

Protector PRO-CO-1000

Handheld Intrinsically Safe and IP67-Rated
Carbon Monoxide (CO) Gas Detector
Operating Manual



Table of Contents

1. Introduction

- 1.1. Purpose
- 1.2. Product Overview
- 1.3. Protector PRO-CO-1000 main screen

2. Technical Specifications

- 2.1. General Information
- 2.2. Carbon Monoxide Detection Range
- 2.3. Operating Conditions
- 2.4. Physical Specifications
- 2.5. Battery Information
- 2.6. Compliance and Certifications

3. Product Features

- 3.1. Advanced Electrochemical Sensor Element
- 3.2. Carbon Monoxide (CO) Detection Capability
- 3.3. Audible and Visual Alarms
- 3.4. High-Resolution Display and Controls
- 3.5. Customer Replaceable Primary Battery
- 3.6. Cloud Data Storage and Connectivity
- 3.7. Calibration
- 3.8. Bump Testing
- 3.9. Customer Replaceable Sensor

4. Safety Precautions

- 4.1. General Safety Guidelines
- 4.2. Carbon Monoxide Exposure and Health Risks
- 4.3. Operating Environment in Intrinsically Safe Areas
- 4.4. Maintenance and Cleaning

5. Getting Started

- 5.1. Unpacking and Inspection
- 5.2. Battery Installation and Device Sleep
- 5.3. Power On/Off
- 5.4. Initial Calibration

6. Operating Instructions

- 6.1. User Interface
- 6.2. Carbon Monoxide Detection
- 6.3. Alarm System and Thresholds
- 6.4. Data Logging and Retrieval
- 6.5. Calibration
- 6.6. Firmware Updates via Phone App
- 6.7. Bump Test Procedure and Monitoring
- 6.8. Calibration with Phone App
- 6.9 Regulator Information Access

7. Troubleshooting

- 7.1. Common Issues and Solutions
- 7.2. Error Messages

8. Maintenance

- 8.1. Cleaning and Storage
- 8.2. Sensor Calibration and Replacement
- 8.3. Battery Replacement
- 8.4. Customer Sensor Changes

9. Device Label

- 9.1. Purpose of Device Label
- 9.2. Sample Device Label

10. Compliance and Legal Information

- 10.1. Regulatory Compliance
- 10.2. Disposal and Recycling

11. Warranty and Support

11.1. Warranty Coverage

11.2. Support Contacts

11.3. Product Registration

12. Contact Information

13. Revision History

1. Introduction

1.1. Purpose

The Handheld Intrinsically Safe and IP67-Rated Carbon Monoxide (CO) Gas Detector is designed to provide precise and reliable monitoring of carbon monoxide levels in many industries. This manual aims to guide users on proper usage, safety precautions, maintenance, calibration procedures, firmware updates, and bump tests, all accessible through the companion mobile application.

1.2. Product Overview

The Handheld CO Gas Detector utilizes advanced electrochemical sensor technology to detect carbon monoxide gas in the environment. Its rugged and ergonomic design, along with its intrinsic safety and IP67 rating, makes it suitable for on-site applications in oil refineries, gas pipelines, and other facilities. The PRO-CO-1000 (Protector) can be used as a standalone device to display CO parts per million (ppm) values and log shift, alarm, bump, and calibration data. The Protector handheld gas detector has built-in memory for storing 1109 alarms, 359 bump tests, 19 calibrations, and 359 shifts. Each log in the handheld detector will hold these logs until full and then will start to overwrite starting at the beginning. In standalone mode, the logs are accessible through the menu system.

The PRO-CO-1000 (Protector) also features seamless cloud data storage and connectivity, enabled through built-in Bluetooth Low Energy (BLE) technology. Two options are provided to connect and send data to the cloud. A phone app allows quick and efficient data synchronization and provides basic functions to initiate bumps, calibrations, and firmware updates. Optionally, a small footprint dock is available to facilitate data synchronization, bumps, calibrations, and firmware updates through an insertion pocket that the Protector slides into.

Cloud storage and data analysis are available on a facility app visible from the internet or mobile devices. Fleet management compliance reports and specific data related to all devices in the protector system can be viewed. Data can be sorted, viewed, and downloaded in a way suitable to each customer. Adjustable parameters for the PRO-CO-1000 (Protector) are synchronized between the handheld and Facility app allowing setting from the menu or from the cloud.

When the PRO-CO-1000 (Protector) is turned on, the main screen gives other aspects above displaying the continuously updating gas reading including battery status, time, TWA, and STEL. The latter two are OSHA standards of interest. TWA is the time-weighted average which is the max average exposure one should be exposed to continuously for 8 hours. STEL is similar but

represents the max exposure one should be exposed to for a 15-minute interval.

1.3. Protector PRO-CO-1000 main screen

Protector PRO-CO-1000 Main Screen



2. Technical Specifications

2.1. General Information

- Product Model: PRO-CO-1000
- Manufacturer: Molex/Sensorcon
- Intended Use: Portable Carbon Monoxide Gas Detector

2.2. Carbon Monoxide Detection Range

- Detection Range: 0 to 1000 ppm
- Resolution: .1 ppm
- Accuracy: $\pm 10\%$ of reading

2.3. Operating Conditions

- Operating Temperature: -20°C to 50°C (14°F to 122°F)
- Operating Humidity: 10% to 95% RH (non-condensing)

2.4. Physical Specifications

- Dimensions: 90 mm x 50 mm x 48 mm (with clip)
- Weight: 105 grams (with clip)
- Enclosure Rating: IP67 (dust-tight and protected against immersion in water up to 1-meter depth)

2.5. Battery Information

- Battery Type: Non-Rechargeable Primary Battery (Tadiran TL-5935)
- Battery Life: Over 2 years under normal operating conditions.
- Battery Life Under Alarm: 72 hours of constant Hi-Hi alarms on a fresh battery

2.6. Compliance and Certifications

- The Handheld CO Gas Detector complies with CE and RoHS requirements, ensuring its safety and environmental standards.
- It is intrinsically safe and holds certifications for hazardous environments, including Ex ia IIC T4 Ga.
- The device is also certified for use in explosive atmospheres and holds ATEX and IECEx certifications.

3. Product Features

3.1. Advanced Electrochemical Sensor Element

The gas detector has an advanced electrochemical sensor that provides reliable and stable CO gas readings. Electrochemical sensor elements are designed to have a linear output response over the

operating range. Very small and very large levels of gas can be detected and accurately processed with a microcontroller.

The electrochemical sensor and corresponding circuit board are designed to be replaced as a pair. Factory calibration data specific to the sensor is stored on its companion circuit board. More information is available in later sections.

3.2. Carbon Monoxide (CO) Detection Capability

The PRO-CO-1000 detector is specifically designed to detect and measure carbon monoxide (CO) gas levels accurately. It can measure small CO levels and is designed to provide warnings of various exposure limits. The element should be exposed to the ambient environment by clipping the handheld on the exterior clothing. Precautions should be taken to ensure an article of clothing or a coat does not cover the Protector. The recommended location is on the outside lapel not on the belt and never in a pocket.

3.3. Audible and Visual Alarms

The Protector includes four (4) different alarms which are combinations of sounds, vibrations, display changes, and lights to warn the user of various levels of gas detection. Alarm sequences increase the intensity with increased exposure risk. The simplest is the low alarm which can be silenced with a button push. TWA is projected for an average exposure over an 8-hour shift and a small excursion above the threshold may not represent a large risk. TWA has a unique alarm and can be silenced. Other alarms cannot be silenced, the PRO-CO-1000 must be removed from the gas environment. High alarm has a uniquely identifiable alarm sequence and may not be silenced. The worst exposure risks high-high and STEL share the most aggressive alarm sequence. Alarm thresholds are programmable by the menu system or the cloud data storage application. Users can set alarm thresholds for low, High, High-High, TWA, and STEL.

Default CO alarm thresholds are as follows:

Low	High	High-High	TWA	STEL
35	70	200	35	200

Low, high, and High-High alarm thresholds are very much dependent upon how and where the Protector is being used. The user should read and understand CO safety discussed in section 4 before setting their threshold.

Occupational Safety and Health Administration (OSHA) has set the Time-Weighted Average (TWA) permissible exposure limit (PEL) for carbon monoxide (CO) at 50 parts per million (ppm) over an 8-hour work shift. This means that workers should not be exposed to CO levels exceeding 50 ppm, averaged over an 8-hour time period.

Occupational Safety and Health Administration (OSHA) has set the Short-Term Exposure Limit (STEL) for

carbon monoxide (CO) at 200 parts per million (ppm) over a 15-minute time-weighted average. The STEL represents the maximum concentration of CO to which workers can be exposed continuously for a short duration without experiencing adverse health effects.

3.4. High-Resolution Display and Controls

The device features a high-resolution LCD screen that displays real-time CO concentrations and other essential information. Battery status, current time, STEL and shift TWA are also displayed along with the gas concentration in the main screen. The main screen also displays special alarm identifiers around the gas type during an alarm condition. The display has a backlight that illuminates on a button press. More information about the display screens can be found in section 6,

The Protector controls consist of two (2) buttons and a menu system to navigate settings, information, and gas functions. The left button when facing the display functions as the select button and the right is the scroll function. Menu structures and how to navigate them will be discussed in section 6 in more detail.

3.5. Non-Rechargeable Primary Battery

The gas detector is powered by a non-rechargeable primary battery, ensuring continuous operation without the need for recharging. The PRO-CO-1000 uses a 1700mA/hr lithium battery from Tadiran. The Tadiran TL-5935 is replaceable by way of three (3) sockets on the electronics board that accept the three (3) pins on the battery. It is recommended to replace the battery with a new one when its capacity is depleted to the last bar on the status indicator. Battery replacement will be covered in more detail in 8.3.

3.6. Cloud Data Storage and Connectivity

The PRO-CO-1000 features seamless cloud data storage and connectivity, enabled through built-in Bluetooth Low Energy (BLE) technology. BLE technology allows the Protector to communicate wireless to a dock or mobile device to create a path to the cloud. The BLE technology ensures fast and reliable data transmission to the cloud, while the cloud platform offers data backup and data export functionalities, enhancing data security and accessibility. The cloud data storage provides a secure and convenient way to manage, analyze, and share gas detection data across different devices and locations.

Data sent to the cloud can be viewed, sorted, and downloaded on the cloud application. Through the app, real-time data, historical measurements, and device settings can be remotely accessed and monitored. Users can pair the gas detector with their smartphones or tablets using the companion mobile application.

3.7. Calibration

The Protector can be calibrated in the field in different ways. The device has a menu system that can be used to initiate a calibration with the use of a calibration cup that snaps onto the housing. A phone app can also make use of the calibration cup and initiate the process from the app. A third way to perform calibrations is with a dock that can be used to calibrate PRO-CO-1000 devices.

Calibrating Protectors is recommended at an interval of 30 days to maintain the accuracy of aging sensors. Smaller calibration intervals may be suitable for specific applications. Calibration intervals are adjustable in the device's menu or with the cloud application. The PRO-CO-1000 will prompt when the interval has expired. The dock will automatically calibrate a Protector when the interval has expired.

3.8. Bump Testing

The gas detector features a bump function that allows users to initiate and monitor bump tests directly from the companion mobile app.

3.9. Customer Replaceable Sensor

The gas detector is designed with a customer-replaceable sensor module, allowing users to easily replace the CO sensor when needed.

Follow the instructions in the user manual for the correct sensor replacement procedure.

Regularly inspect and replace the sensor to maintain the gas detector's accuracy and performance.

4. Safety Precautions

4.1. General Safety Guidelines

Read this manual carefully before using the gas detector.

Comply with all relevant safety regulations and guidelines in your workplace.

Use the gas detector solely for its intended purpose.

4.2. Carbon Monoxide Exposure and Health Risks

Carbon monoxide is a colorless, odorless, and tasteless gas produced by the incomplete combustion of carbon-based fuels, such as gasoline, natural gas, and oil.

Exposure to elevated levels of carbon monoxide can lead to serious health risks and even death.

When inhaled, CO molecules bind to hemoglobin in the blood more readily than oxygen, reducing the blood's ability to carry oxygen to vital organs and tissues.

Early symptoms of CO exposure may include headaches, dizziness, nausea, weakness, confusion, and flu-like symptoms.

Prolonged exposure to high CO concentrations can result in loss of consciousness, brain damage, and ultimately, death.

As CO is undetectable by human senses, a reliable gas detector is essential for protecting workers from this silent threat.

4.3. Operating Environment in Intrinsically Safe Areas

The gas detector is intrinsically safe, meaning it is designed to operate in hazardous environments where flammable gases or vapors may be present.

An intrinsically safe environment is one in which electrical equipment, like the gas detector, is constructed to prevent the ignition of flammable substances present in the atmosphere.

It is essential to use the gas detector only in areas approved for intrinsically safe equipment usage and in accordance with local regulations and guidelines.

Always verify the intrinsically safe area classification before using the gas detector.

Avoid using the gas detector in non-approved areas or in areas with unknown or potentially hazardous atmospheres.

Warning: Avoid very close proximity to strong radiofrequency (RF) sources such as walkie-talkies, as they may interfere with the gas detector's operation.

4.4. Maintenance and Cleaning

Regularly inspect and clean the gas detector following the guidelines provided in the maintenance section of this manual.

Do not immerse the gas detector in water or any other liquids.

5. Getting Started

5.1. Unpacking and Inspection

- Carefully unpack the gas detector and inspect it for any signs of damage during transportation.
- If any damage is observed, do not use the device, and contact your supplier immediately.

5.2. Battery Installation and Device Sleep

- The gas detector will be shipped with a battery pre-installed.
- The device is designed to conserve power and will be in sleep mode when you first receive it. To activate the gas detector, press and hold the power button for a few seconds until the display lights up.

5.3. Power On/Off

- To power off the gas detector, press and hold the power button again until the display turns off.

5.4. Initial Calibration

- Follow the step-by-step instructions in the user manual to perform the initial calibration of the CO gas detector.
- Calibration should be performed regularly as per the recommended schedule and whenever necessary.

6. Operating Instructions

6.1. User Interface

- Familiarize yourself with the gas detector's display symbols and icons.
- Navigate through the menus using the designated buttons.

6.2. Carbon Monoxide Detection

- In normal operation, the gas detector continuously monitors the ambient air for the presence of carbon monoxide.
- The detected CO concentration will be displayed on the screen in parts per million (ppm).

6.3. Alarm System and Thresholds

- The gas detector is equipped with adjustable alarm thresholds for CO concentrations.
- Learn how to set and customize the alarm levels based on your organization's safety protocols.

6.4. Data Logging and Retrieval

- If your gas detector supports data logging, learn how to access and retrieve the stored CO measurement data.
- Use the cloud-based platform to analyze historical data and generate reports for compliance and safety purposes.

6.5. Calibration

- Regular calibration is essential to ensure accurate CO gas measurements.

- Follow the calibration procedure outlined in the user manual.
- Use a certified calibration gas with a known concentration of CO to calibrate the gas detector.
- Perform calibrations regularly as per the manufacturer's recommendations or local regulations.

6.6. Firmware Updates via Phone App

- The companion mobile app allows users to initiate firmware updates for the gas detector directly from their smartphones or tablets.
- Regularly check for firmware updates to ensure your gas detector has the latest features and improvements.
- Ensure you have a stable Bluetooth connection during the update process.

6.7. Bump Test Procedure and Monitoring

- The gas detector features a bump function that allows users to initiate and monitor bump tests directly from the companion mobile app.
- A bump test is a quick verification of the gas detector's functionality and response to a known concentration of CO gas.
- Follow the bump test procedure outlined in the user manual and the app's instructions.
- Perform bump tests regularly before each use or as recommended by the manufacturer to ensure the gas detector's accuracy and proper functioning.
- The app will display the bump test results, and any deviations from the expected values will trigger alerts or recommendations for further actions.

6.8. Calibration with Phone App

- The companion mobile app also provides step-by-step guidance for performing calibrations on the gas detector.
- Calibration using the app ensures precise and reliable calibration results.
- Follow the calibration instructions on the app carefully for accurate CO gas measurements.

6.9. Regulatory Information Access

- Access the main menu by pressing and holding the left button
- Use the right button to scroll down to the menu entry "FCC/IC"
- Select the corresponding menu entry "FCC" or "IC" to view regulatory information for the device

7. Troubleshooting

7.1. Common Issues and Solutions

Issue Description	Possible Causes	Solutions
Gas detector does not power on	Depleted battery	Replace the non-rechargeable primary battery
	Battery installed incorrectly	Check the battery polarity and re-install
	Defective power button	Contact technical support for assistance
Inaccurate or unstable CO readings	Sensor calibration issue	Perform sensor calibration following the user manual
	Interference from other devices	Move away from potential RF sources and EMF
	Contaminated sensor	Clean the sensor as per the maintenance guidelines

	Low battery level	Replace the battery if the low battery warning is displayed	
False alarms	Environmental contaminants	Ensure the area is free from other gases or substances	
	Sensor sensitivity adjustment	Adjust the alarm thresholds as per the user manual	
Display not functioning properly	Screen damage	Inspect for physical damage, contact technical support if needed	
	Software issue	Power off and restart the gas detector	
		If the issue persists, contact technical support	
Data not logging or retrieving	Data storage capacity reached	Transfer data to the cloud platform or a computer	
Connectivity issues	Check Bluetooth connection, restart the app, or device		

7.2. Error Messages

In case the gas detector displays any error messages, refer to the user manual for a comprehensive list of error codes, their meanings, and recommended actions to resolve them.

8. Maintenance

8.1. Cleaning and Storage

- Regularly clean the gas detector's external surfaces with a soft, dry cloth.
- Store the gas detector in a cool, dry place when not in use.

8.2. Sensor Calibration and Replacement

- Regularly calibrate the gas detector's CO sensor following the calibration guidelines in the user manual.
- Replace the CO sensor as per the recommended maintenance schedule or when indicated by the device.

8.3. Battery Replacement

- If the battery capacity depletes significantly or when the gas detector's low battery warning is displayed, replace the non-rechargeable primary battery with a new one following the correct polarity.

8.4. Customer Sensor Changes

- The gas detector is designed with a customer replaceable sensor module, allowing users to easily replace the CO sensor when needed.
- Follow the instructions in the user manual for the correct sensor replacement procedure.

9. Device Label

9.1. Purpose of Device Label

The device label provides important information about the Handheld Intrinsically Safe and IP67-Rated Carbon Monoxide (CO) Gas Detector. It includes details such as the model number, serial number, manufacturing date, safety warnings, intrinsic safety

rating, and IP67 enclosure rating. Familiarize yourself with the information on the label before operating the gas detector.

10. Compliance and Legal Information

10.1. Regulatory Compliance

FCC ID: 2BCPVPROT

IC: 30855-PROT

This device complies with Part 15 of the FCC Rules / Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the

user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC RF Exposure statement

The device shall be used in such a manner that the potential for human contact normal operation is minimized. This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 1.5 cm between the radiator and your body. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada RF Exposure Statement

The device shall be used in such a manner that the potential for human contact normal operation is minimized. This equipment complies with RSS-102 radiation exposure limits. This equipment should be installed and operated with a minimum distance of 1.5 cm between the radiator and your body. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Le dispositif doit être utilisé de manière à minimiser le potentiel de fonctionnement normal par contact humain. Cet équipement est conforme aux limites d'exposition au rayonnement RSS-102. Cet équipement doit être installé et utilisé avec une distance minimale de 1.5 cm entre le radiateur et votre corps. Cet appareil et son (ses) antenne (s) ne doivent pas être co-localisés ou utilisés conjointement avec une autre antenne ou un autre émetteur.

The Handheld CO Gas Detector complies with all relevant safety and environmental regulations and standards, including CE, RoHS, ATEX, and IECEx certifications.

- It meets the requirements for intrinsic safety (Ex ia IIC T4 Ga) in hazardous environments.
- The gas detector is IP67-rated, ensuring dust-tight protection and protection against immersion in water up to 1 meter depth.

10.2. Disposal and Recycling

- At the end of the gas detector's life cycle, please follow local regulations and dispose of the device responsibly.
- Proper recycling and disposal help protect the environment and conserve natural resources.

11. Warranty and Support

11.1. Warranty Coverage

- Warranty Period: [Warranty Period in months/years]
- Coverage: Covers manufacturing defects and normal use during the warranty period.

11.2. Support Contacts

- Customer Support: [Support Contact Information]
- Technical Support: [Technical Support Contact Information]

11.3. Product Registration

- Register your product online at [Product Registration URL] to avail of warranty benefits and receive product updates.

12. Contact Information

For any inquiries, support, or technical assistance, please contact:

- Customer Support: [Customer Support Contact Information]
- Technical Support: [Technical Support Contact Information]

13. Revision History

Version	Date	Description	Author
1.0	YYYY-MM-DD	Initial Release	[Author Name]
1.1	YYYY-MM-DD	Updated Section 10.2	[Author Name]

Version	Date	Description	Author
1.2	YYYY-MM-DD	Added Section 11	[Author Name]
1.3	YYYY-MM-DD	Added Section 6.7	[Author Name]

This revised manual incorporates the requested changes, including separate sections for calibration, bump tests, and firmware updates, with the addition of calibration with the