



Standard Operating Procedure

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Revision History		
Version No.	Effective Date	Description
1.0	01/01/2024	Original composition by M.Kachmar

Procedure Owners:

Date:

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Date:

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1 Purpose

The purpose of this SOP is to provide concise guidance and methodology for maintaining the HOBO temperature loggers on a monthly basis to accurately collect year round temperature data.

2 Scope

This SOP is pertaining to the EPA Long Island Sound Study funded Oyster Health project that is incorporating water quality metrics to understand host-pathogen-environment relationships.

3 Definitions/Acronyms

4 Safety Precautions

All survey team members will wear appropriate clothing dependent on weather conditions including but not limited to waders, rubber boots or protective footwear, gloves, hats, sunglasses, long sleeve shirts, and pants. Thick protective gloves (e.g garden gloves) should be worn when handling fouling organisms. Team members will wash hands thoroughly after field trips end. A first aid kit will be present for any injury. Extra water will be provided to avoid dehydration or heat stroke. Team members will take regular breaks when needed.

Exercise weather-appropriate field safety measures by monitoring conditions before and during the trip. Do not perform fieldwork during dangerous conditions (e.g. lightning, extreme winds, extreme floods). Do not visit field sites alone (use buddy system). Inform PIs of dates and times of fieldwork. Confirm safe return to the lab. At intertidal sites, perform procedures during low tide. At subtidal sites, divers are to follow NOAA diving regulations according to the instructions of the lab diving coordinator (Barry Smith, barry.smith@noaa.gov)

5 Reagents/Media

6 Supplies/Equipment

1. Field tablet (containing HOBObconnect app)
2. Robust zip-ties for securing HOBO to sonde or housing(e.g., 6-12 inches and 18-24 inches)
3. Scrub brush
4. Shucking knife
5. First aid kit
6. Wire cutters

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7. Hand sanitizer
8. Spare HOBO battery (Murata brand CR2477 premium lithium 3V coin cell batteries).
9. Spare O-rings for HOBO data logger. ([MX2203 Replacement O-ring](#)).

7 Quality Control

All team members will be trained to complete all field tasks, including training on data entry requirements for each specific task. Environmental monitoring data will be regularly checked for drift.

8 Preparation (At the lab)

1. Ensure that all SOPs and field notebooks are available offline on the field tablet.
 - a. [Monthly Sonde Maintenance](#)
 - b. [Monthly HOBO Maintenance](#)
 - c. [Water Sampling and Chemistry](#)
 - d. [Sonde Sensor Calibration](#)
 - e. [Sonde Field Notebook](#)
 - f. [Site specific field notebook](#)
2. Ensure that the field tablet is fully charged.

9 Procedures

1. Setup and deployment:

Note: The following steps occur when the HOBO is out of the water.

- a. Log into the Field tablet
- b. Enable bluetooth in the tablet settings.
- c. Open the HOBObconnect app.
- d. To activate the temperature logger, firmly press the magnetic button (top circular part of the protective boot with "HOBO" embossed on it), holding it for 1 second against the logger (Figure 1). The app will detect the instrument on the tablet given the device is within range.

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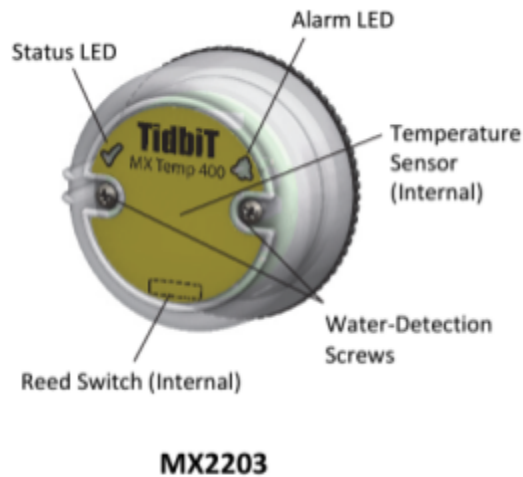


Figure 1: TidBiT MX Temp 400 HOBO. Left: Instrument parts. Right: HOBO mounted in its protective boot. ("Press" indicates area to press when waking up the HOBO).

- e. An icon for the specific HOBO device will appear in the app. Click on the icon to connect it to the tablet.
- f. To create a new log session, click the "Start Logging" icon and follow the prompts to set up the session. Settings should be as follows:
 - i. Logging Interval = 10 min;
 - ii. Start Logging = manual (starts on save) or set a date and time, if appropriate;
 - iii. Stop Logging = Never Stop (overwrites old data);
 - iv. Logging Mode = Fixed Logging Mode;
 - v. Power Saving Mode = Bluetooth Always Off;
 - vi. Show LED = On (swipe right in the app);
 - vii. Alarms = Not Configured.
- g. Write down the settings in the [field notebook](#).
- h. Some notes (from the manual) about the Status and Alarm LEDs:
 - i. The Status LED blinks green every 4 seconds when the logger is logging (unless Show LED is disabled when configuring the Logger).
 - ii. If the logger is waiting to start logging because it was configured to start "On Button Push" or with a delayed start, it blinks green every 8 seconds.

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- iii. Both the Status LED and the Alarm LED blink once when you press the button to wake up the logger, or blink four times when you press the button to start or stop logging.
- iv. If you click the LED icon in the app, both LEDs are illuminated for 5 seconds.
- i. Initial Deployment:
 - i. Intertidal sites:
 1. During field season (March–November), HOBOs are attached to rebar anchoring spat collector bags to the seabed. Spat collector bags are located within the oyster bed at the lowest zone or fringe. Attach the HOBOs using small zip-ties threaded through the top and bottom rubber lip of the HOBO (Figure 2).
 2. During off season (December–February), all HOBO loggers are attached to sonde housings. Attach HOBOs using large zip ties threaded through the top and bottom of the rubber lip of the HOBO and secure the device below mean low water around the sonde housing.



Figure 2: Depiction of where to thread the zip-ties

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ii. Subtidal sites:

1. At Gold Star Beach (from Cornell Extension FLUPSY):

- Use the long brush to clean the inside and outside of the PVC housing, making sure the vent holes are clear to allow water flow.
- Place the sonde plus attached HOBO (zip-tied at top of sonde) inside the PVC housing with the probes facing downwards.
- Clip the tether from the anchor onto the top of the data sonde.
- Pass a zip-tie through one of the PVC vent holes and out another (about half way up the sonde) and use it to secure the sonde tight against the inside of the PVC housing.
- Lower the mushroom anchor to the seabed and fasten the line on a cleat.

2. Retrieving deployed HOBO:

a. Intertidal sites:

- Wade to the location of the HOBO (See 9.1.j) and remove the HOBO using a wire cutter. Be sure that you are cutting the zip-ties and not the HOBO itself.

b. Subtidal sites:

- For subtidal sites, HOBO loggers are always attached to sonde housings/ mushroom anchors. See [Monthly Sonde Maintenance SOP](#) for more details on retrieving sonde housing at subtidal sites.
- Gold Star Beach: Access Cornell Extension's FLUPSY. Pull up the 25 pound mushroom anchor from the seabed and place it on the dock. The HOBO is zip-tied to a data sonde attached to the anchor.

3. Downloading data

- Data can be downloaded once the HOBO logger is out of the water.
- Log into the Samsung tablet. Enable Bluetooth in the tablet Settings.
- Open the HOBObconnect app.
- Wake up the temperature logger by firmly pressing the magnetic button (top circular part of the protective boot with "HOBO" embossed on it),

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holding it for 1 second against the logger (Figure 1). The app should detect the instrument on the tablet.

- e. On the tablet, connect to the HOBO by clicking its icon.
- f. Click the Download Data icon.
- g. When “Download Complete” is displayed, click Export & Share.
- h. When “Export successful” is displayed, click Share.
- i. Save the file to the site specific folder on the shared drive (shortcut to *Data_Sondes* folder; full path: *Project Planning / Data Management / Field Data / Data_Sondes/HOBO data*).
 - i. Rename the file using the format MMYYSITE_HOBO. Where MMYYY refers to the month and year data was downloaded and SITE refers to the four character site code (ASHC, FENC, GOLD, or STAR)
- j. Once saved, the app will return to the home screen (it should indicate “Logging” is still in progress near the top).
- k. The remaining battery level should display in the app home screen. If $\leq 50\%$, stop the logging session (icon on app home screen) and change the battery (see 9.4- this should be a rare event). If $> 50\%$ disconnect the app (arrow at the top left of the screen) and redeploy the HOBO (see below).
- l. On return to the lab, sync the downloaded data (see Section 10).

4. Changing the battery

- a. Battery changes must occur when the HOBO has been retrieved, surfaced, and brought to shore. The HOBO must be out of the water.
- b. Pop the data logger out of its protective boot.
- c. Clean, rinse and thoroughly dry the data logger.
- d. Undo the back of the logger by pushing down on the back and rotating the cover counterclockwise (align the unlock icon with the double-ridge on the side of the logger) (Figure 3).

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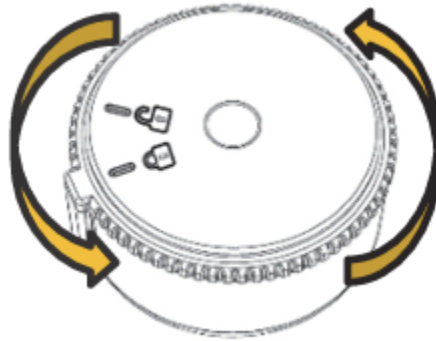


Figure 3: Counterclockwise rotation to remove back of HOBO logger.

- e. Lift the cover off the logger and remove the battery.
- f. Insert a new battery (CR2477 lithium 3V) with the positive side facing up.
- g. Make sure the O-ring is clean, seated properly and free of cracks. If damaged, replace the O-ring as follows:
 - i. Spread a small dot of silicone-based vacuum grease on the new O-ring, making sure the entire O-ring surface is completely covered in grease.
 - ii. Place the O-ring on the cover and clean off any debris. Make sure the O-ring is fully seated and level in the groove and not pinched or twisted. This is necessary to maintain a waterproof seal.
- h. Place the cover back on the logger, lining up the unlock icon with the double-ridge on the side of the logger case. Make sure the cover is level as it is placed on the logger case to ensure the battery terminal maintains its proper position.
- i. While pushing down on the cover, rotate it clockwise until the tab is aligned with the double-ridge in the logger case (Figure 4). Rotate the locked icon so that the icon moves from the unlocked to locked position (Figure 4). When the cover is properly positioned, the tab and the locked icon will be aligned with the double-ridge in the logger as shown.

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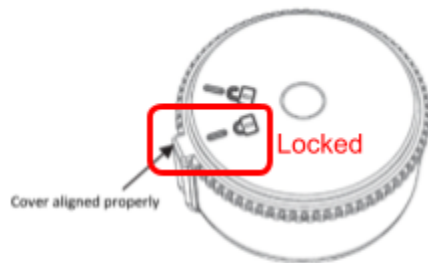


Figure 4: Aligning the cover and logger case to close the battery compartment.

- j. Place the logger back in the protective boot, making sure the double-ridge on the logger case slides into the groove inside of the boot. Viewed from the front, the writing on the logger should be visible and horizontally aligned inside the boot.
 - i. Once the battery has been changed make sure that the logger is recording data from the previous session. If it is not, create a new log session following the steps in section 9.1.g.
 - k. Use zip-ties to attach the logger + protective boot onto its deployment structure (rebar, around sonde housing, etc). Ensure the back of the protective boot is against something or covered to prevent the logger popping out.
- 5. Checking the accuracy of the temperature sensor (Ice bath method), See Appendix A.**
- This only needs to be performed in the event that the recorded temperatures seem to be drifting or otherwise inaccurate.

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10 Lab return

1. Rinse all tools (wrenches, pliers, wire cutters) with fresh water, dry them with a towel, and spray with WD40 (kept on field gear shelves).
2. Take the Samsung tablet to the library and connect it to the WiFi in order to sync the shared Google drive (contains the downloaded data files from the sonde and HOBO).
3. Quality control and assurance (QAQC) data following the [github repository](#).

11 References

[HOBO manual](#)

[HOBO TidbiT MX Temperature 400' Bluetooth enabled data logger](#)

[HOBO TidbiT MX Temp 400 \(MX2203\) and Temp 5000 \(MX2204\) Logger Manual.](#)

[HOBO's ice bath test protocol](#)

12 Appendices

A. Checking the accuracy of temperature sensor (Ice bath method)

Note: HOBO temperature sensors are factory-calibrated. There is no option for a user to calibrate the sensor, but its accuracy can be tested using an ice bath test, as [recommended by the HOBO manufacturer](#).

- a. Fill a 5-gal bucket with ice (the ice machine in the basement of Milford Lab, Building 1).
- b. Pour all the ice into a cooler (e.g., the oyster project's 38 quart cooler). It should fill the cooler at least half way. If not, add some more ice.
- c. Pour tap water into the cooler, adding just enough to make a thick slurry of icy water.
- d. Set the HOBO to record every 1 minute (see above), then place it in the ice (hover it mid-depth within the watery ice slurry).
- e. Close the cooler lid and leave the HOBO to record for at least 90 minutes (it takes a while for the HOBO to cool down, and you want a good period of stabilized low temperature readings to check consistency).
- f. Retrieve the HOBO and download the data (see section 3 above).
- g. Examine the data in Excel. The temperature should have declined steadily, then stabilized very near 0°C. Select 30 readings (a 30 minute period) from the stabilized records (ignore the last few records in the log, which may have recordings after the HOBO was removed from the ice). From the 30 readings, calculate the mean, minimum, and maximum. The



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mean should be within 0.25°C of 0°C (the manual states an accuracy of plus or minus 0.25°C at 0°C). Check the minimum and maximum values for out-of range fluctuations. Note that minor changes in the true temperature (assumed to be 0°C) may be caused by dissolved salts in the ice and water (both tap water), and by changes in atmospheric pressure. These effects are considered negligible.

- h. Save the Excel file on the project shared Google drive under the folder Fieldwork/Data sondes and HOBOS/Ice Bath Tests

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