H_2S in natural gas production, storage, transportation and distribution

Benefits at a glance

- Low maintenance
- No tape, no light source or probe replacement, no carrier gas
- Repeatable, fast measurements
- No field recalibration needed
- Reliable in harsh environments
- Analog and serial outputs for remote monitoring
- AMS100 analyzer management software

Natural gas sweetening

H_2S naturally occurs in oil and gas reservoirs. Produced gas containing high levels of H_2S requires treatment to avoid corrosion problems. Gas companies use different technologies to sweeten natural gas. Common processes include directly injected liquid scavengers, chemical amine treating systems and granular solid scavengers. Some processes require the gas to be saturated with moisture. Close proximity to the outlet of a sweetening plant increases the chance of liquid carryover.

Measurement of H_2S

H_2S 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 H_2S because cross-interferences that affect the reading accuracy and the response rates must be avoided.

Issues with traditional measurements

H_2S measurements have traditionally been performed using lead acetate tape. This type of analyzer utilizes mechanical systems that feed a roll of tape through a sensor that detects stains on the tape caused by reaction with H_2S. The analyzers require a great deal of maintenance, the tape contains lead that must be handled accordingly, and the systems are prone to failing low (unsafe). Alternatively, analyzers utilizing broadband UV light sources and spinning filter wheels have been used to measure H_2S in natural gas streams. Due to interferences from other sulfur containing components, the analyzers must use chromatograph columns to separate the H_2S species. The technique is slow and prone to error in streams with changing backgrounds.

Endress+Hauser’s solution

Tunable diode laser absorption spectroscopy (TDLAS) was introduced to hydrocarbon applications by Endress+Hauser using SpectraSensors technology more than a decade ago. 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 with 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 trace H_2S concentration can be very important to gas companies. The analyzers are equipped with validation gas connections to accept binary gas blends of H_2S. Additionally, automated validation options are available for triggering validations by schedule or on-demand either manually or digitally.

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Application data

Target component	H_2S in natural gas
Typical measurement ranges	0-10, 0-20, 0-50, 0-100, 0-500 ppmv
Extended measurement ranges	0-1000, 0-2500, 0-5000 ppmv*
Typical repeatability	±250 ppbv or ±2% of reading
Typical accuracy	±500 ppbv at 4 ppmv or 16 ppmv
Measurement update time	<5 seconds**
Principle of measurement	Tunable diode laser absorption spectroscopy (TDLAS)
Cell pressure range	800-1200 mbar or 700-1700 mbar - optional
Sample flow rate	3 slpm (5.4 scfh) + 1 slpm (2.1 scfh) bypass
Recommended validation	Binary cal gas with methane or nitrogen background (nitrogen is optional with auto-validation)

* The primary intent of the product is for readings below 500 ppmv. The measurement repeatability is ±10 ppmv up to 500 ppmv and ±5% of reading above 500 ppmv. Dedicated H_2S measurements above 500 ppmv and below 60% are available – factory evaluation is necessary before quoting.
** 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 ppmv
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 expected values for each component, especially water, the measured component. Other stream components may be allowable with approval.

*** Up to 2% water allowed with H_2S ranges from 100 to 5000 ppmv.