

n.e.t.

twenty years
of advanced solutions
for gas detection

20
YEARS
ANNIVERSARY

innovative gas sensing



NET REMORA®

New OEM Sensor Module for A2L Refrigerant Leak Detection

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Atlanta | Feb. 7th, 2023

HIGHLIGHTS

Detectable gases: R-1234yf,
R-1234ze, R-134a, R-32, R-454a,
R-454b, R-454c, R-455a,
R-404a, R-407c, R-410a

Detection principle: Non-Dispersive Infrared (NDIR)

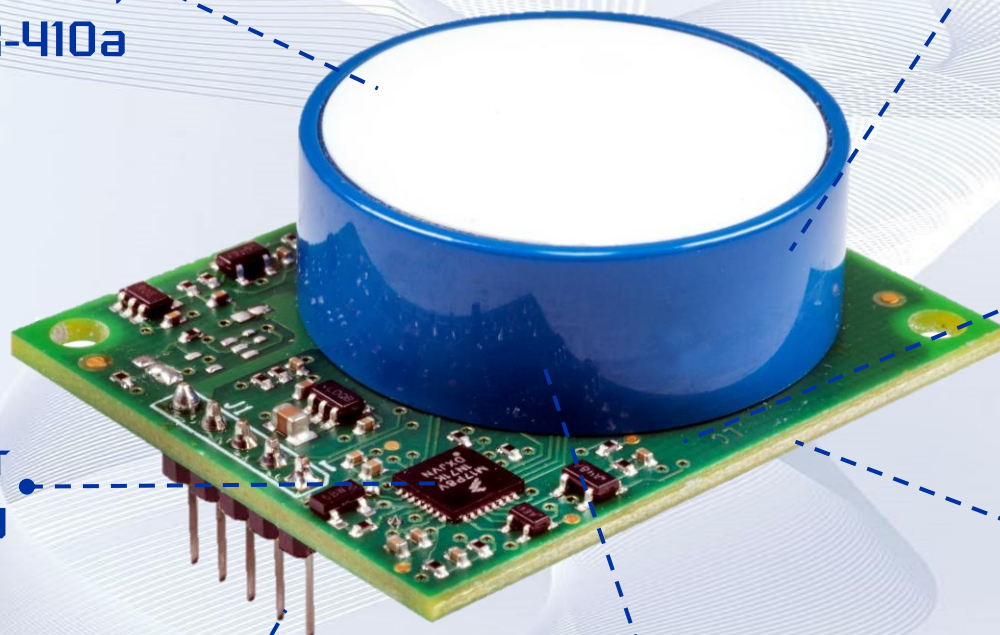
MTBF > 10 years,
Maintenance free

Compact dimensions
(typical: 50x34x15 mm)

compliant with:
• IEC 60335-2-40 ANNEX LL,
ISO 5149-3, EN 378-3, EN 50676

Internal Microprocessor
advanced signal processing

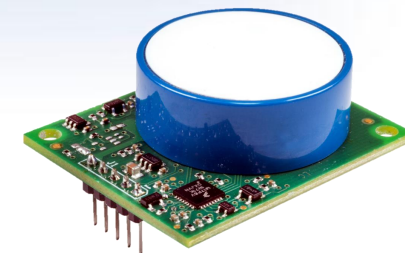
Customizable analogue
and digital interface



NEW-GENERATION REFRIGERANTS AND FLAMMABILITY (A2L)

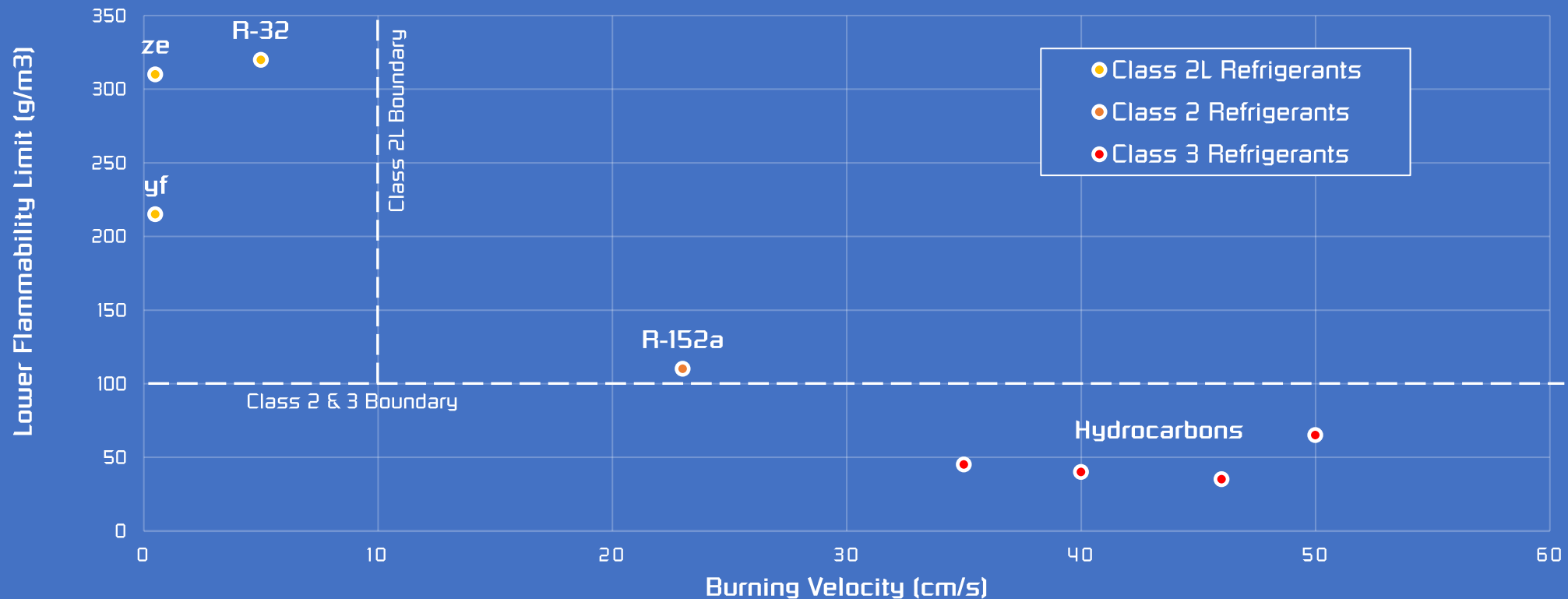
- ❑ There's growing concern about the impact on environment and climate change of high-GWP refrigerants
- ❑ The industry is developing a new class of lower-GWP refrigerants which possess some level of flammability.
- ❑ Refrigerant flammability is classified by ISO Standard 817-2014 Refrigerants—Designation and Safety Classification or by ASHRAE Standard 34-2016.
- ❑ To express the flammability properties of the new unsaturated HFCs (referred to as HFOs) and other refrigerants with similar properties, ISO 817-2014 made 2L a separate class, characterized by burning velocities less than or equal to 10 cm/s.

REFRIGERANT SAFETY GROUPS		
Class 3 – Higher Flammability	A3	B3
Class 2 – Lower Flammability	A2	B2
Class 2L – Lower Burning Velocity	A2L	B2L
Class 1 – No Flame Propagation	A1	B1
	Lower Toxicity	Higher Toxicity



NEW-GENERATION REFRIGERANTS AND FLAMMABILITY (A2L)

CLASSES OF REFRIGERANT FLAMMABILITY COMPARING THE LOWER FLAMMABILITY LIMITS (LFL) AND BURNING VELOCITY (BV) FOR VARIOUS REFRIGERANTS.

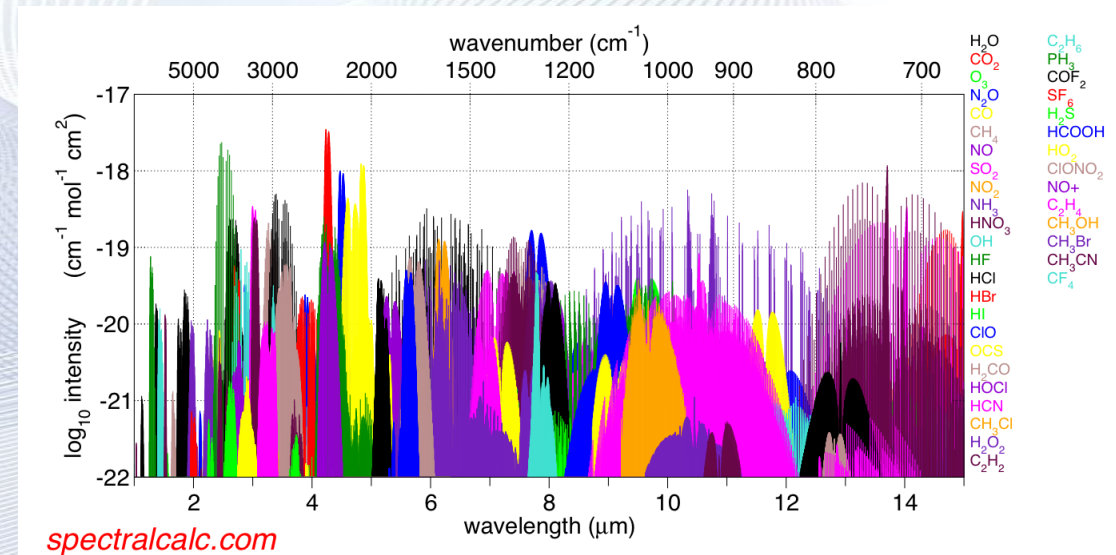
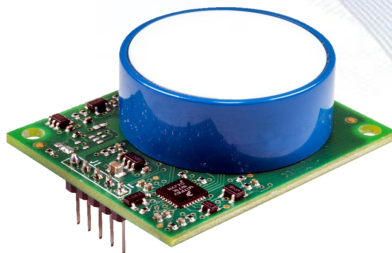


COMPLETE DETECTION RANGE

ppm RANGE	%LFL RANGE
R-1234yf (0-5.000ppm)	R-1234yf (6.2%vol)
R-1234ze (0-5000ppm)	R-1234ze (6.5%vol)
R-134a (0-5.000ppm)	R-32 (14.4%vol)
R-32 (0-10.000ppm)	R-454a (6.3%vol)
R-404a (0-5.000ppm)	R-454b (7.7%vol)
R-407c (0-5.000ppm)	R-454c (6.2%vol)
R-410a (0-10.000ppm)	R-455a (11.8%vol)

NON DISPERSIVE INFRARED (NDIR) GAS DETECTION WORKING PRINCIPLE

- ❑ Gas molecules absorb light at specific **wavelengths** (or “color”) that are characteristic of their molecular structure.
- ❑ For IR energy to be absorbed, that is for vibrational energy to be transferred to the molecules, the frequency must match the frequency of the mode of vibration.
- ❑ Specific molecules absorb IR radiation at precise frequencies and each gas has a unique and well defined light absorption curve in the infrared spectrum.
- ❑ When IR radiation passes through a volume containing a specific gas, **only frequencies matching the vibration mode** are absorbed, while the rest of the light is transmitted **without interference**.



Infrared absorption bands of all major trace gases
https://commons.wikimedia.org/wiki/File:Spectralcalc_infrared_bands.png

REMORA BENEFIT #1
GAS SELECTIVITY
(NO CROSS INTERFERENCE)

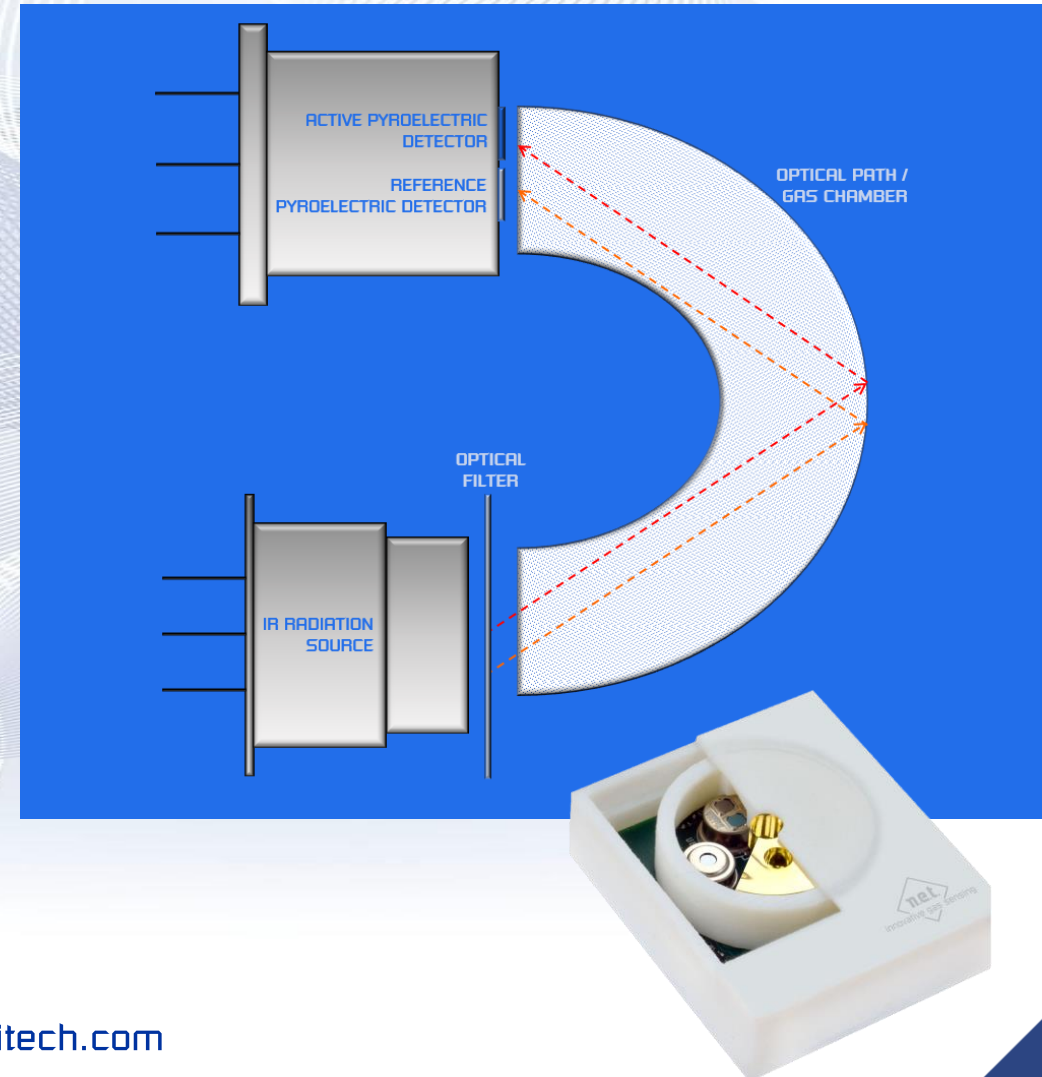


NON DISPERSIVE INFRARED (NDIR) GAS SENSOR WORKING PRINCIPLE

- ❑ Remora employs a dual wavelength technique, using an IR energy source aimed at two pyroelectric detectors, each sensitive to different wavelengths in the IR spectrum.
- ❑ The Active detector is sensitive in the range of absorption of the target gas, while the Reference detector wavelength band is chosen in a region of the IR spectrum where there is minimal absorbance of the gas of interest.
- ❑ The differential absorption technique, where the target gas is always monitored with respect to a reference measurement, attenuates the effect of background distortions due to response to other gases, source aging or optical surface contamination. Both Active and Reference channels are equally attenuated when contaminants are present within the IR beam or when the source decays over time.

REMORA BENEFIT #2

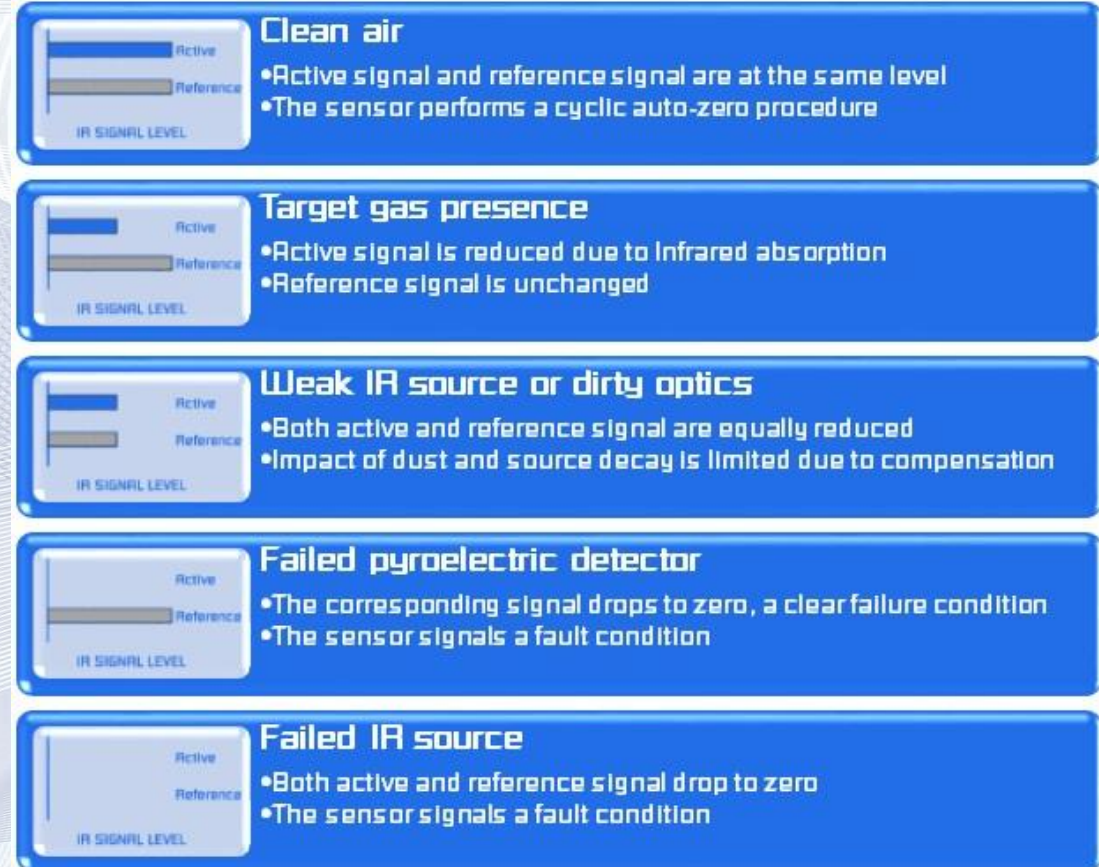
STABILITY, GREATER LIFETIME, NO
MAINTENANCE REQUIRED



FAIL- SAFE DETECTION

- ❑ The most frequent cause of failure on technologies such as **Metal Oxide Semiconductor (MOS)** and **Catalytic** (or pellistors), other than progressive wear, is the exposure to inhibitors and poisons causing the sensor to enter a condition unresponsive to the target gases.
- ❑ Dual-beam/dual detector Infrared sensors provide instead a **fail-safe** means to detect when a fault condition arises. The possible cause of failure in IR technology is the failure of either the transmitter or the receiver component.
- ❑ As IR detectors cannot be poisoned, only a physically blocked gas inlet would prevent the sensor from indicating a problem.

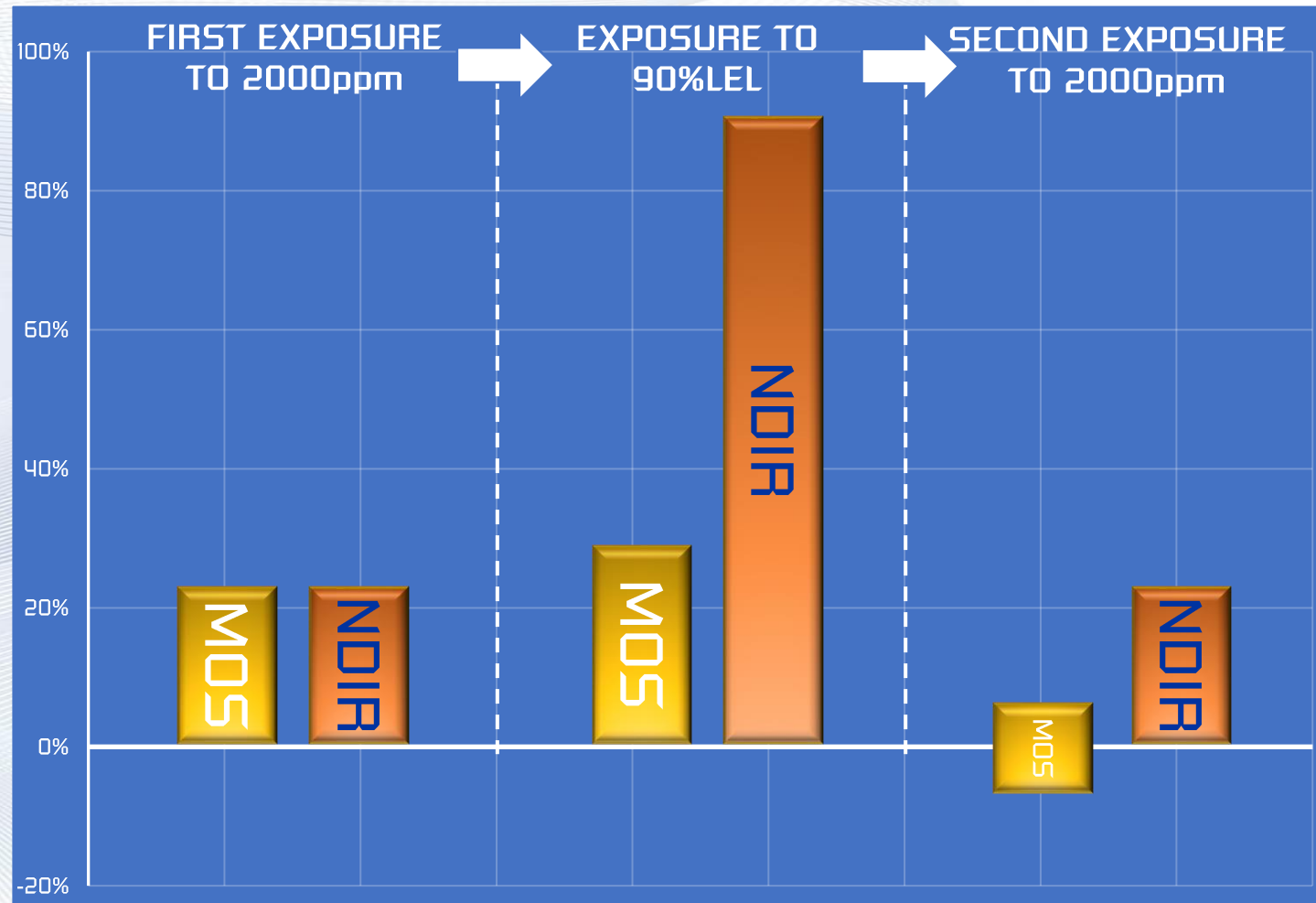
REMORA BENEFIT #3 FAIL-SAFE DETECTION



IMMUNITY TO POISONING

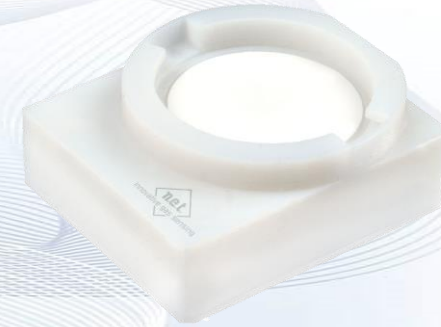
- ❑ Technologies such as Metal Oxide Semiconductor (MOS) and Catalytic and EC cells can be deteriorated or “burned-out” when exposed to high concentrations of the target gas, significantly reducing their ability to detect future leaks.
- ❑ After high exposures, MOS, EC cells and Catalytic sensors should normally be recalibrated or substituted.
- ❑ As NDIR detection does not involve chemical reactions on the sensor, exposure to high concentrations does not alter its characteristics and its ability to correctly detect future leaks is unaffected.

REMORA BENEFIT #4 IMMUNITY TO POISONING



MICROPROCESSOR-BASED DETECTION

- ❑ Remora is a microprocessor-based, smart sensors with many advantages:
 - ❑ The sensor has a high-level interface, with a standardized, linear output. This eliminates the time and complexity required to deal with low-level signals, calculations and calibrations.
 - ❑ Communication with the sensor is bidirectional via digital protocols (Modbus and UART). The user can not only get readings, warnings and alarms but also change communication parameters and input updated calibration values.
 - ❑ Fail-safe operation and dependability are enhanced by several self-checks routines and consistency controls continuously performed by the sensor.
 - ❑ Faster response time, with accelerator algorithm.



CUSTOMIZABLE:

- Detection range
- Power supply rating
- Digital output/protocol
- Analog output
- Response time
- Temperature range
- Connector
- Housing

REMORA BENEFIT #5
EASE OF INTEGRATION



APPLICATIONS



**REFRIGERATED
CABINETS**



ROOFTOP UNITS



COLD ROOMS



**REFRIGERATED
TRUCKS/TRAILERS**



VRF SYSTEMS



HVACR APPLIANCE

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twenty years
of advanced solutions
for gas detection

20
YEARS
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innovative gas sensing



THANK YOU FOR YOUR ATTENTION

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