

Development of Gas Sensors for R32, R454B and R290 Refrigerant Detection

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EXTENDED ABSTRACT

To phase out fluorocarbons contributing to global warming, the industry is shifting toward refrigerants classified as A2L or A3 with lower Global Warming Potential (GWP) values. As GWP decreases, the relative flammability of the gas increases, necessitating gas sensors capable of detecting refrigerant leaks for safe operation. Our company has released the FCM2630 series, featuring R32, R454B, and R290 leak detection modules (Table 1), which have been well-received for their low false detection rate. A key feature of our products is the use of two sensors, achieving an expected lifespan of 15 years. This extends the gas sensor replacement interval specified in JRA4068:2023 from 5 to 10 years. FCM2630-K1 and FCM2610-G1 models offer IP55-equivalent waterproof performance, enabling use in environments exposed to dripping water.

Table 2 shows the product specifications for the refrigerant leak detection sensors currently under development: “FCM2630-L0, L1 (R32, R454B)” and “FCM2610-L1 (R290)”. FCM2630-L0 is primarily intended for embedded use in indoor air conditioners in Japan, while FCM2630-L1 is intended for North America. Both feature open collector outputs. FCM2610-L1 is primarily intended for Europe, designed for R290 detection to comply with F-gas regulations. For these two models, we have successfully reduced the board area by approximately 30% compared to existing products while retaining the characteristic of using two sensors. Both products are also scheduled to incorporate the sensor drift correction function (self-monitoring) required by UL60335-2-40ed.4.1, scheduled for issuance in FY 2025.

Table.1 Current Lineup of Refrigerant Leak Detection Sensors

			
Product Name	FCM2630-H0	FCM2630-K1	FCM2610-G1
Target Gasses	R32	R454B	R290
Circuit Voltage	5.0 ± 0.25V		
Operating Temperature	− 35~60°C	− 40~95°C	− 40~70°C
Output	Open collector	RS485	Open collector
Size	30.0 × 34.0 × 18.0mm	69.6 × 51.6 × 24.0mm	69.6 × 51.6 × 24.0mm
Compliance Standards	JRA4068:2023 IEC TS 63542 ed.1.0	UL60335-2-40 ed.4 IEC TS 63542 ed.1.0	JRA4068:2023 IEC TS 63542 ed.1.0

Table.2 Refrigerant Leak Detection Sensors Under Development

		
Product Name	FCM2630-L0, L1	FCM2610-L1
Target Gasses	R32, R454B	R290
Circuit Voltage	5.0 ± 0.25V	
Operating Temperature	− 35~60°C	
Output	Open collector	
Size	26.0 × 26.0 × 18.0mm	
Compliance Standards	<ul style="list-style-type: none"> • JRA4068:2023 • IEC TS 63542 ed.1.0 • UL60335-2-40 ed.4.1 (Expected to be published within FY2025)	IEC TS 63542 ed.1.0