FIREBOY® - XINTEX®

MODEL: CO SENTINEL
MARINE CARBON MONOXIDE ALARM

CMD-4M	CMD-4M-RLY
CMD-4MR	CMD-4MR-RLY

Installation and Operation Manual
Made in U.S.A.

IMPORTANT: READ THIS MANUAL CAREFULLY. SAVE FOR FUTURE REFERENCE. KEEP THIS MANUAL WITH THE CO SENTINEL.

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18236 REV 7.0 10/17

!DANGER!: Actuation of this device indicates the presence of carbon monoxide (CO) which can be FATAL. The source of the CO may be an appliance such as a furnace, a wood burning stove, a vehicle, or other combustion source. EVACUATE THE PREMISES IMMEDIATELY. DO A HEAD COUNT TO CHECK THAT ALL PERSONS ARE ACCOUNTED FOR. CALL THE NEAREST FIRE DEPARTMENT AND ASK THEM TO DETERMINE THE SOURCE OF CARBON MONOXIDE. DO NOT REENTER PREMISES UNTIL IT HAS BEEN AIRED OUT AND THE PROBLEM IS CORRECTED!

⚠ **"WARNING": To reduce the risk of carbon monoxide poisoning, test alarm operation when not in use for 10 days or more.**

⚠ **"WARNING": There are no user or field serviceable parts in this product. The CO Sentinel must be returned to the manufacturer for any repair or performance checks.**

⚠ **"WARNING": This carbon monoxide alarm is designed to detect carbon monoxide (CO) gas from ANY source of combustion. It is NOT designed to detect smoke, fire or any other gas, unless the product has been investigated and determined to comply with the applicable requirements.**

⚠ **"WARNING": Any person with medical problems may consider using warning devices that provide audible and visual signals for carbon monoxide concentrations less than 30 PPM.**

⚠ **"WARNING": This product is not intended for use in ordinary outdoor locations of family living units. It is not designed to comply with Occupational Safety and Health Administration (OSHA) commercial or industrial standards.**

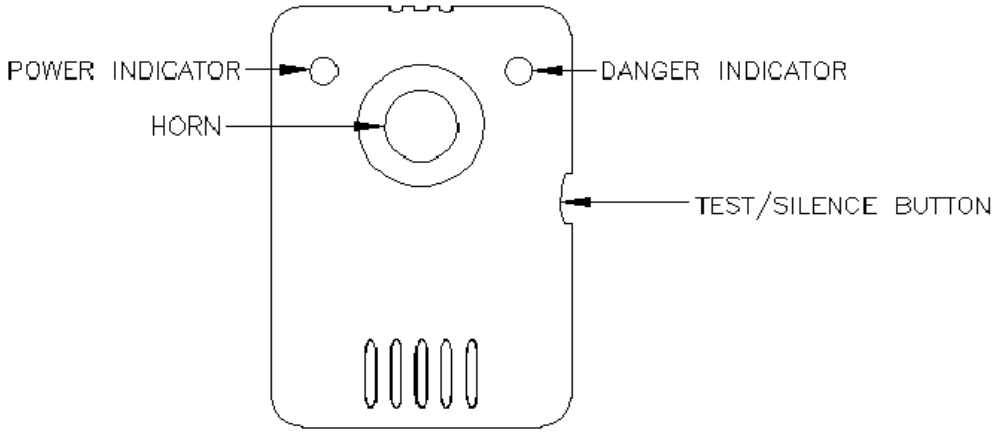
!CAUTION!: Installation shall be done by qualified personnel authorized to do so by the authorities having jurisdiction for the particular application in which the product is being used. Electrical wiring shall be in accordance with applicable codes. Improper wiring may render the unit inoperable, damage components, or cause a fire, and will void all warranties.

!CAUTION!: To function as intended, the CO Sentinel must be connected to a correct power source, and for maximum effectiveness, be powered at all times.

!CAUTION!: This Device shall not be installed or used in aircraft and/or racing vehicles. Fireboy-Xintex reserves the right to change features without notice.

!CAUTION!: This alarm will only indicate the presence of carbon monoxide gas at the sensor. Carbon Monoxide gas may be present in other areas.

Location of Alarms, Indicators, and Test Switch



Carbon Monoxide (CO) – "The Silent Killer"

A by-product of combustion, carbon monoxide is invisible, tasteless, odorless, and is produced by all engines, heating and cooking appliances. The most common sources of CO on boats are gasoline engines, auxiliary generators and propane heating or cooking devices. All of these produce large amounts of CO and should never be operated while occupants are sleeping. A slight build-up of carbon monoxide in the human body over several hours causes headaches, nausea and other symptoms similar to food poisoning, motion sickness or the flu. High concentrations can be fatal within minutes. The following symptoms are related to CARBON MONOXIDE POISONING and should be discussed with ALL passengers:

a. Mild exposure: Slight headache, nausea, vomiting and fatigue (often described as "Flu like symptoms").
b. Medium exposure: Severe throbbing headache, drowsiness, confusion, and fast heart rate.
c. Extreme exposure: Unconsciousness, convulsions, cardio-respiratory failure, and death.
d. Many cases of reported CARBON MONOXIDE POISONING indicate that while victims are aware they are not well, they become so disoriented they are unable to save themselves by either exiting the location or calling for assistance. Also, young children and pets may be the first affected. SEE TABLE 1.

Information on conditions which can result in transient CO situations, such as:

a. Excessive spillage or reverse venting of fuel burning appliances caused by outdoor ambient conditions, such as:
    i. Wind direction and/or velocity, including high gusts of wind. Heavy air in the vent pipes (cold/humid air with extended periods between cycles).
    ii. Negative pressure differential resulting from the use of exhaust fans.
    iii. Simultaneous operation of several fuel burning appliances competing for limited internal air.

iv. Vent pipe connections vibrating loose from clothes dryers, furnaces or water heaters.
v. Obstructions in or unconventional vent pipe designs which can amplify the above situations.

b. Extended operation of un-vented fuel burning devices (range, oven, etc.).
c. Temperature inversions that can trap exhaust gases near the ground.

TABLE 1

200 PPM:	Slight headache within 2 to 3 hours.
400 PPM:	Frontal headache within 1 to 2 hours.
800 PPM:	Dizziness, nausea and convulsions within 45 minutes. Insensible within 2 hours.
1600 PPM:	Headache, dizziness and nausea within 20 minutes. Death within 30 minutes.
3200 PPM:	Headache, dizziness and nausea in 5 to 10 minutes. Death within 30 minutes.
6400 PPM:	Headache and dizziness in 1 to 2 minutes. Death in less than 15 minutes.
12800 PPM:	Death in less than 3 minutes.

Drug or alcohol use increases the effect of CO exposure. Individuals with cardiac or respiratory conditions are very susceptible to the dangers of carbon monoxide. CO poisoning is especially dangerous during sleep when victims are unaware of any side effects. The following are symptoms that may signal exposure to CO:

- Headache
- Tightness of chest or hyperventilation
- Flushed face
- Nausea
- Drowsiness
- Fatigue or Weakness
- Inattention or Confusion
- Lack of normal coordination

Persons who have been exposed to carbon monoxide should be moved into fresh air immediately. Persons who have been subjected to high concentrations of CO should be placed in the care of a physician. To learn more about CO poisoning, contact your local health authorities.

Where Must We Guard Against Carbon Monoxide?

Carbon monoxide is a by-product of combustion. CO exists wherever fuels are burned to generate power or heat. Boats may utilize propane or compressed gas for cooking and/or heating. Boats have the added hazard of an auxiliary power generator where exhaust fumes may drift into the vessel. This hazard may also be created by a neighboring boat's exhaust fumes circulating into the cabin. The "station wagon effect", is another hazard that is caused by exhaust fumes that are captured via a rear opening while underway.

Boat Hazards

Boats that are underway should close all aft portholes and open a forward hatch, which may lend to pressurize the living spaces within the boat. As in RV's, no sleeping, particularly in aft cabins, should be permitted while underway. Occupants of the "bridge" should also maintain proper ventilation by opening a forward window or windshield to

drive “station wagon” effect fumes away from the occupants. Extreme caution must be taken while at anchor or in a slip while an auxiliary power generator is operating. Wind still nights can easily allow fumes to enter the boat. Inspect the exhaust systems of propulsion and auxiliary generators frequently for possible leaks. High concentrations of CO in your boat may originate from an adjacent boat. Exhaust fumes from nearby boats may enter your boat through open hatches or windows.

The CO Sentinel – How It Works

The CO Sentinel uses a microprocessor to measure and accumulate CO levels. Using the principle of “time-weighted averaging” (TWA), the CO Sentinel monitors CO concentrations, temperature, and time to calculate levels of carboxyhemoglobin (COHb). COHb is the degree to which the oxygen carrying capacity of the blood is impeded by the union of carbon monoxide to the hemoglobin and is expressed as a percentage. In layman’s terms, our bodies prefer absorbing CO to oxygen and COHb is the ratio of absorbed carbon monoxide to oxygen in the bloodstream. The CO Sentinel calculates this COHb level as a function of time and determines the appropriate alarm time. SEE TABLE 2.

Should a very high level of carbon monoxide exist, the CO Sentinel will alarm in a few minutes. However, if small quantities of CO are present or high levels are short-lived, the micro controller will accumulate the information and determine when an alarm level has been reached. This feature eliminates nuisance alarms. For example, in a boat it is possible to see high levels of CO for a very short time such as when docking or maneuvering. The CO Sentinel takes this all under consideration by totaling the quantity of CO detected over a period of time.

The CO Sentinel is programmed to alarm at a COHb level of 10%. SEE TABLE 2.

Features of the CO Sentinel (CMD-4M, CMD-4MR)

The CO Sentinel is designed to meet applicable marine standards.
The CO Sentinel conducts a self-diagnosis of critical components every 10 seconds. Should a major component fail, the CO Sentinel will enter a fault mode. Both audible and visual warning indicators are activated.

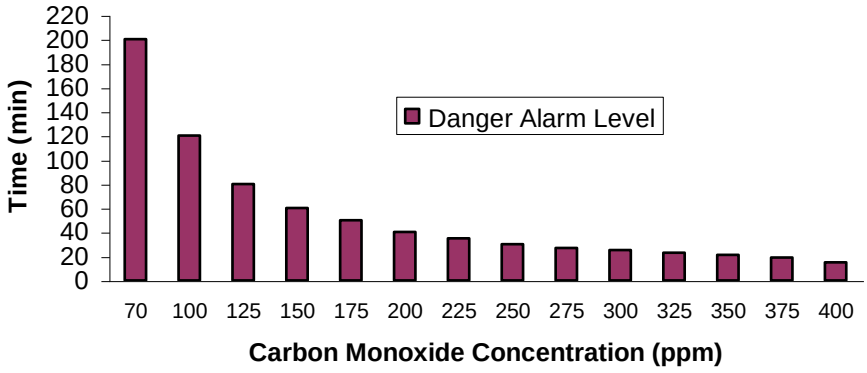
The CO Sentinel circuit board is sealed against moisture and corrosion to withstand the harshest environments and ensure durability.

The CO Sentinel is designed to tell you when your power source has dropped to a level insufficient for proper operation. The red light will come on accompanied with an intermittent horn beep. Restore the power and the unit will return to normal operation.

Features of the CO Sentinel Deluxe (CMD-4M-RLY, CMD-4MR-RLY)
The deluxe model is designed to interconnect with other deluxe models. If the unit senses CO at an alarm level, it will communicate with other interconnected units and send them into alarm. The unit that senses CO will have a distinct LED pattern compared to the interconnected units. The CO Sentinel Deluxe is designed to connect up to a maximum of six interconnected units.

The deluxe model is also designed with relay outputs. The relay connection is rated at 12VDC,1A max and can be used to shutdown a generator or other possible carbon monoxide source, or trigger a remote horn or alarm for example.

Table 2



Pleasure Boat and Yacht Installation

Because of the high risk of carbon monoxide injuries due to the nature of boats, we recommend a carbon monoxide alarm be installed in the “main cabin area” and in “each sleeping area” (ABYC A-24.7.2). Small craft with an open design may only require one CO Sentinel for adequate protection. If any two sleeping areas are partitioned, then one CO Sentinel should be installed in each sleeping area. Larger craft often have aft and forward cabins with convertible sofas in the salon. These boats will require three CO Sentinel monitors. Installation should be at eye level height for convenient monitoring and service. Ordinary thermostat height is adequate. Ceiling installation is also allowed but care must be taken to avoid the areas listed under “Where NOT to install your CO Sentinel”.

Where NOT to install your CO Sentinel

DO NOT install a CO Sentinel near a hatch or porthole through which seawater could be spilled on the device.
DO NOT install in locations where temperature, moisture, and/or ultraviolet light affect the operation.
DO NOT install in locations where the normal ambient temperature is below -30^{o}C (-22^{o}F) or exceeds 70^{o}C (-158^{o}F)
DO NOT mount within one foot of corners or other ‘dead’ air spaces.
DO NOT locate CO Sentinel within 5 feet (1.5 m) of any cooking appliance or in direct airflow from air conditioning or heat vents.
DO NOT locate CO Sentinel in close vicinity of curtains, pillows, or other obstructions.

Installing the CO Sentinel

The CO Sentinel consists of three basic components: the cover, the circuit board and a base plate. In addition, four screws are included, two each Phillips Head No. 6 metal screws and two each 6-32 machine screws. The CO Sentinel can be mounted either to a flat vertical surface or directly on to a standard electrical handi-box.

The CO Sentinel comes with the circuit board installed in the base plate. When installing, it may be necessary to remove the circuit board from the base plate. To do this, follow the directions below. After removing the circuit board, hold the base plate firmly in place and install screws. Replace the circuit board and replace the connector(s) on the circuit board. Snap the cover in place and installation is complete.

After installation is complete, attach one of the enclosed "Warning" stickers to the wall next to the alarm. Place the other sticker near a source of fresh air where you would gather after an alarm indicates the presence of carbon monoxide. The phone numbers of emergency services and qualified technicians should be added to the stickers.

TO REMOVE CIRCUIT BOARD FROM BASE PLATE

FOLLOW THESE TWO STEPS:

1. Push "locking pins" outward and lift bottom portion of board toward you.

2. Holding the board with one hand, pull to remove the connector(s).

TO RE-INSTALL: Reverse this procedure.

TO INSTALL CIRCUIT BOARD INTO BASE PLATE, FOLLOW THESE TWO STEPS:

1. Insert top of board (with 45' angles) under holding tabs on base plate.

2. Gently lower bottom until board "snaps" into locking pins.

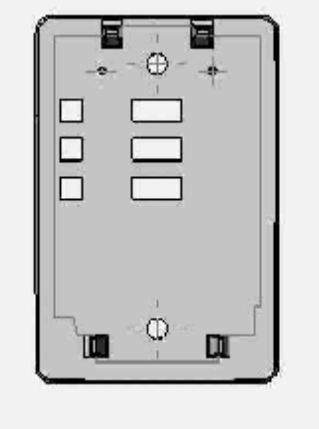
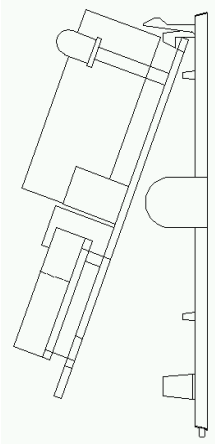
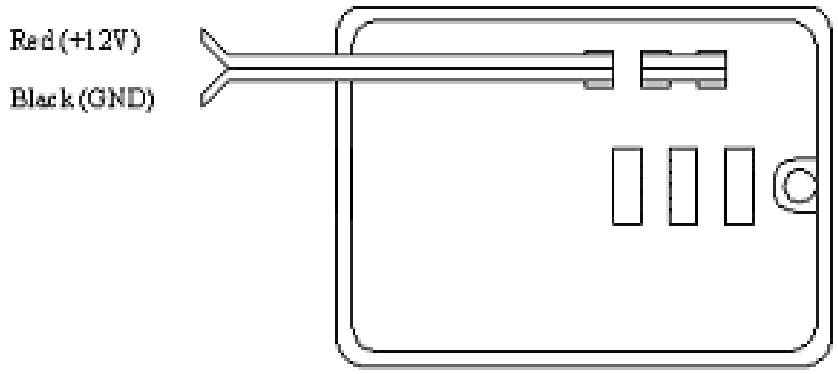


FIGURE 2



Wiring Instructions for the CMD-4M(R)
Follow all applicable codes and regulations for wiring. Use at least 18 AWG, UL Listed, stranded wire that can be found at your local hardware store for all connections. Connect the red wire to a 12V source (battery preferred) and the black wire to Ground.

FIGURE 3
CMD-4M(R) Wiring Schematic



CONTINUOUS OPERATION IS PREFERRED. If your power is unlimited, it is recommended that the CO Sentinel be operated continuously day and night. The CO Sentinel was designed to minimize current draw in order to allow for direct wiring to a battery. This is the "healthiest" condition for solid state devices. In addition, it provides advance warning when entering an area where a hazard may exist.

!NOTE!: For installations differing from those outlined above, please contact the engineering department of FIREBOY-XINTEX for application and suitability information.

Interconnect wiring
To interconnect multiple units the yellow and brown wires (4-wire harness) need to be tied in parallel (see figure 4). In this mode of operation only the unit detecting CO will go into a true alarm and actuate its relay opening the contacts. Interconnected units will produce an audible and visual alarm but will not open their relay contacts.

Relay wiring
This unit is designed with a relay for generator shutdown. The relay contacts are closed when the unit is powered and in normal operation and open during alarm or when the test/silence button is pressed. Because the only unit that opens the relay contacts is the unit that detects the CO it is necessary to wire all relay contacts in series so that any unit detecting CO has the ability to shutdown the generator.

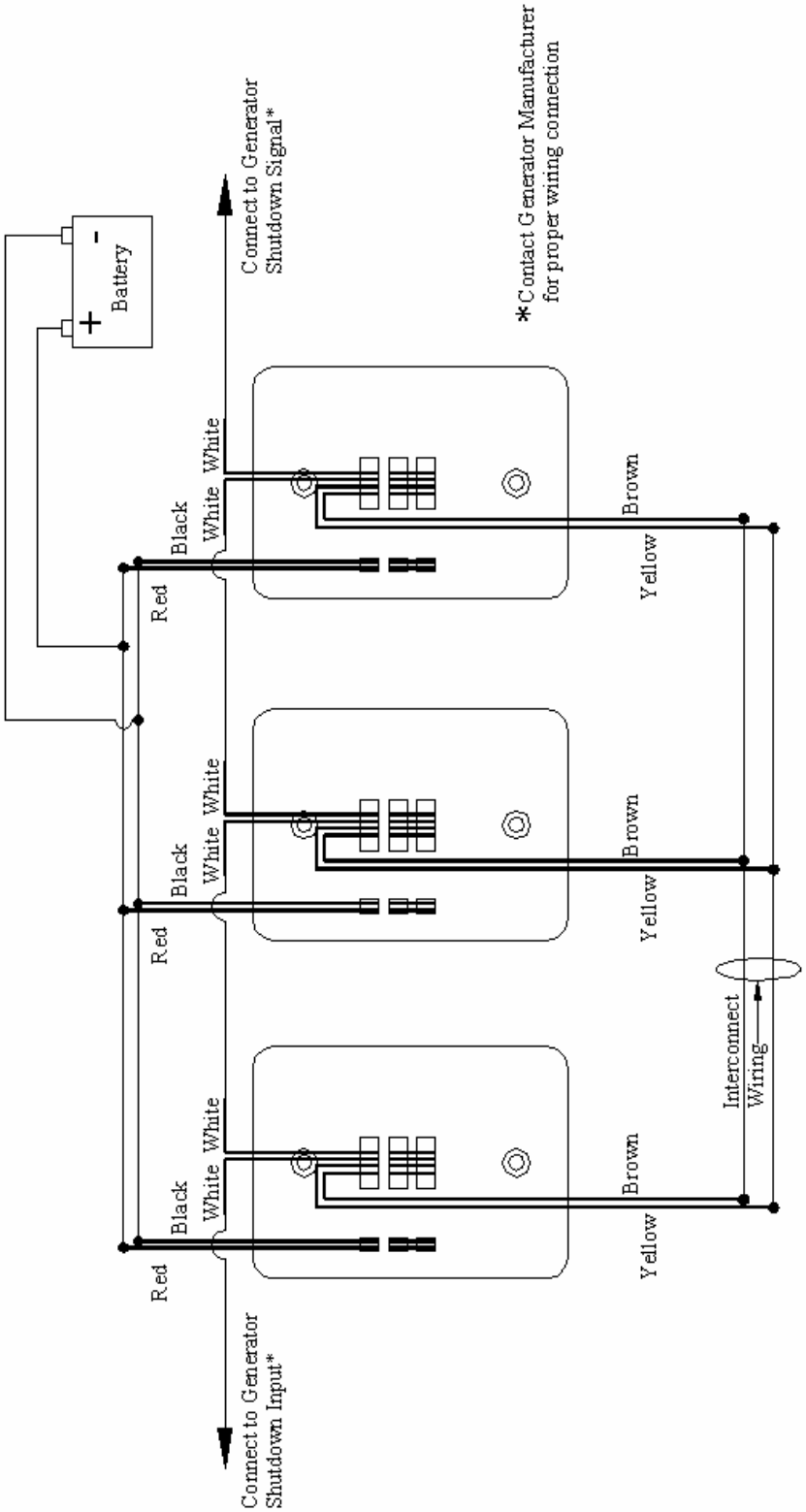


Figure 4
CMD-4M(R)-RLY Wiring Schematic

Test/Silence Button
To test the horn, LED indicators and sensor hold in the test/silence button until the alarm indicator comes on. Release the button and the unit will cycle through the alarm pattern two times. If the unit is in alarm or fault, press the test/silence button to silence the horn. If the unit is still in alarm or fault after 60 seconds the unit will re-enter alarm mode. (Note: The sensor also goes through a self diagnosis every second to verify the sensor is operating properly)

The left power indicator light shining solid green indicates normal operation. Refer to the chart below for status indicators and explanations.

SYSTEM STATUS	Green LED INDICATOR	Red LED INDICATOR	AUDIBLE HORN
Normal:	On	Off	Off
Warm-up:	On	On	Off
Alarm:	On	Flashing	4 Beep 5 sec. Silence
Remote Alarm:	Off	Flashing	4 Beeps 5 sec. Silence
Fault:	Off	Flashing	Int. Beep (30 sec.)
EOL:	Off	On	Int. Beep (30 sec.)
Hi/Lo Voltage:	Flashing	Off	Int. Beep (30 sec.)

!CAUTION!: The audible alarm cannot be checked by the internal circuitry and therefore the CO Sentinel should be tested frequently using the test button and verifying proper alarm sequences and operation.

Warm-up
If the unit is below 0C an internal heater will turn on. This heater will allow the unit to operate down to -30C. If the temperature is below -30C or if the heater has stopped working the red led will come on. This indicates that the unit is below operating temperature. When the heaters have the unit back into operating range the red led will go off. The unit is still detecting CO while the LED is on and will change to alarm if 10% COHb is reached. See Table 2 for alarm times vs concentration.

Take Action When the CO Sentinel Alarms
ALARM: When the CO Sentinel enters the danger alarm, the warning (!) indicator is flashing red and the horn beeps 4 times and pauses for 4-5 seconds in a repeat pattern. This indicates that the COHb level has been reached.

⚠ **"WARNING": Actuation of your CO alarm indicates the presence of carbon monoxide (CO), which can KILL YOU. If alarm sounds**:

Alarm
If your unit alarms follow the guidelines below:

A. Operate reset/silence button
B. Call your emergency services (fire department or 911).
C. Immediately move to fresh air – outdoors or by an open door/window. Do a head count to check that all persons are accounted for. Do not re-enter the premises or move away from the open door/window until emergency services

responders have arrived, the premises have been aired out and your alarm remains in its normal condition.

D. After following steps a-c, if your alarm reactivates within a 24-hour period, repeat steps a-c and call a qualified appliance technician to investigate for sources of CO from fuel burning equipment and appliances, and inspect for proper operation of the equipment. If problems are identified during this inspection, have the equipment serviced immediately. Note any combustion equipment not inspected by the technician and consult the manufactures' instructions, or contact the manufacturers directly, for more information about CO safety and this equipment.

!NOTE!: The CO Sentinel will alarm at approximately 10% COHb. SEE TABLE 2. The alarm will clear when the ppm of CO present are below 40.

Remote Alarm
This indicates that another CO alarm that is interconnected is going into alarm. If the unit in remote alarm detects a high enough level of CO to alarm then it will change from remote alarm to alarm in its signaling patter. A remote alarm should be treated the same as a CO alarm.

Fault
Indicates a fault has been detected with the internal circuitry of the unit. If the unit generates this signal pattern it is no longer able to detect CO and must be replaced or repaired.

End-of-Life (EOL)
The unit is equipped with a 5 year EOL timer. This timer is continuously operated independently from a lithium battery. When the timer has run for 4 years and 11 months from the date of manufacture, the unit will signal the first EOL (green LED – Off, red LED – On, horn – Int. Beep every 30 sec.) alarm.

While the unit is EOL alarming, press and hold the test/silence button until both lights come on. This is will reset the device to normal operation for 72 hours. This process can be repeated during the next 30 days. After this time the unit will continually signal EOL and will no longer detect CO. (unit must be replaced)

!NOTE!: During EOL reset the unit will go through a self diagnostic process followed by the test sequence.

!CAUTION!: REMOVING THE LITHIUM BATTERY WILL CAUSE THE UNIT TO SIGNAL EOL PERMANENTLY! This will void the warranty.

Hi/Lo Voltage
Indicates that the unit is out of its operating voltage range. Check batteries and or charger.

Maintenance:
Spaces are to be well ventilated when household cleaning supplies or similar contaminants are used.

Unit should be cleaned weekly without the use of solvents.
Cleaning solvents and oils can cause the alarm to stop functioning. Test the alarm if it has come in contact with any cleaning solvents or any condition that may cause the alarm to stop working.
After pro-longed storage the CO Sentinel may require up to 72 hours of continuous operation to reach optimal sensing.

Nuisance Alarms
Although the CO Sentinel will detect only carbon monoxide in a normal environment, studies have found that unusually high concentrations of chemicals and/or vapors may affect the sensor.

The device may be triggered by any number of hydrocarbons at very high levels. These include toluene, isopropyl alcohol, methyl ethyl ketone, mica, and various adhesives.

Many of these chemicals are the result of out gassing in new boats. While these may be considered nuisance alarms, levels high enough to create an alarm condition are also hazardous. Treat these “nuisance” alarms as an actual carbon monoxide alarm condition. Evacuate and ventilate the area. Before, during, and immediately after working with any chemicals, make sure enough fresh air ventilation is available.

Limitations

- This carbon monoxide alarm is designed to detect carbon monoxide gas from ANY source of combustion. It is NOT designed to detect smoke, fire or any other gas.
- The CO Sentinel will not detect carbon monoxide that is not in the vicinity of the alarm. Carbon monoxide in other rooms or areas will not be detected. Alarms mounted near obstructions or in ‘dead’ air spaces will not detect carbon monoxide.
- The CO Sentinel does not guarantee or imply that CO poisoning will not occur. Do NOT use the CO Sentinel as a replacement for ordinary precautions or periodic inspections of equipment. NEVER rely on alarm systems to save your life, common sense is still prudent and necessary.
- The audible horn on the CO Sentinel meets UL requirements; however, the horn may not be heard in remote areas.
- The nature of an alarm system is to produce an irritating and loud noise. The audible signal of the CO Sentinel may shock or startle persons near the alarm. Hearing damage can occur if prolonged exposure to the audible alarm is allowed.
- All electric devices have limited life spans and may fail without warning. Inspect the CO Sentinel on a periodic basis. Do NOT assume that the CO Sentinel will prevent CO poisoning. It is a supplement-warning device only.

Specifications

Voltage: +12 VDC nominal (+10.2 min to +15 max)

Temperature (0°C to 70°C) (32°F to 158°F)

Current Draw:	CMD-4M(R)	CMD-4M(R)-RLY
Typical	16 (mA)	46 (mA)
Alarm	25 (mA)	25 (mA)

Temperature (-30°C to 0°C) (-22°F to 32°F)

Current Draw:	CMD-4M(R)	CMD-4M(R)-RLY
Typical	116 (mA)	146 (mA)
Alarm	120 (mA)	120 (mA)

Temperature: Storage –40°C to +70°C (-40F to +158°F)
Operation -30°C to 70°C (-22°F to 158°F)

Alarm Points: Time Weighted Average (TWA)
Alarm @ 10% COHb (<15 @ 400 PPM)

Alarm dB: 85 dB(A) at 10’ (3m)
Dimensions: H: 3.5” (89mm), W: 2.4” (61mm), D: 1.3” (33mm)
Housing Material: Polypropylene meets UL-94-5VB
Warranty: One (1) year

Returning Fireboy-Xintex Equipment

No product may be returned for credit or repair without a written "Returned Material Authorization" (RMA) form. Purchaser must call or email Fireboy-Xintex 616-735-9380 or fireboy@fireboy-xintex.com for a RMA.

FIREBOY-XINTEX, INC.
Mailing Address: P.O. Box 152, Grand Rapids, Michigan USA 49501-0152
Shipping: O-379 Lake Michigan Drive NW, Grand Rapids, Michigan USA 49534

ONE (1) YEAR LIMITED WARRANTY
This warranty is in lieu of all other expressed or implied Warranties

Seller warrants title, materials, and workmanship on Fireboy-Xintex equipment, and assigns the original manufacturer's warranty on those components manufactured by others, as permitted. Seller's warranty shall be for a period of one (1) year from the date of sale to the ORIGINAL CONSUMER. Fireboy-Xintex, Inc., does not assume the costs of removal and/or installation of the product or any other incidental costs which may arise as a result of any defect in materials or workmanship. Any non-conforming equipment returned to the Seller at Buyer's expense and risk shall be repaired or replaced at Seller's option, provided that: (a) the product has not been subjected to abuse, contamination, neglect, accident, incorrect wiring not our own, improper installation or servicing, or used in violation of the instructions furnished by Fireboy-Xintex, Inc.; (b) the product has not been repaired or altered by anyone other than Fireboy-Xintex Inc.; (c) the serial number has not been removed, defaced, or otherwise changed; (d) the product is determined to contain defective materials or workmanship; and (e) use of the product is discontinued upon discovery of defective materials or workmanship and Fireboy-Xintex Inc. is notified immediately.

ANY WARRANTY IMPLIED BY LAW, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS, IS IN EFFECT ONLY FOR THE DURATION OF THE EXPRESSED WARRANTIES SET FORTH ABOVE. NO PERSON IS AUTHORIZED TO GIVE ANY OTHER WARRANTY, OR TO ASSUME FOR FIREBOY-XINTEX, INC., ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF ITS PRODUCTS. FIREBOY-XINTEX, INC. SHALL NOT BE LIABLE FOR LOSS OF USE, REVENUE, PROFIT, INJURY, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES. BUYER IS NOT RELYING ON SELLER'S JUDGEMENT REGARDING BUYER'S PARTICULAR REQUIREMENTS, AND HAS HAD AN OPPORTUNITY TO INSPECT THE PRODUCT TO BUYER'S SATISFACTION.

This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.