SNG: methanator outlet

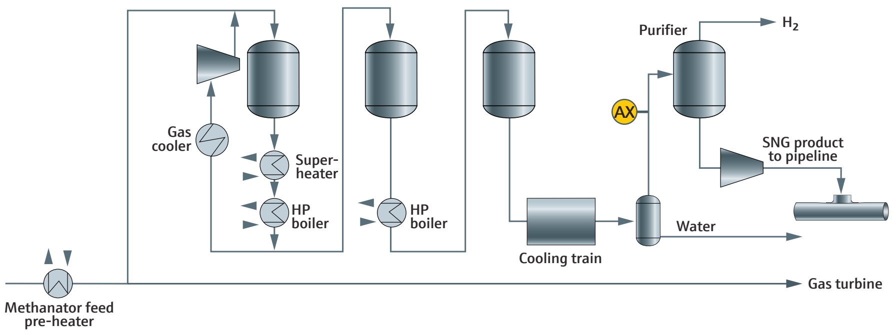

Figure 1: Typical methanator outlet measurement point*

Benefits at a glance

- Unique spectroscopic capability to measure CH_4 as well as any residual H_2 or CO_2
- Pipe-centric sampling and measurement at the sample tap
- Sample can often be returned to process, avoiding disposal to flare header
- Complete syngas speciation
- No valves, columns, or carrier gas
- No interference from moisture vapor in the raw syngas sample when the sample is kept above its dewpoint

After the H_2S and CO_2 have been removed from the syngas via acid gas removal (AGR), the resulting 'sweet' syngas stream can be used either to synthesize SNG or as fuel for a gas turbine to generate electricity. When SNG is the desired product, the shift converter operation can be adjusted to produce a H_2/CO ratio close 3, which is ideal stoichiometry for the subsequent methanation process. The methanator converts the syngas into CH_4, with some residual H_2 or CO_2, depending on the operational configuration of the shift converter and AGR. Steam is another by-product of methanation of syngas, so, depending on the location of the sampling point, the sample may have a high water content.

Measurement of the methanator outlet stream

The Raman Rxn5 analyzer is a unique solution to the sampling and measurement challenges for analyzing the methanator output stream. A typical Raman spectrum for a methane-rich SNG stream after the methanator is shown in Figure 2. Note the simplicity, baseline separation, and complete speciation of H_2, CO_2 and CH_4 as individual peaks in the Raman spectrum. In addition, as the Raman Rxn5 is essentially transparent to moisture, the analysis represents a dry basis result. The Raman Rxn5 uses a normalized analysis, which makes it very robust to changes in process pressure, temperature, and flow, as well as to any slow fouling that may occur.

Reliability issues with traditional methods for SNG analysis

The methanator outlet stream composition is typically measured with process gas chromatography (GC) or mass spectrometry (MS). Both technologies require transporting the sample and doing sample conditioning at both the sample tap and at the sample conditioning panel close to the analyzer. Protecting the GC or MS analyzers from liquid carryover becomes the main sampling system challenge, as this event can damage columns in a GC or damage the ionization chamber in a MS. The Rxn-30 probe cannot be damaged by liquid carryover or fouling, and cleaning is simple and straightforward.

* See the general IGCC plant SNG: production analytics overview

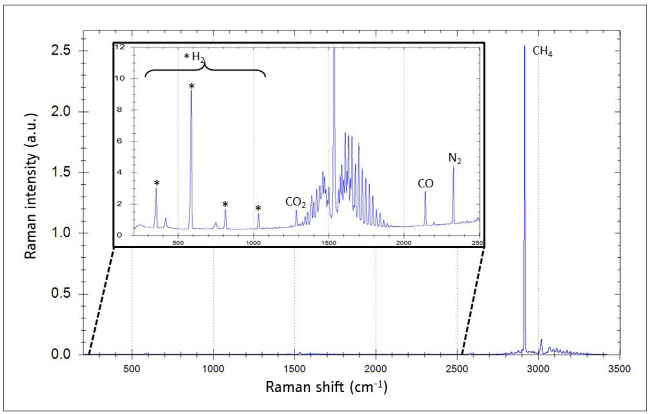

Figure 2: Typical Raman spectrum for methanator outlet

Solution: Raman Rxn5 analyzer with the methanator outlet method

The use of a liquid removal system is mandatory for a shift converter outlet stream, which is saturated with steam at high temperature (typically 200-350°C). The Rxn-30 probe can be easily integrated into sample conditioning systems to measure process streams at higher temperatures and pressures. The ability to measure at higher pressures often allows the sample to be returned to the process, eliminating waste and costly flaring. The use of fiber optic cables allows the probe to be placed at the sample tap location, eliminating the need for long heated sample transfer lines and sample lag time.

The Raman Rxn5 analyzer for the methanator outlet contains the following per measurement point:

- Dedicated laser module
- Rxn-30 fiber optic probe
- Industrial hybrid electro-optical cable (up to 150 m long, customized to your plant requirements)
- Combined pressure and temperature sensor with cable (up to 150 m long, customized to your plant requirements)
- Dedicated methanator outlet method

Typical process conditions	P (barg)	T (°C)
At sample tap	29	35
At Rxn-30 probe	29	35

Typical stream composition

Component	Range (Mol%)	Normal (Mol%)	Precision (Mol%) k=2	Cal gas (Mol%)	Precision (Mol%) k=2
Hydrogen	0-5	1	0.02	64	0.02
Nitrogen	0-5	1.5	0.01	16	0.01
Carbon monoxide	0-2	0.5	0.01	7	0.01
Carbon dioxide	0-2	0.5	0.01	10	0.01
Methane	75-100	96.5	0.02	3	0.02

Table 1: Typical process conditions and stream composition

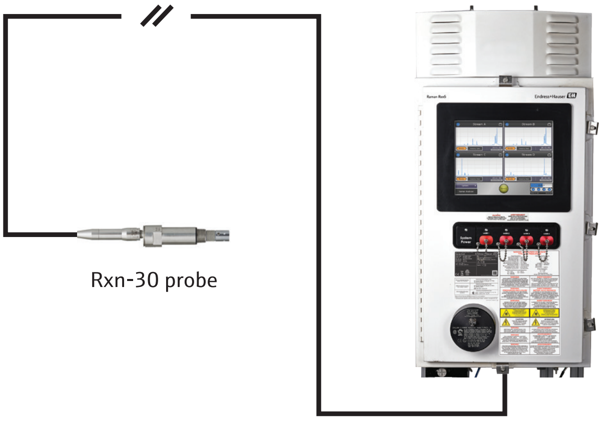

Figure 3: Recommended system configuration

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