Molecular Property Spectrometer™

MPS™ Extended Range Methane Gas Sensor

OVERVIEW

NevadaNano's MPS Extended Range Methane Gas Sensor is designed and optimized for open-air detection of methane and natural gas plumes over a full range of concentrations, from 50 to 1,000,000 ppm. In field testing, the sensor has detected methane emitted at a rate of 2 standard cubic feet per hour (SCFH) at distances up to 10 meters with nominal false positive readings over weeks of outdoor operation.

The smart sensor is intrinsically safe, robust, and extremely poison-resistant. It has built-in environmental compensation and performs constant self-testing for fail-safe operation. Sensor readings are output on a standard digital bus—no added electronics are required. With no field calibration required, the MPS Extended Range Methane Gas Sensor delivers industry-leading performance and a low cost of ownership.

Note: the MPS Extended Range Methane Gas Sensor is not suited for safety applications or for detection of gradually accumulating concentrations (e.g. slow leaks into confined, poorly ventilated spaces).

To achieve the sensor's notable combination of high sensitivity with near-zero false positives, proper mechanical integration is required. Refer to the guidelines provided in the MPS Extended Range Methane Gas Sensor User Manual, Section 4 "Electromechanical Integration."

PERFORMANCE

Range*	50 - 1,000,000 ppm
Resolution	1 ppm
Calibration	Factory calibrated
Accuracy *(Typical, at 20C, 50 %RH)*	± 10% error (> 300 ppm)

**Onboard sensor algorithms utilize a smart, variable lower detection limit, updated every sensor cycle, based on "live" sensor conditions.*

FM APPROVED

IECEx

ATEX UKEX

ENVIRONMENTAL OPERATING RANGE

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

FEATURES

- Built-in environmental compensation
- Inherently poison-resistant
- No calibration required
- Supports 15+ year lifetimes
- Low power — 29 mW average
- Intrinsically safe (IS) certified
- Built-in self-test for fail-safe operation

OPERATING PRINCIPLE

The Molecular Property Spectrometer (MPS) is a micro-machined membrane with an embedded Joule heater and resistance thermometer. This MEMS transducer is mounted on a PCB and packaged inside a rugged enclosure open to ambient air. Presence of methane 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 concentrations.

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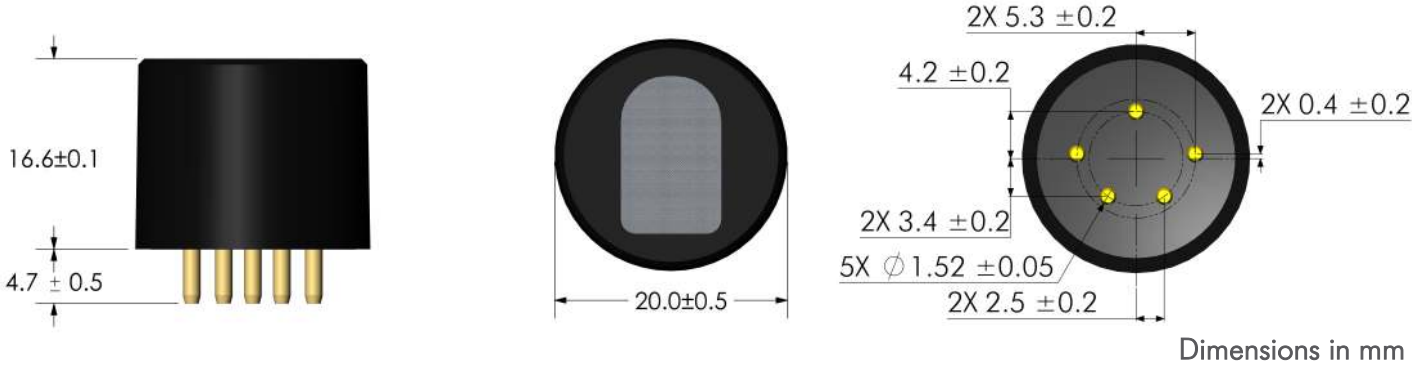
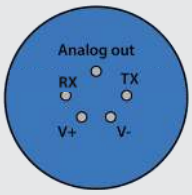
MECHANICAL



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		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 out (not currently available)

SELF-DIAGNOSTICS

The MPS Extended Range Methane Gas Sensor automatically performs dozens of built-in tests every 2 seconds to ensure fail-safe operation. The MPS alerts the user of any sensor failure or status alert. For additional information on how to interpret and handle detected faults, refer to the MPS Extended Range Methane Gas Sensor User Manual at:

www.nevadanano.com/downloads

CERTIFICATION

Certification Body	IECEx	ATEX NB 2809 / UKEX AB 1725	FM C US 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

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 Extended Range Methane Gas Sensor has been subjected. The sensor has passed all of these tests by demonstrating normal gas detection performance both before and after each test.

PART NUMBER ORDERING GUIDE

Please refer to the following table below when ordering the MPS Extended Range Methane Gas Sensor. When ordering a MPS S4 Evaluation Kit, please specify the MPS part number to be evaluated.

Manufacturer Part Number	Description
MPSM01-S40501-EX	MPS Extended Range Methane Gas Sensor, S4, 5-Pin, UART, EX

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

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Digital Scent for the Internet of Things

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