

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 1.2.09

Fixed-Station Water-Quality Data Sonde Maintenance, Calibration, Deployment and Retrieval—Version 3.0

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Summary

The purpose of this standard operating procedure (SOP) is to standardize instrument handling, maintenance, calibration, deployment, and post deployment procedures for the Southeast Coast Network Inventory and Monitoring Program. Sonde deployment and retrievals are usually done in conjunction with water sample collection following procedures set forth in SOP 1.2.11 *Fixed-station Water Sample Collection and Processing*—Version 2.0 (McCay and Starkey 2022). This SOP does not replace the latest version of the sonde-specific manual. Thus, the user needs to be familiar with procedures in these manuals. This SOP was originally adapted from the National Estuarine Research Reserve’s (NERRS) System-Wide Monitoring Program (SWMP) Standard Operating Procedure (2011) and outlines procedures for deploying and retrieving sondes from fixed stations as well as other related subtasks. Previous versions of this SOP (v1.0, 2.0, 2.1) were used from 2007 to 2020 and were specific to YSI 6600 series sondes. Version 3.0 has been updated to clarify workflow and more thoroughly describe sonde calibration and deployment procedures specifically for YSI EXO sondes (YSI 2021).

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
9/07/2012	B. Gregory	Increased detail in pre- and post-calibration sections	Increased usability as a technical training document	2.0
1/17/2013		Citation updated	Protocol publication	2.1
3/01/2021	D. L. McCay and E. N. Starkey	Title and citation updated. Workflow and procedures were updated to reflect the use of YSI EXO model sondes. The order of operations was changed to facilitate more accurate calculation of sensor fouling and drift.	SECN equipment upgrade from YSI 6600 to YSI EXO sondes. Changes to SECN database and data processing in Aquarius.	3.0

Suggested Training

While not required, the following training or similar is suggested prior to the implementation of this SOP.

USGS-QW2298, Guidelines for the Operation and Computation of Records of Continuous Water-Quality Monitors. DOI Talent Link: [USGS-OED-QW2298-OprCompRecQW \(doi.gov\)](#)

Contents

	Page
Fixed-Station Activities and Workflow Summary.....	6
Overview.....	7
Workflow for SOP 1.2.09.....	7
Pre-deployment Initial Preparation	10
Cleanliness and Maintenance Check	10
Anti-fouling Wrap Application	10
Pre-deployment Calibration	12
Preparation for Calibration	12
Temperature Thermistor Check and Specific Conductivity Sensor Calibration	15
Calibration Constraints	15
Procedures	15
Dissolved Oxygen Sensor Calibration.....	17
Calibration Constraints	17
Procedures	17
Depth/Pressure Sensor Calibration.....	19
Calibration Constraints	19
Procedures	19
pH Sensor Calibration	20
Calibration Constraints.....	20
Procedures	20
Turbidity Sensor Calibration	22
Calibration Constraints.....	22
Procedures	22
Chlorophyll and Blue-green Algae Sensor Calibration.....	24
Calibration Constraints.....	24

Procedures	24
Pre-deployment Final Preparation	26
Overview of Procedures	26
Wiper Brush Installation.....	26
Procedures	26
Battery Installation and Check	27
Pre-Deployment Sonde Settings.....	27
Procedures	28
Final Check.....	29
Sonde Retrieval and Deployment	29
Overview	29
General Considerations	29
Procedures	30
Post-deployment	33
Archive Log File.....	33
Procedures	33
Sonde Cleaning.....	34
Procedures	34
Post Deployment Calibration Drift Check	35
Final Cleaning and Storage	35
Procedures	35
Literature Cited	37
Appendix A. Equipment/Materials List.....	38
Literature Cited	40
Appendix B. Datasonde Deployment and Retrieval Datasheets.....	41
Appendix C. KorEXO Initial Setup Instructions	43
Appendix D. Reference Tables for Calibration	45
Appendix E. Total Algae Sensor Standard Instructions	51

Appendix F. EXO Handheld Deployment/Retrieval Instructions	53
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Fixed-Station Activities and Workflow Summary

An overview of fixed-station activities and workflow are presented in Figure 1. SOPs are presented left to right in the general order of operations for each activity. This SOP (1.2.09) pertains to the Data Collection activity.

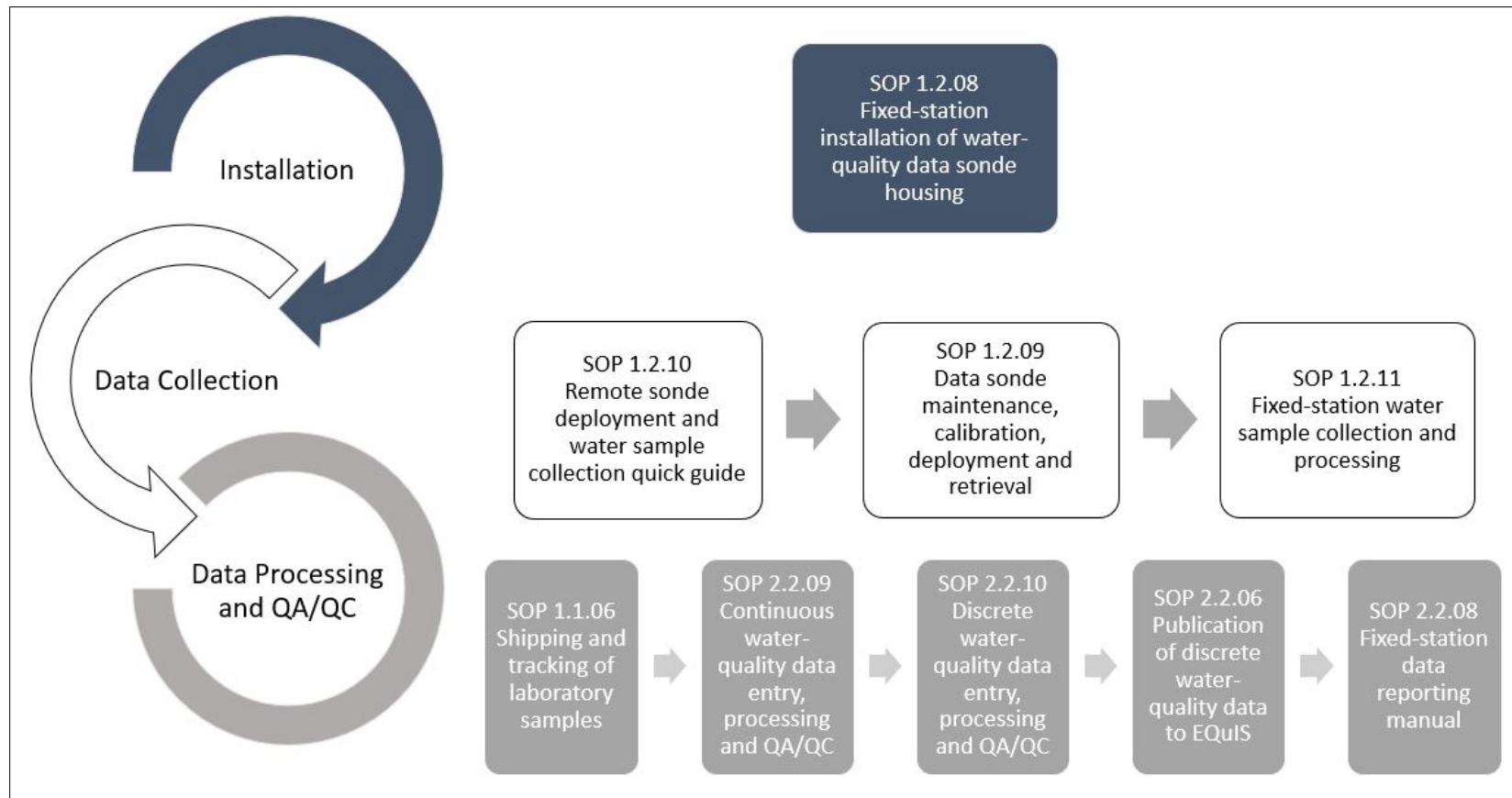


Figure 1. Fixed-station activities and workflow. SOPs are presented left to right in the general order of operations for each activity.

Overview

This standard operating procedure (SOP 1.2.09) outlines methods for the collection of data using YSI EXO2 multi-parameter water-quality monitors (sondes) for the National Park Service Southeast Coast Network (SECN) Inventory and Monitoring (I&M) Program. This SOP does not replace the latest version of the sonde specific manual. Thus, the user needs to be familiar with procedures in the manual and refer to it where necessary. The purpose of this SOP is to standardize instrument handling, maintenance, calibration, deployment, and post deployment procedures. The SECN staff and cooperators deploying sondes at fixed sites must follow procedures outlined in this SOP or in exceptional cases explicitly document divergence from the SOP.

Multiparameter sondes are complex instruments that require maintenance and calibration on a regular basis. The exact timing of maintenance and calibration varies due to field conditions, instrument type, and sensor array. For each monitoring station, a sonde is calibrated, deployed for approximately one month, and then retrieved for post-deployment drift checks. When a sonde is removed for calibration/maintenance it is replaced by another recently calibrated sonde. In other words, there are two sondes for each monitoring station, one that is deployed and another that has come back from the field and is being prepared for the next deployment. **This SOP is laid out based on a sonde already being deployed and being swapped out with a recently calibrated sonde. The sonde being retrieved is referred to as the *in situ* sonde, while the instrument being deployed is referred to as the *field* sonde. A more specific workflow is shown in the Workflow section below and in Figure 2.**

Workflow for SOP 1.2.09

Workflow items shown in bold are procedures conducted in the field. All other procedures are done in the lab/office.

1. Pre-deployment
 - a. Initial Preparations
 - b. Sensor Calibration
 - i. Temperature (check only)/Specific conductance
 - ii. Dissolved oxygen
 - iii. Depth
 - iv. pH
 - v. Turbidity
 - vi. Chlorophyll and blue green algae (optional)
 - c. Final Preparations
2. Retrieval

- a. **Stop data logging and download copy of the log file**
 - b. **Deployment tube maintenance**
 - i. **Barnacle removal**
 - ii. **Inspection and replacement of sonde pipe hardware**
 - c. **On site in situ & field sonde measurements**
- 3. Deployment**
- a. **Review log file and start data logging**
 - b. **Placement of field sonde in the water**
- 4. Post-deployment**
- a. **Format and archive log file**
 - b. **Clean sonde body and sensors**
 - c. **Calibration drift check**
 - d. **Maintenance and storage**

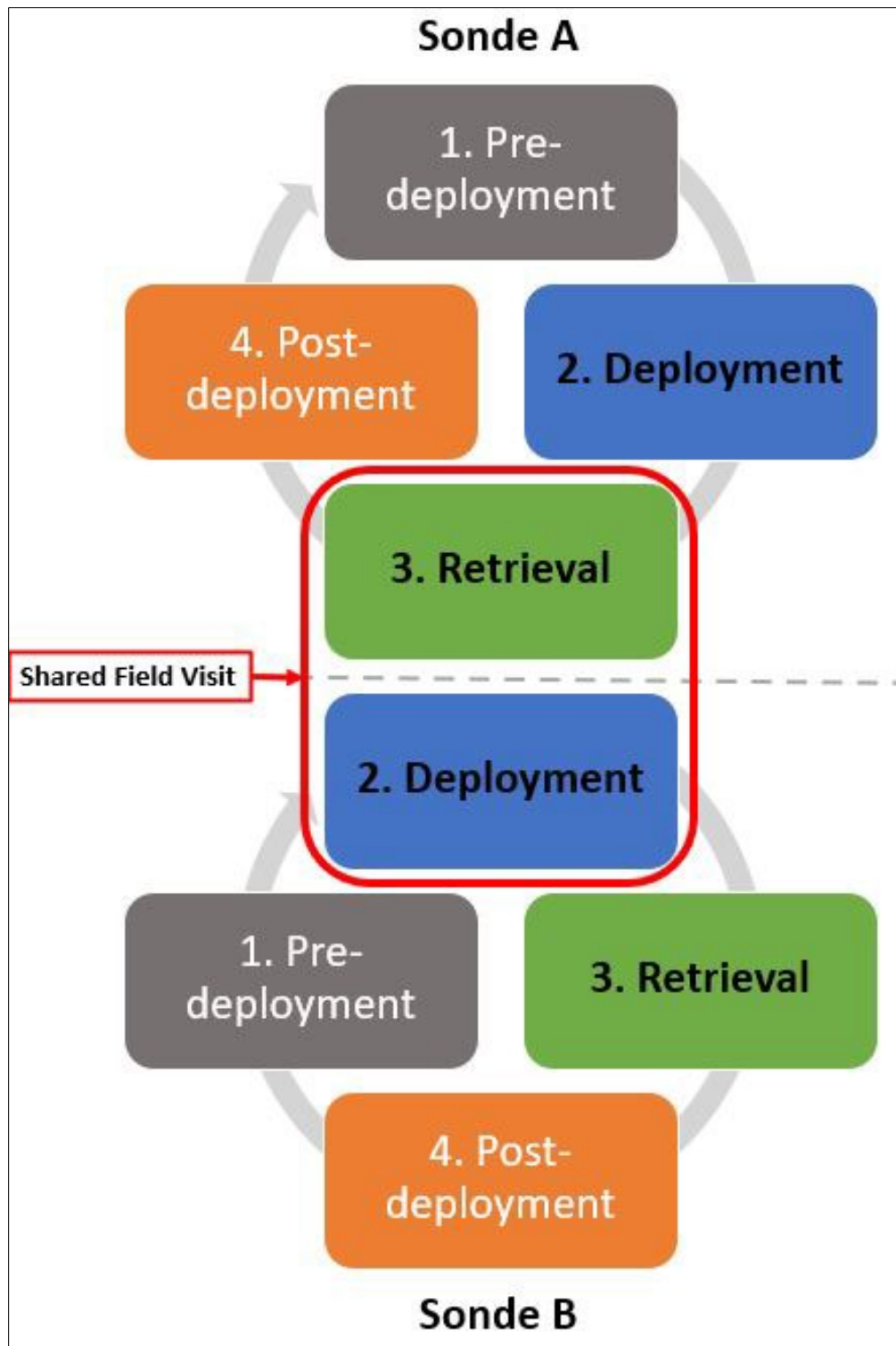


Figure 2. Workflow and cycle for sondes associated with a single fixed monitoring station.

Pre-deployment Initial Preparation

Again, we are starting from the basis that a sonde is currently deployed (*in situ*) and that we are preparing a field sonde to replace the *in situ*. The steps laid out below will guide the reader through the process sequentially. Prior to deployment, several procedures must be followed to ensure sondes and sensors are protected from environmental exposure and that data files are named and stored properly to reduce potential for error.

Cleanliness and Maintenance Check

As cleaning is primarily done after retrieval it will not be covered here. This pre-deployment section assumes the instrument has already undergone cleaning and is being prepared for deployment. See the Post-deployment section below for detailed cleaning instructions. Although you should be starting with a clean instrument, double check for cleanliness and proper maintenance throughout the entire process. Visually inspect the instrument for any abnormalities, such as damaged probes, failed gaskets, or cracks in the sonde body or bulkhead. All seals/o-rings must be free of cracks and dirt and be lightly greased, namely the battery compartment cap and sensor mating surfaces (wetmate connectors). The sonde and sensors must be free of fouling debris and wrapped with shrink wrap and/or copper tape according to the sections below. Specifically, check the inside of the wiper brush housing for debris that could contaminate calibration standards.

Anti-fouling Wrap Application

The application of anti-fouling wraps—such as plastic shrink wrap on the outside of the sonde and copper tape on the outside of the probes—helps keep biofouling from occurring directly on the instrument, cuts down on cleaning between deployments, and extends the life of the instrument and probes (Figure 3). See Equipment/Materials List in Appendix A.

1. Wrap the upper part of sonde body with a corresponding size plastic heat-shrink-wrap making sure to cover entire upper body from top of instrument to top of sensor guard/calibration cup threads. Gently use a heat gun to tighten the shrink-wrap.
 - a. Sonde shrink wrap: Uline—roll of 5-inch (12.7 centimeters [cm])-wide, 200 Gauge PVC, 0.05 millimeter thickness or YSI sonde specific EXO2 shrink wrap.
2. Copper tape is applied to the outside of each probe. This tape usually lasts through several deployments but may need to be changed when the tape becomes thin or starts to wear off.
 - a. Cut shrink wrap to the length of the sensor, place wrap over the sensor, and use the heat gun on low to shrink in place. Repeat for each sensor.
 - b. Next, cut the copper tape to the length of the sensor, peel away backing, and use the perforated line of the shrink wrap to roughly align the long edge of the tape. Once the initial edge of the tape is affixed, then use a smooth cylindrical object, such as a sharpie marker, to gently press the tape onto the sensor, slowly turning the sensor until tape is completely secure. Keep copper tape clear of active sensor surfaces,

specifically the DO cap and the top portion of the pH probe. See Figure 4 below for an example of proper wrapping that leaves active surfaces uncovered and accessible.

3. Optional: A light application of antifouling spray (C-Spray) on the C/T probe conductivity chambers and sonde bulkhead can help further reduce fouling. Follow application instructions on the bottle.



Figure 3. A sonde covered in barnacles. Note that the copper tape on the sensors shows no major fouling and the central wiper has prevented buildup on the sensor faces.



Figure 4. Sensors wrapped in shrink wrap and copper tape.

Pre-deployment Calibration

Now that the instrument has been properly prepared it can be inspected and calibrated. The battery voltage must be greater than 5.0 volts before beginning the calibration process. Standard solutions must be active (check expiration date) and fresh for all final calibrations and checks. Previously used or expired standards can be used for rinses, but NOT final checks and calibrations.

During the calibration of the probes **never** accept any calibrations for which you have been given a warning message. You must determine the cause of the problem, correct the problem, and recalibrate the probe before deploying the instrument. The following sections are steps designed to ensure proper functioning of the sondes and need to be completed in the order in which they are presented below. Good lab practices are mandatory throughout the calibration process. Prior to beginning a calibration session, make sure that you have data sheets available (Appendix B), standards, and a traceable certified/NIST thermometer, referred to as NIST thermometer in this document. Also, the sonde and calibration standards must all be at room temperature.

Preparation for Calibration

1. Line up the blue calibration cups, one for each parameter (C/T [Conductivity/Temperature], pH 7, pH 10, Turbidity 0.0 and 124.0) and prepare to add the appropriate calibration standard/buffer up to the marked fill line (first line on EXO cups; Figure 5).

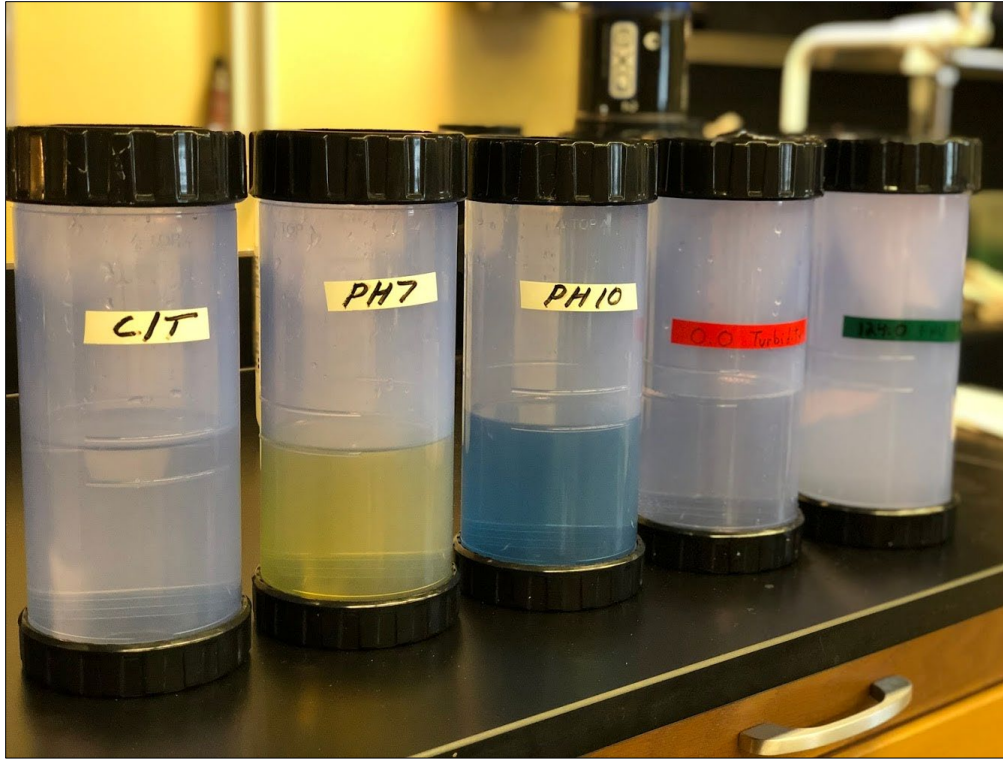


Figure 5. Calibration cups for each parameter.

2. Have another clean calibration cup available for rinsing the sensors between calibrations.
3. Connect the KorEXO program to the sonde using Bluetooth or the cable. Consult the EXO manual for instructions on connecting through Bluetooth.
4. A Calibration, Deployment, and Retrieval Data sheet (Appendix B) must be completed for each instrument during calibration. Begin to fill out the Pre-deployment section of the data sheet (i.e., station name, calibration date, sonde serial number)
5. Start EXO handheld and record the barometric pressure in the section marked “Barometric Pressure (mmHg)” to a minimum precision of 0.1 mmHg.
6. Attach a clean black plastic guard onto the sonde body. The lower plastic guard end cap needs to be removed to reduce the number of surfaces that can accumulate debris or other substances which might dilute or contaminate standards. Note that it is always advised to calibrate sonde sensors as close as possible to how they are deployed. The Southeast Coast Network chooses not to calibrate using the copper guards installed during deployments for the calibration process because it can shed particles that can contaminate standards and lead to inaccurate calibrations.
7. Remove the central wiper brush to prevent fouling and cross contamination. It will be reinstalled and checked during the Final Preparation section. See Figure 6 for an example of a sonde with black guard installed correctly and wiper removed, ready for calibration.



Figure 6. Sonde ready for calibration.

The workflow below is based on sonde calibrations using the KorEXO program on a computer. Though the general process will remain the same, there are different button configurations if the EXO handheld is used. Refer to Appendix C to setup KorEXO on a new computer.

Temperature Thermistor Check and Specific Conductivity Sensor Calibration

Calibration Constraints

- Temperature thermistor check: one-point check at room temperature. SECN temperature tolerance is ± 0.2 degrees Celsius (32.4°F) and all data are recorded to a minimum precision of 0.01 degrees.
- Specific conductivity calibration: one-point check/calibration at 1 or 50 mS/cm (millisiemens per centimeter). SECN specific conductivity tolerance is ± 1.5 mS/cm and all data are recorded to a minimum precision of 0.01 mS/cm.

Procedures

The conductivity and temperature sensors are housed together in the same sensor body (CT sensor) and are checked/calibrated concurrently using the same standard. Although the sonde temperature sensor cannot be calibrated, all measurements made by the sonde require accurate temperature measurements (DO and pH are highly affected by temperature). Therefore, temperature sensor readings are evaluated first every time the sonde is checked/calibrated using a NIST thermometer. If found to be within tolerance, the thermistor check is immediately followed by the specific conductivity calibration procedure.

1. Triple rinse the sonde probes in conductivity solution. For non-wiped CT sensors, make sure this includes pouring some of the rinse solution through the holes of the conductivity sensor to ensure that water is not trapped inside, thereby affecting the calibration accuracy. Gently shake sonde to remove excess rinse standard.
2. Fill the calibration cup to the bottom line with fresh conductivity standard (50.00 mS/cm conductivity solution for coastal water-monitoring; 1.00 mS/cm for fresh-water). Record this standard value in the section marked "Temp" - "Standard." Place the NIST thermometer into the standard and allow time for equilibration. Record in Celsius degrees the thermometer temperature reading in the section marked "Temp" - "Standard." Remove the NIST thermometer once completed.
3. Slowly place the sonde into the fresh standard and allow for equilibration. Record in Celsius degrees the sensor temperature reading in the Calibration/Pre-Deployment section marked "Measured." Record in mS/cm the sensor specific conductance reading in the Calibration/Pre-Deployment section marked "Measured."
4. If temperature readings are within tolerance, leave sonde and calibration cup as they are and move on to conductivity calibration. If not, investigate further to determine why. If necessary, the sonde can be removed and a second reading can be taken with the NIST thermometer to confirm the first.
5. If the specific conductivity readings are within tolerance stop here and do not proceed with the calibration. If not, try gently taping the sonde to remove potential bubbles and check for cleanliness. Only calibrate the sensor after investigating and attempting basics fixes.

6. To calibrate the CT sensor:

- a. Select the “Calibration” tab in KorEXO, scroll down and select either “Wiped Conductivity” or “Conductivity.”
- b. Now select the “Calibrate” button next to “Sp Cond”, the Conductivity calibration screen should come up. Make sure the right standard value is entered – either 1 mS/cm (for deployment in freshwater) or 50 mS/cm (for deployment in estuarine water).
- c. Once the “Data Stability” reads “Stable” you can select “Apply.” Click “Ok” to continue.
- d. At this point the program will read out the final calibration values. You can now either “Cancel” “Redo...”, or “Complete Calibration.” If everything is accurate then select complete to finalize the calibration. The readings should now be close to the standard value.
- e. Record the final reading in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”

The conductivity cell constant should be 4.60–5.45 with 5.0 being preferred. Note any change between the last calibration and the most recent cell constant. A sensor that suddenly goes out of range could mean the standard was contaminated, there was a trapped air bubble, or not enough standard was used to sufficiently cover the sensor. As an additional quality control check, the specific conductance of a dry CT sensor while in the air will read $0.0 \text{ mS/cm} \pm 0.2$ and no more than $\pm 0.5 \text{ mS/cm}$.

Dissolved Oxygen Sensor Calibration

Calibration Constraints

- SECN dissolved oxygen calibration: one-point with water-saturated air; tolerance is ± 0.3 mg/L and all data are recorded to a minimum precision of 0.01 mg/L.

Procedures

The one-point water-saturated air method is used by the Southeast Coast Network for dissolved oxygen sensor calibrations. Before beginning the calibration, check that the DO sensor cap is not severely worn or scratched. The black coating needs to be mostly intact with little to no blue light shining through from the sensor body, and the cap must be snug on the probe body (Figure 7).

If the DO sensor cap is replaced, the calibration constants **MUST** be updated using the values on the installation sheet provided with the new DO cap. Go to the “Instrument and Sensors” tab, select “DO Sensor”, enter the new values and select “Apply.” Archive the DO cap installation sheet with the calibration constants so that they can be accessed if necessary.

1. Rinse the probes, black guard, and a clean calibration cup with tap water. Shake the sonde gently to remove excess water. Wipe DO probe and DO optic dry with a clean Kimwipe taking special care to gently dry the black DO cap surface.
2. Fill calibration cup with approximately 0.25 inches (0.64 cm) of tap water and insert the sonde into the cup. Do not screw the cup tight around the sonde. Leave it loose to allow air exchange.
3. Allow the sonde to sit in the calibration cup for a minimum of 5 minutes to ensure the air is 100% saturated and that the temperature is stable.
4. In the “Live Data” tab, watch for the readings to stabilize. Once stable, record the “DO (%Sat)” and “DO (mg/L)” in the Calibration/Pre-Deployment section of the datasheet marked “Measured.”
5. Calculate the “Standard” DO % saturation by dividing the handheld barometer reading by 760 and then multiply that number by 100. Example: $750 / 760 = 0.9868 \times 100 = 98.68\%$. Record in the Calibration/Pre-Deployment section of the datasheet marked “Standard.”
6. Use the temperature and handheld barometer reading to find the “Standard” DO mg/L using the table provided in Appendix D, Table D-1. The USGS also provides a website, <https://water.usgs.gov/water-resources/software/DOTABLES/>, that can calculate the standard DO mg/L. Use section “A.-Single-Value Computation”, enter the sonde temperature reading into the “Water temperature” box, and enter the handheld barometer reading into the “Barometric pressure” box. Select “Submit” The results will populate in the “Results” section. Record in the Calibration/Pre-Deployment section of the datasheet marked “Standard.”

7. If the dissolved oxygen readings are within tolerance stop here, do not proceed with the calibration, and move instead to Step 9. If not, check that there is not significant moisture buildup on the sensor optics. Also, check that the temperature and barometer readings have remained stable throughout the process. Only calibrate the sensor after investigating and attempting basic fixes.
8. To calibrate the DO sensor:
 - a. Select the “Calibration” tab in KorEXO, scroll down and select “DO.” Now select the “Calibrate” button next to “DO (% Sat),” the DO calibration screen should come up.
 - b. Enter the current handheld barometer reading into the “Barometer” box. Once the “Data Stability” reads “Stable” you can select apply. Click “Ok” to continue.
 - c. At this point the program will read out the final calibration values. You can now either “Cancel” “Redo...,” or “Complete Calibration.” If everything is accurate then select complete to finalize the calibration. The readings should now be close to the standard value. Record the final readings in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”
9. After the DO sensor check/calibration find the DO Gain in the “Instrument and Sensors” tab, select “DO Sensor.” Record this value on the datasheet in the Calibration/Pre-Deployment section, an acceptable range is 0.7 to 1.4 with 1.0 being preferred. If the value is outside this range the dissolved oxygen probe needs to be changed and recalibrated.



Figure 7. From left, DO sensor cap heavily damaged with large scratch, DO sensor cap with moderate wear, and new DO sensor cap.

Depth/Pressure Sensor Calibration

Calibration Constraints

- The SECN depth calibration: one-point using current barometric pressure; tolerance is ± 0.01 meters and all data are recorded to a minimum precision of 0.001 meters.

Procedures

The depth sensor is calibrated to sea level or the level of your lab. Since most SECN calibrations are done in the lab and usually at a higher elevation than sea level, an offset is applied to the actual pressure reading for an accurate depth to be displayed after the sondes are deployed. This is done by entering a depth offset which is based on the current atmospheric pressure. Refer to the depth offset chart, Appendix D, Table D-2.

1. Remove the sonde from the calibration cup and gently shake off any excess moisture. Place the sonde on the counter and let it equilibrate for one minute.
2. In the “Live Data” tab, watch for the readings to stabilize. Once stable, record the “Depth (m)” in the Calibration/Pre-Deployment section of the datasheet marked “Measured.”
3. Then, use the handheld barometer reading to find the depth “Standard” using Appendix D, Table D-1. Record this value in the Calibration/Pre-Deployment section of the datasheet marked “Standard.”
4. If the depth reading is within tolerance, stop here and do not proceed with the calibration. If not, check that dirt or debris is not trapped inside the sensor ports. Also, check that the barometer readings have remained stable throughout the process. Only calibrate the sensor after investigating and attempting basics fixes.
5. To calibrate the depth sensor:
 - a. Select go to the “Instrument and Sensors” tab. Scroll down to and select the “Depth Sensor.” Make sure the settings are correct: “Mounting” = “Fixed,” “Latitude” = 0, “Altitude” = 0. Enter the “Standard” value in Step 3 into the “Offset” box. Select “Apply Sensor Settings.”
 - b. With the offset now applied, the instrument still needs to be zeroed out. Go to the “Calibration” tab. Scroll down and select “Depth,” then select “Calibrate.” The “Standard Value” should already be zero. Select “Apply.”
 - c. At this point the program will read out the final calibration values. You can now either “Cancel” “Redo...,” or “Complete Calibration.” If everything is accurate then select complete to finalize the calibration. The readings should now be close to the standard value. Record the final reading in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”

pH Sensor Calibration

Calibration Constraints

- SECN pH calibration: two-point using pH 4, pH 7, or pH10; tolerance is ± 0.2 pH units and all data are recorded to a minimum precision of 0.01 pH units.

Procedures

The pH probe is calibrated using a two-point calibration. Remember that the pH calibration solutions are certified at a temperature of 25°C (77°F; see chart bottle label), and standard values must be temperature adjusted using the pH temp chart. Always start the calibration with the lowest standard (pH 4 or pH 7) then move on to the higher standard (pH 7 or pH 10) for the second calibration point. The workflow below describes the most common SECN process, which is the pH 7 and pH 10 calibration to account for the observed pH range of our coastal sites. For freshwater sites the Southeast Coast Network uses a pH 4 and pH 7 calibration.

The pH probe is comprised of a sensor base and sensor module. The pH modules have a maximum life span of approximately two years so any pH probes over one year old are near needing replacement. If probes will not accept calibrations or are slow to respond to standards, suspect aging and replace if necessary.

pH sensors slowly drift over time because the reference solution inside the sensor degrades. To account for this, always proceed through the pH calibration as if you will accept the calibration, while remembering you have the option to cancel if the values are within tolerance. Only during the “Post-deployment Check” can you use the “Live Data” screen instead of the “Calibration” window.

1. To begin go to the “Calibration” tab, select “pH”, select “Calibrate.” Within this calibration window will be all the relevant readings: pH, temperature, and pH millivolts (pH raw).
2. Make sure the sensors are clean and then triple rinse with pH 7 standard.
3. Fill the calibration cup to the bottom line with fresh pH 7 standard. Insert the sonde into the calibration cup. In the calibration window, wait at least two minutes for the three readings (pH, temp, pH raw) to stabilize. New pH sensors can stabilize in as little as two minutes, but older sensors can take up to 10 minutes. Once stable, record the pH reading in the Calibration/Pre-Deployment section marked “Measured” and the “pH raw” reading in the “pH mV” section of the datasheet.
4. Use the temperature reading from the previous step and Appendix D, Table D-3 to derive the pH standard value for pH 7. Record this value in the Calibration/Pre-Deployment section of the datasheet marked “Standard.” Enter this value into the calibration window in the “Standard Value” box. Select “Apply,” then “Ok.”
5. Now select the “Add Another Cal Point” button to proceed with pH 10 standard. Repeat steps 2 through 4 with the pH 10 standard. Stop once you select “Apply” and then select “Ok” (i.e., end of step 4).

6. At this point the program will read out the final calibration values. You can now either “Cancel” “Redo...”, or “Complete Calibration.” If everything is accurate then select complete to finalize the calibration. The readings should now be closer to the standard value. Record the final readings in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”
7. After calibration of pH probe is completed, perform a pH probe slope check using the pH millivolt values recorded during the calibration procedure. pH slope is defined as the difference between the pH 7 millivolt reading and the pH 10 millivolt reading. Record this value in the Calibration/Pre-Deployment section of the datasheet marked “pH Slope.”

$$\text{slope} = \text{pH 7 mV} - \text{pH 10 mV} \text{ or } \text{slope} = \text{pH 4 mV} - \text{pH 7 mV}$$

Watch the pH millivolts readings as an indicator of a stable reading. The millivolts reading should not change for at least four seconds when the pH has stabilized. Older probes may also take longer to stabilize. Slope values between 150 and 210 are acceptable, with a slope value closer to 180 being preferred. Slope values outside this range indicate that the probe needs to be replaced, and recalibration performed prior to deployment. An additional quality control check is that in pH 4 buffer the pH millivolts should read 180 ± 50 , in pH 7 buffer the pH millivolts should read 0 ± 50 , and in pH 10 buffer the pH millivolts should read -180 ± 50 .

Turbidity Sensor Calibration

Calibration Constraints

- SECN turbidity calibration: two-point using 0.0 FNU DI water and 124.0 FNU standard; tolerance is ± 0.5 at 0 FNU and ± 6.2 at 124.0 FNU. All data are recorded to a minimum precision of 0.1 FNU.

Procedures

Turbidity calibrations are performed using a two-point calibration with lab DI water for 0.0 FNU and a YSI standard for 124.0 FNU. The EXO turbidity sensor is extremely precise and as a result is prone to miscalibrations, especially at the low end (0.0 FNU). When the sensor is first put into service take special care to apply an accurate calibration by following the steps and tips below. After an accurate initial calibration, the sensor should rarely need further calibrations as these sensors drift very little. Remember, in the attempt to replicate actual sonde conditions, wrap a rag around the calibration cup to block potential light interference.

Since turbidity is a two-point calibration it is best to proceed through the calibration process as if you will accept the calibration, while remembering you have the option to cancel if the values are within tolerance. Only during the “Post-deployment Check” can you use the “Live Data” screen instead of the “Calibration” window.

1. To begin go to the “Calibration” tab, select “Turbidity,” select “Calibrate.” Within this calibration window will be all the relevant readings. Record on the datasheet the standard values 0.0 FNU in the section marked “Turbidity Low” – “Standard” and 124.0 FNU in “Turbidity High” – “Standard.”
2. Fill a calibration cup up to the bottom line with DI water for the 0.0 FNU calibration. Fill slowly to prevent bubbles from forming. If bubbles are present, cover the cup with plastic wrap and let sit for one minute.
3. Rinse the sonde guard and sensors thoroughly with DI water. Wipe off the turbidity sensor face with a Kimwipe. Now rinse one last time, angling the sensors downward and starting at the sensor bases working down to the sensor faces. This will help push errant debris off the sonde. Shake gently to remove any excess DI water.
4. Insert the sonde slowly into the calibration cup. Keep a close watch on the readings. Optimally the readings will settle around a low value (between -0.2 and 0.5 FNU) and you can proceed to Step 5. See below for troubleshooting.
 - a. The 0.0 FNU calibration is the most sensitive of all the calibrations because the standard can easily become contaminated during the process. Steps 2 and 3 may have to be repeated multiple times before you can get an accurate reading.
 - b. If the readings are off, try removing the sensor from the calibration cup and re-inserting it. Sometimes bubbles form on the sensor face and can affect readings. The longer the sensor sits in the standard the higher the potential for the standard to

become contaminated by debris falling off the sonde or the copper tape shedding particles. If the readings do not settle out after one minute, repeat steps 2 and 3.

- c. These sensors rarely drift so before calibrating repeat steps 2 and 3 to prove the value is incorrect. Operate under the assumption the standard has been contaminated or another issue is affecting the reading whenever the sensor reads out of tolerance. Repeat and proof.
 - d. YSI advises wiping the turbidity sensor face with the central wiper; however, the Southeast Coast Network has found that removal of the wiper reduces cross contamination during this and other calibration procedures (see Pre-deployment Calibration section above).
5. Once you are confident in the observed low-end calibration value and the “Data Stability” reads “Stable,” select “Apply” in the calibration window. Record this value in the Calibration/Pre-Deployment section marked “Measured” in the “Turbidity Low” section of the datasheet.
 6. Now select “Add Another Cal Point” in the calibration window to start the 124.0 FNU calibration point.
 7. Prepare a 124.0 FNU calibration standard by gently pouring 124.0 FNU standard from the storage container into a calibration cup, filling to the bottom line. Be careful not to agitate the standard or introduce any bubbles into the liquid as you pour into the calibration cup.
 8. Remove the sonde from the 0.0 FNU standard and shake gently to remove excess DI water. Remove the sonde guard used previously. Use Kimwipes to dry off the sensors. Once dry, pour a small amount of turbidity standard over the sensor faces and sensor bodies. This will help remove DI water in between the sensors. Now attach another clean, dry guard.
 9. Slowly, insert the sonde into the 124.0 FNU standard calibration cup. Wait at least 30 seconds for the reading to stabilize. The 124.0 FNU calibration point is less sensitive to dilution or contamination. Still be cognizant of potential errors sources though, namely bubbles in the standard and bubbles on the sensor face. Record this value in the Calibration/Pre-Deployment section marked “Measured” in the “Turbidity High” section of the datasheet.
 10. Once the “Data Stability” reads “Stable,” select “Apply” and select “Ok.” At this point the program will read out the final calibration values. You can now either “Cancel,” “Redo...,” or “Complete Calibration.” If everything is accurate and is within the tolerances, then select “Complete...” to finalize the calibration. The readings should now be closer to the standard value. Record the final readings in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”

Chlorophyll and Blue-green Algae Sensor Calibration

Calibration Constraints

- SECN BGA-PE calibration: two-point using 0.0 ug/L DI water and 126.0 ug/L standard; tolerance is ± 0.5 at 0.0 ug/L and ± 6 at 126.0 ug/L. All data are recorded to a minimum precision of 0.1 ug/L.
- SECN chlorophyll calibration: two-point using 0.0 ug/L DI water and 66.0 ug/L standard; tolerance is ± 0.5 at 0.0 ug/L and ± 3 at 66.0 ug/L. All data are recorded to a minimum precision of 0.1 ug/L.

Procedures

Chlorophyll (Chl) and Blue-green algae-Phycoerythrin (BGA-PE) calibrations are performed using separate two-point calibrations with lab DI water for the low end and a rhodamine dye solution standard for the high end. This sensor is extremely precise yet is limited by the uncertainty associated with producing standards in the SECN lab. The procedures laid out in the manual (Appendix E) for producing the standards are good, but there are many potential sources of error in the measuring and dilution of the different solutions. As such the data recorded from this sensor are often flagged as “Estimated” and are only useful for general trends and recording possible algal bloom events. This data should be used in tandem with and not in place of laboratory analyzed discrete samples.

1. Prepare the 66.0 ug/L Chlorophyll standard and 126.0 ug/L BGA-PE standard according to the EXO manual (Appendix E).
2. Get the 0.0 turbidity, Chl, and BGA-PE calibration cups ready. These will be used for the 0.0 ug/L, 66.0 ug/L Chl, and 126.0 ug/L calibrations respectively.
3. Each parameter, Chlorophyll and Phycoerythrin, will be calibrated separately, but the process is the same just with different standards. We will start with Phycoerythrin.

Phycoerythrin

4. To begin go to the “Calibration” tab, select “Phycoerythrin,” select “Calibrate.” Within this calibration window will be all the relevant readings.
5. Fill a calibration cup up to the bottom line with DI water for the 0.0 ug/L calibration. Triple rinse the sonde sensors in DI water. Insert the sonde into the calibration cup and wait for the readings to stabilize.
6. Once the “Data Stability” reads “Stable,” select “Apply,” select “Ok” in the calibration window. Record this value in the Calibration/Pre-Deployment section marked “Measured” in the “BGA-PE Low” section of the datasheet.
7. Now slowly pour fresh 126.0 ug/L BGA-PE standard into the properly marked calibration cup. Triple rinse the sonde sensors in a separate cup with some of the leftover standard and then insert into the standard calibration cup.

8. Once the “Data Stability” reads “Stable,” select “Apply,” select “Ok” in the calibration window. Record this value in the Calibration/Pre-Deployment section marked “Measured” in the “BGA-PE High” section of the datasheet.
9. If the readings are off significantly you can try to remove and reinsert the sonde to dissipate any bubbles on the sensor face. The sensor face can also be wiped using Kimwipes. If readings continue to be out of the acceptable range, the sensors are either in need of calibration or the standard was mixed improperly. Investigate accordingly and either move forward with the calibration or repeat the process to make a new batch of standard.
10. You can now either “Cancel” “Redo...,” or “Complete Calibration,” If everything is accurate, but is outside the tolerances, then select “Complete...” to finalize the calibration. The readings should now be closer to the standard value. Record the final readings in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”

Chlorophyll

11. Now proceed to the Chlorophyll calibration. To begin go to the “Calibration” tab, select “Chlorophyll,” select “Calibrate,” Within this calibration window will be all the relevant readings.
12. Fill a calibration cup up to the bottom line with DI water for the 0.0 ug/L calibration. Triple rinse the sonde sensors in DI water. Insert the sonde into the calibration cup and wait for the readings to stabilize.
13. Once the “Data Stability” reads “Stable,” select “Apply,” select “Ok” in the calibration window. Record this value in the Calibration/Pre-Deployment section marked “Measured” in the “Chl Low” section of the datasheet.
14. Now slowly pour fresh 66.0 ug/L Chlorophyll standard into the properly marked calibration cup. Triple rinse the sonde sensors in a separate cup with some of the leftover standard and then insert into the standard calibration cup.
15. Once the “Data Stability” reads “Stable,” select “Apply,” select “Ok” in the calibration window. Record this value in the Calibration/Pre-Deployment section marked “Measured” in the “Chlorophyll High” section of the datasheet.
16. If the readings are off significantly you can try to remove and reinsert the sonde to dissipate any bubbles on the sensor face. The sensor face can also be wiped using Kimwipes. If readings continue to be out of the acceptable range, the sensors are either in need of calibration or the standard was mixed improperly. Investigate accordingly and either move forward with the calibration or repeat the process to make a new batch of standard.
17. You can now either “Cancel” “Redo...,” or “Complete Calibration.” If everything is accurate, but is outside the tolerances, then select “Complete...” to finalize the calibration.

The readings should now be closer to the standard value. Record the final readings in the Calibration/Pre-Deployment section of the datasheet marked “Calibrated.”

Pre-deployment Final Preparation

This is the final step in preparation for a deployment/retrieval site visit.

Overview of Procedures

1. Install wiper.
2. Load fresh batteries and check voltage.
3. Create/check sonde deployment settings.
4. Prepare for transportation.

Wiper Brush Installation

The wiper brush ensures that biofilm and hard fouling does not collect on the end of the sensors. ***It is integral*** that wiper brushes and the central wiper body are maintained properly to allow for accurate data collection. The central wiper housing must be sent to YSI for routine servicing every four years (two years deployment time). The wiper brush must be replaced as necessary when it shows excessive splaying or becomes degraded (Figure 8). Remove an old wiper brush by loosening the small set screw on the back of the wiper with a small Allen wrench and pulling the wiper brush off the wiper mast. To reinstall the wiper line up the flat section of the wiper mast with the flat section of the wiper brush hole. Once seated, gently the tighten set screws. Under normal use, the wiper will last up to 30 days of deployment time, but excess fouling will shorten the life of the wiper. Brushes exhibiting minor splaying and fouling can be refurbished and returned to service for another deployment.

Procedures

1. Prior to deployment, check to make sure the wiper brush parks 180° from the optics. The parking location can be calibrated in KorEXO by going to the “Calibrate” tab, select “Wiper,” select “Calibrate.” On the datasheet, circle “Y” if the central wiper is parking 180° from the optic.
2. In the wiper calibration window, you can move the wiper on its axis using the “Jog Left” and “Jog Right” buttons.
3. Once you have it properly located in the black plastic wiper brush housing then select “Apply.”
4. On the datasheet, circle “Y” if the central wiper was replaced.



Figure 8. In order from left to right. Central wiper with brush parked. New wiper brush. Wiper brush with moderate splaying. Wiper brush with heavy splaying.

Battery Installation and Check

Load four D batteries, with leads pointing up, into the sonde battery compartment. Make sure the battery springs are secure and not compromised. Next, check the battery cap seals are greased and free of debris. Install the battery cap with the yellow battery cap tool. Secure the cap until tight. Connect to the handheld or computer and use the “Live Data” area to confirm that the batteries are working properly and above 5.3v. This minimum voltage is enough for a 30-minute interval for a deployment of 1 to 1.5 months.

Pre-Deployment Sonde Settings

Sonde “Deployment Templates” can be created in KorEXO to expedite the deployment process and minimize potential errors when in the field. Only one template can be applied to the sonde at any given time, although many site-specific templates can be saved on your computer. These can be found here: S:\Monitoring\EstuarineWaterQuality\FixedStation\Operations\Equipment\KorEXO. It is best to have all site-specific templates saved on your field computer for easy access and editing. The templates only control basic information such as site name, logging interval, and file name prefix. The actual data logged within this template will be based on the KorEXO display settings. This means whatever is displayed in the “Live Data” tab will be logged according to time interval set by the template. Refer to Pre-deployment Settings for the initial KorEXO display settings.

Procedures

1. First, create all necessary sites by selecting the “Deployment” tab and selecting “Create New Site”. Enter the site name using standard SECN convention of PARKxxxx##, where PARK is the 4-letter park abbreviation, xxxx is a station location identifier, and ## is the two-digit station installation specific number (ex. CANAvctr01). For quick reference, see Table 1 for active site names. You can enter a basic description if it is helpful, but this is not necessary. Now select “Save.”
2. With all the sites created, you can go back to the “Deployment” tab and select “Create Template.”
3. Enter the site name as the “Deployment Template Name” and the “File Name Prefix.” Use the drop-down box to select the appropriate “Site Name.”
4. Now select the “+” button next to username. Enter the appropriate agency and your initials (ex. SECN-DLM), select “Ok.” Your specific username will now be available in the drop-down box.
5. Next, use the drop-down boxes under “Logging Interval Time” to select the appropriate logging interval for the site (30 minutes, 0:30.00.00 for most sites; 15 minutes, 0:15.00.00 for CALO sites).
6. Once all the correct basic information is entered and reviewed, select “Save and Apply Template to Sonde.” This will save a copy locally to your field computer and apply the template to the sonde.
7. A prompt will appear to ask if you want to start logging, select “No.” Be aware the template is still applied to the sonde and you are just declining to start logging that template.

Table 1. Active SECN water-quality monitoring site locations and names.

Park	Waterbody	Site Location	Site Name
CAHA	Pamlico Sound	Ocracoke boat ramp	CAHAocbr01
CALO	Core Sound	Shackleford Banks Dock	CALOshak01
CALO	Core Sound	Middle Marshes area of Rachel Carson Reserve	CALOmidm02
CANA	Mosquito Lagoon	Canaveral NS visitor center dock	CANAvctr01
CONG	Cedar Creek	Near Bannister Bridge	CONGbann01
CONG	Cedar Creek	Bridge B on Cedar Creek	CONGccbr01
CUIS	Cumberland Sound	Sea Camp dock	CUISseac03
FOMA	Matanzas River	FOMA visitor center dock	FOMAvctr01
FOPU	Lazaretto Creek	Fishing dock	FOPUlazz01
TIMU	Fort George River	Kingsley Plantation dock	TIMUking01

Final Check

At this point your field sonde is ready for deployment. Look over the sonde again for any obvious issues. Attach a clean black guard and insert the sensors into a clean calibration cup with a small amount of tap water. Screw down the cup tightly for transportation. Now gather up the requisite equipment based on the deployment/retrieval equipment list and proceed to the next section.

Sonde Retrieval and Deployment

Overview

The procedures outlined in this section are to be carried out in the field while conducting a site visit. Importantly, the procedures discussed below assume that there is a sonde (*in situ*) to be retrieved before a freshly calibrated sonde (field) is deployed.

Procedures are carried out sequentially and only deviated from during special circumstances. That being said, special cases often occur in the field. Professional judgement is used when this is the case, while adhering to the underlying objectives of this procedure. The main objectives of the sonde retrieval and deployment procedure are to: allow for sufficient time for the field sonde to properly equilibrate, preserve data that have been collected, get accurate side-by-side sonde readings for accurate correction factors, and deploy a freshly calibrated sonde. The procedures below lay out operations that result in the completion of these objectives. Cables and Bluetooth can be used interchangeably where necessary.

General Considerations

All sondes are deployed so the probes stay submerged at low tide and are at a fixed distance off the bottom to allow for tidal and flow amplitude measurements. The method preferred by the Southeast

Coast Network uses a perforated 4-inch (10.16 cm) PVC tube with a machined brass antifouling end designed to house the sonde while attached to a dock piling. This ensures the probes are 0.25 to 1.0 meter (0.8 to 3.3 ft) off the bottom. Sonde deployment and retrieval up and down the PVC tube is accomplished via a secure tagline. The tube must be periodically inspected for fouling and the inside cleaned often. Frequent checks for wear on the tagline are also required. The length of time the instrument is deployed is dependent on the rate of fouling at the site—usually up to four weeks although longer deployments are possible. Refer to SOP 1.2.08 *Fixed-Station Installation of Water-Quality Data Sonde Housings*—Version 3.0 (Starkey and McCay 2022) for more detailed sonde pipe installation and maintenance instructions.

Procedures

1. Open your field computer, open KorEXO, and turn on the EXO handheld.
2. Remove the calibration cup and black guard from the field sonde. Attach the copper guard to the field sonde (Figure 9). Attach a data cable and hook it up to your field computer using the USB adapter.



Figure 9. Sonde with copper guard, dummy connectors attached, and tagline secured; ready to be deployed.

3. Place the field sonde into the water up to the bottom of the blue sonde body casing. Secure in this location using the cable (Figure 10). The field sonde will be equilibrating while we move on to other tasks.



Figure 10. Field sonde and *in situ* sondes deployed side by side for the collection of “On Site Readings.”

4. Use the SECN key to unlock the sonde pipe cap. Remove the bolt and lock. Set aside in a safe location. Pull up the cap to remove.
5. Before pulling up the tagline, check the time to ensure that removal of the sonde does not overlap with the current logging interval. Now pull the tagline up to remove the *in situ* sonde from the sonde pipe. Record the retrieval time on the *in situ* sonde datasheet in the Retrieval section marked “Retrieval Date” & “Retrieval Time.”
6. Quickly note any debris or fouling on the *in situ* sonde guard and sensors in the Retrieval section of the datasheet marked “Fouling Presence.”
7. Wave the EXO Bluetooth tool across the horseshoe magnet sign on the sonde, to turn on the *in situ* sonde Bluetooth transmitter. Connect to the *in situ* sonde through KorEXO. Immediately, go to the “Deployment” tab and select “Stop Deployment.” Now go to the “Instrument and Sensors” tab, select “Sonde,” select “Import” next to the data file. If retrieval is completed with the EXO handheld, instructions for stopping the sonde can be found in Appendix F.
8. While the file is downloading, check the shackle and tagline; replace if necessary. Now lower the *in situ* sonde, still attached to the tagline, into the water up to the bottom of the blue casing. Do this as close as possible to the field sonde (Figure 10). Tie off the *in situ* sonde in this position using the tagline.

9. While the in situ sonde is equilibrating, take the “barnacle buster” and clean the sonde pipe (Figure 11). “Barnacle buster” is a calibration cup filled with cement, it can be lowered and retrieved with a rope. Raise and lower the buster aggressively until you feel a thud from the buster contacting the lower bolt. Some sites require little or no cleaning, while others will take many minutes of “busting” before it is clear.



Figure 11. Sonde tube fouling removal device aka “barnacle buster.”

10. At this point, you have let both sondes equilibrate, preserved a copy of the prior deployments data file, and cleaned the sonde pipe. Now you are ready to record the field readings.
11. Still connected to the in situ sonde, record the readings from the “Live Data” tab into the in situ sonde datasheet marked “Retrieval” - “On Site Readings” – “In situ.” Also, record the handheld barometric pressure in this section. Record data to the same precision used for the calibration.
12. In the KorEXO program, disconnect from the in situ sonde and connect to the field sonde. Record the readings from the “Live Data” tab into the in situ sonde datasheet marked “Retrieval” - “On Site Readings” – “Field Meter.” Also, record the handheld barometric pressure in this section.
13. Review the on-site readings and make sure site-specific conditions are not contributing to any discrepancies. For example, temperature readings are far apart because one sonde is in direct sunlight. Take care to record sonde readings in as similar conditions as possible and repeat Steps 10 and 11 in a different location if necessary.
14. **Still connected to the field sonde, select the “Deployment” tab then select “Start Deployment.” This will start logging based on the template you applied in the previous section. Select “Next Interval” unless you require a custom time. In that case enter the**

appropriate time to start logging. Select “Start.” If deployment is completed with the EXO handheld, instructions for starting the sonde can be found in Appendix F. Record the date and time you select in the “Deployment” – “Sonde Start Date” and “Sonde Start Time.”

15. Remove both sondes from the water. Remove the cable from the field sonde and reattach the dummy connectors (Figure 9). Swap the shackle and tagline over from the in situ sonde to the field sonde.
16. Using the tagline, lower the field sonde into the sonde pipe until it contacts the lower bolt. Reattach the sonde pipe cap, upper bolt, and lock. Spray the lock lightly with WD-40 to prevent corrosion. Record the actual deployment time in the field sonde datasheet marked “Deployment” – “Actual Deployment Date” and “Actual Deployment Time...”
17. Double check that all readings have been recorded and that the sonde pipe is secured properly. Now turn off the in situ sonde, remove the copper guard and, install the black guard and calibration cup.
18. Record any noteworthy observations or conditions in the “Deployment” – “Comments,” “Site Observations,” and “Observation Description” areas of the datasheet.
19. Collect all your equipment and return to the office after repeating this process at all sites.

Post-deployment

After returning from the field, the previous data file must be archived, the sonde cleaned, sensors checked for calibration drift, and the sonde prepared for storage. These processes are laid out in sequential order below.

Archive Log File

The first step in the post-deployment process is to properly format, name, and archive the data file. Once this is complete the original data file on the instrument can be deleted and you can proceed to sonde cleaning.

Procedures

1. Following sonde retrieval, you should already have a copy of the raw data file on your computer. If not, follow the procedure for downloading the file from the sonde in Step 7 of the previous section.
2. Open KorEXO on your computer and select the “Recorded Data” tab. Select the “Search” icon and then check the box next to “Recently Downloaded.” You should see your file appear with correct start date/time and site name. Now check the box next to the appropriate file and select “View Selected Recorded Data.”
3. You will be brought back to the main “Recorded Data” tab, but now you can see and scroll through the selected data file. Now select “Export to CSV.” Name the file using the site name (Table 1) and actual deployment date, example CANAvctr01_20210322. Save this file on the

SECN server in the “Sonde Data” folder corresponding to the site, year, and “Formatted” file type (e.g., S:\Monitoring\EstuarineWaterQuality\FixedStation\Data\Sonde Data\CANAvctr01\2021\Formatted).

4. After saving the file, KorEXO will automatically open the CSV file in Microsoft Excel. Quickly screen the data for false values at the beginning and end of the deployment. SpCond and Depth are useful for this because they will change rapidly when the sonde is removed or deployed. Also, consult the deployment and retrieval times to validate this screening. Delete the entire row if the data are deemed unusable. Save when finished.
5. Now that a formatted copy is saved, you will need to archive the raw file. Navigate to the KorEXO Archive folder on your computer, Documents – YSI – EXO Exports – Archive (e.g., C:\Users\dmccay\YSI\EXO Exports\Archive). You should see a long file name that has the site name and deployment date/time incorporated into it. Do not rename this file. Cut the file from this location and paste into the SECN server in the “Sonde Data” folder corresponding to the site, year, and “Raw” file type (e.g., S:\Monitoring\EstuarineWaterQuality\FixedStation\Data\Sonde Data\CANAvctr01\2020\Raw).
6. Once both the raw and formatted files are copied into the network folders then you can delete the copies located on the sonde, in KorEXO’s Recorded Data tab, and in your computers KorEXO Archive folder. It is best to keep these areas clear so as not to confuse files.

Sonde Cleaning

The sonde and sensors must be thoroughly cleaned so you can get accurate calibration drift checks in the next step. You will also clean the copper guard during this process, but it will not be used until the next deployment cycle. After initial vinegar and bleach soaks, most probes will come clean with the gentle use of soft brushes while rinsing thoroughly with water. Additional and more detailed cleaning instructions can be found in the YSI EXO Manual (YSI 2021).

Procedures

1. Prior to cleaning, remove the plastic, heat-shrink-wrap on the outer sonde body.
2. Use a 15-minute 50:50 bleach/water soak to kill any biologics. Immediately, follow with a thorough tap water rinse.
3. Then use a 50:50 distilled vinegar/water 15-minute soak to soften hard fouling and remove light corrosion on copper and other metal surfaces. Immediately rinse again in clean tap water.
4. After rinsing, use dish soap, soft paint brushes, toothbrushes, and similar tools to gently clean probes and sonde body. Use only soft bristle brushes or Kimwipes on the sensor faces and sensor body. You can be more aggressive on the metal and plastic surfaces (i.e., sensor bases, bulkhead and sonde body).

5. If needed, a small test tube brush can be used for cleaning the C/T probe. The depth sensor can be cleaned using a 10-milliliter (0.34 ounces) syringe to plunge water through the depth sensor hole and may be followed using a soft, clean pipe cleaner rod if needed.
6. Be gentle, but thorough in this process and repeat any of the above steps if necessary. All sonde and sensor surfaces must be free of dirt, debris, and biofilm before proceeding to the calibration drift check.

Post Deployment Calibration Drift Check

Post deployment calibration checks are performed to document sensor drift and/or malfunctions that may have occurred during deployment. Post calibration checks are performed as soon as possible after sonde retrieval for all collected parameters. These procedures are identical to the calibration procedures laid out in the Pre-deployment Calibration section, only you will NOT accept any calibrations. It is advised to use the “Live Data” tab to observe and record the sensor readings instead of the calibration window. All other aspects concerning standards, order of operations, and troubleshooting remain the same. Data for the post deployment readings are recorded on the Retrieval datasheet in the “Post Deployment” section.

Final Cleaning and Storage

The final step of the process is to perform cleaning and maintenance on the wetmate connectors and battery compartment seals, as well as preparing the pH sensor for storage. The connectors and seals are integral for maintaining the integrity of the sonde. If they degrade then the sonde could have water intrusion causing equipment failure and a loss of data.

Procedures

1. Remove all sensors and dummy connectors from the sonde body.
2. Gently clean all rubber surfaces on the sonde and sensors using 90% alcohol and a soft bristle brush. The sonde wetmate ports can be soaked in 90% alcohol and cleaned with a Q-tip.
3. After the surfaces are clean and dry, apply a thin layer of Krytox grease to all the rubber surfaces using a soft bristle paint brush. Any excess grease can be wiped off with a microfiber cloth.
4. Remove the battery compartment cap. Now remove the two rubber seals from the cap. Wipe off both the cap and the seals with a microfiber cloth. Inspect the seals for cracks or degradation, replace if necessary.
5. Apply a thin layer of Krytox grease onto the seals and replace onto the battery cap.
6. Wipe the opening of the battery compartment using a microfiber cloth and remove the batteries.
7. Reinstall the battery cap, all the sensors, and the dummy connectors.
8. Fill a plastic sensor cap with pH 4 storage solution and place it over the pH sensor face.

9. Fill a clean calibration cup with a small amount of tap water, install a clean black guard, and secure the sonde inside the calibration cup. The probes must NOT be immersed in the water, nor should deionized water be used in place of tap water.

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Appendix A. Equipment/Materials List

Sonde Preparation and Calibration/Post-deployment Checks (Workflow Step 1)

- Shrink wrap
 - YSI sensor specific shrink wraps
 - Sonde shrink wrap
- Scissors
- Copper tape
 - Regular sharpie marker
- Replacement Sonde Parts (if necessary)
 - pH module
 - DO cap
 - Sensors
 - Battery cap
 - Dummy connectors
- Sonde with sensors and black guard installed
- NIST thermometer
- Standard specific calibration cups
- Standards
 - EXO Handheld (barometric pressure)
 - Specific Conductivity: 1.0 mS/cm & 50.0 mS/cm
 - pH 4, pH 7, & pH 10
 - Turbidity: DI water & 124.0 FNU standard
 - Chl/BGA-PE 2.5% Rhodamine WT dye
 - three labeled 1000 milliliter (33.8 ounces) glass flasks
 - 5 milliliter (0.17 ounces) pipette
 - 1 milliliter (0.03 ounces) pipette
 - Magnetic stirrer and three stirring rods
- Kimwipes
- Deployment/Retrieval Datasheet
- Field Computer

Deployment/Retrieval Site Visit (Workflow Steps 2 and 3)

- Park Approval/Notification
- Transportation
- Calibrated, prepared sonde
- Copper guard
- SECN key
- Field computer
- Backup tablet computer
- EXO handheld
 - One long cable
 - One short cable
 - Adapter for sonde cable-to-USB
 - Two EXO Bluetooth tools
- Spare Parts and Maintenance Supplies
 - Stainless steel shackle
 - Polyester tagline
 - SECN lock
 - Zipties
 - WD-40
 - Barnacle Buster
 - Extra sonde parts
 - Two dummy connectors
 - One battery cap
 - Four D batteries
- Water sample collection equipment if applicable (see SOP 1.2.11 *Fixed-Station Water Sample Collection and Processing*—Version 2.0 [McCay and Starkey 2022])

Sonde Cleaning and Storage (Workflow Step 4)

- Bleach
- Vinegar
- Dish soap
- Various brushes (toothbrush, large brush, wire brush, etc)
- Krytox grease
- Spare seals for the battery cap & sensor bases
- Sensor caps
- Microfiber rags
- Kimwipes

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McCay, D. and E. N. Starkey. 2022. Fixed-station water sample collection and processing—Version 2.0. Southeast Coast Network Standard Operating Procedure NPS/SECN/SOP—1.2.11. Southeast Coast Network, Athens, Georgia. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2284575> (last accessed June 2022).

Appendix B. Datasonde Deployment and Retrieval Datasheets

SECN Coastal Water Quality Monitoring Datasonde Datasheet v1.44 (01/2022)—DEPLOYMENT						Station Name	
Calibration / Pre-Deployment							
Instrument (Sonde) # (SN)							
Calibration Date		Calibrated By					
Battery Voltage Pre-Calibration		Battery Voltage >5.3		Y / N		Battery Voltage Post-Calibration	
Central Wiper Replaced		Y / N		Central Wiper Parking 180°		Y / N	
Barometric Pressure (mmHg)		Conductivity Cell Constant		ODO Gain			
pH7 (mv)		pH10 (mv)		pH4 (mv)(optional)		pH Slope	
Parameter	Temp (°C)	Sp. Cond. (mS/cm)	Depth (m)	ODO (% Sat.)	ODO (mg/l)	pH7	pH10
Standard							
Measured							
Calibrated							
Parameter	pH4 (optional)	Turbidity Low (FNU)	Turbidity High (FNU)	Chl Low (µg/l)	Chl High (µg/l)	BGA-PE Low (µg/l)	BGA-PE High (µg/l)
Standard							
Measured							
Calibrated							
Deployment							
Deployed By:		File Name: _____ (Station name _YYYYMMDD)					
Sonde Start Date:		Sonde Start Time:		Eastern Standard Time (EST)			
Actual Deployment Date:		Actual Time Placed in Water:		(EST)			
Comments:							
Site Observations: Fish Kill ☐ Algal Bloom ☐ Debris ☐ Hurricane / Tropical Storm ☐ Other ☐							
Observation Description:							
Computer Entry By / Date:				Accepted By / Date:			

Figure B-1. Example of Datasonde Datasheet v1.44 for deployment.

SECN Coastal Water Quality Monitoring YSI Datasonde Datasheet v1.44 (01/2022)—RETRIEVAL											Station Name
Retrieval											
In situ Sonde # (SN)				Retrieved By							
Retrieval Date				Retrieval Time	(EST)						
Field Meter # (SN)				Field Meter Calibration Date							
On Site Readings											
	Temp (°C)	Baro. Pres. (mmHg)	ODO (% Sat.)	ODO (mg/l)	Sp. Cond. (mS/cm)	Salinity (psu)	pH	Turb. (FNU)	Depth (m)	Chla (µg/l)	BGA-PE (µg/l)
Field Meter											
In situ Sonde											
Fouling presence: Please record <u>type</u> of fouling AND <u>amount</u> (e.g. A, B, E, / H). Types A= Algae, B= Barnacles, C= Crabs, E= Eggs, F= Fish, O= Other, N= none, S = Sediment / Amount H=Heavy, M= Moderate, L= Light, N= None											
Sonde/Guard: _____ Temp/Cond: _____ ODO Probe: _____ pH Probe: _____ Turbidity: _____											
Post Deployment											
Post Deployment Reading Date				Battery Voltage				Central Wiper Parking 180°		Y / N	
Barometric Pressure (mmHg)				Conductivity Cell Constant							
pH7 (mv)				pH10 (mv)				pH4 (mv) (optional)			
pH Slope											
Parameter	Temp (°C)	Sp. Cond. (mS/cm)	Depth (m)	ODO (% Sat.)	ODO (mg/l)	pH7	pH10				
Standard											
Measured (clean sensors)											
Parameter	pH4 (optional)	Turbidity Low (FNU)	Turbidity High (FNU)	Chl Low (µg/l)	Chl High (µg/l)	BGA-PE Low (µg/l)	BGA-PE High (µg/l)				
Standard											
Measured (clean sensors)											
Any Probe Malfunctions? Y / N											
Checked By _____ If Y, describe in the comments.											
Comments:											
Computer Entry By / Date _____ Accepted By / Date _____											

Figure B-2. Example of Datasonde Datasheet v1.44 for retrieval.

Appendix C. KorEXO Initial Setup Instructions

This appendix is added to help properly set up the KorEXO software after the initial installation on a field computer.

Procedures

1. Have your computer administrator apply “Full Permissions” to the hidden C drive – ProgramData – YSI folder, allowing you the ability to both read AND write files. If this folder is locked, then it will restrict KorEXO from functioning normally.
2. Open KorEXO on your field computer. Select the “File” tab and select “Settings.”
3. The initial screen will be “General Settings,” which will control basic functions when the sonde is initially connected to the computer.
 - a. Turn “On” – “Automatically Update Software and Firmware”
 - b. Turn “Off” – “Automatically Download Data from Instrument to PC”
 - c. “Automatically Connect to Instrument” is optional based on your preferences.
 - d. !Important! It is advised to turn “On” – “Automatically Update Instrument Time to PC Time”, but this REQUIRES the field computer time to always be set to EST without daylight savings time adjustments. If this option is turned on and the computer time set to constant EST then this will assure that the instrument time will always be correct.
 - i. If you choose to turn this setting off then you will have to set the instrument time manually either using the handheld directions in Appendix D – Step 1 – C or through the KorEXO – “Instrument and Sensors” tab – “Sonde Settings” – “Sonde Time” – “Apply Sensor Settings.”
 - e. Now check the “File Export” section.
 - i. Make sure “CSV Delimiting Character” is set to “Use ’,’ as delimiter”
 - ii. Make sure “CSV Export Type” is set to “With Header”
4. Now navigate through EVERY other “Settings” tab and make sure only the ones listed below are turned “On” or “Enabled.”
 - a. Algae, Phycoerythrin, ug/L
 - b. Barometer, mmHg
 - c. Conductivity
 - i. Specific Conductivity, mS/cm

- ii. Salinity, psu
 - d. Chlorophyll, Chlorophyll, ug/L
 - e. Depth, Depth, m
 - f. DO
 - i. % Sat
 - ii. DO mg/L
 - g. pH
 - i. pH
 - ii. pH mV
 - h. Sonde, Battery Voltage
 - i. Temperature, degrees C
 - j. Turbidity, Turbidity FNU
 - k. Wiper, Wiper Position
- 5. Now the program is setup to display the proper data and units as well as basic sonde functions. Check these settings after software updates.

Appendix D. Reference Tables for Calibration

Table D-1. Solubility of oxygen in freshwater at various temperatures and pressures (Rounds et al. 2013). Solubility shown in milligrams per liter. Values based on published equations by Benson and Krause (1980). ^a Atmospheric pressure, in millimeters of mercury (mmHg).

Temp. (°C)	700 ^a	705 ^a	710 ^a	715 ^a	720 ^a	725 ^a	730 ^a	735 ^a	740 ^a	745 ^a	750 ^a	755 ^a	760 ^a	765 ^a	770 ^a	775 ^a	780 ^a	785 ^a	790 ^a	795 ^a
14.5	9.38	9.44	9.51	9.58	9.65	9.72	9.78	9.85	9.92	9.99	10.06	10.13	10.19	10.26	10.33	10.40	10.47	10.53	10.60	10.67
15.0	9.27	9.34	9.41	9.48	9.54	9.61	9.68	9.75	9.81	9.88	9.95	10.02	10.08	10.15	10.22	10.29	10.35	10.42	10.49	10.56
15.5	9.18	9.24	9.31	9.38	9.44	9.51	9.58	9.64	9.71	9.78	9.84	9.91	9.98	10.04	10.11	10.18	10.24	10.31	10.38	10.44
16.0	9.08	9.14	9.21	9.28	9.34	9.41	9.47	9.54	9.61	9.67	9.74	9.80	9.87	9.94	10.00	10.07	10.13	10.20	10.27	10.33
16.5	8.98	9.05	9.11	9.18	9.24	9.31	9.37	9.44	9.50	9.57	9.64	9.70	9.77	9.83	9.90	9.96	10.03	10.09	10.16	10.22
17.0	8.89	8.95	9.02	9.08	9.15	9.21	9.28	9.34	9.41	9.47	9.54	9.60	9.66	9.73	9.79	9.86	9.92	9.99	10.05	10.12
17.5	8.80	8.86	8.92	8.99	9.05	9.12	9.18	9.24	9.31	9.37	9.44	9.50	9.57	9.63	9.69	9.76	9.82	9.89	9.95	10.01
18.0	8.70	8.77	8.83	8.90	8.96	9.02	9.09	9.15	9.21	9.28	9.34	9.40	9.47	9.53	9.59	9.66	9.72	9.78	9.85	9.91
18.5	8.62	8.68	8.74	8.80	8.87	8.93	8.99	9.06	9.12	9.18	9.24	9.31	9.37	9.43	9.50	9.56	9.62	9.69	9.75	9.81
19.0	8.53	8.59	8.65	8.72	8.78	8.84	8.90	8.96	9.03	9.09	9.15	9.21	9.28	9.34	9.40	9.46	9.53	9.59	9.65	9.71
19.5	8.44	8.50	8.57	8.63	8.69	8.75	8.81	8.87	8.94	9.00	9.06	9.12	9.18	9.25	9.31	9.37	9.43	9.49	9.55	9.62
20.0	8.36	8.42	8.48	8.54	8.60	8.66	8.73	8.79	8.85	8.91	8.97	9.03	9.09	9.15	9.21	9.28	9.34	9.40	9.46	9.52
20.5	8.28	8.34	8.40	8.46	8.52	8.58	8.64	8.70	8.76	8.82	8.88	8.94	9.00	9.06	9.12	9.18	9.25	9.31	9.37	9.43
21.0	8.19	8.25	8.31	8.37	8.43	8.49	8.55	8.61	8.67	8.73	8.79	8.85	8.92	8.98	9.04	9.10	9.16	9.22	9.28	9.34
21.5	8.11	8.17	8.23	8.29	8.35	8.41	8.47	8.53	8.59	8.65	8.71	8.77	8.83	8.89	8.95	9.01	9.07	9.13	9.19	9.25
22.0	8.04	8.09	8.15	8.21	8.27	8.33	8.39	8.45	8.51	8.57	8.63	8.68	8.74	8.80	8.86	8.92	8.98	9.04	9.10	9.16
22.5	7.96	8.02	8.08	8.13	8.19	8.25	8.31	8.37	8.43	8.48	8.54	8.60	8.66	8.72	8.78	8.84	8.89	8.95	9.01	9.07

Temp. (°C)	700 ^a	705 ^a	710 ^a	715 ^a	720 ^a	725 ^a	730 ^a	735 ^a	740 ^a	745 ^a	750 ^a	755 ^a	760 ^a	765 ^a	770 ^a	775 ^a	780 ^a	785 ^a	790 ^a	795 ^a
23.0	7.88	7.94	8.00	8.06	8.11	8.17	8.23	8.29	8.35	8.40	8.46	8.52	8.58	8.64	8.69	8.75	8.81	8.87	8.93	8.98
23.5	7.81	7.86	7.92	7.98	8.04	8.09	8.15	8.21	8.27	8.33	8.38	8.44	8.50	8.56	8.61	8.67	8.73	8.79	8.84	8.90
24.0	7.73	7.79	7.85	7.90	7.96	8.02	8.08	8.13	8.19	8.25	8.30	8.36	8.42	8.48	8.53	8.59	8.65	8.70	8.76	8.82
24.5	7.66	7.72	7.77	7.83	7.89	7.94	8.00	8.06	8.11	8.17	8.23	8.28	8.34	8.40	8.45	8.51	8.57	8.62	8.68	8.74
25.0	7.59	7.65	7.70	7.76	7.81	7.87	7.93	7.98	8.04	8.10	8.15	8.21	8.26	8.32	8.38	8.43	8.49	8.54	8.60	8.66
25.5	7.52	7.58	7.63	7.69	7.74	7.80	7.85	7.91	7.97	8.02	8.08	8.13	8.19	8.24	8.30	8.35	8.41	8.47	8.52	8.58
26.0	7.45	7.51	7.56	7.62	7.67	7.73	7.78	7.84	7.89	7.95	8.00	8.06	8.11	8.17	8.22	8.28	8.33	8.39	8.44	8.50
26.5	7.38	7.44	7.49	7.55	7.60	7.66	7.71	7.77	7.82	7.88	7.93	7.99	8.04	8.10	8.15	8.20	8.26	8.31	8.37	8.42
27.0	7.32	7.37	7.43	7.48	7.53	7.59	7.64	7.70	7.75	7.81	7.86	7.91	7.97	8.02	8.08	8.13	8.19	8.24	8.29	8.35
27.5	7.25	7.30	7.36	7.41	7.47	7.52	7.57	7.63	7.68	7.74	7.79	7.84	7.90	7.95	8.01	8.06	8.11	8.17	8.22	8.27
28.0	7.19	7.24	7.29	7.35	7.40	7.45	7.51	7.56	7.61	7.67	7.72	7.77	7.83	7.88	7.93	7.99	8.04	8.10	8.15	8.20
28.5	7.12	7.18	7.23	7.28	7.33	7.39	7.44	7.49	7.55	7.60	7.65	7.71	7.76	7.81	7.87	7.92	7.97	8.02	8.08	8.13

Table D-2. Depth Offset Table adapted from NOAA-NERRS (2021) [mmHg= atmospheric pressure, in millimeters of mercury]; [m=meters].

Pressure (mmHg)	Offset ^a (m)
730	-0.408
731	-0.394
732	-0.381
733	-0.367
734	-0.353
735	-0.34
736	-0.326
737	-0.313
738	-0.299
739	-0.285
740	-0.272
741	-0.258
742	-0.245
743	-0.231
744	-0.218
745	-0.204
746	-0.19
747	-0.177
748	-0.163
749	-0.15
750	-0.136
751	-0.122
752	-0.109
753	-0.095
754	-0.082
755	-0.068
756	-0.054

Pressure (mmHg)	Offset ^a (m)
757	-0.041
758	-0.027
759	-0.014
760	0.000
761	0.014
762	0.027
763	0.041
764	0.054
765	0.068
766	0.082
767	0.095
768	0.109
769	0.122
770	0.136
771	0.150
772	0.163
773	0.177
774	0.190
775	0.204
776	0.218
777	0.231
778	0.245
779	0.258

Table D-3. pH standard temperature compensation table (based on North Central Laboratories pH buffer solutions)

Temperature	pH 4 ^a	pH 7 ^b	pH 10 ^c
10	4.00 ^a	7.07 ^b	10.19 ^c
15	4.00 ^a	7.05 ^b	10.12 ^c
16	4.00 ^a	7.05 ^b	10.11 ^c
17	4.00 ^a	7.04 ^b	10.10 ^c
18	4.00 ^a	7.03 ^b	10.08 ^c
19	4.00 ^a	7.02 ^b	10.07 ^c
20	4.00 ^a	7.02 ^b	10.06 ^c
21	4.00 ^a	7.02 ^b	10.05 ^c
22	4.00 ^a	7.01 ^b	10.04 ^c
23	4.00 ^a	7.01 ^b	10.02 ^c
24	4.00 ^a	7.00 ^b	10.01 ^c
25	4.00 ^a	7.00 ^b	10.00 ^c
26	4.00 ^a	7.00 ^b	9.99 ^c
27	4.00 ^a	7.00 ^b	9.98 ^c
28	4.01 ^a	6.99 ^b	9.96 ^c
29	4.01 ^a	6.99 ^b	9.95 ^c
30	4.01 ^a	6.99 ^b	9.94 ^c
35	4.02 ^a	6.98 ^b	9.90 ^c
40	4.03 ^a	6.97 ^b	9.85 ^c

^a Red denotes that pH 4 is dyed red.

^b Yellow denotes that pH 7 is dyed yellow.

^c Blue denotes that pH 10 is dyed blue.

Literature Cited

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Appendix E. Total Algae Sensor Standard Instructions

4.22 Total Algae Calibration

For best performance assure that the sensor face is clean prior to calibration. We advise that new sensors should be calibrated before use, and calibration checks and the user's own tolerance of drift should be used to determine when recalibration is necessary.

Users will prepare their own calibration standards. Rhodamine WT is a secondary standard (the actual pigments would be primary standards). It is used because of its stability and affordability. The units that the sensor delivers are in either RFU (recommended) or $\mu\text{g/L}$ pigment equivalent units. We strongly recommend using RFU, but in either case Table A below must be used to derive the calibration values that the user will enter during the process outlined below. Use of this table requires a temperature measurement, and the best way to do this is to have an EXO conductivity/temperature sensor on the sonde bulkhead during calibration. In general fluorescence is inversely related with temperature, and this effect will be accounted for to optimize the accuracy of your calibration by using Table A.

Table A. Temperature-compensated standard solution values for TAL sensors.

Solution Temperature (°C)	Chlorophyll 0.625 mg/L Rhodamine		Phycocyanin 0.625 mg/L Rhodamine		Phycoerythrin 0.025 mg/L Rhodamine	
	Chl RFU	$\mu\text{g/L}$ chlorophyll	PC RFU	$\mu\text{g/L}$ phycocyanin	PE RFU	$\mu\text{g/L}$ phycoerythrin
30	14.0	56.5	11.4	11.4	37.3	104.0
28	14.6	58.7	13.1	13.1	39.1	109.0
26	15.2	61.3	14.1	14.1	41.0	115.0
24	15.8	63.5	15.0	15.0	43.0	120.0
22	16.4	66	16.0	16.0	45.0	126.0
20	17.0	68.4	17.1	17.1	47.0	132.0
18	17.6	70.8	17.5	17.5	49.2	138.0
16	18.3	73.5	19.1	19.1	51.4	144.0
14	18.9	76	20.1	20.1	53.6	150.0
12	19.5	78.6	21.2	21.2	55.9	157.0
10	20.2	81.2	22.2	22.2	58.2	163.0
8	20.8	83.8	22.6	22.6	60.6	170.0

Steps 1-3 below describe a standard two point calibration performed with Kor EXO 2.0 software. Calibration can also be performed using the EXO Handheld, the main differences simply being the references to windows. In some cases users may prefer to perform a re-zeroing of the sensor, sometimes referred to as a "one point calibration," and that is described later in this section.

Figure E-1. YSI, EXO manual, Section 4.22, Page 1. Total algae sensor calibration and standard preparation.

Step 1: Prepare Rhodamine WT Dye Solution

Purchase Rhodamine WT as a 2.5% solution to follow the procedure below. Note that there are many types of Rhodamine—make sure Rhodamine WT is selected. If a 2.5% solution cannot be obtained commercially, prepare it from a solid or liquid solution to a 2.5% final concentration, or adjust the dilutions below accordingly. Kingscote Chemicals (Miamisburg, OH, 1-800-394-0678) has historically had a 2.5% solution (item #106023) that works well with this procedure. It should be stored in the refrigerator when not in use.

1. For any TAL sensor calibration, prepare a 125 mg/L solution of Rhodamine WT. Transfer 5.0 mL of the 2.5% Rhodamine WT solution into a 1000 mL volumetric flask. Fill the flask to the volumetric mark with deionized or distilled water and mix well to produce a solution that is approximately 125 mg/L of Rhodamine WT. Transfer to a storage bottle and retain it for future use.

*This solution can be stored in the refrigerator (4°C). Its degradation will depend upon light exposure and repeated warming cycles, but solutions used 1-2 times a year can be stored for up to two years. Users should implement their own procedures to safeguard against degradation.

2. For calibration of any chlorophyll channel (on either the TAL-PC or the TAL-PE sensor) and the TAL-PC phycocyanin channel, prepare a 0.625 mg/L solution of Rhodamine WT. Transfer 5.0 mL of the 125 mg/L solution prepared in step one into a 1000 mL volumetric flask. Fill the flask to the volumetric mark with deionized or distilled water. Mix well to obtain a solution that is 0.625 mg/L of Rhodamine WT. Use this solution within 24 hours of preparation and discard it after use.

3. If using a TAL-PE sensor, additionally prepare a 0.025 mg/L solution of Rhodamine WT for calibration of the phycoerythrin channel. Transfer 0.2 mL of the 125 mg/L solution prepared in step one into a 1000 mL volumetric flask. Fill the flask to the volumetric mark with deionized or distilled water. Mix well to obtain a solution that is 0.025 mg/L of Rhodamine WT. Use this solution within 24 hours of preparation and discard it after use.

Step 2: Select the pigment and channel to be calibrated.

In the Kor software or on the handheld, select the channel you want to calibrate (chl, PC, or PE) and the units you intend to use (RFU or µg/L).

Note that each channel of the sensor must be calibrated independently. Calibration of the chlorophyll channel does not set the calibration for the PC channel or the PE channel. Likewise, even just for the chlorophyll channel, calibration of RFU does not automatically calibrate the µg/L units. Calibration must be performed for each channel of interest, each unit of interest, and each calibration point (zero and the second point). It is thus possible that Step 3 below will be performed up to 8 times total, if one wants reading for all units from all channels. This is cut in half if only RFU are used, which is YSI's recommendation.

Figure E-2. YSI, EXO manual, section 4.22, Page 2. Total algae sensor calibration and standard preparation.

Appendix F. EXO Handheld Deployment/Retrieval Instructions

Procedures

1. First, setup the handheld properly. Skip to Step 1 – C if the handheld is already configured.
 - a. Press the “Handheld” button and then select “Display”. Now select “Units”.
 - i. Temperature, degrees C
 - ii. ODO, DO % & DO mg/L
 - iii. Conductivity, Sp. Conductance, SPC ms/cm
 - iv. Conductivity, Salinity, SAL PSU
 - v. ISE, pH & pH mV
 - vi. Turbidity, Turbidity FNU
 - vii. TAL, Chlorophyll, Chloro ug/L
 - viii. TAL, TAL-PE, BGA-PE ug/L
 - ix. Wiper, Position V
 - x. Depth, Depth, m
 - xi. Barometer, mmHg
 - xii. Sonde, Battery V
 - b. Navigate through each option and make sure only the ones listed below are checked.
 - i. Temperature, degrees C
 - ii. ODO, DO % & DO mg/L
 - iii. Conductivity, Sp. Conductance, SPC ms/cm
 - iv. Conductivity, Salinity, SAL PSU
 - v. ISE, pH & pH mV
 - vi. Turbidity, Turbidity FNU
 - vii. TAL, Chlorophyll, Chloro ug/L
 - viii. TAL, TAL-PE, BGA-PE ug/L
 - ix. Wiper, Position V
 - x. Depth, Depth, m
 - xi. Barometer, mmHg
 - xii. Sonde, Battery V
 - c. Now use the “Esc” button to back out. Press the “Handheld” button again and then select “Date/Time”. Routinely check and change the handheld time for clock drift.
 - i. Date Format, MM/DD/YY
 - ii. Date, current date
 - iii. Time Format, 24-hour
 - iv. Time, current time in Eastern Standard Time.
2. The handheld is set properly and can be used to deploy or retrieve the sonde. To deploy, press the “Deploy” button and select “Deployment Setup”.

- a. The “Log Interval” should be set to either “00:30:00.00” for most sites or “00:15:00.00” for CALO sites.
 - b. Enter the “Site Name”.
 - c. Enter your “User ID”. Either your initials or your agency.
 - d. Enter the “File Prefix”, which will be the same as the site name.
 - e. Press the back arrow button to return to the “Deployment” screen.
3. Scroll down and select “Save Deployment Settings” if you made any changes during Step 2.
4. Now scroll up and select “Start Deployment”.
 - a. Select “Deploy [Now]” and then select “Next Interval”.
 - b. Now it should read out “Deploy [Next Interval]”.
 - c. Scroll down and select start “Start Deployment”.
5. Now scroll up and select “Start Deployment”.
 - a. Select “Deploy [Now]” and then select “Next Interval”.
 - b. Now it should read out “Deploy [Next Interval]”.
 - c. Scroll down and select start “Start Deployment”.
6. To retrieve the sonde, press the “Deploy” button and then select “Stop Deployment.”