SpectraSensors Gas Analyzers for LNG Processing

Accurate measurements for process control and product quality

SpectraSensors®
An Endress+Hauser Company

SpectraSensors: A leading global provider of laser-based process instrumentation

Laser spectroscopy technology SpectraSensors specializes in the design and manufacture of laser spectroscopy analyzers for on-line measurements of process gas streams. This core competency and world-class metrology form the foundation of the process gas measurement solutions we supply.

Tunable diode laser absorption spectroscopy (TDLAS) technology SpectraSensors' TDLAS analyzers perform on-line real-time measurements of impurities in process gas streams from sub-ppm levels to low percentage levels. The technology is widely used for measurements of moisture (H_20), Carbon Dioxide (CO_2), Hydrogen Sulfide (H_2S), Ammonia (NH_3), Acetylene (C_2H_2) and other compounds.

Raman spectroscopy technology Raman Optograf analyzers perform on-line, real-time compositional analysis of process gas streams. The Optograf analyzer measures multiple components in gas streams containing from 0.1% to 100% of Hydrogen (H_2), Nitrogen (N_2), Oxygen (O_2), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Hydrogen Sulfide (H_2S), Methane (CH_4) and other components.

Industries served SpectraSensors' analyzers are used in natural gas production, transport, processing, liquefied natural gas (LNG), refining, and petrochemical industries. Our commitment to providing accurate and reliable measurement solutions is evidenced by an installed base of 7,500 + analyzers around the world.

TDLAS and Raman Optograf Analyzers for LNG Processing

Critical measurements supporting LNG production and on-time shipments

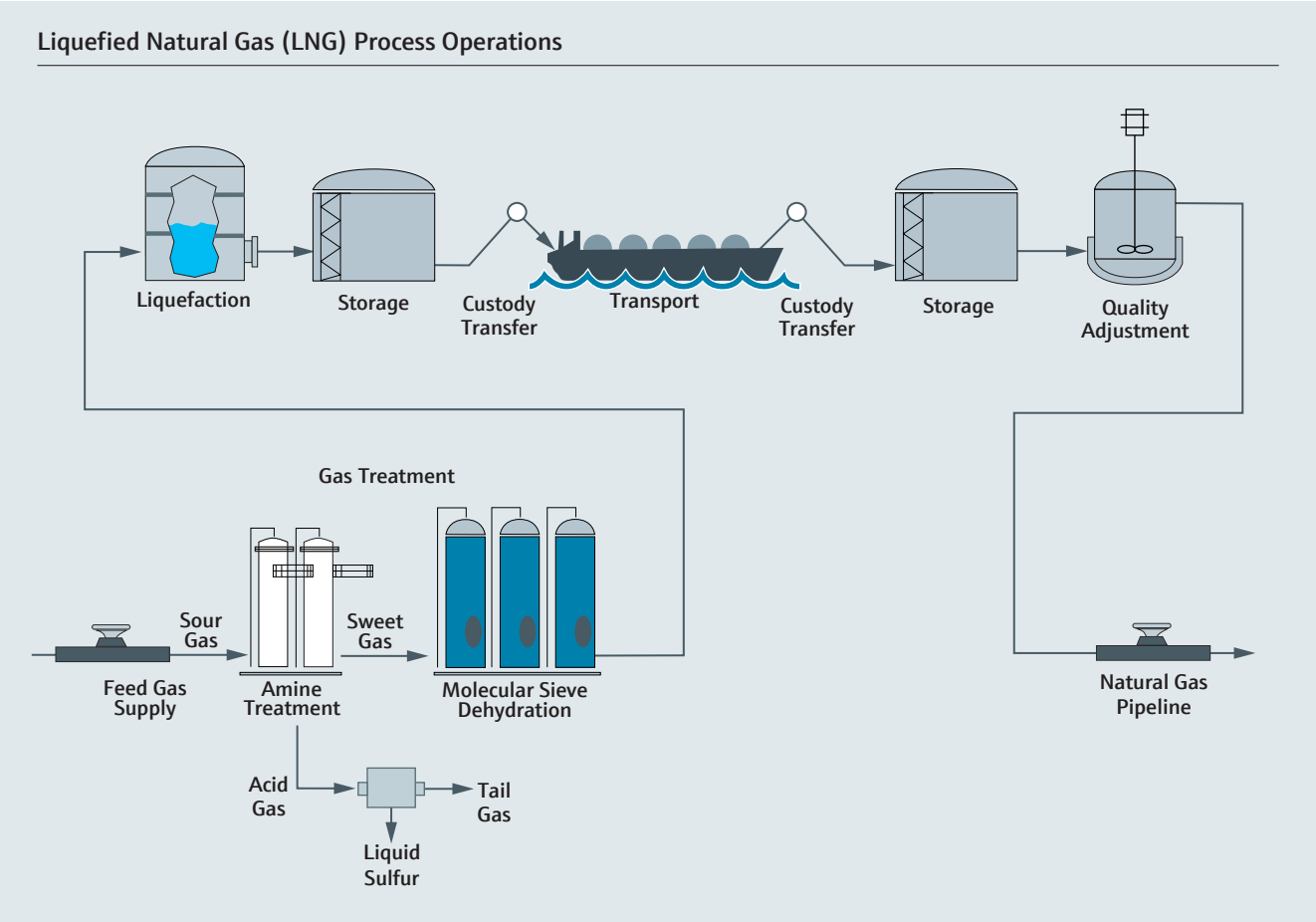
Enhanced process monitoring with TDLAS and Raman technologies

SpectraSensors' laser spectroscopy analyzers perform critical measurements throughout the LNG value chain; from pre-treatment to liquefaction through custody transfer and regasification.

Processing feed gas to remove contaminants is critical to the operation of LNG plants. Tunable diode laser absorption spectroscopy analyzers monitor H_2O, H_2S, and CO_2 concentrations in natural gas as the gas undergoes treatment to remove and control these contaminants prior to liquefaction.

Compositional measurements of natural gas in gaseous and liquefied states, and of mixed refrigerants help LNG plants operate efficiently and determine the energy value (BTU and Wobbe Index) of LNG product. Raman Optograf analyzers perform on-line composition measurements of feed gas, LNG as a cryogenic liquid, mixed refrigerants, and gas following LNG regasification.

Continuous uninterrupted operation of the gas pre-treatment, dehydration, and liquefaction process trains is essential to ensure on-time LNG loading and shipment. SpectraSensors laser spectroscopy analyzers monitor key points in LNG processing operations to support on-time shipments.



Laser-based analyzers for LNG processing

Laser spectroscopy – a better solution for challenging process conditions

TDLAS Analyzers
Tunable diode laser absorption spectroscopy (TDLAS) analyzers from SpectraSensors perform on-line, real-time measurements of impurities in natural gas from sub-ppm levels to low percentage levels.

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ptograf LNG analyzers om Kaiser Optical ystems use Raman ectroscopy to perform n-line composition easurements of natural as (NG) for determining TU, Wobbe Index, and her critical parameters.

The unique design of SpectraSensors' TDLAS analyzers provide significant advantages over other technologies for monitoring H_2O, H_2S and CO_2 in natural gas feed for LNG production.

Non-contact measurement The laser and solid state detector components of TDLAS analyzers are isolated and protected from the process gas and entrained contaminants flowing through the sample cell. This design avoids the fouling, corrosion, and memory effects associated with AI_2O_3 moisture sensors and Quartz Crystal Microbalances analyzers ensuring reliable long-term operation.

Fast response and analysis time TDLAS analyzers detect changes in analyte concentration much faster than other techniques. The wet-up and dry-down times associated with Quartz Crystal Microbalances can result in a delayed response or failure to detect a sudden increase in H_2O concentration signaling breakthrough in a molecular sieve dehydration vessel. Gas chromatography (GC) results can be delayed several minutes awaiting completion of a chromatographic run.

Fully automated analyzer validation SpectraSensors' TDLAS analyzers for trace moisture measurement are equipped with an integrated permeation device to perform automated analyzer validation at user-specified time intervals.

Low cost of ownership Unlike lead acetate tape analyzers or GCs, TDLAS analyzers have virtually no consumable components resulting in a lower cost of ownership and a lower service and maintenance burden on technicians.

The unique properties of this laser-based technology provide significant advantages when measuring the composition of liquefied natural gas, mixed refrigerants, or LNG quality after adjustments to meet local pipeline specifications.

In-situ measurement of cryogenic liquids The analyzer uses proprietary optical probe technology to measure the composition of LNG as a cryogenic liquid, eliminating the need for a vaporizer, with its associated cost and maintenance.

Enhanced safety by using photons By analyzing samples using laser light transported via robust telecommunications-grade optical fiber cables, there is no need to transfer NG or LNG to the analyzer or an analyzer shelter. Samples can be analyzed up to 250 meters from the base unit, providing enhanced safety by reducing worker exposure to hazardous materials.

Fast update times The Optograf analyzer provides faster compositional analysis than other techniques, particularly for cryogenic liquid samples, with update times in seconds, not minutes. The system can measure up to 4 streams in parallel, not sequentially, for significantly faster results per stream.

Environmentally robust Rated to operate from -20° to +50° C, the system does not require an analyzer shelter. The unit can be placed in a 3-sided shelter or under a sun shield in a convenient location for user access.

Low cost of ownership The Optograf LNG analyzer does not require a vaporizer, has virtually no consumables, and requires minimal maintenance, reducing the burden on technicians.

Amine treatment & gas sweetening

H_2S and CO_2 measurements for process control and optimization

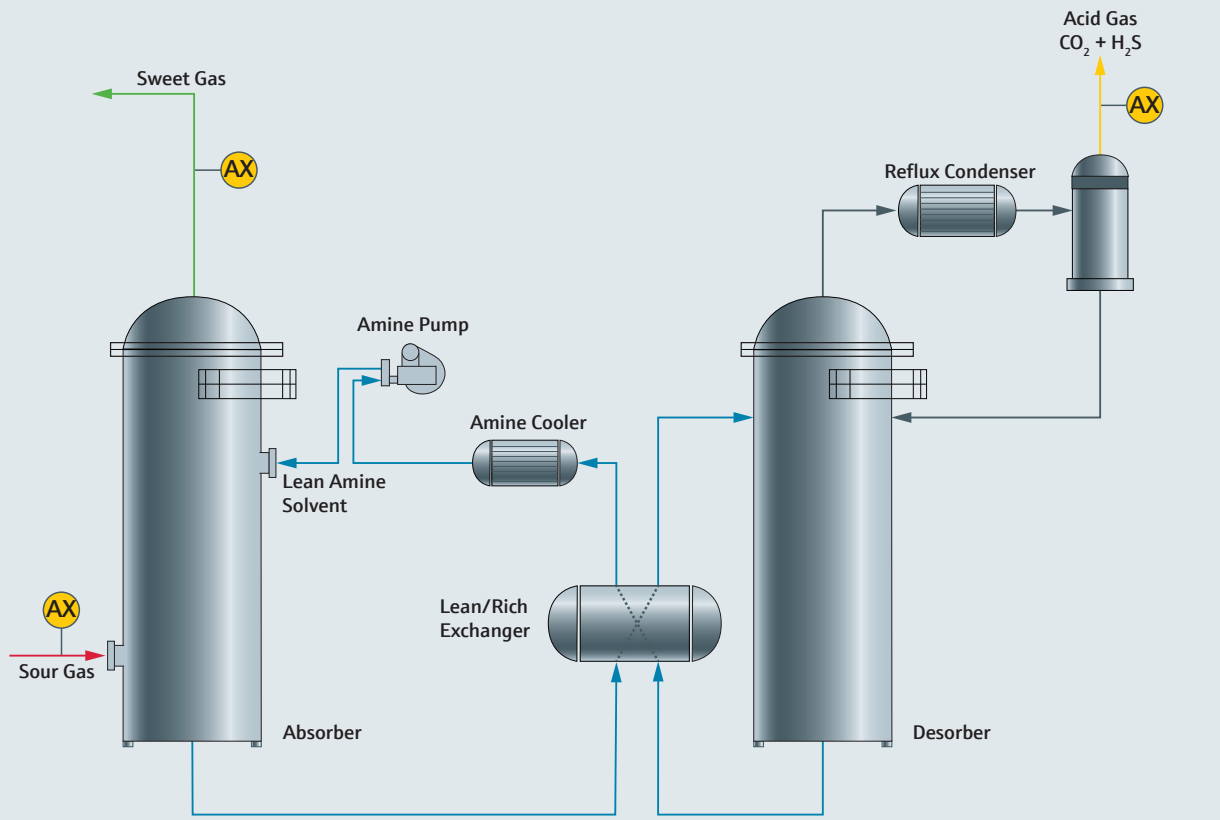
Raw natural gas from different geological formations contains varying amounts of acid gases (H_2S and CO_2). These contaminants must be removed from LNG feed gas to prevent CO_2 from freezing at cryogenic processing temperatures and H_2S from exceeding gas quality specifications.

Gas sweetening processes are designed to remove acid gases from sour gas. Amine treatment is the most common process employed to scrub H_2S and CO_2 from natural gas. In operation, sour gas is contacted with an aqueous amine solution which removes H_2S and CO_2 by chemical reaction and absorption.

On-line monitoring of the H_2S and CO_2 concentrations in sour gas at the inlet and sweet gas at the outlet gas of an Amine Treatment Unit is important for control and optimization of the treatment process.

Acid gas containing elevated levels of H_2S and CO_2 is a byproduct of the process which may be fed to a Sulfur Recovery Unit (SRU) to convert and recover elemental sulfur from H_2S in the acid gas. Measuring the H_2S concentration in the acid gas stream is critical for optimization of the oxidation process occurring inside the SRU.

Amine Treatment / Gas Sweetening



Molecular sieve dehydration

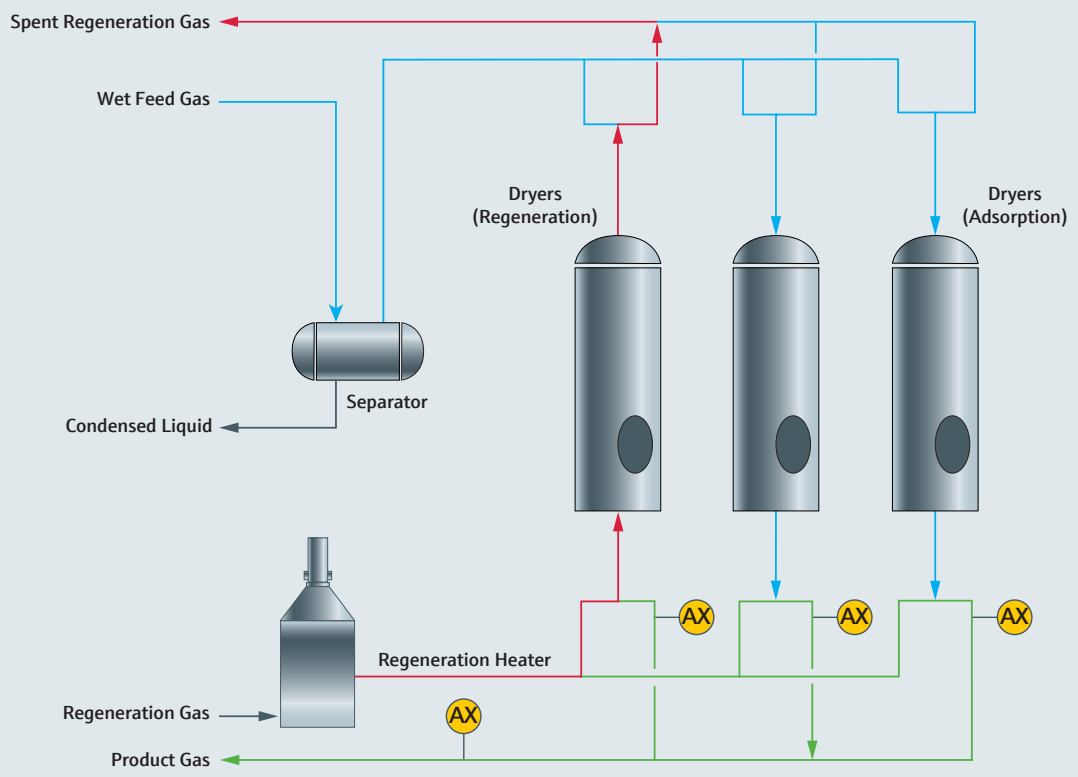
Trace level H_2O measurement in LNG feed gas

Molecular sieve dehydration is used to meet stringent specifications for H_2O concentration (< 0.1 ppm) in LNG feed gas. Performance of the molecular sieve dehydration system is an important factor in the efficient, un-interrupted operation of an LNG plant.

Three or four vessels containing molecular sieves are typically operated in parallel with a piping system that allows a saturated adsorbent bed to be taken off line for regeneration with heated gas. On-line monitoring of the H_2O concentration in the outlet gas stream of a dryer vessel using a SpectraSensors TDLAS analyzer provides real-time indication of adsorbent bed saturation and breakthrough, preventing gas with an elevated H_2O content from reaching the liquefaction train.

Initially no H_2O is detected in the dry gas exiting a molecular sieve vessel. Over time the adsorbent bed adsorbs more water and trace (sub-ppm) levels of H_2O are present in the gas. The TDLAS analyzer responds rapidly to this change ensuring the H_2O content of LNG feed gas does not exceed the user-specified process control set point.

Molecular Sieve Dehydration

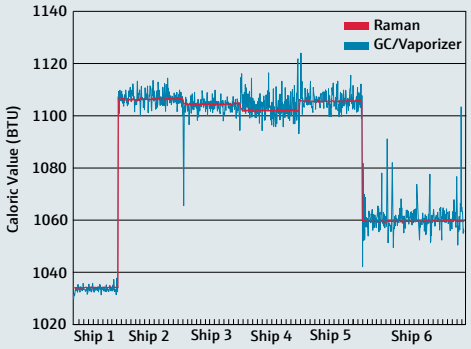


Improving efficiency and profitability

Accurate, precise composition of LNG and mixed refrigerants

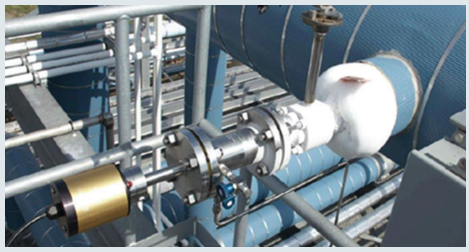
Reduced uncertainty in BTU during custody transfer

Kaiser Optical Systems has developed optical probe technology that allows LNG to be measured as a cryogenic liquid, eliminating the need for vaporizing LNG in order to measure BTU and Wobbe Index. This capability reduces the uncertainty in BTU of transferred LNG ten-fold, while increasing the speed of response to seconds, rather than minutes. BTU measurements can be made during the entire transfer period, even with fluctuations in LNG flow, and there is no need to restart the analyzer after flow interruptions.



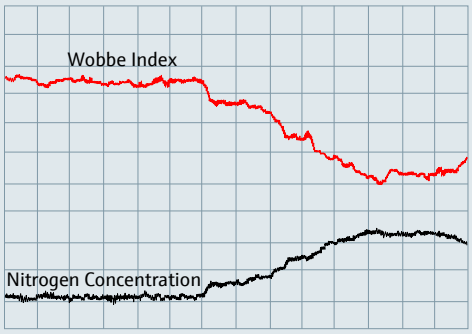
Optimized efficiency and versatility of liquefaction trains

Large LNG export facilities handle natural gas feeds of varying quality from multiple sources, and need to adjust refrigerant composition to ensure the lowest energy consumption during liquefaction. In addition, these plants need to dynamically compensate for refrigerant losses with make-up refrigerant (MR). The Optograf Raman technology from SpectraSensors measures NG and MR composition in both the gas and liquid phases, so plant operators can know the quality of the feed gas and can adjust their MR for optimum plant operating efficiency.



Meet pipeline quality requirements with higher speed and precision

LNG import terminals often receive LNG from multiple sources, with varying composition and quality (BTU, Wobbe Index). Many LNG terminals regasify the LNG with the goal of inserting it into the local natural gas pipeline. The LNG received often does not meet local pipeline specifications, so quality adjustments must be made. The Optograf analyzer provides near real time full compositional analysis of the NG while it is being adjusted, in the gas or liquid phase, ensuring that not only does the gas meet the target WI, but that no penalties are incurred due to excess levels of inerts.



Endress+Hauser is a global leader in measurement instrumentation, services and solutions for industrial process engineering. The company acquired SpectraSensors in 2012. Soon thereafter Kaiser Optical Systems was also acquired bringing the Raman-based Optograf analyzer into the product portfolio further solidifying Endress+Hauser's position in process gas analytics.

Contact

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