OpreX™ Analyzers | Application Note

YOKOGAWA
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Gas Mixing Ratio Analysis for Methanation Process with Gas Density Meter

Feedback control CO_2/H_2 gas mixing ratio

Challenge

- Improve mixing ratio control of feed gases for methanation



Methanation is a technology for synthesizing methane, the main component of natural gas, from hydrogen (H_2) and carbon dioxide (CO_2). By utilizing recovered CO_2 from industrial facilities as a feedstock, methanation enables carbon recycling.
Reliable monitoring and control of the methane synthesis process are essential for scaling up methanation plants to industrial-scale production.

▶Efficient methane synthesis requires maintaining the CO_2/H_2 feed ratio of 1:4. However, flow-based control can result in gas feed rate errors and fluctuations of several percent.

▶The H_2 feed rate should be adjusted in response to fluctuations in recovered CO_2 to maintain the target CO_2/H_2 ratio. However, conventional process gas analyzers used to measure H_2 and CO_2 concentrations typically require more than one minute to respond, resulting in delayed feedback control.



Gas density-based gas mixing ratio analysis helps improve production efficiency with a simple and cost-effective measurement solution.

Value

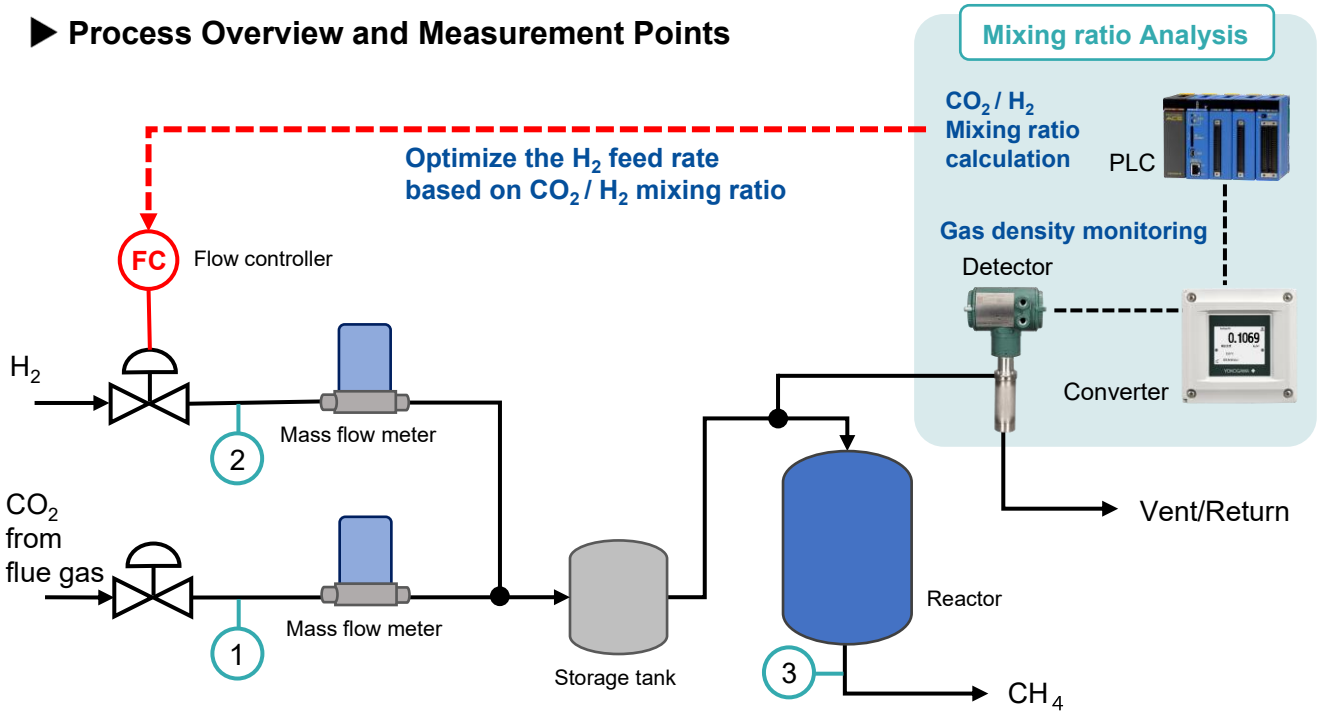
☑ Simplify instrumentation configuration and reduce operating cost with a single gas density analyzer.

☑ Enhance synthetic methane purity and ensure consistent product quality with fast-response gas ratio feedback control.

Installation and Operation Concept

Conventional measurement systems require separate analyzers for each gas component. Since the methanation feed gas consists only of clean CO_2 and H_2, the gas mixing ratio can be accurately estimated from gas density measurements.
With a repeatability of ±0.5% and a response time of approximately 5 seconds, Yokogawa's gas density meter GD series enables rapid process condition monitoring and responsive feedback control based on the gas mixing ratio.

▶ Process Overview and Measurement Points



▶Applications of gas density meter to methanation process monitoring

Measurement point	Monitoring objective	Measurement target
1	Feed CO_2 purity	CO_2 / air
2	Feed H_2 purity	H_2 / air
3	Methane conversion rate	CO_2 / H_2 / methane

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[Ed:01, Nov 2026]

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