



- Direct measurement of mass flow or standard volume flow
- Negligible pressure loss
- High measuring accuracy, even with small flows
- Measuring value indication from 0 Nm³/h on
- No additional measuring instruments required for pressure or temperature compensation
- Easy installation using screwed or flanged pipe units

1 Problem

Biogas is produced in agricultural enterprises using substrates of vegetable or animal origin in varying proportions. The produced biogas has an average methane content of 53 to 55 % by volume and is used for power generation in combined heat and power (CHP) plants after the appropriate conditioning process.

In order to control the fermentation process and allow for balancing, the gas quantity in larger plants is measured at different points: directly downstream the production site (F1) and upstream the induct into the gas engine (F2). Different problems arise from this.

Tag F1: The humidity-saturated biogas escaping from the fermenter/after-fermenter with a minor overpressure of only a few hPa passes a subsequent condenser, where most of the contained water precipitates, together with a small amount of hydrogen sulfide.

In order to be able to control the fermentation process, the gas quantity must be measured directly after the fermenter without any pressure loss. Due to the low overpressure, pipes with relatively big internal diameters – as compared to the gas flow – (e.g. DN 100 at 100 Nm³/h) are used. As a result, orifice flow elements or other volume flow measuring units can be used only with restrictions or not at all for this purpose.

Tag F2: In the controlled gas system upstream the gas engine induct the biogas is compressed using a compressor stage in order to achieve an overpressure of 30 to 50 hPa. At this point you can also use temperature or pressure compensated volume measurement units. Compensation is required for balancing by means of the mass flow or standard volume flow. If no pressure compensation is made, additional measuring errors of several percent may result even from variations in the ambient air pressure.

2 Solution

Using thermal mass flowmeters is the best solution for both tags. Sensyflow D flowmeters work without any pressure loss under the said conditions and require only a minor inflow. The measured values are output directly as mass flow or standard volume flow without any additional compensating calculations or measurements.

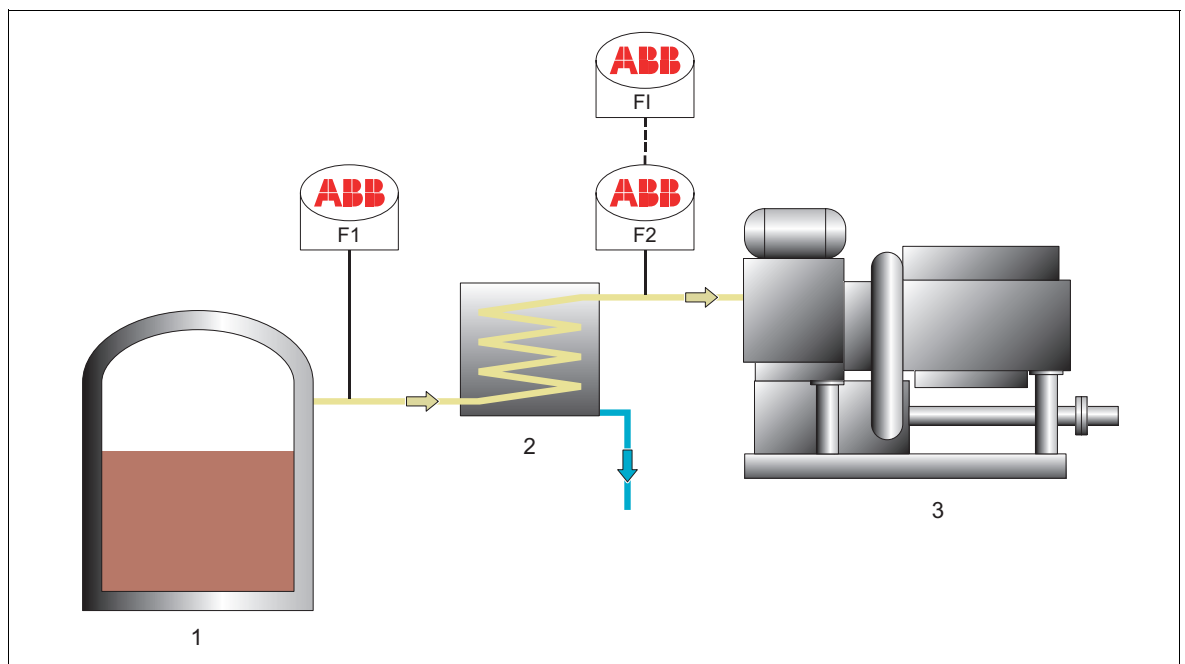


Fig. 2-1: Biogas flow measurement

- 1 Fermenter
- 2 Condensate separator
- 3 Combined heat and power plant

Sensyflow D provides an extremely wide measuring range of 1:100 and, thus, allows you to measure gas quantities that are far above or below the original quantity for which the system has been dimensioned. As a result, the plant can be extended without changing the gas measuring equipment. Also, individual fermenters can be put out of operation temporarily.

The measuring system can be installed in a 2" pipe directly upstream the CHP plant. The 4...20 mA signal of the measured flow can be visualized and totalized directly by a type C150 indicator (COMMANDER). Alternatively, a type SM500F videographic recorder can be used for recording and monitoring historical data.



Fig. 2-2: Thermal mass flowmeter in the biogas pipe upstream the block heat and power plant with gas engine

3 Benefit analysis

Due to the reliable measurement of the gas quantities the ratio of the used substrate to the produced electrical and thermal power can be determined more precisely. As a result, optimal fermenter feed leading to an improved efficiency of the biogas production plant can be achieved, which has a direct impact on the operating profit.

4 Features of the used components



Meter Location	Instrumentation	
<p>F1, F2</p>		<p>Thermal mass flowmeter FMT200-D (Sensyflow D)</p> <ul style="list-style-type: none"> • Output signal: 0/4 ... 20 mA • Pipe unit with threads or flanges • Recommended installation site: upstream of induct into the combined heat and power plant • Dimensioning: depending on produced biogas quantity and used piping
<p>FI</p>		<p>Process indicator C150</p> <ul style="list-style-type: none"> • High visibility LED display • Totalizer function <p>alternatively</p> <p>Videographic recorder SM500F</p> <ul style="list-style-type: none"> • High-contrast display • Archiving function

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