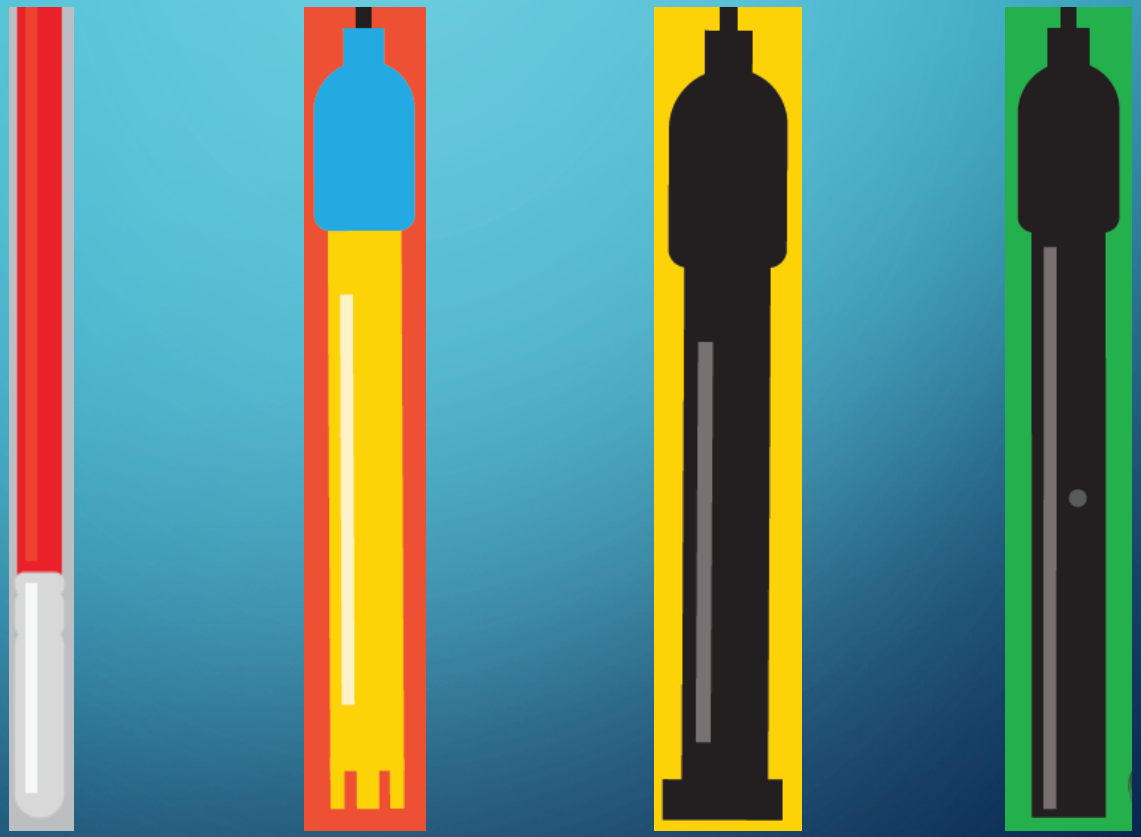
Calibrating *Atlas Scientific* Water Quality Probes



US EPA, Science and Ecosystem Support Division, Athens GA. 2018.

PT-1000
Temperature Probe

Reads	**Temperature**
Range	**-200˚C to 850˚C**
Probe type	**Class A platinum, RTD**
Accuracy	**+/- (0.15 + (0.002*t))**
Reaction Time	**90% in 13s**
Cable length	**81cm**
Output	**Analog**
Time before recalibration	**3–5 years**
Life expectancy	**15 years**
Maintenance	**N/A**

Temperature Probe

- NIST verification, not calibration!
- Equipment thermistors should be verified against a NIST (National Institute of Standards and Technology) traceable thermometer prior to use and should agree within ± 4.0°C.
- Temperature verification is vital, as other probes rely on accurate temperature readings for temperature compensated parameters. Verify temp before proceeding to conductivity, pH, and DO calibration.

Don’t forget to clean the probe end with DI water and wipe dry before placing in any calibration or reference solution.

Conductivity
Probe K 10

Platinum

Reads	**Conductivity**
Range	**10 µS/cm – 1 S**
Response time	**90% in 1s**
Max pressure	**200 PSI**
Max depth	**60m (197 ft)**
Temperature range °C	**1 – 110 °C**
Cable length	**1 meter**
Internal temperature sensor	**No**
Time before recalibration	**~10 years**
Life expectancy	**~10 years**
Maintenance	**N/A**

Conductivity Probe Calibration

- Temperature has a significant effect on conductivity readings, thus the temperature probe must be placed in the calibration solution with the conductivity probe.
- Conductivity values displayed will be in microsiemens per centimeter (µS/cm).
- Calibrated conductivity values displayed will not be compensated for temperature, but logged values will be.

**SESD's Conductivity Cal and End-Check Acceptance Criteria:

± 5% of Cal Standard (± 5% of 12,880µS/cm = 644µS/cm)

Conductivity Probe Calibration

1. Ensure probe is clean and dry, this will serve as the zero point calibration. You should see a pre-cal value of 0.00 µS/cm. Temperature probe must also be clean and dry and in same environment as conductivity probe.
2. Clean both probes with DI water and blot dry.
3. Pour a small amount of 12,880* µS/cm standard into a clean cup, then place the clean and dry conductivity and temperature probes into the cal solution. Shake the probe to make sure you do not have trapped air bubbles in the sensing area. Allow 1 minute for readings to stabilize, then record pre-cal value. Then accept and record cal value if within acceptance criteria.

*If the calibration solution is not within ± 2.5°C of 25°C, check the temperature chart on the side of the calibration solution bottle, and calibrate to that value.

pH Probe

Silver / silver chloride

Reads	**pH**
Range	**0 – 14**
Response time	**95% in 1s**
Max pressure	**100 PSI**
Max depth	**60m (197 ft)**
Temperature range °C	**1 – 99 °C**
Cable length	**1 meter**
Internal temperature sensor	**No**
Time before recalibration	**~1 Year**
Life expectancy	**~2.5 Years +**
Maintenance	**N/A**

pH Probe Calibration

- Temperature has an effect on pH readings, thus the temperature probe must be placed in the calibration solution with the pH probe.
- The first calibration point must be the midpoint (pH 7)
- Will be using a 2 point calibration in the order of 7 – 4.
- pH 10 solution will be used for verification.
- pH values displayed will be in pH Standard Units (SU).

**SESD's pH Cal and End-Check Acceptance Criteria:

± 0.2 SU for General Applications

pH Probe Calibration

1. Pour a small amount of pH 7* standard into a clean cup, then place the clean and dry pH and temperature probes into the cal solution. Allow 1-2 minutes for readings to stabilize, then record pre-cal value. Then accept and record cal value if within acceptance criteria.
2. Clean both probes with DI water and blot dry.
3. Pour a small amount of pH 4* standard into a clean cup, then place the clean and dry pH and temperature probes into the cal solution. Allow 1-2 minutes for readings to stabilize, then record pre-cal value. Then accept and record cal value if within acceptance criteria.
4. Clean both probes with DI water and blot dry.
5. Pour a small amount of pH 10 standard into a clean cup, then place the clean and dry pH and temperature probes into the cal solution. Allow 1-2 minutes for readings to stabilize, then record the read-only value.

*If the calibration solution is not within ± 2.5°C of 25°C, check the temperature chart on the side of the calibration solution bottle, and calibrate to that value.

Dissolved Oxygen Probe

Reads	**Dissolved Oxygen**
Range	**0 – 100 mg/L**
Response time	**~0.3 mg/L/per sec**
Max pressure	**3,447 kPa (500 PSI)**
Max depth	**343 meters (1,125 ft)**
Temperature range °C	**1 – 50 °C**
Cable length	**1 meter**
Internal temperature sensor	**No**
Time before recalibration	**~1 Year**
Life expectancy	**5 Years +**
Maintenance	**~18 Months**

DO Probe Calibration

- Calibrate first, compensate later.
- Once deployment site has been established, enter site barometric pressure (estimated from altitude) in kPa into Arduino sketch before uploading. This will provide an estimate of site barometric pressure during deployment.
- Pressure estimate: www.altitude.org/air_pressure.php
- Calibrate DO at deployment site when possible.
- DO values displayed will be in mg/L.

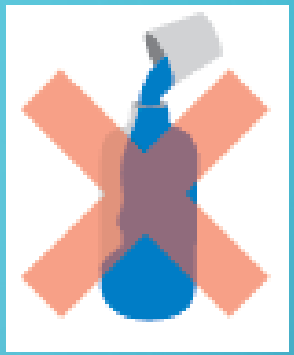
**SESD's DO Cal and End-Check Acceptance Criteria:

± 0.2 mg/L

DO Probe Calibration

1. Pull off (do not unscrew) protective cap from the DO probe.
2. Allow the DO probe to sit, exposed to air, for 5– 30 seconds.
3. Record pre-cal value. Then accept and record cal value if within acceptance criteria, which should be ~9.09 mg/L. This cal value is set at default compensation values, serving as a check that the probe is functioning properly.
4. Allow the DO probe to sit, exposed to air, for 5 – 30 seconds, record post-cal value.

Special Considerations



- Calibrate all probes with full length of cables used during field deployment because voltage will change with cable lengths.
- Never pour used calibration standards back into the bottle, as this can cause cross-contamination between used and unused calibration standards.
- The Calibration and End-Check Acceptance Criteria listed in this presentation are the values used by SESD. You may use these values, values defined in your respective SOP’s, or any values that will meet your Data Quality Objectives.

References

- https://www.atlas-scientific.com/_files/_datasheets/_circuit/EZO_RTD_Datasheet.pdf
- https://www.atlas-scientific.com/_files/_datasheets/_circuit/EC_EZO_Datasheet.pdf
- https://www.atlas-scientific.com/_files/_datasheets/_circuit/pH_EZO_datasheet.pdf
- https://www.atlas-scientific.com/_files/_datasheets/_circuit/DO_EZO_Datasheet.pdf
- https://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches

Additional Resources

- U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A10; available online at http://pubs.water.usgs.gov/twri9A.
- Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; available online at at http://pubs.water.usgs.gov/tm1d3.