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EXO Sonde Calibration

Overview:

Although EXO Sondes have much the same sensors on them as other devices, such as the Aqua Troll, there are some idiosyncrasies of the larger device and it's software that make calibrating a little more time consuming. An EXO is also typically deployed for an extended period of time so ensuring the calibrations are as accurate as possible is essential. With this in mind ensure you have sufficient time to calibrate the device, perhaps a day or two before deployment. Once calibrated refer to the Sonde Setup manual for deployment protocols.

Connecting

Connect to the device with Bluetooth (see: EXO Sonde Setup) or the USB adaptor. The USB adaptor makes for a faster connection but can be prone to coming off while moving the device around when rinsing/calibrating, resulting in a lost connection and perhaps having to start a calibration again. Open the KorEXO software and connect to the desired device. Upon connection the software may warn of any sensors needing your attention, close this popup window. Sensors should be displayed in green when calibrations are complete and up to date.

Cleaning

Clean a device on site as it is being removed. Clean again more thoroughly once back at the office.

Ensure the sensors are thoroughly clean before performing any calibrations. Also ensure the protective housing is clean as grime on this may influence calibrations. Pay particular attention to the sensor tips of the Conductivity Sensor as this can get grime inside; the small black brushes supplied are ideal for cleaning these.

Instruments and Sensors Tab

Begin on the 'Instruments and Sensors' Tab. Click on each of the sensor boxes for relevant information regarding sensor calibrations etc. *Note: The "Next Calibration Reminder" date that the KorEXO software displays is beyond what Horizons deems acceptable, refer to Assets for appropriate calibration intervals.*

- **pH/ORP Sensors:** Horizons should only be utilising pH/ORP sensors, if any pH only sensors are found please refer them to David Brown. Check the date when the 'sensor module' was last replaced. This should not exceed 9 months during the period of deployment. They also may need to be replaced before 9 months if readings during calibration are not satisfactory.

  o **Replacing the Sensor Module:**

  o Remove the sensor from the EXO.

  o Peel off the date sticker that should cover the junction between the metal sensor base and the plastic sensor module.
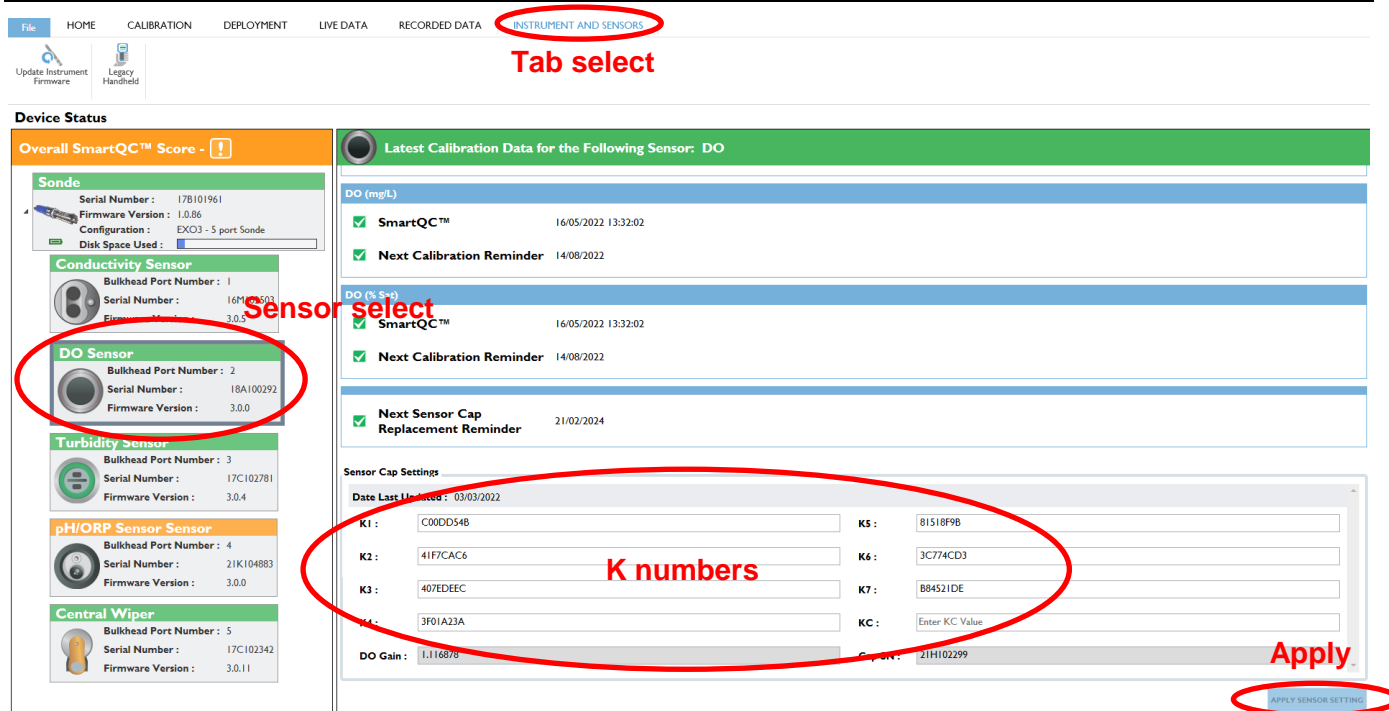
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- o Using a small screwdriver (or similar) remove the small black square at the base of the sensor module.

- o Squeeze the plastic base together (into the space created by removing the square) and pull the sensor module straight apart from the sensor base. **Do Not Twist**!

- o Remove the new sensor module from its packaging. Take care to remove the solution attached to the tip as this is pH 4 solution. Discard the solution.

- o Line up the sensor module plugs correctly with the sensor base and push firmly into place.

- o Write todays date on the supplied sticker and firmly wrap this around the junction between the sensor base and sensor module. Wrap so the date is visible.

- o Clean and reapply grease to the sensor 'O' ring and insert back into the EXO.

- o In KorEXO software on "instruments and Sensors" tab – "pH/ORP" sensor, update the "Replacement date" to today's date and "Apply Sensor Setting".

- o Add a calibration in the Asset system for this sensor with today's date. *Note: the sensor modules themselves are not recorded separately in assets.*

- **DO Sensors:** Refer to the Asset system for sensor cap replacement date. Horizons use a 12 month replacement schedule, while the KorEXO software automatically displays a "Next Sensor Cap Replacement Reminder" date approximately 2 years from the last replacement.

   - o **Replacing the DO sensor cap:**

   - o Remove sensor from device.

   - o Remove sensor tip and 'O' ring.

   - o Clean lens

   - o Replace new 'O' ring and lube taking care not to get lube on the lens.

   - o Clean lens again.

   - o Screw on new cap with the rubber cap still attached. Leave on until after calibration.

   - o Clean and re-lube the sensor 'O' ring and attach back to the device.

   - o **Important!** In the 'Instruments and Sensors' tab – DO, update K numbers to the numbers provided with the new sensor cap. "Apply sensor settings". *See Figure 1.*

   - o The sensor is now ready to calibrate.

   - o Add a calibration for this sensor in the Asset system with today's date.

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Figure 1: DO sensor cap replacement.

Calibration Tab

This tab is used to calibrate sensors or to view previous calibration records. Use the "Find Calibration Records" button to select a previous calibration/s to view.

To calibrate a sensor, click the small arrow to the left of the sensors to display the parameters that can be calibrated for each sensor. *Note: as soon as the "Calibrate" button next to the parameter is clicked the sensor begins the calibration, so the sensor needs to already be in calibration solutions before clicking "Calibrate". See: Figure 2.*

Keep in mind that EXOs are deployed for extended time periods. Allow sufficient time for calibrations to truly stabilise beyond when the software allows you to accept. This will ensure the most accurate calibration.

Complete a single page in the EXO calibration book.

Unless Depth needs calibrating, the DO sensor should be calibrated first if the device has been stored correctly as the calibration cup should be in the correct condition for the calibration to occur.

- **Depth:** This parameter is will only appear as an option to calibrate when needed.

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- o With the device out of any solution, click the arrow next to the Depth box to expand the calibration options.

- o In the "Depth" line click "Calibrate", wait, "Apply", "Complete Calibration", "Exit".

- **DO**: *Note: New sensors come with a moist rubber cap on the tip, remove the rubber cap prior to calibration.*

  - o Ensure the calibration cup is slightly damp and the black tightening cuff is loose to ensure the sensor is in a 100% humid and relative barometric pressure environment.

  - o NOTE: a drip on the sensor tip can affect the quality of the calibration. Shake off any drips before calibrating.

  - o In the "Calibration" tab click the arrow next to the DO box to expand the calibration options.

  - o Click the "Calibrate" button on the DO (%Sat) line. *See: Figure 2*

  - o Change the barometric pressure value (**in mmHg**) from default to match the barometric pressure of the Victoria Ave sensor. This is the bottom number on the Victoria Ave sensor readout. *See: Figure 2*

  - o Allow sufficient calibration time then click the green "Apply" button. "Accept Calibration", then "Exit".

  - o Change to the "Live Data" tab. Write the raw DO%Sat value in the top left corner of the DO%Sat box in the calibration book. Apply the following calculation to the DO %Sat value:

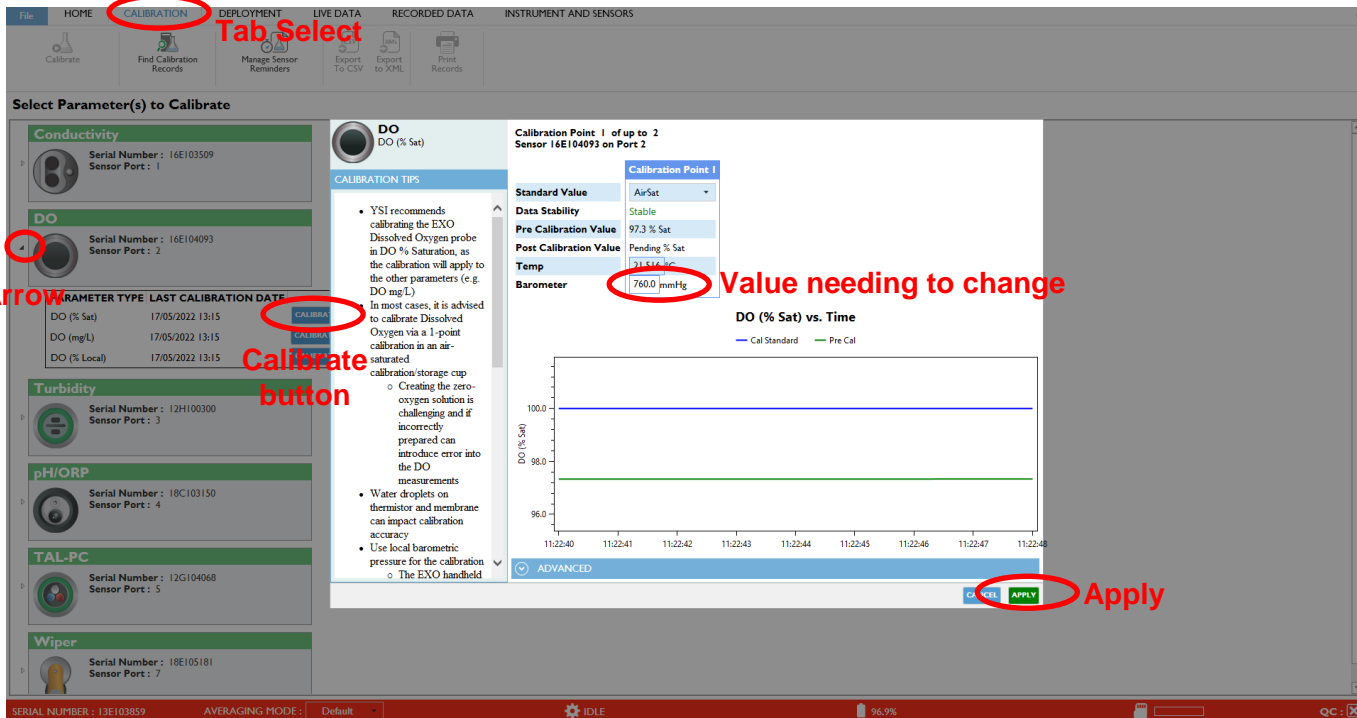$$\frac{DO\ \%\ Sat\ \ x\ \ 1013.25}{Vic\ Ave\ Baro\ (in\ hPa,\ top\ number\ on\ display)}$$

  - o Write the result in the DO % Sat box in the calibration book along with Temperature. This is the value that needs to be within the calibration range.

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Figure 2: DO Calibration.

- **Conductivity**: *Note: Make sure the sensor tip is cleaned thoroughly*. This calibration is much the same as calibrating an Aqua Troll.

    o Remove the EXO sensor housing to access the individual sensors.

    o Hang the EXO on the red hooks behind the sink.

    o Place a 148μS/cm solution cup over just the conductivity sensor ensuring the sensor is completely covered.

    o On the "Live Data" tab record the pre-calibration value and temperature in the calibration book. *See Figure 3*.

    o Rinse thoroughly and place a 1428μS/cm solution cup over the conductivity sensor.

    o On the "Calibration" tab click the arrow next to the Conductivity box and then the "Calibrate" button next to the Sp Cond (μS/cm) parameter. *See Figure 3*.

    o Change the "Standard Value" to match the calibration solution. Record the Solution value and temperature in the calibration book. *See Figure 3*.

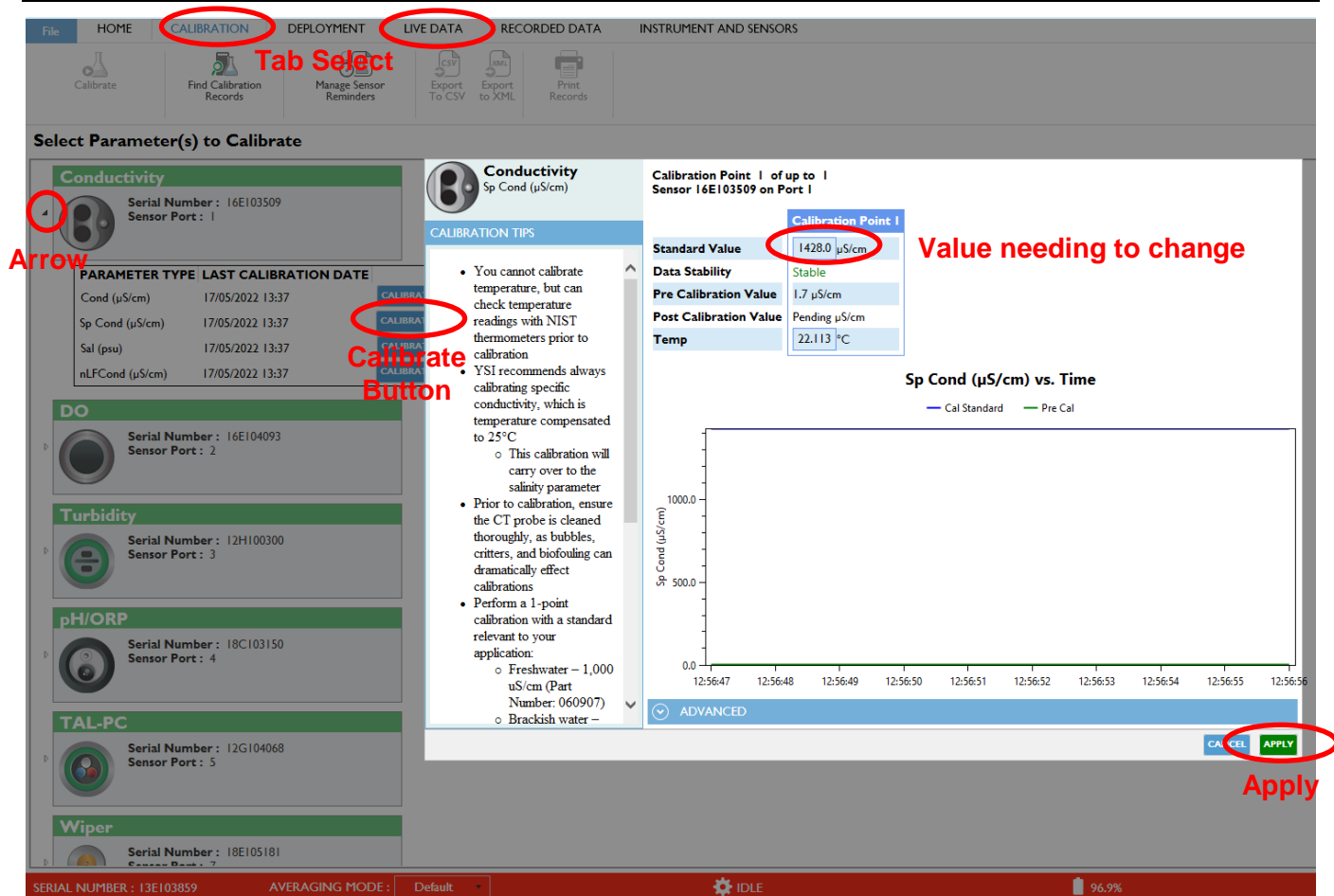|	**Hydrology Operations Manual**	

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- o Wait a sufficient time and "Apply", "Complete Calibration", then "Exit".

- o Rinse thoroughly and use the 148µS/cm again. Write the Sp Cond (µS/cm) in the calibration book along with Temperature. Check the value is within the required range.

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Figure 3: Conductivity calibration.

- **pH**: pH shares a sensor with ORP, but each parameter calibrates separately:

  o Rinse the sensors thoroughly.

  o Ensure the pH/ORP sensor head and the conductivity sensor (which houses the temperature sensor) are completely submerged in pH 7 buffer.

  o In the 'Calibration' tab click the arrow next to the 'pH/ORP' sensor to expand the calibration options.

  o Next to the pH parameter click the "Calibrate" button. The sensor will start calibrating immediately.

  o Check the "Standard Value" is set to 7.0, change if necessary.

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- o Wait until the calibration has fully stabilised and "Apply".

- o Rinse thoroughly, before completely submerging the pH sensor head and conductivity sensor in pH 4 solution.

- o Click "Add Calibration Value". The calibration will start immediately.

- o Check the "standard Value" is set to 4.0, change if necessary.

- o Wait until the calibration has fully stabilised and "Apply".

- o Rinse thoroughly, before completely submerging the pH sensor head and conductivity sensor in pH 10 solution.

- o Click "Add Calibration Value". The calibration will start immediately.

- o Check the "standard Value" is set to 10.0, change if necessary.

- o Wait until the calibration has fully stabilised and "Apply".

- o Click "Complete Calibration".

- o Write the standard values and corresponding temperature values in to the pH section of the calibration book.

- o Click "Exit".

- **ORP (Oxidation Reduction Potential)**: ORP shares a sensor with pH, but each parameter calibrates separately:

  - o Rinse the sensors thoroughly.

  - o Ensure the pH/ORP sensor head and the conductivity sensor (which houses the temperature sensor) are completely submerged in Zobells solution.

  - o In the 'Calibration' tab click the arrow next to the 'pH/ORP' sensor to expand the calibration options.

  - o Next to the ORP parameter click the "Calibrate" button. The sensor will start calibrating immediately.

  - o Check the "Standard Value" is set to 230, change if necessary.

  - o Wait until the calibration has fully stabilised and "Apply" then "Complete Calibration".

  - o Write the Standard value and temperature in the ORP section of the calibration book.

  - o Click "Exit".

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- **Turbidity**: There is no need to calibrate the turbidity sensor. The factory default is the most relevant.

- **TAL-PC (Total Algal Package)**: There is no need to calibrate the TAL-PC sensor. The factory default is the most relevant.

Calibration documentation

Scan and save the white calibration sheet to:

\\ares\Hydrology\Hydrology Calibrations\Sonde Calibration files

File name should be "date_Sonde#".

In Assets create a new calibration for the Sonde and attach this file. The recurrence interval for calibration should match the type of sensors that are installed:

- pH: 3 months.

- Conductivity (Funded): 3 months

- All other sensors (including unfunded conductivity): 12 months minimum.