

Emerson Offers Landfill & Biogas Solutions for H₂S Measurement Applications

Applications

As a by-product of recycled waste and raw materials, Landfills and Biogas facilities generate gases that can be used for multiple purposes such as fuel for boilers, dryers and heaters, power generators for engines and turbines, or even be supplied into a natural gas network. Comprised primarily of methane (CH₄) and carbon dioxide (CO₂), these gases may also include traces of oxygen, nitrogen and water, and in some cases contain hydrogen sulfide (H₂S) at concentration levels of several hundred ppm.

Local power production facilities often use the processed gas from these facilities to power the engines of the generators. Because the combination of H₂S and moisture is highly corrosive, operators use gas analyzers to closely monitor the H₂S levels in order to prevent corrosion, which can cause costly damages to the engine.

Another common application of Landfill and Biogas usage is the production of Biomethane, where the extraction of CO₂, H₂O and H₂S components allows the resulting purified gas to be injected into natural gas grids. Even though Biomethane is purified, low levels of H₂S may still remain, and therefore local authorities often set strict regulation limits towards its use. For example, in Europe the H₂S limit is 3.3 ppm.



Typical Biogas Facility

Electrochemical Sensors for H₂S

Rosemount Analytical offers electrochemical sensors for H₂S in three measuring ranges:

- 0–50 ppm
- 0–200 ppm
- 0–2,000 ppm

With Rosemount Analytical's electrochemical cell, H₂S is oxidized to sulfuric acid (H₂SO₄) which produces a current proportional to the H₂S concentration. These inexpensive sensors are quite selective and sensitive down to low ppm concentration levels, however they require moisture and oxygen to maintain constant sensitivity, therefore an ambient air purge cycle is implemented.

The **X-STREAM Enhanced™** analyzer has an internal programmable logic controller (PLC), which is used to control the internal valve logic for implementation of the purge cycle. Purge and measurement intervals are set to 10 minutes each but can be easily configured to other field conditions.

Integrated Solution

In addition to H₂S measurements at Landfill and Biogas sites, other measurements are needed. Methane (CH₄) and carbon dioxide (CO₂) are the main constituents and define the calorific value or quality of the gas and are measured with an IR photometer. Oxygen (O₂) is a safety measurement performed with electrochemical cells or paramagnetic detectors. These additional measurements are done continuously in series with H₂S when the H₂S sensor is in measurement mode. When the H₂S sensor is in a purge cycle, it is switched to parallel mode, relative to the active measurements.

In addition to providing continuous accurate measurement analysis, the X-STREAM Enhanced includes built-in purge, calibration valves and pumps, providing a complete turn-key solution ideal for Landfill and Biogas applications.

Landfill & Biogas

The X-STREAM *Enhanced* analyzer provides accurate measurement of CH₄, CO₂, O₂ and H₂S combined into one single housing. For added installation flexibility, the analyzer is available in three housing options for Landfill and Biogas applications:

- General purpose 19 inch housing
- Field housing with IP66
- Flameproof housing for hazardous area installations



X-STREAM Enhanced analyzers for Landfill and Biogas applications

The landfill solution is provided as a complete system including all necessary sample conditioning, connections for sample and calibration gas, exhaust or vent, autocalibration solenoids, pressure and flow control, protective particulate filter, and back pressure regulator. It may be supplied in a temperature controlled NEMA 4 or 4X enclosure with heating and/or cooling if required.

The package can be provided for one up to four measurement channels, with water removal system, and sample pump as needed. Area classification of the enclosure as well as an explosion proof air conditioner are also available. For high moisture sample gases, a chiller and/or coalescing filter with a condensate monitor (alternate wording is carry-over sensor) should be installed to avoid condensation inside the analyzer.

Figure 1 – X-STREAM Analyzer System for CH₄, CO₂, O₂ and H₂S

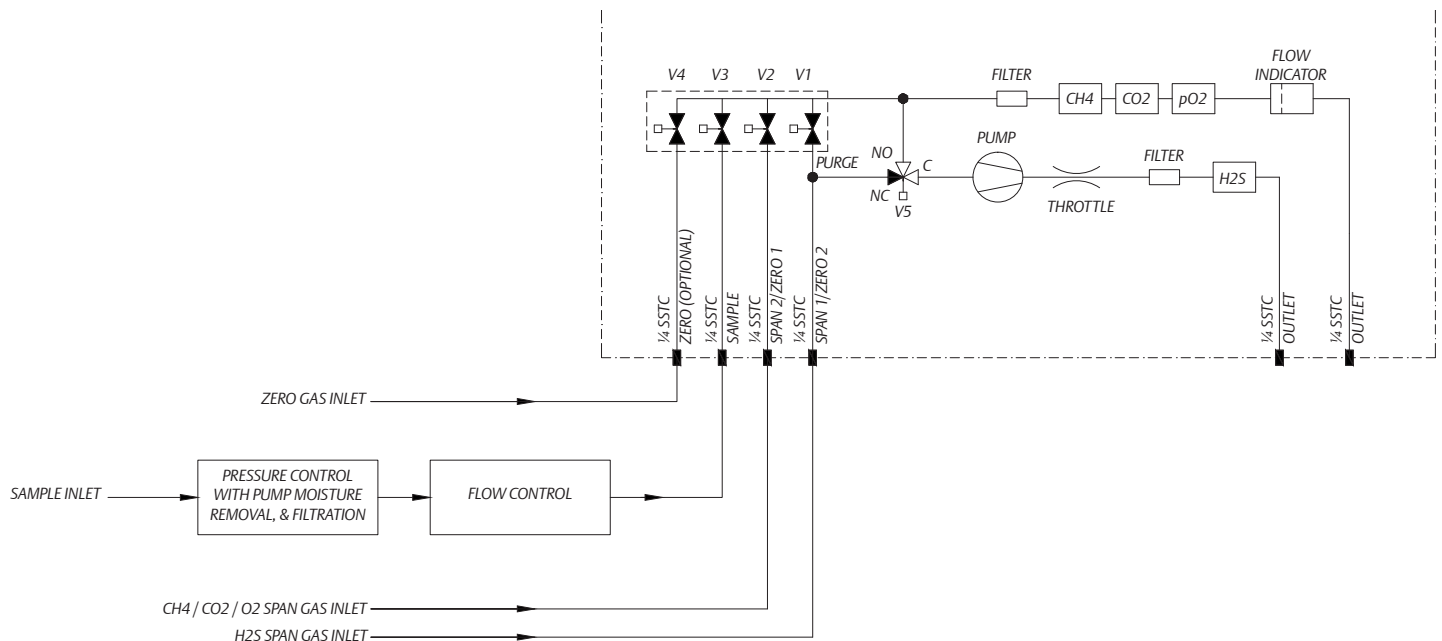


Table 1 - H₂S Standard Measurement Performance Specifications

	Hydrogen Sulfide (H ₂ S)		
Measurement Range (Sensor Dependent)	0 to 50 ppm	0 to 200 ppm	0 to 2,000 ppm
Overgas Limit	200 ppm	500 ppm	10,000 ppm
Detection Limit ⁽¹⁾	< 0.2 %		
Repeatability ⁽¹⁾	< 2 %		
Drift ⁽¹⁾	< 1 % per month		
Response Time (t ₉₀)	< 35 s		
Operating Life	> 24 months		
Sensor Operating Temperature	-30 to 50 °C		
Gas Pressure Range	800 to 1200 hPa (-3 to 2.7 psig)		
Gas Humidity Range (Rel. Humidity)	15 to 90 %		
Thermostat Control	none		

(1) Related to full scale

NOTE: These sensors require oxygen and moisture to work properly.

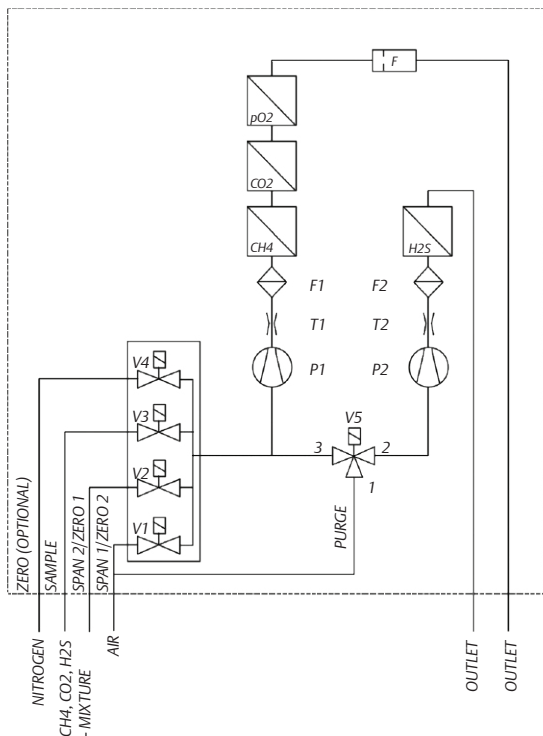
Reference the Rosemount Analytical X-STREAM XE Analyzer Product Data Sheet for more information.

Several configuration solutions are available, including a Four Channel and a Single Channel solution.

Four Channel Solution (see Figure 2)

- CO₂ and CH₄ IR channels
- O₂ measurement with pO₂ or eO₂
- CO₂, CH₄ and O₂ are measured continuously
- Electrochemical H₂S channel
- Only one calibration gas bottle
- Includes internal sample handling (*)
 - Sample gas pump
 - Valve block for auto calibration
 - 3/2 way valve and pump for H₂S purge cycle

Figure 2 - Four Channel Solution



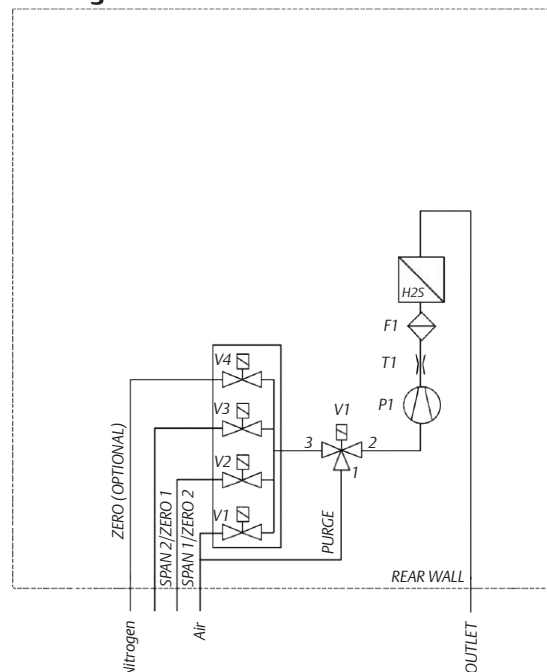
Single Channel Solution for H₂S (see Figure 3)

- Autocal block
- Purge cycle with pump and 3/2 way valve (**)

Available Options:

- Without autocal block
- No internal SHS (***)

Figure 3 - Single Channel Solution



(*) Part or all of the Sample Handling can be realized externally

(**) H₂S sensor should be purged on a regular basis to extend lifetime
 (***) Ambient air measurements do not require H₂S purge cycle

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