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**Toxi Vision EX**

**Combustible Gas  
Detector**

**Reference Manual**



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Version 2.00  
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# **WARNING**

**THE TOXI VISION EX PERSONAL PORTABLE GAS DETECTORS HAVE 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 ATMOSPHERIC CONDITIONS, IT IS ESSENTIAL THAT THE INSTRUCTIONS IN THIS REFERENCE MANUAL BE READ, FULLY UNDERSTOOD, AND FOLLOWED.**

**Toxi Vision EX Reference Manual  
Sperian Instrumentation Part Number 13-293  
Version 2.00  
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by  
Sperian Protection Instrumentation, LLC  
Middletown, Connecticut 06457**

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## Certifications

UL Class I, Division 1, Groups A, B, C, D

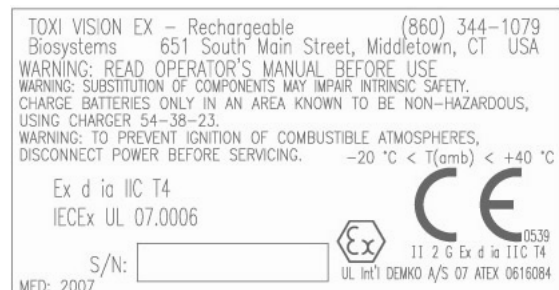
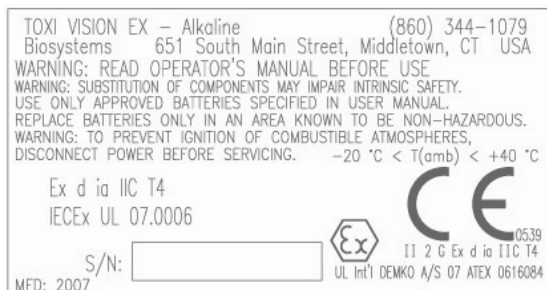
CSA Class I, Division 1, Groups A,B,C,D Temp Code T4

ATEX: 07 ATEX 0616084

Ex d ia IIC T4

IECEX: IECEX UL 07.0006

## ATEX Labeling



## Warnings and Cautions

### A. Signal Words

The following signal words, as defined by ANSI Z535.4-1998, are used in the Toxi Vision EX Operator's Guide.

**⚠ 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.

## B. Warnings

1. **⚠️WARNING** The Toxi Vision EX personal, portable gas detector has been designed for the detection of accumulations of combustible gases and vapors. An alarm condition indicates the presence of a potentially life-threatening hazard and should be taken very seriously.
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 may result in serious injury or death.
3. **⚠️WARNING** Use only Duracell MN1500 or Ultra MX1500, Eveready Energizer E91-LR6, or Eveready Energizer EN91 size AA 1.5V alkaline batteries. Substitution of batteries may impair intrinsic safety.
4. **⚠️WARNING** To reduce the risk of explosion, do not mix old or used batteries with new batteries and do not mix batteries from different manufacturers.
5. **⚠️WARNING** The accuracy of Toxi Vision EX instruments should be checked periodically with known concentration calibration gas. Failure to check accuracy can lead to inaccurate and potentially dangerous readings.
6. **⚠️WARNING** A sensor that cannot be calibrated or is found to be out of tolerance must 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.
7. **⚠️WARNING** Do not reset the calibration gas concentration setpoints in the Toxi Vision EX unless the concentrations of your calibration gas differ from the concentrations of the calibration gas that is normally supplied by Sperian for use in calibrating the Toxi Vision EX.
8. **⚠️WARNING** Use of non-standard calibration gas and/or calibration kit components when calibrating the Toxi Vision EX can lead to dangerously inaccurate readings and may void the standard Sperian Instrumentation warranty.  
Sperian offers calibration kits and long-lasting cylinders of test gas specifically developed for easy calibration. Customers are strongly urged to use only Sperian calibration materials when calibrating the Toxi Vision EX.
9. **⚠️WARNING** Substitution of components may impair intrinsic safety.
10. **⚠️WARNING** For safety reasons the Toxi Vision EX must be operated by qualified personnel only. Read, understand and follow the directions set forth in this reference manual before operating the Toxi Vision EX.
11. **⚠️WARNING** The Toxi Vision EX has been tested for intrinsic safety in Explosive Gas/AIR (21.0% O<sub>2</sub>) Only.

## 1. Overview

The Toxi Vision EX is a single sensor gas detector designed to detect combustible gases and vapors. The Toxi Vision EX includes numerous features designed to meet specific user requirements. This chapter will broadly discuss the use and capabilities of the Toxi Vision EX.

### 1.1 Methods of sampling

The Toxi Vision EX may be used in either diffusion or sample-draw mode. In either mode, the gas sample must enter the sensor compartment for the instrument to register a gas reading.

In diffusion mode, the atmosphere reaches the sensor by diffusing through the sensor port on the front of the instrument. Normal air movements are enough to carry the sample to the sensor. The sensor reacts quickly to changes in the concentration of the gas being measured.

It is also possible to use the Toxi Vision EX to sample remote locations with the hand-aspirated sample-draw kit that is available separately. During remote sampling, the gas sample is drawn into the sensor compartment through the probe assembly and a length of tubing.

### 1.2 Combustible Gas Sensors

As an environment becomes contaminated with combustible gases and/or vapors, concentrations can climb until they eventually reach ignitable or explosive levels. The minimum amount of a combustible gas or vapor in air that will explosively burn if a source of ignition is present is known as the Lower Explosive Limit (LEL). Toxi Vision EX combustible gas readings are given in percent LEL, with a range of zero to one-hundred percent explosive. The Toxi Vision EX combustible gas sensor is non-specific and responds to all combustible gases and vapors.

The combustible sensor in the Toxi Vision EX contains two coils of fine wire coated with a ceramic material to form beads. These two beads are strung onto the opposite arms of a balanced Wheatstone Bridge circuit. The "active" bead is additionally coated with a palladium-based material that allows catalyzed combustion to occur on the surface of the bead. The palladium catalyst is not consumed in the reaction; it simply enables it to occur. It is

not necessary for the combustible vapor to be present in LEL concentrations in order for this reaction to occur. Even trace amounts of combustible gas present in the air surrounding the sensor will be catalytically burned on the surface of the bead.

The "reference" bead lacks the palladium outer coating but in other respects exactly resembles the active bead. A voltage is applied across the active and reference elements, causing them to heat. If combustible vapors are present, the active bead will be heated by the reaction to a higher temperature. The temperature of the untreated reference bead is unaffected by the presence of gas. The difference between the temperatures of the two beads will be proportional to the amount of combustible gas present.

Since the two beads are strung on the opposite arms of a Wheatstone Bridge electrical circuit, the difference in temperature between the beads is perceived by the instrument as a change in electrical resistance.

It is important to note that catalytic "hot bead" type combustible sensors require the presence of oxygen (at least 10 percent by volume) in order to detect combustible gas accurately. A combustible sensor located in a 100 percent pure combustible gas or vapor environment containing no oxygen will be unable to burn the combustible gas and will produce a reading of zero percent LEL.

**Note: In the event that the Toxi Vision EX is to be used to monitor a combustible gas that is NOT the same as the calibration gas, see Appendix B for LEL correction factors.**

### 1.3 Alarm logic

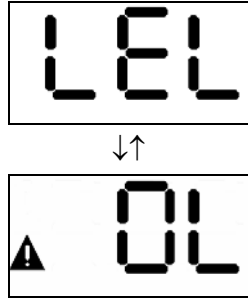
#### 1.3.1 Gas alarms

Toxi Vision EX gas alarms are user-adjustable and may be set anywhere within the sensor range. When the alarm set point is exceeded the loud two-tone audible alarm sounds, and the bright red LED alarm light flashes. The instrument reading will be shown on the display as long as the alarm level does not exceed 100% LEL.

#### 1.3.2 LEL sensor over limit alarm

In the event that the instrument detects combustible gas and generates a reading

that exceeds 100% LEL, the power will be interrupted to the LEL sensor and the screen will alternate between the “LEL” and “OL”. OL indicates that the instrument is currently reading over 100% LEL.



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

**⚠WARNING** In the event of an LEL overrange alarm the Toxi Vision EX must be turned off, brought to an area that is known to be safe (containing 20.9% oxygen, 0% LEL and 0 PPM toxic gases), and then turned on again to reset the alarm.

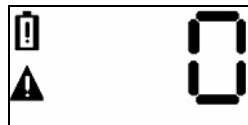
### 1.3.3 Battery alarms

The Toxi Vision EX is equipped with a three stage low battery alarm.

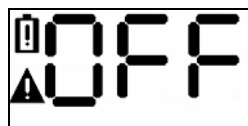
When battery voltage is reduced to the point where this is approximately one hour of battery life remaining, the battery icon will be displayed on the LCD.



When battery voltage is reduced to the point where this is approximately 15 minutes of battery life remaining, the battery and warning icons will be displayed on the LCD.

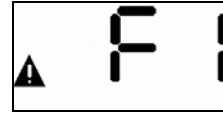


If the battery voltage is reduced to the point where the battery can no longer power the instrument, the instrument will go into a high alarm while displaying “OFF” on the screen as long as it can or until the MODE button is pressed to turn the instrument off.



### 1.3.4 Missing sensor alarm

If the Toxi Vision EX determines that the LEL sensor is missing, the instrument will go into alarm and indicate F1 on the screen with the warning symbol.



### 1.3.5 Optional vibrating alarm

A vibrating alarm is available as an option for instruments that will be used in high noise areas.

## 1.4 Calibration

The Toxi Vision EX features one-button fresh air/zero and span calibration functions.

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

## 1.5 Communications

The Toxi Vision EX features a built-in IrDA port that is used to facilitate communications between a PC and the instrument. The IrDA port is located under the alarm LED. See figure 1.8 below.

## 1.6 Features

### 1.6.1 Security beep

The Toxi Vision EX includes a security beep that can be enabled or disabled according to the needs of the user. At the default interval, the Toxi Vision EX will emit a short beep every 60 seconds to remind the user that the instrument is active.

### 1.6.2 Latching danger alarm

The Toxi Vision EX includes a latching danger alarm that can be enabled or disabled according to the needs of the user.

With the latching alarm enabled, once the Toxi Vision EX enters a danger alarm, it will remain in alarm even after the readings have dropped back below the danger alarm threshold. To acknowledge the alarm and return to normal operation, press the MODE button.

With the latching alarm disabled, no user intervention is required following a danger alarm. The Toxi Vision EX will automatically return to normal operation and the alarms will cease as soon as the reading drops below the danger alarm threshold.

## 1.7 Data storage

Rechargeable versions of the Toxi Vision EX are equipped with a Black Box Datalogger and an Event Logger as standard equipment. The Toxi Vision EX may also be purchased with an Enabled Datalogger.

The upgrades necessary to convert the Black Box Datalogger into an Enabled Datalogger must be performed at the Sperian Instrumentation factory. Call Sperian for details.

### 1.7.1 Black box datalogger

A black box data recorder is a standard feature in the rechargeable versions Toxi Vision EX. The “black box” is continually in operation whether the user is aware of it or not. The black box stores important information such as gas readings, turn-on times, turn-off times, temperatures, battery conditions, the most recent calibration date and settings, types of sensors currently installed, sensor serial numbers, warranty expiration and service due dates, and current alarm settings.

There is a finite amount of memory storage available in the black box data recorder. Once the memory is “full”, the Toxi Vision EX will begin to write the new data over the oldest data. The black box data recorder will store approximately 40 hours of data in one-minute increments before it begins to write new data over the oldest data. In this way, the newest data is always conserved.

To extract the information from the black box data recorder, the Toxi Vision EX must be returned to Sperian Instrumentation. Once the data is downloaded from the instrument, a report will be generated. The unit and the report will then be returned to the user. Simply call Sperian’s Instrument Service Department to obtain a return authorization number. There is no charge for the downloading service, but the user is responsible for any freight charges incurred.

### 1.8.2 Event logger

Rechargeable versions are also equipped with an event logger, which stores data associated with alarm conditions. Each (alarm) event includes the following data for each of the installed sensors: Sensor type, max reading, average reading, start time, end time and duration of the event. The Toxi Vision EX stores the 20 most recent events. Once 20 events have been stored,

the Toxi Vision EX will begin to systematically overwrite the data from the oldest event in memory with data from new events. One event may be a combination of different alarms occurring simultaneously or in immediate succession. The event logger may be downloaded using Sperian’s BioTrak software. The PC must be equipped with IrDA to provide a connection.

## 1.8 Design components

- 1. Case:** The instrument is enclosed in a solid, metal-plated ABS case. A black EPDM gasket between the upper and lower sections of the case protects against leakage or exposure to liquids.
- 2. Front face:** The front face of the instrument houses the graphics capable LCD display, sensor port, LED alarm and audible alarm port.
- 3. LCD display:** The liquid crystal display (LCD) allows display of gas readings, messages and other information. A built-in backlight allows the display to be read even in low light conditions.
- 4. Alarm light (LED)** A bright red LED (light-emitting diode) alarm light provides a visual indication of the alarm state. The light is visible from the front and top of the instrument.

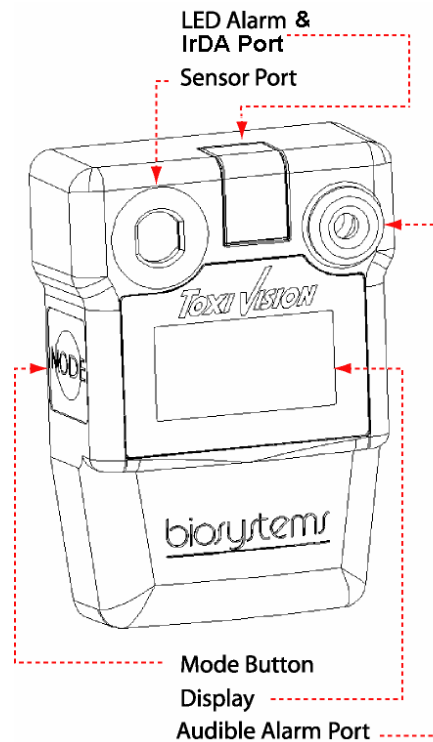


Figure 1.8 Exterior front view.

5. **IrDA Port:** The IrDA port is located under the LED alarm light and is used to communicate with a PC.
6. **MODE button:** The large push-button on the left side of the instrument is called the MODE button. The MODE button is used to turn the Toxi Vision EX on and off, to turn on the backlight, to view the MAX screen and to access the automatic calibration sequences.
7. **Audible alarm orifice:** A cylindrical resonating chamber contains the loud audible alarm.
8. **Sensor port:** The combustible gas sensor is located just below the sensor port at the upper left corner of the instrument.
9. **Bottom surface:** The belt clip attaches to the bottom surface of the instrument.

### 1.9 Standard accessories

Standard accessories with every Toxi Vision EX include installed sensor, reference manual, quick reference card and calibration/sample draw adapter.

Alkaline versions include a set of 2 AA alkaline batteries.

Rechargeable versions include a built-in rechargeable NiMH battery and a charger.

Optional accessories include manual (hand-aspirated) sample draw kit, PC software kit, and rubber boot.

Toxi Vision EX instruments that are not ordered in a value pack are delivered in a cardboard box.

### 1.10 Value pack kits

Toxi Vision EX value packs include all standard accessories, calibration fittings, 34-liter cylinder of calibration gas, and fixed flow rate regulator in a foam-lined, hard-shell carrying case.

## 2. Instrument Functions

Field operation of the Toxi Vision EX is controlled entirely through the MODE button, which is located on the left side of the instrument.

The MODE button is used to turn the Toxi Vision EX on and off, to turn on the backlight, to access MAX gas readings for the current session and to initiate the fresh air/zero and span calibration functions.

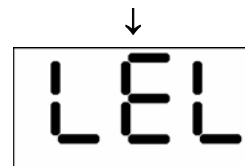
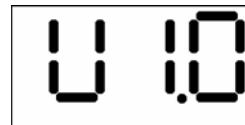
### 2.1 Turning the Toxi Vision EX on

Press and hold the MODE button until the following display test screen is shown, then release the MODE button.



At start-up, the Toxi Vision EX will automatically go through a basic electronic self-test and start-up sequence that will take approximately thirty seconds. During the self-test sequence, the display backlight will momentarily turn on.

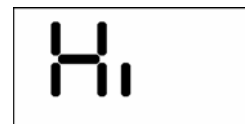
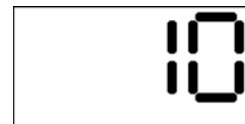
The Toxi Vision EX will then display the software version, followed by the sensor type.



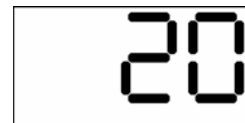
The warning alarm levels (indicated by Lo) will then be displayed, followed by the danger alarm levels (indicated by Hi). The instrument will also test the low and high audible alarms.



↑ Alternate 3 times ↓



↑ Alternate 3 times ↓



The current gas reading will then be displayed.



## 2.2 Backlight

The Toxi Vision EX includes a backlight that is automatically turned on during an alarm condition. The backlight can also be manually activated while the current gas reading is displayed by pressing the MODE button once. The backlight will automatically turn itself off in about twenty seconds.

## 2.3 MAX readings

From the current gas reading screen, press the MODE button once to activate the backlight and then once more to view the MAX value screen. The MAX value represents the highest reading recorded by the instrument during the current operating session.



## 2.4 Turning the Toxi Vision EX off

To turn the Toxi Vision EX off, press and hold the MODE button down until the instrument beeps three times and OFF is displayed.



Once OFF is displayed, release the MODE button. The instrument has been successfully turned off when the display goes blank.

## 2.5 Sampling

The Toxi Vision EX may be used in either diffusion or sample-draw mode. In either mode, the gas sample must enter the sensor compartment for the instrument to register a gas reading.

In diffusion mode, the atmosphere reaches the sensor by diffusing through the sensor port on the front of the instrument. Normal air movements are enough to carry the sample to the sensor. The sensor reacts quickly to changes in the concentration of the gas being measured.

It is also possible to use the Toxi Vision EX to sample remote locations with the hand-aspirated sample-draw kit that is available separately. During remote sampling, the gas sample is drawn into the sensor compartment through the probe assembly and a length of tubing.

### 2.5.1 Sample draw kit usage

1. Connect the end of the hose that is closer to the squeeze bulb to the sample draw adapter. Then connect the other end of the hose to the sample probe.
2. Attach the sample draw adapter to the Toxi Vision EX.
3. Cover the end of the sample draw probe assembly with a finger, and squeeze the aspirator bulb. If there are no leaks in the sample draw kit components, the bulb should stay deflated for a few seconds.
4. Insert the end of the sample probe into the location to be sampled.
5. Squeeze the aspirator bulb several times to draw the sample from the remote location to the sensor compartment. Allow one squeeze of the bulb for every one foot of sampling hose for the sample to reach the sensors. Continue to squeeze the bulb for an additional 45 seconds or until readings stabilize.
6. Note the gas measurement readings.

**CAUTION: Hand aspirated remote sampling only provides continuous gas readings for the area in which the probe is located when the bulb is being continuously squeezed.**

**Note: Each time a reading is desired, it is necessary to squeeze the bulb a sufficient number of times to bring a fresh sample to the sensor compartment.**

## 3. Calibration

The Toxi Vision EX features fully automated fresh air/zero and span calibration functions. The MODE button is used to initiate the automatic calibration sequence. Calibration adjustments are made automatically by the instrument.

### 3.1 Verification of accuracy

Calibration of the Toxi Vision EX is a two step procedure.

Step one is to take the Toxi Vision EX to an area where the atmosphere is known to be fresh and check the readings. If the readings differ from those expected in fresh air, then a fresh air calibration adjustment must be made as discussed below in section 3.4.

Step two is to make sure the sensor is accurate by exposing it to a test gas of known concentration and noting the sensor response. The reading is considered to be accurate when the displayed value falls between 90%\* and 120% of the expected value for the gas being used. If readings are considered accurate, there is no need to adjust your gas detector. If the readings are inaccurate, the instrument must be span calibrated before further use as discussed in section 3.5.

**\* 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.**

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

### 3.2 Atmospheric effects on the LEL sensor

The atmosphere in which the Toxi Vision EX is used can have lasting effects on the sensor. Sensors may suffer losses in sensitivity leading to degraded performance if exposed to certain substances.

#### 3.2.1 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.

**Note: The Canadian Standards Association (CSA) requires gas**

**detectors to be tested for accuracy following any known exposure to contaminants.**

For a comprehensive list of known sensor poisons, see the last paragraph of the ToxiVision EX Warranty on page 20.

**Note: If sensitivity of the combustible sensor is lost due to poisoning, it tends to be lost first with regards to methane.**

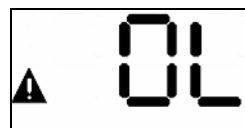
A partially poisoned sensor might still respond accurately to propane while showing a dangerously reduced response to methane.

Sperian's "Propane Equivalent" calibration gas mixtures have been developed to eliminate this potentially dangerous source of calibration error. Because Sperian's "Propane Equivalent" mixtures are based on methane, any loss of sensitivity to methane is detected (and can be corrected) immediately.

**Using Sperian brand calibration gas and verifying accuracy before each day's use insures that proper sensitivity is maintained over the life of the sensor.**

#### 3.2.2 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 Toxi Vision EX is designed to "alarm latch" whenever the concentration of combustible gas exceeds 100 percent LEL. Under these conditions the combustible gas reading will show "OL" 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 in an area where the air is known to be fresh.



**⚠WARNING** Make sure that the Toxi Vision EX is located in fresh air before turning the instrument back on after a combustible sensor over limit alarm has occurred. After a combustible sensor over limit alarm has occurred,, the accuracy of the combustible gas sensor must be verified by exposure to

known percentage LEL concentration test gas before further use.

**⚠WARNING** The combustible sensor used in the Toxi Vision EX requires a minimum of 10% oxygen by volume in order to generate accurate combustible gas readings. Combustible sensor accuracy may be diminished if the instrument is used in oxygen-deficient atmospheres.

**⚠WARNING** A rapid up-scale reading followed by a declining or erratic reading may indicate a hazardous combustible gas concentration that exceeds the Toxi Vision EX's zero to 100 percent LEL detection range. Failure to leave the area immediately may result in serious injury or death!

### 3.3 Response (bump) testing

The accuracy of the Toxi Vision EX may be verified at any time by a simple functional (bump) test.

To perform a response (bump) test, do the following:

1. Turn the Toxi Vision EX on and wait at least three minutes to allow the readings to fully stabilize.
2. Make sure the instrument is located in fresh air.
3. Verify that the current gas readings match the concentrations present in fresh air. The reading should be shown as 0% LEL in fresh air.
4. Apply the calibration gas as shown below in figure 3.3.
5. Wait for the readings to stabilize. (Forty-five seconds to one minute is usually sufficient.)
6. Note the readings. Readings are considered sufficiently accurate if they are between 90%\* and 120% of the expected reading. If the readings are considered accurate, then the instrument may be used without further adjustment.

**\*The Canadian Standards Association (CSA) considers readings accurate when the displayed values fall between 100% and 120% of the expected value for the gas.**

For further instructions on calibration frequency recommendations and a more detailed explanation of accuracy requirements, see Appendix A.

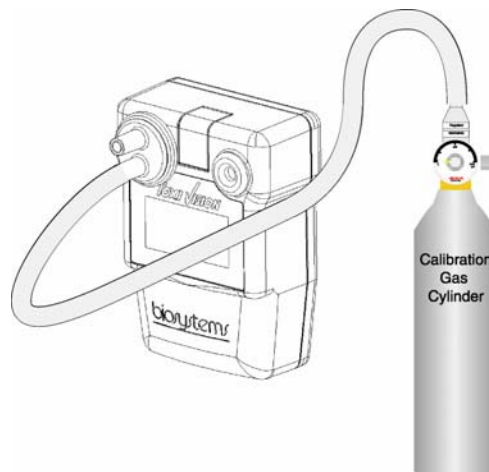


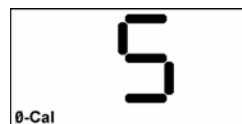
Figure 3.3: Proper bump-test/span calibration set-up

**Note:** If gas concentration readings do not fall between 90% and 120% (between 100% and 120% to meet the CSA specification) of the expected values during a functional (bump) test, the instrument must be adjusted using the “span” calibration procedures discussed in section 3.5 before further use.

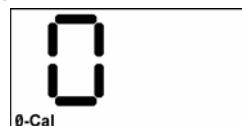
### 3.4 Fresh air/zero calibration

To initiate the fresh air/zero calibration procedure:

1. From the current gas reading screen, press the MODE button three times within two seconds to begin the fresh air/zero calibration sequence. The Toxi Vision EX will briefly display “CAL” and then begin a 5 second countdown.



2. Press the MODE button before the end of the 5-second countdown to begin the fresh air/zero calibration. The fresh air/zero calibration has been successfully initiated when the Toxi Vision EX alternates between the following two screens:



↑ Alternating ↓



- Once the fresh air/zero calibration is complete, the instrument will begin another 5-second countdown for the span calibration. If span calibration is not required, allow the countdown to reach 0 without pressing the MODE button.

**⚠WARNING** Fresh air/zero calibrations may only be performed in an atmosphere that is known to be fresh. Fresh air should contain 20.9% oxygen, no combustible gases or vapors and no toxic gases. Performing fresh air/zero calibrations in an atmosphere that is not comprised of fresh air may lead to inaccurate and potentially dangerous readings.

### 3.5 Span Calibration

To perform a span calibration, first perform a fresh air/zero calibration as discussed above in section 3.4. After successful completion of the fresh air/zero calibration, the instrument will begin a second five-second countdown with the calibration gas bottle icon highlighted.



- Press the MODE button before the countdown is complete to initiate the span calibration. The display will alternate between "GAS" and the expected concentration of calibration gas in terms of percent LEL.



↑ Alternating ↓



- Apply calibration gas as shown above in figure 3.3. Once calibration gas is detected, the readout will change to show the gas reading.



- The calibration is fully automatic from this point on. Once the instrument successfully completes the span calibration, it will emit three short beeps and display the maximum span calibration value for two seconds.



**Note:** The max span calibration adjustment value shown is an indication of the relative health of the sensor. As a sensor loses sensitivity, the maximum adjustment level will approach the calibration gas concentration, letting you know when the sensor is losing sensitivity. Once the maximum span adjustment is within 10% of the calibration gas concentration, it is time to order a new sensor.

- The instrument will then turn off.

**Note:** Once the calibration cycle is completed, the Toxi Vision EX automatically returns to normal operation and the gas alarms may be activated. Disconnect the calibration assembly immediately after calibration.

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

### 3.6 Failure to calibrate

In the event of calibration failure, the "no" and "CAL" screens will be alternately displayed as shown below before the instrument returns to the gas reading screen.

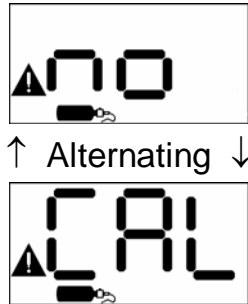
Fresh air/zero calibration failures often result from the attempt to calibrate the instrument in a contaminated atmosphere.



↑ Alternating ↓



In the case of a span calibration failure, the “no” and “CAL” screens will be shown with the calibration bottle icon highlighted.



Span calibration failures can be caused by the following:

1. Expired calibration gas.
2. Calibration gas whose concentration fails to match the concentration expected by the instrument.
3. Calibration gas scale is incorrect. (e.g. instrument was calibrated with methane or methane equivalent gas in the past and is now being calibrated with propane or propane equivalent gas)
4. Sensor failure.

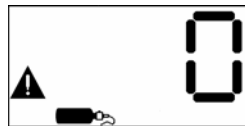
After a failed calibration attempt, the warning icon will appear in the current gas reading screen until a successful calibration is made.



The Toxi Vision EX will also emit a beep every 10 seconds and display the 0-cal or span cal icon to show which type of calibration failure has occurred.



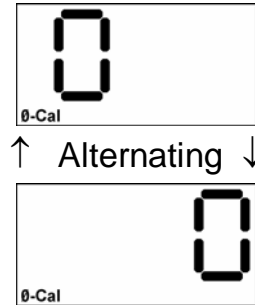
or



### 3.6.1 Forced fresh air/zero calibration

If a fresh air/zero calibration fails in an atmosphere known to be fresh, the Toxi Vision EX can be forced to fresh air calibrate as follows.

1. Follow instructions 1 and 2 in section 3.4 to begin the fresh air/zero calibration sequence.
2. As soon as the alternating right and left 0's are shown on the screen, press and hold the MODE button.



3. The forced fresh air/zero calibration is complete when the instrument emits three short beeps and then moves on to the span calibration procedure.

### 3.7 Fresh air calibration in a contaminated atmosphere

To calibrate in a contaminated atmosphere, it is necessary to use special calibration gas, whose composition is identical to that of fresh air. Sperian offers the “Zero Air” calibration gas cylinder as part number 54-9039, which contains 0 PPM toxic gas and 20.9% oxygen.

1. Apply “Zero Air” calibration gas to the instrument as shown above in figure 3.4 for at least 15 seconds or until the readings fully stabilize.
2. Perform the fresh air/zero calibration procedure as described in section 3.4.
3. Once the fresh air/zero calibration is complete, disconnect the calibration assembly and move on to the span calibration if necessary as described in section 3.5.

## 4. Maintenance

### 4.1 Replacing alkaline batteries

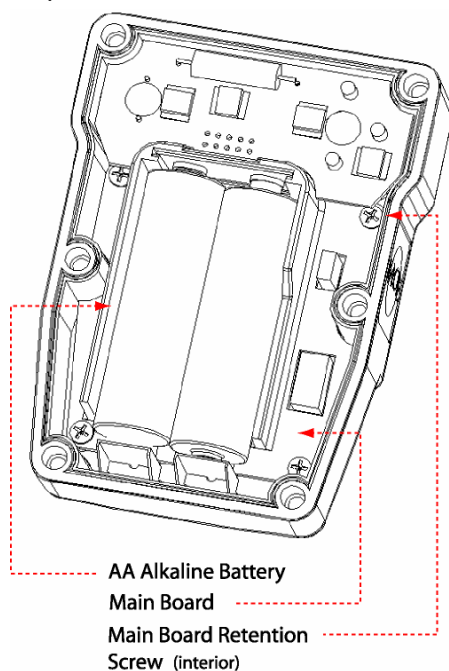
**⚠WARNING** Removal or replacement of alkaline batteries in potentially combustible atmospheres may lead to serious injury or death. The alkaline batteries used in the Toxi Vision EX may only be removed or replaced in an atmosphere that is known to be free of combustible gas.

**⚠WARNING** To reduce the risk of explosion, do not mix old or used batteries with new batteries and do not

### **mix batteries from different manufacturers.**

To replace the batteries:

1. Remove the six screws on the back of the Toxi Vision EX.
2. Remove the back cover plate. The two AA alkaline batteries are located near the center of the main board.
3. Remove the old alkaline batteries and install new batteries. Be sure to align the polarity of the batteries in accordance with the diagram on the battery compartment.
4. Replace the back cover plate.
5. Reinstall the six screws on the back of the instrument that were removed in step 1.



**Figure 4.1: Interior view**

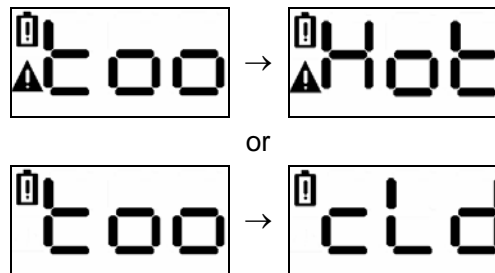
**⚠WARNING** Use only Duracell MN1500 or Ultra MX1500, Eveready Energizer E91-LR6, or Eveready Energizer EN91 size AA 1.5V alkaline batteries. Substitution of batteries may impair intrinsic safety.

### **4.2 Charging NiMH batteries**

The Nickel Metal Hydride (NiMH) batteries contained in the Toxi Vision EX are encapsulated in the instrument for safety and may not be accessed by the user.

To charge the batteries, simply plug the Toxi Vision EX into a standard electrical socket using the charger that was delivered with the instrument. The Toxi Vision EX should charge fully in 12 hours.

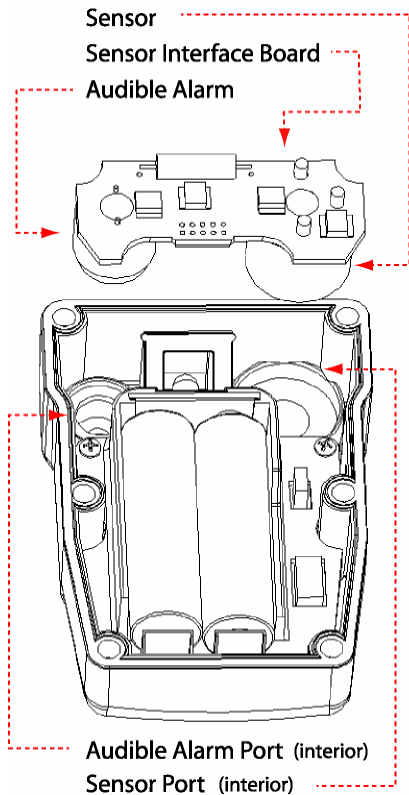
The NiMH battery in the ToxiVision LEL may not be charged at temperatures lower than 5 degrees Celsius (40 degrees Fahrenheit) or higher than 38 degrees Celsius (100 degrees Fahrenheit). In the event that charging is attempted outside of the charging range, the instrument will display “too hot” or “too cld” as appropriate.



### **4.3 Replacing sensors**

The sensor in the Toxi Vision EX may require periodic replacement. To replace the sensor:

1. Loosen the six screws on the back of the Toxi Vision EX.
2. Remove the back cover.
3. Remove the batteries.
4. The sensor interface board is located in the top section of the instrument and can be removed by pulling it up from the main board.
5. Once the sensor interface board has been removed, gently remove the old sensor and install a new sensor of the same type.
6. Replace the sensor interface board. Be careful to properly align the connector pins, sensor and alarm gaskets before pressing the sensor interface board back into place.
7. Replace the batteries.
8. Replace the back cover.
9. Retighten the six screws on the back of the instrument that were removed in step 1.
10. Following a sensor change, the LEL sensor in the ToxiVision EX requires a 5 minute warm-up period. The detector must be powered off and functional batteries must be installed for the sensors to stabilize.



**Figure 4.3 Interior view with sensor interface board removed**

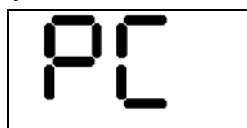
**Note: The Toxi Vision EX must be calibrated after any sensor change. See section 3.4 and 3.5 above for details on the fresh air/zero and span calibration sequences.**

## 5. Direct programming

In the event that an instrument setting needs to be changed in the field and a PC with the appropriate software is not available, the Toxi Vision EX can be programmed directly with the MODE button.

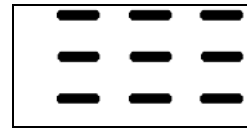
**⚠WARNING** Reprogramming the Toxi Vision EX is reserved for authorized personnel. Inappropriate changes made in the Advanced Menu may lead to inaccurate and potentially dangerous readings.

Turn the Toxi Vision EX off. Then turn the Toxi Vision EX back on, but instead of releasing the MODE button, continue to hold it. The “PC” screen will be shown in approximately 6 seconds.



Continue to hold the MODE button for about 15 additional seconds until the “dashes”

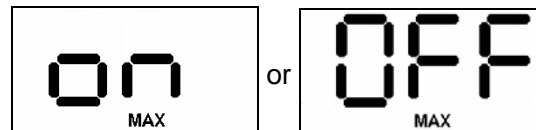
screen is shown. Release the MODE button as soon as the dashes are shown.



Once dashed lines are shown, immediately click the MODE button three times within three seconds to enter the Configuration Menu. “ini” will be shown.



Click the MODE button once with “ini” shown. After a few seconds, the “ini” screen will be replaced by the “on MAX” or “OFF MAX” screen.

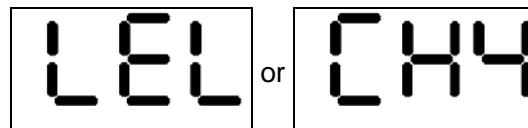


### 5.1 MAX on or off

With MAX set to on, the maximum reading that the instrument has experienced in this operating session can be accessed from the current gas readings screen by pressing the MODE button twice (once to turn on the back light and once to show the MAX screen).

With the MAX setting off, the instrument will not show the max readings during normal operation.

After a few seconds, the screen will change over to the LEL or CH4 setting.



### 5.2 LEL or CH4

The default setting for the Toxi Vision EX is in terms of percentage of LEL, which stands for Lower Explosive Limit.

With the Toxi Vision EX configured to read in terms of percent by volume of methane (CH<sub>4</sub>), the LEL sensor must be calibrated to the actual percent by volume of methane used in Sperian calibration gas cylinders, not to the %LEL value given on the label. The actual percentage by volume of CH<sub>4</sub> will be stamped in indelible black ink on the side of the cylinder body. For example, Sperian’s popular all-in-one mix, part number 54-9044E, with 50% LEL propane

equivalent will list  $\pm 1.62\%$  CH<sub>4</sub> on the side of the cylinder body. In this case, the percent by volume CH<sub>4</sub> calibration gas value should be set to 1.62%.

For easy reference, the actual percent by volume of CH<sub>4</sub> for the following Sperian LEL component mixtures is listed in the following table.

LEL Component Description	Volume % Methane (CH <sub>4</sub> )
50% LEL Methane	$\pm 2.50$
50% LEL Propane Equivalent	$\pm 1.62$
50% LEL Pentane Equivalent	$\pm 1.25$

A few seconds after the LEL or CH<sub>4</sub> screen is shown, the Toxi Vision EX will shut itself down.

## 6. PC-Instrument Communications

### 6.1 Data / Event logging

Each ToxiVision EX equipped with the NiMH battery includes a built-in event logger and black box datalogger that store instrument readings during alarm conditions, calibration values and other data. A full datalogger is

also available as an upgrade. BioTrak software and an IrDA port are necessary to download the collected data to a PC.

### 6.2 Initiating communications

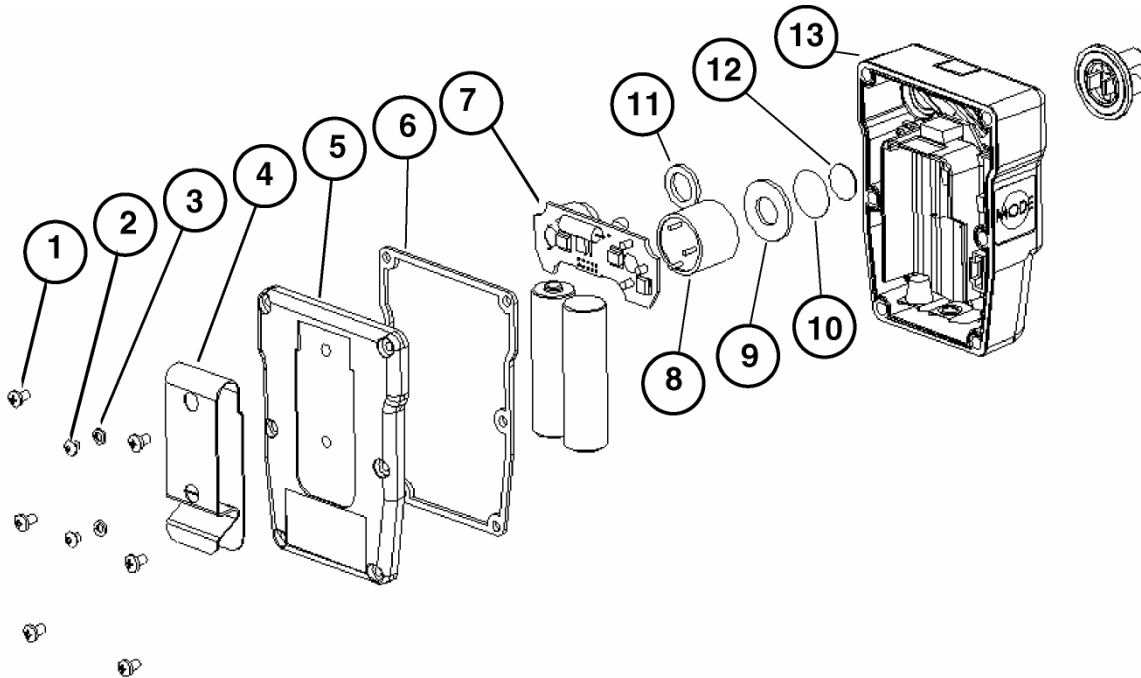
To initiate communications, hold the MODE button as if you are turning the instrument off. Once "OFF" or "on" is shown, continue to hold MODE until the "PC" screen is shown and the LED/IrDA port turns on.



Once "PC" is shown release the MODE button and align the infrared port at the top front of the instrument with the PC's infrared port to proceed with the download. The LED/IrDA port will blink during communication with the PC. The ToxiPro should be located directly in front of the IrDA Port about 6" away.

If the IrDA connection is lost during data transmission, the ToxiVision EX will beep to let the user know that there is a problem. Lost connections are most frequently caused by poorly aligned infrared ports.

### Exploded View



- |    |            |                             |     |           |                                 |
|----|------------|-----------------------------|-----|-----------|---------------------------------|
| 1. | 05-1147(6) | Case retention screws       | 8.  | 54-39-80  | Sensor                          |
| 2. | 05-630(2)  | Belt clip retention screws  | 9.  | 61-037    | Sensor filter                   |
| 3. | 05-213(2)  | Belt clip retention washers | 10. | 34-065(1) | Sensor gasket                   |
| 4. | 55-392(1)  | Belt clip                   | 11. | 34-066(1) | Alarm gasket                    |
| 5. | 10-391(1)  | Bottom housing              | 12. | 10-390(1) | Top housing                     |
| 6. | 34-063(1)  | Main gasket                 | 13. | 54-38-01  | Calibration/sample draw adapter |
| 7. | 35-0666    | Sensor interface board      |     |           |                                 |

## Appendix A: Calibration Frequency Recommendation

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’s website is located at

<http://www.biosystems.com>

## Appendix B: LEL Correction Factors

The commonly accepted way to estimate the relative response of a sensor calibrated on one combustible gas to exposure to another gas is by taking the actual instrument reading, and multiplying it by a correction factor.

It is very important to understand that if an error is made in determining the specific kind of gas present, and the wrong correction factor is used, the accuracy of the calculation may be significantly affected.

**In actual practice, the relative response varies somewhat from sensor to sensor. The response ratios may also shift over the life of a particular sensor, especially in the event the sensor loses sensitivity as a consequence of being “poisoned”.**

Using correction factors

As an illustration, consider a Cannonball3 calibrated on methane, which is then used to monitor ethanol. When calibrated to methane, the instrument is actually less responsive to ethanol than to methane, so the readings will be low. Multiplying the instrument reading by the correction factor for ethanol will produce the true % LEL.

Given that the correction factor for ethanol is 1.2, if the instrument reading is 40 percent LEL, then the true concentration is seen to be about 48% LEL.

$$(40 \% \text{ LEL}) \times (1.2) = (48\% \text{ LEL})$$

Instrument Reading	Correction Factor	Actual Concentration
--------------------	-------------------	----------------------

It is important to note that the correction factor for ethanol is different when the instrument is calibrated on propane. In the case of a propane calibrated instrument,

instrument readings for ethanol will be high. Given that the correction factor for ethanol in this case is 0.76; when the instrument reads 40 percent LEL, the true concentration for ethanol is 30% LEL.

$$(40 \% \text{ LEL}) \times (.76) = (30\% \text{ LEL})$$

Instrument Reading	Correction Factor	Actual Concentration
--------------------	-------------------	----------------------

Combustible Gas / Vapor	Correction factor when instrument is calibrated on Propane	Correction factor when instrument is calibrated on Methane
Hydrogen	0.54	0.83
Methane	0.65	1.0
Propane	1.0	1.5
n-Butane	1.0	1.5
n-Pentane	1.1	1.7
n-Hexane	1.2	1.8
n-Heptane	1.3	2.0
n-Octane	1.6	2.5
Methanol	0.65	1.0
Ethanol	0.76	1.2
Isopropyl Alcohol	1.0	1.5
Acetone	0.93	1.4
Ammonia	0.46	0.71
Toluene	1.6	2.5
Methyl Ethyl Ketone	1.2	1.8
Ethyl Acetate	1.2	1.8
Gasoline (Unleaded)	1.1	1.7

# Toxi Vision EX

Software Version \_\_\_\_\_

Vibrating Motor

Datalogging

Serial Number \_\_\_\_\_

MFG Date \_\_\_\_\_

## Sperian Instrumentation Toxi Vision EX Standard Warranty

### 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 standard 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
ToxiVision EX	As long as the instrument is in service
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
ToxiVision EX	LEL**	2 Years

\*\* 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 Instrument Service department) void Sperian's Standard Warranty as it applies to the replacement of combustible gas sensors.