

Molecular Property Spectrometer™ MPS™ Flammable Gas Sensor

NevadaNano's MPS Flammable Gas Sensor is the next generation of gas detection and quantification for worker safety and leak detection in drilling, transportation, and production of oil & gas and chemical products. The smart sensor, with built-in environmental compensation, detects and accurately quantifies a dozen gases and gas mixtures. The MPS Flammable Gas Sensor is intrinsically safe, robust, extremely poison-resistant, and calibrated for all gases by performing only a single calibration with methane. Sensor readings are output on a standard digital bus or industry-standard analog output – no added electronics are required. With a 5-year lifetime and greater than 1-year calibration interval, the MPS Flammable Gas Sensor delivers industry-leading performance and a low cost of ownership.

GAS DETECTION

Gas	Detection Range	Accuracy (at 50% LEL)
butane (C ₄ H ₁₀)	0-100 %LEL	±5 %LEL
ethane (C ₂ H ₆)	0-100 %LEL	±5 %LEL
ethylene (C ₂ H ₄)	0-100 %LEL	±15 %LEL
hexane (C ₆ H ₁₄)	0-100 %LEL	±5 %LEL
hydrogen (H ₂)	0-100 %LEL	±5 %LEL
isopropanol (C ₃ H ₈ O)	0-100 %LEL	±5 %LEL
methane (CH₄)	0-100 %LEL	±3 %LEL
pentane (C ₅ H ₁₂)	0-100 %LEL	±5 %LEL
propane (C ₃ H ₈)	0-100 %LEL	±5 %LEL
propylene (C ₃ H ₆)	0-100 %LEL	±10 %LEL
toluene (C ₇ H ₈)	0-100 %LEL	±5 %LEL
xylene (C ₈ H ₁₀)	0-100 %LEL	±10 %LEL

Accuracy guaranteed for methane across full environmental range. Other gases will typically meet the published tolerances across the full environmental range, but are guaranteed only at standard conditions¹.

Resolution	0.1 %LEL (methane)
Response time (T90)	< 20 seconds (methane)
Calibration interval	> 1 year
Sensor lifetime	> 5 years

ENVIRONMENTAL OPERATING RANGE

Temperature	-40° to 75° C
Humidity	0% to 99% RH, non-condensing
Pressure	80 to 120 kPa

FEATURES

- Automatic multi-gas accuracy in real-time
- Built-in environmental compensation
- Extremely poison-resistant
- 1 year calibration interval
- 5+ year lifetime
- Low power — 29 mW average
- Intrinsically safe
- ATEX certification pending
- Built-in self-test for fail-safe operation

OPERATING PRINCIPLE

The Molecular Property Spectrometer (MPS) Flammable 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 open to ambient air. Presence of a flammable gas causes changes in the thermodynamic properties of the air/gas mixture that are measured by the transducer. Sensor data are processed by patent-pending algorithms to report accurate concentration and classify the flammable gas.

NOTES

¹ Standard conditions: 20° C, 50 %RH

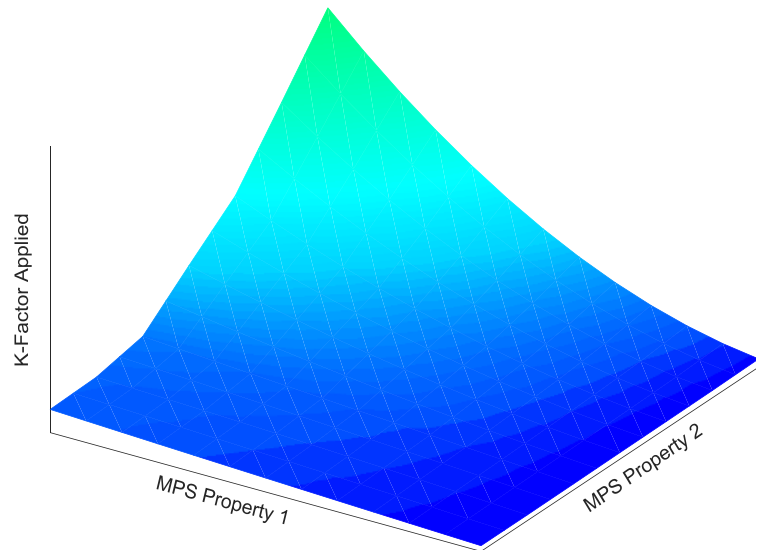


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GAS CLASSIFICATION

The old way: Conventional sensing technologies (e.g. catalytic bead, NDIR) use a “k-factor” multiplier to convert raw sensor signals to gas concentrations in % LEL. These “k-factors” are based on known relative sensitivities of these sensors to different gases. A single “k-factor”, corresponding to a particular gas, must be selected manually during system setup; if the sensor is then exposed to a gas other than the one selected, significant errors in reported concentration can occur.

The MPS way: The MPS Flammable Gas Sensor applies a real-time conversion factor automatically, using the latest measured thermal properties of the ambient air/gas and the environmental conditions. The %LEL values reported for the bulk, which may contain a mixture of gases, achieves the same high levels of accuracy achieved with single gases. Additional smart algorithms enable determination of the class of gas present, according to the following categories:



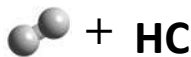
CLASS 1: Hydrogen

Molecular weight: 2.0 [g/mol]
Density: 0.09 [kg/m³]
carbons: 0



CLASS 2: Hydrogen Mixture

Avg. Mol. weight: 2-14 [g/mol]
Avg. Density: 0.1-0.6 [kg/m³]
carbons: varies



*This classification is unique as it guarantees the presence of hydrogen and another flammable gas

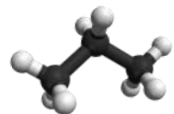
CLASS 3: Methane/Natural Gas

Avg. Mol. weight: 16 to 19 [g/mol]
Avg. Density: 0.6-0.9 [kg/m³]
Typical # carbons: 1-2



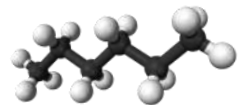
CLASS 4: Light Gas (or Light Gas Mixture)

Avg. Mol. weight: 25 to 65 [g/mol]
Avg. Density: 1.2-2.5 [kg/m³]
Typical # carbons: 2-3
Likely Gases: Ethane, Propane, Butane, Isopropanol



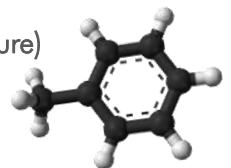
CLASS 5: Medium Gas (or Medium Gas Mixture)

Avg. Mol. weight: 55 to 90 [g/mol]
Avg. Density: 2.5-4.25 [kg/m³]
Typical # carbons: 3-7
Likely Gases: Pentane, Hexane



CLASS 6: Heavy Gas (or Heavy Gas Mixture)

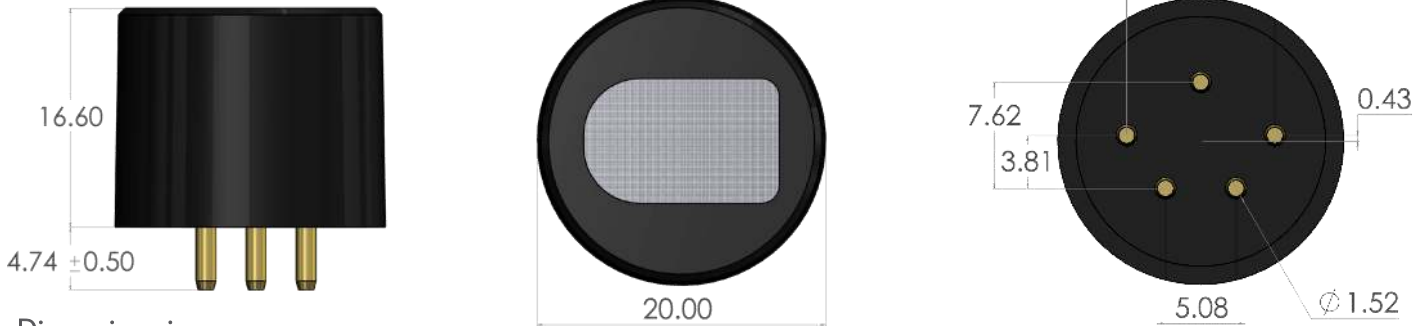
Avg. Mol. weight: 90+ [g/mol]
Avg. Density: 4.1+ [kg/m³]
Typical # carbons: 7+
Likely Gases: Toluene, Xylene (aromatic hydrocarbons)





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MECHANICAL



Dimensions in mm

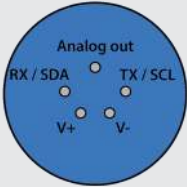
Dimensions	16.6 mm (H) x 20.0 mm (D)
Mass	8.0 ± 0.5 grams
Body material	Ultem PEI

ELECTRICAL

Operating voltage	3.3 - 5.0 ± 5% VDC	
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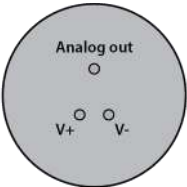
Current consumption [mA]	Average	Operating Range
	8.9	5.0-21.0

Digital Input/Output



Communication: 4 or 5 pin UART / I2C
 Logic level: 3.3 V
 UART - Baud rate: 38,400. 8 data, 1 stop bits. No parity
 Programmable Analog out (optional)

3-pin Pellistor Replacement Programmable Output



Industry standard 0.4 to 2 volt linearized, compensated for temperature, humidity and pressure.

CERTIFICATION

- The MPS Flammable Gas Sensor is currently in review for certification to the following standards:
 - IEC/EN60079-0
 - IEC/EN60079-11
- Product categories:
 - Ex ia IIC T4 Ga
 - Ex ia T85C Da
 - -40°C < T_{amb} < 75°C