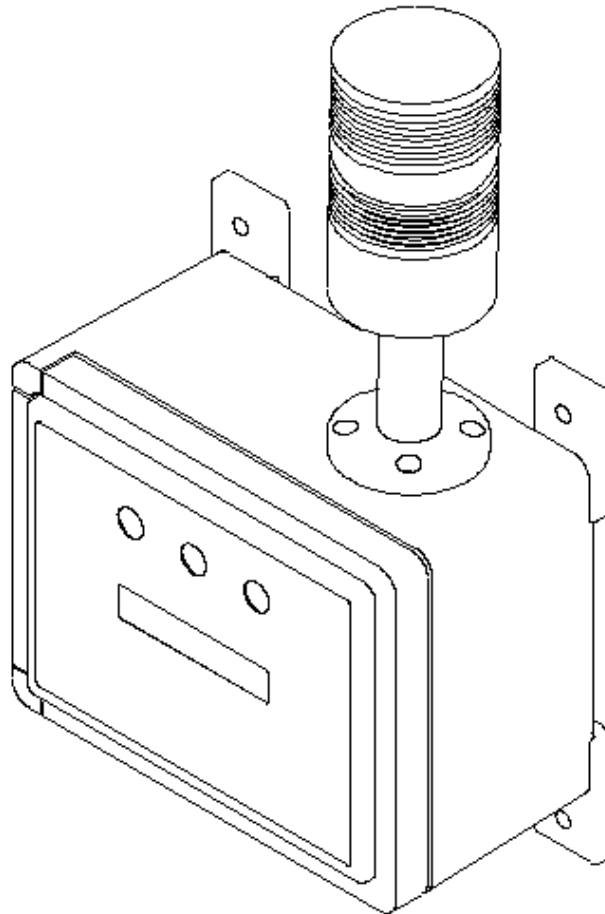




# **ZoneGuard**

## **Single Channel Fixed Gas Detection System**

### **Reference Manual**



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# **WARNING**

**THE ZONEGUARD SINGLE CHANNEL FIXED GAS DETECTION SYSTEM HAS BEEN DESIGNED FOR THE DETECTION AND MEASUREMENT OF POTENTIALLY HAZARDOUS ATMOSPHERIC CONDITIONS**

**IN ORDER TO ASSURE THAT THE USER IS PROPERLY WARNED OF POTENTIALLY DANGEROUS CONDITIONS, IT IS ESSENTIAL THAT THE INSTRUCTIONS IN THIS MANUAL BE READ, FULLY UNDERSTOOD, AND FOLLOWED.**

**ZoneGuard Operation Manual  
Version 2.4  
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by  
Sperian Instrumentation  
651 South Main Street  
Middletown, Connecticut 06457**

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## SIGNAL WORDS

The following signal words, as defined by ANSI Z535.4-1998, are used in the Zoneguard Reference Manual.

**⚠DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**⚠WARNING** indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**⚠CAUTION** indicates a potentially hazardous situation, which if not avoided, may result in moderate or minor injury.

CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

## WARNINGS

1. **⚠WARNING** The Zoneguard personal, portable gas detector has been designed for the detection of dangerous atmospheric conditions. An alarm condition indicates the presence of a potentially life-threatening hazard and should be taken very seriously. Failure to immediately leave the area during an alarm condition may result in serious injury or death.
2. **⚠WARNING** In the event of an alarm condition it is important to follow established procedures. The safest course of action is to immediately leave the affected area, and to return only after further testing determines that the area is once again safe for entry. Failure to immediately leave the area during an alarm condition may result in serious injury or death.
3. **⚠WARNING** The accuracy of the Zoneguard should be checked periodically with known concentration calibration gas. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.
4. **⚠WARNING** The accuracy of the Zoneguard should be checked immediately following any known exposure to contaminants by testing with known concentration test gas before further use. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.
5. **⚠WARNING** A sensor that cannot be calibrated or is found to be out of tolerance should be replaced immediately. An instrument that fails calibration may not be used until testing with known concentration test gas determines that accuracy has been restored, and the instrument is once again fit for use.
6. **⚠WARNING** Do not reset the calibration gas concentration unless you are using a calibration gas concentration that differs from the one that is normally supplied by Sperian Instrumentation for use in calibrating the Zoneguard. Use of inappropriate calibration gas may lead to inaccurate and potentially dangerous readings.  
Customers are strongly urged to use only Sperian calibration materials when calibrating the Zoneguard. Use of non-standard calibration gas and/or calibration kit components can lead to dangerously inaccurate readings and may void the standard Sperian Instrumentation warranty.
7. **⚠WARNING** Use of non-standard calibration gas and/or calibration kit components when calibrating the Zoneguard can lead to inaccurate and potentially dangerous readings and may void the standard Sperian Instrumentation warranty.  
Sperian Instrumentation offers calibration kits and long-lasting cylinders of test gas specifically developed for easy Zoneguard calibration. Customers are strongly urged to use only Sperian calibration materials when calibrating the Zoneguard.
8. **⚠WARNING** Substitution of components may impair intrinsic safety.
9. **⚠WARNING** For safety reasons this equipment must be operated and serviced by qualified personnel only. Read and understand this reference manual before operating or servicing the Zoneguard.
10. **⚠WARNING** A rapid up-scale reading followed by a declining or erratic reading may indicate a hazardous combustible gas concentration that exceeds the Zoneguard's zero to 100 percent LEL detection range. The safest course of action is to immediately leave the affected area, and to return only after further testing determines that the area is once again safe for entry.

# CHAPTER 1. DESCRIPTION

## 1.1 ZoneGuard capabilities

The ZoneGuard is a microprocessor based fixed gas detection system designed to accept the input from a single oxygen, combustible gas or toxic sensor. ZoneGuard systems are designed to provide continuous round-the-clock monitoring for a variety of common atmospheric hazards including oxygen deficiency and/or enrichment, combustible gases and vapors, and specific toxic contaminants such as carbon monoxide (CO), hydrogen sulfide (H<sub>2</sub>S), sulfur dioxide (SO<sub>2</sub>), chlorine (Cl<sub>2</sub>), chlorine dioxide (ClO<sub>2</sub>), phosphine (PH<sub>3</sub>), and nitrogen dioxide (NO<sub>2</sub>). Sensors may be integrally mounted to the ZoneGuard controller housing, or located up to 50 feet away from the controller. Remote detector assemblies are available in explosion-proof or non-explosion-proof versions. (Combustible sensors may only be mounted in explosion-proof sensor housings.) The unit is designed for operation via 120VAC 60 Hz. external power source.

Standard features include two independently adjustable alarm setpoints, built-in loud audible alarm (85 dB at 3-feet), easily-read, backlit LCD display, and bright LED alarm light indicators for OK / power on (green), low alarm (amber) and high alarm (red) conditions. Standard features also include DPDT relay contacts (rated 5A at 250V non-inductive load) for low and high alarm conditions. Optional accessories include externally mounted high intensity strobe lights and high intensity horn.

The ZoneGuard offers a choice of two modes of operation, Text Only ("OK"), and Basic (numeric readings) to provide the right amount of information for users with different skill levels and monitoring requirements. "One Button" operating logic allows all procedures necessary for normal day-to-day operation, including fully automatic calibration adjustment, to be made through the use of the single On/Off "Mode" button.

ZoneGuard sensors which are installed in explosion-proof remote detector housings are classified by Underwriters Laboratories, Inc. and the Canadian Standards Association as Explosion-Proof for use in Class I, Division 1, Groups A, B, C, D, E, F and G hazardous locations.

Each ZoneGuard system includes the controller with all standard alarms, relays and electronics installed in a NEMA 4X fiberglass housing; sensor, mounting ears, calibration adaptor, Reference Manual, Quick Reference Card, and other standard accessories. Remote detector assemblies include the remote sensor housing, the appropriate amplifier board (installed in the remote detector housing), and sensor.

**Note: Conduit, wire and other components necessary to connect the remote detector assembly with the instrument controller are not included and must be ordered separately.**

The ZoneGuard design includes many user selectable features and is designed to be easily customized to meet specific customer requirements. This chapter discusses

some of these special features as well as basic capabilities used on a day-to-day basis.

## 1.2 Method of sampling

Once it has been connected to a power source and placed in normal operation, the ZoneGuard system continuously monitors for the hazard the sensor is designed to detect. ZoneGuard sensors may be either integrally mounted to the controller housing, or remotely located up to 50 feet away from the controller. The atmosphere being measured reaches the sensor by diffusing through a protective filter into the sensor. Normal air movements are enough to carry the sample to the sensor. The sensor reacts to changes in the concentration of the hazard being measured. Values are constantly updated and displayed on the ZoneGuard controller LCD.

### 1.2.1 Wiring recommendations

For oxygen remote detectors use (minimum) 22 gauge AWG, 6 conductor twisted-pair shielded with drain. For toxic remote detectors use (minimum) 22 gauge AWG, 4 conductor twisted-pair shielded with drain. For combustible remote detectors use 18 gauge AWG, 4 conductor twisted-pair shielded with drain.

The maximum distance a ZoneGuard remote detector may be located from the controller is 50 feet.

## 1.3 Sensor options

ZoneGuard systems can be configured to monitor for a number of different atmospheric hazards. The hazard the system is configured to detect is determined by the type of sensor installed. The types of sensors currently available include a galvanic oxygen (O<sub>2</sub>) sensor, a catalytic-bead pellistor for LEL combustible gas, and substance-specific electrochemical sensors for carbon monoxide (CO), hydrogen sulfide (H<sub>2</sub>S), sulfur dioxide (SO<sub>2</sub>), chlorine (Cl<sub>2</sub>), chlorine dioxide (ClO<sub>2</sub>), phosphine (PH<sub>3</sub>), and nitrogen dioxide (NO<sub>2</sub>). Oxygen readings are given in percent-by-volume, combustible gas readings in percent LEL, and toxic gas readings in PPM (parts per million) or 0.1 PPM concentrations.

## 1.4 Calibration

ZoneGuard systems have been designed for easy verification of accuracy.

**⚠WARNING** The accuracy of the Zoneguard should be checked periodically with known concentration calibration gas. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.

### 1.4.1 One Button Auto Calibration

"One Button" logic means that all normal day-to-day operating procedures, including automatic calibration adjustment, may be made through the use of the single On/Off Mode button.

**Calibration procedures are discussed in detail in Chapter 3.**

## 1.5 Displays and controls

ZoneGuard systems include an 8-character LCD readout located at the controller which is used to display gas readings and other messages. Built-in LED alarm lights are used to indicate “OK” / Power-on (green), “Low Alarm” (amber), and “High Alarm” (red) conditions.

The On/Off “Mode” button is to initiate the automatic calibration sequence and to control most other day-to-day procedures. The button is located on the exterior of the controller housing, on the underside of the case. Four additional push-button controls (“-”, “+”, “Alarm” and “Cal”) are located on the inside of the controller housing door. These buttons are used for advanced procedures such as changing operating modes, changing alarm setpoints, adjusting calibration gas values, making optional setup choices, and other advanced procedures.

## 1.6 Alarm Logic

**⚠WARNING** The Zoneguard personal, portable gas detector has been designed for the detection of dangerous atmospheric conditions. An alarm condition indicates the presence of a potentially life-threatening hazard and should be taken very seriously. Failure to immediately leave the area during an alarm condition may result in serious injury or death.

**In the event of an alarm condition it is important to follow established procedures. The safest course of action is to immediately leave the affected area, and return only after further testing together with other appropriate safety procedures determine that the area is once again safe for entry.**

ZoneGuard alarms are user adjustable and may be set anywhere within the range of the specific sensor. When an alarm set point is exceeded the audible alarm sounds, the appropriate bright LED alarm light indicator are turned-on, and (if equipped) the optional external strobe light(s) and/or remote high intensity audible alarm are activated. (Any external alarm devices controlled by means of the ZoneGuard alarm relay contacts will also be activated.)

ZoneGuard alarms are normally of the self-resetting type. When readings drop back below the pre-set alarm levels, the instrument returns to normal operation, and the visual and audible alarms cease.

It is possible to set ZoneGuard alarms so that they “latch”. In the latched condition, once an alarm occurs both visual and audible alarms will continue to sound even after the atmospheric hazard has cleared. The instrument must be manually reset before the alarms are silenced.

**Procedures for latching ZoneGuard alarms are given in Chapter 4.**

ZoneGuard systems equipped with toxic or combustible gas sensors are provided with two levels of gas alarm: “Low” (warning) and “High” (danger). Toxic and combustible alarms are configured as “ascending”, meaning that they are triggered when gas concentrations exceed the alarm setpoints.

ZoneGuard systems equipped with oxygen sensors have four levels of gas alarm, two “ascending” alarms (“Warning” and “Danger”) for oxygen enrichment, and two “descending” (“Warning” and “Danger”) alarms for oxygen deficiencies. Descending alarms are activated when oxygen concentrations drop below the alarm setpoints for oxygen deficiency.

**Note: “Warning” level alarms may be manually acknowledged and silenced for a period of 10 minutes by pressing the Mode button. If the alarm condition continues to exist after 10 minutes has elapsed, the “Warning” alarms will be reactivated. If the alarm condition reaches the “Danger” level during this 10 minute period, the “Danger” level alarms will immediately be activated regardless of whether or not the “Warning” alarm has been silenced. “Danger” level alarms may not be manually silenced.**

The procedures for adjusting alarm setpoints are given in Chapter 4.

## 1.7 Special microprocessor features

Several automatic programs prevent tampering and misuse of the ZoneGuard by unauthorized persons. Each time the detector is turned on, an electronic self-test is performed that assures the user of proper performance.

Optional setup choices include latching alarms, changing the concentration of the gas that is used during Auto Calibration adjustment, as well as changing or restoring the factory alarm settings by using the 4 push-buttons on the instrument keypad. It is also possible to enable or disable use of the external Mode button.

ZoneGuard software also includes an “Alarm Test” function that can be used to automatically “ramp” readings throughout the full range of the sensor. The “Alarm Test” function is used to verify alarm setpoints as well as the proper activation of the audible alarm, LED alarm light indicators, optional strobe lights or horn, as well as other alarm devices or peripheral equipment controlled by means of the ZoneGuard relay contacts.

**Chapters 4 and 5 describe how to use these advanced technical features and setup choices in greater detail.**

## 1.8 Relays and outputs

**See Appendix F for ZoneGuard electrical schematics and wiring diagrams.**

### 1.8.1 VAC relay contacts

ZoneGuard systems include DPDT relay contacts for warning (low) and danger (high) gas alarm conditions. ZoneGuard relay contacts are rated at 5 Amp at 250 VAC, non-inductive load.

### 1.8.2 VDC outputs

ZoneGuard systems also include +12 VDC outputs rated at 0.5 Amp for warning (low) and danger (high) gas alarm conditions.

**CAUTION: ZoneGuard +12 VDC outputs may only be used to provide power to remote alarm devices which**

have been approved by Sperian Instrumentation for use with the ZoneGuard system. Use of non-approved devices may cause damage to the ZoneGuard system, and void the Sperian Instrumentation Standard Warranty for Gas Detection Products. Contact Sperian's Technical Service Department at (860) 344-1079 for additional information on approved remote alarm devices.

### 1.8.3 Output operation

ZoneGuard alarms are normally of the "self-resetting" type, and will cease when readings drop back below the pre-set alarm levels. ZoneGuard alarms may also be configured to "latch" so that the alarms remain activated even after the alarm condition has ceased. Once activated, a latched alarm will continue to sound until the instrument is manually reset by pressing the mode button.

**The procedure for changing the alarm latch setting is given in Chapter 4**

If the gas concentration causes the activation of the low (warning level) alarm, the audible alarm is activated, the low level (amber) alarm LED illuminates, and the low alarm relay is activated. Warning level alarms may be silenced and the relay deactivated for a period of 10 minutes by pressing the Mode button.

If the gas concentration causes the activation of the high (danger level) alarm, the audible alarm is activated, the high level (red) alarm LED illuminates, and the high alarm relay is activated. High level alarms may not be manually silenced by pressing the Mode button.

ZoneGuard systems are supplied with relays and outputs preset with the following standard factory setup:

VAC relays:	
Warning (low) alarm	Normally energized (fail safe)
Danger (high) alarm	Normally energized (fail safe)
12 VDC outputs:	
Warning (low) alarm	Normally de-energized
Danger (high) alarm	Normally de-energized

## 1.9 Classification for use in hazardous locations

ZoneGuard remote detector assemblies are available in both explosion-proof and non-explosion-proof versions. Explosion-proof version remote detector assemblies have been submitted to Underwriters Laboratories, Inc. for Classification per UL<sub>C</sub> as Explosion-Proof for use in Class I, Division 1, Groups A, B, C, D, E, F, and G explosive atmospheres.

### 1.10 ZoneGuard design components

**See Appendix F for dimensional drawings, mounting schematics, and wiring diagrams for the ZoneGuard controller and remote detector assemblies.**

#### 1.10.1 ZoneGuard controller

The ZoneGuard controller unit is enclosed in a durable, gasketed, fiberglass NEMA 4X case. The On/Off Mode

button is located on the exterior of the controller housing, on the underside of the case. Four additional push-button controls ("-", "+", "Alarm" and "Cal") are located inside the door of the controller housing.

#### 1.10.1.1 LED alarm light indicators

ZoneGuard controllers include 3 bright system status and alarm condition LED indicators; green for "OK" / Power On, amber for "Warning", and red for "Danger".

#### 1.10.1.2 Audible alarm

A loud (85 dB at 3 feet) built-in audible alarm is provided to warn users of hazardous conditions. Optional remote audible alarms and high intensity horns are also available.

#### 1.10.1.3 Detector display

An 8-character LCD readout is used to display gas readings and other information.

**Readings, messages, and modes of operation are discussed in Chapter 2.**

### 1.10.2 Remote detector assemblies

Remote detector assemblies include sensor, sensor specific amplifier board (installed in the remote detector housing), and remote detector housing. Oxygen and toxic gas remote detector assemblies are available in both "standard" (non-explosion-proof) and "explosion-proof" versions. Remote detector assemblies for combustible gas are only available in explosion-proof housings.

**Installation procedures are discussed in Chapter 2.**

#### 1.10.2.1 Standard Detector housing

"Standard" remote detector assemblies are housed in a heavy-duty, nickel-coated, molded junction box. Not for use in hazardous locations.

#### 1.10.2.2 Explosion-proof detector housing

"Explosion-proof" remote detector assemblies are housed in a heavy duty steel explosion-proof (Class I, Division 1, Groups A, B, C, D, E, F, G) junction box with threaded lid.

## CHAPTER 2. INSTALLATION AND BASIC OPERATION

### 2.1 Installation overview

Sperian Instrumentation's gas detection systems are fully tested and calibrated before they leave the factory. However, after installation we strongly recommend that full testing and verification of proper operation is carried out before the system is placed in normal service. Make sure all ZoneGuard system elements and/or peripheral alarm, notification, or control devices are properly installed before connecting the system to a power source!

Make sure that the ZoneGuard system is disconnected from the external power source before installing, replacing, or handling ZoneGuard system components!

Repair of system components damaged as a result of improper installation can be expensive! ZoneGuard installation, initial setup, and / or system modification should only be undertaken by individuals who are qualified and authorized to do so. Call Sperian's Service Department at (860) 344-1079 if you need help or have any questions.

### 2.2 ZoneGuard controller unit

The ZoneGuard controller unit is designed for wall mounting in any convenient non-hazardous location where a suitable power supply is available. ZoneGuard controller units are designed for use with 120VAC, 60Hz. external power.

**Note: ZoneGuard controller housing accessories include a set of 4 external mounting brackets. Use of these mounting brackets is optional. The controller housing may be mounted directly to the wall or other mounting surface by use of screws inserted through apertures in 4 mounting wells located on the back of the controller case, or by means of the external mounting brackets, whichever is more convenient.**

ZoneGuard controller housing accessories also include a ½" NPT galvanized cable grab "gland". If the cable connecting the remote detector housing with the controller is run through conduit, it will be necessary to remove the cable grab gland and replace it with a threaded ½" NPT conduit bushing (not provided). When making use of ZoneGuard relay contacts to control or actuate external alarm devices it will be necessary to remove the "hole-seal" from the bottom of the controller case, and install the appropriate glands or bushings. To prevent dust and water ingress all cable entries and knockouts must be checked and sealed as necessary.

#### 2.2.1 Controller PCBs

The ZoneGuard controller includes a display PCB located underneath the hinged controller case cover, and the relay PCB located on a mounting plate inside the controller case. In the case of ZoneGuard systems with integrally mounted sensors, a sensor specific amplifier board is mounted onto the relay PCB. In the case of ZoneGuard systems with

remote sensors, the amplifier board is located in the remote detector housing.

The four push-buttons ("+", "-", "Alarm", and "Cal") used to make use of advanced features and setup choices are located on the display PCB on the inside of the controller housing door.

### 2.3 Remote detector assemblies

Oxygen and toxic gas remote detector assemblies are available in both "standard" (non-explosion-proof) and "explosion-proof" housings. Remote detector assemblies for combustible gas are only available in explosion-proof housings.

ZoneGuard remote detector assemblies may be located up to 50 feet away from the controller. Power is provided to the remote detector by the ZoneGuard controller.

The ZoneGuard remote detector assembly contains a factory installed, sensor specific amplifier PCB. The remote detector assembly is labeled as to the type of hazard it is designed to measure (i.e. H<sub>2</sub>S, CO, O<sub>2</sub>, etc.).

#### 2.3.1 Standard remote detector housing

Sensors for the measurement of oxygen and toxic gas may be installed either in explosion-proof or "standard" remote detector housings.

**⚠WARNING** Sensors that are housed in "standard" remote detector housings may not be installed in hazardous locations requiring an "Explosion-Proof" classification.

#### 2.3.2 Explosion-proof remote detector housing

Explosion-proof remote detector housings can be installed in Class I, Division 1 Groups A through G hazardous locations.

Explosion-proof remote detectors are installed in a heavy duty stainless steel explosion-proof (Class I, Division 1, Groups A through G) junction box with threaded lid.

**ZoneGuard sensors for the measurement of combustible gas may only be installed in explosion-proof remote detector housings.**

### 2.4 Siting of remote detectors

The specific placement of remote detector assemblies should be a function of the type of area being monitored, the type and source of atmospheric hazard being measured, prevailing wind patterns, and other information.

**Call Sperian's Technical Service Department at (860) 344-1079 for additional advice.**

In general, for gases lighter than air, the detector should be placed at a level slightly above the area where leaks are likely to occur. For gases which are heavier than air the detectors should be located close to floor level or in inspection pits or ducts into which heavier than air gases may collect or flow.

There are many circumstances which may modify this general advice. For example, the molecular weight of nitrogen (MW ≅ 28) is very close to that of air (MW ≅ 29).

When nitrogen is at the same temperature as the air into which it is introduced, it mixes readily, and tends to spread evenly through the affected atmosphere. On the other hand, if the nitrogen is under pressure, and then suddenly released into the atmosphere, as the gas expands (going from higher pressure to a lower pressure) it cools. Because the cooler gas is now denser than the air into which it is being introduced, it no longer mixes in as readily. Instead, the nitrogen tends to fall to floor level, then spread laterally. In this case remote detectors being used to monitor for oxygen deficiency should be located near floor level in order to detect the deficiency as quickly as possible.

The nearer in density to air a gas is, the more easily it will flow with air due to draughts, ventilation etc. A compromise approach for placement of detectors used to measure gases which are only slightly lighter (such as carbon monoxide) or heavier (such as hydrogen sulfide) than air is to mount the detectors at a height as close as possible to the breathing area of personnel being protected.

When installing detector assemblies it is important to ensure that the sensor is not exposed to liquid or dust contamination which would interfere with the passage of gas through the protective filter into the sensor. Remote detector assemblies should be placed so that the axis of the sensor points straight downward. Splash deflectors should be used when water or other liquid is chronically present in the area where the detectors have been located.

## 2.5 Wiring recommendations

For oxygen remote detectors use (minimum) 22 gauge AWG, 6 conductor twisted-pair shielded with drain. For toxic remote detectors use (minimum) 22 gauge AWG, 4 conductor twisted-pair shielded with drain. For combustible remote detectors use 18 gauge AWG, 4 conductor twisted-pair shielded with drain.

The maximum distance a ZoneGuard remote detector may be located from the controller is 50 feet.

Due to the relatively low signal levels carried by wiring between gas detectors and their control unit, it is essential not to run wire near high power electrical equipment. When ZoneGuard systems are installed in environments which contain high power electrical equipment it is usually best to install the wire in conduit.

### 2.5.1 Grounding

Wire used to connect ZoneGuard remote detector assemblies with the controller should always be with drain lead. In order to reduce the chances for electromagnetic interference (EMI), the screen (drain) of the wire should be connected to the ground plate of the detector head (long reach glands and/or the screen terminals should be used for this purpose). Ground loops must be avoided! Grounding is done through the normal circuit ground of the system.

## 2.6 Connecting remote alarm and detector assemblies with the ZoneGuard controller

### 2.6.1 Cautions

**CAUTION:** Make sure that the ZoneGuard system is disconnected from the external power source before installing, replacing, or handling installed ZoneGuard system components!

**CAUTION:** Make sure the remote detector housing is properly connected to the correct controller terminal block connector as discussed below.

**CAUTION:** +12 VDC outputs may only be used to provide power to remote alarm devices which have been approved by Sperian Instrumentation for use with the ZoneGuard system. Use of non-approved devices may cause damage to the ZoneGuard system, and void the Sperian Instrumentation Standard Warranty for Gas Detection Products. Contact Sperian's Technical Service Department at (860) 344-1079 for additional information on approved remote alarm devices.

### 2.6.2 ZoneGuard controller connections

Electrical connections and wiring diagrams for the ZoneGuard controller are shown in Appendix F.

Full wiring schematics are available on the Sperian Instrumentation website (<http://www.biosystems.com>) or by contacting Sperian Instrumentation directly.

Connections are by screw terminal blocks located on the mounting plate and relay PCB located in the ZoneGuard controller. Warning (Low) and Danger (High) VAC output relays are DPDT, are isolated from the system power supply, and are rated at 5 Amp, 250VAC, non-inductive. Warning (Low) and Danger (High) VDC outputs (+12 VDC at 0.5 Amp) may only be used to provide power to remote alarm devices which have been approved by Sperian Instrumentation for use with ZoneGuard systems.

## 2.7 Initial setup

1. Make sure the controller is not connected to any other peripheral or external equipment or alarm devices.
2. Disconnect the built-in "loud" 85 dB audible alarm.
3. Make sure any other alarm or notification devices controlled by means of the ZoneGuard relay contacts are disconnected or turned off.
4. Connect mains power to the controller.
5. Connecting the ZoneGuard system with mains power will cause the detector to turn on in normal operation. The green "OK / Power On" LED indicator should be lit and the LCD display should be on. The LCD display should show a sequence of start-up screens as the detector goes through a self test sequence, followed by the current gas level readings. The ZoneGuard's built-in alarm indicators, optional strobe lights, remote audible alarms, and other devices may be activated while the sensor is stabilizing. The ZoneGuard may be

turned off at this point to allow the sensor to stabilize. The sensor stabilization period is given in step 6.

**Note: The ZoneGuard system is designed so that in the event of a power interruption, the instrument will automatically turn itself back on. To turn the system off it will be necessary to hold down the Mode button until the display goes blank. When the Mode button is released the display will indicate "OFF".**

- The sensors require a brief stabilization period that begins when the instrument is first plugged in. The ZoneGuard must not be used to detect gas until the appropriate stabilization period has passed. The stabilization period is determined by sensor type and given in the following chart.

Sensor	Stabilization Period
Oxygen	1 hour
LEL	5 minutes
All Toxic sensors available for ZoneGuard	15 minutes

- Once the stabilization period has passed, the ZoneGuard should be fresh air zero calibrated. Since the amount of adjustment required at the time of initial setup may be large, it is usually better to make a "manual" fresh air zero adjustment. To do a manual fresh air zero, make sure the sensor is currently located in fresh air, then press the "Cal" button to enter the "Zero Adjust Mode". The display should show the message "Zero Gas". Press the Cal button once more to automatically make a fresh air zero adjustment. **(The complete procedures for zero and span calibration are discussed in Chapter 3.)**
- Reconnect the 85dB audible alarm and any other alarm devices which were turned off or disconnected prior to "powering up" the ZoneGuard system.

**The ZoneGuard system must be properly calibrated as discussed in Chapter 3 at the time of initial installation before the system is put into normal service.**

## 2.8 Normal operation

### 2.8.1 Overview of ZoneGuard operation

The ZoneGuard offers a choice of two modes of operation, Text Only, ("OK") and Basic, (numeric readings). Mode selection should be determined based on how much information is required, the skill level of the user, and the nature of the environment in which the ZoneGuard system is installed.

### 2.8.2 Turning the ZoneGuard on

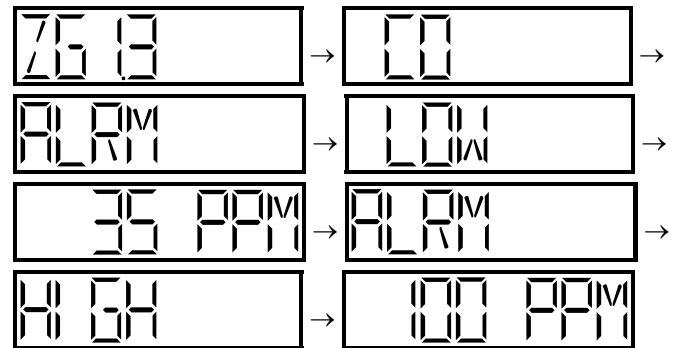
The black switch located on the bottom of the exterior of the ZoneGuard controller housing is called the Mode button. It is used to turn the ZoneGuard on and off, as well as to control most other operations of the instrument. Press and hold the Mode button for one second to turn the ZoneGuard on.

### 2.8.3 Turning the ZoneGuard off

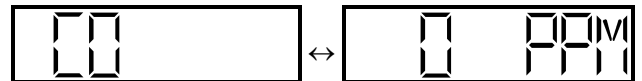
Turn the ZoneGuard off by pressing and holding the Mode button until the LCD goes blank. When the button is released the LCD will display the message "OFF".

### 2.8.4 Start-up sequence

After the ZoneGuard has been turned on, it will automatically go through an electronic self test and start-up sequence that takes approximately twenty seconds. During start-up the LCD display will show several messages or "screens" in sequence. The first screen displays the software version number: The second shows the type of sensor installed. Additional screens will briefly appear indicating the current low (warning) and high (danger) alarm setpoints. For instance, a ZoneGuard for carbon monoxide being operated in the Basic mode would show the following sequence of factory installed (default) alarm set points when the instrument is first turned on. (Note: The software version installed in your ZoneGuard may differ with that shown below.)



At the conclusion of the startup sequence, the screen will cycle back and forth between the current gas readings screen and the sensor identification screen.



**Note: LCD screens indicating readings or alarm setpoints include the measurement units being used. In the case of toxic gas the last three characters will indicate "PPM" (parts-per-million). In the case of combustible gas (LEL) and oxygen the last three display characters will indicate "PCT" (percent).**

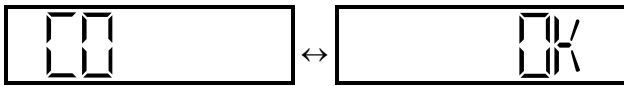
The alarm set-point screens are omitted when the instrument is turned on while in the "Text Only" mode.

## 2.9 Operating modes

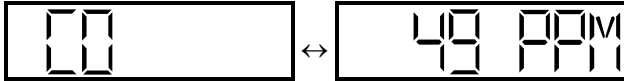
Two operating modes provide ZoneGuard users with the right amount of information to meet their monitoring needs. The ZoneGuard is designed to be as simple or as sophisticated as the job that needs to be done.

### 2.9.1 Text Only mode

The simplest mode of operation is the "Text Only" mode. In this mode, during normal operation the LCD screen displays an "OK" message rather than numerical readings as long as no alarms are present. The "OK" screen alternates with the sensor identification screen.



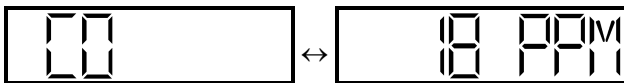
During an alarm condition (when the sensor readings exceed a pre-set alarm level), the ZoneGuard will show readings as a numerical value, activate the appropriate LED alarm light, sound the audible alarm, and (if equipped) activate the optional high intensity strobe light(s), remote audible alarm, and/or other alarm or notification devices controlled by the ZoneGuard relay contacts.



ZoneGuard alarms are normally self-resetting. When readings drop back below the pre-set alarm levels, the screen returns to the "OK" indication, and visual and audible alarms cease.

### 2.9.2 Basic mode

Basic mode provides numerical readings during normal operation.



### 2.9.3 Changing operating modes

To change operating modes, with the instrument running open the door of the controller housing to access the four mini-push-buttons, and simultaneously press and hold the "+" and "-" buttons until the word "MODE" is displayed. Each time the operating mode is changed the display screen will briefly indicate which operating mode "TEXT" or "BASIC" (Basic) has been selected.

**Note: Shifting modes or otherwise reprogramming the instrument should only be done by employees who are authorized to do so.**

### 2.10 Enabling or disabling use of the Mode button

Most day-to-day operating procedures (such as automatic calibration adjustment) are normally made by using the On/Off Mode button. It is possible to disable the use of the Mode button. Once disabled, the Mode button may no longer be used for any purpose. To restore normal functions, the Mode button must be re-enabled.

To enable or disable use of the Mode button press and hold down the "+" key while the ZoneGuard system is in normal operation. The display will show the message "MODE OFF" or "MODE ON" to indicate when the procedure of enabling or disabling the Mode button is complete.



## CHAPTER 3 CALIBRATION

### 3.1 Warnings and cautions concerning verification of accuracy

**⚠WARNING** The accuracy of the Zoneguard should be checked immediately following any known exposure to contaminants by testing with known concentration test gas before further use. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.

**⚠WARNING** A sensor that cannot be calibrated or is found to be out of tolerance should be replaced immediately. An instrument that fails calibration may not be used until testing with known concentration test gas determines that accuracy has been restored, and the instrument is once again fit for use.

**⚠WARNING** Do not reset the calibration gas concentration unless you are using a calibration gas concentration that differs from the one that is normally supplied by Sperian Instrumentation for use in calibrating the Zoneguard. Use of inappropriate calibration gas may lead to inaccurate and potentially dangerous readings.

Customers are strongly urged to use only Sperian calibration materials when calibrating the Zoneguard. Use of non-standard calibration gas and/or calibration kit components can lead to dangerously inaccurate readings and may void the standard Sperian Instrumentation warranty.

**⚠WARNING** Use of non-standard calibration gas and/or calibration kit components when calibrating the Zoneguard can lead to inaccurate and potentially dangerous readings and may void the standard Sperian Instrumentation warranty.

Sperian Instrumentation offers calibration kits and long-lasting cylinders of test gas specifically developed for easy Zoneguard calibration. Customers are strongly urged to use only Sperian calibration materials when calibrating the Zoneguard.

### 3.2 Calibration overview

The ZoneGuard gas detection system has been designed for easy calibration. A single button, the on / off Mode button, is used to initiate the "Auto-Calibration" sequence, and automatically make all calibration adjustments.

It is also possible to manually calibrate the instrument by using simple push-button controls located on the inside of the door of the ZoneGuard controller housing.

"One-Button Auto-Cal" procedures are discussed in Section 3.6. Manual calibration procedures are discussed in Section 3.7.

### 3.3 Verification of accuracy

To verify accuracy, first place the Zoneguard in Basic Mode so that readings are given in numbers. **See section 2.9.3 for instructions on changing operating modes.**

Verification of accuracy for a ZoneGuard equipped with an O<sub>2</sub> sensor is a one-step procedure. Simply provide the sensor with a known source of fresh air and verify that the display reads 20.9% oxygen. If the display shows anything besides 20.9% while exposed to a known source of fresh air, it must be fresh air calibrated as discussed below in section 3.6.1.

Verification of accuracy for a ZoneGuard equipped with either a combustible gas / LEL sensor or any toxic sensor is a two-step procedure.

Step one is to provide the sensor with a known source of fresh air and verify that the display shows "0 PCT" for LEL units or "0 PPM" for toxic units. If an instrument equipped with an LEL or toxic sensor shows anything besides "0" while exposed to a known source of fresh air, it must be fresh air calibrated as discussed below in section 3.6.1. If the ZoneGuard is located in an area in which the air may not be fresh, see section 3.3.1 below for instructions on fresh air "zero" calibrations in contaminated air.

Step two is to test sensor response by exposing the sensor to appropriate test gas of known concentration. This is known as a functional (bump) test. Readings are considered to be accurate when the display shows a reading between 90% and 120% of the expected values as given on the calibration gas cylinder. If readings are accurate, there is no need to adjust your gas detector. See section 3.5 for explicit functional/bump test instructions.

If the readings are inaccurate, the instrument must be calibrated before further use as discussed in section 3.6.

**Sperian Instrumentation offers calibration kits and long lasting cylinders of test gas specifically developed for easy ZoneGuard calibration. Customers are urged to use Sperian calibration materials when calibrating their ZoneGuard detectors.**

### 3.3.1 Fresh air "zero" in contaminated air

The fresh air "zero" for all types of sensors must be done while the sensor is located in fresh, uncontaminated air. In this procedure the instrument automatically adjusts its readings to match the concentrations present in fresh air. Fresh air should contain 20.9% oxygen, 0% LEL combustible gas, and 0 parts-per-million toxic gas.

If the atmosphere in which the ZoneGuard sensor is located is not fresh, or if it is not certain whether or not the air is contaminated, special procedures are required. In this case, the zero adjustment must be made while the sensor is exposed to contaminant free atmosphere by means of a cylinder of "Zero Air" which contains 20.9% oxygen, 79.1% nitrogen and no contaminants. This gas is supplied to the sensor and the instrument may then be fresh air "zero" calibrated as discussed in section 3.6.1.

## 3.4 Effect of contaminants on ZoneGuard sensors

The atmosphere in which the ZoneGuard monitor is being used can have an effect on the sensor. Sensors may be poisoned or suffer degraded performance if exposed to certain substances.

**Caution: The accuracy of the ZoneGuard should be checked immediately following any known exposure to contaminants by testing with known concentration test gas before further use.**

The ZoneGuard is available with three basic types of sensors: oxygen, combustible gas (LEL), and electrochemical toxic. Each type of sensor uses a slightly different detection principle. The kinds of conditions that affect the accuracy of the sensors vary from one type of sensor to the next.

### 3.4.1 Effects of contaminants on oxygen sensors

Oxygen sensors may be affected by prolonged exposure to "acid" gases such as carbon dioxide. The oxygen sensors used in Sperian Instruments are not recommended for continuous use in atmospheres which contain more than 25 % CO<sub>2</sub>.

### 3.4.2 Effects of contaminants on combustible sensors

Combustible sensors may be affected by exposure to substances containing silicone (found in many lubricants and hydraulic fluids), the tetra-ethyl-lead in "leaded" gasoline, and halogenated hydrocarbons (Freons<sup>®</sup>, or solvents such as trichloroethylene and methylene chloride). High concentrations of hydrogen sulfide may also damage the sensor.

**For a comprehensive list of known LEL sensor poisons, see the last paragraph of the Sperian Instrumentation Standard Warranty at the end of this manual.**

If sensitivity of the combustible sensor is lost due to poisoning, it tends to be lost first with regards to methane. A partially poisoned sensor might still respond accurately to propane while showing a dangerously reduced response to methane.

Sperian Instrumentation's "Equivalent" calibration gas mixtures have been developed to eliminate this potentially dangerous source of calibration error. Sperian Instrumentation's "Equivalent" mixtures are based on methane, so any loss of sensitivity to methane is detected (and can be corrected) immediately. Sperian Instrumentation offers several different "Equivalent" combustible calibration gas mixtures for use in various monitoring applications. Please contact Sperian Instrumentation's Service Department at (800) 711-6776 for help in deciding which calibration gas mixture to specify for use.

**Using Sperian brand calibration gas insures that proper sensitivity is maintained over the life of the sensor.**

### 3.4.2.1 Effects of high concentrations of combustible gas on the combustible sensor

The accuracy of combustible sensors may also be affected by exposure to high concentrations of combustible gas. To minimize the chance for damage or loss of sensitivity to the

combustible sensor, the ZoneGuard system is designed to "alarm latch" whenever the concentration of combustible gas exceeds 100 percent LEL. Under these conditions the combustible gas reading will show an "X" to indicate an over-limit condition. The audible and visual alarms will sound continuously until the instrument is manually reset by turning it off, then turning the instrument back on.

**⚠WARNING** A combustible sensor overrange alarm indicates a potentially explosive atmosphere. Failure to leave the area immediately may result in serious injury or death!

**Note:** If the over limit condition still exists at the time the instrument is turned back on, the ZoneGuard system will revert to the over-limit alarm-latch condition.

**⚠WARNING** Make sure the alarm condition has truly cleared before attempting to make an auto-zero adjustment. Auto-zero adjustments may only be made when the ZoneGuard sensor is located in air that is known to be fresh. Accuracy of the combustible gas sensor should be verified by exposure to known concentration test gas before further use.

**Note:** The combustible sensor used in the ZoneGuard design requires the presence of oxygen in order to detect combustible gas. The accuracy of the combustible sensor may be affected if the instrument is used in oxygen deficient atmospheres.

**⚠WARNING** Any rapid up-scale reading followed by a rapid declining or erratic reading may indicate a gas concentration beyond the upper scale limit which may be hazardous.

### 3.4.3 Effects of contaminants on toxic gas sensors

Sperian's "substance-specific" electrochemical sensors used to measure toxic gases such as CO, H<sub>2</sub>S, SO<sub>2</sub>, Cl<sub>2</sub>, ClO<sub>2</sub>, PH<sub>3</sub>, and NO<sub>2</sub> have been carefully designed to minimize the effects of common interfering gases.

"Substance-specific" sensors are designed to respond only to the gases they are supposed to measure. The higher the specificity of the sensor the less likely the sensor will be affected by exposure to other gases which may be incidentally present. For instance, a "substance-specific" carbon monoxide sensor is deliberately designed not to respond to other gases which may be present at the same time, such as hydrogen sulfide or methane.

Even though care has been taken to reduce cross-sensitivity, some interfering gases may still have an effect on toxic sensor readings. In some cases the interfering effect may be "positive" and result in readings which are higher than actual. In some cases the interference may be negative and produce readings which are lower than actual.

**Cross sensitivity of ZoneGuard toxic sensors to common interfering gases is listed in Appendix E.**

## 3.5 Functional (bump) test

**Note:** The functional (bump) test is only used on instruments equipped with a combustible gas / LEL or

**toxic gas sensor. For further details on verifying the accuracy of an instrument with an O<sub>2</sub> sensor, see section 3.3.**

To perform a Functional (bump) test,

1. Place the Zoneguard in Basic Mode so that readings are given in numbers.
2. Make sure the sensor is located in fresh air. If you are not certain the air is fresh, use a cylinder of Zero Air to supply atmosphere to the sensor.
3. Verify that the readings match the concentrations present in fresh air. Instruments equipped with an LEL sensor or any of the toxic gas sensors should read "0". If necessary, fresh air "zero" calibrate the instrument using the procedures discussed in Section 3.6.1.
4. Screw the regulator into the cylinder and connect it to the detector using the short section of tubing and the calibration adapter. The regulator will automatically begin flowing calibration gas at the correct flow rate as soon as it is screwed into the cylinder of gas.
5. The instrument will display the sensor readings as they rise. When they have stabilized at their highest value, note the readings. Readings are considered to be accurate when the display is between 90% and 120% of the expected values as given on the calibration gas cylinder. If readings are accurate, there is no need to span calibrate the detector.

**Readings that are considered inaccurate indicate the instrument must be adjusted using the "span" calibration procedures discussed in Section 3.6 before further use.**

## 3.6 Auto-calibration

Sperian's "One-Button Auto-Calibration" mode may be used to verify accuracy any time during normal operation while the instrument is being used in the Basic operating mode. Press the Mode button 3 times in rapid sequence to initiate the "Auto-Calibration" sequence. Sensor adjustments are made automatically in Auto Calibration mode.

Auto-calibration is a one step procedure for instruments equipped with an oxygen sensor. If the detector doesn't read 20.9 PCT in a known fresh air environment, perform the fresh air "zero" calibration as described in section 3.6.1.

Auto-calibration is a two step procedure for instruments equipped with either a combustible gas / LEL sensor or a toxic gas sensor. In the first step the sensor is exposed to fresh air and a "zero" adjustment is made automatically as discussed below in section 3.6.1. The second step is the sensor response or "span" calibration adjustment. In this step the accuracy of the ZoneGuard sensor is established by exposing it to known concentration calibration gas as discussed below in section 3.6.2. The sensitivity or "span" is automatically adjusted.

### 3.6.1 Fresh air "zero" auto-calibration sequence

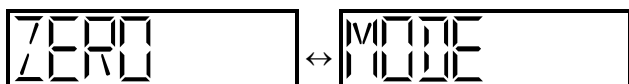
The "One Button" fresh air zero procedure may only be done while the ZoneGuard system is being operated in the Basic operating mode.

1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Make sure the ZoneGuard system has been turned on and operating for a sufficient period of time for the sensor readings to have stabilized fully **before** initiating auto-calibration procedures.

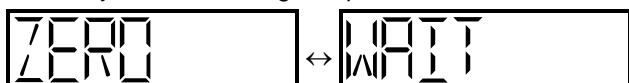
If the sensor has just been replaced, the ZoneGuard should be turned on and allowed to stabilize for the following period of time prior to performing any of the calibration options.

Sensor	Stabilization Period
Oxygen	1 hour
LEL	5 minutes
All Toxic sensors available for ZoneGuard	15 minutes

3. Make sure the sensor is located in an area where the air is known to be fresh or provide fresh air to the sensor with a cylinder of "Zero Air". See section 3.3.1 for more details on using a "Zero Air" cylinder during the Fresh Air "zero" calibration.
4. Press the Mode button 3 times within two seconds. This will "wake up" the instrument from normal operation, and put it into the "Auto-Calibration" mode. A screen will briefly display the message "ZERO MODE".



5. Press the Mode button within five seconds to initiate the fresh air adjustment. (If the Mode button is not pushed within 5 seconds, the instrument will return to normal operation.)
6. The screen will show the message "ZERO WAIT" while the adjustment is being completed.



7. After successful completion of the "zero" auto-calibration, the display will prompt you with the message "SPAN MODE" to continue with a span calibration adjustment.

Span calibration is covered in detail below in section 3.6.2.

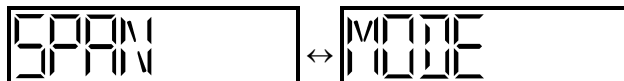
### 3.6.1.1 Reading "Too High" or "Too Low" for zero adjust

To reduce the chances of the ZoneGuard being inadvertently zeroed in contaminated air, only small adjustments are allowed through the use of the "One Button" auto-zero sequence. If the necessary adjustments are too large the display will indicate that the ZoneGuard "CANT ZERO". In this case the instrument must be fresh air zeroed using the "Cal" button on the instrument keypad and procedures discussed in **Section 3.7.1**.

Once the instrument has been successfully zeroed using the "Cal" button, subsequent calibration adjustments may be made using the Mode button and "One Button Auto Cal" logic discussed in this section.

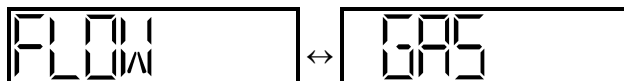
### 3.6.2 "Span" auto-calibration sequence

After successful completion of the FRESH "zero" auto-calibration adjustment, instruments equipped with either a combustible gas / LEL sensor or a toxic gas sensor will automatically move on to "SPAN MODE".



1. Press the Mode button within 5 seconds to initiate "span" auto-calibration. The screen will show "FLOW GAS" and will continue to display this screen until it determines that calibration gas has been applied. If the Mode button is not pushed within five seconds a span calibration adjustment will not be made, and the instrument will be returned to normal operation.

**Note: It is possible to exit the auto-calibration mode at any time prior to completion by pressing and holding down the Mode button to turn the instrument off.**



2. Screw the regulator into the cylinder and connect it to the detector using the short section of tubing and the calibration adapter. The regulator will automatically begin flowing calibration gas at the correct flow rate as soon as it is screwed into the cylinder of gas.

**⚠WARNING** Make sure the regulator, cylinder seating surfaces and threads are clean and dry before attaching the regulator to the cylinder of gas. Introduction of contaminants through the regulator fittings may alter or degrade the concentration of the gas contained in the cylinder and may lead to inaccurate and potentially dangerous gas readings.

3. The instrument will display the sensor readings as they rise. When they have stabilized at their highest value, the instrument will note the response and, if necessary, adjust the readings to match the concentration of gas being used to calibrate the detector. (The instrument will beep as the adjustment is being made.)

**⚠WARNING** Use of non-standard calibration gas and/or calibration kit components when calibrating the ZoneGuard may lead to dangerously inaccurate readings and may void the standard Sperian Instrumentation warranty.

4. When span adjustment has been completed, the display will show the message "DONE".



**Note: Make sure the calibration adaptor and all other fittings have been removed from the detector before it is returned to service.**

### 3.7 Manual calibration procedure

It is also possible to calibrate the ZoneGuard manually using the four buttons on the instrument keypad.

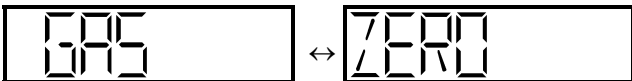
#### 3.7.1 Manual Fresh air "zero" through keypad buttons

1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Make sure the ZoneGuard system has been turned on and operating for a sufficient period of time for the sensor readings to have stabilized fully **before** initiating manual calibration procedures.

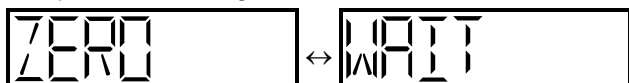
If the sensor has just been replaced, the ZoneGuard should be turned on and allowed to stabilize for the following period of time prior to performing any of the calibration options.

Sensor	Stabilization Period
Oxygen	1 hour
LEL	5 minutes
All Toxic sensors available for ZoneGuard	15 minutes

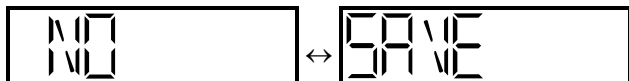
3. Make sure the sensor is located in fresh, contaminant free atmosphere or use a cylinder of Zero Air to supply atmosphere to the sensor.
4. Press the keypad button marked "Cal". The "GAS ZERO" calibration message will appear on the instrument LCD.



5. Press "Cal" to automatically zero the instrument. The LCD will show the message "ZERO WAIT" while the adjustment is being made.



6. After completion of the zero adjustment the ZoneGuard will automatically return to the current gas readings screen.
7. The manual fresh air zero adjustment can be canceled at any time prior to completion by pressing the Mode button. Pressing the Mode button causes the calibration values in the memory to remain unchanged from the last time a fresh air adjustment was made. An information screen is displayed briefly which verifies that the zero values have not been changed. The instrument will then return to normal operation.



#### 3.7.2 "Manual" span calibration through keypad buttons

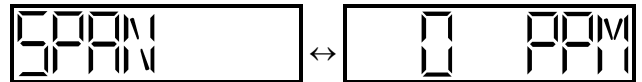
Span calibration procedures using buttons on the instrument keypad are only necessary when the adjustment necessary to restore accuracy is outside the permissible window of adjustment for "One Button Auto Calibration" procedures. Span calibration using the keypad buttons may only be done while in the Basic operating mode.

1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Make sure the ZoneGuard system has been turned on and operating for a sufficient period of time for the sensor readings to have stabilized fully **before** initiating manual calibration procedures.

If the sensor has just been replaced, the ZoneGuard should be turned on and allowed to stabilize for the following period of time prior to performing any of the calibration options.

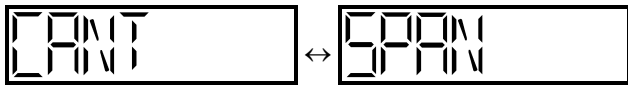
Sensor	Stabilization Period
Oxygen	1 hour
LEL	5 minutes
All Toxic sensors available for ZoneGuard	15 minutes

3. Turn the instrument off by pressing and holding the Mode button.
4. While holding down the "Cal" button, press the Mode button to turn the ZoneGuard back on. A screen showing the message "SPAN" will be displayed which alternates with the sensor readings.



Press the Mode button at any time to cancel the calibration.

5. Screw the regulator into the cylinder and connect it to the detector using the short section of tubing and the calibration adapter. The regulator will automatically begin flowing calibration gas at the correct flow rate as soon as it is screwed into the cylinder of gas.
6. Allow the readings to stabilize. When the readings stabilize, use the "+" and "-" keys to raise or lower the readings to match the concentration printed on the calibration cylinder label.
7. Make sure the correct cylinder of gas is attached before attempting to adjust the span! If the concentration of gas reaching the sensor is too low to allow the instrument to be adjusted, or if the wrong type of gas is applied to the sensor being adjusted, the alarms will be activated and a screen will be displayed indicating that the instrument "CANT SPAN". Pressing the Mode button clears the "CANT SPAN" message and returns the instrument to normal operation.



In the event that a "CANT SPAN" message is displayed, verify the type and concentration of the gas being used is correct for the sensor being calibrated, and replace the cylinder if necessary. Verify that the flow rate of the regulator is 1.0 lpm. If the "CANT SPAN" message is repeated it may indicate that the sensor is unresponsive, or dead, and requires replacement.

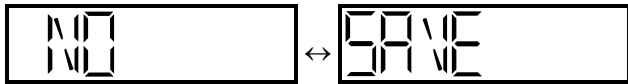
- When span calibration has been completed, press and hold the "Cal" button down until the LCD screen indicates that calibration is complete by showing the message "DONE". The ZoneGuard will then turn itself off.



**Caution:** The "Cal" button must be held down until the screen indicates that span calibration has been successfully completed.

If the button is released before this message is displayed, span values will not be updated, and remain unchanged from the last time a span calibration was successfully completed.

Pressing the Mode button at any time cancels the manual span calibration procedure. A screen will announce "NO SAVE" after which the instrument will turn itself off.



**⚠WARNING** A sensor that cannot be calibrated or is found to be out of tolerance should be replaced immediately. An instrument that fails calibration may not be used until testing with known concentration test gas determines that accuracy has been restored, and the instrument is once again fit for use.

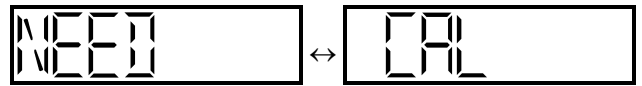
Pressing the Mode button at any time during the span adjustment cancels the procedure, and causes the calibration values in memory to remain unchanged from the last time a span calibration adjustment was made.

### 3.7.3 Manual true zero span calibration for oxygen sensors

**Note:** During normal operation of a ZoneGuard system for the detection of oxygen, the only calibration adjustment necessary is the automatic fresh air "zero" procedure as discussed in Section 3.6.1.

Following reinitialization of the instrument, or in cases where the ZoneGuard is being used to monitor oxygen levels that are close to 0.0%/volume and increased accuracy near 0 is required, the ZoneGuard may be manually span adjusted. A cylinder of calibration gas containing 100% nitrogen and no oxygen is necessary for this calibration routine.

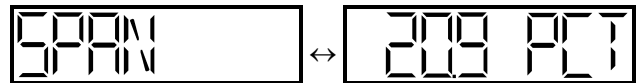
If the ZoneGuard is not span adjusted following reinitialization, message screens will indicate "NEED CAL" when the instrument is next turned on.



- Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
- Make sure the ZoneGuard system has been turned on and operating for a sufficient period of time for the sensor readings to have stabilized fully **before** initiating manual calibration procedures. If the oxygen sensor has just been replaced, the ZoneGuard for oxygen should be turned on and allowed to stabilize for one hour prior to performing any of the calibration options.
- Turn the instrument off by pressing and holding the Mode button until Off is displayed.



- While holding down the "Cal" button, press the Mode button to turn the ZoneGuard back on. Release the button when the word "SPAN" appears. The display should alternate between "SPAN" and the current oxygen reading (20.9 in fresh air). Pressing the Mode button at any time cancels the span calibration.



- Screw the regulator into the cylinder and connect it to the detector using the short section of tubing and the calibration adapter. The regulator will automatically begin flowing calibration gas at the correct flow rate as soon as it is screwed into the cylinder of gas.
- Allow the reading to stabilize. If the reading is a positive number, use the "+" and "-" keys to bring the value to zero.
- When finished, press and hold down the "Cal" key until the display reads "DONE".
- Perform a fresh air zero adjustment as discussed in section 3.6.1 when the instrument is next turned on.

## CHAPTER 4. SETTING ALARM LEVELS

ZoneGuard alarms are user adjustable and may be set anywhere within the range of the sensor channel. When an alarm set point is exceeded a loud audible alarm sounds, the appropriate LED is activated, and (if equipped) the optional strobe light(s) and/or remote audible alarms are activated. In addition, any other alarm devices controlled by means of the ZoneGuard relays will also be activated.

ZoneGuard alarms are normally self resetting. When readings drop below the alarm setpoint, the alarm ceases. It is possible, if desired, to set ZoneGuard alarms so that they "latch". In the latched condition, once an alarm occurs both visual and audible alarms continue to sound even after the atmospheric hazard has cleared. The instrument must be manually reset by pressing the Mode button. Pressing the Mode button silences the alarms and restores normal operation. Procedures for latching ZoneGuard alarms are given in the next section.

### 4.1 Alarm adjustment sequence

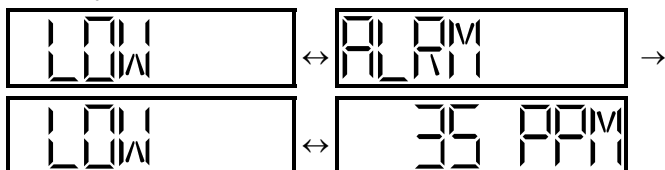
It is necessary to be in the "Alarm Adjust" mode to change alarm settings.

**ZoneGuard default alarm settings are listed in Appendix C.**

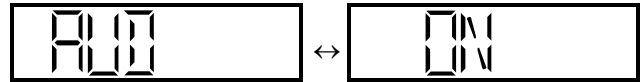
**Note: The order of these screens may be different depending on software version and sensor type. Instruments equipped with a toxic or combustible gas sensor are equipped with a low "warning" alarm and a high "danger" alarm. Instruments equipped with an oxygen sensor include ascending and descending low "warning" alarms and high "danger" alarms (a total of four alarm settings).**

To enter the alarm adjust mode:

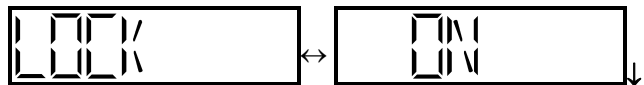
1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Turn the ZoneGuard off by pressing and holding the Mode button until the LCD goes blank. When the button is released the LCD will display the message "OFF".
3. With the unit turned off, press and hold down the "Alarm" button.
4. While holding down the "Alarm" button, press the Mode button to turn the ZoneGuard back on.
5. A screen will appear showing the first alarm point to be adjusted, the "Low" (warning level) alarm set point. Use the "+" and "-" keys to raise or lower the Low alarm set point.



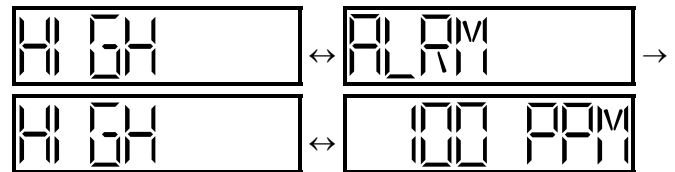
6. Press the "Cal" button again to advance the display to the next available alarm adjustment option, enabling or disabling the warning level (Low) audible alarm. The display alternates between a screen which shows the message "AUD" and the status of the warning level alarm, either "ON" or "OFF". Use the "+" or "-" buttons to enable or disable this feature.



7. Press the "Cal" button again to advance the display to the next available alarm adjustment option, "latching" the warning alarm. In the latched condition, the warning alarms will continue to sound even after the alarm condition has cleared. Latched alarms will continue to sound until they are manually silenced by pressing the Mode button. The display alternates between a screen which shows the message "LOCK" and the status of the alarm latch condition, either "ON" or "OFF". Use the "+" or "-" buttons to enable or disable this feature.



8. Press the "Cal" button again to advance the display to the next available alarm adjustment option, the high level (Danger) alarm setpoint. Use the "+" and "-" keys to raise or lower the High alarm set point.



9. Press "Cal" again to advance to the enable/disable option for the Danger level alarm. Set as discussed in Step 6.
10. Press "Cal" again to advance to the alarm latching option for the "Danger" (high) alarm. Latching the Danger level alarm is in the same way as latching the warning level alarm (see step 7).
11. When all alarm adjustments have been completed, press and hold the "Alarm" button down until an information screen indicates that alarm adjustment is DONE.

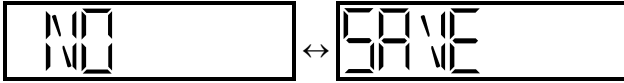


**Caution: The "Alarm" button must be held down until the screen indicates that alarm adjustment has been successfully completed.**

Failure to press and hold the "Alarm" button down until the "DONE" message is displayed will cause the alarm settings to revert to the way they were the last time the adjustment was successfully completed.

Pressing the Mode button at any time cancels the alarm adjustment mode, and returns the instrument to the gas

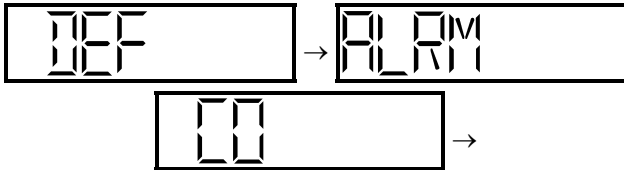
reading screen. A screen will announce "NO SAVE" after which the instrument will turn itself off.



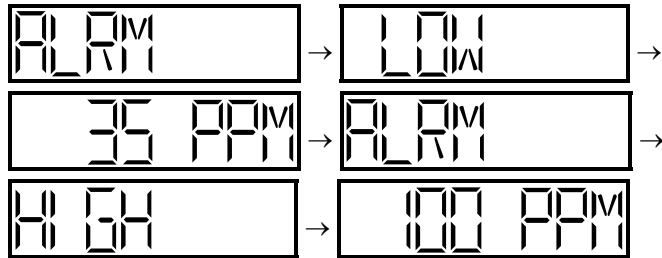
## 4.2 Restoring the factory default alarm settings

ZoneGuard alarm settings are set conservatively at the factory. (See Appendix C) It is possible to restore these default settings at any time by doing the following.

1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Press the "Alarm" button on the instrument key-pad. The display will briefly show the default alarm message, and the type of sensor currently installed.



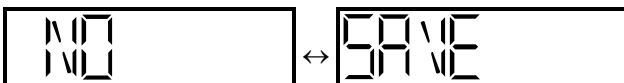
3. This screen will be followed by several more showing the specific default alarm settings. These screens will be shown in continuous rotation. In the case of a ZoneGuard with a hydrogen sulfide sensor installed, the following sequence of screens would be shown.



4. Push and hold the "Alarm" button to restore the factory default alarm settings. The display indicates when the settings have been restored:



5. If the Mode button is pushed, the current alarm settings remain unchanged, and the display shows the following screen:



6. After selection of the default or current alarm settings has been made, the display reverts to the current gas reading screen.

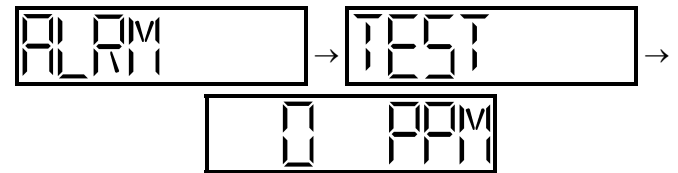
## 4.3 Alarm Test function

ZoneGuard software includes an "Alarm Test" function that can be used to automatically "ramp" readings throughout the

full range of the sensor. The "Alarm Test" function is used to verify alarm setpoints as well as the proper activation of the audible alarm, LED alarm light indicators, optional strobe lights or horn, as well as other alarm devices or peripheral equipment controlled by means of the ZoneGuard relay contacts.

To use the "Alarm Test" function:

1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Simultaneously press the "Alarm" and "Cal" buttons to begin the test. The display will show the message screens, "ALRM TEST", followed by numerical readings.



3. The readings shown on the ZoneGuard display will slowly "ramp" up from zero to 10% above the high alarm setpoint, then back down again. The audible and visual alarms will be activated as the readings exceed the pre-set alarm levels. (In the case of ZoneGuard systems equipped with an oxygen sensor, readings will both ramp up through the "ascending" warning and danger alarms for oxygen enrichment, as well as ramp "down" in order to test the "descending" warning and danger alarms for oxygen deficiency.)
4. The ZoneGuard will automatically return to normal operation when the Alarm Test function has been completed.
5. The Alarm Test can be terminated at any time by pressing the Mode button.

## CHAPTER 5. ADVANCED FUNCTIONS

### 5.1 ZoneGuard Advanced features overview

The ZoneGuard microprocessor circuitry makes possible a number of advanced features and capabilities. The four pushbuttons located on the inside of the controller housing door are used to program advanced ZoneGuard functions. The technique for using these buttons requires several buttons to be pressed and held at the same time.

**Caution:** Do not use this technique with any other combination of buttons than those listed below. Doing so may result in unintended changes to the instrument setup.

### 5.2 Re-setting the calibration gas concentration

During auto calibration adjustment the ZoneGuard adjusts the sensitivity of the sensor to match the concentration of the gas used to calibrate the sensor. The value the instrument uses to adjust the reading is the calibration gas concentration stored in the instrument memory.

For instance, Sperian Instrumentation normally supplies 50 ppm carbon monoxide calibration gas for use in calibrating CO ZoneGuard detectors. This is the default calibration gas concentration stored in the instrument memory. When gas is applied to the sensor during auto calibration, the instrument automatically adjusts the calibration constants to produce readings which match this 50 ppm concentration.

Sensor	Gas used to calibrate sensor	True cal gas concentration	Value used by ZoneGuard to adjust readings
Oxygen	Zero Air	20.9%	20.9%
Combustible gas	Propane Equivalent	50% LEL	50% LEL
Carbon monoxide	CO	50 ppm	50 ppm
Hydrogen sulfide	H <sub>2</sub> S	25 ppm	25 ppm
Sulfur dioxide	SO <sub>2</sub>	10 ppm	10 ppm
Chlorine	Cl <sub>2</sub>	5 ppm	5 ppm
Chlorine dioxide	Cl <sub>2</sub>	5 ppm	1.7 ppm
Phosphine	PH <sub>3</sub>	5 ppm	5 ppm
Nitrogen dioxide	NO <sub>2</sub>	5 ppm	5 ppm

**Table 5.2. Default calibration gas concentrations used during auto-calibration adjustment**

It is necessary to re-set the calibration gas concentration stored in instrument memory before making use of a different calibration gas concentration.

**⚠WARNING** Do not reset the calibration gas concentration unless you are using a calibration gas

concentration which differs from that normally supplied by Sperian Instrumentation for use in calibrating your instrument. Non-matching calibration gas and calibration gas value settings will lead to inaccurate and potentially dangerous readings.

**Customers are strongly urged to use only Sperian Instrumentation calibration materials when calibrating their ZoneGuard detector. Use of non-standard calibration gas and/or calibration kit components can lead to dangerously inaccurate readings and may void the standard Sperian Instrumentation warranty.**

Use the following procedure to re-set the calibration gas concentration:

1. Make sure gas readings are given in numbers. If the display shows "OK", then the ZoneGuard is currently being operated in the "Text Only" mode. To change over to Basic mode, simultaneously hold down the "+" and "-" keys as discussed in section 2.9.3.
2. Turn the instrument off by pressing the Mode button until the display blanks.
3. While holding down the "+" button, press the Mode button to turn the ZoneGuard back on.
4. The ZoneGuard LCD will display alternating "CAL" and "GAS" messages for 4 seconds. The display will then alternate between the current concentration stored in memory and the "GAS" message screens.
5. Use the "+" and "-" buttons to change the concentration.
6. Once the proper new concentration has been selected, press and hold down the "Alarm" button for three seconds. Do not release the "Alarm" button until the LCD displays the message "DONE" to indicate that the new value has been successfully entered.
7. Pressing the Mode button at any time cancels the procedure. The LCD will show the message "NO SAVE" to indicate that the calibration gas concentration values have not been changed.

## Chapter 6. ZoneGuard Condensed Operating Instructions

Operation	Procedure
Turn on	Press Mode.
Turn off	Press and hold Mode until ZoneGuard shuts off.
Change operating mode	Turn ZoneGuard on. Simultaneously press "+" and "-" to switch between TEXT ONLY and BASIC operating modes.
Enable/disable use of Mode button	Turn ZoneGuard on. Press and hold "+" to disable the Mode button. Press and hold "+" to re-enable the Mode button.
Auto calibration	Turn ZoneGuard on. In fresh air, press Mode 3 times to enter "Auto Calibration Mode". Press Mode to do Auto-Zero. When complete press Mode to do Auto Span. Attach calibration adapter. Apply span gas. Remove fittings when Auto Cal complete.
Manual fresh air calibration	Turn ZoneGuard on. In fresh air, press CAL to enter fresh air "zero" mode. Press CAL to do the fresh air zero; or press Mode to exit without doing "zero".
Manual span calibration	Hold CAL down and turn ZoneGuard on. Attach calibration adapter. Apply span gas. Wait for the ZoneGuard's reading to stabilize. Use "+" and "-" to adjust the reading to the value printed on the span gas container. Press and hold CAL to save the span adjustment; or press Mode to exit the manual span without saving.
Set default alarms	Turn ZoneGuard on. Press ALARM to enter "Default Alarm Mode". ZoneGuard will display the default alarm settings. Press and hold ALARM to restore the factory default alarm settings; or press Mode to exit without setting the alarm levels to the default values.
Alarm adjustments	Hold ALARM down and turn ZoneGuard on. Press CAL to switch to the alarm option to be changed. Use "+" and "-" to adjust the alarm option to the desired value. Press and hold ALARM to save the changes to the ZoneGuard; or press Mode to exit alarm adjustment mode without saving any changes.
Alarm test	Turn ZoneGuard on. Press ALARM and CAL simultaneously to do an alarm test. Press Mode to return ZoneGuard to normal operation.

## APPENDICES

### Appendix A ZoneGuard fixed gas detection system ordering information

ZoneGuard system for:	With integrally mounted sensor	With remote sensor in standard housing	With remote sensor in explosion-proof housing
	Part No.	Part No.	Part No.
Oxygen	54-16-90	54-16-900	54-16-901
LEL combustible	NA	NA	54-16-801
Carbon monoxide	54-16-01	54-16-010	54-16-011
Hydrogen sulfide	54-16-02	54-16-020	54-16-021
Sulfur dioxide	54-16-03	54-16-030	54-16-031
Chlorine	54-16-08	54-16-080	54-16-081
Chlorine dioxide	54-16-12	54-16-120	54-16-121
Phosphine	54-16-13	54-16-130	54-16-131
Nitrogen dioxide	54-16-09	54-16-090	54-16-091

<b>Accessories</b>	
<b>Part No.</b>	<b>Description</b>
54-17-A0101	Single integrally mounted external strobe (red)
54-17-A0102	Dual integrally mounted external strobes (red and amber)
54-17-A0201	Remote programmable (volume adjustable) audible alarm
54-17-A0202	Remote high intensity audible alarm
54-17-A0301	Splash guard for sensors installed in explosion-proof remote housings
54-17-A0302	Splash guard for sensors installed in standard housings
54-17-A0401	Wire, 22 gauge, 6 conductor, twisted pair, shielded with drain, used to connect oxygen remote detectors with ZoneGuard controller, 50 feet
54-17-A0402	Wire, 22 gauge, 4 conductor, twisted pair, shielded with drain, used to connect toxic remote detectors with ZoneGuard controller, 50 feet
54-17-A0403	Wire, 18 gauge, 4 conductor, twisted pair, shielded with drain, used to connect combustible remote detectors with ZoneGuard controller, 50 feet
<b>Calibration Materials</b>	
54-17-K0301	Calibration kit for ZoneGuard fixed detection systems. Includes foam lined carrying case with room for up to 3 cylinders of gas, one standard 1.0 LPM fixed flow rate regulator, calibration adaptors, and 3 feet of tubing. Kit does not include gas.
54-17-A0303	Calibration adaptor for sensors installed in standard housings
54-17-A0304	Calibration adaptor for sensors installed in explosion-proof housings
54-9031	Methane 50% LEL in air, 103 liters
54-9032E	Propane 50% LEL equivalent in air, 103 liters
54-9033	Carbon monoxide (CO), 50 ppm in air, 103 liters
54-9034	Hydrogen sulfide (H <sub>2</sub> S), 25 ppm in nitrogen, 58 liters
54-9037	Sulfur dioxide (SO <sub>2</sub> ), 10 ppm in nitrogen, 58 liters
54-9052	Chlorine (Cl <sub>2</sub> ), 5 ppm in nitrogen, 58 liters
54-9055	Nitric oxide (NO), 30 ppm in nitrogen, 58 liters
54-9056	Nitrogen dioxide (NO <sub>2</sub> ), 5 ppm in nitrogen, 58 liters
54-9065	Phosphine (PH <sub>3</sub> ), 5 ppm in nitrogen, 58 liters
54-9039	Zero Air, 20.9% oxygen in nitrogen, 103 liters

## Appendix B ZoneGuard fixed gas detection system technical specifications

ZoneGuard VAC Outputs	Warning (Low) and Danger (high) alarm, DPDT relay - contacts rated 5 Amp at 250 VAC, non-inductive load
ZoneGuard VDC Outputs	Warning (Low) and Danger (high) alarm +12 VDC at 0.5 Amp
ZoneGuard Display	8 character 14-segment backlit LCD for gas readings and other messages
ZoneGuard Indicators (LED)	Power on: green; low alarm: amber; high alarm: red
Audible alarm	Built-in audible alarm (85 dB at 3 feet)
Power Requirements	110 VAC - 50/60 Hz
Temperature Range	System components designed to function over range of -40° F to 110° F (-40° C to 43° C) (Type of sensor installed may modify range.)
Humidity Range	0 to 100% RH
Classification for use in hazardous locations	Sensors installed in explosion-proof remote housings: Submitted for Classification by UL <sub>C</sub> Gas Explosion-Proof for Class 1, Division 1, Groups A, B, C, D, E, F, and G hazardous locations.
Weather Protection	Controller housing: NEMA 4X enclosure (IP rating of 654)
Dimensions	ZoneGuard controller: 10" (25 cm) x 7.5" (19 cm) x 5.25" (13 cm)
Wiring:	For oxygen remote detectors use (minimum) 22 gauge AWG, 6 conductor twisted-pair shielded with drain. For toxic use (minimum) 22 gauge AWG, 4 conductor twisted-pair shielded with drain. For combustible use 18 gauge AWG, 4 conductor twisted-pair shielded with drain.

### Appendix C ZoneGuard default alarm settings

Gas	Warning Level	Danger Level
Combustible gas	10% LEL	20% LEL
Oxygen	Low: 19.5% High:22.0%	Low: 18.0% High:23.5%
Carbon monoxide	35 PPM	100 PPM
Hydrogen sulfide	10 PPM	20 PPM
Sulfur dioxide	2.0 PPM	5.0 PPM
Nitrogen dioxide	1.0 PPM	5.0 PPM
Chlorine	0.5 PPM	1.0 PPM
Chlorine dioxide	0.3 PPM	1.0 PPM
Phosphine	0.3 PPM	1.0 PPM

### Appendix D ZoneGuard sensor ranges

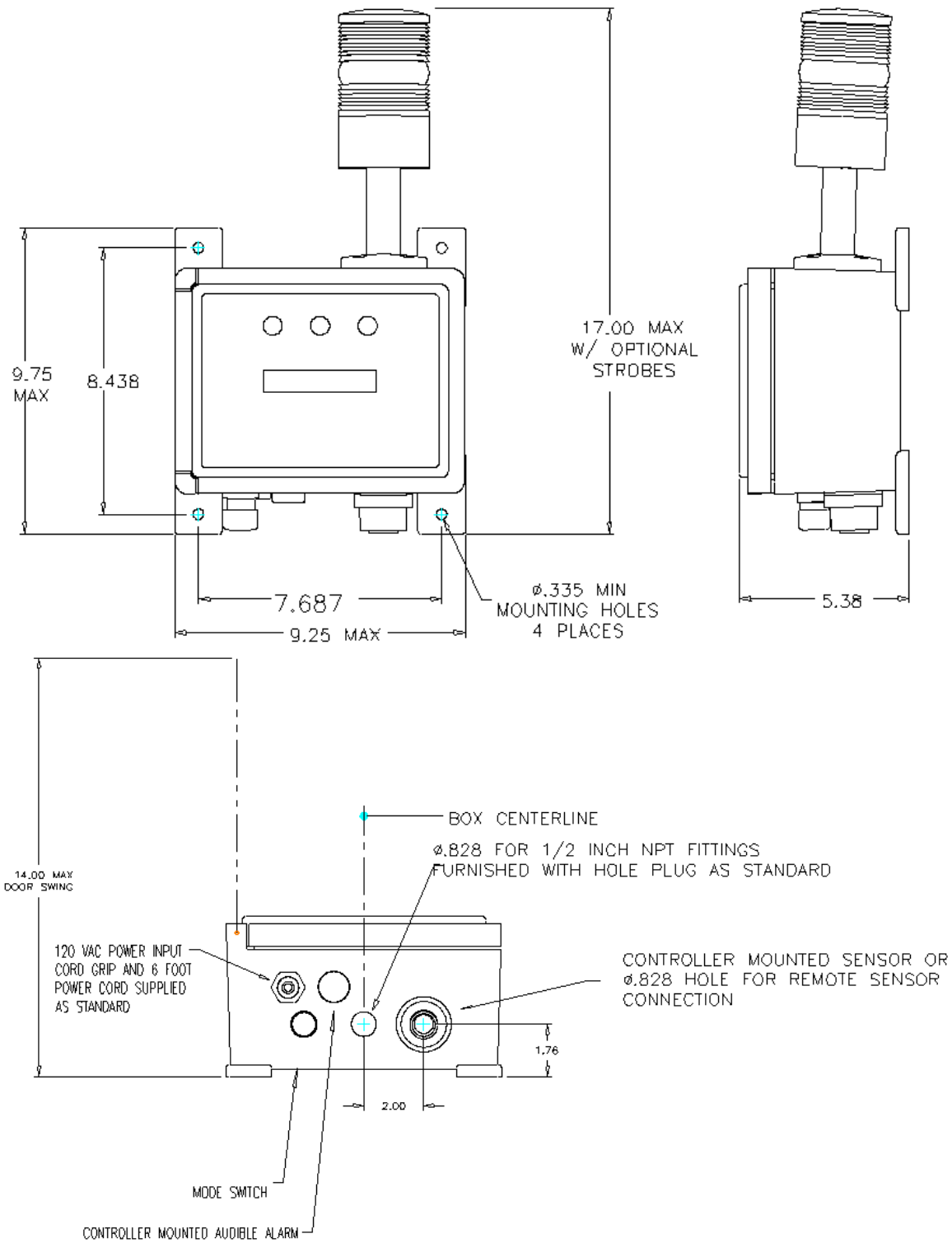
Gas	Range
Combustible gas	0-100% LEL
Oxygen	0-25%
Carbon monoxide	0-1000 PPM
Hydrogen sulfide	0-200 PPM
Sulfur dioxide	0-100 PPM
Nitrogen dioxide	0-20 PPM
Chlorine	0-20 PPM
Chlorine dioxide	0-10 PPM
Phosphine	0-10 PPM

### Appendix E ZoneGuard toxic sensor cross sensitivity data

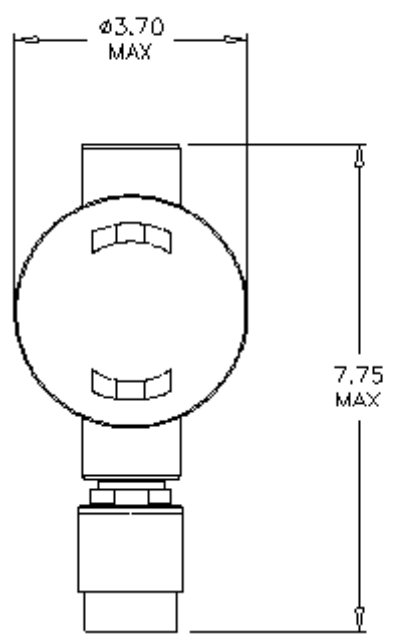
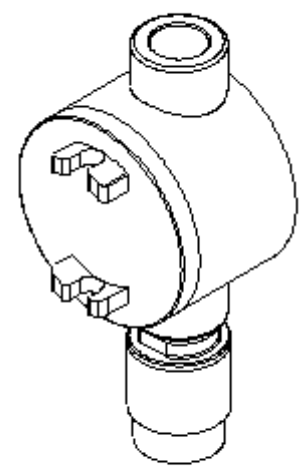
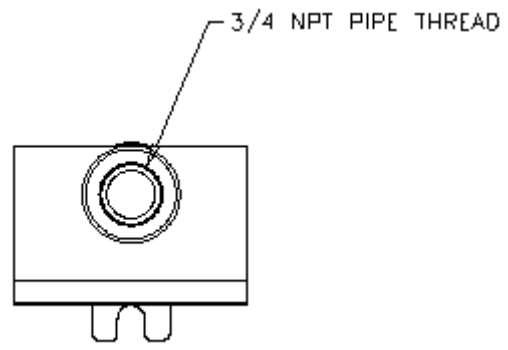
The table below lists the cross sensitivity of electrochemical toxic sensors used in Sperian Instrumentation portable gas detectors to gases other than their target gas. Depending on the nature of the reaction each gas has with the sensor, the effect can either decrease the signal (negative cross sensitivity) or increase the signal; (positive cross sensitivity). Each figure represents the reaction of the sensor to 100 ppm of gas, thus providing a percentage sensitivity to that gas relative to its target gas.

	SENSOR TYPE						
	Carbon monoxide (CO)	Hydrogen sulfide (H2S)	Sulfur dioxide (SO2)	Nitrogen dioxide (NO2)	Chlorine (Cl2)	Chlorine dioxide (ClO2)	Phosphine (PH3)
CO	100	< 10	0	0	0	0	
H2S	< 10	100	0	~ - 20	~ - 20	~ - 7	
SO2	< 10	~ 20	100	< - 0.5	0	0	
NO	< 30	< 0	0	0	0	0	
NO2	< 15	~ - 20	~ - 120	100	120	40	
Cl2	< 10	~ - 20	< 5	90	100	~ 33	
H2	< 60	< 5	0	0	0	0	
HCN	< 15	0	< 50	< 1	0	0	
HCl	< 3	0	0	0	0	0	
NH3	0	0	0	0	0	0	
Ethylene	~ 50	0	0	0	0	0	

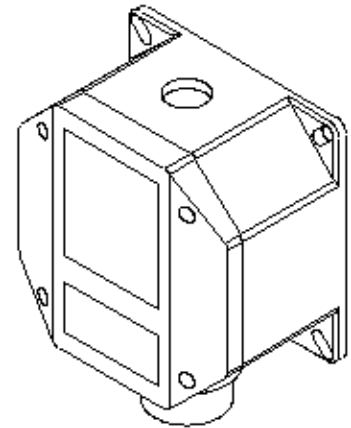
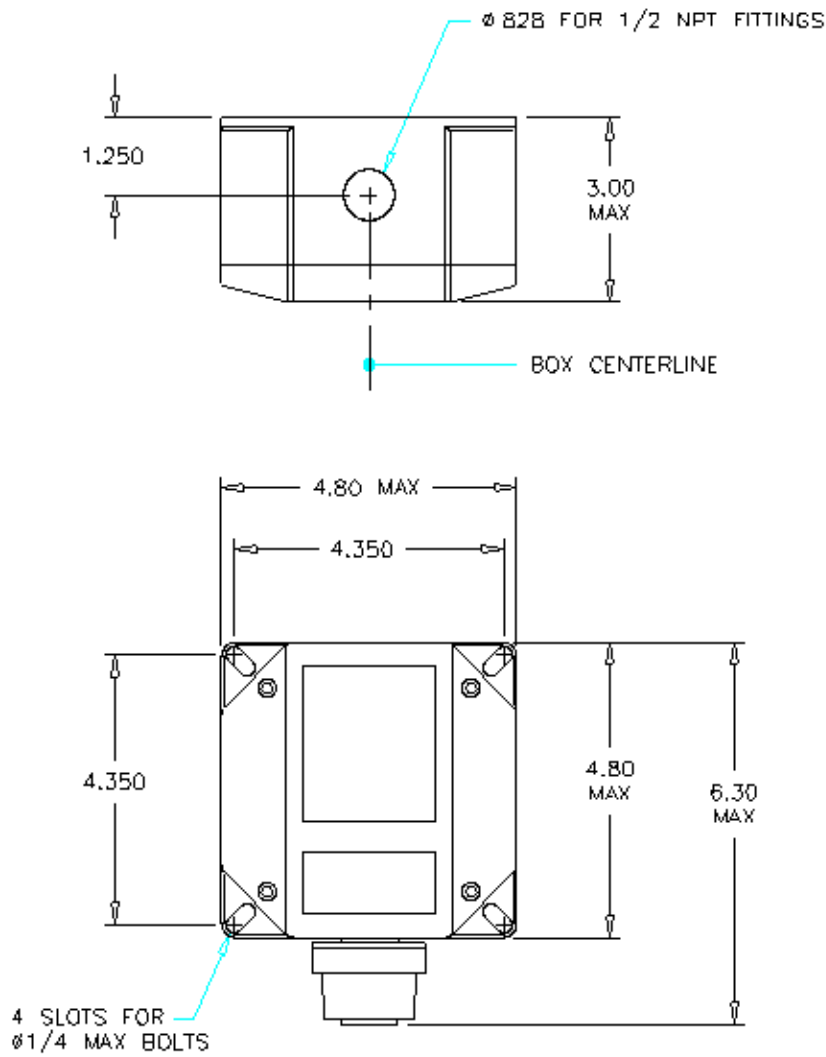
# Appendix F ZoneGuard dimensional drawings, electrical schematics, and wiring diagrams



**Dimensional drawing of ZoneGuard controller**



**Dimensional drawing of ZoneGuard explosion-proof remote detector assembly**



**Dimensional drawing of ZoneGuard standard (non-explosion-proof) remote detector assembly**

## Appendix G Calibration Frequency

One of the most common questions that we are asked at Sperian Instrumentation is: **“How often should I calibrate my gas detector?”**

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### Sensor Reliability and Accuracy

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Today's sensors are designed to provide years of reliable service. In fact, many sensors are designed so that with normal use they will only lose 5% of their sensitivity per year or 10% over a two-year period. Given this, it should be possible to use a sensor for up to two full years without significant loss of sensitivity.

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### Verification of Accuracy

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With so many reasons why a sensor can lose sensitivity and given the fact that dependable sensors can be key to survival in a hazardous environment, frequent verification of sensor performance is paramount.

There is only one sure way to verify that a sensor can respond to the gas for which it is designed. That is to expose it to a known concentration of target gas and compare the reading with the concentration of the gas. This is referred to as a “bump” test. This test is very simple and takes only a few seconds to accomplish. **The safest course of action is to do a “bump” test prior to each day's use.** It is not necessary to make a calibration adjustment if the readings fall between 90%\* and 120% of the expected value. As an example, if a CO sensor is checked using a gas concentration of 50 PPM it is not necessary to perform a calibration unless the readings are either below 45 PPM or above 60 PPM.

**\*The Canadian Standards Association (CSA) requires the instrument to undergo calibration when the displayed value during a bump test fails to fall between 100% and 120% of the expected value for the gas.**

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### Lengthening the Intervals between Verification of Accuracy

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We are often asked whether there are any circumstances in which the period between accuracy checks may be lengthened.

Sperian Instrumentation is not the only manufacturer to be asked this question! One of the professional organizations to which Sperian Instrumentation belongs is the Industrial Safety Equipment Association (ISEA). The “Instrument Products” group of this organization has been very active in developing a protocol to clarify the minimum conditions under which the interval between accuracy checks may be lengthened.

A number of leading gas detection equipment manufacturers have participated in the development of the ISEA guidelines concerning calibration frequency. Sperian Instrumentation's procedures closely follow these guidelines.

If your operating procedures do not permit daily checking of the sensors, Sperian Instrumentation recommends the following procedure to establish a safe and prudent accuracy check schedule for your Sperian instruments:

1. During a period of initial use of at least 10 days in the intended atmosphere, check the sensor response daily to be sure there is nothing in the atmosphere that is poisoning the sensor(s). The period of initial use must be of sufficient duration to ensure that the sensors are exposed to all conditions that might have an adverse effect on the sensors.
2. If these tests demonstrate that it is not necessary to make adjustments, the time between checks may be lengthened. The interval between accuracy checking should not exceed 30 days.
3. When the interval has been extended the toxic and combustible gas sensors should be replaced immediately upon warranty expiration. This will minimize the risk of failure during the interval between sensor checks.
4. The history of the instrument response between verifications should be kept. Any conditions, incidents, experiences, or exposure to contaminants that might have an adverse effect on the calibration state of the sensors should trigger immediate re-

verification of accuracy before further use.

5. Any changes in the environment in which the instrument is being used, or changes in the work that is being performed, should trigger a resumption of daily checking.
6. If there is any doubt at any time as to the accuracy of the sensors, verify the accuracy of the sensors by exposing them to known concentration test gas before further use.

Gas detectors used for the detection of oxygen deficiencies, flammable gases and vapors, or toxic contaminants must be maintained and operated properly to do the job they were designed to do. Always follow the guidelines provided by the manufacturer for any gas detection equipment you use!

If there is any doubt regarding your gas detector's accuracy, do an accuracy check! All it takes is a few moments to verify whether or not your instruments are safe to use.

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### One Button Auto Calibration

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While it is only necessary to do a “bump” test to ensure that the sensors are working properly, all current Sperian gas detectors offer a one-button auto calibration feature. This feature allows you to calibrate a Sperian gas detector in about the same time as it takes to complete a “bump” test. The use of automatic bump test and calibration stations can further simplify the tasks, while automatically maintaining records.

**Don't take a chance  
with your life.  
Verify accuracy frequently!**

Please read also Sperian Instrumentation's application note: *AN20010808 “Use of ‘equivalent’ calibration gas mixtures”*. This application note provides procedures to ensure safe calibration of LEL sensors that are subject to silicone poisoning.

Sperian Instrumentation's website is located at

<http://www.biosystems.com>

# SPERIAN INSTRUMENTATION WARRANTY GAS DETECTION PRODUCTS

## General

Sperian Protection Instrumentation, LLC (hereafter Sperian) warrants gas detectors, sensors and accessories manufactured and sold by Sperian, to be free from defects in materials and workmanship for the periods listed in the tables below.

Damages to any Sperian products that result from abuse, alteration, power fluctuations including surges and lightning strikes, incorrect voltage settings, incorrect batteries, or repair procedures not made in accordance with the Instrument's Reference Manual are not covered by the Sperian warranty.

The obligation of Sperian under this warranty is limited to the repair or replacement of components deemed by the Sperian Instrument Service Department to have been defective under the scope of this standard warranty. To receive consideration for warranty repair or replacement procedures, products must be returned with transportation and shipping charges prepaid to Sperian at its manufacturing location in Middletown, Connecticut, or to a Sperian Authorized Warranty Service Center. It is necessary to obtain a return authorization number from Sperian prior to shipment.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY AND ALL OTHER WARRANTIES AND REPRESENTATIONS, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. SPERIAN WILL NOT BE LIABLE FOR LOSS OR DAMAGE OF ANY KIND CONNECTED TO THE USE OF ITS PRODUCTS OR FAILURE OF ITS PRODUCTS TO FUNCTION OR OPERATE PROPERLY.

## Instrument & Accessory Warranty Periods

Product(s)	Warranty Period
PHD6, PhD <sup>5</sup> , PhD Lite, PhD Plus, PhD Ultra, Cannonball3, MultiVision, Toxi, Toxi/Oxy Plus, Toxi/Oxy Ultra, ToxiVision, Ex Chek	As long as the instrument is in service
ToxiPro <sup>®</sup> , MultiPro	2 years from date of purchase
ToxiLtd <sup>®</sup>	2 years after activation or 2 years after the "Must Be Activated By" date, whichever comes first
Toxi3Ltd <sup>®</sup>	3 years after activation or 3 years after the "Must Be Activated By" date, whichever comes first
Mighty-Tox 2 Prorated credit is given towards repair or purchase of a new unit of the same type.	0 – 6 months of use 100% credit 6 – 12 months of use 75% credit 12 – 18 months of use 50% credit 18 – 24 months of use 25% credit
IQ Systems, Series 3000, Airpanel, Travelpanel, ZoneGuard, Gas✓Chek1 and Gas✓Chek4	One year from the date of purchase
Battery packs and chargers, sampling pumps and other components, which by their design are consumed or depleted during normal operation, or which may require periodic replacement	One year from the date of purchase

## Sensor Warranty Periods

Instrument(s)	Sensor Type(s)	Warranty Period
PhD Plus, PhD Ultra, PhD <sup>5</sup> , PhD Lite, Cannonball3, MultiVision, MultiPro, ToxiVision, ToxiPro <sup>®</sup> , Ex Chek	O <sub>2</sub> , LEL**, PID, CO, CO+, H <sub>2</sub> S & Duo-Tox	2 Years
	All Other Sensors	1 Year
Toxi, Toxi/Oxy Plus, Toxi/Oxy Ultra	CO, CO+, H <sub>2</sub> S	2 Years
	All Other Sensors	1 Year
All Others	All Sensors	1 Year

\*\* Damage to combustible gas sensors by acute or chronic exposure to known sensor poisons such as volatile lead (aviation gasoline additive), hydride gases such as phosphine, and volatile silicone gases emitted from silicone caulks/sealants, silicone rubber molded products, laboratory glassware greases, spray lubricants, heat transfer fluids, waxes & polishing compounds (neat or spray aerosols), mold release agents for plastics injection molding operations, waterproofing formulations, vinyl & leather preservatives, and hand lotions which may contain ingredients listed as cyclomethicone, dimethicone and polymethicone (at the discretion of Sperian's Instrument Service department) void Sperian Instrumentation's Standard Warranty as it applies to the replacement of combustible gas sensors.