



## Standard Operating Procedure

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

**Procedure Owners:**

**Date:**

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**Approved By:**

**Date:**

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## 1 Purpose

The purpose of this SOP is to provide concise guidance and methodology for maintaining the Aqua Troll 600 data sonde(s) on a monthly basis to accurately collect temperature, salinity, pH, dissolved oxygen (DO), and chlorophyll-a data to characterize site water quality.

## 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 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](mailto:barry.smith@noaa.gov)).

## 5 Reagents/Media

1. Bottle of distilled water (1 L) for rinsing sonde and probes.
2. In-Situ [pH filling solution](#) for replacing fluid inside pH sensor (SKU 0056900).  
Stored in the Garage with LISS field supplies.
3. In-Situ [Quick Cal solution](#) for calibrating pH sensor (SKU 0033250). Stored in the fridge in Building 1 Rm 29. Refer to note under Section 8 (Quality Control).

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## 6 Supplies/Equipment

1. Field Tablet (containing VuSitu app).
2. Robust zip-ties (e.g., 24 inch) for securing the sonde to the PVC housing at subtidal sites.
3.  $\frac{15}{16}$  inch socket wrench
4.  $\frac{15}{16}$  inch open-end wrench
5. Adjustable wrench
6. Sonde supply box
  - a. High vacuum grease
  - b. RDO sensor Calibration sponges
  - c. Extra pins and bolts for housing
  - d. Desiccant tube
  - e. Screw drivers
  - f. Hex driver
  - g. Allen key
  - h. Sonde wipers (Aqua Troll part #0078940)
  - i. Alcohol pads
  - j. D batteries (minimum of 2, Energizer or Duracell only).
  - k. Paper towels (for collecting discarded pH filling solution).
  - l. Q-tips or cotton buds
7. Bottle with fresh water for cleaning sonde
8. Towel / cloth for wiping things down.
9. Dish scrubbing pad
10. Scrub brush
11. Shucking knife
12. 500 mL empty container with sealable top
13. First aid kit
14. Hand sanitizer
15. Wire cutters
16. Gray floating tray

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## 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 and sensors will be calibrated when necessary.

## 8 Preparation (At the lab)

1. Restock the servicing tools and supplies in the gray floating tray, specifically in the servicing kit (clear container with black snap locks, [Appendix A](#)).
2. Ensure that all SOPs and field notebooks are available offline on the field tablet.
  - a. Monthly Sonde Maintenance (this SOP)
  - b. [Monthly HOBO Maintenance](#)
  - c. [Water Sampling and Chemistry](#)
  - d. [Sonde Sensor Calibration](#)
  - e. [Sonde Field Notebook](#)
  - f. [Site specific field notebook](#)
3. Ensure that the field tablet is fully charged.



In-Situ Aqua TROLL 600 Multiparameter Sonde

Figure 1: Anatomy of the Aqua Troll 600.

## 9 Procedures

1. Removing sonde from housing
  - a. Intertidal sites
    - i. Obtain the gray tray that has all appropriate tools for servicing the data sonde (see [Appendix A](#)).

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- ii. Attach the gray tray to self using the string and clip so that the tray does not drift away with the current. (Figure 2)
- iii. Wade to data sonde housing with the tray.
- iv. Using a socket wrench and pliers, unscrew the stainless steel security bolt that passes through the exposed top end of the PVC housing.
- v. *Place the screw and bolt in the gray tray immediately so you don't lose it.*
- vi. Unscrew and remove the PVC cap using the tongue and groove pliers if necessary.
- vii. The cap is attached to a clear tether (fishing line) that is linked to the sonde. Pull the tether to lift the sonde out of the PVC housing. Place the sonde and cap into the gray tray.
- viii. Servicing can be done directly at the sonde or by returning to shore depending on time, tide height, and weather conditions. (Figure 3)



Figure 2. Gray tray tethered to self.

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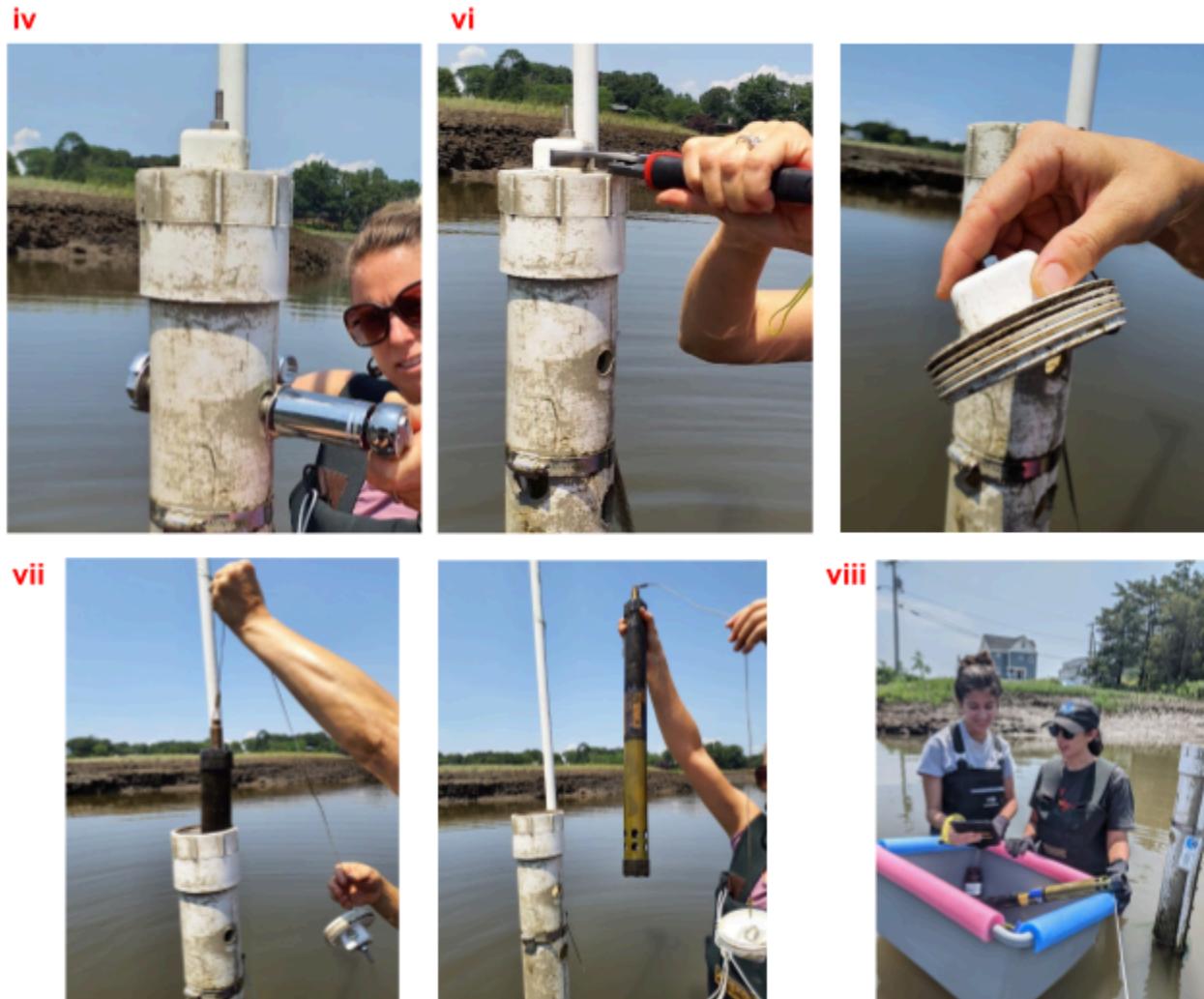


Figure 3. Demonstration of removing sonde at intertidal sites from PVC housing. Red roman numerals are following the specific steps in the text above.

- b. Subtidal sites
  - i. *Laurel Hollow*: The data sonde is attached to the mushroom anchor (marked by a NOAA buoy). Divers will need to:
    1. Unclip the parachute cord that loops from the top of the data sonde around the shank of the anchor.

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2. Use wire cutters to cut a zip-tie that secures the data sonde to the PVC housing (the one that passes through the vent holes of the PVC housing, not the zip-ties holding the PVC housing to the anchor itself).
3. Remove the data sonde from the PVC housing (it also has a HOBO data logger attached near its top end).
4. Return the sonde + HOBO to the support boat or shore party.

ii. *Gold Star Beach:*

1. **Access Cornell Extension's FLUPSY (first left on the town dock; gate combination = 2+4 together, then 3).**
2. The data sonde is deployed on a 25 pound mushroom anchor from inside a locked hatch on the floating dock.
3. Obtain the key to the floating dock. Demetrios Caroussos has the key (if there, he will open it; otherwise, make arrangements for him to leave the key in advance: email dc2233@cornell.edu, cell 631-418-6570).
4. Pull up the 25 pound mushroom anchor from the seabed and place it on the dock.
5. Unclip the line that attaches the top end of the sonde to the anchor.
6. Cut the zip-tie that holds the sonde inside the PVC housing (not the ones attaching the PVC housing to the anchor).
7. Remove the data sonde from the PVC housing.

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Figure 4: Map showing approximate location of all gear deployments at Gold Star. Inset shows an image of the sonde housing secured to the mushroom anchor.

2. Remove any accumulated fouling organisms from the exterior of the sonde before proceeding. Use the dish scrubbing sponge or bristle brush. Barnacles may need to be removed with a shucking knife.
3. Downloading data
  - a. Log into the Samsung tablet .
  - b. Invert the data sonde so the sensors are facing upwards (the blue screen of the data sonde should illuminate and initiate bluetooth connectivity). (Figure 4). Once connected, the sonde can be back in the upright position to ensure no damage to probes.
  - c. Open the VuSitu app and click the sonde it detects (each sonde has a unique serial number which is logged in the [downloaded data](#), in addition to any location information provided during setup).
  - d. Once connected, click *Logging*.
  - e. On the next screen, click *Download*. Choose the option to download 'only new data".

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f. Downloading takes a few minutes (~5-10 min). During this time, clean the probes and area around them of any fouling (see section 4 'Cleaning probes')

g. Once the data has been downloaded, a screen of the last 5 readings will appear. Take note of the most recent readings for temperature, salinity and pH in the field notebook (needed for discrete [water chemistry samples](#)). **Pay attention to the values in the event that drift occurs.**

**Sensors may need calibration:**

i. The pH sensor should be calibrated every 10-12 weeks or if drift occurs. See [Sonde Calibration SOP](#) for specific instructions.

ii. RDO sensors should be calibrated every 12 months. See [Sonde Calibration SOP](#) for specific instructions.

iii. Conductivity, Temperature and Chlorophyll-a sensors should be calibrated every 12 months. (this is factory calibration that requires sending the sondes in for servicing)

h. Then, Click Save As. Save the data to the shared drive (shortcut to *Data\_Sondes* folder; full path: *Project Planning / Data Management / Field Data / Data\_Sondes / Sonde Data / Site specific folder*).

i. Rename file as MMYY SITE\_Sonde where MMYY corresponds to the month and year of the download date.

i. Once completed, return to the home screen (back out of the *Logging* screen using the top left arrow).

j. The homescreen should indicate that the logging session is still in progress (logging is paused during data download, but it restarts automatically once the download procedure has been completed).

k. If you've finished working with the sonde, click *Disconnect*.

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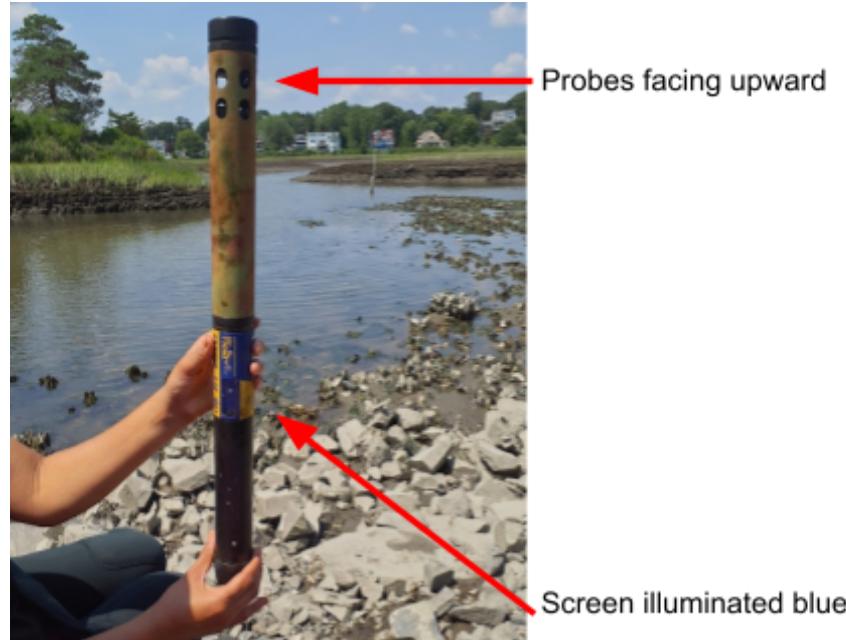


Figure 5. Inversion of the Sonde to initiate bluetooth connection.

**4. Cleaning probes**

- a. Remove the copper guard from the sonde by twisting counterclockwise. Gently lift over the probes avoiding disturbing the wiper. (Figure 6)



Figure 6. Copper guard removed from sonde to expose sensors.

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- b. Place the copper guard and sonde in the gray float tray.
- c. Assess the biofouling on the wiper. If the fouling is significantly covering the wiper and is difficult to remove, replace the wiper with a new one.
  - i. Using the thin screwdriver (in the sonde supply box), unscrew the wiper from the wiper poll. The screw is very small and is in the bottom corner adjacent to the wiper poll. If fouling is covering the screw, **gently** remove fouling from that area using a shucking knife. *Be sure to never touch the probe sensors with the shucking knife to avoid damage.*
  - ii. Gently lift the wiper up and off of the wiper poll and discard into the gray tray.
  - iii. Obtain new wiper and slide into place. Secure by screwing the small screw back into place.
- d. Using Q-tips gently remove fouling from the sensors. Rinse periodically with water as needed.
  - i. *The pH sensor should not be directly touched using the Q-tips. Only clean the area around the sensor.*
  - ii. Conductivity, Temperature, Chlorophyll-a, and RDO can be **gently** wiped using the Q-tip and water. (Figure 7)

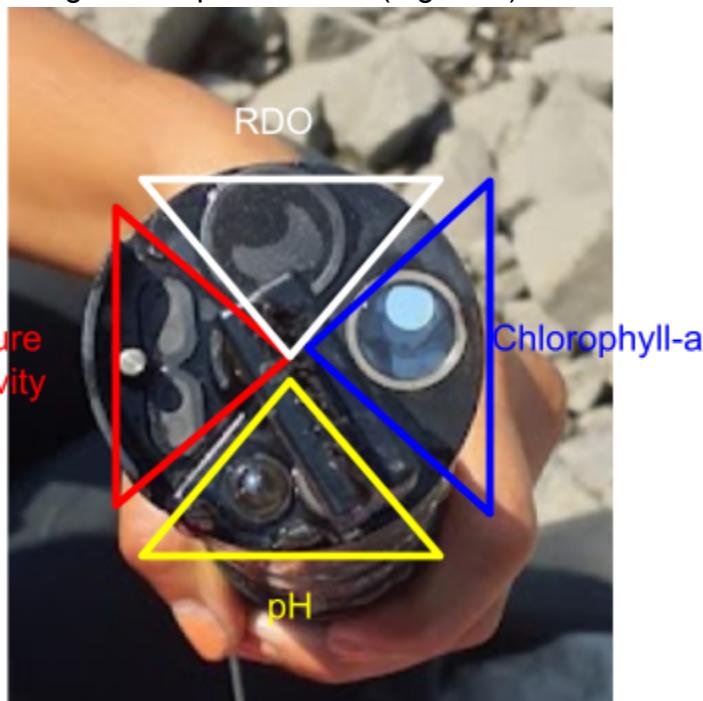


Figure 7: Identification of sensors on the sonde.

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- e. If there are calcified organisms in crevices, use the shucking knife or Hex screwdriver to remove. ***Do not use these tools to remove calcified animals directly on sensor screens. (see Appendix B for removing calcified materials)***
  - i. In the event that calcified organisms are present directly on the sensors, decalcification will need to occur in the lab. Follow the instructions in the [Sonde Deployment SOP](#) to store the sonde for transport back to the lab. If a backup sonde is available in the field kit, follow the Sonde Deployment SOP instructions to set-up and deploy the replacement sonde.
- f. Once sensors are clean, remove fouling from the inside of the copper guard and gently twist back onto the sonde clockwise in the data logging position (holes near probes/sensors).
- 5. Battery Change (Figure 8)
  - a. ***If the sonde battery level is less than 50%, change the batteries. Duracell or Energizer name brands preferred (recommended by InSitu).***
  - b. First ensure that the data has been downloaded from the current logging session (as described above in section 9.3 Downloading data). Stay connected to the VuSitu app.
  - c. End the current logging session (click *Logging*, then *More*, then *Stop*).
  - d. Return to the app main screen, then click *Disconnect* to disconnect the sonde from the tablet.
  - e. Dry the sonde with a towel or cloth. Unscrew the battery compartment (black part of the sonde). It unscrews at the joint between the middle screen section of the sonde and the black top section.
  - f. Remove the two installed D batteries and replace them with two new ones. Put the old batteries in the dry box with servicing tools. New batteries are in a ziplock bag. Keep old batteries and new batteries separated.
  - g. Check the small desiccant capsule inside the battery compartment and replace it if pink, as follows:
    - i. Use an Allen wrench to remove and check the desiccant compartment/color (Figure 9).
    - ii. If the present desiccant is pink, that is the indicator that it needs to be replaced.

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- iii. Snap a new desiccant pill into the compartment if color indicates replacement is needed.
- h. Clean and dry the O-rings of the battery compartment.
- i. Apply a thin layer of vacuum grease over the surface of the O-rings (tubes of grease are in the red box).
- j. Screw the sonde back together to seal the battery compartment. *There will be a distinctive click when it is screwed on fully.* If the sonde's blue screen displays any prompts, complete those steps.
- k. ***Ensure that a logging session has been activated (shown in app home screen before disconnecting) before redeploying the sonde.***



Open the battery compartment.

Install alkaline batteries.

Use Allen wrench to remove and check desiccant color. If pink, replace.

Close battery compartment. LCD screen should activate.

Figure 8: changing the batteries in the data sonde



Figure 9: Demonstration of removing desiccant pill.

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6. If drift is apparent or regularly scheduled calibration is needed, see [Sonde Sensor Calibration SOP](#) and complete calibrations at this step.
7. Redeploying Sonde
  - a. Before deploying the sonde, make sure that the copper guard (covering the probes) is attached in the data logging position and that the sonde has been set to record data. The copper guard vent holes should be near the sensors to allow water flow.
  - b. Intertidal sites
    - i. Using a cleaning brush scrub or shucking knife, clean the PVC housing and PVC cap to remove any mud, algae or fouling organisms.
    - ii. Insert the sonde into the PVC housing and gently lower it with the probes facing downward until it hits the cross bolt threaded near the bottom of the housing.
    - iii. Screw the PVC cap (still tethered to the data sonde) into the top of the PVC housing. Do not over tighten.
    - iv. Insert the stainless steel security bolt through the top of the PVC housing (i.e., through the two holes drilled near the top of the housing), then screw on its corresponding nut until it's snug.
  - c. Subtidal sites
    - i. Laurel Hollow
      1. Take the sonde and its attached HOBO and tether/clip + 1 large zip-tie + the brush to the mushroom anchor (by boat, or swim from shore).
      2. Dive to the mushroom anchor and use the brush to clean the inside and outside of the PVC housing, making sure the vent holes are clear to allow water flow.
      3. Place the sonde inside the PVC housing with the probes facing downwards.
      4. Loop the parachute cord (attached to the top of the sonde) around the anchor shank and clip it back on itself.
      5. Pass a zip-tie through one of PVC vent holes and out another vent hole (both about half way up the sonde) and

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use it to secure the sonde tight against the inside of the PVC housing.

ii. *At Gold Star Beach:*

1. Use the brush and shucking knife to clean the inside and outside of the PVC housing, making sure the vent holes are clear to allow water flow.
2. Check the hose clamps and zip ties securing the housing to the anchor and reinforce as needed.
3. Place the sonde inside the PVC housing with the probes facing downwards.
4. Clip the tether from the anchor onto the top of the data sonde.
5. Pass a zip-tie through one of the PVC vent holes and out another vent hole (both about half way up the sonde) and use it to secure the sonde tight against the inside of the PVC housing.
6. Lower the mushroom anchor to the seabed and fasten it on a cleat.
7. Close and lock the trap door of the FLUSPY.
8. Return to lab & clean up
  - a. Rinse all tools (wrenches, pliers, wire cutters) with fresh water, dry with a towel, and spray with WD40 (kept on field gear shelves, extra in Rm 29).
  - b. Connect the Samsung tablet to WiFi in order to sync the shared Google drive (contains the downloaded data files from the sonde and HOBO).
  - c. Used batteries can be disposed of in a box in the 1st floor administrative office.
  - d. Restock sonde kits of supplies used in the field.
  - e. Quality control and assurance (QAQC) data following the code in the [github repository](#).

## 10 Waste Disposal

1. Dispose of discarded pH filling solution and Quick Cal solution (See Section 9.3 and [Sonde Calibration SOP](#)).

## 11 References

[Data sonde, main unit](#)



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- [Aqua TROLL 600 Multiparameter Sonde](#)

[Quick Start Guide](#)    [Manual](#)

### Data sonde, added on components

- [Aqua TROLL Temperature-Conductivity Sensor](#)
- [Aqua TROLL RDO Sensor \(Includes RDO X Cap\)](#)
- [Aqua TROLL Chlorophyll a Sensor](#)
- [Aqua TROLL pH / ORP Sensor](#)
- [Aqua TROLL Wiper](#)
- [Twist-Lock Backshell Hanger](#)

[Instruction Sheet](#)  
[Instruction sheet](#)  
[Manual](#)  
[Manual](#)

### Data sonde accessories

- [Quick Cal solution](#)
- [Aqua TROLL Replacement Desiccant](#)
- [pH Filling Solution](#)

[Safety Data Sheet](#)  
[Manual](#)  
[Manual](#)

### Spec Sheet for Data Sonde and Sensors

Data Sonde Instruction Sheets: All hard copies of the instruction sheets that came with the data sondes and sensors are kept in a binder in Rm 26 (not all of the sheets are available online).

## 12 Appendices

- A. Items in the gray floating tray for servicing the sonde:
  - a. Field Tablet ( has a yellow float containing VuSitu app).
  - b. Zipties of appropriate size
  - c. Socket wrench
  - d.  $\frac{15}{16}$  inch open-end wrench
  - e. Adjustable wrench
  - f. Extra pins and bolts for housing
  - g. Towel / cloth for wiping things down.
  - h. Dish scrubbing pad
  - i. Scrub brush
  - j. Shucking Knife
  - k. 500 ml empty container with sealable top
  - l. wire cutters
  - m. Sonde supply box
    - i. High vacuum grease
    - ii. RDO sensor Calibration sponges
    - iii. Desiccant tube
    - iv. Hex driver

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- v. allen key
- vi. sonde wipers
- vii. Alcohol pads
- viii. D batteries (minimum of 2, Energizer or Duracell only). The should be in a plastic bag to distinguish from old batteries.
- ix. Paper towels (for collecting discarded pH filling solution).
- x. Q-tips or cotton buds

B. Removing fouling organisms from sonde (see [Sonde Assembly, Deployment, Storage SOP](#))

- a. pH sensor -
  - i. To remove crystalline deposits:
    1. Soak the sensor with warm water and mild soap and rinse with fresh water to clean. Soak the sensor in 5% HCl solution for 10 to 30 minutes. If deposits persist, alternate soaking in 5% HCl and 5% NaOH solutions.
  - ii. To remove oily or greasy residue:
    1. Soak the sensor with warm water and mild soap and rinse with fresh water to clean. Methanol or isopropyl alcohol may be used for short soaking periods, up to 1 hour. ***Do not soak the sensor in strong solvents, such as chlorinated solvents, ethers, or ketones, such as acetone.***
  - iii. To remove protein-like material, or slimy film:
    1. Soak the sensor with warm water and mild soap and rinse with fresh water to clean. Soak the sensor in 0.1 M HCl solution for 10 minutes and then rinse with deionized water.
- b. RDO sensor:
 

If extensive fouling or mineral buildup is present, soak the sensor in vinegar for 15 minutes, then soak in deionized water for 15 minutes. ***Do not use organic solvents—they will damage the sensor cap. Do not remove the sensor cap when rinsing or brushing.***
- c. Temperature/Conductivity sensor:
  - i. To remove crystalline deposits:
    1. Clean the sensor face with warm water and mild soap. Use a soft brush to gently clean the sensor pins and temperature button. Ensure removal of all debris around the base of the pins and button. If crystalline deposits persist, soak in 5% HCl for 10 to 30 minutes followed by warm soapy water and soft brushing. If deposits persist, alternate soaking in 5% HCl and 5% NaOH solutions followed by warm soapy water and soft brushing.
  - ii. To remove oily or greasy residue:



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1. Clean the sensor face with warm water and mild soap. Using a soft brush, gently clean the sensor pins and temperature button. Ensure removal of all residue around the base of the pins and temperature button. Isopropyl alcohol may be used for short soaking periods, up to one hour. *Do not soak in strong solvents such as chlorinated solvents, ethers or ketones (such as acetone).*
- iii. To remove protein-like material, or slimy film:
  1. Clean the sensor face with warm water and mild soap. Using a soft brush, gently clean the sensor pins and temperature button. Ensure removal of all material/film around the base of the pins and temperature button. Soak the sensor in 0.10% HCl for 10 minutes and then rinse thoroughly with distilled water.

**END OF DOCUMENT**