

TN 2023:

Calibrating GfG Micro IV instruments equipped with hydrogen chloride (HCl) sensors



Sensors used to measure hydrogen chloride (HCl) are dependable, accurate, and easy to use.

Hydrogen chloride (HCl) is an extremely toxic, colorless, lighter than air gas associated with a number of industries and industrial processes. At room temperature, it is a colorless gas, which forms white fumes of hydrochloric acid upon contact with atmospheric water vapor. Hydrochloric acid, the aqueous solution of hydrogen chloride, is also commonly given the formula HCl. HCl is highly corrosive, and forms hydrochloric acid upon contact with tissue. HCl is extremely irritating to skin and mucous membranes. Inhalation can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory system failure, and death. Skin contact can cause redness, pain, and severe skin burns. HCl can also cause blindness by rapid destruction of the corneas, and requires immediate medical attention upon exposure.

Hydrogen chloride exposure limits

OSHA PEL: The Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for hydrogen chloride is 5.0 ppm as a Ceiling limit.

NIOSH REL: The National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) for hydrogen chloride is also 5.0 ppm as a Ceiling limit.

ACGIH® TLV®: The American Conference of Governmental Industrial Hygienists® TLV® is 2.0 ppm as a Ceiling limit.

HCl sensor characteristics

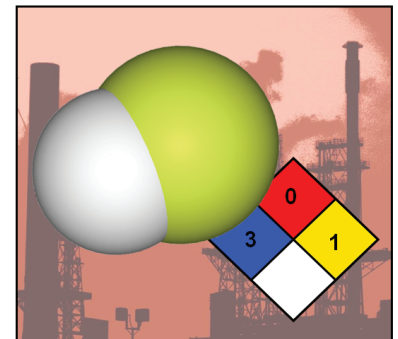
GfG uses Sensoric model HCl-3E-30 substance-specific electrochemical sensors for HCl measurement. The linear measuring range is 0 – 30 ppm. The maximum (over-limit) concentration varies by sensor, but is approximately 40.0 ppm. The resolution of the sensor (at 20°C) is ± 0.2 ppm. The expected lifespan of the sensor is approximately 18 - 24 months. The sensor is warranted for 1.0 year from the date of purchase. Extended ranges and resolutions are available per customer request. Contact the GfG factory for details.

The HCl sensor takes a little longer to reach a final stable reading than some of the other common electrochemical sensors such as those used to measure CO and H₂S. The HCl sensor response time at 20°C to 50% of its final stable reading (t_{50}) is less than 30 seconds. The response time to 90% of its final stable reading (t_{90}) is less than 70 seconds.

The HCl sensor is significantly affected by sudden shifts in humidity, causing momentary shifts or zero reading "transients." However, the sensor rapidly recovers as soon as conditions stabilize. Be careful to avoid breathing on the sensor, or holding the sensor opening against a moist palm or fingers. Give the sensor a few moments to stabilize if you move into an area with a different relative humidity.

Exposure limits for Hydrogen Chloride (HCl)

- **TLV:**
 - Ceiling = 2.0 ppm
- **US OSHA PEL:**
 - Ceiling = 5.0 ppm
- **US NIOSH REL:**
 - Ceiling = 5 ppm



GfG Instrumentation

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The HCl sensor responds to a number of acid gases with similar chemistry. The following table lists the relative of some of the most common interfering gases:

HF sensor cross sensitivities at 20° C		
Gas	Concentration applied	HF sensor response
Arsine	0.2 ppm	0.7 ppm
Alcohols	1,000 ppm	0
Carbon dioxide	5,000 ppm	0
Carbon monoxide	100 ppm	0
Chlorine	5.0 ppm	± 0.1 ppm
Hydrocarbons	Percent (%) range	0
Hydrogen cyanide	20 ppm	7.0 ppm
Hydrogen sulfide	20.0 ppm	60.0 ppm
Sulfur dioxide	20 ppm	8.0 ppm

Calibrating GfG monitors equipped with HCl sensors

1. Calibrating a single-sensor Micro IV instrument:

- Consult the Owner's Manual for complete procedures for fresh air zero-adjusting and span calibrating the Micro IV instrument. You can download a copy of the Micro IV owner's Manual at www.goodforgas.com
- Allow the instrument to stabilize completely after initially turning the instrument on before starting a calibration. A stable sensor should read 0.0 ppm in fresh air without fluctuation.
- Perform a fresh air AutoCal calibration.
- Connect the gas, regulator, tubing, and Teflon® calibration adapter. Make sure the regulator is designed to flow at a rate of 1.0 lpm (liters per minute) Make sure to use PTFE lined tubing to connect the regulator to the calibration adapter, and use the minimum possible length of tubing to connect the calibration adapter to the regulator.

- Remove the protective boot from the instrument, and insert the Micro IV into the Teflon® calibration adapter. Make sure that the Micro IV is inserted so that the sensor is next to the gas inlet in the adapter.



- After inserting the instrument into the calibration adapter, open the regulator valve to begin flowing HCl gas to the instrument. When the reading reaches 5.0 ppm, or has run for two minutes, THEN initiate the AutoCal "Gas" calibration step. Newer sensors respond more quickly than older and may reach 5.0 ppm, or more, within one minute.



- To initiate the AutoCal "Gas" calibration step, press the right-hand ("Down") and center ("Quit") buttons at the same time to display the "Service" menu, then use the "Down" button to advance to the next choice. Press the center ("Quit") button to select the "Gas" adjustment choice.
- GfG recommends using 10 ppm HCl calibration gas to adjust the sensor. The display will show the concentration the instrument expects you to use. Verify the concentration of gas you are using matches the concentration the instrument expects. If it does, press the center ("Quit") button again to begin the adjustment procedure.

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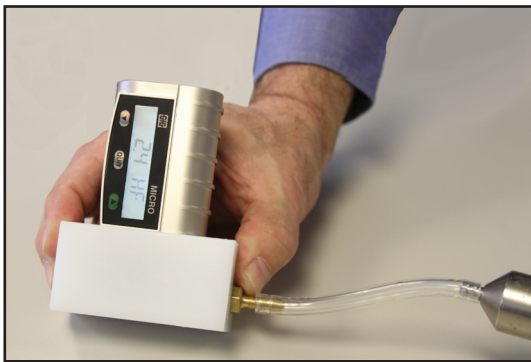


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- The instrument will wait for the sensor to reach its final stable reading, then adjust the reading to match the concentration of the calibration gas.



- After successfully finishing the "Gas" calibration adjustment procedure, the instrument will return to normal operation
- Turn the gas flow off, remove the instrument from the calibration adapter, and allow the sensor to recover in fresh air. The alarm will sound as the sensor stabilizes in fresh air. This may take several minutes.
- If the calibration fails, the display will show a calibration error ("Err") message.
 - (1) Without turning the gas off, repeat the "Gas" calibration procedure.
 - (2) Make sure that the regulator has a flow rate of 1.0 lpm.

- (3) Make sure that the that the instrument is properly inserted into the calibration adapter, and that the sensor is adjacent to the gas inlet.
- (4) Make sure that the cylinder contains 10.0 ppm HCl calibration gas, is still within dating, and that the cylinder has sufficient remaining pressure to complete the calibration procedure.
- (5) If the sensor fails calibration on the second attempt, the sensor may need to be replaced.
- (6) If the instrument still fails to calibrate, contact the GfG Service Department for help, or to arrange for the shipment of a replacement sensor.

