

Application Note

HYGROPHIL F 5673

Process Trace Moisture Analyzer for
Biogas Metering and Gas Grid Infeed Plant



APPLICATION NOTE

Part of the “Energiewende” (energy transition) towards reduction of greenhouse gas emissions and increase of renewable energy is the production of biogas.

Biogas can be produced from a broad range of feedstocks. In a process of anaerobic digestion the biomass or energy crops are converted to biogas by several types of bacteria within the fermenter. Once the process has started the bacteria must be fed constantly without interruption.

The produced biogas is typically consisting of 60% methane and 40% carbon dioxide with traces of hydrogen sulfide and water vapour. The gas is sent to the treatment plant where impurities are removed by use of different techniques like Pressure Swing Adsorption,

Amine Wash Processes or Membrane technologies. After removing carbon dioxide, moisture, nitrogen, hydrogen sulfides and siloxanes the Biomethane is interchangeable with conventional natural gas.

After the compression stage the gas is sent through the gas metering unit where amongst other flowrate, calorific value, composition, heating value, H₂ and H₂S content and humidity is measured. When all quality criteria are met, the gas can be fed into the existing natural gas pipeline grid.

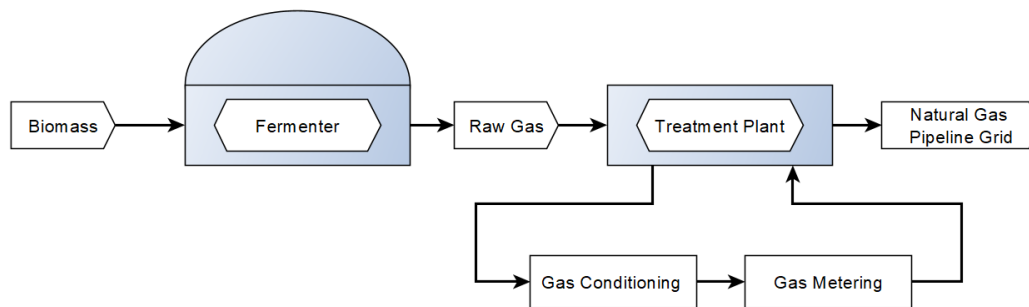


Figure 1: Simplified diagram of a biogas production and feed-in plant

The raw biogas from the fermenter is usually saturated with moisture which may lead to accumulation within the interconnection pipe from fermenter to treatment plant. In startup or shutdown processes this may lead to liquid slugs which may overburden the dehydration units. As long as the moisture content is too high for feed-in the gas must be flared. Most plants

do not have the capability to store the gas for later reconditioning. Also based on the process the bacteria will continuously produce raw biogas.

Robust and reliable trace moisture measurement is essential especially when the process is not running at full efficiency.

Reliable inline moisture measurement for process and quality control

A reliable inline moisture measurement helps to ensure that the produced gas meet the sales gas criteria all the time. Most of the plants are small sized and unmanned most of the time. Therefore regular sensor exchange or extensive maintenance must be avoided to keep the operational cost as low as possible.

Capacity type moisture sensors are sensitive to liquid slugs which can lead to a great drift or even to a breakdown. The BARTEC BENKE's trace moisture sensors are trimmed to superior

robustness and even (unwanted and unexpected) water slugs does not damage the sensor. And in case of yearly check, the installation of the sensor with a sensor retraction armature makes maintenance easy, quick and without process interruption.

The reliability of the sensor calibration is assured and tested by an independent and accredited laboratory on request.



Figure 2: Sensor installed in sensor retraction tool

APPLICATION NOTE

The HYGROPHIL F is designed for the needs of the natural gas industry.

The core element of the moisture sensor is an optical thin film element made of silicon dioxide and zirconium dioxide. The microporous stack of alternating high and low refracting optical layers is forming a Fabry-Pérot Interferometer with a distinctive and reliably detectable reflection minimum in the spectral range around 820 nm.

Selective to water, molecules can diffuse into the porous Fabry-Pérot element, which then performs a shift of the reflection minimum in proportion to the actual water vapour pressure. The spectral shift is detected and evaluated with a compact high-resolution polychromator, which is located in the evaluation unit together with the light emitting diode. The interconnecting fiber optic cable can be up to 800 m long because of the detection of an optical minimum instead of an intensity change.

The evaluation unit processes and calculates the present dew point temperature as well as other units such as water vapour pressure, parts per million, mg/m³ and further more. It offers the indication of the dew point temperature at current line pressure as well as to different defined reference pressure. Optionally the calculation from dew point temperature to mg/m³ can be done in conformity to DIN EN ISO 18453, which takes respect of the entered gas composition.

Several analog outputs, MODBUS, PROFIBUS RTU and via TCP/IP as well as relay contacts are equipped as standard for interconnection to the control system.

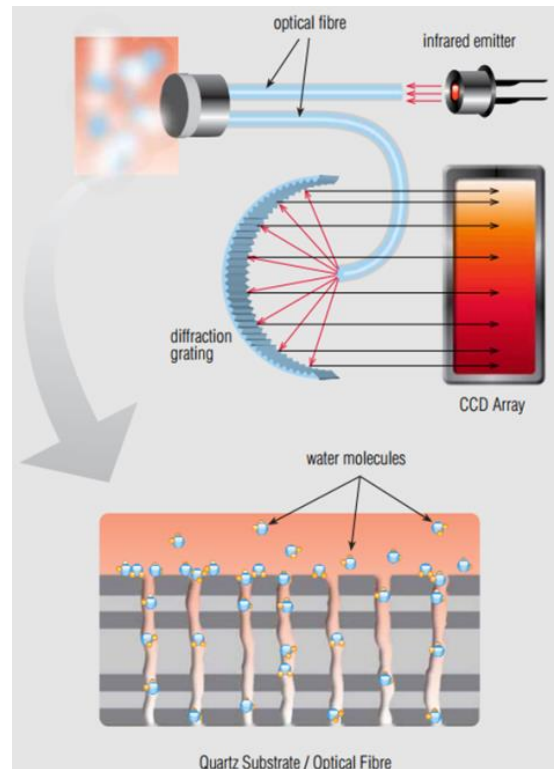


Figure 3: Schematic of the Measurement Principle

Thousands of installations worldwide prove the advantages of this measurement principle:

- Robust sensor construction for outstanding long-term stability
- Sensor validation at process conditions by accredited and independent laboratory on request
- Easy sensor cleaning and almost no maintenance required
- In-line installation with sensor retraction armature possible (fast response and emission-free)
- Flexible on-line solutions with customized sample conditioning systems
- Certified for safe operation in hazardous area (ATEX, IECEx, CSA, TR CU)