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Standard Operation Procedure 11: Water Chemistry Measurement

Version 1.00 (12/27/2016)

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Standard Operation Procedure 11: Water Chemistry Measurement

Eureka Manta 1

In situ water chemistry data is measured at well monitoring sites using a Eureka Manta 1 data logger. The data logger consists of four probes, referred to collectively as the Manta, which are connected to a Hewlett-Packard IPAQ with a waterproof case, referred to as the amphibian. The Manta's four probes measure pH, dissolved oxygen, conductivity, and temperature. Taken together the Manta + Amphibian are referred to as the Manta 1. This SOP should be considered a quick-start guide, but workers who operate the data logger must read the associated user guides as well.

Managing Power for the Manta 1

The battery pack provides approximately 16 hours of use and supplies the power to the Manta. If the battery pack dies, the IPAQ will run on its own batteries. If the Amphibian is running on the IPAQ battery, it will show "internal battery power remaining". The IPAQ battery by itself cannot power the Manta alone. If the voltage drops below a certain level, the Eureka program will indicate that there is "no probe attached". If the IPAQ battery is completely drained, a reinstallation of the Eureka software from the SD Card may be necessary.

Charging the Manta 1

1. A full charge of the Amphibian battery pack takes approximately 4-6 hours. Charge the battery pack overnight before field use.
2. Charging is complete when the orange light (IPAQ) becomes constant.
3. Note: Do not charge the battery pack or IPAQ using the USB charging option. This can cause serious damage to the unit. Make sure the USB charging capability is turned off by tapping the battery icon on the main screen and selecting the USB charging tab.

Manta Calibration

The pH, dissolved oxygen, and conductivity probes must be calibrated, and the pH reference and DO membranes must be changed periodically (Table 11.1). Calibration procedures are described in detail below.

Table 11.1. Cleaning and maintenance schedule for the Eureka Manta.

Sensor	Action	Schedule	Solution
pH	Cleaning	Before first use and every two months thereafter.	pH bulb: soft cloth & alcohol; Junction (white piece on reference electrode): soft brush; Stems: warm soapy water
	Replace reference electrolyte	Before first use and if air bubble is present	3.3M KCL w/ AGCL
	Calibration	24 hours after reference electrolyte is replaced (March, July)	pH Buffers 4, 7 and 10
Clark Cell Dissolved Oxygen (DO)	Cleaning	Before the start of each event and weekly during the season when used regularly	Membrane: soft cloth & alcohol; Stem: warm soapy water
	Replace DO membrane and electrolyte solution	Before first use then every two months after, or if hole develops in membrane	Solution: 2 M KCL w/1% triton X; DO Membrane: 1 mil
	Calibration	24 hours after DO membrane is replaced	Conductivity Standard (Potassium Chloride, 0.01M, 1412 uS/cm)
Conductivity	Cleaning	Monthly during the field season	Cotton swab inside
	Calibration	Before first use and every two months after	Conductivity Standard (Potassium Chloride, 0.01M, 1412 uS/cm)
Temperature	Cleaning	Monthly during the field season	Soapy water
	Calibration	Should not be necessary	Factory calibration – return to Eureka

Materials

1. Large containers (2): one filled with deionized water (if available) or tap water and one container for disposal.
2. Conductivity standard (available from Eureka: 512-302-4333).
3. pH standard (4, 7 and 10) (available from Eureka: 512-302-4333).
4. Paper towels

Preparation

1. Wait 24 hours before calibrations if the pH reference solution or dissolved oxygen membrane was replaced.
2. Use the conductivity standard to calibrate dissolved oxygen (DO) (% saturation method) and conductivity, then calibrate the pH.
3. To use the Amphibian for calibration, connect it to the Manta and open the Eureka program. Click on the *Probe* tab and select *Calibration*.
4. Remove the storage cup from the Manta and attach the calibration cup.
5. Remove the rubber cap.
6. Secure the Manta with the sensors pointing up.
7. Rinse the sensors with a small amount of calibration standard. Discard the rinsate.
8. Refill the calibration cup with the calibration standard and secure the rubber cap tightly.
9. Select the appropriate parameter for calibration and press *Calibrate*.
 - a. The temperature sensor is factory-calibrated.

- b. Calibrate the Clark Cell Dissolved Oxygen sensor with the percent saturation method
 - i. Determine the barometric pressure at the location where the unit is calibrated. This is calculated using the equation: $760 - [2.5 \times (e/100)]$, where e is elevation.
 - ii. Elevation at the Boston Heights Resource Management buildings is approximately 900 feet, so barometric pressure is 737.5 mmHg.
 - iii. The calibration cup is filled with tap water 3/4 of the way to the top, leaving some air at the top of the cup.
 - iv. After the rubber cap is replaced tightly, shake the Manta vigorously for several minutes until the % dissolved oxygen sensor begins to equalize and values change minimally (within 1%).
 - v. Continue to shake occasionally to keep levels close to 100% during the calibration.
 - c. Calibrate the pH sensor
 - i. pH can be calibrated using 2 or 3 pH buffers (4, 7, and/or 10). Use buffers 7 and 10 if a 2-point calibration is used. Before beginning the calibration, be sure the appropriate (2-point or 3-point) method is selected on the calibration screen.
 - ii. Since multiple buffer solutions are used, take care to properly rinse the cup and sensors (Step 4) with tap water and the new buffer solutions, each time the buffer is changed.
 - d. Calibrate the conductivity sensor
 - i. To calibrate specific conductance, use a standard similar to freshwater at approximately 1mS/cm. We typically use a 0.01M potassium chloride solution (1.412 micro S/cm).
 - ii. Gently tap the calibration cup to make sure there are no air bubbles trapped in the conductivity sensor during calibration.
10. Follow the instructions on the screen
 11. Rinse the sensors thoroughly with deionized water or tap water between calibrations.
 12. When calibrations are complete, exit the Eureka program.
 13. Calibration records are automatically stored in the Manta on a data file called "CAL.LOG".
 14. To access logs, connect the Manta to a desktop PC that has the Eureka software and the driver for the USB cable installed. Once the Eureka Multiprobe Manager is opened, go to the calibration tab and click on *Calibration log*.

Collecting Water Quality Data in the Field

Navigation to Well

See SOP 2 Navigate using the monitoring well locations waypoint file.

Preparing Manta 1 for Use

1. To operate the Manta, assemble the Amphibian by connecting the IPAQ to its casing, then connecting the Manta to the Amphibian using the 9 pin serial connector at the top of the Amphibian case.
2. Note: Do not turn the power on until the probe is connected.
3. After 10 – 15 seconds, when the power indicator light in the Manta housing begins flashing green at steady 1 second intervals, turn on the Amphibian by pressing any of the four smaller buttons on the front of the Pocket PC. The buttons are pre-programmed to launch different programs (Figure 11.1).

- a. Button 1: Notes
- b. Button 2: Contacts
- c. Button 3: Calendar
- d. Button 4: Eureka

Water Collection

1. Surface water sampling
 - a. If the Manta can stand upright on the ground adjacent to the well, and the probes are submersed beneath surface water, surface water chemistry is measured instead of groundwater. The measurements are made adjacent to the monitoring well at each visit. Put on the weighted sensor guard before collecting surface water readings and take care not to stir up the water near the location of the Manta.
2. Ground water sampling
 - a. If groundwater is sampled instead of surface water, bail the well using a Solinst® Point Source Bailer (outer diameter = 25.4 mm, capacity = 190 ml) (Figure 11.2). Lower the bailer into the well to collect and bail all standing water from inside of the well.
 - b. Use some of the bailed water to rinse the Manta storage cup and eliminate excess sediment from other wells.
 - a. Wait for the water to recharge and collect another bailer-full of water.
 - b. Slowly pour the water into the storage cup. Slow pouring will help maintain accurate DO levels.



Figure 11.1. HP IPAQ Buttons, showing the Eureka quick launch button.

Water Chemistry Measurement

1. To launch the Eureka software and communicate with the data logger, press the arrow button on the bottom right hand side of the unit to open the Eureka software. The IPAQ should display the water quality parameters in Figure 11.3.
2. Submerge probes in water (or storage cup depending on sample type) and wait a few minutes for readings to stabilize. The DO tends to continue to fluctuate. A good rule of thumb is that when other measurements are stable and the DO is beginning to decrease by .01 for three consecutive numbers (Ex. 8.34, 8.33, 8.32) measurements are taken.
3. Note: The CUVA data logger is only equipped with the four probes discussed, which measure pH, DO, conductivity/salinity, and temperature. Measurements are recorded when stabilized.
4. Record measurements on the CUVA Wetland Monitoring Water Chemistry Data form (Attachment 11.1).
4. Exit the Eureka program when finished. To exit the Eureka software, go to File, *Exit*. The Manta will continue recording as long as it is connected to the Amphibian. Clicking on the X in the top right does not exit the program; it keeps the program running in the background. As a result, the Eureka will not turn off and the battery will continue running.

5. Close all running programs by tapping on Settings, System, Memory, *Running Programs*, and close the programs by selecting them and clicking *Stop*.
6. Turn off the unit.

Cleaning the Data Logger

Amphibian Cleaning

1. Use soap and water to clean the Amphibian case. A window cleaner can be used for the membrane and plastic guard.
2. Do not use acetone or alcohols cleaners.
3. When necessary, clean the inside by first removing the IPAQ and batteries.
4. Do not allow water to come into contact with the regulator board.

Manta Cleaning

1. Probes (Figure 11.3) should be inspected and cleaned at the beginning and end of the field season and as necessary after each use.
2. Use warm soapy water or mild household cleaners to clean the stems and probe sensors.
3. The stems can be cleaned with a soft brush, but each probe has slightly different techniques (Table 11.1).

Troubleshooting

Problems with calibration may indicate problems with a probe. Contact Eureka Environmental to troubleshoot. The Manta 1 is no longer sold and product support is limited. This unit will eventually need to be upgraded to the Manta 2.

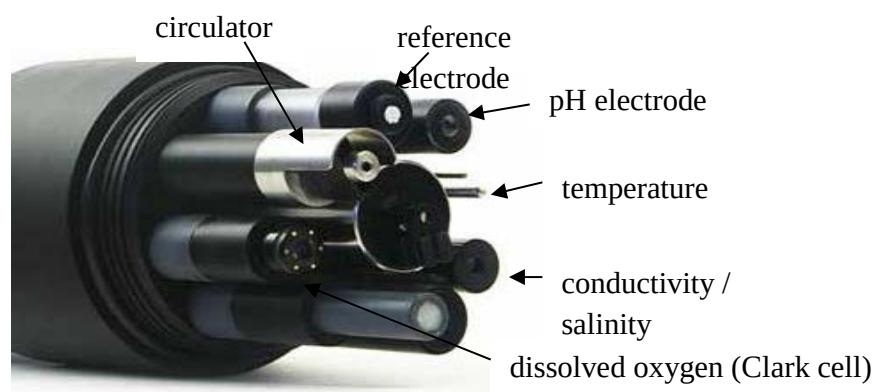


Figure 11.3. Eureka Manta probes. Only those installed on the unit used in this protocol unit are indicated.

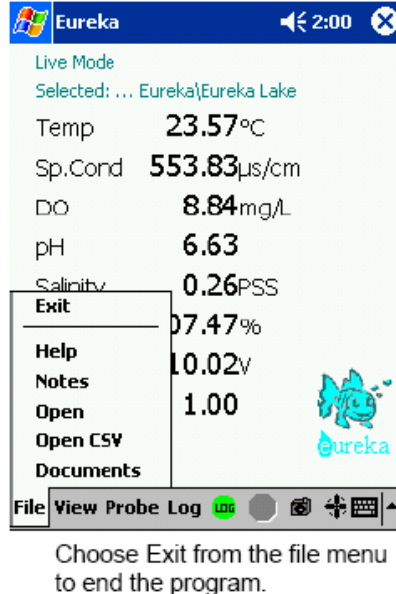


Figure 11.2. Eureka logging display.

Attachment 11.1. Water Chemistry Data Form

Sample Year: _____ (YYYY)
 Sample Event: _____ (01 thru 12)

CUVA Wetland Monitoring Water Chemistry Data Form
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Well ID	Date (MM/DD/YY)	Time (HH:MM)	check one (x)		Temp (°C)	Spec Cond (ms/cm)	DO (mg/L)	pH	Salinity (pss)	Depth to Water (cm)	Depth to Ground (cm)
			Surface Water	Ground Water							
28											
29											
30											
32											
39											
43											
56											
192											
305											
306											
307											
309											
310											
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623											
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885											
887											
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947											
950											
951											
953											
957											
1007											
1017											
1034											
1036											
1058											
1068											
1069											
1070											
1104											
1188											
1196											
1205											
1221											
1351											

Sample Year: _____ (YYYY)
 Sample Event: _____ (01 thru 12)

CUVA Wetland Monitoring Water Chemistry Data Form
 Page 2 of 2

Well ID	Date (MM/DD/YY)	Time (HH:MM)	check one (x)		Temp (°C)	Spec Cond (ms/cm)	DO (mg/L)	pH	Salinity (pss)	Depth to Water (cm)	Depth to Ground (cm)
			Surface Water	Ground Water							
1364											
1468											
1485											
1043 (PV)											
1047 (PV)											
1049 (PV)											
968 (gauge)											
968PV968											
969 (PV)											
970 (ecotone)											
970PV											
1079RS1											
1079RS2											
1079RS3											
124 (ecotone)											
1427 (ecotone)											
1622KR1 (gauge)											
1627KR2											
241K (ecotone)											
241KL (gauge)											
241VK3											
241VK4											
242VK1											
242VK2											
365BM (gauge)											
365BM2											
365BM3											
365BM4											
365BM5											
365BM6											
398 (ecotone)											
526 (ecotone)											
526SB1											
526SB2											
526SB3											
540SF1											
540SF2											
540SF3											
540SF4											
554 (ecotone)											
683 (ecotone)											
977 (gauge)											
977FP1											
977FP2											
977FP3											
977FP4											
977FP5											
Megapond											