

DISSOLVED OZONE MONITOR

Model DOM-EC

Instructions for use



I. GENERAL

The DOM-EC is designed for monitoring dissolved ozone in water, and to send control signals to external devices. The monitor is available in several concentration ranges: 0-2, 0-20, and 0-200 ppm. A

key principle of the DOM-EC's operation is stripping the ozone from the water so that the reading is made in the gas phase. A proprietary stripping chamber accomplishes this. Removing the ozone from water before measuring it eliminates or substantially reduces fouling of the sensor, and also reduces interference from other chemicals such as chlorine and salt.

Additionally, use of an electrochemical ozone sensor provides a greatly reduced sensitivity to dissolved hydrocarbons, as well as a much broader analytical range than that of Eco Sensors' original DOM-1 monitor.

The DOM-EC has a digital readout for ppm of dissolved ozone, a relay closure with an adjustable setpoint to control external devices such as an ozone generator, and a 4-20 mA signal output for transmitting the readings to a computer or PLC device. The instrument is typically calibrated for operation at normal room temperatures. The calibration will change at other temperatures (Henry's Law), but it is easily adjusted if the user has an independent method of measuring the dissolved ozone concentration.

The DOM-EC has two subsystems: a stripper assembly and an electronic unit. The stripper assembly takes a small continuous sample (< .2 L/min or about 3 gallons/hour) from the water line, strips ozone from it and sends the ozone-in-air continuous sample to the sensor in the electronic unit. The stripper assembly also filters the incoming water for general particulate and solids, it has a pressure regulator to bring the sample stream to a standard for the stripper chamber of 10 psi (.7bar), it has a tap and spigot just before the stripper chamber to take a sample of the water for testing by another instrument and it has a gauge to indicate if the mechanism in the stripper chamber is clogging up. There is no wiring to the stripper assembly. It does not contain any electronics. The stripper assembly must be mounted so that the stripping chamber is in a vertical position (the water input and air tubing at the top, the drain at the bottom). The feed water pressure to the DOM-EC should be at least 15 psi (1 bar) and 20-25 psi (1.3-1.7 bar is recommended).

The electronics unit includes the Electro-chemical ozone sensor and amplifier, electronic circuitry to provide the digital readout, 4-20 mA signal output and relay set-point. The electronic unit also houses the air pump for the stripping chamber (which makes an audible vibratory noise because it is a diaphragm pump), the catalytic ozone destruct filter for the exiting sample, and any special electronic or power supplies. The input to the electronic unit is 12VDC, 800mA unregulated.

II. Required Facilities and Location

There are four major considerations for installing the DOM-EC that should be planned in advance of the equipment delivery. They are (Refer to Figures 1, 2 and 3):

1. Connection from your process to the DOM-EC stripper assembly. This should be as short as practical to avoid significant ozone decay loss - the DOM-EC requires only a low flow rate (.2L/min or 3 gallons/hour) from your process pipe to our stripper assembly. It should preferably be ozone resistant plastic tubing to dampen out any vibrations that could be transmitted to the instrumentation and to make inter-unit alignment easier. There should also be a valve between your pipe and our stripper assembly so the water flow can be cut off when installing or servicing our equipment. A single turn chemical resistant valve is recommended. The water input to our stripper assembly can be a 1/4" NPT female input to the strainer, a compression fitting via an adapter to the NPT thread, or a 1/4 " (6-7mm) hose barb adapter. Be sure the sample valve just below the gauge is in the closed position (handle perpendicular to the flow channel).

The stripper assembly is mounted on a back-plate that includes four mounting holes (see Figure #1)

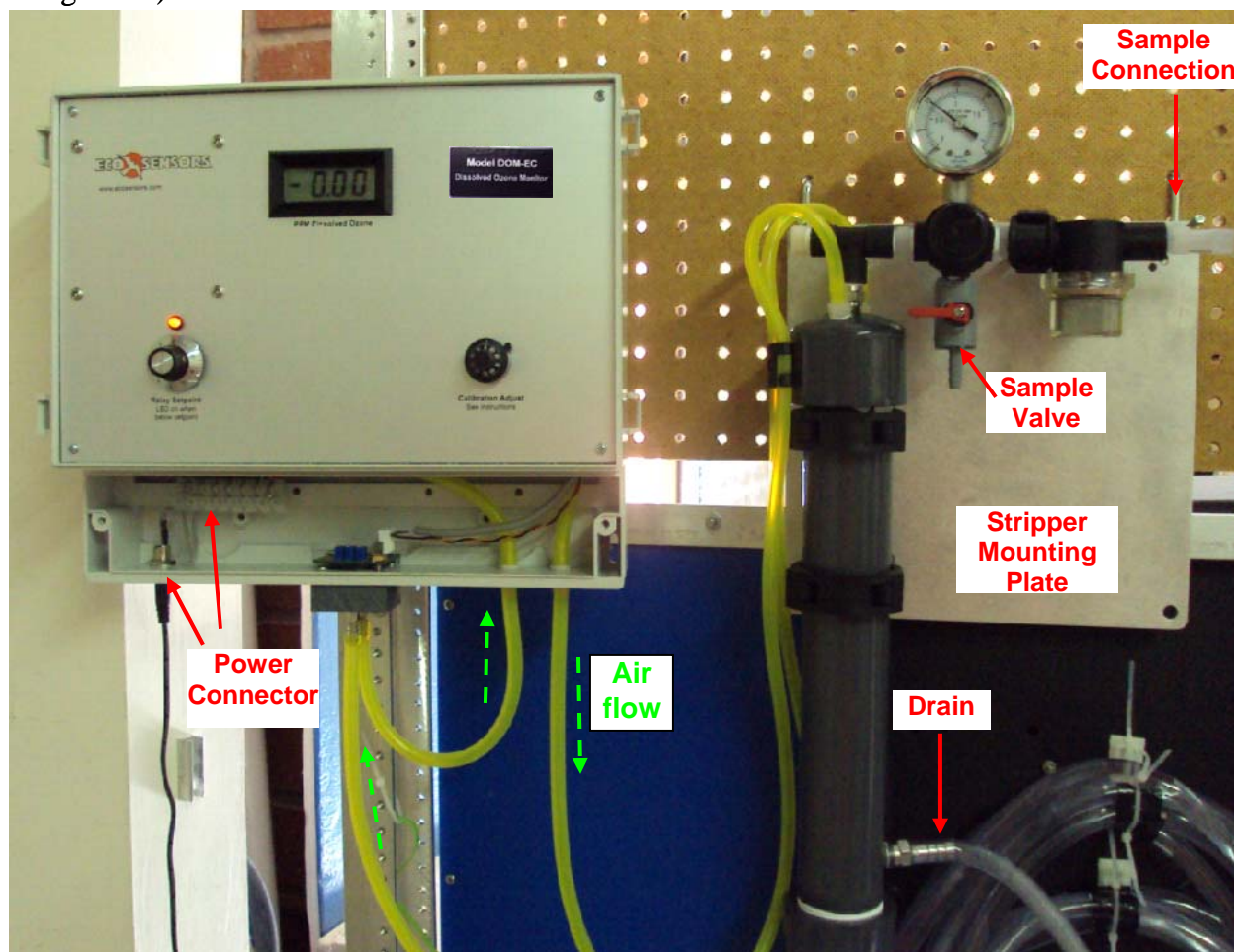


Figure 1: Typical DOM-EC installation, showing Electronics Module and Separator, or Stripping Assembly.

2. Drain for receiving the sample water from the stripper assembly. The drain from the stripper assembly is 9.5mm (.375") inside diameter (ID) plastic tubing at least 50cm (18") long. Its upper end is to be connected to the tubing barb on the lower outside surface of the stripping chamber. This tube should always be oriented so that the drain water is freely flowing down to the plant drain.

****WARNING: Do not allow the drain water to rise and back up into the stripper assembly.***

3. Connection between the stripper assembly and the electronic unit. There are two 3 foot lengths of 3/16" ID (5mm) chemical resistant tubing that interconnect the two components using the pair of tubing barbs found on the top of the stripping chamber, through black hold down clip and ending at the barbs on the electronic unit one labeled 'From Sensor' and one labeled "Air out". These tubing lengths or materials must not be changed because this factor is included in the calibration.

***Note:** Do not connect the tubing from the stripper assembly to the electronic unit until the stripping assembly has been tested with water under pressure. These are airlines and no water should be present.

There are three mounting holes for the electronic unit: one is a keyhole located at the upper center in the back and two lower corner side holes accessed by removing the access cover (See Figure #2).

4. Power to the DOM-EC. The DOM-EC requires an AC adapter that delivers 12 VDC unregulated at 800 mA. Most common adapters of this nominal rating deliver 12-14 volts, which is an acceptable range for the DOM-EC. The adapter can plug into the power jack [***Center Positive***] on the bottom of the DOM-EC or can be wired to the terminal block in the left side of the access tray in the DOM-EC. Alternately, 12 VDC can be brought in by standard electrical conduit from elsewhere in your plant. The conduit can attach at a knockout at the bottom of the electronics unit and the 12 VDC wiring made to the terminal block just inside. Be sure that good earth grounding practice is followed.

III. INSTALLATION

STRIPPER ASSEMBLY SETUP:

With water running from your process line into the stripper assembly, check to be sure there are no leaks. If threads of fittings are sealed with Teflon tape or Teflon compound, make sure pieces of Teflon can not break loose and clog downstream orifices. The pressure gauge should read 10 psi (.7 bar). If there are no leaks and if the water is exiting from the stripping chamber at about .2 L/min, adjust the pressure regulator to 10 psi (.7 bar) by loosening the ring nut around its adjustment screw and adjusting its pressure regulation.

Before connecting the electronic unit to the stripping chamber, run the system for a few hours to make sure no problems develop such as leaks or water flowing from the stripping chamber to its air inlet/outlet ports.

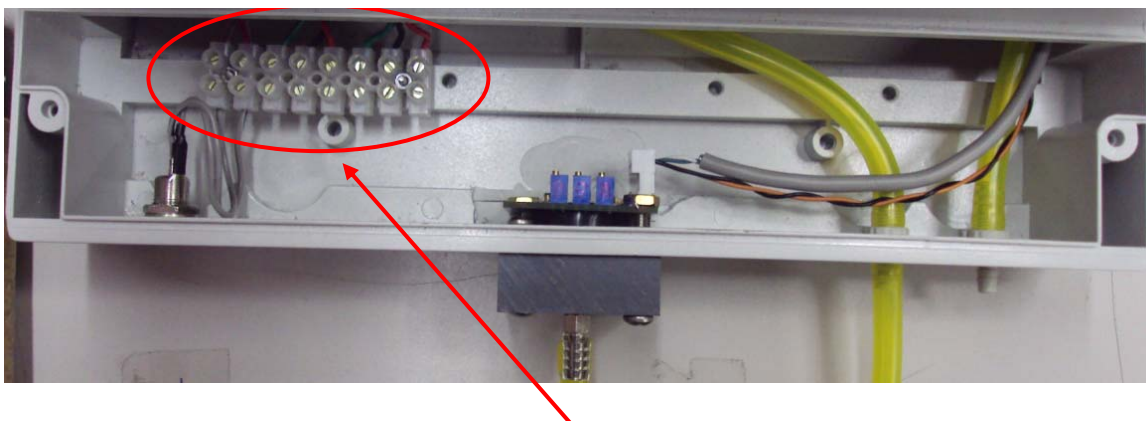
CONNECT POWER: AC ADAPTER

The AC adapter for the DOM-EC should provide a nominal **12 VDC, 800 mA** unregulated output. Many 12 VDC adapters are available at 500 mA, but this is near the DOM-EC's nominal power consumption. Therefore a 500 mA adapter is likely to run fairly warm (or hot) and so a higher current rating adapter such as 800 mA is strongly recommended. The input power jack accepts plugs with the center + and plugs that mate to either a 2.1 or 2.5 mm center pin in the jack. Eco Sensors, Inc. supplies 110 VAC 60 Hz AC adapters with the instrument. *For other line voltages such as 240 VAC, obtain appropriate power supply from local supply house.*

OUTPUT CONNECTIONS

The external connections to the outputs of the DOM-EC are made to the terminal block located inside the access cover on the lower part of the DOM-EC enclosure.

Figure 2: Closeup showing terminal block and location of sensor electronics:



The terminal block is wired as shown:

12VDC		GND	4-20mA		Relay		
-	+		-	+	N.O.	C	N.C.

12 VDC: (800 mA) Terminals for power input as an alternate to the power jack on the bottom of the unit (see Figure 3).

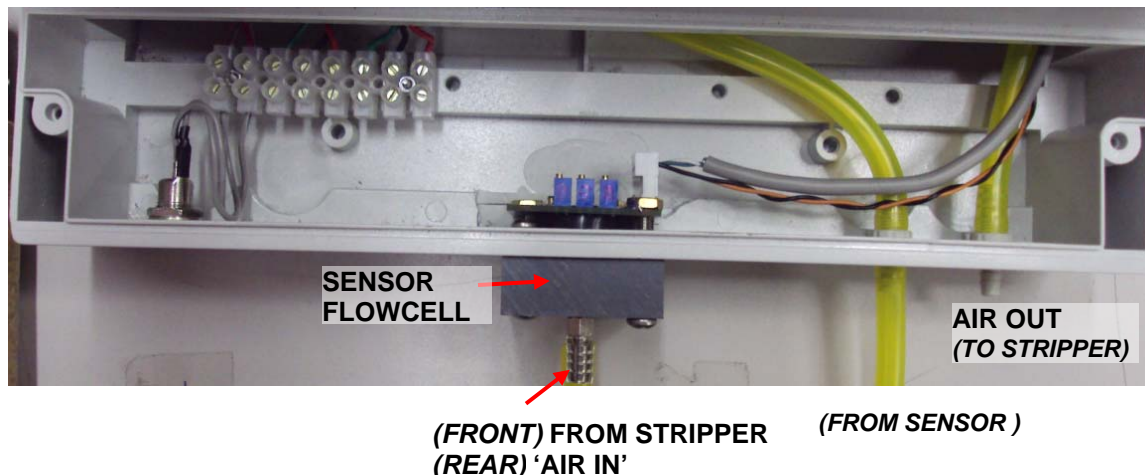
GND: Independent connection to your earth ground. Is connected to two terminals for convenience.

4-20 mA: Current output proportional to the dissolved ozone concentration. Scaled as 4 mA = 0 ppm and 20 mA = maximum range [2, 20, or 200 ppm]. The 4-20 mA contacts are conveniently available at the terminal block under the access cover.

Relay: The relay contacts are rated 5 amps 250 volts and its set-point is the control on the left side of the front panel. NO-C are the Normally open contacts when the concentration is below set-point; and NC-C are the normally closed contacts when the concentration is below set-point.

AIR/SAMPLE FLOW CONNECTIONS: Connect tubing from stripping chamber to detector ports as indicated in Figures 1 and 3 (below):

Figure 3: Closeup showing location of sensor electronics and pneumatic connectons:



IV. STARTUP AND OPERATION

****CAUTION:*** Do not connect the tubing from the stripping assembly to the electronic unit until the stripping assembly has been tested with water under pressure. The tubing should not be connected to the electronics unit until you are certain that no water is leaking through the tubing. The water could damage the components in the electronic unit.

There is no on-off switch to power up the instrument. Simply plug in the AC adapter or connect to other DC power. Digits will appear on the panel meter, and you will be able to hear the air pump running. Leave the instrument running all the time, if possible, to keep the sensor warmed-up and purged of unwanted contaminants.

****Note:*** We recommend running the electronic unit for 30-60 minutes before attempting to use the instrument.

With no water from your process yet entering the DOM-EC stripping chamber, the digital readout of the DOM-EC should read 0.00. If it reads slightly higher, there may be some work area ozone working its way into the sensor. This effect should disappear when water is running through the stripping chamber.

Now open the valve from your process pipe to the DOM-EC stripper assembly. Check for leaks in the stripper assembly and tighten any connections as required. Be sure to maintain the stripping chamber in a vertical position (water inlet on the top).

If you have ozone dissolved in your process water, the DOM-EC should start to read within 10-30 minutes. Startup requires a longer time until an initial ozone readout because the ozonated water has to flow through the stripping chamber for a few minutes, and additional time is required to carry the ozone to the electronics unit and to sensitize the sensor which has been inactive.

Once the electronics unit is reading ozone, it will adjust to changes in the dissolved ozone concentration within tens of seconds.

The Pressure Gauge and Standard Pressure

The sample water inlet pressure to the DOM-EC should be at least 15 psi (1 bar) and 20-25 psi (1.3-1.7 bar) is preferred. There should be a PRESSURE control valve between the main water flow pipe and the DOM-EC sample stream input. The pressure gauge should read 10 psi \pm 10%. If it is more than 1psi off upon initial installation, you may adjust using the pressure regulator. Water should start trickling into the drain tubing.

[NOTE: As long as you are within \pm 10% of 10 psi you are OK. Large changes in pressure indicate when something is going wrong (such as reduced inlet pressure or downstream blockage). If the gauge is reading much higher than 10 psi, and there is no water in the drain tubing, there is a blockage in the stripping chamber. Contact Eco Sensors, Inc. for a solution.

If the gauge reads near zero and a lot of water is in the drain tubing, the internal system in the stripping chamber needs repair. Contact Eco Sensors, Inc.

If the pressure reads almost but not exactly 10 psi, you can do one of two procedures:

- 1 - Adjust the pressure regulator (pull and twist the pressure regulator control knob and adjust for 10 psi) or
- 2 - Mark on the gauge face your present pressure.

Deviations greater than about 10% from this "standard pressure" indicate that something is wrong downstream in the water channel or up stream in the pressure regulator. Pressure regulator problems can arise due to corrosion or blockage of its components.

Check that the stripping chamber is trickling water (~ .2 L/min) to the drain. Avoid blockages of the stripping chamber drain. Observe the semi-transparent air tubing to be sure that water has not filled the stripping chamber and is flowing through the air tubing to the electronics unit. If this is the case, immediately shut off the water to the stripping assembly and disconnect the air tubing connected at the bottom of the electronics unit to prevent water from penetrating the electronics assemblies.

V. CALIBRATION

The DOM-EC is shipped from the factory tested with ozonated water and calibrated against a Hach Model 850 digital colorimeter. Accuracy is better than 20% and 10% is typical. However, the DOM-EC calibration is sensitive to temperature, and any other instrument will be sensitive to temperature or interfering gases or chemicals, so the agreement between the DOM-EC and another instrument should be checked from time to time to refine the basis for agreement between the two instruments. We recommend checking the DOM-EC calibration against a standard such as titration chemistries or indigo dye colorimeter tests at least every 3 months, or more frequently if water temperature fluctuates by more than $\pm 5^{\circ}\text{C}$.

We recommend running the DOM-EC for 1-3 days first before attempting a calibration to make sure all systems are understood and stabilized. Also this should be done when the ozone concentration is not changing in the water and at a concentration typical for your operation.

1. Zero check and

Adjustment: The Zero check is performed by locating the tubing running between the “air in” (3) and the stripper. Remove this tubing at the stripper and connect to the “air out” (1) (after removing the tubing at this connection). This sets up a clean air sample for zeroing the instrument. Perform zeroing by adjusting the zero potentiometer (Z) on the amplifier located above the sensor. After adjustment display should have a 0.00 ppm reading on the display.

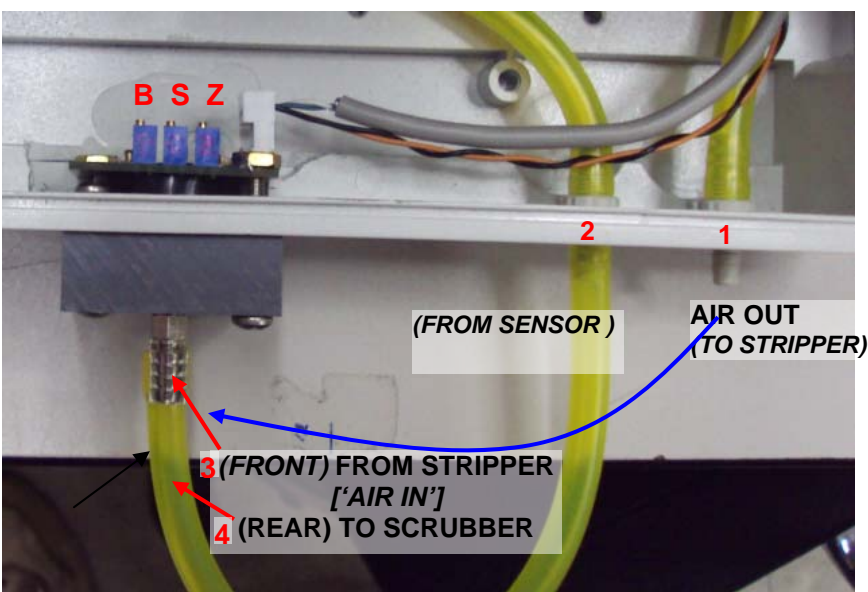


Figure 4: Location of zero (Z) and span (S) adjustments; and tubing connections.

2. Calibration:

Reconnect the stripper and electronic unit as in normal operation and run until a stable reading is displayed. Referring again to Figure 1, take a test sample from the sample valve, and measure the dissolved O₃ by the Reference method. At the same time record the reading of the DOM-EC. Adjust the span potentiometer (S) until the display matches the reference reading.

3. Validation: It is good practice to take a second sample 5-10 minutes after calibration to validate the calibration of the DOM-EC.

NOTE: The DOM-EC calibration is sensitive to temperature, and any other instrument will be sensitive to temperature or interfering gases or chemicals, so the agreement between the DOM-EC and another instrument should be checked from time to time to refine the basis for agreement between the two instruments.

Adjusting the relay set-point The DOM-EC relay has a set-point which can be adjusted over the 0-1 V range. The LED just above it goes on when the dissolved ozone concentration is below set-point. This could be used for example to indicate that the ozone generating system has failed. The relay has both normally open (N.O.) and normally closed (N.O.) contacts which can be connected to remote external readout or alarm devices. The relay contacts are accessed at the terminal block under the access cover. Full scale (full clockwise) on the relay set-point control at the lower left of the DOM-EC control panel is 10. The best way to set it to an exactly desired ppm set-point is to wait until that ppm appears on the digital readout, and slowly rotate the set-point control until the LED just changes from on to off or off to on.

VI. MAINTENANCE

Components of the DOM-EC that should be regularly checked and serviced are:

Strainer: Remove by unscrewing transparent bowl and rinse strainer and bowl in running water.

Pressure Regulator (PR-1A): Pressure regulators usually fail due to particulates in the water or due to chemical attack of plastic parts. Usually the failure develops gradually over a few hours or days. Our pressure regulator is easily changed. Observe the flow markings and use Teflon tape or other thread sealant. Avoid Teflon tape fragments or sealant particles in the flow path. Disconnect the tubing to the electronics unit and adjust the regulator to 10 psi (.7 bar). Correct any leaks, and reconnect the tubing to the electronics unit. Observe "out" and "in" markers or flow direction markings. **NOTE:** Alternative regulators are available which are more resistant to strong oxidizing environments.

Stripping Chamber: Over time, accumulation of particles or algae growth may affect the performance of the stripper:

- i. fouling or clogging, as evidenced by significantly increased backpressure and no exit water flow, or
- ii. damaged nozzle, evidenced by no backpressure and excessively large water flow.

If evidence of a faulty stripper occurs, call Eco Sensors customer service for assistance.

VII. SPECIFICATIONS

Sample water pressure: At least 15 psi (1 bar.) 20-25 psi (1.3-1.7 bar) is preferred. Water pressure should not exceed 90 psi (6 bar).

Outputs: Relay contacts (normally closed and normally open), and 4-20 mA signal.

Response time and warm-up: Response time up to 10's of seconds. At least one hour warmup and running is recommended.

Temperature range: 20-30 degrees C unless recalibrated for a specific temperature.

Supply voltage required: 12-14 VDC 800 mA.

Relay ratings: SPDT non-latching.

Contacts: 5 amps at 250 volts AC.

Protection Classifications: IP 52. Enclosure is polycarbonate. Front cover is clear polycarbonate.

Size and weight:

Stripper assembly approximately 305 X 305 X 153 mm (12" X 12" X 6") 4 kg (.9 lbs)

Electronic unit: 318 mm wide X 267 mm high X 127 mm deep (12.5" X 10.5" X 5") 2.0 kg (4.4 lbs.)

VIII. 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 electronics and sensor dry.
- Do not drop the electronics unit. Damage may not be immediately obvious.
- Operate this system in areas of normal room temperature. Operation at extreme temperatures will require recalibration for operation at those temperatures.

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

LIMITED WARRANTY

This product is warranted against defects in materials and workmanship for one 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. US OEMs and distributors call Eco Sensors at 877-xxx-xxx, international call 510-405-5911 or e-mail: 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.

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