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Introduction of an LED-based NDIR Refrigerant Detector for R32 Building-use Multi Air Conditioners

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EXTENDED ABSTRACT

Introduction

In recent years, the trend in refrigerants has been shifting toward those with lower Global Warming Potential (GWP), driven by the growing seriousness of environmental issues and the tightening of regulations. International agreements, such as the Kigali Amendment (to the Montreal Protocol on Substances that Deplete the Ozone Layer) and fluorocarbon regulations in Europe, have mandated the gradual reduction in the use of high-GWP refrigerants. As a result, the transition to climate-friendly refrigerants has accelerated, including relatively low-GWP refrigerants such as R32 among Hydrofluorocarbons (HFCs), Hydrofluoroolefins (HFOs), and natural refrigerants such as R744 (Carbon dioxide), R717 (Ammonia), and R290 (Propane).

However, in the case of A2L refrigerants like R32 and A3 refrigerants like R290, both in the operating environment of equipment and in installation or servicing sites, the use of stationary or portable refrigerant detectors is essential.

In this context, we introduce a non-dispersive infrared (NDIR) refrigerant detector that employs an LED light source—featuring high accuracy, low power consumption, and no risk of igniting flammable gases.

Principle

In general, non-dispersive infrared absorption (NDIR) technology detects gases by measuring the absorption of infrared light at specific wavelengths. Since the amount of absorbed light is proportional to the gas concentration, it achieves high accuracy and reliability. Unlike chemical sensors, it does not require consumables such as replacement electrolytes or electrodes, thereby ensuring long service life. The figure below illustrates the principle of NDIR technology.

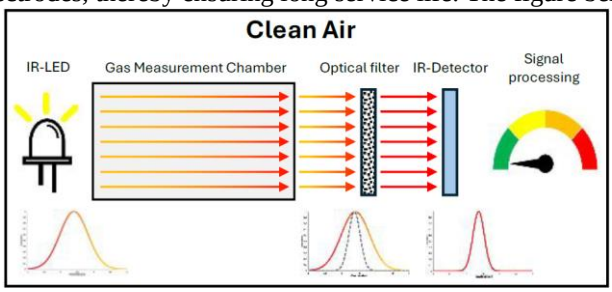

Fig.1 Clean Air

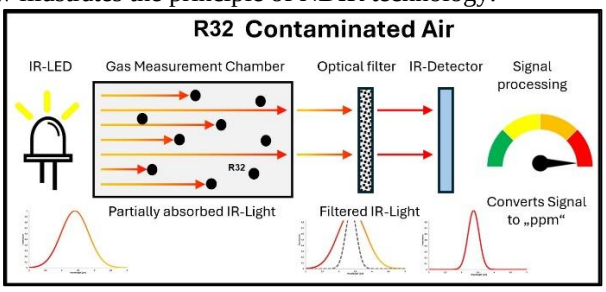

Fig.2 R32 Contaminated Air

Refrigerant detectors using NDIR technology with an LED light source offer higher energy efficiency, a more compact design, and greater durability compared to those with conventional infrared light sources. Unlike traditional lamps, they require no warm-up time, provide long-term stability, and pose no risk of igniting flammable gases, delivering numerous advantages in leak detection applications.

Conclusion

In pursuit of achieving carbon neutrality by 2050, Japan's Act on Rational Use and Proper Management of Fluorocarbons stipulates the adoption of low-GWP refrigerants (such as R32) in building-use multi-air conditioning systems, with sales having begun in April 2025. According to the "Guideline of design construction for ensuring safety against refrigerant leakage from commercial air conditioners using lower flammability (A2L) refrigerants" (JRA GL-16), established by The Japan Refrigeration and Air Conditioning Industry Association (JRAIA), the installation of refrigerant detectors is required under certain conditions. With our LED-based NDIR refrigerant detector, we will maximize the benefits of this technology to develop products that meet market needs.

Fig.3 Sensor Appearance