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# Update



## Non-Invasive Gas Flow Measurement FLUXUS® G Stands its Ground in the Industrial World

Simply clamp on and measure. Without cutting into the pipes or interrupting the process. Because of its obvious advantages, ultrasonic clamp-on flow technology has the greatest growth rates in the flowmeter market. This practical technology has now also been extended to the measurement of gases.

### A challenge for the developers

The transfer of the know-how in fluids clamp-on technology to gases posed special challenges to the researchers and developers due to the great density and sound velocity differences between metal pipe walls and the gases flowing in the pipes. 'Only a small fraction of the energy radiated in reaches the gas,' explains Dr. Mathias Panicke, R&D Director at FLEXIM. 'The remainder is noise in the pipe walls.' Dr. Panicke can present the physical difficulties of the gas flow measurement using the clamp-on method in a relaxed manner, for his development team has solved the problem. A certificate from the independent Colorado Experiment Engineering Station Inc. (CEESI) hanging in Dr. Panicke's office attests the precision and reliability of the non-invasive gas flow measurement. Extensive experience in the field of ultrasonic technology and a broad range of practical application in flow measurement established the foundation of the success; the imagination, persistence and diligence of the developer team made the rest.

### Intelligent solutions

Innovations at all levels of signal emission, reception and processing brought the breakthrough. A unique emission and signal treatment process was developed. In order to maximize the signal-to-noise-ratio, the intelligent measurement algorithm adapts to the varying application conditions and automatically optimizes the measurement. An integral transducer system rounds off the concept. The universally applicable shear wave trans-



*Not impressed at all by high pressures! The clamp-on transducers are on the safe side of the pipe.*

ducers of the GS type cover a broad nominal width range and can measure flexibly on pipes with different wall thicknesses. In addition to that, FLEXIM has developed new transducers that operate with Lamb waves. These GL transducers are attuned to a specific pipe wall thickness range and are thus thought for permanent installation. They are ideal for measurement at high flow velocities and for gases with high acoustic damping.

### Comprehensive consulting

'We do not expect our customers to have a doctorate on the acoustic characteristics of gases,' says Mirko Blümke, Product Manager Flow at FLEXIM. 'Our application engineers study exhaustively the customer's application and the specific measuring points in order to determine which transducer type is best suited.' The rest is taken care of by the transmitter. No matter whether GS or GL type, FLUXUS® G recognises all FLEXIM transducers automatically when connected.

The non-invasive measurement procedure is outright predestined for employment in high-pressure applications such as plants for natural gas extraction, distribution and storage.

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### Poster

Environmental Protection of Enclosures

FLUXUS® G is also successfully used in offshore natural gas extraction. Another field of application for the non-invasive technology lies in the chemical industry, where clamp-on measuring methods are particularly practical solutions in high-pressure applications such as synthesized gas. Moreover, this non-invasive, leak-free method is ideal for the flow measurement of aggressive and poisonous reaction gases conveyed in special plastic pipes. Mathias Panicke is sure: 'The effort was worth it.' And Mirko Blümke is glad that the time for pilot projects is finally over. FLUXUS® G stands its ground in the industrial world.



*Mirko Blümke,  
Product Manager Flow*

# Elegant Solutions for Explosive Matters

## The RWE Group measures natural gas using the non-invasive FLUXUS® G

**Most flows go in one direction only. Not so in a natural gas reservoir. There, gas is either stored or removed depending on the market situation. A classic application for the non-intrusive gas flow measurement with FLUXUS® G.**

The secure supply of energy gains significance globally in light of the finite supply of fossil resources. Germany is an energy importing country. Only a fraction of the raw materials used for creating energy here stems from domestic extraction. In order to ensure the supply of natural gas to the consumer at all times the energy corporations operate large subterranean reservoirs. The RWE Group operates such a natural gas reservoir in Kalle in the north of Germany (Lower Saxony).

Natural gas reservoirs serve as a buffer between supply and demand. The extraction as well as the transport rates of this energy carrier are variable only to a certain degree. The demand however fluctuates depending on the time of day as well as, above all, on the season. Natural gas consumption can be 15 times larger during the winter than it is in the summer. It is therefore necessary to follow the example set by the squirrel: When extraction and acquisition from foreign sources exceeds the demand, the excessive natural gas is stored so that it is available at short notice if needed.



*Secure measurement in hazardous areas: FLUXUS® G800 ensures a reliable measurement of the gas volume flow*

In the course of the liberalisation of the gas market in Europe, the storage and extraction of natural gas receives an additional economic relevance.

### Reliable supply

For nearly three decades, the Kalle natural gas reservoir has been insuring a reliable supply for the European natural gas customers of the RWE group. In 1976, test drillings had confirmed the existence of a suitable porous rock bed at a depth of 2100 metres. The plant was erected and operations started in October 1978. The subterranean reservoir at Kalle is an aquifer reservoir. The reservoir stratum 'Volpriehausen sandstone' has a thickness of about 13 to 16 metres. The aquifer basin extends to about 70 km<sup>2</sup>. With a total reservoir volume of 630 million standard cubic metres natural gas, Kalle is the second largest aquifer reservoir in Germany.

The gas that is stored is dry, marketable natural gas. The Kalle natural gas reservoir is connected to the European pipeline network by means of three connection lines. The natural gas received from there passes at first a calibrated quantity measurement. The pressure in the transport network is about 50 bar. To force the gas into the subterranean reservoir the pressure needs to be increased to up to 275 bar by compressors. Finally the compressed natural gas is led through high-pressure pipes to the boreholes and pressed there into the subterranean aquifer reservoir stratum where it displaces the water that is in the pores. All together the compressors in Kalle can attain a maximum storage capability of up to 250 000 m<sup>3</sup>/h [V<sub>n</sub>].

The extraction is done through the same boreholes as the storage. The natural gas, which ascends by its own pressure, is now water-vapour saturated wet gas. It therefore needs to be dried and depressurised prior to being fed back into the transport network. For that it is fed through water separators and then depressurised to 80 bar. The humid gas is then dried in the absorber towers by injecting glycol. Afterward, it is fed through the same calibrated

quantity measurement back into the transport network. The maximum extraction capability of 450 000 m<sup>3</sup>/h [V<sub>n</sub>] is nearly twice as high as the storage capability.

### Reliable measuring equipment

In Kalle, a total of nine boreholes into the reservoir stratum are available for storage and extraction. The quantity measurements mentioned above are not sufficient for process control. Required is also dependable information about the bi-directional flows at the individual boreholes. In the past, RWE relied on the measured values supplied by permanently installed orifice plates. However, these are maintenance-intensive and lack accuracy considering the enormous measuring range.

Now, FLUXUS® G ultrasonic measuring systems measure the gas flow rates at the nine boreholes. A further FLUXUS® G measures the gas compressed by compressor 3. Since the measuring points are located in the explosion hazard zone 1, all transducers are explosion protected. Most of the measuring points are set up so that the transducer cables lead into parts of the plant that are outside of the explosion hazard zone. There, the 19" rack version of FLUXUS® G can be used: FLUXUS® G709. At the 4 measuring points where this is not possible, the ATEX-certified FLUXUS® G800 is employed. All transmitters feature two measuring channels so that the gas flow of two measuring points can be measured simultaneously. Additionally, a FLUXUS® F flowmeter for liquids is measuring process water.

Sebastian Vreemann, the FLEXIM engineer responsible for northwest Germany, has taken over the project from Claus Weihermüller, who now supplies the Asian flowmeter market with measuring equipment made in Berlin. He is proud of the 20 greenlit LEDs that are indicating the fault-free function of the measuring installation. The high moisture content at extraction does not interfere with the measurement. Even the pipe wall thickness of 22 mm is no problem for the powerful FLUXUS® G. Since the transducers are so to say 'on the safe side',



*Sebastian Vreemann is a welcomed guest at Kalle, not only because he is so friendly, but also because he installs his instruments during the process, without production stop.*

namely on the outer wall of the pipe wall, they are completely insensitive to condensation, pressure peaks, or solid particles in the gas flow. The commissioning of the measuring systems was conducted as the plant was in operation.

### Extreme dynamics

'Gas flow measurement with ultrasonic clamp-on technology is optimally suited for conditions as can be found here,' explains Sebastian Vreemann. 'The high pressures, which mean special technical requirements and enormous added costs for other measuring methods, guarantee an outstanding signal quality for the ultrasonic measurement. And then we have this extremely large dynamic range - for both flow directions!' Indeed, the direction of flow is completely irrelevant for the acoustic measuring method. The outstanding dynamics are also a consequence of the measuring principle: ultrasonic waves follow the flow without inertia and slack. Thus even the measurement of very low flow velocities in

very large pipes delivers utilizable values. The velocity limit is determined by the blow of the sonic signal. In practical applications flow velocities of up to 30 m/s can be measured.

The shift personnel in the control room of the natural gas reservoir runs the plant according to the requirements of the dispatcher in the RWE headquarters in Dortmund. Thanks to the ultrasonic measurements each borehole can be controlled individually and precisely. Furthermore the measuring values are needed for the reservoir simulation.

Since its commissioning in 1978 the reservoir plant in Kalle has continuously expanded and modernised. With the now liberalised energy markets, the demands on its capacity will continue to grow. In this situation, it is good to be able to rely on measuring instruments that simply measure dependably and which are completely unimpressed by the amounts that rush in and out under high pressure.

### Natural Gas Reservoirs

44 subterranean natural gas reservoirs are currently in operation in Germany with a total operable gas volume of 19.1 billion m<sup>3</sup> [V<sub>n</sub>]. The Federal Republic is thus on the fourth place on the list of gas storing nations, following the U.S.A., Russia and the Ukraine. The reservoir capacity of the German natural gas reservoirs roughly equals the amount of the domestic natural gas extraction or one fifth of the total German gas consumption.

Of the German subterranean natural gas reservoirs 23 are pore reservoirs; the other 21 are cavern reservoirs. Cavern reservoirs are man-made subterranean caverns that are created by solution mining in a salt dome. They function as underground high-pressure tanks and therefore reach quite high extraction rates if needed.

In pore reservoirs a suitable porous strata of stone functions as a reservoir which holds the gas as a sponge. These are often exhausted oil or gas deposits. Many natural gas reservoirs are therefore located in close proximity to natural gas gathering. The aquifer reservoir is also a pore reservoir whose reservoir horizon is saturated with water. For natural gas storage this needs to be displaced by the pumped in natural gas. A condition for the usability as a reservoir is a suitable geological formation in which an impermeable strata of rock over the reservoir horizon prevents the gases from rising.

## FLEXIM's Man for Asia – Claus Weihermüller



Claus Weihermüller started working for FLEXIM in October 1999 as a sales engineer for Northern Germany. He actually was FLEXIM's very first sales representative in Germany. With a Master Degree in Chemical Engineering and Process Control and many years of sales and application experience, he was a perfect candidate for the job. Later, he took over sales responsibilities for Scandinavia (2003) and for Russia (CIS, 2005). He also played a decisive role in developing FLEXIM's European Sales Network.

As FLEXIM Instruments Asia Pte Ltd was founded in May 2006, Claus Weihermüller was ready for a new challenge: He took over the Managing Director functions.

An office was opened in Singapore, Shanghai followed. Claus will develop FLEXIM's Asian sales representative network. He will also support FLEXIM's Asian Sales Engineer Team. His aim is to offer the same service and same quality to the Asian customers as European customers are used to. He enjoys starting for the scratch and creating something completely new.

In spite of some language comprehension difficulties, Claus Weihermüller is enthusiastic about his new job challenge and the countries he now has to travel regularly. "It is amazing here, you can find everything. Everyday brings surprises and something new. And the food is great!" When he misses his home Northern Germany, he looks at the games of the German Soccer League on TV. He is a supporter of HSV, the team of his home town Hamburg, and used to play in an Amateur League in Hamburg.

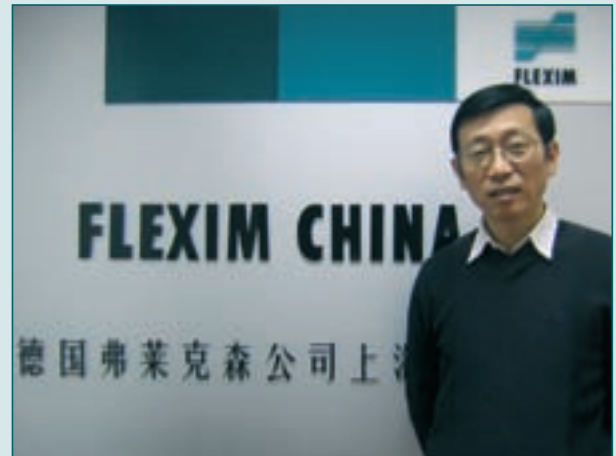
*FLEXIM first own exhibition booth at the OGA in Kuala Lumpur was a great success.*



## New People @ FLEXIM

**Mr. Yi Liu has been appointed Country Manager for China.**

He brings many years of experience in the domain of ultrasonic flow measurement, amongst others as Country Manager for Panametrics China. He will lead FLEXIM's new office in Shanghai and care for FLEXIM's Chinese customers.



**Mr. Bas Tammen has been appointed Managing Director of FLEXIM France.**

Mr. Tammen has 15 years of professional experience in the domain of instrumentation. He has worked for renowned German and Swiss instrumentation manufacturers, and spent the last three years as Product Manager Flow with Vega Technique, one of FLEXIM's partners in France. In Spring 2007, Mr. Tammen opened FLEXIM's new office in Strasbourg.



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