

Best Practices for Continuous Water Quality Monitoring

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water
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Top 5 Tips

1. Stay Up-to-date
2. Maintain Power
3. Clean & Replace Parts
4. Check Calibration
5. Deploy Properly

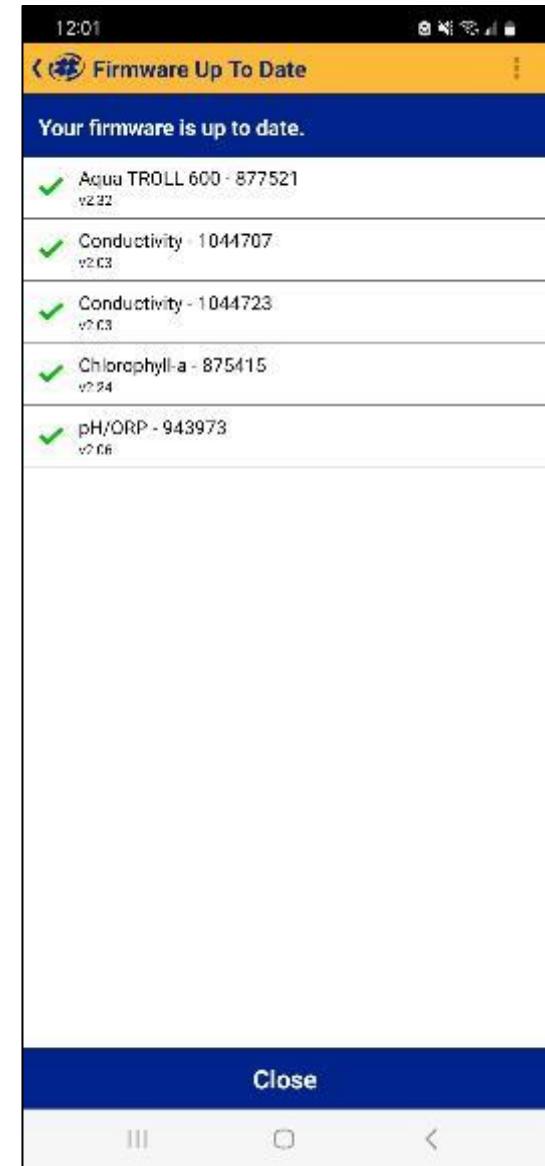
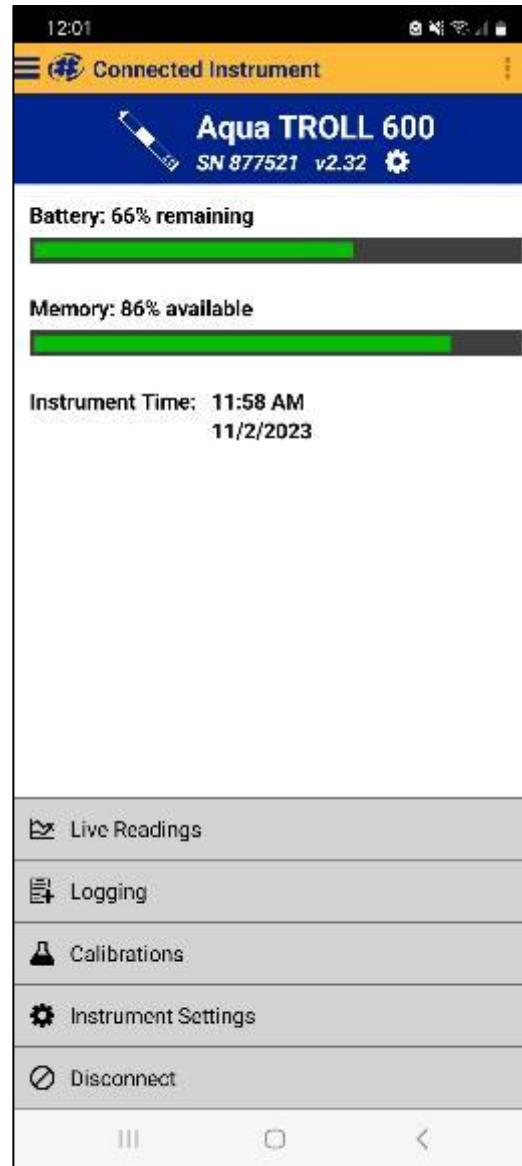




1. Stay Up-to-date

Phone & Computer

- Software updates periodically
 - New features
 - Bug fixes
 - Firmware updates
- Information found on websites or on mobile device application store
- Recommendation: Check Monthly (or set to automatic updates)



Sondes & Sensors

- Firmware updates periodically
- Information found on websites
- Recommendation: Check Quarterly



Telemetry System

- Firmware updates periodically
- Information found on websites or on mobile device application store
- Some updates performed over-the-air
- Recommendation: Check Monthly (or set to automatic updates)





2. Maintain Power

Traditional Setup

- Typically includes:
 - Solar panel(s)
 - Marine grade battery(-ies)
 - Regulator
 - Wiring
- Solar panels need proper placement for maximum solar exposure
- Solar panels need cleaning
- Batteries need replaced and recharged



VuLink Setup

- Operates on 3 D-cell batteries
- Replacement time dependent on:
 - Number of parameters
 - Transmit interval
 - Weather
- Transmit battery level
- Alarms for low-voltage



Phone & Computer

- Make sure to charge before going to the field
- Have in-vehicle charging options
- Portable charging devices helpful





3. Clean and Replace Parts

Build a Field Kit

- Typically includes:
 - Soft brushes
 - Cotton swabs
 - Lint-free cloths
 - Sponges
 - Canned air
 - Mild soap
 - Water
 - Batteries
 - Chargers
- Follow manufacturer's instructions for cleaning and maintaining equipment!



Replace O-Rings

- Know where they are!
- Check for nicks, cuts, breaks, etc.
- Replace periodically even if ok
- Use grease recommended by manufacturer to lubricate
- Only takes a small amount of grease
- Do not stretch when installing. Simply roll or press them into position.



Sensor Maintenance

- Items needing attention:
 - pH/ISE solution or module
 - DO lens cap or membrane
 - Wiper brush head
 - Desiccant packets/cartridges
- Check equipment manual for complete instructions





4. Check Calibration

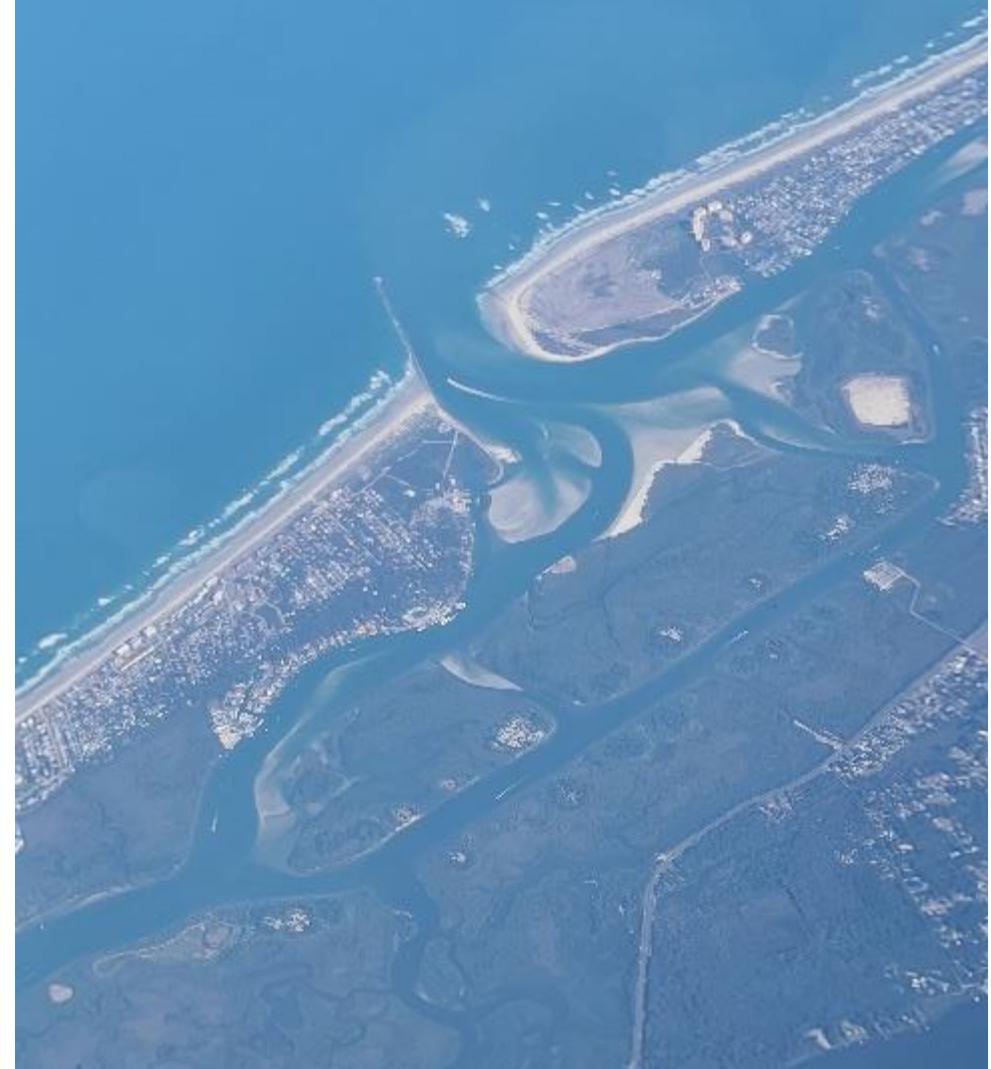
Frequency of Calibration

- Dictated by YOUR standard operating procedure
- Manufacturer's sometimes offer recommendations of frequency:
 - Check equipment manual
 - Examples:
 - pH: 10-12 weeks
 - DO: 1 year
 - ISE: 1 month



Bracket Conditions

- Each water body is unique
- Standards for calibration and checks should represent expected conditions
 - Example:
 - SC: Freshwater vs Brackish
 - pH: Ocean vs Mine drainage
 - DO: Top vs Bottom of lake
 - TBY: Mountain vs urban area



Standard Expiration Dates

- Yes, they do expire!
- They expire faster when opened
- Avoid expired standards:
 - Solution may have changed
 - Legal reasons
- Label bottles with the date opened
- All standards should have solution expiry information available for unopened and opened bottles

Solutions

Solution	Shelf Life - Unopened	Shelf Life - Opened
Quick Cal	4 months. Store in a cool, dark place. Shake before use.	7 to 21 days (± 10 mV, ± 0.05 pH, ± 50 μ S/cm)
ZoBell's	9 months. Store in a cool, dark place.	3 to 6 months
Low Conductivity (147 μ S/cm)	12 months	Hours (± 1 μ S/cm, check before use)
Other Conductivity	12 months	3 to 6 months
pH Calibration Buffers	24 months	3 to 6 months
Sensor Reference Filling Solution	24 months	12 months
pH Storage Solution	24 months	12 months
Sodium Sulfite	12 months	3 to 6 months
Turbidity	12 months	12 months from expiration date
Deionized Water	24 months	Hours, check before use for calibration
Ammonium	12 months	3 to 6 months
Chloride	12 months	3 to 6 months
Nitrate	12 months	3 to 6 months



The Basic Process

- Five simple steps:
 1. Clean everything
 2. Rinse 3 times
 - Ideally all with standard to be used
 3. Fill the calibration cup with standard
 4. Wait for stabilization
 5. Accept calibration
- Videos often available for help
- Sometimes can batch calibrate

Quality Assurance Information

- Calibration reports include:
 - Pre- and Post-calibration info
 - Slope or Gain
 - Offset
 - Constants
- Need to watch QA parameter changes over time. They indicate:
 - Errors in procedure
 - Sensor malfunction
 - Sensor maintenance time

Sensor	pH/ORP
Serial Number	574714
Last Calibrated	1/25/2019
<i>Calibration Details</i>	
<i>Calibration Point 1</i>	
pH of Buffer	4.00 pH
pH mV	155.9 mV
Temperature	26.58 °C
<i>Pre Measurement</i>	
pH	4.20 pH
pH mV	155.9 mV
<i>Post Measurement</i>	
pH	4.00 pH
pH mV	156.8 mV
<i>Calibration Point 2</i>	
pH of Buffer	7.00 pH
pH mV	-8.9 mV
Temperature	26.52 °C
<i>Pre Measurement</i>	
<i>Calibration Point 3</i>	
pH of Buffer	10.00 pH
pH mV	-187.5 mV
Temperature	26.74 °C
<i>Pre Measurement</i>	
pH	9.97 pH
pH mV	-187.6 mV
<i>Post Measurement</i>	
pH	10.00 pH
pH mV	-188.6 mV
<i>Slope and Offset 1</i>	
Slope	-54.94 mV/pH
Offset	-8.9 mV
<i>Slope and Offset 2</i>	
Slope	-59.53 mV/pH
Offset	-8.9 mV
<i>ORP</i>	
ORP Solution	Quick-Cal
Offset	7.4 mV
Temperature	22.37 °C

Sensor	Conductivity
Serial Number	599067
Last Calibrated	1/25/2019
<i>Calibration Details</i>	
<i>TDS Conversion Factor (ppm)</i>	
Cell Constant	0.65
Reference Temperature	0.952
<i>Pre Measurement</i>	
Actual Conductivity	25.00 °C
Specific Conductivity	13,485 µS/cm
<i>Post Measurement</i>	
Actual Conductivity	13,157 µS/cm
Specific Conductivity	13,211 µS/cm
<i>Pre Measurement</i>	
Sensor	RDO
Serial Number	596662
Last Calibrated	10/19/2018
<i>Calibration Details</i>	
Slope	1.063145
Offset	0.00 mg/L
<i>Calibration point 100%</i>	
Concentration	7.41 mg/L
Pre Measurement	103.53 %Sat
Post Measurement	100.00 %Sat
Temperature	27.67 °C
Barometric Pressure	22.37 °C
Barometric Pressure	1,013.5 mbar

Extras to Check

- Compare sensor reading to NIST-certified thermistor
- Check conductivity sensor reading in air
- Verify barometer is reading correctly and calibrate, if possible



Tech Support

- If anything goes wrong, always make Technical Support your #1 call!





5. Deploy Properly

Cross-Sections

- Important for verifying that a location is well-mixed
- Well-mixed ensures that sampling or monitoring anywhere will be representative of entire water body



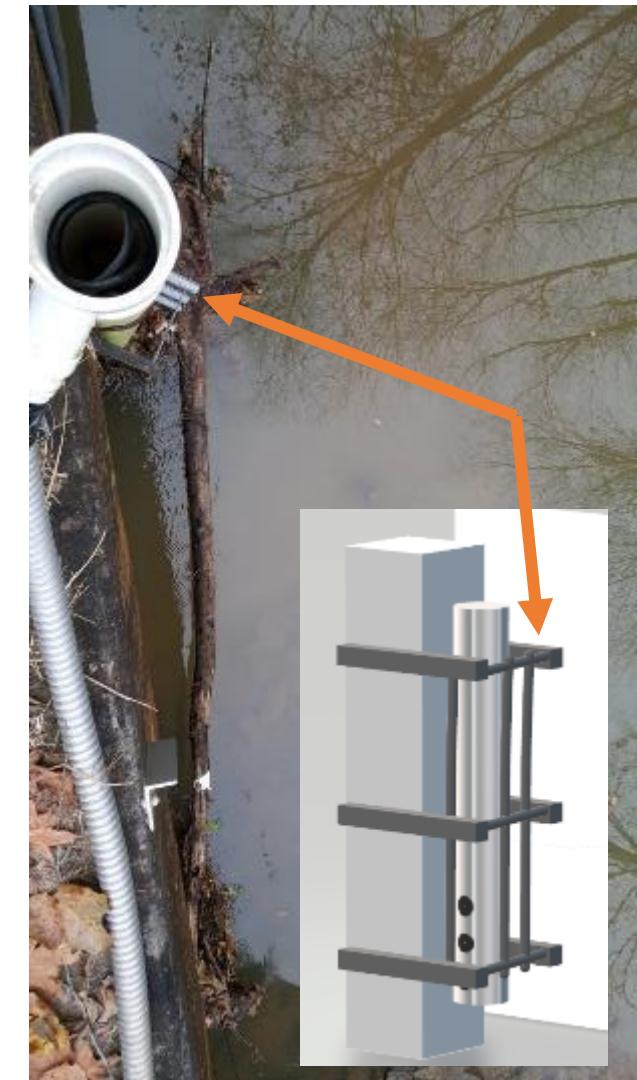
Discrete Sampling

- Collect data in a consistent location
- -or- Collect data where you collect samples for laboratory analysis
- Stand downstream of the sonde
- Ensure all sensors are in water
- Keep sensors off streambed
- Look at graphs for stability



Continuous Monitoring

- Monitoring location should be representative of water body
 - Compare deployment location readings to cross-section data
 - Do not deploy in an eddy
- Deployment pipe should have holes to ensure proper flow across sensors
 - For long pipes and those with heavy sediment, put holes down entire pipe
- The more vertical, the better
- Angle pipe downstream to deflect some debris and sediment
- Ensure sonde is safely accessible at all flows



Quick Recap

1. Stay Up-to-date
2. Maintain Power
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In-Situ

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