

ECO SENSORS, INC.

DISSOLVED OZONE MONITOR

Model DOM-1

INSTRUCTIONS FOR USE

GENERAL

The DOM-1 is designed for monitoring dissolved ozone in the 0-2 ppm range, and to send control signals to external devices. A key principle of the DOM-1's operation is removing the ozone from the water so that it is read by the sensor in air. This is accomplished by a proprietary stripping chamber. Removing the ozone from water before measuring it eliminates or substantially reduces interference from other chemicals such as chlorine and salt. It also avoids fouling of the sensor by various water borne contaminants. The DOM-1 has a digital readout in ppm of dissolved ozone, a set-point controlled relay closure to external devices such as an ozone generator, and a 4-20 mA signal output to a computer or PLC. The instrument is designed to be operated at normal room temperature only. The calibration will change at other temperatures, but it is easily adjusted if the user has an independent method of measuring the dissolved ozone concentration.

The DOM-1 has two subsystems: a Stripper Assembly and an electronics 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 electronics unit. The stripper assembly also filters the incoming water for general particulates and solids; it has a pressure regulator to bring the sample stream to a standard for the stripper chamber of 10 psi (.7 bar); 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 pressure 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-1 should be at least 15 psi (1 bar) and 20-25 psi (1.3-1.7 bar is recommended).

The electronics unit includes the HMOS ozone sensor, electronic circuitry to provide the digital readout, 4-20 mA signal output, and relay set-point. The electronics unit also houses the air pump for the stripping chamber (which makes an audible vibratory noise because it is a diaphragm pump); the pump's intake cartridge air filter which should be replaced annually, the catalytic ozone destruct filter for the incoming sample from the stripping chamber, and any special electronics or power supplies. The input to the electronics unit is 12 VDC, 800 mA, unregulated.

The connections between the stripper assembly and the electronics unit are two lengths of plastic tubing with 3/16" (5 mm) ID. These tubing lengths must not be changed significantly because this factor is included in the calibration.

INSTALLATION

There are four major installation steps for the DOM-1 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-1 stripper assembly. *This should be as short as practical to avoid significant ozone decay loss in its slow passage (.2 L/min or 3 gallons/hour) from your process pipe to our stripping chamber.* It should be preferably ozone-resistant plastic tubing to damp 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 unit so that the water flow can be cut off when installing or working on our equipment. A single turn chemical resistant valve is recommended. The water input to our stripper assembly can be to a 1/4" NPT female input in the strainer unit, a compression fitting via an adapter to the NPT thread, or to a 1/4" (6-7 mm) hose barb adapter. Be sure that the sample valve just below the gauge is closed (handle perpendicular to the flow channel).

The stripper assembly could be mounted to the wall by standoff clamps. It should be oriented so that the water flows in horizontally and the drain output of the stripping chamber is pointing down. It is important that the stripping chamber be maintained in a vertical position (the air tubing and water inlet at the top). See figure 1.

2 - Draining of the sample water from the stripper assembly. The drain from the stripper assembly is 9.5 mm (.375") inside diameter (ID) plastic tubing at least 127 mm (5") long. Its upper end is 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.

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

3 - Connections between the Stripper Assembly and the Electronics Unit. There are two 2 foot (600 mm) lengths of 3/16" ID (5 mm) chemical-resistant tubing that interconnect the two units using the pair of tubing barbs found on the bottom right of the electronics unit and at the top of the stripper assembly. Either tubing can be attached to either barb. There is no inherent directionality that need be maintained. Before attaching to the barbs on the stripping chamber the two tubings are run through the black hold-down clip on the side of the chamber to organize and secure the tubing.

Do not connect the tubing from the stripping assembly to the electronics 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 severely damage the sensor and other components in the electronics unit.

The Electronics Unit has three mounting points: a keyhole at the upper center in the back, and two lower corner side holds accessed by removing the access cover at the lower edge of the Electronics Unit.

4 - Power to the DOM-1 The DOM-1 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-1. The adapter can plug into the center+ power jack on the bottom of the DOM-1 or can be wired to the terminal block in the left side of the access tray in the DOM-1. 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.

STRIPPER ASSEMBLY ADJUSTMENT

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 electronics 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.

AC ADAPTER

The AC adapter for the DOM-1 should have a nominal 12 VDC unregulated output at 800 mA. Many 12 VDC adapters are available at 500 mA, but this is exactly the DOM-1's 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 AC adapters for 110 VAC 60 Hz.

OUTPUT CONNECTIONS

The external connections to the outputs of the DOM-1 are made to the terminal block located inside the access cover on the lower part of the DOM-1 enclosure. The terminal block is wired as follows:

12 VDC	GND	4-20 mA	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 the two - terminals.

4-20 mA Current output proportional to the dissolved ozone concentration. Scaled as 4 mA = 0 ppm and 20 mA = 2 ppm.

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.

STARTUP AND OPERATION

Do not connect the tubing from the stripping assembly to the electronics 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 severely damage the sensor and other components in the electronics 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. We recommend running the electronics unit for 8-24 hours before attempting to use the instrument.

With no water from your process yet entering the DOM-1 stripping chamber, the digital readout of the DOM-1 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-1 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-1 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 pressure to the DOM-1 should be at least 15 psi (1 bar) and 20-25 psi (1.3-1.7 bar) is preferred. There should be a flow control valve between the main water flow pipe and the DOM-1 sample stream input.

The gauge should read 10 psi and in a short while water should start trickling into the drain tubing. *As long as you are within +/- 10% of 10 psi you are OK. The purpose of the gauge is to indicate when something is going wrong (such as downstream blockage) by the gauge reading above or below its usual pressure.*

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 (push 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.*

Adjusting the calibration You may want to adjust the DOM-1's calibration to agree with your present in house standard such as a sample-based colorimeter. We recommend running the DOM-1 for 1-3 days first before attempting this 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. Referring now to figure 1, take a test sample from the sample valve to measure by other instrumentation the dissolved ozone concentration. At the same time record the reading of the DOM-1.

IMPORTANT: At this time, record the setting of the multiturn adjustment control at the lower right of the DOM-1 front panel. This is the factory calibration, and you may want to

return to it or discuss it with Eco Sensors, Inc. The reading will be 1 digit from the little window and two digits from the control periphery.

Recalibration to agree with your existing standard is done simply by simple ratio adjustment. For example if the DOM-1 reads .90 ppm with a calibration potentiometer setting of 565 when your existing standard reads 1.00 ppm, reset the calibration potentiometer to $565 \times 1.00/.90 = 628$.

The DOM-1 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-1 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-1 relay has a set-point which can be adjusted over the 0-1ppm 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-1 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.

4-20 mA output This is a standard current loop output set at 0 ppm = 4 mA and 2 ppm = 20 mA. Its output would typically go to a PLC (programmable logic controller). The 4-20 mA contacts are conveniently available at the terminal block under the access cover.

MAINTENANCE

Components of the DOM-1 that should be regularly checked and serviced are:

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

Pressure Regulator Could eventually fail due to constant ozone attack of plastic parts.

Stripping Chamber Could foul or clog as evidenced by significantly increased back pressure and no exit water flow or no back pressure and excessively large water flow.

Air Filter in Electronics Unit Check by removing tube from output air connector on bottom of electronics unit. Should be about 3 liters/minute flow. Filter accessed by removing access panel at bottom front of electronics unit. Do not attempt to clean. Replace.

Replacement Parts Kit Eco Sensors, Inc. is developing a spare parts kit based on field experience. Please maintain contact with the factory about the contents of the kit and the cost as these are developed.

CALIBRATION

The DOM-1 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. We recommend checking the DOM-1 calibration against a standard such as dilution chemistries or indigo dye colorimeter tests at least every 3 months.

Recalibration to agree with your existing standard is done simply by simple ratio adjustment. For example if the DOM-1 reads .90 ppm with a calibration potentiometer setting of 565 when your existing standard reads 1.00 ppm, reset the calibration potentiometer to $565 \times 1.00/.90 = 628$.

The DOM-1 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-1 and another instrument should be checked from time to time to refine the basis for agreement between the two instruments.

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.

Response time and warm-up: Response time up to 10's of seconds. More than one hour warmup and running 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)

Electronics 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.)

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 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.

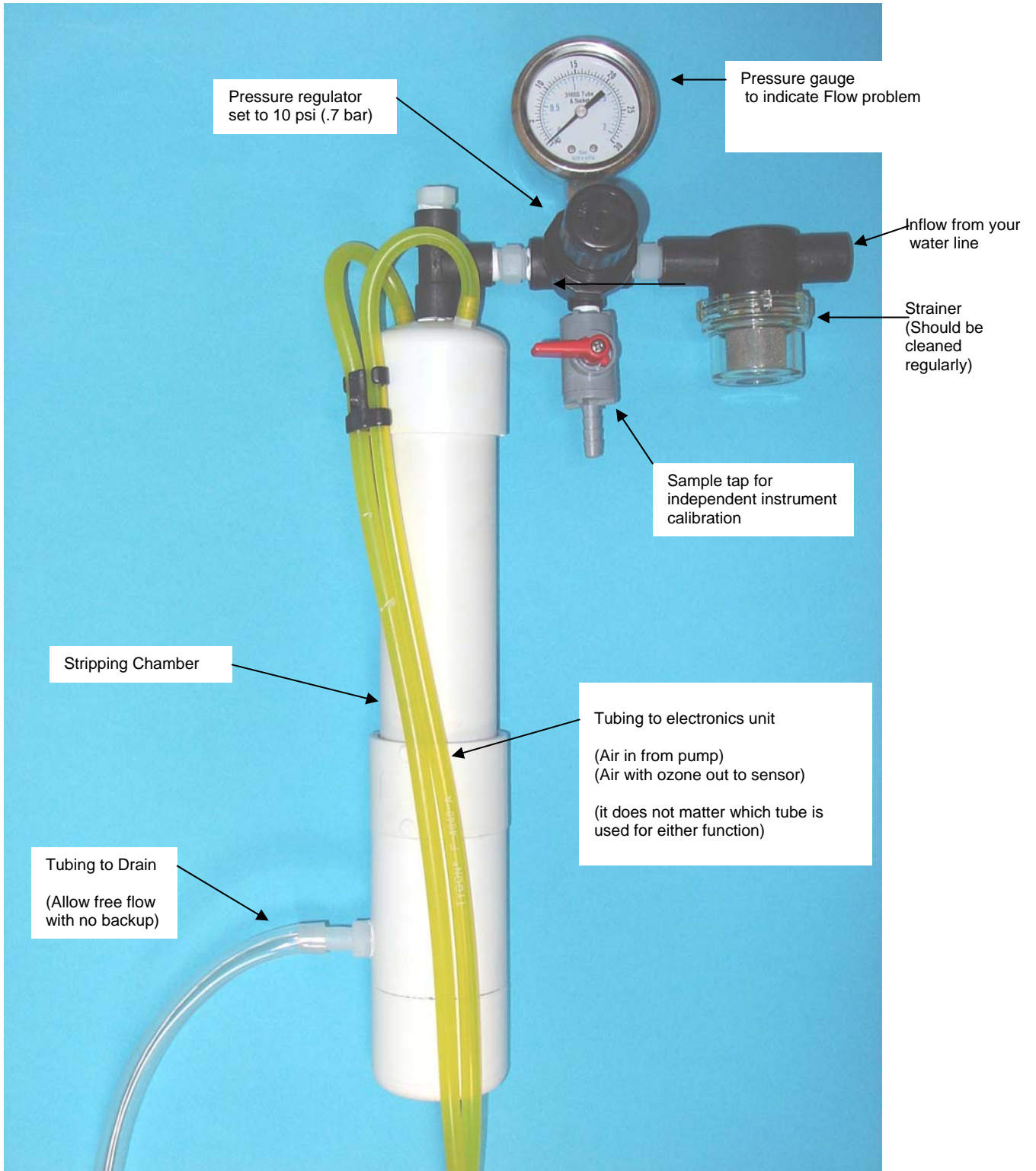
Except as provided herein, Eco Sensors makes no warranties, express or implied, including warranties of merchantability and fitness for a particular purpose. Eco Sensors shall not be liable for loss of use of this instrument or other incidental or consequential damages, expenses or economic loss, or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

KEEP THIS MANUAL AND WARRANTY FOR YOUR RECORDS.

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Patents applied for.

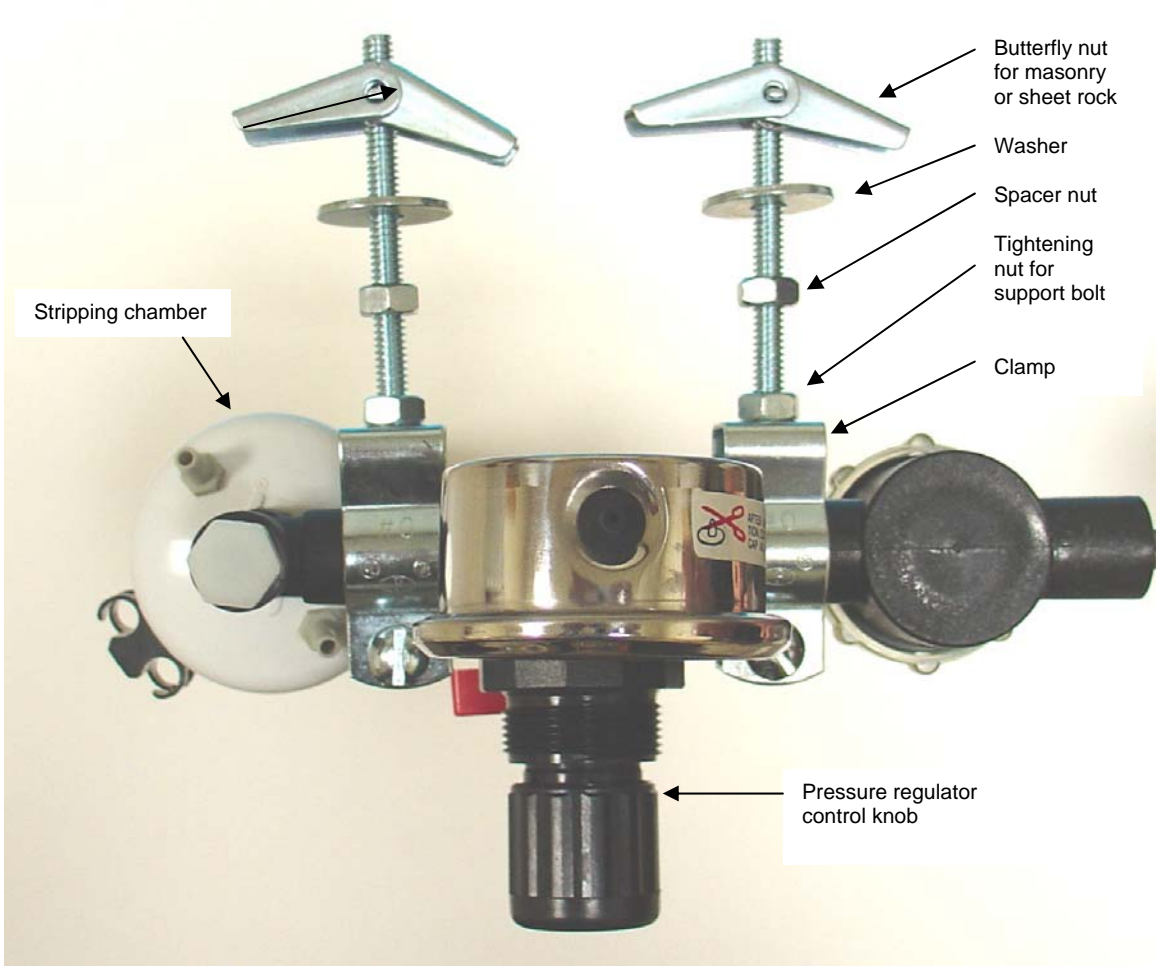
Rev. 4/06

Figure 1 - Stripping Assembly



Showing Wall Mounting Attachments

Top View



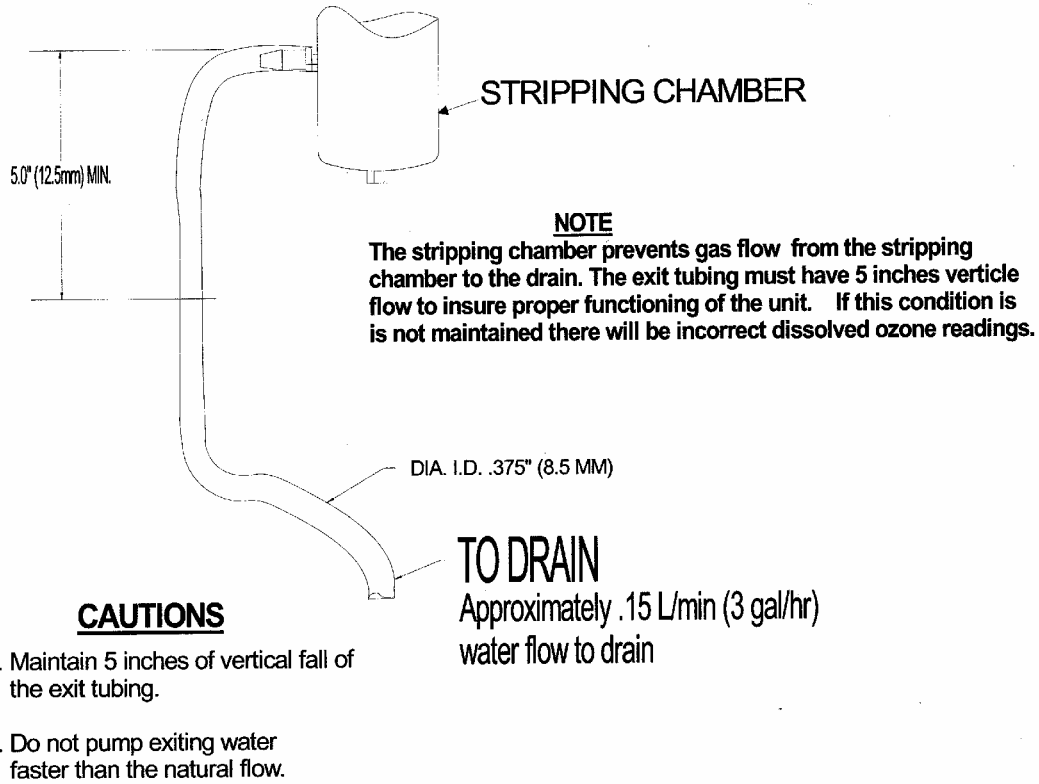
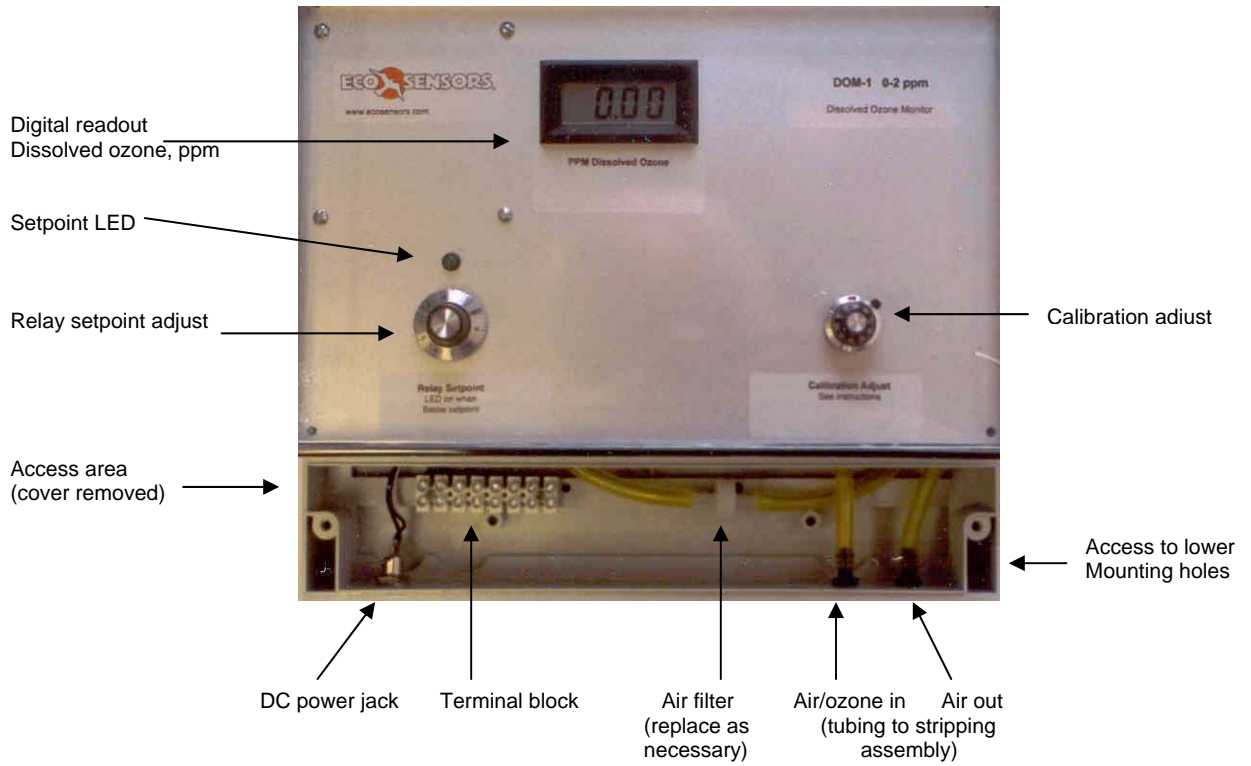


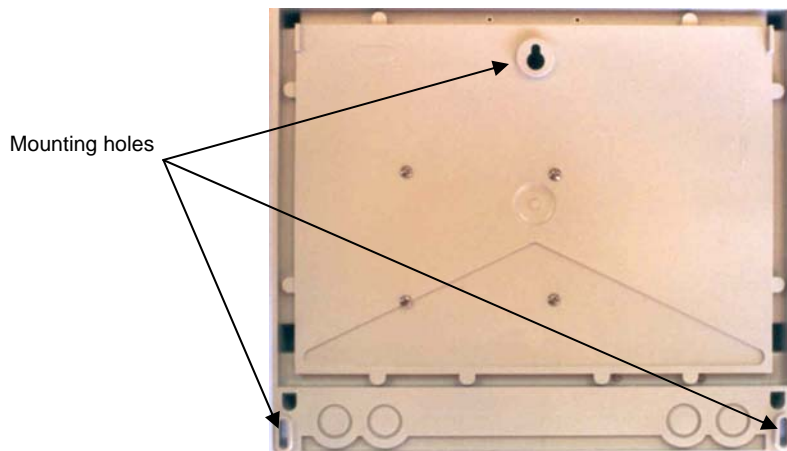
Figure 2

Sample Flow From Stripping Chamber to Drain

Figure 3 - Electronics Unit



Rear View Showing Mounting Holes



REPLACEMENT PARTS

Pressure Regulator (PR-1)

Pressure regulators usually fail due to particulates in the water or due to chemical attack. 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.

Observe "out" and "in" markers or → flow direction marking.

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.

Air Filter (AF-1)

The air filter is found in the access tray of the lower part of the electronics and is installed to replace the existing filter using its barb fittings into the tubing. Air filter service life typically is 6-24 months depending on the particulates in the air.



Sensor Module (SM-DOM1)

The sensor modules are a sensor and preamplifier in a plug-in module. There are no user serviceable parts in the module. The sensor can be desensitized by water that inadvertently flows in from the stripping chamber.

The module is replaced as follows: place the electronics unit on a bench facing up. Remove the 4 screws of the front panel and carefully lift it to access the sensing electronics shown here.

Remove the two yellow tubings from the sensor module. Carefully pull and slightly rock the sensor module so that it unplug the rom the board.

Reverse these steps to install the new sensor module.



Module