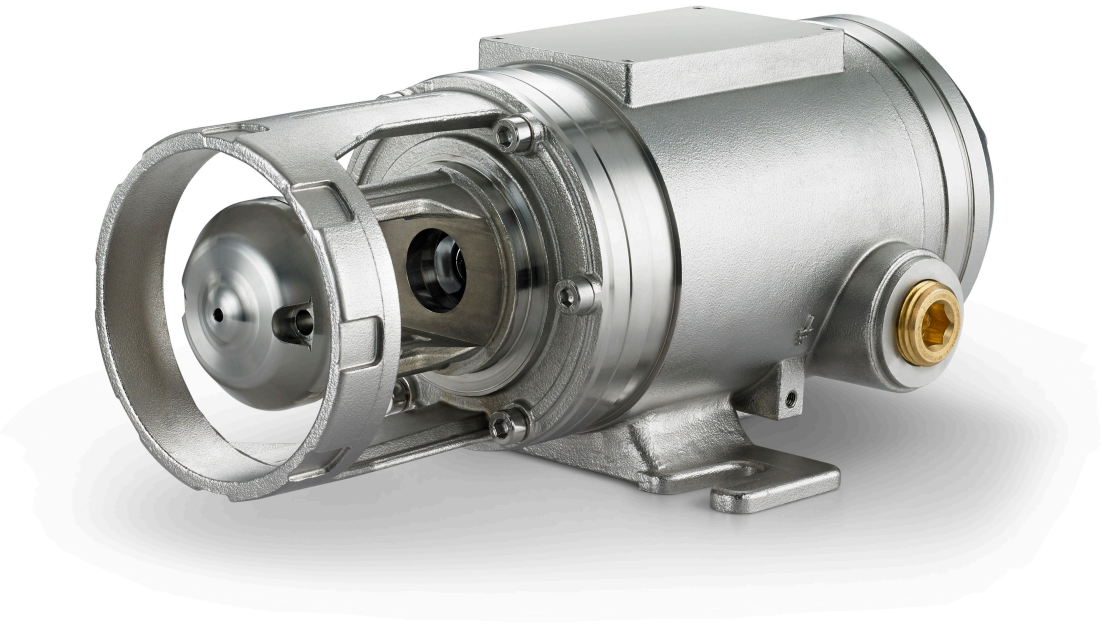
**Safety Manual**
MS-00809-0200-3625, Rev AA
January 2024

# Rosemount 625IR Optical Gas Detectors

## Safety Manual



ROSEMOUNT™

EMERSON™

## Safety information

### ⚠ WARNING

If the product is not used and maintained in accordance with the manufacturer's instructions, the product may not perform as intended.

All individuals who have or will have responsibility for using, maintaining, or servicing this product must read this manual thoroughly.

### ⚠ WARNING

**Physical access**

Unauthorized personnel may potentially cause significant damage to and/or misconfiguration of end users' equipment. This could be intentional or unintentional and needs to be protected against.

Physical security is an important part of any security program and fundamental to protecting your system. Restrict physical access by unauthorized personnel to protect end users' assets. This is true for all systems used within the facility.

# Contents

# 1 Overview

## 1.1 Scope

This Safety Manual addresses the specific safety requirements and recommendations applicable to the proper installation, operation, and maintenance of the Rosemount 625IR/ 625IR Duct Optical Gas Detector (hereafter Rosemount 625IR). For complete information regarding installation, operation, maintenance, and performance of the device, please refer to the *Rosemount 625IR Manual*.

The Rosemount 625IR is classified as a Type B field device according to IEC 61508.

## 1.2 Validity

This Safety Manual is valid for all Rosemount 625IR Detectors with the following hardware and software release level:

- 625IR hardware version: 2
- 625IR firmware version: 3.0.2

## 1.3 Design

The Rosemount 625IR is an explosion-proof rugged optical gas detector for the detection of flammable gases.

Emerson calibrates the detector for life at the factory; therefore, customers can install and maintain the detector with very little effort.

Emerson has designed the Rosemount 625IR for long maintenance intervals in very demanding environments, such as extreme temperatures and tough vibrations. It has built-in condition monitoring that enables better maintenance planning and less risk of unplanned shutdowns.

The Rosemount 625IR provides a 0-20 mA output (current loop) that gives information on gas concentrations, according to the relevant scale. The device also has continuous, extensive self-diagnostics that output warnings and errors on the current loop. In addition, the device provides HART® communication on top of the current loop and an RS-485 Modbus® communication interface.

The Functional Safety Certification, according to IEC 61508, covers the basic current loop output.

The Functional Safety Certification does not include the HART or Modbus communication channels. These channels are only used for diagnostics and troubleshooting and do not interrupt the safety critical functions of the detector.

## 1.4 Non-SIL functionality

In addition to the main safety function of signaling gas concentration on the current loop output, the Rosemount 625IR Gas Detector has the following non SIL features:

### Indicator

At the front of the detector, there is an LED indicator that can show the status of the detector. You can activate or deactivate this indicator and configure the behavior of signaling. See the *Rosemount 625IR Gas Detector Manual* for details.

### HART® interface

The detector is equipped with a standard HART protocol feature on top of the current loop. With a suitable HART device/software, you can use this to read various kinds of data from the detector suitable for diagnostics, as well as to configure non safety critical parameters. See the *Rosemount 625IR Manual* for details.

# 2 Technical specifications

## 2.1 Operator competence

**⚠ WARNING**

Only allow operators that have been specifically trained according to manufacturer requirements to manage this product. Proof of training must be presented on request.

## 2.2 Valid input range

The Rosemount 625IR is intended to be installed in a control system where a relevant control device will interpret the status of the current loop.

The control device must be programmed to indicate a warning or fault condition when the current level is less than 3.5 mA.

## 2.3 Diagnostic response time

The Rosemount 625IR will perform an extended self-diagnostic when powered up.

The worst case diagnostic time before the device is fully operational as a functional safety device is shown in Table 2-1.

**Table 2-1: Start-up time**

| Ambient temperature | Start-up time |
|---|---|
| Above -4 °F (-20 °C) | < 2 minutes |
| -40 to -4 °F (-40 to -20 °C) | < 20 minutes |
| Below -40 °F (-40 °C) | < 60 minutes |

## 2.4 Certification and failure rate data

Results from failure modes, effects, and diagnostic analysis (FMEDA) are summarized in Table 2-2. Safety analysis has been done for different test intervals. The probability of failure on demand (PFD) is listed for different proof test intervals ranging from one to five years, with the product in a one out of one (1oo1) configuration and an HFT 0. The product has a Safety Capability of 3 and can also be used in a one out of two (1oo2) configuration and an HFT1 for safety integrity level (SIL) 3.

**Table 2-2: Proof-tests**

| | SIL 2 requirement | Proof-test interval in years | | | | |
|---|---|---|---|---|---|---|
| | | 1 year | 2 years | 3 years | 4 years | 5 years |
| Proof test interval in hours | | 8760 | 17,520 | 26,280 | 35,040 | 43,800 |

**Table 2-2: Proof-tests *(continued)***

| | SIL 2 requirement | Proof-test interval in years | | | | |
|---|---|---|---|---|---|---|
| | | 1 year | 2 years | 3 years | 4 years | 5 years |
| PFD | ≥ $10^{-3}$ to ≤ $10^{-2}$ (0.001 to 0.01) | 0.000361 | 0.000721 | 0.001082 | 0.001443 | 0.001804 |
| Probability of failure per hour (PFH) | ≥ $10^{-7}$ to ≤ $10^{-6}$ | 8.24 E-08 | | | | |
| Safe failure fraction (SFF) | N/A | 0.952127 | | | | |
| Diagnostic coverage (DC) | N/A | 0.9 | | | | |

**Table 2-3: FIT**

| | |
|---|---|
| λDU | 82.36 |
| λDD | 1016.76 |
| λS | 147.23 |
| λH | 10.43 |
| λL | 463.56 |
| λA | 146.86 |

The Rosemount 625IR and 625IR Duct have a high degree of diagnostics and can accurately and effectively signal if the safety function is available. The probability of failure per hour is listed in Table 2-2. For further details about implementing a continuous demand system, please contact your supplier.

**NOTICE**

Ensure alternate means are in place to maintain the process in a safe space.

**⚠ WARNING**

If the Rosemount 625IR is in a classified area, do not open the wiring compartment unless the power to the detector has been removed or unless the area has been declassified. Contact customer support for further information.

## 2.5 Ambient conditions influence

When performing precise testing of gas detector accuracy, make sure to use the correct equipment and take into account ambient conditions influencing accuracy.

- Accuracy of gas detector

  **NOTICE**

  For extreme temperatures, accuracy is different from what is stated at room temperature.

| | |
|---|---|
| **$\delta_{detector}$** | Gas detector accuracy |

- The accuracy of the test gas ($\delta_{gas}$) directly influences how precise the test can be performed. Make sure to add this to the uncertainty.

  | | |
  |---|---|
  | **$\delta_{gas}$** | Uncertainty of gas cylinder content |

- The ambient pressure affects the concentration of the calibration gas. Rated concentration of the content in the gas cylinder is specified for standard pressure at sea level, 14.692 psi (1.013 bar). When the gas leaves the gas cylinder, the actual gas concentration is influenced by the actual ambient pressure, which in turn is influenced by both weather conditions and height above sea level. If ambient pressure is unknown, use ±5 percent as added uncertainty for gas cylinder concentration.

  | | |
  |---|---|
  | **$\delta_{ambient}$** | 5% or a calculated actual compensated concentration as shown below. |

Total worst case uncertainty is then:

$\delta_{total} = \delta_{detector} + \delta_{gas} + \delta_{ambient}$

For example, a detector with 3% accuracy, test gas of 50% lower explosive limit (LEL) with 2% accuracy and unknown ambient pressure, will have the following total uncertainty:

$\delta_{total} = \delta_{detector} + \delta_{gas} + \delta_{ambient}$ (3% LEL+ 2% LEL + 5% LEL) = 10% LEL

So a measurement inside 50 ±10% LEL is expected.

If ambient pressure is known, the corrected gas concentration ($C_{corr}$) is as follows:

$$C_{corr} = \frac{P_{amb}}{1013} x C_{gascylinder}$$

where:

| | |
|---|---|
| **$C_{gas\ cylinder}$** | Gas concentration of the cylinder |
| **$P_{amb}$** | Actual ambient pressure in millibars |

With ambient pressure of 970 mbar, we would then get the actual expected measured gas concentration with a 50% LEL gas specification on the cylinder:

$$C_{corr} = \frac{P_{amb}}{1013} x C_{gascylinder} = \frac{970}{1013} x 50\% LEL = 47.9\% LEL$$

With the remaining uncertainty of the example above, we would get: $\delta_{total} = \delta_{detector} + \delta_{gas}$ = 3% LEL +2% LEL = ±5% LEL.

So a measurement within 47.9 ± 5% LEL is to be expected. With more precise test gas, it is possible to get even more accurate measurements.

# 3 Certification

The Rosemount 625IR is certified by TUV Nord for an SIL capability of SIL2 when used in 1oo1 Safety System architecture and SIL3 when used in a 1oo2 Safety System architecture.

# 4 Installation

**⚠ WARNING**

Make all other wiring connections before connecting to power.

**NOTICE**

For complete information related to installation, operation, and maintenance of the Rosemount 625IR, please refer to the *Rosemount 625IR Manual*.

If correctly installed per the instructions in the Manual, there are no additional requirements to make the 625IR work as a Functional Safety device.

Although the device will work no matter which direction it is mounted in, Emerson recommends putting it in a horizontal position to slow down the gradual build-up of contamination on the optics.

The exact placement of the detector is up to local procedures and requirements, but consider the following:

- Proximity to strong heat sources
- Proximity to potential gas leakage spots
- Typical wind directions
- Strong magnetic or electrical fields (the device is certified for radio frequency interference [RFI] resistance, but strong fields may be out of range, thus causing interference).
- Environmental and technical conditions within the specified limits according to the technical specifications in the *Rosemount 625IR Manual*.

# 5 Operation, maintenance, inspection, and proof-testing

In general, follow the operation and maintenance requirements in the *Rosemount 625IR Manual*.

The essentials for inspection and proof-testing (functional testing) are repeated in the following sections.

## 5.1 Inspection

The Rosemount 625IR continuously monitors the signal level of the optical signal and issues a warning signal on the current loop when the signal level is below a certain threshold.

However, to take advantage of this warning signal, the control system must have a way to analyze the signal. If this capability is not present in the control system, you will need to regularly inspect the contamination level of the optics on the detectors to maintain continuous operation of the functional safety device.

## 5.2 Proof-testing

The purpose of proof-testing is to make sure the gas detector will respond within specified tolerances when exposed to gas. Perform this test on a regular basis to verify the safety functions of the detector. Emerson recommends performing proof-testing in non-condensing controlled ambient conditions.

### Proof-test interval

The time between two periodical tests of the detector safety function is from a safety context called the test interval. Details about the proof test interval and the probability of failure on demand is given in Table 2-2. The Rosemount 625IR is certified in accordance with the standard IEC 61508 with an SIL2 rating. If used in a 1oo2 configuration, the Rosemount 625IR is rated for SIL3.

**NOTICE**

The density of the test gas when presented to the gas detector may be different than what is actually on the gas bottle. Several factors, such as ambient pressure, wind conditions, and the way gas is presented to the detector (nozzle, gas test kit, and remote unit) will have a significant impact on the reading. Take these factors into consideration.

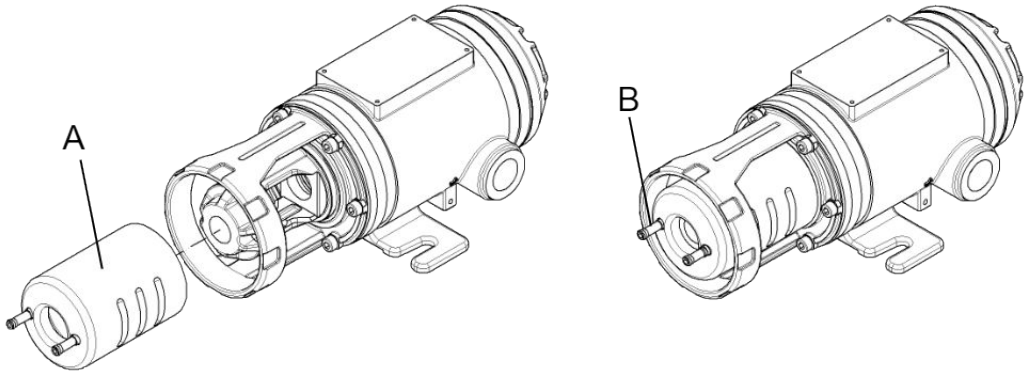
Perform proof-testing under controlled conditions using either a gas test kit or a gas sampling kit and a test gas with known parameters.

### 5.2.1 Proof-test Rosemount 625IR

Use one of the two Rosemount 625IR gas kits to properly proof-test the detector.

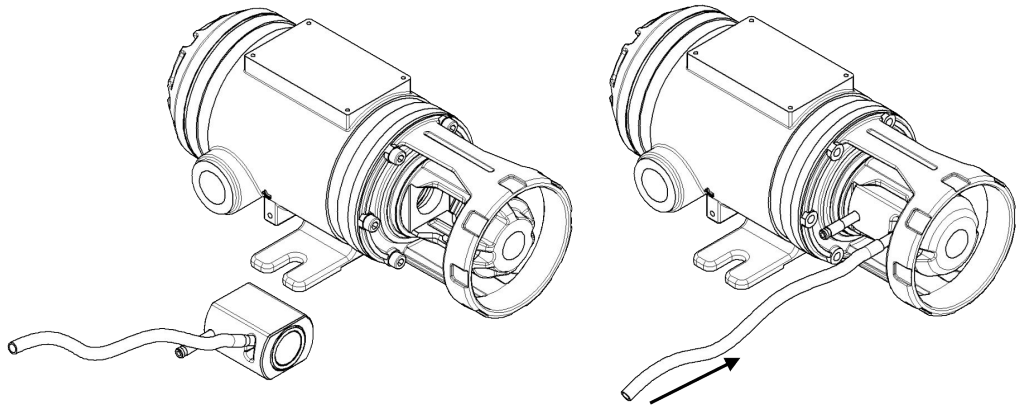
The gas test kit has an opening in the front between the gas nozzles to allow you to see the indicator that shows the status of the detector.

**Figure 5-1: Gas test kit**




*A. Gas test kit*
*B. Gas test kit nozzles*

**Figure 5-2: Gas sampling kit**



### Prerequisites

- Gas cylinder with the same type of gas the detector is rated to detect
  - Concentration of test gas shall be higher than 30 percent FS, recommended 50 ± 10 percent FS
  - Flow rate of approximately 0.3 gallons per minute (1 liter per minute)
- Flexible gas hose

### Procedure

1. Connect the hose from the gas cylinder to one of the nozzles.
2. Apply gas from the gas cylinder while observing the detector current loop safety output.
3. Wait for the current loop safety output to be stable.

The response shall be within gas detector accuracy and uncertainty in test gas accuracy and ambient pressure influence.

## 5.3 Fault/failure action plan

If proof-testing fails, record and document the result in the relevant log book and replace the detector to restore the system to the necessary safety level.

## 5.4 Product repair

Other than the standard cleaning actions described in the *Rosemount 625IR Manual*, there are no serviceable parts in the Rosemount 625IR. Therefore, if the device fails, you must send it back to Emerson for failure analysis.

If you need to replace hardware, purchase all spare parts from Emerson. Consult Emerson Customer Care for additional information.

## 5.5 Decommissioning and disposal

### Procedure

When the detector has reached the end of its life, decommission and dispose of it in a safe way and in accordance with local regulations.

Emerson encourages customers to dispose of the detectors in a sustainable way to allow a high degree of recycling.

# 6 Accessories

For a list of accessories, refer to the relevant section of the *Rosemount 625IR Product Data Sheet*.

# 7 Related documents

All product documentation is on Emerson.com.

For more information, see the following documents:

- Rosemount 625IR and 625IR Duct FMEDA Report
- Rosemount 625IR and 625IR Duct Manual

MS-00809-0200-3625
Rev. AA
2024

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

©2024 Emerson. All rights reserved.

Emerson Terms and Conditions of Sale are available upon request. The Emerson logo is a trademark and service mark of Emerson Electric Co. Rosemount is a mark of one of the Emerson family of companies. All other marks are the property of their respective owners.

ROSEMOUNT™

EMERSON™