Calibration and Use of Mettler Toledo SevenMulti® for Measuring Conductivity and Salinity

(Based on Mettler Toledo SevenMulti® Operating Instructions)

1. SCOPE AND APPLICATION

1.1. This method is based on the Mettler Toledo SevenMulti® operating instructions. It is used to calibrate the SevenMulti® and to measure conductivity and salinity in aqueous solutions.

2. SUMMARY OF METHOD

2.1. The SevenMulti® is set up and calibrated. After the initial set-up, daily calibration checks are performed and recorded in LIMS. A two-point daily (when used) calibration check is performed for conductivity and a one-point daily (when used) calibration check is performed for salinity. To perform the calibrations, the meter is turned on; and, the desired mode (COND, SAL) is selected. The probe is placed in the aqueous standard solution, briefly swirled then held still until the display stabilizes (locks). The probe is removed from the solution, rinsed, and placed in the storage solution. End-of-day measurements are made and recorded in LIMS to ensure the probe readings have not drifted.

2.2. The instrument setup calibration is performed when the values of the calibration standards change. The operator must check the conductivity on each standard container when the standard solution is replaced and compare the “new” conductivity with the “old” conductivity. If those values differ, an instrument set-up calibration is needed. This calibration is also done when a new probe is installed, to test a suspect probe, when a daily-check reading is out of tolerance, suspicious readings, etc.

2.3. Calibration checks are performed each day prior to the first use of the meter and after last use of the meter for parameters that are being measured. If the meter is used more than two hours after the daily calibration check, standards are rechecked.

2.4. Use of this SOP constitutes acknowledgement that the user has read the Mettler Toledo SevenMulti Manual.

2.5. Interferences: temperature probe not rinsed thoroughly, not waiting for meter to stabilize, contaminated standards.

2.6. Definitions:

2.6.1. ATC: automatic temperature compensation

2.6.2. NIST: National Institute of Standards and Technology

2.6.3. Stabilized: 1) Conductivity and salinity — when the endpoint icon (A) stops blinking.

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3. EQUIPMENT AND SUPPLIES

3.1. Mettler Toledo SevenMulti® with conductivity probe (probe with temperature sensor)

3.2. 30 mL Plastic cups

3.3. Waste cup

3.4. Rinse cups

3.5. Electronic thermometer (Calibrated and used per SOP TA-06.13)

3.6. LIMS

3.7. Logbook

4. REAGENTS AND STANDARDS

4.1. Deionized (DI) Water and rinse bottle

4.2. Conductivity standards; very low-NIST (~10 µmhos-cm), low-NIST (~100 µmhos-cm), medium-NIST (~1,000 µmhos-cm), high-NIST (~10,000 µmhos-cm), and a daily calibration standard of NIST 1,413 µmhos-cm (NIST ~1,000 µmhos-cm can be used).

4.2.1. Actual values will vary.

4.2.2. A 100 mmhos-cm standard may be useful for extremely high (>50 mmhos) conductivity samples.

4.2.3. NIST traceable standards are purchased from Fisher Scientific.

4.3. Salinity Standard, 35 ppth (This can be used as an ~ 53,000 µmhos-cm conductivity standard).

5. SAMPLE COLLECTION, PRESERVATION, AND HANDLING

5.1. See SOP FS 1000 for sample collection and preservation.

6. INTIAL SET-UP AND DAILY CALIBRATION

6.1. Turn the meter on by pressing the [On] button.

6.2. For initial and daily conductivity calibration:

6.2.1. Press [Right]. Select **Menu** and then **2. Calibration Setting**. Use up/down arrow keys to highlight **1. Set Calibration Standard**. Press [Enter].

6.2.2. Select the 1,413 µmhos-cm standard or the ~ 1,000 µmhos-cm standard (if using), use the up/down arrow keys to highlight **6. Enter Your Special Standard**. Press [Select]. Using the numerical keypad, enter your chosen standard (usually the ~1,000 µmhos-cm standard).

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Note: display is in mmhos-cm not µmhos-cm; ex. 998 µmhos is entered as 0.998 mmhos.

6.2.3. Pour calibration standard into a 30 ml plastic cup. Place probe into vial. Press [**CAL**]. When reading stabilizes, press [**END**]. Press [**SAVE**] to accept the calibration. To disregard, press [CANCEL]. Repeat process if canceled.

6.2.4. Calibration in 6.2 is done daily, and when the calibration standard value changes, a new probe is installed, or there is an issue with daily calibration checks.

7. DAILY CALIBRATION CHECK

7.1. Conductivity (meter should be on Step 6.1)

7.1.1. Pour ~25 mL each of the Calibration Standard (1,413 µmhos-cm standard or the 1,000 µmhos-cm standard, FDEP typically uses the 1,000 umhos-cm standard), the low conductivity standard and the high conductivity standard into separately labeled 30 mL plastic cups. Take and record the temperature of the 'Calibration' standard.

7.1.2. Press [Right]. Make sure conductivity is selected (MODE). Remove the probe from the storage bottle, rinse with DI water and shake off the excess water.

7.1.3. Immerse the probe into the lowest conductivity standard to be measured. (Measurements are made from low to high standards.) Swirl the probe then hold it still. Press [Read]. When the endpoint icon stops blinking, record the value in the *LIMS TOX_COND_SAL logbook*.

7.1.4. Repeat Step 7.1.3 for each conductivity standard to be measured. Rinse the probe with DI water and return the probe to the storage bottle (BOD bottle ½-¾ full of DI water).

7.1.5. The temperature of the medium conductivity standard (~1,000 µmhos-cm) is taken and recorded in the *LIMS TOX_COND_SAL logbook* in the *ENTRY_COMMENTS* of the lowest conductivity standard.

7.1.6. See 8.6.1 for end of day measurement using the Calibration Standard (1,413 µmhos-cm or ~1,000 µmhos-cm standard).

8. DAILY MEASUREMENTS

8.1. Ensure that the instrument is in the correct mode.

8.1.1. Conductivity: [Right] or [Dual] then [Right]

8.1.2. Salinity: in conductivity mode, press [Mode] then [Sal]

8.1.2.1. Salinity can also be determined by conversion by going to https://www.hamzasreef.com/Contents/Calculators/SalinityConver

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sion.php Conductivity and temperature values are needed for conversion.

8.2. Remove the conductivity probe from its storage bottle. Rinse the probe with DI water and shake off the excess water.

8.2.1. Conductivity probe is also used to measure salinity.

8.3. Immerse the probe in the solution, swirl, hold still, then press [Read]. Avoid touching the sides and the bottom of the cup. When the reading stabilizes, record the measurement in the appropriate logbook. Remove the probe from the sample and rinse with DI water.

8.4. Repeat Step 8.3, until all samples have been read.

8.4.1. Measure one sample at a time. Rinse probe between measurements with deionized water. When the one parameter has been read on the last aliquot of the last sample, select the next parameter and repeat.

8.4.1.1. It is suggested that conductivity be measured before pH is measured in any sample due to possible leaking of fill solution from the pH electrode into the sample.

8.5. When the last sample is measured and recorded, remove the probe from the sample, rinse with DI water and return to the appropriate storage bottle.

8.6. At the end of the day, or after the last measurement has been taken, perform an end-of-day calibration check.

8.6.1. Conductivity: measure the conductivity of the Calibration Standard (1,413 µmhos-cm or ~1,000 µmhos-cm standard) and record the reading in the *LIMS.*

8.6.2. After performing 8.6.1, remove the probe from the standard, rinse with DI water and return to the appropriate storage bottle

8.7. Turn the meter off by pressing the **on/off** button.

9. DATA ARCHIVAL

9.1. Use a black, waterproof pen for all bench sheets and logbooks.

9.2. Record daily calibrations in the *LIMS.* Record daily sample and control measurements in the appropriate bioassay logbooks.

9.3. To correct raw data entries, place a single line through the incorrect or illegible entry. Write the corrected entry near the error, date and initial the correction. Do not overwrite entries.

9.3.1. The corrected entry is written as near as possible to the error or in the comment box on the appropriate bench sheet.

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9.3.2. If the correction requires an explanation, write a comment and reference the error with a letter. Initial and date the explanation. Do not attempt to put all information (correction and comments) into a small space.

9.3.3. Use sequential alphabetical annotation to identify errors and corresponding comments (use A for first error and use A for corresponding explanatory comment; use B for second error, etc.).

10. QUALITY CONTROL

10.1. During the daily conductivity calibration check, if the value obtained from any of the conductivity standards is not within ±5% of the listed value, the calibration check should be repeated. If a value still is not within ±5% of the listed value, then an initial calibration procedure should be performed. The additional daily calibration must be recorded in the *LIMS*. If the problem is not resolved, notify the toxicity lab coordinator.

10.2. Samples, standards, and controls should be warmed to near 25˚C before being poured into their cups for measurement.

10.3. Sample parameters are read from lowest value to highest value to minimize the potential for contamination. (Probe is rinsed with deionized water between measurements).

10.4. If a problem occurs during the sample processing or testing, the following steps are performed: 1) Lab supervisor is notified. 2) Client is notified (client makes decision for additional testing). 3) Section administrator is notified. 4) A non-conformance report (NCR) is submitted describing the problem and the corrective action.

10.6.1. To create NCR: open LIMS and go to Laboratory/Administrative/Non-Conformance Report. Refer to https://floridadep.gov/dear/quality-assurance/content/dep-sops for sample collection and preservation, and the Laboratory Quality Manual for corrective action and handling out-of-control data.

10.5. Refer to the FDEP Laboratory Quality Manual for corrective action and handling out-of-control data.

10.6. Proper laboratory protection, including lab hood or ventilation system, lab coat, gloves, and safety glasses, is required when working with chemicals and unprocessed samples.

11. SAFETY AND HAZARDOUS WASTE MANAGEMENT

11.1. Refer to FDEP Laboratory Quality Manual for sample disposal.

11.2. Refer to the FDEP Laboratory Health and Safety Plan.

11.3. Read MSDS information for reagent handling and disposal.

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11.4. Mettler Toledo SevenMulti® Instruction Manual.

12. REFERENCES

12.1. DEP Laboratory Quality Manual

12.2. DEP Laboratory Health and Safety Plan

12.3. DEP SOP FS 1000, *General Sampling*

12.4. DEP SOP TA-06.13, *Thermometer Accuracy Check and Use*

Appendix of Significant Changes

08/19/2013 Combined SOPs TA-06.24-1.9 and TA-06.25-1.9 and reformatted and saved the resulting SOP as TA-06.25-2.0.

03/15/2016 Updated links. Corrected manual references.

03/28/2017 Updated links.

03/21/2018 Reworded to make calibration sections less confusing. Updated links/hyperlinks.

03/27/2019 Removed repeated links and added the thermometer SOP.

03/21/2020 Updated links and removed logbook references

03/22/2022 Updated links and removed logbook reference about recording temperature for the medium conductivity standard. Added References section.

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