FLUXUS® G

Non-Invasive Gas Flow Measurement

Natural Gas Extraction
Offshore
Gas Transmission
Storage
Chemical Industry
Petrochemical Industry
Manufacturing Industry

External Measurement of Internal Flow
Non-Invasive Gas Flow Measurement with FLUXUS® G

FLEXIM’s ultrasonic gas flow meters use the proven clamp-on transit-time correlation technique also employed for the F series liquid meters. Special ultrasonic transducers are simply clamped onto the outside of the pipe and never come in contact with the gas.

The FLUXUS® G series contains a broad variety of transmitters and transducers: from basic models for standard applications up to robust measuring systems for offshore use or for use in hazardous areas.

Our tradition is innovation

Ever since its inception, FLEXIM has been among the pioneers in the field of ultrasonic flow measurement. Many years of application experience combined with innovative concepts and solutions have allowed FLEXIM to extend the scope of the ultrasonic technology to non-invasive measurement of gases.

Now, with the FLUXUS® G series, FLEXIM sets a new standard. Special transmission technology combined with powerful software algorithms and intelligent adaptive signal processing gives these instruments the dependability you have come to expect from FLEXIM.
Adaptive Signal Processing

In order to maximize the signal to noise ratio, an optimized transmission process featuring multipulse excitation was developed. The versatile measurement algorithm automatically adapts to the varying application conditions. Thus, disturbing factors such as beam dispersal and structure-borne pipe noise can be effectively compensated.

The FLUXUS® G series instruments use digital signal processing. This enables them to adapt easily to a great variety of measuring tasks. Up to 1000 raw signals per second are transmitted for signal processing and analysis.

FLEXIM’s signal processing algorithms reflect many years of experience in extracting desired signals and rejecting unwanted noise signals. Thus, even weak signals of only a few µV are reliably detected and processed.

Wide dynamic range amplifier

The FLUXUS® G measurement amplifier offers a uniquely wide dynamic range by including various frequency filters which are automatically tuned to the appropriate transducer frequency. This is particularly advantageous in the case of clamp-on ultrasonic gas flow measurement, which has to contend with very low signal levels.
FLUXUS® G represents the ideal solution for non-invasive gas flow measurement. FLEXIM’s non-invasive technology is an advantageous and cost-effective alternative to conventional methods, particularly with chemically aggressive, poisonous or high pressure media. With their extremely wide turn-down ratios, the instruments of the FLUXUS® G series register even the smallest flows.

Non-invasive measurement

➔ No contact with the medium, therefore no possibility of chemical attack. No need for expensive special materials (sour gas applications for example)

➔ No wear and tear, even with high flow velocities or with gas containing particles

➔ No clogging of small bore impulse lines with deposits, condensate, inhibitors, oil vapours, dust (as happens when using impulse lines in the measuring system)

➔Insensitive to dust and humidity
Transducers are mounted on the pipe

- Very cost-effective installation
- Easy installation without process interruption
- No welding work
- No risk of leakage
- Cost-advantageous, especially in high-pressure applications and for large pipe diameters
- Absolutely no pressure loss, thus low operating costs
- No pipe diameter reduction, therefore no pipe clogging

No moving mechanical or pressure loaded parts

- Safe and maintenance-free
- Measurements can be made even at high operating pressures
- Unharmed by pressure peaks (for example at the onset of condensation)

Precise, bi-directional flow measurement with high measurement dynamics

- Even minute flows are measurable
- Measurement is unaffected by gas density, viscosity and composition, dust, humidity, temperature or pressure
- Not sensitive to velocity peaks, swirling flows or transverse flows
- Long-term stable measurement results
- High measurement rate, fast response time

Approved for explosion hazard areas
Ultrasonic flow meters natively measure the actual volumetric flow. The transmitters feature an integrated flow computer which makes use of external temperature and pressure data to convert the actual volumetric flow into standard volume (mass) flow based on ISO 12213-1.

In principle, flow measurement is possible on all types of gases. However, when measuring on metal pipes, a certain minimum pressure is required, depending on the composition of the gas and the pipe material. Plastic pipes will support operation at atmospheric pressure.

Our application engineers will be pleased to advise you.

The Transit Time Difference Correlation Principle makes use of the fact that the time of flight of an ultrasonic signal is affected by the flow velocity of the carrier medium. Like a swimmer working his way across a flowing river, an ultrasonic signal travels slower upstream than downstream. Our instruments work according to this transit-time principle: an ultrasonic pulse is sent downstream through the medium, another pulse is sent upstream. By measuring the transit-time difference, the flow velocity can be determined. The volumetric flow is then calculated out of the flow velocity and the pipe parameters.

### General Technical Data

<table>
<thead>
<tr>
<th>Measuring principle:</th>
<th>Transit time difference correlation principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow velocity:</td>
<td>0.03 to 115 ft/s, pipe size dependent</td>
</tr>
<tr>
<td>Repeatability:</td>
<td>0.15 % of reading ± 0.03 ft/s</td>
</tr>
<tr>
<td>Accuracy (given a fully developed rotationally symmetric flow profile)</td>
<td>Volume flow: ± 1 % to 3 % of reading ± 0.03 ft/s, depending on the application ± 0.5 % of reading ± 0.03 ft/s with field calibration</td>
</tr>
<tr>
<td>Measurable gases:</td>
<td>Ratio of the characteristic acoustic impedance of the pipe wall material to that of the gas &lt; 3000</td>
</tr>
<tr>
<td>Operating pressure:</td>
<td>Measurement does not restrict the maximum operating pressure</td>
</tr>
<tr>
<td>Pipe size range:</td>
<td>1/4 inch to 62 inches</td>
</tr>
<tr>
<td>Gas temperature:</td>
<td>−40 °F to 390 °F, depending on the transducer type</td>
</tr>
</tbody>
</table>
Applications

Oil and Gas

- Measurement on natural gas pipelines
- Measurement in natural gas storage installations (storage and extraction)
- Management of gas storage facilities (efficiency maximization, performance optimization, salt cavern leaching)
- Regulation and control of drilling sites in natural gas extraction
- Control of compressor stations
- Dimensioning of extraction sites and drilling probes (efficiency maximization)
- Measurement of ethane, propane and hydrogen
- Measurement of sour gas
- Measurement for the gas supply industry
- Measurement of injection gas in the petroleum industry
- Allocation and checkmetering
- Inventory control / Lost and unaccounted for gas analysis
- Measurement of injection media in gas processing (monoethylamine, TEG, etc.) with upgraded instrument.

Ask FLEXIM!

Chemical Industry

- Measurement of synthesized gas
- Gas measurement in the plastics production process (high pressure)
- Measurement of ethylene, helium and nitrogen

Manufacturing Industry

- Measurement of compressed air

Service

- Supervision of permanently installed meters
- Error diagnostics
- Service and maintenance
A FLUXUS® G for all purposes

Whether for portable use, for rack-mounting or for permanent installation, or even for offshore use: FLEXIM offers the appropriate FLUXUS® G to meet each measurement challenge. ATEX and FM certified measurement systems for use in hazardous areas are available. Versatile process interfaces assure optimal integration into the user’s process.

Guaranteed user friendly

No complex and elaborate instructions are required in order to use the intuitively structured menu of the FLUXUS® G. The pipe and material parameters are easily entered, thanks to the internal media and materials data bank. Explosion-proof instruments can be operated without opening the housing and without requiring any additional devices.

Technical Data

Operating temperature:

Measuring channels:

Protection degree acc. to EN60529 / NEMA:

Explosion protection in:

Inputs:

Outputs:

Calculation of the standard volume flow according to AGA-8 and ISO 12213-1:

Communication protocol:
The Portable All-round Meters
FLUXUS® G601 (CA Energy)
FLUXUS® G608

The highly mobile and versatile G601 is perfectly suited for temporary usage during servicing, maintenance, check metering or as back-up for short term replacement of failed meters. As product variant G601 CA Energy, the portable meter is the ideal instrument when compressed air and thermal energy flows have to be measured. The G608 goes even further and is ATEX as well as FM approved for its usage in explosion hazard areas.

The Multi-function Meters
FLUXUS® G704
FLUXUS® G709

Permanently installed and freely configurable: The FLUXUS® G704 is designed for permanent installation. With its range of electrical inputs and outputs, it can handle a variety of process parameters. Although technically identical to the G704, FLUXUS® G709 is designed for permanent installation in 19” rack systems.

The Explosion-proof Experts
FLUXUS® G800
FLUXUS® G801

FLUXUS® G800 and G801 are ATEX certified for use in hazardous areas. The especially robust G801 is completely seawater-resistant and therefore ideal for offshore applications.

Technical Data

<table>
<thead>
<tr>
<th>G601</th>
<th>G704</th>
<th>G709</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 to 140 °F</td>
<td>14 to 140 °F</td>
<td>−4 to 122 °F</td>
</tr>
<tr>
<td>Measuring channels:</td>
<td>1 or 2</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Protection degree acc. to EN60529 / NEMA:</td>
<td>IP65 / NEMA 4X</td>
<td>G704: IP65 / NEMA 4X</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosion protection in:</td>
<td>G608: ATEX Zone 2 (1), FM Class I Div II</td>
<td>ATEX Zone 2, FM Class I Div II for G704</td>
</tr>
<tr>
<td>Inputs:</td>
<td>Standard: —</td>
<td>2 x current, 1 x voltage, 1 x temperature</td>
</tr>
<tr>
<td></td>
<td>Multifunctional: 2 x current, 1 x voltage, 1 x temperature</td>
<td>Maximum 4. Available are: temperature (Pt 100 / Pt 1000), current, voltage</td>
</tr>
<tr>
<td>Outputs:</td>
<td>Standard: 2 x current, 2 x binary</td>
<td>2 x current, 2 x binary, 1 x frequency</td>
</tr>
<tr>
<td></td>
<td>Multifunctional: 2 x current, 2 x binary, 1 x frequency</td>
<td>A variety of combinations are available from the following: current [0/4 mA to 20 mA], voltage, frequency, pulse, alarm</td>
</tr>
<tr>
<td>Calculation of the standard volume flow according to AGA-8 and ISO 12213-1:</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Communication protocol:</td>
<td>—</td>
<td>HART, Modbus RS485</td>
</tr>
</tbody>
</table>
Two transducers types providing a uniquely wide application range

All FLUXUS® G transmitters support both lamb wave and shear wave transducers at all transducer frequencies. In this way the measuring system can be optimized to the process. The Lamb wave transducer is ideal for high velocity gas measurement as found in natural gas pipelines. The shear wave transducer covers a wide range of pipe diameters and wall thicknesses. It is the best choice for mobile measurement and application diagnostics, as well as for thick-wall pipes.

Robust construction

All FLEXIM clamp-on transducers are watertight and especially made for use in harsh industrial environments. The transducer housings are made of PEEK or PPSU with stainless steel protection caps. Robust construction and rugged wiring guarantee long-term stability and measuring reliability.

Paired, calibrated transducers

Each pair of transducers has been wet-flow calibrated at the factory. All calibration data is stored in a transducer-resident non-volatile memory and is automatically transferred to the transmitter upon connection. Consequently, parameterization errors are eliminated and there is never a need for a zero adjustment.
Robust transducer mounting fixtures

The PermaLok mounting fixtures hold the transducers safely in place and ensure continuous and constant contact pressure between the transducers and the pipe surface, even if temperature variations cause the pipe diameter to change. Made of stainless steel, they are corrosion-proof and wear resistant. The transducers can be removed and remounted onto the PermaLok rail without readjustment.

General Technical Data of the Transducers

<table>
<thead>
<tr>
<th>Application range*</th>
<th>Shear wave transducers: Transducers available for diameters from 0.6 to 44 inch. A minimal pipe wall thickness is required.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lamb wave transducers: Transducers are available for diameters from 1/4 to 62 inch and wall thicknesses from 0.002 to 0.9 inch. Each transducer type is assigned to a given wall thickness range.</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Gas temperature and ambient temperature: between -40 to 390 °F, depending on the transducer type.</td>
</tr>
<tr>
<td>Use in explosion hazard area</td>
<td>Transducers for ATEX Zone 1 and 2 as well as for FM Div 2 available</td>
</tr>
<tr>
<td>Explosion protection temperature</td>
<td>Depends on the transducer type and on the atmosphere type. The explosion protection range is usually wider than the operating temperature range.</td>
</tr>
<tr>
<td>Protection degree acc. to EN60529 / NEMA</td>
<td>IP56, IP65, IP67, IP68 / NEMA 4, NEMA 6, NEMA 6P</td>
</tr>
<tr>
<td>Material</td>
<td>PPSU or PEEK with stainless steel caps</td>
</tr>
</tbody>
</table>

* the specified range is valid for natural gas in steel pipes, under the conditions defined in the specification sheets.
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.