CO_2 in natural gas production, storage, transportation and distribution

Benefits at a glance

- Low maintenance
- No carrier gas
- Repeatable, fast measurements
- No field recalibration needed
- Reliable in harsh environments
- Analog and serial outputs for remote monitoring
- Analyzer management software

Natural gas processing

CO_2 naturally occurs in oil and gas reservoirs. Produced gas contains high levels of CO_2 and requires treatment to avoid corrosion problems. Gas companies use different technologies to remove CO_2 from natural gas. Common processes include membrane systems and chemical amine treating systems. Close proximity to the outlet of an amine plant increases the chance of liquid carryover.

Measurement of CO_2

CO_2 measurement is critical for gas companies to meet quality specifications and to protect pipelines from corrosion. False positives are extremely problematic because the downstream customer may “shut-in” the gas supplier, which can be very costly for both parties. Natural gas streams may contain high levels of solid and liquid contaminants as well as corrosive gases in varying concentrations (glycol, methanol, compressor oil, sulfur compounds). This presents a challenge for the measurement of CO_2 as cross-interferences which affect the reading accuracy and the response rates must be avoided.

Issues with traditional measurements

On-line gas chromatographs are the traditional method widely used for monitoring the levels of CO_2. However, even with the latest in chromatography techniques and dedicating a GC to only the measurement of CO_2, the analysis can take 3 to 6 minutes between measurement updates. Due to rapid changes in the acid gas concentration, this delay may not be acceptable. Gas chromatographs consume carrier gases, so the consumable costs of GC’s are high. Nondispersive IR spectroscopic methods using broadband light sources and narrow band pass filters have been used but are prone to interferences from changing background concentrations.

Endress+Hauser's solution

Tunable diode laser absorption spectroscopy (TDLAS) is a SpectraSensors technology introduced to the natural gas market in the early 2000's. The rugged nature of these laser-based analyzers has allowed them to be used in natural gas pipelines with very little maintenance, no interference, and no detrimental effects from glycol, methanol, amine, moisture slugs, etc. Since its inception, this technology has demonstrated its reliability in thousands of installations worldwide.

Validation

Endress+Hauser analyzers require no calibration in the field and the calibration is stable for the life of the analyzer, however, validation of CO_2 concentration can be very important to gas companies. The analyzers are equipped with validation gas connections to accept certified blends of CO_2. Additionally, automated validation options are available for triggering validations by schedule or on-demand either manually or digitally.

Endress+Hauser

People for Process Automation

Application data	
Target components	CO_2 in natural gas
Typical measurement ranges	0-5%, 0-10%, 0-20%*
Typical repeatability	±400 ppmv or ±2% of reading
Measurement update time	1 second**
Principle of measurement	Tunable diode laser absorption spectroscopy (TDLAS)
Cell pressure range	700-1400 mbar or 700-1700 mbar - optional
Sample flow rate	0.5-1 SLPM (1-2 scfh) + 1SLPM (2.1 scfh) bypass
Recommended validation	Binary cal gas with methane or nitrogen background

* Contact factory for alternative ranges

** Total system response dependent on flow and sample volume

Typical stream composition

Component	Minimum (Mol%)	Typical (Mol%)	Maximum (Mol%)
Hydrogen sulfide (H_2S)	0	10-1000 ppmv	5000
Moisture (H_2O)	0	100-200 ppmv	2
Carbon dioxide (CO_2)	0	5-10	20
Nitrogen and oxygen (N_2+O_2)	0	1	1 0
Methane (C1)	50	90	100
Ethane (C2)	0	3	20
Propane (C3)	0	1	15
Butanes (C4)	0	<2	5
Pentanes plus (C5+)	0	<1	2

The background stream composition must be specified for proper assessment, calibration and measurement performance. Specify the normal composition, along with the minimum and maximum expected values for each component and the measured component. Other stream components may be allowable with approval from Endress+Hauser.