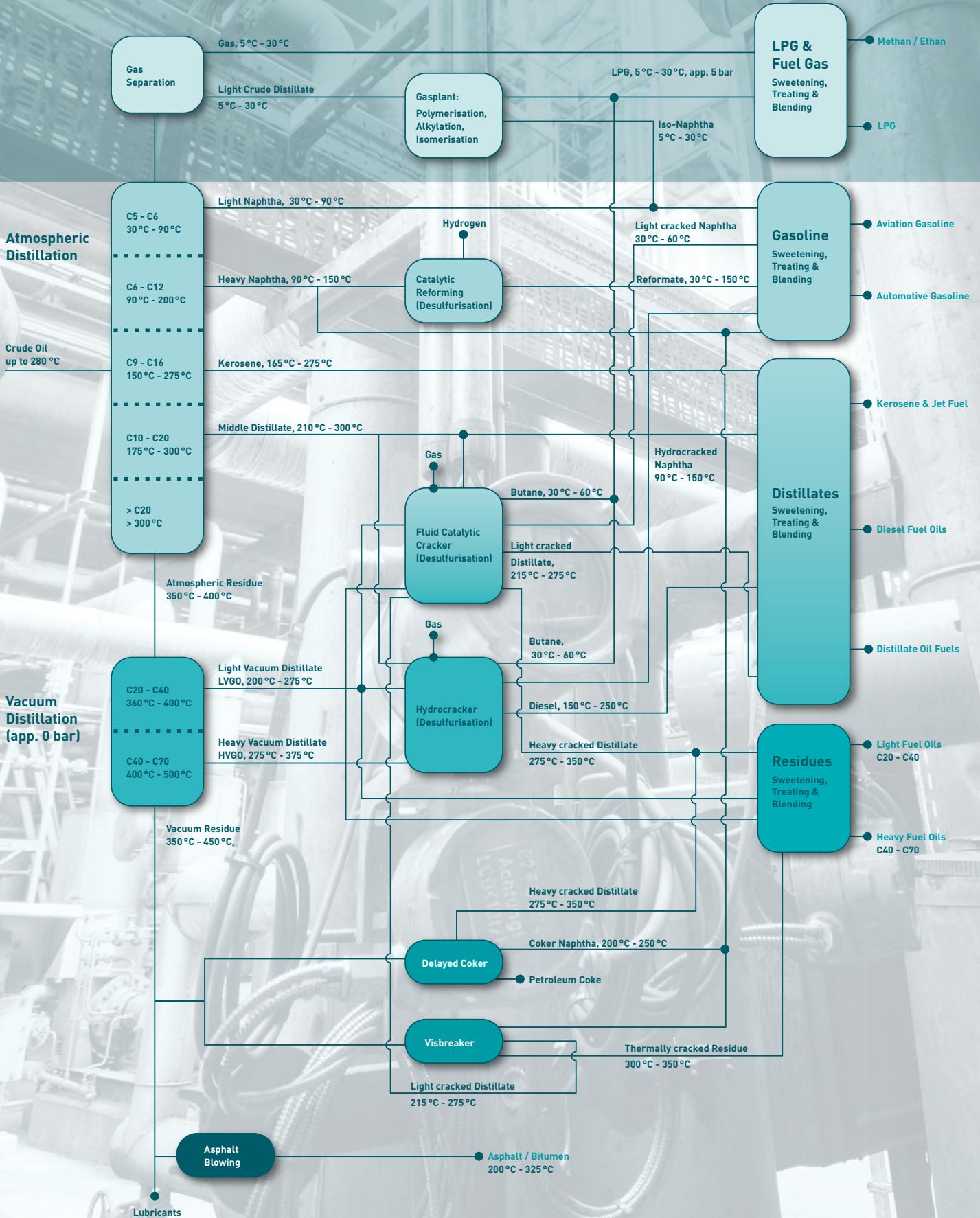
In comparison to conventional measurement technologies, FLUXUS® ultrasonic clamp-on liquid and gas flowmeters offer a superior solution for virtually any liquid and gaseous media, especially within challenging applications.

### Also for portable measurements

With the FLUXUS® F/G60X portable flowmeters, FLEXIM also provides solutions for the temporary measurement of liquids, gases and thermal energy / BTU quantities - even within hazardous areas (ATEX / IECEx Zone 2 and FM Class I, Div. 2 approved).



# Refinery Flows





## Distillation Columns (ADU / VDU)

Particularly on heavier hydrocarbons and residue lines, conventional inline flow measurement technologies, such as DP meters, often struggle with impulse line clogging causing operational and safety issues. FLEXIM's Wavelnjector® measures from the outside of the pipe wall, independent of the internal pressure and temperature, solving flow applications such as:

- Crude oil heating prior to ADU
- ADU outlets with various distillates
- Overflash circulation
- ADU and VDU residues
- LVGO outlets
- HVGO outlets
- Stop oil

Moreover, with the Wavelnjector® there is **no need for process interruption** during installation and **preventive maintenance is not required**.

## Coking (DCU) and Visbreaking

Delayed coking works under extreme process conditions with the highly viscous and particle-loaded medium tending to already coke before reaching the drum.

For this reason, very reliable but also accurate flow rate monitoring at the coker feed lines is essential to prevent such premature coke formation and avoid operational safety risks.

The Wavelnjector® **has proven its high reliability in such extreme conditions again and again** without showing any measurement drift, **without causing internal pressure drops** and offering a virtually maintenance-free solution.

## Hydrocracking (HCU)

Hydrocracking operates at high temperatures and pressure ranges with highly dynamic flow rates. Such conditions place high demands on the inline flowmeters used, such as Vortex meters, and often require NACE-compliant material certificates. Being mounted outside the pipe wall, **the Wavelnjector® never poses a safety risk to the process by itself**. Given this advantage, the ultrasonic measurement system has already **been put in place at many HCU loop control points with pipe temperatures up to 400°C and pressure rates of around 200 bar**.

In addition to the safety aspect, non-intrusive ultrasonic flow measurement is also maintenance-free and does not require any process interruption for installation which in turn makes it **a very cost-efficient metering solution**.

For measuring hydrogen streams, **FLEXIM also provides non-intrusive ultrasonic gas flowmeter solutions eliminating the risk for potential leaks**.

## Fluid Catalytic Cracking (FCC)

Flowmeters in FCC reflux lines or fractionator bottoms face the challenge of abrasive catalyst particles in slurry causing a high degree of wear and tear on any inline measurement systems. FLEXIM's clamp-on ultrasonic flowmeters are **neither affected by abrasion, nor are they a leakage risk**.

## Tank Storage - Hydrocarbon Product Identification and Tank Dewatering

With the FLUXUS® HPI meter, it is possible to combine flow metering with **hydrocarbon product identification**. As hydrocarbon products can be distinguished through the ultrasonic signal, the FLUXUS® HPI meter is the meter of choice in **tank storage applications** when different hydrocarbons are successively passing through the lines. Moreover, it is also the ideal tool for **tank dewatering applications** as water / hydrocarbon cuts can clearly be detected.

## Portable Flow and Energy Surveys

Not every measurement point within a refinery 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**.



## Flow Measurement of Gases

FLEXIM also offers accurate and reliable clamp-on flow measurement of gases such as hydrogen, natural gas and many other media. This can be the case when measuring (bidirectional) volume or mass flow rates over a huge turndown ratio during gas separation and subsequent processing or at fuel gas lines feeding Cracker or other refinery processes.

FLUXUS® gas flowmeters are **independent of the pipe material, wall thickness and diameter, do not cause internal pressure losses and aren't limited by any maximum process pressures.** Even low pressurised gas lines down to 5 bar can be precisely monitored.

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 interruptions.**

## Other Refinery Applications

FLUXUS® clamp-on ultrasonic flowmeters are the ideal choice for a wide spectrum of flow applications within a refinery.

Previously proven flow applications include the clamp-on measurement of:

- Heat transfer oil lines
- Cooling and circulation water lines
- Highly pressurised and strongly vibrating quench water lines (coke cutting water)
- Pipes within a refinery's wastewater treatment plants
- Technical gases and compressed air lines
- Small diameter lines with very low flow velocities (e.g. anti-foam agents and chemical mixing / dosing)
- and many other support processes

## Spent Acid Strength Measurement

Within alkylation plants highly concentrated sulfuric or hydrofluoric acid is used to form high molecular weight olefins from lower molecular weight fractions. It is of **crucial importance to continuously monitor the concentration level of the process feed and spent acid** for acid recovery processes and further process improvements. FLEXIM's process analysers PIOX® measure the acid's concentration either non-intrusively from outside the pipe wall by determining the liquid's sonic velocity, which stands in distinct relation to its temperature compensated concentration, or inline by refractometry.

## Hydrocarbon Quality Assurance

The online analysis of hydrocarbon products, such as aromates, oil distillates or raffinates is of utmost importance to guarantee agreed quality levels. FLEXIM's inline Process Refractometer PIOX® R is the ideal measuring solution for such real-time analysis and can either determine the content of saturated aromatic and olefin compounds or, as another example, the quality of oil distillates and waxes **making cost-intensive laboratory testing obsolete.**



*IECEx*  
certified



# 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 20 years. In addition to non-intrusive flow measurement, FLEXIM specializes in innovative online process analytics 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.