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Creative Gas Detection Solutions

CO-Guard-MOS
Compressed Airline CO Monitor
Operation and Maintenance Manual

Table of Contents

List of Figures

List of Tables

Reference Information:

NOTE: *[important information about use of instrument]*
CAUTION: *[affects equipment – if not followed may cause damage to instrument, sensor etc.…]*
WARNING: *[affects personnel safety – if not followed may cause bodily injury or death.]*

Attention / Warning


Earth Ground

1.0 Introduction

The **CO-GUARD-MOS** is a compressed air monitoring instrument that measures and detects Carbon Monoxide (CO) in industrial compressed breathing air systems utilizing a gas-sensitive metallic-oxide semiconductor (MOS) sensor. The **CO-GUARD-MOS** is NOT in an enclosure rated for use in a Class I, Div. 1, Groups B, C, D classified area and CAN NOT be installed in a hazardous location.

Sandblasting, welding, and spray painting are examples of activities that create potentially hazardous environments. Such environments contain toxic gases, dust and fumes. An air compressor system with hoods or masks supplies clean breathing air to workers and minimizes the risk of injury or death; however, carbon monoxide (CO) can contaminate the air in a compressor system. Carbon monoxide contamination can occur either when the intake air itself is contaminated, or when the compressor breaks down and overheats. Because of this hazard, Federal OSHA regulations (Sec. 1910.134) require monitoring of CO in compressed air systems. In addition, the Compressed Gas Association has set up guidelines governing maximum tolerable levels of CO and other contaminants (Spec. G-7.1) to ensure the health and safety of persons who use respiratory air lines.

The ***ENMET*** **CO-GUARD-MOS** (See Figure 1) monitors the carbon monoxide in compressed air used for human breathing. If the CO concentration exceeds any predetermined levels, the **CO-GUARD-MOS** will trigger audio-visual alarms and activates any associated equipment to alert personnel in potential danger.
Features of the **CO-GUARD-MOS**:

- continuous monitoring of the sample air
- continuous LCD display of gas and vapor concentrations
- menu driven operational and maintenance controls
- menu driven calibration procedure
- audio and visual alarms indicate unsafe conditions
- alarm relay contacts available on terminals
- a fault relay and visual fault alarm
- a sensor head assembly
- alarm acknowledgement capability including audio defeat
- mA outputs for target gas

NOTE: *All specifications stated in this manual may change without notice.*

1.1 Operation Principle

The **CO-GUARD-MOS** is an all solid-state electronic gas-detecting instrument designed to continuously monitor the carbon monoxide level in compressed air. The sensing element is a gas-sensitive metallic-oxide semiconductor (MOS). A regulator-humidifier assembly collects and humidifies a small air sample from the respiratory airline and passes it over the sensor. When the level of CO in the air passing over the sensor increases to preset values, the instrument alarms with audio (horn) and visual (light) signals.

The **CO-GUARD-MOS** operates on 110 VAC or 220 VAC and is equipped with relay contacts to provide additional alarm signals. In addition, the **CO-GUARD-MOS** model part number 03481-040 is designed to operate on 24 VDC and model part number 03481-041 is designed to operate on 12 VDC power.

1.2 Unpack

Unpack the **CO-GUARD-MOS** and examine it for shipping damage. If such damage is observed, notify both ***ENMET*** customer service personnel and the commercial carrier involved immediately.

Regarding Damaged Shipments

NOTE: *It is your responsibility to follow these instructions. If they are not followed, the carrier will not honor any claims for damage.*

- This shipment was carefully inspected, verified and properly packaged at ***ENMET*** and delivered to the carrier in good condition.
- When it was picked up by the carrier at ***ENMET***, it legally became your company's property.
- If your shipment arrives damaged:
  - Keep the items, packing material, and carton "As Is." Within 5 days of receipt, notify the carrier's local office and request immediate inspection of the carton and the contents.
  - After the inspection and after you have received written acknowledgment of the damage from the carrier, contact ***ENMET*** Customer Service for return authorization and further instructions. Please have your Purchase Order and Sales Order numbers available.
- ***ENMET*** either repairs or replaces damaged equipment and invoices the carrier to the extent of the liability coverage, usually $100.00. Repair or replacement charges above that value are your company's responsibility.
- The shipping company may offer optional insurance coverage. ***ENMET*** only insures shipments with the shipping company when asked to do so in writing by our customer. If you need your shipments insured, please forward a written request to ***ENMET*** Customer Service.

Regarding Shortages

If there are any shortages or questions regarding this shipment, please notify ***ENMET*** Customer Service within 5 days of receipt at the following address:

ENMET
680 Fairfield Court
Ann Arbor, MI 48108
734-761-1270 Fax 734-761-3220
Toll Free: 800-521-2978

1.3 Check Order

Check, the contents of the shipment against the purchase order. Verify that the **CO-GUARD-MOS** is received as ordered. Each **CO-GUARD-MOS** is labeled with its target gas. If there are accessories on the order, ascertain that they are present. Check the contents of calibration kits. Notify ***ENMET*** customer service personnel of any discrepancy immediately.

1.4 Serial Numbers

Each **CO-GUARD-MOS** is serialized. These numbers are on tags on the equipment and are on record in an ***ENMET*** database.

2.0 Components of the CO-GUARD-MOS

2.1 CO-GUARD-MOS elements

See **Figure 1** and **Figure 1a** for location of elements:

Feature	Description
Enclosure	A polycarbonate box, approximately 7 x 5 x 3, with a detachable front cover. 4 holes for mounting the enclosure to a vertical surface. Located at the corners of the bottom of the enclosure, directly beneath the 4-front cover retaining screws. See **Figure 3**
Front Cover	Detachable front cover of **CO-GUARD-MOS** with Display Panel. See **Section 2.2 and Figure 1** There are 4 Screws that hold the front cover in place.
Sensor Cable	Oil tight cable. Connects the sample head assembly to the control unit (length 8-10 feet). See Section 2.3 and **Figure 1a** *See Caution in section 4.0 Installation step 5.*
Regulator	To connect to the compressed air line. Sample pressure to the **CO-GUARD-MOS** should be set to between 7and 15 PSI. See Section 2.3 and **Figure 1a**
Filter, Hydrocarbon	To enhance low level calibrations by removal of hydrocarbon vapors for the air sample.
Humidifier	Plastic bottle, this adds moisture to the air sample that passes over the sensor.

2.2 CO-GUARD- MOS Operational Features

The Display Panel is attached by a cable and is released by unscrewing the 4 screws located in the corners. After releasing the panel, it is swung upward, exposing the interior of the enclosure. See **Figure 1** for location of features.

Feature	Description
Display	A single line, 8-character LCD with backlight. Indicates the level of gas detected by sensor. The numerical value of gas concentration and other information is displayed.
Audio Alarm(Horn)	Audio alarm (105 dB at 30cm/12in). The audio alarm is on when the unit is in alarm. Audio alarm can be set for Alarm 1, 2 or 3
Visual Indicators and Alarms	LED indicators: Power / Fault Indicator LED, Green / Red Alarm (3) Indicator LED, Red
Membrane Switches	2 Pushbutton Switches on front panel control the instrument maintenance functions. The pushbutton switch locations are indicated by: **MENU ↓**: Advances the instrument display through operation information and maintenance menus **SELECT→**: Disables audio alarm temporally and Selects the maintenance menu operations such as, Zero, Span, exit menu or sets proper calibration values for Zero or Span See **Section 4.0 and 5.0** for operational and maintenance flow charts.

Three alarm points are preprogrammed into the **CO-GUARD-MOS**. At each alarm point, an LED on the front panel and a 10Amp @ 110VAC relay is activated. These internal alarm settings are independent of the 4-20mA output alarm values that can be set at a controller. A fault 10Amp @ 110VAC relay is provided.

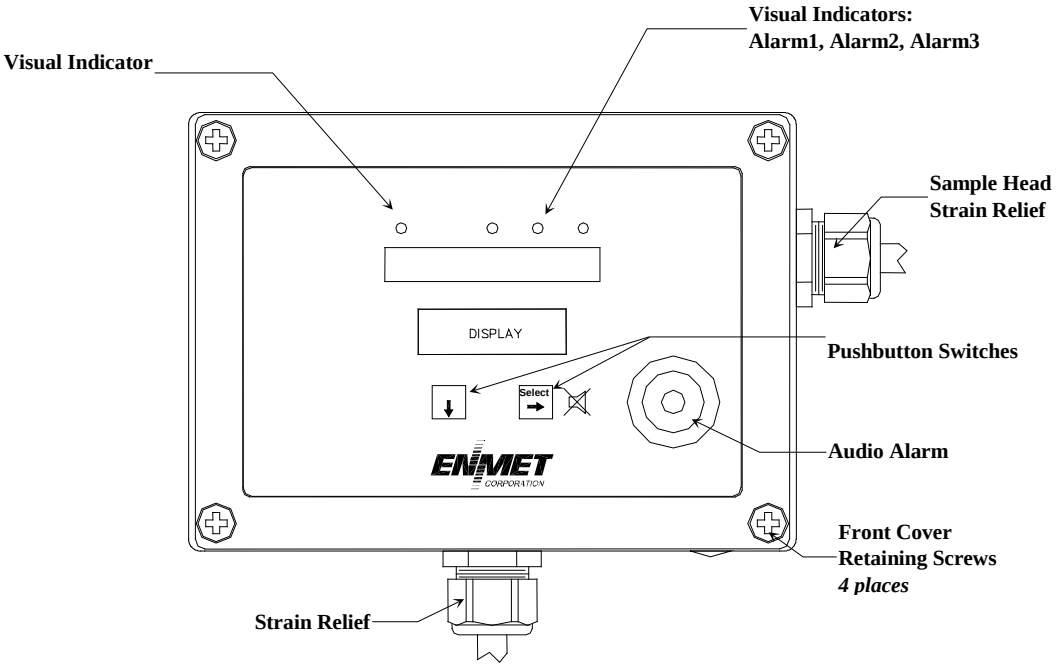
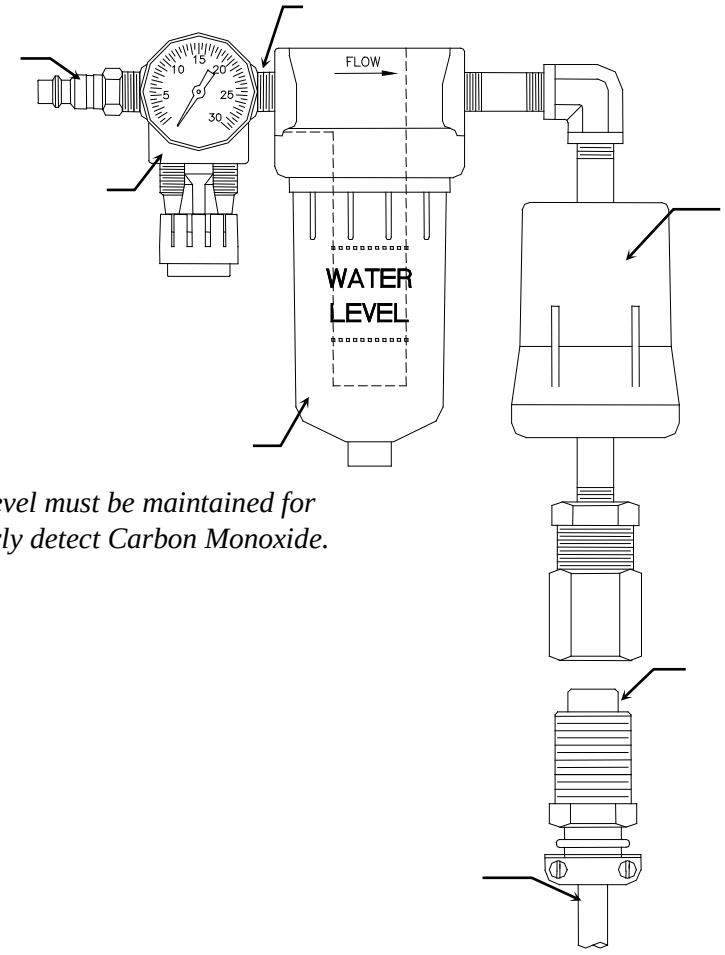


Figure 1: External CO-GUARD-MOS Features

2.3 Sample Head Assembly

The sample head connects to a compressed air line. This unit continuously monitors the respiratory lines for carbon monoxide levels. **Figure 1a** illustrates this unit. Assembly parts are listed and defined below.

Pressure Regulator	Reduces the pressure of a small sample of air from the compressed air line before passing over the sensor. It includes a meter to measure the pressure in pounds per square inch (psi) at the regulator exit.
Quick Release	For quick connect/disconnect; fits into the port of an airline. Air inlet fitting is a Milton 727, compatible with Hansen 1000 series. If you substitute other fittings, the calibration fixture must also be changed.
Humidifier	Plastic bottle. This adds moisture to the air sample that passes over the sensor.
Metallic Oxide Semiconductor Sensor	Solid-state gas sensing element contained in sensor housing. When the amount of CO in the air passing over the sensor increases to a preset level, the equipment alarms and relays activate.
Metering Orifice	This replaceable assembly has a tiny orifice to ensure constant flow of air between the humidifier and pressure regulator.
Hydrocarbon Filter	To enhance low level calibrations by removal of hydrocarbon vapors from the air sample.



WARNING: *Water level must be maintained for instrument to properly detect Carbon Monoxide.*

Figure 1A: Sample Head Assembly

2.4 Circuit Board Features

The Display Panel is attached by a cable and is released by unscrewing the 4 screws located in the corners. After releasing the panel, it is swung upward, exposing the interior of the enclosure. The Circuit Board is mounted at the back surface of the enclosure interior. Features are shown in **Figure 2**.

Feature	Description
Relay Terminals	This group of terminals is located on the Circuit Board. For the contacts for each of three alarm relays, and for the contacts of a fault relay. See **Section 3.2.3**
Output Terminals	For the 4-20 mA output.
Sensor Terminal	Connect Sensor Cable to circuit board 1 = White = Heater 2 = Green = Signal 3 = Black = Ground

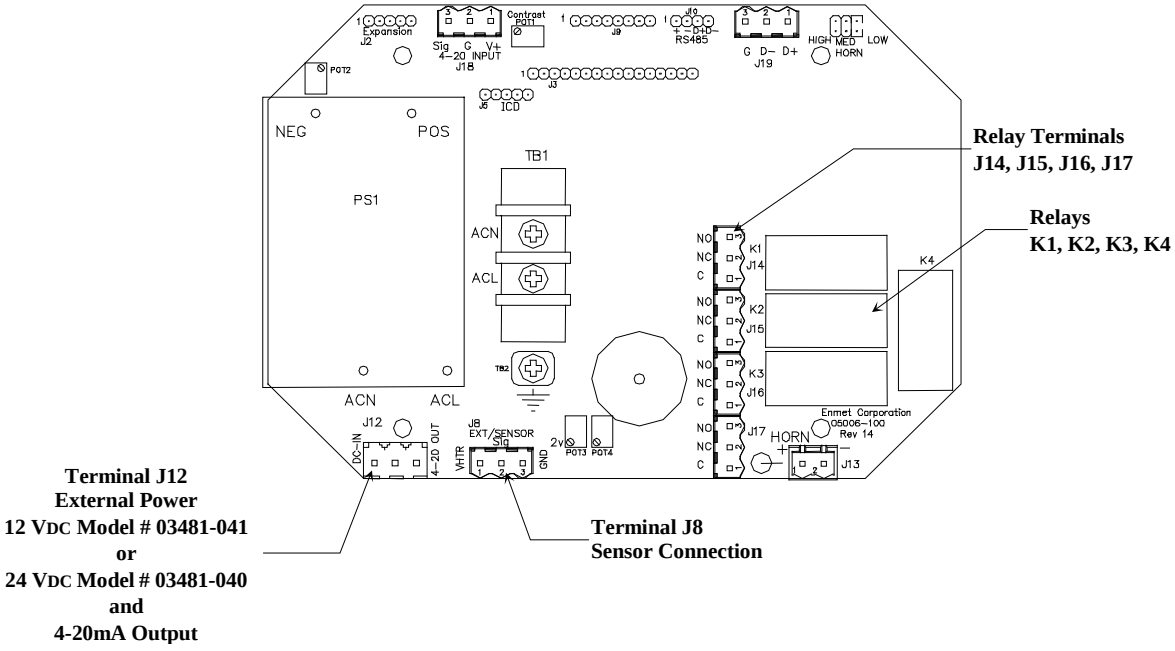


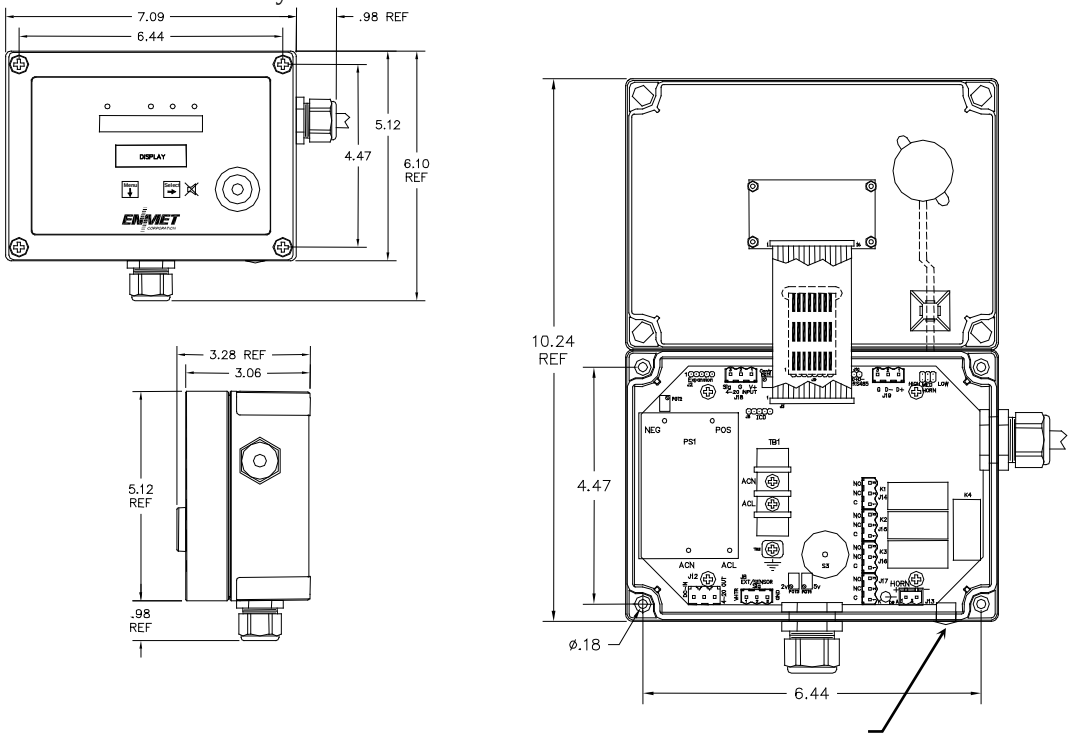
Figure 2: CO-GUARD-MOS Circuit Board Features

3.0 Installation

The **CO-GUARD-MOS** should be located near the pipe or tank containing the air to be monitored, and upstream from where the air is being used. The **CO-GUARD-MOS** must be installed such that it samples the compressed air before it reaches the users.

3.1 Mounting CO-GUARD-MOS

Mount the **CO-GUARD-MOS** instrument on an appropriate vertical surface, leaving room for lid to be opened, using the mounting holes provided. Avoid areas with excessive vibration or temperature extremes. The holes in the bottom of the enclosure are 0.18 inch in diameter and form a 6.44″ x 4.47″ rectangle. **See Figure 3**. It is recommended to use #8 drywall anchors and screws for mounting the **CO-GUARD-MOS** to a drywall/sheetrock surface.



Dimensions are in inches.

Figure 3: Mounting CO-GUARD-MOS

3.2 Wiring the CO-GUARD-MOS

The electrical installation should conform to appropriate electrical codes, such as the National Electrical Code in the United States.

3.2.1 Power Supply

The input power can vary from 100 to 240 VAC, 50/60 Hz. Power should be connected to the power input terminal **TB1** and the ***Ground screw***. Se**e Figure 4** for location.

WARNING: *Continuous gas detection and alarm systems (110VAC/220VAC / 24VDC/12VDC powered) become inoperative upon loss of primary power. Contact factory for specifications and pricing of backup battery systems.*

WARNING: *The compliance of the installation to appropriate codes is not ENMET's responsibility.*
The CO-GUARD-MOS should be powered through circuit breakers provided for this purpose.

3.2.2 Air Supply

Tap the pipe or tank containing the breathing air and use appropriate fittings to connect the sample input hose. The instrument is designed to operate from an air supply pressure between 50 and 250 PSIG. The sample input hose length should be as short as possible. The **CO-GUARD-MOS** should be tapped into the compressed air line upstream of all respirator connection points to ensure the **CO-GUARD-MOS** monitors the supplied air ***Before*** it gets to the respirator connection points.

CAUTION:
DO NOT *use a rubber hose to connect regulator to airline. This may cause inaccurate meter readings and false alarms.*
DO NOT *locate the sample point on a low spot in the line. Water condensation may clog or damage the regulator or sensor assembly.*
DO NOT *modify or extend the sensor cable without first contacting* ***ENMET*** *customer service personnel for instructions regarding heater voltage and adjustment.*

Add tap water to the *upper* Water Level mark.
Replace bowl and ensure water does not go higher than the upper edge of the bowl.
Adjust the pressure regulator to between 7 and 15 PSI.

Upon Supplying Air and Power to The **CO-GUARD-MOS**:

- The green power on LED is lit.
- The display backlight is lit, and instrument will step through a start-up sequence: unit serial number and software revision may be shown on the display.

The instrument may go into alarm briefly, but the sensors stabilize quickly. If the instrument persists in alarm, acknowledge the alarm by pressing the **SELECT** button. If alarm persists longer than 30 minutes, call ***ENMET*** customer service personnel.
For DC wiring of 12 or 24VDC may be wired to J12, (J12-1) position 1 + with ground connected to (J12-2) position 2.

AC Power Supply Terminal: TB1

	Label on PCB	Function
110VAC	TB1 ACN	Neutral
	TB1 ACL	Line
Ground Screw	⏚	AC GND
220VAC	TB1 ACN	Neutral
Optional	TB1 ACL	Line
Ground Screw	⏚	AC GND

DC Power Supply Terminal: J12
Model part number 03481-040

Position	Function
1 +	24 VDC power
2	GND
3	4 - 20 mA output

DC Power Supply Terminal: J12
Model part number 03481-041

Position	Function
1 +	12 VDC power
2	GND
3	4 - 20 mA output

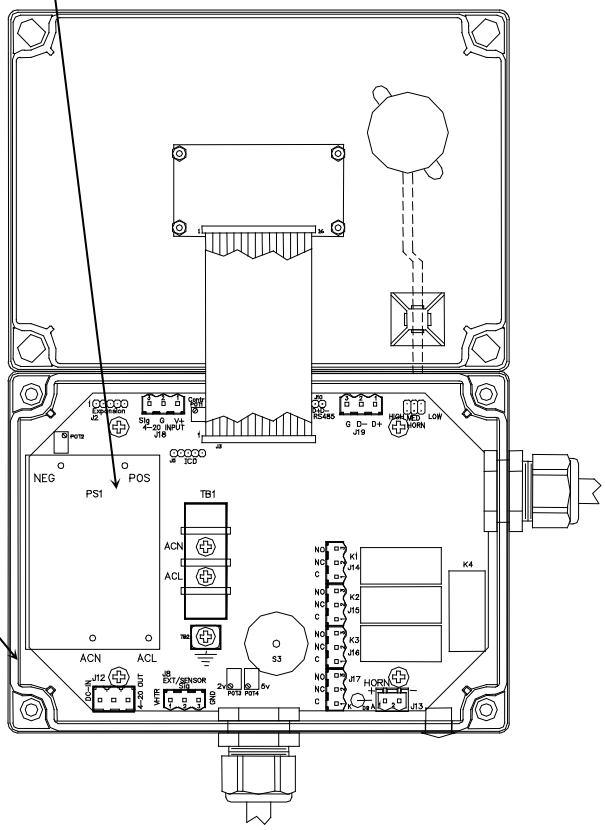


Figure 4: Power Terminal Connections CO-GUARD-MOS

3.2.3 Relay Contacts

Relay contacts are available for each alarm; these are SPDT, rated at 10Amp at 110VAC, and may be latching or non-latching as required by the application.
They are accessed on the terminals next to each relay see **Figure 5**. The contact positions are noted on the circuit board next to each terminal.

The following table is for the relays in their un-energized state. This is also the alarm condition state. Non-failsafe configured relays in the alarm state, are the reverse of the PC board labeling. Note that the Fault(FLT) relay, Relay 4 cannot be set to operate in a Non-Failsafe mode. Please see **Table 1**:

Table 1: Relay Failsafe Settings

Alarm	Position	
Alarm 1	J14 (K1) Relay 1 - NO	Normally Open
	J14 (K1) Relay 1 - NC	Normally Closed
	J14 (K1) Relay 1 - COM	Common
Alarm 2	J15 (K2) Relay 2 - NO	Normally Open
	J15 (K2) Relay 2 - NC	Normally Closed
	J15 (K2) Relay 2 - COM	Common
Alarm 3	J16 (K3) Relay 3 - NO	Normally Open
	J16 (K3) Relay 3 - NC	Normally Closed
	J16 (K3) Relay 3 - COM	Common
Fault Alarm	J17 (K4) Relay 4 - NO	Normally Open
	J17 (K4) Relay 4 - NC	Normally Closed
	J17 (K4) Relay 4 - COM	Common

These relay contacts can be used to operate auxiliary alarms or other functions. Auxiliary alarms should be powered from an independent power source separate from the instrument power to avoid alarm failure due to controller malfunction. Use the existing hole in the enclosure for a wire exit, and use appropriate cable fittings. See **Figure 2**. Be sure to note the location and depth of hardware inside the enclosure.

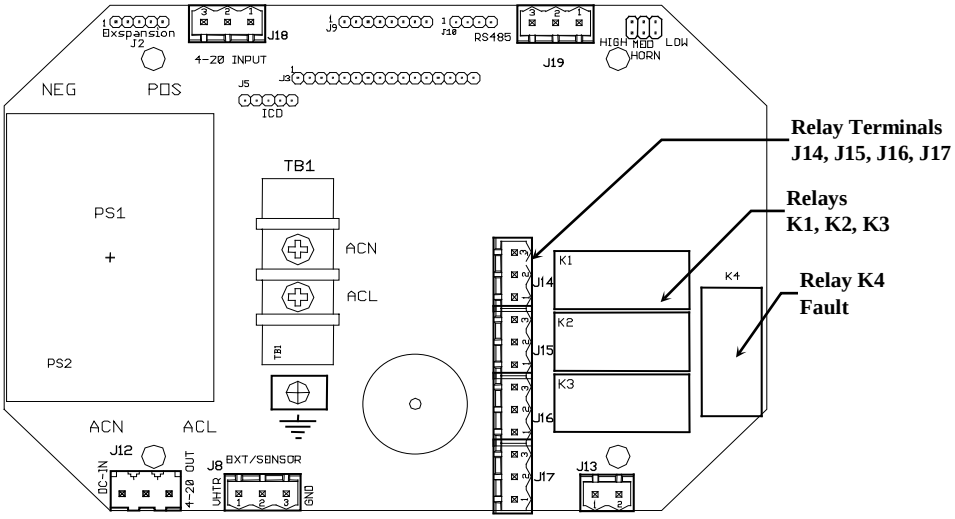


Figure 5: Relay Terminal Connections CO-GUARD-MOS

4.0 Operation

When the **CO-GUARD-MOS** is installed as described in **Section 3**, and in clean air, the POWER green LED is on, the display is lit and the information on the display is measurement of carbon monoxide detected by the **CO-GUARD-MOS**. The red alarm and fault LEDs are not lit.

4.1 Start Up CO-GUARD-MOS

When the **CO-GUARD-MOS** is first powered up, it goes through a series of momentary screens, which identify the instrument model number, serial number and software revision. After all of the momentary screens have been displayed, the instrument arrives at the Main Gas Display showing the gas concentration and unit of measurement.

Depending on transmitter configuration and calibration condition, the furthest right character in the display may flash a letter indicating the instrument status. See the Section 4.1.1 below

4.1.1 Typical Start Up

When power is supplied to the **CO-GUARD-MOS,** the instrument will display the following sequence of information: Typical start up sequence of information displayed.

Example of Typical Start Up Display	Function
CO-Guard M	The instrument: Model **CO-GUARD-MOS**
305- 20	The instrument: Serial Number
S/W 6.9F	The instrument: Software Revision
IF the right most character is a flashing **W** 0 ppW	The instrument is in Warm-up mode ▪ This should last about 1 minute ▪ The Signal Output is held at 4mA during warm-up
IF the right most character is a flashing **C** 0 ppC	The instrument has failed Calibration The last good calibration values are retained, but the sensor may not be responsive to gas A new Calibration should be performed *As Soon As Possible*
IF the right most character is a flashing **R** 0 ppR	The instrument is in Recovery-up mode. This occurs after the purge function has completed. ▪ Typically lasts about 5 minutes ▪ Relays and alarms are disabled during this time
0 ppm	The instrument: Normal Display Mode Measurement of Carbon Monoxide

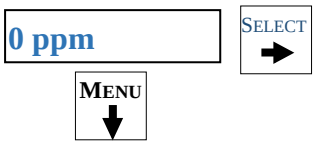
NOTE: *Software revision may cause variations of display output.*

4.2 Normal Display Mode

When the **CO-GUARD-MOS** is installed as described in section 3, and in clean air, the POWER green LED is on, the display is lit and the information on the display is measurement of carbon monoxide detected by the **CO-GUARD-MOS**. The red alarm and fault LEDs are not lit.
To advance through displays of operational information press the **MENU** button.

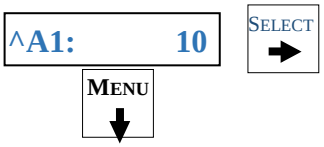
See sequence of operational information below:

Display Measurement of CO
Press **MENU** button



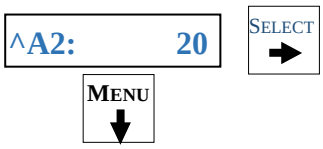
To temporally disable audio alarm, see **Section 4.2.1**

Display indicates Alarm 1 Set point
Press **MENU** button



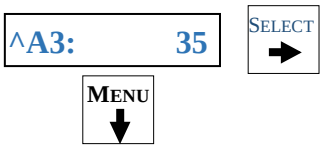
To temporally disable audio alarm, see **Section 4.2.1**

Display indicates Alarm 2 Set point
Press **MENU** button



To temporally disable audio alarm, see **Section 4.2.1**

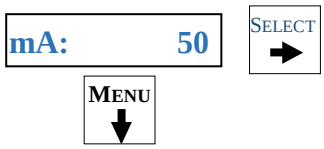
Display indicates Alarm 3 Set point
Press **MENU** button



To temporally disable audio alarm, see **Section 4.2.1**

Display indicates mA Span range (Full Scale)
Press **MENU** button

Display returns to CO measurent



To temporally disable audio alarm, see **Section 4.2.1**

Operational Display Flow Chart

4.2.1 Alarm Conditions CO-GUARD-MOS

There are three alarm set points for CO. The factory settings of these alarm set points are shown in **Table 2**.

Table 2: Factory Alarm Set Points

Gas	Alarm 1	Alarm 2	Alarm 3
Carbon Monoxide	10 ppm	20 ppm	35 ppm

The alarm set points can be changed within limits; see the maintenance section of this manual for the procedure.
If the CO concentration increases above that of the alarm set point, the associated red LED is lit, the associated relay changes state, and the audio alarm is activated.

Pressing the **SELECT** button can temporally disable the Audio Alarm. The horn will be disabled for about five minutes. If a second alarm condition occurs during this time the horn will re-activate. If the alarm condition(s) have ended during this time the horn will not re-activate.

5.0 Maintenance

The **CO-GUARD-MOS** maintenance menus that are accessed by pressing the **MENU** button and entering a valid access code. The access code is set at the factory and may be changed by following the access code menu explained in section 5.5.

5.1 Maintenance Menus

CAUTION*: Do Not Attempt a Span Procedure Without Calibration Gas Applied to The Sensor; if this is done, the instrument is forced into a calibration fault mode.*

Pushbutton switches control the **MENU** and **SELECT** functions. The **MENU** and **SELECT** button locations are indicated on the display panel, see **Figure 3.** The **MENU** button is used to display the various menu options and make incremental changes to numbers such as alarm points, calibrations gas, etc. The **SELECT** button is used to select that option, set zero or span digit. To enter the maintenance menu, press and hold the **MENU** button for 2 to 4 seconds

Table 3 indicates the maintenance menu sequence see **Figure 6** for a detailed maintenance menu flow chart.

Table 3: CO-GUARD-MOS Maintenance Menus Sequence

Example of Display	Function
5ppm Normal Display Mode	Measurement of CO
Press and *hold* the **MENU** button for 2 – 4 seconds to enter the Maintenance Menu The Power/Fault LED will flash Green – Red to indicate the **CO-GUARD-MOS** is in Maintenance Mode	
Exit	To exit the maintenance Menu and return to the Normal Display Mode: If intended function Press **SELECT** button
Press the **MENU** button to advance to the Zero procedure	
Zero	For adjusting Zero: If intended function Press **SELECT** button
Press the **MENU** button to advance to the Span procedure	
Span	For adjusting the Span: If intended function Press **SELECT** button
Press the **MENU** button to advance to each Alarm set point procedures	
Alarm1 Alarm2 Alarm3	For adjusting the Alarm 1, 2 and 3 set points: If Intended Function, Press **SELECT** button
Press the **MENU** button to advance the mA Span set point procedure	
mA Span	For adjusting the mA Span set point: If intended function Press **SELECT** button

Pressing the **MENU** button without pressing the **SELECT** button will allow you to cycle through the menu options. You must Press the **SELECT** button in order to initiate the desired operation

Normal Gas Display

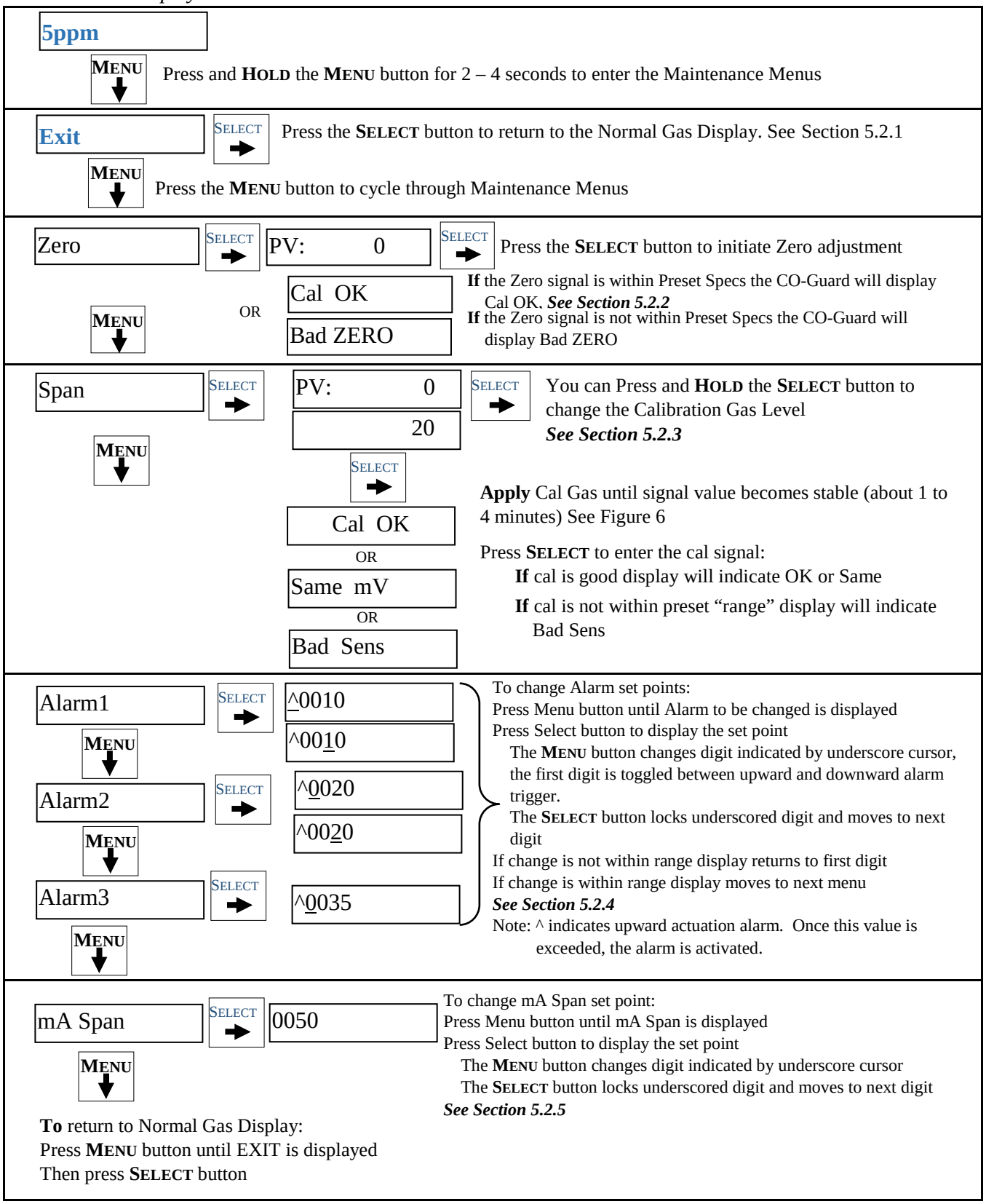


Figure 6: CO-GUARD-MOS Maintenance Menu Flow Chart

5.2 Calibration of the CO-GUARD-MOS

Calibration is the process of setting the instrument up to read accurately when exposed to a carbon monoxide gas. The Zero function sets the clean air reference point and the Span function sets the sensitivity of the instrument.

Initial Calibration: Wait 3 – 4 hours after initially supplying power to the **CO-GUARD-MOS** instrument before initial calibration. The **CO-GUARD-MOS** has been pre-calibrated at the factory, and initial field calibration should result in only fine tuning to circuit, as well as a way to check that installation is successful. It is not necessary to open the enclosure to make adjustment. The calibration functions are operated with pushbuttons from outside the enclosure through the **MENU** and **SELECT** switches. Calibration Zero and Span functions are two separate procedures. They operate independently of each other. It is recommended that the Zero procedure be done prior to the Span procedure.

ENMET *recommends at least quarterly calibration of the* **CO-GUARD-MOS** *instrument.*
Calibration equipment is available from ***ENMET*** to calibrate the **CO-GUARD-MOS** instrument.

- Calibration adapter, a length of tubing with a regulator for the gas cylinder on one end, and a quick release fitting to connect to the sample input of the **CO-GUARD-MOS** on the other.
- Gas cylinder, Zero gas 20.9% oxygen or Span gas, typical 20 ppm CO

Generally, a cylinder of 20.9% Oxygen is used to provide a Zero point or fresh air reference for the calibration.
A cylinder of Carbon Monoxide is used to provide the Span reference point for calibration. 20ppm CO is recommended.

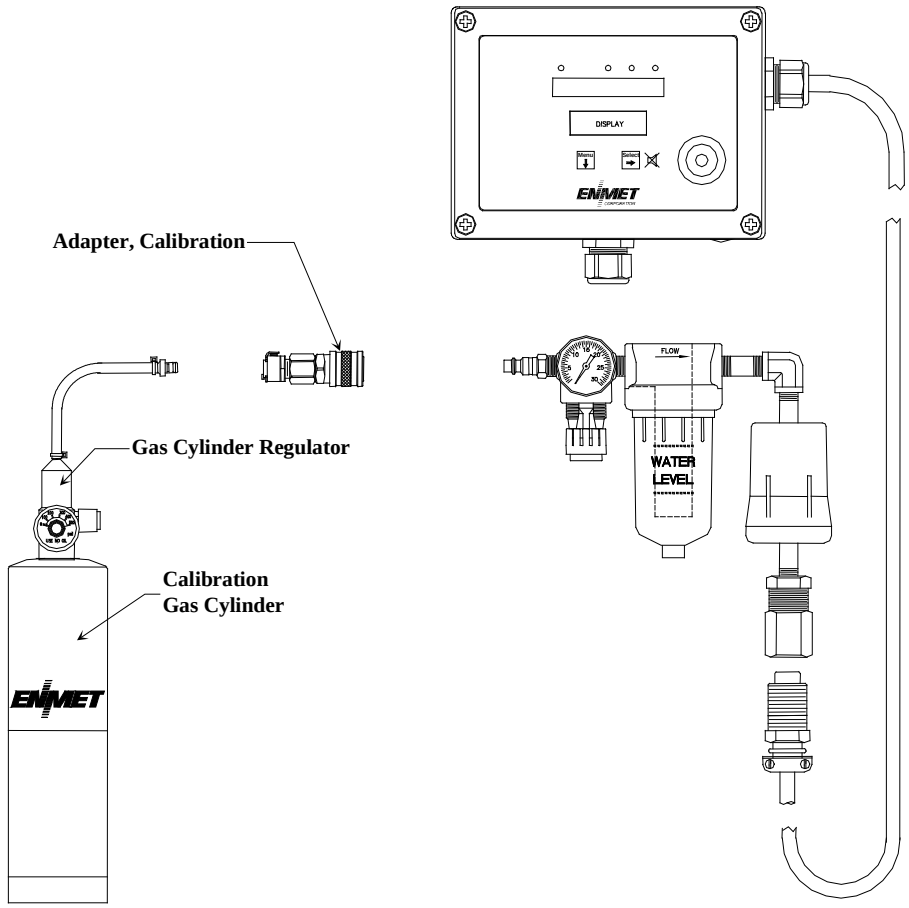


Figure 7: CO-GUARD-MOS Calibration Adapter

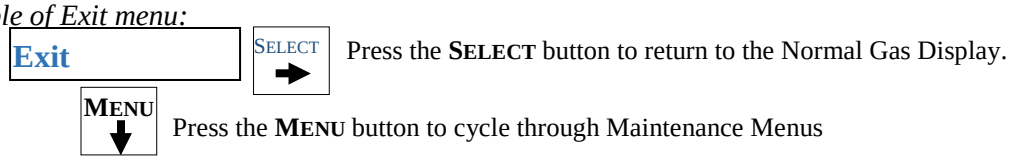
Table 4: Calibration Gas

Gas	Range	Alarm 1	Alarm 2	Alarm 3	Sensor Part Number	Span Calibration Gas
Carbon Monoxide	0 – 50 PPM	10 PPM	20 PPM	35 PPM	67025-1200	20 PPM Carbon Monoxide

5.2.1 Exit Maintenance Menu

Exit maintenance, by pressing the Exit appears on the display. Press the **SELECT** button to return to the instrument Normal Gas Display.

Example of Exit menu:



5.2.2 Zero Adjust

The ZERO function must be performed by exposing the **CO-GUARD-MOS** instrument to clean fresh air. If the air at the sensor is in question, use a cylinder of 20.9% oxygen to provide a clean air reference. As shown in **Figure 7** Calibration adapter. Enter the maintenance menu by pressing and holding **MENU** button for 2 to 4 seconds. See **Figure 6, CO-GUARD-MOS** Maintenance Menu flow chart.

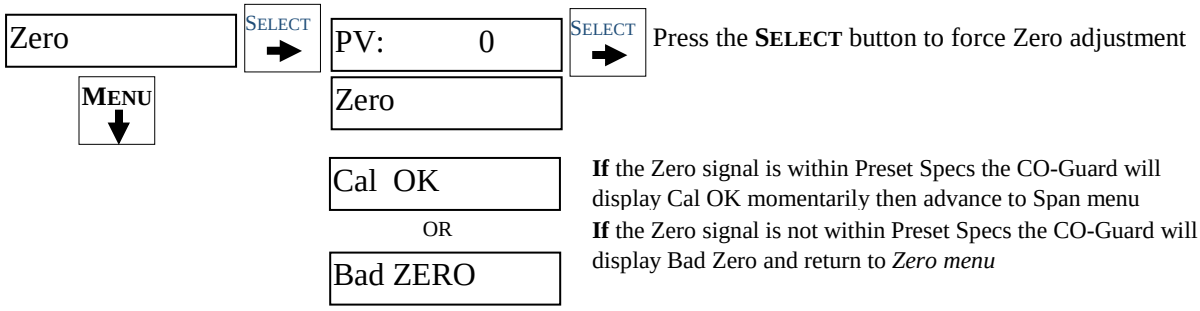
After entering the maintenance menu, Press the **MENU** button until the Zero menu is displayed.
Apply Zero gas.
Press the **SELECT** button to start the Zero procedure.
The display will alternate between Zero and PV: To abort Zero function press and hold **MENU** button for 3 – 4 seconds, Abort? will appear, press **SELECT** button to return to Zero.
Press the **SELECT** button to initiate a Zero adjustment.

An auto detect sequence is initiated. After 15 seconds, the **CO-GUARD-MOS** will monitor the zero reading for stability.

- *If the reading stabilizes*, within the pre-programmed perimeters, an automatic zero adjustment will be made.
  Cal OK appears on the display and in 1 – 2 seconds, display will change to Span.
  If you wish to Span the sensor press the **SELECT** button you are now ready to apply gas. **Proceed to gas span step 2**
  If you wish to Exit the maintenance menu, press **MENU** button until Exit is displayed, then press **SELECT** button to return to the instrument Normal Gas Display
- *If the reading does not stabilize*, within 255 seconds, the procedure will be aborted. Sensor is outside of safe parameters to be zeroed, the display will read Bad Zero. Repeat Section 5.2.2 Zero Adjust making sure to use a Zero gas of 20.9% Oxygen. ***ENMET*** part number 03296-209 or 03100-209.

NOTE: *You can Press and **HOLD** the **MENU** button to abort Zero*
When "Abort?" appears, press SELECT button to return to Zero menu

Example of Zero adjustment display:



5.2.3 Gas Span

It is recommended that the Zero Function be performed first.

Do not perform a calibration unless span gas is applied to sensor. Calibration can be aborted by pressing and holing the **MENU** button for 3 – 4 seconds.

Enter the maintenance menu. See **Figure 6, CO-GUARD-MOS** Maintenance Menu flow chart.

1. Press the **MENU** button until Span display.
2. Attach the associated calibration gas cylinder to the calibration adapter. See **Figure 7**
3. Open the valve, to apply the calibration gas to the sensor and connect to regulator. Verify air flow, bubbles will be moving through water.
4. Press the **SELECT** button to perform a Span procedure.
   The display will alternate between the calibration gas concentration (Cal 20) and a signal level (PV).
   To Abort calibration press and Hold **MENU** button for 3 – 4 seconds, Abort? will appear, press **SELECT** button to return to Span.
   To change calibration gas level to be used, press and Hold **SELECT** button for 3 – 4 seconds, use menu button to change digit and select button to move to next digit.
5. An auto detect sequence is initiated after 30 seconds, the **CO-GUARD-MOS** will monitor the Cal reading for stability. Watch for the signal level to stabilize. 3 – 8 minutes.
6. Once the signal level has stabilized,
   - If the Span is successful, Cal OK appears momentarily, then will advance to Alarm1 menu.
   - If the sensor is outside of acceptable parameters, Bad Span is displayed.
   - If the sensor did not respond, an incompatible span gas was applied and the sensor did not respond at all, Same mV is displayed then will return to Span.
     ➔ If calibration is not successful, it is suggested that calibration be attempted again in 30-60 minutes. If the sensor will not calibrate See Section 5.4.
7. Remove the calibration gas.
8. Calibration is complete.
   Note: The instrument will return to operation mode in 3 – 5 seconds.
9. Press the **MENU** button to advance to next desired menu

NOTE: *To abort calibration or change calibration gas level.*

MENU

You can Press and **HOLD** the **MENU** button to abort Calibration

When "Abort?" appears, press SELECT **button to advance to Alarm1 menu**

Abort? SELECT

SELECT

You can Press and **HOLD** the **SELECT** button to change the Calibration Gas Level

-Use the **MENU** button to change digits

-Use the **SELECT** button to move to next digit

20

Example of Calibration Display:

SELECT PV: 0 SELECT

PV: 0

20

Cal OK

Span

MENU

Bad Sens

OR

Same mV

Apply Cal Gas until signal value becomes stable (about 1 to 4 minutes) See **Figure 7**

When cal signal is stable **CO-GUARD** will automatically update:

If cal is good display will indicate OK or Same and advance to Alarm1

If cal is not within preset "range" display will indicate Bad Sens or Same mV The **CO-GUARD** will return to the Span Menu

To exit press **MENU** button until Exit appears and press **SELECT**

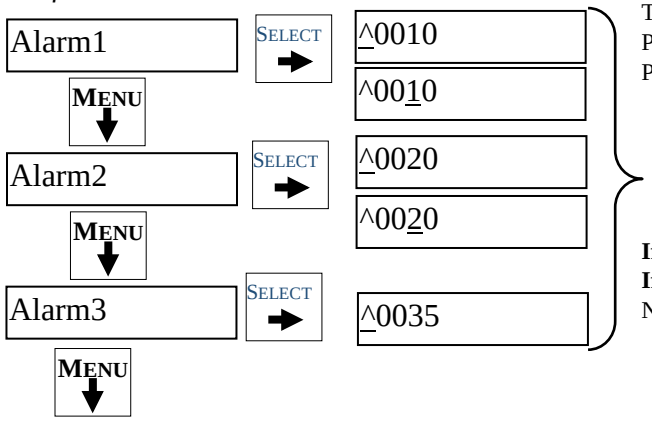
5.2.4 Alarm Set Points

The **CO-GUARD-MOS** alarm set points can be changed within limits. See **Table 4** for factory set alarm points.
To change any of the three alarm points:

Enter the maintenance menu as shown in **Figure 6 CO-GUARD-MOS** Maintenance Menu flow chart.

1. Press the **MENU** button until to display Alarm1 is displayed.
2. Press the **SELECT** button to initiate alarm set point change
3. Press the **MENU** button to change the digit indicated by the underscore cursor
4. Press the **SELECT** button to move the cursor to the next digit
   When last digit is entered the **CO-GUARD-MOS** will advance to the next menu
5. Press the **MENU** button to advance to the next menu

Example of Alarm Set Point menus:



To change Alarm set points:
Press Menu button until Alarm to be changed is displayed
Press Select button to display the set point
The **MENU** button changes digit indicated by underscore cursor, first digit is toggled between ascending and descending triggered alarm.
The **SELECT** button locks underscored digit and moves to next digit
If change is not within range display returns to first digit
If change is within range display moves to next menu
Note: ^ indicates upward actuation alarm. Once this value is exceeded, the alarm is activated.

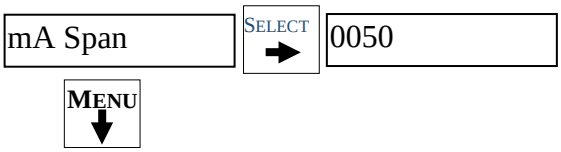
5.2.5 Span Set

The **CO-GUARD-MOS** 4-20mA span range can be changed within limits. See **Table 4** for factory set range.
To change the span range:

Enter the maintenance menu as shown in **Figure 6 CO-GUARD-MOS** Maintenance Menu flow chart.

1. Press the **MENU** button until to display Span is displayed.
2. Press the **SELECT** button to initiate the mA Span menu
3. Press the **MENU** button to change the digit indicated by the underscore cursor
4. Press the **SELECT** button to move the cursor to the next digit
   When last digit is entered the **CO-GUARD-MOS** will advance to the next menu
5. Press the **MENU** button to advance to the next menu

Example of mA Span menu:



To change mA Span set points:
Press Menu button until mA Span is displayed
Press Select button to display the set point
The **MENU** button changes digit indicated by underscore cursor
The **SELECT** button locks underscored digit and moves to next digit

Default mA Span

4mA	20mA
0 ppm	50 ppm

5.3 Sensor Replacement

WARNING: *Power must be removed from the CO-GUARD-MOS before this or any internal procedure. Failure to do so may cause damage to equipment, bodily injury or death.*

Sensors should be replaced when they can no longer be calibrated. Replacement sensor part numbers are listed in **Section 6.0** of this manual. If you do not know the proper part number for your sensor, have the **CO-GUARD-MOS** serial number available when contacting your Distributor or ***ENMET*** Technical Support.

- Remove, the 4 retaining screws from **CO-GUARD-MOS** lid, see Figure 8
- Remove, the sensor from the terminal connector on the PCB, see **Figure 8**.
- Remove the sensor cable form the enclosure.
- Insert the new sensor cable through the strain relief.
- Attach the wiring per Sensor Wiring Terminal J8 chart within **Figure 8**.
- Replace, lid and the 4 retaining screws.
- Re-supply power to the **CO-GUARD-MOS**

Sensor Wiring Terminal J8		
1	Heater	White
2	Signal	Green
3	Ground	Black

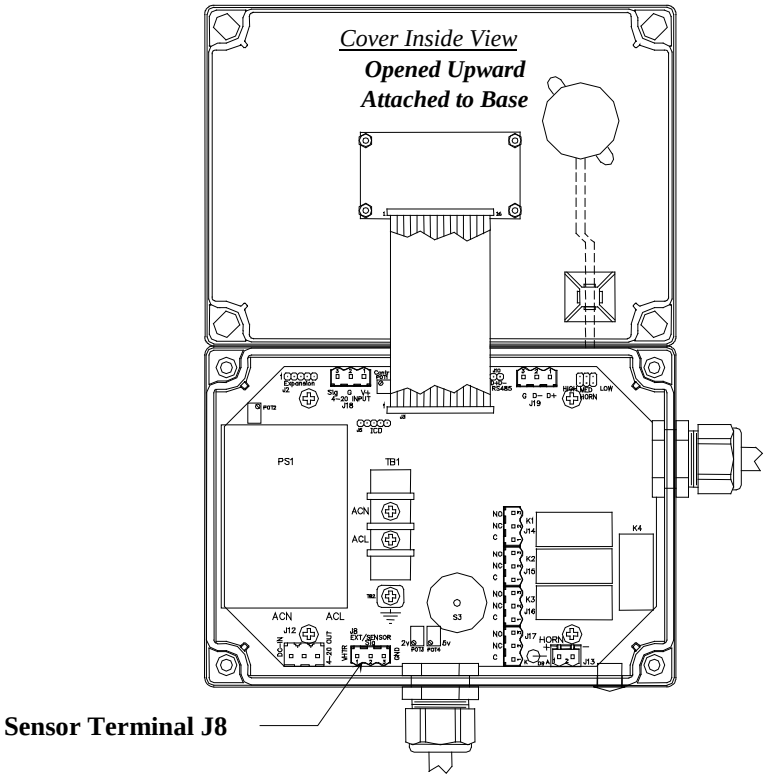


Figure 8: CO-GUARD-MOS Sensor Replacement

The heater voltage is measured between terminals 1 & 3. During normal operation, it is 0.89V ± 0.05. During purge the heater voltage is ground 1.5V. After the new sensor assembly has been installed, it is suggested to allow the sensor to stabilize for 3 – 4 hours.

A Factory calibration must be performed.

After entering the Maintenance menu, press and hold the **MENU** button for 2-4 seconds while viewing the Zero menu.
After 2-4 seconds, an F will appear on the far-right hand side of the display. The F indicates that the instrument is in Factory mode. Perform the calibration Zero and Span procedures as outlined in **Section 5.2**. Be sure that the F is present when selecting the Zero and Span functions.

The Factory calibration sets a calibration window for future standard instrument calibrations.

6.0 Replacement Parts

ENMET replacement part numbers:

Description of Part	Part Number
Sensor CO	03035-109
Calibration gas, 20ppm CO (steel cylinder)	03219-020
Zero Gas, 20.9% O2, 17 liters	03296-209
Adapter, Calibration	03700-039
Regulator, Calibration Gas (steel cylinder)	02506-008
Horn	62013-007

7.0 Technical Data and Specifications

Electrical Power	15 Amp fused branch circuit	
	100-240 VAC	
	0.45A, 50/60 Hz	
	0.6A, 24VDC 1.25A, 12VDC	
Storage and Transport	Temperature:	-20° to +60°C (-4° to +140°F)
	preferred	0° to +20°C (32° to 68°F)
	Relative Humidity	10-99% RH, non-condensing
	Atmospheric Pressure	20 to 36 inHg (68 to 133 kPa)
Operation	Temperature:	0° to +40°C (32° to +104°F)
	Relative Humidity	10-99% RH, non-condensing
	Atmospheric Pressure	20 to 36 inHg (68 to 133 kPa)
Mechanical	Dimensions:	7.1 x 5.1 x 3 in(180x130x75mm)
	Weight:	2 lbs (0.9 kg)
	Material:	Polycarbonate
	Strain relief:	3 - 6.5 mm OD
Outputs	Relays:	SPDT Resistive Load Inductive Load 10A at 110 VAC 7.5A at 110 VAC 10A at 30 VDC 5A at 30 VDC
	Analog:	4-20mA
	Digital:	RS-485-modbus
	Audio:	105 dB at 30cm/12in

NOTE: *All specifications stated in this manual may change without notice.*

8.0 Terms and Conditions

8.1 Ordering Information

Address orders to:

ENMET
Attention: Customer Service Department
680 Fairfield Court
Ann Arbor, MI 48108

Email Orders: orderentry@enmet.com
Phone: 734-761-1270
Fax: 734-761-3220
You may also contact our customer service department by email info@enmet.com. MINIMUM ORDER IS $50.00.

8.2 Shipping Terms

All shipments are F.O.B. ENMET's facility in Ann Arbor, MI, USA or Bowling Green, KY, USA. Shipping and handling charges are prepaid and added, and must be paid by the customer. Shipping and handling charges may be billed to VISA, MasterCard, American Express, or to the customer's preferred carrier account number. Delivery to the carrier constitutes delivery to the customer, and risk of loss passes to the customer at that time, however, title shall remain with ENMET until payment is received in full. Claims for shortages and damage must be made by the customer to the carrier within 5 days of receipt. **Refer to section "1.1 Unpack" for more information on this matter.**
A special service of $50.00, or more, may be assessed on expedited shipments.
NOTE: Calibration gases are classified as Dangerous Goods for transportation purposes, and shipping companies charge a hazardous material fee for processing the documentation required for handling such items. Also, other restrictions apply to shipment of Danger Goods by air. Check with ***ENMET*** for clarification and additional information.

8.3 Payment

Open accounts must be established in advance with ENMET's Accounting department.
Address Payments to:

ENMET
680 Fairfield Court
Ann Arbor, MI 48108

Phone: 734-761-1270
We accept payments by VISA, MasterCard, and American Express. Payment by credit card must be specified at time of order placement. Your credit card will be charged on the date of shipment.
ENMET invoices for products that are shipped on open account are due and payable 30 days from the date of shipment from the ***ENMET*** site. ***ENMET*** may institute collection services should any bona fide invoice remain unpaid with no payment schedule negotiated by the customer with the ***ENMET*** Accounting Department. Any cost incurred by ***ENMET*** for professional collection services or legal fees to collect on a customer invoice will be added to any future business conducted between ***ENMET*** and that customer.

8.4 Warranty Information and Guidelines

Equipment must be returned prepaid to the point of origin, and ENMET will prepay the return transportation charges. Transportation prepaid by ENMET will be by most economical means (e.g. FedEx Ground). If an expedient means of transportation is requested during the warranty period, the customer must pay the difference between the most economical means and the expedient mode. ENMET warrants new instruments to be free from defects in workmanship and material under normal use for a calibration and expendable parts such as filters, detector tubes, batteries, etc. In addition, some oxygen cells and other sensors are limited to a warranty period of six months from date of shipment. Refer to the instrument manual for specific warranty details. If the inspection by ENMET confirms that the product is defective, it will be repaired or replaced at no charge, within the stated limitations, and returned prepaid by FedEx Ground to any location in the United States. ENMET shall not be liable for any loss or damage caused by the improper use or installation of the product. The purchaser indemnifies and holds harmless the company with respect to any loss or damagers that may arise through the use by the purchaser or others of this equipment. This warranty is expressly given in lieu of all other warranties, either expressed or implied, including that of merchantability, and all other obligations, or liabilities of ENMET which may arise in connection with this equipment. ENMET neither assumes nor authorizes any representatives or other persons to assume for it any obligation or liability other than that which is set forth herein.

If a component is purchased and installed in the field, and fails within the warranty term, it can be returned to ENMET and will be replaced, free of charge. If the entire instrument is returned to ENMET with the defective item installed, it will be replaced at no cost, but the instrument will be subject to labor charges at half of the standard rate.
NOTE: When returning an instrument to the ENMET for service:

- Be sure to include all paperwork (the "Request for Service" form).
- Include any specific instructions.
- For warranty service, include the date of purchase.
- If you require an Estimate, please contact ENMET.

The "Request for Service" form is on the final page of this manual. This form can be copied or used as needed. For service requests, outside of the warranty period, please refer to the "Returning an Instrument for Service Instruction" found later in this section.

8.5 Return Policy

All returns for credit must be approved by ENMET and identified with a "Return Material Goods" number. Such returns are subject to a minimum of a $50.00 or 20% restocking fee, whichever is greater. **Approval of equipment for return is fully at the discretion of ENMET.** All requests for return/exchange must be made no later than 30 days of the original shipping date from ***ENMET***. The actual amount of any resulting credit will not be determined prior to a complete inspection of the equipment by ***ENMET***. Calibration gas cylinders cannot be returned or restocked due to the Department of Transportation refill restrictions. Air Filtration Systems (AFS series & parts) cannot be returned or restocked because their internal surfaces and filters are not amenable to re-inspection.
Certain products, such as stationary systems, or instruments with custom sensor configuration (non-standard) are built to order, and cannot be returned. Cancellation of orders for custom-built products, prior to shipment, will result in the assessment of a cancellation fee. The amount of the cancellation fee will be based upon the size and complexity of the order, and the percentage of total cost expended prior to cancellation.

8.6 Returning an Instrument for Service Instructions

Contact the ENMET Service Department for all service requests.
Phone: 734-761-1270
Email: repair@enmet.com
Fill out the "Service Request Form" found at the end of this manual and return with your instrument for all needs. Please send your instrument for service to the site in which the product was purchased. A new "Service Request Form" may be requested if the one found in the manual is not available. All instruments should be shipped prepaid to ENMET.
Address for Service:

Michigan Location:

ENMET
Attention: Service Department
680 Fairfield Court
Ann Arbor, MI 48108

Kentucky Location:

ENMET
62 Corporate Court
Bowling Green, KY 42103

Providing the "Service Request Form" assists in the expedient service and return of your unit and failure to provide this information can result in processing delays. ***ENMET*** charges a one hour minimum billing for all approved repairs with additional time billed to the closest tenth of an hour. All instruments sent to ***ENMET*** are subject to a minimum evaluation fee, even if returned unrepaired. Unclaimed instruments that ***ENMET*** has received without appropriate paperwork or attempts to advise repair costs that have been unanswered after a period of 60 days may, be disposed of or returned unrepaired COD and the customer will be expected to pay the evaluation fee. Serviced instruments are returned by UPS/FedEx Ground and are not insured unless otherwise specified. If expedited shipping methods or insurance is required, it must be stated in your paperwork.

NOTE: Warranty of customer installed components.
For Warranty Repairs, please reference ***ENMET's*** "Warranty Information and Guidelines" (found earlier in this section).

Mailing/Shipping Address:
ENMET
680 Fairfield Court
Ann Arbor, MI 48108
repair@enmet.com

Phone: 734.761.1270
Fax: 734.761.3220

Service Request Form

Product Name or Number:
Product Serial Number:

Describe Problem or Needed Service:

Warranty Claim? ☐ Yes ☐ No

CUSTOMER INFORMATION

Billing Address: _____

_____

_____

Shipping Address: _____

_____

_____

Contact Name: _____ **Phone #:** _____

Email: _____ **Fax #:** _____

PO/Reference #: _____

PAYMENT METHOD

☐ COD ☐ VISA/MasterCard ☐ American Express

_____ _____ _____

Card Number Exp. Date Security Code:

Name as it Appears on Card: _____

RETURN SHIPPING METHOD

☐ UPS Ground ☐ UPS 3 Day Select ☐ UPS Next Day Air ☐ UPS ND Air Saver ☐ UPS 2 Day Air

UPS Account #: _____

☐ FedEx Ground ☐ FedEx Air Express Saver ☐ FedEx Air Overnight Std. ☐ FedEx Air 2 Day ☐ FedEx Air Overnight P-1

FedEx Account #: _____

Insure Shipment: ☐ Yes ☐ No

Insurance Amount: $ _____