OEM-3 OZONE CONTROLLER

## INSTRUCTIONS FOR USE

GENERAL

The OEM-3 is a system to control ozone generators and alarms based on an adjustable ozone concentration set point. It is designed to work with user-replaceable sensor modules that are preconfigured for ozone detection ranges of 0-0.1 ppm, 0-1 ppm, and 0-10 ppm. The desired set point is specified when ordering. For example: a 1 ppm OEM-3 would be OEM-3-1, and the replacement ozone sensor module would be OEM-O3-1. The Eco Sensors' SM-100 may be used to operate the sensor modules remotely at cable lengths up to 8 m (25 ft).

The OEM-3 incorporates the power supply, final sensor signal processing, set-point controls, analog output signals, and the output relay. The user-replaceable sensor module includes the ozone sensor and its associated electronics in a square, flat board with an edge connector. The sensor module is pre-calibrated in our lab so that the sensor module and OEM-3 work together as a calibrated system. If the sensor module is damaged or loses accuracy, it is simply replaced by another pre-calibrated module.

The controller design incorporates hysteresis and a time delay (set at 8 seconds) to eliminate chatter and other excessive interactions between the sensor and generator. The SPDT relay contacts will handle up to 5 A at 250 VAC. The OEM-3 should not be used outdoors or in the presence of NOx, nitric acid, acid gases, or halogen compound fumes (see Precautions section).

Features

- **SPDT non-latching relay.** NO & NC contacts are available. Relay commutates at set point. Contact rating: 5 A at 250 VAC

- **Zero Button** allows re-zeroing of sensor output.

- **0-2 V analog voltage output** which is a buffered version of the sensor module signal. 1 V represents the calibration point of the sensor module.

- **4-20 mA current output** which is proportional to the sensor module's output. 12 mA represents the calibration point of the sensor module.

- **Driver circuit for an audible alarm**, including an acknowledge switch input to silence this alarm. The alarm will turn on again after the ozone level drops below the switch threshold and then rises again.

- **SM-100 extension cables up to 8 m** are available for remote mounting of the sensor module.
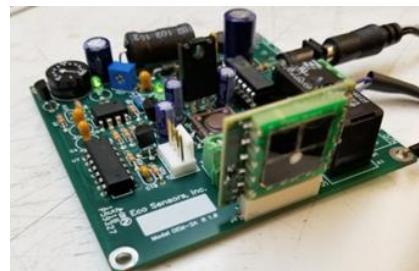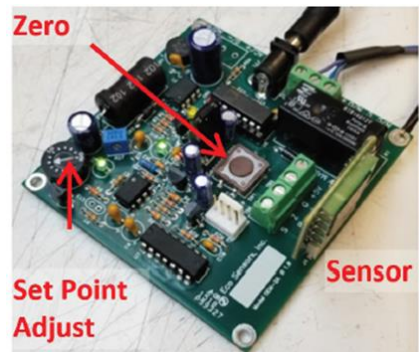
INSTALLATION

CAUTION!

It is best to bench test the board with an AC adapter 12 VDC supply (see below). Do not let solder connections on the OEM-3 board short circuit to any metal surfaces.

1. **Mounting OEM-3:**
   - The OEM-3 should be attached to your equipment (such as inside the ozone generator) by four standoffs, with mounting holes in the case aligned with the 4 holes at the corners of the OEM-3 board *(see Drawing on next page)*
   - The board surface on the solder side should be kept at least 6 mm (1/4") from any metal surface.
   - The OEM-3 should be wired to 12-24 VAC or VDC at terminal block, TB3.
   - Alternately, the OEM-3 may be powered by 12 VDC via jack J2. This low voltage power option was provided especially for bench testing the OEM-3 without exposing personnel to high line voltages.

2. **Connections**

   - Along one edge of the OEM-3 board are three 3-position terminal blocks. These are labeled on the board as TB1, TB2 and TB3.
     - TB1 includes connections to the relay. The relay is capable of switching up to 5 A at 250 VAC.
     - TB2 includes connections for the 4-20 mA and 0-2 V analog output signals.
     - TB3 includes connections for the power input. Any supply from 12-24 VAC or VDC is acceptable, with a current drain of approximately 75-100 mA.
   - To operate the board from AC power, connect the supply leads to the two outside screws of TB-3. DC power may be applied between either of the outside screws and the center screw (the center screw is board ground and MUST be the negative side of the DC supply). *Note that when powered from AC, the board's circuit ground is NOT connected directly to either supply lead.*
   - For convenience, a DC power input connector J2 is located between TB-2 and TB-3. *An Eco Sensors Model P-20 power adapter (or equivalent 12 VDC 300 mA source with center-positive 5.5/2.5 mm jack) may be plugged into this connector to power the board. P-20 works for inputs of 100-240 VAC and 47-63 Hz. Plug is Type A (North America). **Other adapters are available - Tech Note P-101***

BOARD DIMENSIONS AND COMPONENT LOCATIONS:
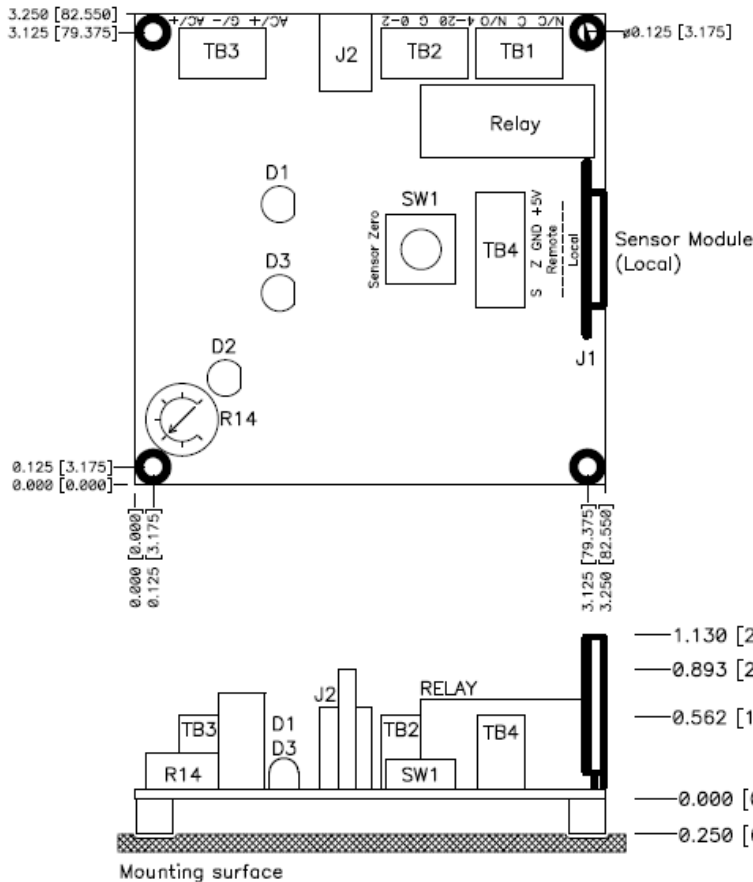
Terminal Block Connections:

TB1: Relay contacts (5 A @ 250 VAC MAX).

TB2: 0–2Volt and 4–20 mA analog outputs.

TB3: Board power supply input.
14–24 V AC/DC.

TB4: Remote sensor connections.
+5V: Power out
GND: Ground
Z: Re–zero out
S: Signal in

LED Indicators

D1 (Yellow): On when relay energized

D2 (Green): On when below setpoint

D3 (Green): On when power applied

Other Features:

R14: Setpoint adjust
(0–100% of Setpoint)

SW1: Sensor re–zero

J1: Sensor Module connector

Sensor Module (Local)

1.130 [28.700]
0.893 [22.675]
0.562 [14.275] Sensing Orifice
0.000 [0.000]
0.250 [6.350]

Mounting surface

Installation Notes

1. Line voltage is present on the board around terminal block TB1. Allow at least 0.250 inches (6.35 mm) clearance behind board.

2. All mounting holes are connected to circuit ground and also to position 1 of terminal blocks TB2 and TB3.

3. Maximum component height above board mounting surface is 1.13 inch (28.70 mm).

4. Sensor module is shown mounted directly to main circuit board. With the SM–100, the sensor may be operated remotely at cable lengths up to 25ft.

5. The 0–2 V and 4–20 mA analog outputs are configured to output 1 V and 12 mA at Setpoint. Setpoint is determined by the sensor module.

6. Potentiometer R14 controls the relay switching threshold. It is scaled from 0–100% of Setpoint. Setpoint is determined by the sensor module.

7. LED D1 (yellow) is illuminated when detected level is greater than threshold seting and relay is energized. It responds with a short time delay.

8. LED D2 (green) is illuminated when detected level is less than threshold setting. It responds quickly to changes.

9. To reduce shock hazard during bench testing, connector J2 may be used to supply DC power (12 VDC nominal, center pin positive)

10. Mounting holes are 0.125" / 3.175 mm diameter. Maximum outer diameter for screws, standoffs, washers, etc. is 0.25 inch / 6.35 mm.

OPERATION

a. Warm-Up

Allow warm-up according to the table below. At least 24 hours is recommended if the system hasn't been used for a week or more. This is because the sensor will gradually return to its initial uncharged state when it is not powered, and it will take 12-24 hours to re-establish the stable low zero current state required for accurate measurement at low-ppb levels.

If possible, it is best to wire the OEM-3 such that it is always powered, even when the host system is in a standby or shutdown state. When the ozone generator or other equipment is turned back on, the OEM-3 is ready to respond immediately and accurately.

Otherwise, warm-ups are required. Recommended warm-up times are:

Time Since Last Powered	Setpoint	Warm-up Time
1 minute – 24 hours	0.1 ppm 1 ppm 10 ppm	60 minutes 10 minutes 10 minutes
1 - 7 days	0.1 ppm 1 ppm 10 ppm	12 hours 1 hour 1 hour
More than 1 week	0.1 ppm 1 ppm 10 ppm	24 hours

If the sensor is easily accessible, the warm-up time can be minimized by checking for zero in clean ozone-free air and full response with an ozone generator of known output. The Eco Sensors OG-3 Ozone Source Calibrator is a portable source which is designed to check for response at 0.1 ppm or 1 ppm.

b. Zero Adjustment

The OEM-3 provides the ability to adjust the zero calibration. To do this, place the OEM-3, or remote sensor, in an ozone-free location (placing activated carbon cloth over the sensor will remove ambient ozone and ensure an accurate zero calibration). Allow the signal to stabilize for at least 5 minutes or longer - depending on the O_3 level from which the sensor is recovering. When output signal is stable, simply press and release the Sensor Zero button, SW1.

c. Set Point Adjustment

The OEM-3 1 V set point is calibrated at the factory by comparison with a NIST traceable UV analyzer. Lower set points can be set using the calibrated dial pot R14 on the main board. Its numbers represent percentage of the 1 V set point. For example, 50 on the dial pot is 50% of 0.1 ppm or 50 ppb. We do not recommend operating with a set point for detection below 20% set point because too many chemical, atmospheric, and electronic variables can collectively make lower set points inaccurate and unreliable. A rough check of the instrument's functionality and calibration in abusive environments should be done every three months. This can be easily done with our model OG-3 Ozone Source Calibrator, which is available in both 0.1 and 1 ppm versions.

Before attempting to adjust the set point, the OEM board must be powered on for at least 60 minutes. This is the time required for sensor elements to fully warm up and equilibrate to the local ambient conditions. If the board has not been run for a very long time (weeks or months), additional time may be required for maximum stability and accuracy – see warm-up table.

When power is applied to the OEM-3, a green LED (D3) located directly behind the sensor Zero reset button is illuminated. This is simply an indication that power is available and that the on-board power supply is working.

A second green LED (D2) is located adjacent to the set point potentiometer (R14) and indicates whether the level of ozone currently being sensed is above or below the set point. This LED is illuminated when the detected level is below the set point and goes out when the level exceeds this threshold. Note that the hysteresis of the comparator circuit makes it impossible to turn off D2 by setting the threshold to zero when the ambient ozone level is extremely low. At higher levels (up to the sensor module's calibration point), turning the set point pot up and down should make D2 turn on and off.

A yellow LED (D1) located behind the sensor module connector indicates the state of the board's relay. When this LED is on, the relay is active. Note that there is a delay of 6-10 seconds between D2 and D1, so it is possible to have both LEDs on or off for short periods when the ozone level crosses above or below the set point.

d. Alarm Circuit

An audible or visual alarm and an acknowledge button may be connected to header, J3. Header, J3 has four pins (0.025" square) on 0.1" centers. Pin 1 is located closest to the sensor module. An audible or visual alarm may be connected between pins 1 and 2 of this header (pin 1 is the +12 VDC supply, 50 mA max; pin 2 is pulled low to turn on the alarm).

An acknowledge button (normally open momentary) may be connected between pins 3 and 4 (pin 4 is circuit ground). When this button is pressed, pin 3 will be pulled to circuit ground and it will silence the alarm signal. The alarm also goes silent when the ozone level falls below the set point value. If the ozone level again rises above the set point, the alarm will again come on.

e. Care and Use of Sensor

The electrochemical (EC) O_3 Sensor used with the OEM-3 is less sensitive to RH and low-level VOC vapors than HMOx sensors. However, condensation of moisture, as well as collection of dust and vapors, on the face of the sensor may block gas access and decrease sensitivity. It is recommended that a porous, water repellant PTFE membrane (eg – Porex Mupor or comparable) is placed over the sensor face, and inspected periodically. This membrane should be replaced when contamination is detected.

Factory Calibration: The sensor is calibrated in the sensor module by comparison with an NIST traceable UV analyzer. The accuracy when shipped is within 20% at full sensor response.

Performance Specifications

Sensor Technology:	Electrochemical (EC)		
Max Setpoint	0.1ppm	1ppm	10ppm
Lower Detection Limit**:	0.03 ppm	0.03	0.3 ppm
Resolution*:	0.005 ppm	0.01	0.1 ppm
Accuracy*:	The greater of: ± 20% of reading or ± 0.03 ppm	The greater of: ± 10% of reading or ± 0.05 ppm	The greater of: ± 10% of reading or ± 0.2 ppm
Response Time*:	< 30s TO 50% FS, <180s to 90% FS		
Turn-on, turn-off time delay:	8 seconds standard. Other times by request.		
Relay ratings:	SPDT non-latching. Contacts: 5 A at 250 VAC		
Data Update Rate:	1 second		
Temperature Compensation:	Yes [10-40C]		
Recommended Temperature Range:	50 °F to 86 °F (10 °C to 30 °C)		
Recommended Humidity Range:	25 - 75% RH		
Warm-up Time:	1 hour before testing; for best results allow 12 hours before continued use.		
Supply Voltage:**	12-24 VDC or VAC, 250 mA.		
Size of board:	83 X 83 mm (3.25" X 3.25"). Requires 28 mm (1.125") clearance from top surface of board and 6 mm (.250") clearance from bottom surface of the board.		

  * At ambient conditions: 25 °C, 50% RH
** For additional power and input/output specifications, please contact Customer
   Service:www.ecosensors.com/support.

PRECAUTIONS

- Read all instructions in this manual.
- Review safety procedures in testing and operating this system.
- Call a qualified electrician if you have any doubts about voltages, wiring, electrical codes and practices, etc.
- Keep the boards and sensor dry. Never let water or other liquids into the system.
- Do not drop the boards. Damage may not be immediately obvious.
- Operate this system in areas of normal room temperature. Operation at lower temperatures, such as warehouses or refrigerated areas, should only be attempted after testing in the proposed environment for correct and reliable operation.
- Do not attempt to service the instrument yourself.
- Do not operate this system or rely on its operations where there are high concentrations of:
  - Chlorine or other halogen compounds
  - Sulfur compounds.
  - Nitrides of oxygen (NOx).
  - Urine residues and ammonia compounds.
  - Acid gases and vapors such as sulfuric or nitric acid fumes.

When in doubt, operate the system at least 24 hours in your worst-case environment.

LIMITED WARRANTY

This product is warranted against defects in materials and workmanship for own year following the date of purchase by the OEM. This warranty does not include damage to the product as a result of misuse, damage, modifications or alterations, and it does not apply if the instructions in this manual are not followed.

If a defect develops during the warranty period, Eco Sensors at its election will repair the product or replace it with new or reconditioned product of equivalent quality. In the event of replacement with a new or reconditioned product, the replacement will continue the warranty of the original model.

To return this system or any module of it, call your distributor or OEM. OEMs and distributors call Eco Sensors at (800) 472-6626 or e-mail at: sales@ecosensors.com to receive return instructions and a Return Goods Authorization (RGA) number.

Except as provided herein, Eco Sensors makes no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose. Eco Sensors shall not be liable for loss of use of this instrument or other incidental or consequential damages, expenses or economic loss, or claims for such damage or economic loss.

RECORD YOUR SERIAL NUMBER HERE: _____

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