

NOTICE

In the beginning of 2008, Eco Sensors Inc. was merged into KWJ Engineering Inc. The two companies are now combined as one corporate entity, under the name of KWJ Engineering Inc., a company that has been engaged in the manufacture of gas detection instruments since 1993. The former Eco Sensors Inc. is now known as the Eco Sensors Division of KWJ Engineering Inc.

Under its new management, the Eco Sensors Division will continue to produce and service its many existing quality ozone measurement instruments, as well as new instruments like DO3. KWJ Engineering offers its own line of toxic gas detecting equipment as well. Learn more by visiting kwjengineering.com.



WARNING!

Read all of the information in this booklet, and any relevant Application Notes, before using the Eco Sensors DO3.

Many factors can affect water quality. This instrument will give a dependable indication of ozone levels in water, but should not be considered an all-inclusive monitor for overall water quality. DO3 is only one tool for ozone in water measurement.

DO3's "Self-Test" function checks most of its functionality, but does not test the ozone sensor, which can only be tested with actual exposure to ozone. Period testing by exposing to a source of water with a known concentration of ozone is recommended.

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1. Specifications

Size:	3.13 x.1.56 x 1.36 inches (79.5 x 39.6 x 34.5 mm)
Weight:	< 2 ounces (49 grams)
Range:	0.00 - 5.00 mg/L (ppm in water by volume)
Recommended Water Temperature:	20 – 30 C (68 - 86 F)
Operating Temperature:	0 - 40 C (32-105 F)
Accuracy:	Within 20% when operated near room temperature.
Response Time:	5 minutes to take final reading, but >90% value available on display after 3 minutes.
Alarms: Buzzer	Alarms once when measurement completes Alarms if temperature above 50°C / 122°F: "HOT" displayed Alarms if temperature below 0°C / 32°F: "COLD" displayed
Sampling method:	Gaseous diffusion
Environmental Use:	Only for measurement of ozone in water with bottle and sampling method provided. Note to be used for measuring ozone in air.
Interferences*:	Dissolved Chlorine.
Display:	Digital LCD in increments of 0.01 mg/L.
User interface:	Single button operation.
Tests:	Self-Test on startup checks circuitry, alarms, battery, and operating temperature. Does not check if sensor is operating normally.
Calibration:	Recommended at least 1x per year, or whenever accuracy of reading is critical.
Sensor:	Transducer Technology T-Series electrochemical (3ET1PO3)
Battery information:	Battery check on startup and during operation. User replaceable CR2450 coin battery.
Warranty:	Instrument, including sensor: One year. Does not include battery.

* The amount of interference depends upon the interfering gas concentration and type. Contact Eco Sensors for additional information if needed.

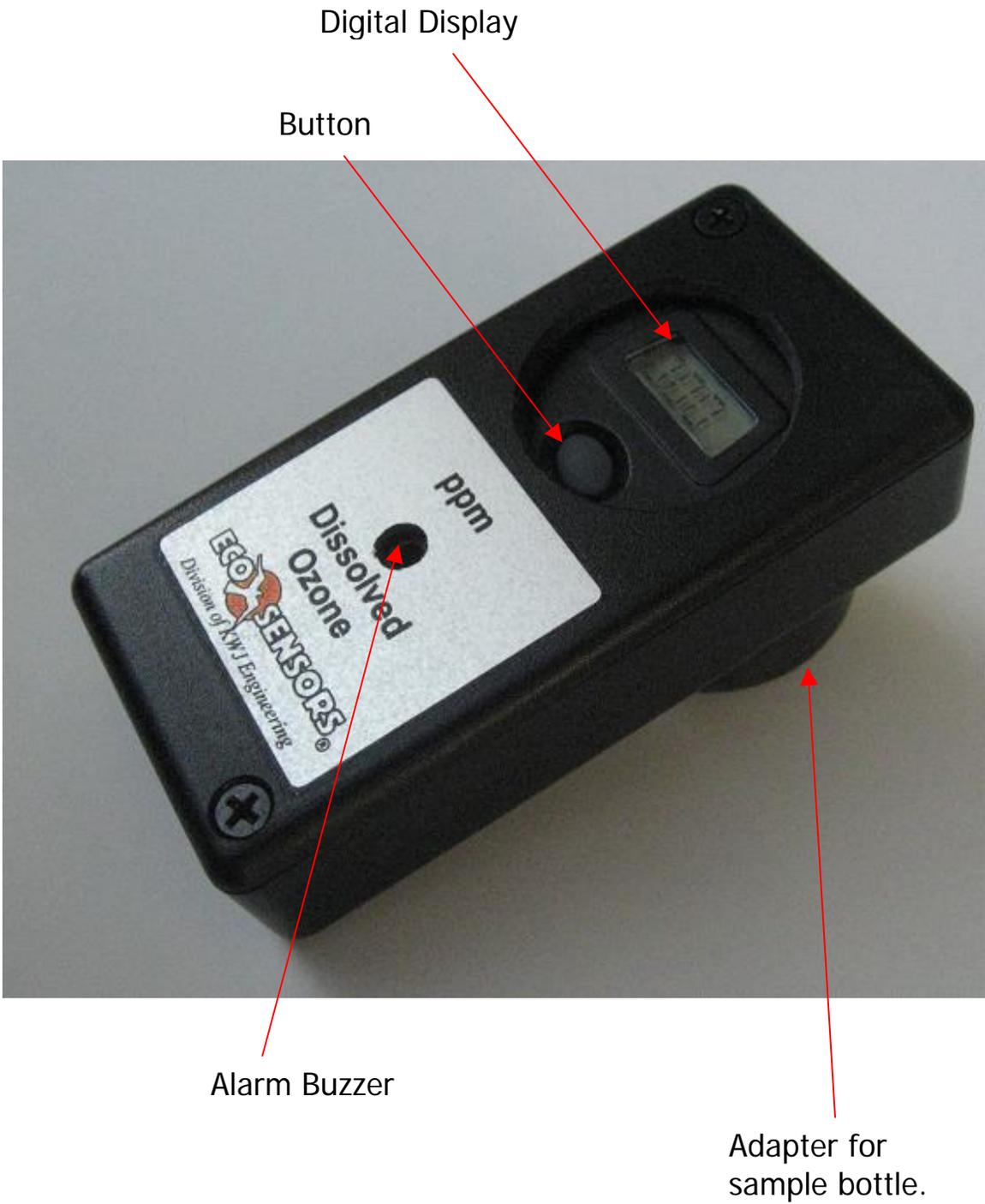


Figure 1: DO3 by Eco Sensors

2. Using Your DO3

2.1 About Measurements

DO3 by Eco Sensors (a division of KWJ Engineering) is a rapid, simple to use device for checking the ozone concentration in water and is calibrated in mg/L (same as parts-per-million by volume in water). This small, battery-operated detector offers an inexpensive alternative to more costly inline monitors and requires no disposable reagents. DO3 is a practical, versatile detector for applications where the user needs to confirm that a system is ozonating the water, but does not need the “accuracy” and high cost of complicated analytical, inline dissolved ozone meters.

DO3 provides rapid readings (5 minutes or less), with typical accuracy of $\pm 20\%$ when compared to the indigo colorimetric reference method. DO3 measures the ozone in the airspace above the sample, taking advantage of the ratio between the ozone actually present in the water and the ozone in the air immediately above the surface of the water. While affected to some extent by temperature and atmospheric pressure, this simple measurement is sufficiently accurate for use in a wide range of ozonated water applications.

2.2 Making Measurements

Note: See accompanying flowchart in Figure 2.

With the instrument off, push and release the button once. After a self-test, the display will show 'MEAS' for 2 seconds, and then begin showing mg/L of ozone on the display (e.g. 0.00). Make sure this ppm reading is less than 0.02* before proceeding.

The display will flash during this time, which means the instrument is in the recovery state. This state allows you to wait for the reading on the display to come back down to 0.00 after a previous measurement. If the instrument reading is stable in the recovery state and is less than about 0.02 mg/L, DO3 is ready use. Make sure to read the instructions below and perform them as described:

1. Clean out all beakers and bottles with ozone-free water before first test and any subsequent tests.
2. Start the ozonated water source, if required, and allow it to warm up as directed by instructions from the manufacturer.
3. If the ozonated water system operates at constant flow, open the bypass or sample line to collect a sample of the ozonated water. Allow water to flow through sample line for 10 seconds, or until the sample line has been flushed of any standing water. Then collect a 200 mL sample of the water in the provided beaker.

* If reading is consistently stable at some value greater than 0.02, then see application notes about re-zeroing, available at: www.kwjengineering.com/pocketozone.

4. Allow the beaker to sit for 30 seconds to allow any entrained ozone to clear, then pour half (100 mL) of the sample water into the 500mL sample bottle and screw on the cap.
5. Allow the water to sit in the bottle for no more than 1 minute, then shake the bottle for 5 seconds (10 shakes).
6. Immediately after shaking the bottle, press-and-release DO3's button. The display will briefly read "STRT", which indicates the start of the 5 minute measurement period. After this the display will stop flashing, and will read mg/L ozone on the display (e.g. 0.00 mg/L). Immediately unscrew the cap from the bottle and place DO3 over the bottle neck (see Figure 3), until seated. The display will update with a new reading every 5 seconds.
7. If ozone is present, you should see the display reading begin to increase within about 15 seconds. It will reach 60-70% of the final value in about 1 minute, and 75-80% of the final value in about 2 minutes. To obtain 100% of the final value, wait for the entire measurement period of 5 minutes. To quit early¹, push the button once and DO3 will turn off.
8. After 5 minutes the instrument will sound its alarm to indicate the end of the measurement period. The instrument display will alternate between "RSLT" and the *maximum* measured level of ozone in the water (mg/L) until the button is pushed (read next step before pushing).

¹ Note: If the water contains dissolved chemicals, organic matter, etc, that react with ozone (known as "chemical ozone demand") the ozone level in the water may drop off more rapidly than normal. If you notice that the measured ozone reaches a maximum and then starts dropping, you can record the maximum and stop the measurement early.

9. Remove DO3 from the bottle and set down. Press DO3's button once. The display will show "MEAS" for 3 seconds. If you are done, press the button again to turn DO3 off. If, however, you want to perform an additional measurement, do not push the button again. After showing "MEAS", the instrument will enter the Recovery State. In this state the display will flash, and update every 5 seconds with the concentration of ozone. Wait until the reading on the display has returned to below 0.02 before pushing the button to proceed with another measurement.

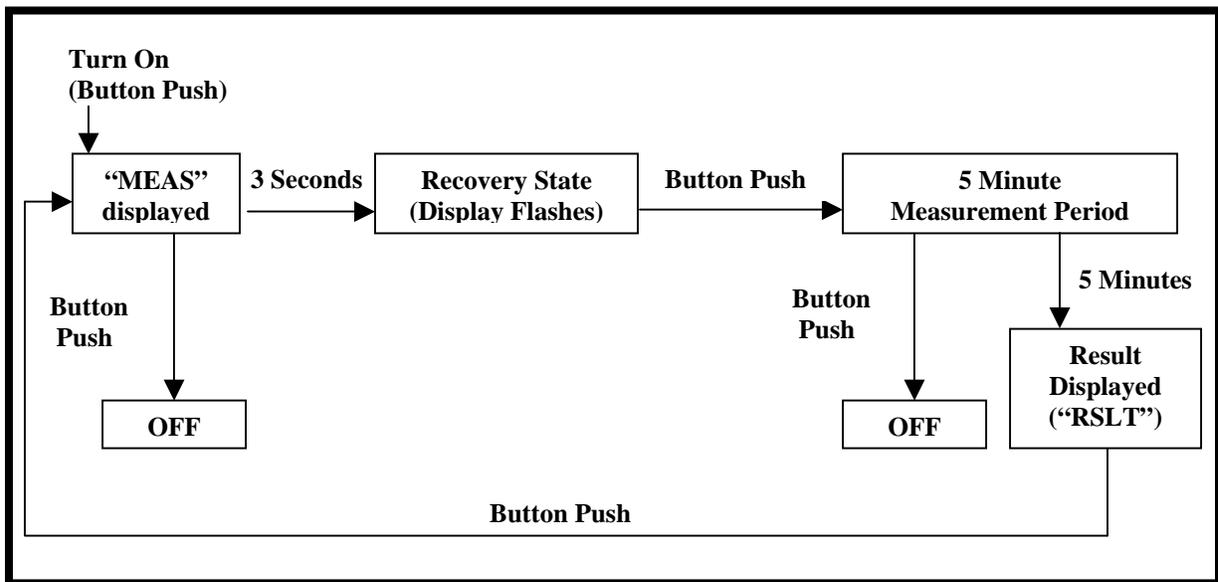


Figure 2: Flowchart that describes DO3 operation.



Figure 3: DO3 on sample bottle for measurement.

2.3 Replacing the Battery

The lifetime of the battery in DO3 will vary depending on usage. With typical usage of 5 days per week, and minimal alarming, the battery should last at least 3 months. Most batteries also have a shorter lifetime if used in a cold environment.

DO3 will let you know that the battery is weak by displaying "BATT" for several seconds during the Self-Test.

When you see the "BATT" warning, you have some time left before the battery is fully discharged, but you should take action soon to replace the battery. When the battery becomes too low for DO3 to operate, the display will show "----" after the Self-Test.

The battery in DO3 is easily replaceable, and available through Eco Sensors and at many stores. Be sure to purchase a new, CR2450 coin battery for replacement (any high-quality brand), and insert it according to the steps shown in Figure 4.



1. Remove the 2 screws in opposite corners of the adapter case (don't lose them!)



2. After removing screws, remove face-plate, exposing the instrument inside.



3. Put aside face-plate and remove the instrument from the cavity inside.



4. Lay the instrument face-down, and remove the screw from the battery cover. Put screw aside (don't lose it!).



5. Use coin to remove battery cover. Turn coin *clockwise*. Battery cover will pop off.



6. Remove old battery. Wait 10 seconds before inserting new one.

Check inside of battery cover for calibration due date.



7. Insert new battery, positive (+) side facing up.



8. Gently push battery forward as far as it will go.



9. Replace cover, as shown. Cover will snap into place. Replace screw. Place instrument back into the adapter case, and replace 2 screws on face-plate.

Figure 4: Replacing the Battery

After inserting a new battery, DO3's display may show high readings, or the message "SNSR". This new battery warmup period will last from a few minutes to a few hours, depending on how long the instrument was without power. Place DO3 in an area free of ozone or other interfering gases and wait for the reading to return to 0.00 mg/L before beginning to use.

When changing the battery, always check the inside of the battery cover to see when the next calibration is due. See Section 2.4 for important information about calibration.

2.4 Calibration

DO3 uses an electrochemical sensor to detect ozone. The sensitivity of this type of sensor can drift with environment and time, resulting in less accurate measurements. Thus **calibrating DO3 at least once per year, or whenever the accuracy of the reading is critical, is strongly recommended.** Failing to do so may result in lower accuracy measurement.

A sticker underneath the battery cover indicates the date of the next recommended calibration. Check this date every time you change the battery. When calibration is due, visit this website for more information on how to send your DO3 in for calibration service.

<http://kwjengineering.com/pocketozone>

2.5 Additional Usage Information

Application Notes:

Application notes for DO3 are available on the KWJ website (<http://kwjengineering.com/pocketozone>), and provide helpful information on proper use and applications for DO3 and should be read/used to get the most from DO3.

3. Interferences

For best results, do not use DO3 to test water with high levels of chlorine. Chlorinated water may contain dissolved chlorides. These not only reduce the ozone concentration, but also generate chlorine species that may give a false high reading on DO3. For best results, feed water into ozonation systems should have no chlorine, or should pass through a chlorine-removing filter.

4. Glossary of Terms

mg/L: Milligrams per liter is a concentration term that indicates the number of milligrams of ozone in 1 liter of water.

PPM: Parts per million by volume is a concentration term that indicates that there is one part ozone in one million parts water. Because water has a mass of 1 g per mL, 1 mg/L corresponds to 1 ppm by volume.

HOT: Temperature is more than 50°C (122°F).

COLD: Temperature is less than 0°C (32°F).

SNSR: Sensor may be malfunctioning, or may be responding to a strongly interfering gas. Move DO3 to an area free of ozone and other interfering gases. If message does not go away after 1-2 hours, contact Eco Sensors or your authorized supplier.

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5. Care and Maintenance

To maintain best performance clean it with a cloth, lightly dampened with water. Never use soap, cleansers, alcohol, gasoline, paint thinner, or other solvents to clean the device. Do not submerge the device in water or any liquids. Do not refrigerate or heat the device, or subject it to extremes of temperature or pressure. Non-adherence to general maintenance will void the warranty.

For optimum lifetime and use, keep the device away from extremes in temperature and humidity, and store it in a clean place away from solvents, chemicals, disinfectants, pesticides, and cleaners. Also avoid excess exposure to smoke. For maximum lifetime of electronics and sensors, store and operate in moderate environmental conditions, such as temperatures between 40-80°F (4-27°C), RH between 40-85%, and atmospheric pressure. Maximum accuracy is achieved when the unit is calibrated and used under the same environmental conditions. All DO3 instruments are calibrated at KWJ Engineering in conditions of approximately 72 F and 50% RH.

For highest accuracy results, or if DO3 is being used in non-standard environmental conditions (such as very dry air or high humidity), calibration may be required at more frequent intervals. It is best for every user to determine optimum calibration cycles in their particular application.

6. Contact Us

By Telephone:

For technical or operational questions about DO3, you may contact our technical support at: (510) 791-0951.

For other questions, or sales information, you may call our toll-free customer service line at (800) 472-6626.

Both phone numbers are answered between the hours of 8:00 a.m. and 5:00 p.m., Pacific Standard Time.

By Email:

Support: tech@ecosensors.com

Sales: sales@ecosensors.com

On the Web:

<http://www.ecosensors.com>

<http://www.kwjengineering.com>

By Mail:

KWJ Engineering Inc.
Eco Sensors Division
8440 Central Ave. Suite # 2D
Newark, CA 94560

7. WARRANTY

KWJ Engineering warrants to the original purchaser that this product shall be free from any defect in the materials or workmanship for 1 year from the date of purchase (excluding the battery). This warranty does not cover wear and tear due to normal use. It does not apply to any product that has been subjected to misuse, abuse, neglect, accident, tampering or unauthorized repairs. KWJ Engineering may elect to replace the unit, at no extra cost, with the same or a similar unit rather than repair it.

KWJ is confident you will have many years of use from your DO3. If a defect covered by this warranty should occur, contact KWJ and obtain a return authorization. Then return the product to us at your expense, along with a dated sales receipt, and a brief explanation of the problem.