SpectraSensors®
An Endress+Hauser Company

APPLICATION NOTE - NATURAL GAS

# Moisture in Natural Gas

## Natural Gas Dehydration

All natural gas contains water (moisture) which is measured in natural gas pipelines at production and gathering sites, custody transfer points, compression stations, storage facilities and in the distribution markets. Several methods are used for dehydration such as pressurizing, chilling, and absorption processes that use liquid and solid desiccants. Commonly, dehydration is achieved in the field with triethylene glycol (TEG) contactors. Glycol carryover to the analyzer is more likely at closer proximities to the outlet.

## Measurement of $H_2O$

Moisture measurement is critical for gas companies to meet quality specifications and to protect pipelines from corrosion. False positives are very costly because often the gas cannot be delivered if it is "wet". Natural gas streams may also 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 moisture because the contaminants destroy some moisture sensors and cross-interference effects with the moisture readings must be avoided.

## Issues with Traditional Measurements

Moisture measurements have traditionally been performed using a chilled mirror. A chilled mirror determined dew point on a carefully cooled mirror, but it is a slow and subjective measurement because many other components in natural gas can condense on the mirror. Additionally, a variety of electronic sensors have been used which rely on the adsorption of water onto a sensitive surface which is placed into the natural gas stream. In practice, sensors that are in contact with natural gas streams are adversely affected by natural gas components, which cause errors, interferences, and failures. Ultimately, they are too costly to operate and the measurement is unreliable.

## SpectraSensors' Solution

Tunable diode laser absorption spectroscopy (TDLAS) was introduced to the natural gas industry by SpectraSensors 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, $H_2S$, moisture slugs, etc. Since its inception, this technology has demonstrated its reliability in thousands of installations worldwide.

## Validation

SpectraSensors analyzers require no calibration in the field and the calibration is stable for the life of the analyzer, however, validation of $H_2O$ concentration is simple to perform. The analyzers are equipped with validation gas connections to accept binary gas blends blend of $H_2O$. A detailed procedure and recommended setup for performing validations is available from SpectraSensors.

### KEY POINTS

- Virtually maintenance free
- No interference from glycol, methanol or amine
- Accurate, real-time measurements
- No wet-up or dry-down delays
- Reliable in harsh environments
- Short term payback; no consumables
- NIST-traceable calibration
- Analog and serial outputs for remote monitoring
- AMS100 Analyzer Management Software

# Moisture in Natural Gas

## Application Data

| | |
|---|---|
| Target Components | $H_2O$ in Natural Gas |
| Typical Measurement Ranges | 0-50, 0-100, 0-200, 0-500ppmv |
| Extended Measurement Ranges | 0-1000, 0-2500ppmv* |
| Typical Repeatability SS2000(e) | ±4ppmv or ±2% of Reading |
| Typical Repeatability SS2100(a)(i)(r) | ±2ppmv or ±2% of Full Scale |
| Measurement Response Time | 1-2 seconds** |
| Principle of Measurement | Tunable Diode Laser Absorption Spectroscopy |
| Sample Flow Rate | 0.5-1 L/min (1-2 scfh) |
| Recommended Validation | Bureau of Mines Chilled Mirror, Portable TDL or Binary Cal Gas with Methane Background |

* The primary intent of the analyzer is to measure low moisture. Readings above 500ppmv have a repeatability of approximately ±5% of reading.

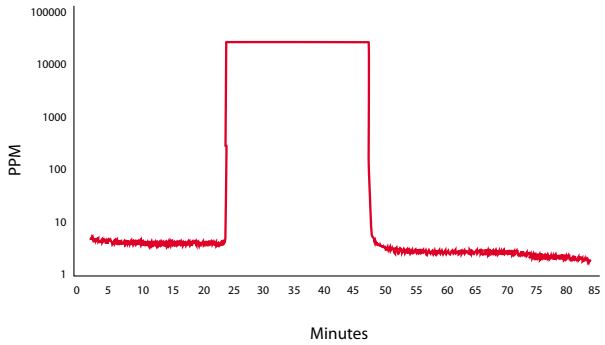
**Total system response dependent on flow and sample volume.

## Typical Stream Composition

| Component | Minimum (Mole %) | Typical (Mole %) | Maximum (Mole %) |
|---|---|---|---|
| Hydrogen Sulfide ($H_2S$) | 0 | 2-4ppmv | 0.5 |
| Moisture ($H_2O$) | 0 | 30-80ppmv | 0.25 |
| Carbon Dioxide ($CO_2$) | 0 | 2 | 20 |
| Nitrogen and Oxygen ($N_2$+$O_2$) | 0 | 1 | 20 |
| Methane (C1) | 50 | 90 | 100 |
| Ethane (C2) | 0 | 7 | 20 |
| Propane (C3) | 0 | 3 | 15 |
| Butanes (C4) | 0 | <2 | 5 |
| Pentanes Plus (C5+) | 0 | <1 | 3 |

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 from SpectraSensors.

## Typical Performance




The chart on the left demonstrates the rapid response of the SpectraSensors TDL analyzer with a >10,000ppmv moisture slug. The analyzer also demonstrates a rapid return (fast dry down).

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