AC

Operation Manual

ECOM America
1628 Oakbrook Drive
Gainesville, Georgia 30507
Tel: 770.532.3280
Fax: 770.532.3620
info@ecomusa.com
www.ecomusa.com

Table of contents

SECTION 3 - BASIC STACK SAMPLING

SECTION 4 - CALIBRATION OF THE ECOM A-PLUS

APPENDIX

Section 1
INTRODUCTION

1.1 Introduction

The ECOM-AC is a portable, microprocessor controlled, electrochemical sensor based emission-analyzer that incorporates proven technology for accurate exhaust gas analysis. The ECOM-AC can be fitted with up to 7 separate gas sensors.

The ECOM-AC is suited for a variety of applications: Boiler/Burner Flue Gas Analysis; Engine Emissions Analysis; Pollution Source Testing; and Environmental Reporting of Stack Gas Parameters, among others. It provides measurements for O_2, CO (low range 0-4,000 ppm), and / or CO (high range 0-40,000 ppm), NO, NO_2, SO_2, and Hydrocarbons / Combustibles. It also measures Gas and Ambient Temperatures, Stack Draft (pressure) and will perform a standardized smoke test. The calculated parameters include CO_2, Combustion Efficiency, Excess Air, and Losses. An on-board printer allows hard copy printing of vital stack parameters, while an RS232 interface provides the option to store the data to a computer.

1.2 List of Abbreviations

Listed below are some abbreviations that are used throughout this manual.

O_2	Oxygen
CO	Carbon Monoxide
CO_2	Carbon Dioxide
C_XH_Y	Hydrocarbons / Combustibles
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X ($NO+NO_2$)	General term for Oxides of Nitrogen
SO_2	Sulfur Dioxide
Temp	Temperature
EFF	Efficiency
Batt	Battery
T. Room	Room Temperature
T. Gas	Flue Gas Temperature
Losses	Percent of Losses of Efficiency
Lambda	Excess Air
In w.g.	Inches of water gauge (pressure)
% v	Percent by Volume
ppm	Parts Per Million
mg	Milligrams
mv	Millivolts
V	Volts
CO_2 Max	Maximum CO_2 Value
NO-Limit	Signal indicating that the battery voltage for the NO sensor is low

1.3 Optimal Performance

The ECOM-AC is a portable gas analyzer that enables qualified personnel to collect accurate emissions data for a variety of purposes, i.e. the servicing and maintenance of combustion sources and environmental compliance. Designed as a portable analyzer for semi-continuous operation only, the ECOM-AC is not recommended for continuous gas emission measurement.

Upon receipt of your instrument, you should find the following components and accessory items contained within the carry case:

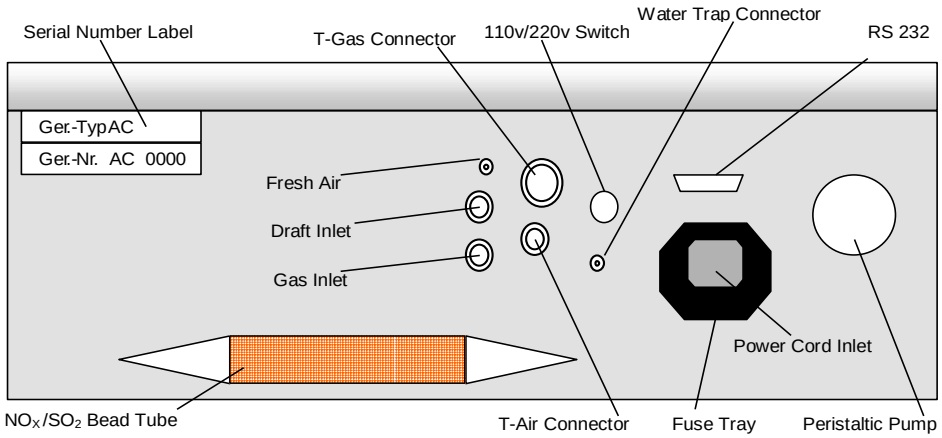
1. ECOM-AC analyzer
2. 15 ft. sample hose with pistol grip probe connection
3. 13" coaxial probe assembly with connections for draft, gas, temperature gas, and slot for smoke test filter (other probe lengths available upon request)
4. 1 package of NOx / SO2 Filter media (p/n 79275, 1 lbs. bag)
5. 2 rolls of printer paper 5 rolls/box :
   Serial #s 8252 and above use matrix paper p/n 79285
   Serial #s 8251 and below use thermal paper p/n 79274
6. 50 smoke paper test discs (p/n 71283)
7. 1 package of 10 water trap filters (p/n 75316)
8. 8 ft. AC power cord
9. single water trap assembly with integral flowmeter
10. ambient thermocouple with magnet
11. 2 keys for case latches
12. carry strap
13. User manual

Section 2
OPERATION
FRONT PANEL FEATURES

2.1 Getting Started

To begin analyzer operation, open the case by releasing the two latches located on the top panel next to the carry handle, so that the top of the case opens upward to expose the top panel, display and keypad. Carefully remove the hoses and cables from the front compartment of the case. Plug in the supplied power cord to the front panel of the analyzer and to an appropriate power outlet. (The ECOM AC is switchable between 110v AC and 220v AC. Check the 110v / 220v switch for the correct position) Remove the water trap assembly and mount it on the slot provided on the top edge of the right side of the unit. The water trap should hang on the inside of the case with the black tubing freely feeding directly into the instrument. Check the tubing connection on the bottom of the water trap bowl for cracks or tears, and be sure the top filter cap is secure.

Making the Connections (See diagram below)
Plug in the connector from the water trap assembly to the front panel of the analyzer. Next, connect the ambient air thermocouple to the correct receiver on the front panel of the analyzer. The sample line consists of a 15 foot '3 chamber hose' with connectors on each end. The connectors are sized to fit only in the correct receiver. Connect one end of the sample line to the pistol grip probe. Please note the notched fitting on the thermocouple connection that fits into the bottom of the pistol grip probe. This must be inserted properly. Insert the Gas and Draft connectors into the proper receivers in the bottom of the pistol grip. Next, connect the larger thermocouple connection to the front panel of the analyzer, then connect the Gas and Draft lines.



To turn the instrument on, press the rocker switch marked **I/O** until the display acknowledges power ON and reads:

```
Fuel Type Function Confirm by <E> !
Calibrate.  3:00 min
------------------------------------------------------------
Natural Gas
------------------------------------------------------------
CO2max = 11.7, A1/K = 0.35
```

If the T-Gas, T-Air or Water Trap Connections are not made, an error message will appear on the screen indicating the source of the error.

Solution:

ECOM-AC Plus --- Adjust water catchpot !	Plug in Connector from Water Trap to Front panel
ECOM-AC Plus --- T. air sensor ?	Connect ambient Air-Thermocouple
ECOM-AC Plus --- T. gas sensor?	Connect T-Gas-Thermocouple (in Sample Line) to Pistol-Grip probe and Front panel of analyzer

2.2 Auto Zero / Auto Span

Once all connections are made and the analyzer is switched on, the instrument begins its automatic Zero / Span procedure. The analyzer should be in fresh air during this period. During this process, the Oxygen sensor is automatically calibrated to ambient air, (20.9%) while the other sensors are zeroed and checked for proper signal outputs. The ECOM-AC will count down from 180 seconds to complete the Auto Zero/Auto Span warm up period.

2.3 Fuel Selection

There are several pre-programmed fuel selections in the ECOM-AC. These will include Natural Gas, Diesel Oil, Propane, Butane, Fuel Oil #2, #4, and #6, Coal, Wood (at varying moisture contents) and others. During the Auto Zero / Span procedure, you may enter the type of fuel being burned in the combustion process. Use the up / down arrows to select the type of fuel being burned, then press **Enter**. You may now insert the probe into the stack.

Fuel Type Function, confirm by <E> !

Natural gas

CO_2 max = 11.7, A1/K = 0.35

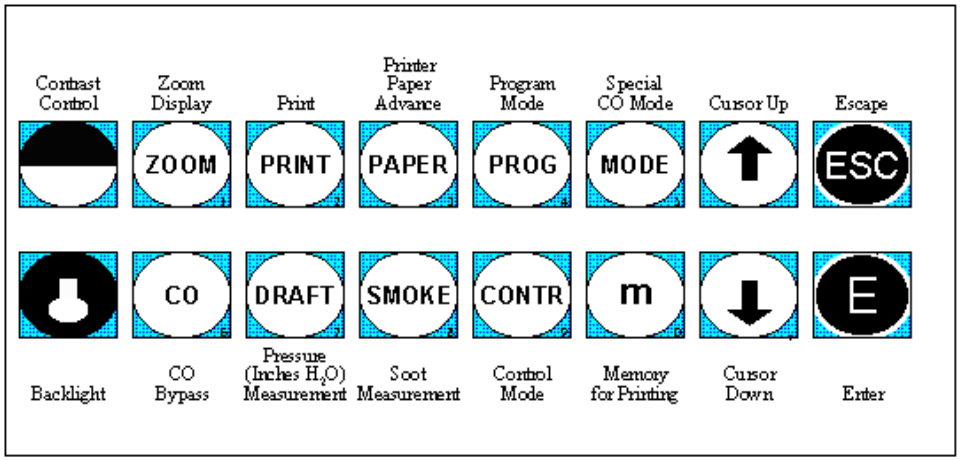
2.4 Normal Measurement Mode

After the instrument has completed its 180-second calibration cycle, the display will read real-time emission values.

O_2	21.0 %	Eff.	------ %	
CO_2	----- %	Losses	------ %	
CO	0 ppm	Exc. Air	------	
NO	0 ppm	T. Gas	77	F
NO_2	0 ppm	Draft	0.00	i.w.g.
NO_x	0 ppm	T. Air	73	F
C_XH_Y	0.00 %	Sensor Temp:	74	
SO_2	0 ppm			

Please note: CO_2, Efficiency, Lambda, and Losses are calculated values. In order for the analyzer to begin calculating these values, the Oxygen content has to drop below 20.5% and the T-Gas must be at least 5 degrees higher than T-Air. When these values are not being calculated, the display will show ""------"" in these fields.

KEYPAD FUNCTIONS



2.5 Contrast

Once the unit is up and running, you can adjust the contrast of the display by pressing and holding the **Contrast key**, on the keyboard until the desired contrast level is obtained.

2.6 Backlight

The ECOM-AC is equipped with a backlit digital display for easy viewing. Simply press the light **Backlight key** to illuminate the display. To turn off, press again and the light will go off.

2.7 Zoom Feature

The **Zoom key** can double the display size. Pressing this key once changes the display from 8 lines to 4 lines. You may scroll through the different values being displayed by pressing the arrow keys. The up arrow key will allow you to view values for the 3rd line of display. The down arrow key will allow you to view values for the 4th line of display.

8-Line-Display

O_2	14.7 %	Eff.	87.4 %	
CO_2	5.3 %	Losses	12.6 %	
CO	297 ppm	Exc. Air	42.00	
NO	114 ppm	T. Gas	77	F
NO_2	22 ppm	Draft	0.00	i.w.g.
NO_x	136 ppm	T. Air	73	F
C_XH_Y	0.81 ppm	Sensor Temp:	74	
SO_2	34 ppm			

4-Line-Display

O_2	14.7	%
CO_2	5.3	%
CO	297	ppm
NO	114	ppm

Pressing the **Zoom key** again will change the display from 4 lines to 2 lines. You may scroll through the values being displayed by again pressing the arrow keys. The up arrow key will allow you to view values for the 1st line of the display. The down arrow key will allow you to view values for the 2nd line of display.

2-Line-Display

CO	**297 ppm**
NO	**114 ppm**

Pressing the **Zoom key** again will return the display back to the initial 8 line display.

2.8 CO Bypass

Activates a mechanical by-pass allowing fresh-air to purge the CO-sensor. When levels exceed 4000 ppm, an automatic CO bypass activates.

2.9 Printing

To utilize the print facility of the ECOM-AC, you must press the **m-key** for the instrument to store the currently displayed measurements. When the memory function is activated, a "**m"** will appear in the top right corner of the LCD display.

O_2	14.7 %	Eff.	87.4 %	**m**
CO_2	5.3 %	Losses	12.6 %	
CO	297 ppm	Exc. Air	42.00	
NO	114 ppm	T. Gas	77 F	
NO_2	22 ppm	Draft	0.00 i.w.g.	
NO_x	136 ppm	T. Air	73 F	
C_XH_Y	0.81 %	Sensor Temp.	75	
SO_2	34 ppm			

After pressing the **m key**, press the **Print key** located on the instrument key pad, then use the arrow keys to select **"Start Printing"** on the LCD display. Press

Enter to print the stored emission values. After printing is complete, the display will again show real-time emission values.

Press **m** again to clear the memory for the next test (this will remove the **"m**" from the top right corner of the LCD Display). *It is important to clear the memory before you begin the next test to ensure that only the new information is entered into the memory when the next printing is performed.*

2.10 Draft Measurement 

The ECOM-AC is equipped with a high quality piezoresistive sensor for differential pressure measurements that are used to measure stack draft.

To perform the draft measurement, press the **Draft key** on the keypad of the analyzer. The pump will shut off and the display will read:

```
  Draft measurement
--------------------------------------------------------------------------------
  Draft                0.00i.w.g.

Reset zero point   :   release draft
hose, then press   <MODE>
```

At this point, remove the draft hose from the front panel of the analyzer, (the connector with 3 rings) then press the **Mode key**. The pressure sensor will now auto-zero.

Allow 15 seconds for reading to sensor to zero and stabilize, then replace the draft hose connector to the front panel of the analyzer. The display will now show the exact value for draft in inches of water from 0 to +/- 40.00 inches. Press the **m key** to store the draft reading, then press **Escape** to return to the normal test mode. The Draft reading is now stored in memory and will be printed on the next print-out.

2.11 Paper 

Advances paper in printer.

2.12 Smoke Measurement 

To begin the Smoke measurement, press the **Smoke key** on the keypad. The pump will stop. Depress the trigger on the pistol grip probe to insert the smoke test paper disk in the slot. Release the trigger. Re-insert probe into the exhaust stack being measured. Press the **Enter** to begin the smoke measurement. The pump will re-start and draw 1.62 liters of exhaust through the Smoke paper. (You will see the 1.62 liters count-down on the display). When the countdown is complete, depress the trigger to remove the Smoke paper. You can now determine the smoke level by comparing the smoke spot with the included smoke chart. The results (0.0 – 9.9) can now be entered via the keypad. This value will be stored and printed on the next test print. Up to 3 smoke test can be entered, and the instrument will print all three and calculate the average smoke test value.

Soot measurement			
1. Smoke d		2. Smoke d	3. Smoke d
4.0		5.5	3.0
Oil derj.	-----	Mean value	4.2

2.13 Program 

Allows user to make adjustments to the calculated and measured values.

You may alter the calculated and measured values by changing certain options via the ECOM-AC's default settings. Press the **Program key** when in the normal measurement mode to access the option menu, then move the cursor to the relevant position and press **Enter**.

Adjustments		
Unit	ppm	Fuel type
Undiluted	No	Clock set
Refe. -O_2	15.0%	Fuel type ← PC
Boil. Temp		
Air Pres.	14.70psi	
Probe heat.	No	

The following settings are possible:

Unit — Factor for calculating gas concentration in:
ppm = volume concentration (parts per million) mg/m_3 = mass concentration per volume
#/mBtu = lbs. pollutant per mm/Btu

Undiluted — Calculation of gas concentration using reference oxygen. **Undiluted: YES** will correct toxic gas values (CO, NO, NO_2) to a theoretical O_2 level (i.e., 3%) selected below under the Reference O_2 section. When **Undiluted: YES** is activated, a (U) will appear after the toxic readings on the display. **Undiluted: NO** will provide normal toxic readings to the actual O_2 concentration. Formula for calculation:

$$E_{ref} = E_{meas} * \frac{(21 - O_{2\,ref})}{21 - O_{2\,meas}}$$

Reference O_2 — Reference oxygen value for O_2 correction (i.e., 3%). This will only calculate if **Undiluted: YES** is activated.

Probe heating — Probe heating on/off for Smoke Test. This turns on automatically when **Smoke key** is pressed.

Fuel type — Changes fuel types without turning unit off

Clock set — Sets the internal clock, dd:mm:yy hh:mm:ss

Fuel type ← PC — Upload fuel program from software, done by ECOM America Ltd.

2.14 Control 

Allows user to view millivolt reading of sensors and accesses calibration mode. It shows hours of operation, serial number, and service phone #.

2.15 Mode 

Allows user to view O_2 corrected values and facilitates “zero” of pressure sensor.

2.16 Memory 

Pressing **m key** activates storage of readings into short term memory for printing – press **m key** after printing to clear memory.

2.17 Arrows 

Use the **Arrow keys** to scroll up and down.

2.18 Escape 

Exits current screen and returns to previous screen or operation mode.

2.19 Enter 

Enters or confirms information displayed.

Section 3
BASIC STACK TESTING

3.1 Performing an Emission Test

Allow the analyzer to complete the Auto Zero / Span procedure prior to beginning the emission test. Insert the probe into the designated sampling port in the stack and allow the analyzer to draw the gas sample for a minimum of 3 minutes to allow the readings to stabilize and the sensors to respond fully to the gas concentration.

Please note: The entire operational procedure for performing the emission test is dependent on the application and the objective of the emission testing. For service and maintenance applications, setting the instrument up properly and allowing the analyzer's reading to stabilize prior to making adjustments to the combustion source may be sufficient. For regulatory compliance testing, please contact your local Air Quality Board or similar agency to determine if specific test protocols are to be followed. ECOM America Ltd. can help you obtain acceptable protocols for your area, if required.

Notes:
1) Variances in the analyzer's core temperature may affect the reading and accuracy of electrochemical sensors. Care should be taken to insure that the core temperature of the analyzer not vary by more than 10 degrees F in either direction over the testing time. It is best to allow the analyzer to acclimate to ambient temperatures prior to start-up.

3.2 Turning the Instrument Off

When turning the instrument off, remove the probe from the stack and allow the pump to draw fresh air through the sample line for a few minutes. Allow the CO, NO, NO_2, etc. readings to return to below 15 ppm and O_2 to rise above 20.0% before switching the ECOM-AC off.

Upon being switched off, the instrument will automatically start a purging cycle that continues until the gas values drop to close to zero, a process that prevents the instrument from being stored with gas in the line. The condensate pump will run and empty any moisture that may have collected in the water trap bowl.

Carefully place the water trap assembly into the storage compartment, then replace the probe and sample line into the storage compartment.

If the instrument is to be stored in excess of 1 month, it must be fully charged before storage and charged again for approximately 24 hours prior to usage.

Section 4
CALIBRATION OF THE ECOM-AC

4.1 Introduction

Ease of Calibration is a distinctive feature of the ECOM-AC.
The ECOM-AC may be configured with up to 7 electrochemical sensors including Oxygen (O_2), Carbon Monoxide (CO), Nitric Oxide (NO), Sulfur Dioxide (SO_2), AND Combustibles (CxHy). Note: There are two sensors available for CO with ranges of 0-4,000 ppm (1 ppm resolution) and 0-40,000 ppm (5 ppm resolution).

To calibrate the ECOM-AC, you will need a Calibration Accessory Kit, available separately from ECOM AMERICA, Ltd. You will also need Certified Calibration gas for CO, NO, NO_2, SO_2, etc. depending upon the type of sensors your analyzer is equipped with. If you have any question as to the configuration of your instrument, check the printout or LCD to confirm the actual sensors found in the analyzer.

4.2 Getting into Calibration Mode

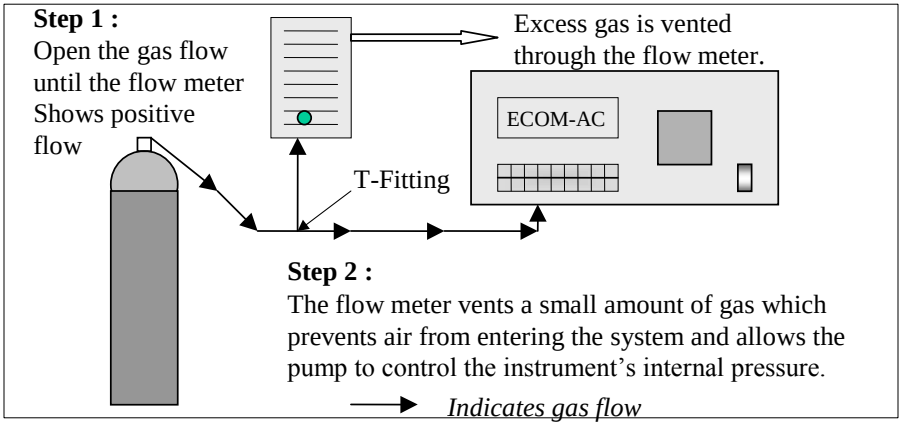
When the ECOM-AC is switched on, it will perform a three-minute auto-zero of the toxic sensors (CO, NO, NO_2, SO_2, and Combustibles) and auto-span for the O_2 sensor. No calibration gas is used for calibrating the O_2 sensor. The auto-zero function sets the baseline or zero point for the toxic sensors. From the normal measurement screen, press the **CONTROL key** and the display will show the millivolt signals for the sensors, as well as other instrument data. Place the supplied magnet on the **'CAL MAGNET HERE'** sticker located on the upper center portion of the top panel of the analyzer. The unit will beep and enter into Calibration mode.

4.3 Calibration Methods

There are three recommended methods of calibration for the ECOM AC. In each method, the gas line should be connected to the instrument by placing the tubing over the end of the probe or by connecting it to the gas inlet of the instrument. Note: Some Regulatory Test Protocols require a "Sampling System Bias" test which determines the difference in analyzer response when calibrated through the probe and when calibrated directly to the gas inlet, essentially bypassing the probe and sample line. System bias testing is not necessary if the analyzer is calibrated through the probe and sample line and calibration gases with nitrogen balances are used to check for leaks. When checking for air leaks, it is best to connect the gas line to the probe.

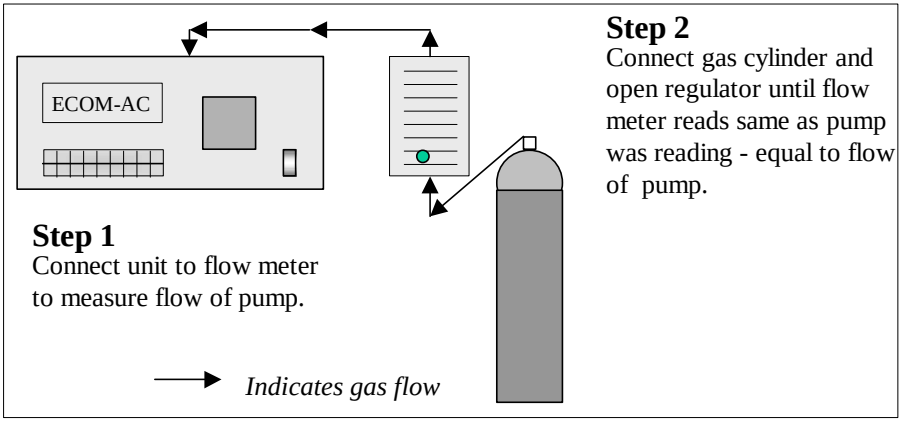
IT IS VERY IMPORTANT THAT THE SENSORS ARE NOT OVER- OR UNDER-PRESSURIZED. THE FLOW OF THE GAS MUST EQUAL THE PULL OF THE PUMP, OR THE PUMP MUST BE ALLOWED TO PULL THE GAS AT ITS OWN RATE.

1. The first and most common method employs a regulated flow meter that is used as a vent in the gas line to ensure that the sensors are not over or under pressurized. This process connects the instrument probe, the gas cylinder and the flow meter using a "T" connector.

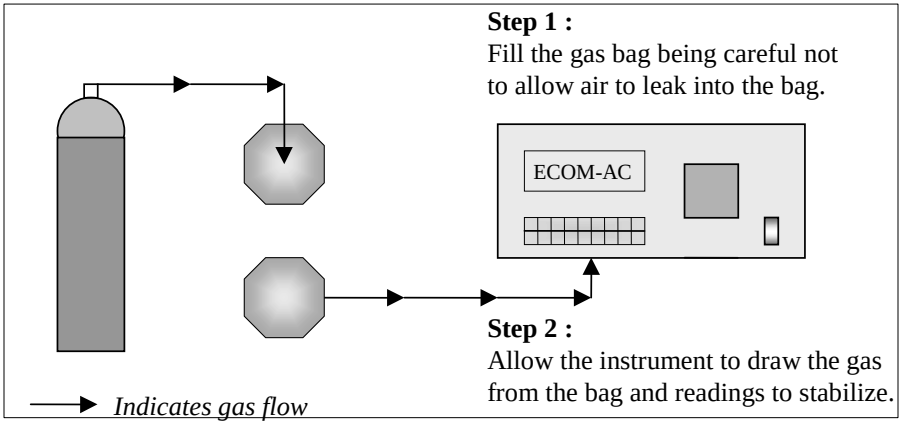


obe using
low meter
e the flow
s cylinder

2.



3. A gas calibration bag can be used to draw gas into the instrument for calibration. By allowing gas to be drawn from the bag, rather than a cylinder, this method ensures the maintenance of the correct flow rate. We recommend that you use a 15-liter or larger gas bag to ensure that enough gas is present for the instrument to stabilize. Be sure to fill the bag completely with calibration gas in order to eliminate dilution of the gas concentration.



4.4 Calibration Gas

During calibration, use a different calibration gas for each sensor (O_2 excluded) to ensure accuracy for each parameter, keeping in mind that accuracy standards for calibration gases can vary depending on the type or classification of the gas. Individual cylinders or certain blends can also be used for instrument calibration. Some types include:

a) Small disposable cylinders
b) Larger refillable cylinders—NIST traceable
c) Larger refillable cylinders—EPA Protocol Gas

Your application or instrument requirements may dictate which type of calibration gas to use, and your gas supplier can recommend which type to use for the balance of the gas (generally Nitrogen). Non-absorbing materials such as stainless steel regulators and non-absorbing tubing should be used to eliminate the loss of the gas sample—primarily NO, NO_2, or SO_2.

For best results, the gas concentration should be as close to the expected levels of emissions as possible. Because each sensor is linear through a nominal range, one calibration gas concentration can often be used for a reasonably wide range of emission levels. For applications with extremely low or extremely high levels of emissions, with respect to the sensors operating range, the sensors should be calibrated as close as possible to the desired levels to be measured. It is also recommended that, in gas mixtures that will support an oxygen content, that a small percentage of oxygen (i.e. 2%-5%) be in the calibration gas to aid in the system leak check.

4.5 Applying Calibration Gas

Position the cursor on the sensor you wish to calibrate first and apply the gas at the correct flow rate by using any of the three methods mentioned above. Flow the gas for 2-3 minutes allowing the reading to approach the specified value of the calibration gas. Response time will vary depending on the sensor being calibrated. Generally, the reading will reach 90-95% of full span very quickly, and the remaining 5-10% will then level off and stabilize within 2-3 minutes.

Once the reading has stabilized, press [E] to enter the "Input Screen". Using the numerals on the keypad, input the correct numerical value of the calibration gas being applied. Press [E] to confirm and the unit will return to the previous screen. That sensor has now been calibrated. Position the cursor on the next sensor to be calibrated, and repeat these steps with the appropriate calibration gas for each sensor.

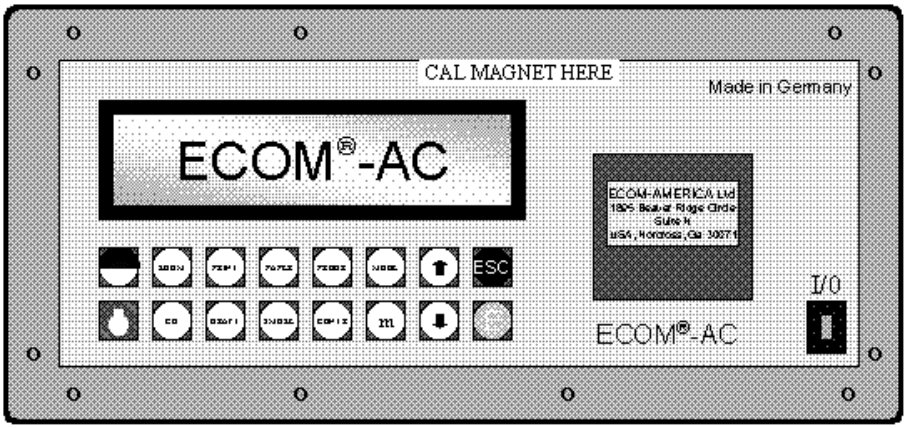
Note: The O_2 level should fall to near 0.0% when applying a gas with a Nitrogen balance as the O_2 is being displaced by the N_2. An excellent method for checking air leaks and calibration is to apply the gas throughout the entire sampling system, including the probe and sample line. After calibration of each sensor is completed, press ESC (Escape) twice to return to normal measurement mode.

4.6 Calibration Protocol

Verification of the portable analyzer for calibration, drift, span, interference, and other parameters, before and after an emissions compliance test may be required by the local regulatory agency. You can ensure accurate and repeatable results by following an established protocol. Check with the agency for any existing protocols they may prefer or acknowledge.

4.7 Data Acquisition Software (DAS) Procedure - see instruction with Advanced DAS Software package

Appendix I
FRONT PANEL DISPLAY FEATURES



Appendix II
TECHNICAL SPECIFICATIONS

PHYSICAL:

Instrument: 19” X 16 “ X 6.5” Aluminum Carry Case with locks

Probe: 13” length X 3/8” OD Inconel Probe with aluminum handle, pistol grip handle with threaded quick disconnect probe connection

Hose: 15’ high temperature flex hose with thermocouple wire. Additional lengths available.

Weight: 28 lbs.

ELECTRICAL:

AC: 110V 60 Hz/220V 50 Hz Standard. User selectable on panel. 1 Amp fuse

Batteries: Lead acid rechargeable—life 3 hours, 8 hour recharge

MISCELLANEOUS:

Pump Draw: Flow rate 2.5 LPM (approximately)

Display: 24 Character, 8-line backlit display with adjustable contrast and zoom. Displays all parameters simultaneously.

OPERATING TEMPERATURE:

Instrument: 20 F to 122 F

Probe: 0 F to 1800 F

MEASURED PARAMETERS:

1. OXYGEN – O2

Range-	0-21%
Sensor Type-	Electrochemical
Sensor Life-	2 years*
Accuracy-	2% of reading**
Resolution-	0.1%

2A. CARBON MONOXIDE (low) - CO

Range-	0-4000 ppm
Sensor Type-	Electrochemical (4 electrode H2 compensated)
Sensor Life-	3 years*
Accuracy-	2% of reading**
Resolution-	1 ppm

2B. CARBON MONOXIDE (high) - CO

Range-	0-40,000 ppm
Sensor Type-	Electrochemical
Sensor Life-	3 years*
Accuracy-	2% of reading**
Resolution-	5 ppm

3. NITRIC OXIDE - NO

Range-	0-4000 ppm
Sensor Type-	Electrochemical
Sensor Life-	3 years*
Accuracy-	2% of reading**
Resolution-	1 ppm

4. NITROGEN DIOXIDE – NO2

Range-	0-500 ppm
Sensor Type-	Electrochemical
Sensor Life-	3 years*
Accuracy-	2% of reading**
Resolution-	1 ppm

5. SULFUR DIOXIDE – SO2

Range-	0-5000 ppm
Sensor Type-	Electrochemical
Sensor Life-	3 years*
Accuracy-	2% of reading**
Resolution-	1 ppm

6. COMBUSTIBLES – C_xH_y

Range-	0-6%
Sensor Type-	Catalytic Pellistor (Wheatstone bridge principle)
Sensor Life-	5 years
Accuracy-	2% of reading**
Resolution-	0.01%

7. AMBIENT TEMPERATURE

Range-	0-250 Degrees F
Sensor Type-	PTC Sensor
Sensor Life-	10 years
Accuracy-	3 F
Resolution-	1 F

8. STACK TEMPERATURE

Range-	0-1800 F
Sensor Type-	Type K Thermocouple
Sensor Life-	10 years
Accuracy-	3 F
Resolution-	1 F

9. STACK DRAFT

Range-	0-40.00" H_2O
Sensor Type-	Piezoresistive Electronic Sensor
Sensor Life-	10 years
Accuracy-	2% of Reading
Resolution-	0.01 H_2O

10. SMOKE MEASUREMENT

Scale-	0-9 spot method

11. TIME/DATE – Time in hours, minutes, and seconds
Date in day, month, and year

* Depends on usage and gas concentration

** When tested to 40 CFR Part 60, RAA test (Calibrated prior to emission test)

CALCULATED PARAMETERS:

1. CARBON DIOXIDE - CO_2

   Range- 0-40%
   Resolution- 0.1%
   Formula: $CO_2 = CO_2 \text{ max} \times \frac{(21 - O_2 \text{ meas.})}{21}$

2. COMBUSTION EFFICIENCY

   Range- 0-100%
   Resolution- 1%
   Formula- $\text{Eff.} = 100 - \frac{(A2 + B)}{21 - O_2} * (T \text{ gas} - T \text{ air})$

3. EXCESS AIR (LAMBDA)

   Range- 0-50%
   Resolution- 0.01%
   Formula: $\text{Lambda} = \frac{1 + O_2}{21 - O_2}$

4. LOSSES

   Range- 0-100%
   Resolution- 1%
   Formula: $\text{Losses} = \frac{(A2 + B)}{21 - O_2} * (T \text{ gas} - T \text{ air})$

Appendix III
TROUBLE SHOOTING

1. The purple beads (Potassium permanganate) remove NO_X and SO_2 compounds going to the CO sensor only. This eliminates any cross-interference on the CO sensor and provides true CO readings. When replacement is necessary, the beads will turn brown, then ashy white. Remove the bead tube from the front panel of the analyzer, remove one of the conical ends, dispose of the used beads in trash and refill the tube with fresh beads. (1 lbs. Bag, p/n 79295). Replace the bead tube securely.

2. Air leaks in the sampling system are usually indicated by higher than expected Oxygen readings. (See calibration section on how to confirm leaks). Check sample line and probe, tubing to / from water trap, filter holders and connectors for source of leaks. Dirt in the fresh air solenoid valve, water trap assembly and pump head can also cause leaks. If you are unable to find the source of the leak, please contact ECOM for service. By using a calibration gas with a Nitrogen balance, the O_2 will be displaced or and the O_2 reading should be near 0.0%. This serves as an excellent method of checking the integrity of the sampling system for leaks.

3. A low or high reading on calibration gas could be the result of improper flow. Be sure not to over/under pressurize the sensors. Follow all calibration instructions for applying gas.

4. The filter on top of the water trap can be saturated with water. Be sure to check this periodically as it will cause the pump to work against this blockage. Replace the water trap filter when dirty.

5. After a printout has finished, be sure to press **m** again to remove the prior test from the short term memory.

6. When connecting a unit to a PC via an RS232 cable, the pins of the cable must be modified (Pins 2&3 – Reversed, Pin 5 – Common) in order for the two to be compatible (RS232 Cable, Part No.: 79280)

7. Use the trigger on the pistol grip only for inserting the smoke dot paper. Pulling the trigger during a normal emission test will result in an air leak causing diluted toxic readings and high O_2.

8. A small magnet used for accessing calibration is located at the end of the Ambient Thermocouple. We also include a separate ECOM magnet.

9. A proper pre- test calibration will result in correct emission readings. An improper pre-test calibration will result in incorrect stack/exhaust readings and may invalidate any subsequent testing.

Appendix IV
FACTORY SERVICE RECORDS

ECOM AC
*Serial No.:*_____

Analyzer service was performed.

Technician:_____

Date:_____

Notes:
_____
_____
_____
_____
_____
_____
_____

Analyzer service was performed.

Technician:_____

Date:_____

Notes:
_____
_____
_____
_____
_____
_____
_____

Analyzer service was performed.

Technician:_____

Date:_____

Notes:
_____
_____
_____
_____
_____
_____
_____

Analyzer service was performed.

Technician:_____

Date:_____

Notes:
_____
_____
_____
_____
_____
_____
_____

Analyzer service was performed.

Technician:_____

Date:_____

Notes:
_____
_____
_____
_____
_____
_____
_____

Analyzer service was performed.

Technician:_____

Date:_____

Notes:
_____
_____
_____
_____
_____
_____
_____

NOTES:

NOTES:

We appreciate your business and strive to provide the best products and customer service in the industry. Should you have any comments, questions, or unaddressed issues regarding your analyzer or the information contained in this manual, please contact ECOM America at the numbers / email below.

ECOM America Ltd.
1628 Oakbrook Drive
Gainesville, Georgia 30507 USA
Telephone: 770.532.3280 / Toll Free USA & Canada 877.326.6411
Fax: 770.532.3620
Email: ecom.info@ecomusa.com
URL: www.ecomusa.com