RC SYSTEMS

SenSmart 1000

Operations Manual

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UM-1032
Revision A

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Chapter 1 Safety Information

1.1 Safety Information – Read Before Installation and Applying Power

The following symbols are used in this manual to alert the user of important instrument operating issues:

This symbol is intended to alert the user to the presence of important operating and maintenance (servicing) instructions.

This symbol is intended to alert the user to the presence of dangerous voltage within the instrument enclosure that may be sufficient magnitude to constitute a risk of electric shock.

WARNINGS:

- **Shock Hazard** - Disconnect or turn off power before servicing this instrument.
- **WARNING- EXPLOSION HAZARD** - DO NOT REPLACE FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- **WARNING- EXPLOSION HAZARD** - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- Use a properly rated CERTIFIED AC power (mains) cable installed as per local or national codes
- A certified AC power (mains) disconnect or circuit breaker should be mounted near the controller and installed following applicable local and national codes. If a switch is used instead of a circuit breaker, a properly rate CERTIFIED fuse or current limiter is required to be installed as per local or national codes. Markings for positions of the switch or breaker should state (I) for on and (O) for off.
- Clean only with a damp cloth without solvents.
- Equipment not used as prescribed within this manual may impair overall safety.

1.2 Contacting R.C. Systems Inc.

To contact R.C. Systems Inc., call, fax, email or write:
409–986-9800 FAX 409-986-9880 Email: info@rcsystemsco.com
8621 Hwy. 6 Hitchcock, TX 77563
Or visit us on the Web at www.rcsystemsco.com

Chapter 2 General Description

The SenSmart 1000 Series is a blind gas detector capable of supporting electrochemical, infrared and catalytic bead sensors.

SenSmart 1100 – Low-power, 4-20mA loop powered gas detector for toxic and oxygen detection.

SenSmart 1200 – 3-wire direct bridge, gas detector for catalytic bead combustible gas detection.

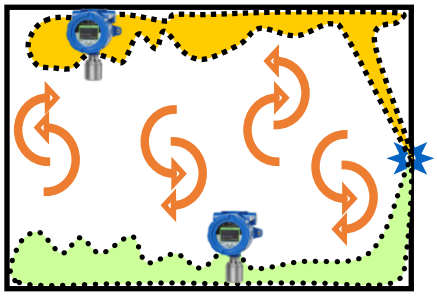
SenSmart 1300 – Blind Low-power IR, for combustible gas detection.

All models use RC Systems latest Smart Sensor technology, providing smarter gas detection with simplified solutions.

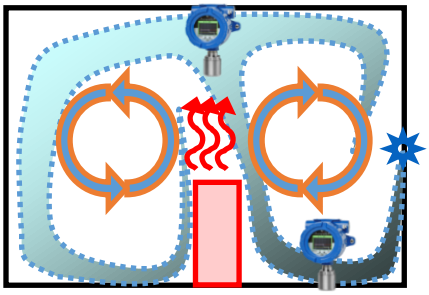
Chapter 3 Installation Instructions

3.1 Selecting a Location

Factors such as air movement, gas density in relation to air, emission sources and environmental variables affect correct sensor location.

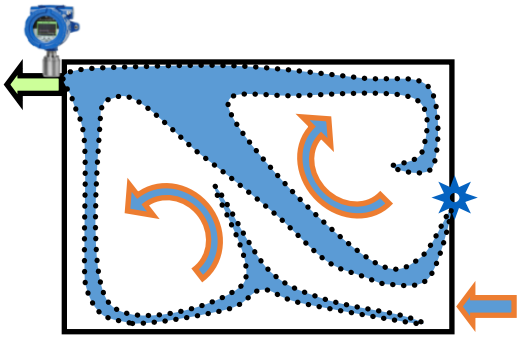


Air movement by fans, prevailing winds and convection should be carefully evaluated to determine if a leak is more likely to raise gas levels in certain areas within the facility.



Vapor density of a gas determines if it will rise or fall in air when there are no significant currents. Lighter than air gases should have the detector mounted 12 to 18 inches (30 to 45 cm) above the potential gas leak, and heavier than air gases should be this distance below the potential gas leak.

The Universal Series of gas detectors are designed for rugged service in the field. However, sensors should always be protected from environmental damage from water, snow, shock, vibration and dirt.



3.2 Mounting the Enclosure

Install the detector to a wall or bracket using the predrilled mounting flanges with I.D. 0.25 on 5 inch centers (Figure 3-1). If conduit is rigid and able to support the weight of the universal detector, the mounting bolts may be omitted.

After you have determined the appropriate location for your gas detector, it is important to securely mount the gas detector using the predrilled mounting flanges on the enclosure. Dimensions for the mounting holes can be found for both the aluminum and poly enclosures in Figure 3-1.

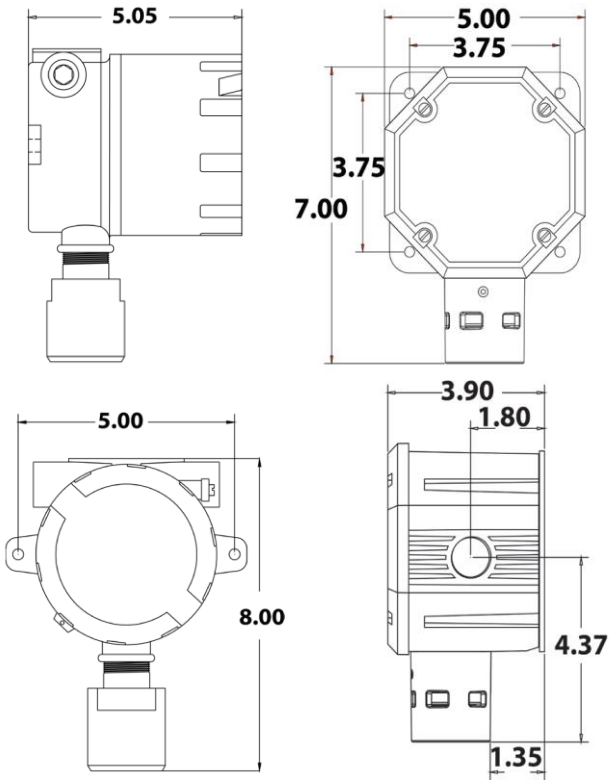


Figure 1 Mounting Dimensions

3.3 Power and Analog Outputs Wiring

WARNING: Qualified personnel should perform the installation according to applicable electrical codes, regulations and safety standards. Ensure correct cabling and sealing fitting practices are implemented. Do not aim the sensor pointing upward.

The SenSmart 1100 is powered through a non-polar 4-20mA loop.

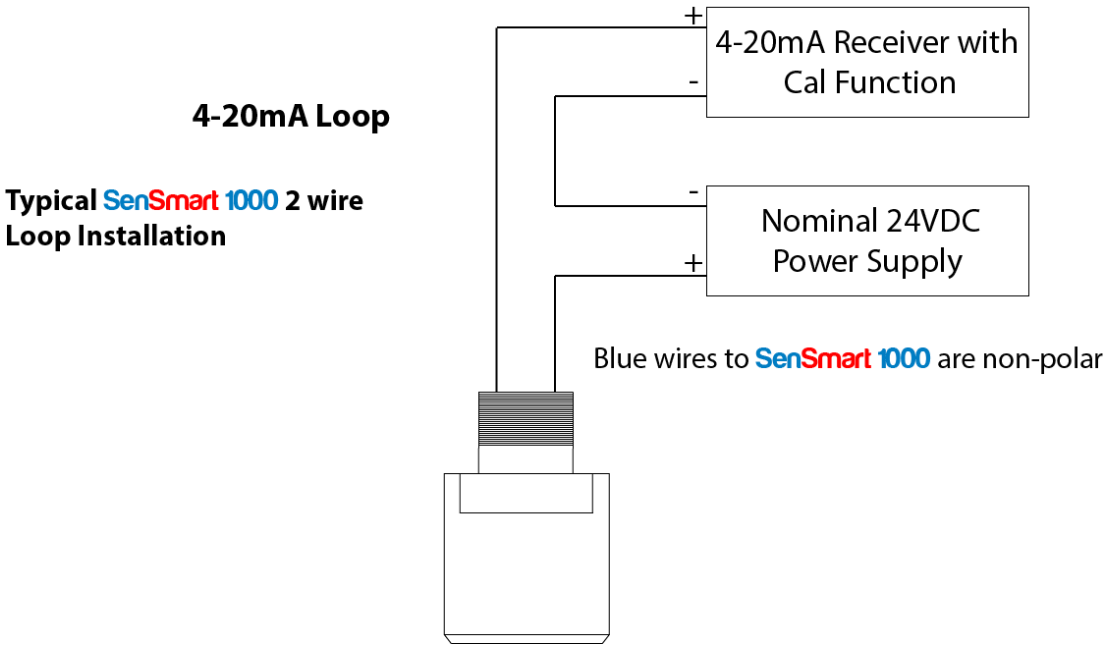


Figure 2 SenSmart 1100 Wiring

3.4 Sensor Installation and Replacement

The SenSmart 1000 series of monitors utilize RC Systems' Gen II Smart Sensors. These sensors come factory installed, and provide our highest level of performance with increased accuracy and signal to noise ratio.

WARNING: Prior to performing sensor replacement ensure the area has been declassified.

To install a new sensor, simply remove the sensor head cap, remove the old sensor assembly and align the alignment arrows on the new sensor assembly with the sensor head body and press the sensor assembly toward the sensor head body until it has fully seated in the connector. The sensor board should be flush with the edge of the sensor head body when fully seated. Reinstall the sensor head cap.

Important: Sensor assembly must be **fully inserted** into the sensor head body when tightening the sensor head cap. Failure to do so could result in damage to the sensor and/or the sensor head body.

Chapter 4 General Operating Instructions

4.1 Normal Operation

4.1.1 Warmup

Once power has been applied to the sensor it will enter its factory programmed warm up time period (varies by sensor type). During this time a standard 4mA output will be broadcast from the transmitter (~13mA for Oxygen) until the warmup timer has expired at which time the detector will commence standard 4-20mA output.

4.1.2 PGA Gain Adjustment

******NOTE: Should be performed by factory trained technicians only!!******

During normal operation adjustments to PGA are made by holding a magnet against the dot engraved on the sensor head base.

To adjust the PGA setting, hold the magnet over the switch for 10 seconds, and remove the magnet to release the switch.

Resume holding the magnet to the switch to increase PGA gain, up to 100%. Release the switch when desired level is reached.

To reset the PGA Gain to 0, increase the PGA Gain to 100. Release the switch by removing the magnet. Apply the magnet to the switch again. This will reset the PGA Gain to 0. Release the switch. Applying and removing the magnet to the switch will increment by 1. If magnet is not applied to the switch within a five second period, the detector will save the current value, and exit the PGA Gain adjustment mode.

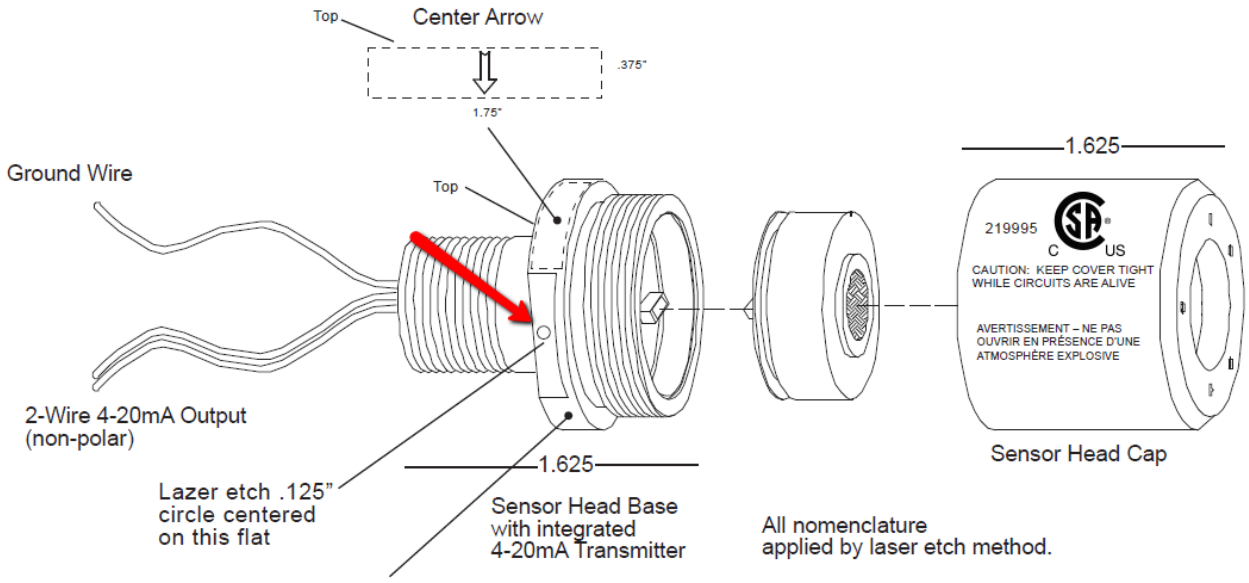


Figure 3 SenSmart 1100

4.2 Fault Condition

A fault condition is indicated when a sensor is malfunctioning or the sensor is missing.

Chapter 5 Calibration Procedure

5.1 Preparation

Calibration is the most important function for ensuring correct operation of the Universal Series of gas detectors. The CAL MODE is designed to make calibration quick, easy and error free, and a successful Zero and Span calibration requires only four keystrokes. The 4-20mA output transmits 3mA during the calibration, and 4mA during calibration purge to prevent alarms. After 5 minutes of inactivity the gas detector will exit calibration mode automatically.

- R.C. Systems recommends performing calibrations
  - ✓ Immediately prior to placing a gas detector in service
  - ✓ Any time a new sensor is installed
  - ✓ Every three months for routine calibrations (more often if sensor is known to have been exposed to gas for extended periods of time)
  - ✓ Periodic bump tests are recommended if detector has potentially been exposed to incompatible gases to ensure correct operation

- Follow these calibration guidelines to ensure proper operation of your RC Systems, Inc. gas detector:
  - ✓ Calibration accuracy is only as good as the calibration gas accuracy. R.C. Systems recommends calibration gases with National Institute of Standards and Technology (NIST) traceable accuracy to increase the validity of the calibration.
  - ✓ Do not use gas cylinders beyond their expiration date.
  - ✓ Calibrate a new sensor before it is put in use.
  - ✓ Allow the sensor to stabilize before starting calibration.
  - ✓ Calibrate on a regular schedule. R.C. Systems recommends once every 3 months, depending on use and sensor exposure to poisons and contaminants.
  - ✓ Calibrate only in a clean atmosphere, free of background gas.

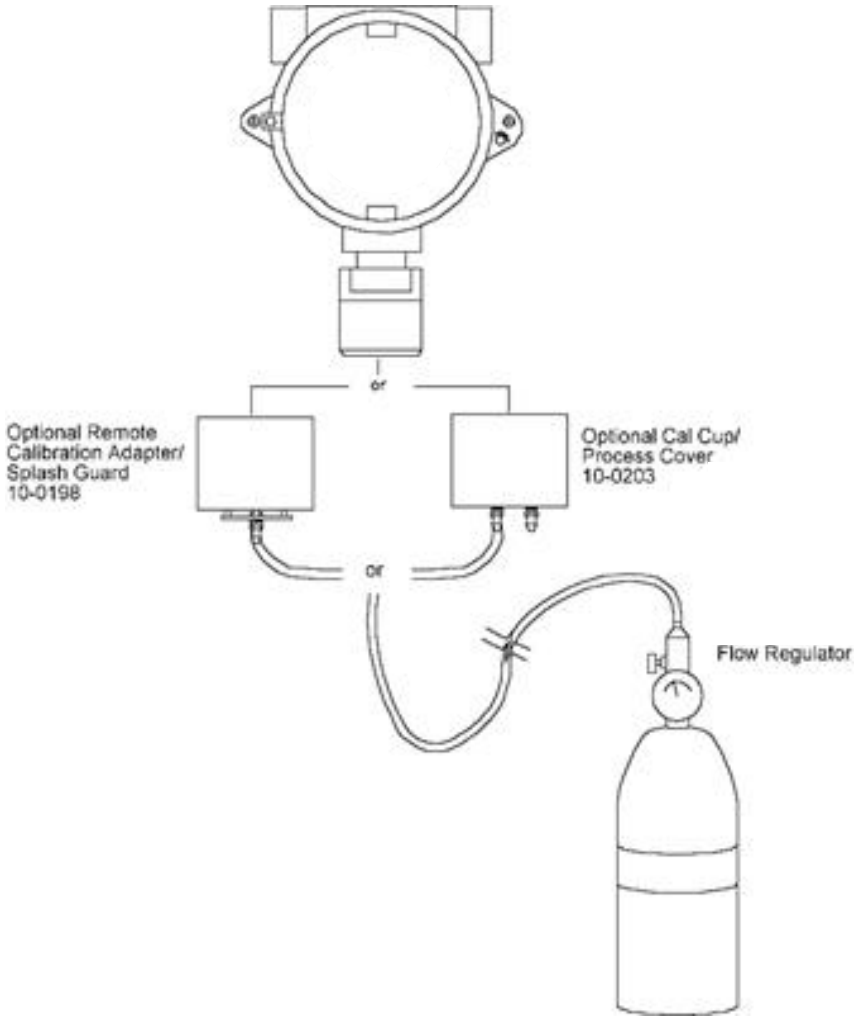


Figure 4 Calibration Diagram

Prior to beginning your calibration make sure you have the following items:

1. A cylinder of **calibration gas** with concentration equal to the SPAN GAS VALUE setting (RC Systems typically recommends choosing a value at 50% of full scale.)
2. A cylinder of **Zero Air** (unless you are confident there is no target gas potentially present in the area)
3. A **Flow Regulator**, a fixed flow of 0.5LPM is recommended for most applications, but some instances may require a 1.0LPM fixed flow regulator.
4. A **Calibration Cup** or **Calibration Adaptor**
5. Sufficient length of flexible tubing to connect the regulator to the calibration adaptor

5.2 Routine Calibration Procedure

Use the following step-by-step procedure to perform Zero and Span calibrations (Figure 1-2 may be used for reference to the Menus.):

Note: The first three steps must be performed before the timer in the bottom right corner expires, 15 seconds, otherwise the SenSmart 6000 will exit back to the Data Display Screen.

1. Enter Cal mode from any of the Data Display Screens by swiping the DOWN/CAL key.
2. Swipe the EDIT key to enter Cal Mode.
3. Apply a clean Zero Gas (Figure 1-1), using the Cal Cup, part number 10-0203, or be sure there is no background target gas in the monitored area. After the reading is stable, swipe the EDIT key to set the Zero Calibration. To skip the Zero calibration and go to the Span calibration swipe the NEXT key. When a message that the Zero calibration was completed successfully, proceed to the next step.
4. Apply the correct, as indicated, span gas (Figure 1-1). After the reading is stable, swipe the EDIT key to set the Span Calibration. To skip the Span Calibration, swipe the NEXT key. When a message that the Span calibration was completed successfully, the gas detector will exit back to the Data Display Screen.
5. Remove the Cal Gas. Once the Cal Purge Delay has expired, normal alarm and relay functionality will be restored.

Calibration history records are logged, and may be viewed in the Sensor Information.

5.3 Bump Test Procedure

Note: A bump test, when performed correctly, is meant to check both sensor and alarm functionality. This results in expected alarms, and proper precautions should be taken.

Also known as a functionality test, a bump test is not meant to test the accuracy of the detector, and no calibration settings are changed during the test.

To perform a bump test, briefly expose the sensor to a gas of known concentration (above the Low Alarm set point), and check to ensure the display reading increases to a value within tolerance of the concentration applied and check for alarm actuation. If the sensor does not perform as expected, R.C. Systems recommends performing a routine calibration and/or replacing the sensor. If the alarm does not perform as expected check the detector's alarm settings.

Chapter 6 Maintenance Procedure

6.1 Regular Maintenance

R.C. Systems recommends performing calibrations at regular intervals to ensure proper functionality of the Universal Gas Detector. During routine calibration, R.C. Systems recommends a visual inspection of sensor head, enclosure and conduit entries to check for cleanliness and physical integrity. Cleaning the detector is recommended when necessary, but be aware that some cleaning compounds may be detected by an operational detector depending on the sensor type. So, proper precautions should be taken.

R.C. Systems recommends calibrations:

- ✓ Immediately prior to placing a gas detector in service
- ✓ Any time a new sensor is installed
- ✓ Every three months for routine calibrations (more often if sensor is known to have been exposed to gas for extended periods of time)
- ✓ Periodic bump tests are recommended if detector has potentially been exposed to incompatible gases to ensure correct operation

6.2 Sensor Replacement

When a sensor has reached its end of life, it is necessary to replace the sensor. For sensor replacement instructions, refer to Chapter 3.4.

Appendix 1 Sensor Specifications

Target gas	Formula	Relateive Gas Density	TWA	IDLH	Min Span	Max Span
Acetaldehyde	C2H4O	1.5	200ppm	2000ppm (Ca)	30ppm	1500ppm
Acetylene	C2H2	0.91	--	asphyxiant	--	0-100% LEL
Ammonia	NH3	0.6	50ppm	300ppm	25ppm	1000ppm
Ammonia	NH3	0.6	50ppm	300ppm	1250ppm	5000ppm
Arsine	AsH3	2.69	0.5ppm	3ppm	--	0.5ppm
Arsine	AsH3	2.69	0.5ppm	3ppm	--	1ppm
Benzene	C6H6	2.6961	1ppm	500ppm	3ppm	25ppm
Butane	C3H8	1.55	1000ppm (pel)	2100ppm	--	0-100% LEL
Carbon Dioxide	CO2	1.53	5000ppm	40000ppm	--	0-100%vol
Carbon Dioxide	CO2	2.33	0.1ppm C	5ppm	--	5%/vol
Carbon Dioxide	CO2	1.53	5000ppm	40000ppm	--	5%/vol
Carbon Dioxide	CO2	1.53	5000ppm	40000ppm	--	1.5%/vol
Carbon Monoxide	CO	0.97	50ppm	1200ppm	40ppm	5000ppm
Chlorine	Cl2	2.47	1ppm C	10ppm	5ppm	20ppm
Chlorine Dioxide	ClO2	2.33	0.1ppm C	5ppm	2ppm	6ppm
Combustible	Hydrocarbons	varies	--	asphyxiant	--	100%LEL
Ethane	C2H6	1.07	--	asphyxiant	--	0-100% LEL
Ethanol	C2H6O	1.6	1000ppm	3300ppm	--	0-100% LEL
Ethylene	C2H4	0.98	200ppm	asphyxiant	--	0-100% LEL
Ethyl Alcohol	C2H6O	1.59	1000ppm	3300ppm	40ppm	3300ppm
Ethylene Oxide	C2H4O	1.49	<0.1ppm (Ca)	800ppm (Ca)	2ppm	100ppm
Flourine	F2	1.31	0.1ppm	25ppm	--	1ppm
Hexane	C6H14	2.97	500ppm	1100ppm	--	0-100% LEL
Hydrazine	N2H4	1.1	C 0.03ppm (Ca)	50ppm (Ca)	--	1ppm
Hydrogen	H2	0.07	--	asphyxiant	250ppm	5000ppm
Hydrogen	H2	0.07	--	asphyxiant	500ppm	10000ppm
Hydrogen	H2	0.07	--	asphyxiant	5000ppm	40000ppm or 100%LEL
Hydrogen Chloride	HCl	1.27	5ppm C	50ppm	20ppm	100ppm
Hydrogen Cyanide	HCN	0.94	ST 4.7ppm	50ppm	35ppm	100pm
Hydrogen Flouride	HF	0.69	3ppm	30ppm	10ppm	10ppm
Hydrogen Sulfide	H2S	1.19	20ppm	100ppm	5ppm	2000ppm
Methane	CH4	0.6	--	asphyxiant	5%/vol (100%LEL)	100%/vol
Methane	CH4	0.6	--	asphyxiant	--	0-100% LEL
Methane	CH4	0.6	--	asphyxiant	--	0-100% LEL
Nitric Oxide	NO	1.04	25ppm (pel)	100ppm	10ppm	250ppm
Nitric Oxide	NO	1.04	25ppm (pel)	100ppm	70ppm	500ppm
Nitrogen Dioxide	NO2	2.62	5ppm C	20ppm	15ppm	20ppm
Nitrogen Dioxide	NO2	2.62	5ppm C	20ppm	25ppm	200ppm
Oxygen	O2	1.1	--	19.50%	--	25%/vol
Ozone	O3	1.66	0.1ppm	10ppm	510ppb	2ppm
Pentane	C5H12	2.487	1000ppm	1500ppm	--	0-100% LEL
Phosphine	PH3	1.18	0.3ppm	50ppm	5ppm	10ppm
Propane	C3H8	1.55	1000ppm (pel)	2100ppm	--	
Propane	C3H8	1.55	1000ppm (pel)	2100ppm	--	0-100% LEL
Propane	C3H8	1.55	1000ppm (pel)	2100ppm	--	0-100% LEL
Propylene	C3H6	1.45	--	asphyxiant	--	0-100% LEL
Silane	SiH4	1.11	5ppm	asphyxiant	45ppm	50ppm
Sulfur Dioxide	SO2	2.26	5ppm	100ppm	10ppm	100ppm
Sulfur Dioxide	SO2	2.26	5ppm	100ppm	100ppm	2000ppm

TYPE	T50	T90	TEMP °F	Relative Humidity (non-condensing)	Application Notes	A1	A2	A3
PID	--	<3	-40° to 131°	0 to 99%		20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
EC	<20	<60	-4° to 104°	15 to 90%		20%	40%	60%
EC	<30	<90	-4° to 104°	15 to 90%		20%	40%	60%
EC	<20	<60	-4° to 104°	20 to 95%		20%	40%	60%
EC	--	<30	-4° to 104°	10 to 95%	Available with or without H2S filter	20%	40%	60%
PID	--	<3	-40° to 131°	0 to 99%		20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%		20%	40%	60%
IR	<15	<30	-4° to 122°	0 to 95%	Specify span when ordering	20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%	Low power IR in development	20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%	Low power IR	20%	40%	60%
EC	--	<30	-4° to 122°	15 to 90%		20%	40%	60%
EC	--	<60	-4° to 122°	15 to 90%		20%	40%	60%
EC	--	<60	-4° to 122°	15 to 90%		20%	40%	60%
CB	3	8	-4° to 158°	0 to 100%		20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
PID	--	<3	-40° to 131°	0 to 99%		20%	40%	60%
EC	--	<200	-22° to 122°	15 to 90%		20%	40%	60%
EC	<30	<80	14° to 104°	15 to 90%		20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
EC	<30	<120	14° to 104°	20 to 95%		20%	40%	60%
EC	--	<80	-22° to 122°	15 to 90%		20%	40%	60%
EC	<40	<70	-4° to 104°	16 to 90%		20%	40%	60%
EC	<40	<60	-4° to 104°	15 to 95%		20%	40%	60%
EC	--	<200	-22° to 122°	15 to 90%		20%	40%	60%
EC	--	<120	-22° to 122°	15 to 90%		20%	40%	60%
EC	--	<90	-4° to 104°	15 to 90%		20%	40%	60%
EC	--	<55	-22° to 122°	15 to 90%		20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%	Specify span when ordering	20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%	Low power IR	20%	40%	--
IR	<5	<10	-40° to 158°	0 to 99%	Millenium sensor	20%	40%	60%
EC	--	<30	-22° to 122°	15 to 90%		20%	40%	60%
EC	--	<75	-22° to 122°	15 to 90%		20%	40%	60%
EC	--	<60	-22° to 104°	15 to 85%		20%	40%	60%
EC	--	<40	-4° to 122°	15 to 90%		20%	40%	60%
EC	--	<15	-22° to 131°	5 to 95%		19	18	17
EC	--	<150	-4° to 122°	15 to 90%		20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
EC	--	<20	-22° to 122°	15 to 90%		20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%		20%	40%	--
IR	<5	<10	-40° to 158°	0 to 99%	Millenium sensor	20%	40%	60%
IR	--	<30	-4° to 122°	0 to 95%	Low power IR	20%	40%	60%
IR	<5	<10	-40° to 158°	up to 99%	Millenium sensor	20%	40%	60%
EC	--	<60	-4° to 104°	10 to 95%		20%	40%	60%
EC	--	<40	-22° to 122°	15 to 90%		20%	40%	60%
EC	--	<30	-22° to 122°	16 to 90%		20%	40%	60%