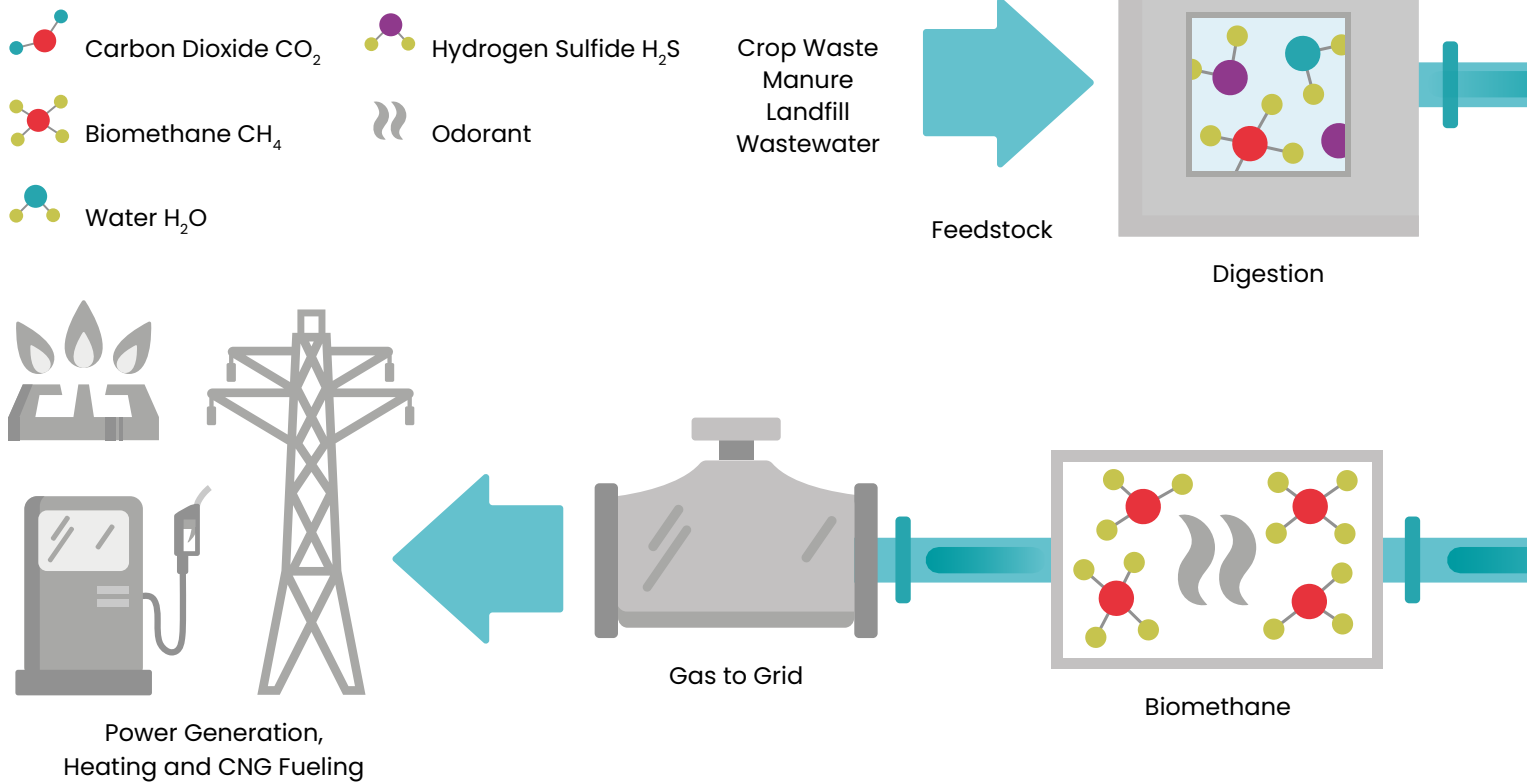


Renewable Natural Gas Waste Turned into Green Energy

Smart sensor technologies to optimize
upgrading your biogas to biomethane

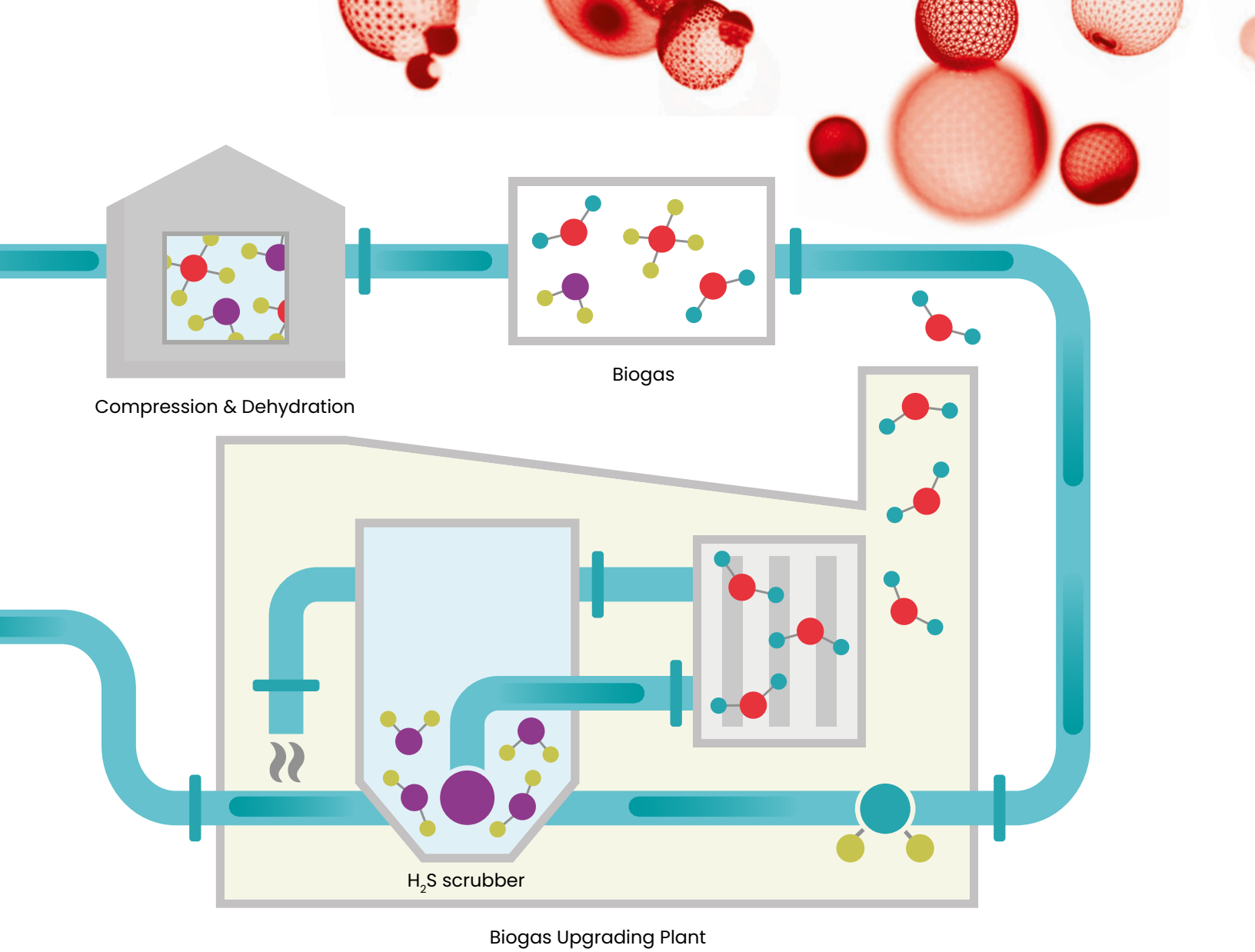


Upgrading process:



Biogas is increasingly seen as a more renewable source of natural gas. Biogas is the mixture of gases produced by organic waste in the absence of oxygen. Upgrading biogas to biomethane includes removing carbon dioxide and water vapor along with trace gases such as nitrogen, hydrogen sulfide, and hydrogen.

Operators make several measurements in these processes. Methane, the main component in biogas, is flammable. Oxygen will typically be kept to less than 2% for safety during storage and transportation. Oxygen is typically measured directly after the digester. Hydrogen sulfide is scrubbed from the gas to trace levels. Membrane filters separate the carbon dioxide from the methane, and the concentration of each on either side of the membrane indicates separation efficiency. Accurate flow metering is vital throughout these processes, especially when there is a change in owner from producer to user. To meet tariff limits, water vapor is measured before biomethane entry into the gas grid. These measurements take place in hazardous area environments.





Panametrics process analyzers and flow measurement instruments have been ensuring customer and process safety for decades.

As a recognized leader in moisture and oxygen analyzers and liquid, steam, and gas flow meters with proven technologies, you can be sure that we provide the best combination of technology and expertise to ensure accurate process measurements. Panametrics analyzers and flow meters are designed for complex applications that require maximum reliability and measurement accuracy.

A partnership with Panametrics brings you reliability and consistency in measurement, and offers solutions completely tailored to your process, supported by local technical teams.

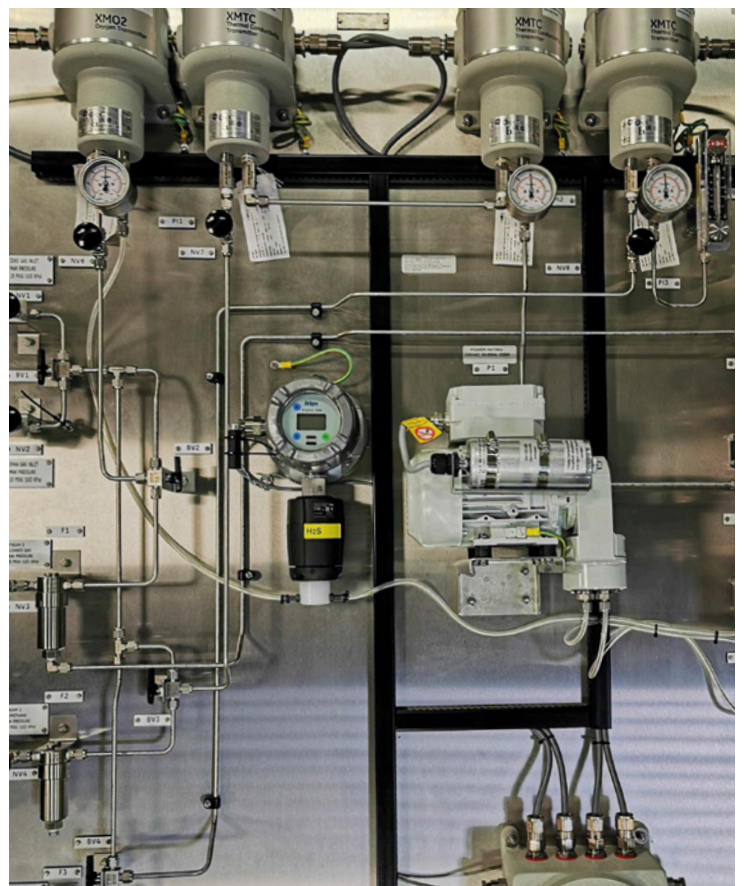
Our technology and application specialists are experts in developing the best gas analysis and flow solutions for your measurement. Along with our global network we ensure our partners receive first-class local support for all requirements starting from technical assessment to commissioning and assistance.



Integrated Systems

Measurement Parameters

- O_2 is measured in the gas generated by the decomposition of waste to pipe the biogas safely: $<2\%$
- H_2S scrubbed from the CH_4 before entering the networks: <10 ppm
- CO_2 is measured in the tail gas to monitor separation efficiency from methane: 90% – 100%, balance CH_4
- CH_4 of the RNG for entry into the grid: 90% – 100%, balance CO_2





Process Analyzers

XMTC

Thermal conductivity binary gas analyzer

With no moving parts, the XMTC provides a robust measurement of carbon dioxide in methane with little maintenance and unsurpassed calibration stability. The transmitter uses the differences in thermal conductivity to report percent level measurement.



Features

- Percent level measurement ranges up to 100 percent CO₂ in CH₄
- Percent level measurement ranges up to 100 percent CH₄ in CO₂
- Flame-/Explosion-proof and weatherproof enclosure
- Push-button calibration
- Compact, rugged sensor with no moving parts



XMO2

Thermoparamagnetic oxygen analyzer

With no moving parts and unsurpassed calibration stability, the XMO2 provides a robust oxygen measurement in biogas with little maintenance. The transmitter uses the thermal and paramagnetic properties of oxygen to generate a 'magnetic wind' of oxygen to enable a reliable measurement.



Features

- Measurement ranges up to 100% O₂ in gas
- Flame-/Explosion-proof and weatherproof enclosure
- Push-button calibration
- Compact, rugged sensor with no moving parts
- Measurement circuit compensates for variations in background gas composition
- Unique dual-chamber, temperature-controlled cell provides resistance to contamination

Ultrasonic Flow Meters

PanaFlow Z2G

Ultrasonic gas flow meter for hazardous area with optional methane content determination in biogas

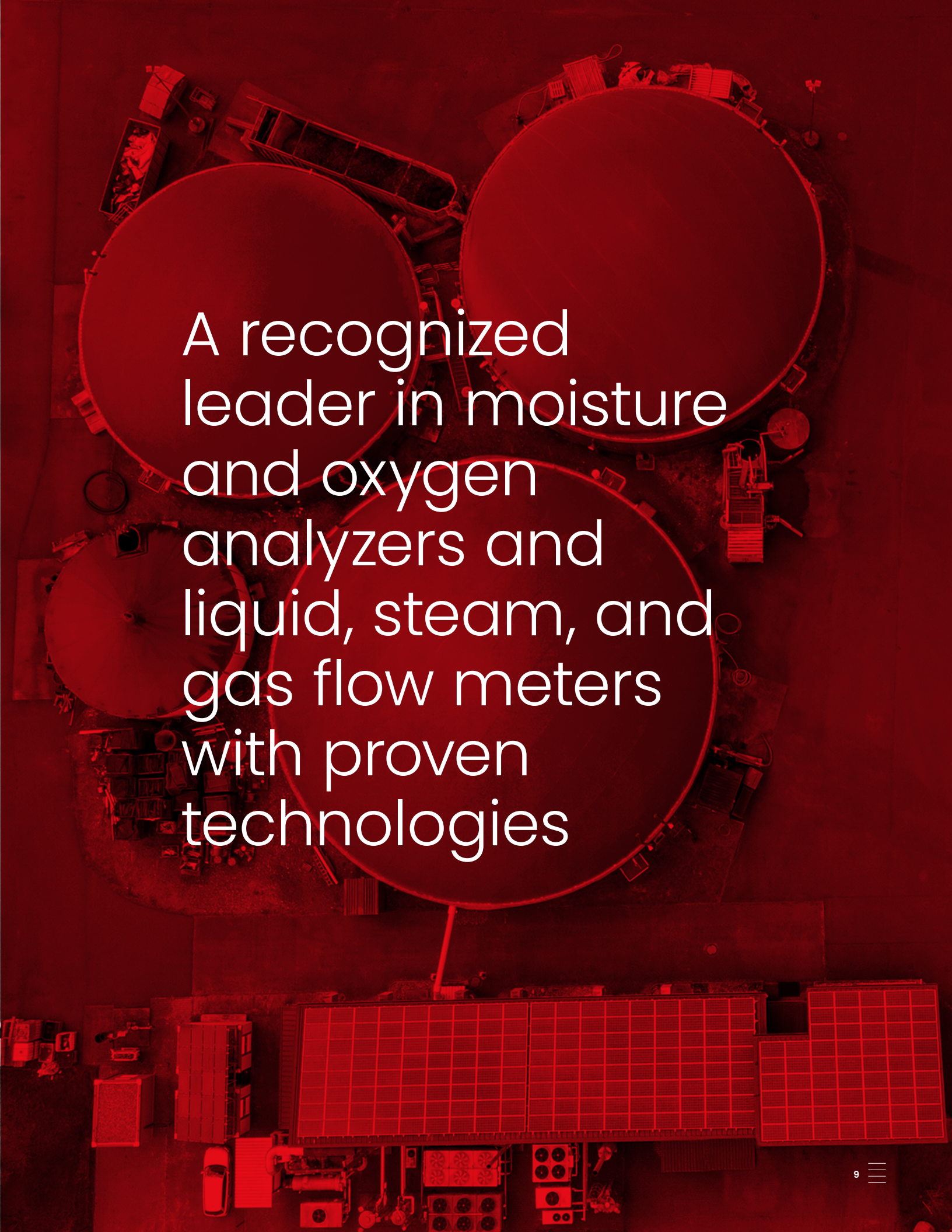
The biogas that comes from the digester is typically low pressure. It is saturated with water (6% @ 40 °C) and contains CO₂ (20% - 40%). Such an application requires powerful transducers to be able to measure this gas mixture at very low pressure. Biomethane is the other typical measurement here, easier to handle.

Panametrics holds a strong heritage in difficult gas flow measurement gained from flare gas experience.



Features

- Industrial designed flow cell to minimize flow disturbances at optimal chord locations
- T19 high performance transducers with high signal to noise ratio (SNR)
- Advanced diagnostics to not just measure flow but understand meter performance and validate process conditions and stability
- ±1% of measurement typical accuracy (two path), ± 1.5% accuracy (one path).
- Dedicated biogas algorithm to measure CH₄ concentration with ±2% accuracy. This measurement requires an external temperature probe input.
- Analog, Pulse, Frequency, HART, and Foundation Fieldbus are available communication
- Available for 2" to 16" (50mm to 400mm) sizes standard (other sizes and/or special design available upon request)
- Material of construction is carbon steel, stainless steel, duplex stainless steel (other materials available upon request)
- Flange ratings from 150# to 600# or PN10 to PN63 (other flanges sizes available upon request)
- Shares a Panametrics heritage of engineering design and global field service support



A recognized
leader in moisture
and oxygen
analyzers and
liquid, steam, and
gas flow meters
with proven
technologies

Moisture Analyzers

Aurora

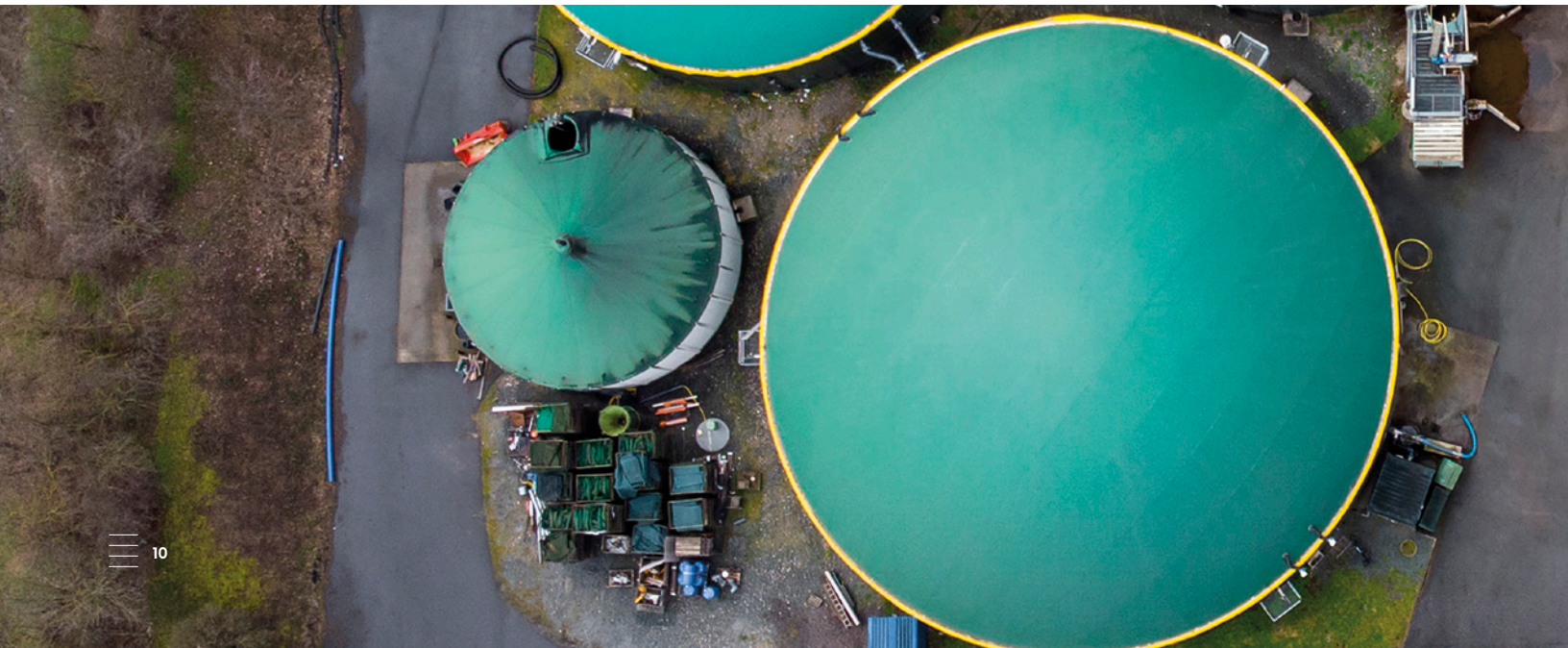
Tunable Diode Laser Moisture Analyzer

The Aurora is built upon a heritage of moisture measurement, calibration, and sample system expertise. It provides a sealed laser source with glass window separating the laser from the process gas, superior background gas compensation, and pressure and temperature compensation, living up to its specifications as stated.



Features

- 0 to 5000 ppm in natural gas and air
- 0 to 1000 ppm in carbon dioxide
- Available in AC and DC powered versions
- Flame-/Explosion-proof and weatherproof configuration standard
- All filtration requirements built in
- Fast recovery from process upset conditions



Aurora TransPort

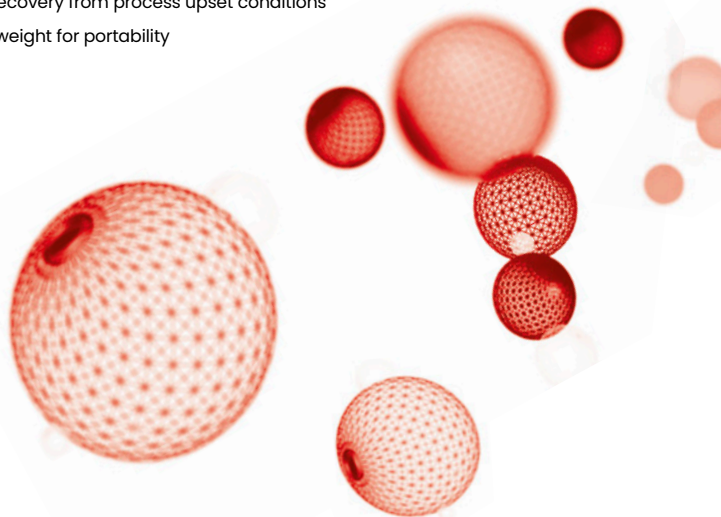
Portable Tunable Diode Laser Moisture Analyzer

Take Aurora's design expertise, features, benefits, and measurement fidelity and package it for portable measurements. Panametrics proudly calls this Aurora TransPort.



Features

- 0 to 5000 ppm in natural gas and air
- 0 to 1000 ppm in carbon dioxide
- Operates on battery or AC power
- All filtration requirements built in
- Fast recovery from process upset conditions
- Light weight for portability



HygroPro^{II}

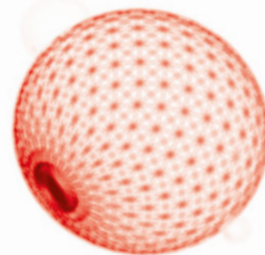
Moisture transmitter for general purpose and hazardous area

The HygroPro^{II} combines a technologically advanced aluminum oxide moisture sensor with state-of-the-art software and electronics for unrivaled overall performance. The HygroPro^{II} moisture transmitter is a compact, loop- powered moisture transmitter designed specifically to meet the demands of rugged industrial applications. With certified intrinsically safe electronics packaged in an IP67/Type 4X housing, the HygroPro^{II} offers unrivaled installation flexibility in these applications.



Features

- Intrinsically safe
- Ambient to ppb moisture levels using aluminum oxide moisture sensor
- Built-in temperature and pressure sensors
- Gas and liquid applications
- HART communication over the 4 – 20 mA analog output



PM880

Portable Aluminum Oxide Moisture Analyzer

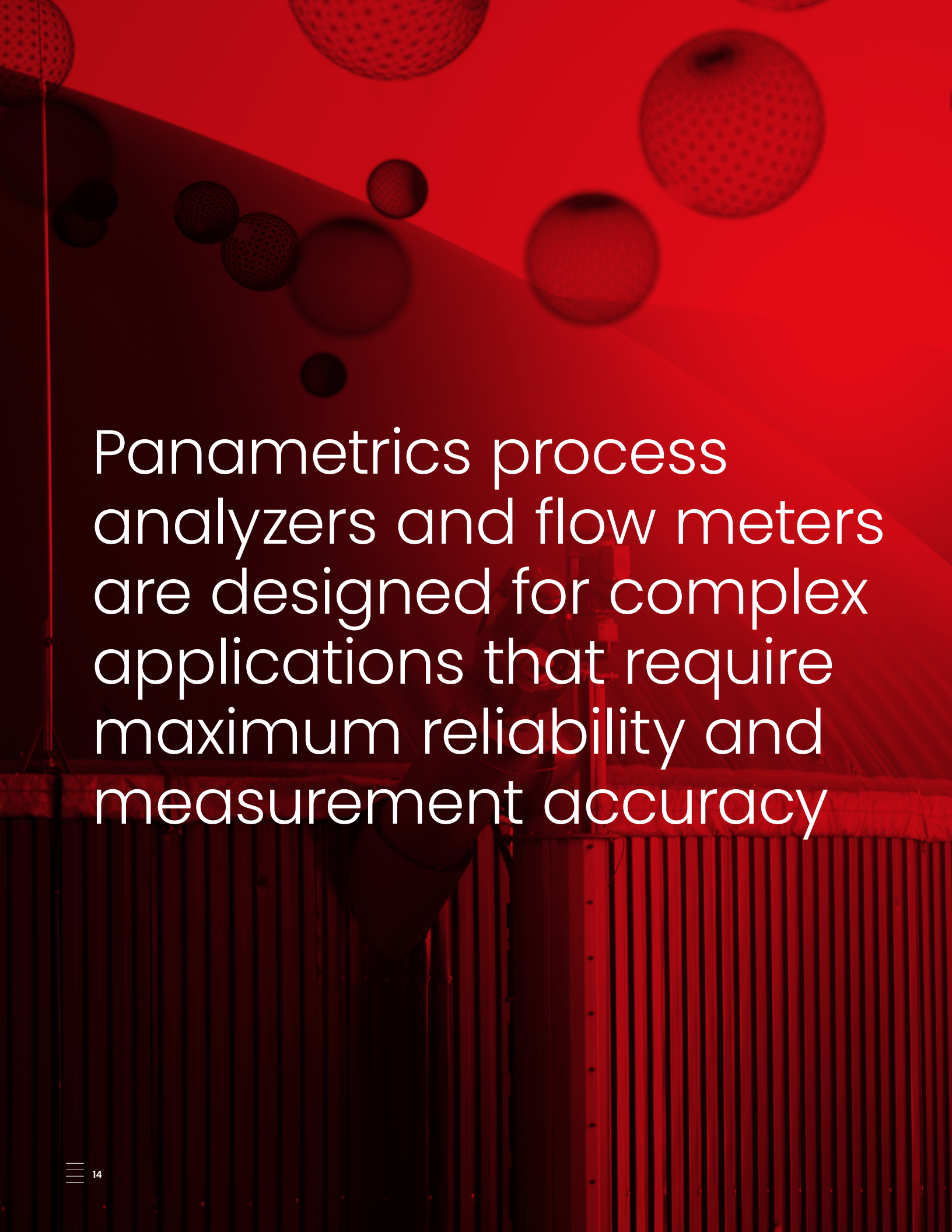
With its MISP2 moisture probe and SS880A sample system, this portable is packaged as a kit for all spot-sampling moisture measurement needs.



Features

- Intrinsically safe
- Ambient to ppb moisture levels using aluminum oxide moisture sensor
- Built-in temperature and pressure sensors
- Gas and liquid applications
- HART communication over the 4 – 20 mA analog output





Panametrics process
analyzers and flow meters
are designed for complex
applications that require
maximum reliability and
measurement accuracy



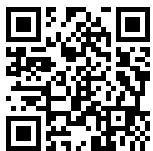
Panametrics provides solutions in the toughest applications and environments for moisture, oxygen, liquid and gas flow measurement. Experts in flare management, Panametrics technology also reduces flare emissions and optimizes performance.

With a reach that extends across the globe, Panametrics' critical measurement solutions and flare emissions management are enabling customers to drive efficiency and achieve carbon reduction targets across critical industries including: Oil & Gas; Energy; Healthcare; Water and Wastewater; Chemical Processing; Food & Beverage and many others.

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