

QuickGuide for Onset HOBO DO/T Loggers

CN 004.42 Appendix B

Updated 12/18/24 (supersedes CN 4.81)

SCHEDULING: To schedule a HOBO DO/T logger, use a Probe Request Form and upload the completed form to the “Probe Request” folder under [Monitoring](#) (usually under Targeted Monitoring YYYY) prior to your survey date (with sufficient advance notice)

GENERAL DESCRIPTION: The Onset HOBO DO/T logger is a programmable data logger fitted with optic-dissolved oxygen and temperature sensors for long-term, continuous deployment. The User Manual is in Appendix A (below).

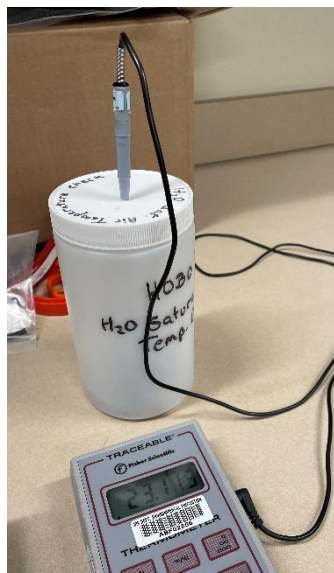
RESTRICTIONS:

- 1) DO sensor cap life span 7 months after initialization (sensor stops logging exactly 7 months after initialization)
- 2) % SAT not automatic (DO Data Assistant must be used with BP information to generate DO%SAT. This is OPTIONAL)
- 3) DO NOT USE IN TIDAL AREAS (no conductivity on-board)
- 4) Battery replacement by factory only (at least 3-year life span)

WPP'S DEFAULT SETTINGS: 30-minute logging interval ; GMT offset= -4; “start on date/time”

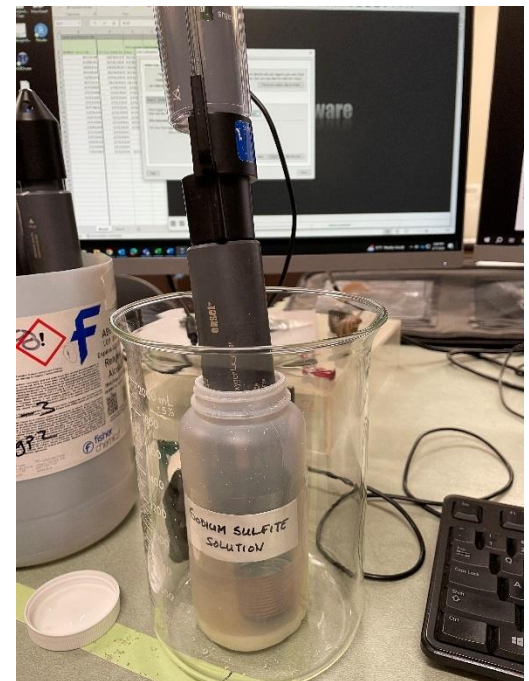
PRE-SURVEY CALIBRATION, CHECKS & SETUP

- 1) Sensor Cap Installation: See Appendix B. Following install, initialize cap and check “Device”/”Lab Calibration”/”Status”. Record the cap installation date on the calibration bench sheet.
- 2) Timing of Calibrations: Calibrate loggers any time before they are needed for surveys. It is not recommended to calibrate them the day before a survey due to the quantity of loggers needed.
- 3) Required Documentation:
 - a. HOBODO calibration bench sheet
 - b. HOBODOT_calibration_records_YYYY (YYYY = year) spreadsheet (entered during the season)
- 4) DO Calibration (saturated-air AND zero DO checks): BEFORE SURVEY. See Appendix A for more detailed information.
 - a. Place lab thermometer in saturated air bottle (w/ moist sponge). Use temperature readings with barometric pressure to determine DO table value.
 - b. 100%SAT DO check: Open Hoboware program. Place DO sensor in calibration boot w/ wet sponge and place in large beaker to keep vertical. Connect logger to PC using HOBO base station, lining up the notch on the logger with the notch on the base station (connect to the computer USB port last – if it doesn’t connect, take out the USB and re-connect).





- c. In Hoboware, go to **"Device/Lab Calibration"** (this will also initiate a new DO sensor cap). Enter ambient BP. After equilibration period (up to 5 min.), click **"Get DO Value"** at 15-30 sec. intervals until it is stable. Click **"Next"**.
 - d. Zero DO calibration: Remove the calibration boot and submerge DO sensor in saturated sodium sulfite solution. (Careful not to knock the base station connection!) Wait for the readings to drop (about 2-5 minutes). Click **"Get DO Value"** at 15-30 second intervals until it is stable and 0.0 ± 0.08 mg/L. (If the time for the readings to drop increases as time goes on, add more sodium sulfite to the solution.) Then **"Next"**.
 - e. Finish Calibration: Record the new gain and offset values on the bench sheet. Then, click **"Send Calibration to Logger"** (press 1X only). Wait for cal data to change to **"—"** (there are no other indications that it is finished, but it is).
 - f. Rinse probe thoroughly in tap water.
- 5) DO Re-Check: Place DO sensor in CAL BOOT w/ wet sponge and place in beaker vertically. Go to "Lab Calibration" and enter ambient BP. Compare DO conc. to DO calc. (and to table value for same BP and temperature). If $\text{diff} < 0.2$, OK. If $\text{diff} > 0.2$, restart with new logger. Hit **"Close"** (not **"Next"**)
 - 6) Launching the Loggers: Go to Device/ "Launch". DO NOT ENABLE "Battery Voltage". Select logging interval (30-minute interval). Input delayed start date/time for 6:00 AM on the date of the launch and press **"Start"**.
 - 7) Check battery status and record: Go to Device/Status. Battery voltage is listed in the small window.
 - 8) Label the probes with OWMIDs (according to the probe request sheet), ready for monitoring coordinators.



POST-SURVEY CHECKS AND DATA FILE UPLOADS (IN THE LAB):

- 1) When the loggers are returned to the lab (still recording), the field crew cleans the outsides of sondes and places each in cal cup w/ wet sponge.
- 2) Inspect for signs of damage to the DO sensor.
- 3) Place logger as-is (DO sensor NOT wiped) into CAL BOOT w/ wet sponge to record DO readings at prescribed interval (do not connect to PC yet---this is a CHECK, not a calibration). Wait 1-2 hours (2-4 readings).
- 4) Connect to PC and click "**Readout**" to stop logging. Select degrees Celsius for temperature format and "-4" GMT offset. Plot graph. Save the data files in .hobo format with the following naming convention:

probe#_FileStartDate-FileEndDate_probetype

E.g. **10250139_20230606-20231006_DOT.hobo**

- 5) Save the files to Field & Lab Operations Coordinator's OneDrive folder (link below). Field & Lab Coordinator will do the bulk export of files to .csv format and upload to the BWR SharePoint folder.

Directory	Directory Type	File Formats
Probe downloads temporary	OneDrive	.hobo
DEP BWR - RawData - All Documents	SharePoint	.hobo, .csv

- 6) Clean, rinse, wipe DO sensor, and put back on the calibration boot with wet sponge. Connect to the computer and re-launch probe in Hoboware: readings every 1-5 minutes, starting "now". Put back in beaker to sit vertically. Allow to read for ~ 30 min.
- 7) Re Connect to PC and click "**Readout**" to stop logging. Select degrees Celsius and "-4" GMT offset and plot graph. Save the data files in .hobo format to the *Probe_downloads_temporary* file with the following naming convention:

probe#_Calcheck_yyyymmdd_probetype

E.g. **10250139_CalCheck_20231006_DOT.hobo**

- 8) Review file to record post-survey QC check data on probe calibration bench sheet.

CLEANING, MAINTENANCE & STORAGE

- Logger Body: Mild soap and water, brush scrub, rinse (sensor cap ON).
- DO Sensor: gently rinse/wipe/soft brush to remove debris, films, deposits, etc. (H2O only). If nasty build-up, soak in vinegar (15 minutes, then DIW for 15 minutes)
- O-rings: replace as needed
- Store in cal boot w/ wet sponge. Periodically wet sponge as needed. Store at 5-25C.
- Battery replacement by vendor: After ~3 years or if battery/readout fails.

ANNUAL TEMPERATURE CHECKS VS. NIST:

Use WPP's NIST traceable thermometer to check all HOB0 logger thermometers for accuracy on an annual basis. Logger accuracy should be within 0.4 C.

SATURATED SODIUM SULFITE SOLUTION ("0.0" D.O.): Prepare fresh (and replenish) as needed. Add enough sodium sulfite to have some left un-dissolved at the bottom of the bottle.

VENDOR CONTACT INFORMATION: 1-800-LOGGERS (564-4377) • 508-759-9500

www.onsetcomp.com • loggerhelp@onsetcomp.com

ONSET HOBO DO/T MANUAL



HOBO® Dissolved Oxygen Logger (U26-001) Manual



HOBO Dissolved Oxygen Logger with
Included Calibration Boot and
Sponge (Shown Wet in Photo)

HOBO Dissolved Oxygen Logger

U26-001

Included Items:

- Dissolved Oxygen Sensor Cap
- Protective Guard
- Calibration Boot and Sponge

Required Items:

- Coupler (COUPLER-2-C) with USB Optic Base Station (BASE-U-4) or HOBO Waterproof Shuttle (U-DTW-1)
- HOBOWare Pro 3.3.1 or later

Accessories:

- Replacement Dissolved Oxygen Sensor Cap (U26-RDOB-1)
- Anti-Fouling Guard (U26-GUARD-2)
- Sodium Sulfite (U26-CAL-SOL)

You May Also Need:

- For saltwater, salinity or conductivity measurements are required; HOBO Conductivity/Salinity Logger (U24-002) recommended
- For percent saturation, barometric pressure is required; HOBO Water Level Logger (U20-001-0x) recommended

The HOBO Dissolved Oxygen logger is a standalone logger that uses RDO® Basic Technology to measure dissolved oxygen (DO). The logger has an optical sensor that provides 0.2 mg/L accuracy. The logger also features an easily replaceable sensor cap and an integrated temperature sensor. Using HOBOWare® software for logger setup and a HOBO Waterproof Shuttle for quick data offload, this logger is easy to deploy in both freshwater and saltwater environments making it an ideal tool for environmental impact studies as well as ecological and oceanographic research.

Using the data offloaded from the logger, the HOBOWare Dissolved Oxygen Assistant can calculate percent saturation and salinity-adjusted DO concentration as well as correct for measurement drift from fouling.

Specifications

Dissolved Oxygen

Sensor Type	Optical (dynamic luminescence quenching)
Measurement Range	0 to 30 mg/L
Calibrated Range	0 to 20 mg/L; 0 to 35°C (32 to 95°F)
Accuracy	0.2 mg/L up to 8 mg/L; 0.5 mg/L from 8 to 20 mg/L
Resolution	0.02 mg/L
Response Time	To 90% in less than 2 minutes
DO Sensor Cap Life	6 months (cap expires 7 months after initialization)

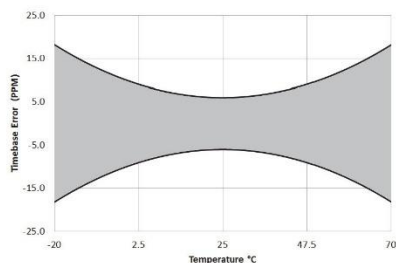
Temperature

Temperature Measurement/ Operating Range	-5 to 40°C (23 to 104°F), non-freezing
Temperature Accuracy	0.2°C (0.36°F)
Temperature Resolution	0.02°C (0.04°F)
Response Time	To 90% in less than 30 minutes

Logger

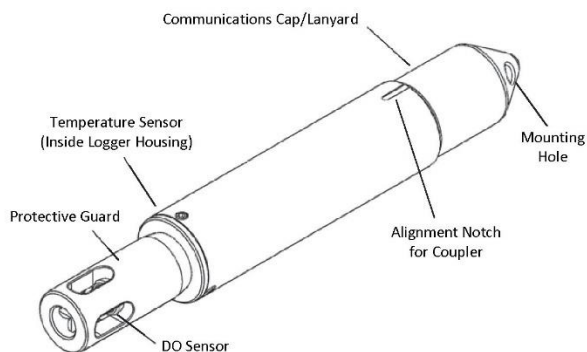
Memory	21,700 sets of DO and temperature measurements (64 KB total memory); logging stops when memory fills
Logging Rate	1 minute to 18 hours
Time Accuracy	±1 minute per month at 0 to 50°C (32 to 122°F) (see Plot A on next page)
Battery	3.6 V lithium battery; factory replaceable
Battery Life	3 years (at 5 minute logging)
Download Type	Optical
Depth Rating	100 m (328 ft)
Wetted Materials	Black Delrin®, PVC, EPDM o-rings, silicon bronze screws; rated for saltwater use
Size	39.6 mm diameter x 266.7 mm length (1.56 x 10.5 inches)
Weight	464 g (16.37 oz)
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

Specifications (continued)



Plot A: Time Accuracy

Logger Components and Operation



Communications Cap/Lanyard. This removable cap protects the optical communications window. An LED in the communications window of the logger confirms logger operation. When the logger is logging, the LED blinks once every four seconds. The LED also blinks when the logger is recording a sample. When the logger is awaiting a start because it is configured to start "At Interval," "On Date/Time," or "Using Coupler," the LED blinks once every eight seconds until logging begins. See *Connecting the Logger to a Computer or Waterproof Shuttle* for details on using the communications window.

Mounting Hole. Use the hole on the communications cap to mount the logger. See *Deploying the Logger* for more information.

Alignment Notch for Coupler. Use this notch to align the coupler when communicating with the logger. See *Connecting the Logger to a Computer or Waterproof Shuttle* for more information.

DO Sensor. This optical sensor measures dissolved oxygen using RDO® Basic Technology. It is shipped with a red dust cap that must be replaced with a green sensor cap that lasts for six months plus a one-month grace period. See *Installing the Sensor Cap* for more details.

Protective Guard. This removable guard protects the DO sensor. Unscrew it to install or replace the sensor cap as needed. See *Installing the Sensor Cap* for more details.

Temperature Sensor. This built-in sensor (not visible in diagram) measures temperature.

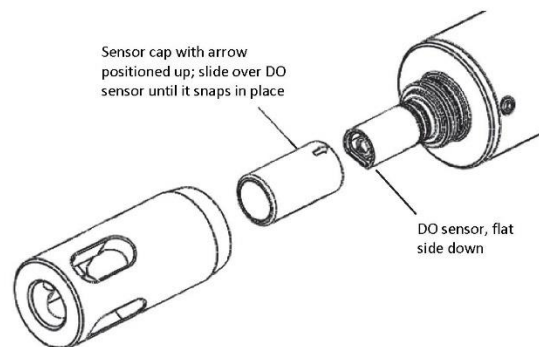
WARNING: This logger can be damaged by mechanical shock. Always handle the logger with care. The logger may be damaged if it is dropped. Use proper packaging when transporting or shipping the logger.

Do not attempt to open the logger case or sensor housing. Disassembling the logger case or sensor housing will cause serious damage to the sensor and logger electronics. There are no user-serviceable parts inside the case. Contact Onset Technical Support at 1-800-LOGGERS (1-800-564-4377) or an authorized Onset dealer if your logger requires servicing.

Installing the Sensor Cap

The logger ships with a replaceable sensor cap that provides six months of continuous use. Once the cap is initialized, an internal clock within the logger will count down until the sensor cap expiration date. When the sensor cap expires, you will need to replace it with a new cap (U26-RDOB-1). The sensor cap is intended for six months of actual deployment, but the expiration date is seven months from the date the cap was initialized. This allows for any time needed between launching the logger and physically deploying as well as extra time in case you are not able to get the logger after exactly six months of deployment. To install the sensor cap:

1. Unscrew the protective guard covering the DO sensor (see diagram at left).
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 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 the external protective guard back on until tight.

Important: The sensor cap expires 7 months (to the day) after it has been initialized. The logger will record a value of -888 mg/L at each logging interval after the cap has expired. Initialization occurs automatically when the cap is installed while the logger is logging. You can also initialize it from the Status window in HOBOWare or when using the Lab Calibration tool. To see when the sensor cap expires after being initialized, check the Status in HOBOWare for the expiration date. The cap also has a shelf life; check the "Install By" date printed on the canister.

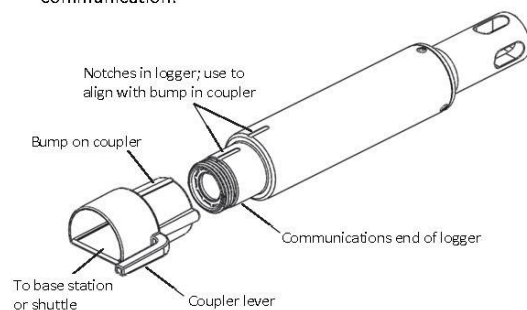
Connecting the Logger to a Computer or Waterproof Shuttle

To connect the logger to a computer, use either the Optic USB Base Station (BASE-U-4) or HOBO Waterproof Shuttle (U-DTW-1) with a coupler (COUPLER2-C). To launch and read out the logger in the field, use one of these three methods:

- Laptop computer with Optic USB Base Station (BASE-U-4) and coupler (COUPLER2-C)
- HOBO Waterproof Shuttle (U-DTW-1, Firmware Version 3.2.0 or later) and coupler (COUPLER2-C)
- HOBO U-Shuttle (U-DT-1, Firmware Version 1.16 or later) with Optic USB Base Station and coupler (COUPLER2-C)

IMPORTANT: USB 2.0 specifications do not guarantee operation outside the range of 0°C (32°F) to 50°C (122°F).

1. Follow the instructions that came with your base station or Waterproof Shuttle to attach it to a USB port on the computer.
2. Unscrew the pointed cap on the communications end of the logger.
3. Attach the coupler to the base station or shuttle.
4. Insert the logger into the coupler, aligning the bump/arrow on the coupler with the notches on the logger. Be sure that it is properly seated in the coupler. If the logger has never been connected to the computer before, it may take a few seconds for the new hardware to be detected by the computer. **Note:** If you are using the HOBO Waterproof Shuttle as a base station with a computer, briefly press the coupler lever to put the shuttle into base station mode. A green LED on the shuttle or base station indicates good communication.



5. After logger communications are complete, remove the logger from the coupler. Make sure the o-ring is still in the groove inside the cap and then reinstall the communications cap.

IMPORTANT: When connected to a coupler, the logger is “awake” and consumes significantly more power than when it is disconnected and considered “asleep.” The logger will automatically “go to sleep” after being left in the coupler for 30 minutes. It will no longer appear as a USB device connected to the computer. If this occurs, remove it from the coupler and start the instructions to connect the logger to a computer or waterproof shuttle over again.

Calibrating the Logger with the Lab Calibration Tool

Use the Lab Calibration tool in HOBOWare when you need to calibrate the logger before deploying it or after replacing an expired sensor cap. The tool sets the gain and offset adjustment values for the logger by:

- Restoring logger calibration values to the factory defaults,
- Using your own gain and offset adjustment values, or
- Calculating the values with a three-step calibration procedure.

In the three-step procedure, the logger is first calibrated to 100% saturation by placing it in water-saturated air. Then, you can calibrate the logger to 0% saturation by placing it in sodium sulfite or another 0% oxygen environment (recommended if the logger will be deployed in water with DO levels of 4 mg/L or less).

IMPORTANT: Lab calibration only affects future launches; any data saved in the logger will be based on the previous calibration values. If the sensor cap is installed and it has not yet been initialized, you will be prompted to do so. Follow the instructions on the screen.

To complete these steps, you will need fresh water, the calibration boot and sponge supplied with the logger, and a source for current barometric pressure at your current location. You will also need sodium sulfite solution and a 7.6 cm (3 inch) beaker if you will be calibrating to 0% saturation.

The fresh water, logger, and sodium sulfite (if applicable) should be left out in the lab where the calibration is being done long enough so that they are at room temperature. If the logger was deployed previously, make sure the sensor is clean and dry (see *Maintenance* for more details). To use the Lab Calibration tool:

1. Connect the logger to the computer as described in the previous section. Stop the logger if it is currently logging or awaiting a coupler or delayed start.
2. From the Device menu, click Lab Calibration.
3. 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). Completing Steps 1 through 3 in the Lab Calibration tool will result in new gain and offset adjustment values based on the current logger conditions. Continue to the next section for details on how to complete these steps.

If you already know what the gain and offset values should be (for example, the values from a previous calibration that you want to use again) or want to return to the default factory values, click the “I know my values, skip to Finish” button. This will automatically move you to “Step 3: Finish” in the Lab Calibration window. Either click the “Reset to Factory Defaults” button or type in the desired gain adjustment and offset adjustment values and click the “Send Calibration to the Logger” button. **Note:** If you decide you do not need to change the calibration, click Close to cancel the calibration and revert back to the last saved logger values.

Step 1: 100% Saturation

1. In “Step 1: 100% Saturation” in the Lab Calibration window, enter the barometric pressure for your current location. If the barometric pressure reading has been adjusted for sea level (such as a reading taken from the National Weather Service weather station), select the “If using sea level barometric pressure, enter elevation” checkbox and enter your elevation in either meters or feet.
2. Make sure the logger either has the protective guard or the anti-fouling guard installed (whichever guard you plan to use in the deployment) so that the sensor is covered.
3. Wet the small sponge with fresh water. Squeeze out any excess water.
4. Place the sponge in the end of the calibration boot.
5. Insert the logger in the calibration boot so that there is approximately a 1 cm (0.5 inch) 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).
6. Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
7. Click the “Get DO value from the logger” button to display the 100% saturation results. You can click this button as often as needed. The results are updated each time you click the button. To check for equilibrium, click the “Get DO value from the logger” button several times in a row to check the current “DO Conc from logger at 100% Saturation” value. If the value remains the same or varies very little with each button click, then temperature equilibrium has likely been reached.
8. When you are satisfied with the results displaying in the “Step 1: 100% Saturation” tab, click the Next button to proceed to “Step 2: 0% Saturation.”

Step 2: 0% Saturation (optional)

If the logger will be deployed in water with DO levels greater than 4 mg/L, click the “Skip this Step” button. Otherwise, continue with the following procedure.

1. Make sure the logger either has the protective guard or the anti-fouling guard installed (whichever guard you plan to use in the deployment) so that the sensor is covered.
2. Pour the sodium sulfite into the beaker so that it is about two-thirds full.
3. 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 (1 inch) of the logger body are submerged in the beaker. Allow it to rest on the bottom of the beaker.
4. Wait for approximately 15 minutes until the logger reaches temperature equilibrium (and less than 30 minutes so the logger does not go to sleep).
5. Click the “Get DO value from the logger” button to display the 0% saturation results. As with the 100% calibration, you can click this button as often as needed. The results are automatically updated each time you click the button. If the value remains the same or varies very little with each

button click, then temperature equilibrium has likely been reached.

6. When you are satisfied with the results displaying in the “Step 2: 0% Saturation” tab, click the Next button to proceed to “Step 3: Finish.”

Step 3: Finish

The results from the first two steps are displayed as well as the overall calibration results and the new gain and offset adjustment values. If you are satisfied with the results, click the “Send Calibration to Logger” button. The logger will then be calibrated based on the new values. These values will not take effect until the logger is launched. If you do not want to save these values, click Close to cancel the calibration and revert back to the last saved logger values. Or, click “Reset to Factory Defaults” to return to the original values. If you performed Step 2, then remove the logger from the solution and thoroughly rinse it with fresh water to remove any excess sodium sulfite. See *Maintenance* for additional details on cleaning the logger.

Launching the Logger

After calibrating the logger, it needs to be launched to configure it before taking it to the field for deployment. Once launched, the logger will record two types of data: samples and events. Samples are the sensor measurements recorded at each logging interval. Events are independent occurrences triggered by a logger activity, such as Bad Battery or Host Connected. Events help you determine what was happening while the logger was logging. To launch the logger:

1. With the logger connected to the computer, open HOBOWare. From the Device menu, select Launch.
2. Select both the DO and Temperature channels to log. **Note:** HOBOWare provides the option of recording the current battery voltage at each logging interval, which is disabled by default. Recording battery life at each logging interval takes up memory and therefore reduces logging duration. It is recommended that you only record battery voltage for diagnostic purposes. Even with the channel disabled, a bad battery event will still be recorded.
3. Select a logging interval.
4. Choose when to start logging and click the Start button.
5. Remove the logger from the coupler and screw the communications cap back on the logger.

IMPORTANT: If this is the first launch with a new sensor cap, the sensor cap will expire six months (plus a one-month grace period) from the time of the first sensor reading. Two caps per year are required for year-round deployment.

Deploying the Logger

The logger is designed to be easy to deploy in many environments. Follow these guidelines when deploying it:

- Remove the calibration boot before deploying the logger.
- Make sure the logger is located where it will receive an unrestricted flow of the water being monitored to the sensor.

- Make sure the logger is fully submerged and not in direct sunlight to minimize temperature changes that are unrelated to water temperature.
- When deploying the logger in rivers, streams, and ponds, insert the logger in a PVC or ABS pipe for protection from debris (if possible). The pipe should have enough holes to ensure good circulation of water to the sensor.
- If possible, position the logger so the sensor face is oriented vertically. After deploying in the water, move the logger around slightly to eliminate any bubbles that may have formed.
- Do not deploy the logger in freezing water with moving ice where the logger could be crushed.
- Use the optional anti-fouling guard to protect against fouling. Unscrew the protective guard and replace it with the anti-fouling guard.
- If fouling is expected during deployment, use field calibration readings from both the beginning and end of the deployment as described in the next section. These readings can then be entered into the HOBOWare Dissolved Oxygen Assistant to compensate for any measurement drift due to fouling. Scrub fouling off the logger with a plastic bristle brush.
- When deploying the logger in saltwater, you will need a conductivity value to enter in the Dissolved Oxygen Assistant that adjusts the data from the logger for salinity. If the salinity is constant through the deployment, you will need a single salinity reading from either a conductivity meter or salinometer. However, if the conductivity changes, then you will need a data file with salinity or specific conductivity readings for the entire deployment. Consider deploying a HOBO Conductivity logger (U24-002) next to this DO logger to use the resulting data file for salinity data.
- To generate a percent saturation series, you will need to deploy a barometric pressure logger (such as a HOBO Water Level Logger, U20-001-0x) or have access to a nearby weather station to gather barometric pressure data. This data is necessary for the Dissolved Oxygen Assistant to calculate percent saturation.

Taking Field Calibration Readings

If fouling is expected during the deployment, you can take calibration readings at the beginning and end of the deployment to enter in the Dissolved Oxygen Assistant. This will adjust the data from the logger to compensate for any measurement drift due to fouling. There are two methods for taking field calibration readings: the first method involves taking readings using a dissolved oxygen meter or titration while the second method involves calibrating the logger in 100% water-saturated air. The first method is recommended because it is quicker to get the necessary calibration readings; the second method can take 40 minutes or more to achieve equilibrium with temperature extremes.

To Take Calibration Readings Using a DO Meter or Titration:

1. The logger must be logging. Take a DO measurement of the water where the logger is being deployed using either a DO meter or by titration. If using a meter, make sure it is calibrated and allow time for the meter probe to stabilize (this will occur when three meter measurements taken in a row are within your accuracy tolerance).
2. Record the reading, date, and time of the measurement in a field notebook.
3. At the end of the deployment, repeat steps 1 and 2.

To Take Calibration Readings Using 100% Water-Saturated Air:

1. The logger must be logging. You will need fresh water, the included calibration boot and sponge, and the current barometric pressure from a HOBO U20 Water Level logger, a barometer, or a nearby weather station.
2. If the logger has been in salt water, clean the logger body and sensor cap as described in the *Maintenance* section. Make sure the sensor cap is dry before continuing.
3. Make sure the protective guard or anti-fouling guard is installed on the logger.
4. Wet the small sponge with fresh water. Squeeze out any excess water.
5. Place the sponge in the end of the calibration boot.
6. Insert the logger in the calibration boot so that there is approximately a 1 cm (0.5 inch) 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).
7. Allow at least 40 minutes for the logger to reach temperature equilibrium, and then write down the date and time in a field notebook.
8. Write down the barometric pressure at that time (note the elevation if the barometric reading has been adjusted for sea level).
9. Repeat these steps at the end of the deployment.

Reading Out the Logger and Redeploying

Your readout and maintenance schedule will be determined by the amount of fouling at the site. To read out the logger in the field:

1. Take a field calibration reading as described in the *Taking Field Calibration Readings* section.
2. If the logger was in saltwater and you did not deploy a HOBO Conductivity Logger, then use a conductivity meter or salinometer to take a conductivity reading. Write down the reading and the date and time.

3. Remove the logger from the water and read out the data from the logger using a shuttle or computer with a base station.
4. If you are deploying it again, clean the sensor (see *Maintenance* for details).
5. Check the expiration date for your cap and make sure it will not expire before the end of your deployment. Replace it if needed.
6. Relaunch the logger if it is not already logging.
7. Take another field calibration reading after the logger is cleaned.
8. Redeploy the logger.

Using the HOB0ware Dissolved Oxygen Assistant

Use the Dissolved Oxygen Assistant to obtain accurate Dissolved Oxygen readings if the logger was deployed in a saltwater environment or if percent saturation is required. Also use this assistant if you took field calibration readings. The Dissolved Oxygen Assistant is only available in HOB0ware from the Plot Setup window when you open a file from this logger. To use the assistant:

1. Offload the most recent data files from the shuttle or logger to your computer.
2. Open a data file in HOB0ware.
3. In the Plot Setup window, select the Dissolved Oxygen Assistant and click Process.
4. In the Dissolved Oxygen Assistant window, enter the salinity, barometric pressure, and field calibration information as needed. Click the Help button in the Dissolved Oxygen Assistant for more details and to learn about the ranges of input data allowed.
5. Plot the data and save it as a project file.

Maintenance

To clean the sensor cap:

1. Remove the protective guard or anti-fouling guard, but leave the sensor cap on the sensor.
2. Rinse the logger with clean water from a squirt bottle or spray bottle.
3. Gently wipe the cap with a soft-bristled brush (such as a toothbrush) or soft cloth if biofouling is present. Use Alconox® to remove grease.
4. If extensive debris or mineral build-up is present, soak the cap end in vinegar for 15 minutes, then soak it in deionized (DI) water for another 15 minutes.
5. If the logger is being immediately redeployed with the same sensor cap, a field calibration is adequate. If a new sensor cap is being installed, a lab calibration with HOB0ware is recommended. When storing the logger between

deployments, keep it in the calibration boot (wet the small sponge with fresh water, place the sponge in the end of the calibration boot, and then insert the logger in the boot.)



WARNING: Do not use organic solvents; they will damage the sensor. Do not remove the sensor cap from the sensor prior to cleaning with a brush. Only clean the sensor when you replace the sensor cap. See the full instructions that ship with the replacement sensor cap. Do not wet the sensor optical lens area with water or any solution. Remove the cap and gently wipe the window with a soft cloth.

To clean the logger body:

1. Make sure the sensor cap is installed on the logger.
2. Gently scrub the logger body with a plastic bristle brush or nylon dish scrubber.
3. Use Alconox® to remove grease.
4. Soak in vinegar to remove mineral deposits.
5. Rinse the logger with deionized (DI) water.

Battery Guidelines

The battery life of the logger should be three years or more. Actual battery life is a function of the number of deployments, logging interval, and operation/storage temperature of the logger. Frequent deployments with fast logging intervals, continuous storage/operation at temperatures above 35°C (95°), and keeping the logger connected to the coupler will result in significantly lower battery life. For example, the battery may last less than a year with a 1-minute logging interval. To obtain a three-year battery life, a logging interval of five minutes or greater should be used and the logger should be operated and stored at temperatures between 0° and 25°C (32° and 77°F).

The logger can report and log its battery voltage. If the battery falls below 3.2 V, the logger will record a “bad battery” event in the datafile. The logger will record a second “bad battery” event and stop logging when the battery falls below 3.1 V. If the datafile contains “bad battery” events, the logger should be returned to Onset for battery replacement. Note the logger does not have to be recording the battery channel for it to detect bad battery events. The logger will record these events regardless of what channels are logged. To have your logger’s battery replaced, contact Onset or your place of purchase for return arrangements. Do not attempt to replace the battery yourself. Severe damage to the logger will result if the case is opened without special tools, and the warranty will be voided.



WARNING: Do not cut open, incinerate, heat above 100°C (212°F), or recharge the lithium battery. The battery may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery case. Do not dispose of the logger or battery in fire. Do not expose the contents of the battery to water. Dispose of the battery according to local regulations for lithium batteries.

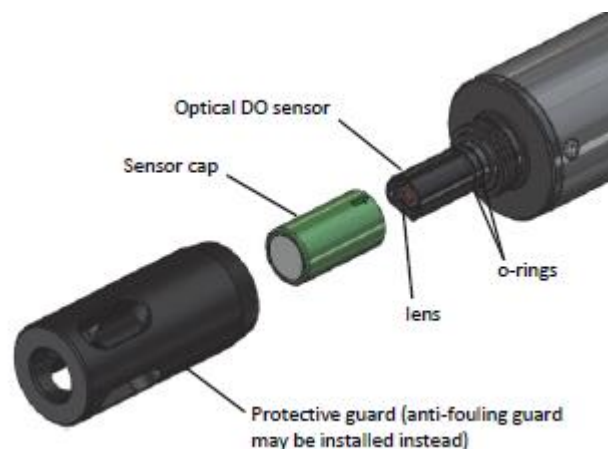
Optic DO Sensor Cap Replacement

RDO® Basic Sensor Replacement Kit (U26-RDOB-1) for HOBO® Dissolved Oxygen Loggers (U26-001)

Items included: Sensor cap, 2 o-rings, lubricant, lens wipe

Important: Install the cap only when ready to use. Avoid allowing moisture, including atmospheric humidity, inside the cap. Keep the cap in its sealed canister until you are ready to install it. Once installed, the sensor cap will expire seven months after it is initialized, which occurs automatically if the logger is currently logging. If it is not logging, you can initialize it the next time you launch the logger, check the status, or use the Lab Calibration tool in HOBOWare®.

1. Clean the logger to remove major biofouling. With the old sensor cap on, gently scrub logger body with a soft-bristled brush or nylon dish scrubber. Use Alconox® to remove grease. Soak in vinegar to remove mineral deposits. Rinse with deionized (DI) water.
2. Unscrew the protective guard or anti-fouling guard from the logger.
3. Pull the used sensor cap off the sensor without twisting.
4. Remove existing o-rings from the base of the optical DO sensor body.
5. Use the included lint-free cloth to remove any moisture from the optical DO sensor. **Note:** Make sure the o-ring grooves are dry. Avoid touching or cleaning the lens with anything other than the supplied lens wipe.
6. Use your finger to apply a thin layer of lubricant on the o-rings. Place the o-rings on the sensor. **Note:** Do not transfer lubricant to the lens or sensor pins (on the flat side of sensor).
7. Clean the lens on the sensor with the wipe provided in the kit; allow it to dry thoroughly. Inspect for scratches or dirt.
8. Remove the new cap from its sealed canister.
9. With the flat part of the sensor pointing down and 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. Make sure that the o-rings are not pinched or rolled between the cap and the sensor.
10. Screw the protective guard or anti-fouling guard back on the logger.
11. Use the HOBOWare Lab Calibration tool to calibrate the logger with the new cap (see the HOBO Dissolved Oxygen Logger Manual or the HOBOWare help for details). Or, perform a field calibration as described in the HOBO Dissolved Oxygen Logger Manual.



HOBO® Waterproof Shuttle (U-DTW-1) Manual



The HOBO Waterproof Shuttle performs several major functions:

- Reads out all logger information (serial number, deployment number, data, etc.) from loggers in the field for transfer to host computer, and stores each logger's data in a "bank"
- Nonvolatile memory preserves data, even if batteries are depleted
- Relaunches the logger, resetting the logger's time to the shuttle's time and synchronizing the logging interval on relaunch
- Can be used as an optic-to-USB base station
- Can be used to read out and relaunch loggers underwater

Although the HOBO Waterproof Shuttle is easy to use, Onset strongly recommends that you spend a few minutes reading this manual and trying out the procedures described here before taking the shuttle into the field.

HOBO Waterproof Shuttle

U-DTW-1

Included Items:

- USB cable
- Set of couplers;
 - For UA Pendant (COUPLER2-A)
 - For U20 Water Level (COUPLER2-B)
 - For U20L Water Level, U22 Water Temp Pro v2, U24 Conductivity, and U26 DO (COUPLER2-C)
 - For UTBI Tidbit v2 (COUPLER2-D)
 - For U23 HOBO Pro v2 (COUPLER2-E)

Required Items:

- HOBOWare Pro 2.2 or later
- Compatible logger and matching coupler

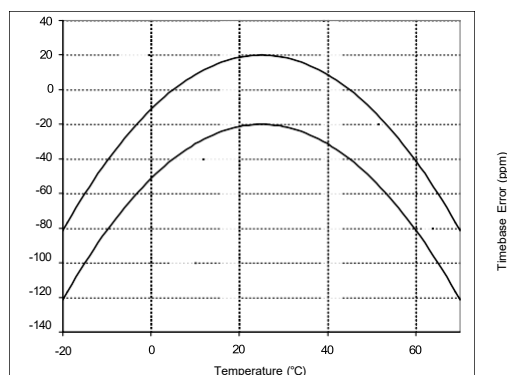
Important: Remove the batteries from the shuttle if it will be out of service for more than a month at a time to prevent the batteries from leaking and damaging the shuttle. Reinstall them just before you begin using the shuttle again as described in *Replacing the Shuttle's Batteries*.

Specifications

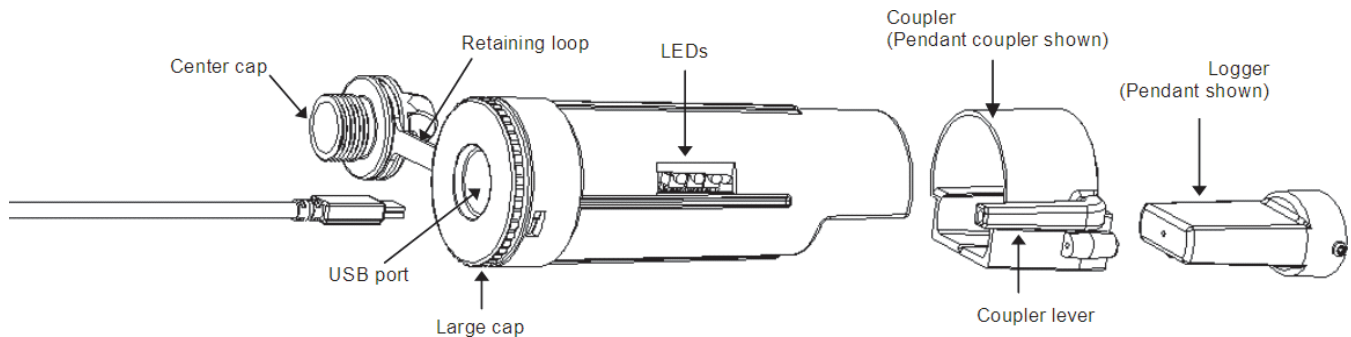
Compatibility	All HOBO U-Series loggers with optic USB. Not compatible with the HOBO U-Shuttle (U-DT-1).
Data Capacity	63 logger readouts of up to 64K each
Operating Temperature	0° to 50°C (32° to 122°F)
Storage Temperature	-20° to 50°C (-4° to 122°F)
Wetted Materials	Polycarbonate case, EPDM o-rings and retaining loop
Waterproof	To 20 m (66 feet)
Time Accuracy	±1 minute per month at 25°C (77°F); see Plot A
Logger-to-Shuttle Transfer Speed	Reads out one full 64K logger in about 30 seconds
Shuttle-to-Host Transfer Speed	Full shuttle offload (4 MB) to host computer in 10 to 20 minutes, depending on computer
Batteries	2 AA alkaline batteries required for remote operation
Battery Life	One year or at least 50 complete memory fills, typical use
Weight	150 g (4 oz)
Dimensions	15.2 x 4.8 cm (6.0 x 1.9 inches)



The CE Marking identifies this product as complying with all relevant directives in the European Union (EU). To maintain CE compliance, this product must be used with the supplied USB cable or equivalent (less than 3 m long).



HOBOWare Waterproof Shuttle Features



Preparing to Go on Location

Before using the shuttle for the first time, you must launch it with HOBOWare Pro 2.2 or greater. You must also launch any compatible loggers that were last launched with an earlier version of HOBOWare Pro, or have never been launched at all.

1. Use HOBOWare Pro 2.2 or greater to launch each logger you wish to read out and relaunch with the shuttle later. (Read "Using the shuttle as a base station" for instructions if you do not have another base station for the loggers.) The shuttle cannot relaunch loggers that were last launched with an earlier version of HOBOWare Pro. (You only have to do this once for each logger.)
2. Plug the large end of a USB interface cable into a USB port on the computer. (Avoid using a USB hub, if possible.)
3. Unscrew the center cap on the shuttle. If the cap is too tight to loosen by hand, insert a screwdriver through the lanyard hole and rotate counterclockwise until the cap is loosened.
4. Plug the small end of the USB interface cable into the USB port in the shuttle. (If the shuttle has never been connected to the computer before, it may take a few seconds for the new hardware to be detected.)
5. Follow the instructions in the *HOBOWare User's Guide* to access the **Manage Shuttle** dialog. Make sure the battery level is good and change the batteries now if they are weak.

Important: If you change or remove the batteries, the shuttle's clock will stop, and the shuttle will not read out loggers again until you relaunch it in HOBOWare.

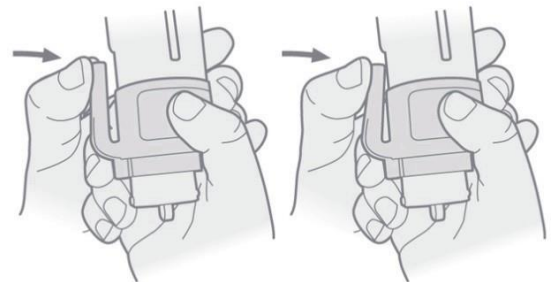
6. If you are using the shuttle for the first time, launch the shuttle as described in the *HOBOWare User's Guide*. Launching synchronizes the shuttle's clock to the host computer and initializes the shuttle's header.
7. If you have used the shuttle before, make sure there are enough banks available to accommodate the loggers you plan to read out.
8. Disconnect the USB cable from the shuttle and replace the center cap securely.

Important: The shuttle's clock is used to set the logger's clock at relaunch. For most accurate results, make sure the host computer's clock is correct before launching the shuttle. If you need to adjust the computer's clock, quit HOBOWare, set the computer's clock, then reopen HOBOWare and launch the shuttle.

Reading Out and Relaunching Loggers in the Field

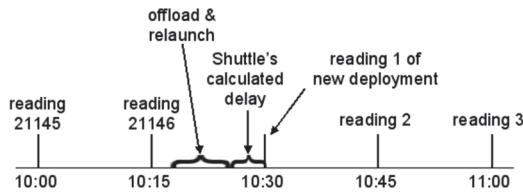
After you have ensured that the shuttle's batteries are good, there is sufficient memory available, and the shuttle's clock is synchronized, follow these steps to read out and relaunch a logger in the field:

1. Make sure the shuttle's large cap and center cap are closed securely. Tighten the center cap until it is just flush with the large cap, or until the O-ring is no longer visible.
2. Make sure the communication end of the shuttle is clean. Attach the correct coupler for the logger, and ensure that it is seated properly.
3. Insert the logger into the coupler, following the instructions that came with the coupler.



4. Momentarily press the coupler lever (pressing hard enough so the lever bends). Readout should begin immediately. The amber LED blinks continuously while readout and relaunch are in progress. Do not remove the logger when the amber LED is blinking.
5. After reading out the logger, the shuttle synchronizes the logger's clock to the shuttle's internal clock and relaunches the logger, using the description, channels to log, logging interval, and other settings that are already in the logger. (If the logger was launched with multiple logging intervals, the final defined logging interval will be used.) The logger is

launched with a slight delay that causes its readings to be synchronized with those of the previous deployment, as shown in the following diagram.



Important: If the logger was launched with multiple logging intervals, there will be no synchronizing delay. The logger will start immediately with the last defined logging interval.

6. When the relaunch has completed, the green LED blinks for 15 minutes, or until you momentarily press the coupler lever to stop it (press hard enough so the lever bends). If the red LED blinks instead, there was an error, and the logger may have stopped. Refer to "Troubleshooting" in this manual for details.
7. Remove the logger from the coupler.

Checking Shuttle Status in the Field

The shuttle's memory has 63 "banks." One logger readout can be stored in each bank. To check the shuttle's memory and batteries in the field, remove the logger and press the coupler's lever for at least three seconds (pressing hard enough so the lever bends). When you release the lever, the green LED blinks once for each unoccupied bank in the shuttle's memory. (Press the lever momentarily to stop the blinking, pressing hard enough so the lever bends.)

If the shuttle's batteries are running low, all of the shuttle banks are full, or the clock has not been set, the red LED blinks. (Press the lever momentarily to stop the blinking, pressing hard enough so the lever bends) Use HOBOWare to check the shuttle's battery level, available memory, and clock. You may need to change the batteries or offload the datafiles to the host computer and delete them from the shuttle to free up memory before you can continue reading out loggers.

Offloading Data to the Host Computer

You can offload the data stored in the shuttle even when the batteries are depleted. Take the following steps:

1. Connect the shuttle to a host computer running HOBOWare.
2. Follow the instructions in the *HOBOWare User's Guide* to offload the new datafiles or access the **Manage Shuttle** dialog. The **Manage Shuttle** dialog shows you how many banks are occupied, and whether they have already been offloaded and saved to the host computer.
3. Offload and save data from the banks of your choice. Refer to the *HOBOWare User's Guide* for details on saving datafiles offloaded from the shuttle.

4. Review the list of banks and delete any that are no longer needed. Make sure the battery level is good, and change the batteries now if they are weak. (If you change the batteries in the field, the shuttle's clock will stop, and the shuttle will not read out loggers.) Update the shuttle's clock, if necessary.
5. When finished, disconnect the shuttle from the computer and close the center cap securely.

Using the Shuttle as a Base Station

You can use the shuttle as a base station for any U-Series logger with an optic USB interface. (This function is available even when the batteries are depleted.) To use the shuttle as a base station:

1. Connect the shuttle to the host computer running HOBOWare.
2. Attach a compatible logger and coupler.
3. Momentarily press the coupler's lever (pressing hard enough so the lever bends).
4. The amber LED blinks momentarily, then the green LED should glow steadily to indicate that the logger is ready to communicate with HOBOWare. (If the red LED blinks instead, the logger was not found. Make sure the logger and coupler are aligned and seated properly, and that there is no dirt or strong sunlight interfering with communications.)

Important: The Waterproof Shuttle cannot be used as a base station with Pendant logger models UA-001 and UA-003 (including rain gauges RG3 and RG3-M) with serial numbers less than 988278. These loggers require a BASE-U-1 for communication with the host computer.

5. When finished, remove the logger from the coupler. The green LED stops glowing when you disconnect the logger or the USB cable.

Indicator Lights

Green "OK" LED

The green "OK" LED blinks when HOBOWare recognizes it as a base station; when it finishes reading out and relaunching a logger; and when you press the coupler lever to check the shuttle's status (see "Checking shuttle status in the field" for details). Momentarily press the coupler lever to stop the blinking (pressing hard enough so the lever bends).

The green LED glows steadily when the shuttle is being used as a base station.

Amber "Transfer" LED: The amber "Transfer" LED blinks when the shuttle is reading out a logger and relaunching it. Do not remove the logger when the Transfer light is lit.

Red "Fail" LED: The red "Fail" LED blinks whenever the shuttle encounters an error condition. Refer to "Troubleshooting" for details.

All LEDs: All LEDs blink in unison when the shuttle has just been powered up, either by installing fresh batteries or (if batteries are not installed) by connecting to the computer's USB port.

Troubleshooting

This section describes problems you may encounter while using the shuttle.

Shuttle is not recognized by host computer

If HOBOWare does not recognize the shuttle when you connect it to the computer, simply disconnect and reconnect the shuttle.

Red “Fail” LED blinks

The red “Fail” LED blinks (for 15 minutes, or until you press the coupler lever, pressing hard enough so the lever bends) whenever the shuttle encounters an error. There are several conditions that might cause an error:

- **Shuttle is full:** If the red LED blinks when you try to read out a logger, check whether all of the banks are full, as described in “Checking shuttle status in the field.” Or, use HOBOWare to check the shuttle’s memory.
- **Shuttle batteries are low:** If you cannot read out any loggers at all, check the logger’s status, as described in “Checking shuttle status in the field,” or use HOBOWare to check the shuttle’s batteries. The batteries may simply need to be replaced.
- **Compatibility:** The shuttle cannot read out or relaunch loggers that were last launched from HOBOWare Pro prior to version 2.2. You will need to read out these loggers on the host computer and relaunch them in HOBOWare Pro 2.2 or greater before you can use them with the shuttle.
- **Shuttle clock is not set:** The shuttle has experienced a power failure that caused the clock to reset. You must use HOBOWare to offload the files that are already on the shuttle, then relaunch the shuttle before you can read out another logger.
- **Can’t communicate with logger:** Remove the logger and coupler. Inspect them and the shuttle to ensure that all are free of dirt that could block the optic communication sensor. Carefully reassemble the shuttle, coupler, and logger, and make sure they are all seated properly. Shield the shuttle from strong sunlight, if applicable, which can interfere with optic communications.
- **Other logger problems:** If you can read out some loggers but not others, or if you cannot read out any loggers even with fresh batteries in the shuttle, check the loggers in HOBOWare. Make sure their batteries are at acceptable levels and that there is no “corrupted header” message.

Amber “Transfer” LED stays on without blinking

The amber light is magnetically activated when you press the coupler lever. If it glows steadily at any other time, the magnet in the lever may be too close to the magnetic switch in the shuttle, or another strong magnet

may be present. Try bending the lever away from the coupler to reduce the magnet’s effect.

LEDs do not function

If the LEDs are not functioning at all, the batteries may be completely exhausted. To test this, attach the shuttle to the host computer and check the battery level. The shuttle should be able to communicate with the host computer, blink its LEDs normally, and perform as a base station even when the batteries are missing or depleted.

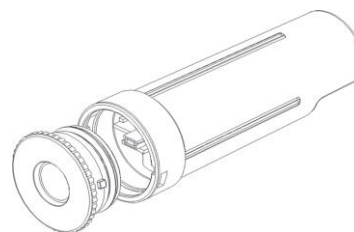
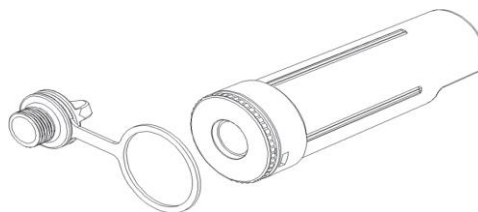
Replacing the Shuttle’s Batteries

The shuttle’s batteries should last about one year or at least 50 complete memory fills in typical conditions. When the shuttle’s batteries run low (2.2 V or less), any logger data that is already in the shuttle will remain safe, but the shuttle will not read out another logger until its batteries are replaced.

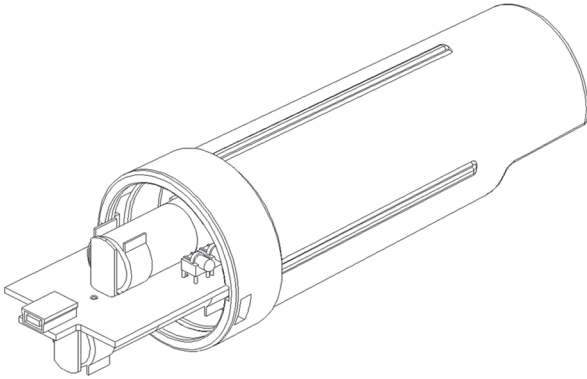
To avoid battery problems, always check the shuttle’s batteries in HOBOWare before going into the field, and replace them if needed. In addition, remove the batteries if the shuttle will be out of service for more than a month at a time to prevent the batteries from leaking and damaging the shuttle. Reinstall them and relaunch the shuttle just before you begin using it again.

To change the shuttle’s batteries:

1. Work over a clean surface to provide a safe platform for the disassembly.
2. Unscrew the center cap on the shuttle. If the cap is too tight to loosen by hand, insert a screwdriver through the lanyard hole and rotate counterclockwise until the cap is loosened.
3. Use the center cap to help you carefully pull the rubber loop free of the large cap. The large cap cannot be removed while the rubber loop is in place.
4. Turn the large cap counter-clockwise slightly, then pull it off.



5. Turn the shuttle over and tap it gently. The circuit board should slide into your hand.



6. Remove the old batteries and install two new ones in the correct orientation. Both batteries should be turned the same way, with their positive ends facing the USB port on the board. (When the second battery makes contact, all of the shuttle's LEDs will blink in unison.) It is recommended that you replace the desiccant (DESICCANT2) when replacing the batteries.
7. Put the board back into the case, taking care not to bend the communication LEDs. Align the circuit board with the runners in the case. The USB port should face the open end of the shuttle, and the LEDs should show through the window on the label.
8. Close the shuttle's case. Line up the tabs on the large cap with the slots on the case, press gently, and turn slightly clockwise until the large cap is closed securely.
9. Replace the rubber loop and center cap. Tighten the center cap until it is just flush with the large cap, or until the O-ring is no longer visible.
10. Using HOBOWare, offload any datafiles that are on the shuttle and launch the shuttle before going into the field again. The shuttle will not read out and relaunch loggers until the clock has been synchronized.



WARNING: Do not install batteries backwards, recharge, put in fire, expose to extreme heat, or mix with other battery types, as the batteries may explode or leak. Contents of an open or leaking battery can cause chemical burn injuries.
Replace all used batteries at the same time. Recycle or dispose of batteries according to applicable federal, state, and local regulations.