



# Operator's Manual



## **SAM-V1**


Engine & Carbon Monoxide Monitor  
with LCD Digital Display


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## 1. IMPORTANT MESSAGE AND INSTRUCTIONS

**IMPORTANT!** READ ALL INSTRUCTIONS BEFORE USE AND SAVE THIS MANUAL FOR FUTURE REFERENCE.

 **CAUTION!** THIS MONITOR WILL ONLY INDICATE THE PRESENCE OF CARBON MONOXIDE GAS AT THE SENSOR. CARBON MONOXIDE GAS MAY BE PRESENT IN OTHER AREAS. THIS MONITOR IS DESIGNED TO DETECT CARBON MONOXIDE GAS FROM ANY SOURCE OF COMBUSTION. IT IS NOT DESIGNED TO DETECT SMOKE, FIRE OR ANY OTHER GAS. THIS MONITOR IS DESIGNED TO HELP PROTECT INDIVIDUALS FROM THE ACUTE EFFECTS OF CARBON MONOXIDE EXPOSURE. IT WILL NOT FULLY SAFEGUARD INDIVIDUALS WITH SPECIFIC MEDICAL CONDITIONS. IF IN DOUBT, CONSULT A MEDICAL PRACTITIONER.

 **CAUTION!** CO detection is best achieved by the installation of CO monitors on all equipment utilized in one area.

**IMPORTANT!** Monitors must be replaced after five years from installation date.

**CLEANING THE MONITOR:** You can clean the monitor by using a vacuum cleaner brush to vacuum around the openings on the monitor. The outside of the monitor may be wiped with a lint-free cloth slightly dampened with water only.

## 2. WARNING MESSAGES

**DANGER!** ALL internal combustion engines produce Carbon Monoxide (CO), a highly toxic, invisible, odorless, tasteless gas that can cause injury and death within minutes. Only operate machines with internal combustion engines in well ventilated areas and always follow machine manufacturers operation instructions.

**WARNING!** This CO monitor is designed to measure compliance with the U.S. Occupational Safety and Health Administration (OSHA) jobsite exposure limits, and does not comply with ACGIH, Cal/OSHA or NIOSH, which recommend lower exposure limits than OSHA. Consult with your local authority about the exposure limits permitted for your jobsite. To provide protection for individuals with medical conditions, consider using warning devices which provide audible and visual signals for carbon monoxide concentrations under 30 ppm.

### 3. FEATURES AND SPECIFICATIONS

- Commercial Carbon Monoxide Monitor with Alarm & Engine Shutdown
- Optional Hour Meter, Tachometer, and Battery Voltage Meter
- Air Fuel Ratio Indicator (if equipped with optional O2 sensor)
- Alpha Numeric LCD Readout with Memory
- Audible and Visual Alarm Signals
- Complies with OSHA Permissible Exposure Limit (PEL)
- Five Year Limited Warranty



### SPECIFICATIONS

**CO Monitoring:**

**CO Parts Per Million (PPM)** measures CO PPM every second, alarms above 35ppm. Engine shutdown at 5 minutes when above 35ppm continuously, shutdown at 4 minutes when above 200ppm continuously, shutdown at 2 minutes when above 1200ppm continuous.

**Sensor Type:**

Electrochemical with temperature and humidity sensors

**Operating Temperature and Humidity:**

0°F to 120°F @ 10% to 95% RH

**Air Fuel Ratio Monitoring:**

Buzzer Horn Sounds 85 dB, LCD Screen Flashes During Alarm

**Sensor Life**

5 years from time of installation.

**Electrical Rating:**

12 Volts

## 4. INFORMATION ABOUT CARBON MONOXIDE

### WHAT IS CARBON MONOXIDE?

Carbon monoxide (CO) is a highly toxic, invisible, odorless, tasteless gas.

### HOW IS CO GENERATED?

Carbon monoxide is generated through incomplete combustion of fuel in applications such as automobiles, forklifts, and small engines.

### HOW DOES CO POISON PEOPLE?

The human body depends on oxygen for the burning of fuel (food) to provide us with the energy that allows our cells to live and function. Oxygen makes up approximately 21% of the atmosphere and enters our lungs when we breathe. In our lungs the oxygen combines with the hemoglobin in the blood (oxyhemoglobin) and is carried in the blood stream throughout the body where it releases oxygen to the cells.

Carbon monoxide is dangerous because it bonds more tightly to the hemoglobin (carboxyhemoglobin, COHb) than oxygen does. When CO combines with hemoglobin, the hemoglobin's ability to combine with oxygen is lost. As the COHb concentration rises, people become nauseous, unconscious and ultimately die (see below).

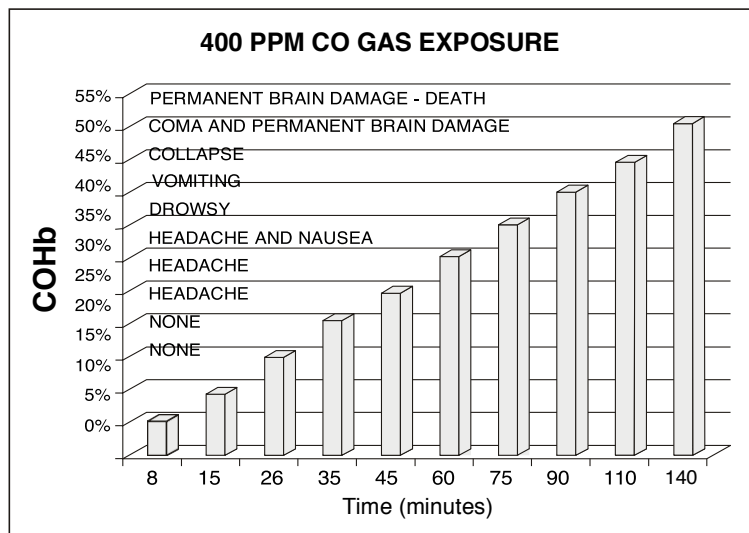
### WHAT ARE THE SYMPTOMS OF CARBON MONOXIDE POISONING?

Many people often confuse carbon monoxide poisoning with the flu; the initial symptoms being very similar. Different concentrations of CO over various lengths of time cause different symptoms.

The following symptoms may be related to CARBON MONOXIDE POISONING and should be discussed with EVERYONE.

<b>MILD EXPOSURE:</b>	Slight headaches, nausea, vomiting, running nose, sore eyes, fatigue (often described as "Flu-like" symptoms).
<b>MEDIUM EXPOSURE:</b>	Severe throbbing headache, dizziness, drowsiness, confusion, fast heart rate.
<b>EXTREME EXPOSURE:</b>	Unconsciousness, convulsions, cardiorespiratory failure, brain damage, death.

Many cases of CARBON MONOXIDE POISONING indicate that while victims are aware they are not well, they become so disoriented that they are unable to save themselves by either exiting the building or calling for assistance. Older adults, young children, pregnant women (and their unborn children), and persons with medical conditions are typically the first affected.

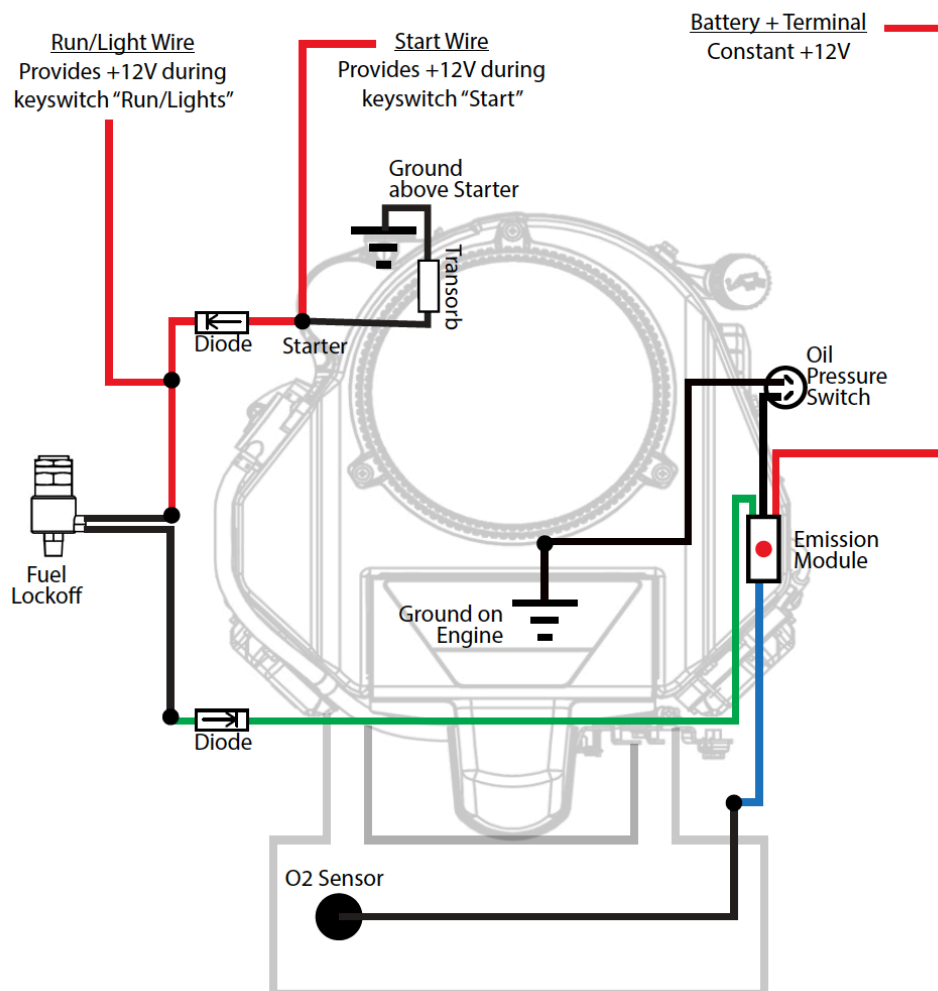


## 5. INSTALLATION INSTRUCTIONS

SAM Safe Air Monitor should be mounted in the ambient air above the operators waistline if possible. A monitor should be installed on every machine in use in the area.

Follow these steps to install the monitor:

1. Locate an area on the machine close to the operator, preferably above the operator waist area and where the LCD screen can easily be seen.
2. Use the two included mounting brackets to secure the monitor to the machine using the screws provided.
3. Connect the wires according the following wiring schematic:

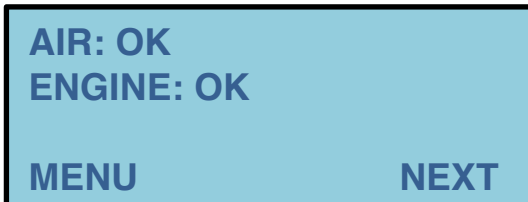


4. Once wired, the SAM LCD screen should illuminate.
5. SAM Safe Air Monitor is now ready for use.

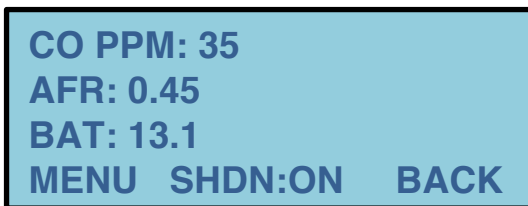
## 6. FUNCTIONS AND OPERATION

**OPERATION:** The SAM Safe Air Monitor is operational once the engine is started. The SAM will begin to monitor carbon monoxide levels every 15 seconds.

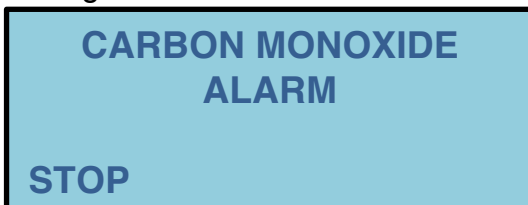
**HOME SCREEN:** The HOME screen will indicate that the CO and ENG AFR is OK. If the CO or ENG AFR is high, it will indicate alarm.



**DETAIL SCREEN:** The DETAIL screen will display current **CO PPM** & **AFR**. The AFR represents the oxygen sensor voltage, below 0.50 indicates a LEAN AFR, above 0.50 indicates a RICH AFR.



**ALARM SCREEN:** The ALARM screen will display Carbon Monoxide alarms and AFR alarms. To stop the engine, press STOP. Engine will automatically shutdown if alarms are ignored and conditions do not improve in allotted time.



## 7. WHAT TO DO WHEN THE ALARM SOUNDS

### If alarm signal sounds:

- 1) Immediately move machine to cleaner air preferably by a window or door. Monitor CO PPM and AFR in the new fresh air environment. CO PPM should drop below 35PPM and AFR should be less than 500mV. If the CO PPM and/or AFR remain above 35PPM and/or 500mV and the alarm continues to sound, discontinue use of the machine and contact your supervisor. The machine will shut down automatically if the CO PPM limit remains exceeded. If the machine shuts down, move the machine to a clean air environment, restart machine and continue operation.
- 2) If the CO PPMs remain elevated, check AFR reading on the monitor by pressing the NEXT button. If AFR reading is above 500mV when in use this indicates a rich air fuel ratio which produces higher levels of CO. A common issue to rich running conditions is dirty air filters. Check and clean air filters and restart the machine. If the AFR reading continues to be above 500mV with the filters cleaned contact your supervisor or service technician.

### Conditions that contribute to high levels of CO:

- 1) Extended operation of internal combustion engine.
- 2) Temperature inversions which can trap exhaust gases near the ground.
- 3) Car or forklift idling in an open or closed attached garage, or near building.

## 8. LIMITATIONS OF CO MONITORS

Carbon monoxide monitors respond to the presence of CO. They do not detect smoke. If the alarm does activate, follow instructions in Section 7 **WHAT TO DO WHEN THE ALARM SOUNDS**.

Carbon monoxide monitors are devices that can provide an early warning of the presence of CO. However, monitors have sensing limitations and may not always sound a warning in the presence of CO. Carbon monoxide monitors cannot sense CO that does not reach the sensor, and therefore CO monitors may not detect CO which is in another area of the building. Furthermore, the monitor may not alert someone who is located in a different area than the monitor. The use of drugs and alcohol may impair one's ability to hear the monitor. Monitors should be installed on every internal combustion engine being utilized.

Although CO monitors can help save lives by providing an early warning to the presence of carbon monoxide, they are not a substitute for an insurance policy. Employers, property owners, leaseholders, and renters should have adequate insurance to protect everyone's health, lives and property.



## 9. DESCRIPTION OF AUDIBLE AND VISUAL SIGNALS

LCD Readout	Condition	Alarm
AIR: OK	Indicates CO levels are below OSHA limits	If CO levels are above OSHA limits, displays HIGH CO, alarm will sound
ENGINE: OK	Indicates Engine Air Fuel Ratio is below 500mV indicating a low CO running condition	If Engine Air Fuel Ratio is rich, displays RICH MIXTURE, alarm will sound
CO PPM:	Indicates the current CO parts per million	Above 35PPM, alarm sounds, engine shutdown above 35ppm for 5 minutes, 200PPM for 4 minutes, Above 1200PPM for 2 minutes.
AFR:	Indicates whether the engine is running rich or lean. Below 500mV the engine is running lean, above 500mV the engine is running rich	Alarm when engine runs rich for continuous 2 minutes, engine shutdown at 5 minutes.
BAT:	Indicates battery voltage. If voltage is below 10 volts, the display reads low voltage	

## 10. FIVE-YEAR LIMITED WARRANTY

SAM Safe Air Monitors are manufactured in the United States under stringent ISO 9001 quality management practices. The manufacturer warrants that, for a period of five years from the date of purchase, this carbon monoxide monitor will be free from defects in material and workmanship. The manufacturer, at its option, will repair or replace this product or any component of the product found to be defective during the warranty period. Replacement will be made with a new or re-manufactured product or component.

If the product is no longer available, replacement may be made with a similar product of equal or greater value. This warranty is valid for the original end-user purchaser from the date of initial purchase from an authorized distributor, dealer or contractor, and is not transferable. Keep the original sales receipt. Proof of purchase is required to obtain warranty service. Distributors, dealers or contractors selling SAM Safe Air Monitor products do not have the right to alter, modify or in any way change the terms and conditions of this warranty.

This warranty does not cover normal wear of parts or damage resulting from any of the following: improper storage, negligent use or misuse of the product, use contrary to the operating instructions, operation in unconditioned space (below 0°F or above 100°F), disassembly, or repair or alteration by anyone other than the manufacturer or an authorized service center. Further, the warranty does not cover acts of God, such as fire, flood, earthquakes, hurricanes and tornadoes.

The manufacturer shall not be liable for any incidental or consequential damages caused by the breach of any express or implied warranty. Except to the extent prohibited by applicable law, any implied warranty of merchantability or fitness for a particular purpose is limited in duration to the duration of the above warranty. Some states or jurisdictions do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above limitations or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

### **Warranty Service:**

If service is required, do not return the product to your supplier. Contact our team at (704) 729-7788, Monday through Friday, from 8 AM to 5 PM EST to obtain a Return Authorization (RA) number. To assist in serving you, please have the model number, date of purchase, and manufacturing date available when calling.

Prior to returning, pack monitor carefully in a padded container, and ship freight prepaid with your original sales receipt, an explanation of the problem, and your return address.

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