

# EMS

EMISSIONS SYSTEMS, INC.

## Portable Exhaust Gas Analyzer Operators Manual

Model # 5002 (4 & 5 Gas) Model # 8000 (Wireless)



**Emissions Systems, Inc.**

**480 Wright Dr.**

**Lake In The Hills, IL. 60156**

**Voice & Fax: 1-847-669-8044**

**Website: [www.emsgas.com](http://www.emsgas.com)**

**Email Address: [sales@emsgas.com](mailto:sales@emsgas.com)**

# Table of Contents

1. Technical Data .....	Page 3
2. General Information.....	Page 4
3. Button Operation Model 5002.....	Page 5
4. Rear Panel Description.....	Page 6
5. Gas Analyzer Preparation.....	Page 7
6. Gas Analyzer Operation.....	Page 8-10
7. Calibration.....	Page 11-12
8. Error Messages.....	Page 13
9. Maintenance.....	Page 14-23
10. Diagnostic Accessories & Diagnostics.....	Page 24-25
11. Warranty.....	Page 26

# Technical Data

Power: 10 -16 VDC  
Ranges: HC: 0 - 2000 ppm (0-20,000 ppm High Range)  
CO: 0 - 10%  
CO2: 0 - 20%  
O2: 0 - 25%  
NO: 0 - 5000 ppm ( Nitric Oxide ) \*

- Warm up: Less than 5 minutes
- Display resolution: HC: 1 ppm vol.  
CO: 0.01% vol.  
CO2: 0.1% vol.  
O2: 0.01% vol.  
NO: 1ppm\*
- Digital display: Four 0.5" LCD
- Accuracy ( Bar 97 EPA ASM ) HC: 4 ppm HC  
CO: 0.06% CO  
CO2: 0.3% CO2  
O2: 0.1% O2  
NO: 25 ppm\*
- Drift: Zero and span drift are less than  $\pm 0.6\%$  of full scale for the first hour and less than  $\pm 0.4\%$  of full scale per hour thereafter.
- System response time: Bench: 1.5 Sec/25 ft. hose 5 sec. to 90% of final reading
- Ambient conditions: 35F (2C) to 120F (45C), rel. humidity 0-98%
- Sample hose:25 feet ( 7.5 m) with QD coupling /200 F Degrees Max.
- Sample probe:Stainless steel 1200 Degrees F ( replaceable flex tip )  
Mass: Approx.: 10 LBS. ( 4.5 Kg )

The AMBII I.R Bench from Sensors Inc. was designed to meet the following standards for emission inspection and maintenance programs:

- BAR97
- OIML R 99 class I
- OIML R 99 class 0
- ISO 3930

# General Information

Congratulations on your purchase of an EMS Exhaust Gas Analyzer. This product is designed to assist you in the process of diagnosing driveability issues. With proper care and maintenance this product will provide accurate information for many years to come.

**IMPORTANT NOTE:** Moisture is the biggest concern for prolonged good operation of the gas analyzer, always allow the analyzer to dry out by running the unit with ambient air. This may take only one auto shut down cycle or as much as 1 hour or more! The analyzer will not be harmed by powering up and letting it sit in standby mode till ready to use. Running the analyzer with ambient air in-between sampling and after a day of testing, is the best thing to do for prolonged life of the bench and components not allowing the carbon build up due to moisture!

Figure 1 highlights the features and buttons available on the Model 5002 front display area. The HC will display up to five digits and is in ppm, CO is in percentage, CO2 is in percentage, and NOX is in ppm. O2 is in percentage and you can change to either LAMBDA or AFR. The buttons will be described later in this manual.

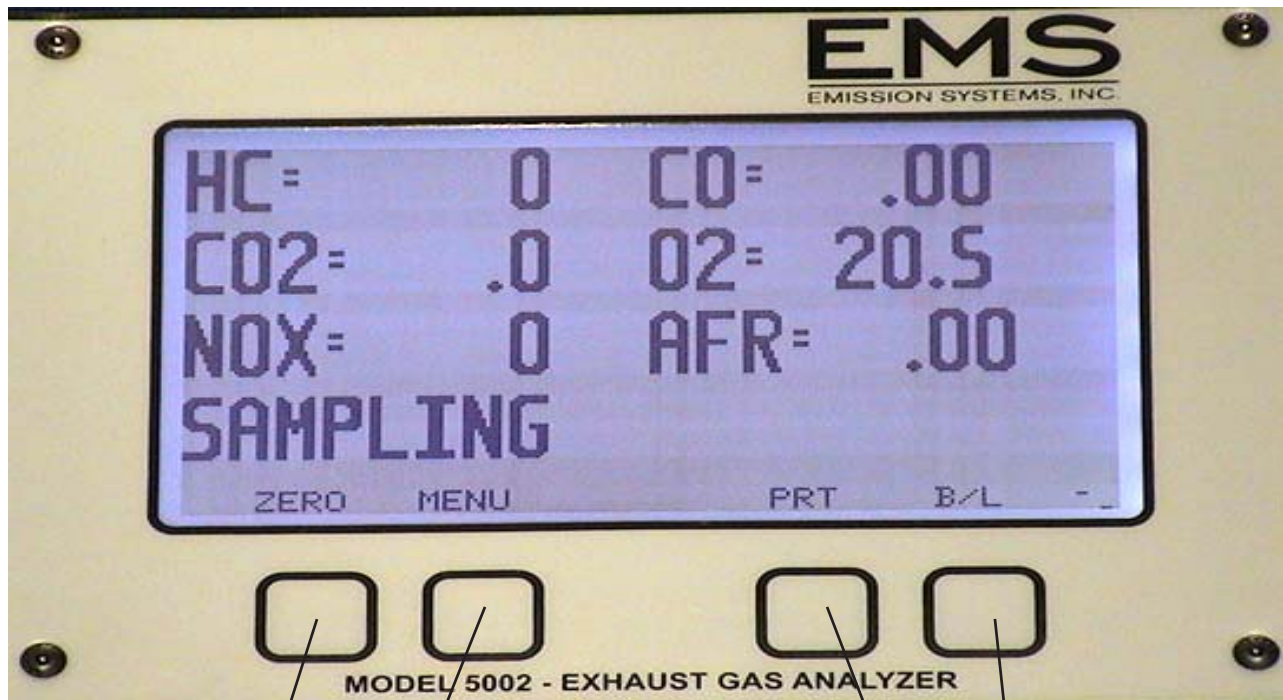


Figure 1

**ZEROING  
BUTTON**

**MENU  
BUTTON**

**BACK LIGHT  
BUTTON**

**PRINT  
BUTTON**

# Button Operation Model 5002

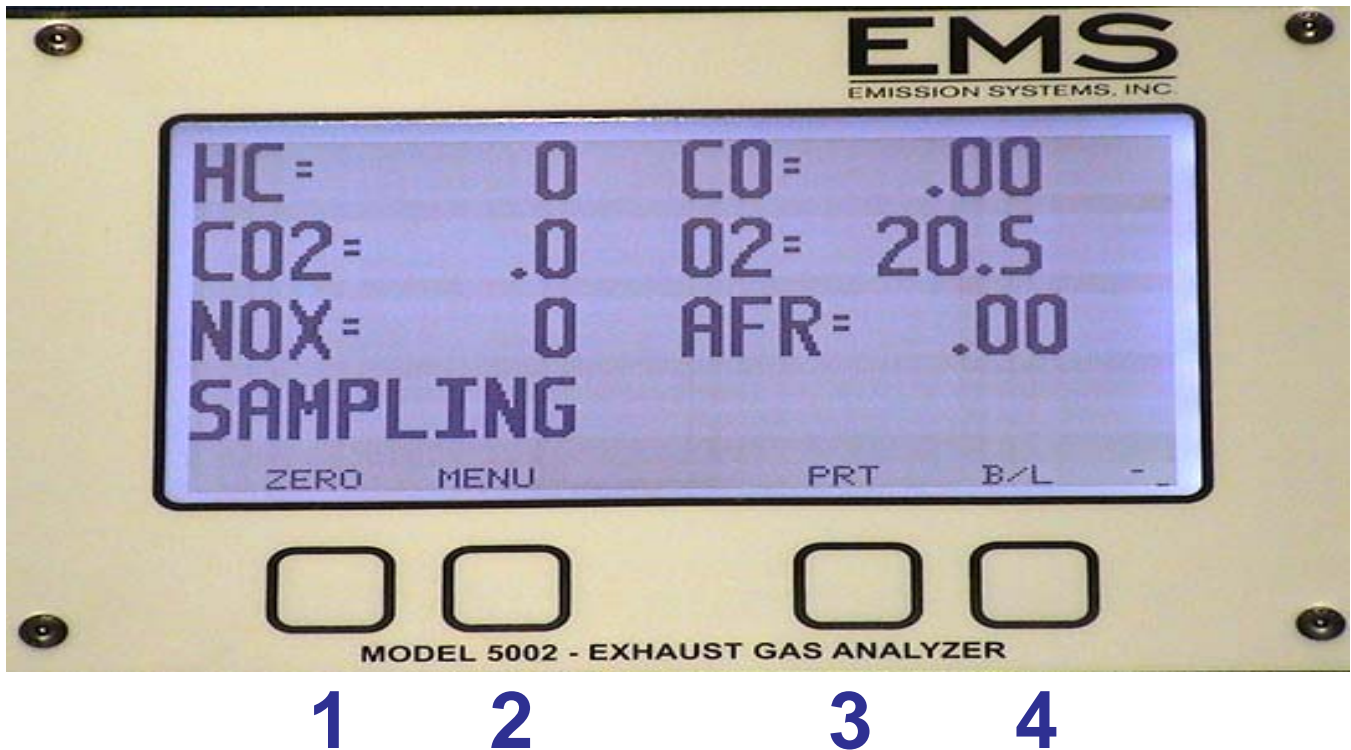


Figure 2

Figure 2 shows the control buttons on the front of the gas analyzer:

1. The “Zero” button has two functions.
  - a. Zeroing the gas analyzer as needed during use.
  - b. Restarting the pump following automatic shutdown.
2. The “Menu” button has several functions.
  - a. Access calibration screen
  - b. Change between AFR/Lambda
  - c. Access ERROR message screen
3. The “Print” button is used to print a snapshot of gas reading information. A parallel printer will need to be connected to the 25 pin connector on the back of the analyzer.
4. The “B/L” button is used to turn the back light off and on. The back light default is in the on position for all screens. You can turn the back light off on the main sampling screen only.

# Rear Panel Description

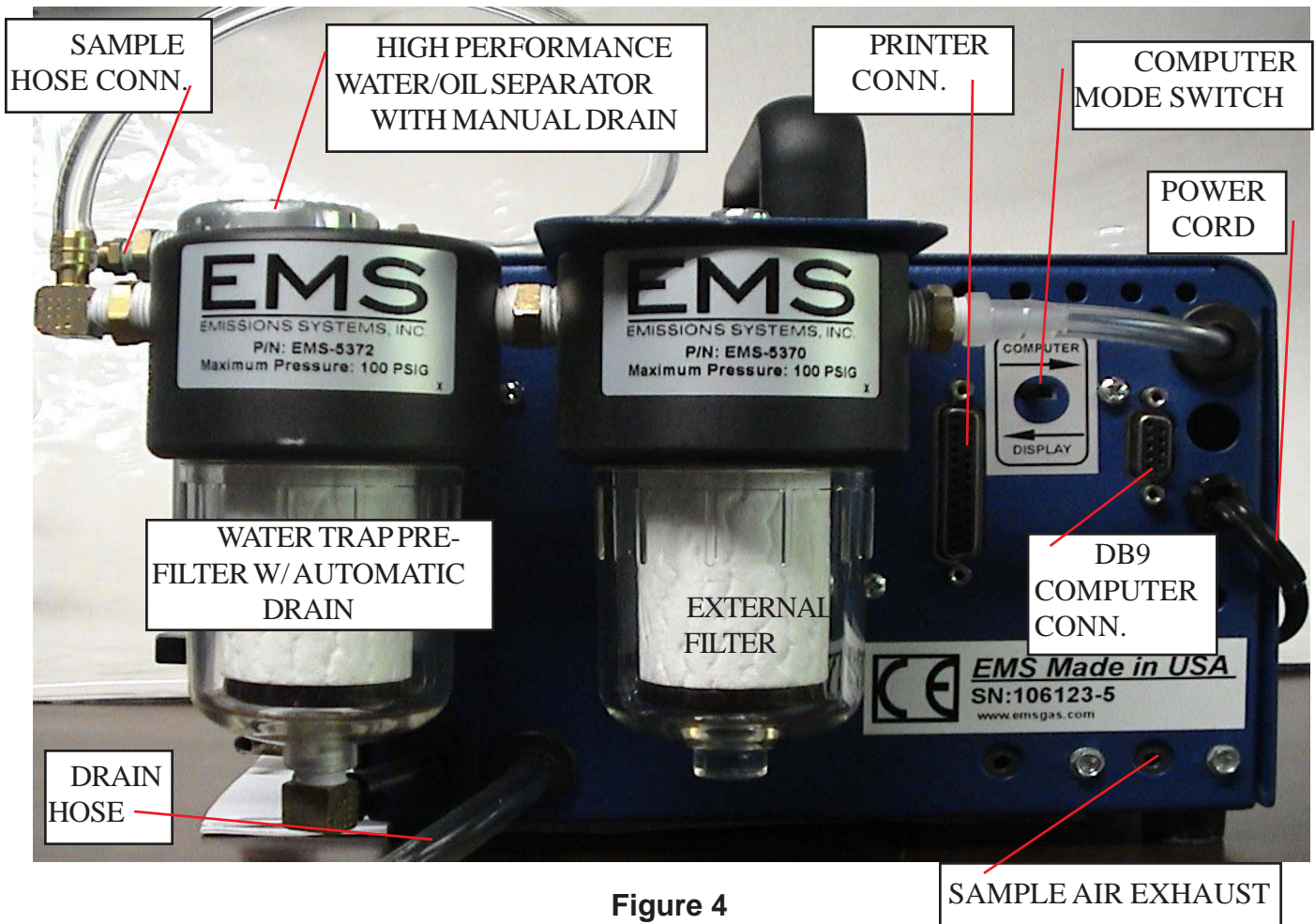


Figure 4

Figure 4 shows the view from the back of the analyzer. The specific details of each item are described below, starting from the upper left corner of the analyzer and working clockwise. **NOTE: The standard EMS filter arrangement has been changed and must be upgraded.**

**Sample Hose Connection:** The sample hose connection uses a quick disconnect coupler. This is helpful for storage of the analyzer and maintenance of the sample hose.

**Display Control Switch:** The display switch has two basic positions, Computer and Display. The switch should normally be in the right position "Display". If you are using PC software for display or recording, the switch should be in the left position. **Note: The switch direction is based upon you looking at the display. The switch can be changed any time during operation with out turning the power off.**

**DB9 Computer Connection:** This is used to connect the analyzer to your PC/laptop or for the wireless antenna.

**Power Cord:** Connect to the appropriate voltage supply source.

**Sample Air Exhaust:** The analyzer discharges the sample air out these ports. **Do not plug.**

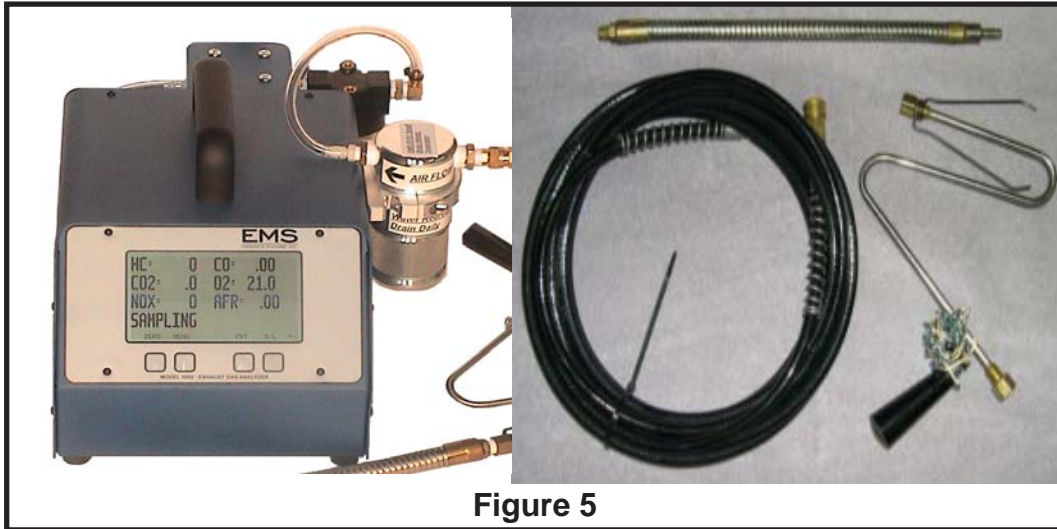
**Printer Connection:** Connect to an standard parallel printer.

**Drain Hose:** This hose will drain moisture collected during the sample process.

**External Filter, Water Trap, Water Separator:** This is the primary sample filter. Filter maintenance will be discussed in the Maintenance section of this manual.

# Gas Analyzer Preparation

Getting started is simple. Figure 5 shows the items you should have received in the shipping container. **Note: This description applies to the Model 5002 analyzer with a display, see Page 16 for instructions on setting up a Model 5002-W & 8000 bluetooth wireless analyzer.** The first step is assembling the sample hose. Once the sample hose is assembled, connect the hose to the sample hose fitting on the back of the analyzer.



The next step is providing power to the analyzer. The analyzer should be connected to a 12v DC power source. You have several options:

1. Cigarette Lighter Connection - Figure 6 (Supplied by EMS)
2. Cigarette lighter to battery connection with adapter - Figure 7 (Optional)
3. AC to DC Power Supply - Figure 8 ( 3 AMP min.) Optional)



Figure 6



Figure 7



Figure 8

The Power LED in the lower left corner of the display will light once voltage is applied.

# Gas Analyzer Operation

Immediately after applying power, the analyzer will display EMS warming up (Figure 9) for a set amount of time. This starts the analyzer warm-up mode and will continue for approximately 5 to 10 minutes, depending on ambient temperature. Once the warm-up mode is complete, the analyzer will go into the "ZEROING" mode to set all the gases to zero (Figure 10).

Then the gas sample mode will display all the gas values (Figure 11). **Note: If the display only shows "COMPUTER MODE" (Figure 12), check the "Display/Computer" switch on the back of the analyzer. The switch should be in the right position.**

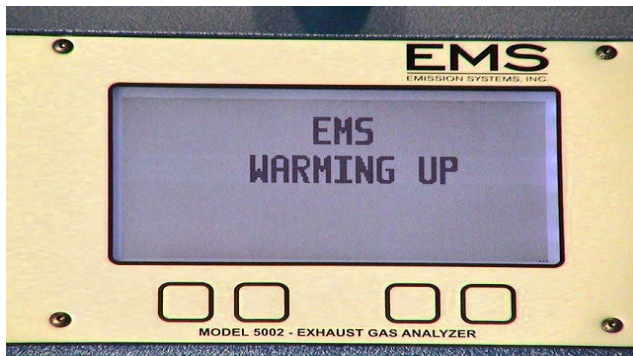


Figure 9

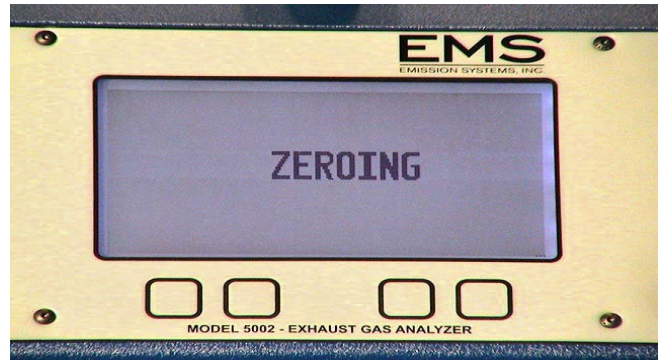


Figure 10

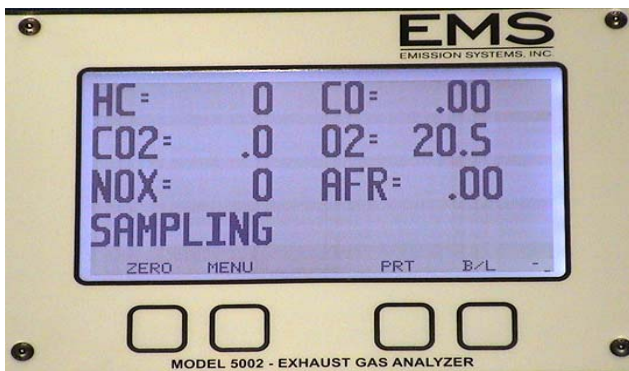


Figure 11

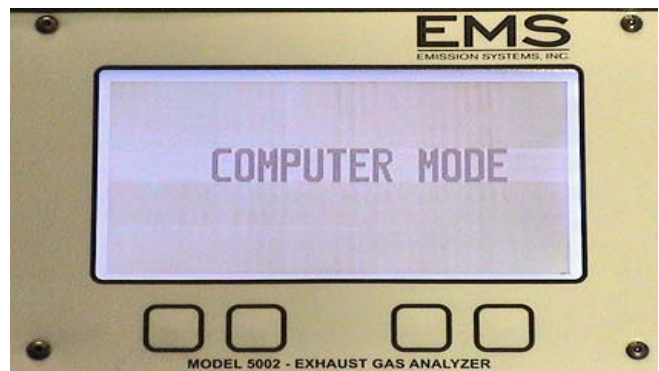


Figure 12

Once the analyzer has completed the warm-up the sample hose can now be connected and the probe placed in the tailpipe.

**Caution: Exhaust gases pass through the gas analyzer and vent through its exhaust. Use the analyzer in a well vented area.**

**Note: Gas analyzers are designed for diagnostics and verification of repairs. The sample probe should be removed from the tailpipe after taking readings to prolong analyzer life and save on maintenance costs.**

The pump will continue to operate as long as the CO<sub>2</sub> level is above 3%. The pump will automatically shut-off after the CO<sub>2</sub> level has been below 3% for approximately 15 minutes.

The pump can be turned back on by depressing the "ZERO" button.

**Caution: Monitor the clear hose between the filter assembly and the cabinet. If moisture appears in the tubing, remove the probe from the tailpipe and disconnect the sample hose from the analyzer immediately. Use compressed air to remove moisture from the sample hose. Operate the analyzer without the exhaust hose connected, until the moisture is removed. It may be necessary to replace the filters. Once the lines are dry, normal operation can continue.**



# Gas Analyzer Operation

**Manual Zero:** Any time after warm-up, you can zero the gas readings and calibrate O<sub>2</sub> by pressing the “ZERO” button (Figure 13). When this operation is being done “ZEROING” will be displayed (Figure 14). The analyzer will shut down automatically if no CO<sub>2</sub> is detected after approx. 15 min. If the pump is off, “STAND BY” will be displayed (Figure 15). Push the “ZERO” key and the pumps will automatically start. **Note: The sample probe should be removed from the tailpipe, when the unit is being zeroed.**

**Automatic Zero:** The analyzer will automatically zero as needed. If the analyzer does not sense exhaust gases, the automatic zero procedure will begin. “ZEROING” will be displayed during this process. If exhaust gases are present, the analyzer will wait until the gases are clear.

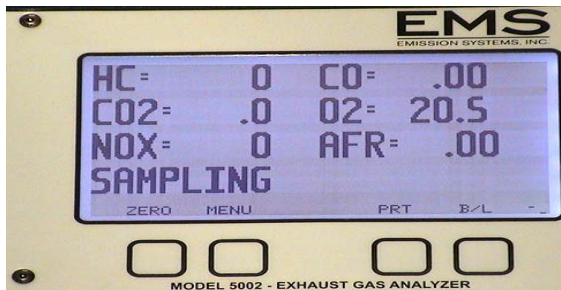


Figure 13

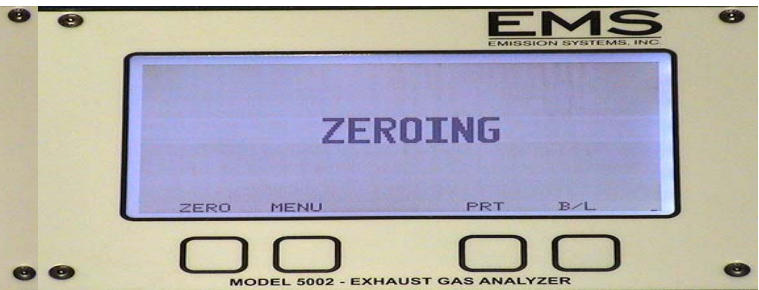


Figure 14

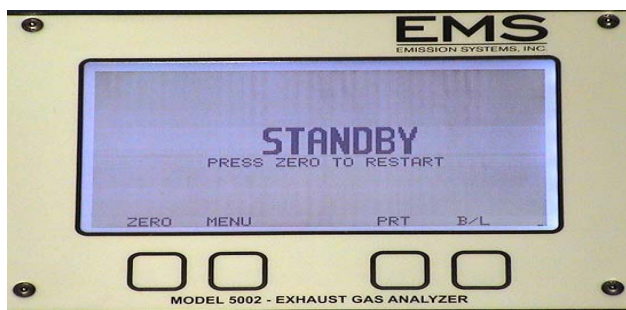


Figure 15

**Low Flow Warning:** If gas flow into the bench becomes restricted due to clogged filters or restricted sample hose, the **screen will indicate “LOW FLOW”** (Figure 16). Check the sample hose for restrictions or kinks. If no problems are found, check the filters. Begin with the External filter and then check the Internal filter. Keep in mind the gas flows through the inside to the outside of the filter. The filter may look clean on the outside, but be clogged on the inside. The best check is to look at the bottom of the external filter. If the **LOW FLOW** continues to be displayed, the solenoid valve will need to be replaced due to carbon build-up.

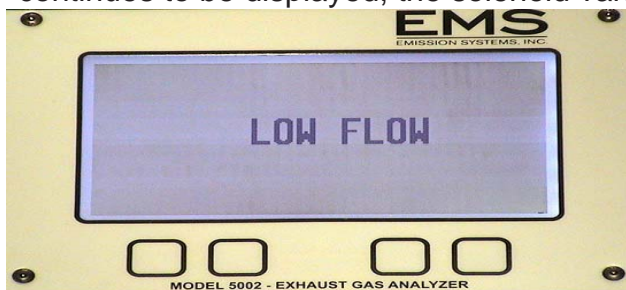


Figure 16

# Gas Analyzer Operation

**Printing:** Connect a parallel printer to the 25 pin connector on the back of the analyzer. Press the "P" button to begin the printing process. The print button prints the gases as displayed when depressed, Figure 17 shows how the gases will be printed. **Note: To avoid print communication problems, connect and power on the printer first, then provide power to the analyzer.**

## FOUR GAS ANALYSIS

CUST: \_\_\_\_\_

DATE: \_\_\_\_\_

VEH: \_\_\_\_\_

VIN: \_\_\_\_\_

TECH: \_\_\_\_\_

CO2 = 000.0  
CO = 00.00  
O2 = 020.8  
HC = 0004  
LAMBDA = 00.00

## FIVE GAS ANALYSIS

CUST: \_\_\_\_\_

DATE: \_\_\_\_\_

VEH: \_\_\_\_\_

VIN: \_\_\_\_\_

TECH: \_\_\_\_\_

CO2 = 000.0  
CO = 00.00  
O2 = 020.7  
HC = 0013  
NOX = 0010  
AFR = 00.00

Figure 17

**Computer Connection:** PC software can enhance the diagnostic benefits of the analyzer. The analyzer can be connected to a PC using a 9 pin serial communications cable (DB9). EMS offers software that will display the sample gases, graph data and record information. Using the portable gas analyzer with a laptop will help diagnose problems that only occur when driving. The EMS software will be discussed later in this manual.

# Calibration

The gas analyzer should be checked periodically for accuracy, for normal shops using the analyzer this would be approx. 6-9 months. For higher useage approx. every 3 months.. The analyzer can be calibrated in the field. In order to perform the calibration procedure you will need a bottle of calibration gas and a calibration kit assembly (Figure 18). The calibration assembly can be purchased from EMS or your local distributor. The recommended calibration gas is Bar 97 Low and can be purchased from EMS, Part No.EMS-5502, BAR 97 LOW



Figure 18

## Calibration Procedure:

1. To begin the calibration procedure depress the "Menu" button on the sampling screen. The main menu screen will show you the "CAL" button (Figure 19). Press the "CAL" button and the display will show the stored calibration gas values (Figure 20), compare these numbers to the calibration gas bottle. If the numbers do not match, change the values using the "L" and "INC" buttons. The "\_" indicates which # will change, the "L" button move the \_ left to the next digit, the "INC" changes the value. This process is continued until all the calibration gas values are correct. At this point press the "CAL" button.



Figure 19

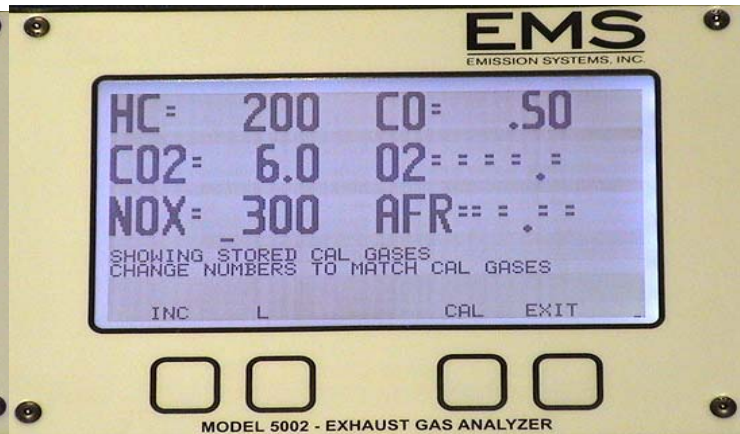


Figure 20

# Calibration

2. The screen will display “sending cal data” (figure 21). Once the calibration gas values have been sent to the bench, the calibration procedure can continue.

3. The screen will display the gases (Figure 22) and the message to connect the CAI gas. Connect the hose from the regulator assembly to the sample hose inlet. Open the valve on the gas bottle. (**Note: Do not adjust the regulator, this was preset to the appropriate flow rate.**) Once the calibration gas values stabilize, depress the “CAL” button. The analyzer will capture the gas concentrations and perform the final calibration procedure. The calibration process is now complete.

4. The screen will display a message “calibration complete” (Figure 23). If the calibration procedure was canceled, the screen will display a message “calibration canceled” (Figure 24), if the calibration was unsuccessful, an error message will be displayed on the main sampling screen. If this occurs, go to the menu screen and errors. one of the gases will show up as “HC or CO or CO2 C Warn”. Go back to the main sampling screen and “ZERO” the unit to clear the error. After either situation, perform the calibration procedure again. If the problem continues, contact EMS or your local distributor.

**NOTE:** The hydrocarbon gas in the calibration cylinder is propane, and the gas analyzer generally measures hexane. This is problematical, as hexane is a molecule that is about twice as large as propane. This means that the typical HC reading on the gas analyzer (hexane) should be about ½ the propane value on the calibration cylinder tag. That is, if the tag states that the cylinder contains 1200 ppm propane, then an analyzer measuring HC as hexane will report HC at about 600 ppm.

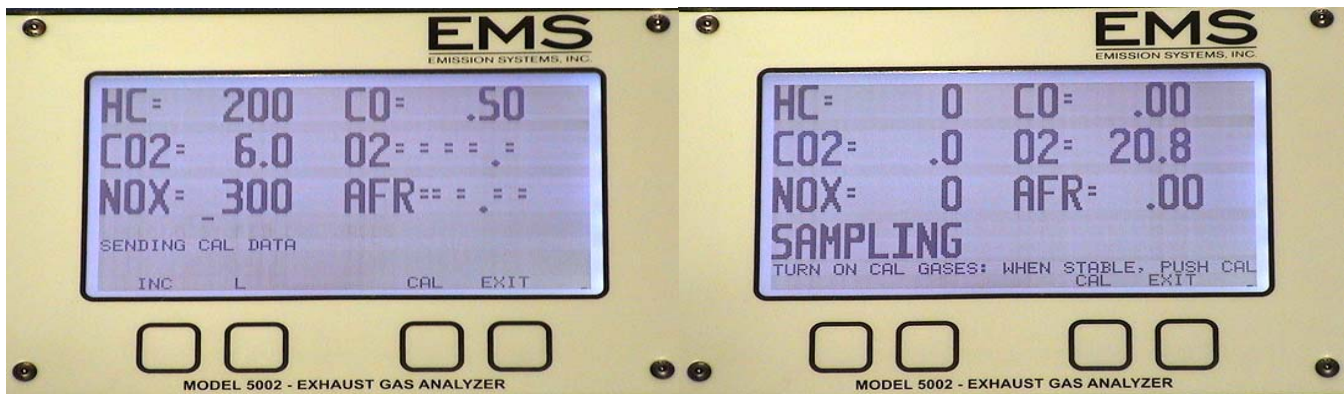


Figure 21

Figure 22

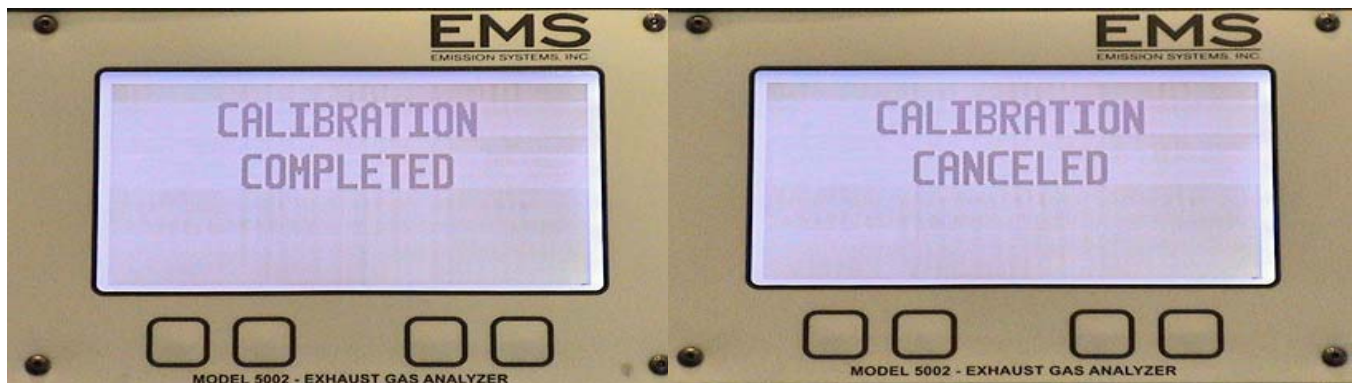


Figure 23

Figure 24

# ERROR MESSAGES

If the optical bench detects any errors during operation, a message will be displayed on the sampling screen "SEE ERRORS" (Figure 25). If this message comes up, depress the menu button, and the main menu screen will be displayed (Figure 26). Depress the "errors button" and the errors screen will be displayed (Figure 27). At this point you can see any errors being sent from the optical bench. The errors that would possibly be displayed are:

- HC C WARN: This could be a bad calibration or bad optical bench.
- CO C WARN: This could be a bad calibration or a bad optical bench.
- CO2 C WARN: This could be a bad calibration or a bad optical bench.
- NOX C WARN: This could be a bad calibration or a bad NOX sensor.
- O2 C WARN: This would be a bad O2 sensor.

If an error message does appear and is just bad calibration or something the optical bench detected as not normal, depress the "ZERO" button on the main sampling screen to clear the error. If the error message doesn't go away, either the bench has an error or is bad or one of the sensors ( O2, NOX) need to be replaced.

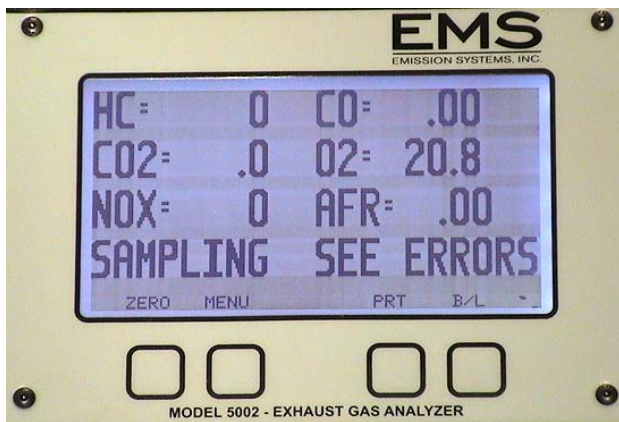


Figure 25

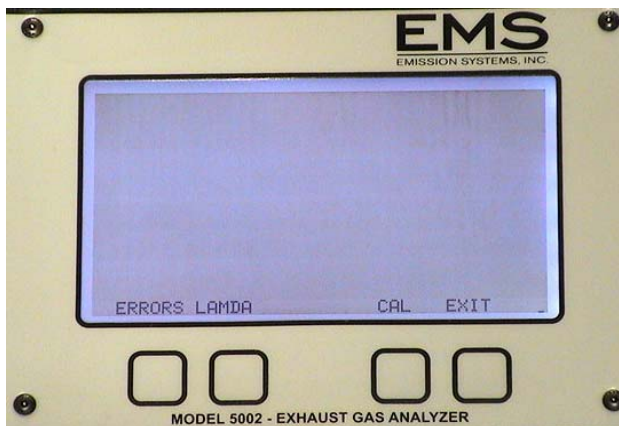


Figure 26

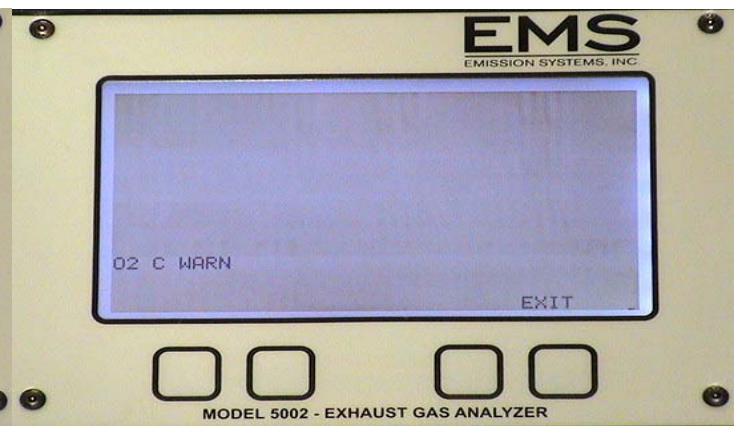


Figure 27

# Maintenance

Maintenance of the analyzer is essential for accuracy and optimal performance. The filters, hoses and connections should be checked on a regular basis. Maintenance of the gas analyzer is simple and only requires a few minutes, but the time you spend will pay off, with accuracy during the diagnostic process. Specific maintenance procedures are described below:

## External Analyzer Maintenance:

1. The exhaust sample hose should be cleaned once a week (Figure 28). Disconnect the hose from the filter assembly and blow shop air through the hose. This will remove carbon, dirt and moisture that collects inside the hose. The exhaust probe tip should be checked for leakage around the flex tube. Exhaust gas should only enter through the holes in the exhaust tip end. If the flex tube is worn and loose, oxygen may enter around the worn flex tube. A simple way to check the flex tube is blowing shop air through the hose and spraying soapy water around the flex tube. If bubbles are seen the exhaust probe tip should be replaced. The sample hose and plumbing should be checked for leaks. Checking for leaks is simple, with the analyzer in sample mode, place a rubber cap over the probe tip holes. Within a few seconds the analyzer display should read low flow. If this does not occur a leak is present in the system. Check the sample hose for leaks first, check the external filter next and finally the internal hoses. Contact EMS or your local distributor for assistance if required.

2. The External Filter should be checked often (Figure 29 NOTE: This filter has been discontinued as of Aug 2017 see pg. 16 for replacement filter ). This filter catches most of the particles and impurities. The life-cycle of this filter depends on usage, but the average shop replacement is 3 months. To determine the correct replacement interval for your shop, check the filter once a month. Keep in mind the bottom port of the External Filter has a 1/4 plastic cap that must be re-used or replaced when a new filter is installed. Not plugging the bottom of the filter will cause O<sub>2</sub> contamination. Another way to keep track of replacement intervals is to write the replacement date on the filter with a marker.

## Filter Replacement:

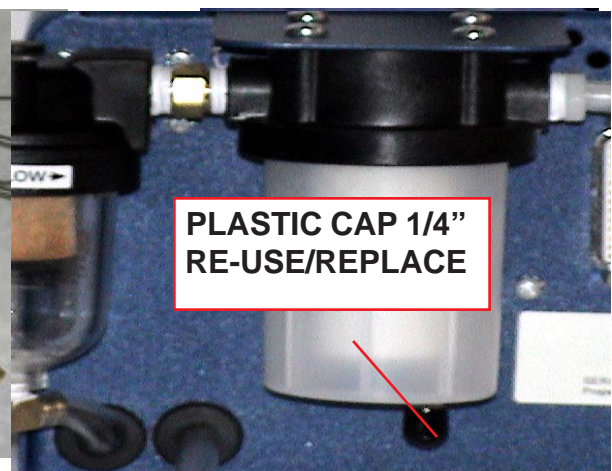
- a. Remove Plastic Cap from the bottom of the filter.
- b. Rotate the filter counter-clockwise to remove.
- c. The new filter o-ring should be lubricated prior to installation.
- d. Re-install the filter assembly clockwise hand tight, replace Plastic Cap.

Figure 28



Sample Hose Assembly

Figure 29



External Filter Discontinued!

# Maintenance

## Internal Analyzer Maintenance:

The maintenance items discussed below are located inside the analyzer. The outside cover will need to be removed to gain access. The cover is held in place with 12 screws, 5 on each side panel and two at the top behind the handle.

3. The Internal Filter is located inside the analyzer (Figure 30). This filter is designed to catch particles missed by the External Filter. The replacement interval varies, but a good starting point, is replacing the filter every other time you replace the External Filter. Note: This filter is directional, check the arrow on the filter.

4. Oxygen Sensor should be replaced as required (Figure 31). Replacement intervals will vary, but the average life-cycle is 9 to 12 months. A fault code will flash when the sensor needs to be replaced, the analyzer cannot be used until the sensor is replaced. To avoid unexpected down time, the O<sub>2</sub> sensor display can be monitored, if the reading drops below 17.0% the O<sub>2</sub> sensor should be replaced or with a volt meter when below 5 MV. Average O<sub>2</sub> sensor life is approx. 1 year. The oxygen sensor is located inside the analyzer.

- Remove the analyzer cover. Note: The power should be disconnected prior to cover removal. The sensor is located at the left rear of the analyzer (Figure 31).
- Disconnect the two wire connector from the sensor. Rotate the sensor counter-clockwise.
- Install the new sensor, rotate clockwise until the o-ring seats. Re-connect the two wire connector. Replace the cover and power the analyzer. No additional steps are required.

5. NO<sub>x</sub> Sensor should be replaced as required (Figure 32). Replacement intervals will vary. A error will message will be displayed when the sensor needs to be replaced. The average life of a NO<sub>x</sub> sensor is approx. 3 years.

- Remove the analyzer cover. Note: The power should be disconnected prior to cover removal. The sensor is located at the left rear of the analyzer (Figure 32).
- Disconnect the four wire connector from the sensor. Rotate the sensor counter-clockwise.
- Install the new sensor, rotate clockwise until the o-ring seats. Re-connect the four wire connector. Replace cover and power the analyzer. No additional steps are required.

**Figure 30**



**Internal Filter**

**Figure 31**



**Oxygen Sensor**

**Figure 32**



**NO<sub>x</sub> Sensor**

# Maintenance



**Figure 33**



**Figure 34**

The NEW EMS filter Housing assembly ( Fig 33) is part #: EMS-5370 (External particulate) and Water Trap assembly is part # EMS-5372 (EMS-5371 coalescing filter). Maintenance procedures are described below:

1. The External Filter should be checked often (Figure 34; EMS-5371). This filter catches most of the particles and impurities. The life-cycle of this filter depends on usage, but the average shop replacement is 3 months. To determine the correct replacement interval for your shop, check the filter once a month (EMS-5070). The water trap filter is the same coalescing filter (Figure 35; EMS-5372) with the sample gas flow from inside out, so NO contamination can be visibly seen as with the external filter. The water trap filter is a disposable filter and should be changed every 3 months.

## **Filter Replacement:**

- a. Remove the filter bowl turning clockwise to loosen the bowl.
- b. Rotate the filter retainer below the filter clockwise to remove.
- c. Replace the filter and re-screw in the retainer turning counter-clockwise.
- d. Re-install the filter bowl tightening counter clockwise.
- e. The water trap bowl is the same as the external filter only that the water drain hose needs to be disconnected and re-connected after filter replacement.
- f. Do a leak check to make sure of NO leaks.



# Maintenance



The above pic shows a dual filter arrangement for industrial testing, NEW EMS filter Housing assembly is part #: EMS-5370-Dual Assy. 2x (External particulate) and Water Trap assembly is part # EMS-5372 (EMS-5371 coalescing filter). Maintenance procedures are described below:

1. The External Filter should be checked often (Figure 36; EMS-5371). This filter catches most of the particles and impurities. The life-cycle of this filter depends on usage, but the average shop replacement is 3 months. To determine the correct replacement interval for your shop, check the filter once a month (EMS-5070). The water trap filter is the same coalescing filter with the sample gas flow from inside out, so NO contamination can be visibly seen as with the external filter. The water trap filter is a disposable filter and should be changed every 3 months.

### **Filter Replacement:**

- a. Remove the filter bowl turning clockwise to loosen the bowl.
- b. Rotate the filter retainer below the filter clockwise to remove.
- c. Replace the filter and re-screw in the retainer turning counter-clockwise.
- d. Re-install the filter bowl tightening counter clockwise.
- e. The water trap bowl is the same as the external filter only that the water drain hose needs to be disconnected and re-connected after filter replacement.
- f. Do a leak check to make sure of NO leaks.

# Maintenance

The parts in need of consistent interval change out are the external & internal filters and the O2 sensor. The intervals, tools needed, part #'s, and other maintenance tips for instrument life are described below:

## 1) Internal Filter; part #: EMS-5093; 90 DAY (3 month min.) Interval.

- TOOLS: 2 mm key style allen wrench, needle nose pliers, wire/zip tie strap cutter .
- Remove the 11 or 12 #6 button head screws with 2mm allen. Be careful not to strip allen head when loosening & ONLY FINGER tight when tightening.
- Remove the cover, int. filter located in the back right, cut off zip ties and use needle nose pliers to remove the hose. Install new filter and attach two (2) new zip ties on each end to ensure no LEAKS. Attach cover back on the main housing.

## 2) External Filter; part #: EMS-5371; 90 DAY (3 month min) Interval.

- TOOLS: None required.
- External filter is located on the back side angle bracket, remove the filter bowl from the filter head, turn clockwise to loosen and remove. Loosen the retainer holding the filter turning clockwise. replace the filter, screw filter retainer counterclockwise to tighten. Make sure the filter goes on straight, this is the most common point for leaks! Screw on filter bowl turning counterclockwise. Do a leak check after any filter change.

## 3) O2 Sensor; part #: EMS-5060; 12-18 month (1- 1 1/2 Year) Interval or ERROR code O2 C WARN 5002 model.

- TOOLS: 2 mm key style allen wrench
- Remove the 11 or 12 #6 button head screws with 2mm allen. Be careful not to strip allen head when loosening & ONLY FINGER tight when tightening.
- Open O2 container, remove plastic sticker on bottom of sensor, and turn upside down back inside the container. Allow to breath for 15-20 minutes. Remove the cover, O2 located in the back left. Unplug the three pin connector on the top of the sensor, loosen turning counter clockwise and remove. Install new sensor, marking install date, turning clockwise into the sensor block. Re-attach the three pin connector to the sensor. Attach cover back on the main housing.

These three items must be regularly changed out per the above intervals. Other items not as critical or more complicated are described below and should be maintained at the intervals indicated.

# Maintenance

## **4) NOX Sensor; part #: EMS-5065; 6 month min. re-calibration for accuracy and 2-3 Year Interval** change out, or ERROR code NOX Z WARN 5002 model.

- NOX Sensors should re-calibrated a min of 6 month intervals. New NOX sensors require re-calibration as well as NOX accuracy checks.
- NOX Sensor NOX C WARN model 5002 will appear if the sensor is bad.
- TOOLS: 2 mm key style allen wrench
- Remove the 12 #6 button head screws with 2mm allen. Be careful not to strip allen head when loosening & ONLY FINGER tight when tightening.
- Remove the cover, NOX located in the back left. Unplug the four pin connector on the top of the sensor, loosen turning counter clockwise and remove. Install new sensor, marking install date, turning clockwise into the sensor block. Re-attach the four pin connector to the sensor. Attach cover back on the main housing.

## **5) 5) Water Trap Assembly Filter; part #: EMS-5371; 3-6 month min. Interval**

- Water Trap Assembly filter is a disposable filter, with the sample flow from inside/out so you will not see contamination. Carbon build up could cause a LOW Flow error. Unscrew the filter bowl turning clockwise to loosen. Unscrew the filter retainer turning clockwise, remove the coalescing filter. Install new filter, tighten filter retainer counterclockwise, Screw on the filter bowl turning counter clockwise to tighten. NOTE: The air flow through this filter is from the inside/out, so to inspect the filter contamination, the coalescing filter must be removed to inspect.

## **6) General Every Day Operation Tips for Instrument Life.**

- Turn the 4 or 5 gas on in the morning in display mode and allow the instrument to warm up and go into auto shut down mode. This will keep the bench ready for use when needed, with out having to wait for the instrument to warm up. This will not damage the unit and help save time when your ready to use the analyzer.
-

# Maintenance

- Moisture is your BIGGEST enemy** for this instrument life! If any moisture build up is visible in the analyzer clear hoses, allow the instrument to dry out by running ambient air through the analyzer continuously for a minimum of 30 minutes or until NO moisture is present in the hoses.
- Sample Hose and S.S. probe should be blown out with compressed air at the end of the day. Moisture build up will leave carbon build up inside the hose and deteriorate the hose causing leaks. Clean sample hose once or twice a year by soaking in hot soapy water, blow out with compressed air.
  - Leak Check should be performed after every filter change out to insure no O<sub>2</sub> leaks causing invalid gas readings. Plug the inlet quick connector on the analyzer for an internal leak check. The model 5002 will show LOW FLOW on the screen and the pumps will shut off, and if the pumps stay off 30 seconds there are no leaks.
  - Leak Check your sample hose and probe every filter change out only after you have verified no internal instrument leaks. Connect the sample hose to the analyzer and plug the end of the probe with the red/black plastic cap supplied by EMS. The same low flow codes will come up as described above and the low flow should hold for 30 seconds.
  - Leak check failures would be if the 5002 model pumps turn on during the 30 seconds. The most common leak location is at the external filter head, this can be checked with a butane lighter to see if your HC reading increases. Make sure the filter is screwed on straight and the O-Ring is moistened. If the leak is at the internal filter, twist the filter in the hose and make sure zip tie is tight or replace. If a leak is found in the sample hose or probe, ORDER NEW parts. Sample Hose part #: EMS-5096-25, Handle part #: EMS-5097, S.S. Probe part #: EMS-5098.
  - **Two Cycle gasoline testing:** Two cycle fuel is much more of a maintenance issue than standard gasoline or diesel testing. In order to determine a good maintenance schedule, check the filters once a week with a visual inspection. If a yellowish build up in the external filter is present, this is oil contamination, and will possibly give you inaccurate readings due to HC residual build up. This would be seen after ZEROING the unit, and HC readings being displayed without taking an exhaust sample. This would indicate filter change out is required. For the pre-filter water trap sintered bronze filter, any yellowish or oil build up would require cleaning with hot soapy water. Make notes of how many tests have been performed so you can get a bench mark for your filter change out or cleaning. If you are not changing out and cleaning the filters, this could result in a bench failure due to oil contamination build up inside the IR bench. Also be careful of how long you sample this exhaust. A longer test can result in contamination, so only allow the unit to sample as long as needed, and afterwards, always allow the unit to purge out any contamination by running fresh air for as long as possible, or a minimum of 15 minutes or auto shut down in stand by mode. This is the best thing to do after sampling any engine and will prolong the analyzer component life.

# Maintenance

**OIL/WATERSEPARATOR:** The new High Performance Oil Water Separator, EMS-5151, has been added to remove more oil/water before the automatic drain water trap assembly. The separator should be drained daily opening a ball valve to drain. The separator will work better in colder weather, to enhance the capability of the separator in hot humid weather, EMS recommends to make a home made oil/water condenser to cool the sample with a simple ice bath. This can be done with a plastic cup filled with ice around the reservoir. This simple trick will be very effective in pulling more moisture out of the sample, very similar to the official state run facilities with DYNO testing. Give it a try and you will see a huge difference!



**Small Body Oil/Water Separator EMS-5151**



**Large Body Oil/Water Separator EMS-5150**



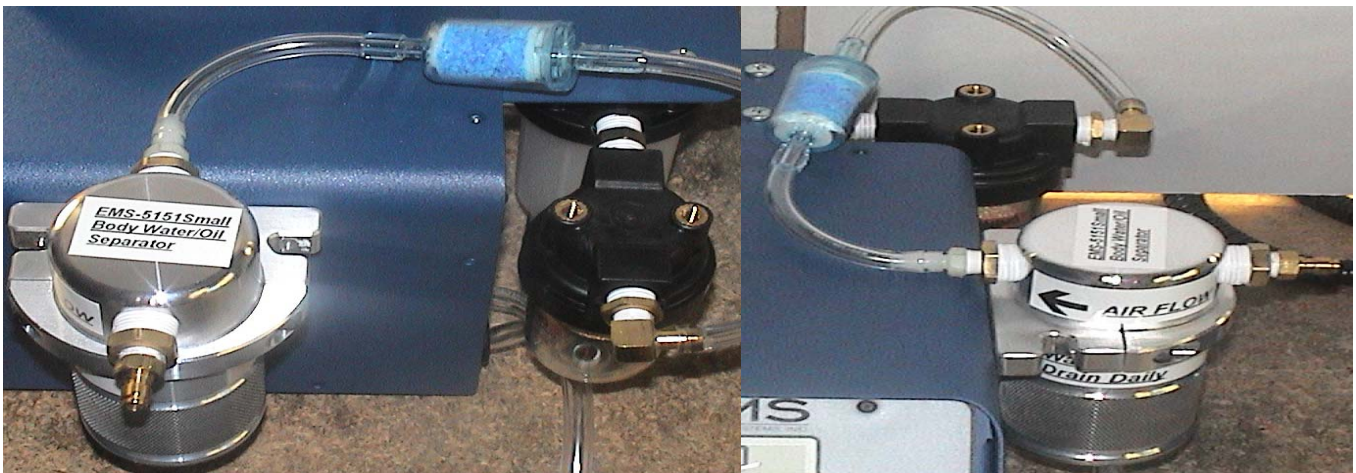
**Oil/Water Separator with Plastic Cup Ice Bath**

# Maintenance



## Oil/Water Separator with Can Cooler Ice Bath

- **Diesel Testing when Urea is used to reduce NOX (SCR) :** The EMS analyzer is fully capable of diesel testing. Your HC reading will only be accurate for Hexane gas, so a Smoke/Opacity meter would be required to check PM. All other gases will be accurate including NOX. For diesel systems using the SCR system that sprays UREA in the exhaust to eliminate NOX, this chemical reaction produces Ammonia. The presence of ammonia in vehicle exhaust presents some problems for gas analyzers and sampling systems. Ammonium salts readily precipitate in the exhaust sample stream, which can contaminate FID and optical gas bench components. To protect the AMBII bench, a special version of the inline filter element, EMS-5093-CS, has been developed that will absorb the ammonia before entering the analyzers. This would need to be added in the field, or ordered as an extra accessory for any new units.



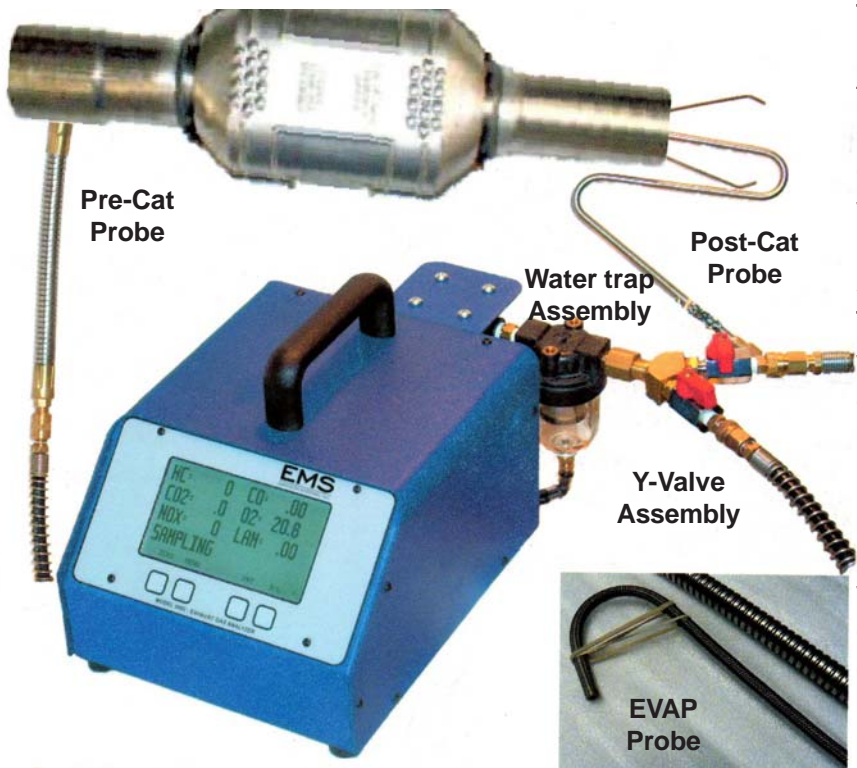
# Maintenance

## Spare Parts and Accessories

### Part No:    Description

EMS-5060	Oxygen Sensor
EMS-5065	NOx Sensor
EMS-5093	Internal Filter
<b>EMS-5095</b>	<b>External Filter</b>
EMS-5096	Exhaust Hose
EMS-5097	Exhaust Handle
EMS-5098	Exhaust Probe
EMS-5210	Power Cord
EMS-5500	Gas Calibration Kit
EMS-5020	12V Sample/Water Pump
EMS-5031	12V HD Solenoid Valve
EMS-5040	Optical Bench
EMS-5041	Repaired Optical Bench
EMS-5050	Flow Switch
EMS-5250	Display PC Board
EMS-5200	Front Membrane Switch
EMS-5072	HD Water Trap Assembly
EMS-5256	AC/DC Power Supply 5.5 AMP
EMS-5257	USB to Serial Adapter 13"
EMS-5258	DB9 Serial Cable 6 ft Long
EMS-5259	DB9 Serial Cable 15 ft. Long
EMS-5098-1/4-20	Exhaust Probe 1/4-20 Threaded End
EMS-5099	EVAP/Small Engine/Motor Cycle Probe
EMS-5151	Small Body Oil/Water Separator
EMS-5093-CS	Inline Absorber Filter for Diesel/Urea
EMS-5370	External Filter Bowl.
EMS-5371	External Filter/Water Trap
EMS-5372	Water Trap Bowl

# Diagnostic Accessories



The EMS water trap assembly (Fig. 1) is essential for road testing, Dyno use, Diesel testing, motor cycle testing, and two cycle fuel testing. This accessory will prolong the analyzer life by pulling more moisture out of the sample gas.

The Y-Valve assembly (Fig. 2) was designed for pre-catalytic converter testing. With the real benefit being able to hook up both pre & post cat sample hose & probes. And switch between both readings at the analyzer, which saves you time. Also check back pressure on the pre-cat side at the analyzer with our inline pressure gauge (Fig.3)

EMS also offers a pop nut insert tool kit (Fig.4) for the pre-cat probe w/ a 1/4"-20 threaded end. The kit includes the pop nut insert tool, 1/4-20 mandrel, box of 40 nuts, 50 pc's 1/4-20x3/8" stainless steel SHCS, 25/64" drill bit. The EMS EVAP probe,( small engine) (Fig. 5) is 3/16" O.D. and very flexible to help find radiator or exhaust leaks in tight spaces.



Figure 1



Figure 2



Figure 3



Figure 4

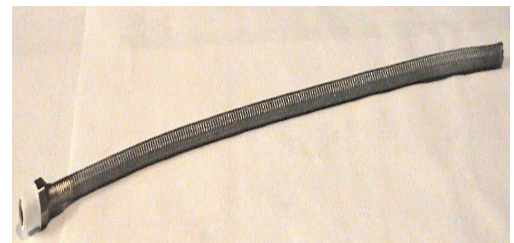


Figure 5



# Diagnosics

Exhaust gas analyzers can be used to diagnose driveability concerns, ignition system problems, fuel management issues, engine mechanical problems, excessive emissions problems and many other vehicle systems. Vehicle inspection and preparation are the keys to getting the most out of your gas analyzer.

1. A visual inspection should include; vacuum hoses, air filter, exhaust system, air management system, emission related components, etc. If the malfunction indicator light (MIL) is illuminated, check the diagnostic trouble codes (DTC's) prior to testing.
2. Vehicle preparation:
  - a. The engine should be at operating temperature prior to testing.
  - b. Start the engine and run until the cooling fan cycles on and off. Another option is using a scan tool to check the engine coolant temperature (ECT). The temperature should exceed 190 degree F.
  - c. After the engine is warm, increase the engine speed to 2500 RPM for approximately 60 seconds.
  - d. Return the engine speed to idle.
  - e. Insert the sample probe and begin your diagnostics.

Understanding the relationship of exhaust gases will enhance your ability to diagnose

<b>EFFECTS OF ENGINE CONDITIONS ON EMISSIONS</b>					
	HC	CO	CO2	O2	NOx
Ignition misfire	Very high	Lower	Lower	Much higher	Much lower
Compression loss	Very high	Lower	Lower	Higher	Much lower
Rich fuel mixture	Higher	Very high	Lower	Lower	Much lower
Lean fuel mixture	Higher	Much lower	Lower	Higher	Much lower
Very lean fuel mixture	Very high	Very low	Lower	Very high	Higher
Slightly retarded timing	Lower	No change	No change	No change	Much lower
Very retarded timing	Higher	No change	Much lower	No change	Higher
Advanced timing	Higher	No change	No change	No change	Much higher
EGR operating	No change	No change	Lower	No change	Much lower
EGR leaking	Higher	No change	No change	No change	No change
AIR system defective	Higher	Higher	Lower	Much lower	No change
Catalytic converter dead	Higher	Higher	Lower	Higher	Higher
Exhaust leak	Lower	Lower	Lower	Higher	No change
Worn rings/valve guides	Higher	Higher	Lower	Lower	No change
Flat camshaft lobe	No change	No change	Lower	No change	No change

Exhaust gas analyzers can be used to diagnose other vehicle systems. Here are a few suggestions:

1. Evaporative emission system operation.
2. Evaporative emission system leaks.
3. Fuel odors in and around the vehicle.
4. No-Start conditions.
5. Engine combustion gases in the cooling system.
6. Air injection emission systems.
7. Exhaust system leaks.
8. More...

# Warranty

- Emission Systems products are guaranteed to be free of defects in material and workmanship to the original purchaser, for a period of **one year** from the date of purchase. Probes and electrical leads are warranted for ninety days. The optical bench is warranted for **18 Months**.

- This warranty does not apply to products which have been:

- 1) Altered
- 2) Improperly installed, maintained or repaired.
- 3) Damaged by accident, negligence or misuse.

- **THIS WARRANTY EXCLUDES ALL INCIDENTAL OR CONSEQUENTIAL DAMAGES**

- If you suspect there is a problem with your unit, the operating manual should be reviewed first. Your particular problem may be covered in the operating instructions. If the issue cannot be resolved, contact EMS or your authorized distributor for additional information. If the unit requires repair, contact EMS to obtain a Return Authorization Number. The unit should be properly packaged and should include all accessories. The unit should be returned in the shortest possible timeframe at customers cost, EMS will return the unit with the same shipping.

- In the USA and Canada call: 847-669-8044 for assistance.

- Outside USA call your authorized distributor for assistance.

## Warranty Information:

- Date of Purchase: \_\_\_\_\_

- Serial Number: \_\_\_\_\_