

GrayWolf Tech Note

SEN-SMT-HCHO-L Formaldehyde Sensor Specifications

August 2024 v1.5



Description:

The SEN-SMT-HCHO-L is GrayWolf's newly offered Low Range (0 to 1000ppb) Formaldehyde Smart Sensor for use in DirectSense® II probes.

The HCHO sensor has a 0 to 1000 ppb range, limit of detection (L.O.D) of 10ppb, and a 20%-90%RH operating range (some moisture is critical to achieve low-range HCHO performance for this sensor). The SEN-SMT-HCHO-L Formaldehyde smart sensor has a larger diameter than GrayWolf's other smart sensors and is designed to be fitted into socket 5 for DSII-8 or socket 3 for DSII-5 and DSII-3 probes.

Electrochemical HCHO sensors often have a high cross-sensitivity to carbon monoxide. Due to the enhanced sensor technology used in this sensor, we have been able to test and confirm little to no cross-sensitivity in concentrations of CO up to 5ppm. Between 5-10ppm CO we have confirmed little response to CO. We recommend GrayWolf's smart CO sensor (not included) to accompany the Formaldehyde sensor for automatic alerts when CO levels may start to significantly influence the Formaldehyde readings.

IMPORTANT:

The SEN-SMT-HCHO-L sensor is intended to detect low levels of Formaldehyde in indoor environments. **Do NOT expose the sensor to levels of Formaldehyde in excess of 1ppm (1000 ppb). Do NOT use Formalin or pure Formaldehyde gas to bump test the sensor.** Using Formalin or exposing the sensor to >1ppm of Formaldehyde will permanently damage the sensor.

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Measurement Principle:

The sensor's measurement method is Solid Polymer Electrochemical technology, which uses a more stable solid polymer electrolyte rather than a liquid or gel. It is based on the principle of electrochemical catalytic reaction, which measures the gas concentration through the electrical signal produced from the electrochemical reaction of a gas. The sensor is composed of three electrodes in contact with the electrolyte. The electrode, electrolyte and the surrounding air are in contact, and the gas diffuses through the back of the porous membrane into the working electrode of the sensor. At this electrode, the gas is oxidized (or "reduced"), and this electrochemical reaction causes a current to flow through the external circuit.

Specifications:

Range	0 - 1000ppb
Resolution	1 ppb
Limit of Detection	10 ppb
Display Units	ppb, $\mu\text{g}/\text{m}^3$
Burn-in time	3-5 minutes (except in high concentrations of polluted gas)
T90 Response time	<180 seconds
Life Expectancy	>24-36 Months
Operating Principle	Solid Polymer Electrochemical Sensing Technology
Operating temperature	0-40°C, storage temperature -20-55°C
Operating humidity	20% - 90% RH, 40%-70% for optimal results. (Non-condensing)

NOTE: Low levels of %RH (<20% RH) will negatively impact HCHO Readings. **This sensor is NOT recommended for use <20%RH.**

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Installation & Operation:

The HCHO sensor is mounted to a smartboard for easy plug and play use into the DirectSense II probes. The sensor has a larger housing than a typical GrayWolf sensor and fits best into socket 5 when installed in a DSII-8 and socket 3 for DSII-5 and DSII-3 probes.



The HCHO sensor can take between 3-5 minutes to burn-in after start-up and will provide live readings from your DirectSense II to any platform of your choice. The sensor operating range is 20%-90%RH, and 0-40°C. Some moisture is critical for the operation and high-level performance of the sensor. To alert the user of any environments that may adversely affect the HCHO readings, the following alerts will be displayed in our software on any platform:

"Low levels of %RH (<20% RH) will negatively impact HCHO Readings. This sensor is NOT recommended for use <20%RH"

"Warning: High CO levels (>10ppm) will influence Formaldehyde readings."

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Compatibility:

SEN-SMT-HCHO-L is compatible with the DirectSense II -8/ -5/ -3 probes. The DirectSense II probe must have main board revision 10.4 or greater and be manufactured after September 2021. For probes manufactured before June 2022, a firmware update to FW 2.18 or higher may be necessary to add HCHO compatibility. For older probes, please inquire Salesteam@GrayWolfSensing.com for additional trade-in and upgrade information. Windows tablets must be running WolfSense LAP 2022.26 or later. The AdvancedSense XM and WolfSense Mobile app are fully compatible with the HCHO smart sensor.

User Calibration:

Bump Testing:

Bump tests can be performed on the HCHO sensor to confirm that the sensor has a healthy response. Bump tests work by exposing a sensor to a high concentration of the target gas, or reference gas within the operational range of the sensor. This type of test does not verify the accuracy of the calibration on a sensor.

Due to the specialized equipment needed to generate formaldehyde gas, GrayWolf recommends the HCHO sensor is bump tested using 95 ppm CO as a reference gas. Start by powering on the DirectSense II probe and connecting it to any compatible platform for viewing live readings (the DirectSense II Configuration Tool can display readings and be used for the low point user calibration). Allow the sensor to stabilize for at least 10 minutes. After stabilization, open the probe hatch to access the sensors. Set up the reference gas by connecting the 0.3 LPM regulator to a bottle of 95 ppm CO calibration gas and connect the HCHO calibration cap to the regulator with the supplied tubing. Place the calibration cap over the sensor, turn on the calibration gas and wait about 3-5 minutes to observe the full response of the sensor. A healthy sensor will yield about a 200-300 ppb response from 95 ppm CO. Turn off the gas and allow the sensor to stabilize for at least 10 minutes before taking Formaldehyde readings.

Do NOT expose the sensor to levels of Formaldehyde in excess of 1ppm (1000 ppb). Do NOT use Formalin or pure Formaldehyde gas to bump test the sensor. Using Formalin or exposing the sensor to >1ppm of Formaldehyde will permanently damage the sensor.

Low Point User Calibration:

Users can perform a low point calibration on the HCHO sensor through either the DirectSense II Configuration Tool (<https://graywolfsensing.com/downloads/dsii/dsii.exe>), WolfSense LAP software, or other platforms with user calibration built in.

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Formaldehyde gas or suitable reference gas is not available for user calibration, so ambient air must be used for the zero point user calibration. The user must be confident there is no presence of HCHO, and relative humidity between 40%-70%. HCHO concentration in the air can be verified with GrayWolf's FP-31G formaldehyde meter. Outdoor air can have zero HCHO, but it is important to avoid any possible sources when performing the low point calibration. Possible sources include construction materials, automobile exhaust, power plants or manufacturing facilities, urban areas, etc. To perform the low point calibration, do the following.

1. Power on the equipment in an environment with no HCHO and at least 40-70% RH.
2. Let the equipment acclimate for at least 30 minutes
3. Start the user calibration tool on the platform of your choice
 - a. DirectSense II Configuration Tool – Go to **Calibrate**
 - b. WolfSense LAP software – Go to **Probe → User Calibration**
4. Select the Formaldehyde sensor and click **Next**
5. Only select **Calibrate Low Point** and confirm it is set to 0 ppb. Click **Next**
6. The calibration tool will walk you through the remaining steps. Allow the sensor 3-5 minutes before clicking **measure** so the sensor has time to stabilize to the environment.
7. Save the calibration and reboot the probe for the adjustment to take effect.

Cross-Sensitivity:

Gas	Molecule formula	Concentration (ppm)	Response (ppm)
Ethanol	C ₂ H ₆ O	20	0.35
Carbon Monoxide (0-5ppm)	CO	0 - 5	0.00
Carbon Monoxide (5-10ppm)	CO	5-10	~0.08
Carbon Monoxide (>10ppm)	CO	>10	Varies by sensor
Isobutylene	C ₄ H ₈	10	0.058
Carbon Dioxide	CO ₂	2000	0
Hydrogen	H ₂	1000	6.4
Nitrogen Dioxide	NO ₂	10	0
Sulfur Dioxide	SO ₂	3	0
Methane	CH ₄	1000	0
Benzene	C ₆ H ₆	0.5	0
Toluene	C ₇ H ₈	0.5	0
Xylene	C ₇ H ₁₀	0.5	0

Specifications are subject to change without further notice.

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