Technical Note
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Rosemount™ 625IR Point Gas Detector

The Cornerstone of Flame & Gas Systems, Safely Protecting Personnel and Assets

ROSEMOUNT™

EMERSON™

Introduction

The risk of explosion or fire is an ever-present risk in many industries that use hydrocarbons. Personnel safety and asset protection through safe gas leak detection is mission critical for modern day plants processing explosive substances.

More and more, industrial processes and maintenance are being automated, and it is not unusual to have unmanned process skids. The reliance on gas detection technology to protect these assets is higher than ever.

Very reliable gas detectors are essential. Activation of a gas leak alarm can generate events that lead on to an emergency shutdown causing cleanup, lost production, and perhaps a lengthy period of time to complete root-cause investigations. Additionally, there may be a need for issuing regulatory reports and other approvals before restarting the system. Because of these requirements, a false alarm can be nearly as disruptive as an actual gas leak.

Accurate measurement of any gas leaks are most important from a community perspective. Monitoring the facility in real time is the social responsibility of industrial companies.

Immediate vicinity, point gas detection

Point gas detectors are usually placed near potential hazardous gas leak sources, with the number and location of sensors determined by the extent and geometry of the area requiring coverage, air movement, and other factors. Consequently, a large outdoor area, such as the space between hydrocarbon storage tanks, calls for many detectors since there are numerous potential gas sources and the potential for extensive air movement.

IR detectors exploit the characteristic of hydrocarbon gases to absorb radiation in the IR spectral band. This absorption of radiation in the IR wavelength at certain gas specific wavelengths is defined by the Beer-Lambert law.

An IR absorption detector has a light source, rich in the IR band, which transmits across an open space onto a sensor. If a target gas is present in the space, it will absorb and attenuate IR radiation, which is measured by the sensor. The degree of attenuation provides an accurate value of gas concentration on a near real-time basis. If above a defined threshold, the detector will trip to alert plant personnel.

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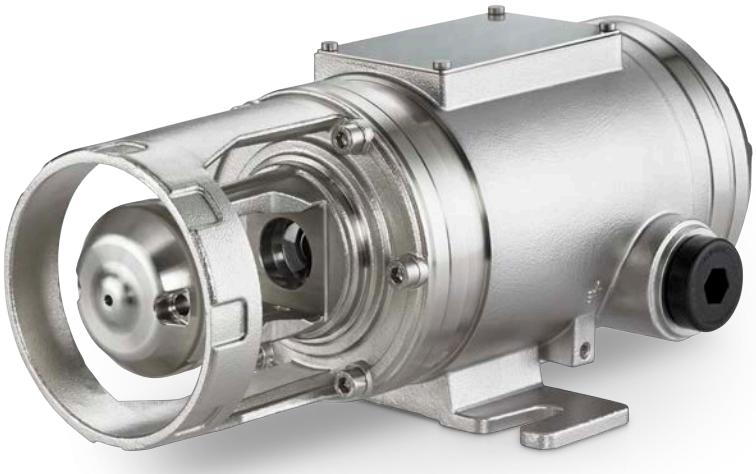
Figure 1: Emerson's Rosemount 625IR Fixed Gas Detector: Fast, safe, and reliable



Optimizing the light source

There are several technologies available that can produce the correct IR intensity with a form factor suitable for the detection of a range of hydrocarbon gasses. Detecting the gas depends on analyzing a small range of very specific wavelengths. Therefore, the light source must be capable of producing those wavelengths consistently and reliably. Some light sources, over time, tend to change their spectrum, which in this type of application could cause a loss of accuracy.

The selection of a solid-state IR light source is natural decision for a number of reasons: reliability, availability, accuracy and stability. From experience, filament based light sources are less repeatable and also drift over time resulting in a need for detector calibration.

Flash frequency is an important factor in gas detection. A higher flash rate means more data and a more reliable and faster reacting sensor. Approximately a 10-fold increase in data collection performance is seen through using solid state light source.

Avoiding false alarms

Safety system responses to a fire are disruptive, and may include clearing people from a facility, to slamming valves shut and spraying extinguisher foam. Consequently, a false alarm can create major problems. Unfortunately, a variety of conditions can cause false alarms if a detector does not have an effective built-in self-check architecture.

Rosemount 625IR Fixed Gas Detector has the following features to increase the false alarm immunity:

- The 625IR is designed with solid state IR sources, which are much more repeatable than the filament bulbs which are traditionally used for creating IR: because of better repeatability they drift less.
- The 625IR uses two independent IR sources that are independently controllable
  - To create ‘measurement’ and reference’ beams of IR, most manufacturers use a single filament bulb, then put the light through a splitter and finally through IR filters. This design does not allow users to independently ‘adjust’ the IR concentration for just the measurement or reference wavelengths.

- The 625IR uses two independent receivers:
  1. The first receiver verifies that the IR energy levels from the measurement and reference sources are correct.
  2. The second receiver detects gas concentration and obscuration of the lenses. This second receiver is also used for verification of the IR energy levels from the sources.
- Because there are two fully independent sources and two fully independent receivers, this means we can check all IR levels against each other and make small internal adjustments if any levels are different than expected. Thus, there is no observable drift:
  - IR source 1 energy level is compared in compensation receiver and measurement receiver
  - IR source 2 energy level is compared in compensation receiver and measurement receiver
  - IR source 1 energy level and IR source 2 energy level are checked against each other in compensation receiver
  - IR source 1 energy level and IR source 2 energy level are checked against each other in measurement receiver
- There is also an auto zero feature. This is only active when gas is not detected, and only minor adjustments are made within the stated accuracy of +/-2% LEL versus factory calibration. This auto zero feature runs continuously.

These bedrock elements of architecture build a fast, safe, reliable gas detector.

Installation considerations

The target gas behavior changes depending on the concentration of the leak. The relative density of the gas does not necessarily mean it will rise or fall. Thermal sources and ventilation will influence the gas pattern in enclosed structures. Atmospheric conditions (Wind, temperature, humidity etc.) will influence the gas pattern in outdoor areas.

- In very high concentrations, light gases tend to rise and heavy gases tend to fall and accumulate in low areas
- Consider the construction of the facility
- Air movement patterns in the facility
- Sensor obstructions
- Likely concentrations of gas leaks from the process
- Use redundant systems to enhance protection & reliability
- Place in an area with easy access for service, or consider an extraction solution that brings a sample to the detector

Maintenance considerations

Maintenance of any instrument in a hazardous process environment as described in the manufacturer's recommendations is very important, especially for flame and gas detectors.

Depending on the control system configuration, flame and gas detectors can shut down a process in the event of an alarm condition or an instrument fault. The Rosemount 625IR is designed to minimize the need for costly preventative maintenance activities and provide operators the option of increasing the preventative maintenance intervals while maintaining detector up time.

- SIL2 certified 5 year proof test interval - operators can choose to increase time between preventative maintenance visits up to 5 years and still meet the requirements of the SIL2 certification.
- Advanced real time health diagnostics
- No replaceable components
- Design life beyond 15 years

Note
The frequency of cleaning operations is ultimately dependent upon the existing environmental conditions and the applications used.

Accessories

The following accessories are available for the Rosemount 625IR Fixed Gas Detector with more launching soon.

Environmental shield (00625-9200-0021)
The shield keeps contamination away from the optical parts, and is shipped with every detector.

- Material: Anodized aluminum & plastic compound.
- No need for rotation when detector is rotated,
- Installed and removed very quickly without the use of tools,
- Gas is guided directly inside the shield for fast response during testing when using the gas nozzle.

2" Pole mount kit (00625-9200-0102)
To be used when mounting on a pipe

- — Material: SS316
- — Comes with U-bolts for 2" pipes and bolts to secure theg 625IR
- — Can be used on both horizontal and vertical pipes
- — Sunshade can be installed directly on the pole mount kit

3" and 4" Pole mount kit (00625-9200-0003)
To be used when mounting on a pipe

- — Material: SS316
- — Comes with U-bolts for both 3" and 4" pipes
- — Can be used on both horizontal and vertical pipes
- — Sunshade can be installed directly on the pole mount kit

Gas Test Kit (00625-9200-0012)
Suitable for both bump testing and accurate gas testing. Comes with two gas nozzles so the test gas may be vented to a safe area if needed.

- Material: Anodized aluminum
- Small volume for fast and accurate testing
- Status indicator remains visible for visual feedback of testing

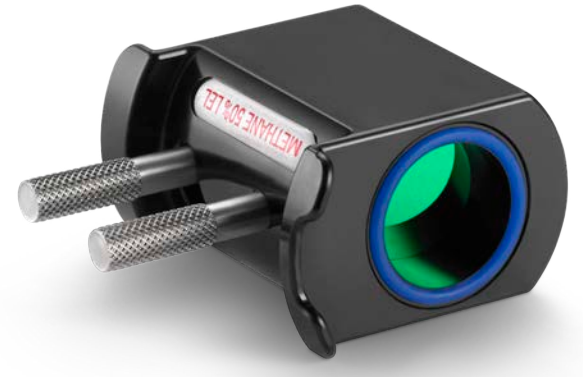
Remote Gas Test Kit (00625-9200-0011)
Remote gas test kit with housing for easy access to gas nozzle for testing of detector at remote location.

- Material: SS316
- Enclosure contains:
  - — Connection for 6mm (1/4”) tubing/piping to remote location
- Cover to protect gas inlet

Gas Free tester (00625-9200-0001)
This tester attenuates the measurement wavelength and not the reference wavelength, so precisely mimics the effect of gas as it passes through the measurement chamber.

This tester is only suitable for the methane calibrated 625IR and simulates 50% LEL. Other filters will be launched in the future

- Variance: 50% LEL +/- 10% across detectors
- Repeatability: +/-2% FS on the same detector



Sunshade (00625-9200-0005)
Extra environmental shielding from sunlight, snow/rain and deluge.

- Material: SS316
- Can be fitted on both horizontal and wall mounted installations
- The small plate is used when mounting onto horizontal pipes and extra protection is needed from inclement weather

Mosquito shield (00625-9200-0006)
Kit to keep small insects out of the measuring section of the detector.

- Material: SS316
- Integrated gas nozzle to simplify testing
- Fits over the standard environment shield
- Indicator visible with guard mounted

Maintenance Blocking Kit (00625-9200-0008)
The yellow section is inserted where the environment shield is usually located. Once fitted, the detector goes into beam block status.

The gray bag goes over/around the detector during area maintenance or shutdowns and turnarounds and keeps the unit clean.

Activity examples:

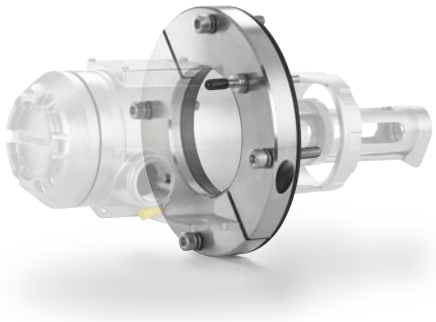
- Cleaning
- Paint work
- Sand blasting

Gas sample kit (00625-9200-0010)
Snap-in gas sampling/aspiration kit for extractive solutions. It replaces the environmental shield.

- Material: Anodized aluminum
- Quickly installed without the use of tools
- Easy access to optical parts
- Unmatched fast response for sampling loops. Up to 20x faster than existing solutions

Duct flange kit
Various duct flange kits are available and are designed specifically for installing in ducts and pipes.

- Material: SS316
- Integrated gas nozzle for in-situ testing
- Available as a standard model for HVAC and similar applications
- Available in several JIS and DIN versions



Gas test kit for duct detection (00625-9200-0022 & 00625-9200-0023)
Gas test kit for the Rosemount 625IR Duct Fixed Gas Detector, slides over the extended optical path. Standard 6mm (1/4”) nozzle for simple connection to sample tube.

- Material: Anodized aluminum
  - Available for both probe lengths
- Optimized volume for fast and accurate testing
- Note: Install an access port opposite the detector to make it easier to use this accessory

Gas test kit duct flange (00625-9200-0031)
This accessory fits onto the F03 and F04 variant of 625IR Duct and allows gas to be injected into the measurement chamber without having to remove the detector. This accessory is generally used with the Duct flange kit (00625-9200-0028).

- Material: Stainless steel
- Supplied with 6mm (1/4”) nozzle for simple connection to sample tube.

Environmental Cap (00625-9200-0034)
This accessory fits onto F02 variant of 625IR. It covers the optical front end and gives increased immunity when used in continuous heavy rain applications.

- Material: Stainless steel
- Can be rotated to give protection from any direction
- T90 response time is not increased when using this accessory

Status indication

The Rosemount 625IR Fixed Gas Detector has a built-in multi-colored status indicator. The status indicator correlates to the 0-20mA output and can be user configured.

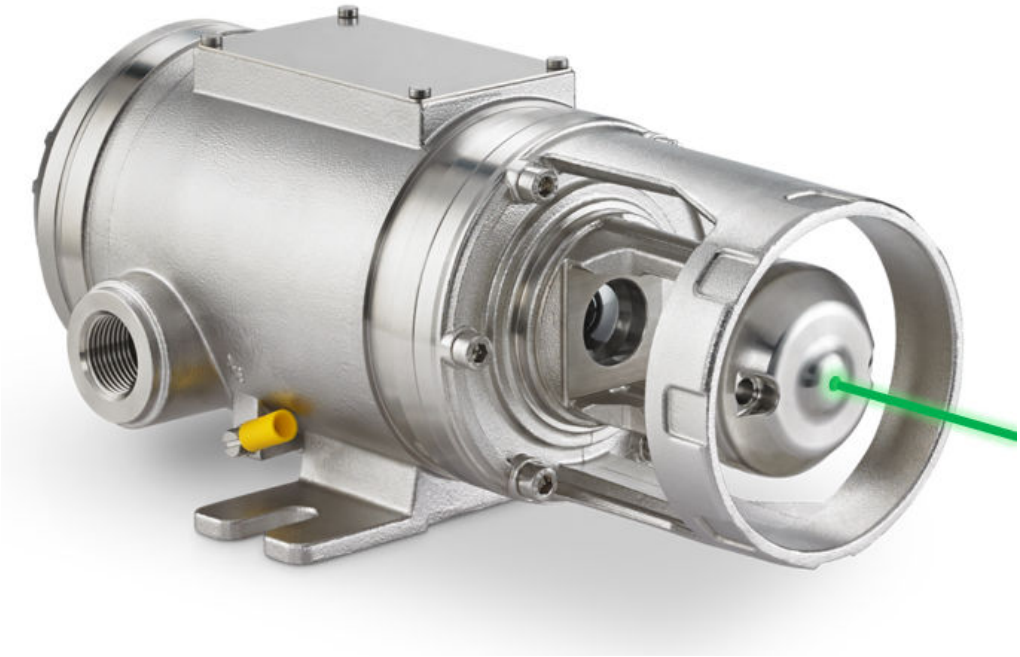


Table 1: Light Indicator Settings

Status type	Indicator	Description
Maintenance request	Green	Detector is measuring gas, and no issues are detected.
Out of specification	Green blinking	The optics are getting dirty, and Emerson recommends cleaning them soon. The detector is still detecting gas inside specifications.
Function check	Yellow	Indicates temperature is above or below this detector's rating. The detector will measure gas, but its accuracy will be outside specification.
Function check	Yellow	Activated if the operator has the detector set to SERVICE mode.
Failure	Yellow blinking	No gas is detected due to one of the following: ■ Detector is booting up. ■ Beam block ■ Faulty detector
Alarm 1	Red	Gas concentration is above the first alarm set point. Default setting is 20% full scale (FS), non-latching.
Alarm 2	Red blinking	Gas concentration is above the highest gas alarm set point.

Analog safety output

All analog output values in table 2 have a ±0.25 mA range applied and are in accordance with recommendations by NAMUR NE043 (2003) and NE107 (2017).

Status type	Output priority[1]	Default output setting	Configurable values[2]	Comment sett
Normal operation	3[3]	4 - 20 mA	Not configurable	The current loop output is configured such that 4 mA represents 0% FS. If the value is varying around 4 mA when there is no gas, the dead band filter (default on) might have been turned off or set too narrowly. Consult the HART interface on how to adjust this setting.
Over range	4[3]	20 mA	20 or 21 mA	Signaled if gas concentration is measured above the configured range. The default setting is 20 mA for over range. High concentrations do not have a negative effect on the detector.
Maintenance request	5	3 mA	0.6 - 3.5	Suggests output if optics are getting dirty. Emerson recommends cleaning the lens and mirror if you see this alert. Detector is still detecting gas inside the specifications.
Out of specification	6	2.5 mA	0.6 - 3.5	Signaled if temperature is outside the maximum ratings of this detector. Detector will measure gas, but the detector might be damaged if operating outside ratings. This might void the warranty.[3]
Function check	2	2 mA	0.6 - 3.5	This value is activated if the operator has set the detector to Service mode (for example, if the operator is zeroing the detector).
Failure	1	1 mA	0.6 - 3.5	No gas detection due to one of the following: ■ Detector is booting up. ■ Beam block ■ Faulty detector Emerson recommends investigating the detector status flags through the HART interface.
< 0.5 mA	Power supply fault or not booted up. No gas detection and no HART communication.			

(1) *A lower number is prioritized first.*
(2) *Configurable through either HART® or Modbus® RTU.*
(3) *Will output gas value if detection is above 7 percent full scale (FS).*

Point gas detection applications

Fire hazards exist anywhere hydrocarbons exist, which means in every part of the energy (primarily oil and gas) production chain. Combustible gas detectors should be considered an important element of a fire protection system consisting of gas detectors, both point source and open path (which may also include various toxic gases), and flame detectors. Such larger systems must be designed, installed, and certified by experts. Nonetheless, it is important for all users to understand the technologies involved, with their applications and capabilities.

Typical hydrocarbon production placements include:

- Floating production, storage, and offloading (FPSO) vessels
- Offshore and onshore production platforms
- Land-based oil and gas well collection sites
- Pipeline pump and compressor stations
- Production and storage area monitoring
- Facility perimeter (fence-line) monitoring
- Refinery storage tanks
- Distribution tank farm and transfer facility monitoring

Outside of the oil and gas industry, other placement opportunities include:

- Waste water treatment plant digesters
- Landfill gas processing collectors
- Agricultural digesters and biogas collectors

Point gas detectors, by their nature, are best when placed in close proximity to identified gas leak sources. Importance of location cannot be stressed enough, and a gas mapping study is best practice to avoid false confidence that a gas leak will be detected.

Where there is a group of storage tanks, more point detectors will be required and often the addition of open path detector pairs could be placed around the perimeter, as close as practical, ideally on the downwind side based on normal weather patterns.

Conclusion

Point gas detectors arguably form the foundation layer of most Flame & Gas Systems. They are the critical cornerstone of detection strategy for leaked Hydrocarbon gases.

The philosophy utilized in the development of the Rosemount 625IR Fixed Gas Detector delivers:

- Immunity to the effects of humidity and condensation
- Excellent speed of response through utilizing solid-state light source
- Solid stable measurement: calibrated in the factory for life, no field calibration needed
- Various mounting accessories to fulfill maximum application demands
- Safety integrity SIL2. SIL3 in 1oo2 redundancy setup
- Global hazardous area certification, and performance approved
- Various function testing accessories available to reduce maintenance hours

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For more information: **Emerson.com/global**

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