

Data Sonde Calibration and Maintenance

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A. Introduction

B. Procedural Steps

1. Quanta Calibration and Maintenance- Make sure you have the following ready prior to calibration:

- Container half-filled with tap water (with a conductance at least 200 us/cm, but less than 500us/cm), equilibrated to room temp (allow to sit uncapped at least 20 minutes but preferably overnight)
- pH 4, 7, and 10 buffer solutions in 500 or 1000 ml containers, equilibrated to room temperature
- Conductivity calibration solution (the conductance of solution used will vary based on the region of GA in which you are sampling)
- Calibration cup
- Rubber calibration cup cover

DO Calibration:

- 1- Fill the calibration cup with tap water to the black O-ring of the DO sensor. Ensure there is no water on the membrane of the sensor. If water is present on the membrane, use a Kim wipe to GENTLY remove the water.
- 2- Place the black rubber cap, upside-down and off centered, on top of the cup, so that there is a small opening (fig. 1).
- 3- Turn the Quanta on and allow the readings to stabilize for at least 1 minute and no more than 5 minutes.
- 4- Record the initial temperature, DO mg/l, and DO %sat on the calibration form.
- 5- Calibrate the DO by selecting “Calib”→ “DO%” and enter the known barometric pressure in mm Hg to the nearest whole number. Hit “Enter (↵)” to confirm the BP and calibrate the sensor.
- 6- Record the final DO concentration in mg/L on the calibration form. Refill the water container to the halfway point in preparation for future calibrations.



Figure 1: Note the water level is just touching the o-ring, and the cap is slightly off-centered.

pH Calibration:

- 1- Fill the calibration cup with pH 7 buffer such that the thermometer is half submerged. Place the rubber cap firmly over the opening and swirl/shake for 7-10 seconds. Pour out the buffer and repeat the rinsing process once more.
 - 2- Fill the calibration cup with pH 7 buffer to within 1cm of the opening. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and pH readings on the pH 7 line of the calibration form.
 - 3- Select “Calib” → “pH” and use the arrow keys to scroll to the actual value for the buffer (in this case 7.0). Hit “Enter (↵)” to confirm the value and calibrate the sensor.
 - 4- Repeat the rinsing and calibration process with pH 4 buffer.
 - 5- Finally, check the calibration with pH 10 buffer. Repeat the rinsing process with pH10 and fill with buffer to within 1 cm of the top of the calibration cup, but do not calibrate. Allow the readings to stabilize (max of 3 minutes) and record the temp and pH readings on the calibration form. If the stabilized reading falls within +/- .2 units of the buffer (in this case 10.0), the sensor is functioning correctly and is ready to be used; if the readings fall outside of this margin, consult the troubleshooting guide at the end of this text.
- NOTE: If you are planning to sample an aquatic environment in which reported pH values tend to be alkaline, calibrate with 7 buffer first, then 10, and check with 4.

Specific Conductance Calibration:

- 1- Fill the calibration cup with conductivity solution such that the thermometer is half submerged. Place the rubber cap firmly over the opening and swirl/shake for 7-10 seconds. Pour out the solution and repeat the rinsing process once more.
- 2- Fill the calibration cup with conductivity solution to within 1cm of the opening. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and conductance values on the “SpC” line of the calibration form.
- 3- Select “Calib” → “SpC” and use the arrow keys to scroll to the actual value for the solution. Hit “Enter (↵)” to confirm the value and calibrate the sensor.

NOTE: The Quanta utilizes a single-point calibration procedure for conductivity. All minisondes require a two-point calibration process.

Quanta Post-Calibration

All datasondes utilized in the field must be post-calibrated upon returning to the office. This important step allows for the detection and documentation of any sensor drift or malfunction that may have occurred throughout the course of the day. If the Quanta is to be used on concurrent sampling days, then the following morning’s pre-calibration may be utilized as the post-calibration for the previous days’ activities.

DO Post-Calibration:

- 1- Fill the calibration cup with tap water to the black O-ring of the DO sensor. Ensure there is no water on the membrane of the sensor. If water is present on the membrane, use a Kim wipe to GENTLY remove the water.
- 2- Place the black rubber cap, upside-down and off centered, on top of the cup, so that there is a small opening (fig. 1).
- 3- Turn the Quanta on and allow the readings to stabilize for at least 1 minute and no more than 5 minutes.
- 4- Record the initial temperature, DO mg/l, and DO %sat on the calibration form.
- 5- DO NOT CALIBRATE. Use the DO saturation chart in Appendix A to determine the proper DO concentration in mg/l at 100% saturation based on the BP.
- 6- Record the appropriate DO concentration in mg/L at 100% saturation on the calibration form. Refill the water container to the halfway point in preparation for future calibrations.

pH Post-Calibration:

- 1- Fill the calibration cup with pH 7 buffer such that the thermometer is half submerged. Place the rubber cap firmly over the opening and swirl/shake for 7-10 seconds. Pour out the buffer and repeat the rinsing process once more.
- 2- Fill the calibration cup with pH 7 buffer to within 1cm of the opening. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and pH readings on the pH 7 line of the calibration form. DO NOT CALIBRATE.
- 3- Repeat steps 1 and 2 with pH 4 buffer, and again with pH 10.

Specific Conductance Post-Calibration:

- 1- Fill the calibration cup with conductivity solution using a higher concentration than observed in the field such that the thermometer is half submerged. Place the rubber cap firmly over the opening and swirl/shake for 7-10 seconds. Pour out the solution and repeat the rinsing process once more.

- 2- Fill the calibration cup with conductivity solution to within 1cm of the opening. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and conductance values on the “SpC” line of the calibration form. DO NOT CALIBRATE.

NOTE: The Quanta utilizes a single-point calibration procedure for conductivity. All minisondes require a two-point calibration process.

Quanta Deployment and Maintenance:

-Store the Quanta in pH4 buffer at all times. If you are low on pH4 buffer, you may use pH 7 buffer during field deployment, but it must be replaced with 4 buffer during overnight or long-term storage. Fill the storage cup to the fill line etched on the cup, and replenish with new buffer at the end of the sampling day. If the buffer is lost in the field, fill the cup with water but ensure that the conductance exceeds 200 us/cm.

-Following the end of each sampling day, inspect the Quanta probes, body, pH reference junction cap, and DO membrane for signs of dirt, wear or damage. If dirt has accumulated on the pH bulb use a soft cotton swab to GENTLY wipe the probe clean. The following maintenance should be performed once per week for Quantas used frequently in the field (at least one day per week) or once monthly for units in storage:

pH Reference Junction Solution Refresh:

- 1- Turn the junction counter-clock-wise to unscrew it from the base. With the junction off, pour the old electrolyte solution out.
- 2- Place two salt tablets in the now empty junction sleeve and fill the reference until the electrolyte forms a slight dome over the top. Gently “flick” the sides of the junction cylinder a few times to ensure that no bubbles are trapped at the bottom.
- 3- Gently place the new junction into the top of the reference tube so that no air remains inside, and turn it clock-wise until the o-ring is sealed tightly. As you tighten you will see a small amount of electrolyte and possibly bubbles being forced out of the junction. This is the air being purged from inside the junction. If this purging effect does not occur, the junction may be clogged and must be replaced.

DO Membrane Replacement:

- 1- Remove the o-ring at the top of the sensor and discard the old membrane and electrolyte.
- 2- Refill the sensor with the electrolyte so that there is a slight dome on top and no bubbles. Gently “flick” the side of the probe a few times to ensure that no bubbles are trapped.
- 3- Place a new membrane over the top and secure it with the o-ring so that it does not wrinkle and no air is trapped underneath it. If a bubble is trapped under the membrane, discard the membrane and try again with a new one. Trim the excess membrane with scissors.

The sensor must soak in pH buffer (or clean tap water, as long as the conductance exceeds 200 us/cm) and the membrane allowed to relax for at least 4, but preferably 24 hours prior to calibration. The dissolved oxygen readings will drift if the sensor is calibrated early.

Cleaning

The housing and probes should be cleaned at least once per month. If the Quanta is frequently deployed in waters that carries the potential to quickly foul the sensors (such as systems with heavy sediment loading, for example), then consider cleaning once per week.

- 1- Inspect the pH bulb and reference junction. If any dirt is visible on the bulb, use a cotton swab or soft brush and soapy water to clean it. You can also use simple green cleaner if it is very dirty. The glass bulb is very thin and fragile. Care should always be taken not to damage it when servicing the instrument. The reference junction is a threaded cap with a sleeve of porous Teflon in the center. The Teflon allows the reference electrolyte to make an electrical connection to the sample water while preventing them from mixing freely. If it becomes clogged or dirty, replace it.
- 2- Using a moist kimwipe, wipe the inside of the conductivity sensor chamber to remove any accumulated sediment.
- 3- Check the condition of the DO electrodes. The anode should be a white or off-white triangle in the center of the sensor. As it ages it may begin to turn black or break apart. When it reaches this stage, the readings may become unstable or inaccurate and the sensor must be replaced. The cathode is a gold ring around the top of the sensor. It should be a bright yellow. If it appears tarnished or dirty, it can be gently cleaned with a cotton swab and toothpaste, a mildly abrasive detergent or hand cleaner with pumice. Rub the swab around the ring wiping towards the open part of the cathode on both sides; this will ensure that the ring will not peel up over time. When the original yellow shine is restored, rinse the inside of the sensor several times with the 'DO' electrolyte provided in the maintenance kit.
- 4- Using a soft brush and non-ethanol based soap, clean the thermometer and sides of the probes. Rinse with tap water and store unit in pH 4 buffer.

2. Minisondes

Make sure you have the following ready prior to calibration:

- Container half-filled with tap water (with a conductance at least 200 us/cm, but less than 500us/cm), equilibrated to room temp (allow to sit uncapped at least 20 minutes but preferably overnight)
- pH 4, 7, and 10 buffer solutions in 500 or 1000 ml containers, equilibrated to room temperature
- Conductivity calibration solution (the conductance of solution used will vary based on the region of GA in which you are sampling)
- Calibration cup
- Plastic minisonde screw cap

DO Calibration:

- 1- Shake the container of tap water vigorously for 40 seconds. Fill the calibration cup with tap water above the DO sensor, to the bottom of the calibration cup threads.
- 2- Place the cap upside-down on top of the cup.
- 3- Turn the minisonde on and allow the readings to stabilize for at least 1 minute no more than 5 minutes.
- 4- Record the initial temperature, DO mg/l, and DO %sat on the calibration form.

- 5- Calibrate the DO by selecting “Calibrate” → “DO%: SAT” and enter the known barometric pressure in mm Hg. Hit “enter” to confirm the BP and calibrate the sensor.
- 6- Record the final DO concentration in mg/L on the calibration form. Refill the water container to the halfway point in preparation for future calibrations

pH Calibration:

- 1- Fill the calibration cup with pH 7 buffer such that the fluid level is above thermometer and below the DO and pH probes. Screw the minisonde cap on (or, if you have a rubber quanta cap, place it firmly over the opening) and swirl/shake for 7-10 seconds. Pour out the buffer and repeat the rinsing process once more.
- 2- Fill the calibration cup with pH 7 buffer to the bottom of the calibration cup threads. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and pH readings on the “pH 7” line of the calibration form.
- 3- Select “Calibrate” → “pH: Units” and enter the actual value of the buffer (in this case 7.0). Hit “Enter” to confirm the value and calibrate the sensor.
- 4- Repeat the rinsing and calibration process with pH 4 buffer.
- 5- Finally, check the calibration with pH 10 buffer. Repeat the rinsing process with pH10 and fill with buffer to the bottom of the threads at the top of the calibration cup, but do not calibrate. Allow the readings to stabilize (max of 3 minutes) and record the temp and pH readings on the calibration form. If the stabilized reading falls within +/- .2 units of the buffer (in this case 10.0), the sensor is functioning correctly and is ready to be used; if the readings fall outside of this margin, contact your assigned equipment manager.

NOTE: If you are planning to sample an aquatic environment in which reported pH values tend to be alkaline, calibrate with 7 buffer first, then 10, and check with 4.

Specific Conductance Calibration:

- 1- Empty and remove the calibration cup from the Minisonde.
- 2- Using a kimwipe, thoroughly dry the inside of the conductivity chamber.
- 3- Wait 30 seconds for stabilization, and record the initial temp and conductivity readings within the “cond 0” line of the calibration form.
- 4- Select “Calibrate” → “SpCond” and enter “0” as the calibration value.
- 5- Replace the calibration cup onto the minisonde and fill it with conductivity solution such that the fluid level is above thermometer and below the DO and pH probes. Screw the minisonde cap on (or, if you have a rubber quanta cap, place it firmly over the opening) and swirl/shake for 7-10 seconds. Pour out the solution and repeat the rinsing process once more.
- 3- Fill the calibration cup with conductivity solution to the bottom of the calibration cup threads. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and conductance values on the “SpC” line of the calibration form.
- 4- Select “Calibrate” → “SpCond” and use the arrow keys to scroll to the actual value for the solution. Hit “Enter” to confirm the value and calibrate the sensor.

NOTE: The Quanta utilizes a single-point calibration procedure for conductivity. All minisondes require a two-point calibration process.

Minisonde Post-Calibration

All datasondes utilized in the field must be post-calibrated upon returning to the office. This important step allows for the detection and documentation of any sensor drift or malfunction that may have occurred throughout the course of the day. If the Minisonde is to be used on concurrent

sampling days, then the following morning's pre-calibration may be utilized as the post-calibration for the previous days' activities.

DO Post-Calibration:

- 1- Shake the container of tap water vigorously for 40 seconds. Fill the calibration cup with tap water above the DO sensor, to the bottom of the calibration cup threads.
- 2- Place the cap upside-down on top of the cup.
- 3- Turn the minisonde on and allow the readings to stabilize for at least 1 minute no more than 5 minutes.
- 4- Record the initial temperature, DO mg/l, and DO %sat on the calibration form.
- 5- DO NOT CALIBRATE. Use the DO saturation chart in Appendix A to determine the proper DO concentration in mg/l at 100% saturation based on the BP.
- 6- Record the appropriate DO concentration in mg/L at 100% saturation on the calibration form. Refill the water container to the halfway point in preparation for future calibrations.

pH Post-Calibration:

- 1- Fill the calibration cup with pH 7 buffer such that the fluid level is above thermometer and below the DO and pH probes. Screw the minisonde cap on (or, if you have a rubber quanta cap, place it firmly over the opening) and swirl/shake for 7-10 seconds. Pour out the buffer and repeat the rinsing process once more.
- 2- Fill the calibration cup with pH 7 buffer to the bottom of the calibration cup threads. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and pH readings on the "pH 7" line of the calibration form. DO NOT CALIBRATE.
- 3- Repeat steps 1 and 2 with pH 4 and 10 buffers.

Specific Conductance Post-Calibration:

- 1- Empty and remove the calibration cup from the Minisonde.
- 2- Using a kimwipe, thoroughly dry the inside of the conductivity chamber.
- 3- Wait 30 seconds for stabilization, and record the initial temp and conductivity readings within the "cond 0" line of the calibration form. DO NOT CALIBRATE.
- 4- Replace the calibration cup onto the minisonde and fill it with conductivity solution using a higher concentration than observed in the field such that the fluid level is above thermometer and below the DO and pH probes. Screw the minisonde cap on (or, if you have a rubber quanta cap, place it firmly over the opening) and swirl/shake for 7-10 seconds. Pour out the solution and repeat the rinsing process once more.
- 5- Fill the calibration cup with conductivity solution to the bottom of the calibration cup threads. Allow the readings to stabilize for at least 30 seconds, but no more than 3 minutes. Write the initial temperature and conductance values on the "SpC" line of the calibration form. DO NOT CALIBRATE.

NOTE: The Quanta utilizes a single-point calibration procedure for conductivity. All minisondes require a two-point calibration process.

Minisonde Deployment and Maintenance:

-Store the Minisonde in pH4 buffer at all times. If you are low on pH4 buffer, you may use pH 7 buffer during field deployment, but it must be replaced with 4 buffer during overnight or long-

term storage. Fill the storage cup to 1/3 of its total capacity when not attached to the minisonde, and replenish with new buffer at the end of the sampling day. If the buffer is lost in the field, fill the cup with water but ensure that the conductance exceeds 200 us/cm.

-The substrate on the LDO cap is fragile. Take care not to scratch the top or sides of the cap while installing/removing the storage cup and guard. The cap must be moist at all times. If it dries out, it must be allowed to rehydrate for at least 30 minutes prior to calibration or field use.

-Following the end of each sampling day, inspect the probes, body, pH reference junction cap, and DO cap for signs of dirt, wear or damage. The following maintenance should be performed once per week for monitors used frequently in the field (at least one day per week) or once monthly for units in storage:

pH Reference Junction Solution Refresh:

- 1- Turn the junction counter-clock-wise to unscrew it from the base. With the junction off, pour the old electrolyte solution out.
- 2- Place two salt tablets in the now empty junction sleeve and fill the reference until the electrolyte forms a slight dome over the top. “Flick” the sides of the junction cylinder a few times to ensure that no bubbles are trapped at the bottom.
- 3- Gently place the new junction into the top of the reference tube so that no air remains inside, and turn it clock-wise until the o-ring is sealed tightly. As you tighten you will see a small amount of electrolyte and possibly bubbles being forced out of the junction. This is the air being purged from inside the junction. If this purging effect does not occur, the junction may be clogged and must be replaced.

DO Membrane Replacement (for Minisonde 4a):

- 4- Remove the o-ring at the top of the sensor and discard the old membrane and electrolyte.
- 5- Refill the sensor with the electrolyte so that there is a slight dome on top and no bubbles. Gently “flick” the side of the probe a few times to ensure that no bubbles are trapped.
- 6- Place a new membrane over the top and secure it with the o-ring so that it does not wrinkle and no air is trapped underneath it. If a bubble is trapped under the membrane, discard the membrane and try again with a new one. Trim the excess membrane with scissors.

The sensor must soak in clean pH buffer (or clean tap water, as long as the conductance exceeds 200 us/cm) and the membrane allowed to relax for 24 hours prior to calibration. The dissolved oxygen readings will drift if the sensor is calibrated early.

Cleaning

The housing and probes should be cleaned at least once per month. If the Minisonde is frequently deployed in waters that carries the potential to quickly foul the sensors (such as systems with heavy sediment loading, for example), then consider cleaning once per week.

- 5- Inspect the pH bulb and reference junction. If any dirt is visible on the bulb, use a cotton swab or soft brush and soapy water to clean it. The glass bulb is very thin and fragile. Care should always be taken not to damage it when servicing the instrument. The reference junction is a threaded cap with a sleeve of porous Teflon in the center. The Teflon allows the reference electrolyte to make an electrical connection to the sample water while preventing them from mixing freely. If it becomes clogged or dirty, replace it.

- 6- Using a moist kimwipe, wipe the inside of the conductivity sensor chamber to remove any accumulated sediment.
- 7- Check the condition of the DO cap. If any scratches appear on >50% of the surface, or if you can see a blue light emitting from the top of the cap, notify the monitoring equipment manager.
- 8- Using a soft brush and non-ethanol based soap, clean the thermometer and sides of the probes. Rinse with tap water and store unit in pH 4 buffer.

C. Troubleshooting and Error Management

◆Potentially erroneous sonde values- If, during a site visit, the sonde is reporting water quality values that deviate substantially from typical values given at a particular site, relocate the sonde to a different section of the sample site and check to see if the values at the new position agree with the original readings. If both readings agree with one another, use the field verification kit to confirm or refute the sonde's reported values, and note the results in the log book.

◆Damage to the sonde- If any damage occurs to the sonde that impairs its ability to function (i.e., the case or one of the sensors is physically cracked, the membrane on the Clark cell is removed or destroyed, the pH bulb is broken), do not continue to use it in the field.

D. References