



STANDARD OPERATING PROCEDURE

MAINE VOLUNTEER RIVER MONITORING PROGRAM

METHODS FOR USING THE YSI PROFESSIONAL OPTICAL DISSOLVED OXYGEN (ProODO) INSTRUMENT IN RIVERS AND STREAMS



Note: The mention of brand names does not constitute recommendation of a specific company.



Volunteer River Monitoring Program (VRMP)
Standard Operating Procedure
Methods for using the YSI Professional Optical Dissolved Oxygen (ProODO) Instrument

Prepared by
Mary Ellen Dennis
Maine Department of Environmental Protection
Bureau of Land and Water Quality
Division of Environmental Assessment
17 State House, Augusta, ME 04333

1. Applicability. This standard operating procedure (SOP) is used by the Volunteer River Monitoring Program (VRMP) of the Maine Department of Environmental Protection’s Division of Watershed Management. It applies to the collection of dissolved oxygen (DO) and temperature from rivers and streams in Maine using the YSI Professional Optical Dissolved Oxygen (ProODO) Instrument.

2. Purpose. This purpose of this SOP is to provide standardized methods for volunteer groups to determine dissolved oxygen and temperature of rivers and streams as an instantaneous reading using the YSI Professional Optical Dissolved Oxygen (ProODO) Instrument. This SOP also provides standardized methods for DEP VRMP staff to conduct quality assurance checks on volunteer groups’ equipment.

3. Definitions.

A. YSI. Yellow Springs International, manufacturer of water quality monitoring meters.

B. Optical Dissolved Oxygen Sensor (ODO). Sensor that measures the light emission characteristics of a luminescent reaction.

C. Sensor Cap. Removable sensing cover that protects the sensor and is replaced once per year.

D. Calibration. Set of procedures established by the manufacturer to ensure that the meter is operating properly; a critical quality assurance step in meter preparation prior to use.

E. Probe Guard. A protective cover for the ODO sensor cap.

F. Calibration/Storage Sleeve. Cover for the probe guard that keeps the probe in a moist atmosphere for storage or calibration.



4. Responsibilities.

A. *Volunteer Monitors & Volunteer Groups*

- **Certification.** It is the responsibility of the individual obtaining this data to maintain current certification for the parameter(s) they collect if they wish their data to be entered into the VRMP database. Training will be provided to volunteers on an annual basis by VRMP/DEP staff, and certification will last for one year from the date of training.
- **Data Recording.** It is the responsibility of the individual obtaining this data to record the results and additional qualifying information on current field sheets obtained from their affiliated watershed association or through the VRMP program of the DEP.
- **Data Quality Checks and Data Submission.** The data manager for the volunteer group will collect and enter volunteer field sheet data onto the appropriate computer file, perform quality assurance checks (refer to Section 5.10 of the Quality Assurance Program Plan), and submit data to the VRMP following protocols outlined in the volunteer group’s latest sampling and analysis plan (SAP) that has been approved by the VRMP.

B. *Volunteer River Monitoring Program (VRMP) Staff*

- **Oversight of Volunteer Groups and Volunteers.** VRMP staff will oversee volunteer groups and volunteers through a variety of ways including maintaining an up-to-date VRMP quality assurance program plan (QAPP); reviewing sampling and analysis plans (SAPs) of the volunteer groups; providing annual training/certification sessions for volunteers; conducting quality assurance checks on volunteer data collection and data submitted by volunteer groups and laboratories; and uploading data into the DEP’s EGAD database. These tasks are described in greater detail in the VRMP’s latest QAPP.

5. Guidelines and procedures.

A. *YSI ProODO Instrument Preparation.*

- **First time use.** Follow manufacturer’s instructions for preparing meter for first time use. (refer to Appendix A; “Initial Setup”, pgs. 4-14 and “ODO Probe Setup” pgs. 15 – 18).
 - If you plan to use the data storage features of the meter (in addition to manually writing down data on the VRMP field data sheet), then familiarize yourself with Appendix A, “Files and Site Lists”, pgs. 25-29.



- **Beginning of field season.** Before each field season, volunteer monitoring groups shall conduct a full inspection of the meter. A new sensor cap and batteries shall be installed prior to the start of field sampling and additionally, as needed. Refer to Appendix A, “Sensor Cap Replacement”, pgs. 31-33.
 - *Note of Caution:* Only use optical tissue or cotton swabs and water to clean the sensor cap. Do not use organic solvent solutions such as acetone or alcohol with the sensor cap and do not scrub the sensor cap or the sensor lens. In addition, each meter “setup” should be equipped with the following items so that field repairs can be undertaken as necessary:
 - Extra batteries
 - Field data sheet
 - Pencil with eraser

- **Prior to field sampling.** Before each field sample collection, the volunteer shall inspect the meter including an inspection of the condition of the sensor cap and batteries.
 - (1) Batteries should be checked for charge and/or expiration.
 - (2) The sensor cap should be kept clean. To clean, gently wipe away any fouling with a lens cleaning tissue that has been moistened with water.
 - (3) Be familiar with the testing, inspection, maintenance, and calibration considerations described in sections 5.6 through 5.8 of the VRMP QAPP (MDEP, 2009).

- **Dissolved Oxygen Calibration.** For best performance, a one-time calibration initialization should be performed when a new sensor is installed. Additionally, calibrations can be performed at the operator’s discretion but are not required. YSI recommends verifying the instrument’s calibration on a daily basis. To verify the instrument’s calibration, place the sensor in its calibration environment and check to see that the DO% is reading its calibration value based on the barometric pressure. Refer to Appendix A, “DO% Calibration Values”, pg. 44.

Calibration can be performed manually using one of several options: Water saturated air (recommended), air saturated water, calibration to a solution with a known DO concentration (usually determined by a Winkler Titration) or zero calibration (followed by one of the previous options). For instructions, refer to Appendix A, “Calibration – Dissolved Oxygen”, pgs. 18-22. Note: VRMP staff have found that an air saturated water sample method provides the best results.

- **Barometer Calibration.** The barometer is calibrated in the factory. If the barometer requires calibration, refer to Appendix A, “Barometer”, pgs. 23-24.

B. Dissolved Oxygen and Temperature Measurements.



- **Sampling Period and Site Location.** Sampling period and site location information will be documented in the volunteer groups’ SAPs (that require approval by the VRMP) which are submitted by the volunteer groups prior to any sampling. (Detailed information regarding how volunteer groups are to obtain and document site location information can be found in VRMP SOP-02 [Documenting Site Location].)
- **Sample Timing.** Dissolved oxygen data collected between dawn and 8 am are important for assessment of attainment of DO criteria within Maine’s Water Quality Standards. But, except as naturally occurs, DO concentrations below the applicable DO criteria at any time of day signal non-attainment. If there are no DO concentrations below the criteria after 8 am, then data between dawn and 8 am must be collected to assess attainment of the criteria.
- **Re-Familiarize Yourself With the Meter and its User Manual.** Familiarize yourself with the basic operations, keypad and readouts of the meter. See Appendix A; “Key Pad”, pg. 2 and “Main Display”, pg. 6. If applicable, see Appendix A, “Logging”, pg. 13.
- **General Sampling Protocol.**
 - Record site location on data sheet.
 - Remove probe from calibration/storage sleeve.
 - Submerge probe in the water at the site where you are monitoring, as described in your group’s approved SAP. Move the probe in the sample to release any air bubbles.
 - Allow the temperature reading to stabilize and wait approximately 25-30 seconds for the DO readings to stabilize before recording the value on the field sheet.
 - Follow the instructions below measuring specific parameters.
 - Since there is no warm-up period associated with the YSI ProODO and because the calibration is stable, you may wish to turn off the instrument between readings to conserve battery power.
- **Dissolved Oxygen Measurements.**
 - (1) Review and follow the instructions for making DO measurements in Appendix A, “Taking Measurements”, pg. 24.
 - (2) In most cases, only a limited amount of initial probe movement in the water is required for taking measurements (as opposed to older styles of dissolved oxygen meters which require continuous flow or movement across their membranes).
- **Temperature Measurements.**
 - (1) Temperature will display when taking Dissolved Oxygen measurements. Refer to Appendix A, “Taking Measurements”, p. 24.



(2) Record temperature value displayed on the screen.

- **Quality Control.**

(1) At the beginning of each field season, all VRMP staff and VRMP volunteers who collect dissolved oxygen and temperature data will have a training/refresher/certification session to (re)familiarize themselves with the contents of this SOP.

(2) For every volunteer, a field duplicate shall be obtained for all parameters for at least 10% of their own sampling efforts. A field duplicate will be collected for every 10 samples monitored.

(3) Refer to the VRMP quality assurance project plan (QAPP) for more QA/QC details.

6. Equipment Care.

A. *Start of field season.*

1. Follow manufacturer's directions for preparation of a new probe or renewing probe in the spring. Be sure to replace sensor cap at the start of each sampling season. (Refer to Appendix A, "Sensor Cap Replacement", pgs. 31 - 33).
 - *Note of caution:* Avoid handling the face of the sensor cap. DO NOT use alcohol or other organic solvents to clean the face of the sensor cap. These solvents will destroy the sensor cap.
2. Use new batteries at start of each sampling season. An extra set of appropriate size batteries should be included in the meter carrying case.
3. Each D.O. meter should have the spare items for making repairs in the field. See section 5-A of this SOP for a list of necessary items.

B. *Field Season*

1. Ideally the meter should be in water-resistant case with padding to protect it from damage.
2. Allow the case and contents to air-dry at end of each day. This may be accomplished by simply propping the lid open. When contents are very wet, remove the contents and spread out to facilitate drying.
3. Keep meter from freezing.
4. Refer to Appendix A, "Maintenance and Storage", pg. 30 and "Sensor Storage", pg. 34.
5. When the ODO sensor is not in use, it must be stored in a moist environment. Moisten the sponge in the calibration/storage sleeve with a small amount of clean water and place over the probe. If the cap dries out, it will need to be rehydrated. See Appendix A, "Rehydrating the Sensor Cap", pg. 33.

C. *End of field season*

1. Completely dry meter, case, and all items in the case before storing.
2. Remove batteries.
3. Keep meter dry and at room temperature to prevent corrosion of electronic parts.



4. Record winterization date and equipment repairs in your volunteer group's Equipment Log.
5. Label the meter and case as 'WINTERIZED' in an obvious manner (so users will know the current status of the unit).
6. Moisten the sponge in the red protective plastic cap that was provided with the probe and place it over the sensor with the sensor cap installed. Inspect the sponge every 30 days to make sure it is still moist. If you no longer have the red protective cap, then moisten the sponge in the calibration/transport sleeve and place this over the probe.

7. Specifications

Measurement	Range	Resolution	Accuracy
Temperature	-5°C - 70 °C	0.1 °C	±0.2 °C
Dissolved Oxygen (mg/L)	0-50 mg/L	0.01 or 0.1 mg/L (auto scaling)	0-20 mg/L, ± 0.1 mg/L or ± 1% of reading, whichever is greater.
			20-50 mg/L, ± 10% of the reading.
Dissolved Oxygen (%)	0-500%, air saturation	0.1% air saturation	0 to 200% air saturation, ± 1% of the reading or ± 1% air saturation, whichever is greater.
			200-500% air saturation, ± 10% of the reading.



8. Appendices.

A. *YSI ProODO User Manual.*

YSI. March 2009. Yellow Springs, Ohio.

9. References

A. *DEP Standard Operating Procedures:*

- Document number #:DEPLW-0890: Dissolved Oxygen and Temperature, Instantaneous Measurement using Electronic Meters
- Document number #: DEPLW-0636: Protocols for using Hanna Dissolved Oxygen and Specific Conductance/Temperature/pH Meters

B. *Maine VRMP QAPP:*

- Maine Department of Environmental Protection (MDEP). 2009. Maine Volunteer River Monitoring Program (VRMP) Quality Assurance Program Plan (VRMP). Portland, ME. Document number#: DEPLW-0984.