

Multi-Refrigerant Calibration

For SGD43S-M3-Sx Refrigerant Detection System

1 Multi-Refrigerant Calibration

SGD43S-M3-Sx is based on Sensirion's thermal conductivity sensing technology. The sensor measures the heat transfer between an emitter and a receptor. The rate at which the heat is transmitted is influenced by the surrounding medium's thermal conductivity. In the context of gases, different gases have distinct thermal conductivities, allowing the sensor to quantify the presence of specific gases based on their thermal properties.

To monitor refrigerant leakage, a thermal conductivity sensor can be employed due to its sensitivity to changes in gas composition. When a refrigerant leaks, it alters the thermal conductivity of the air near the sensor. This method is particularly effective because refrigerants have thermal conductivities that differ significantly from air. Hence, by continuously monitoring the thermal conductivity, the sensor can detect even small changes that may indicate a leak.

In the context of A2L refrigerants, R-32 and R-454B generate a similar thermal conductivity, or sensor output, at the concentrations of 11%LFL R-32 and 12 %LFL R-454B. As a result, it is possible to monitor both refrigerants, using the same SGD43S-M3-S5 sensor, calibrated to a single alarm level. This is schematically shown in **Figure 1**. Sensirion's CMOSens® technology ensures that this calibration is guaranteed over the full range of humidity, temperature, and pressure conditions of the application.

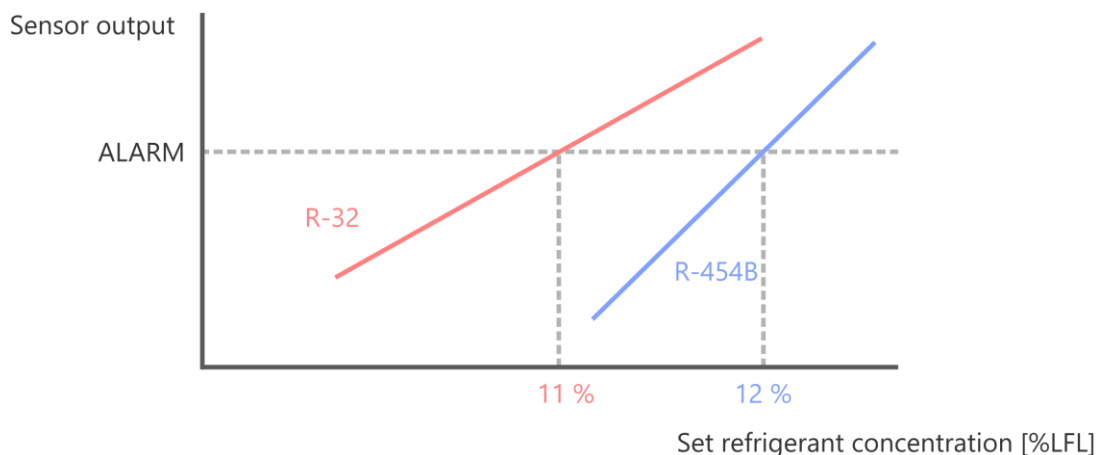


Figure 1: Schematic representation of the SGD43S-M3-S5 sensor output as a function of the set refrigerant concentration of R-32 and R-454B.

The same approach can be used to set a triple calibration point on the SGD43S-M3-S7 sensor for the A2L refrigerants R-454A, R-454C and R-455A, at the respective concentrations of 14 %LFL R-454A, 14%LFL R-454C, and 10 %LFL R-455A.

In summary, Sensirion's CMOSens® thermal conductivity sensor offers a precise and efficient method for detecting refrigerant leaks. By leveraging the distinct thermal properties of different refrigerants and employing a single sensor output as the alarm point, SGD43S-M3-Sx can effectively monitor multiple refrigerants, while ensuring the safety of HVACR systems.

2 CO₂ Cross-Sensitivity

Just like refrigerants, CO₂ alters the thermal conductivity of air. Therefore, the thermal conductivity of measured air correlates with the CO₂ concentration. The thermal conductivity sensor of the SGD43S-M3-Sx is therefore cross-sensitive to CO₂, as shown in the plot below.

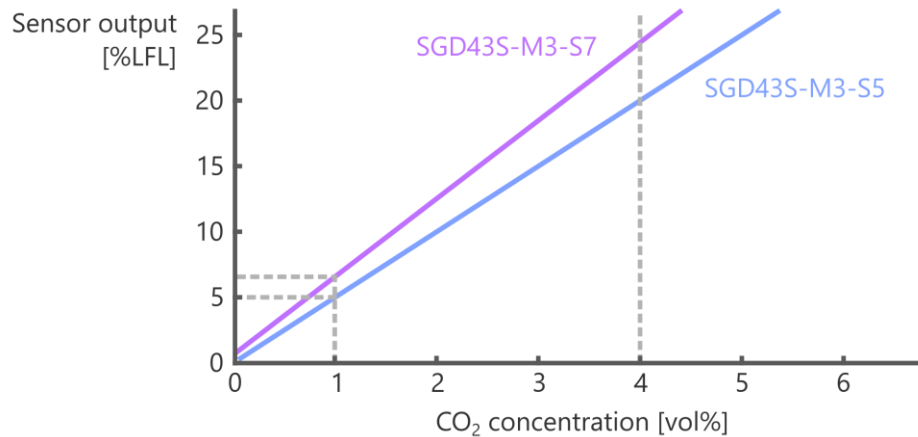


Figure 2: CO₂ cross-sensitivity of the SGD43S-M3-Sx.

In common indoor environments, the CO₂ concentration rarely exceeds 10'000 ppm (1 % CO₂). This concentration corresponds to ~ 5 - 7 %LFL of the sensor's output. Because the DTLV is set at refrigerant concentrations superior to 10 %LFL, it is not expected that the CO₂ cross-sensitivity of the sensor leads to false refrigerant leak alarms.

The CO₂ concentration in human breath is typically ~ 40'000 ppm (4 % CO₂). This concentration exceeds the set DTLV points of the SGD43S-M3-Sx sensor. As a result, by directly blowing onto the gas inlet of the SGD43S-M3-Sx, one may be able to trigger an alarm.



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3 Revision History

Date	Version	Pages	Changes
April 2025	1.0	all	Initial version