



STANDARD OPERATING PROCEDURE
MAINE VOLUNTEER RIVER MONITORING PROGRAM
METHODS FOR USING THE YSI PROFESSIONAL PLUS
HANDHELD METER 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 Plus Handheld Meter

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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 Plus handheld meter.

2. Purpose. This purpose of this SOP is to provide standardized methods for volunteer groups to determine dissolved oxygen of rivers and streams by volunteers as an instantaneous reading using the YSI Professional Plus handheld meter.

3. Definitions.

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

B. Sensor. Electrode sensing portion of the cable assembly.

C. O2 solution. Electrolyte solution used to fill the probe.

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. Membrane. A clear, transparent and paper-thin substance similar to cellophane on the end of the probe. The membrane is permeable and allows gases such as oxygen to pass through into probe sensors while at the same time isolating most other undesirable substances.

F. Jigging. To move the probe under water using steady movements. Unless the probe is being held in swiftly flowing water, the probe shall be moved (“jigged”) to overcome the inherent consumption of oxygen by the sensor. The rate of jigging depends on the type of membrane on the sensor:

- 3” per second for 2.0 PE membrane
- 6” per second for 1.25 PE membrane
- 12” per second for Teflon membrane



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 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 Professional Plus Meter Preparation.*

- **Sensor options.** The Professional Plus has two sensor options for dissolved oxygen – Polarographic or Galvanic sensor. Be sure of which type of sensor is installed and follow requirements for that type of sensor and setup.
- **First time use.** Follow manufacturer’s instructions for preparation and set up of the meter for first time use. (Refer to Appendix A: “Setup”, pg. 2; “Preparing the DO Sensor for the First Time, pg. 21; and “Setup – Dissolved Oxygen, pg. 22).



- **Beginning of field season.** Before each field season, volunteer monitoring groups shall conduct a full inspection of the meter. If membrane has been stored dry, follow manufacturer’s instructions for first time use (see above). A new membrane and batteries shall be installed prior to the start of field sampling and additionally, as needed (refer to Appendix A, “Sensor Maintenance – Dissolved Oxygen”, pg. 60). In addition, each meter “setup” should be equipped with the following items so that field repairs can be undertaken as necessary:
 - Extra O2 solution and membrane caps for probe
 - Extra batteries
 - Field data sheet
 - Screwdriver for removing back of meter to replace batteries
 - 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 probe membrane, membrane, and batteries.
 - (1) Check the membrane for air bubbles and wrinkles. If bubbles or wrinkles are present, remove membrane, refill with O2 solution, and replace membrane (Refer to Appendix A, “Sensor Maintenance – Dissolved Oxygen”, pg. 60).
 - (2) Check to make sure drops of water are not clinging to the membrane. If drops are present, blow on membrane to gently remove droplets. Don’t tap; these probes are very fragile. Replace probe into the calibration chamber on the side of the meter.
 - (3) Batteries should be checked for charge and/or expiration.
 - (4) Be familiar with the testing, inspection, maintenance, and calibration considerations described in sections 5.6 through 5.8 of the VRMP QAPP (MDEP, 2009).
 - (5) Power on the meter and allow sufficient warm-up time prior to initial use for the day. The Polarographic sensor requires 5-15 minutes to warm-up. The Galvanic sensor does not require a warm-up.

- **Dissolved Oxygen Calibration.** If collecting dissolved oxygen measurements, the YSI Professional Plus meter shall be calibrated each time the unit is turned on. Meters shall be calibrated to a 100% water-saturated air environment (for instructions, refer to Appendix A, “Calibration – Dissolved Oxygen”, pg. 27).

- **Dissolved Oxygen Check Against “Zero Dissolved Oxygen” Standard.** VRMP staff shall check DO meter using zero oxygen solution at the beginning of the field season. Volunteers shall check their DO meter using zero oxygen solution in mid-season and at the end of the field season. The zero oxygen solution is provided by VRMP/DEP staff. Volunteers shall record the dissolved oxygen value they measure with their meter in the appropriate blank on the field data sheet.

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.
- **Familiarize Yourself With the Meter.** Familiarize yourself with the basic operation, keypad, and readouts of the meter (Appendix A, “Key Pad”, pg. 9 and “Main Display”, pg. 11).
- **General Sampling Protocol.**
 - Record site location on data sheet.
 - Remove probe from calibration cup or sleeve.
 - Submerge probe in the water at the site where you are monitoring, as described in your group’s approved SAP. Give the probe a quick shake to release any air bubbles.
 - For either parameter (DO or temperature), allow the temperature reading to stabilize (at least 15 seconds) before recording the value on the field sheet.
 - Follow the instructions below measuring specific parameters.
 - The meter should remain turned on between stations, unless time between samplings exceeds 30-60 minutes. If meter is turned off, the field probe should be stored inside the calibration chamber during transport, sufficient time (5-15 min) should be allowed for warm-up, and the meter should be re-calibrated.
- **Dissolved Oxygen Measurements.**
 - (1) Review and follow the instructions for making DO measurements in Appendix A, “Taking Measurements”, pg. 51. Record DO in both mg/L (or ppm) and % saturation.
 - (2) *Note of caution:* Unless the probe is equipped with a stirrer, jiggling of the probe is extremely important for obtaining accurate dissolved oxygen readings, unless you have placed the probe in a swiftly-moving section of stream or river. (The probe is dependent on the amount of oxygen that passes across the membrane, and the probe actually consumes oxygen as it is making measurements.)
- **Temperature Measurements.**



(1) 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, temperature, specific conductance, and salinity 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.

(4) Review “Preparing the DO Sensor for the First Time”, p. 21, “Set-up – Dissolved Oxygen”, p. 22 and “Sensor Maintenance – Dissolved Oxygen”, p. 60.

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 membrane at the start of each sampling season.
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 be equipped with extra items for making repairs in the field. See section 5-A of this SOP for a list of items.

B. Field Season

1. Ideally the meter should be in water-resistant case with padding to protect it from damage.
2. Store the sensor in the sensor storage cup or sleeve. Keep the sponge moistened with tap water to maintain a 100% saturated air environment.
3. 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.
4. Keep meter from freezing.
5. Refer to Appendix A, “Sensor Maintenance – Dissolved Oxygen”, p. 60 and Appendix B, “YSI Calibration Tips” for manufacturer’s recommendations for maintenance requirements.

C. End of field season

1. Completely dry meter, case, and all items in the case before storing.
2. Remove batteries.
3. Remove membrane.
4. Rinse entire probe and calibration chamber with distilled water and allow to air dry.



5. Install a clean dry new membrane cap over top of probe to keep dust and dirt out for winter.
6. Keep meter dry and at room temperature to prevent corrosion of electronic parts.
7. Review Appendix A for more tips.
8. Record winterization date and equipment repairs in your volunteer group's Equipment Log.
9. Label the meter and case as 'WINTERIZED' in an obvious manner (so users will know the current status of the unit).

7. Specifications

Measurement	Range	Resolution	Accuracy
Temperature	-5 °C to 70 °C	0.1 °C	±0.2 °C
Dissolved Oxygen (%)	0 to 200%	0.1% or 1% user selectable	±2% air sat or ±2% of reading, whichever is greater
	200 to 500%		±6% of reading
Dissolved Oxygen (mg/L)	0 to 20 mg/L	0.01 mg/L or 0.1 mg/L, user selectable	±0.2 mg/L or ±2% of reading, whichever is greater
	20 to 50 mg/L		±6% of reading

8. Appendix

A. YSI Meter owner's manual:

YSI Incorporated. March 2009. YSI Model Professional Plus User Manual. Yellow Springs, Ohio.

B. YSI Professional Plus Calibration Tips.

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9. References

A. DEP Standard Operating Procedures:

- Document number #:DEP-LW0890: Dissolved Oxygen and Temperature, Instantaneous Measurement using Electronic Meters
- Document number #: DEPLW0636: 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. DEPLW-0984.