Real-time Quality Measurements in Biomethane (RNG)

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Endress+Hauser

1:45 pm - 2:30 pm Wednesday, October 9, 2024
Session Track: GMRS
Location: Sheraton Hall C

Energy Nexus | Annual Technical Conference
Fuelling the Future

Real-time Quality Measurements in Biomethane (RNG)

CGA Energy Nexus & ATC – Toronto - October 9, 2024

Endress+Hauser
People for Process Automation

What drives us

Our heart beats for measurement technology

- Careful use of resources
- Safe supply of goods
- Protection of our environment

3 mil. sensors

Endress+Hauser delivers annually

Part of our lives

The world is full of process engineering

- Many everyday goods are produced with the help of process engineering
- Endress+Hauser products enable safe and reliable supply

5.3 bil. people

come into contact every day with products that are manufactured using our measurement technology

Committed to doing our part

1st Private Funded: Net Zero Energy, Zero Carbon Building & LEED Gold per Canada Green Building Council

Located in Burlington, ON

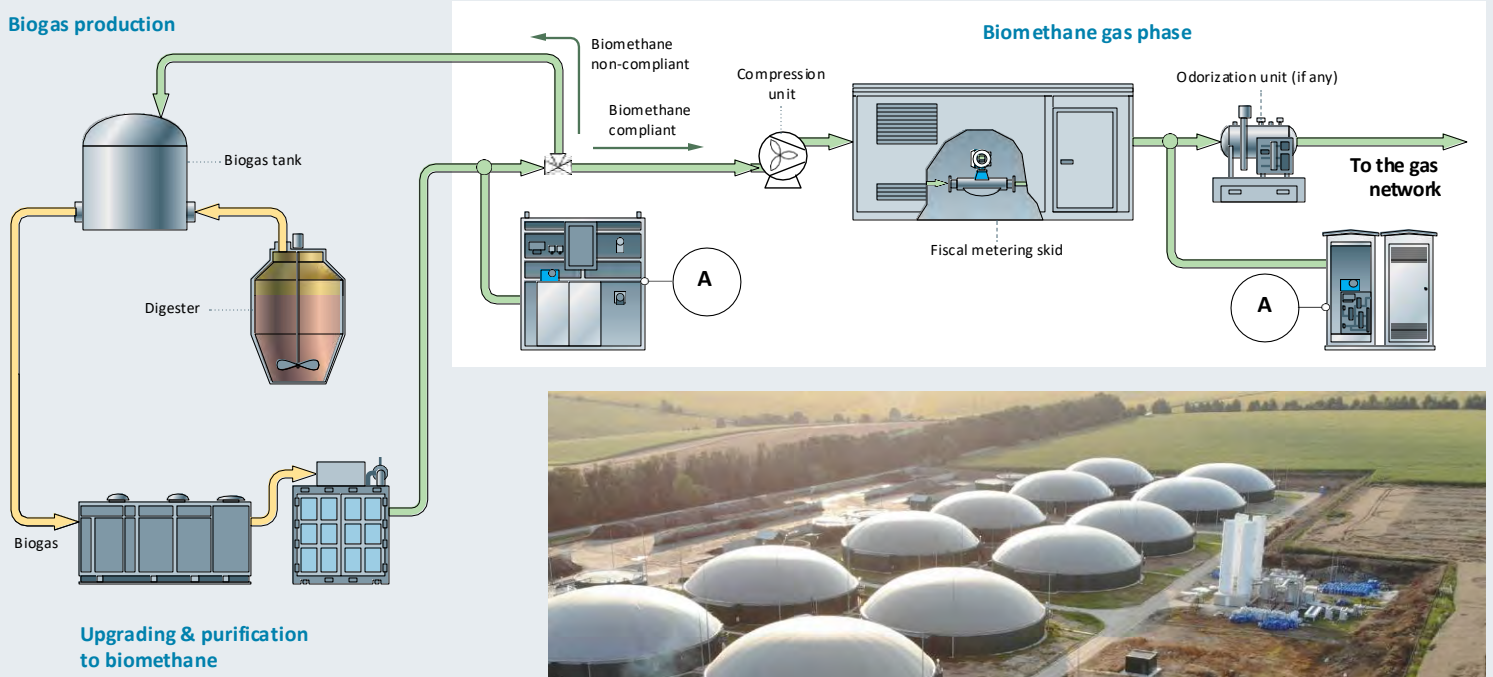
Biomethane

Biomethane, or renewable natural gas (RNG) as it is called in some regions, is produced through the aerobic fermentation of biological material known as biogas. After purification stages, the resulting biomethane is similar in composition to traditional natural gas.

The measurement of contaminants such as H_2O, H_2S, CO_2 & O_2 are important parameters to ensure that the final biomethane meets quality specifications.

CH_4, H_2O, H_2S, CO_2, O_2 & N_2 concentration are measured as part of the custody transfer process.

TDLAS gas analyzers provide reliable, accurate measurements for each party and ensure that the biomethane producer's purification processes are working properly.



Your challenge

Measuring task (typical):

H_2O: (0-100 ppmv) or (0…85 mg/m3)

H_2S: (0-10 ppmv) or (0…7 mg/m3)

CH_4: (90 – 99%)

CO_2: (0…3%)

N_2: (0…1%)

O_2: (0…1%)

Composition: IS pipeline-quality natural gas

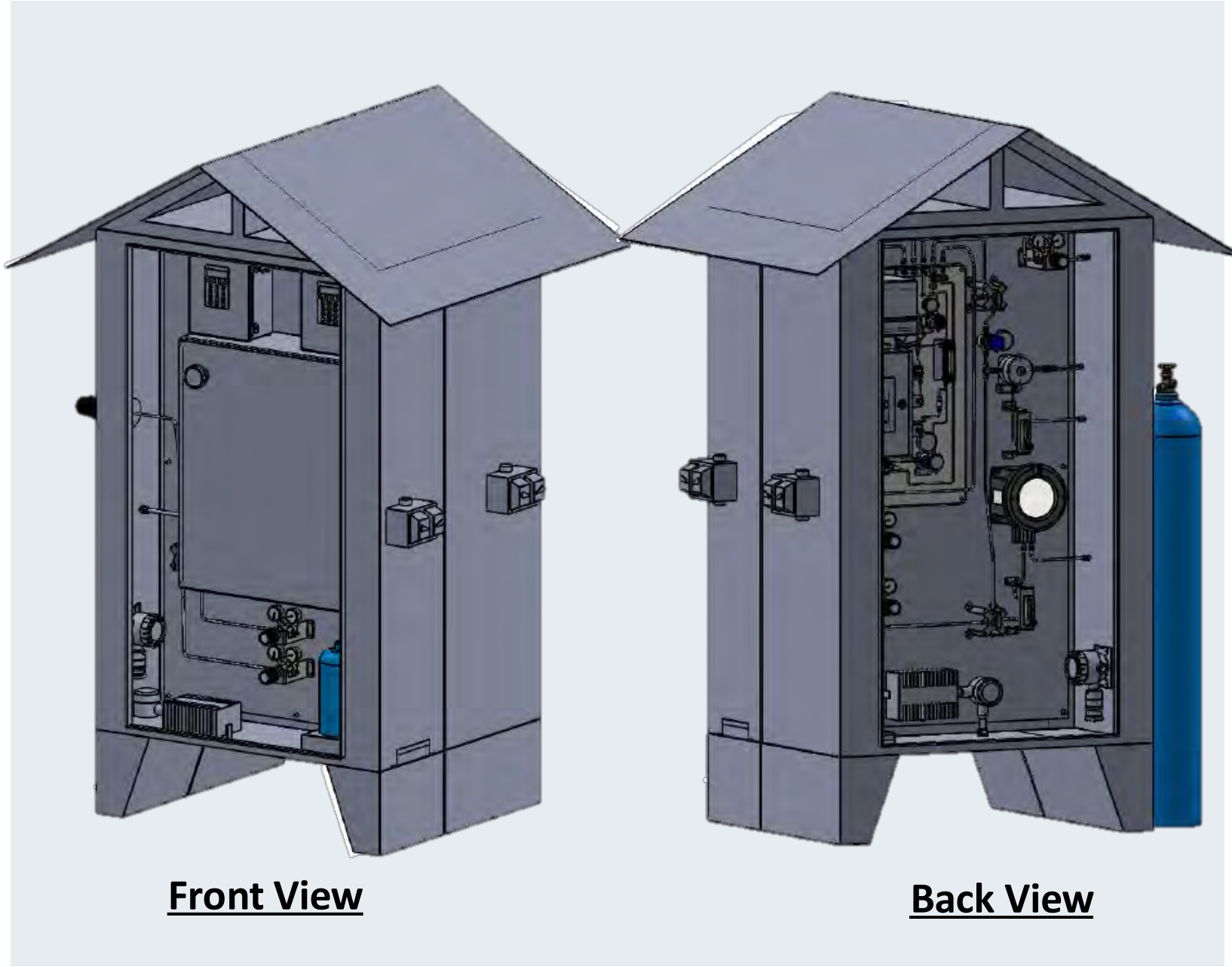
Compact Analyzer Station

Analyzers prevent corrosion and minimize the risk of an uncontrollable event, ensuring asset integrity in biomethane pipelines.

Measurement is also a requirement for custody transfer.

Integration of a Gas Chromatograph provides a comprehensive yet compact Analyzer Station that is fit for purpose

- Fit for purpose freestanding heated enclosure without the need for expensive shelters that must be designed for occupancy saving hundreds of thousands of dollars plus time lost due to red tape and permits
- Complete system pretested and commissioned prior to arrival on site minimizing on site activities
- Station includes toxicity and LEL monitors to ensure the safety of those before they open the enclosure



Front View **Back View**

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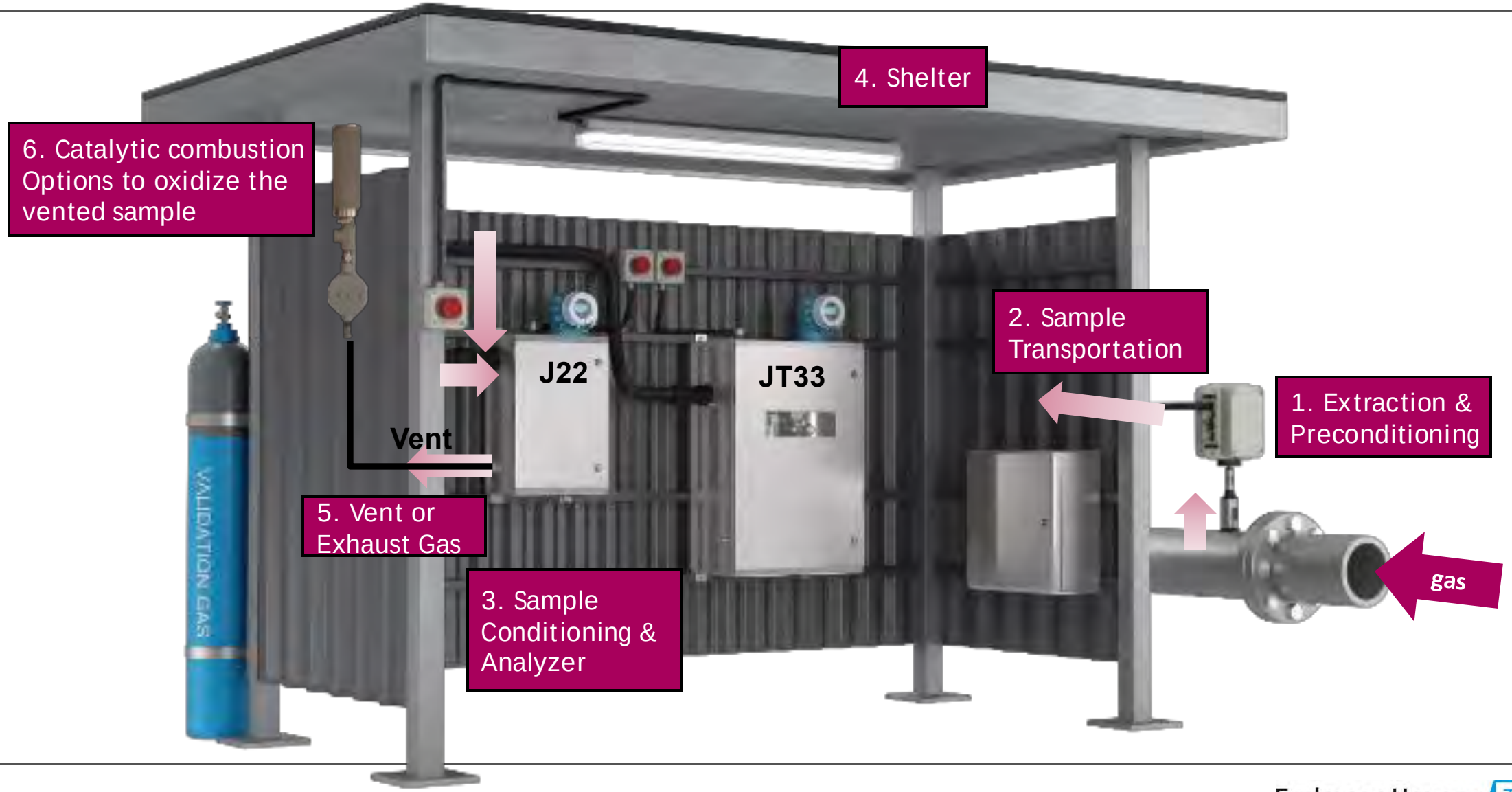
Measurement is also a requirement for custody transfer.

Integration of a Gas Chromatograph provides a comprehensive yet compact Analyzer Station that is fit for purpose

- Complete station is CSA approved
- Complete system pretested and commissioned prior to arrival on site minimizing on site activities
- Validation bottles can be stored in the enclosure ensuring that the correct equipment is available to support operations.

Front View

Extractive Gas Analyzer Installation Scheme – Tap to Vent Solutions



TDLAS measuring principle

Proven laser-based optical technology for rapid, reliable analyte measurement

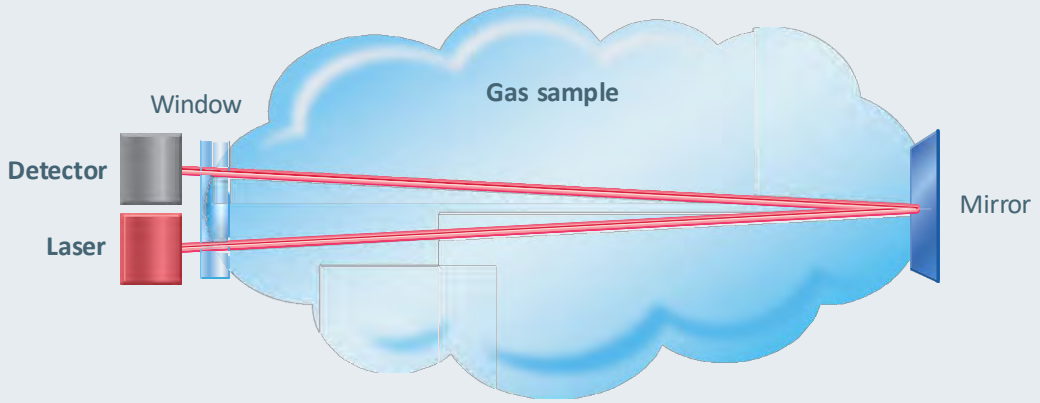
Tunable diode laser absorption spectroscopy (TDLAS) is a laser-based optical technique to detect and measure the concentration of impurities in process gas streams.

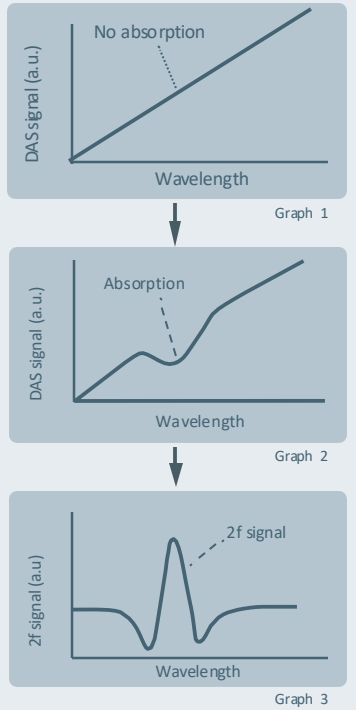
In normal operation, process gas from a sampling probe is introduced to the sample cell of the TDLAS analyzer. A tunable diode laser emits a light with a specific near-infrared (NIR) or visible wavelength that can be absorbed by H_2S molecules.

The laser light enters the sample cell, passes through the gas, gets reflected by one or more mirrors, and is finally aimed into a photodiode detector.

A window isolates the laser and detector from the process gas. Using this design, measurements can be performed with absolutely no contact between the process gas (and entrained contaminants) and critical analyzer components.

H_2S molecules in the gas sample absorb and reduce the intensity of light in direct proportion to their concentrations according to the Lambert-Beer law.





The system measures the transmitted laser intensity as a function of the scanned laser wavelength as depicted in Graph 1 and 2 above. Graph 1 has no absorption and Graph 2 has significant absorption as indicated by the “dip” in intensity at a specific wavelength. To improve detection sensitivity over simple direction absorption spectroscopy (DAS), wavelength modulation spectroscopy (WMS) with second harmonic (2f) detection is employed. The 2f signal is illustrated in Graph 3.

This approach significantly improves the signal-to-noise ratio supporting high-sensitivity measurements. The 2f signal is processed using advanced algorithms to calculate analyte concentration in the process gas.

Differential technology

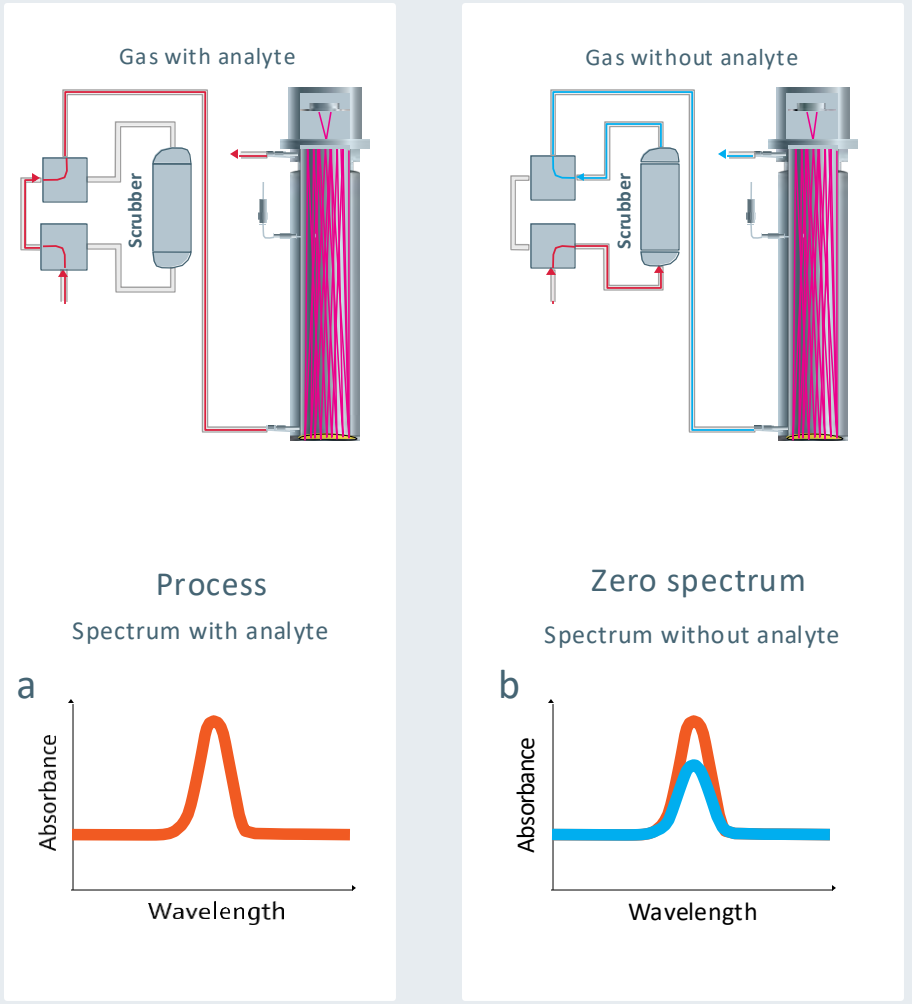
A patented spectral subtraction TDLAS technique for accurate trace-level measurement of H_2S

TDLAS analyzer systems, powered by SpectraSensors TDLAS technology, include a patented spectral subtraction technique that enables trace-level (sub-ppm) measurements of H_2S to be made when a process gas sample contains very low levels of an analyte and background gas interferences.

In operation, the TDLAS analyzer performs a sequence of steps to obtain a “zero” or “dry” spectrum and “process” or “wet” spectrum that are used to calculate analyte concentration by spectral subtraction, as depicted in the figure at right.

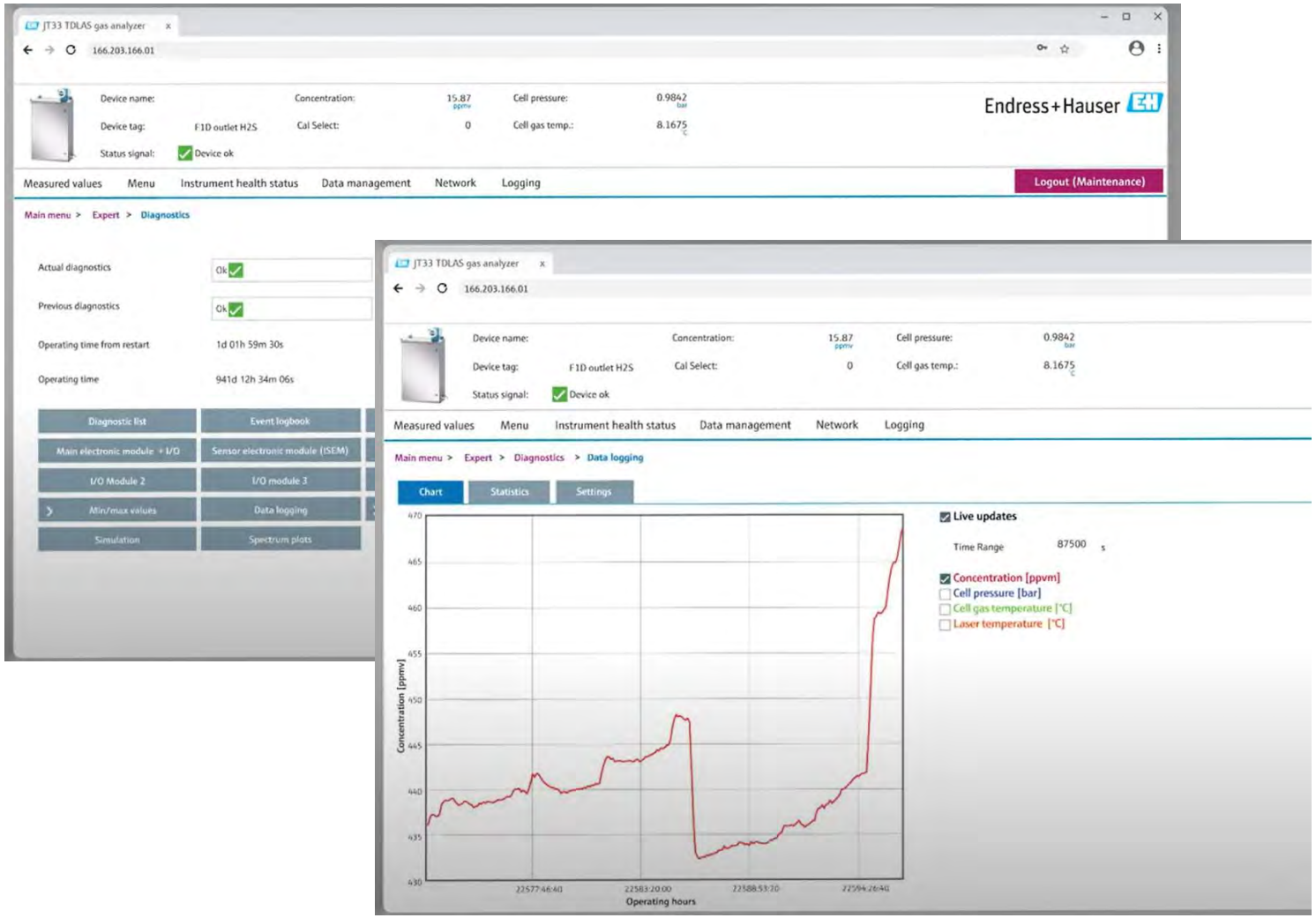
The dry spectrum is obtained by passing the process gas sample through a high- efficiency scrubber which selectively removes the trace analyte without altering the process gas composition and background absorbance. The analyzer records the resulting dry spectrum of the process gas and automatically switches the sample gas flow path to bypass the scrubber and collect the wet spectrum.

Subtraction of the recorded dry spectrum from the wet spectrum generates a differential spectrum of the trace analyte which is free of background interferences. The analyte concentration is calculated from the differential spectrum.



Differential technology uses gas with the analyte (a) and subtracts gas with the analyte removed (b) to calculate the analyte concentration.

TDLAS gas analyzer – web server / web browser



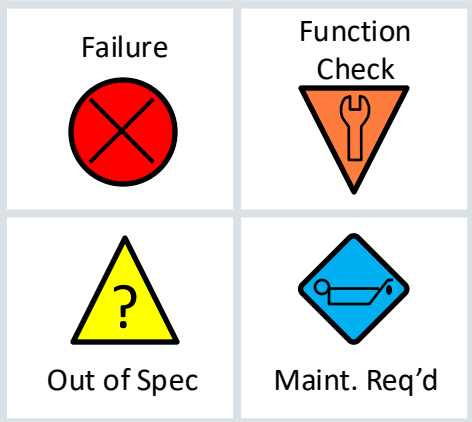
Service access via web browser!

- No software installation required
- Easy intuitive interface
- Easily connect with IP address
- Setup and commissioning parameters
- View operational and diagnostic data
- Visualize spectrum and trend data
- Review activity and alarm history
- Save data from device to your computer
- Upgrade device firmware
- View and save PDF verification reports

TDLAS gas analyzer - Heartbeat Technology

Heartbeat Technology

Diagnostic alarms

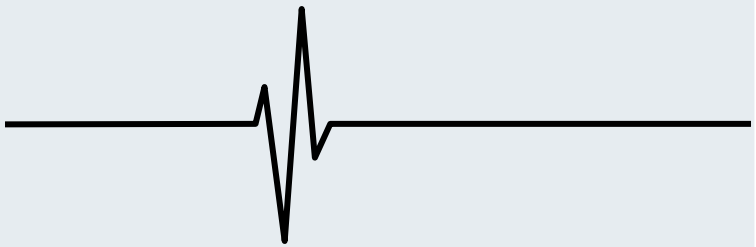


- 4 alarm severity levels
- Enable decisive action

Verification

- PDF generated by analyzer
- Report for compliance records
- Auto validation

Monitoring



- Health monitoring of electronics and spectroscopy
- Intelligent problem analysis

Canadian examples of RNG Projects Endress+Hauser has been involved in

Canadian examples of RNG Projects showing Endress+Hauser Analyzers

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