



SenSmart 4000

Operations Manual

8621 Hwy 6
Hitchcock, TX 77563
409-986-9800
www.rcsystemsco.com

UM-1067
Revision A

Table of Contents

Table of Figures	I
Chapter 1 Safety Information	1
1.1 <i>Safety Information – Read Before Installation and Applying Power</i>	<i>1</i>
1.2 <i>Contacting RC Systems Inc.</i>	<i>1</i>
Chapter 2 General Description	2
Chapter 3 Installation Instructions	3
3.1 <i>Selecting a Location</i>	<i>3</i>
3.2 <i>Mounting the Enclosure</i>	<i>4</i>
3.3 <i>Power and Analog Outputs Wiring.....</i>	<i>4</i>
3.4 <i>Sensor Installation and Replacement</i>	<i>6</i>
3.5 <i>Smart Sensors.....</i>	<i>6</i>
Chapter 4 General Operating Instructions	7
4.1 <i>Introduction.....</i>	<i>7</i>
4.2 <i>General Setup.....</i>	<i>7</i>
4.3 <i>Normal Operation</i>	<i>7</i>
4.4 <i>Fault Condition</i>	<i>8</i>
4.5 <i>Alarm Conditions.....</i>	<i>8</i>
Chapter 5 Calibration Procedure	9
5.1 <i>Preparation</i>	<i>9</i>
5.2 <i>Routine Calibration Procedure</i>	<i>11</i>
5.3 <i>Bump Test Procedure</i>	<i>12</i>
Chapter 6 Maintenance Procedure	13

6.1	<i>Regular Maintenance</i>	13
6.2	<i>Sensor Replacement</i>	13
Appendix 1	Gas Detector Specifications	14
Appendix 2	Sensor Specifications	16
Appendix 3	Menu Navigation	18
Appendix 4	Ordering Information	24
Appendix 5	Frequently Asked Questions	25
Appendix 6	Channel States	26

Table of Figures

Figure 1 Mounting Dimensions	4
Figure 2 SenSmart 4000 Wiring	5
Figure 3 Stainless Steel Sensor Head	6
Figure 4 Universal Gas Detector Data Display Screens	8
Figure 5 SenSmart 4000 Fault Screen	8
Figure 6 Calibration Diagram	10
Figure 7 Calibration Menu Flowchart	11
Figure 8 SenSmart 4000 and SenSmart 5000 Specifications Table	14

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:

- **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 RC Systems Inc.

To contact RC 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 Universal Transmitter Series consists of a common processor board connected to various combinations of input output options. The models are based on wireless vs wired communications; and powering as follows:

SenSmart 4000 – Low-power, 4-20mA loop powered gas detector for toxic and oxygen detection. Includes a 4-20mA output.



SenSmart 4000

SenSmart 5000 – 10-30VDC powered gas detector for toxic, oxygen, combustible, VOC and CO2 detection. This model adds a color backlit LCD display, and has Modbus and/or 4-20mA communications and relays available.



SenSmart 5000

SenSmart 8000 – Battery powered wireless gas detector for toxic, oxygen, combustible and CO2 detection. Available in either 900MHz or 2.4GHz models.

SenSmart 8000X – 10-30VDC powered wireless gas detector for toxic, oxygen, combustible and CO2 detection. This model adds a color backlit LCD display.

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



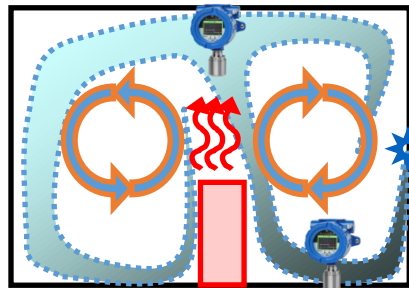
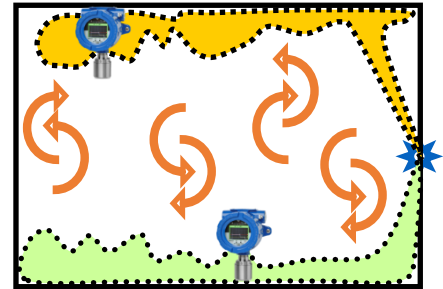
SenSmart 8000 and 8000X

Chapter 3 Installation Instructions

3.1 Selecting a Location

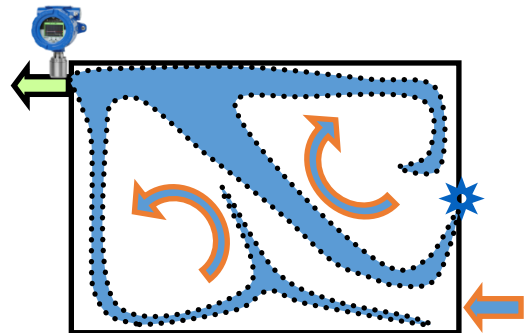
Factors such as air movement, gas density in relation to air, emission sources and environmental variables affect correct sensor location.

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 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.

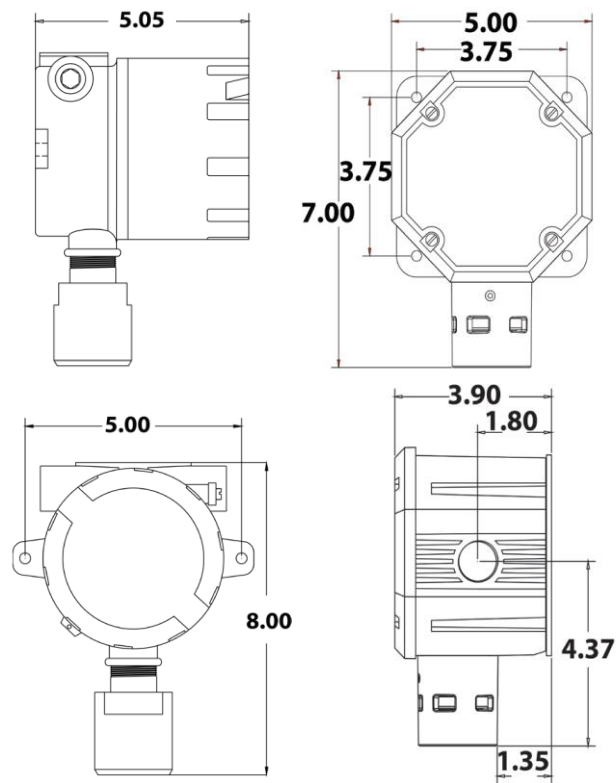


Figure 1 Mounting Dimensions

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.

Modular design simplifies the installation of the universal gas detectors. A top display assembly is mounted with captive thumbscrews, and is easily removed to access field-wiring terminals. Power, input and output wires mount to the power supply board.

The SenSmart 4000 is powered through a non-polar 4-20mA loop connected to TB2. Connect the +10-30VDC/4-20mA loop wires to TB2.1 and TB2.2 on the 2-wire 4-20mA Output Board (Figure 2).

TB2.1 - +10-30VDC/4-20mA
(non-polar)

TB2.2 - +10-30VDC/4-20mA
(non-polar)



Figure 2 SenSmart 4000 Wiring

3.4 Sensor Installation and Replacement

The Universal Gas Detector 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. The 8-conductor Smart Sensor interface connector attaches to the J1 connector on the base board, and the detector detects the type of sensor automatically. This makes it easier than ever to switch from any of our electrochemical Smart Sensors to any of our bridge (infrared, catalytic bead and PID) Smart Sensors without having to reconfigure wiring.

3.5 Smart Sensors



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, and follow the on-screen prompts to upload the sensor settings into the gas detector.



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.

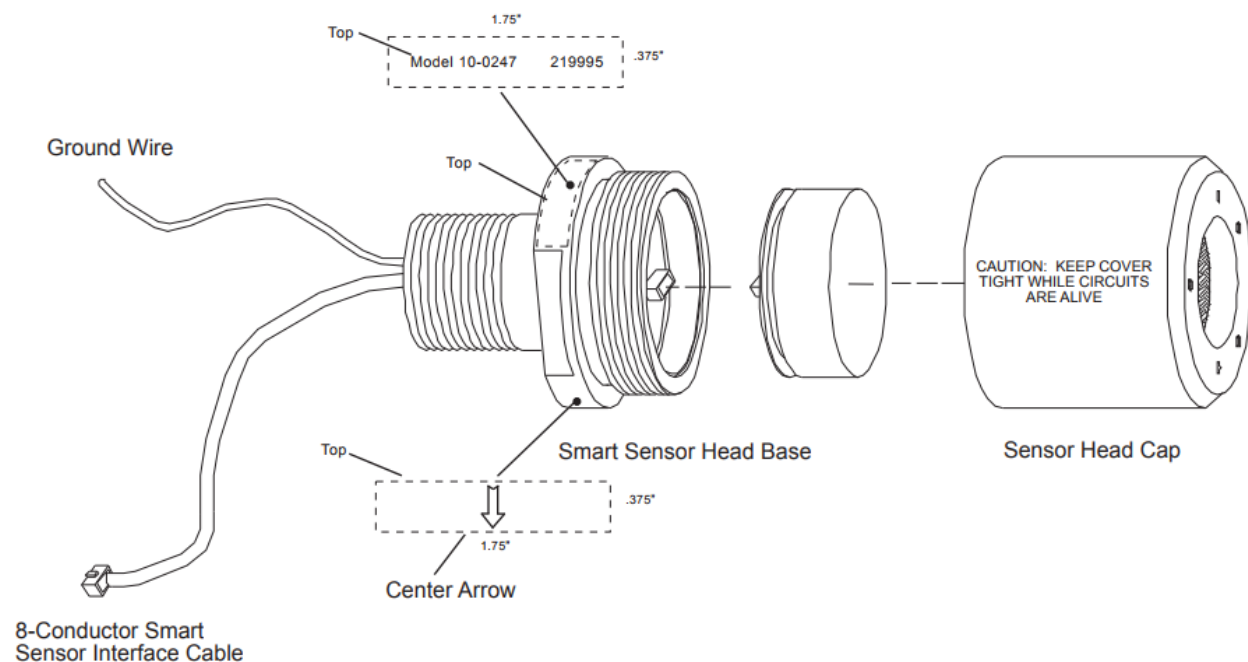


Figure 3 Stainless Steel Sensor Head

Chapter 4 General Operating Instructions

4.1 Introduction

Swiping a magnetic wand past the *Edit* key, from any of the **Data Display** screens, displays the **Main Menu**. The *Up* and *Down* keys maneuver the selection bar up and down, and *Edit* selects the highlighted item to enter the sub-menus. All items with a sub-menu are indicated by a right facing arrow at the end of the line. To edit menu item values swipe the *Edit* key, and use the *Up* and *Down* keys to edit the value. Once the desired value is entered, swipe the *Edit* key again to save the value. Swipe the *Next* key to reverse out of a sub-menu.



Important: Some values require a **Technician Sequence** to be entered to change their values. This is to prevent the operator from inadvertently changing the values. When prompted to “Enter technician sequence:” simply swipe the *Up* key four times to unlock the value for editing.

4.2 General Setup

After ensuring proper installation perform the following steps:

1. Apply power to the gas detector
2. Verify the detector has begun startup.

Note: Once the detector is on the data screen, you may notice high or low values out of the full-scale range. These values should quickly return to the zero gas value if no gas is present. No false alarms should be indicated at this time as the zero gas value will be transmitted by the detector during the user-defined warmup delay period (up to 5 minutes).

3. Using the magnetic interface, navigate the menus to ensure:
 - a) Alarm levels for Alarm 1, 2 and 3 are set to the desired value
 - b) Time and date are set correctly
 - c) Engineering units are set to the desired value
 - d) Calibration span gas value is set to the value of the calibration gas that will be used to perform initial calibration
 - e) Calibration marker is set to the desired value (this is the value the output will be held at during calibration and the calibration purge delay)
4. After sensor has stabilized, perform routine sensor calibration in accordance with [Chapter 5](#).

4.3 Normal Operation

During normal operation the sensor data is displayed on one of three data display screens as shown below. To cycle through the data display screens, use a magnet and swipe the *Next* key until the desired screen is reached.

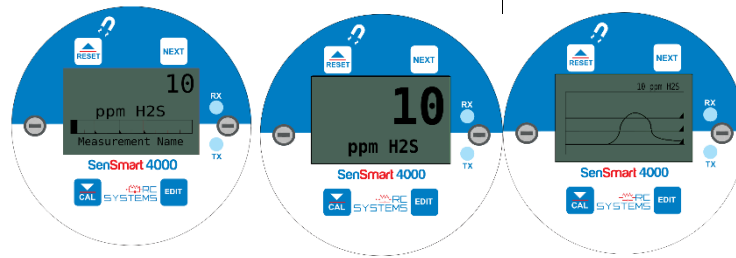


Figure 4 Universal Gas Detector Data Display Screens

4.4 Fault Condition

The Fault alarm is used to indicate a condition when there is a failure from the sensor or an out of range state has been reached. It is recommended to set the fault alarm level to -10% of the span value. For example if an H2S sensor is installed with a span value of 100, the fault should be set at -10, or if an oxygen sensor is installed with a span value of 25, the fault setting should be -2.5.

When a fault condition is reached, the fault condition will be indicated by the fault LED and “Fault” flashing on the display.

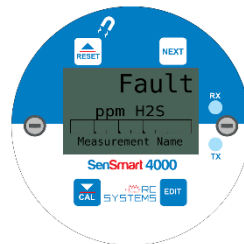


Figure 5 SenSmart 4000 Fault Screen

4.5 Alarm Conditions

Alarm levels are user configured.

When an alarm level is reached, the alarm condition will be indicated by the alarm LED and the alarm level flashing on the display. If Latching is turned on, the alarm will stay enabled until the user acknowledges the alarm, even if the alarm condition has cleared.

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.

- RC Systems recommends performing calibrations
 - ✓ Immediately prior to placing a gas detector in service
 - ✓ Any time a new sensor is installed
 - ✓ Every six 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. RC 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. RC Systems recommends once every six months, depending on use and sensor exposure to poisons and contaminants.
 - ✓ Calibrate only in a clean atmosphere, free of background gas.

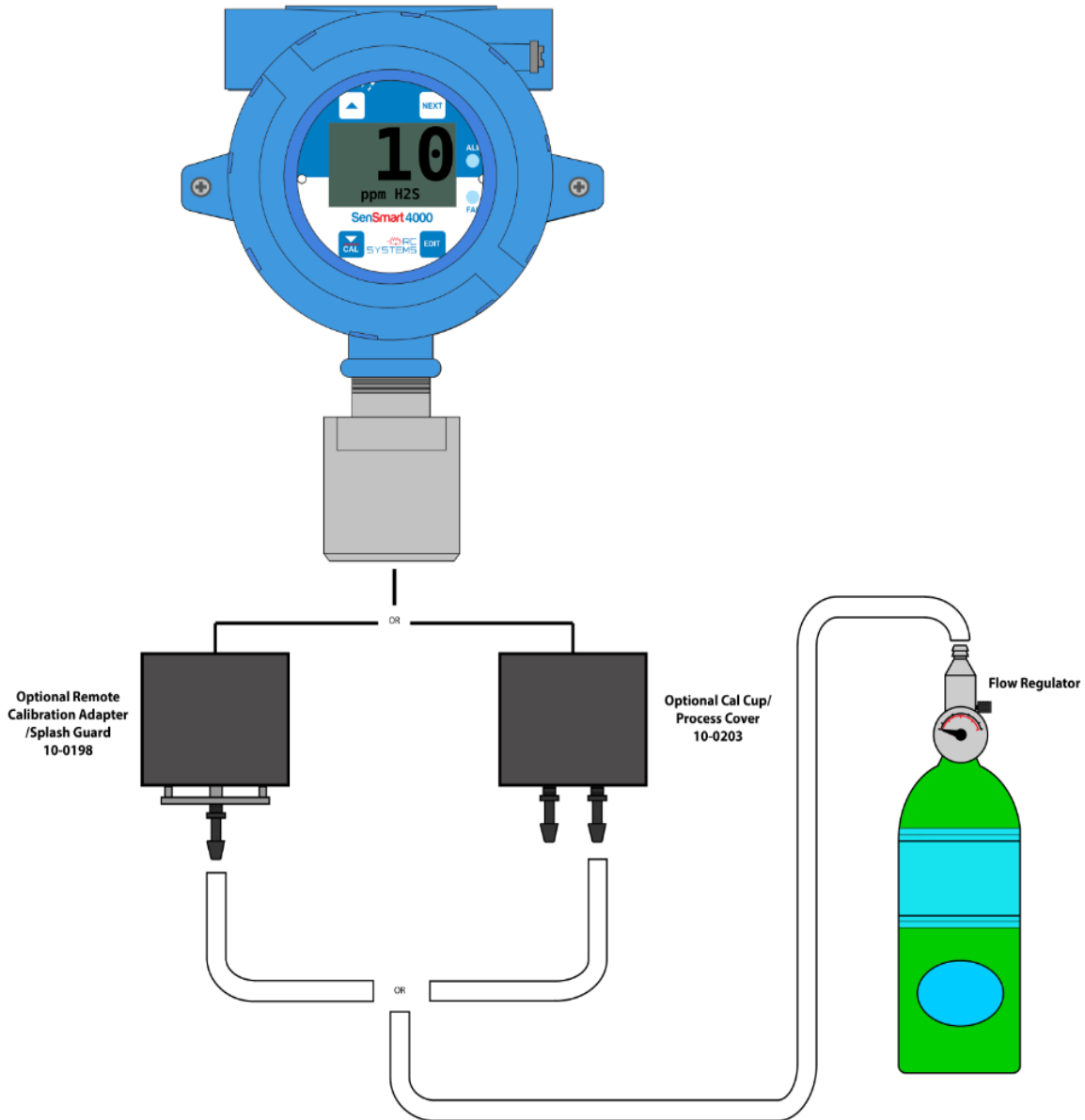


Figure 6 Calibration Diagram

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.

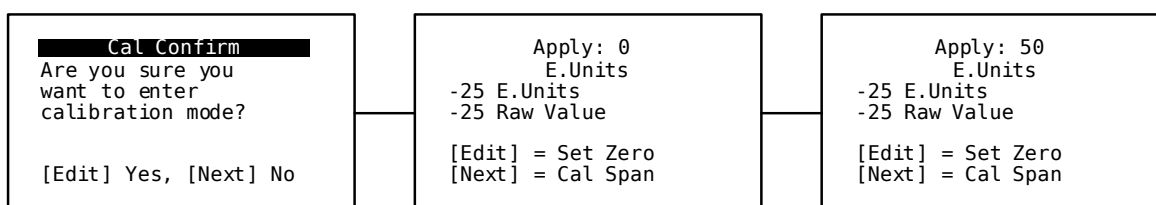


Figure 7 Calibration Menu Flowchart

1. Enter Calibration 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 9), using the Calibration Cup 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. Once a message that the Zero calibration was completed successfully has been displayed, proceed to the next step.
4. Apply the correct, as indicated, span gas (Figure 9). 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 is displayed, the gas detector will exit back to the Data Display Screen.
5. Remove the calibration 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, RC 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

RC Systems recommends performing calibrations at regular intervals to ensure proper functionality of the Universal Gas Detector. During routine calibration, RC 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.

RC 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 3.5](#).

Appendix 1 Gas Detector Specifications

SenSmart 4000		SenSmart 5000
CERTIFICATIONS		
CSA Certification	Class I, <u>Div</u> 1, Groups A, B, C, D; Class I, Zone 1, Group IIC, T4 Class I, <u>Div</u> 2, Groups A, B, C, D; Class I, Zone 2, Group IIC, T4	
ENVIRONMENTAL		
Operating Temperature	-40°C to +60°C	
SPECIFICATIONS		
Power Supply	Loop Powered 10-30VDC at <.75 watt	10-30 VDC at <6.5 watts with relay board (all relay energized)
Display	2.1" x 1.2" (53.9 x 31mm) and 64 x 128 pixel LCD w/ 30-min trend, bar graph and engineering units	
Backlight	N/A	RGB Color Backlight for Alarm Indication
Standard Output	2-wire 4-20mA 600Ω Max with nominal 24VDC power supply	3-wire 4-20mA current source 750Ω Max with nominal 24VDC power supply
Optional Outputs	N/A	RS-485 MODBUS master/slave ports 3x programmable Form C (SPDT) 5A @30VDC(240~VAC) Resistive alarm relays
SENSOR SPECIFICATIONS		
Sensor Type	Electrochemical toxic and oxygen Low Power Combustible & CO2 IR	Electrochemical toxic and oxygen Catalytic Bead Infrared Photoionization Analog 4-20mA current input
INSTALLATION		
Housing	Aluminum with epoxy paint #316 stainless steel, UL94 Poly Black Plastic Enclosure	
Wire Gauge	Screw type terminals (power and Modbus) 12AWG Spring type terminals 16AWG RS 485 cable recommendation = Belden 9841 (2-wire) Belden 9842 (4-wire) or equivalent	
Warranty	5 year limited warranty. For sensor warranty see sensor specifications sheet	
Dimensions	(Aluminum) W 5.4" (137 mm), H 8" (203 mm), D 5" (127 mm) Shipping weight 6.5 pounds (3 kg) (Stainless Steel) W 5.4" (137 mm), H 8" (203 mm), D 5" (127 mm) Shipping weight 9.5 pounds (4 kg) (Poly) W 5" (127 mm), H 7" (178 mm), D 4" (101 mm) Shipping weight 3 pounds (2 kg)	

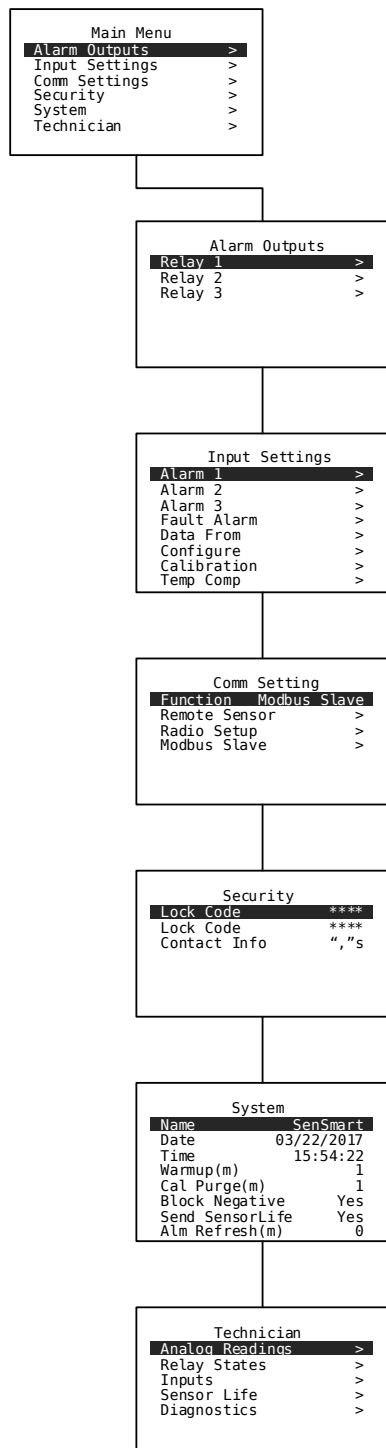
Figure 8 SenSmart 4000 and SenSmart 5000 Specifications Table

Appendix 2 Sensor Specifications

Target gas	Formula	Relative 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	100ppm
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%

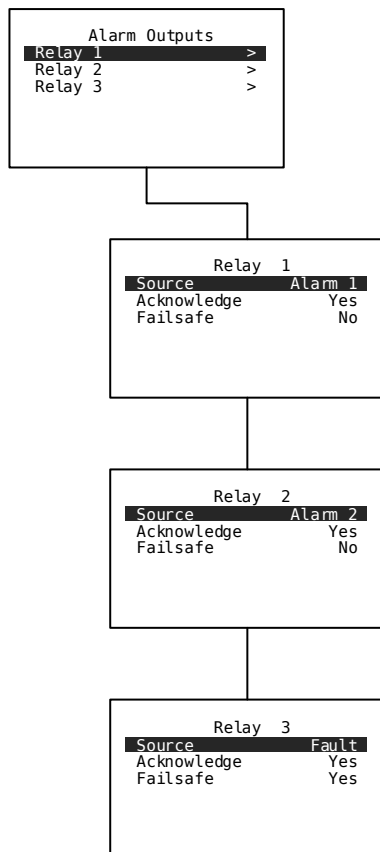
Appendix 3 Menu Navigation



Appendix 3 menus shown are for the Universal Series of Gas Detectors, some menus may not be visible on the SenSmart 4000

Main Menus

- **Alarm Outputs**
The Alarm Outputs Menu is accessed via the Main Menu, and is used to configure the mapping of the three programmable relays to the alarm setpoints, and relay configuration items such as Acknowledge, Failsafe and Override.
- **Input Settings**
The Input Settings Menu provides access to user configurable input parameters. This includes Alarm settings for all three alarms, access to the data from menus (where you can adjust sensor settings for various types of sensors including sensor voltage for bridge type sensors), input configuration settings including tag name, engineering units and inCal mA, calibration span value, and the Temperature compensation table.
- **Com Settings**
The Com Settings Menu provides access to the settings for the Modbus configuration, when installed.
- **Security**
Allows the user to enter a passcode to restrict access to some settings
- **System**
User adjustable items which effect the entire gas detector, and are not specific to either channel.
- **Technician**
The Technician Menu provides access to a variety of useful troubleshooting screens to view ADC reading, Discrete I/O, Current input, Sensor life and access to the diagnostics mode.



Alarm Output Menus

➤ Source

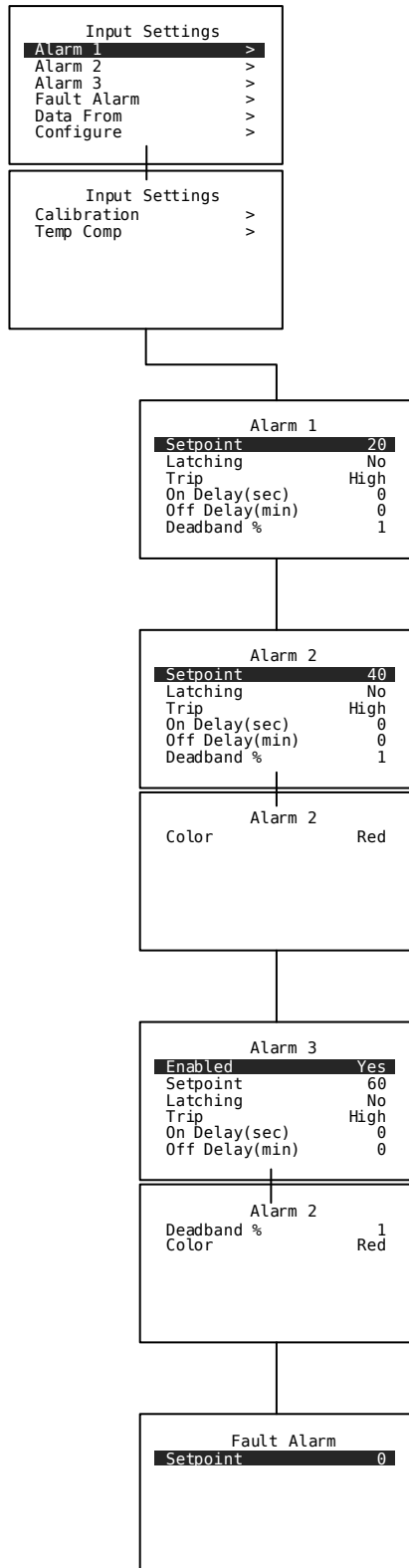
The Source setting can be set to Alarm 1, Alarm 2, Alarm 3 or Fault. This setting determines which condition must be met in order for the relay to actuate.

➤ Acknowledge

When set to Yes, Acknowledge means the *UP/RESET* key will set the relay to its normal state even if the alarm condition still exists. This can be useful for silencing audible devices driven from the relay.

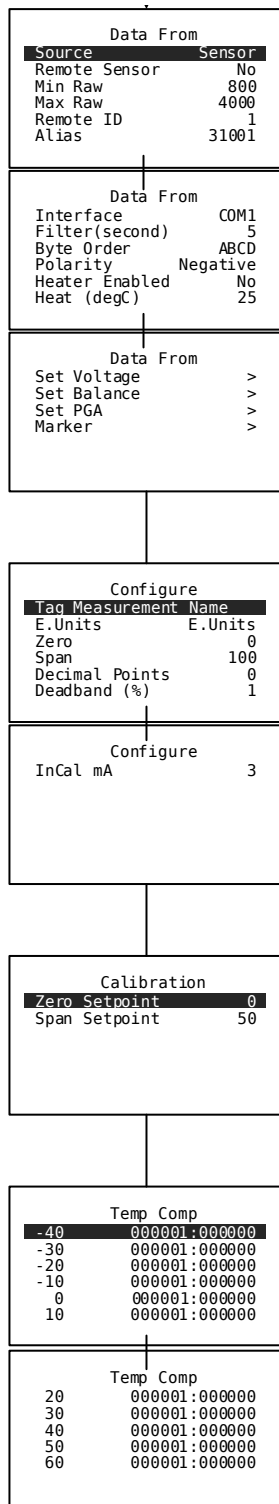
➤ Failsafe

When set to Yes, Failsafe means the relay de-energizes during alarm and energizes with no alarm. This is useful for signaling an alarm on a loss of power. The dedicated Fault relay is always Failsafe.



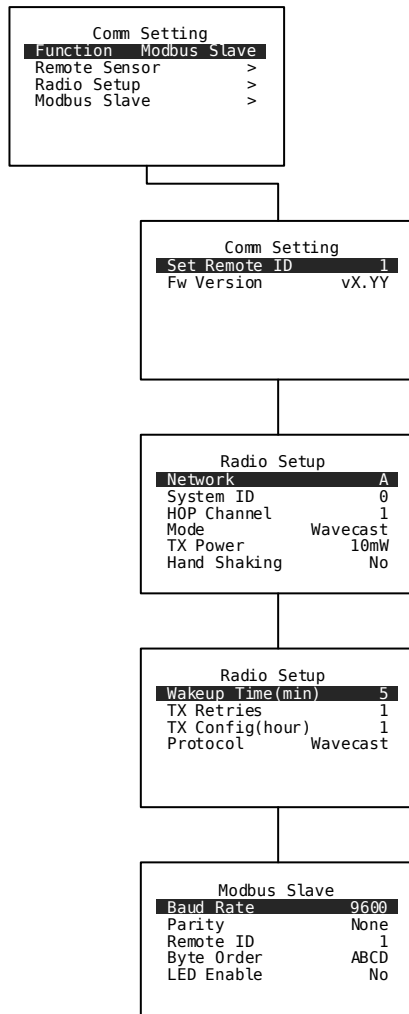
Input Settings Menu

- **Enabled (Alarm 3)**
Set to YES to enable Alarm 3 and NO to disable.
- **Setpoint (Alarm 1, 2, 3 and Fault)**
Setpoint enters the engineering unit value where the alarm will trip. It may be negative, and trip when monitored values fall out of range in this direction.
- **Latching (Alarm 1, 2, 3)**
Setting Latching to YES causes the alarm to remain active even after the condition is gone, and to reset only when the *UP/RESET* key is swiped from a data display.
- **Trip (Alarm 1, 2, 3)**
Set Trip to HIGH to have the alarm trip when the value goes above the setpoint. Set to LOW to trip when the value falls below the setpoint.
- **On Delay (sec) (Alarm 1, 2, 3)**
On Delay allows entering a maximum 10 second delay before this alarm becomes active. This is useful for preventing spurious alarms by brief spikes beyond the alarm setpoint.
- **Off Delay (min) (Alarm 1, 2, 3)**
Off Delay allows entering a maximum 120 minute delay before clearing an alarm after the alarm condition is gone. This is useful for continuing an alarm function, such as operation of an exhaust fan, for a period of time after the alarm condition clears.
- **Deadband % (Alarm 1, 2, 3)**
Deadband allows forcing low values to continue to read zero. This is useful when there are small amounts of background gases that cause fluctuating readouts above zero. The highest amount of Deadband allowed is 5%.
- **Color (Alarm 1, 2, 3)**
Selecting Color changes the color associated with the particular alarm. Options are Red, Blue, Purple and Orange.



Input Settings Menus (cont'd)

- **Data From (certain menu items only show up depending on the input type)**
 - **Source** determines the type of sensor installed in the detector. E.g. bridge, electrochemical, etc.
 - **Remote Sensor** set to Yes indicates that the sensor is installed remotely with Remote sensor option.
 - **Min and Max Raw** set the range of the input to the A/D converter. Normally set to 800/4000. Useful when the sensor's output doesn't provide a full range signal.
 - **Remote ID** is where the Modbus slave's ID number is entered
 - **Alias** is the register number which defines the location of the variable representing the input value of the Modbus data received through the communication ports
 - **Interface** assigns which communication port the Modbus slave is connected to and the detector will get its data from
 - **Filter (second)** sets the number of seconds over which samples are averaged
 - **Byte Order** determines WORD and BYTE alignment of data at the remote Modbus transmitter when sending 4 byte IEEE floating point values
 - **Polarity** determines the polarity of the sensor
 - **Heater Enabled** determines if the sensor heater is turned on or off
 - **Heat (degC)** is the thermostat setting of the sensor
 - **Set Voltage** set's the voltage being supplied to bridge type sensors
 - **Set Balance** adjusts the balance of a catalytic bead sensor, and must only be adjusted with ZERO gas on the sensor.
 - **Set PGA** is the adjustment that matches the input signal range to the detectors input signal conditioning circuits.
 - **Marker** used to detect special modes of operation from analog inputs, which some monitors use to indicate special modes of operation, such as calibration mode
- **Configure**
 - **Measurement Name** is a 16 character ASCII field typically used to describe the monitored point by user tag number or other familiar terminology.
 - **E. Units** or engineering units may have up to 10 ASCII characters, and is usually factory configured based on sensor type.
 - **Zero** defines the reading to be displayed when the output is 4mA (0%)
 - **Span** defines the reading to be displayed when 20mA (100%) is the output.
 - **Decimal Points** sets the resolution of the displayed reading, and may best to zero, one or two.
 - **Deadband (%)** allows forcing low values to continue to read zero. This is useful when there are small amounts of background gases that cause fluctuating readouts above zero. The highest amount of Deadband allowed is 5%. Note: Deadband affects all outputs as well as the local reading.
 - **InCal mA** determines the output when the channel is in Calibration mode. It may be set from 0 to 20mA. This signal may be used by the controller to determine that the unit is in calibration.
- **Calibration**
 - **Zero Setpoint** is set to the zero value.
 - **Span Setpoint** is set to the calibration gas value, typically 50% of full scale.
- **Temp Comp** allows the user to adjust the gain and offset that is applied to sensors to compensate for temperature drift. Factory supplied sensors are preprogrammed with these values which are automatically uploaded to the SenSmart 6000 from the Smart Sensor.



Comm Settings Menu

- **Function**
Determines the mode of operation for the communication port.
- **Remote Sensor**
 - **Set Remote ID** is where the Modbus slave's ID number is entered
 - **FW Version** displays the version of firmware that is programmed in the detector.
- **Radio Setup (Coming soon)**
- **Modbus Slave (when installed)**
 - **Baud Rate** allows users to set the data rate of the communication port. The options include 9600, 19200, 38400, 57600 and 115200.
 - **Parity** is a bit that is added to ensure that the number of bits with the value "1" in a set of bits is even or odd. Parity bits are used as the simplest form of error detecting within code. The default is None.
 - **Remote ID** is where the Modbus slave's ID number is entered
 - **Byte Order** determines WORD and BYTE alignment of data at the remote Modbus transmitter when sending 4 byte IEEE floating point values
 - **LED Enable** enables the RX and TX LEDs to flash green on valid transmit and receive transmissions. For ports configured as master, the RX LED will flash red if there is a Comm Error or if an exception is received. Slave ports will cause the RX LED to flash red under the same conditions, but can also cause the TX LED to flash red if an invalid function code is received or if the wrong register is given.

Appendix 4 Ordering Information

(To configure your custom gas detector visit www.rcsystemsco.com)

Part Number	Description	Reference
10-0517	SenSmart 4/5/8000 CPU Board	
10-0519	SenSmart 4000 and SenSmart 5000 Shield Board	
10-0535	SenSmart 4000 Current Out Board	<u>5</u>
Accessories		
10-0198	Sensor Head Splash Guard With Remote Cal Port	
10-0203	Sensor Head Calibration Adaptor	
10-0270	Stainless Steel Duct Mount	
10-0379	PVC Duct Mount	
1000-2498	Gas Detector Stand	
1000-2499	Transmitter Pole Mount Bracket 1.5"	
10-0322	Magnetic Mounting Kit for Aluminum Enclosure	
10-0480	Magnetic Mounting Kit for Poly Enclosure	

Appendix 5 Frequently Asked Questions

How do I perform a calibration?

- To perform a calibration, please refer to Chapter 5. RC Systems recommends performing calibrations
 - ✓ Immediately prior to placing a gas detector in service
 - ✓ Any time a new sensor is installed
 - ✓ Every six months for routine calibrations (more often if sensor may 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

Is there a Quick Start Guide available?

- Yes, visit www.rcsystemsco.com/downloads for a complete list of all of our product materials available for download.

My universal gas detector is responding to gas but the controller is in fault.

- Verify the analog signal wire is connected to the correct terminal at the monitor ([Chapter 3.3](#)).
- Verify the analog signal wire is connected to the correct terminal at the controller. For RC Systems controllers the HI terminal on the analog input board is where the signal wire connects.
- Verify monitor's 4-20 mA output by disconnecting the signal wire and measure across 4-20 output (+) and common (-) ([Chapter 3.3](#)).

My universal gas detector is reading NO SENSOR.

- Remove sensor head cover and verify the Smart Sensor module is fully engaged in the Smart Sensor connector.
- Verify the Smart Sensor connector is fully plugged into the Smart Sensor connection on the I/O board.

I can't loosen the XP enclosure cover.

- Make sure the set screw has been loosened.

My universal gas detector is failing calibration.

- Make sure the calibration gas is the proper concentration and gas type.
- Be sure to follow the [calibration procedure](#).

Appendix 6 Channel States

Priority	Channel State	Screen Color		Description
		SenSmart 5000 only		
1	MFG	Green		State when performing manufacturers checkout process
2	Diagnostic	White		Not visible since it is a menu item
3	Inhibit	Green		Used in PGA/Balance/Voltage screens
4	Corrupted	Red		Sensor Memory is corrupted
5	Sensor Error	Red		Sensor is found/valid, but failed to read information from the sensor
6	Type Error	Red		Sensor mismatch, and user failed to accept the sensor
7	No Sensor	Red		Sensor is not found
8	Cal Needed	Red		A calibration of the sensor is required
9	Comm Error	Red		Indicates timeout or invalid reply from Modbus or wireless device
10	I/O Error	Red		Indicates a failure to communicate between I/O board electronics
11	Config Error	Red		Indicates interface for Modbus/wireless is configured for something else
12	Warmup	Green		Indicates the detector is in the user defined warmup time period
13	Overrange	Current Alarm Color		Indicates the sensor is reading over the maximum allowable range
14	Cal Zero	Pink		Indicates calibration mode
15	Cal Span	Pink		Indicates calibration mode
16	Cal Purge	Pink		Indicates the detector is in the user defined cal purge time period
17	Fault	Red		Indicates a fault condition exists
18	Alarm 3	User Programmed		Indicates the Alarm 3 condition exists
19	Alarm 2	User Programmed		Indicates the Alarm 2 condition exists
20	Alarm 1	Yellow		Indicates the Alarm 1 condition exists