

# PROTÉGÉ ZM

PORTABLE, ZERO-MAINTENANCE, SINGLE-GAS MONITOR

USER GUIDE 087-0047, Rev. G



**WARNING: ALL INDIVIDUALS WHO HAVE OR WILL HAVE RESPONSIBILITY FOR USING, MAINTAINING, OR SERVICING THIS PRODUCT, MUST READ THIS ENTIRE MANUAL CAREFULLY. FAILURE TO USE THIS EQUIPMENT PROPERLY COULD RESULT IN SERIOUS INJURY OR DEATH.**

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## RELATED PRODUCT DOCUMENTATION

Document Title	Document Number	Purpose
Protégé ZM System Guide	087-0048	Installation, configuration, operation, maintenance and troubleshooting information on the Protégé ZM monitor, test station, applicable software and firmware.

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## 1. ABOUT THIS GUIDE

This guide instructs gas detection personnel on the features and usage of the Protégé ZM Portable, Zero-Maintenance, Single-gas Monitor (also referred to as “the monitor”). It also provides information on configuration, operation, maintenance, specifications and trouble shooting.

This user guide assumes the reader has a basic knowledge of gas detection procedures.

The user guide is divided into the following topics:

- [INTRODUCTION](#)
- [OPERATION](#)
- [MAINTENANCE](#)
- [SPECIFICATIONS](#)
- [GAS INTERFERENCES](#)
- [PARTS](#)
- [TECHNICAL SUPPORT](#)

### 1.1. Guide Conventions

The following visual elements are used throughout this guide:



**WARNING: THIS ICON AND TEXT INDICATE A POTENTIALLY HAZARDOUS SITUATION, WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR INJURY.**



**CAUTION: This icon and text indicate an action or situation, which, if not avoided, could result in damage to the equipment.**







**NOTE: This icon and text designates information of special note.**

## 1.2. Certifications and Approvals

Table 1: Certifications and Approvals details the monitor's certifications and approvals.

**Table 1: Certifications and Approvals**

Mark
 <b>Intertek</b> Class I, Groups A, B, C, D, and T4 -50°C to +50°C (O <sub>2</sub> ) -40°C to +50°C (H <sub>2</sub> S) -30°C to +50°C (CO)
 II1G Ex ia IIC T4 Ga Ambient temperature: -50°C to +50°C (O <sub>2</sub> ) -40°C to +50°C (H <sub>2</sub> S) -30°C to +50°C (CO) ITS 12ATEX27643X
 Ex ia IIC T4 Ga Ambient temperature: -50°C - +50°C (O <sub>2</sub> ) -40°C - +50°C, (H <sub>2</sub> S) -30°C - +50°C (CO) IECEx ETL 12.0016X
 ATEX Directive EMC Directive
<p>Note: The monitors covered in this manual have not been evaluated for enriched oxygen atmosphere &gt;21%.</p>

### 1.3. General Safety Information



**WARNING: READ, UNDERSTAND AND FOLLOW THE ENTIRE CONTENT OF THIS GUIDE PRIOR TO USE. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH.**



**WARNING: ALL INDIVIDUALS WHO HAVE OR WILL HAVE RESPONSIBILITY FOR USING OR TESTING THIS PRODUCT MUST READ AND UNDERSTAND THE CONTENTS OF THIS MANUAL. THE PRODUCT WILL PERFORM AS DESIGNED ONLY IF USED AND TESTED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. FAILURE TO FOLLOW MANUFACTURER'S INSTRUCTIONS WILL RENDER THE WARRANTY AND APPROVALS NULL AND VOID. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY ALSO RESULT IN SERIOUS INJURY OR DEATH.**



**WARNING: THE CAPACITANCE MEASURED ON THE ENCLOSURE'S METAL PARTS EXCEED 3PF (MAXIMUM MEASURED CAPACITANCE WAS 4.4PF). THE USER SHALL DETERMINE THE SUITABILITY OF THE EQUIPMENT IN THE END APPLICATION AND SHALL TAKE THE NECESSARY PRECAUTIONS IN THE USE OF THIS EQUIPMENT. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH.**

The Company can take no responsibility for use of its equipment if it is not used in accordance with the instructions. If further operational or maintenance details are required but not provided in this guide, contact the Company or their agent. The Company shall not be liable for any incidental or consequential damages in connection with any modifications, errors or omissions in this guide.

All pertinent regional and local safety regulations must be observed when installing and using this product. For reasons of safety and to assure compliance with documented system data, repairs to components should be performed only by the manufacturer.

Additionally, industry standards, codes, and legislation are subject to change. Updated copies should be obtained by users to ensure the most recently issued regulations, standards and guidelines are available.

All pertinent regional and local safety regulations must be observed when handling and disposing of hazardous material, Toxic (E-Chem) Sensors, batteries and other similar items that may fall under the classification of hazardous material.

The electrical, electronic, and battery elements of this product must not be disposed of via municipal waste streams but should be delivered to collection facilities. Information on collection facilities is given by the local authorities or importer's representative.

For products sold in Europe, the end of life procedures for battery operated electronic products must comply with the RoHS Directive 2002/95/EC, the WEEE Directive 2002/96/EC and the Battery Directive 2006/66/EC. These directives dictate how to dispose of the electronic and battery elements of the product after use. For Protégé products sold in the UK, contact Teledyne Gas Measurement Instruments Ltd for further information. For other parts of Europe, please contact your local provider of GMI products.

## 1.4. Warnings and Cautions – Monitor Use and Care



**WARNING: ONLY QUALIFIED PERSONNEL — AS DEFINED ACCORDING TO LOCAL, COUNTY, STATE, FEDERAL AND INDIVIDUAL COMPANY STANDARDS — MAY OPERATE AND SERVICE THIS EQUIPMENT. READ AND UNDERSTAND THE GUIDE COMPLETELY BEFORE OPERATING OR SERVICING.**



**WARNING: WHEN IN DOUBT VACATE THE AREA IMMEDIATELY. YOU SHOULD VACATE THE AREA IMMEDIATELY SHOULD THE MONITOR INDICATE A WARNING OR ALARM CONDITION. YOU SHOULD KNOW, UNDERSTAND AND FOLLOW YOUR COMPANY'S SAFETY PROTOCOLS.**



**WARNING: IF THE MONITOR DOES NOT FUNCTION AS DESCRIBED HEREIN, REMOVE FROM SERVICE AND MARK FOR MAINTENANCE. ONLY USE GMI REPLACEMENT PARTS WHERE APPLICABLE.**



**WARNING: ONLY USE THE MONITOR IN ATMOSPHERES FOR WHICH IT IS INTENDED.**



**WARNING: TO PREVENT IGNITION OF AN EXPLOSIVE ATMOSPHERE, READ AND ADHERE TO THE MANUFACTURER'S MAINTENANCE PROCEDURES.**



**WARNING: READ THIS MANUAL FOR INTRINSIC SAFETY PRECAUTIONS. SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY, RESULTING IN SERIOUS INJURY OR DEATH.**



**WARNING: DO NOT ATTEMPT PART REPLACEMENT OR SUBSTITUTION AS THIS COULD IMPAIR THE INTRINSIC SAFETY RATING AND WILL VOID THE WARRANTY OF THE PRODUCT.**



**ATTENTION: NE PAS ESSAYER DE LA REMPLACER UNE PARTIE OU LA SUBSTITUTION, CAR CELA POURRAIR NUIRE À LA COTE DE SÉCURITÉ INTRINSÈQUE ET ANNULERA LA GARANTIE DU PRODUIT.**



**CAUTION: The monitor only detects gases while powered.**



**CAUTION: Periodically verify alarm operation by exposing the monitor to a gas concentration above the high alarm set point.**



**CAUTION: Verify the gas inlet port is free of dirt and debris prior to use.**



**CAUTION: Do not expose the monitor to severe mechanical or electrical shock. Always conduct device startup and bump test procedures after such exposure to verify the monitor's operation and accuracy.**

## 1.5. Warnings and Cautions – Sensor Use and Care



**WARNING: EXTENDED EXPOSURE OF THE MONITOR TO HIGH CONCENTRATIONS OF TOXIC GASES MAY RESULT IN DEGRADED SENSOR PERFORMANCE. IF AN ALARM OCCURS DUE TO HIGH CONCENTRATION OF TOXIC GASES, EXIT TO A SAFE AREA AND BUMP TEST OR RECALIBRATE AS NECESSARY.**

## 1.6. Warnings and Cautions – Battery Use and Care



**CAUTION: The battery cannot be recharged and is not replaceable.**



**CAUTION: Discard monitor when battery indicator shows a fully discharged battery.**

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## 2. INTRODUCTION

### 2.1. Monitor Overview

The Protégé ZM is a portable, single-gas, disposable monitor that operates with a single button and has a two (2) year life span (typical). It comes ready for use with a lithium-based battery, a filter and a sensor.

Gas indication is via a direct-reading backlit LCD, multiple bright LEDs, a loud audible alarm and a vibratory alarm. The monitor includes a downloadable data log for twenty-five (25) events, recording exposures, calibrations, and gas values.

The Protégé ZM monitors the atmosphere for potentially hazardous levels of gases. Three types are available: Hydrogen Sulfide (H<sub>2</sub>S), Carbon Monoxide (CO), and Oxygen (O<sub>2</sub>), as detailed in [Table 1-1: Monitor Types](#).



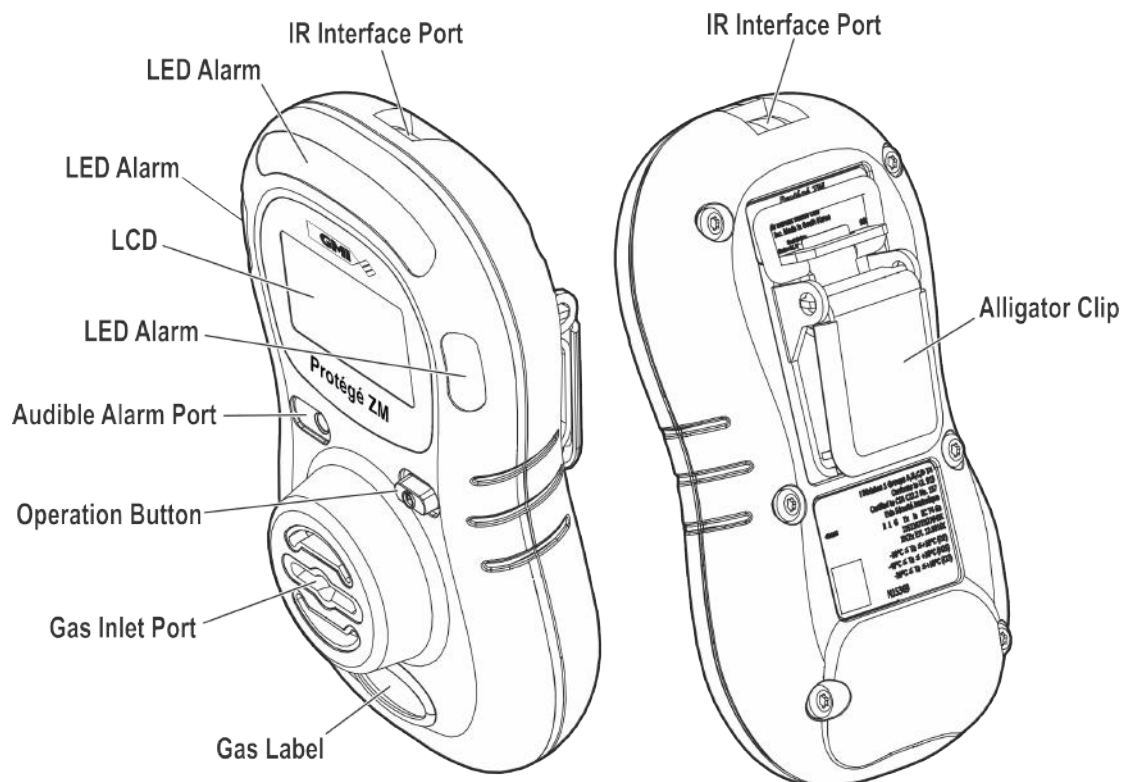
NOTE: The monitor is supplied with factory default settings. Some settings can be altered to suit varying applications.

**Table 1-1: Monitor Types**

Gas	Hibernation Mode Option*	Factory Default Alarm Set Points**
Oxygen (O <sub>2</sub> )	No	Low = 19.5% High = 23.5%
Hydrogen Sulfide (H <sub>2</sub> S)	Yes	Low = 10 PPM High = 15 PPM
Carbon Monoxide (CO)	Yes	Low = 35 PPM High = 200 PPM
<p>*Hibernation mode fully switches off the monitor to extend battery life. This can only be performed with the IR Connect software or Test Station. When a device is hibernated, the event log is cleared.</p> <p>** Customer may change these set points using IR Connect after delivery. To display alarm set points, press the monitor's button. Monitors may be ordered with custom alarm set points.</p>		

For any questions about the monitor or its operation, refer to [Section D. TECHNICAL SUPPORT](#).

Figure 2-1: Major Parts of the Monitor shows the major parts of the monitor.



**Figure 2-1: Major Parts of the Monitor**



NOTE: The monitor is shipped with a calibration adapter (refer to [C.1. Applicable Parts List](#)).



## 3. OPERATION

### 3.1. Operating the Monitor



**WARNING: IF THE MONITOR FAILS TO RESPOND PROPERLY UPON START UP, OR IF CALIBRATION IS OUT OF DATE, DO NOT USE THE DEVICE UNTIL IT HAS BEEN PROPERLY CALIBRATED. FAILURE TO DO SO COULD RESULT IN DEATH OR INJURY.**

In the absence of gas, the LCD displays life remaining. If gas is present, the display automatically shows the gas concentration and a battery icon.

To activate the monitor, press and hold the front button for about five (5) seconds. On activation, the monitor vibrates, flashes and sounds an audible alarm. A successful activation will display 24 months of life remaining.



**NOTE:** You can change the monitor's default display using the IR Connect Software.

#### 3.1.1. MONITOR LCD DISPLAY



**WARNING: YOU MUST FAMILIARIZE YOURSELF WITH THE ICONS IN BOTH THE NON-ALARM AND ALARM STATES.**



**WARNING: DO NOT USE IF THE DISPLAY IS MISSING ICONS OR CANNOT BE CLEARLY READ.**

Figure 3-1: Monitor LCD Indicators details LCD Display.

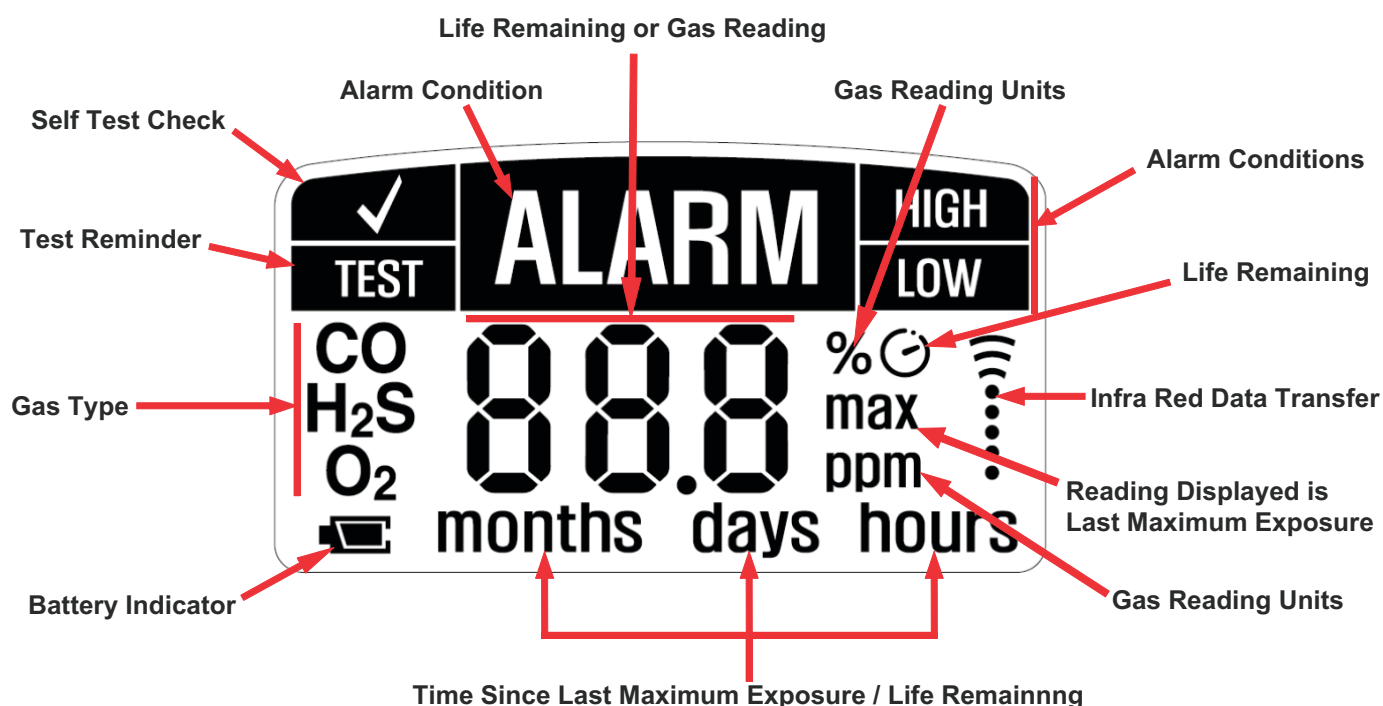


Figure 3-1: Monitor LCD Indicators

## 3.2. Powering Up the Monitor








**WARNING: DO NOT USE THE MONITOR IF IT DOES NOT OPERATE AS DESCRIBED HERE.**

**Table 3-1: Monitor Power-Up Sequence**

Action	LCD Display	Results
Press & hold the button for five (5) seconds.		<p>The monitor starts and runs through a self-test:</p> <ul style="list-style-type: none"> <li>• The monitor emits one audible beep</li> <li>• All LEDs light and monitor vibrates</li> <li>• All LCD display elements appear</li> </ul>
	 	<p>Next, the LOW and HIGH alarm set points are displayed.</p>
		<p>When a self-test is successful, the monitor emits one short beep and displays:</p> <ul style="list-style-type: none"> <li>• self-test check icon</li> <li>• months / life remaining icon</li> </ul>

### 3.3. Monitor LCD Alerts & Alarms

Table 3-2: Monitor Alerts and Alarms Descriptions

LCD	Reason	LED	Beeps	Vibration
	Low Alarm	1 slow flash every second	1 slow beep every second	1 slow vibration every second
	High Alarm and Over Limit (OL) Alarm	2 fast flashes every second	2 fast beeps every second	2 fast vibrations every second
	Detector Life Countdown Alarm*	8 slow flashes per minute	8 slow beeps per minute	8 slow vibrations per minute
 	Bump Test Due**  Note: LCD toggles between buP & reading.	Alternating flashes (left and right) every 5 seconds		
* When Life Remaining displays 0 hours, the detector operates for 8 hours before deactivating. ** Applies if a bump test interval is set.				

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## 4. MAINTENANCE

### 4.1. Bump Testing / O<sub>2</sub> Calibration



**WARNING: OPERATING A MONITOR THAT HAS EXCEEDED ITS CALIBRATION DATE CAN CAUSE FALSE GAS READINGS. THESE READINGS MAY BE INVALID AND COULD LEAD TO DEATH OR INJURY.**

The monitor must be operated and maintained correctly. Sensors can lose sensitivity through normal degradation, exposure to high gas concentrations, or sensor poisoning. Calibration and daily bump testing are essential to ensure the monitor performs as intended.

The frequency of calibration and bump testing is best determined from local regulatory standards, company policies, and industry best practices. The Company is not responsible for setting policies or practices.

- Calibration — Adjusts of the monitor's response to match a known concentration of gas.
- Bump Test — Verifies the calibration by subjecting the monitor to a known concentration of gas.

#### 4.1.1. BUMP TEST USING CALIBRATION ADAPTER

Required Items:

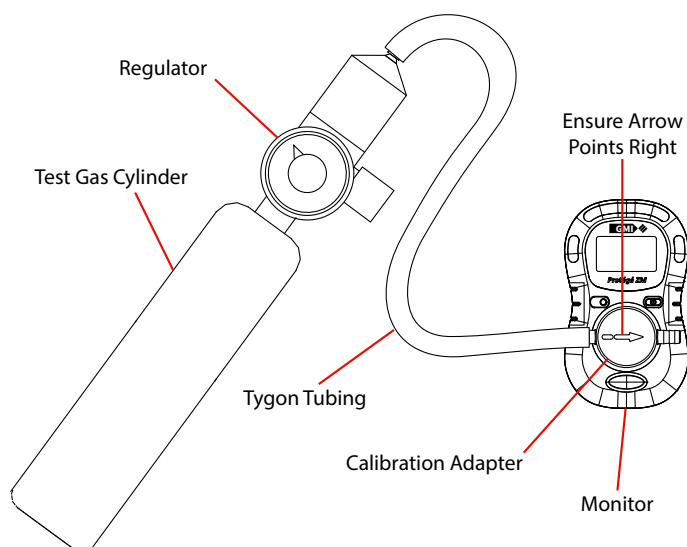
- Calibration gas
- Tygon tubing – 2 feet of 3/16" ID
- Regulator – Set at 0.5 LPM
- Calibration adapter – Shipped with monitor

Perform the following:

1. Verify the concentration of the calibration gas exceeds the monitor's alarm set-point and the expiration date of the cylinder has not passed.
2. Attach regulator to the gas cylinder. Verify cylinder pressure.
3. Connect the Tygon tubing to the regulator and calibration adapter.
4. Attach the calibration adapter to the monitor and apply gas (see [Figure 4-1: Bump Test - Calibration Adapter Attached](#)).



**NOTE:** Ensure the calibration adapter is fitted onto the monitor with the arrow head pointing to the right (see [Figure 4-1: Bump Test - Calibration Adapter Attached](#)).



**Figure 4-1: Bump Test - Calibration Adapter Attached**

5. Verify monitor responds to target gas and activates the visual, audible, and vibrating alarms.
6. Turn off gas cylinder and remove Calibration Adapter.



**WARNING: IF THE MONITOR FAILS TO ACTIVATE ALL ALARMS WITHIN ONE (1) MINUTE, REMOVE FROM SERVICE.**

#### 4.1.2. CLEARING A BUMP TEST INTERVAL ALARM ALERT



**NOTE:** The monitor can be configured to alert the user if a bump test is due.

When a bump test is due, buP flashes on the screen and the LEDs flash.

This alert may be cleared by either:

1. Performing a bump test at anytime using the Test Station and target gas (refer to “[RELATED PRODUCT DOCUMENTATION](#)” on page ii).
2. Performing a manual bump test by pressing the front button once.
  - A. After Alarms screens, the monitor displays gAS and the TEST icon flashes (see [Figure 4-2: Manual Bump Test - Apply Gas](#)).



**Figure 4-2: Manual Bump Test - Apply Gas**

- B. Once gas is applied and test is successful, the check mark ✓ appears.
- C. If gas is not applied or detected after 45 seconds, the test is aborted.  
Also, press button at any time to abort the test.

### 4.1.3. O<sub>2</sub> CALIBRATION USING THE FRONT BUTTON



**WARNING: ONLY PERFORM O<sub>2</sub> CALIBRATION IN NORMAL AIR (20.9% OXYGEN) THAT IS FREE OF HAZARDOUS GASES.**

1. Press and hold the front button for four (4) seconds.
2. CAL displays and the O<sub>2</sub> icon flashes.
3. After a successful calibration, the monitor emits one (1) beep, vibrates and the LEDs flash.
4. If unsuccessful, the monitor will not beep or flash and will continue displaying CAL.  
If repeated calibrations fail, remove from service.

### 4.2. Self-test





Prior to daily use, the device prompts for a self-test. This ensures safe operation of the monitor. During the self-test, the audio, visual and vibration alarms are activated and the sensor is tested.

[Table 4-1: Self-Test Procedure](#) details the self-test process.

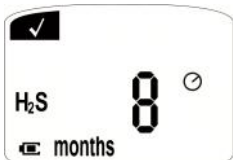




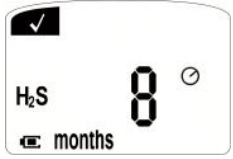


**WARNING: THE SELF-TEST DOES NOT REPLACE THE NEED TO BUMP TEST OR CALIBRATE, WHICH VERIFIES THE MONITOR'S RESPONSE TO GAS.**

**Table 4-1: Self-Test Procedure**

LCD Display	Steps
	When the TEST icon appears, a self-test is required.  Press the monitor's button to perform the self-test.
	This screen will appear. Ensure: <ul style="list-style-type: none"> <li>• The monitor emits one audible beep</li> <li>• All LEDs light and monitor vibrates</li> <li>• All LCD display elements appear</li> <li>• Test icon flashes</li> </ul>
 	Next, the LOW alarm and HIGH alarm set points are displayed.

**Table 4-1: Self-Test Procedure**

LCD Display	Steps
	<p>If alarms have not been previously activated and the self-test was successful:</p> <ul style="list-style-type: none"> <li>• check mark ✓ is displayed,</li> <li>• monitor returns to the original screen,</li> <li>• one short audible beep sounds.</li> </ul> <p>By default, another self-test will be prompted in twenty (20) hours.</p>
	<p>If programmed with a USER ID, characters will now scroll across the LCD.</p> <p>This can be two (2) screens with of up to six (6) characters.</p>
  	<p>If alarms have been activated, the following is displayed:</p> <ul style="list-style-type: none"> <li>• MAX / MIN gas reading detected</li> <li>• MAX icon</li> </ul> <p>The time (hours/days/months) since the MAX / MIN reading was detected is now displayed.</p> <p>The next screen is CLP (Clear Last Peak).</p> <p>Press the button while this is displayed to reset the MAX reading stored.</p> <p>Note: The MAX reading is reset on the display, but is still stored in the monitor's event log.</p>
	<p>Monitor now returns to original screen.</p>



**CAUTION:** If the self-test fails, the monitor emits five (5) short beeps and flashes before displaying TEST.



**CAUTION:** If the self-test fails three (3) consecutive times the monitor enters Fail Safe mode. Remove from service.



**CAUTION:** During normal operations, the battery is continuously monitored. If the battery is low for more than three (3) hours the monitor enters Fail Safe mode.





**CAUTION:** If the battery self-test fails five (5) consecutive times the LCD goes blank.  
Remove from service.

### 4.3. Error Codes

Table 4-2: Error Codes lists the monitor's error codes.

**Table 4-2: Error Codes**

Error Code	Fault
E01	Configuration memory
E02	Gas memory
E03	Program memory
E05	Battery
E06	Sensor



**CAUTION:** If any error code is displayed, remove from service.



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## A. SPECIFICATIONS

**Table A-1: Monitor Specifications**

Category	Specifications	
Battery Life	2 years, assuming a maximum 4 minutes of alarm time per day	
Alarms	Visual, vibrating, & audible (95 dB)	
Tests	Self-test on activation and every 20 hours. Continuous, automatic battery tests.	
Data Log	Lasts 25 events	
Housing	Thermoplastic Elastomer (TPE)	
Hydrogen Sulfide (H <sub>2</sub> S)	Range / Resolution	1 to 100 PPM / 1 PPM
	Low Alarm Set Point	10 PPM*
	High Alarm Set Point	15 PPM*
	Calibration Gas Concentration	25 PPM
Carbon Monoxide (CO)	Range / Resolution	1 to 300 PPM / 1 PPM
	Low Alarm Set Point	35 PPM*
	High Alarm Set Point	200 PPM*
	Calibration Gas Concentration	100 PPM
Oxygen (O <sub>2</sub> )	Range / Resolution	1 to 30% volume / 0.1%
	Low Alarm Set Point	19.5%*
	High Alarm Set Point	23.5%*
	Calibration Gas Concentration	16%
Dimensions	3.7" H X 2.2" W X 1.3" D (94 mm X 56 mm X 33 mm)	
Weight	2.7 oz. (76 g)	
Intrinsically Safe Approved Temperature Range	H <sub>2</sub> S: -40° F to +122° F (-40° C to +50° C) CO: -22° F to +122° F (-30° C to +50° C) O <sub>2</sub> : -58° F to +122° F (-50° C to +50° C) This differs from the operating temperature range	
Operating Temperature Range	H <sub>2</sub> S, CO, and O <sub>2</sub> : 14° F to +122° F (-10° C to +50° C) Outside this temperature range, reduced performance or alarm functionality may occur.	
Operating Humidity	5% to 95% RH, non-condensing	
*Factory defaults can be changed.		

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## B. GAS INTERFERENCES

### B.1. Gas Interferences

The monitor may respond to other gasses or interference gasses. [Table B-1: Gas Interferences](#) provides some of the known gas interferences.



NOTE: [Table B-1: Gas Interferences](#) details selected gas interferences. This data is for guidance only and must not be used as calibration factors. A monitor's response to an interference gas may vary from the values shown.

**Table B-1: Gas Interferences**

INTERFERENCE GAS:	Sensor Types (all values in PPM)	
	CO	H <sub>2</sub> S
Carbon Monoxide (CO)	1	< 0.02
Hydrogen (H <sub>2</sub> )	< 0.4	< 0.1
Hydrogen Sulfide (H <sub>2</sub> S)	< 0.02	1
Nitric Oxide (NO)	< 0.1	Not Tested
Sulfur Dioxide (SO <sub>2</sub> )	0	= 0.3
Ethanol (C <sub>2</sub> H <sub>5</sub> OH)	0	= -0.005
The table shows how 1 PPM of an Interference Gas appears on that specific sensor type. For example, 1 PPM CO appears as less than <0.02 PPM on a H <sub>2</sub> S sensor. For further information or clarification, please contact technical support.		





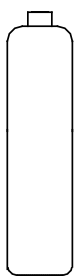

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## C. PARTS

### C.1. Applicable Parts List

[Table C-1: Applicable Parts List](#) details replacement parts and accessories for the monitor.

**Table C-1: Applicable Parts List**

Category	Item	Description	Part Number	
			Americas / APAC	EMEA
Monitor		Carbon Monoxide (CO)	096-3459-01	2025938
		Hydrogen Sulfide (H <sub>2</sub> S)	096-3459-02	2025937
		Oxygen (O <sub>2</sub> )	096-3459-03	2025939
Accessories		Alligator Belt Clip	073-0355	2025957
		Calibration Adapter	074-0564	2025956
		Tygon Tubing 3/16" ID 10' length	096-3167	66118
Gas Cylinders & Regulator		H <sub>2</sub> S 25 PPM 34L @ 500PSI	077-0272	2019127
		CO 100 PPM 103 L @ 1000 PSI	077-0246	99167
		O <sub>2</sub> 16% 103 L @ 1000 PSI	077-0039	2026297
		Regulator 0.5 LPM (For Manual Calibration)	077-0018	2019125
Note: For calibration equipment, contact your 3M sales representative.				