New Mexico Environment Department
Surface Water Quality Bureau

Standard Operating Procedure

for

SONDE CALIBRATION AND MAINTENANCE

Approval Signatures

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1.0 PURPOSE AND SCOPE

The purpose of this document is to describe the procedure for calibrating and maintaining sondes.

2.0 RESPONSIBILITIES

All personnel who deploy sondes are responsible for implementing this procedure. Additionally, one individual within SWQB is designated as the "Sonde Manager." A second individual is designated as the "Alternate Sonde Manager" who fulfills the manager's responsibilities when the manager is unavailable. Whether the manager or alternate performs the required duties, electronic data files will be stored on SWQB PUBLIC and calibration sheets in binders stored in the lab in order to avoid confusion and/or misplacement of data. An individual within SWQB is also designated as "Long Term Deployment (LTD) Coordinator " to coordinate data collection, QA/QC procedures, validation, correction, and upload into SQUID. The LTD Coordinator is appointed annually or as needed, and if no appointment is made, LTD coordination is the responsibility of the survey Project Coordinators.

The Sonde Manager or Alternate is responsible for:

- ensuring that the sondes are properly maintained and stored
- maintaining the "Sonde Tracker" spreadsheet
- provide training for field personnel, as needed, so that they are capable of operating sondes, including calibration, post-deployment checking, and data recording

The LTD Coordinator (Project Coordinator if no LTD Coordinator is named) is responsible for:

- recommending stations or areas of concern that require LTD collection.

- downloading sonde data after long-term deployment (SOP 6.2).
- QA of sonde data (SOP 6.4), review and qualifying data. Correction for sensor drift.
- Upload LTD to SQUID (SOP 6.4).

Bureau personnel who deploy sondes are responsible for ensuring that the sondes are properly calibrated, checked, and maintained, and that the data are properly recorded.

3.0 BACKGROUND AND PRECAUTIONS

This procedure is based on the capabilities of the YSI and Hydrolab sondes and sensors and Onset HOBO DO loggers and conductivity loggers described in Section 5.0.

4.0 DEFINITIONS

A sonde is a water quality monitoring device that is placed in the water to gather water quality data. Sondes may have multiple probes. Each probe may have one or more sensors that measure water quality data. A DO logger records only dissolved oxygen and temperature. A conductivity logger only records specific conductance and temperature.

5.0 EQUIPMENT AND TOOLS

The primary field instruments employed by SWQB are sondes manufactured by YSI, Inc. and Hach Environmental, and HOBO DO loggers manufactured by Onset Computer Corporation.

YSI, Inc. **1700/1725 Brannum Lane** **Yellow Springs, OH 45387** **Phone: (937) 767-7241 or (800) 765-4974** **Fax: (937) 767-9320** **Email: info@ysi.com** **Internet: www.ysi.com**	**Hach Environmental** **P.O. Box 289** **Loveland, CO 80539-0389** **Phone: (800) 949-3766** **Fax: (970) 461-3921** **Email: sales@hachenvironmental.com** **Internet: www.hydrolab.com**	**Onset Computer Corporation** **470 MacArthur Blvd** **Bourne, MA 02532** **Phone: (800) 564-4377** **Fax: (508) 759-9500** **Email: sales @onsetcomp.com** **Internet: www.onsetcomp.com**

The specific YSI sonde model numbers are 6820, 6920, and 600XLM, and 650 MDS data loggers. All use Ecowatch software (current version 3.18) which is a proprietary product of YSI, Inc. Sonde models 6920 and 600XLM can be set to collect data automatically while deployed unattended in streams for extended periods. The specific Hydrolab sonde model number is MS5 which uses Hydras 3LT software to interface with PCs. This software is a proprietary product of Hach Company. The specific Onset devices are the HOBO DO Logger model U26-001 and HOBO Conductivity Logger model U24-001which both use the proprietary software HOBOware to communicate with a PC. Sondes and sensors are described in Table 1. Instruction manuals for the sondes and sensors are available in the lab. The following procedures are based largely on information in these manuals.

Table 1. Sonde and Sensor Characteristics

Sensor	Parameter	Units	Range	Accuracy
<u>YSI</u>				
6560	Temperature	°C	-5 to +50	± 0.15 °C
6560	Conductivity	µS/cm	0 – 100,000	± 0.5% of reading; ± 1 µS/cm
6562	Dissolved Oxygen	% saturation	0 – 500	± 2%
6150 (Optical)	Dissolved Oxygen	% saturation	0 – 500	± 1%
6562	Dissolved Oxygen	mg/L	0 – 50	0 to 20 mg/L: ± 0.1 mg/L or 1% of reading, whichever is greater; 20 to 50 mg/L: ±15% of reading
6150 (Optical)	Dissolved Oxygen	mg/L	0 – 50	0 to 20 mg/L: ± 0.2 mg/L or 2% of reading, whichever is greater; 20 to 50 mg/L: ±6% of reading
6561	pH	SU	0 – 14	± 0.2 SU
6026 or 6136	Turbidity	NTU	0 – 1000	± 2%
<u>Hydrolab</u>				
MS5				
Thermistor	Temperature	°C	-5 to +50	± 0.10 °C
004468	Conductivity	µS/cm	0 – 100,000	± 1% of reading; ± 1 µS/cm
007455	Dissolved Oxygen	% saturation	0 – 500	± 1%
007455	Dissolved Oxygen	mg/L	0 – 60	± 0.1 mg/L for 0–8 mg/L; ± 0.2 mg/L for greater than 8 mg/L
004446	pH	SU	0 – 14	± 0.2 SU
007140	Turbidity	NTU	0 – 3000	± 1% up to 100 NTU, ± 3% up to 100–400 NTU, ± 5% from 400–3000 NTU
<u>Onset</u>				
U26-001	Dissolved Oxygen	mg/L	0-20	0.2mg/L up to 8mg/L ; 0.5 mg/L from 8 to 20mg/L
Thermistor	Temperature	°C	-5 to 40	0.2°C
U24-001	Specific Conductance	µS/cm	0 to 10,000	3% of reading, or 5 µS/cm, whichever is greater

6.0 STEP-BY-STEP CALIBRATION PROCESS DESCRIPTION

6.1 General

Sonde calibration should be recorded on the **Sonde Calibration Form**, which is available as part of this SOP and on the SWQB Public folder. Calibration records must not be discarded. Completed worksheets should be filed in the lab binder. The sonde manager should annually remove the calibration sheets older than 5 years.

For instantaneous field measurements, calibrate all sensors (excluding temperature) preceeding each field trip according to manufacturer instructions. For unattended deployments, calibrate all sensors (excluding temperature) preceeding deployment. At the conclusion of the field trip or deployment, verify calibration by running the sonde or instrument in normal data collection mode and record results for standard values. If the instrument sensors are fouled or dirty, clean the equipment according to manufacturer instructions and recheck the sensor in the standard solution. Any difference in performance following cleaning is attributable to fouling drift. Calibration and calibration verification must bracket the data collection event both temporally and quantitatively. Instructions for thermistor calibration verification are included in section 6.6.4.

For multi-parameter sondes, calibration and calibration verification must be performed in the following order to prevent solution interference during readings:
1. Dissolved Oxygen
2. Specific Conductance
3. pH
4. Turbidity

Calibration standards for specific conductance, pH, and turbidity should be taken in the field during deployments or field trips in case verification of instrument performance or recalibration are necessary.

Prior to deployment or after extended storage periods, clean and calibrate the probes, particularly the DO probe. If probes require cleaning **see Section 7.5 Probe Maintenance for specific cleaning procedures.** For rapid pulse DO sensors, after changing the membrane, let the sonde run in “discrete” mode for at least 15 minutes, calibrate the DO and check the DO value after 3-5 minutes of “cool down” for drift. This is to check for any problems such as a hole in the membrane before deployment.

6.2 DO Calibration Procedure for Instantaneous Sampling

6.2.1 YSI - Rapid Pulse and Optical (ROX) Dissolved Oxygen Sensor

1. When using model 600XLM, 6820, or 6920 for instantaneous sampling, the auto sleep must be disabled. From the Main menu, select 8-Advanced and then 2-Setup. If the Auto Sleep functions are enabled, select 5-Auto Sleep RS232 and 6-Auto Sleep SDI12 and press Enter to disable.
2. Calibration of an optical DO sensor is similar to calibration of a rapid pulse sensor except that there is no DO charge to record. Verify that the wiper arm is parking correctly, that the wiper pad is not excessively discolored and that the sensor membrane disc is not damaged.

3. Place approximately 1/8 inch of water in the bottom of the YSI calibration (transport/storage) cup. Place the cup on the sonde body. Make certain that the DO and temperature probes are not immersed in the water. Wait at least 10 minutes for the air in the calibration cup to become water saturated and for the temperature to equilibrate. After 10 minutes, loosen the calibration cup such that only one thread of the calibration cup is engaged. This is to ensure that the DO probe is vented to the atmosphere (i.e., pressure inside the cup is equal to ambient atmospheric pressure).
4. From the Calibrate menu, select 2-DO, then 1-DO percent to access the DO percent calibration procedure.
5. Obtain the estimated barometric pressure for your current elevation from the elevation/pressure table in the appendix of the manufacturer's operations manual, or enter the current barometric pressure in mm of mercury (Hg) (inches of Hg × 25.4 = mm Hg) derived from a field barometer. NOTE: Remember to use barometric pressure readings that have not been corrected to sea level (i.e., absolute barometric pressure). Weather reports provide barometric pressure corrected to sea level.
6. Observe the temperature and DO readings and when there is no significant change for approximately 30 seconds, press Enter. The screen will indicate that the calibration has been accepted. Press Enter again to return to the Calibrate menu.
7. Record calibration information (barometric pressure, DO charge, initial and calibrated DO % saturation values, and DO gain (Sonde Menu → Advanced → Cal Constants)) on calibration worksheet. For the optical (ROX) DO sensor there is no DO charge to record.
8. DO Charge (does not apply to ROX optical DO sensor). DO charge must be within the range of 25 millivolts (mV) to 75 mV. Low charge likely indicates dilute electrolyte solution (perforated membrane). Replace electrolyte and membrane, then recalibrate DO (allow probe to run for a minimum of 15 minutes before calibrating. This is known as "burning-in"). There are two likely causes of high (>75 mV) charge: moisture in the probe socket and a short in the probe itself. Inspect socket for moisture; if socket is wet, rinse with DI water, then 95% ethanol, blow out with canned air and allow to air dry for 24 hours. If socket is dry, replace probe and return the old probe to the sonde manager or alternate for reconditioning or disposal.

6.4.2 HYDROLAB - (LDO) LUMINESCENT DISSOLVED OXYGEN SENSOR

1. The LDO sensor compensates for the temperature of the water. To perform an accurate calibration it is important that the temperature of the water remain constant during the procedure. The easiest way to do this is to allow the water used for calibration to sit for an adequate time in an open container until it equilibrates to ambient temperature. If the temperature changes by more than 0.5C during calibration, dissolved oxygen measurements may be inaccurate and the sensor will need to be recalibrated when the temperature of the water stabilizes. For this reason, the calibration should also not be done in direct sunlight.
2. Stand the sonde so the sensors are pointed upwards with the storage cup attached. Add about one liter of **room temperature** de-Ionized water (or clean tap water with a conductivity of less than 500 µS/cm) to a clean one

gallon container. A one liter bottle filled about halfway can also be used. Shake the jug or bottle very vigorously for 40 seconds to ensure DO saturation.

3. Establish a connection to the sonde using Hydras3 LT and click the button labeled '**Operate Sonde**'. Wait for Hydras to initialize the sensors. Progress can be monitored on the bar at the bottom of the screen.
4. Fill the storage cup with the DO saturated water over the sensors to the bottom of the threads and place the storage cap on upside-down. Do not screw the cap on.
5. When the sonde is ready to operate, click the '**Calibration**' tab in Hydras3 LT.
6. Select the '**LDO (%Sat)**' tab. A picture of the LDO sensor should appear on the screen.
7. Wait for the current value and temperature readings to stabilize. If the cap was stored wet this should happen very quickly. A dry cap may take several minutes to stabilize.
8. Enter the current absolute barometric pressure in mm Hg in the box. Click '**Calibrate**'. A "Calibration Successful" message will be displayed.

6.3 DO Calibration Procedure for Unattended Sampling (Logging)

6.3.1 YSI

1. When using the Model 600XLM or Model 6920 in the unattended mode, the "auto sleep" (Sonde Menu → Advanced → Setup → Enable Auto Sleep RS232) must be enabled, as must "wait for DO" (Sonde Menu → Advanced → Sensor) if equipped with a rapid pulse DO sensor. "Power Sonde" (650 Main Menu → System Setup → Power Sonde) must be disabled (unchecked).
2. Follow the calibration procedure described for YSI in Section 6.2.1.
3. DO warm-up time (minimum 40 seconds) should not be decreased; it may be increased to yield better results. Contact the sonde manager or alternate before adjusting the DO warm-up time.

6.3.2 Hydrolab

Follow the calibration procedure described for Hydrolab in Section 6.2.2.

6.3.3 Onset HOBO DO Logger – Optical (dynamic luminescence quenching)

The logger uses a replacable sensor cap that provides 6 months of continuous use. To install the sensor cap:

1. Unscrew the protective guard covering the DO sensor.
2. Remove the red dust cap that protects the sensor during shipping.
3. Take the green sensor cap out of the canister.
4. With the flat part of the DO sensor pointing down and the the green sensor cap oriented with the arrow up, slide the sensor cap over the sensor until it

snaps in place. The cap should be snug against the logger housing without any gaps.

5. Screw on the protective anti-fouling guard.

Calibration is conducted using the Lab Calibration tool in HOBOware following these steps:

1. Open HOBOware and establish computer connection with the logger using a HOBO base station or HOBO waterproof shuttle. The optical ports on the logger are located under the pointed cap.
2. Stop logging if the sensor is currently logging.
3. From the device menu, click Lab Calibration.
4. The current gain and offset adjustments are displayed in the top pane of the Lab Calibration window along with the date and time the last lab calibration was completed (if applicable). Completion of steps 1-3 in the Lab Calibration tool will result in new gain and offset adjustment values based on the current logger conditions.
5. Step 1: 100% Saturation
    a) In the Lab Calibration window enter the barometric pressure for your current location.
    b) Make sure the logger either has the protective guard or the anti-fouling guard installed so that the sensor is covered.
    c) Wet the small sponge with fresh water. Squeez out any excess water.
    d) Place the sponge in the end of the calibration boot.
    e) Insert the logger in the calibration boot so that ther is approximately a 1cm overlap between the end of the boot and the body of the logger. This will ensure there is enough space between the end of the logger and the sponge (the logger should not be pressed up tightly against the sponge).
    f) Wait approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
    g) Click the “Get DO value from the logger” button to display the 100% saturation results. The results are updated each time you click this button. Click several times to confirm consistent readings.
    h) When you are satisfied with the results displaying in the “Step 1: 100% Saturation” tab, click the Next button to proceed.
6. Step 2: 0% Saturation (**optional**).
    a) If DO levels above 4 mg/L are expected, click “Skip this Step” button. Otherwise continue with the following procedure
    b) Make sure the logger has either the protective guard or the anti-fouling guard installed.
    c) Pour sodium sulfite calibration solution into a 3 inch beaker so that it is about two-thirds full.
    d) Place the sensor end of the logger into the solution so that the entire protective guard or anti-fouling guard and at least 2.5 cm of the logger body are submerged in the beaker. Allow it to rest on the bottom of the beaker.
    e) Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).

f) Click the “Get DO value from the logger” button to display the 0% saturation results. As with the 100% calibration, you may click this button multiple times to confirm consistent measurements. When you are satisfied with the results in the “Step 2: 0% Saturation” tab, click the Next button to proceed to “Step 3: Finish”.

7. Step 3: Finish
   a) The results from the first two steps are displayed along with the overall calibration results and the new gain and offset adjustment values.
   b) Click “Send Calibration to Logger” button. The logger is now calibrated based on the new values.
   c) The Calibration will take effect when the logger is launched. Refer to SOP 6.2 for deployment instructions.

In addition to the lab calibration, the HOBO DO Logger should also be field calibrated. This is necessary in order to use the DO Assistant feature of the HOBOware software to adjust for drift over the deployment period. Field calibration is accomplished simply by recording DO at the deployment location (with a sonde that has been calibrated to the deployment elevation) at the time of deployment AND retrieval.

Alternately, the HOBO DO Logger can be lab calibrated in the field (assuming one has a laptop and other equipment and supplies necessary for lab calibration) at the deployment elevation, precluding the necessity of a deployment field calibration. This would NOT preclude the necessity of a retrieval field calibration.

6.4 CONDUCTIVITY, SPECIFIC CONDUCTANCE, SALINITY AND TOTAL DISSOLVED SOLIDS.

Conductivity standards are very sensitive to contamination. Inscribe the date the container is opened on the label and discard the solution one month after opening. Perform the conductivity calibration before the pH calibration. Ensure that the sensor and calibration cup are clean and double rinse the sensor and calibration cup with the calibration standard.

6.4.1 YSI

1. Place conductivity standard into a clean, dry, or pre-rinsed calibration cup.
2. Rinse the sensor twice with a small amount of standard that can be discarded. Be certain to avoid cross-contamination of standard solutions with other solutions.
3. Carefully immerse the probe end of the sonde into the solution. Gently tap the sonde and/or cup to remove any bubbles from the conductivity cell. The probe must be completely immersed past its vent hole.
4. Allow the temperature to equilibrate before proceeding.
5. From the Calibrate menu, select Conductivity to access the conductivity calibration procedure and then 1-SpCond to access the specific conductance calibration procedure. Enter the calibration value of the standard you are using (mS/cm at 25°C) and press Enter. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.

6. Observe the readings under Specific Conductance or Conductivity and when they show no significant change for approximately 30 seconds, press Enter. The screen will indicate whether the calibration has been accepted or is "Out of Range", and prompt you to press Enter again to return to the Calibrate menu. Never accept an "Out of Range" calibration.
7. Record calibration information (see "YSI Calibration Worksheet"). Calibration error limit for SC is ± 5 percent. Rinse probe in tap or DI water.
8. Record the conductivity cell constant ((Sonde Menu → Advanced → Cal Constants) (Range = 5.0 +/- 0.45)).
9. Rinse the probes in tap or purified water.

6.4.2 HYDROLAB

1. Establish a connection to the sonde with Hydras 3LT. Click the button labeled '**Operate Sonde'.** When the sonde finishes its initialization, click the '**Calibration**' tab, then click either the '**SpCond [mS/cm]**' or the '**SpCond [µS/cm]** tab. You will see a picture of the two conductivity probes available, the current conductivity reading, the date and time, and the current temperature.
2. The first calibration point is done with a dry sensor to establish a zero point. Rinse the sensors with de-ionized water and dry them thoroughly. Be sure the inside of the conductivity cell is dry. In the box on the Hydras screen, type a value of '0' and click '**Calibrate**'. A "Calibration successful" message will appear.
3. Fill the storage cup about 25% with a conductivity standard higher than the highest expected value of the water at your deployment site. Screw the cap on and shake vigorously for six seconds. Discard the standard.
4. Fill the cup with the calibration standard again, this time so the conductivity cell is completely submerged. Wait one minute for the readings to stabilize. When the readings are stable, type the labeled value of the standard into the box and click the '**Calibrate**' button. A "Calibration successful" message will appear. The sensor is now calibrated.

Optionally, a second standard midway between '0' and the calibration value can be used to check the linearity of the sensor. Repeat the process used for the high standard with the second standard, but <u>do not</u> click the calibrate button again. The reading for the second standard should be +/- 1% of the labeled value.

6.4.3 ONSET HOBO CONDUCTIVITY LOGGER

It is important to take temperature and conductivity calibration readings with a separate calibrated conductivity meter at both the beginning (launchtime) and end of a deployment (readout) because these readings are necessary for data calibration and to compensate for any measurement drift during deployment. The conductivity calibration readings should be the actual conductivity without temperature compensation (not in specific conductance at 25°C).

Calibration is conducted using the Conductivity Assistant tool in HOBOware following these steps:

1. Take readings directly in ambient water or standard solution at deployment and retrieval and record the results on the Sonde Deployment/Retrieval Field Sheet.
    a) Gently tap the logger to remove any bubbles from the surface.
    b) Allow enough time for the logger temperature to stabilize for the best accuracy (approximately 15 minutes).
    c) Measure the temperature and actual conductivity with a calibrated meter.
2. Upon retrieval or download, open HOBOware and establish a computer connection with the logger using a HOBO base station.
3. Offload the most recent data files from the shuttle or loggers to your computer.
4. Open a data file in HOBOware.
5. Use the HOBOware Conductivity Assistant to calibrate the readings and adjust for drift. Enter the field meter conductivity and temperature readings and times from the beginning and the end of that segment of the logger's deployment. Refer to the Help for the Conductivity Assistant for more details. Save your changes to the project file.

6.5 pH Sensor

Calibrate the pH sensor with buffers of pH 7.0, and either pH 4.0 for acidic waters or pH 10.0 for alkaline waters. If the expected pH of the water being sampled is unknown, then a 3-Point calibration should be performed following the pH 7, 4, then 10 pattern. The pH buffers contain high concentrations of phosphate. Take care during calibration to avoid leaving traces of buffer on equipment or at the work place that could contaminate water samples. Inscribe the date the container is opened on the label. Label buffer solutions prepared from reagent powder or concentrate with date of preparation. Discard all buffer solutions after one month of being opened.

Two-Point or Three-Point Calibration:

6.5.1 YSI

pH 7: Calibration to pH 7 is always performed first

1. Place enough pH 7 buffer into a clean, dry or pre-rinsed calibration cup to immerse the tip of the pH probe and thermistor (i.e., the temperature sensor on the conductivity probe). Allow the temperature to equilibrate before reading.
2. From the Calibrate Menu, select 4-ISE 1 pH to access the pH calibration choices; then press 2-2 Point (or 3-3 Point). Press Enter and input the value of the buffer at the prompt. Press Enter and the current values of all enabled sensors will appear on the screen.
3. Observe the pH reading and when it shows no significant change for approximately 30 seconds, record initial pH value on calibration worksheet, then press Enter. The display will indicate that the calibration is accepted. Record post calibration pH and mV values. mV value should range from -50 to +50.

4. After the pH 7 calibration is complete, press Enter again to continue. Rinse the probes in water then next buffer to be used before proceeding.

pH 4 and/or 10

1. Next, place enough of the pH 4 or 10 buffer into a clean, dry or pre-rinsed calibration cup to immerse the tip of the pH probe and thermistor. Press Enter and input the value of the second buffer at the prompt. Press Enter and the current values of all enabled sensors will appear on the screen.
2. Allow the temperature to equilibrate before reading. Observe the pH reading and when it shows no significant change for approximately 30 seconds, record initial value on calibration worksheet, then press Enter.
3. The display will indicate that the calibration is accepted. Record post calibration pH and mV values. The mV value should range from +180 +/- 50 mV for pH 4 buffer or -180 +/- 50 mV pH 10 buffer and the difference between the pH 7 buffer and the pH 4 or 10 buffer should be between 165 and 180 mV. If probes do not match these specifications they should be reconditioned and then recalibrated. Press Enter again to continue.
4. If a three point calibration is being performed, pH 4 buffer should follow pH 7 buffer, preceding pH 10 buffer. If performing a 2-Point Calibration the screen will return to the Calibrate Menu.
5. Confirm that all calibration information is recorded (see “YSI Sonde Calibration Worksheet”). Rinse the probes with tap water. Rinse the calibration cup for future use.

NOTE: If the range of expected pH values is < 7.0, use pH 4 buffer in steps E through I for the 2-point calibration instead of pH 10 buffer.

6.5.2 HYDROLAB

VERY CAREFULLY clean the glass bulb with a very soft brush and a mild soap. The bulb is made from extremely thin glass and is very fragile. Replace the reference junction if it is visibly fouled, following the instructions provided with the new junction. Water with strong biological activity tends to foul the junction more rapidly. Replace the electrolyte solution regularly. After the reference junction or electrolyte solution was changed, fill the calibration cup with tap water and allow the pH probe to soak for at least 20 minutes before recalibrating. Water with very low levels of dissolved solids or high flow rates will leach the salts out of the solution and dilute it more quickly. Your specific water conditions will determine how frequently this should be done. Use of the salt tablets from the maintenance kit will keep the electrolyte solution saturated for longer periods of time.

1. Clean the glass bulb with a very soft brush and a mild soap.
2. Establish a connection to the sonde with Hydras 3LT. Click the button labeled ’**Operate Sonde’.** When the sonde finishes its initialization, click the ‘**Calibration**’ tab, then click the ‘**pH Units**’ tab. You will see pictures of the four different pH probes available as well as the current pH value, the date and time, and the current temperature.
3. Rinse with tap water. Either dry the sensors and rinse once with pH 7 buffer or rinse twice with pH 7 buffer. To rinse, fill the cup about 25% with pH buffer 7 and screw the storage cap on. Shake for six seconds. Remove the storage

cap and pour the pH 7 buffer out. Fill the cup with pH 7 buffer again, this time over the top of the pH sensor. Wait one minute for the readings to stabilize. When the readings are stable, type a value of 7.00 into the box, and click '**Calibrate**'. A "Calibration Successful" message will appear.

4. If the pH readings continue to drift for an extended period of time, or jump up and down, the sensor may need to be cleaned or replaced.
5. Pour the pH 7 buffer out and rinse with tap water. Either dry the sensors and rinse once with pH 4 or 10 buffer or rinse twice with pH 4 or 10 buffer. To rinse, fill the cup about 25% with pH 4 buffer or pH 10 buffer solution depending on your expected deployment conditions. Screw on the storage cap and shake for six seconds. Remove the storage cap and pour the buffer solution out. Fill the cup with the same type of buffer solution again, this time over the top of the pH sensor. Wait one minute for the readings to stabilize. When the reading stabilizes, type the labeled value of the buffer into the box, and click '**Calibrate**'. A "Calibration Successful" message will appear.
6. If the pH readings continue to drift for an extended period of time, or jump up and down, the sensor may need to be cleaned or replaced. The pH sensor is now calibrated.

If desired, a linearity test may be performed with a buffer opposite that used for pH slope calibration. For example, if pH 10 buffer was used to calibrate, check with pH 4, buffer or if pH 4 buffer was used to calibrate, check with pH 10 buffer. Repeat the process used for the previous calibration with the opposing buffer solution, but do not click the calibrate button again.

6.6 Temperature Sensor

YSI and Hydrolab

Thermistors cannot be calibrated. Calibration verification shall be performed once at the beginning of field season (prior to deployment or sampling) and once at the conclusion of field season, or when a malfunction is suspected. Check the temperature reading against a NIST traceable and calibrated thermometer to ensure suitable instrument performance, ±0.5 °C (see Table 2). Verifications must be performed at values of approximately 4° and 35° Celcius in order to adequately bracket the range of environmental temperatures encountered during monitoring.

6.7 Turbidity Sensor

Inscribe the date the turbidity standard container is opened on the label. Discard the solution one month after opening. Prior to using any turbidity standard gently swirl the standard to re-suspend the formazin. Failure to do so will bias your calibration (high), and all those that follow (low).

Two-Point or Three-Point Calibration:

6.7.1 YSI

1. Observe and record wiper park position on calibration worksheet.
2. Perform a 2 point test (DI water for 0 NTU and 126 NTU standard).
3. Double rinse the YSI sonde calibration cup or sensor guard and probes with DI water.

Point 1:

1. For **6600, 6920**: Fill cup with DI water to fully immerse the face of the turbidity probe. For **6920V2, 600OMS**: Fill 500mL beaker or other clear container with DI water and fully immerse sensor while in probe guard.
2. Enter 0 NTU at the prompt; and press Enter
3. Select “clean optics” option from the menu (upper right of screen) prior to calibrating.
4. Record initial and calibrated values (NTUs), press Enter to accept the calibration. Discard the DI water.

Point 2:

1. Gently swirl/mix standard (do not create air bubbles), rinse storage cup and probe twice with a small amount of standard;
2. Gently pour standard down side of cup (to reduce bubble formation), fill with enough standard to fully immerse the face of the turbidity probe, loosely screw the calibration cup onto the sonde and press Enter:
3. Enter 126 NTU at the prompt;
4. Select “clean optics” option from the menu (upper right of screen) prior to calibrating. Press Enter to accept the calibration and record initial and calibrated values (NTUs).
5. Retain the used standard as a rinsing solution for the next calibration.
6. Rinse the sonde probes gently with deionized water to remove residual 126 NTU standard from the probes and wiper pads.

Point 3:

1. Gently swirl/mix standard (do not create air bubbles), rinse storage cup and probe twice with a small amount of standard;
2. Gently pour standard down side of cup (to reduce bubble formation), fill with enough standard to fully immerse the face of the turbidity probe, loosely screw the calibration cup onto the sonde and press Enter:
3. Enter 1000 NTU at the prompt;
4. Select “clean optics” option from the menu (upper right of screen) prior to calibrating. Press Enter to accept the calibration and record initial and calibrated values (NTUs).
5. Retain the used standard as a rinsing solution for the next calibration.
6. Rinse the sonde probes gently with deionized water to remove residual 1000 NTU standard from the probes and wiper pads.

6.7.2 HYDROLAB

Only Hach StablCal turbidity standard (or standard from a Hach approved supplier) can be used for this calibration.

1. Establish a connection to Hydras3 LT and click the ‘**Operate Sonde**’ button. Wait for the sensors to initialize. To minimize ambient light interference during calibration, the calibration cup can be darkened by wrapping it in thick paper or cloth.
2. Zero Point Calibration – Fill the cup about 25% with de-ionized water or <0.1 NTU StablCal and screw the storage cap on. Shake for six seconds. Remove the storage cap and pour the de-ionized water out.

3. With the sensors pointed upwards, fill the storage cup approximately 75% with de-ionized water or <0.1 NTU StablCal and screw the storage cap on tightly. Slowly turn the sonde over so the sensors point downwards.
4. Click on the '**Turbidity [NTU]**' tab. In the box labeled '**Turbidity** [**NTU]**' enter a value of **0.3**.
5. Wait one minute for the readings to stabilize. Click '**Calibrate**'. Click the '**OK**' button in the "Calibration Successful" window.
6. High-End Calibration – The high-end calibration point should be a value higher than 23 NTU, or the current highest turbidity threshold in the SWQB Assessment Protocol. The standard factory high point is 100 NTU.
7. Pour the De-ionized water out of the storage cup and either dry the sensors or repeat rinse step #I twice.
8. Gently swirl and/or invert the bottle of 100NTU StablCal for two to three minutes to mix the suspension. DO NOT shake the bottle of StablCal! This will suspend air bubbles in the solution and change the turbidity of the standard.
9. Pour the StablCal into the storage cup until it is about 25% filled. Screw the cap on tightly and shake the sonde. Remove the cap and pour the solution out.
10. Gently pour StablCal into the storage cup again, this time filling the cup to 75%. Screw the cap on and gently turn the sonde over so the sensors are pointing downward.
11. In the box labeled '**Turbidity** [**NTU]**' enter a value of '100'.
12. Wait one minute for the readings to stabilize. Click '**Calibrate**'. Click the '**OK**' button in the "Calibration Successful" window. The Turbidity sensor is now calibrated.

6.7.3 CALIBRATION RANGE

In-calibration range limits are shown in SOP6.3 (Sonde Quality Assurance). If sensors cannot be calibrated within these limits, the instrument should be returned to the sonde manager or alternate for maintenance. Post-deployment calibration verification checks that are not within the in-calibration range will be addressed by the Project Coordinator. A portion of the table from SOP6.3 is included below:

Table 2. Calibration Ranges

Measurement	Standard	Standard Value	In-Calibration Range
Temperature, °C	NIST Traceable Thermometer	Ambient Temperature	± 0.5
Conductivity µS/cm	Standard Solution	0, 1413, 8974	± 5% ±1
Dissolved Oxygen, %	Saturated Air	100	RP ±2% Optical ±1%
pH, SU	Buffer Solution	4,7,10	± 0.2
Turbidity, NTU	DI Water	0	± 1
	Standard Solutions	126 (YSI) 100 (Hydrolab)	± 5
		1000	± 50

6.8 Calibration Verification

Turn on sonde or instrument and begin data collection according to manufacturer's instruction. Compare and record instrument results to standards of known value for the following: pH, specific conductance, and turbidity. For DO, check instrument results to a volume of 100% water saturated air. For temperature, check instrument results to that of a NIST-traceable and calibrated thermometer. It is important to ensure that calibration and calibration verification bracket the range of values encountered during monitoring.

7.0 MAINTENANCE

7.1 General

Refer to the instrument manual or manufacturer for detailed maintenance requirements specific to YSI, Hydrolab, or Onset instruments. A copy of all manuals are kept in the sonde room and the sonde manager has several additional copies. They are also available at the manufacturer's respective web sites and technical support hotlines.

Maintenance activities (e.g., probe replacement, software updates) should be performed by the Sonde Manager, or at the direction of the Sonde Manager. Any maintenance activities should be logged in the Sonde Tracker spreadsheet.

While in the field, document sonde maintenance issues, probe replacement, or other instrument notes in the log book assigned to each sonde. The log books must accompany sondes in the field to ensure documentation is completed. For DO loggers,conductivity loggers or thermographs, record maintenance issues or instrument notes in their respective tracking spreadsheets.

7.1.1 Scheduled Maintenance

Minimum maintenance must be conducted, regardless of the use that the instruments get.

After each sampling trip, complete calibration verification thenperform general cleaning and maintenance.Clean and rinse the sensors and store them in tap water. Do not use distilled or DIW for storage.

7.1.2 Replacement Parts

See the Sonde Manager or Alternate for replacement parts. Do not discard any malfunctioning parts, as these may be under warranty.

7.2 O-ring Maintenance

If O-rings and sealing surfaces on sondes are not maintained properly, water can enter the battery compartment and/or sensor or cable connector ports of the sonde. Water can severely damage battery terminals or probe ports causing loss of battery power during a deployment, inaccurate readings, and corrosion to the contacts. Therefore, when the battery compartment lid is removed from YSI 600XLM or 6920 sondes, or Hydrolab sondes, the O-rings that provide the seal should be carefully inspected for contamination (e.g. hair, grit, etc.) and cleaned if necessary using the instructions provided below. The same inspection should be made of the O-rings associated with probes, port plugs, and field cable connectors when they are removed. If no dirt or damage to O-rings is evident,

then they should be lightly greased (see below) without removal from their groove. However, if there is any indication at all of damage, the O-ring should be replaced with an identical item from the YSI 6570 Maintenance Kit or Hydrolab Maintenance Kit supplied with the sondes. At the time of O-ring replacement, the entire O-ring assembly should be cleaned as described below.

7.2.1 O-RING REMOVAL

Use a small, flat-bladed screwdriver or similar blunt-tipped tool to remove the O-ring from its groove. Check the O-ring and the groove for any excess grease or contamination. If contamination is evident, clean the O-ring and nearby plastic parts with lens cleaning tissue or equivalent lint-free cloth soaked in a mild detergent solution.

CAUTION: Do not use alcohol on O-rings as this may cause a loss of elasticity and promote cracking. Do not use a sharp object to remove the O-rings. Damage to the O-ring or the groove itself may result. Before re-installing the O-rings, make sure that you are using a clean workspace, clean hands, and are avoiding contact with anything that may leave fibers on the O-ring or grooves. Even a very small bit of contamination (hair, grit, etc.) may cause a leak.

7.2.2 O-RING INSTALLATION

Place a small amount of lubricant supplied in the Maintenance Kit or food-grade silicone grease between your thumb and index finger. (More grease is NOT BETTER!) Draw the O-ring through the grease while pressing the fingers together. Use this action to place a VERY LIGHT covering of grease to all sides of the O-ring. Place the O-ring into its groove making sure that it does not twist or roll. Use the previously grease-coated finger to once again lightly go over the mating surface of the O-ring. DO NOT use excess grease on the O-ring or O-ring groove. Grease is a lubricant, not a sealant. Its purpose is to allow the sealing surface to glide over the O-ring without kinking or twisting it.

CAUTION: Do not over-grease O-rings. Excess grease may collect grit particles that can compromise the seal. Excess grease can also cause the waterproofing capabilities of the O-ring to diminish, potentially causing leaks into the compartment. If excess grease is present, remove it using lens cloth or lint-free cloth.

7.3 PORTS

7.3.1 SONDE PROBE PORTS

Whenever you install, remove, or replace a probe or port plug, it is extremely important that the entire sonde and all probes and plugs be thoroughly dried prior to removal of the probe or port plug. This will prevent water from entering the port. Once you remove a probe or plug, examine the connector inside the sonde probe port. If any moisture is present, rinse both the port and the probe with DI water, remove the water with three rinses of 95% ethanol and dry thoroughly with compressed air. Equipment subjected to this procedure must be completely dry before re-assembly. If the connector is corroded, return the sonde to the Sonde

Manager or Alternate. When you reinstall a probe or port plug, lightly grease the O-ring with lubricant supplied in the Maintenance Kit or food-grade silicone grease. Wet-mateable electrical connections are more resistant to problems created by the presence of moisture; however, the same procedures should be followed.

7.3.2 Cable Connector Port

The cable connector port at the top of the sonde should be covered at all times. When a communications cable is not connected to the cable connector port, the pressure cap supplied with the instrument should be securely tightened in place.

If moisture has entered the connector port, dry it completely using 95% ethanol and compressed air. Never attempt to dry the connector port with a rag or paper towel as this may bend the pins. Apply a very thin coat of lubricant from the Maintenance Kit or food-grade silicone grease to the O-ring inside the connector cap periodically throughout the year.

7.4 Probe Maintenance

7.4.1 YSI 6560 Conductivity/Temperature Probes

The openings that allow fluid access to the conductivity electrodes must be cleaned if response is slow or the reading fails to stabilize. The small cleaning brush included in the 6570 Maintenance Kit is provided for this purpose. Dip the brush in a mild detergent solution and insert it into each hole 15-20 times; rinse well. Never use anything but mild detergent to clean a conductivity probe. After cleaning, check the response and accuracy of the conductivity cell with a calibration standard.

NOTE: If this procedure is unsuccessful, or if probe performance is impaired, it may be necessary to return the probe to the sonde manager or alternate for evaluation.

The temperature portion of the probe requires no maintenance.

7.4.2 Hydrolab Conductivity Probes

The only maintenance required is cleaning of the probe's cell and body. Debris, organisms, and other contaminants in the sensor cell will have a negative impact on the accuracy and stability of the readings. The inside of the cell should be cleaned out after every deployment with a cotton swab or small brush. Additionally, prior to calibration of conductivity, all sensors should be cleaned. Any residue or debris on the sensors may contaminate conductivity standards and change their value, resulting in an inaccurate calibration. Clean the oval measurement cell on the specific conductance sensor with a small,non-abrasive brush or cotton swab. Use soap to remove grease, oil, or biological growth.Rinse with water.

The temperature portion of the probe requires no maintenance.

7.4.3 ONSET HOBO DO PROBE

The logger is equipped with a replaceable sensor cap that provides six months of continuous use. The sensor cap expires 7 months after the cap is initialized to allow a month buffer between lab calibration and deployment. The sensor should olny be cleaned with a sensor cap installed. To clean the sensor cap within the active 6 month period:

1. Remove the protective guard or anti-fouling guard, but leave the sensor cap on the sensor. Rinse the logger with clean water from a squirt or spray bottle.
2. Gently wipe the cap with a soft-bristled brush or soft cloth if biofouling is present. Use Alconox to remove grease.
3. If extensive debris or mineral build-up is present, soak the cap end in vinegar for 15 minutes, then soak it in DI water for another 15 minutes.
4. Field calibration is adequate if reusing the same sensor cap. Lab calibration is required if a new sensor cap is installed.
5. Between deployments, store the logger in the calibration boot (wet the small sponge with fresh water, place the sponge in the end of the calibration bott, and then insert the logger in the boot.).

The internal lithium batteries should last 3 years under normal use. Once the battery voltage falls below 3.2 V, the logger requires factory service to replace the battery. Attempting to replace the battery yourself can cause severe damage and voids the warranty.

The temperature portion of the DO Logger is internal and requires no maintenance or calibration.

7.4.4 YSI 6562 DO PROBES

For best results, the potassium chloride (KCl) solution and the Teflon membrane at the tip of the 6562 probe should be changed prior to each sonde deployment and at least once every 30 days during use of the sonde for instantaneous sampling (“grab” samples). In addition, the KCl solution and membrane should be changed if:

- Bubbles are visible under the membrane;
- There is any apparent physical damage to or wrinkling of the membrane,
- If the DO charge is <25 mV or >75 mV;
- Significant deposits of dried electrolyte are visible on the membrane or the O-ring; or
- Probe shows unstable readings or is slow to stabilize.

After removing the used membrane from the tip of the 6562 probe, examine the electrodes at the tip of the probe. If either or both of the silver electrodes are discolored or pitted, the probe should be resurfaced using the fine sanding disks which are provided in the 6035 reconditioning kit. To resurface the probe using the fine sanding disk, follow the instructions below.

1. Dry the probe tip completely with lens cleaning tissue.

2. Hold the probe in a vertical position, place one of the sanding disks under your thumb and stroke the probe face lightly in a direction parallel to the gold electrode (located between the two silver electrodes). The motion is similar to that used in striking a match. Usually 10-15 strokes of the sanding disk are sufficient to remove black deposits on the silver electrodes. However, in extreme cases, more sanding may be required to regenerate the original silver surface.
3. Repeatedly rinse the probe face with clean water and wipe with lens cleaning tissue to remove any grit left by the sanding disk. After cleaning, thoroughly rinse the entire tip of the probe with distilled or DIW, then remove as much of the rinse water as possible, refill the probe with KCl solution, and install a new membrane.

IMPORTANT: Be sure to:

- Use *only* the fine sanding disks provided in the 6035 maintenance kit in the resurfacing operation;
- Avoid any contamination of the contacts with fluids;
- Sand in a direction parallel to the gold electrode*. Not adhering to all of these instructions can seriously damage the electrodes.*

NOTE: If this procedure is unsuccessful, as indicated by improper probe performance, it may be necessary to return the probe to the Sonde Manager or Alternate for evaluation.

7.4.5 HYDROLAB LDO PROBES

The Hach LDO probe is nearly maintenance-free. To ensure accurate readings and long sensor life, the probe should be kept clean. After each deployment, the sensor should be cleaned with a cotton swab or soft brush and soapy water to remove any oils or organisms. Organisms living on the sensor will consume or produce oxygen and change the readings. Hard scrubbing will remove the black coating from the outside of the sensor cap. If more than half of the coating is removed, the cap must be replaced. If deposits on the sensor are difficult to remove, soak the sensor in warm tap water until the deposits soften. NEVER use organic solvents such as acetone or methanol on any part of the sensor or cap. When the sensors are clean, the LDO is ready to calibrate.

7.4.6 YSI OPTICAL PROBES – 6026 TURBIDITY, 6136 TURBIDITY AND 6150 DO

The 6026, 6136 and 6150 probes require only minimal maintenance. After each deployment, the optical surface on the tip of the turbidity probe should be inspected for fouling and cleaned if necessary by gently wiping the probe face with moist lens cleaning paper. In addition, we recommended replacing the wiper pad when it becomes discolored. Do not discard wiper arms. The frequency of this replacement depends on the quality of water under examination.

A replacement wiper is supplied with the probes, along with the small hex driver required for its removal and reinstallation. Follow the instructions supplied with the probe to ensure proper installation of the new wiper assembly. Spare wipers and pads are kept in stock by SWQB. Remove old pad and replace with new

pad; when new pad are installed on optical probes the wiper block should be spaced the thickness of a standard business card off of the probe face.

Do not manually turn the wiper shaft, doing so will damage or destroy the wiper motor.

6150 DO probe membranes should only be changed by the sonde manager or alternate as they require the EcoWatch program and certain codes from the packaging to be input.

7.4.7 Hydrolab Optical Turbidity Probes

The standard turbidity sensor's only maintenance requirement is to be kept clean. The optics should be cleaned before and after each deployment with a soft brush or lint free wipe and soapy water. Rinse the sensors well with clean fresh water after cleaning to prevent soap residue from building up on the lenses.

7.4.8 YSI 6561 pH and 6565/6566 Combination pH-ORP Probes

Cleaning is required whenever deposits or contaminants appear on the glass and/or platinum surfaces of these probes or when probe response becomes slow or unstable.

1. Soak the probe in a dilute detergent solution for 10 minutes. Using a soft cloth or cotton swab dipped in the detergent solution, gently wipe the bulb and reference electrode. Rinse thoroughly.
2. Soak the probe in dilute hydrochloric acid (1 molar) for 10 minutes. Using a soft cloth or a cotton swab dipped in the dilute hydrochloric acid, gently wipe the bulb and reference electrode. Soak the probe in clean tap water (do not use distilled or deionized water) for one hour.

CAUTION: When using a cotton swab with the 6561 or 6565, be careful NOT to wedge the swab tip between the guard and the glass sensor. If necessary, remove cotton from the swab tip, so that the cotton can reach all parts of the sensor tip without stress.

If biological contamination of the sensor is suspected, or if good response is not restored by the above procedures, perform the following additional cleaning step:

1. Soak the probe for approximately 1 hour in a 1 to 1 dilution of commercially-available chlorine bleach and DI water.
2. Rinse the probe with clean water and then soak for at least 1 hour in clean tap water with occasional stirring to remove residual bleach from the sensor. (If possible, soak the probe for period of time longer than 1 hour in order to be certain that all traces of chlorine bleach are removed.)
3. Re-rinse the probe with clean water and retest.

7.4.9 Hydrolab Integrated Reference pH Probes

In order to give consistently accurate readings, the pH sensor should be maintained on a regular basis. Oils, sediment, and biological contaminants on the

bulb or reference junction will result in errant readings or a very slow response. Leaching or dilution of the electrolyte solution in the reference will cause the readings to drift over time. The glass bulb is very thin and fragile. Care should always be taken not to damage it when servicing the instrument. The sensor should be cleaned with a cotton swab or soft brush and soapy water. The reference junction is a threaded cap with a sleeve of porous Teflon® in the center. The Teflon® allows the reference electrolyte to make an electrical connection to the sample water while preventing them from mixing freely. If it becomes clogged or dirty, replace it. Turn the junction counter clockwise to unscrew it from the base. If you have the integrated sensor/reference, you will need a flat screwdriver to do this. With the junction off, pour the old electrolyte solution out and replace it with fresh solution.

For extended deployments or for monitoring extremely low conductivity water, add a salt tablet to the reference electrolyte as well. This will maintain the saturation level of the electrolyte as the salt slowly leaches through the Teflon® junction. Fill the reference until the electrolyte forms a slight dome over the top. Gently place the new junction into the top of the reference tube so that no air remains inside, and turn it clockwise until the O-ring is sealed tightly. As you tighten, you will see a small amount of electrolyte and possibly bubbles being forced out of the junction. This is the air being purged from inside the junction. If this purging effect does not occur, the junction may be clogged and must be replaced.

8.0 STORAGE

8.1 YSI SHORT-TERM STORAGE

No matter what sensors are installed in the instrument, it is important to keep them moist without actually immersing them in liquid, which could cause some of them to drift or result in a shorter lifetime. For example, the sensor of a pH probe must be kept moist to minimize its response time during usage, but continued immersion in pure water may compromise the function of the glass sensor and/or result in long term leaching of the electrolyte through the reference junction.

YSI recommends that short term storage of all multiparameter sondes be done by placing approximately 3 mm (1/8 inch) of water in the calibration/storage cup that was supplied with the sonde, and by placing the sonde with all of the probes in place into the cup.

The key for interim storage is to use a minimal amount of water so that the air in chamber remains at 100 percent humidity. The water level has to be low enough so that none of the sensors are actually immersed. Use clean tap water for storage between sampling runs. If the storage water is inadvertently lost during field sampling studies, environmental water can be used to provide the humidity. Do not use DI water, as this will degrade the performance of the pH probe.

Interim sonde storage is easy. Simply remember the following key points:

- Use enough water to provide humidity, but not enough to cover the probe surfaces.
- Make sure the storage vessel is sealed to minimize evaporation.

- Check the vessel periodically to make certain that water is still present.

8.2 YSI Long-term Storage

8.2.1 Sondes

The following recommendations are applicable for sondes with typical sensor configurations.

YSI 600XLM – Remove the pH or pH/ORP probe from the sonde and store it according to the instructions found in the following section on individual sensors. Seal the empty port with the provided plug. Leave the conductivity/temperature and the DO probe in the sonde with a membrane and electrolyte on the DO sensor. Place enough deionized, distilled or tap water in the calibration cup to cover the sensors, insert the sonde into the vessel and seal with the cap/O-ring to minimize evaporation.

YSI 6820, 6920, 6820 V2, 6920 V2 – Leave the conductivity/temperature, turbidity, and DO probes in the sonde with a membrane and electrolyte on the DO sensor. Remove the pH probe from the sonde and store according to the instructions found in the following section on individual sensors. Seal the empty ports with the provided plugs. Place enough deionized, distilled or tap water in the calibration cup to cover the sensors, and tighten the threaded cup to attain a good seal and minimize evaporation.

YSI 600 OMS - Store sonde dry with optical probe left in port. Cover membrane on ROX sensor with moist sponge.

All Sondes with Batteries – Because batteries can degrade over time and release battery fluid, it is extremely important to remove the batteries from all sondes prior to long term storage. Failure to remove batteries can result in corrosive damage to the battery compartment and terminals if the batteries leak.

8.2.2 Probes

The following sections provide additional details on the storage of individual sensors associated with instruments in the 6-Series product line from YSI. Probes should be cleaned prior to being placed in long term storage.

Temperature - No special precautions are required. Sensors can be stored dry or wet, as long as solutions in contact with the thermistor probe are not corrosive (for example, chlorine bleach).

Conductivity - No special precautions are required. Sensors can be stored dry or wet, as long as solutions in contact with thermistor probe and conductivity electrodes are not corrosive (for example, chlorine bleach). However, it is recommended that the sensor be cleaned with the provided brush prior to long term storage.

Dissolved Oxygen - Rapid pulse DO sensors should always be stored with a membrane and electrolyte in place and in such a way that drying of the

electrolyte on the probe face is minimized. For long-term storage, the medium should be water rather than the moist air used in interim storage.

pH - The key to pH probe storage, short or long-term, is to make certain that the reference electrode junction does not dry out. Junctions that have been allowed to dry out due to improper storage procedures can sometimes be rehydrated by soaking the sensor for several hours (overnight is recommended) in a 2 molar potassium chloride solution. If potassium chloride solution is not available, soaking the sensor in commercial pH buffers may restore probe function. However, in some cases the sensor may have been irreparably damaged by the dehydration and will require replacement. It is also important to remember not to store the pH sensor in distilled or DIW as the glass sensor may be damaged by exposure to this medium and the electrolyte will be depleted through the reference electrode.

Turbidity - No special precautions are necessary for either the short or long-term storage of the optical turbidity probes. However, for long-term storage, the user may wish to remove the probe from the sonde, replace it with a port plug and store the probe in dry air to minimize any cosmetic degradation of the probe body and to maximize the life of the wiper.

Optical DO - When the 6150 optical membrane is not in field use, it MUST BE STORED IN A MOIST ENVIRONMENT, i.e., either in water or in water-saturated air with storage in water being preferable. If the sensor membrane is allowed to dry out by exposure to ambient air, it is likely to drift slightly at the beginning of the next deployment unless it is rehydrated. Thus, to make the use of the sensor as simple as possible, remember to store it WET whenever possible. The easiest storage method is to use the protective plastic cap (and enclosed sponge) which was included with purchase of the probe. Soak the sponge in water and replace the cap on the probe tip. Inspect the sponge every 30 days to make sure it is still moist.

8.3 HYDROLAB STORAGE

When Hydrolab equipment is not in use, most sensors must be kept moist to prevent damage. Hach recommends using pH 4 buffer as a storage medium for both long and short term storage. After performing a slope calibration with pH 4, rather than discarding the buffer, save it to use as a storage medium. Although calibration standards should never be reused for calibration, used pH 4 buffer is acceptable as a storage medium. In the absence of pH 4 buffer, clean tap water is second best. If field water must be used, replace it with a recommended medium as soon as the instrument is back at the lab. Do not use deionized water or allow the storage medium to freeze.

8.4 ONSET HOBO DO LOGGER STORAGE

Between deployments, keep the logger in the calibration boot. Wet the sponge with fresh water, place the sponge in the end of the calibration boot, and then insert the logger in the boot. The DO sensor should be stored with a sensor cap installed (preferably NOT a new un-initiated sensor cap).

Table 3. Troubleshooting

Symptoms	Possible Cause	Action
DO reading unstable or inaccurate	Probe not properly calibrated	Follow DO calibration procedures
	Membrane not properly installed	Follow 6562 setup procedure
	DO probe electrodes require cleaning	Follow DO cleaning procedure. Use 6035 maintenance kit
	Water in probe port	Dry connector; reinstall probe
	Algae or other contaminant clinging to DO probe	Rinse DO probe with clean water
	Calibrated using improper barometric pressure	Repeat DO calibration procedure using proper barometric pressure
	Calibrated at extreme temperature	Recalibrate at (or near) sample temperature
	DO Charge too high (>75) 1. Anodes polarized (tarnished) 2. Moisture in probe port 3. Probe has internal short	Recondition probe with 6035 Maintenance Kit. Follow DO cleaning procedure. Dry port carefully using instructions above. Replace probe. Return defective probe to sonde manager.
	DO Charge too low (<25) 1. Insufficient or diluted electrolyte (membrane may be compromised). 2. DO probe has been damaged 3. Internal failure	Replace electrolyte and membrane. Replace 6562 probe Return sonde for service
pH, ORP, readings are unstable or inaccurate. Error messages appear during calibration.	Probe requires cleaning	Follow probe cleaning procedure
	Probe requires calibration	Follow calibration procedures
	pH probe sensor has dried out from improper storage	Soak probe in tap water or buffer until readings become stable
	Water in probe port	Dry port; reinstall probe
	Probe has been damaged	Replace probe
	Calibration solutions out of spec or contaminated with other solution	Use new calibration solutions
	Internal failure	Return sonde for service
Conductivity unstable or inaccurate. Error messages appear during calibration.	Conductivity improperly calibrated	Follow calibration procedure
	Conductivity probe contains bubbles or requires cleaning	Flush bubbles or follow cleaning procedure
	Conductivity probe damaged	Replace probe
	Calibration solution out of spec or contaminated	Use new calibration solution
	Internal failure	Return sonde for service
	Calibration solution or sample does not cover entire sensor	Immerse sensor fully
Temperature, unstable or inaccurate	Water in probe port	Dry port; reinstall probe
	Probe has been damaged	Replace the 6560 probe
Turbidity probe: general	Probe requires cleaning.	Follow probe cleaning procedure
	Probe requires calibration	Follow calibration procedures
	Probe has been damaged	Replace probe
	Water in probe port	Dry port; reinstall probe
	Calibration solutions out of spec	Use new calibration solutions
	Wiper is not turning or is not synchronized	Activate wiper. Assure rotation. Make sure setscrew is tight.
	Wiper is fouled or damaged	Clean or replace wiper or wiper pad
	Internal failure	Return probe for service
Installed probe has no reading	Sensor has been disabled	Enable sensor
	Water in probe connector	Dry connector; reinstall probe
	Probe has been damaged	Replace the probe
	Report output improperly set up	Set up report output
	Internal failure	Return sonde for service
Outside calibration range	Faulty calibration, internal failure	Reset the calibration using UnCal

9.0 RELATED FORMS

YSI Sonde Calibration Form
YSI Calibration Tips
YSI Table 2: Calibration Values for Various Atmospheric Pressures and Altitudes

10.0 REVISION HISTORY

Revision 3 – February 2016 – updated to include instructions for YSI V2 sondes, requirements for calibration verification bracketing, and maintenance documentation, formatted to SOP 1.1.

Revision 2 – February 2013 – updated to incorporate Onset HOBO DO Loggers, updated Table 2 to current Calibration Range values. Directed “Sonde Data Manager” duties to the survey Project Coordinators.

Revision 1 – February 2012 – updated to incorporate Hydrolab sondes
Original modified from SOP 2007.

11.0 REFERENCES

None