Flexim™ Non-Intrusive Natural Gas Flow Measurement

Upstream • Midstream • Downstream

FLEXIM™

EMERSON™

Flexim™ FLUXUS G

The superior solution for the oil and gas industry

Flexim™ FLUXUS measures gas flow rates non-intrusively. As a result, there is no disruption to ongoing production operations and supply. There are no drops in pressure across networks or operational risks associated with leak paths and flanges. There is also no wear and tear. And furthermore, Flexim™'s flowmeters do not cause any fugitive emissions .

Our clamp-on ultrasonic meters and transducers are simply mounted on the outside of the pipe thus offering a more practical and flexible solution to conventional wetted measuring technologies. Differential pressure meters are often exposed to specific challenges such as high pressures and can face various shortcomings. These include unsatisfactory measuring dynamics, susceptibility to wear and tear, process downtime required for installation, frequent maintenance, and pressure losses within the network.

Leading Technology

Gas flow measurement requires highly accurate and dynamic metering, knowledge, and expertise. The combination of state-of-the-art processing techniques, analytics and robust and reliable ultrasonic technology is at the heart of every clamp-on flow meter we manufacture. With multiple housing and mounting options, multi-channel options for increased accuracy and measurement stability, inputs for pressure and temperature changes, etc., Emerson leads the market both in quality and performance in virtually every gas application – from produced natural gas to ammonia gas in refrigeration plants and from process gases in the chemical industry to compressed air flows in industrial production.

Emerson | Flexim is the world's only provider of clamp-on ultrasonic systems for non-intrusive gas flow measurement with SIL 2 certification.

Exploration and Production

- Gas at the Separator Outlet
- Wellhead Gas Flow Measurement
- Gas Injection & Lift
- Gas Treatment

Transportation & Distribution Networks

- Compressor Stations
- Pipeline Flow & Integrity Monitoring
- Medium Pressure Networks
- Odorizer Stations

Storage

- Underground Storage – Gas Injection and Withdrawal
- Gas Dehydration
- LNG Plants
- Storage Terminals
- Check Metering

External Excellence and Efficiency

Flexim™'s non-intrusive gas flow measurement with FLUXUS G combines the excellent bidirectional measuring performance of wetted ultrasonic measuring systems with the advantages of clamp-on measuring technology. Measuring from the outside not only means measuring from the safe side. The advantages of non-intrusive clamp-on gas flow measurement pay off over the entire lifecycle. As the clamp-on transducers are installed during ongoing operation, the installation costs are significantly lower than with wetted devices. The acoustic measuring equipment is not subjected to wear and tear which means it is practically maintenance-free. Internal pipeline pig inspections do not require any modification to the measuring system installed outside.

Non-intrusive gas flow measurement with Flexim™ means:

- No process interruption for installation, future inspections, or modifications
- Cost-effective and convenient:
  - minimal installation and maintenance costs
  - long lifespan
  - independence of line sizes
  - no need for process interruptions
- Precise flow measurement over a high measuring range, independent of the flow direction (bidirectional)
- Not subject to wear and tear – virtually maintenance-free (no need for frequent work in hazardous areas)
- No potential for leaks
- No pressure losses, no energy losses
- Highly robust and completely unaffected by solid particles in the gas flow

Unique features of the FLUXUS G gas flow meters are:

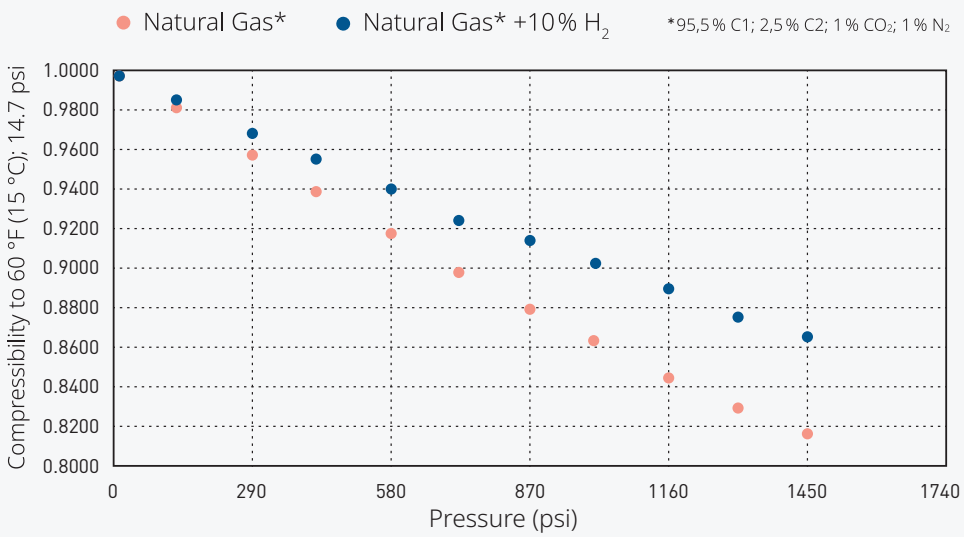
- Every measurement system is calibrated in-house
- No zeroing necessary
- Integrated temperature compensation according to ANSI/ASME MFC-5.1-2011 regulations guarantees a high zero point and flow measurement stability
- Permanent transducer coupling – no maintenance needed
- Robust stainless steel transducer mountings ensure long-term stability even under the roughest conditions
- Stainless steel transmitters available for use offshore
- Wet gas capability up to a liquid volume fraction of 5%
- SIL 2 capable
- Portable measuring systems available for temporary measurements

Dynamic Gas Meter (DGM) for Calculation of Media Properties

FLUXUS measures the velocity of the gas in the pipe. This measurement – in combination with pressure and temperature inputs – can be used to calculate **compressibility z**, **molar weight**, standard and actual **density**.

With known $CO_2/N_2/O_2$ and H_2O content, calculation of **Heating Value** and **Wobbe Index** is possible.

Changes in gas compositions can be tracked in real time and correct standard volume or mass correction can be applied.



Production

Wellhead Gas Flow Measurement

- Extremely robust: No wear and abrasion of the instrumentation
- No pressure losses
- No leak risk
- Huge turndown ratio and independence from pressure rating
- Ideal solution for sour gas measurements as the measurement system is not in contact with the gas
- Easy retrofitting possibilities facilitate individual wellhead monitoring for optimising production or injection rates
- Measurement system is not susceptible to fouling
- One meter for both high and low pressure operating extremes

Gas Treatment

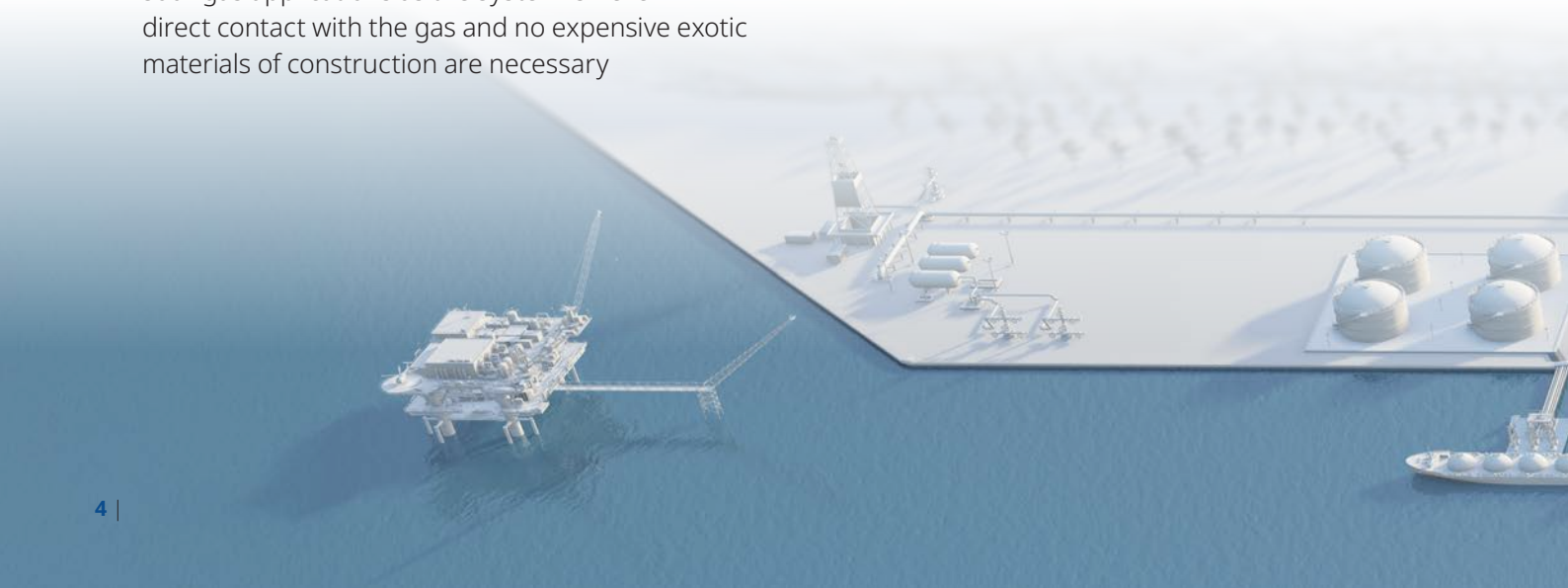
- Accurate and reliable flow measurement independent of pressurisation and wall thickness
- Ideal measurement solution for corrosive and toxic sour gas applications as the system is never in direct contact with the gas and no expensive exotic materials of construction are necessary

Gas Injection and Gas Lift

- Gas mass flow measurement independent of pipe dimensions, material, wall thickness and internal pressurisation
- No susceptibility to abrasive wear as being installed outside the pipe wall
- High turndown ratio and wide measurement range
- No measurement drift – highly accurate and reliable
- No process interruption for installation
- Easy retrofitting possibilities for optimising injection or lift flow rates

Gas at the Separator Outlet

- Consistent, repeatable and accurate gas flow measurement in demanding conditions
- No problem in measuring wet gas with high liquid volume fractions or at high pipe temperatures
- Highly robust measurement system withstanding the harshest environments, including offshore applications



Distribution

Medium Pressure Networks

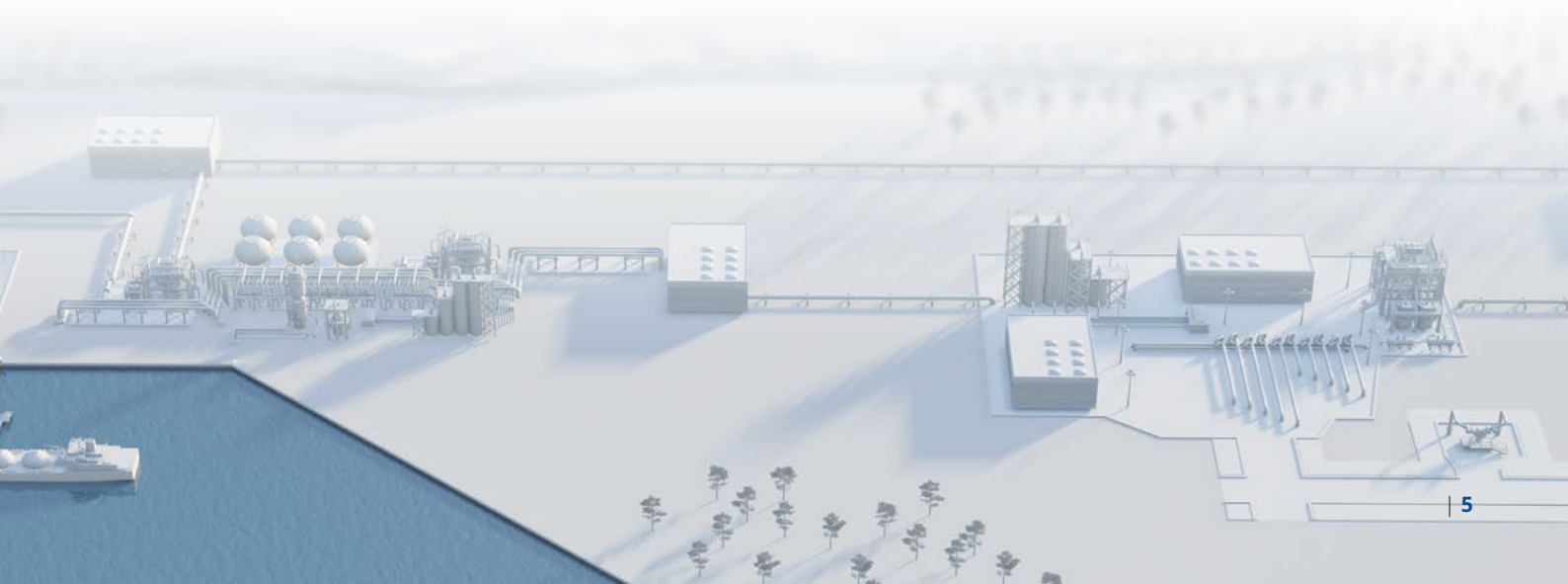
- Simple installation without interruption of the gas supply
- Easy installation of underground IP68 equipment and therefore, no need for expensive manhole structures
- No mechanical wear or tear of the flow meter
- No leakage risk through the measuring system

Odoriser Stations

- Measurement from the pipe wall outside – no more maintenance issues
- Constant availability: no pipework necessary for the installation of the ultrasonic flow measurement system or for maintenance
- Ideal for odoriser dosing measurements at extremely low flow rates (below the range of intrusive measuring technologies)
- Standard volume flow rates calculation within the meter (optional)

Related Applications & Flow Surveys

- Flexim™'s FLUXUS non-intrusive flow meters cover a wide application range. Our permanent and portable solutions also measure a variety of other liquid and gaseous media such as:
- Liquid Hydrocarbon Products (flow and media detection)
- Brine during leaching processes
- Compressed air
- Nitrogen, etc.



Transportation

Compressor Stations

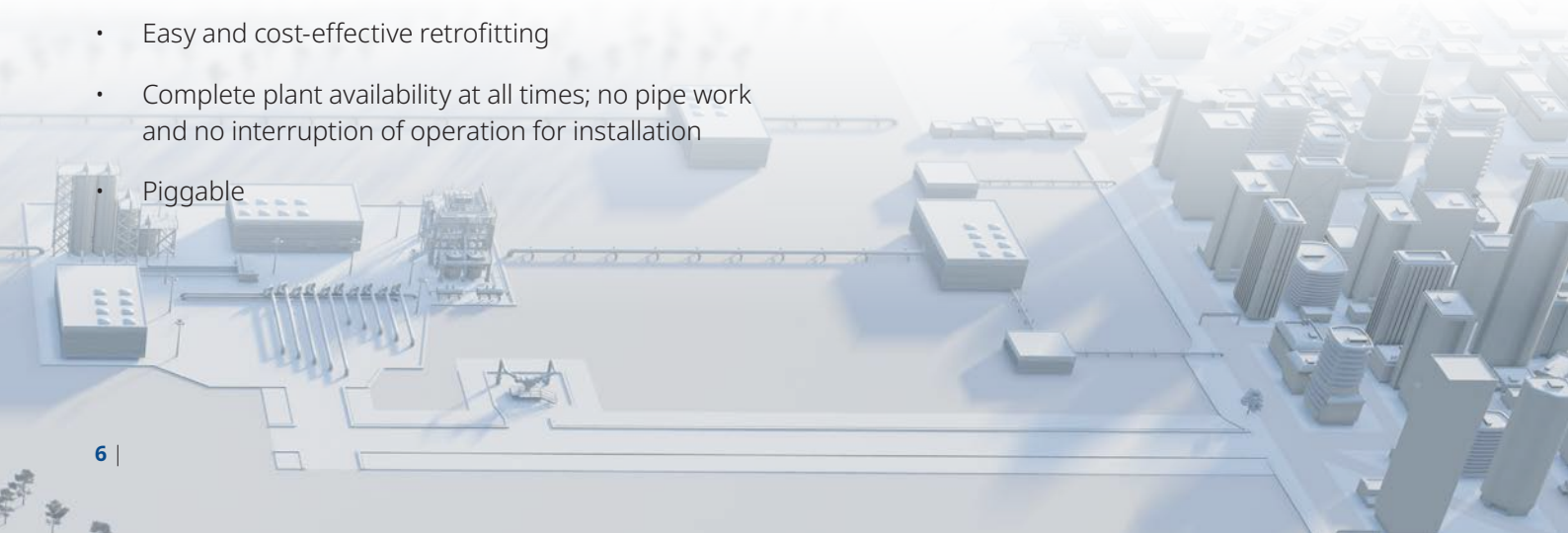
- **Highly cost-effective:** much lower CAPEX in comparison to inline instrumentation
- No pressure loss, which means no reduction in efficiency
- **Highly reliable:** Maintenance-free measurement, no moving or vibrating parts, dual-beam redundant measurements
- **Maximum availability**:
  - no pipework modifications and no interruption of operation for installation
  - any failed sensor or meter can be replaced within a few hours

Flow Direction Monitoring

- Non-intrusive determination of flow direction
- Effective increase in transport network safety, no risk of leakage
- No wetted parts, no wear and tear, no maintenance required
- Maximum operational safety due to robust non-intrusive measurement
- Easy and cost-effective retrofitting
- Complete plant availability at all times; no pipe work and no interruption of operation for installation
- Piggable

Pipeline Flow Monitoring

- Reliable, bidirectional flow measurement at large diameter and thick-walled pipes with exceptionally high measuring dynamics
- **Significant cost savings:**
  - Most types of protective coatings can remain on the pipe
  - Cathodic corrosion protection is not affected
- Commissioning without any pipe work and without any pipeline downtime
- No mechanically moving parts, no additional costs for high-pressure levels or large nominal widths, no pressure loss
- Piggable
- Long-standing experience with IP68 buried solutions



Storage

Underground Gas Storage – Gas Injection and Withdrawal

- Accurate and reliable flow metering at highly pressurised and thick-walled steel pipes (up to 35 mm / 1.4 inches)
- Reliable bidirectional flow measurement over a wide turndown range
- Measurement not affected by high moisture content – absolutely wear-resistant, little maintenance work required
- Long-term stability, no calibration intervals required

Gas Dehydration

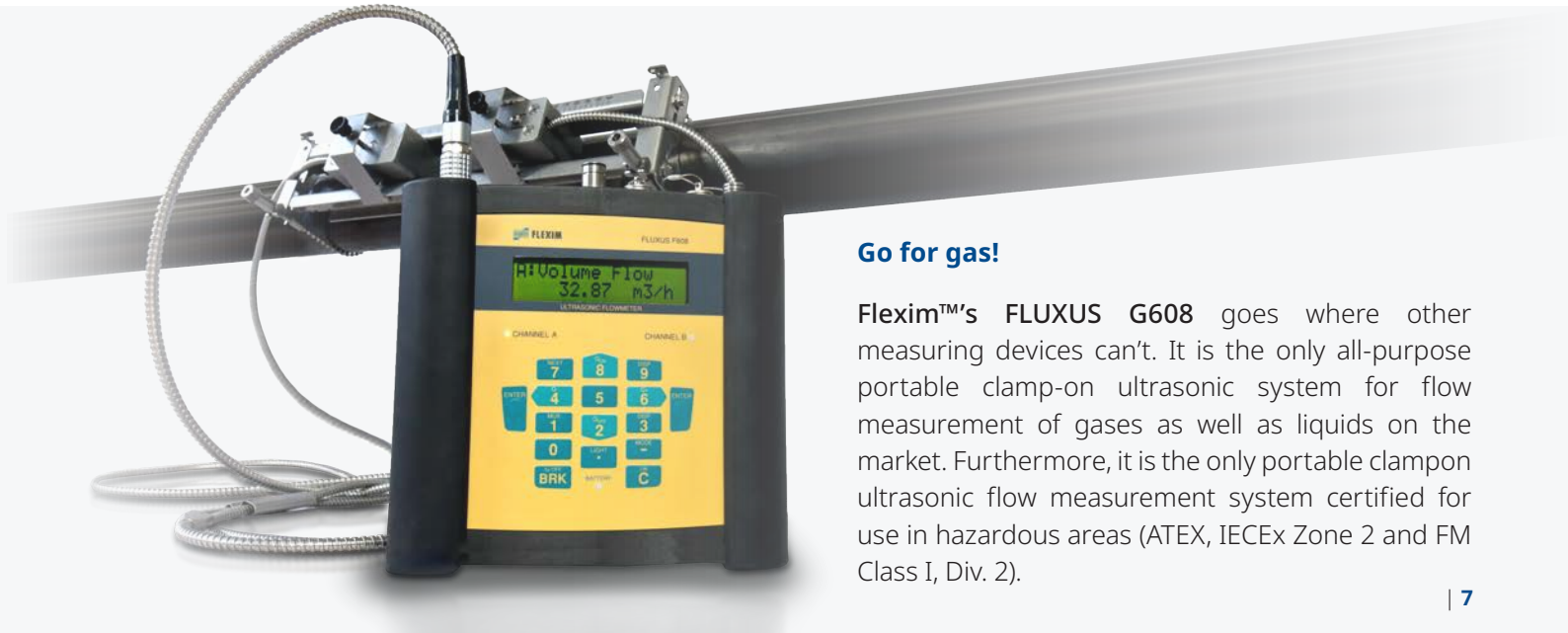
- Consistent, repeatable and accurate gas flow measurement in demanding conditions
- No problem in measuring wet gas with high liquid volume fractions
- Efficient dehydration processes by online flow and concentration measurement of the circulated glycol

Check Metering

- Highly accurate flow measurement redundancy to avoid line downtimes in case a custody transfer meter is temporarily taken out out of service for recalibration
- Increase in reliability, meter confidence and plant availability

LNG Terminals

- Reliable non-intrusive flow measurement even under extreme conditions (-163 °C / -261 °F) without pressure drops
- **Highly economical:** No extra costs due to special materials, no pipework, one-man installation without lifting gear
- Safe equipment due to the non-intrusive technology – no gaskets, no leakage points
- Further information can be found in the Flexim™ FLUXUS Cryo Brochure



Go for gas!

Flexim™'s FLUXUS G608 goes where other measuring devices can't. It is the only all-purpose portable clamp-on ultrasonic system for flow measurement of gases as well as liquids on the market. Furthermore, it is the only portable clampon ultrasonic flow measurement system certified for use in hazardous areas (ATEX, IECEx Zone 2 and FM Class I, Div. 2).

Laboratory Accuracy under Field Conditions

High accuracy and proven laboratory performance under reference conditions is one task. Accuracy under field conditions is quite another thing:

- Flexim™'s transducers automatically compensate for ambient temperature changes – according to ANSI/ ASME MFC-5.1-2011. This prevents false measurement readings during temperature swings (day/night).
- Flexim™'s transducers are carefully paired according to their individual properties. This process lays the foundation for superior accuracies over a wide temperature and application range. It also ensures a negligible zero offset and facilitates the measurement of very low flow rates. There is no need for zeroing, or programmed "automatic zero" workarounds.
- Flexim™'s transducers are all individually calibrated by factory engineers , with storage of the calibration data on a "Sensprom"chip. The calibrated transmitter automatically reads the individual calibration data, avoiding potential errors and making transducer exchanges easy.
- Flexim™ calibrates pairs of transducers and measuring transmitters independently of one another so that the narrowly defined measurement uncertainties are always observed, regardless of which transducers are used with which transmitter.

For Flexim™, accuracy is a topic we take very seriously. Flexim™'s specified installed accuracy claims can seem conservative but we firmly believe that clients expect us to overperform rather than disappoint.

Ask us, if you want to learn more about the total measurement uncertainty for your specific application.

TECHNICAL FACTS	
Temperature ranges:	-40...+225 °C / -40...+437 °F (for liquefied gases down to -200 °C / -330 °F)
Flow velocity:	0.01...35 m/s / 0.03...115 ft/s
Repeatability:	0.15% of reading, ± 0.01 m/s / ± 0.02 ft/s
Accuracy (if field calibrated):	± 1...2% of reading, ± 0.01 m/s / ± 0.03 ft/s (application dependent) ± 0.5% of reading, ± 0.01 m/s / ± 0.03 ft/s (liquids and gases)
Pipe sizes (OD):	12...1600 mm / 1/2 inch to 64 inches
Protection degree:	P65/IP66; Transducers up to IP68
Hazardous area approvals:	ATEX, IECEx Zone 1 and 2, FM Class I, Div. 1 / 2
Pressurisation:	> 3 bar(g) for gases in steel pipes; plastic pipes no limitation
Communication protocols:	HART, Modbus RTU or TCP/IP, Foundation Fieldbus, Profibus PA, RS485
Quantities of measurement:	Actual and normalized gas volume flow rates, mass flow, flow velocity

ISO 9001
ISO 14001

DAkkS Deutsche Akkreditierungsstelle D-K-20792-02-00

For more information, visit
Emerson.com/Flexim

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