



STANDARD OPERATING PROCEDURE

MAINE VOLUNTEER RIVER MONITORING PROGRAM

METHODS FOR USING THE HACH HQ30d SINGLE INPUT MULTI-PARAMETER DIGITAL METER WITH THE HACH LDO101 IntelliCAL RUGGED OPTICAL DISSOLVED OXYGEN PROBE 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 Hach HQ30d Single-Input Multi-Parameter Digital Meter with the Hach LDO101 IntelliCAL Rugged Optical Dissolved Oxygen Probe

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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 Hach HQ30d single-input multi-parameter digital meter with the Hach LDO101 IntelliCAL Rugged Dissolved Oxygen Probe.

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 Hach HQ30d digital meter with the LDO101 IntelliCAL Rugged Dissolved Oxygen Probe. This SOP also provides standardized methods for DEP VRMP staff to conduct quality assurance checks on volunteer groups' equipment.

3. Definitions.

- A. Hach.** Manufacturer of water quality monitoring meters.
- B. Luminescent Dissolved Oxygen Sensor (LDO).** 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. iButton®.** A computer chip enclosed in a 16mm thick stainless steel can that contains the calibration codes specific to individual sensor caps. iButtons® are replaced once per year.
- E. 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.

F. **Shroud.** A protective cover for the LDO sensor cap.

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. *Hach HQ30d Meter Preparation.*

- **First time use.** Follow manufacturer's instructions for preparing meter for first time use. (refer to Appendix A; Section 3: Installation, pgs. 11-17 and Section 4: System Start Up, pgs. 19 – 23).



- *Note of Caution:* Before attaching the LDO probe for the first time, set the date and time in the meter. If the meter data and time are incorrect when the probe is installed, the probe will retain this incorrect time stamp for the remainder of its service life. (Refer to Appendix A, Section 4.4: Setting the Date and Time, pg. 22).
- 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, Section 5: Standard Operation, pgs. 25-45.
- **Beginning of field season.** Before each field season, volunteer monitoring groups shall conduct a full inspection of the meter. A new sensor cap, iButton® and batteries shall be installed prior to the start of field sampling and additionally, as needed. Refer to Appendix C for details on sensor cap and iButton® replacement (pgs. 3 – 7).
 - *Note of Caution:* Only use optical tissue or cotton swabs and soapy water to clean the sensor cap. Do not use organic solvent solutions such as acetone or methanol with the LDO101 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) Ensure that there is no water present between the sensor cap and the clear plastic sensor lens at the top of the probe (Refer to Appendix B, Section “Maintenance”, pg. 4)
 - (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.** The Hach HQ30d meter and LDO probe are factory-calibrated. For best performance, a one-time calibration initialization can be performed when a new sensor is installed. Additionally, calibrations can be performed at the operator’s discretion but are not required. Ensure that the shroud is removed prior to calibrating the probe (Refer to Appendix B, “Removing and Replacing the Shroud, pgs. 2 – 3).

Calibration can be performed manually using one of two standards: Water saturated air (manufacturer recommended) or calibration to a solution with a known DO



concentration (usually determined by a Winkler Titration). Note: VRMP staff found that an air saturated water sample method provides the best results.

- *For the annual standardization & calibration of VRMP staff “benchmark” Hach HQ30D meters and LDO101 probes for use in accuracy-checking of equipment at volunteer certification workshops.* VRMP staff will follow the instructions in Appendix A, Section 8.2: Calibrating the LDO Probe (pgs.79 – 81). VRMP staff will obtain the ‘Winkler titration method’ measurements of the dissolved oxygen concentration of the test water sample using the laboratory-grade Winkler titration setup at DEP facilities in Augusta. This data obtained using the Winkler setup will be used as the calibration/standardization value that is entered into the Hach HQ30D meter annually.
- *For general purpose use of the Hach HQ30D meter and LDO101 probe.* Hach recommends meter calibration using the DO % water-saturated-air calibration. (For instructions, refer to Appendix A, Section 8.2: Calibrating the LDO Probe, pgs. 79 - 81). For best performance, a one-time calibration initialization can be performed when a new sensor is installed. Additional calibrations can be performed at the operator’s discretion but are not required.
 - A count down message appears on the screen 30 days before the sensor-cap expiration date of the LDO IntelliCAL probe. This message will be displayed until there are zero days remaining and the sensor cap must be replaced. All measurements taken after the sensor cap expiration date appear with the calibration ? icon at the top left corner of the screen.

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 meter, including Appendix A, Section 1: General Information, pgs.



7-8, Section 3: Installation, pgs. 11 - 16, and Section 4: System Start Up, pgs. 19 - 22.

- **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.
 - For any of the parameters measured, allow the reading to stabilize (at least 30 seconds) 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 Hach HQ30D meter and LDO probe 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, Section 8.1: Taking a Dissolved Oxygen Measurement, pg. 79.
 - (2) Refer to instructions regarding display of units (e.g., mg/L, ppm, or DO % [% saturation]) in Appendix A, Subsection 8.4.4: Modifying the LOD Measurement Units, pg. 86.
 - (3) 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, Section 8.1: Taking a Dissolved Oxygen Measurement, pg. 79.
 - (2) For information on how to change units, refer to Appendix A, Section 9.10: Changing the Temperature Units, pg. 99.

- **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 C, LDO Sensor Replacement Kit, pgs. 3 - 7).
 - *Note of caution:* Avoid handling the black face of the sensor cap. DO NOT use alcohol or other organic solvents to clean the black 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, Section 10: Maintenance, pg. 101 and Appendix B, Section, "Maintenance", pg. 4 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. Keep meter dry and at room temperature to prevent corrosion of electronic parts. The Hach HQ30D and IntelliCAL LDO probe should be stored between -20° C to 60° C.
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).

7. Specifications

Measurement	Range	Resolution	Accuracy
Temperature	0°C - 50 °C	0.1 °C	±0.3 °C
Dissolved Oxygen	1 – 200% saturation	0.01 mg/L	± 0.1 mg/L for 0.1 – 8 mg/L
	0.1 – 20.0 mg/L (ppm)		± 0.2 mg/L for greater than 8.0 mg/L



8. Appendices.

A. Hach Meter and Probe owner's manual:

Hach. 2006. Hach HQ Series Portable Meters User Manual. Loveland, Colorado.

B. Hach Probe Instruction Sheet:

Hach. 2006. Hach LDO101-05, LDO101-10, LDO101-15, or LDO101-30 Probe Instruction Sheet. Loveland, Colorado.

C. Hach LDO™ Sensor Replacement Kit:

Hach. 2006. Hach LDO™ Sensor Replacement Kit, for use with Hach LDO101 Standard and Rugged Dissolved Oxygen Probes User Manual. Loveland, Colorado.

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.