



# SAFESITE® Sentry™ 24/7 Continuous Chemical Agent Detector

## Instruction Manual

### WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, this instrument will perform as designed only if it is used and serviced in accordance with the manufacturer's instructions. OTHERWISE, IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

In North America, to contact your nearest stocking location, dial toll-free 1-800-MSA-INST  
To contact MSA International, dial 1-412-967-3354

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Manufactured by

## MSA NORTH AMERICA

P.O. Box 427, Pittsburgh, Pennsylvania 15230

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## MSA Instrument Warranty

1. **Warranty-** Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of one (1) year, provided it is maintained and used in accordance with Seller's instructions and/ or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the goods sold under this contract. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but will pass onto the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**
2. **Exclusive Remedy-** It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/ or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/ or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any nonconforming product shall not cause the remedy established hereby to fail of its essential purpose.
3. **Exclusion of Consequential Damage-** Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of non-operation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.

## General Warnings

### WARNING

1. The SAFESITE Sentry Detector has not been tested for intrinsic safety and must not be used in environments having explosive atmospheres.
2. If a SAFESITE Sentry Detector has been exposed to concentrations of CW agents, it is possible that some instrument components will be contaminated with CW agent and could present an exposure hazard. Properly decontaminate the unit after exposure to CWA agents to remove trace contamination prior to servicing the instrument. Consult a professional to determine the proper procedures and precautions necessary.
3. The SAFESITE Sentry Detector described in this manual must be installed, operated and maintained in strict accordance with their labels, cautions, warnings, instructions, and within the limitations stated.
4. Electrochemical sensors are sealed units which contain a corrosive electrolyte. Should a sensor develop leakage, it must be immediately removed from service; then, remove the sensor from the sensing head and discard it properly. Caution must be exercised so that the electrolyte does not contact skin, eyes, clothing or circuitry; otherwise, serious personal injury (burns) and/or equipment damage may result.
5. Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair instrument performance. Repair or alteration of the SAFESITE Sentry Detector, beyond the scope of these maintenance instructions or by anyone other than an authorized MSA service personnel, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain serious personal injury or death.
6. The SAFESITE Sentry Detector is a gas detection instrument. The inlet cap must be removed for the instrument to function properly.

7. Liquids sucked into the inlet will damage the instrument and may inhibit gas detection.
8. The SAFESITE Sentry Detector has been carefully designed to minimize the likelihood of false alarms caused by chemical vapor interferences normally found in the environment. The probability of a false alarm increases with the quantity of potentially interfering vapors in the air.  
  
Develop and follow site-specific, standard operating procedures for responding to alarm conditions. These procedures should include steps to protect the site and to confirm the hazard.
9. The SAFESITE Sentry Detector is a very sensitive instrument. Exposing it to very high concentrations of chemical vapors (e.g., close to a "puddle" of liquid) may overload the sensor causing an alarm condition and will require at least a 15-minute "clear-down" time in clean air to eliminate the vapor from the instrument.
10. The only absolute method to ensure proper overall operation of a SAFESITE Sentry Detector is to check it with a known concentration of the gas for which it has been calibrated. Consequently, calibration checks and bump checks must be included as part of the routine inspection of the system.  
  
Failure to follow the above can result in injury, product damage, and/or death.

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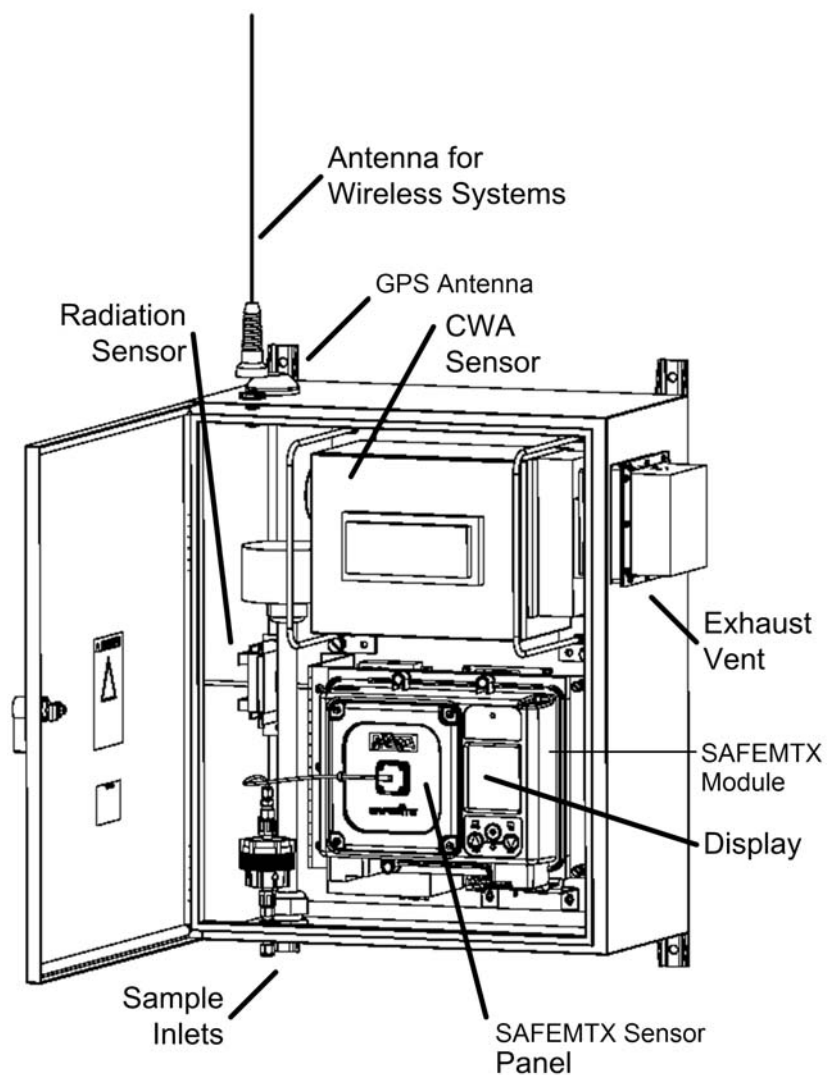
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## Chapter 1, General Information



**Figure 1-1. SAFESITE Sentry Chemical Agent Detector**

- The SAFESITE Sentry Continuous Chemical Agent Detector:
  - is a versatile instrument that detects trace levels of:
    - CW (Chemical Warfare) agent and
    - TICs (Toxic Industrial Chemicals)
    - Radiation
  - is designed for continuous (24/7) operation
  - CWA Sensor performs a sample analysis every 30 seconds
  - communicates critical information to the Command Center (referred to as SAFECOM) through either a wireless or wired communication network.

## **Radio Information**

The wireless version of the SAFESITE Sentry Detector:

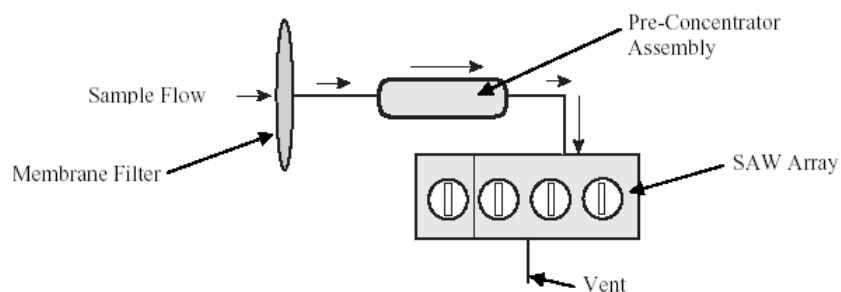
- contains transmitter modules FCC ID: KNY-6231812519
- complies with Part 15 of the FCC rules.

## **Principle of Operation**

- The SAFESITE Sentry CWA (Chemical Warfare Agent) Detector:
  - uses a SAW (Surface Acoustic Wave) microsensor array for the detection of nerve and blister agents (see TABLE 1-1 for the list of agents detected and threshold levels)
  - uses a high velocity fan to transport the sample to the instrument
  - sampling system collects a representative sample by delivering a large amount of air into the Detector
    - This air stream is then sampled by the Detector's internal sensor module
  - can be equipped with SAFEMTX sensors for combustible, toxic, VOC (Volatile Organic Compounds) and oxygen gases
  - is easily adapted to building control and security monitoring software systems.

## SAW Sensor Detector Operation

- SAW chemical sensors are:
  - small, solid state devices
  - extremely sensitive to minute changes in mass
  - coated with different polymers that:
    - act as a sponge to selectively absorb air contaminants
    - respond rapidly and reversibly to air contaminants.
- The SAFESITE Sentry Detector uses an array of three coated SAW sensors.
- The SAW polymers are selected to provide a response pattern or fingerprint unique to the chemicals or chemical class of interest.
- Using a SAW array:
  - provides for excellent chemical discrimination
  - allows the SAFESITE Sentry Detector to:
    - be highly specific for the chemical agents of interest
    - reject other common environmental chemicals that could cause false positive alarms often associated with other monitoring technologies.



**Figure 1-2. SAW Sensor Array Configuration**

## System Components

- The first of three major components is the stainless steel case, which contains the following sub-components:
  - Inlet Baffle Filter
  - Power Supply
  - Data Output Ports
  - Vent Fan
  - Sample Exhaust.
- A second major component is the CWA sensor engine assembly (a gray metal box located inside the exterior case) that contains the following sub components:
  - Sensor Module Filter
  - Two or four Sample Pumps
  - Vapor Diffusion Check Source
  - Thermoelectric Cooler
  - SAW Sensor Array.
- A third major component is the MSA SAFEMTX Module that contains the following:
  - Enclosure holding up to four electrochemical toxic, combustible gas, VOC or oxygen sensors
  - LCD display
  - Keypad
  - Interface to the Command Center.
- Optional components include:
  - Radiation Sensor
  - GPS Module

## Choosing a Location for the SAFESITE Sentry Multi-Threat Detector

The unit should be mounted as close as possible to the area of interest or where gas presence is expected.

### WARNING

Do not locate the SAFESITE Sentry Detector in an area which may contain a flammable mixture of gas and air; otherwise, an explosion may occur. Locate it only in a non-hazardous area in accordance with all applicable codes.

Do not paint the SAFESITE Sentry Detector. If painting in an area where a sensor is located, exercise CAUTION to ensure paint is not deposited on the sensor inlet fitting. Such paint deposits would interfere with the pump process, where-by a sample of the monitored atmosphere diffuses into the sensor.

Failure to follow the above can result in serious personal injury or death.

### CAUTION

Protect the SAFESITE Sentry Detector from extreme vibration. Do not mount the SAFESITE Sentry in direct sunlight or near a heat source as this may cause the sensors to over-heat.

- For wireless systems, the SAFESITE Sentry location must first be surveyed to ensure acceptable radio link quality and reliable communication to the SAFECOM.
- Wired systems have communications line limitation of 3000 feet.
- See SAFECOM Command Center Instruction Manual (P/N 10057028) for important guidelines in performing the site survey and establishing optimal radio communication.
- A 90-240 VAC power source must be available at the SAFESITE Sentry location.
- Connect the SAFESITE Sentry power supply to the AC outlet.

**Table 1-1. System Specifications**

<b>WEIGHT</b>	75 pounds (34 Kg)
<b>SAFESITE SENTRY EXTERIOR CASE DIMENSIONS</b>	24 x 20 x 10 " (61 x 51 x 25 cm)
<b>POWER SUPPLY</b>	90-240 volt, 50/60 Hz (60 watts)
<b>HEIGHT OF ANTENNA ABOVE CASE</b>	36 inches (91 cm)

**PERFORMANCE SPECIFICATIONS FOR CWA SENSOR**

<b>CWA SENSOR TECHNOLOGY</b>	Surface Acoustic Wave Microsensor Array
<b>ANALYSIS TIME</b>	30-second analysis cycle
<b>SENSOR WARM UP TIME</b>	Less than five minutes at 25°C
<b>CWA DETECTION THRESHOLDS</b>	<b>NERVE AGENTS (G)</b> Detects at the ECt50 level for severe effect
	Nerve Agents (G)
	GA (Tabun) $\geq 0.5 \text{ mg/m}^3$
	GB (Sarin) $\geq 0.7 \text{ mg/m}^3$
	GD (Soman) $\geq 0.5 \text{ mg/m}^3$
	GF (Cyclosarin) $\geq 0.5 \text{ mg/m}^3$
	<b>BLISTER AGENTS (H)</b> Detects at the ECt50 level for severe effect
	Blister Agents (H)
	HD (Mustard) $\geq 2 \text{ mg/m}^3$
	HN-3 (Nitrogen Mustard) $\geq 2 \text{ mg/m}^3$
<b>OPERATING TEMPERATURE RANGE</b>	0° to 40°C (32° to 104°F)
<b>EXTENDED OPERATING TEMPERATURE RANGE*</b>	-20° to 45°C (-4° to 113°F)
<b>OPERATING HUMIDITY</b>	0 to 95% non-condensing; dew point not to exceed 32°C

**PERFORMANCE SPECIFICATIONS FOR OTHER SENSORS**

<b>GAS TYPES AND DETECTORS</b>	Combustibles, Oxygen, Toxics, Radiation, CWA
<b>OPERATING TEMPERATURE RANGE</b>	0 to 40°C (32 to +104°F); Calibrate within operating range
<b>EXTENDED TEMPERATURE RANGE *</b>	-20 to +50°C (-4 to +122°F)
<b>EXTENDED RANGE PID</b>	-20 to +40°C (-4 to +104°F)



<b>EXTENDED RANGE</b> <b>NH<sub>3</sub>, CL<sub>2</sub>, CLO<sub>2</sub></b>		-10 to +40°C (14 to 104°F)
<b>DRIFT</b>	<b>ZERO DRIFT</b>	Less than 5%/year, typically
	<b>SPAN DRIFT</b>	Less than 10%/year, typically
<b>NOISE</b>		Less than 1% FS

<b>ACCURACY**</b>	<b>GAS</b>	<b>LINEARITY</b>	<b>REPEATABILITY</b>
	CARBON MONOXIDE	the greater of +2 % full scale (FS)	+1% FS or 2 ppm
	OXYGEN	+2% FS	+1% FS
	HYDROGEN SULFIDE	+10% FS or 2 ppm	+1% FS or 2 ppm
	CHLORINE	+10% FS or 2 ppm	+5% FS or 1 ppm
	SULFUR DIOXIDE	+10% FS or 2 ppm	+1% FS or 2 ppm
	NITRIC OXIDE	+10% FS or 2 ppm	+1% FS or 2 ppm
	NITROGEN DIOXIDE	+10% FS or 2 ppm	+4% FS or 1 ppm
	HYDROGEN CYANIDE	+10% FS or 2 ppm	+4% FS or 2 ppm
	HYDROGEN CHLORIDE	+10% FS or 2 ppm	+10% FS or 2 ppm
	CATALYTIC COMBUSTIBLE GAS	<50% LEL +3% FS >50% LEL +5% FS	+1% FS
	CHLORINE DIOXIDE	+10% FS or 2 ppm	+5% FS or 1 ppm
	ETHYLENE OXIDE	+10% FS	+5% FS
	AMMONIA	+10% FS	+5% FS
	HYDROGEN	+5% FS	+5% FS
	PHOSPHINE	+10% FS	+10% FS
	ARSINE	+10% FS	+10% FS
	GERMANE	+10% FS or 0.5 ppm	+10% FS
	SILANE	+10% FS or 2 ppm	+1% FS or 2 ppm
	DIBORANE	+10% FS or 2 ppm	+1% FS or 2 ppm
	FLUORINE	+10% FS or 2 ppm	+5% FS or 1 ppm
	BROMINE	+10% FS or 2 ppm	+5% FS or 1 ppm

\*Extended Range = The sensor may not meet all of the accuracy parameters listed.

\*\*Typical performance

<b>STEP CHANGE RESPONSE</b>	<b>TIME TO REACH 20% OF SCALE-OXYGEN &amp; TOXICS</b>	Less than 12 seconds (typically 6 seconds) Less than 20 seconds (ETO)
	<b>TIME TO REACH 50% OF SCALE-OXYGEN &amp; TOXICS</b>	Less than 90 seconds (NH <sub>3</sub> ) Less than 30 seconds (typically 12 seconds) Less than 45 seconds (ETO)
	<b>TIME TO REACH 50% OF SCALE-COMBUSTIBLES</b>	Less than 10 seconds
	<b>TIME TO REACH 90% OF SCALE-COMBUSTIBLES</b>	Less than 30 seconds
<b>CWA TIME TO ALARM</b>		Less than 90 seconds
<b>RADIATION TIME TO ALARM</b>		Less than 30 seconds
<b>HUMIDITY</b>		15 to 95% RH, non-condensing, 24 hours or less 35 to 95% RH, long term
<b>SENSOR LIFE</b>	<b>CATALYTIC COMBUSTIBLES</b>	3 years, typically
	<b>OXYGEN &amp; TOXICS</b>	2 years, typically
	<b>RADIATION SENSOR</b>	Greater than 2 years, typically
	<b>CWA SENSOR</b>	1 year, typically

**Table 1-2. Cross-Sensitivity Data**

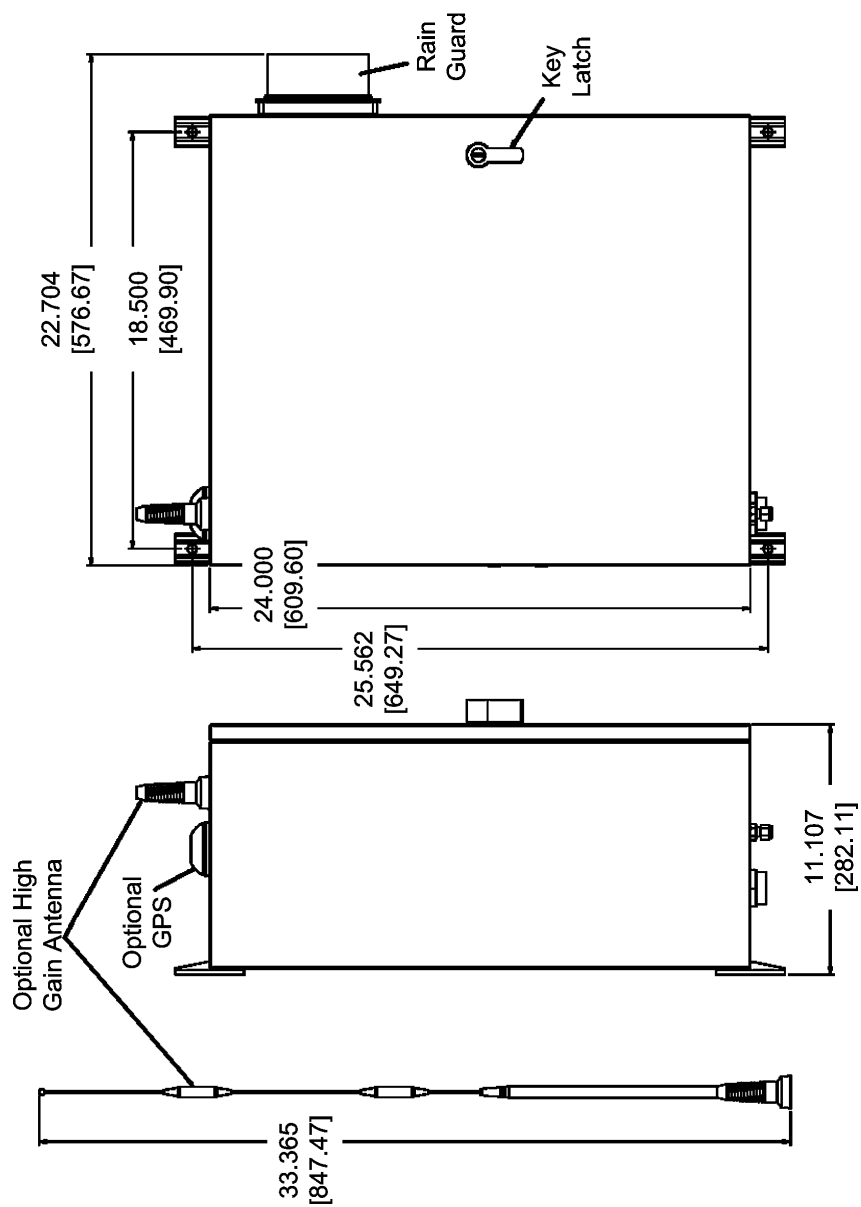
If your readings are higher or lower than expected, it could be due to the presence of an interferant gas. The gas listed in column 1 is presented to the sensor. Column 2 indicates the concentration of that gas presented to the sensor. The remaining columns indicate the respective responses by the sensors to each particular gas.

For Example: Scan column 1 until you locate "hydrogen". Column 2 shows that 500 ppm of hydrogen was presented to the sensor. Column 3 shows that a CO (filtered) sensor gave an equivalent response of 200 ppm. Column 4 shows that an H<sub>2</sub>S sensor gave an equivalent response of 0.5 ppm, etc.

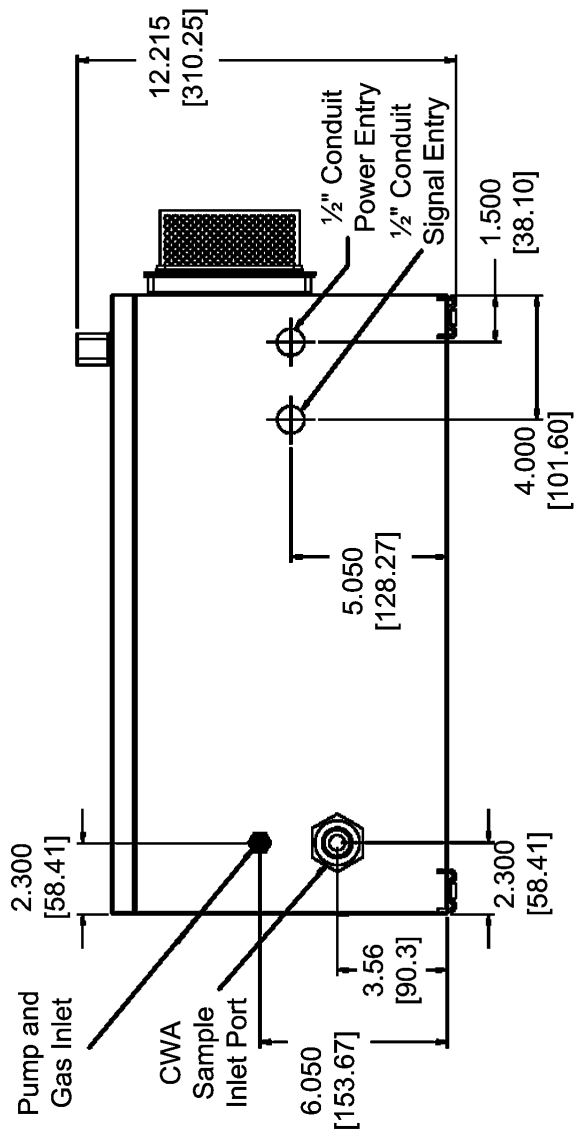
INTER-FERANT	CONCENTRATION (PPM)	CO*	H <sub>2</sub> S	CL <sub>2</sub>	SO <sub>2</sub> *	NO	NO <sub>2</sub>	HCN	HCL
* = Filtered									
ND = No Data									
Acetone	1000	0	0	0	0	ND	0	ND	ND
Acetylene	12000	0	0	0	0	ND	ND	ND	ND
Ammonia	25	0	0	0	0	ND	0	0	0
Arsine	1	0	0	0	0	0	ND	ND	1
Benzene	20	0	0	0	0	ND	ND	0	ND
Bromine	2	0	0	2.5	ND	0	0	0	ND
Carbon Dioxide	5000	0	0	0	0	0	0	0	
Carbon Disulfide	15	0	0	0	0	0	ND	0.1	0
Carbon Monoxide	100	100	0.3	0	0.2	ND	0	0	0
Chlorine	5	0	-3	5	0	0	0	-0.2	0
Diborane	20	0	0	0	0	ND	ND	ND	0
Ethylene	50	100	0.1	0	0	ND	0	-0.3	ND
Ethyl Alcohol	100	115	0	0	0	ND	ND	0	ND
Ethylene Oxide	10	ND	ND	ND	0	ND	ND	ND	ND
Ether	400	3	0	0	0	ND	0	ND	ND
Fluorine	5	0	0	2.5	0	0	ND	0	0
Freon 12	1000	0	0	0	0	0	0	0	0
Germane	1	0	0	0	0	0	ND	ND	1
Hexane	500	0	0	0	0	ND	0	0	ND
Hydrogen	500	200	0.5	0	15	ND	-10	0	0
Hydrogen Chloride	50	0	0	0	0	4	0	ND	50
Hydrogen Cyanide	10	0	0	0	0	0	0	10	0

INTER-FERANT	CONCEN-TRA-TION (PPM)	CO*	H <sub>2</sub> S	CL <sub>2</sub>	SO <sub>2</sub> *	NO	NO <sub>2</sub>	HCN	HCL
* = Filtered									
ND = No Data									
Hydrogen Fluoride	10	0	0	0	0	ND	ND	ND	ND
Hydrogen Sulfide	10	1	10	-0.1	0	1	-8	50	40
MEK	200	0	0	0	0	0	0	ND	ND
Mercaptan (Methyl)	5	0	4.5	-0.1	0	1	ND	6	ND
Methane	50000	0	0	0	0	0	0	0	0
Nitric Oxide	100	0	2	0	2	100	ND	-3	40
Nitrogen Dioxide	5	-1	-4	0.5	-5	1.5	5	ND	0
Phosphine	0.5	ND	0	0	ND	0	ND	ND	2
Silane	5	0	0	0	0	0	ND	ND	7
Sulfur Dioxide	10	0	0.3	0	10	0.5	ND	-0.3	0
Tichloro-ethylene	1000	0	0	0	0	0	ND	ND	ND
Acetone	1000	0	ND	ND	ND	ND	ND	ND	0
Acetylene	12000	0	ND	ND	ND	ND	ND	ND	0
Ammonia	25	0	0	ND	ND	ND	ND	ND	0
Arsine	1	0	ND	0.7	1	1	1	5	0
Benzene	20	0	ND	ND	ND	ND	ND	ND	0
Bromine Dioxide	2 5000	1 0	ND ND	ND ND	ND ND	ND ND	ND ND	ND ND	2 0
Carbon Disulfide	15	0	ND	0	0	0	0	0	0
Carbon Monoxide	100	0	ND	0	1	0	0	0	0
Chlorine	5	2.5	5	ND	ND	ND	ND	ND	4
Diborane	20	0	ND	3.5	5	4	5	20	0
Ethylene	50	0	ND	0.5	1	1	1	2	0
Ethyl Alcohol	100	0	ND	ND	ND	ND	ND	ND	0
Ethylene Oxide	10	0	ND	ND	ND	ND	ND	ND	ND
Ether	400	0	ND	ND	ND	ND	ND	ND	0
Fluorine	5	1	ND	ND	ND	ND	ND	ND	2
Freon 12	1000	0	0	0	0	0	0	0	0
Germane	1	0	ND	0.7	1	1	1	5	0
Hexane	500	0	ND	ND	ND	ND	ND	ND	0
Hydrogen	500	0	ND	0	0	0	0	0	0
Hydrogen Chloride	50	0	30	ND	ND	ND	ND	ND	0

INTER-FERANT	CONCEN-TRA-TION (PPM)	CO*	H <sub>2</sub> S	CL <sub>2</sub>	SO <sub>2</sub> *	NO	NO <sub>2</sub>	HCN	HCL
* = Filtered									
ND = No Data									
Hydrogen Cyanide	10	0	0	ND	ND	ND	ND	ND	0
Hydrogen Fluoride	10	0	ND	ND	ND	ND	ND	ND	0
Hydrogen Sulfide	10	0	0	ND	ND	ND	ND	ND	0
MEK	200	0	ND	ND	ND	ND	ND	ND	0
Mercaptan (Methyl)	5	0	ND	ND	ND	ND	ND	ND	0
Methane	5000	0	ND	ND	ND	ND	ND	ND	0
Nitric Oxide	100	0	2	ND	ND	ND	ND	ND	0
Nitrogen Dioxide	5	0.2	2.5	ND	ND	ND	0.5	ND	0.4
Phosphine	0.5	0	ND	0.5	1	0.7	1	3	0
Silane	5	0	ND	0.1	0.2	5	0.2	15	0
Sulfur Dioxide	10	0	2.7	0.5	1	2	3	6	0
Tichloro-ethylene	1000	0	ND	ND	ND	ND	ND	ND	0



**Figure 1-3. SAFESITE Sentry Detector Dimensions  
(part 1 of 2)**



**Figure 1-3. SAFESITE Sentry Detector Dimensions  
(part 2 of 2)**

## Chapter 2, Installation and Setup

### Shipping Configuration

- Upon receipt:
  - inspect the shipping containers for physical damage or watermarks
  - if damage is detected, contact the shipping company immediately to file a shipping claim
  - **open the packages carefully**, remove the contents, and perform a visual inspection
  - retain all package materials until the installation of the SAFESITE Sentry Detector is completed.

### Installation Requirements

- The SAFESITE Sentry Detector:
  - samples external air and is not watertight
  - is designed to be water and weather resistant
  - must be installed in a location that protects it from:
    - direct sunlight
    - severe water hazards, such as immersion and flooding
    - excessive routine chemical vapor exposures and
    - temperature extremes
  - is rated for operation at:
    - external temperatures of -20° to 50°C and
    - relative humidity between 0% and 95%, non-condensing.
  - is configured in a stainless steel enclosure for a wall-mount installation
  - can also be mounted on a horizontal surface if the inlet and air vent are ported downward to prevent rain ingress
  - weighs 75 pounds (34 Kg)
    - It is very important that the wall or structure supporting the SAFESITE Sentry Detector is able to support at least 75 pounds



- should be located in an area visible and accessible to the equipment operators
- mounting area should provide 12" of clearance on all sides of the unit, providing room to fully open the external case door for access to the:
  - power switch
  - interface cabling and
  - replaceable inlet filter/baffle.
- For wireless communications networks, allow 36 inches above the unit for the antenna.

## System Power

**Table 2-1. System Power Requirements**

<b>LINE VOLTAGE</b>	90 to 240 Volts AC at 47 to 400 Hz
<b>LINE CURRENT</b>	2 AMP circuit

- The SAFESITE Sentry Detector uses a switching power supply configured to accept either 110 or 220 Volt line supplies.
- It is recommended that a dedicated power circuit be provided for the Detector.
- Often, it is advisable to condition the power source via UPS or battery-backed UPS.
  - Using a battery-backed UPS:
    - provides the additional advantage of emergency power
    - avoids the possibility of short power interruptions.
- The power cord is a grounded IEC type 239.
  - The IEC end plugs directly into the power entry receptacle located on the bottom of the Detector.
  - The pronged end is then plugged into a power outlet.

### **⚠ WARNING**

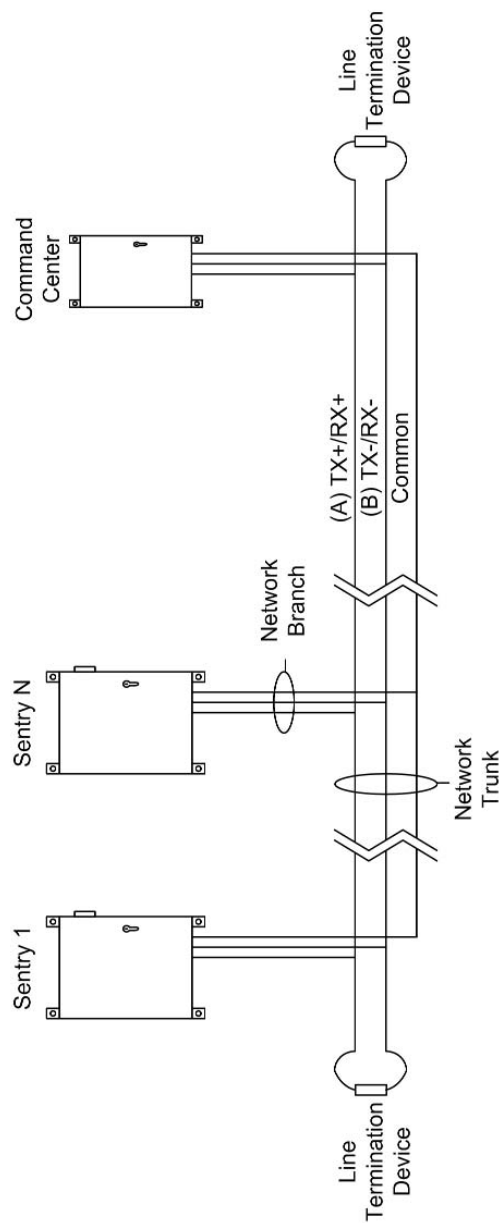
**Before plugging the power cord into the power mains, make sure the SAFESITE Sentry Detector power switch is in the OFF position.**

The wired SAFESITE Sentry system:

- uses ModBus protocol
- runs on RS-485 hardware network
- is limited to up to 16 SAFESITE Sentry devices for each network.
  - Each device must have a unique ModBus address.
  - The address may be set on the SAFEMTX display.

## **RS485 Communications**

- Three-wire cable, 22 AWG is labeled:
  - A = Transmit + / Receive +
  - B = Transmit - / Receive -
  - C = Common.
- Typical Communications Wiring Scheme is shown in FIGURE 2-1.
- Maximum RS-485 communications cable length is:
  - Trunk: 3000 feet
  - Branch: 60 feet.
- Use the termination devices to match communication line characteristics (typically 120 Ohms).



**Figure 2-1. Communications Wiring Scheme**

## Chapter 3, System Operation

### Turning ON the Detector

- The SAFESITE Sentry Detector uses a switching power supply configured to accept 110 volt or 220 volt line supply.
  - The power can be routed through an IEC type 236 power cord or conduit, depending on the instrument configuration.

#### **⚠ WARNING**

**The power switch must be in the OFF position when connecting AC power to the Detector.**

**Make sure the Detector is properly grounded by observing all electrical codes required by this installation. The Detector is supplied with an ISC 239 grounded plug for that purpose.**

**For 110 volt installations, a 2 amp fuse is required.  
For 220 volt installations a 1 amp fuse is required.**

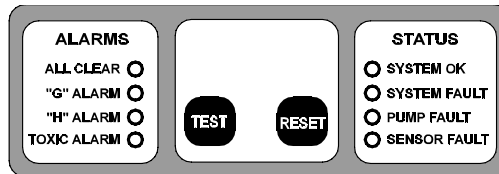
**These fuses are located directly above the power switch in either configuration.**

**Failure to follow this warning can result in personal injury or death.**

- It is advisable to condition the power source, if possible.
- Using an external Universal Power supply (UPS) provides the advantage of emergency power and avoids the possibility of short power interruptions or small line voltage variations.

### Start-up Test Sequence

- To confirm proper instrument function, it is recommended that the lid to the external case be left open to monitor the initial self-diagnostics.
- Activate the power switch on the power entry panel.
- At initial power-up:
  - the sample transport fan activates
  - all LEDs on the Sensor Module front-panel display activate simultaneously and then sequentially turn OFF
  - the SYSTEM OK LED begins flashing
  - after about 60 seconds, the "ALL CLEAR" green LED turns ON
  - the Detector begins operation and performs a system self diagnostics.



**Figure 3-1. CWA Sensor Module Display Panel**

## **Sample Flow Path - SAFEMTX™ Module**

- The SAFESITE Sentry Detector:
  - uses a separate pump and sample system for the SAFEMTX module
  - draws a gas sample from the monitored area (outside of the enclosure - see FIGURE 3-3), through a separate sample line and inline filter to the SAFEMTX Multi-Threat Detector sensors
    - additional sample line tubing may be used to sample areas that are remote, inaccessible, too hot or too cold for direct sensor monitoring, such as ducts carrying combustible or toxic gas

### **⚠ WARNING**

**Use sample line materials that are compatible with the target gases and the environment. Failure to do so may inhibit gas detection and lead to lower than actual sensor readings.**

- has electronics located in the main monitor enclosure
- notifies user of a detected flow fault via the SAFEMTX Multi-Threat Detector LCD display and Alert LED light.

## **Sample Flow Path - CWA Module**

- The SAFESITE Sentry Detector uses a high velocity fan (located on the upper right hand side of the exterior case) to transport the sample to the instrument.
  - The gas or vapors pass through the inlet filter to remove large particles.
  - The gases are then drawn in through the sensor module filter to remove finer dust and particulates.
  - The sample is then:
    - drawn into the concentrator
    - heated
    - passed into the SAW sensor array and
    - exhausted by the sampling pump.

- The filters described above are shown in FIGURE 3-2.

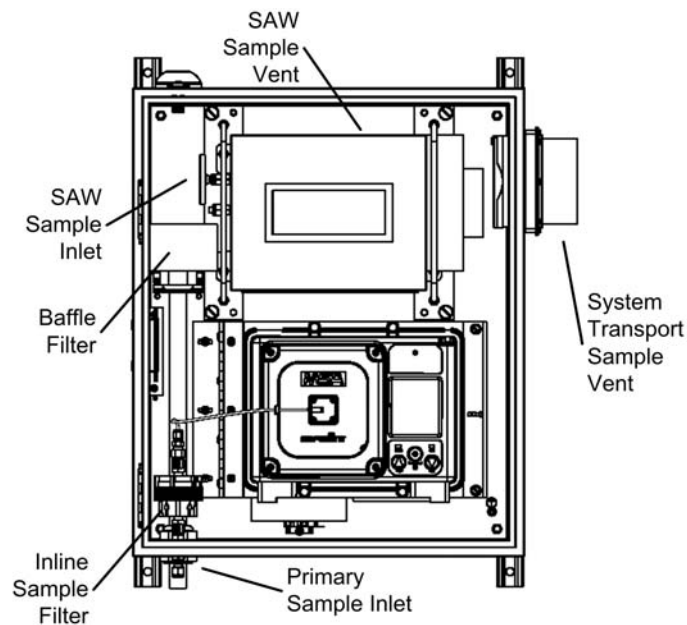


**Figure 3-2. Baffle Filter and Teflon Filter**

- The air is vented from the sensor engine and exhausted by the fan to the exterior of the case.
- The Sample Exhaust Assembly is designed to prevent the entry of water or cleaning fluids into the instrument.
- The air flow from the fan also removes heat from the Detector.

**⚠ CAUTION**

Blocking vent fan exhaust airflow may damage the instrument due to overheating.



**Figure 3-3. Sampling System**

## Remote Location Sampling

- The nominal air flow into the sample inlet is about 20 liters per minute.
- The SAFESITE Sentry Detector can be configured to allow a pipe run of up to 20 feet of 3/4" OD CPVC.
  - It is recommended that the shortest possible length of sample tubing be used.
- As a general rule, if a branched sampling configuration is desired, the branches should be of equal length to maintain equal flow rates at each entry point.

### **⚠ WARNING**

**Do not exceed sample line length recommendations; otherwise, this will increase the response time for agent detection.**

## CWA Sensor Bump Check Using Vapor Simulant

The Chemical Warfare Agents (CWA) sensor:

- requires no user calibration
- operational testing can be performed by using a simulant check source.
  - This simulant check source is a Teflon diffusion tube containing a small amount of DMMP (dimethylmethylphosphonate), which is a simulant for nerve "G" agent.

### **⚠ CAUTION**

**Bump check the CWA sensor prior to deployment to ensure proper operation. Failure to follow the above can result in serious personal injury or death.**

Perform this Bump Check procedure prior to deploying the SAFESITE SENTRY unit. Repeat as necessary:

1. Power the SAFESITE SENTRY monitor and allow the CWA detector to reach room temperature before subjecting to ambients below 10°C.

NOTE: The CWA detector requires a "warmup" time which can take up to 15 minutes if instrument is powered up in temperatures below 10°C.

2. Prepare the DMMP diffusion tube by removing the end caps.
3. Position the DMMP diffusion tube against the sample inlet of the CWA sensor (see FIGURE 3-3).
4. Hold the DMMP diffusion tube at the sample inlet for **one to two seconds** and remove it, wait 12 to 15 seconds, and repeat by holding the diffusion tube against the sensor inlet for one to two seconds.  
NOTE: The Flow Filter must be in place for proper operation.
5. Place the end caps back onto the tube.
  - The CWA reading on the SAFEMTX module display screen should read "SIM", "LO G", "MED G", or "Hi G" depending on the exposure rate concentration.
  - If there is no "SIM" or output alarm indicator on the display, repeat the procedure above.
6. Continue to run the SAFESITE SENTRY unit until the instrument reports "CLR" on the display.
7. Replace the end caps on the ends of the diffusion tube and return it to its plastic container.

#### **WARNING**

**Perform a Bump Check for CWA prior to deploying the SAFESITE SENTRY unit.**

**Make sure the CWA sensor reading on the SAFESITE SENTRY unit returns to "CLEAR" status. Failure to allow the instrument to flush before turning it off could cause an alarm condition on the next power up.**

**Do not leave the DMMP check source exposed to the SAFESITE SENTRY unit for a prolonged period, exceeding the recommended time. Otherwise, the simulant will overload the sampling system and the unit will require a long flush time to return to "CLEAR" status.**

**Do not locate the SAFESITE SENTRY unit under direct sunlight or near a heat source as this may cause the CWA sensor to over-heat and fail to function.**

**Make sure the CWA filter is in place securely during operation. Failure to follow the above may cause the CWA sensor to fail to function.**



## Sensor Calibration (non CWA)

### Calibration Basics

- During normal operation, the:
  - SAFEMTX module displays the gas concentration of the surrounding environment
  - gas concentration and other pertinent information are transmitted to the Command Center.
- As with any type of gas monitor, the only true check of its performance is to apply gas directly to the sensor.
- The frequency of the calibration gas tests depends on the operating time and chemical exposures of the sensors.
  - New sensors should be calibrated more often until the calibration records prove sensor stability.
  - Calibration frequency can then be reduced to the schedule set by the safety officer or plant manager.
- Before calibrating the sensors, it is good practice to turn ON the unit to allow the sensor to adapt to the new environment, especially for units with the following gas sensor types:
  - Chlorine
  - Nitric oxide
  - Hydrogen cyanide
  - Hydrogen chloride
  - Chlorine dioxide
  - Volatile Organic Compound (VOC).
- Sensors should be powered at least one half hour before any calibration attempt is made.

#### CAUTION

**Before attempting a calibration, the unit must be powered for at least one half hour.**

**When performing a calibration bump check on a SAFESITE Sentry unit, one must proceed with these cautions:**

- **After all sensors have returned to zero or normal level, wait at least two minutes before proceeding to the next sensor.**

- If both Chlorine (CL<sub>2</sub>) and Ammonia (NH<sub>3</sub>) sensors are present, always calibrate the CL<sub>2</sub> sensor first.
- If both Hydrogen Chloride (HCL) and Hydrogen Sulfide (H<sub>2</sub>S) sensors are present, always calibrate HCL first.
- If both Hydrogen Chloride (HCL) and Ammonia (NH<sub>3</sub>) sensors are present, always calibrate NH<sub>3</sub> first.
- If an error message "QUICK UNDER" is displayed with any of the above sensor combinations, follow these steps:
  1. Do not perform a zero calibration.
  2. Wait for all other sensors to return to zero or a normal level.
  3. Cycle the power.
  4. Continue the calibration or the bump check on the next sensor, as necessary.
- To ensure a fully functional unit, perform a calibration check and adjustments at initial start-up and at regular intervals.
- To calibrate the sensor, access the Calibration menu from the Main menu:

CALIBRATION MENU

ZERO ALL CALIBRATION

ZERO CALIBRATION

SPAN CALIBRATION

ZERO/SPAN CAL

RETURN TO MAIN

**Figure 3-4.**  
**Calibration Menu**

- Use the UP and DOWN Arrow buttons to move around the menu.
- Use the Power/Accept button to select the menu option.
- To help navigate through the menu, see Appendix A, "SAFEMTX Display Screens" for the menu structure.

NOTE: CWA (chemical warfare agents) sensor module requires no user calibration. Refer to Bump Check Procedure for CWA below.

## **Non-combustible Chemicals that Reduce Catalytic Sensor Sensitivity**

- Silanes
- Silicates
- Silicones
- Halides  
(compounds containing Fluorine, Chlorine, Iodine or Bromine)

NOTE: See TABLE 1-2 for electrochemical sensors.

## **Calibration Kit**

Calibration kit A-CAL-53-G is available for the SAFESITE Sentry unit.

### **Calibration Kit for SAFESITE Sentry SAFEMTX Module**

- Calibration Kit A-CAL-53-G will calibrate a SAFESITE Sentry SAFEMTX module for all target gases, except CWA and radiation sensors.

## **Calibration Procedure for Toxic, VOC and Combustible Sensors**

- Read all calibration instructions before attempting an actual calibration.
- Identify and become familiar with all of the calibration components.
- During calibration, it is necessary to quickly apply the span sample to the unit to avoid timeouts.
- Prior connection of the calibration components will aid in the ease of unit calibration.
- The only true check of any gas monitor's performance is to apply gas directly to the sensor.
- This calibration procedure must be performed regularly.

### **Zero/Span Calibration**

Zero/Span Calibration:

- is recommended when the unit is powered up for the first time, or when a new sensor module is placed in the unit

- enables the unit to gather data about the sensor to make accurate decisions for the CHANGE SENSOR function and the CAL FAULT function to work properly.
- should only be used, during normal use, when a regular calibration will not clear a fault condition due to use of incorrect calibration sample or another similar situation.

## **Regular Calibration**

- Regular calibration includes the following procedures:
  - zero all sensors
  - zero calibration
  - span calibration.
- If the user chooses to perform a "zero all" procedure, it may be done by selecting the ZERO ALL option on the menu.
  - See Appendix A, "SAFEMTX Display Screens" for information on the menu structure.

## **Zeroing All Sensors**

1. If the ambient air is suitable (with no traces of the target gas), proceed to the next step; otherwise, perform the next procedure, "Zero Calibration".
2. Select the ZERO ALL CALIBRATION menu option to start zeroing.
  - The display shows "APPLY ZERO SAMPLE".
  - The display shows "SENSOR ZEROING"
3. Once the gas value on the display is stable and the calibration is successful, the display returns to the Main Display screen.
  - The display shows "CALIBRATION COMPLETE".
  - If using the calibration cover, remove it.
4. If CAL FAULT appears on the display, this indicates:
  - an unsuccessful attempt to zero the SAFEMTX module, or
  - the SAFEMTX module is operating with the calibration parameters defined before the calibration was attempted.
    - See TABLE 5-3, "Troubleshooting Guidelines".
    - To extinguish the CAL FAULT, a complete, successful calibration procedure must be performed.

## Zero Calibration

Use the Zero Calibration procedure to perform zero calibration on a specific sensor.

1. If the ambient air is suitable (no traces of the target gas), proceed to step 3; otherwise, go to step 2.
2. If using zero gas:
  - a. Locate the:
    - zero gas cylinder and
    - Calibration Kit Flow Regulator.
  - b. Screw the Flow Controller onto the top of the zero gas cylinder.
  - c. Locate the Tube Assembly from the cal kit.
  - d. Push one end of the Tube Assembly over the Flow Regulator gas outlet and ensure tubing completely covers the gas outlet.
  - e. When using Cal Kit for SAFEMTX *Pump* Version:
    - 1) Connect larger end of the Calibration tube to the cylinder match flow demand regulator.
    - 2) Insert smaller end of the tube assembly into the sensor inlet.
3. Select the ZERO CALIBRATION option from the Calibration menu and select the sensor number.
  - The display shows "APPLY ZERO SAMPLE".
  - The display shows "SENSOR OFFLINE" on the other sensors not selected for zeroing.
  - Once the gas value on the display is stable and the calibration is successful, the display shows "CALIBRATION COMPLETE" and returns to the Main Display screen.
  - If using a zero gas cylinder with manual control:
    - 1) Turn OFF the gas flow by turning the flow regulator knob.
    - 2) Remove the tubing.
4. If CAL FAULT appears on the display, this indicates:
  - an unsuccessful attempt to zero the SAFEMTX Multi-Threat Detector, or
  - the SAFEMTX Multi-Threat Detector is operating with the

calibration parameters defined before the calibration was attempted.

- See TABLE 5-3, "Troubleshooting Guidelines".
- To extinguish the CAL FAULT, a complete, successful calibration procedure must be performed.

The SAFEMTX Multi-Threat Detector:

- allows automatic zero adjustment only within a pre-defined range
- cannot make corrections outside this range, such as when:
  - an empty or wrong gas cylinder is applied or
  - failure to begin gas flow within the allotted 30-second countdown occurs.

## Spanning

1. Locate the:
  - span gas cylinder and
  - Calibration Kit Flow regulator.
2. Screw the Flow regulator onto the top of the span gas cylinder.
3. Locate and install the Tube Assembly from the cal kit.
4. Push one end of the Tube Assembly over the Flow Regulator gas outlet and ensure tubing completely covers the gas outlet.
5. When using Cal Kit for SAFEMTX *Pump* Version:
  - a. Connect larger end of Calibration tube to the cylinder regulator.
  - b. Insert smaller end of the tube assembly into the sensor inlet.
6. Select the SPAN CALIBRATION option from the Calibration menu and select the sensor number.
  - The display shows "APPLY SPAN SAMPLE".
  - The display shows "SENSOR OFFLINE" on the other sensors that were not selected for zeroing.
  - Ensure that any calibration gases are applied when the display shows "APPLY SPAN GAS".
  - A CAL FAULT indication displays if:
    - the user is unable to apply the gas and
    - a steady state gas condition is not reached
      - it is necessary to restart the calibration process to clear this condition.
7. Once the gas value on the display is stable and the calibration is successful, the display:
  - shows "CALIBRATION COMPLETE" and
  - returns to the Main Display screen.
8. Remove the:
  - tubing from the flow regulator and
  - flow regulator from the cylinder.
9. Return all items to their appropriate location in the calibration kit.

## Calibration Documentation

- The SAFEMTX module records the date of the last successful calibration.
- This date can be displayed by selecting the PREVIOUS CAL DATE option on the menu for each sensor.

## Bump Check Procedure for Radiation

Although the SAFESITE Sentry Detector was calibrated at the factory, it is recommended to "bump check" the sensor prior to deployment.

1. Place a 10  $\mu$  Ci (micro Curie) one-inch disc source of Cesium 137 (Cs-137) on the outer left side of the SAFESITE Sentry enclosure adjacent to the radiation sensor.

NOTE: Disc sources of Cs-137 are not shipped with the SAFESITE Sentry Detector, but are available through any supplier of Exempt Quantity radio isotope sources.

2. The SAFESITE Sentry Detector will indicate an exposure dose rate\* (mREM/hr) in 30 seconds or less

### CAUTION

**Avoid excessive vibration of the SAFESITE Sentry Detector when calibrating, bump checking or attempting to measure radio isotopes.**

**The SAFESITE Sentry Detector is designed to detect high energy (660 keV) Gamma Sources only.**

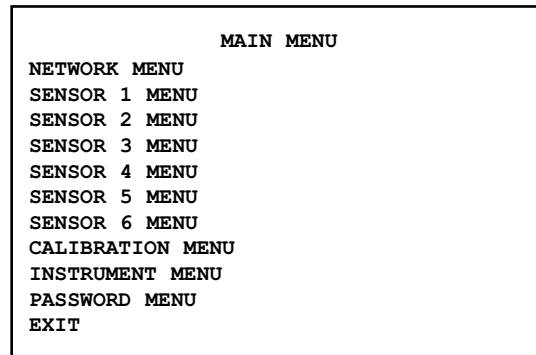
**\*Dose rates may vary depending on variations in the micro Curie disc source employed.**



## Chapter 4, Instrument Settings

The Main Menu depicted below provides the user with access:

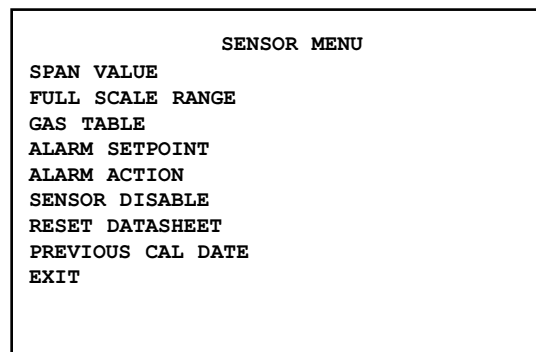
- to display and modify the factory-set parameters of the SAFEMTX module
- the instrument-level status.



*Figure 4-1. Main Menu*

A summary of the Main Menu structure is provided in Appendix B, TABLE B-1, "Main Menu Structure".

### Sensor Menu



*Figure 4-2. Sensor Menu*

## **Span Value**

- When selected, this options displays the span value on-screen.
- The displayed span value:
  - corresponds to the concentration of the sample used to calibrate the sensor
  - is user-adjustable.

NOTE: Span value must match with the concentration of the sample used to calibrate the sensor. If a calibration gas with a different concentration value is used, the span value must be adjusted prior to calibration. Failure to do so may cause the sensor to return a wrong reading or the calibration process may fail entirely.

## **Full Scale Range**

- When selected, this option displays the full-scale range value of the sensor on-screen.
- The full-scale range of the sensor is not user-adjustable.

## **Alarm Setpoint**

- When selecting this option, the alarm setpoint value of the sensor is displayed on-screen.
- This value can be changed by the user via buttons:
  - Press UP arrow to increment by ones
    - Hold the UP arrow to increment by 10's/100's.
  - Press DOWN arrow to decrement by ones.
    - Hold the DOWN arrow to decrement by 10's/100's.
  - Press ACCEPT button to enter the desired alarm setpoint value.

## **Alarm Action**

- When selected, this option allows the user to select if the instrument alarm indicators are:
  - latching/non-latching
  - increasing/decreasing or
  - disabled.

## Sensor Disable

- When Selected, this option allows the user to disable any sensor not installed in the unit.
- When a sensor is installed, the unit will automatically enable the sensor.

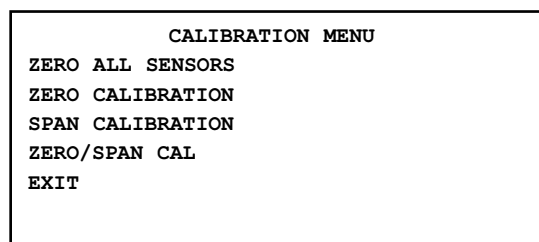
## Reset Datasheet

- When selected, this option allows the user to return the sensor module parameters to a known state.
- Calibration is required after this operation is complete.

## Previous Cal Date

- This option displays the previous successful calibration date.

## Calibration Menu Option



**Figure 4-3.**  
**Calibration Menu**

## Zero All Sensors

- When selected, this option allows the user to zero all of the sensors installed in the instrument.

## Zero Calibration

- When selected, this option allows the user to zero a specific sensor installed in the instrument.

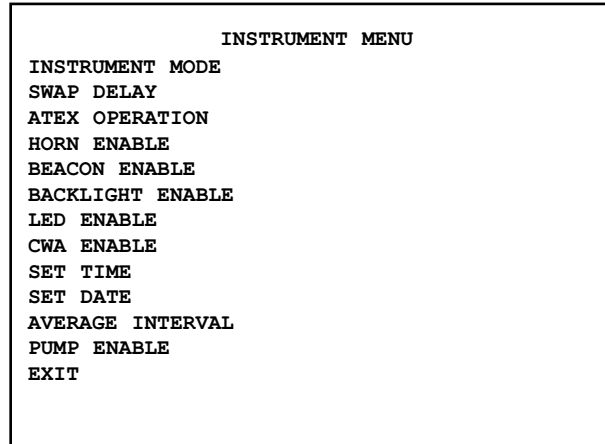
## Span Calibration

- When selected, this option allows the user to span a specific sensor installed in the instrument.

## Zero/Span Calibration

- When selected, this option allows the user to perform a full calibration on a specific sensor installed in the instrument.

## Instrument Menu Option



*Figure 4-4. Instrument Menu*

## Instrument Mode

- This option is reserved for future use.

## Swap Delay

- When enabled, this option allows the user to remove a sensor without getting a fault condition for 60 seconds.
- The default is disabled with a fault condition in eight seconds.

## Horn Enable

- When selected, this option allows the user to enable/disable the horn output during instrument operation.
- If the horn icon is visible on the display, the horn is enabled.

## Beacon Enable

- When selected, this option allows the user to enable/disable the beacon output during instrument operation.
- If the beacon icon is visible on the display, the beacon is enabled.

### **Backlight Enable**

- When selected, this option allows the user to enable/disable the instrument display backlight.

### **LED Enable**

- When selected, this option allows the user to enable/disable the LEDs on the keypad during instrument operation.

### **CWA Enable**

- This option is reserved for future use.

### **Set Time**

- When selected, this option displays the instrument time on-screen.
- The value can be changed by pressing the buttons:
  - Press the UP arrow to increment by ones.
    - Holding the UP arrow will increment by 10's.
  - Press the DOWN arrow to decrement by ones.
    - Holding the DOWN arrow will decrement by 10's.
  - Press the ACCEPT button to enter the desired hours and then minutes for the instrument time.

### **Set Date**

- When selected, this options displays the instrument date on-screen
- This value can be changed by pressing the buttons:
  - Press the UP arrow to increment by ones.
    - Holding the UP arrow will increment by 10's/100's.
  - Press the DOWN arrow to decrement by ones.
    - Holding the DOWN arrow will decrement by 10's/100's.
  - Press the ACCEPT button to enter the desired year, month, and day for the instrument date.

### **Average Interval**

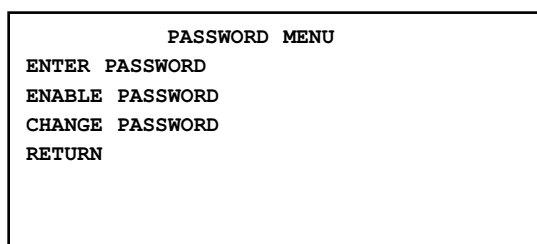
- When selected, this option allows the user to set the min/max/average interval for the instrument.
- The user can select between a one-, eight-, or 24-hour update time.

## Pump Enable

- When selected, this option allows the user to enable/disable the instrument pump.

NOTE: This setting must be enabled for units with diffusion modules attached.

## Password Menu Option



*Figure 4-5.  
Password Menu*

## Enter Password

- When selected (if the Password option is enabled), this option prompts the user to enter their password to unlock the menus.
- The factory default password is **1**.
- If the user cannot remember their password, a value of **672** can be entered.
  - Press the UP arrow to increment by ones.
    - Holding the up ARROW will increment by 10's/100's.
  - Press the DOWN arrow to decrement by ones.
    - Holding the DOWN arrow will decrement by 10's/100's.
  - Press the ACCEPT button to enter the password.
    - If the correct password is entered, the password icon will flash for one hour; then, the unit will become password-protected again.
    - If the incorrect password is entered, the unit will become password protected.

- To exit the one-hour unlocked function, see "Enable Password".

### **Enable Password**

- When selected, this option allows the user to enable the password protection.
  - The password icon displays when ENABLED is selected.
  - The unit will immediately lock if the one-hour unlock timer is running.
  - The password can only be disabled if the correct password was entered.

### **Change Password**

- When selected, this option allows the user to change the instrument password to any number from 0 to 999.
  - Press the UP arrow to increment by ones.
    - Holding the up ARROW will increment by 10's/100's.
  - Press the DOWN arrow to decrement by ones.
    - Holding the DOWN arrow will decrement by 10's/100's.
  - Press the ACCEPT button to enter the new password.

## Chapter 5, Maintenance

### General

The SAFESITE Sentry Detector is constantly performing a self-check. When a problem is found, it:

- displays the appropriate error message (see TABLE 5-2, "Troubleshooting Guidelines")
- reports the error status to the SAFECOM™ Command Center and SAFESITE software
- turns ON the Fault LED as a visual indicator.

### Preventive Maintenance Schedule

- It is necessary to perform periodic maintenance on the SAFESITE Sentry Detector; otherwise, a degradation in system capability could occur.

#### **WARNING**

**When opening and closing the Detector case, make sure that the door is completely secured.**

**Failure to properly secure the door changes sample transport patterns by causing a leak in gasket that seals the unit door.**

**It is important that the sample transport occur through the primary inlet filter.**

**System leaks may cause delayed detection of agents.**

**Failure to follow this warning can result in personal injury or death.**

- The recommended maintenance interval runs on a three-month schedule. TABLE 5-1 indicates the items that must be replaced at each maintenance interval.



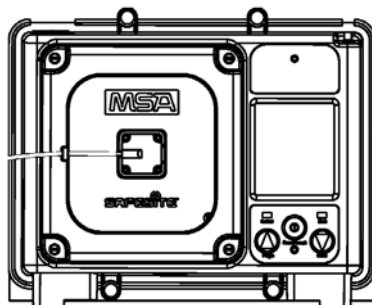
**Table 5-1. CWA Detector Projected Maintenance Schedule**

MAINTENANCE	PART NUMBER	PERFORM EVERY:
Replace Inlet Baffle Filter	10072905	three months
Replace SAW sensor Filter <sup>1</sup>	10068235	three months
Check Vapor Simulant Source	10074657	by expiration date on source

<sup>1</sup> In known atmospheres where high levels of particulate matter are present, this schedule should be changed to a one-month filter replacement.

## Replacing a SAFEMTX Module Gas Sensor

- The SAFEMTX module may house up to four sensors, accessed through the front sensor cover.
- The sensors beneath the front sensor cover are referred to as the SAFEMTX gas sensor assembly, which are sensors that detect:
  - combustible gases
  - toxic gases and
  - volatile organic compound gases.



**Figure 5-1. SAFEMTX Gas Sensor Module**

- The only routine maintenance item on the SAFEMTX gas sensor is the sensing element itself, which has a limited lifetime.
- When the SAFEMTX module's display indicates that the sensor must be changed, there is very little sensor lifetime remaining.

- It is a good practice to obtain a replacement sensing element before the sensing element within your detector becomes inoperative.

#### **⚠ WARNING**

Handle the sensor carefully; the electrochemical version is a sealed unit which contains a corrosive electrolyte. If electrolyte is leaking from the sensor, exercise caution to ensure the electrolyte does not contact skin, eyes or clothes, thus avoiding burns. If contact occurs, rinse the area immediately with a large quantity of water. In case of contact with eyes, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

#### **⚠ CAUTION**

Do not install a leaking sensor in the sensing head assembly. The leaking sensor must be disposed of in accordance with local, state and federal laws. To obtain a replacement sensor, contact MSA at the address given under "Obtaining Replacement Parts".

#### **⚠ WARNING**

**Explosion Hazard:** Do not replace the sensor unless power is switched OFF or the area is known to be non-hazardous.

1. Remove the sensor cover by unscrewing the screws.
  - Carefully detach the pump wiring connector from the socket.
2. Carefully unplug the sensor assembly from its socket by pulling straight back, without any rocking action.
3. Remove the sensing element module from the sensor assembly.
4. Beneath the sensing element module is a label identifying the sensor gas type. Obtain the appropriate replacement and replace the sensing element module.

**NOTE:** When replacing a sensor module with the same gas type, the operational settings such as alarm setpoints and alarm functions (latching/unlatching and upscale/downscale) will remain unchanged.

When changing a sensor module with a different gas type sensor (e.g., changing from a chlorine to an oxygen sensor), these operational settings will change to the new sensor's default settings.

5. Carefully and firmly plug in the sensor assembly without using any rocking action.
6. Reassemble the front sensor cover.
  - Carefully plug in the pump wiring connector to the socket; otherwise, the pump will be inoperable.
7. Calibrate the sensor (see Chapter 2, "Start-up and Calibration").

It is recommended that all other maintenance requiring SAFEMTX enclosure disassembly (other than maintenance done through the front sensor cover) be performed at an MSA factory-authorized service center.

## **PID Sensor Cleaning Procedure**

It is recommended that the VOC/PID sensor cleaning be performed using the PID Cleaning Kit (P/N 10074583) or by an MSA factory-authorized technician.

1. To remove the VOC/PID sensor:
  - Follow step 1 through step 3 of the "Replacing a SAFEMTX Gas Sensor" procedure given earlier in this chapter
  - Observe WARNINGS and CAUTIONS given in that procedure.
2. Follow the lamp cleaning instructions given in the PID Tech Lamp Cleaning Procedure Instruction Sheet (P/N 10066063).
3. To reassemble the VOC/PID sensor module:
  - Follow steps 5 through step 7 of the "Replacing a SAFEMTX Gas Sensor" procedure given earlier in this chapter.

## **Replacing the Radiation Sensor**

- The radiation sensor is located inside the enclosure on the left side (see FIGURE 5-4).
- There are no user-serviceable parts on the radiation sensor.
- Radiation sensor replacement must be performed by an MSA factory-authorized service technician.

## Replacing the CWA Sensor

- The CWA sensor is located above the SAFEMTX module (see FIGURE 5-4).
- The filter of the CWA sensor is user-replaceable and can be safely done without adversely affecting the sensor.
- There are no other user-serviceable parts on the CWA sensor.
- CWA sensor replacement must be performed by an MSA factory-authorized service technician.

## Obtaining Replacement Parts

To obtain a replacement part, address the order or inquiry to:

- **Mine Safety Appliances Company**  
**P.O. Box 427**  
**Pittsburgh, PA 15230-0427**

Or call, toll-free, **1-800-MSA-INST.**

### **WARNING**

**Use only genuine MSA replacement parts when performing any maintenance procedures provided in this manual. Failure to do so may seriously impair sensor performance. Repair or alteration of the SAFESITE Sentry Detector, beyond the scope of these maintenance instructions or by anyone other than authorized MSA service personnel, could cause the product to fail to perform as designed and persons who rely on this product for their safety could sustain serious personal injury or death.**

**Table 5-2. Replacement Sensor Modules**

SAFEMTX SENSORS			
A-SAFEMTX-SENS			
0	1	2	3
<p><b>0 Matrix Revision Level</b></p> <p><b>1 Gas Type</b>            0 = None            11 = Carbon Monoxide 0-100 PPM            12 = Carbon Monoxide 0-500 PPM            13 = Oxygen 0- 10%            14 = Oxygen 0-25%            15 = Hydrogen Sulfide 0-10 PPM            16 = Hydrogen Sulfide 0-50 PPM            17 = Hydrogen Sulfide 0-100 PPM            18 = Chlorine 0-5 PPM            19 = Sulfur Dioxide 0-25 PPM            20 = Nitric Oxide 0-100 PPM            21 = Nitrogen Dioxide 0-10 PPM            22 = Hydrogen Cyanide 0-50 PPM            23 = Hydrogen Chloride 0-50 PPM            24 = Chlorine Dioxide 0-3 PPM            25 = Hydrogen Cyanide 0 – 500 PPM            26 = HF 0 – 10 PPM            27 = Sulfur Dioxide 0-100PPM            28 = Chlorine 0-10 PPM            29 = Phosgene 0-1%            41 = Phosphine 0-2 PPM            42 = Arsine 0-2 PPM            43 = Silane 0-25 PPM            44 = Germane 0-3 PPM            45 = Diborane 0-50 PPM            46 = Bromine 0-5 PPM            47 = Fluorine 0-10 PPM            48 = Ammonia 0–50 PPM            49 = Hydrogen 0-1000ppm            50 = Ethylene Oxide 0-10 PPM            54 = Ammonia 0-1000 PPM            55 = Oxygen-Solvent Tolerant 0-25%            57 = Carbon Monoxide 0-1000 PPM            61 = Chlorine 0-20 PPM            62 = Oxygen-Solv &amp; CO2 Tolerant 0-25%            63 = Oxygen – Low 0-25%            64 = Oxygen- Low, Solv Tolerant 0-25%            65 = Volatile Organic Compounds 0 - 200 PPM            66 = Volatile Organic Compounds 0 - 1500 PPM            67 = Combustible 0-100% LEL</p>	<p><b>2 Enclosure Options</b>            0 = Plastic</p> <p><b>3 Custom</b>            0 = None            C = Custom operations necessary</p>		

**Table 5-3. Troubleshooting Guidelines**

DISPLAYED MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
SENSOR MISSING	Instrument has lost communication with the sensor module	Remove sensor assembly unit for eight seconds; then, reconnect sensor assembly  Check sensor module connection or replace sensor module
CHANGE SENSOR	Sensor is at its end of life	Replace sensor
SNSR SPAN CAL FAULT	Unsuccessful span calibration	Repeat span calibration. Check for proper calibration gas. Check for blockage in the flow system
SNSR ZERO CAL FAULT	Unsuccessful zero calibration	Repeat zero calibration. Check for proper zero gas. Check for blockage in the flow system
SENSOR WARNING	Sensor approaching its end of life	Prepare to replace sensor module
FLASH FAULT	Sensor module program memory is invalid	Replace sensor module
RAM FAULT	Sensor module has a defective RAM memory	Replace sensor module
DATA FAULT	Sensor module datasheet invalid	Perform reset datasheet command from the menu. If error persists, replace sensor
INVALID SENSOR	Attached sensor module not compatible with the instrument	Replace with correct sensor type
CONFIG RESET	Main EEPROM memory was reset	Verify user-settings are correct
LAMP FAULT	Lamp failure	Replace or consult factory
SUPPLY FAULT	The negative supply sensor module is out of range	Check wiring or replace sensor module
PARAM FAULT	An operational parameter is out of range or sensor failed internal check	Restart. Replace, if necessary
POWER FAULT	Power at the sensor module is out of range	Correct sensor connection error. Replace main PC board, or sensor module
SENSOR WARMUP	In $T_{\text{ambient}} > 40^{\circ}\text{C}$ , the CWA sensor may have exceeded its maximum temperature	Allow CWA sensor to cool; place instrument in ambient temperature less than $40^{\circ}\text{C}$

DISPLAYED MESSAGE	POSSIBLE CAUSE	CORRECTIVE ACTION
SENSOR OFFLINE	Calibration active	Wait for cal to complete
SENSOR ZEROING	ZERO ALL CAL selected	Wait for cal to complete
SENSOR WARM UP	Sensor power up	Wait for warmup to complete
MUX FAULT	Incorrect sensor just connected	Verify compatible sensor
QUICK UNDER	Sensor reading drifted down scale	Zero the sensor
SLOW UNDER	Sensor reading drifted down scale	Zero the sensor
OVERRANGE	Gas reading above fullscale limit	None. Atmosphere contains high concentration of gas(es)
OVERRANGE LOC	Combustible overrange	Zero the sensor
DATASHEET RESET	User initiated or corrupt memory	Verify user settings and calibrate

## System Performance Check

- Check the SAFESITE Sentry Detector on a regular basis.
- The following tests provide diagnostic information to help maintain the Detector.

## System Inlet Sample Flow

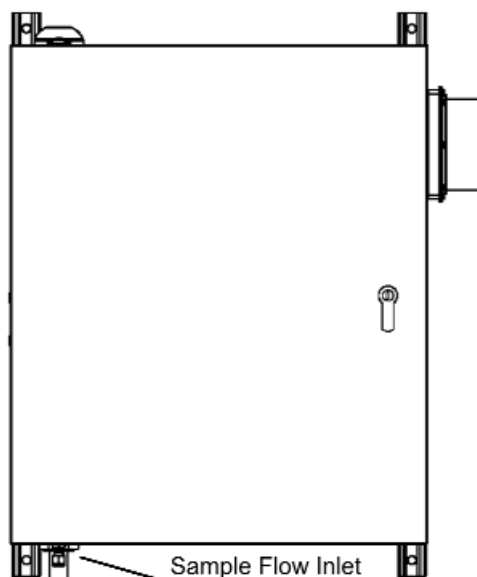
- This is an important system check for the composite sampling system.

### **⚠ WARNING**

**If transport flows are below specification, instrument response time is delayed. Failure to follow this warning can result in personal injury or death.**

- This measurement is an important diagnostic of ambient particulate contamination.
  - It is recommended that flow be measured and recorded over time to allow you to adjust filter replacement intervals.
  - Extremely dirty environments may require more frequent filter replacement.

1. Check for indication of sample inlet flow at the left-hand bottom of the instrument.
2. If flow is not indicated:
  - system transport system is dirty
  - baffle filter must be replaced
  - sampling pipe may need to be cleared of particulate obstructions.



**Figure 5-2. Sample Inlet Flow Diagram**

## **Inlet Baffle Filter**

- This Filter is:
  - the primary filter to the Detector inlet
  - removes particulate matter:
    - from the air stream through magnetic attraction and a 400-mesh filter screen
    - at the >10 micron size level.
  - accessed by opening the Detector case door
  - located in the left-hand bottom of the instrument



- a silver can assembly that attaches to the Detector by a removable pipe fitting.
- The pipe fitting is:
  - removed by rotating in a counter-clockwise direction
  - re-installed by rotating in a clockwise direction.
- When opening and closing the Detector case, make sure that the door is completely secured.

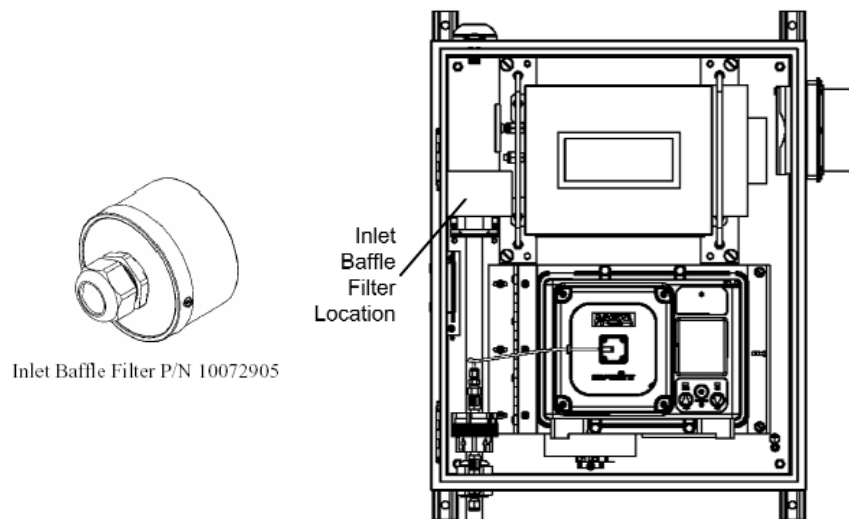
### **⚠ WARNING**

**Failure to properly secure the door changes sample transport patterns by causing a leak in gasket that seals the unit door.**

**It is important that the sample transport occur through the primary inlet filter.**

**System leaks may cause delayed detection of agents.**

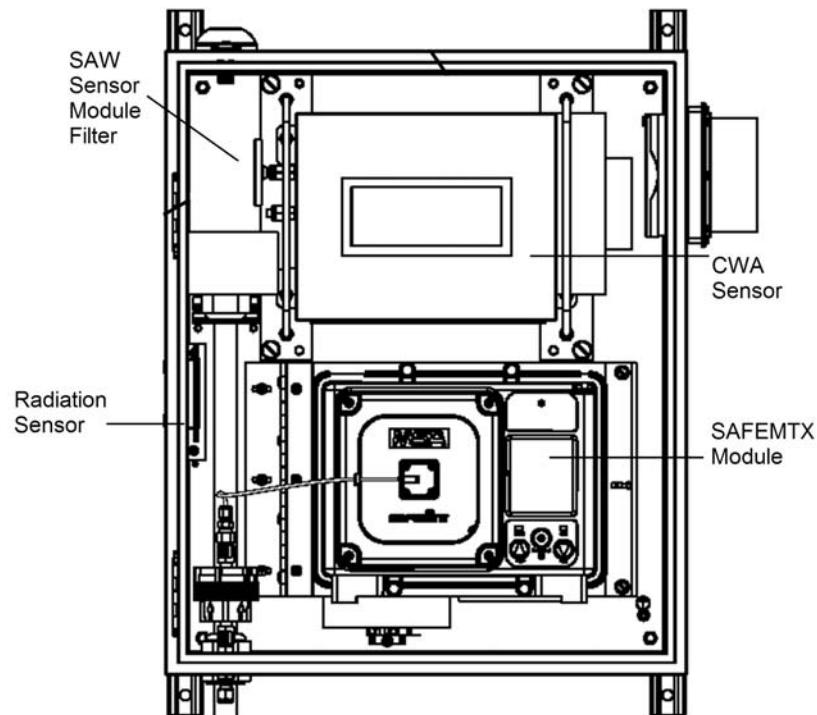
**Failure to follow this warning can result in personal injury or death.**



**Figure 5-3. Inlet Baffle**

## Sensor Module Filter

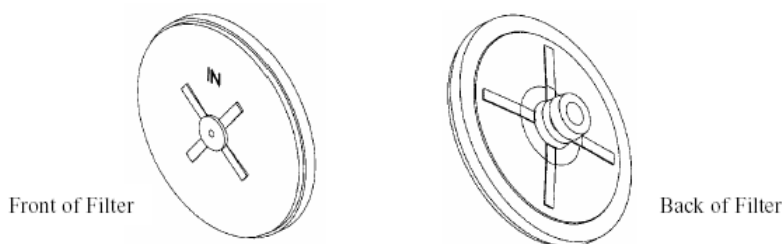
- This filter assembly:
  - is connected directly to the SAW sensor module inlet
  - is a Teflon membrane filter with a very large surface area
  - material is pure white and located inside a translucent, circular plastic housing about 5 cm in diameter
  - cannot be cleaned
  - is to be discarded when removed.



*Figure 5-4. Inlet Filter Location*

## SAW Inlet Filter Replacement

- The Sensor Module filter is:
  - located on the left-hand side of the CWA Sensor Module Assembly inside the SAFESITE Sentry enclosure.
  - attached by compression to the ¼" sample inlet.
- Inspect the Teflon filter for dust and debris.
  - This filter is pure white Teflon when new.
  - A gray discoloration:
    - appears with use
    - depends on the sampling environment
    - or dust appears on only one side of the filter.
      - If debris appears on the other side of the Teflon membrane:
        - it is possible that the material has contacted the concentrator inlet
        - the SAW Array Sensor Assembly may require replacement due to possible contamination.
- The SAW filter may also turn brown, depending on the color of the dust

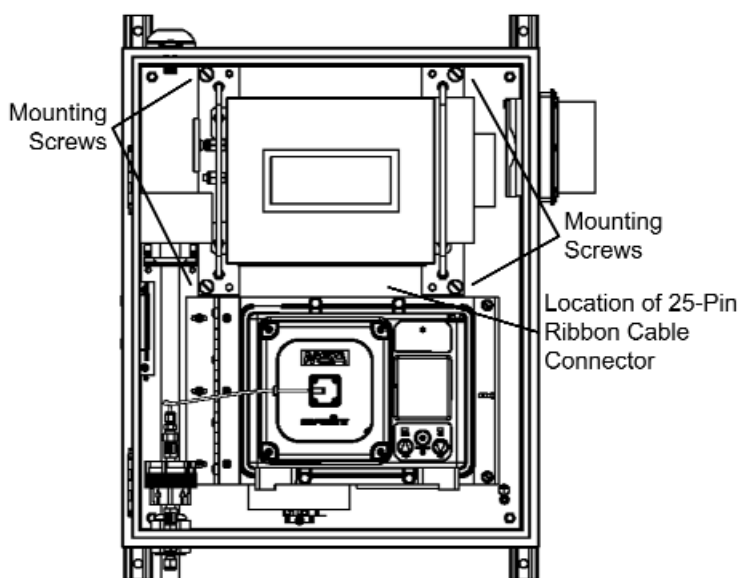


**Figure 5-6. SAW Inlet Filter**

1. Replace the Teflon Inlet Filter with a new one.
  - a. To remove, gently pry off the filter.
  - b. Replace with a new filter in the sample inlet location before returning the Detector to operation.
2. Verify the sensor operation with simulant bump check.

## Removing the Sensor Engine

- There may be several reasons to remove the SAFESITE Sentry Detector sensor engine.
  - Vapor diffusion check source replacement is easier to perform when the engine is removed from the exterior case.
- To remove the sensor engine:
  1. Turn OFF instrument power.
  2. Disconnect the 4-conductor inline connector between the thermoelectric cooler and the power routing printed circuit board.
  3. Disconnect the 25-conductor ribbon cable from the 25-pin DB connector on the right side of the sensor engine.
    - This can be traced to J2 on the power routing board.
  4. Remove the four  $\frac{1}{4}$  x 28 flat head mounting screws from the threaded inserts in the back of the fiberglass case.



**Figure 5-7. Mounting Screw and Ribbon Connector**

## Installing the Sensor Engine

1. To re-install the sensor engine, first make sure the instrument power is turned OFF.
2. Tighten the four ¼ x 28 flat head mounting screws into the threaded inserts in the back of the case.
3. Connect the 25 conductor ribbon cable to the 25 pin DB connector on the side of sensor engine.
  - This cable can be traced to J2 on the power routing printed circuit board on the lower part of the fiberglass case.
4. Connect the 4-conductor inline connector between the thermoelectric cooler on the end of the sensor engine and the power routing printed circuit board.
5. Verify operation with simulant bump check.



## Appendix A, Parts List

**Table A-1. Parts List**

<b>PART</b>	<b>PART NO.</b>
Routing Board	10072918
Fan, External Case	10072914
Cable, Fan Power	10074681
Thermo-Coller Controller MPT-5000	10072923
Cable, Routing to MPT-5000	10072908
Cable, Routing Box	10072909
Cable, Main Power	10074682
Power Supply	10074683
Cable, Power CW Sensor Engine	10072919
Fuse, Power Supply	10074684
Fuse, Routing Board	10074685
Filter, Sensor Inlet	10068235
Filter, Baffle Inlet	10072905
Filter, Inline Media	10073956
Pump, Sample	10074659
Valve, Latching 3-Way	10074686
Check Source, Detector(New Style)	10074657
Assembly I/O Panel	10074687
Fuse, 1A (110 V)	10074688
Fuse, 2A (220 V)	10074689
Lockout Pane, Panel Label and Two Schrems (must order all three part numbers)	10062972 10066270 10064304
Calibration Cover	10066581
Software	10067904
Pump Only	10066265

## Appendix B, SAFEMTX Display Screens

**Table B-1. Main Menu Structure**

MENU SELECTIONS	SUBMENU SELECTIONS	OPTIONS
NETWORK MENU	MODBUS ADDRESS	1..16
	BASE ADDRESS	
	BAUD RATE	1200, 2400, 4800, 9600, 19200
	PARITY	EVEN, ODD, NONE, RETURN
	STOP BITS	1, 2, RETURN
	MEDIA	RF, WIRED, RETURN
	DIAGNOSTICS	% RATE NOISE DBM SIGNAL DBM VSWR
	RETURN TO MAIN	
SENSOR 1 MENU	SPAN VALUE	
	FULL SCALE RANGE	
	GAS TABLE	
	ALARM 1 SETPOINT	
	ALARM 1 ACTION	
	ALARM 2 SETPOINT	
	ALARM 2 ACTION	
	ALARM 3 SETPOINT	
	ALARM 3 ACTION	
	SENSOR DISABLE	
	RESET DATASHEET	
	PREVIOUS CAL DATE	
	RETURN TO MAIN	
	(SAME AS ABOVE)	
SENSOR 2 MENU	(SAME AS ABOVE)	
SENSOR 3 MENU	(SAME AS ABOVE)	
SENSOR 4 MENU	(SAME AS ABOVE)	
SENSOR 5 MENU	(SAME AS ABOVE)	
SENSOR 6 MENU	(SAME AS ABOVE)	
CALIBRATION MENU	ZERO CALIBRATION	SENSOR 1 SENSOR 2 SENSOR 3 SENSOR 4 SENSOR 5 SENSOR 6
	SPAN CALIBRATION	SENSOR 1 SENSOR 2 SENSOR 3 SENSOR 4 SENSOR 5 SENSOR 6



MENU SELECTIONS	SUBMENU SELECTIONS	OPTIONS
	ZERO/SPAN CAL	SENSOR 1 SENSOR 2 SENSOR 3 SENSOR 4 SENSOR 5 SENSOR 6
	ABORT CALIBRATION	SENSOR 1 SENSOR 2 SENSOR 3 SENSOR 4 SENSOR 5 SENSOR 6
	RETURN TO MAIN	
INSTRUMENT MENU	INSTRUMENT MODE	RESERVED
	SWAP DELAY	SWAP DELAY? OFF, ON
	ATEX OPERATION	ATEX? OFF, ON (future option)
	HORN ENABLE	HORN? OFF, ON
	BEACON ENABLE	BEACON? OFF, ON
	BACKLIGHT ENABLE	BACKLIGHT? OFF, ON
	LED ENABLE	LEDS? OFF, ON
	CWA ENABLE	RESERVED
	SET TIME	
	SET DATE	
	AVERAGE INTERVAL	
	PUMP ENABLE	
	RETURN TO MAIN	
PASSWORD MENU	ENTER PASSWORD	
	ENABLE PASSWORD	OFF, ON
	CHANGE PASSWORD	
EXIT		

# Appendix C, ModBus Registers

## ModBUS Communications

- Default serial settings are ModBUS RTU, address 247, 19200 baud, even parity. The stop bits are fixed at 1 stop bit. For data types that are larger than one word, the most significant word is located in the first word register (big-endian).

**Table C-1. Supported ModBUS Function Codes**

FUNCTION NUMBER	DESCRIPTION
3	Read Holding Registers
5	Write Single Coil
6	Write Single Register
16	Write Multiple Registers

**Table C-2. ModBUS Memory Map Overview**

DESCRIPTION	START ADDRESS	END ADDRESS	SIZE IN WORDS	ACCESS
ModBUS Data Table Start Base Address	1000	1000	1	Read/Write
Factory Configuration Data	Base+1	Base+033	33	Read Only
User Configuration Data	Base+101	Base+177	83	Read/Write
Status Information	Base+201	Base+311	111	Read Only
Control Words	Base+401	Base+403	4	Read/Write
Custom Registers	Base+501	Base+620	120	Read only, for future use only
Indirect Addressing	Base+700	Base+2	2	Read/Write

**Table C-3. ModBUS Base Address (Read/Write)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
ModBUS Data Table Base Address	1000	1000 - 60000 (default - 10000)

NOTE: Regardless of the contents of register address 1000, writing to this register sets the base address.

**Table C-4. ModBUS Factory Configuration Data (Read Only)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Device Type	Base+1	3(Tox X3 US) 4(Tox X3 Europe)
Firmware Version	Base+2	0..32767 Integer, divide by 100 for range 00.00 to 99.99
Relays Option Installed	Base+3	0-Relays not installed, 1-Relays installed
Reserved for future use	Base+4	
Date of Mfg Year, Sensor 1	Base+5	20XX
Date of Mfg Month, Sensor 1	Base+6	1..12
Date of Mfg Day, Sensor 1	Base+7	1..31
Date of Mfg Year, Sensor 2	Base+8	20XX
Date of Mfg Month, Sensor 2	Base+9	1..12
Date of Mfg Day, Sensor 2	Base+10	1..31
Date of Mfg Year, Sensor 3	Base+11	20XX
Date of Mfg Month, Sensor 3	Base+12	1..12
Date of Mfg Day, Sensor 3	Base+13	1..31
Date of Mfg Year, Sensor 4	Base+14	20XX
Date of Mfg Month, Sensor 4	Base+15	1..12
Date of Mfg Day, Sensor 4	Base+16	1..31
Date of Mfg Year, Sensor 5	Base+17	20XX
Date of Mfg Month, Sensor 5	Base+18	1..12
Date of Mfg Day, Sensor 5	Base+19	1..31
Date of Mfg Year, Sensor 6	Base+20	20XX
Date of Mfg Month, Sensor 6	Base+21	1..12
Date of Mfg Day, Sensor 6	Base+22	1..31
Full Scale Range-Default Sensor 1	Base+23	Single Precision Float
Full Scale Range-Default Sensor 2	Base+25	Single Precision Float
Full Scale Range-Default Sensor 3	Base+27	Single Precision Float
Full Scale Range-Default Sensor 4	Base+29	Single Precision Float
Full Scale Range-Default Sensor 5	Base+31	Single Precision Float
Full Scale Range-Default Sensor 6	Base+33	Single Precision Float

**Table C-5. ModBUS User Configuration Data (Read/Write)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
MODBUS SLAVE ADDRESS	BASE+101	1..247
BAUD RATE CODE	BASE+102	0..4, SEE SECTION 27 FOR DETAILS
PARITY CODE	BASE+103	0..2, SEE SECTION 28 FOR DETAILS
STOP BITS	BASE+104	0 – ONE, 1 – TWO STOP BITS
FOR FUTURE USE	BASE+105	
FOR FUTURE USE	BASE+106	
FULL SCALE RANGE, SENSOR 1	BASE+107	SINGLE PRECISION FLOAT
FULL SCALE RANGE, SENSOR 2	BASE+109	SINGLE PRECISION FLOAT
FULL SCALE RANGE, SENSOR 3	BASE+111	SINGLE PRECISION FLOAT
FULL SCALE RANGE, SENSOR 4	BASE+113	SINGLE PRECISION FLOAT
FULL SCALE RANGE, SENSOR 5	BASE+115	SINGLE PRECISION FLOAT
FULL SCALE RANGE, SENSOR 6	BASE+117	SINGLE PRECISION FLOAT
SPAN GAS VALUE, SENSOR 1	BASE+119	SINGLE PRECISION FLOAT
SPAN GAS VALUE, SENSOR 2	BASE+121	SINGLE PRECISION FLOAT
SPAN GAS VALUE, SENSOR 3	BASE+123	SINGLE PRECISION FLOAT
SPAN GAS VALUE, SENSOR 4	BASE+125	SINGLE PRECISION FLOAT
SPAN GAS VALUE, SENSOR 5	BASE+127	SINGLE PRECISION FLOAT
SPAN GAS VALUE, SENSOR 6	BASE+129	SINGLE PRECISION FLOAT
ALARM 1 SETPOINT, SENSOR 1	BASE+131	SINGLE PRECISION FLOAT
ALARM 1 SETPOINT, SENSOR 2	BASE+133	SINGLE PRECISION FLOAT
ALARM 1 SETPOINT, SENSOR 3	BASE+135	SINGLE PRECISION FLOAT
ALARM 1 SETPOINT, SENSOR 4	BASE+137	SINGLE PRECISION FLOAT
ALARM 1 SETPOINT, SENSOR 5	BASE+139	SINGLE PRECISION FLOAT
ALARM 1 SETPOINT, SENSOR 6	BASE+141	SINGLE PRECISION FLOAT
ALARM 2 SETPOINT, SENSOR 1	BASE+143	SINGLE PRECISION FLOAT
ALARM 2 SETPOINT, SENSOR 2	BASE+145	SINGLE PRECISION FLOAT
ALARM 2 SETPOINT, SENSOR 3	BASE+147	SINGLE PRECISION FLOAT
ALARM 2 SETPOINT, SENSOR 4	BASE+149	SINGLE PRECISION FLOAT
ALARM 2 SETPOINT, SENSOR 5	BASE+151	SINGLE PRECISION FLOAT
ALARM 2 SETPOINT, SENSOR 6	BASE+153	SINGLE PRECISION FLOAT
ALARM 3 SETPOINT, SENSOR 1	BASE+155	SINGLE PRECISION FLOAT
ALARM 3 SETPOINT, SENSOR 2	BASE+157	SINGLE PRECISION FLOAT
ALARM 3 SETPOINT, SENSOR 3	BASE+159	SINGLE PRECISION FLOAT
ALARM 3 SETPOINT, SENSOR 4	BASE+161	SINGLE PRECISION FLOAT
ALARM 3 SETPOINT, SENSOR 5	BASE+163	SINGLE PRECISION FLOAT
ALARM 3 SETPOINT, SENSOR 6	BASE+165	SINGLE PRECISION FLOAT
ALARM FUNCTION WORD 1	BASE+167	0..32767, SEE SECTION 22
ALARM FUNCTION WORD 2	BASE+168	0..32767, SEE SECTION 23

DESCRIPTION	ADDRESS	POSSIBLE VALUES
ALARM FUNCTION WORD 3	BASE+169	0..32767, SEE SECTION 24
ALARM FUNCTION WORD 4	BASE+170	0..32767, SEE SECTION 25
AVERAGE TIME INTERVAL	BASE+171	1,8 OR 24
CURRENT DATE - YEAR	BASE+172	20XX
CURRENT DATE – MONTH	BASE+173	1..12
CURRENT DATE – DAY	BASE+174	1..31
CURRENT TIME -HOUR	BASE+175	1..24
CURRENT TIME – MINUTE	BASE+176	0..59
CURRENT TIME – SECOND	BASE+177	0..59
GAS TABLE NUMBER SENSOR 1 (XIR)	BASE+178	0..50
GAS TABLE NUMBER SENSOR 2 (XIR)	BASE+179	0..50
GAS TABLE NUMBER SENSOR 3 (XIR)	BASE+180	0..50
GAS TABLE NUMBER SENSOR 4 (XIR)	BASE+181	0..50
GAS TABLE NUMBER SENSOR 5 (XIR)	BASE+182	0..50
GAS TABLE NUMBER SENSOR 6 (XIR)	BASE+183	0..50
DISPLAYABLE MESSAGE	BASE+184	10 BYTES ASCII

**Table C-6. ModBUS Device Status (Read only)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
General Status Bits	Base+201	0..32767, See section 12
General Status Bits 2	Base+202	0..32767, See section 13
General Alarm Bits 1	Base+203	0..32767, See section 14
General Alarm Bits 2	Base+204	0..32767, See section 15
Fault Status Bits 1	Base+205	0..32767, See section 16
Fault Status Bits 2	Base+206	0..32767, See section 17
Gas Level – Sensor 1	Base+207	Single Precision Float
Gas Level – Sensor 2	Base+209	Single Precision Float
Gas Level – Sensor 3	Base+211	Single Precision Float
Gas Level – Sensor 4	Base+213	Single Precision Float
Gas Level – Sensor 5	Base+215	Single Precision Float
Gas Level – Sensor 6	Base+217	Single Precision Float
Longitude	Base+219	Single Precision Float
Latitude	Base+221	Single Precision Float
Expansion MSB Model Numbers LSB	Base+223	Signed Char
Unsigned char see section 29		
Expansion	Base+224	Signed Integer
Temperature – Sensor 1	Base+225	Signed Integer
Temperature – Sensor 2	Base+226	Signed Integer
Temperature – Sensor 3	Base+227	Signed Integer
Temperature – Sensor 4	Base+228	Signed Integer
Temperature – Sensor 5	Base+229	Signed Integer
Temperature – Sensor 6	Base+230	Signed Integer
Gas Label – Sensor 1	Base+231	4 bytes ASCII*** (see below)
Gas Label – Sensor 2	Base+233	4 bytes ASCII*** (see below)
Gas Label – Sensor 3	Base+235	4 bytes ASCII*** (see below)
Gas Label – Sensor 4	Base+237	4 bytes ASCII*** (see below)
Gas Label – Sensor 5	Base+239	4 bytes ASCII*** (see below)
Gas Label – Sensor 6	Base+241	4 bytes ASCII*** (see below)
Engineering Units – Sensor 1	Base+243	See document 10000012883**
Engineering Units – Sensor 2	Base+244	See document 10000012883**
Engineering Units – Sensor 3	Base+245	See document 10000012883**
Engineering Units – Sensor 4	Base+246	See document 10000012883**
Engineering Units – Sensor 5	Base+247	See document 10000012883**
Engineering Units – Sensor 6	Base+248	See document 10000012883**
Calibration Step	Base+249	0..7, See section 26
Battery Level	Base+250	Unsigned integer 0 – 100%
RSSI Level	Base+251	Unsigned integer
Min Gas Reading over average Interval – Sensor 1	Base+252	Single Precision Float

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Min Gas Reading over average Interval – Sensor 2	Base+254	Single Precision Float
Min Gas Reading over average Interval – Sensor 3	Base+256	Single Precision Float
Min Gas Reading over average Interval – Sensor 4	Base+258	Single Precision Float
Min Gas Reading over average Interval – Sensor 5	Base+260	Single Precision Float
Min Gas Reading over average Interval – Sensor 6	Base+262	Single Precision Float
Max Gas Reading over average Interval – Sensor 1	Base+264	Single Precision Float
Max Gas Reading over average Interval – Sensor 2	Base+266	Single Precision Float
Max Gas Reading over average Interval – Sensor 3	Base+268	Single Precision Float
Max Gas Reading over average Interval – Sensor 4	Base+270	Single Precision Float
Max Gas Reading over average Interval – Sensor 5	Base+272	Single Precision Float
Max Gas Reading over average Interval – Sensor 6	Base+274	Single Precision Float
Avg Gas Reading over average Interval – Sensor 1	Base+276	Single Precision Float
Avg Gas Reading over average Interval – Sensor 2	Base+278	Single Precision Float
Avg Gas Reading over average Interval – Sensor 3	Base+280	Single Precision Float
Avg Gas Reading over average Interval – Sensor 4	Base+282	Single Precision Float
Avg Gas Reading over average Interval – Sensor 5	Base+284	Single Precision Float
Avg Gas Reading over average Interval – Sensor 6	Base+286	Single Precision Float
Date of Last Cal Year, Sensor 1	Base+288	20XX
Date of Last Cal Month, Sensor 1	Base+289	1..12
Date of Last Cal Day, Sensor 1	Base+290	1..31
Date of Last Cal Year, Sensor 2	Base+291	20XX
Date of Last Cal Month, Sensor 2	Base+292	1..12
Date of Last Cal Day, Sensor 2	Base+293	1..31
Date of Last Cal Year, Sensor 3	Base+294	20XX
Date of Last Cal Month, Sensor 3	Base+295	1..12
Date of Last Cal Day, Sensor 3	Base+296	1..31
Date of Last Cal Year, Sensor 4	Base+297	20XX
Date of Last Cal Month, Sensor 4	Base+298	1..12
Date of Last Cal Day, Sensor 4	Base+299	1..31
Date of Last Cal Year, Sensor 5	Base+300	20XX

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Date of Last Cal Month, Sensor 5	Base+301	1..12
Date of Last Cal Day, Sensor 5	Base+302	1..31
Date of Last Cal Year, Sensor 6	Base+303	20XX
Date of Last Cal Month, Sensor 6	Base+304	1..12
Date of Last Cal Day, Sensor 6	Base+305	1..31
Drift counter- Sensor 1	Base+306	0..20
Drift counter- Sensor 2	Base+307	0..20
Drift counter- Sensor 3	Base+308	0..20
Drift counter- Sensor 4	Base+309	0..20
Drift counter- Sensor 5	Base+310	0..20
Drift counter- Sensor 6	Base+311	0..20

\*\* 0x0 – none, 0x01 - % LEL, 0x02 - %, 0x03 – PPM, more to be defined.

\*\*\* All characters in ASCII format, except for "~" which means "IR".



**Table C-7. Custom Register Set (Read/Write, Read only registers)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
General Status Bits	Base+501	0..32767, See section 12
General Status Bits 2	Base+502	0..32767, See section 13
General Alarm Bits 1	Base+503	0..32767, See section 14
General Alarm Bits 2	Base+504	0..32767, See section 15
Fault Status Bits 1	Base+505	0..32767, See section 16
Fault Status Bits 2	Base+506	0..32767, See section 17
Gas Level – Sensor 1	Base+507	Single Precision Float
Gas Level – Sensor 2	Base+509	Single Precision Float
Gas Level – Sensor 3	Base+511	Single Precision Float
Gas Level – Sensor 4	Base+513	Single Precision Float
Gas Level – Sensor 5	Base+515	Single Precision Float
Gas Level – Sensor 6	Base+517	Single Precision Float
Longitude	Base+519	Single Precision Float
Latitude	Base+521	Signed integer
Expansion MSB Model Numbers LSB	Base+523	Signed Char Unsigned char see section 29
Expansion	Base+524	Singed int
Gas Label – Sensor 1	Base+525	4 bytes ASCII*** (see below)
Gas Label – Sensor 2	Base+527	4 bytes ASCII*** (see below)
Gas Label – Sensor 3	Base+529	4 bytes ASCII*** (see below)
Gas Label – Sensor 4	Base+531	4 bytes ASCII*** (see below)
Gas Label – Sensor 5	Base+533	4 bytes ASCII*** (see below)
Gas Label – Sensor 6	Base+535	4 bytes ASCII*** (see below)
Engineering Units – Sensor 1	Base+537	See document 10000012883**
Engineering Units – Sensor 2	Base+538	See document 10000012883**
Engineering Units – Sensor 3	Base+539	See document 10000012883**
Engineering Units – Sensor 4	Base+540	See document 10000012883**
Engineering Units – Sensor 5	Base+541	See document 10000012883**
Engineering Units – Sensor 6	Base+542	See document 10000012883**
Calibration Step	Base+543	0..7, See section 26
Battery Level	Base+544	Unsigned integer 0 – 100%
RSSI Level	Base+545	Unsigned integer
Min Gas Reading over average Interval – Sensor 1	Base+546	Single Precision Float

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Min Gas Reading over average Interval – Sensor 2	Base+548	Single Precision Float
Min Gas Reading over average Interval – Sensor 3	Base+550	Single Precision Float
Min Gas Reading over average Interval – Sensor 4	Base+552	Single Precision Float
Min Gas Reading over average Interval – Sensor 5	Base+554	Single Precision Float
Min Gas Reading over average Interval – Sensor 6	Base+556	Single Precision Float
Max Gas Reading over average Interval – Sensor 1	Base+558	Single Precision Float
Max Gas Reading over average Interval – Sensor 2	Base+560	Single Precision Float
Max Gas Reading over average Interval – Sensor 3	Base+562	Single Precision Float
Max Gas Reading over average Interval – Sensor 4	Base+564	Single Precision Float
Max Gas Reading over average Interval – Sensor 5	Base+566	Single Precision Float
Max Gas Reading over average Interval – Sensor 6	Base+568	Single Precision Float
Avg Gas Reading over average Interval – Sensor 1	Base+570	Single Precision Float
Avg Gas Reading over average Interval – Sensor 2	Base+572	Single Precision Float
Avg Gas Reading over average Interval – Sensor 3	Base+574	Single Precision Float
Avg Gas Reading over average Interval – Sensor 4	Base+576	Single Precision Float
Avg Gas Reading over average Interval – Sensor 5	Base+578	Single Precision Float
Avg Gas Reading over average Interval – Sensor 6	Base+580	Single Precision Float
Alarm 1 Setpoint, Sensor 1 *	Base+582	Single Precision Float
Alarm 1 Setpoint, Sensor 2 *	Base+584	Single Precision Float
Alarm 1 Setpoint, Sensor 3 *	Base+586	Single Precision Float
Alarm 1 Setpoint, Sensor 4 *	Base+588	Single Precision Float
Alarm 1 Setpoint, Sensor 5 *	Base+590	Single Precision Float

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Alarm 1 Setpoint, Sensor 6 *	Base+592	Single Precision Float
Alarm 2 Setpoint, Sensor 1 *	Base+594	Single Precision Float
Alarm 2 Setpoint, Sensor 2 *	Base+596	Single Precision Float
Alarm 2 Setpoint, Sensor 3 *	Base+598	Single Precision Float
Alarm 2 Setpoint, Sensor 4 *	Base+600	Single Precision Float
Alarm 2 Setpoint, Sensor 5 *	Base+602	Single Precision Float
Alarm 2 Setpoint, Sensor 6 *	Base+604	Single Precision Float
Alarm 3 Setpoint, Sensor 1 *	Base+606	Single Precision Float
Alarm 3 Setpoint, Sensor 2 *	Base+608	Single Precision Float
Alarm 3 Setpoint, Sensor 3 *	Base+610	Single Precision Float
Alarm 3 Setpoint, Sensor 4 *	Base+612	Single Precision Float
Alarm 3 Setpoint, Sensor 5 *	Base+614	Single Precision Float
Alarm 3 Setpoint, Sensor 6 *	Base+616	Single Precision Float
Alarm Function Word 1 *	Base+618	0..32767, See section 22
Alarm Function Word 2 *	Base+619	0..32767, See section 23

\* Read/write areas.

\*\* 0x0 – none, 0x01 - % LEL, 0x02 - %, 0x03 – PPM, more to be defined.

\*\*\* All characters in ASCII format, except for "~" which means "IR".

**Table C-8. Indirect Addressing Register Set  
(Read/Write, Read only registers)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Type of Data to Change	Base+701	1 - Coil, 2 - register, 3 - float.
Address	Base+702	Valid coil or register address.
Value	Base+703	0 – 1 if Coil, Integer if Register
Value	Base+704	Combined w/Reg above if float.
Trigger	Base+705	Trigger Write.

**Table C-9. ModBUS General Status Bits  
(Read Only at address Base+201)**

NAME	BIT	FUNCTION DESCRIPTION
Device Fault (any fault)	0	Set for all fault conditions
Calibration Active – Sensor 1	1	Set during calibration
Calibration Active – Sensor 2	2	Set during calibration
Calibration Active – Sensor 3	3	Set during calibration
Calibration Active – Sensor 4	4	Set during calibration
Calibration Active – Sensor 5	5	Set during calibration
Calibration Active – Sensor 6	6	Set during calibration
Warm up Mode	7	Set during startup
Low Alarm Active	8	Set while alarm relay is active
Mid Alarm Active	9	Set while alarm relay is active
High Alarm Active	10	Set while alarm relay is active
POR	11	Set upon any reset condition or sensor replacement.
Alarm	12	Set if alarm active
Unit ACK'd	13	Set if ack'd
Hibernate Mode	14	0 = normal run, 1 = hibernate mode
Wireless/Wired Connection	15	0 = wireless, 1 = wired

**Table C-10. ModBUS General Status Bits #2  
(Read Only at address Base+202)**

NAME	BIT	FUNCTION DESCRIPTION
Sensor #1 disabled	0	0 = enabled, 1 = disabled
Sensor #2 disabled	1	0 = enabled, 1 = disabled
Sensor #3 disabled	2	0 = enabled, 1 = disabled
Sensor #4 disabled	3	0 = enabled, 1 = disabled
Sensor #5 disabled	4	0 = enabled, 1 = disabled
Sensor #6 disabled	5	0 = enabled, 1 = disabled
For future use	6	
For future use	7	
For future use	8	
For future use	9	
For future use	10	
For future use	11	
For future use	12	
For future use	13	
For future use	14	
Not used	15	

**Table C-11. ModBUS General Alarm Bits 1  
(Read Only at address Base+203)**

NAME	BIT	FUNCTION DESCRIPTION
Alarm 1 Sensor 1	0	Set while sensor 1 alarm active
Alarm 2 Sensor 1	1	Set while sensor 1 alarm active
Alarm 3 Sensor 1	2	Set while sensor 1 alarm active
Alarm 1 Sensor 2	3	Set while sensor 2 alarm active
Alarm 2 Sensor 2	4	Set while sensor 2 alarm active
Alarm 3 Sensor 2	5	Set while sensor 2 alarm active
Alarm 1 Sensor 3	6	Set while sensor 3 alarm active
Alarm 2 Sensor 3	7	Set while sensor 3 alarm active
Alarm 3 Sensor 3	8	Set while sensor 3 alarm active
Alarm 1 Sensor 4	9	Set while sensor 4 alarm active
Alarm 2 Sensor 4	10	Set while sensor 4 alarm active
Alarm 3 Sensor 4	11	Set while sensor 4 alarm active
Alarm 1 Sensor 5	12	Set while sensor 5 alarm active
Alarm 2 Sensor 5	13	Set while sensor 5 alarm active
Alarm 3 Sensor 5	14	Set while sensor 5 alarm active
Not used	15	

**Table C-12. ModBUS General Alarm Bits 2  
(Read Only at address Base+204)**

NAME	BIT	FUNCTION DESCRIPTION
Alarm 1 Sensor 6	0	Set while sensor 6 alarm active
Alarm 2 Sensor 6	1	Set while sensor 6 alarm active
Alarm 3 Sensor 6	2	Set while sensor 6 alarm active
For future use	3	
For future use	4	
For future use	5	
For future use	6	
For future use	7	
For future use	8	
For future use	9	
For future use	10	
For future use	11	
For future use	12	
For future use	13	
For future use	14	
Not Used	15	

**Table C-13. ModBUS Fault Status Bits  
(Read Only at address Base+205)**

NAME	BIT	FUNCTION DESCRIPTION
Fault Relay Active	0	Set when this fault is detected
Sensor Missing – Sensor 1	1	Set when this fault is detected
Sensor Missing – Sensor 2	2	Set when this fault is detected
Sensor Missing – Sensor 3	3	Set when this fault is detected
Sensor Missing – Sensor 4	4	Set when this fault is detected
Sensor Missing – Sensor 5	5	Set when this fault is detected
Sensor Missing – Sensor 6	6	Set when this fault is detected
Calibration Fault – Sensor 1	7	Set when this fault is detected
Calibration Fault – Sensor 2	8	Set when this fault is detected
Calibration Fault – Sensor 3	9	Set when this fault is detected
Calibration Fault – Sensor 4	10	Set when this fault is detected
Calibration Fault – Sensor 5	11	Set when this fault is detected
Calibration Fault – Sensor 6	12	Set when this fault is detected
Power Fail Fault – Sensor 1	13	Set when this fault is detected
Power Fail Fault – Sensor 2	14	Set when this fault is detected
None	15	

**Table C-14. ModBUS Fault Status Bits  
(Read Only at address Base+206)**

NAME	BIT	FUNCTION DESCRIPTION
Power Fail Fault – Sensor 3	0	Set when this fault is detected
Power Fail Fault – Sensor 4	1	Set when this fault is detected
Power Fail Fault – Sensor 5	2	Set when this fault is detected
Power Fail Fault – Sensor 6	3	Set when this fault is detected
Power Fail Fault – Main Unit +5VDC	4	Set when this fault is detected
Sensor End of life – Sensor 1	5	Set when this fault is detected
Sensor End of life – Sensor 2	6	Set when this fault is detected
Sensor End of life – Sensor 3	7	Set when this fault is detected
Sensor End of life – Sensor 4	8	Set when this fault is detected
Sensor End of life – Sensor 5	9	Set when this fault is detected
Sensor End of life – Sensor 6	10	Set when this fault is detected
ToxX Configuration Reset	11	Set when a datasheet reset occurs
For future use	12	
For future use	13	
For future use	14	
For future use	15	

**Table C-15. Control Words (Read Register/Write Coil)**

DESCRIPTION	ADDRESS	POSSIBLE VALUES
Command Word 1	Base+401	0 to 32767, See section 19
Command Word 2	Base+402	0 to 32767, See section 20
Command Word 3	Base +403	0 to 32767, See section 21
Command Word 4	Base + 404	0 to 32767, See section XX

**Table C-16. ModBUS Command Word 1  
(Read at address Base+401/ Write coils 1 - 16)**

NAME	BIT	COIL	FUNCTION DESCRIPTION
Start Full ICAL Calibration Sensor 1	0	1	Rtn's fault if any Calibration in progress
Start Full ICAL Calibration Sensor 2	1	2	Rtn's fault if any Calibration in progress
Start Full ICAL Calibration Sensor 3	2	3	Rtn's fault if any Calibration in progress
Start Full ICAL Calibration Sensor 4	3	4	Rtn's fault if any Calibration in progress
Start Full ICAL Calibration Sensor 5	4	5	Rtn's fault if any Calibration in progress
Start Full ICAL Calibration Sensor 6	5	6	Rtn's fault if any Calibration in progress
Start Standard Span Calibration Sensor 1	6	7	Rtn's fault if any Calibration in progress
Start Standard Span Calibration Sensor 2	7	8	Rtn's fault if any Calibration in progress
Start Standard Span Calibration Sensor 3	8	9	Rtn's fault if any Calibration in progress
Start Standard Span Calibration Sensor 4	9	10	Rtn's fault if any Calibration in progress
Start Standard Span Calibration Sensor 5	10	11	Rtn's fault if any Calibration in progress
Start Standard Span Calibration Sensor 6	11	12	Rtn's fault if any Calibration in progress
Start Standard Zero Calibration Sensor 1	12	13	Rtn's fault if any Calibration in progress
Start Standard Zero Calibration Sensor 2	13	14	Rtn's fault if any Calibration in progress
Start Standard Zero Calibration Sensor 3	14	15	Rtn's fault if any Calibration in progress
Zero All Sensors	15	16	1 to start the Zero all Calibration.

**Table C-17. ModBUS Command Word 1**  
**(Read at address Base+402/Write coils 17 - 32)**

NAME	BIT	COIL	FUNCTION DESCRIPTION
Start Standard Zero Calibration Sensor 4	0	17	Rtn's fault if any Calibration in progress
Start Standard Zero Calibration Sensor 5	1	18	Rtn's fault if any Calibration in progress
Start Standard Zero Calibration Sensor 6	2	19	Rtn's fault if any Calibration in progress
Start UCAL Calibration – Sensor 1	3	20	Rtn's fault if any Calibration in progress
Start UCAL Calibration – Sensor 2	4	21	Rtn's fault if any Calibration in progress
Start UCAL Calibration – Sensor 3	5	22	Rtn's fault if any Calibration in progress
Start UCAL Calibration – Sensor 4	6	23	Rtn's fault if any Calibration in progress
Start UCAL Calibration – Sensor 5	7	24	Rtn's fault if any Calibration in progress
Start UCAL Calibration – Sensor 6	8	25	Rtn's fault if any Calibration in progress
Step UCAL	9	26	1 to step
Abort Calibration (any)	10	27	1 to abort
Instrument shutdown	11	28	1 turns the unit off.
Display Message/light beacon	12	29	1 turns on the beacon at the unit. 0 turns off the beacon at the unit.
Hibernate Mode	13	30	1 turns on hibernate, 0 goes back to normal run mode.
Wired/Wireless	14	31	0 sets the unit to wireless mode. 1 sets the unit to wired mode.
LEDs	15	32	0 set the LEDs to the OFF mode 1 sets the LEDs to the ON mode.



**Table C-18. ModBUS Command Word 2  
(Read at address Base+403/ Write coils 33 - 48)**

NAME	BIT	COIL	FUNCTION DESCRIPTION
Sensor Swap Delay	0	33	1-Enable, 0-Disable
Alert Option Enable	1	34	1-Enable, 0-Disable
Acknowledge or Reset Latched Alarms(ACK)	2	35	1 to initiate (same functionality as pushbutton or IR command)
Reset Main Board and sensors	3	36	1 to initiate
Reset Data Sheet – Sensor 1	4	37	1 to initiate
Reset Data Sheet – Sensor 2	5	38	1 to initiate
Reset Data Sheet – Sensor 3	6	39	1 to initiate
Reset Data Sheet – Sensor 4	7	40	1 to initiate
Reset Data Sheet – Sensor 5	8	41	1 to initiate
Reset Data Sheet – Sensor 6	9	42	1 to initiate
Disable Sensor 1	10	43	1 to Disable
Disable Sensor 2	11	44	1 to Disable
Disable Sensor 3	12	45	1 to Disable
Disable Sensor 4	13	46	1 to Disable
Disable Sensor 5	14	47	1 to Disable
Disable Sensor 6	15	48	1 to Disable

**Table C-19. Alarm Function Codes – Word 1**  
(Read at address Base+167/ Write coils 49-64 )

NAME	BIT	COIL	FUNCTION DESCRIPTION
Alarm 1 Enable, Sensor 1	0	49	1-Enable, 0-Disable
Alarm 1 Enable, Sensor 2	1	50	1-Enable, 0-Disable
Alarm 1 Enable, Sensor 3	2	51	1-Enable, 0-Disable
Alarm 1 Enable, Sensor 4	3	52	1-Enable, 0-Disable
Alarm 1 Enable, Sensor 5	4	53	1-Enable, 0-Disable
Alarm 1 Enable, Sensor 6	5	54	1-Enable, 0-Disable
Alarm 2 Enable, Sensor 1	6	55	1-Enable, 0-Disable
Alarm 2 Enable, Sensor 2	7	56	1-Enable, 0-Disable
Alarm 2 Enable, Sensor 3	8	57	1-Enable, 0-Disable
Alarm 2 Enable, Sensor 4	9	58	1-Enable, 0-Disable
Alarm 2 Enable, Sensor 5	10	59	1-Enable, 0-Disable
Alarm 2 Enable, Sensor 6	11	60	1-Enable, 0-Disable
Alarm 3 Enable, Sensor 1	12	61	1-Enable, 0-Disable
Alarm 3 Enable, Sensor 2	13	62	1-Enable, 0-Disable
Alarm 3 Enable, Sensor 3	14	63	1-Enable, 0-Disable
Not used	15	64	

**Table C-20. Alarm Function Codes – Word 2**  
(Read at address Base+168/Write coils 65-80)

NAME	BIT	COIL	FUNCTION DESCRIPTION
Alarm 3 Enable, Sensor 4	0	65	1-Enable, 0-Disable
Alarm 3 Enable, Sensor 5	1	66	1-Enable, 0-Disable
Alarm 3 Enable, Sensor 6	2	67	1-Enable, 0-Disable
Alarm 1 Direction, Sensor 1	3	68	1-Increasing, 0-Decreasing
Alarm 1 Direction, Sensor 2	4	69	1-Increasing, 0-Decreasing
Alarm 1 Direction, Sensor 3	5	70	1-Increasing, 0-Decreasing
Alarm 1 Direction, Sensor 4	6	71	1-Increasing, 0-Decreasing
Alarm 1 Direction, Sensor 5	7	72	1-Increasing, 0-Decreasing
Alarm 1 Direction, Sensor 6	8	73	1-Increasing, 0-Decreasing
Alarm 2 Direction, Sensor 1	9	74	1-Increasing, 0-Decreasing
Alarm 2 Direction, Sensor 2	10	75	1-Increasing, 0-Decreasing
Alarm 2 Direction, Sensor 3	11	76	1-Increasing, 0-Decreasing
Alarm 2 Direction, Sensor 4	12	77	1-Increasing, 0-Decreasing
Alarm 2 Direction, Sensor 5	13	78	1-Increasing, 0-Decreasing
Alarm 2 Direction, Sensor 6	14	79	1-Increasing, 0-Decreasing
Not used	15	80	

**Table C-21. Alarm Function Codes – Word 3**  
**(Read at address Base+169/Write coils 81-96)**

NAME	BIT	COIL	FUNCTION DESCRIPTION
Alarm 3 Direction, Sensor 1	0	81	1-Increasing, 0-Decreasing
Alarm 3 Direction, Sensor 2	1	82	1-Increasing, 0-Decreasing
Alarm 3 Direction, Sensor 3	2	83	1-Increasing, 0-Decreasing
Alarm 3 Direction, Sensor 4	3	84	1-Increasing, 0-Decreasing
Alarm 3 Direction, Sensor 5	4	85	1-Increasing, 0-Decreasing
Alarm 3 Direction, Sensor 6	5	86	1-Increasing, 0-Decreasing
Alarm 1 Latch Status, Sensor 1	6	87	0 – Non-Latching, 1 – Latching
Alarm 1 Latch Status, Sensor 2	7	88	0 – Non-Latching, 1 – Latching
Alarm 1 Latch Status, Sensor 3	8	89	0 – Non-Latching, 1 – Latching
Alarm 1 Latch Status, Sensor 4	9	90	0 – Non-Latching, 1 – Latching
Alarm 1 Latch Status, Sensor 5	10	91	0 – Non-Latching, 1 – Latching
Alarm 1 Latch Status, Sensor 6	11	92	0 – Non-Latching, 1 – Latching
Alarm 2 Latch Status, Sensor 1	12	93	0 – Non-Latching, 1 – Latching
Alarm 2 Latch Status, Sensor 2	13	94	0 – Non-Latching, 1 – Latching
Alarm 2 Latch Status, Sensor 3	14	95	0 – Non-Latching, 1 – Latching
Not used	15	96	

**Table C-22. Alarm Function Codes – Word 4**  
**(Read at address Base+170/Write coils 97-112 )**

NAME	BIT	COIL	FUNCTION DESCRIPTION
Alarm 2 Latch Status, Sensor 4	0	97	0 – Non-Latching, 1 – Latching
Alarm 2 Latch Status, Sensor 5	1	98	0 – Non-Latching, 1 – Latching
Alarm 2 Latch Status, Sensor 6	2	99	0 – Non-Latching, 1 – Latching
Alarm 3 Latch Status, Sensor 1	3	100	0 – Non-Latching, 1 – Latching
Alarm 3 Latch Status, Sensor 2	4	101	0 – Non-Latching, 1 – Latching
Alarm 3 Latch Status, Sensor 3	5	102	0 – Non-Latching, 1 – Latching
Alarm 3 Latch Status, Sensor 4	6	103	0 – Non-Latching, 1 – Latching
Alarm 3 Latch Status, Sensor 5	7	104	0 – Non-Latching, 1 – Latching
Alarm 3 Latch Status, Sensor 6	8	105	0 – Non-Latching, 1 – Latching
Relay State-NO Alarm	9	106	1 – Normally Energized, 0 – Normally De-energized
Relay State-NO Alarm	10	107	1 – Normally Energized, 0 – Normally De-energized
Relay State-NO Alarm	11	108	1 – Normally Energized, 0 – Normally De-energized
Backlight	12	109	0 sets the BACKLIGHT to the OFF state 1 sets the BACKLIGHT to the ON state
Horn Enable	13	110	0 sets the horn to disabled 1 sets the horn to enabled
Beacon Enable	14	111	0 sets the beacon to disabled 1 sets the beacon to enabled
Pump Enable	15	112	0 sets the pump to disabled 1 sets the pump to enabled

**Table C-23. Calibration Step**  
**(Read only at address Base+248)**

DESCRIPTION	CODE
30 Sec Countdown to Start Zero	0
Waiting for Zero	1
30 Sec Countdown to Start SPAN	2
Waiting for SPAN	3
Calibration Aborted	4
Zero Cal Fault	5
Span Cal Fault	6
Calibration Completed Successfully	7

**Table C-24. Baud Rate Codes (Read/Write at address Base+102)**

DESCRIPTION	CODE
1200	0
2400	1
4800	2
9600	3
19200(default)**	4

\*\* Default Serial settings are 19200 baud, 1 start bit, 8 data bits, even parity, 1 stop bit.

**Table C-25. Parity Codes (Read/Write at address Base+103)**

DESCRIPTION	CODE
None	2
Odd	1
Even (default)**	0

\*\* Default Serial settings are 19200 baud, 1 start bit, 8 data bits, even parity, 1 stop bit.

**Table C-26. Model Numbers  
(Read at address Base+224/Base + 524)**

DESCRIPTION	CODE
SAFE MTX	0
Sirius	1
Sentry	8