



Molecular Property Spectrometer™

MPS™ R-410A Refrigerant Gas Sensor

OVERVIEW

NevadaNano's Molecular Property Spectrometer (MPS) R-410A Refrigerant Gas Sensor enables accurate and reliable detection of R-410A, an A1 refrigerant gas common in HVAC applications. Sensor readings are output on a digital bus (UART). With no field calibration required, the MPS R-410A Refrigerant Gas Sensor delivers industry-leading performance and a low cost of ownership.

GAS DETECTION

Environmental Condition	Detection Range	Accuracy [<10,000 ppm]	Accuracy [≥10,000 ppm]
Static ¹	1,700 to 130,000 ppm	±1,100 ppm	±11% of delivered concentration
Dynamic ¹	5,100 to 130,000 ppm	±1,100 ppm	±11% of delivered concentration

¹ Static conditions defined as temperature magnitude change rate < 3 °C/min. or relative humidity magnitude change rate < 3 %RH/min.

PERFORMANCE

Resolution	130 ppm
Response time (t_{90})	< 20 seconds

ENVIRONMENTAL OPERATING RANGE

Temperature ²	-40 to 75 °C
Humidity ³	0 to 100 %RH
Pressure	80 to 120 kPa

²Accuracy guaranteed 15 to 30 °C.

³Accuracy guaranteed in non-condensing environments. Alternative mechanical configurations can improve condensation robustness.

SELF-DIAGNOSTICS

The MPS R-410A Refrigerant Gas Sensor automatically performs a comprehensive sequence of self-checks every two seconds to ensure fail-safe operation. The MPS alerts the user of any sensor failure or abnormal status. For additional information on how to interpret and handle detected faults, refer to the MPS A2L Refrigerant Gas Sensor User Manual at www.NevadaNano.com/downloads.

FEATURES

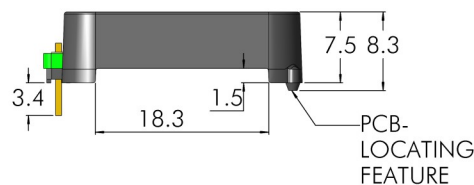
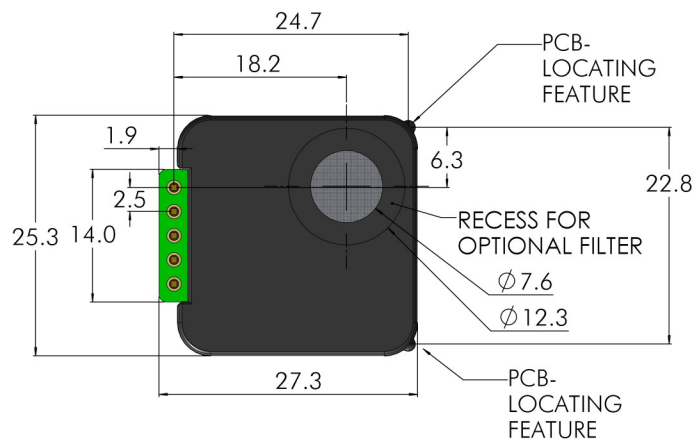
- Built-in environmental compensation
- Extremely poison resistant
- No calibration required
- Supports 15+ year lifetimes
- Low power — 29 mW average
- Built-in self-test for fail-safe operation

OPERATING PRINCIPLE

The MPS R-410A Refrigerant Gas Sensor's transducer is a micro-machined membrane with an embedded Joule heater and resistance thermometer. The MEMS transducer is mounted on a PCB and packaged inside a rugged enclosure with a screened outlet to ambient air. Presence of a refrigerant gas causes changes in the thermodynamic properties of the air/gas mixture that are measured by the transducer. Sensor data are processed by patented algorithms to report accurate concentration.

MECHANICAL — MINI

Mass	4.3 ± 0.5 grams
Body material	PEI



Dimensions in mm

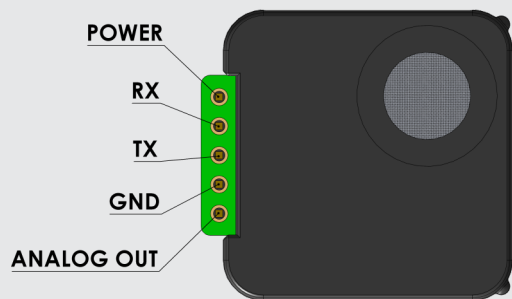
ELECTRICAL — MINI

Operating voltage	3.3 - 5.0 ±5% VDC
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Current consumption

Average
8.9 mA

Operating Range
5.0-21.0 mA



Digital Communication: UART
 Logic signaling standard: 3.3 V
 Baud rate: 38,400. 8 data, 1 stop bits. No parity.
 RX Data Input : Do not exceed 3.6 V
 Input High Voltage (V_{IH}) = 2.0 V minimum
 Input Low Voltage (V_{IL}) = 0.85 V maximum
 TX Data Output : Source / Sink 4 mA maximum
 Output High Voltage (V_{OH}) = 2.45 V minimum
 Output Low Voltage (V_{OL}) = 0.45 V maximum
 Programmable Analog out (optional)

Analog voltage output ("Analog Out")

Industry standard 0.4 to 2.0 volt analog output, linearized and compensated for temperature, humidity, and pressure. Alternate configurations available, with output range and "zero" level configurable between 0.04 and 2.9 Volts and configurable sensitivity slope, including rising or falling Volts per ppm. Contact NevadaNano for details.

MECHANICAL INTEGRATION — MINI

The MPS Mini family of gas sensors is designed to be permanently mounted to a printed circuit board. In addition to the electrical interconnects, the Mini package has two features that can engage with two, unplated 1.10 mm to 1.50 mm dia. holes on the PCB for more precise and secure position of the sensor relative to the PCB.

QUALITY CERTIFICATION

Certificates of Compliance	Specification	Test Lab/Certification Body	Certificate/Report Number
Certificate of Registration of Quality Management System	ISO 9001:2015	National Standards Authority of Ireland (NSAI)	19.8213

ADDITIONAL TEST STANDARDS

Test	Specification	Summary of Test Conditions
Low Temperature Operating	IEC 60068-2-1	500 Hours @ -50°C
High Temperature Operating	IEC 60068-2-2	1000 Hours @ 85°C
Vibration	IEC 60068-2-6	31Hz – 150 Hz (2G acceleration), 1 hour per axis, 3 axes
Shock	IEC 60068-2-27	50G peak/11ms half sine pulse, 3 axes (positive and negative pulses)
Drop	IEC 60068-2-31	1-meter drop onto concrete
Damp heat - steady state	IEC 60068-2-78	500 hours @ 40°C/93% RH
Temperature cycling	JESD22-A104E	From -40°C to 85°C for 200 cycles
Sand/Dust	MIL-STD-810G Method 510.5	Sand: 150-850 μm SiO ₂ particle size, 23 m/s nom. velocity, 1.5 hrs @ 70°C per axis, 3 axes Dust: Red China Clay, 1.5 m/s nom. velocity, 6 hrs @ 20°C and 6 hrs @ 70°C
Poisoning	NevadaNano	1,200 ppm-hours H ₂ S (50 ppm for 24 hours) 10,400 ppm-hours siloxanes (Decamethylcyclopentasiloxane) (100 ppm for 4 hours, then 1,000 ppm for 10 hours) 0.25 ppm-hours NO ₂ (3 ppm for 5 minutes) 0.83 ppm-hours HCN (10 ppm for 5 minutes) 0.75 ppm-hours SO ₂ (9 ppm for 5 minutes) 0.17 ppm-hours Cl ₂ (2 ppm for 5 minutes) 4.17 ppm-hours NH ₃ (50 ppm for 5 minutes)
Electrostatic Discharge	JEDEC JS001-2017	Human Body Model, passed at 2 kV
EMC: Radiated Emissions	EN 55011	30 MHz to 1 GHz
EMC: RF Electromagnetic Field Immunity	IEC/EN 61000-4-3	80 MHz to 6 GHz at 10 V/m
EMC: Magnetic Immunity	IEC/EN 61000-4-8	30 A/m, 3 axes, 50 Hz and 60 Hz

The table above provides a summary of standardized tests and test conditions to which the MPS Flammable Gas Sensor in the S4 form factor has been subjected, and to which the MPS Mini Flammable Gas Sensor is also qualified by assessed similarity. The sensor, which utilizes the same MPS technology as the MPS R-410A Refrigerant Gas Sensor, has passed all of these tests by demonstrating performance within the MPS Flammable Gas Sensor specification both before and after each test.

PART NUMBER ORDERING GUIDE

Please refer to the following table when ordering the MPS R-410A Refrigerant Gas Sensor or MPS Evaluation Kit.



Manufacturer Part No.	Description
MPS130-MN0505-00	MPS R-410 Refrigerant Gas Sensor, Mini, 5-Pin, UART



MPS EVALUATION KITS	
Manufacturer Part No.	Description
MPS999-S40000-99	MPS S4 Evaluation Kit (S4 sensor not included)
MPS999-MN0000-99	MPS Mini Evaluation Kit (Mini sensor not included)