



Molecular Property Spectrometer™

MPS™ Extended Range Low Power Methane Gas Sensor

OVERVIEW

NevadaNano's MPS Extended Range Low Power 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 a 5-year lifetime and no calibration required, the MPS Extended Range Low Power Methane Gas Sensor delivers industry-leading performance and a low cost of ownership.

Note: the MPS Extended Range Low Power 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.

ENVIRONMENTAL OPERATING RANGE

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

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.



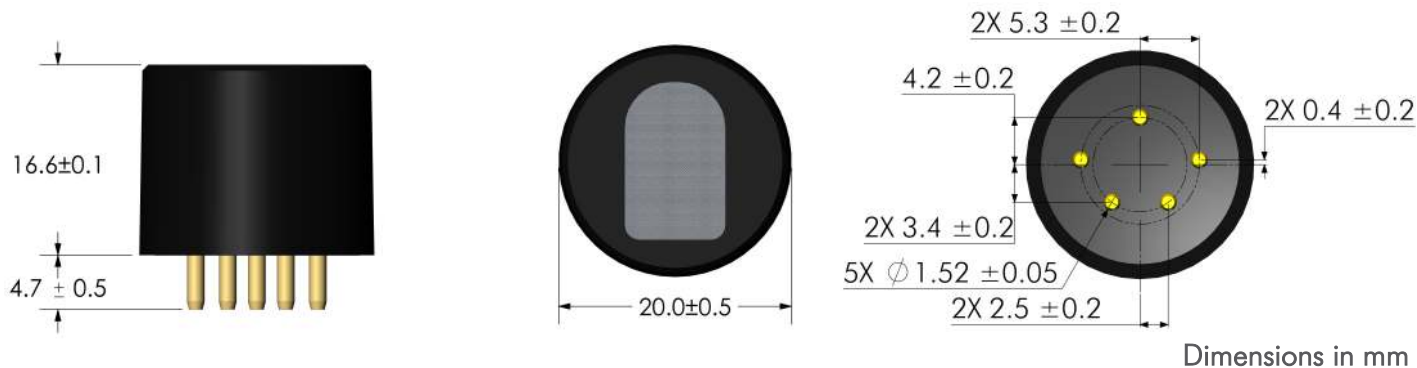
FEATURES

- Built-in environmental compensation
- Inherently poison-resistant
- No calibration required
- 5+ year lifetime
- Very low power — 15 mW average
- Intrinsically safe (IS) certified
- Built-in self-test for fail-safe operation

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MPSTM Extended Range Low Power Methane Gas Sensor

MECHANICAL



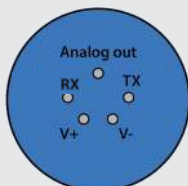
| | |
|---------------|---------------------------|
| Dimensions | 16.6 mm (H) x 20.0 mm (D) |
| Mass | 8.0 ± 0.5 grams |
| Body material | Ultem PEI |

ELECTRICAL

Operating voltage 3.3 - 5.0 ±5% VDC

| Current consumption | Average | Operating Range |
|---------------------|---------|-----------------|
| | 4.5 mA | 4.0-21.0 mA |

5-pin
Digital Input/Output








Communication: UART
 Logic level: 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 Low Power Methane Gas Sensor automatically performs dozens of built-in tests every 4 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 |  |  |  | |
|-----------------------|---|---|--|--|
| 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 |  II 1 G Ex ia IIC Ga  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 |

ADDITIONAL TEST STANDARDS

| Test | Specification | Summary of Test Conditions |
|------------------------------|------------------------------|---|
| Low Temperature Operating | IEC 60068-2-1 | 1000 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: 150-600 μm SiO ₂ particle size, 23 m/s nom. velocity, 5 hrs @ 70°C per axis, 3 axes Dust: Red China Clay, 1.5 m/s nom. velocity, 6 hrs @ 70°C per axis, 3 axes |
| 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) |
| EMC: Radiated Immunity | IEC/EN 61000-4-3 | 80 MHz – 2.7 GHz up to 10 V/m |
| EMC: Magnetic Immunity | IEC/EN 61000-4-8 | 30 A/m, 3 axes |
| EMC: Electrostatic Discharge | IEC/EN 61000-4-2 | Up to 4kV on ground plane; up to 8kV corona discharge |

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.

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PART NUMBER ORDERING GUIDE

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



| Manufacturer Part Number | Description |
|--------------------------|--|
| MPSM10-S40501-E0 | MPS Extended Range Low Power Methane Gas Sensor, S4, 5-Pin, UART, EX |



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



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SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

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