



MassDEP

Massachusetts Department of Environmental Protection
Bureau of Water Resources
Watershed Planning Program

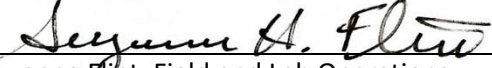
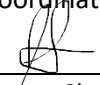

STANDARD OPERATING PROCEDURE

Multi-Probe Discrete (Attended) Water Quality Data Collection

CN 4.26

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List of Revisions

Revision Date	Revision	Pages #s
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2007	General updates	throughout
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1.0 SCOPE AND APPLICATION

Use of water quality probes is an integral component of the MassDEP Watershed Planning Program's (WPP) ambient monitoring program. This SOP describes the use of probes for short term or discrete measurements in streams, rivers, ponds, lakes and estuaries. Typically, setup consists of a display logger cabled to a submersible sonde (multiple probe sonde or single probe). Single probe units are used "hands-on" in the field, while stand-alone multi-probe loggers can be used to collect either discrete or continuous (see CN 4.42 for continuous data collection methods) data.

Key responsibilities:

Staff	Primary Responsibilities
Field & Lab Operations Coordinator	Overall management of calibration lab: calibrations, preparation of standards, training, instrument maintenance, product testing and purchasing
Monitoring Coordinators	Field use and data collection, survey planning, probe requests
Database Manager	Data management, database applications
Seasonal staff	Instrument calibrations, preparation of standards, post-field calibration checks

2.0 COMPONENTS

As of January 2025, WPP's fleet of water quality probes include: YSI EXO1s, YSI EXO1^s (with depth) and YSI EXO2s, SUNAs (not addressed in this SOP), and a Castaway CTD probe (SOP to be developed). For full details including serial numbers, refer to the instrument list maintained by WPP's Database Manager. This SOP focuses on the use and maintenance of the YSI EXOs. For operation maintenance of the YSI EXO2s and Seabird SUNAs, refer to the manufacturer's manual and relevant project QAPP.

In addition, WPP owns accessory equipment to operate and maintain these units, such as auxiliary batteries, cables, solutions, misc. spare parts and hardware, etc. Available cable lengths include 4 meters, 15 meters, 25 meters, and 33 meters. YSI EXO1 units take either a rechargeable battery pack or 2 "D" cell batteries.

3.0 SPECIFICATIONS

Sensor resolution, accuracy and precision, as provided by the manufacturers, are provided below for each water quality parameter measured. These specifications represent a baseline of expected performance and for comparison to results. WPP's well-maintained, calibrated units typically display results well within these specifications. As of 2025, the YSI EXO probes are the primary instrument used for discrete (attended) measurements in freshwaters. YSI EXO2s and Seabird SUNAs are used for continuous and discrete measurements in marine waters.

YSI EXO and EXO2	Resolution	Range	Accuracy (+/-)
Temperature (deg. C)	0.001 C	-5 to + 50 C	-5 to 35°C: ±0.01°C 35 to 50°C: ±0.05°C
Depth (m) "shallow"	0.001 m	0 – 10 m	±0.04% FS (±0.013 ft or ±0.004 m)
pH	0.01 units	0 – 14 units	±0.1 pH units within ±10°C of calibration temperature; ±0.2 pH units for entire temp range
Dissolved Oxygen (mg/l and % saturation)	0.1% air sat. 0.01 mg/L	0 to 500% air sat. 0 to 50 mg/L	0-200%: ±1% reading or 1% air sat., 200-500%: ±5% reading 0-20 mg/L: ±1% of reading or 0.1 mg/L; 20-50 mg/L: ±5% reading

Specific Conductance (uS/cm)	0.0001 to 0.01 mS/cm range-dependent	0 – 200 mS/cm	0-100 mS/cm: $\pm 0.5\%$ of reading or 0.001 mS/cm, whichever is greater; 100-200 mS/cm: $\pm 1\%$ of reading
Turbidity (NTU)			
Specific Conductance (uS/cm) Wiped sensor	0.0001 to 0.01 mS/cm range dependent	0-100,000 uS/cm	$\pm 1\%$ of reading or 2 uS/cm w.i.g.
Total Algae (TAL) (RFU and ug/L) Chlorophyll and Phycoerythrin	Chl: 0.01 RFU, 0.01 $\mu\text{g/L}$ Chl PE: 0.01 RFU, 0.01 $\mu\text{g/L}$	Chl: 0-100 RFU, 0-400 $\mu\text{g/L}$ Chl PE: 0-100 RFU, 0-280 $\mu\text{g/L}$	Linearity: Chl: $R^2 > 0.999$ for serial dilution of Rhodamine WT solution from 0-400 $\mu\text{g/L}$ Chl equivalents PE: $R^2 > 0.999$ for serial dilution of Rhodamine WT solution from 0-280 $\mu\text{g/L}$ PE equivalents
Seabird SUNA V2	Resolution	Range	Accuracy (+/-)
Nitrate	0.001 mg/L	0 – 28 mg/L 0 – 2000 μM	10mm pathlength: $\pm 2\mu\text{m}$ (0.028mgN/L)
Sontek CASTAWAY			
Conductivity	1 uS/cm	1 – 100,000 uS/cm	$\pm 0.05\%$ or ± 5 uS/cm
Sp. Conductivity	1 uS/cm	1 – 250,000 uS/cm	$\pm 0.25\% \pm 5$ uS/cm
Salinity	0.01 PSS-78	0 – 42 PSS-78	± 0.1 (PSS-78)
Temperature	0.01 C	-5 to 45 C	± 0.05 C
Pressure	0.01 dBar	0 – 100 dBar	$\pm 0.25\%$
Depth	0.01 m	1 – 100 m	$\pm 0.25\%$ FS
GPS	---	---	10 m

4.0 STORAGE AND TRANSPORTATION

When not in use, all probes are stored per manufacturer recommendations or as otherwise specified herein, to maximize probe life and maintain probe accuracy.

When used, each probe unit must be transported in a dedicated carrying case along with various accessories. Standard accessories can include sonde weight, over-the-shoulder straps for the carrying case, storage cup for sonde (EXO), extra field data sheets and COC forms, laminated field QuickGuides, and cleaning towels. Carrying cases should be zipped/closed during transport in the vehicle. For YSI EXOs, the storage cap should contain a small amount of water (tap water or surface water) to ensure that the sensors remain moist during transport. Between the vehicle and the sampling site, the multiprobe should be carried securely, ensuring that there is no strain on the cable junction and no risk to the sensors.

Transporting encased units in the beds of pickup trucks or in boats under tow is not allowed. Suitable locations for transport include the trunk or rear seat area of small sedans, the rear seat of pickup trucks, or the floor of a van.

All cables shall be protected from abrasion, unnecessary tension, bending over sharp edges such as boat gunnels or bridges, repetitive twisting, and excessive weight. Cable connectors shall be kept clean and free of dust, sand, grit, and water. Cables shall be coiled neatly after each use and stored in the carrying case. Upon return to the calibration laboratory, all cables shall be cleaned and inspected by the calibrator or laboratory supervisor.

5.0 PRE-SURVEY CALIBRATION AND POST-SURVEY CHECKS

Accurate calibration of probes in concentrated and dilute standards is essential for recording valid *in situ* water quality data. Calibrations shall be performed by competent WPP staff, trained and supervised by the Field and

Laboratory Operations Coordinator or, if necessary, by the supervisor. Pre-survey calibration and post-survey checks shall be performed on all probes used for routine monitoring as well as special projects. All calibration and QC check data is recorded on lab bench sheets and electronically in calibration files.

NOTE: In general all of a probes parameters will be calibrated before field use. Any parameters not calibrated will be noted and readings from the uncalibrated probes will not be used. (E.g. when a sonde might only be calibrated for conductivity if it is used to check conductivity-only deployed probes; in which case, only conductivity readings would be used.)

5.1 Equipment and Supplies

The equipment and supplies listed below are essential for routine calibration of WPP's multiprobes.

- ☐ Water deionization system with 0.2µm porosity final filters. The Barnstead/Thermolyne Corporation's "Barnstead E-pure Operation Manual and Parts List" is descriptive in all aspects of operation, maintenance, and diagnoses of problems. This Manual serves as the Standard Operating Procedure for the E-pure Deionization system.
- ☐ 2000 ml ± 0.5 ml volumetric flask with plastic cap.
- ☐ Volumetric TD ("to deliver") pipets: 10 ml ± 0.04 ml @ 20°C; 2ml ± 0.012 ml @ 20°C.
- ☐ Low-ionic phosphate standard stock solution developed by Metcalf and Peck (1993) as a quality control standard for pH and conductivity of surface waters, such as those typical of central and southeastern Massachusetts. A copy of the recipe for this standard is included as Appendix A.
- ☐ Prepared standards for pH (7.00, 4.00 and 10.00)
- ☐ Prepared standards for specific conductivity (typically 718 uS/cm, 1413 uS/cm, and 2000 uS/cm).
- ☐ Anhydrous sodium sulfite (CAS # 7757-83-7) for zero dissolved check solution.
- ☐ Nalgene® 250 ml LDPE dispensing bottle (Fisher 98/99 catalog no. 03-409-13B) with molded-in side arm spigot.
- ☐ PC Duster®2 (or comparable product); a non-flammable, ozone-safe, compressed gas canister with reusable nozzle.
- ☐ Misc. lab supplies, such as clean single-edge razor blades, Kim-Wipes, pH and DO probe electrolyte solutions, etc.

5.2 Material Safety and Waste Management

Safety Data Sheets (SDS) for all chemicals used are kept in a binder in each lab. Stock and primary calibration standards (liquid) for pH and conductivity (listed above) are non-toxic, stable and safe to dispose of down the drain.

The zero D.O. check solution (saturated sodium sulfite) should be refreshed as needed to maintain <0.2 mg/l D.O. When disposal is needed, dilute the sodium sulfite solution 50-100 times (e.g., for 100 mls., fill 1 gallon bucket to overflow) and drain to sanitary sewer.

The Hydriion dry buffer salts (potassium and sodium phosphate) may cause irritation of the eyes, skin, respiratory tract, and digestive tract if handled improperly or in the case of an accident. Each packet includes a warning about the aforementioned irritations as well as precautions and first aid measures. A primary first aid measure is to "flush eyes with plenty of water for at least 15 minute" and there is an emergency shower and eyewash directly forward of the door to the calibration laboratory (Room 226).

5.3 Preparation of Calibration Standards

Accurate, quantitative preparation of calibration standards is accomplished with skill, patience, and clean bench-top chemistry. Completion of this task on a routine basis shall be the responsibility of the Field and Lab Operations

Coordinator or a trained assistant. Prepared standards are purchased for pH and specific conductivity. Low-ionic strength (“LIS”) standard and zero dissolved oxygen check solutions are prepared in the lab.

Bottle cleaning

Bottles for stock solutions should be clean and free of contamination. Check condition of the calibration standards and bottles periodically and when making fresh standards. If necessary, clean and decontaminate bottles:

- ☐ Use safety glasses, plastic apron, and gloves
- ☐ Shake the solution remaining in the bottle vigorously to help dislodge at least some of the material that may be adhering to the walls of the bottle
- ☐ Add 20 ml of Clorox to a 500 ml bottle (Note: The dose for disinfection, as recommended on the Clorox label, is 1:32, or 15.625 ml per 500 ml; rounded up to 20 ml per 500) and fill the remainder with DI water.
- ☐ Invert bottle to make sure bleach solution makes contact with all inner surfaces
- ☐ Place tape marked “Clorox” or “Bleach” across the cap and neck of the bottle
- ☐ Allow solution to sit in capped bottle for one hour to assure adequate contact time for disinfection
- ☐ Empty solution into sink.
- ☐ Rinse bottle 4 times with DI water and twice with fresh reagent.
- ☐ Refill bottle with the appropriate solution.

This procedure also works well for the plastic rinse bottles and lab carboys.

Low-ionic calibration check standard (LIS)

The procedures described below are for preparation of the low-ionic standard. “Shelf life” or batch preparation cycle for the low-ionic standard is approximately two weeks.

- ☐ Add DI water to a clean 2-liter volumetric flask. Fill to approximately ½ of its volume.
- ☐ Add 10.0 - 20.0 ml of freshly prepared 6.86 pH buffer to the 2-liter volumetric flask with a volumetric pipet and swirl to mix.
- ☐ Fill with the 2-L flask with DI water until the bottom of the liquid meniscus is at the etched line. Cap securely and invert to flask ten (10) times slowly to mix. Be sure to swirl the contents of flask when it is in the inverted position.
- ☐ Dispense contents of volumetric flask into an appropriate glass bottle, labeled with “LIS” and preparation date (which serves as the batch #). Prepare new batch every two weeks.
- ☐ Check the new batch using a freshly calibrated instrument to ensure that it meets acceptance criteria (Table 1).
- ☐ Clean the flask by rinsing five (5) times with DI water. Invert flask to drain and place on calibration rack to air dry.

Zero D.O. Standard

Following Standard Methods and USGS TWRI Book 9, the zero standard is prepared daily as follows:

- ☐ Add sodium sulfite to excess in a 500-1000 ml container. This is achieved by dissolving approx. > 1 gram sodium sulfite per liter DI water.
- ☐ Prepare weekly prior to use and/or as needed.

Following instrument calibrations, perform final check using the zero DO standard by immersing DO probe into solution to confirm <0.5 mg/l reading. If test fails, perform maintenance or use another probe. When done, rinse probe and store in storage cup. See “waste management” section for disposal considerations for this solution.

5.4 Procedures for Calibration and Checks

Laboratory calibration of sensors includes the following provisions:

- ❑ Instrument setup and configuration (including editing of Site List for YSI units)
- ❑ Calibration of multiprobe sensors immediately preceding the survey
- ❑ QC checks within 24 hours following survey.

In general, calibrations of pH, specific conductance and D.O. follow the manufacturer's instructions, with slight modifications (e.g., checks using zero DO and low ionic solutions). See Appendix A for step-by-step QuickGuide for YSI calibration and post-field checks. Depth calibration is done in the field (at each site), prior to taking measurements.

Final pre-check readings in standards and post-field calibration checks should meet the acceptance criteria listed below (Table 1). If pre-checks do not meet criteria, re-calibrate and troubleshoot the instrument if necessary (see manufacturer's manual).

Table 1: Acceptance Criteria for Calibration Checks

Standard	Acceptance Criteria (final readings and checks)
Sp. Conductivity +/- 2% of expected value	1413 uS/cm buffer: 1400-1425 uS/cm 100 uS/cm buffer: 98 – 102 uS/cm
DO Saturation (%)	95% - 105%
DO mg/L	+/- 0.1 mg/L of table value
pH +/- 0.2 SU	7.00: 6.8 – 7.2 4.00: 3.8 – 4.2 10.00: 9.8 – 10.2
LIS (from Hydrion pH buffer 6.86)	Sp. conductivity +/- 1% of expected value (53 – 59 uS/cm) pH +/- 0.2 SU (~ 6.7 – 7.1)
Zero DO	≤0.2 mg/L

Site lists: field site names and calibration check record “site names” are entered in the YSI handheld site list. Field site names are listed by OWMID (as documented on the Probe Request forms) and calibration checks are listed using the format *CAL[project ID]date*. and field readings are recorded under the appropriate site ID. Readings are recorded under the appropriate field site or calibration site name.

Record keeping: The calibration bench sheet (attached in Appendix B) is filled out during calibration/post-field calibration check. The front page of the calibration sheet includes initial record-keeping steps and calibration records. Post-survey quality control (QC) checks of are on the backside of the Calibration sheet. All calibration records and post-field check results are recorded in the “Instrument Lab Workbook” (ILW), a formatted spreadsheet (example in Appendix C).

6.0 PROBE USE

6.1 Requests for Calibrated Probes

If a calibrated multiprobe is needed for a survey, the survey coordinator submits a probe request (Deployment and/or Multiprobe Request Form; Appendix D) to the Field and Laboratory Operations Coordinator at least one week prior to each survey by uploading the probe request form to a SharePoint folder (designated each year). The multiprobes will be calibrated by the Field and Laboratory Operations Coordinator or designee the day before or morning of the survey and available for the field crew in the instrumentation lab on the morning of the survey.

6.2 Multiprobe Use “Rules”

Use of multiprobes shall be restricted to MassDEP employees (primarily WPP staff) that have been trained by the Field and Lab Operations Coordinator or QA Analyst. These individuals shall be designated as primary users. Other trained DEP employees may assist in the monitoring effort, but the primary users shall assume complete responsibility for multiprobes assigned to them and for adhering to the standard operating procedures stated herein. The limitations listed below shall apply to all users of WPP multiprobe instruments.

- ☐ Use of multiprobes from dangerous or precarious locations (cliffs, steep embankments, waterfalls, *et cetera*) is prohibited.
- ☐ Use of multiprobes at municipal or other waste treatment plants, or discharges therefrom, or any other discharge site or outfall other than stormwater, shall be prohibited. Such discharges, including chlorinated effluents, may “foul” and/or interfere with multiprobe sensors. Immediate and subsequent survey data would likely be invalid, as revealed in the post-calibration process and/or data quality control checks.
- ☐ Use of multiprobes from bridges or other such overpasses is allowed provided that it is safe to do so and provided that it is not otherwise prohibited or restricted in these standard operating procedures.
- ☐ Use of multiprobes in turbulent conditions or in areas containing sub-surface eddies is not recommended.

6.3 In situ Measurements of Multiprobe Parameters

The procedures for using multiprobes in the field will depend, in part, on project-specific objectives, as detailed in the WPP Programmatic QAPP, Ten-Year Monitoring Strategy, and project-specific Sampling and Analysis Plans. Addressed in separate SOPs are the procedures for deploying multiprobes and/or single parameter probes to log continuous data at set recording intervals (see CN# 4.42 SOP Multiprobe Deployment) and procedures for taking in-situ measurements and water column profiles in lakes (CN# 151.1 SOP Lakes Sampling). Also note, these procedures are not intended to supplant the manufacturer’s instructions on probe use and maintenance.

A laminated “YSI EXO1 Field Operation – Quick Guide,” located in the inside zipper pocket of each carrying case, provides step-by-step directions for taking field readings using the YSI EXO (Appendix E). In general, readings are recorded every 30 seconds for two (2) minutes, and after all variables are stable.

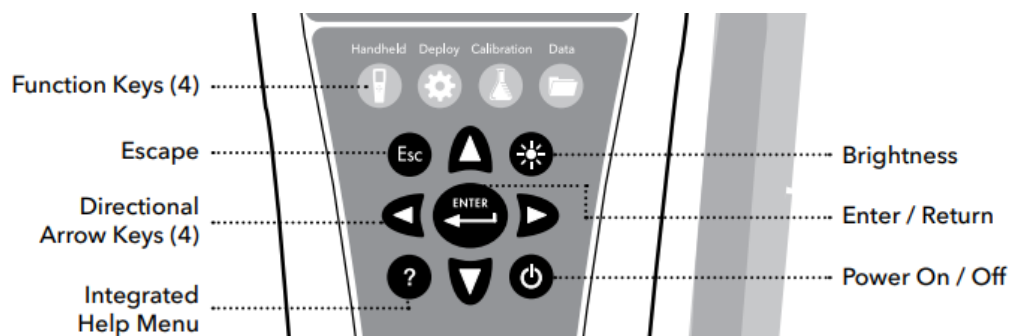
In-situ Measurements in Rivers / Streams

In general multiprobe measurements, like grab samples, should be taken in a section of the river that will provide a representative sample. The probe may be laid on the river bottom if the substrate is rocky/cobble and relatively clear of sediments, can be held mid-water column to keep it clear of sediments, or can be lowered from a bridge into the water column.

Wading safety: Conservatively use USGS rule of thumb: do not wade in to sample if water depth (ft.) x velocity (fps) > 10. Where wading into the flow is not possible for the chosen site and no other alternative is available, ensure that a sample taken from the bank is in the flow and representative of the larger area. IF A REPRESENTATIVE LOCATION CANNOT BE FOUND, DO NOT TAKE READING.

- Depth Calibration (YSI EXO): due to elevation differences between sampling locations, calibrate the “depth” at each site. To calibrate depth on the YSI EXO:
 - Hold the sonde in a horizontal position, above the water surface
 - Press the “Calibrate” button, select depth and press Enter
 - Select calibrate and press Enter
 - Check to make sure calibration value is 0.000 wait to make sure reading is stable (green checkmark appears at the right-hand corner of the graph)
 - Press Enter to accept calibration.
 - Press “Escape” to return to Setup Screen
- Visually scan station for wade-in area that will provide the least disturbance of substrate and provide for a representative sample. Note any site conditions that may affect samples. Discuss among the sample crew how and by who different sampling activities (e.g., sample collection, probe deploys, probe measurements) will be completed, with a goal of avoiding sediment disturbance upstream of the sampling point. Often this will require sampling activities to be completed sequentially and not concurrently due to stream characteristics (e.g., narrow channel, soft substrate bottom).
- If sediments are disturbed upstream of the sampling point at any time, wait until the disturbance has abated (e.g., the sediment plum had passed the sampling point) before taking any readings.

Figure 1: YSI EXO Handheld Keyboard



- Set up multiprobe for logging readings (see Figure 1 for keyboard setup):
 - Site Selection
 - On Home Screen select “Start Logging” and press Enter
 - Do NOT hit “Start Now” yet!
 - Scroll down to “Site” (current selected site will be in brackets E.G.: “Site ID [52-0756]”)
 - Select Site[site ID] and press Enter
 - Select desired Site and press Enter
 - If a site needs to be added that is not in the list, select “add new” and press Enter
 - Enter new site ID using virtual keyboard, scroll down to “enter” bar on keyboard and press Enter
 - IMPORTANT Scroll down and select “Save”, press Enter
 - You can now select this as the site ID and press Enter
 - Turn on Auto Stable
 - Press “Handheld” to return to setup screen.
 - On Setup Screen scroll to “Auto Stable” (should read “Auto Stable [On]”), press Enter
 - Screen should read “Auto Stable” at top

- Scroll down to “Start Auto Stable”, press Enter
 - “Auto Stable in Progress” should be displayed at the bottom of the screen.
 - Auto stable is complete when the “Auto Stable in Progress” no longer at the bottom of the screen.
- Begin Logging: once all parameters are stable (as indicated by autostable or visual observation that readings are not changing significantly), start logging readings for the station.
- To begin logging press Enter on the keypad to “Start Logging”
 - Double check that the desired Site is selected
 - Select “Start Now” and enter to start logging; the logger will start logging at 15 second intervals
 - Note the start time and log for 2 minutes
 - Stop Logging
 - (Press any key to wake up the screen if it has dimmed.)
 - To stop logging select “Stop logging” and press Enter
- Review and Record Data
- To review data press the “Data” button
 - Select “View Data” and press Enter
 - Scroll to “Show Data”, press Enter
 - Data will be displayed on screen
 - Press the down arrow on the keypad to scroll to the last line of stored data
 - Read back the site name (OWMID) and last line of data; a second person can record readings on the field sheet and EDGE form
- Turn off handheld unit to move to the next site
- Place blue cup back on sonde and tighten ring to secure to bulkhead
 - Coil the cable loosely, and put instrument back in carry case

6.4 Special Considerations

Side-by-side QC readings with deployed probes: to get the most accurate assessment of water quality conditions at a deployed probe (used to validate the deployed probe’s readings), the “attended” multiprobe should be placed as close as possible to the deployed probe. If it is not possible to get side-by-side readings, a note should be made on the deployed probe field sheet indicating the distance between the attended and deployed probe readings.

Shallow water: very shallow water may pose problems for in situ monitoring in rivers (e.g. sediments or groundwater intrusion influencing the readings). If an alternative sampling location cannot be found, the sonde may be held vertically, so that the probe tips are in water. Note should be made on the field sheet.

High or turbulent streamflows: if streamflows are high enough that the sonde does not stay where placed or is swept up to the surface, additional weights (available in the carrying case) may be attached to the bottom of the probe guard. Notes should be made on the field sheet.

Winter conditions: Recordings during colder months may require additional recording time, since certain multiprobe variables (particularly pH) are slower to reach equilibrium at cooler water temperatures (<10 °C).

7.0 QUALITY ASSURANCE, QUALITY CONTROL, AND TRAINING

Quality assurance operating principles and quality control measures to produce credible multiprobe data are integral components of these standard operating procedures. WPP’s multiprobes have consistently been proven

to be accurate and reliable instruments for measuring basic physico-chemical water quality variables when properly maintained, stored, calibrated, and used by trained personnel.

When there are problems, the common causes include:

- 1) The conductivity and turbidity sensors may not stabilize when the multiprobe is in turbulent water. Placement at stream locations exhibiting laminar-type flows should lead to equilibrium values.
- 2) Some of the multiprobe sensors (pH in particular) take longer to reach equilibrium in the cold waters. Do not commence data logging until all variables appear to be stable.
- 3) Measurements in very shallow areas can be influence by sediments or groundwater. Similarly, if the probe has hit the lake bottom readings may be influence by the sediments.
- 4) Readings (particularly dissolved oxygen) at the metalimnion of a stratified lake may not stabilize; however, since this is likely a natural condition, the stability of readings at the metalimnion are given a broader data quality objective during data validation.

The aforementioned “problems” are neither pervasive nor complex, but measures to ameliorate them and other similar issues shall be an ongoing component of these standard operating procedures. This shall include *in situ* training. In-lab training and field guides have proven to be successful for the vast majority of primary users of multiprobes, and that practice shall be continued.

8.0 DATA RETRIEVAL (DOWNLOADS)

WPP’s Field and Lab Operations Coordinator is responsible for periodic downloading and archiving of all logged data and relevant information stored in sonde and logger files. When it is confirmed that all logged data have been downloaded and archived successfully, then all logged data can be erased from the handheld logger’s memory.

9.0 DATA VALIDATION and MANAGEMENT

Multiprobe data will be reviewed, validated and assessed for usability by the Field and Lab Operations Coordinator, QA analyst, and Database Manager, consistent with WPP’s SOP for data validation, CN 056.41 Data Validation – Attended Data. CN 056.41 documents WPP’s approach to collating, processing, validating, and finalizing discrete probe data files generated via water quality monitoring surveys (either in conjunction with bottle sample collection or as part of a continuous probe deployment). The procedures involve both automated and manual steps applied to individual-year data sets by WPP data management and quality assurance (QA) staff. Essentially, raw probe data files are assembled, checked for completeness, pre-processed to select “best lines” and assess reading stability, linked to field sheet metadata, checked against laboratory calibration data, then output to standard format for further review. Based on checks against acceptance criteria, data are either accepted “as is”, qualified, or censored. Following review by the Principal Investigators (or assigned staff), reports are provided to staff in a standardized format. Once downloaded and archived, multiprobe data will be managed by WPP’s Database Manager, who will be responsible to ensure that the long-term integrity of data is maintained.

10.0 MAINTENANCE AND REPAIR – YSI EXO

Frequent inspection and regular maintenance of WPP’s multiprobe instruments and accessories shall be performed by the Field and Lab Operations Coordinator (or designee) to assure continuous and reliable operation. Maintenance activities shall be based on training, knowledge of instruments, experience, and reference to technical manuals. Consultation with technical personnel at Hach/Hydrolab and YSI may be required when there is uncertainty about a particular maintenance or repair problem. Otherwise, instruments and/or their component parts shall be shipped to the company for special maintenance problems or for repairs that cannot be performed in WPP’s calibration laboratory.

The key to continuous and reliable performance of multiprobes, display loggers, and accessories is adherence to the principle of responsible care, frequent inspection and proper use by all users. The Field and Lab Operations Coordinator shall inspect each multiprobe sensor for damage prior to its pre-calibration, and routinely during storage.

The standard operating procedures documented by the manufacturer shall be followed to prevent and/or resolve the more common maintenance problems. The YSI EXO manual

(https://www.ysi.com/File%20Library/Documents/Manuals/EXO-User-Manual-Web.pdf?srsId=AfmBOora8ICJKV4MTYQR4ViJoOutGOod6k8qBG_3Ma4q2xiukpCraPOH) recommends:

For interim storage:

- ☐ Users should keep sensors moist but not submerged; submersion during storage may produce sensor drift. Users should aim for a storage environment of water-saturated air (100% humidity) for the sensors. Place approximately 0.5 in (1 cm) of water (deionized, distilled, tap, or environmental) in the bottom of the calibration cup. Then place the sonde with all of its sensors into the cup and close it tightly to prevent evaporation. Users can also use a moist sponge to create a humid environment.
- ☐ Ensure that unused sensor ports are properly protected with port plugs.
- ☐ The sonde itself should be stored in dry air.
- ☐ To protect the cable connector, either leave the cable installed on the connector, or install the port plug.

For longer term storage:

- ☐ Store all removed sensors according to the specific instructions in their sensor storage section. Plug all open ports and store the sonde according to the above instructions for short-term sonde storage.
- ☐ **NOTICE:** Always remove batteries from sondes during long periods of inactivity to prevent potentially harmful battery leaks.

YSI EXO Maintenance:

- ☐ Inspect and service o-rings. User-serviceable o-rings are located in the EXO sonde battery compartments. Perform a thorough visual inspection of o-rings each time they are exposed. Carefully look for grit, hair, etc. on the o-ring and mating surfaces and wipe away any contamination with a lint-free cloth. Without removing them from their grooves, *lightly* grease each o-ring with Krytox. Replace any damaged o-rings.
- ☐ Replace damaged o-rings: If inspection reveals a damaged (split, cracked, or misshapen) o-ring, remove it. Wipe the groove clean with alcohol and a lint-free cloth. Grease the o-ring by drawing it between your *lightly* greased thumb and index fingers. Place the o-ring in its groove, being careful to not roll or twist it, and lightly grease the surface. Inspect the o-ring for contamination. **NOTICE:** Do not apply excess grease to the o-rings. This can cause contamination and seal failure.
- ☐ Inspect, clean, and grease ports: Visually inspect each port for contamination (grit, hair, etc.). Should the user detect contamination, remove it with a blast of compressed air. When the port's rubber appears dry, lightly grease the sensor connector before insertion. **NOTICE:** Never insert solid objects into the sonde ports. This could permanently damage the connectors.
- ☐ Maintain the depth and level sensor: EXO depth and level sensors access the water through small holes (ports) located in the sonde body or bulkhead. Although users cannot access them directly, proper storage and maintenance will help to ensure reliable operation. Depth sensors can be stored dry.
 - Locate depth ports - the two EXO1 depth ports are located in the yellow-plastic section between the bulkhead tube (labeled area) and the blue plastic battery cover. The EXO2 depth ports are located on the metal bulkhead face itself, in the largest open area between ports.
 - Clean depth ports - although users cannot directly access the depth/level sensors, they should periodically clean them with the syringe included in the EXO tool kit (599594). Fill the syringe with clean water and gently force water through one of the ports. Ensure that water flows from the other hole. Continue flushing the port until the water comes out clean. **NOTICE:** Do not insert

objects in the depth ports, as this may cause damage to the transducer not covered under the warranty.

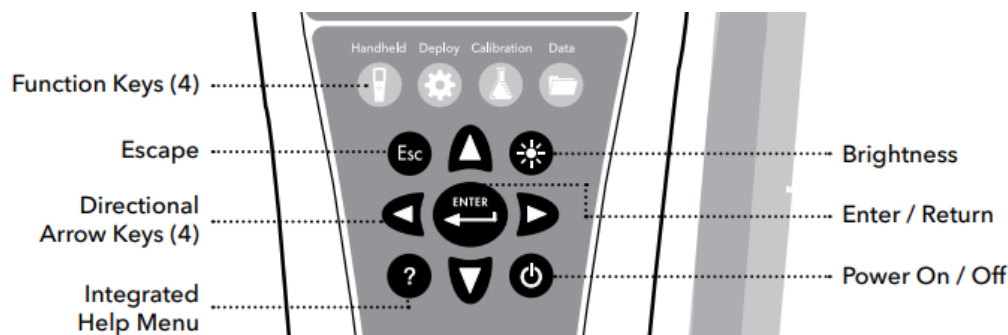
- Turbidity and Total Algae sensors require minimal maintenance. Users should periodically inspect the optical surface at the tip of the sensor and wipe it clean with a non-abrasive, lint-free cloth if necessary. As much as possible, prevent scratches and damage to the sensing window. Users can either remove the sensors or leave them installed in the sonde for long- and short-term storage. If left installed on the sonde, follow guidelines for sonde storage. If users remove them from the sonde, the sensors may be stored in dry air in their shipping cap (to protect against physical damage).
- EXO conductivity and temperature (CT) sensors require little maintenance or special attention for storage. As much as possible, prevent impact to the sensor's exposed thermistor. Clean electrode channels - the only parts of the CT sensor that require special maintenance are the channels leading to the internal electrodes. Dip the sensor's cleaning brush (included in the sonde maintenance kit) in clean water, insert at top of channels, and sweep the channels 15-20 times. If deposits have formed on the electrodes, use a mild solution of dish soap and water to brush the channels. If necessary, soak in white vinegar to aid cleaning. Rinse the channels with clean water following the sweepings or soak.
- EXO DO sensors require separate storage instructions from other optical sensors due to their sensing membranes. Leave the sensor installed in the sonde and submerge it in clean water in the calibration cup. Screw the cup on tightly to prevent evaporation. Users may also store the ODO sensor by itself in two ways. One, submerge the sensing end of the sensor in a container of water; occasionally check the level of the water to ensure that it does not evaporate. Two, store the sensor in water-saturated air. We do not recommend storing the sensor with the connector end unmated or exposed. If unmated, cover with plastic connector cap.
- DO membrane maintenance - users should periodically inspect the optical surface at the tip of the sensor and wipe it clean with a non-abrasive, lint-free cloth if necessary. Never use organic solvents to clean an EXO DO sensor. As much as possible, prevent scratches and damage to the sapphire sensing window. Avoid getting fingerprints on the window. If necessary, wash with warm water and dish soap and rinse with DI water. Sensor rehydration- should DO sensors be left in dry air for longer than eight hours, they must be rehydrated. To rehydrate, soak the DO sensor cap in warm (room temperature) tap water for approximately 24 hours. Following this soak, calibrate the sensor and store it in a moist environment.
- DO sensor caps have a typical life of 12 months. After this point, users should replace the DO membrane cap. Refer to the YSI Manual for instructions on cap replacement.
- pH and pH/ORP sensors have two specific storage requirements: they should not be stored in distilled or deionized water and their reference electrode junction should never dry out. For long term storage, remove the pH sensor from the sonde and insert its sensing end into the bottle that the sensor was shipped in. Install the bottle's o-ring and cap then tighten. This bottle contains a 2-molar solution of pH 4 buffer. If this solution is unavailable, users may store the sensor in tap water. **NOTICE:** Do not store the pH or pH/ORP sensor in Zobell solution, DI or distilled water.
- pH and pH/ORP sensors will require occasional maintenance to clear contamination from the sensing elements. These contaminants can slow the sensor's response time. Clean the sensors whenever deposits, biofouling, or other contamination appear on the glass, or when the sensor's response time slows perceptibly. Remove the sensor from the sonde before performing the following cleaning steps. Do not attempt to physically scrub or swab the glass bulbs. The bulbs are very fragile and will break if pressed with sufficient force.
 - Soak the sensor for 10-15 minutes in a solution of clean tap water and a few drops of dishwashing liquid. Following the soak, rinse the sensor with clean water and inspect. If contaminants remain or response time does not improve, continue to the HCl soak.

- Soak in HCl solution the sensor for 30-60 minutes in one molar (1 M) hydrochloric acid (HCl). Following the HCl soak, rinse the sensor in clean tap water and allow it to soak for an hour in clean water. Stir the water occasionally. Then, rinse the sensor again in tap water and test response time. If response time does not improve or you suspect biological contamination of the reference junction, continue to the next soak. If HCl is not available, soak in white vinegar.
 - Soak in chlorine bleach solution - soak the sensor for approximately one hour in a 1:1 dilution of chlorine bleach and tap water. Following the soak, rinse the sensor in clean tap water and allow it to soak for at least one hour in clean water (longer if possible). Then, rinse the sensor again in tap water and test response time.
 - Refer to the manufacturer's manual for instructions on probe or probe tip replacement for pH / ORP sensors.
- Cables: Inspect the cable's connectors for contamination and remove any detected debris with a blast of compressed air. Periodically inspect the cable for nicks and tears to ensure best performance. Prior to installation, users should apply a thin coat of Krytox grease to both connector ends of the cable and the connector of the sonde. Proper lubrication will help prevent damage to the connectors.
 - **NOTICE:** Only a small coating of grease is recommended; connectors should appear shiny. Too much grease is not recommended as it can encourage contamination.
 - Cable storage: Users should leave the cable installed on the sonde to protect the connectors. If necessary users may remove it from the sonde, but extra care should be taken to protect the connectors. Store the cable in a safe location free from direct sunlight.
- EXO sondes utilize wet-mate connectors that greatly reduce problems associated with traditional underwater connectors. However these connectors must be properly maintained to reap the full benefit of this design. Following these instructions will minimize most potential issues. Never stick any foreign object into a female connector. Use only Krytox grease to lubricate the mating surfaces of the connectors.
 - Female 6-pin connectors are located on field cables, the EXO2 accessory connector, and the EXO Handheld. Periodically inspect the connectors for signs of contamination. If you detect debris, remove it with a gentle blast of compressed air. Prior to initial installation, or when dry, apply a light coat of Krytox grease to the flat rubber mating surface on top of the connector.
 - Male 6-pin connectors are located on field cables and topside sonde connectors. Periodically inspect the connectors for signs of contamination. If you detect debris, carefully remove it. Prior to initial installation, or when dry, apply a light coat of Krytox grease to the rubber mating surfaces of the connector (including the rubber portions of the pins).
 - Sensor connectors (4-pin) are located on sonde bulkheads (sockets) and sensors. Periodically inspect the female portions of these hermaphroditic connectors and the entire socket for contamination and remove any debris with a gentle blast of compressed air. Prior to initial installation, or when dry, apply a light coat of Krytox grease to the rubber area of the sensor's connector.

APPENDIX A: YSI EXO1 Calibration and Download QuickGuide

YSI EXO1 Calibration and Download QuickGuide

(updated 5/16/24)



NOTES

- “Select” means highlight the menu choice and press “Enter”
- **Rinse procedure:** rinse under running tap water, then once in used calibration solution for the next calibration. (Save once-used calibration solution for rinses.)
- To activate “**Auto Stable**”: press “Handheld”; select *Auto Stable [on]*; then select *Start Auto Stable*
- Press “**ESC**” to return to the Dashboard screen displaying live readings

Start aerating the jug of water before starting calibrations.

CREATE SITE ID for CALIBRATIONS and SELECT USER ID

1. Push the key to turn on the handheld.
2. On Dashboard screen, with *Start Logging* in the green-highlighted area, press “Enter”
3. Scroll to, and select, the existing site ID
4. Select *Add new*, then select *Site Name*
5. Enter the calibration “site name”: using the format **Cal[project ID]mmddyy** (e.g., CalRSN041324), highlight and press the “Enter” button. Select *Save*
6. Select the newly created site ID: select *Select [the newly created site ID]*
7. Press “Esc” button to return to Dashboard screen without starting logging
8. **Enter User ID:** Press “Handheld” and select *User ID*; select calibrator’s ID (last name) from User ID list

PRE-SURVEY CALIBRATION – BENCH SHEET

Record the sonde and logger numbers and fill out the general information section of the “PRE-SURVEY CALIBRATION” bench sheet.

CALIBRATE SPECIFIC CONDUCTANCE

1. Remove probe guard.
2. Rinse the probe (see note 2 above) with tap water and then with used conductivity standard.
3. Immerse probes in the first conductivity standard; pour standard into calibration cup to above black tip on conductivity probe (in general, use 1413 uS/cm standard first)
4. Press Calibration key and select *Conductivity / Calibrate / Sp. Conductance*

5. Select *Calibration Value*
6. Enter calibration value of the standard (make sure units are $\mu\text{S}/\text{cm}$), select *Enter*
7. When readings have stabilized (green check mark appears), select *Accept Calibration*; "Calibration successful!" appears in display
8. Pour the calibration standard into the "used" bottle to save for rinses.
9. Calibration file, which appears at the end of each parameter's calibration, includes "*Pre Cal Value* and *Cal Value*" and *Temperature* values; record these on the bench sheet (as "initial reading" and "set to" and temperature).
10. Repeat calibration steps 2- 9 using the second conductivity standard (e.g. 100 $\mu\text{S}/\text{cm}$)
11. If the survey requires a higher standard (as indicated as a note on the probe request sheet), repeat calibration steps 2-9 using a third conductivity standard (e.g. 5000 $\mu\text{S}/\text{cm}$).

SP COND CHECK

1. With probes still in the second (or third) conductivity standard, press ESC to return to Dashboard screen
2. Highlight and select *Start Logging*
3. Select *Site*; scroll to the Site ID for this calibration; then *Select*
4. Confirm logging has begun (while actively logging, the Dashboard screen will display *Stop Logging*)
5. After 1 minute (screen darkens), press "Enter" button to stop logging
6. Record the readings on the bench sheet immediately after stopping logging.

CALIBRATE 100% DO (in air)

1. Rinse the probes thoroughly in tap water.
2. Dry the probes (gently) with a Kim Wipe; make sure there are no drops on the DO sensor cap.
3. Place probes in calibration cup with small amount of water, making sure water does not touch sensor surfaces.
4. Press "Calibration" key and select *ODO*; select *Calibrate*; select *DO% CB*
5. When the reading is stable and green check has appeared, select *Accept Calibration*
6. Record the *Pre Cal Value*, *Cal Value*, *Temperature*, and *Local BP* values on the bench sheet.

CALIBRATE pH (7.01, 10.00, and 4.01)

1. Complete rinse procedure for pH 7.01 buffer solution
2. Immerse probes in pH 7.01 buffer solution
3. Press "Calibration" key and select *pH*
4. Allow about a minute for temperature to stabilize. The unit will automatically recognize the buffer it's in and adjust the calibration value based on temperature. DO NOT manually enter the calibration value.
5. When readings are stable, select *Accept Calibration* (DO NOT select "Finish Calibration")
6. Proceed directly to rinse procedure for next buffer (4.01)
7. Immerse probes into next buffer
8. Allow readings to stabilize. DO NOT manually enter the calibration value.
9. When readings are stable, select *Accept Calibration*
10. Proceed directly to rinse procedure for last pH buffer (10.00)
11. Immerse probes in last buffer. Allow to stabilize.

12. *Accept Calibration* (do **NOT** select *Finish Calibration*; the procedure will automatically finish after using the third buffer)
13. Record the *Pre Cal Value* and *Cal Value* and *Temperature* values for all three pH standards and the *Calibration Slope* and *Calibration Score* from the calibration record on the bench sheet.

FINAL PRE-SURVEY CHECKS

LOW IONIC STANDARD (LIS)

NOTE: Pre-survey checks using the same batch of LIS are to be recorded to the same "Site ID." So, if the Site ID already exists, use it until a new batch is started (i.e., new batch = new site ID).

1. Select "Site ID" for pre-survey check (PRLISmmddyy) or create a new pre-survey "Site ID" by:
 - a. On Dashboard screen, with *Start Logging* highlighted, press the "Enter" button
 - b. Scroll to, and select, the existing site ID
 - c. select *Add new*, then select *Site Name*
 - d. Key-in a name using the format *PRLISMMDDYY* (e.g., PRLIS040519; [Where PR indicates "presurvey check" and LISMMDDYY is the LIS batch being used]), highlight the "ENTER" bar and pressing the "Enter" button. Select *SAVE*.
 - e. Select *Select [newly created site ID]*
2. Complete rinse procedure for LIS
3. Carefully immerse probes into LIS
4. When the readings are stable and the green checkmark appears, press "Enter" button to select Site ID and and "Enter" again to begin logging
5. After 1 minute of logging press "Enter" button to stop logging
6. RECORD the readings on the bench sheet immediately after stopping logging.

CHECK DO 100 % DO (in water)

1. Rinse probes and calibration cup with tap water
2. Fill calibration cup to between the marks with **aerated tap water** (have the aerator running and/or shake the bottle vigorously before use) and immerse the probes.
3. When readings are stable, press "Enter" button twice to select Site ID and start logging (Site ID should still be set to the calibration Site ID)
4. After 1 minute press "Enter" button to stop recording
7. RECORD calibration check now or after all checks (RECORD CALIBRATION CHECK steps above). After 1 minute of logging press "Enter" button to stop logging
8. RECORD the readings on the bench sheet immediately after stopping logging.
9. Check and record the "table value" from DO saturation tables (<https://water.usgs.gov/water-resources/software/DOTABLES/>).

ZERO DO CHECK (check weekly)

1. Carefully immerse probes into saturated Sodium Sulfite solution
2. Watch for DO readings to get to ≤ 0.2 mg/L and press "Enter" button twice to start logging
3. Press "Enter" button to stop logging (no need to capture more than one "0" reading)

DOTABLES Result

Single-Value Computation

The computed oxygen solubility and percent saturation that you requested is pres

Inputs:	Results:
Water temperature: 22.0 °C	Oxygen solubility: 8.58 mg/L
Barometric pressure: 746 mm Hg	Percent saturation: 0.00 percent
Specific conductance: 0 µS/cm	
[optional] Measured DO: 0 mg/L	

To compute another value of oxygen solubility and percent saturation, modify you pressure in a variety of units. Similarly, you may choose to enter a value for either DO measurement divided by the solubility, expressed as a percentage.

Inputs:	
Water temperature: 22.0	degrees Celsius
Barometric pressure: 746	mm Hg
Specific conductance: 0	µS/cm (SC) or ‰ (salinity)
[optional] Measured DO: 0	mg/L
<input type="button" value="Submit"/> <input type="button" value="Reset"/>	

4. RECORD the reading immediately after stopping logging.

Table 2: Acceptance Criteria for Calibration Checks

Standard	Acceptance Criteria (final readings and checks)
Sp. Conductivity +/- 2% of expected value	1413 uS/cm buffer: 1400-1425 uS/cm 100 uS/cm buffer: 98 – 102 uS/cm
DO Saturation (%)	95% - 105%
DO mg/L	+/- 0.1 mg/L of table value
pH +/- 0.2 SU	7.00: 6.8 – 7.2 4.00: 3.8 – 4.2 10.00: 9.8 – 10.2
LIS (from Hydrion pH buffer 6.86)	sp. conductivity +/- 1% of expected value (53 – 59 uS/cm) pH +/- 0.2 SU (~ 6.7 – 7.1)
Zero DO	≤0.2 mg/L

PACKING UP FOR FIELD CREWS

1. Rinse storage/calibration cup and probes thoroughly with tap water and put the probe guard on the sonde.
2. Put 1-2 cm of tap water in storage/calibration cup, slide on over probe guard, and tighten the cup's retaining ring snugly to the bulkhead of the sonde.

CREATE SITE LIST

3. Create a site ID list on the handheld, in the order the survey lead anticipates visiting the sites (sites and order are listed on the probe request sheets), by entering either directly on the Handheld or connecting to the computer:

HANDHELD:

- a. On Dashboard screen, with *Start Logging* showing in the green-highlighted area, press “Enter”
- b. Scroll to, and select, the existing site ID
- c. select *Add new*, then select *Site Name*
- d. Key-in a name using the format xxxxxx (e.g., 23-0124 will be entered at 230123) finishing by highlighting the “ENTER” bar and pressing the “Enter” button. *Save*.
- e. Repeat steps 1 through 5 until all the site IDs for the survey have been entered

COMPUTER:

- f. Launch the KOR software and connect the handheld to the computer (microUSB to USB).
- g. When the connection icon appears on the handheld, select “connect” in the Instrument Connection Panel of the KOR software.
- h. From the Home tab, select “Create New Site”. Enter the OWMIDs (from the probe request sheet) one at a time in Site Name and select *Save and Export to Handheld* (do not select “Save” on the bottom right).

- i. When finished entering sites, select Cancel (and ignore the warning about unsaved data).
4. Recharge battery in EXO handheld
5. Fill in the pre-survey checklist at the top of the “Multi-probe pre-survey checklist and user report” making sure all necessary items are present (not everything on the checklist is required for every survey). Make sure that the longer cable is included (and strain relief connectors) if needed for a lake survey.
6. When all required items are present, put the checklist on top.

POST-SURVEY CHECKS—LIS, DO (SATURATED AIR)

CHECK Low Ionic Std (LIS)

1. Remove probe guard
2. Follow rinse procedure, ending with LIS. (Note: use the same LIS batch for both pre- and post-check!)
3. Carefully immerse probes into LIS to above black tip on conductivity probe
4. Press “Handheld” button; select *User ID*; select calibrator’s ID from User ID list
NOTE: Post-survey checks using the same batch of LIS are to be recorded to the same “Site ID.” So, if the site ID already exists, use it until a new batch is made (i.e., new batch = new site ID)
5. Select an existing Site ID or create a new “Site ID” for the post-survey checks by:
 - a. On Dashboard screen, with *Start Logging* highlighted press the “Enter” button
 - b. Scroll to, and select, the existing Site ID
 - c. select *Add new*, then select *Site Name*
 - d. Key-in a name using the format *POLISMMDDYY* (e.g., POLIS040519; [Where PO indicates post-survey check and LISMMDDYY is the LIS batch being used]), finishing by highlighting the “ENTER bar” and pressing the “Enter” button. Select *Save*.
 - e. Select *Select [newly created site ID]*
 - f. Select *Start Now!* to begin logging
6. After 1 minute of logging press the “Enter” button to stop logging.
7. Record the readings on the bench sheet immediately after stopping logging.

CHECK DO 100% (in water)

8. Rinse probes and calibration cup with tap water
9. Fill calibration cup to between the marks with **aerated tap water** (have the aerator running and/or shake the bottle vigorously before use) and immerse the probes
10. When readings are stable, press “Enter” button twice to select Site ID and start logging (Site ID should still be set to the POLIS Site ID)
11. After 1 minute press “Enter” button to stop recording
12. RECORD the readings on the bench sheet immediately after stopping logging.
13. Check and record the “table value” from DO saturation tables (<https://water.usgs.gov/water-resources/software/DOTABLES/>).

TURN-AROUND CALIBRATION CHECK

If a sonde will be used for another field survey in the following day or two (within the week), a “turn-around” calibration check can be done, i.e. the post-survey check can serve as the calibration for the next survey. However, if the post-survey check does not meet acceptance criteria (Table 1), a full re-calibration must be done.

STORE THE SONDE

Affix probe guard to sonde; leave a cm or two of tap water in storage/calibration cup and secure cup to bulkhead of sonde. Store in carrying case.

Table 3: Site ID Naming Conventions

DESCRIPTION (stored to)	FORMAT	EXAMPLE
Calibration checks ("Site ID")	Cal[project ID]MMDDYY	CalRSN050624
Final pre-survey checks ("Site ID")	PRLISMMDDYY	PRLIS050624
Sample Site ("Site ID")	xx-xxxx	23-0142
Post-survey checks ("Site ID")	POLISMMDDYY	POLIS050724
User ID ("User ID")	user's last name	Jones

DATA UPLOAD**DATA UPLOAD (to Field and Lab Operations Coordinator's computer only)**

Lab Checks and Field Survey Data

1. Connect the handheld logger to the lab computer with the EXO-specific microUSB to USB cable
2. Open the KorEXO software and turn on the handheld (it is recommended that only one device be connected at a time)
3. On the **HOME** page the *Instrument Connection Panel* will display connected devices and begin auto-importing data.
4. Data can be viewed either by:
 - a. Selecting "View Downloaded Collected Data" next to the device shown in the *Instrument Connection Panel*; or
 - b. Clicking on *Recorded Data* in the upper left of the screen
5. Selecting "View Downloaded Collected Data" will go directly to the data-viewing screen; if *Recorded Data* was clicked a blank page is displayed, but clicking on the *Search* icon (green magnifying glass) in upper left of screen will display the data-viewing screen
6. Check the *Start Date* and *End Date* boxes to make sure any entries there encompass all data contained on the handheld
7. Click the check-box at the top of the *Results* column to select all files contained on the handheld
8. Click the *View Selected Recorded Data* button at the bottom right of the window
9. Click *Export to CSV* In the upper left of the data display window
10. Save the unedited file (as a csv) to a dedicated location on laptop using the default file naming convention.
11. **Copy** the unedited file to [RawData/yyyy/Data](#) uploads. Notify Kari Winfield when new data have been uploaded to this folder.

Calibration Records

1. Open KOR, and under the Calibration tab, select Find Calibration Records.
2. Select the date range and parameters desired, and select *View Selected Calibration Records*.

Select Data to View

Search

- RECENT DOWNLOADS
 - Recently Downloaded
- START DATE
 - 4/13/2024
- END DATE
 - Select a date
- DEVICE SERIAL NUMBER(S)
- SITE NAME
- INSTRUMENT ID
 - 23G106336
- FILE NAME
- USER ID
- PARAMETERS

Results

	START DATE	END DATE	INSTRUMENT	FILE NAME	DAT
<input checked="" type="checkbox"/>	4/16/2024 1:42:03 PM	4/16/2024 1:42:03 PM	23G106336	240416-134203-preLIS041624.bin	1
<input checked="" type="checkbox"/>	4/16/2024 1:01:53 PM	4/16/2024 1:02:23 PM	23G106336	240416-130153-cal%20chl041624.bir	3
<input checked="" type="checkbox"/>	4/16/2024 1:35:30 PM	4/16/2024 1:36:30 PM	23G106336	240416-133530-preLIS041624.bin	5
<input checked="" type="checkbox"/>	4/16/2024 1:38:23 PM	4/16/2024 1:39:23 PM	23G106336	240416-133823-preLIS041624.bin	5
<input checked="" type="checkbox"/>	4/17/2024 10:46:17 AM	4/17/2024 10:46:17 AM	23G106336	240417-104617-17%2D1526.bin	1
<input checked="" type="checkbox"/>	4/17/2024 10:49:16 AM	4/17/2024 10:49:16 AM	23G106336	240417-104916-17%2D1527.bin	1
<input checked="" type="checkbox"/>	5/6/2024 4:06:44 PM	5/6/2024 4:06:44 PM	23G106336	240506-160644-preLIS041624.bin	1
<input checked="" type="checkbox"/>	5/13/2024 2:10:06 PM	5/13/2024 2:10:06 PM	23G106336	240513-141006-preLIS050724.bin	1
<input checked="" type="checkbox"/>	4/17/2024 5:06:19 PM	4/17/2024 5:07:19 PM	23G106336	240417-170619-postLIS041624.bin	5
<input checked="" type="checkbox"/>	5/6/2024 3:40:14 PM	5/6/2024 3:41:14 PM	23G106336	240506-154014-cal4tamb224.bin	5
<input checked="" type="checkbox"/>	5/8/2024 3:43:37 PM	5/8/2024 3:44:37 PM	23G106336	240508-154337-postLIS041624.bin	5
<input checked="" type="checkbox"/>	5/13/2024 1:44:21 PM	5/13/2024 1:45:21 PM	23G106336	240513-134421-calTAMB23g7%2005	5
<input checked="" type="checkbox"/>	5/13/2024 2:01:29 PM	5/13/2024 2:02:28 PM	23G106336	240513-140128-preLIS050724.bin	5
<input checked="" type="checkbox"/>	4/17/2024 11:42:15 AM	4/17/2024 11:43:30 AM	23G106336	240417-114215-17%2D1529.bin	6
<input checked="" type="checkbox"/>	5/8/2024 3:47:25 PM	5/8/2024 3:49:10 PM	23G106336	240508-154725-postLIS041624.bin	8

VIEW SELECTED RECORDED DATA CANCEL DELETE

3. Select Export to .csv; all the records in the search will be exported.
4. **Copy** the unedited file to [RawData/yyyy/Data](#) uploads.

Deleting Data from Handheld

5. After file have been copied to the BWR SharePoint and confirmed, the data may be deleted from the handheld.
6. With the handheld turned on, press the “Data” button
7. Select *Delete Data*
8. Select *Delete All Data*
9. Select *Delete Cal Records*; select “yes” on the next screen
10. Delete old OWM IDs from the handheld.

Select Calibration Records to View

Search

RECENT DOWNLOADS

Recently Downloaded

START DATE RANGE

1/1/2023

END DATE RANGE

12/31/2023

SENSOR TYPE

PARAMETERS

All

☒ pH

☐ Phycocyanin (RFU)

☐ Phycocyanin (RFU)

☐ Rhodamine WT (µg/L)

☐ Sal (µm)

☒ Sp Cond (µS/cm)

☐ Turbidity (FNU)

Results

SENSOR TYPE	PARAMETER	SENSOR S/N	CALIBRATION DATE	INSTRUMENT
<input checked="" type="checkbox"/> pH	pH	21F102110	6/21/2023 7:44 AM	198104204
<input checked="" type="checkbox"/> DO	DO (% CB)	19C100761	6/21/2023 7:37 AM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	6/21/2023 7:25 AM	198104204
<input checked="" type="checkbox"/> pH	pH	21F102110	6/12/2023 7:53 AM	198104204
<input checked="" type="checkbox"/> DO	DO (% CB)	19C100761	6/12/2023 7:48 AM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	6/12/2023 7:33 AM	198104204
<input checked="" type="checkbox"/> pH	pH	21F102110	6/7/2023 8:53 AM	198104204
<input checked="" type="checkbox"/> DO	DO (% CB)	19C100761	6/7/2023 8:46 AM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	6/7/2023 8:15 AM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	6/7/2023 8:13 AM	198104204
<input checked="" type="checkbox"/> pH	pH	21F102110	6/5/2023 2:02 PM	198104204
<input checked="" type="checkbox"/> DO	DO (% CB)	19C100761	6/5/2023 1:55 PM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	6/5/2023 1:42 PM	198104204
<input checked="" type="checkbox"/> pH	pH	21F102110	5/30/2023 4:09 PM	198104204
<input checked="" type="checkbox"/> DO	DO (% CB)	19C100761	5/30/2023 4:02 PM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	5/30/2023 3:47 PM	198104204
<input checked="" type="checkbox"/> Conductivity	Sp Cond (µS/cm)	21F101100	5/30/2023 3:45 PM	198104204
<input checked="" type="checkbox"/> pH	pH	21F102110	5/24/2023 2:29 PM	198104204
<input checked="" type="checkbox"/> pH	pH	21F102110	5/24/2023 2:18 PM	198104204
<input checked="" type="checkbox"/> DO	DO (% CB)	19C100761	5/24/2023 2:01 PM	198104204

VIEW SELECTED CALIBRATION RECORDS

At the end of the season, export .csv files for each handheld from KOR:

1. From the Recorded Data tab, select the green magnifying glass “search” tool.
2. Select the full range of dates for the season / year.
3. Filter for each handheld instrument under “Instrument ID”, select all the records, View Selected Recorded Data, and export to .csv file.
4. Save the file using the naming convention:
 yymmdd_EXO[last 4 digits of logger serial number],
 e.g., 190715_EXO4861
5. Repeat for each handheld.
6. Copy the final files to [RawData](#) and alert WPP’s Database Manager that the data has been uploaded.

HOME CALIBRATION PRODIGAL HANDHELD DEPLOYMENT SITES LIVE DATA RECORDED DATA INSTRUMENT

Calibration Record Viewer

Calibration Records Panel	Calibration Record:
<p>pH</p> <p>Serial Number: 21F102110</p> <p>Firmware Version: 3.0.0</p> <p>Calibration Record:</p> <p>Parameter Type: pH</p> <p>Calibration Date: 6/21/2023 7:44:01 AM</p> <p>Calibration Status: Completed</p> <p>Technician Name: De Leon</p> <p>Calibration Record:</p> <p>Parameter Type: pH</p> <p>Calibration Date: 6/12/2023 7:53:59 AM</p> <p>Calibration Status: Completed</p> <p>Technician Name: De Leon</p> <p>Calibration Record:</p> <p>Parameter Type: pH</p> <p>Calibration Date: 6/7/2023 8:53:27 AM</p> <p>Calibration Status: Completed</p> <p>Technician Name: De Leon</p>	<p>Calibration Record:</p> <p>Sensor Type: pH</p> <p>Last Calibration Time: 6/21/2023 7:44:01 AM</p> <p>Calibration Start Time: 6/21/2023 7:44:01 AM</p> <p>Calibration End Time: 6/21/2023 7:44:01 AM</p> <p>General</p> <p>Parameter: pH</p> <p>Instrument S/N: 198104204</p> <p>Instrument Firmware Version: 1.0.86</p> <p>Instrument Type: EXO1</p> <p>Sensor S/N: 21F102110</p> <p>Sensor Firmware Version: 3.0.0</p> <p>Calibrated By: De Leon</p> <p>Calibration Status: Completed</p> <p>QC Score: Good</p> <p>Calibration Point B1</p> <p>Pre Calibration Value: 7.07 pH</p>

[Attachment A]

KorEXO software settings: from the file settings menu the following setup options have been selected:

Tab	Parameter	Setting
General	Automatically connect to instrument	ON
	Automatically update Software/Firmware	ON
	Automatically download data from instrument	ON
	Automatically update time from PC time	ON
	File export CSV, delimiting character	" "
	File export CSV header	Without header
	Startup option for user	OFF
ISE	(NH4+, NH3, NO3-N, and Cl-) all options	OFF
DO	% Sat	ON
	mg/L and % CB	ON
Algae	All options	OFF
ORP	All options	OFF
PAR	All options	OFF
Conductivity	Specific Conductivity (uS/cm) and TDS (mg/L)	Enabled
	Conductivity, Resistivity, Salinity, NLF Conductivity, and Water Density	Disabled
Barometer	Barometer (mmHg)	Enabled
pH	pH	ON
	mV	OFF
Sonde	Cable Power and Battery Voltage	Disabled
Chlorophyll	All options	OFF
Temperature	C	Enabled
Depth	Depth	Enabled
	Vertical position and absolute pressure	Disabled
Turbidity	fDOM and Wiper all option	Disabled/OFF
GPS	GPS (decimal degrees) and altitude (m)	Enabled/ON

Settings

DO ORP PAR pH Rhodamine WT NitraLED Sonde Temperature Turbidity Wiper
General Settings Algae Barometer Conductivity Chlorophyll Depth fDOM GPS ISE

AUTOMATION SETTINGS

Automatically Update Software and Firmware
On ☒

Automatically Download Measurement Data from Instrument to PC
On ☒

Automatically Connect to Instrument
Off ☐

Automatically Download Calibration Records from Instrument to PC
On ☒

Automatically Update Instrument Time to PC Time
On ☒

FILE EXPORT

CSV Delimiting Character
Use ' ' as delimiter

CSV Export Type
Without Header

STARTUP OPTIONS

Require User Login
Off ☐

LANGUAGE SETTINGS

Select Language
English (United States)

Override Regional Settings
☒ Use Selected Language Regional Settings
☐ Use Local OS Regional Settings

SAVE CANCEL

[Attachment B:]

Low Ionic Standard (LIS) Preparation

LIS Stock Solution

1. Prepare the stock solution from Hydrion buffer salts pH 6.86 following the manufacturer's directions:
2. Add two "Chemvelope" packages of buffer to 1-L volumetric flask. Use a funnel to pour the powder into the flask; rinse the envelope and funnel into the flask with DI water.
3. Add DI water to the fill-line on the flask.
4. Add 15 drops of "Color Key Buffer Preservative" and mix well.
5. Store in capped glass bottle with labeled with date.



LIS Standard

1. Rinse a 2-L volumetric flask three times with DI water and drain well.
2. Fill will 2-L volumetric flask about ½ full with DI water.
3. Add 20-ml LIS stock solution using a clean pipette.
4. Swirl to mix.
5. Add DI water to the fill-line on the flask, cap and mix well.
6. Store the LIS either in a capped glass bottle or in the volumetric flask. Label with the preparation date and initials.
7. Try to prepare LIS Standard at least a day in advance of using it.

Note: the "shelf life" for the prepared LIS is two weeks.

Zero Dissolved Oxygen solution:

The zero DO solution is saturated sodium sulfite (Na_2SO_3); Na_2SO_3 is an oxygen scavenger.

1. Dissolved about 25 g or more of sodium sulfite (Na_2SO_3) in 500-ml deionized (DI) water. There should be enough Na_2SO_3 that some undissolved crystals remain in the bottom of the bottle.
2. If all the crystals dissolved, add a little more Na_2SO_3 and mix again.
3. Mix well and let stand long enough to let the undissolved crystals settle to the bottom.
4. Prepare as needed. The solution should be re-used (not disposed of after each calibration use) until it starts to be less effective (i.e. it takes longer than 10-15 minutes for the probe readings to reach <0.2 mg/L).

Disposal: Na_2SO_4 can be disposed of down the sink, flushing with at least a gall

APPENDIX B: Calibration Bench Sheet

PRE-SURVEY CALIBRATION

Sonde #:		Logger #:		Cable Length:	
General Information					
Date:					
Calibrated By:					
Project:					
Calibrate Sp. Cond. (μS/cm)			Sp. Cond. Check (μS/cm)		
Cal. Sp. Cond. to:		Sp. Cond. Std. (μS/cm)			
<input type="checkbox"/> 718 <input type="checkbox"/> 1413 <input type="checkbox"/> 2000 Other <input type="checkbox"/> _____		<input type="checkbox"/> 718 <input type="checkbox"/> 1413 <input type="checkbox"/> 2000 Other <input type="checkbox"/> _____			
Initial Reading				Temperature	
		μS/cm		°C	
Temperature				Final Reading	
		°C		μS/cm	
Set to:				Record for 1 minute <input type="checkbox"/>	
		μS/cm			
Calibrate 100% DO (in air)			Calibrate pH at 7.01		
Temperature				Temperature	
		°C		°C	
Initial DO				Initial Reading	
		%		SU	
Final DO reading				Final Reading:	
		%		SU	
Calibrate pH @ 4.01			Calibrate pH @ 10.01		
Temperature				Temperature	
		°C		°C	
Initial Reading				Initial Reading	
		SU		SU	
Final Reading:				Final Reading:	
		SU		SU	
Calibration Slope:			Calibration Score:		
CHECK LOW IONIC (LIS)			CHECK 100% DO (in water)		
Batch ID: LIS _____					
Temperature				Temperature	
		°C		°C	
Sp. Cond.				B.P.:	
		μS/cm		mm Hg	
pH				DO sat.	
		SU		%	
				DO	
				mg/L	
				Table Value	
				mg/L	
Record for 1 minute <input type="checkbox"/>			Record for 1 minute <input type="checkbox"/>		
9) Zero DO Ck (DO ≤ 0.2) check weekly					
Zero DO Check:				Record one reading <input type="checkbox"/>	
		mg/L			
Data Recorder Battery Check:					
		%			

POST -SURVEY CHECK

General Information	
Date:	Name:
Data Recorder Battery Check: %	
Post cal. check for Project:	

<input type="checkbox"/> Final Check <input type="checkbox"/> Turnaround to project: _____			
CHECK LISBatch ID: _____		CHECK 100% DO (in water)	
Temperature	°C	Temperature	°C
Sp. Cond.	µS/cm	B.P.:	mm Hg
pH	SU	DO sat.	%
		DO	mg/L
		Table Value	mg/L
Record for 1 minute <input type="checkbox"/>		Record for 1 minute <input type="checkbox"/>	

General Information	
Date:	Name:
Data Recorder Battery Check: %	
Post cal. Check for Project	

<input type="checkbox"/> Final Check <input type="checkbox"/> Turnaround to project: _____			
CHECK LIS Batch ID: _____		CHECK 100% DO (in water)	
Temperature	°C	Temperature	°C
Sp. Cond.	µS/cm	B.P.:	mm Hg
pH	SU	DO sat.	%
		DO	mg/L
		Table Value	mg/L
Record for 1 minute <input type="checkbox"/>		Record for 1 minute <input type="checkbox"/>	

General Information	
Date:	Name:
Data Recorder Battery Check: %	
Post cal. Check for Project	

<input type="checkbox"/> Final Check <input type="checkbox"/> Turnaround to project: _____			
CHECK LIS Batch ID: _____		CHECK 100% DO (in water)	
Temperature	°C	Temperature	°C
Sp. Cond.	µS/cm	B.P.:	mm Hg
pH	SU	DO sat.	%
		DO	mg/L
		Table Value	mg/L
Record for 1 minute <input type="checkbox"/>		Record for 1 minute <input type="checkbox"/>	

										1. Low Ionic Standard Calibration Check										2. Dissolved Oxygen Check (Air-Saturated H2O)					
Row	Chub	Sonde	Logget	Project	Grav	Post CalChk & Dat	Calibrator	Low Ionic Std Batch Date	Pre-Survey LIS SpCond Reading (µS/cm)	LIS SpCond Reading (µS/cm)	LIS SpCond QC Res	LIS SpCond QC Qualify	Pre-Survey LIS pH Reading	LIS pH QC Result	LIS pH QC Qualify	DO Reading [mg/L]	DO QC Result	DO QC Qualify	Comments						
69	19E104203	19E104861	Special Projects (2024)			09/06/24	Governor	07/25/24	60.4	60.4	Accept	None	6.83	6.86	Accept	None	100.00	Accept	None						
70	19E104204	19E104862	TAM-B2-2 (2024)	4	09/06/24	Governor	08/06/24	63.0	61.5	Accept	None	6.95	7.04	Accept	None	100.90	Accept	None							
71	19E104204	19E104862	TAM-B2-2 (2024)	5	09/07/24	Governor	08/06/24	61.5	61.0	Accept	None	7.04	7.01	Accept	None	100.80	Accept	None							
72	19E104204	19E104862	TAM-B2-2 (2024)	6	09/08/24	Flint	08/06/24	61.0	61.3	Accept	None	7.01	6.96	Accept	None	99.70	Accept	None							
73	23G105688	22E106796	TAM-B2-1 (2024)	1		09/07/24	Governor	08/06/24	64.0	No Data	No Data	6.86		No Data	No Data		No Data	No Data							
74	23G105688	22E106796	TAM-B2-1 (2024)	2		09/07/24	Governor	08/06/24	62.8	59.3	Accept	None	6.84	6.82	Accept	None	99.00	Accept	None						
75	23G105688	22E106796	TAM-B2-1 (2024)	3	09/08/24	Flint	08/06/24	59.3	59.3	Accept	None	6.82	6.85	Accept	None	98.50	Accept	None							
76	19E104203	19E104861				09/07/24	Governor	08/06/24	62.5	59.3	Accept	None	6.70	6.94	Qualify	i	100.50	Accept	None	YSI borrowed by BVSC					
77	23G105688	22E106796	TAM-B2-4 (2024)	10	09/13/24	Governor	08/06/24	60.9	61.0	Accept	None	6.79	6.90	Accept	None	98.50	Accept	None							
78	23G105688	22E106796	TAM-B2-4 (2024)	11	09/14/24	Governor	08/06/24	61.0	60.5	Accept	None	6.90	6.91	Accept	None	99.20	Accept	None							
79	23G105688	22E106796	TAM-B2-4 (2024)	12	09/15/24	Governor	08/06/24	60.5	59.9	Accept	None	6.91	6.86	Accept	None	98.70	Accept	None							
80	23G105687	23G106336	TAM-B2-3 (2024)	7	09/13/24	Governor	08/06/24	59.3	69.2	Accept	None	6.61	6.96	Qualify	i	98.10	Accept	None							
81	23G105687	23G106336	TAM-B2-5 (2024)	14	09/14/24	Governor	08/06/24	69.2	60.3	Accept	None	6.96	6.90	Accept	None	99.20	Accept	None							
82	19E104204	19E104862	Special Projects (2024)			09/15/24	Governor	08/06/24	61.9	61.1	Accept	None	7.01	6.93	Accept	None	101.70	Accept	None	Special Project - buried probe O2/MD					
83	19E104203	19E104861	TAM-B2-3 (2024)	8	09/14/24	Governor	08/06/24	64.9	59.8	Accept	None	7.02	6.57	Accept	None	100.60	Accept	None							
84	19E104203	19E104861	TAM-B2-3 (2024)	9	09/15/24	Governor	08/06/24	59.8	59.5	Accept	None	6.97	6.57	Accept	None	100.40	Accept	None							
85	23G105687	23G106336	TAM-B2-5 (2024)	15	09/12/24	Flint	08/19/24	63.5	59.7	Accept	None	6.69	6.76	Accept	None	98.10	Accept	None							
86	23G105687	23G106336	TAM-B2-5 (2024)	13	09/27/24	Flint	08/19/24	62.6	58.8	Accept	None	6.66	7.09	Accept	None	98.50	Accept	None							
87	23G105688	22E106796	Special Projects (2024)			09/17/24	Governor	08/19/24	61.4	60.4	Accept	None	6.91	6.85	Accept	None	99.30	Accept	None						
88	23G105687	23G106336	RMNL Lakes (2024)	1	09/04/24	Flint	08/19/24	60.3	61.0	Accept	None	6.90	6.69	Accept	None	99.70	Accept	None							
89	23G105688	22E106796	NOVU (2024)			09/14/24	Governor	08/19/24	61.5	62.2	Accept	None	6.77	6.79	Accept	None	100.50	Accept	None						
90	23G105688	22E106796	TAM-B2-3 (2024)	3	09/06/24	Governor	08/19/24	62	62.5	Accept	None	6.77	6.79	Accept	None	100.00	Accept	None							
91	19E104204	19E104862	TAM-B2-1 (2024)	1	09/06/24	Governor	08/19/24	60.1	60.1	Accept	None	6.81	6.89	Accept	None	101.70	Accept	None							
92	19E104204	19E104862	TAM-B2-1 (2024)	2	09/06/24	Governor	08/19/24	60.1	59.9	Accept	None	6.89	6.85	Accept	None	101.40	Accept	None							
93	23G105688	22E106796	TAM-B2-1 (2024)	3	09/09/24	Governor	09/19/24	62.0	62.3	Accept	None	6.72	6.95	Qualify	i	99.00	Censor	i	DO sensor appears to be OK; something is off						
94	23G105688	22E106796	TAM-B2-2 (2024)	4	09/10/24	Governor	09/19/24	62.3	64.0	Accept	None	6.95	6.92	Accept	None	98.70	Accept	None							
95	23G105688	22E106796	TAM-B2-2 (2024)	5	09/11/24	Governor	09/19/24	64.0	63.5	Accept	None	6.92	6.85	Accept	None	99.90	Accept	None							
96	23G105688	22E106796	TAM-B2-2 (2024)	6	09/12/24	Governor	09/19/24	63.5	64.1	Accept	None	6.85	6.87	Accept	None	101.30	Accept	None							
97	19E104204	19E104862	TAM-B2-3 (2024)	7	09/10/24	Governor	09/19/24	63.0	64.4	Accept	None	7.03	7.05	Accept	None	100.50	Accept	None							
98	19E104204	19E104862	TAM-B2-3 (2024)	8	09/11/24	Governor	09/19/24	64.4	63.7	Accept	None	7.05	7.09	Accept	None	100.80	Accept	None							
99	19E104204	19E104862	TAM-B2-3 (2024)	9	09/12/24	Governor	09/19/24	63.7	63.0	Accept	None	7.09	7.04	Accept	None	102.80	Accept	None							
100	23G105687	23G106336	TAM-B2-5 (2024)	14	09/11/24	Governor	09/19/24	65.6	64.5	Accept	None	7.05	7.17	Accept	None	98.80	Accept	None							
101	19E104203	19E104861	Special Projects (2024)			09/11/24	Governor	09/19/24	65.5	63.9	Accept	None	6.97	6.99	Accept	None	100.50	Accept	None						

APPENDIX D: PROBE REQUEST FORM (EXAMPLE)

[illegible]

ATTACHMENT E – YSI EXO1 FIELD OPERATION QUICKGUIDE

YSI EXO1 Field Operation - QuickGuide

MassDEP Watershed Planning Program
CN 004.34 (updated 5/9/23)

Initial Setup

- Hold blue storage cup and loosen (**do not separate**) black tension ring by turning COUNTERCLOCKWISE to remove storage cup from probe.
- Press power button to turn on EXO
- (If the Handheld does not connect: check the physical connection, check the battery.)

Select User ID

- Press “**Handheld**”
- Scroll down to “**User ID**” (selected user will be in brackets, E.G.: “UserID [Medeiros]”)
- Select “**User ID [last name]**” and press **Enter**
- Select desired ID and press **Enter**
- Select “**Select [last name]**” and press **Enter**

Calibrate Depth

- Calibrate depth BEFORE placing in water
- Hold the sonde in a horizontal position, just above the water surface
- Press the “**Calibrate**” button, select depth and press **Enter**
- Select calibrate and press **Enter**
- Check to make sure calibration value is 0.000 wait to make sure reading is stable (green checkmark appears at the right-hand corner of the graph)
- Press **Enter** to accept calibration.
- Press “**Escape**” to return to **Setup** Screen

Site Selection

- On **Home** Screen select “**Start Logging**” and press **Enter**
- Do **NOT** hit “**Start Now**” yet!
- Scroll down to “**Site**” (current selected site will be in brackets E.G.: “Site ID [52-0756]”)
- Select **Site[site ID]** and press **Enter**
- Select desired Site and press **Enter**
 - If a site needs to be added that is not in the list, select “**add new**” and press **Enter**
 - Enter new site ID using virtual keyboard, scroll down to “enter” bar on keyboard and press **Enter**
 - **IMPORTANT** Scroll down and select “**Save**”, press **Enter**
 - You can now select this as the site ID and press **Enter**

Turn on Auto Stable

- Press “**Handheld**” to return to setup screen.
- On **Setup** Screen scroll to “**Auto Stable**” (should read “Auto Stable [On]”), press **Enter**
- Screen should read “**Auto Stable**” at top
- Scroll down to “**Start Auto Stable**”, press **Enter**
- “**Auto Stable in Progress**” should be displayed at the bottom of the screen.
- Auto stable is complete when the “**Auto Stable in Progress**” no longer at the bottom of the screen.

Begin Logging

- To begin logging press **Enter** on the keypad to “**Start Logging**”
- Double check that the desired Site is selected
- Select “**Start Now!**” and press enter to start logging
- The logger will start logging at 15 second intervals (note the start time and log for 2 minutes)

Stop Logging

- (Press any key to wake up the screen if it has dimmed.)

- To stop logging select “**Stop logging**” and press **Enter**

Review Data

- To review data Hit “**Data**” button
- Select “**View Data**” and press **Enter**
- Scroll to “**Show Data**”, press **Enter**
- Data will be displayed on screen
- Press the down arrow on the keypad to scroll to the last line of stored data
- Read back the Sample (OWMID) in the file when you review the data so that the person writing it down can double check it
- Write this last line of data to appropriate spaces on field sheet

Move to Next Site

- Turn off handheld unit
- Place blue cup back on sonde and tighten ring to secure to bulkhead
- Coil the cable neatly, and put instrument back in carry case