



# Leading Ultrasonic Technology Non-Intrusive Flow Measurement for Liquids and Gases in the Upstream Industry

Flexible. Reliable. Safe.

- Production Separators
- Second and Third Stage Separators
- Test Separators
- Gas and Associated Liquids
- Water Injection
- Produced Water
- Seawater
- Coalescers
- Electrostatic Desalters
- Scrubbers and Reboilers
- Overboard Dumping
- Chemical Injection
- Gas Compression
- Gas Injection
- Gas Lift



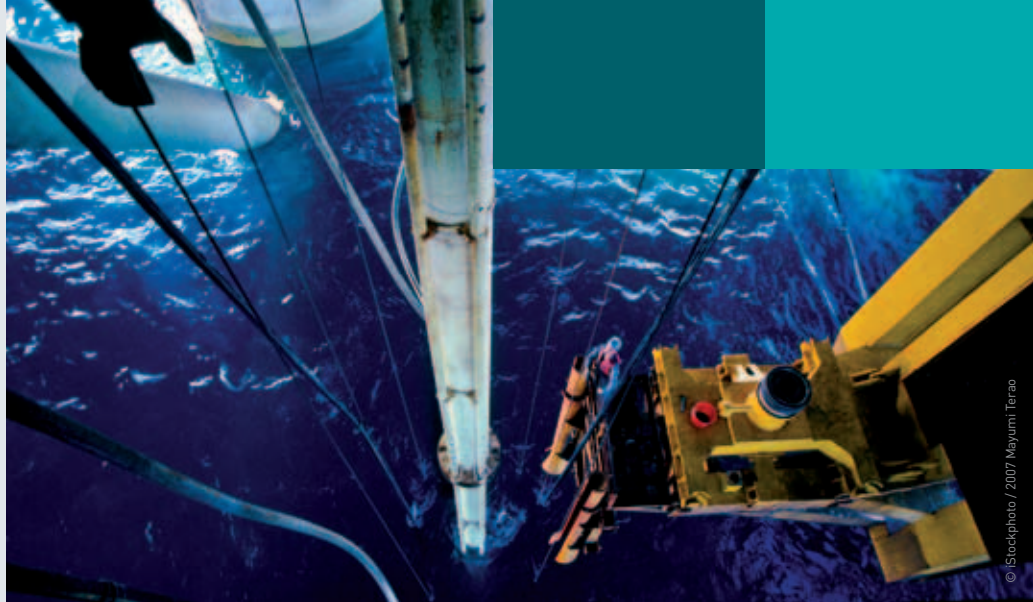
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**External Measurement  
of Internal Flow**

# From Wellhead to Refinery

## Measurement Technology for every Application



### Offshore Gas Measurement

#### FLUXUS® overcomes wall thickness limitations

A large oil company operating offshore in the Asia-Pacific region called on FLEXIM to help with flow measurement in a 6 inch, schedule 160, thick walled pipe carrying natural gas for injection at 1,000 psi. Due to the installation of a new compressor control scheme, an additional flow measurement point was required to be installed on each compressor outlet. Because of high pressure and the fact that a process shut down for installation works was not possible, other flow measurement technologies were not considered.

A FLUXUS® G704 clamp-on ultrasonic gas flow meter from FLEXIM turned out to be the perfect solution. The operator required the flow computer to be installed in a separate equipment room, therefore, ruggedized stainless steel transducers were installed remotely in the field. Connections to the transducers are made through a local junction box which galvanically isolates the transducer's potential from the FLUXUS® G704 in the equipment room. Furthermore, the field equipment is tropicalized with additional surge arresters to protect against lightning strikes.

FLEXIM's clamp-on transducer family makes use of different ultrasonic signal techniques resulting in some distinct benefits. These transducer designs allow

the meters to work over a wide range of applications with little regard for variables such as wall thickness and process conditions.

This demanding high pressure gas application required a wall thickness of 0.98 inch. However, this proved no match for the FLUXUS® G704 flow measurement system in combination with the correct transducer design.

Pressure and temperature inputs in the G704 can be activated to allow the integrated flow computer to calculate compensated mass gas flows.

FLUXUS® overcame the following challenges:

- No susceptibility to abrasive wear
- Thick pipe walls
- Exotic pipe materials
- High turndown and broad measurement range





## Chemical Injection

### FLUXUS® helps to tame sour gas

A major US oil company relies on the FLUXUS® ADM7907 and ADM8027 ultrasonic flow measurement systems for its gas exploration sites. Pulsating low flows on high-pressure liquids in small diameter, thick walled pipes (schedule 160) were the primary challenges for the FLUXUS® flow meters.

Because of high sour gas content, a continuous control of the injection rate of ethylamine into the risers to avoid sulphur crystallization is crucial. The extracted gas later becomes dehydrated in absorber towers using triethylene glycol. Precise flow measurement is important to maintain the glycol volume flow in exact ratio with the gas volume flow.

The FLUXUS® ADM7907, a rack-mounted flow computer with clamp-on transducers, was the answer the company had been searching for. Due to its two channels, the transmitter is able to simultaneously measure the ethylamine as well as the glycol flows.

To date, the company has installed numerous FLEXIM flow systems, including the FLUXUS® ADM8027 for hazardous area applications, which have given eight years of uninterrupted service.

FLUXUS® overcame the following challenges:

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No clogging due to clamp-on nature

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Very low and pulsating flow rates  
0.03 ft/s

\_\_\_\_\_

Resistant to pressure peaks

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No requirement for NACE due to no direct sour gas contact

## Sand Separation in Produced Water

### FLUXUS® WAGs its tail

WAG (Water-Alternating-Gas) injection can boost oil recovery from reservoirs, but sometimes at the cost of increased sand production.

One major Norwegian oil company faced with this problem installed Online Vessel Desanders (OVDs) to remove sand from the separator vessels.

To operate the OVDs correctly, the company needed to measure produced water in 2 inch pipes on the inlet and outlet of each unit.

The answer was the FLUXUS® ADM8127 ultrasonic flow measurement system, which can withstand rough and hazardous offshore environments.

Because of the tremendous success of the system, the company bought 16 dual-channel units with 32 hazardous area certified transducer pairs to monitor the OVD units.

FLUXUS® overcame the following challenges:

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Sand erosion of insertion meters

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Space and weight constraints

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Accurate measurement of multiphase water/sand mix





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## Water Injection

### FLUXUS®, more than a match for erosion

Water injection is a common way to extend reservoir life through intelligent well management.

In order to raise the reservoir pressure and improve the production rate, sea water is injected into the well. The injected water quantities are monitored by flow meters and transmitted to the process control system.

The water injection takes place in two steps. Firstly the booster pumps suck the water out of the reservoir's water tank to create a slight admission pressure of approximately 217 psi. The injection pumps need this pressure in order to work cavitation free. Secondly the injection happens in 10 inch pipes made of 1 inch thick duplex steel, where pressures of about 4,350 psi can be reached during the process.

Measuring such injection rates accurately can be challenging. The high pressure, high velocity water typically causes severe erosive wear to traditional flow meters, which rely on parts protruding into the pipe.

One European producer found this out the hard way on a North Sea platform. Erosion and deposits caused the precision of differential pressure flow meters in the water injection lines to decrease continuously.

A non-intrusive flow measurement with the FLUXUS® ADM7907 was the ideal solution. The installation of the meters can take place without interrupting the production and without cutting into the pipe. The transducers are simply clamped onto the pipe and do not cause any pressure loss. Since they do not come in contact with the medium, they are not subject to wear.

These advantages make the system a perfect solution for retrofit installations. The benefits are also important when considering new installations, taking the system's comparatively low weight and non-existent pressure loss into account.

The company reports that its FLUXUS® ADM7907 flow meters require little or no maintenance yet are completely immune from performance fall-off caused by the high velocities and pressures found in water injection.

FLUXUS® overcame the following challenges:

Thick walls in excess 1.58 inch

Exotic pipe materials (Super Duplex)

No drift due to wear

SS 316 Ti version fully compliant to NORSOK



# FLEXIM Ultrasonic Clamp-On Flow Measurement

## The Best Technology for the Challenges the Upstream Industry is faced with

### Non-intrusive, reliable and accurate

From wellhead to refinery, the flows of liquids and gases need to be measured every step of the way.

FLEXIM flow meters have been proven worldwide and offer a precise flow measurement with high operational reliability and outstanding long-term stability. Thanks to the clamp-on flow transducers, no cutting into the pipe, and thus no production shutdown is needed for installation. The operational costs are very low, since the measurement causes no pressure loss and is absolutely free of wear from any aggressive media. Furthermore, there is no possibility of harm from high temperature (up to 750 °F) or pressure peaks.

### Leading flow measurement technology

The FLEXIM transit-time difference method exploits the fact that the transmission speed of an ultrasonic signal depends on the flow velocity of the carrier medium. An ultrasonic signal moves slower against the flow direction of the medium than when with the flow direction. For the measurement, ultrasonic pulses are sent through the medium in both directions. The transit-time difference is measured and allows an accurate determination of the volume flow.



### Approved innovation

The FLUXUS® range of ultrasonic clamp-on flow meters are the most advanced in the world. They are available with a range of certification options from ATEX zones 1 and 2, FM Class I Div II, IECEx, IP66/67/68 and are capable of withstanding pipe temperatures in excess of 750 °F.

FLEXIM's Oil & Gas Division provides a comprehensive service and full support over the full product range wherever it is located.

### FLEXIM ultrasonic flow meters come with a host of unique features:

- All FLEXIM flow meters are compliant to ANSI/ASME MFC-5M-1985 (R2001) requirements by temperature compensating the transducers to prevent drift
- Every set of transducers leaving the manufacturing facility is calibrated to traceable standards, ensuring both accuracy and zero stability
- The digital signal processor calculates up to 1000 flow measurements per second, providing the basis for continual precision measurement
- The FLUXUS® clamp-on flow meters are the only systems in the world to use two different transducer technologies to cover the widest range of applications
- Solid transducer coupling makes these meters a virtually maintenance free flow measurement solution
- FLEXIM flow meters are capable of both liquid and gas measurement (including wet gas\*)

\* All wet gas applications are to be approved

# FLEXIM

**In partnership  
with you**



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 specialises in innovative online process analysers 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 instrument rentals, on-site measurements, laboratory

analysis, project handling, training, commissioning and consulting services.

The company's focus and dedication is directed towards providing the highest-quality equipment with the best support and service possible.

### FLEXIM Oil & Gas Division

The Upstream Industry makes special demands of its instrumentation, those of high pressures, high temperatures and most importantly, high safety requirements. FLEXIM's product portfolio offers measurement solutions which meet these challenges. In order to better serve the needs of the Upstream Industry, FLEXIM has founded a global network of experts in these applications with supporting offices in many parts of America, Europe and Asia.

The FLEXIM Oil & Gas Division leverages many years of experience, and has found wide acceptance by the world's major oil and gas companies.

### FLEXIM GmbH

Berlin, Germany  
Phone: +49 30 93 66 76 60  
Fax: +49 30 93 66 76 80  
[info@flexim.de](mailto:info@flexim.de)

### FLEXIM AMERICAS Corporation

Edgewood, NY, USA  
Phone: +1 631 492 23 00  
Fax: +1 631 492 21 17  
Toll free: 1 888 852 74 73  
(North America only)  
[usinfo@flexim.com](mailto:usinfo@flexim.com)

### FLEXIM Instruments Asia Pte Ltd.

Singapore  
Phone: +65 67 94 53 25  
Fax: +65 68 62 28 36  
[salessg@flexim.com](mailto:salessg@flexim.com)

Shanghai, China  
Phone: +86 21 64 95 75 20  
[shanghai@flexim.com](mailto:shanghai@flexim.com)

Visit us at:  
[www.flexim.com](http://www.flexim.com)  
[www.upstream.flexim.com](http://www.upstream.flexim.com)