Molecular Property Spectrometer™

MPS™ A3 Refrigerant Gas Sensor (R-290)

OVERVIEW

NevadaNano's MPS A3 Refrigerant Gas Sensor (R-290) quickly detects and accurately quantifies the concentration of R-290 (propane) gas. It has built-in environmental compensation and automatic self-testing for fail-safe operation. It is robust, and extremely poison resistant. Sensor readings are output on a digital bus or configurable analog output—no added electronics are required. With calibration-free operation for 5+ years, the MPS A3 Refrigerant Gas Sensor (R-290) delivers industry-leading performance and a low cost of ownership.

TrueLEL™ DETECTION

Gas	Formula	Detection Range [%LEL]	% volume of gas at 100 %LEL (ISO 10156)	Accuracy 0 to 50 %LEL (ISO 10156)	% volume of gas at 100 %LEL (IEC60079-20-1)	Accuracy 0 to 50 %LEL (IEC60079-20-1)
R-290	C_3H_8	5-110	2.1 %VOL	±3 %LEL standard conditions (~20°C, ~50 %RH) ±10 %LEL all conditions	1.7 %VOL	±3%LEL standard conditions (~20°C, ~50 %RH) ±10 %LEL all conditions

PERFORMANCE

Resolution	0.1 %LEL
Response time (T90)	< 20 seconds
Calibration	Factory calibrated

ENVIRONMENTAL OPERATING RANGE

Temperature	−40 to 75 °C
Humidity	0 to 100 %RH
Pressure	80 to 120 kPa

FEATURES

- Built-in environmental compensation
- Extremely poison resistant
- No calibration required
- R-290 positively ID'd when present
- Other flammable gases classified if detected (%LEL not reported)
- Supports 15+ year lifetimes
- Low power — 29 mW average
- Intrinsically safe (IS) certified
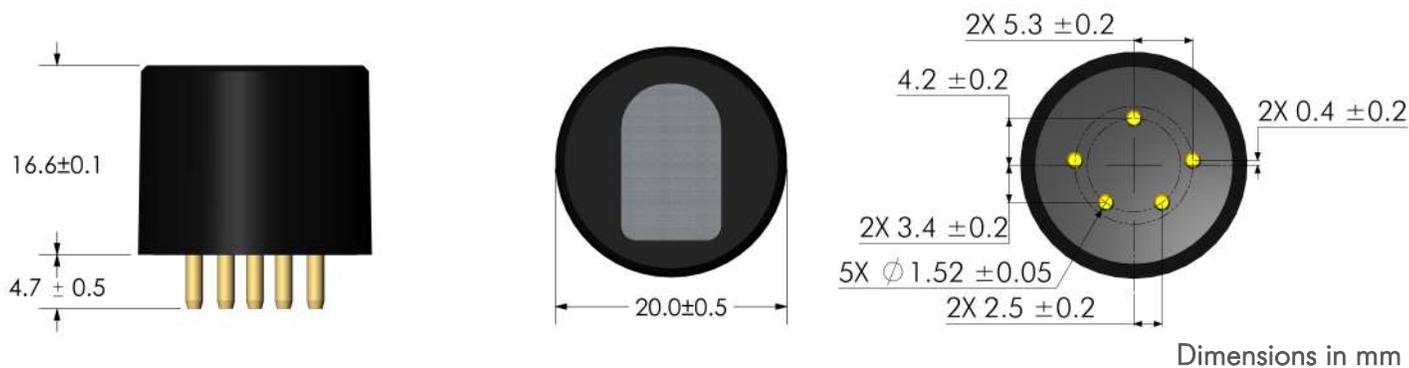- Built-in self-test for fail-safe operation

OPERATING PRINCIPLE

The transducer of the MPS A3 Refrigerant Gas Sensor (R-290) is a patented, 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 open to ambient air. The presence of R-290 in the air causes changes in its thermodynamic properties which are measured by the transducer. Sensor data are processed by patented algorithms to report an accurate concentration.

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MECHANICAL

Dimensions in mm

Dimensions	16.6 mm (H) x 20.0 mm (D)
Mass	8.0 ± 0.5 grams
Body material	Ultem PEI

ELECTRICAL

Operating voltage	3.3 - 5.0 ±5% VDC	

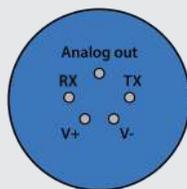| Current consumption	Average	Operating Range
	8.9 mA	5.0-21.0 mA

5-pin Digital Input/Output & Analog Output	Bottom View	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
		Analog output: Industry standard 0.4 to 2.0 Volt linearized, compensated for temperature, humidity and pressure.
		Alternate configurations available, with output range and "zero" configurable between 0.04 and 2.4 Volts and configurable sensitivity slope, including rising or falling Volts per %LEL. Contact NevadaNano for details.

SELF-DIAGNOSTICS

The MPS A3 Refrigerant Gas Sensor (R-290) automatically performs a comprehensive sequence of self-checks every 2 seconds to ensure fail-safe operation and alerts the user of any sensor failure or status alert. For information on how to interpret and handle faults, refer to the MPS Flammable Gas Sensor 4.0 User Manual: https://nevadanano.com/downloads/

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CERTIFICATION

Certification Body	IECEx™	ATEX NB 2809 / UKEX AB 1725	FM APPROVED	
Test Standard	IEC 60079-0:2017 IEC 60079-11:2011	EN 60079-0:2018 EN 60079-11:2012	FM 3600:2018 FM 3610:2018 ANSI/UL 913:2019	CSA 22.2 60079-0:2019 CSA 22.2 60079-11:2014
Protection Categories	Ex ia IIC Ga Ex ia IIIC Da Ta = -40°C to 75°C	Ex II 1 G Ex ia IIC Ga Ex II 1 D Ex ia IIIC Da Ta = -40°C to 75°C	Class I, Division 1, Group A,B,C,D Class II and III, Division 1, Group E,F,G Class I, Zone 0 AEx ia IIC Ga Zone 20 AEx ia IIIC Da Ta = -40°C to 75°C	Class I, Division 1, Group A,B,C,D Class II and III, Division 1, Group E,F,G Class I, Zone 0 Ex ia IIC Ga Zone 20 Ex ia IIIC Da Ta = -40°C to 75°C
Certificate	IECEx FMG 19.0028U	FM19ATEX0184U FM21UKEX0159U	FM19US0145U	FM19CA0077U

For additional information on certifications, refer to the MPS Hazardous Locations User Guide here: www.nevadanano.com/downloads

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
IECEx Quality Assessment Report	IEC 80079-34:2018	FM Approvals LLC	GB/FME/QAR19.0020/00
ATEX Quality Assurance Notification	2014/34/EU	FM Approvals LLC	FM19ATEXQ0200
UK Quality Assurance Notification	UKSI 2016:1107 (as amended)	FM Approvals LLC	FM21UKQAN0168
RoHS (2 & 3) Compliant	2011/65/EU & 2015/863	Underwriters Laboratories	CETR-NNT01.1
China RoHS Compliant	SJT/T 11363 & 11364	Underwriters Laboratories	CETR-NNT01.1
REACH Compliant	EC 1907/2006 (33 & 67)	Underwriters Laboratories	CETR-NNT01.1

The certificates of compliance are available at www.nevadanano.com/downloads

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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_2S (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 has been subjected. The sensor has passed all of these tests by demonstrating performance within the MPS Flammable Gas Sensor specification both before and after each test.

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PART NUMBER ORDERING GUIDE

Please refer to the following table below when ordering the MPS A3 Refrigerant Gas Sensor (R-290). When ordering a MPS S4 Evaluation Kit, please specify the MPS A3 Refrigerant Gas Sensor (R-290) part number to be evaluated.

Manufacturer Part Number	Description
MPS310-S40505-E0	MPS A3 Refrigerant Gas Sensor (R-290) S4, 5-Pin, UART + Analog Out

Manufacturer Part Number	Description
MPS999-S40000-99	MPS S4 Evaluation Kit

Specifications are subject to change without notice.

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