2021 Spatial Study Sensor Data Collection Protocol

Ex-situ manual metabolism chamber procedure – 7/27/2021

Questions – contact Matt Kaufman matthew.kaufman@pnnl.gov

Required equipment:

Two (2) 48 qt coolers ("cooler #1" has three strips of Velcro on the bottom to attach to the chambers and "cooler #2" is full of ice to hold physical water chemistry samples)

Two to four (2-4) medium ice packs or a couple of bags of ice

5-gallon bucket

Pitcher

Six (6) chambers capped and filled with water (3 chambers/lids for the study + 3 extra chambers/lids; 2-liter amber plastic bottle with wide-bore neck. NECK MUST BE DRILLED OUT TO FIT MINIDOT AND CHAMBERS SHOULD HAVE A STRIP OF VELCRO ATTACHED TO THE BOTTOM)

Six (6) miniDOT oxygen sensors (3 sensors for the study + 3 extra sensors)

One (1) baroTROLL barometric pressure sensor, pre-programmed and ready to deploy

Eight (8) small, sealed toy boat motors (three for stirring; five extras in case one or more don't work)

Minimum of three (3) boat motor batteries for each site visited that day + at least six (6) extra batteries (NiMH rechargeable is required. Alkaline batteries do not last long enough). Just bring the whole bag and charger w/ you (can be used in the car to recharge batteries if you run out).

Prior to the field day:

1. If you don't already have Java installed on your laptop, download and install Java on your laptop at https://www.java.com/en/. While we do not expect you to need any of the software installed on the miniDOT, if it becomes necessary to reprogram the logging interval or check remaining battery voltage for the miniDOT for any reason, MiniDOT software (e.g., miniDOTControl.jar) will require Java to run.
2. Check miniDOT battery levels are sufficient to run all day (in general, miniDOT lithium AA batteries last a VERY long time). This must be done by connecting the miniDOT to a computer and running the miniDOT control program that is on the miniDOT's internal storage drive (see MiniDOT Logging and Deployment Protocol).
3. Charge enough NiMH AA boat motor batteries so that you have a minimum of three for each site you will be visiting that day plus six extra batteries in case they're needed.
4. Freeze the ice packs or purchase a bag of ice.
5. Log files have already been created for the baroTROLL (see baroTROLL protocol for instructions) and they are ready to be deployed (i.e., nothing else needs to be done prior to deployment at field sites). The baroTROLLs are scheduled to start logging data at 06:00 PST the morning of the first day of sampling (08/30/21) and are scheduled to stop logging data at 24:00 PST on the last day of sampling (09/03/21).

When leaving the lab/hotel on measurement day:

1. Place ice packs in the empty 40 qt cooler with three Velcro strips on the floor (cooler #1).
2. Turn on the miniDOT (open casing, flip switch to "record", close casing. Do not over-tighten casing). Double-check that the serial number on the outside of the housing and on the interior circuit board match.


3. Record the miniDOT serial numbers (SN) on the (meta)data sheet. Record the time they were turned on in Pacific Standard Time (PST) on the (meta)data sheet as “MiniDOT start time (start of day).”
4. Open the boat motor by unscrewing the front of the housing. There may be a white plastic screw that prevents the housing from coming unscrewed if it abuts the plastic flange extending outward on the lip of the back half. If so, remove the screw. If a screwdriver is unavailable, it is usually possible to simply continue unscrewing the housing until the screw rolls over the flange. This flange/screw combination acts as a “stop” for turning the motor on/off (see Step 10, below).

5. Place a battery into the front half of the boat motor, with the negative end going in first.

6. Screw the front of the motor onto the back half until it is snug. Note, when fully screwed on the propeller will start spinning. The white screw (see Step 8) should be snug against the small plastic flange to the left extending upwards on the lip of the back half. Turn the propellor off by unscrewing the back half ¼-turn until the white screw is snug against the plastic flange to the right that extends outwards on the lip of the back half. **MAKE SURE THE PROPELLER IS NOT SPINNING BEFORE PROCEEDING TO THE NEXT STEP.**

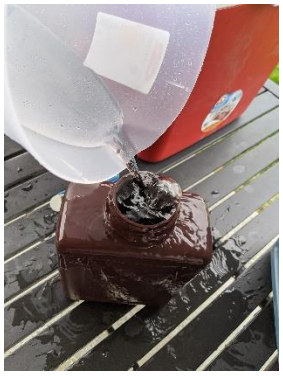
7. Place three miniDOTs, three chambers filled with water and capped, and three toy boat motors in the cooler with the ice packs (cooler #1). At this point, you may fasten the chambers to the Velcro on the bottom of the cooler #1 but it is not necessary.

When you arrive at the measurement site:

1. Before you head down to the site, take the ice packs or ice out of cooler #1 (containing the miniDOT, chambers, etc.) and place them in cooler #2 with ice (this cooler is for the water samples). Leave the miniDOTs, chambers, and boat motors in cooler #1. Leave cooler #2 in the car. Take cooler #1 down to river and place it in the shade if possible, or rig the umbrella so it shades as much of the cooler as possible (use the duct tape to secure it to the cooler if necessary).

2. Hang the baroTROLL near the coolers, in the shade.
3. Fill the pitcher with river water, remove the miniDOTs and boat motors from the pre-chilled cooler (cooler #1), and place them in the pitcher with river water (this is to maintain the temperature equilibrium they have reached with temperature in the cooler #1).

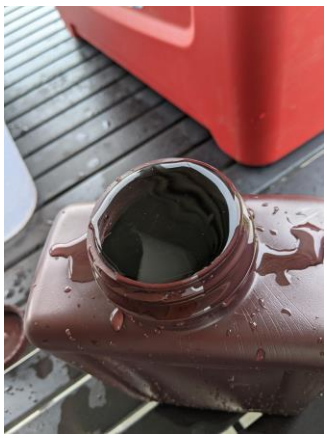
4. Empty the three chambers into the river, triple rinse each one with river water, fill a final time and cap underwater, and attach each chamber to a Velcro strip on the bottom of cooler #1. Then quickly fill the empty cooler with river water using the 5-gallon bucket or pitcher until the chambers are completely underwater. Next, place the pitcher filled with water containing the miniDOTs and stirring motors in cooler #1, close the lid, and record the equilibration start time in PST on the (meta)data sheet as the "Equilibration start time". THESE ITEMS MUST TEMPERATURE EQUILIBRATE FOR 20 MINUTES.
5. Over the 20-minute temperature equilibration period, refresh the cooler water with fresh river water 2-3 times, and keep the cooler closed and out of the sun if possible. Be careful to not flush out the chambers, boat motors, etc. when refreshing the cooler. The Velcro should help keep the chambers submerged and upright and prevent them from being flushed out but adding 5-gallon flushes of fresh water will cause the cooler to overflow and can carry the miniDOTs and boat motors right out of the cooler and into the river.
6. When the 20-minute equilibration time is over, record the equilibration end time in PST on the (meta)data sheet as the "Equilibration end time".



7. Drain each chamber and refill to overflowing with fresh river water. Place the miniDOT inside the chamber, with the sensor window UP (as shown). It is a close fit but should drop in without being pushed hard. The miniDOT will forcefully displace a fair amount of water in the chamber due to the tight fit, so you might want to hold the bottle away from you while doing this.

8. Turn the boat motor propellor on (see Step 8) and drop the boat motor into the chamber, with the propeller end up (as shown). The position of the rudder is not important. **NOTE: MAKE SURE THE PROPELLER IS SPINNING BEFORE PROCEEDING TO THE NEXT STEP.**

9. Since you will lose some of the water in the chamber and some air will be introduced following the insertion of the miniDOT and boat motor, make sure each chamber is filled to overflowing before capping it. Whenever possible, hold the chamber underwater while capping it—either in the river, in the cooler, or in the 5-gal bucket. This is to eliminate as many air bubbles as possible. Do this by holding the open chamber and lid underwater while keeping your hand over the mouth of the chamber (to keep the miniDOT and propellor from coming out). Then tilt the chamber and rotate 360° multiple times all the while holding the chamber upright at an angle and watching for escaping air bubbles. Do the same with the chamber lid by turning it over multiple times to make sure no air bubbles are captured underneath. When you're sure all/most bubbles have escaped, cap the bottle underwater. If this is not possible, use the pitcher to top off the chamber with river water, leaving as much of a meniscus standing above the rim as possible before capping. Air bubbles inside the chamber can really mess with the results, so try hard to eliminate them.



10. Flush cooler #1 until all the water used to equilibrate the equipment has been replaced with fresh river water. Again, place the water-filled chambers into cooler #1, which is full of river water, and secure each one to a Velcro strip glued to the bottom of the cooler.

11. It is best if the bottle stays upright, NOT upside down. The Velcro is intended to keep the chambers upright. While unlikely, you may have to take a little water out of the cooler to keep the chamber from flipping upside down. It's ok if it flips momentarily.


←not great


←Good

12. Close the cooler and record the test start time on the (meta)data sheet as the “Test start time (when cooler closes)”.

13. For the next 2 hours, every 15-20 minutes you must replace some of the cooler water with fresh river water. The hotter and sunnier it is outside the more frequently you must do this. The goal is to keep the chambers at a temperature not TOO different from the temperature of the river itself.

14. After 2 hours, record the test end time on the (meta)data sheet as the “Test end time (before opening)”, open the cooler and remove the chambers, and return the cooler’s water to the river.
15. Open the chambers and pour them out INTO THE PITCHER (this will help you catch the motor and miniDOT)

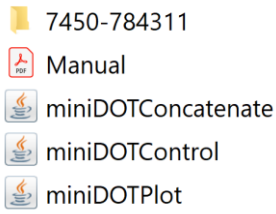
16. You will likely have to shake the chamber a bit and use your fingers to get the miniDOT to slide out.

17. Unscrew the front half of the boat motor ¼-turn to stop the motor from spinning.
18. Refill the chambers with river water from the site. KEEP CHAMBERS FULL OF WATER AT ALL TIMES.
19. If you are going to another site, you can leave the miniDOT logging. If you are done for the day, dry it off, open it, set it to "Halt", and close it up again. Record the time in PST you set the miniDOT to "Halt" on the (meta)data sheet as the "MiniDOT end time (end of day)".
20. If you are going to another site, return the ice packs/ice to cooler #1 containing the miniDOTs, chambers filled with water and capped, and boat motors (be sure the propellors are turn off) to keep the cooler and equipment cool during the trip to the next site.
21. **REMEMBER TO RETRIEVE THE BAROTROLL AT WHEN YOU ARE FINISHED!!!** No data downloads are needed (we don't have enough Rugged TROLL Coms for every baroTROLL). Data will downloaded when the baroTROLLs are returned to the office at the end of the week.

Each night back at the hotel (Questions? Call Stephanie Fulton)

Bring the miniDOTs with you to the hotel every night and download the day's data. Quickly review it to ensure that the miniDOTs were on and recording reasonably good data throughout the day, and then upload it to the RC2 share drive.

1. Remove the sensor housing (white Delrin tube) from the sensor core (the part that consists of the sensor and circuit board) by unscrewing it from the black cap.
2. To download the data, simply connect the sensor to your laptop using the supplied USB cable. (Upon connection, the LED immediately below the USB port should blink green.)
3. In Explorer, click on "Local Disk" (you can read the contents of a miniDOT just like a USB drive). You will see three Java files (.jar) and a data folder. MiniDOTs store data files (aka "log files") as text files (.txt) in the data folder on the sensor's hard drive (local memory). The data folder on each miniDOT is named "7450-SensorSN" where SensorSN = the unique 6-digit serial number associated with each miniDOT:



4. Right-click on the data folder to copy it.
5. Once you've copied the folder, paste it into the appropriate folder on the RC2 shared drive. Sensor data is stored on the RC2 shared drive by date and by watershed. The file folder structure has already been created for you, so all you need to do is locate the folder for each day sampling took place, find the folder for your watershed within that date, and then paste the miniDOT data folder for each miniDOT into that folder. For example, if you worked in the American River watershed on 8/30/2021, you would copy your three miniDOT data folders to the share drive.
6. It's a good idea to quickly review the data to make sure the miniDOTs were 1) turned on and 2) recorded "good" data. Data is recorded once every minute (i.e., the logging interval) on the even minute once you turn the sensor on (flip switch to "Record") and stops recording new data when you turn the sensor off (flip switch to "Halt"). A new log file is created every day starting at midnight Greenwich Mean Time (GMT; subtract 8 hours from GMT to convert to Pacific Standard Time, PST). The miniDOT keeps time in Unix time, which is the number of seconds that have passed since January 1, 1970. You can convert Unix time to PST here: https://www.epochconverter.com/
7. Each log file contains five columns of data and one row or data record for every minute data was recorded.
    - Unix time
    - BV = battery voltage (V)
    - Water temp (°C)
    - DO (mg/L)
    - Q (sensor quality based on degree of light penetration; manufacturer-specific)
8. Open the text file located on the shared drive and check that the data values are representative of the conditions you would expect for the streams that you sampled that day (e.g., temperature, DO concentration). You should be able to recognize two different kinds of data: a) continuous blocks of data that were recorded during each chamber metabolism test followed by b) continuous blocks of data that were recorded when the miniDOT was in the cooler during transport, etc.
9. When you're certain that you copied the data correctly to the shared drive, and that the data looks reasonable, delete the data folder from the miniDOT (not the share drive) by right-clicking the folder and selecting delete.
10. Disconnect the sensor by closing the Control window or simply unplug the USB cable. The Explorer window will close on its own, so you will have to open a new Explorer window each time you connect a new sensor.
11. Replace the sensor housing and hand-tighten until the silicon O-ring is fully inserted below the lip of the housing. DO NOT OVERTIGHTEN or it will be very difficult to remove next time. NOTE:

miniDOTs have the serial number (SN) recorded on the instrument both internally (located on the white circuit board just above the black cap) and externally (on the top of the housing near the cable tie-off). Be careful not to separate or mix-up multiple sensor inner cores from their housings, e.g., DO NOT replace the housing from one sensor on the sensor core of a different sensor or the serial numbers will not match, and you could record the wrong SN in the field. The data stored on the miniDOT is associated with the SN on the inner core. Work with them one at a time so there is only one sensor open at a time.

Eureka Manta+ 35B Calibration, Data Logging, and Deployment Protocol
Questions? Call Stephanie Fulton

General

Your Manta Multiprobe comes pre-programmed to log data at 1-min intervals and save the data to a pre-existing log file that has been created and stored in memory. Logging has already been "enabled" for you and is ready to be deployed (see section below on "Data logging and data downloading"). All you need to do is switch the battery pack on, place the Manta in the river, retrieve it when you are done at each site, and turn it off at the end of the day. Each night you will bring the Manta back to the hotel and download the data.

Equipment
Each Manta kit comes with the following (Figure 1):

Figure 1. Manta+ Multiprobe and associated equipment.

1. Manta+ Multiprobe
    a. The Eureka Manta+ 35B Multiprobe is large multiparameter probe ("multiprobe") that has the capacity to hold up to nine sensors. The Mantas you are using for this study are currently configured with five sensors to measure the following parameters:
        i. Depth (m)
        ii. Temperature (°C)
        iii. Specific conductance (µS/cm)
        iv. Turbidity (Formazin Nephelometric Units, FNU)
        v. pH and reference sensors (Standard Units, SU; a reference sensor is required to measure pH) [Note: only two teams have pH sensors on their Manta, Cle Elum and American.]
    b. Internal battery pack (IBP): consists of a watertight housing secured by a "battery plug" and steel eye bolt, a cassette for batteries, and a battery switch. The IBP powers the Manta in the field when collecting "snapshot" sensor data or during long-term remote deployments.
    c. Storage/Calibration Cup: The Storage/Calibration (S/C) cup protects the sensors when the Manta is not in use and is also used to hold calibration solutions. When not in use, Mantas equipped with pH sensors must be stored with the S/C cap on and a few ounces of tap water to keep the membrane moist. It is good protocol to store all Mantas with the S/C cup and a few ounces of tap water when not in use. The black cap on the top of the S/C cup is a screw-top and can be removed to pour calibration solutions directly into the S/C cup.
2. Weighted Sensor Guard: used during deployment and replaces the S/C cup to protect the sensors and to weigh down the sensor end of the Manta.
3. Manta Flash Drive: contains all software needed to connect the Manta to a computer or other Data Display, plus digital copies of the User's Manual, several instructional videos, and several technical notes.
4. Data Cable: required to communicate directly with the Manta to program log files, calibrate the sensors, and download data.
5. USB Converter: connects between the Data Cable and a USB port on a computer or other Display Device. The USB Converter can also connect an external power supply to your Manta if USB power is not adequate (particularly with long Underwater Cables or large number of sensors).
6. Maintenance Kit: contains all the tools and maintenance items needed to keep your Manta in top shape.
7. Pipe Kit
8. Carabiner
9. Rope

Upon arrival at the first site of the day

1. When you arrive at the first site of the day—before you stow all the sampling equipment in the backpack—remove the Manta S/C cup and replace it with the weighted sensor guard. Dump the excess water in the cup and stow the cup in the vehicle.
2. Turn the Manta battery switch to "ON". The battery switch connects ("ON") and disconnects ("OFF") the power (i.e., batteries) to the sensor's circuitry, effectively turning the sensor on and off.

3. Remember to look for the red LED to blink five times to confirm that Logging is activated, and the green LED blink briefly to confirm that the Manta is receiving adequate voltage to start Logging. The Manta is now logging and will continue logging until you turn the battery switch to its "OFF" position, or your batteries are depleted.
4. Gently slip the Manta into the pipe kit by holding the probe by the eye bolt and lowering the Manta into the pipe. Make sure the Manta is seated on the mesh bottom of the pipe. Be careful when lowering the probe as the sensor guard can get hung up inside the pipe on the lip of the mesh cap near the bottom, and then can drop suddenly to the bottom. The Manta is built tough, but nonetheless should be handled with care.
5. Close and secure the lid using the carabiner. Be sure to run the carabiner through the loop of rope connected to the eye bolt on the lid (Figure 2). If rope is not included in your gear, purchase 50' ASAP, and tie it to the Manta's steel eye bolt using the loop configuration with two buntline hitches (Figure 3).

Figure 3. Secure the pipe kit lid using the carabiner, making sure to run the rope loop through the carabiner.

Figure 3. Buntline hitch used to tie the rope to the steel eye bolt on the Manta pipe kit.

6. Record the "Time turned on (in the morning @ 1st site)" on the (meta)data sheet. **USE YOUR FIELD WATCHES TO ENSURE YOU ARE RECORDING ALL TIMES IN PACIFIC STANDARD TIME (PST).**

Sensor deployment and retrieval

1. Find a representative section of the river to deploy the sensor, and gently lay the pipe kit/Manta on the riverbed as close to the thalweg as you feel comfortable wading but without taking more than a few "incidental" steps on the riverbed. Wherever possible, do not deploy the Manta in or immediately below a riffle or in a deep pool, unless a pool is the only section of river that can accommodate the probe.
2. Tell your partner once the Manta is placed below the surface of the river (i.e., the sensors is "in the water") and have them record the "Time in water (at site)" on the (meta)data sheet.

3. Secure the pipe kit rope to either a large rock or a tree, whichever is more convenient (and secure, if stream discharge is high/fast).
4. If the river is too shallow to accommodate the sensor AND the pipe kit, you can remove the Manta and simply lay the Manta on the riverbed. If necessary, attach a rope to the Manta's eye bolt and secure the rope to the shore (see #3, above).
5. Once all other site data has been collected, but before the metabolism study is done, retrieve the Manta from the river, and record the time the sensor was pulled out of the water as the "Time out of water (at site)" on the (meta)data sheet. **DO NOT TOUCH THE BATTERY SWITCH UNLESS IT IS THE LAST SITE OF THE DAY (see next section).**

At the last site of the day

1. Retrieve the Manta from the river at the last site of the day and record the "Time out of water (at site)" on the (meta)data sheet (see #5, previous section).
2. Pull the Manta out of the pipe kit and use a rag to dry the top of the Manta, particularly around the battery plug to prevent water from seeping into the IBP (which can corrode the batteries or cause the system to short circuit).
3. Loosen the steel eye bolt on the battery plug until you can swing the battery switch back and forth.
4. Move the switch to "OFF"—disconnecting the power supplied to the sensor—and hand-tighten the eye bolt. The battery plug does not need to be overtightened when simply turning the switch off. **NOTE: Be careful to firmly seat the small round peg underneath the switch in the round notch before you tighten the eye bolt.** If the switch is not seated correctly, the switch can snap in two as you tighten the eye bolt.
5. Record the time the battery switch is turned to "OFF" on the (meta)sheet as the "Time turned off (in the afternoon @ last site)".

Back at the hotel each evening

Download and review the review log file. Copy the field data to the appropriate folder on the RC2 shared drive. Check the remaining battery voltage on the Manta and change the batteries if the voltage falls below 7 V. Instructions for installing the software, connecting the Manta to your computer, and changing the batteries (if needed) are provided below the instructions for downloading/reviewing/ uploading the data. If you need assistance, the User's Manual is available on the Manta USB drive, or on the shared drive (see #6, Installing the Eureka Manta Control Software, below).

Data logging and data downloading

All Mantas include data memory and software that allows you to select which parameters you want to measure, set the logging interval (how often you want the Manta to record a measurement), and create a Log file to store sensor data. Log files have already been created for each Manta used for the spatial study. Logging intervals have been set for 1 minute, i.e., the Manta will take a measurement from each sensor once every minute and record the measurements in the pre-existing Log file. After you have installed the Manta2 Control Software (see p. 16, section titled "Installing the Eureka Manta Control Software"), follow the instructions below to enable/disable logging and download the log file every night following field data collection.

1. Connect the Manta to your laptop using the data cable, USB converter, and extension cable (see section .
2. Since logging has already been “enabled” on your Manta, logging must be temporarily disabled before you can download the Log file. To disable logging, click the “Manta2 Logging is ON” hot button (Figure 4). The button should change to “Manta2 Logging is OFF” (Figure 5). **NOTE: IT IS CRITICAL WHEN YOU ARE DONE DOWNLOADING DATA THAT YOU RE-ENABLE LOGGING (see #8, below).**

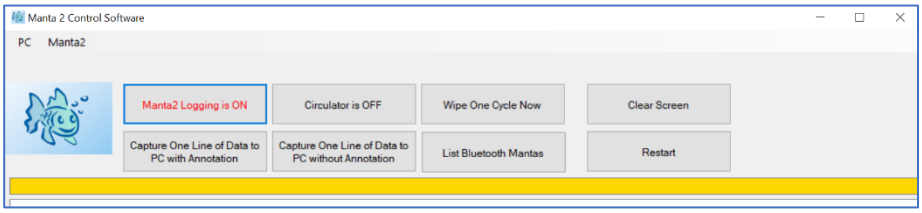


Figure 5. Manta 2 Control Software home page showing that logging has been "activated.”

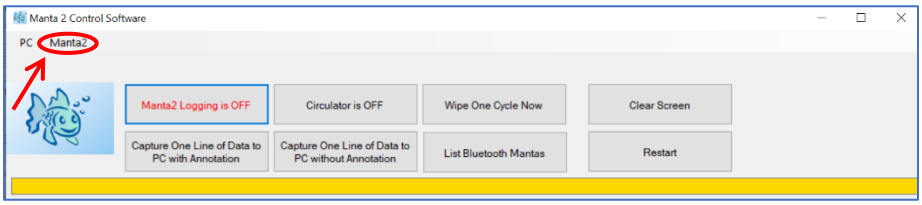


Figure 4. Manta 2 Control Software home page showing that logging has been "deactivated."

3. To download the Log file, first click on the **Manta2** dropdown menu (circled in red, top left in Figure 5), and then select ***Manage Manta2 Files***.
4. A pop-up screen will appear showing the name of the Log file for your watershed and the date the Log file was last modified, along with several options for managing the Log file (Figure 6 and Figure 9). The active Log file name is also displayed in the bottom line of the Home Page (see Figure 9).

Figure 6. Manage Manta2 Files pop-up screen listing available Log files and the available options to manage those files.

5. Highlight your Log file by clicking on it, then click ***View Files***.
6. Another screen will appear with the Log file displayed in table format. Click on the Save As button at the bottom of the screen to save the Log file as a .CSV file on the RC2 shared drive (see next).

7. Raw sensor data is stored hierarchically on the RC2 shared drive by a) study name, b) sensor type, c) data type (in this case "raw data"), d) sampling date, and lastly e) watershed. The file folder structure has already been created for you, so all you need to do is locate the folder for each day sampling took place, find the folder for your watershed within that date, and then save the .CSV file into that folder.
8. Once the file is saved to the shared drive (it will look like an Excel file, but with the .csv file format extension name), open the file and look at the data to make sure the data makes sense to you (see sample Log file, Table 1; note that for two teams your file will also have a column for pH data). Ask yourself the following questions:
    a. Did the Manta start recording data at approximately the same time as you turned it on first thing in the morning?
    b. Did the sensor measurements start reflecting the water quality parameter values you would expect when you placed the Manta in the river, and did the values change as you would expect when the Manta was no longer in the water?
    c. Was data recorded throughout the day, and did the last line of data occur at approximately the time you turned the Manta off?
    d. At the end of the file check to see that the battery voltage is reading at lest 7 V. If not, change all 6 batteries with fresh batteries. DO NOT MIX DIFFERENT BRANDS OF BATTERIES.

Table 1. Sample Log File in comma separated variable (CSV) format.

2021-07-22_MANTA_4659L.LOG.csv						
DATE	TIME	Temp deg C	Depth m	SpCond uS/cm	Turb FNU	Int Batt V
Eureka_Manta_2	V7.13	3214659				
DATE	TIME	Temp_deg_C	Depth_m	SpCond_uS/cm	Turb_FNU	Int_Batt_V
7/22/2021	7:32:00	17.12	0.09	0	0	7.81
7/22/2021	7:33:00	17.52	0.09	0	-0.06	7.84
7/22/2021	7:34:00	17.93	0.09	0	0.12	7.79
7/22/2021	7:35:00	17.72	0.09	0.1	-0.09	7.63
7/22/2021	7:36:00	18	0.09	0	-0.04	7.68
7/22/2021	7:37:00	18.08	0.1	0.1	0.04	7.73
7/22/2021	7:38:00	18.14	0.09	0	0.16	7.59
7/22/2021	7:39:00	22.94	0.37	237.8	2.13	7.57
7/22/2021	7:40:00	22.95	0.37	238	0.06	7.68
7/22/2021	7:41:00	22.97	0.37	238.5	0.05	7.74
7/22/2021	7:42:00	22.97	0.36	238.2	0.02	7.78
7/22/2021	7:43:00	22.98	0.37	238.2	0.03	7.81
7/22/2021	7:44:00	22.98	0.37	237.7	0.02	7.76
7/22/2021	7:45:00	22.98	0.37	238.1	0.09	7.83
7/22/2021	7:46:00	22.98	0.37	237.9	0.09	7.84

9. **CRITICAL:** Once you have copied the file over to the shared drive, **RE-ENABLE LOGGING by clicking on the "Manta2 Logging is ON" hot button. Make certain that the hot button shows that logging is on before you disconnect the Manta.**
10. Disconnect the Manta from the cables and replace and hand-tighten the dumpy plug.

Installing the Eureka Manta Control Software

Try to install the Eureka software ("Manta 2 Control Software" or "CS") on your computer before you leave town.

If you are unable to install the software before you leave, install it using the steps below.

1. Plug the Manta Flash Drive into one of the computer's USB ports.
2. When the dialog box shown below opens, click *Install Manta Software* to upload the Manta 2 Control Software and the USB Driver software onto your computer (Figure 7). When the installation is complete, you will be returned to the same screen that you started with. Click the "*X*" in the upper right corner of the dialog box to close the installation process.

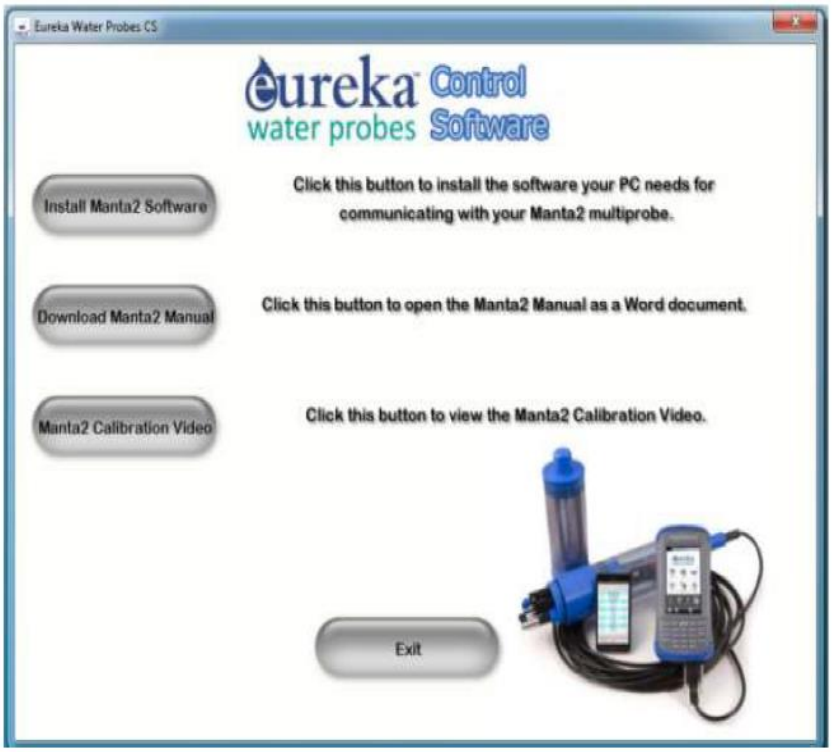


Figure 7. Eureka Manta2 Control Software installation window.

3. If you wish, download onto your computer the Manta manual and various videos and technical documents that are also stored on the flash drive. The User's Manual ("Manta Manual 11-30-20") is a very useful resource for operating the Manta and contains additional information beyond that provided in this protocol.
4. If Windows did not create a Desktop shortcut to the Manta Control Software, and you would like to have one, click your laptop's Start button, click *All Programs*, click the Eureka folder, right-click "Manta 2 Control Software", and drag it to your desktop or taskbar.

5. The User's Manual (Manta Manual 11-20-30.pdf) is very useful.

Connecting the Manta to a Computer/Laptop

The Manta comes with a Data Cable (Figure 8, below left) and USB Converter (Figure 8, below right), and both are needed to connect the Manta to your laptop. The Manta Flash Drive is also shown below (Figure 8, bottom).

Figure 8. Manta Data Cable (left), RS-232 USB Converter and extension cable (right), and Manta Flash Drive (bottom).

1. Remove the waterproof polymer eye bolt (aka "dumpy plug") on the top of the Manta by unscrewing it counterclockwise. This will expose the 6-pin Data Cable connection. One end of the Data Cable has a 6-pin connector (the rubber tip with holes in the same configuration as the 6-pin connector on the Manta) and the other end is a 9-pin RS-232 connector (easily recognized by the old-style computer cable connection used to connect slide projectors, monitors, etc.).
2. Connect the Data Cable 6-pin rubber tipped connector to the Manta by lining up the holes in the rubber tip with the pins on the Manta and push the connector down until the rubber tip is seated snugly over the pins. Connect the other end of the Data Cable (female 9-pin connector) to the male 9-pin connector on the USB RS-232 Converter and screw down the connection. Then, connect the USB connector on RS-232 Converter to the female connector of the USB cable, and plug the other end of the USB cable into your USB port on your computer. Note: the order in which the cables are connect does not matter.
3. Once you are connected to your computer, open the software using the Start Menu or by clicking on the Desktop or Task Bar shortcut. The software can be a little buggy, and typically will

crash the first couple of times you try to open it. When the software successfully opens, the Home Page will appear (Figure 9). The status bar in the lower left-hand corner of the Home Page will initially show the message “Manta Not Connected”. It may take 30 seconds or more, but shortly you should see the message change to “Manta Initializing on COM#,” where *“#”* refers to the USB COM port to which the Manta is connecting. Once connected, the message should read “Connected on COMX” and the Home Page will display the Manta’s real-time data and various menu options. You can close the program by simply clicking the “*X*” in the upper right corner.

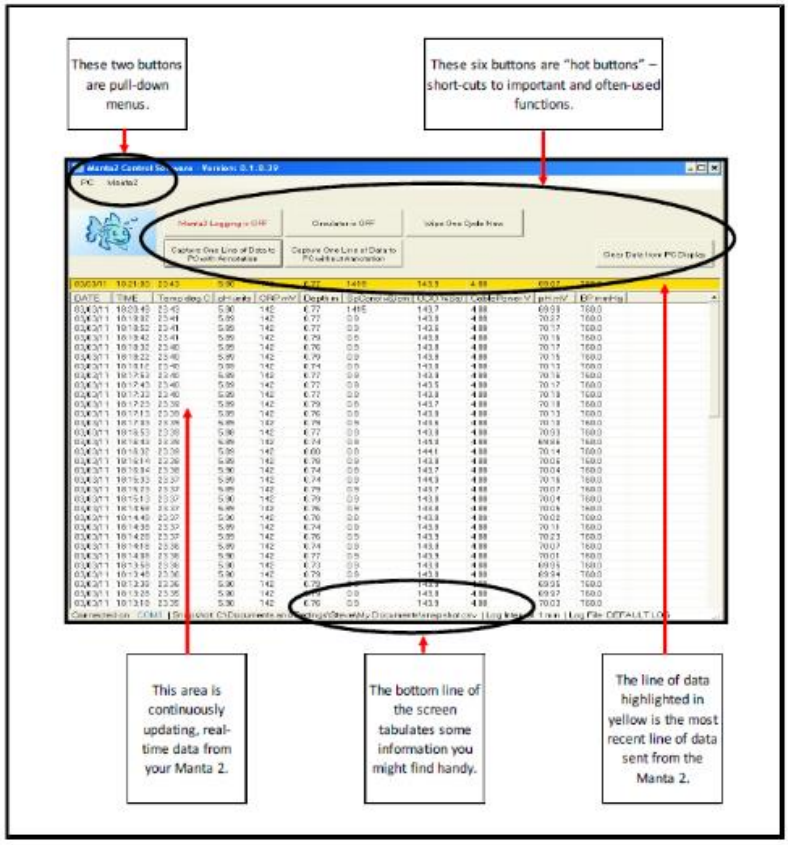


Figure 9. Manta 2 Control Software home page.

Battery Replacement

The IBP holds six (6) “C” batteries supplying the Manta with 9 V. Minimum recommended voltage is 6 V, but the batteries should be replaced before total voltage supplied reaches that minimum level. To replace the batteries:

1. Unscrew the steel eye bolt until you can remove the battery plug and remove the spent batteries.
2. Clean all moisture, dirt, grit, and any other debris off the Manta because you are going to expose sealing surfaces as you change the batteries.
3. Clean all moisture, dirt, grit and any other debris off the exposed O-ring surfaces and the inside of the battery tubes. Add a small amount of silicone grease to the O-rings and to the inside of the battery tubes where the O-rings will seat.

4. Install six (6) alkaline “C” batteries carefully following the polarity diagram on the side of the Manta. Replace all six (6) batteries at the same time using the same brand of battery. NEVER COMBINE DIFFERENT BRANDS OF BATTERIES.
5. Re-attach the battery plug by turning the eye bolt. Use a screwdriver to tighten the eye bolt as much as you can without overtightening. The eye bolt must be secured tightly to ensure the battery plug is tight enough to firmly hold the batteries in place and maintain continuous power to the Manta. If the battery plug is not tightened securely enough, continuous power to the Manta can be broken when the Manta gets knocked around either in the pipe kit in your backpack or during deployment in the river. Momentary loss of power can cause the Manta to “throw” extra header files in log file, which then must be removed during data QA/QC.