Calibration and Use of YSI

650MDS Data Logger and 600XL Sonde
and Professional Plus Data Logger

1. SCOPE AND APPLICATION

1.1 This method details the calibration and use of YSI 650MDS Data Logger and 600XL Sonde and YSI Professional Plus Data Logger.

2. SUMMARY OF METHOD

2.1 Perform a Continuing Calibration Verification (CCV) using the appropriate standards to check if the meter passes the criterion for each parameter (dissolved oxygen, specific conductance, and pH).

2.2 If the meter does not pass for a particular parameter, calibrate for that parameter using the appropriate standards. Perform an Initial Calibration Verification (ICV).

2.3 Document all CCV, calibration, and ICV readings, both passing and not passing, in the YSI Meter Calibration-Verification Logbook.

2.4 Perform field measurements. Perform a CCV, document readings, and store probe appropriately.

3. APPARATUS AND EQUIPMENT

3.1 YSI 650MDS Data Logger with 600XL Sonde with calibration cup (deployable)
3.2 YSI Professional Plus Data Logger and cable assembly with calibration cup (non-deployable)
3.3 Pen with black ink and permanent black marker

4. REAGENTS AND CHEMICALS

4.1 pH 4, 7 and 10 standards (Fisher Scientific) stored at room temperature and used before expiration
4.2 Conductivity standards (Fisher Scientific) stored at room temperature and used before expiration
4.3 Deionized (DI) water

5. SAMPLE COLLECTION, PRESERVATION, AND HANDLING

5.1 Sample measurements are made following SOP FS 7000 – General Biological Community Sampling.

6. METHODS

Before each use, review Table 1. Field Equipment Preventative Maintenance and inspect equipment.

6.1 Turn the meter on by pressing the [power] key. For the 650MDS Data Logger only, select Sonde Run, press [Enter] to connect. Let the meter warm up 3 – 4 minutes.

6.1.1 Power is in the top left corner of the 650MDS (green button).

6.1.2 Enter is in the lower left corner of the 650MDS Data Logger (back arrow button).

6.1.3 Power is in the lower right corner of the Professional Plus Data Logger (green button).

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6.2 Perform a Continuing Calibration Verification (CCV) in Run mode using the appropriate standards to check if the meter passes the criterion for each parameter (dissolved oxygen, specific conductance, and pH).

6.2.1 Criterion are listed in Standard Operating Procedures SOPs FT 1000 – FT 1500 located on the DEP SOP webpage.

6.2.2. Verify or calibrate specific conductance before pH to eliminate interference of specific conductance readings by pH conductance.

6.3 If you open a new bottle of pH or conductivity standard, write your initials and the date opened on the bottle with permanent marker. Write the date opened in the Chemical Reagent Standards Log using a pen with black ink. If you finish a bottle of standard, write the date emptied in the Chemical Reagent Standards Log using a pen with black ink. Rinse the empty bottle and discard in the Toxicity Lab recycling bin.

6.4 Document all CCV, calibration, and Initial Calibration Verification (ICV) readings, both passing and not passing, in the YSI Meter Calibration-Verification Logbook.

6.4.1 See FD 1000 – FD 4000 located on the DEP SOP webpage.

6.5 If the meter does not pass for a particular parameter, calibrate for that parameter (per step 6.6, 6.7, or 6.8). To get to the calibration screen from the Run mode, press [Esc] to get to the 650 Main Menu. Scroll down to Sonde Menu, press [Enter]. Scroll down to Calibrate, press [Enter]. For the Professional Plus Data Logger, press the "Cal" key.

6.5.1 Use the arrow keys to scroll.

6.6 <u>For Dissolved Oxygen</u>:

6.6.1 From Calibrate, arrow down to Dissolved Oxy and press [Enter]. Select DO% and enter the barometric pressure (around 760 mmHg) using the number keys. The Professional Plus has an internal barometer so this field will be automatically populated.

6.5.1.1 See FT 1500 Field Measurement of Dissolved Oxygen

6.6.2 Fill up the calibration cup with tap water to just below the black O-ring on the DO probe making sure not to cover the membrane with water. Replace cap very loosely and wait 1-2 minutes for the calibration cup to completely saturate. When reading stabilizes, press [Enter].

6.6.3 In the YSI Meter Calibration-Verification Logbook, record your initials, the date, the time, the probe charge, the probe gain the meter's DO reading (mg/L), the meter's temperature reading (ºC), the % DO, the saturation DO (mg/L) for that temperature from the DO chart, and whether or not the calibration passed (reading is within the acceptable range) or failed.

6.6.3.1 Make sure you record the "D.O. Charge" reading located to the right of the 'D.O." reading on the display. Also the "D.O. Gain" reading needs to be recorded. Go to Main Menu, scroll down to Smart Terminal, and press [Enter]. Go to Advanced and press [Enter]. Go to Cal Constants and press [Enter]. Record "D.O. Gain" reading. These readings give information regarding the condition of the D.O. probe. Check manual for range specifications.

6.6.3.2 As with all calibrations never accept a "calibration unsuccessful" if asked by the data logger. The DO probe should be checked if the meter fails to calibrate or readings are

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erratic and unstable. Clean probe as instructed by the manual and re-calibrate. Also, see probe maintenance, step 7.1.

6.6.4 Press [Esc] repeatedly to reach the Main Menu. Arrow up to Sonde Run or Run and press [Enter]. Perform and record the results for the ICV.

6.7 For Specific Conductance:

6.7.1 From Calibrate, arrow up to Conductivity. Press [Enter]. Go to SpCond and press [Enter].

6.7.1.1 See FT 1200 Field Measurement of Specific Conductance.

6.7.2 Fill the calibration cup with conductivity standard, swish around, dispose and refill the calibration cup to the top of the temperature/conductivity sensor with standard and allow 1-2 minutes to equilibrate. Press [Enter].

6.7.2.1 For pH and conductivity calibration, fill the calibration cup to cover the pH and conductivity probes with the appropriate standard. Make sure when entering standard values for the conductivity, to adjust the mS/cm, defaulted in the data logger, to uS/cm listed on the bottle (by moving the decimal point 3 places to the left).

6.7.3 In the YSI Meter Calibration-Verification Logbook, record your initials, the date, the time, the standard level, standard's expiration date, standard's lot #, standard's bottle #, the meter's cell constant, the meter's conductivity reading (µmhos/cm), and whether or not the calibration passed (reading is within the acceptable range) or failed.

6.7.3.1 Also record the "conductivity cell constant" reading located in the main menu. Go to Smart Terminal and press [Enter]. Go to Advanced and press [Enter]. Go to Cal Constants and record "Cond: number". This once again monitors the condition of the conductivity probe. Check manual for range specifications.

6.7.3.2 As with all calibrations never accept a "calibration unsuccessful" if asked by the data logger. Clean probe as instructed by the manual and re-calibrate. Also, see probe maintenance, step 7.3.

6.7.4 Press [Esc] repeatedly to reach the Main Menu. Arrow up to Sonde Run or Run and press [Enter]. Perform and record the results for the ICV.

6.8 For pH:

6.8.1 From Calibrate, arrow down to ISE1 pH. Press [Enter]. Select 2-point calibration and press [Enter]. The Professional Plus will automatically sense the buffers and allow up to 6 points to be calibrated with no selection necessary.

6.8.1.1 See FT 1100 Field Measurement of Hydrogen Ion Activity (pH).

6.8.2 Rinse the probe with DI water several times then at least once with pH 7 standard. Fill cup with pH 7 standard to slightly above the pH probe. Enter the standard level using the number keys and press [Enter].

6. 8.2.1 For pH and conductivity calibration, fill the calibration cup to cover the pH and conductivity probes with the appropriate standard.

6.8.3 In the YSI Meter Calibration-Verification Logbook, record your initials, the date, the time, the standard level, standard's expiration date, standard's lot #, standard's bottle #, the slope, the

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meter's pH reading, and whether or not the calibration passed (reading is within the acceptable range) or failed.

6.8.3.1 Be sure to record the "pH millivolt (mV)" reading listed on the data logger display screen with each standard. This gives a pH potential to the calibration standard one is using. Example: a pH 4 standard has a +177 mV slope determined by the Nerst Equation. A pH 7 has a –50 to +50 mV slope and a pH 10 would have a –177mV slope. This monitors the proper function of the pH probe.

6.8.3.2 As with all calibrations never accept a "calibration unsuccessful" if asked by the data logger. Clean probe as instructed by the manual and re-calibrate. Also, see probe maintenance, step 7.2.

6.8.4 Press [Enter]. The meter will ask for the 2nd point. Repeat step 6.7.2 using another standard (pH 4 or pH 10). Record data as in step 6.7.3.

6.8.4.1 Use a standard level that is expected to bracket the pH of the site.

6.8.5 Press [Esc] repeatedly to reach the Main Menu. Arrow up to Sonde Run or Run and press [Enter]. Perform and record the results for the ICV.

6.9 For Temperature:

6.9.1 Temperature does not need calibrating on a per-use basis but rather is calibrated with a NIST-traceable Celsius certified thermometer quarterly by the person designated to maintain the meters.

6.9.1.1 See FT 1400 Field Measurement of Temperature.

6.9.1.2 If the temperature does not calibrate with the NIST-traceable Celsius certified thermometer, the probe should be sent to the certified service dealer. The temperature portion of the probe requires no maintenance.

6.10 In the field, remove the calibration/storage cup and install the protective deployment cap. Take all field measurements in the Run mode and record all readings on the appropriate field data sheets.

6.11 When finished with the meter in the field, fill the calibration/storage cup ¼ full with ambient site water.

6.12 Perform a Continuing Calibration Verification (CCV) in Run mode using the appropriate standards to check if the meter passes the criterion for each parameter (dissolved oxygen, specific conductance, and pH). For temperature, verify that field measurements fall within the temperature range of the most recent quarterly NIST-traceable temperature check. Document all CCV, calibration, and Initial Calibration Verification (ICV) readings, both passing and not passing, in the YSI Meter Calibration-Verification Logbook. If the meter does not pass for a particular parameter, indicate in the YSI Meter Calibration-Verification Logbook that the field data for that parameter will be J qualified.

6.13 Handle opened or emptied standard solution bottles as in step 6.3. After completion of the CCV, rinse the sonde storage cup with tap water.

6.14 To store the sonde, fill the storage cap with tap water and a little pH 4 buffer. Use enough liquid to cover the tip of the pH probe. **Never use D.I. water to store sonde probes**. Disconnect the cable from the sonde and data logger.

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7. PROBE MAINTENANCE

7.1. For Dissolved Oxygen:

7.1.1. For 600XL sondes

7.1.1.1 Remove the probe from the sonde using the probe wrench. Do not allow any water to enter the probe port. If water does enter the probe port, use compressed air or a cotton swab to thoroughly dry the port.

7.1.1.2 Remove the O-ring and membrane located on top of the probe. Dry the probe tip completely with a lens cleaning tissue.

7.1.1.3 Hold the probe in a vertical position, place one of the DO probe sanding disks under your thumb, and stroke the probe face in a direction parallel to the gold electrode (located between the two silver electrodes). The motion is similar to that used in striking a match. Stroke 10 to 15 times to remove black deposits on the silver electrodes.

7.1.1.4 Rinse the probe face with clean water and wipe with a lens cleaning tissue to remove any grit left by the sanding disk.

7.1.1.5 Thoroughly rinse the entire tip of the probe with DI water and install a new membrane.

7.1.1.6 Hold the probe in a vertical position and apply a few drops of KCl solution to the tip such that the fluid completely fills the small moat around the electrodes and forms a meniscus on the tip of the sensor. Be sure no air bubbles are stuck to the face of the sensor.

7.1.1.7 Always handle a DO membrane with care, touching it only at the ends. Secure a membrane between your left thumb and the probe body. With the thumb and forefinger of your right hand grasp the free end of the membrane. With one continuous motion gently stretch it up, over, and down the other side of the sensor. Secure this end of the membrane under the forefinger of your left hand.

7.1.1.8 Roll the O-ring over the end of the probe, being careful not to touch the membrane surface with your fingers. There should be no wrinkles or trapped air bubbles.

7.1.1.9 Trim off any excess membrane with a sharp knife or scissors. Rinse off any excess KCl solution, but be careful not to get any water into the connector.

7.1.1.10 Record maintenance or problems with the probe in the Field Meter Maintenance Logbook.

7.1.2. For Professional Plus Data Logger Sonde

7.1.2.1 Disconnect the probe from the sonde with a probe wrench, and unscrew the membrane cap from the probe. Do not touch any of the exposed surfaces on the electrode or allow water to enter the sonde port.

7.1.2.2 Rinse the electrode head with a gentle stream of DI water.

7.1.2.3 If the gold cathode is tarnished, clean it by rubbing it in a twisting motion on the sanding disk until all deposits are removed.

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7.1.2.4 If the silver anode is dirty, clean it by soaking for 2-3 minutes in a 14% ammonium hydroxide solution. Alternatively, soak the probe overnight in a 3% ammonium hydroxide solution. After cleaning, rinse the probe with DI water.

7.1.2.5 If the membrane is stretched, wrinkled, or damaged replace it with a new membrane.

7.1.2.6 Fill the membrane cap with electrolyte solution. Make sure there are no bubbles in the solution and screw the cap back onto the probe. Do not tighten the cap too much because it can overstretch or tear the membrane. Rinse any excess electrolyte solution. Examine the outside of the membrane, if any bubbles are visible, remove the membrane cap and repeat this step.

7.1.2.7 Reconnect the probe to the sonde.

7.1.2.8 Record maintenance or problems with the probe in the Field Meter Maintenance Logbook.

7.2 <u>For pH</u>:

7.2.1. For 600XLand Professional Plus Data Logger Sondes

7.2.1.1 Remove the probe from the sonde using a probe wrench.

7.2.1.2 Use clean water and a soft clean cloth, lens cleaning tissue, cotton swab, or pipe cleaner to remove all foreign material from the glass bulb or platinum button. Be careful not to wedge the swab tip between the guard and the glass bulb. If necessary, remove cotton from the swab tip so that the cotton can reach all parts of the sensor tip without stress.

7.2.1.3 Use a moistened cotton swab to carefully remove any material that may be blocking the reference electrode junction of the sensor.

7.2.1.4 Reconnect the probe to the sonde.

7.2.1.5 Record maintenance or problems with the probe in the Field Meter Maintenance Logbook.

7.3 <u>For Conductivity</u>:

7.3.1. For 600XL and Professional Plus Data Logger

7.3.1.1 The openings that allow fluid access to the conductivity electrodes must be cleaned regularly. Any small cleaning bristle brush will do.

7.3.1.2 Dip the brush in clean DI water and insert it into each hole 15-20 times. If a deposit build up has accumulated on the electrodes, a mild detergent solution can be used for cleaning.

7.3.1.3 Check probe accuracy using a calibration standard.

7.3.1.4 If the cleaning procedure described above is unsuccessful, the probe is most likely damaged and needs to bereplaced..

7.3.1.5 Record maintenance or problems with the probe in the Field Meter Maintenance Logbook.

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Table 1. Field Equipment Preventive Maintenance

Instrument/ Analysis	Activity	Frequency
Conductivity	Probes checked for: breaks or damage; damage to wire leads. Meters checked for: sufficient battery charge; case damage; proper calibration.	Before each trip
Dissolved Oxygen	Probes checked for: membrane damage; proper filling solution (no bubbles); uncorroded anode and electrode; damage to wire leads. Meters checked for: sufficient battery charge; case damage; proper calibration.	Before each trip
pH	Probes checked for: breaks or damage; proper filling solution level; damage to wire leads. Meters checked for: sufficient battery charge; case damage; proper calibration.	Before each trip
Salinity	Probes checked for: breaks or damage; damage to wire leads. Meters checked for: sufficient battery charge; case damage; proper calibration.	Before each trip
Temperature (thermistor)	Probes checked for: condition of leads.	Before each use

8. QUALITY CONTROL AND DOCUMENTATION

8.1 YSI Meter Calibration-Verification Logbook, Chemical Reagent Standard Log, and Field Meter Maintenance Logbook. Use a pen with black ink for all logbook entries.

8.2 To correct raw data entries, place a single line through the incorrect entry, write the corrected entry near the error, and initial and date the correction. If the correction requires an explanation, write a comment and reference the error.

8.3 See the Laboratory Quality Manual.

9. SAFETY/HAZARDOUS WASTE MANAGEMENT

9.1 Refer to the Material Safety Data Sheet (MSDS) for information about reagents and chemicals in this SOP.

9.2 Refer to the Laboratory Health and Safety Plan.

10. REFERENCES

10.1 FDEP Laboratory Quality Manual, http://www.dep.state.fl.us/labs/library/lab_sops.htm

10.2 FDEP Laboratory Health and Safety Plan, https://www.fldepnet.org/content/dear/bureau-laboratories-safety-documents

10.3 SOP FS 7000, General Biological Community Sampling

10.4 SOP FT 1000, General Field Testing and Measurement

10.5 SOP FT 1100, Field Measurement of Hydrogen Ion Activity (pH)

10.6 SOP FT 1200, Field Measurement of Specific Conductance

10.7 SOP FT 1400, Field Measurement of Temperature

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10.8 SOP FT 1500, Field Measurement of Dissolved Oxygen

Appendix of Changes

12/31/2009	Reformatted the layout following SOP LB-001.
12/31/2009	Added procedure for opening and emptying standards
12/31/2009	Revised sonde storage procedure.
12/31/2009	Added 556MPS and sonde received from Dept. of Health
12/29/2010	Added YSI Professional Plus Data Logger
01/06/2011	Converted SOP IZ-37-1.9 to a general SOP BG-07-1.0
01/06/2012	Added standard handling to step 4, clarified step 6.12, updated Logbook names, and added procedures for probe maintenance (step 7).
11/01/2012	Added preventative maintenance table
10/27/2014	Formatted for 508 compliance.
11/16/2015	Updated links.
11/29/2016	Removed references to YSI 556 MPS Data Logger and 6600 series sondes; Updated links from the 2008 DEP SOPs to the 2014 DEP SOPs.

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