

Coy Anaerobic Monitor Instruction Manual

Coy Laboratory Products, Inc. 14500 Coy Drive Grass Lake, Michigan 49240

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One printed copy of this manual is provided with your Coy anaerobic monitor. It is also available for downloading from the Coy website so you can print additional copies if needed or place a copy on your computer for reference.

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Document History

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Safety, Warranty, and Support Information

WARRANTY INFORMATION

The Coy anaerobic monitor (CAM-12) is warranted against defects in material and workmanship during the first 12 months after the original date of shipment. The factory will, at its option, repair or replace defective parts or material within this period at no charge for parts and labor.

All returns or exchanges must first be authorized by Coy Laboratory Products:

14500 Coy Drive Grass Lake, MI 49240

Phone: 734-475-2200 Fax: 734-475-1846

The responsibility of COY LABORATORY PRODUCTS, INC. is limited to the purchase price of this product. COY LABORATORY PRODUCTS, INC. will not be responsible for any consequential damages.

This warranty does not cover the following: damage in shipment, damage as a result of improper use or maintenance of this product, or damages caused by excessive line transients on the AC supply line. Damage from H₂S contamination may void the warranty if steps have not been taken to minimize H₂S (e.g., purchasing a hydrogen sulfide removal column (HSRC))

Unless otherwise instructed, items to be repaired or replaced should be shipped to:

Coy Laboratory Products, Inc. 14500 Coy Drive Grass Lake, Michigan 49240

WARNINGS

- 1. Do not use combustible or flammable gas mixtures that exceed the recommended levels for safety.
- 2. Do not use pure hydrogen in your chamber. Use only premixed gases. The use of pure hydrogen or premixed gases with a hydrogen content of greater than 5 % may create an explosive mixture in the chamber.
- 3. Do not use the CAM-12 as a control for the introduction of pure hydrogen into the chamber under any circumstances.
- 4. Do not use abrasive cleaners as they may damage the surfaces. Check all cleaners before use to ensure they are compatible with construction materials (see "Construction Materials" in Appendix B).
- 5. Never immerse any portion of the CAM-12 enclosure, power cord, or external power supply, as it may damage the unit. There is also a risk of electrical shock.
- 6. Do not use input power other than the 100 VAC/240 VAC, 50 Hz/60 Hz external power supply provided with the CAM-12, as it may damage the unit.

TECHNICAL SUPPORT

To obtain technical support, contact Coy Laboratory Products by either phone or email: Phone: (734) 475-2200 E-mail: techservice@coylab.com



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The Coy anaerobic monitor (aka CAM-12) monitors the oxygen/hydrogen content inside your anaerobic chamber. It is designed for use in chambers that use hydrogen and palladium catalyst with a nitrogen background to maintain an anaerobic environment:



The concentration levels of both oxygen and hydrogen are constantly updated on the display, allowing you to adjust the chamber atmosphere before gases reach undesirable levels.

If you also have a Coy anaerobic gas infuser (AGI), the hydrogen level in your chamber can be maintained automatically at 2.5 %, based on the readings it receives from the CAM-12. The two devices are connected via an Ethernet cable. When the hydrogen level in the chamber atmosphere falls below 2.5 %, the gas infuser automatically injects hydrogen into the chamber atmosphere until the level meets or exceeds 2.5 %. More information on the gas infuser and the interface between the two components can be found in the gas infuser instruction manual (https://coylab.com/products/options-accessories/atmosphere-regulation/gas-infuser/).

1.1 Features

- Its compact size reduces its "footprint" inside the chamber.
- Less expensive non-certified gas mix tanks can be used.
- Internal sensors eliminate the need for external cable connections.
- Calibration is factory preset, not user dependent.
- Sensors can be easily exchanged for recalibration or replacement.
- CO₂ compensation is operator selectable from 0 % to 20 % for gas mixes containing CO₂,
- No routine maintenance is required.
- An easy-to-read display constantly displays measured H₂ and O₂ levels.
- Limits for alert messages and a LED alarm with a separate audible alarm option are user controlled.



1.2 CAM-12 Connections

The CAM-12 has two main connections—a power connection, which converts AC current to DC, and an Ethernet connection, which is used to pass H_2 and O_2 readings to the gas infuser:



1.2.1 The power supply connection

The CAM-12 has a separate power supply adapter, which converts the AC line voltage to the lower DC voltage required for the unit's electronic operation. The power supply is connected to the CAM-12 via a jack connection in the back. A standard electrical connector connects it to the power strip, which supplies the AC current.

The CAM-12 is turned on and off with a power switch on the back of the unit:



During standard chamber operation, power should remain on at all times. You may need to turn it off for some maintenance procedures.

1.2.2 Ethernet connection

If you have a Coy gas infuser, the Ethernet cable from the gas infuser will be connected to the Ethernet port:



Instructions for setting up your gas infuser to work with the CAM-12 are given in the gas infuser manual.



1.3 The CAM-12 Control Panel



The control panel contains a display area and 4 function keys:

1.3.1 The display

When the CAM-12 is operating, the power indicator LED will be lit and the current oxygen and hydrogen levels will be displayed. When the unit is restarted after being turned off, the hydrogen level will be displayed immediately. The oxygen level will not be displayed correctly until the hydrogen level reaches 1.5 %.

1.3.2 The function keys

The function keys are used to display and navigate through the user setup menu and to set operating parameters.

1.3.2-A Alarm control parameters

You may do the following:

- Set alarm limit levels for hydrogen (upper and lower) and oxygen (upper).
- Enable or disable the audible alarm. The default is disabled.

You may change these settings whenever you wish. Detailed instructions are given in Chapter 3.

1.3.2-B CO₂ compensation

The CAM-12 can handle gas mixes with up to 20 % CO₂. However, the presence of CO₂ can affect H₂ readings. It does not affect O₂ readings. The CO₂ compensation setting provides the CAM-12 with the information needed to adjust for the presence and amount of CO₂ in the gas mix.

The default CO_2 setting is 0 %. If you use a gas mix that contains CO_2 , you must enter the CO_2 compensation so the chamber hydrogen content can be calculated correctly. Detailed instructions are given in Chapter 4.

1.3.2-C Special maintenance functions

Two special maintenance functions are also accessed by the function keys:

- Downloading sensor calibration data to the CAM-12 after a sensor is replaced. Instructions are given in section 7.2 of Chapter 7.
- Recalibrating the zero O_2 point. Information is given in section 6.2 of Chapter 6. DO NOT USE THIS FUNCTION WITHOUT CONSULTING COY!



Warning: These functions can corrupt your CAM-12 calibration if used incorrectly or for situations other than those specified in this manual.



The CAM-12 is delivered ready to run. It is calibrated at the factory and no further preliminary setup is necessary.



2.1 Selecting a Location

The CAM-12 should be placed where it can produce accurate readings for oxygen and hydrogen levels. It should have sufficient airflow around it to enable good gas exchange and temperature stability, both of which are necessary for its operation.

Another factor to consider is the way oxygen enters the chamber. Cycling the airlock produces the largest influx of oxygen. After an airlock cycle, oxygen levels will be highest near the airlock door and quickly eliminated by the catalyst. To accurately monitor the oxygen from an airlock cycle, place the CAM-12 near the door.

The top shelf of a shelving unit (if you have one) is generally a good location. The top of an incubator or other tall piece of equipment is also good. If you must place it on the floor, make sure that the airflow is not blocked by any other equipment or apparatus. Do not tuck it into a back corner!

2.2 Connecting to Power

The power cable for the CAM-12 is an AC/DC power supply adapter that converts the AC line voltage from the power supply to the lower DC voltage required by the CAM-12.

Most CAM-12 units are shipped with a single power cable and a selection of adapter plugs:





You will need to install the correct plug for your facility's voltage and your power strip's receptacles.

Note: In some cases, the cable you receive may already have the correct adapter built in, in which case all you need to do is connect the CAM-12 to the power strip.

To install the adapter plug

- 1. Select the correct plug for your installation.
- 2. Slide the plug into the adapter:



Slide into

3. When it is properly seated, you will here a click:



To connect the CAM-12 to the power strip



- 1. Insert the jack connector on the power cable into the power inlet in the back of the CAM-12.
- 2. Place the CAM-12 in your selected location.
- 3. Plug the AC connector on the cable into the power strip inside the chamber. To avoid covering more than one outlet, plug it into the last outlet in the strip.
- 4. Turn the CAM-12 on.



Note: If you are installing the CAM-12 as part of the setup for a new chamber, it will not power up until the power strip is plugged into a wall outlet. This is generally not done until initial setup has been completed and you are ready to purge the chamber. If you are installing the CAM-12 in an operating chamber, it should power up immediately when you turn it on.

It takes the CAM-12 about 90 minutes to stabilize after it is initially powered up. The H_2 readings will not be valid until it does. For the first few days of operation, the O_2 readings may be higher than expected due to trapped O_2 .



2.3 Setting Operating Parameters

Your CAM-12 is ready to go "out of the box", so to speak. Unless you use a gas mix that contains CO_2 , there is no need to change the default operating parameter settings. However, you may wish to change them to ones of your choice. When you do this depends on whether you are installing the CAM-12 in a new chamber or an operating chamber.

2.3.1 Installing the CAM-12 in a new chamber

If you are setting up a new chamber, no operating parameters need to be set until after you purge your chamber for the first time unless you use a gas mix that contains CO_2 . If you use a gas mix that contains CO_2 , you must set the CO_2 compensation before you purge (see Chapter 4 for instructions).

After you purge, you can change the default alarm limits to those you wish to maintain. If you want an audible alarm, you will need to change the setting as the unit is shipped with the audible alarm disabled. Instructions for both are given in Chapter 3.



Note: If you need to set the CO_2 compensation, you may want to set the alarm parameters at this time as well.

2.3.2 Installing the CAM-12 in an operating chamber

If you are installing the CAM-12 in a working chamber, you will need to set your preferred alarm limits when you install it in the chamber, as the defaults may not be to your preference. You may also enable the audible alarm if you wish. If you use a gas mix with CO_2 , you will need to set the CO_2 compensation also. See Chapters 3 and 4 for instructions.



Setting the Alarm **3**

The alarm parameters are set through the user setup menu. You can specify the upper and lower limits for the chamber hydrogen content and an upper limit for the oxygen content. The default values are 1.5 % (low) and 4.0 % (high) for hydrogen. The default upper limit for oxygen is 350 ppm.

The CAM-12 is shipped with the audible alarm disabled. You may wish to enable it so you will know immediately if the allowable limits have been exceeded. If you find the sound of the alarm too annoying if it goes off while you are working in the chamber, you may want to disable it when you are actually working and enable it when you leave so you can hear it from elsewhere in the lab.

3.1 Using the Setup Menu

The setup menu is accessed with the **MODE** key (**ENT** will also work). Once you have accessed the menu, you can cycle through the available options.

• To access the user setup menu

1. Hold down either MODE or ENT until the following item appears in the display area:



- 2. Press MODE to display the menu options in sequence. There are 6 options:
 - 1. EXIT CAM-12 SETUP MENU
 - 2. SET CAM-12 ALARM LIMITS
 - 3. ENABLE CAM-12 AUDIBLE ALARM
 - 4. ENABLE/DISABLE CO2 COMPENSATION
 - 5. LOAD SENSOR DATA INTO MEMORY
 - 6. RECALIBRATE ZERO O2 POINT

Each time you press MODE, the next option will appear. If you keep pressing MODE, you will cycle back to option 1.

3. When the option you want appears, press **ENT**.



Important: Options 5 and 6 are maintenance functions. DO NOT USE THEM EXCEPT AS INSTRUCTED IN THIS MANUAL!

To exit from the setup menu

1. Press **MODE** to display the next menu option in sequence until option 1 appears:



2. Press ENT to exit the setup menu. You will return to the hydrogen and oxygen values.



3.2 Setting the Alarm Parameters

You may set both upper and lower limits for hydrogen and an upper limit for oxygen. The upper O_2 limit should be high enough to handle the influx of O_2 that occurs when the inner airlock door is opened. After the CAM-12 is up and running, you may want to monitor the O_2 influx to determine what is normal for your chamber and change the setting to accommodate it.

• To set the alarm limits

1. Press **MODE** from option 1 to access the alarm limit functions:

2.	SET CAM-12	
	ALARM LIMITS	

2. Press **ENT** and the prompt for the O_2 high alarm limit will appear:

02 AL	.ARM	LIM	ITS
HIGH	ALAP	RW:	350

The current high alarm limit will be displayed as ppm. The maximum allowable value is 10,000 ppm:

- To skip this prompt, press **MODE** and go to step 3.
- To change the O₂ high alarm limit, use the up and down arrow keys:



Decreases the value. Each time you press the key, the value will decrease by 5 ppm.

- Press ENT to save the value or MODE to cancel your entry and go to step 3.
- 3. When you press MODE or ENT, the prompt for the H_2 low alarm limit will appear:



The current H_2 low alarm limit will be displayed as a percent with one decimal place. The minimum allowable value is 1.5 % (the minimum percentage required for the CAM-12 to function):

- To skip this prompt, press **MODE** and go to step 4.
- To change the H₂ low alarm limit, use the up and down arrow keys:



Increases the value. Each time you press the key, the value will increase by 0.1 %.

Decreases the value. Each time you press the key, the value will decrease by 0.1 %.

Press **ENT** to save the H₂ low alarm limit or **MODE** to cancel your entry.

4. When you press **MODE** or **ENT**, the prompt for the H_2 high alarm limit will appear:





The current H_2 high alarm limit will be displayed. The maximum allowable value is 4.0 % (the maximum value allowed for the chamber to function safely):

- To skip this prompt, press **MODE** and go to step 5.
- To change the H₂ high alarm limit, use the up and down arrow keys:



Increases the value. Each time you press the key, the value will increase by 0.1 %.



Decreases the value. Each time you press the key, the value will decrease by 0.1 %.

5. Press ENT to save the H₂ high alarm limit or MODE to cancel your entry. You will return to option 2:



• To enable or disable the audible alarm

1. Press MODE as needed (once from option 2, twice from option 1) to display the audible alarm menu (option 3):



2. Press **ENT** to select the audible alarm option and the current alarm setting will be displayed:



• To enable the audible alarm, press either 🔽 or 🔺 to change the setting from **OFF** to **ON**:



• To disable the audible alarm, press either \checkmark or \checkmark to change the setting from **ON** to **OFF**:



- 3. Press ENT to save your value. You will return to menu option 3.
- 4. Press MODE until menu option 1 is displayed. Then press ENT to exit the setup menu.



Important: You must press **ENT** after entering a value to store it in the CAM-12's memory. If you press **MODE** without pressing **ENT**, the value will not be changed.





If you use a gas mix that contains CO_2 , you will need to enter the CO_2 compensation. If you do not, the CAM-12 will not be able to accurately determine the hydrogen content of your chamber.

The CO_2 compensation value is the percentage of CO_2 that is in the current gas mix you are using. If you are setting up a new chamber, the CO_2 compensation will need to be set before you purge the chamber to establish your anaerobic environment. If you are installing the CAM-12 in a working chamber, you will need to set it during installation. The CAM-12 cannot give accurate readings until the CO_2 compensation is set.

It should be noted that the actual CO_2 content within the chamber may be different than the stated tank mix. Typically, this will be between 0.5 % and 1.0 % less per 5 % CO_2 mix. This means that a full tank using 15 % CO_2 will actually only deliver about 13 % to 13.5 % CO_2 to the chamber. However, there are a number of variables that will actually determine what the real mix is, the primary one being the tank content. If you have a gas infuser, it should be noted that the gas infuser can, over time, correct this low number to something near the actual tank stated content.

4.1 Accessing the CO₂ Compensation Option

The CO_2 compensation option is accessed from the setup menu. Through this option you can enable or disable CO_2 compensation and change the CO_2 percentage in the gas mix.

▶ To access the CO₂ compensation option

- 1. Press MODE or ENT until the setup menu appears.
- 2. Press **MODE** until the CO_2 compensation option (option 4) appears:



4.2 Enabling CO₂ Compensation

Initially, CO_2 compensation is disabled and no compensation is set. If you use a gas mix containing CO_2 , you will have to enter the compensation value and also enable compensation. This value is set from the setup menu.

- ▶ To enable CO₂ compensation (compensation not currently set)
 - 1. Select the CO_2 compensation option from the setup menu:





2. Press ENT to select the CO₂ compensation menu. You will see the following prompt:

ENABLE	C02	COMP-
ENSAT	ION?	OFF

3. Use either \checkmark or \land to change the setting to **ON**:

ENABLE	C02	COMP-
ENSATI	ON?	ON

4. Press **ENT** and the following prompt will be displayed:

ENTER	C02	AM	OUNT
IN F	ERCEN	IT	0

Since CO_2 compensation has not yet been set, 0 % will be displayed as the compensation value.

- 5. Use the \square and \square keys to enter the percentage of CO_2 in your gas mix:
 - Press **** to increase the value by 1 %.
 - Press **v** to decrease the value by 1 %.
 - To increase or decrease the value rapidly, hold the key down until the value you want to enter appears. If you overshoot, use the opposite key to back up.

The maximum value allowed is 20 %. You will not be able to enter a higher value.

6. Press ENT to save your value and you will return to the CO₂ compensation menu:



Press **MODE** as often as needed until you reach option 1.

Note: If you have a CAM-12S, you will not be limited to the 20 % maximum.

4.3 Viewing or Changing the Compensation Value

Once you enter the compensation value, it is held in the CAM-12's memory. You may change the value as needed (if you use a tank with a different CO_2 compensation, for example). You do not, however, need to set it to zero if you change to a gas mix that does not include CO_2 . You simply disable CO_2 compensation (see section 4.4).

To view or change the CO₂ compensation value (compensation enabled)

1. Select the CO_2 compensation option from the setup menu:





2. Press ENT to select the CO₂ compensation menu. You will see the following prompt:

ENABLE	C02	COMP-
ENSATI	[ON?]	ON

3. Press **ENT** to display the current compensation value:

ENTER	C02	AM(DUNT
IN PE	RCE	NT 👘	15

- 4. To change the value, use the **A** and **V** keys to enter the percentage of CO₂ in your gas mix:
 - Press **** to increase the value by 1 %.
 - Press **V** to decrease the value by 1 %.
 - To increase or decrease the value rapidly, hold the key down until the value you want to enter appears. If you overshoot, use the opposite key to back up.

The maximum value allowed is 20 %. You will not be able to enter a higher value.

5. Press ENT to save the value and you will return to the CO₂ compensation menu:



Press **MODE** as often as needed until you reach option 1.

4.4 **Disabling CO₂ Compensation**

If you change to a gas mix that does not contain CO_2 , you do not need to set your CO_2 compensation setting to 0. You simply disable compensation and the current value will be ignored. The value will still be held in memory and can be reenabled the next time you use a gas mix with CO_2 , assuming that it has the same CO_2 percentage.

▶ To disable CO₂ compensation

1. Select the CO_2 compensation option from the setup menu:

4.Eh	ABLE/DISABLE
C02	COMPENSATION

2. Press ENT to select the CO₂ compensation menu. You will see the following prompt:

ENABLE CO	2 COMP-
ENSATION	? ON



3. Use either or to change the setting to **OFF**:

ENABLE	C02	COMP-
ENSAT	10N?	OFF

4. Press **ENT** to save your value and you will return to the CO₂ compensation option:



Press **MODE** often as needed until you reach option 1.



Reminder: You do not have to set the compensation value to 0 when you disable CO_2 compensation, as it will be ignored automatically when compensation is disabled.



Sensor Recalibration 5

Periodically, the H_2 and O_2 sensors will need to be recalibrated. Sensor recalibration requires specialized equipment, so it is performed by Coy Laboratory Products at the factory. Since the calibration information is stored in the sensors, only the sensors need to be sent to Coy, not the entire CAM-12.

You must schedule all sensor recalibrations with Coy Laboratory Products. The process takes about 2 weeks (depending on lab volume at the time).

5.1 Calibration Frequency

The required calibration frequency depends upon the environmental conditions in your chamber and may vary by sensor type (oxygen or hydrogen). We suggest that you schedule your first calibration for both sensors about one year after purchase. After they have been recalibrated, you can compare the "before" and "after" calibration values that are supplied by Coy when your sensor is returned and adjust your next calibration interval accordingly:

- If the values are not significantly different, increase the calibration interval for your next calibration by 50 % (e.g., 18 months).
- If the values are significantly different, decrease the calibration interval for your next calibration by 50 % (e.g., 6 months).
- If it's somewhere in between, choose a mid-point (± 9 months).

It should be noted that the two sensors will not necessarily follow the same recalibration schedule.

You should continue to monitor the "before and after" values for each sensor for subsequent recalibrations and adjust the interval accordingly. As the sensor ages, you may find that more frequent calibration is necessary. However, as long as the sensor is operating correctly and has shown no signs of failing (see section 7.1 of Chapter 7), you may assume it does not need replacement.

5.2 Removing a Sensor

The sensors are accessed from the back of the CAM-12. They are clearly labeled and can easily be removed with their handles:



You do not have to send the entire CAM-12 back to Coy, only the sensor that needs calibration.



Metal plate Metal plate Circuit board Circuit board Handle

All electronic devices can be sensitive to damage by static charge. Do not touch any part of the sensor except the hndle or the metal plate the handle is attached to:

AVOID TOUCHING THE CIRCUIT BOARD!

To remove a sensor

- 1. Turn off the power to the CAM-12 with the switch in the rear of the unit. Be careful not to disconnect the power connector.
- 2. Using the handle, pull the sensor out of the CAM-12:



3. Pack the sensor carefully in antistatic packaging for shipment.

Important: Ensure that there is sufficient padding to withstand rough handling during shipping, as damage during transportation is the responsibility of the sender.

5.3 Using the Chamber without the Sensor

You must schedule all sensor recalibrations with Coy Laboratory Products. The two sensors are not interdependent, so if only one of the sensors is being recalibrated, the other will continue to deliver valid readings. Sensor recalibration does not affect chamber use, as the chamber can very well function without the CAM-12.

The absence of the O_2 sensor does not affect H_2 sensor operation. You can continue to monitor your hydrogen levels with the CAM-12 as you normally do while the O_2 sensor is being recalibrated.



If the H_2 sensor is being recalibrated, you can still use your chamber. Use the approximate time interval that normally occurs between purges as a guide in determining when you should refresh the hydrogen and perform the number of repetitions you generally perform for your chamber. The other alternative would be to place another device that measures hydrogen in your chamber and use its readings. If the O_2 sensor is not being calibrated, you can still use it to monitor the oxygen content. If it rises significantly, it may signify a reduction in hydrogen content.

If you also have a gas infuser, turn the gas infuser off. You will not be able to use it during the time your H₂ sensor is being recalibrated, as gas infuser operation is totally dependent on H₂ readings from the CAM-12. Therefore, you will need to refresh the hydrogen manually. Every 5 days is probably a good interval to keep the appropriate H₂ balance. Instructions are given in 6.3.3 of Chapter 6 in the *Vinyl Aerobic Chamber Operation Manual*.

5.4 Reinstalling the Sensor

When your sensor returns from Coy, you simply reinsert it into the CAM-12.

To reinstall the recalibrated sensor

1. Carefully remove the sensor from the anti-static bag by its handle:



Do not touch the circuit board or any other part of the sensor except for the metal plate in front.

- 2. Slide the new sensor into the CAM-12 along the plastic tracks until its connector meets the mating connector.
- 3. Push the sensor in by its handle until the metal plate is aligned with the rear panel of the CAM-12. This will require a small amount of force.

If you have a gas infuser, you will also need to check the gas infuser's calibration with the recalibrated sensor and update the gas infuser's H_2 and O_2 values if necessary. This is particularly important for the H_2 sensor, because the gas infuser and the CAM-12 must be in sync for the gas infuser to maintain appropriate hydrogen levels in the chamber. Instructions can be found in the gas infuser instruction manual.



Miscellaneous Maintenance Operations

A healthy CAM-12 needs very little maintenance, aside from periodic recalibration of the sensors.

6.1 Checking Ambient Air Calibration

We recommend that you check the ambient air calibration once a year. If the unit does not return the expected values, it may indicate that one or both sensors are not functioning properly or serve as an indicator of future problems. You will also need to check it in some troubleshooting procedures.

To check ambient air calibration

- 1. Turn the CAM-12 off and disconnect it from the power strip.
- 2. If you have a gas infuser, disconnect its Ethernet cable from the CAM-12.
- 3. Remove the CAM-12 from the chamber through the airlock and place it on a nearby flat surface.
- 4. Plug the CAM-12 into a power source and turn it on.
- 5. Turn CO_2 compensation off.
- 6. Allow the CAM-12 to stabilize for 90 minutes.
- 7. Check the H_2 and O_2 readings. They should be as follows:

Sensor	Reading
H ₂	0.3 % ± 0.2 %
O 2	Less than 50 ppm

If they are not, do one of the following:

- If you are performing this procedure as a periodic maintenance check, contact Coy for advice.
- If you are performing this procedure because one of the sensors has exhibited symptoms of failure (section 7.1 of Chapter 7), continue with the instructions in that section.

6.2 Recalibrating the Zero O₂ Point

There is very seldom, if ever, a need to recalibrate the zero O_2 point. Zero O_2 is determined when your unit is initially calibrated at the factory and recalculated whenever it is sent in to be recalibrated. Arbitrary recalibration of the zero O_2 point can adversely affect the operation of the CAM-12, as the relationship between zero O_2 and the factory-calibrated values will, in all probability, change and it may no longer display the correct values.



If you have reason to believe that your unit's zero O_2 setting needs recalibration, call Coy for advice. Do not perform this function unless Coy technical personnel give you the go-ahead to do so!

• To recalibrate the zero O₂ point

- 1. Access the setup menu.
- 2. Press **MODE** as often as needed until option 6 appears:

6.	RECAL	IBRAT	E
	ZERO	02 P0	INT

3. Press **ENT** to select option 6. The following prompt will appear:

RECAL	.IBRATE	ZERO
- 02	POINT?	NO

• To recalibrate the zero O₂ point, press either \frown or \checkmark to change the setting to **YES**:

RECAL	JIBRATE	ZERO
- 02	POINT?	YES

• Press **ENT** to save the value.

Note: If you entered this function by mistake, press **MODE** to return to option 6 and once again to display option 1.



Sensor Replacement

In most cases, you can expect the CAM-12 sensors to last several years. However, the actual life span of a sensor depends on the environment where it is used, as the cleanliness of your operation, the chemicals you use, and the procedures you perform can affect the sensing pellet adversely. The O_2 sensor is typically more sensitive to environmental factors.

7.1 Symptoms of Sensor Failure

The following symptoms could indicate a failed or failing sensor:

- The sensor readings are clearly erroneous.
- The sensor is not providing any readings at all.
- Your calibration intervals get suddenly shorter and your chamber's environment has not changed significantly.

The following symptoms in particular may indicate a failing O_2 sensor:

- The H_2 level is dropping faster than usual while the O_2 level appears to remain unchanged.
- The O_2 level does not increase temporarily when the airlock door is opened.

If you are not sure the sensor itself is the cause of the problem, contact Coy for assistance. To aid us in properly diagnosing the problem, please provide us with the following information:

- 1. What is the serial number of the monitor?
- 2. When was the sensor last calibrated?

Note: The last calibration date is recorded on the sensor. To view the date, pull the sensor out. Be sure to turn the power off first!

- 3. What is the O_2 reading in the chamber?
- 4. What is the H_2 reading in the chamber?
- 5. What is the percent of gas mix used for H_2 , N_2 , and CO_2 (if any)?
- 6. Does the gas mix contain argon?
- 7. If CO_2 is present in the gas mix, what is the CO_2 compensation setting on the CAM-12?
- 8. Is the CAM-12 used in a Coy chamber?
 - If it is not, what is the brand name of the chamber?
 - If it is used in a Coy chamber, is the top is collapsing?
- 9. Remove the CAM-12 from the chamber and place it in room air for 1 hour:

Note: If you are using a CO₂ compensation setting, turn it off for this test

- What is the O₂ reading in room air?
- What is the H₂ reading in room air?



7.2 Replacing a Sensor

If you have determined that a sensor has failed, you can simply order a new one from Coy. You do not have to return the old one, as it is no longer functional. When your new sensor arrives, you will need to remove the old sensor and replace it with the new one.

The calibration information for the new sensor is stored in the sensor's on-board memory. Before the new sensor can be used, the calibration information must be transferred to the CAM-12.

To install the new sensor

- 1. Turn off the power to the CAM-12 with the switch in the rear of the unit. Be careful not to disconnect the power connector.
- 2. Using the handle, pull the failed sensor out of the CAM-12 and set it aside:



3. Carefully remove the new sensor from the anti-static bag by its handle:



Do not touch the circuit board or any other part of the sensor except for the metal plate in front.

- 4. Slide the new sensor into the CAM-12 along the plastic tracks until its connector meets the mating connector.
- 5. Push the sensor in by its handle until the metal plate is aligned with the rear panel of the CAM-12. This will require a small amount of force.
- 6. When the new sensor is properly seated in the CAM-12, turn the CAM-12 back on. Then follow the instructions below to transfer the calibration information to the CAM-12.



To transfer calibration information

1. Hold down either **MODE** or **ENT** until the first menu option appears in the display area:



2. Press **MODE** to display the menu options in sequence until option 5 appears:

5.	LOAD	SEN	ISOR
	DATA	TO	MEMORY

Continue

nan

3. Press **ENT** to select the option. The following message will appear:

followed by:

	_
ΞN	

- To continue, press ENT
- To cancel, press MODE, ∇ , or \triangle .
- 4. A warning about overwriting memory will be displayed, followed by:

οI

anч

ENT=0	Cont:	inue	
any	othe	er≔Ex	it

- To continue, press ENT
- To cancel, press MODE, ▼, or ▲
- 5. In somewhat rapid succession the CAM-12 will display the following:

DATA	LOAD	
SUCC	ESSFUL	

followed by:



The CAM-12 will return to displaying the oxygen and hydrogen levels.



Important: If you have a gas infuser, you will also need to recalibrate the values on the gas infuser to match the new sensor. For instructions, refer to the gas infuser instruction manual.



Appendixes

To use this table, find the problem you want to diagnose. Then follow the check list questions and arrows to diagnose the problem.

	Problem	Check List	Probable Cause	Action
1	The CAM-12 display is blank.	Is the CAM-12 plugged into the power strip?	The CAM-12 has no power.	Plug the CAM-12 into the power strip.
		Is the blue light on the power cable lit?	The cable may need replacing. <i>Note:</i> Older models may not have a blue light on the power cable.	Check the power cable connections between the CAM-12 and the power strip. If there are no loose connections, contact Coy for a replacement.
		Is the power LED on the CAM-12 lit?	The CAM-12 is not turned on.	Turn the CAM-12 on.
			The display (part number 8250015) needs to be replaced.	Contact Coy for a replace- ment.
2	The H ₂ level is low or dropping.	Is there a leak in your chamber? Yes No	The leak is most likely the cause of the H ₂ level drop. Note: For instructions on detecting leaks, refer to your chamber operation manual.	 Repair the leak and reactivate the chamber: If you have a gas infuser, the hydrogen level will be adjusted automatically. If you do not have a gas infuser, refresh the chamber hydrogen content.
		Do you have a gas in- fuser?	You may not be purging often enough to maintain your desired H ₂ level.	Shorten the interval be- tween purges. If the prob- lem persists, contact Coy.



	Problem	Check List	Probable Cause	Action
2	(continued)	Is the Ethernet cable between the CAM-12 and the gas infuser connected?	There is no communica- tion between the two components.	Reconnect the Ethernet cable.
			Your gas infuser flow rate may be too low to main- tain the specified H ₂ level consistently. If your purges time out frequent- ly, this is most likely the cause.	Try increasing the gas in- fuser flow rate. If this does not solve the problem, contact Coy for advice.
3	The chamber's hy- drogen level is too high.	Do you have a gas in- fuser?	You may have purged too long when you last refreshed the hydrogen.	 Monitor the CAM-12 H₂ level: If you just refreshed the hydrogen, it should drop to a normal level. If it is above 4.0 % and remains so, contact Coy.
		Is the H ₂ value dis- played on the CAM-12 in sync with the value displayed on the gas infuser?	The H ₂ offset value on the gas infuser may be incorrect.	Recalibrate the gas infu- ser. Instructions are given in the gas infuser manual.
			Your H ₂ sensor may be failing.	Refer to Chapter 7 for more information.
4	The H ₂ sensor read- ings are out of range.	Check the H ₂ content in your chamber with another device that measures H ₂ . Do the readings match?	If the second reading is within range, the sensor most likely needs recali- bration.	Send the sensor to Coy for recalibration (see Chapter 5 for more infor- mation).
			If the readings match or are very close, the cause is most likely elsewhere in the chamber.	 If the readings are above 4.0 %, follow the instructions in problem #3. If the readings are below 2.5 %, follow the instructions in problem #2.



	Problem	Check List	Probable Cause	Action
5	The H ₂ sens*or read- ings are unstable.		The sensor is either fail- ing or has failed.	Replace the sensor (see section 7.2 of Chapter 7). Contact Coy if you have questions.
6	The O ₂ sensor read- ings are unstable.		The sensor is either fail- ing or has failed.	Replace the sensor (see section 7.2 of Chapter 7). Contact Coy if you have questions.
7	The readings from the O ₂ sensor are above your high limit.	Check the O ₂ content in your chamber with another device that measures O ₂ . Do the readings match?	If the second reading is within range, the sensor most likely needs recali- bration.	Send the sensor to Coy for recalibration (see Chapter 5 for more infor- mation).
		Operate the airlock to anaerobic and open the inner door. Does the O ₂ reading in- crease?	Your CAM-12 may be positioned in a dead spot.	 Move the CAM-12 to another location closer to the airlock door where there is good air- flow. Operate the airlock to anaerobic again and open the inner door again. If the O₂ reading in- creases, the CAM-12's old position was in a dead spot. Relocate the CAM-12 to a place with better airflow.
		Is the O ₂ level consist- ently above your maxi- mum limit? Yes No	Either the inner airlock door seal is leaking or the catalyst has lost its effectiveness.	 Clean the seal to ensure that no dirt particles are present to cause a leak. Check the inner airlock door seal for leaks and fix any problems. Monitor the CAM-12. If the oxygen level does not return to an acceptable level, change your catalyst Stak-Paks. If changing Stak-Paks does not help, test the catalyst for effective-ness and replace it if necessary.
			Since there are no ap- parent external causes and the sensor does not appear to be failing, your sensor probably needs recalibration.	Have the sensor recalibra- ted (see Chapter 5 for more information).



	Problem	Check List	Probable Cause	Action
8	The H ₂ and/or O ₂ values displayed on the CAM-12 do not agree with the gas infuser values.	Is the Ethernet cable between the CAM-12 and the gas infuser connected?	There is no communica- tion between the two de- vices.	Restore the connection between the CAM-12 and the gas infuser.
			The gas infuser needs to be recalibrated to the CAM-12.	Recalibrate the gas infu- ser. Refer to the gas infu- ser manual for instruc- tions.

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CAM-12 Specifications

Physical and Electrical Specifications		
Footprint size	6.25 in × 6.25 in (15.9 cm × 5.9 cm) 39.0 in ² (252.0 cm ²)	
Overall dimensions	6.25 in × 6.31 in × 3.35 in (15.9 cm × 16.03 cm × 8.52 cm)	
Weight	~1.7 lb (0.77 kg) ~3.0 lb (1.36 kg) shipping weight	
Power requirements	~15W,100 VAC – 240 VAC, 50 Hz – 60 Hz	
Operating environment	15 °C – 42 °C Up to 90 % RH, non-condensing	

Functional Specifications			
Full scale measurement range	O ₂ : 0 ppm – 2000 ppm (readings may be displayed for higher levels)		
	H ₂ : 0 % – 10 % (capable of higher values. However, the unit should not be used in flammable mixtures.)		
Resolution	O ₂ : 1 ppm from 0 ppm –1500 ppm 5 ppm from 1500 ppm – 2000 ppm		
	H ₂ : 0.1 % from 0 % – 5.0 %		
Accuracy	O ₂ : 30 ppm up to 700 ppm		
	H ₂ : 1.0 % H ₂ up to 10.0 % H ₂		
Operating temperature & humidity range	Ambient to 42 °C and non-condensing		
Zero drift due to temperature	O ₂ : < 1 ppm / °C	The factory calibration temperature	
	H ₂ : < 0.1 % / °C	is 29 °C.	
Output display noise level	O ₂ : +/- 1 ppm		
	H ₂ : +/- 0.1 %		
Oxygen alarm	• User-settable high alarm from 0 ppm to 10,000 ppm in 5 ppm in- crements		
	 Flashing LED and message 	je	
	Audible tone (can be silenced by the operator)		
Hydrogen alarm	• User-settable high and low alarms between 1.5 % and 4 % in 0.1 % increments		
	Flashing LED and message		
	Audible tone (can be siler	nced by the operator)	
CO ₂ compensation*	User-settable from 1 % to 20	%	

*If you are using a gas mix containing anything other than H_2 , N_2 and < 20 % CO₂, consult Coy Laboratory Products, as this is outside of the standard CAM-12 range and the CO₂ compensation function may be potentially inaccurate or nonfunctional, depending upon the gas mix. However, a CAM-12S may be appropriate for your application, as it can be calibrated for use with gas mixes containing argon and/or > 20 % CO₂.

Construction Materials		
Enclosure	ABS plastic, 94 V-0	
Front, rear, and sensor panel	Aluminum	



Construction Materials (continued)		
Sensor handles	Anodized aluminum	
Front panel overlay	Polycarbonate	
Rear panel overlay	Vinyl	
Display face	Glass	



Parts List

Part Number	Description
6250000	Anaerobic Monitor (CAM-12) ¹
6250015	Display, CAM-12 Replacement
6250100	Anaerobic Monitor (CAM-12S) for specialty gases ²
6251000	Oxygen Replacement Sensor for CAM-12
6251500	Oxygen Sensor Recalibration for CAM-12
6252000	Hydrogen Replacement Sensor for CAM-12
6252100	Hydrogen Replacement Sensor for CAM-12S
6252500	Hydrogen Sensor Recalibration for CAM-12
6252600	Hydrogen Sensor Recalibration for CAM-12S
6253000	Power Supply

¹The CAM-12 is designed for gas mixes containing ONLY H₂, N₂, and < 20 % CO₂.

 2 The CAM-12S can be programmed for gas mixes containing argon and/or > 20 % CO₂.

