Reference

UCI software

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Table of Contents

Table of Contents

Section 1 Software overview

This UCI software from Sea-Bird Scientific currently supports several sensors and is the interface for new products. Other sensors will be added as is practical. Supported sensors:

- SUNA V2
- Deep SUNA
- HydroCAT
- HydroCAT-EP
- SeaFET V2
- SeapHOx V2
- Deep SeapHOx V2

Note that this software does not support the older versions of SUNA, SeaFET, or SeapHOx.

1.1 Install and start software

Install the manufacturer-supplied software and make sure that the sensor is ready to test for functionality before configuration and deployment. If the sensor is so equipped, install the batteries if necessary. The manufacturer-supplied UCI software communicates with a number of sensors. The sensors that are supported are listed in the **Sensor** menu of the software.

1. Get the software from the manufacturer's website or the manufacturer-supplied USB drive or CD.
2. Install the appropriate software.
   a. For Windows®: Double-click on the file with ".exe" appended to the name.
   b. For Mac OS X®: Double-click on the file with ".pkg" appended to the name. Make sure that the default "Install for all users on this computer" is selected as the destination for the installed software. If "Install for me only" or "Install on a specific disk" is selected, the software will not connect to the sensor.
3. Push **Run** in the new window.
   The setup wizard starts.

1.2 Sensor dashboards

The Dashboard is the main area from which to control and communicate with the sensor.

Information about the status of the sensor is contained in the upper part of the window and is updated each time the sensor is connected to the software.

Common settings

- **Connect-Disconnect** lets the user disconnect the sensor after it is set up for operation.
- **Start-Stop** lets the user start and stop data collection.
- **Sensor Settings** lets the user select options for a specific deployment.
- **Deployment Wizard** lets the user select a deployment mode, start time, the parameters to measure, estimate the deployment time and data collection interval, and make a summary report of the status of the sensor.
- **Transmit Data** lets the user move data saved on the sensor to a PC.
- **Show Saved Data** lets the user see data that was saved on a PC in a graph.
- **Command Terminal** lets the user send terminal program-level commands to the sensor.

Section 2 SUNA V2

2.1 Settings tabs

Push **[*Sensor*] Settings** to change the settings of a connected sensor to verify sensor function or set up for deployment.

2.1.1 General tab settings

The user can deploy the sensor in an autonomous or a logger-controlled mode.

1. If necessary, change the Operational Mode, or push **Default** to use the manufacturer-set values.

   - *Continuous operation*—when started, the sensor operates until the user removes power or pushes **Stop** in the SUNA Dashboard.
   - *Fixed-time operation*—the sensor operates for a user-specified period of time or number of measurements.
   - *Periodic operation*—the sensor operates at user-specified intervals. Data collection begins at a user-specified date and time and stops when the user removes power or pushes **Stop** in the SUNA Dashboard.
     Example: a sensor set up at 8:00 with a "Sample Interval" of 2 hours and an offset of 900 seconds (15 minutes) will operate at 10:15, 12:15, 2:15, etc.

   Logger-controlled modes

   - *Polled operation*—the sensor communicates through and is controlled by an RS232 terminal program.
   - *SDI-12*—The sensor communicates through and is controlled by an SDI-12 controller.

2. Select the *Operational Mode Settings*. The *Sample Averaging* and *Deployment Characteristics* change as the operational settings change.
3. If the sensor has a wiper, put a check in the "Integrated Wiper Enabled" to operate the wiper.
   The wiper operates once before each measurement.
4. Use the default *SUNA Messages* as "INFO."
5. Push **Upload** to change the settings in the software.

2.1.2 Communication

Go to the *Telemetry* tab in **SUNA Settings** to set up communication and data file types.

The default serial baud rate is 57600.

The default for "Transmitted Frame Format" and "Data Format" is "FULL_ASCII."

- **FULL_ASCII**—Contains all collected data in comma-separated fields. The file extension is **.csv**. The frame size is typically 1600–1800 bytes. Use this format so that data can be reprocessed.
- **NONE**—For "Transmitted Frame Format" data output is turned off. For "Data Format" sensor data storage is turned off.

Other available formats:

- **FULL_BINARY**—Contains all collected data. The file extension is **.bin**. The frame size is 632 bytes. Use this format so that data can be reprocessed.
- **REDUCED_BINARY**—Contains data from part of the spectrum and data from some auxiliary sensors. The file extension is **.bin**.The frame size is 144 bytes. Use this format so that seawater data can be reprocessed.
- **CONCENTRATION ASCII**—Contains a time-stamp, nitrate concentration, absorbance at 254 and 300 nm and Root Mean Square Error (RMSE) to measure the quality of the data. The file extension is **.csv**.

- **APF**—Deep SUNA V2 only. Used for APEX floats. Contains the user-selected parts of the spectrum and other auxiliary sensors. The frame size is typically 300–400 bytes.

- The user can set the "Transmitted Frame Format" to "NONE" to turn off data output. This increases the rate at which data is collected, and uses 10–30% less power.
- The user can set the "Frame Format" to NONE to turn off internal data collection.

The default "File Creation Method" is "By File Size." Others are available:

- **By File Size**—The software makes a new file when the data file in use gets to the user-selected maximum size. The file name starts with "C" ("Continuous" file).
- **By Sample Event**—The software makes a new file when data collection starts for the first time after the power has been turned off, then on. The manufacturer recommends that the user select this for test purposes only. Use of this setting can result in so many stored files that the sensor operates slowly or incorrectly. The file name starts with "A" ("Acquisition" file).
- **Daily**—All data that is collected during a calendar day is put into a single file. This file name is a seven-digit number that is the year and the day of the year, for example, D2015142.csv. The file name starts with "D" ("Date-stamped" file).

The default "Maximum File Size" is 2 MB when the "Mode of Operation" is set to "Continuous." It is user-selected from 1–65 MB. The "Daily" and "Sample Event" files contain all of the data that is collected during the day or during one cycle of operation.

2.1.3 Advanced tab settings

The manufacturer recommends that the user change only the "Salt Water Calibration" setting in this tab. Put a check in the "Deployed in Fresh Water" box if the sensor is deployed in fresh water. Put a check in the "Bromide Trace" box to enable this feature. Push **Upload**.

2.2 Deployment wizard

The deployment wizard makes it easy to set up the sensor for a specific deployment.

1. Select the **Operational Mode**. Push **Next**.

   - Continuous: sensor collects data continuously.
   - Periodic: sensor collects data for a user-set time or number of samples at user-set interval.
   - Fixed time: sensor collects data for a user-set amount of time.
   - Polled: sensor collects data as commanded by a controller.
   - SDI-12: sensor collects data as commanded by a SDI-12 controller.
   - APEX Float: (Deep SUNA only):sensor collects data as commanded by the APEX float controller.

2. Select the **General Settings**.

   a. Periodic mode: "Sample Interval" from 1 minute to 24 hours between each sample collected. "Offset" is****
   b. Select "Frame Based Operation" or "Time Based Operation."
   c. Enter a value between 1–65535 for the "Frame Cycle."
   d. Enter a value between 1–200 for the "Number of Measurements to Average."
   e. If the sensor has a wiper: put a check in the box at "Wiper Settings" to enable the wiper.
   f. Select the "Level." "INFO" is the default. Refer to the Message tab on page 26 for details about the levels.
   g. Push **Next**.

3. Select the **Data Settings**.

    a. Select the "Transmitted Frame Format." FULL_ASCII" is the default.

    b. Select the "File Creation Method." "By File Size" is the default. Refer to Communication on page 5 for details.
    The manufacturer recommends that the user selects

    c. Push **Next**.

4. Select whether the sensor will be deployed in fresh water or seawater. Push **Next**.

5. Make a **Deployment Report** for a record of the settings stored in the sensor.

2.3 Update the reference value

1. Push **Reference Update**.
The "Reference Update Wizard" shows.

2. Fill the sample volume with distilled water. Refer to the hardware user manual for details.

3. Make sure the "Operational Mode" is set to "Continuous," then push **Next**.

4. The sensor starts to collect data. This will take approximately 30 seconds.

5. Push **Next**.

6. Look at the graph to see the change between reference spectra.

7. Push **Next**.

8. Push **Browse** to select a directory in which to save the Calibration Report.

9. Optional: write a comment.

10. Put a check in the "View" box to automatically open the new report.

11. Put a check in the "View" box to automatically open the new calibration file.

12. Push **Finish**.
The software makes a report and a calibration file.

2.4 Verify sensor transmits data

> ### *N O T I C E*
>
> Use only the batteries recommended by the manufacturer as replacements. Do not mix chemistries, V-Ah, or new and used batteries.

If the sensor is equipped with internal memory, the collected data is saved in the sensor.

1. Push **Transmit Files** in the SUNA Dashboard area.
The files saved by the sensor show on the right side of the new **File Manager** window.
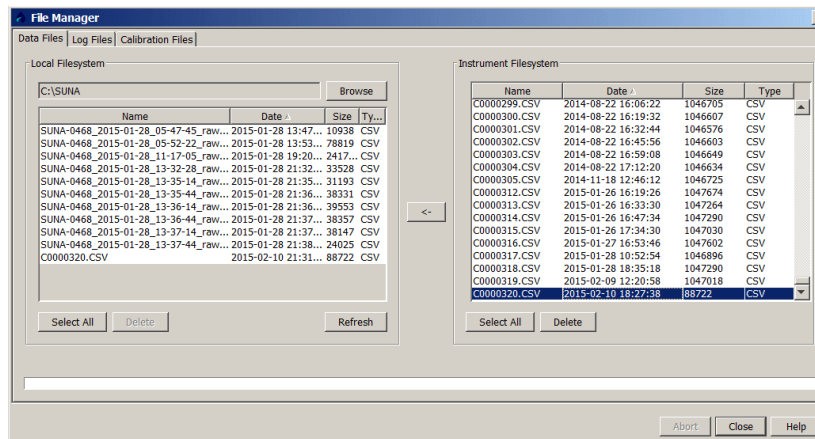
2. Select one or more files to copy to the PC.
   The manufacturer recommends that the user use a USB connection to move the files because it is much faster.

3. Push the **<-** arrow to start the move.
   The status shows at the bottom of the **File Manager** window.

4. Open the file on the PC to make sure it has all of the collected data.

2.5 Operate wiper

If the sensor is equipped with a wiper, make sure that the wiper operates correctly.
Push **Check wiper** to operate the wiper for one cycle.

Section 3 HydroCAT

3.1 Settings tabs

Push **[*Sensor*] Settings** to change the settings of a connected sensor to verify sensor function or set up for deployment.

3.1.1 Set up output format

The parameters selected in this tab change the data that is moved to the PC and the data that shows in the *Real Time Display* tab. Parameters that are not selected are still collected and stored as data by the sensor but do not show in the *Real Time Display* tab.

1. On the *Output Format* tab: if necessary, change any of the <u>Parameter Units</u>.

Table 1 Parameter units

Temperature	Celsius*, Fahrenheit
Conductivity	uS/cm*, S/m, mS/cm
Pressure	Decibar*, PSI
Oxygen	mg/L*, ml/L

* default parameter

2. If necessary, change any of the <u>Parameters to Output</u>, or push **Default** to use the manufacturer-set values.

Table 2 Output parameters

Temperature*	Salinity
Conductivity	Sound velocity
Pressure*	Specific conductivity*
Oxygen*	Sample number

* default parameter

3. Push **Apply** to save the values in the sensor.

3.1.2 Set up data collection

Select the *Data* tab to set the interval at which the sensor collects data.

1. Select the *Data* tab to set the interval between samples.
   The sensor collects data at the end of the specified interval.
2. Enter a value between 10–21600 seconds in the "Sample Interval" area.
3. Put a check in the box so that the data collected during a deployment is sent to a controller or logger and the user can see the data in real time.
   The software enables the "Transmit Real Time" setting whether or not there is a check in the box. The data shows in real time while the sensor is connected to the software.

3.1.3 Set up pump operation

Select the *Pumping* tab to set the values for the operation of the pump. Enter the "Minimum Conductivity Frequency" in the *Pumping* tab. This value is the Zero Conductivity Frequency from the manufacturer-supplied calibration page plus the offset value for either salt water (500 Hz) or fresh water (1 Hz). This sum is the minimum conductivity frequency at which the pump will operate.

1. If necessary, change the "Minimum Conductivity Frequency."

- If the sensor is set up to operate in an autonomous mode, the pump will operate a "pre-flush" for a manufacturer-set default of 300 seconds before data is collected. This removes air from the plumbing and primes the pump. The user can enter a value from 300–600 seconds for the "Pre-flush Duration."
- If the sensor is set up to operate with a controller ("polled" mode), put a check in the box next to " Scheduled Pre-flush for Polled Sampling." Make sure to set the pre-flush cycle to complete before the sensor starts to collect data. Data collection will cancel the pre-flush operation.

2. Select the "Start Date."
3. Select the "Start Time" (hours).
4. Push **Apply**.

3.2 Deployment wizard

1. If necessary, make sure that the sensor is connected to the software.
2. Push **Deployment Wizard** in the Dashboard of the connected sensor.
3. **Deployment Setup** step 1: Select "Autonomous Sampling," or "Polled Sampling" (SDI-12 or RS232).
4. Push **Next**.
5. **Deployment Setup** step 2: For "Autonomous Sampling": Set the date and time to start data collection. Then push **Next**.
   Put a check in the box next to "Transmit Real Time" to see the data as it is collected in a terminal program or a data controller. If the user does not put a check in the box, the sensor still collects and saves data, but it does not show the data in real time.
6. **Deployment Setup** step 3: For "Polled Sampling (SDI-12)": The manufacturer-set default address is 0. Users can change this if necessary. Use the "Bad Data Flag" default value of 9999999, then push **Next**.
7. **Deployment Setup** step 4: If necessary, change any of the settings in the Parameter Units area and Parameters to Output.

8. **Deployment Setup** step 5: Enter the minimum conductivity frequency. Refer to the section on Conductivity check on page 12 for details on this value.

   - Fresh water deployment—add a 1 Hz offset to the zero conductivity value of the sensor.
   - Salt water deployment—add a 500 Hz offset to the zero conductivity value of the sensor.

9. **Deployment Setup** step 6: Put a check in the box to set the internal clock of the sensor to the same time as the PC.

   - Put a check in the box "Clear HydroCAT/EP data" to erase the data from the internal memory of the sensor.
   - If necessary, enter a pressure offset. If the sensor is deployed at sea level, enter 0.0 in the "Pressure Offset" area. The range is from -3402823 to 3402823.

10. **Deployment Setup** step 7: Enter the approximate minimum temperature of the water in which the sensor will be deployed.

    - Enter the approximate depth of water in which the sensor will be deployed.
    - Enter the time interval between each sample for either autonomous or logger-controlled (polled) operation.

      - Range for HydroCAT: 10–21600 seconds
      - Range for HydroCAT-EP: 75–21600 seconds

    The calculated battery capacity and the number of 24-hour periods that the sensor can operate is given as a reference. **Note**: The software calculates "Battery Endurance" for new batteries only. Deployment time decreases for used batteries.

11. Push **Next**.

12. **Deployment Setup** step 8 (optional): make a Deployment Report.

    - Enter the "Operator Name."
    - Enter any text in the "Comments" area.
    - Push **Browse** to change the location at which the report is saved on the PC.
    - Put a check in the box next to "Overwrite if Existing" to save the new report only.

13. Push **Finish.** The sensor disconnects from the software.

    - If the sensor was set up in a logger-controlled or "polled" mode, use the controller unit to control the collection of data.
    - If the sensor was set up in an autonomous mode and there is a check in the "Transmit in Real Time" box from Step 2 of the **Deployment Setup**, start a terminal program to monitor data in real time.

14. When the deployment is complete, the user can connect to the software again and push **Transmit Data** in the Dashboard to move the data that is saved in the sensor to the PC.

3.3 Performance checks

3.3.1 Temperature check

1. Push **Temperature Check** in the Dashboard area.
2. Push **Next** to start the check.
3. Enter the water temperature in °C in the "Temperature" area.
4. Push **Start**.
   The software takes a few minutes to collect data for the test. The results show in the "Status" area.
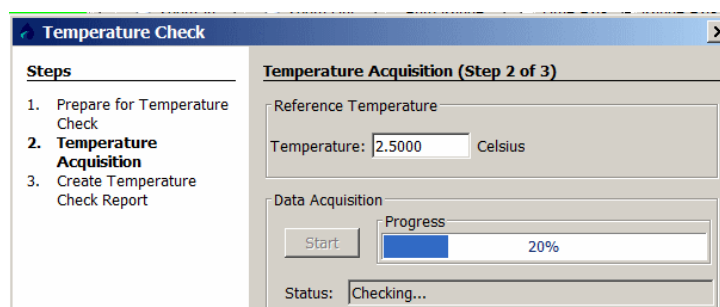
5. Push **Next**.

6. Push **Next**.
   The software saves a .pdf report in the user-specified location on the PC.

7. Push **Finish**.
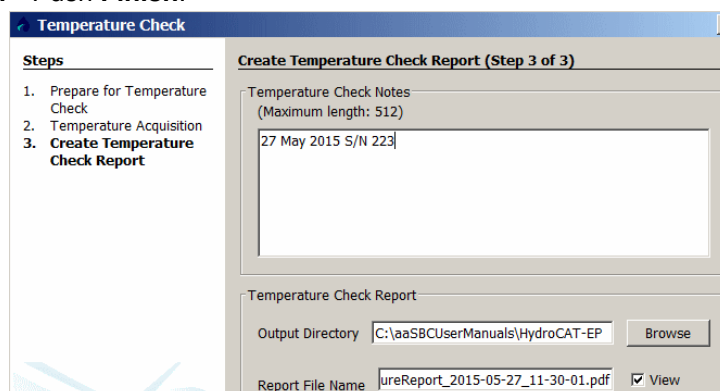
The **Temperature Check** window closes and the .pdf report shows if the "View" box has a check in it.

3.3.2 Conductivity check

The software lets the user do both a zero conductivity check and a check to a user-supplied conductivity standard.

1. Push Conductivity Check in the Dashboard.

2. Push **Next** to start the check.

3. At step 2 of 6, "Zero Conductivity Frequency Check": enter the first value from the "INST FREQ" column on the calibration page supplied by the manufacturer.

4. Push **Start**.

5. Push **Next**.
   The software shows the steps to complete the check for the user-supplied conductivity standard.

6. Push **Next**.

The software is ready to do the check of the user-supplied conductivity standard.

7. Enter the value of the conductivity standard in step 4.

8. Push **Start**.

9. The user can make a report.

    • Enter any text in the "Notes" area.
    • Push **Browse** to change the location where the report is saved on the PC.
    • Change the "Report File Name."
    • Put a check in the "View" box so that the report automatically opens when it is completed.
    • Put a check in the "Overwrite file if it already exists" box to save only the new information.

10. Push **Finish**.
    The Conductivity Check window closes and the report opens if the "View" box has a check in it.

3.4 Transmit data

1. Push **Transmit Data** in the Dashboard area.
    The **Transmit Data** window shows.

    • Information in the Memory Summary lets the user see the available data storage in the sensor.

        • "Bytes" is the amount of memory in use.
        • "Samples" is the number of samples the sensor has collected and stored.
        • "Free Samples" is the number of samples the sensor can store.
        • "Sample Length" is sensor-specific and shows the length of each data record that the sensor stores.

2. In the "Transmit Type" drop-down menu in the Data Transmit Options area, select either "All Data" or "Block size (bytes)."

    • "All Data": all data stored in the sensor is transmitted to the PC in both .csv and .sbsdat file types.
    • "Sample Number Range": a user-specified range of samples. Select the specific samples in the Sample Number Range area.

3. In the Data Transmit area, the software automatically selects the fastest baud rate to use to transmit data, which is 115200.
    The software temporarily increases the sensor's baud rate to upload data more quickly. After the transmission is complete, the software changes the baud rate to the default for the connected sensor.

4. In the Output CSV Data File area, type a new file name or use the automatically generated file name.

5. Optional: change the time stamp to UTC.

6. Push **Transmit**.

- The data is copied to the PC.
- The software uploads a raw **.sbsdat** file and automatically converts the data to a readable **.csv** file type.
- The **Transmit Progress** window shows the status of the file transmission and conversion.
- The default is a check in the boxes for "Show Data when Conversion Completed" and "Close this Dialog when Conversion Completed."

Section 4 HydroCAT-EP

4.1 Settings tabs

Push **[*Sensor*] Settings** to change the settings of a connected sensor to verify sensor function or set up for deployment.

4.1.1 Set up output format

The parameters selected in this tab change the data that is moved to the PC and the data that shows in the *Real Time Display* tab. Parameters that are not selected are still collected and stored as data by the sensor but do not show in the *Real Time Display* tab.

1. Push **Settings** in the Dashboard of the connected sensor.
2. On the *Output Format* tab: if necessary, change any of the Parameter Units.

Table 3 Parameter units

Temperature	Celsius*, Fahrenheit
Conductivity	uS/cm*, S/m, mS/cm
Pressure	Decibar*, PSI
Oxygen	mg/L*, ml/L

* default parameter

3. If necessary, change any of the Parameters to Output, or push **Default** to use the manufacturer-set values.

Table 4 Output parameters

Temperature*	Salinity
Conductivity	Sound velocity
Pressure*	Specific conductivity*
Oxygen*	Sample number

* default parameter

4. Push **Apply** to save the values in the sensor.

4.1.2 Set up data collection

1. Select the *Data* tab to set the interval between samples.
   The sensor collects data at the end of the specified interval.
2. Enter a value between 10–21600 seconds in the "Sample Interval" area.
3. Put a check in the box so that the data collected during a deployment is sent to a controller or logger and the user can see the data in real time.
   The software enables the "Transmit Real Time" setting whether or not there is a check in the box. The data shows in real time while the sensor is connected to the software.

4.1.3 Set up pump operation

Select the *Pumping* tab to set the values for the operation of the pump. The software automatically gets the Zero Conductivity Frequency and the Minimum Conductivity Frequency values from the connected sensor and shows them in the *Pumping* tab. The Minimum Conductivity Frequency value is the Zero Conductivity Frequency plus the offset value for either salt water (500 Hz) or fresh water (1 Hz). This sum is the minimum conductivity frequency at which the pump will operate.

1. If necessary, change the "Minimum Conductivity Frequency."

- If the sensor is set up to operate in an autonomous mode, the pump will operate a "pre-flush" for a manufacturer-set default of 300 seconds before data is collected. This removes air from the plumbing and primes the pump. The user can enter a value from 300–600 seconds for the "Pre-flush Duration."
- If the sensor is set up to operate with a controller ("polled" mode), put a check in the box next to " Scheduled Pre-flush for Polled Sampling." Make sure to set the pre-flush cycle to complete before the sensor starts to collect data. Data collection will cancel the pre-flush operation.
  Select the "Start Date."
  Select the "Start Time" (hours).

2. Push **Apply**.

4.2 Deployment wizard

1. If necessary, make sure that the sensor is connected to the software.

2. Push **Deployment Wizard** in the Dashboard of the connected sensor.

3. **Deployment Setup** step 1: Select "Autonomous Sampling," or "Polled Sampling" (SDI-12 or RS232).

4. Push **Next**.

5. **Deployment Setup** step 2: For "Autonomous Sampling": Set the date and time to start data collection. Then push **Next**.
   Put a check in the box next to "Transmit Real Time" to see the data as it is collected in a terminal program or a data controller. If the user does not put a check in the box, the sensor still collects and saves data, but it does not show the data in real time.

6. **Deployment Setup** step 3: For "Polled Sampling (SDI-12)": The manufacturer-set default address is 0. Users can change this if necessary. Use the "Bad Data Flag" default value of 9999999, then push **Next**.

7. **Deployment Setup** step 4: If necessary, change any of the settings in the Parameter Units area and Parameters to Output.

8. **Deployment Setup** step 5: Enter the minimum conductivity frequency. Refer to the section on Conductivity check on page 12 for details on this value.

   - Fresh water deployment—add a 1 Hz offset to the zero conductivity value of the sensor.

- Salt water deployment—add a 500 Hz offset to the zero conductivity value of the sensor.

9. **Deployment Setup** step 6: Put a check in the box to set the internal clock of the sensor to the same time as the PC.

- Put a check in the box "Clear HydroCAT/EP data" to erase the data from the internal memory of the sensor.
- If necessary, enter a pressure offset. If the sensor is deployed at sea level, enter 0.0 in the "Pressure Offset" area. The range is from -3402823 to 3402823.

10. **Deployment Setup** step 7: Enter the approximate minimum temperature of the water in which the sensor will be deployed.

- Enter the approximate depth of water in which the sensor will be deployed.
- Enter the time interval between each sample for either autonomous or logger-controlled (polled) operation.

    - Range for HydroCAT: 10–21600 seconds
    - Range for HydroCAT-EP: 75–21600 seconds

The calculated battery capacity and the number of 24-hour periods that the sensor can operate is given as a reference. **Note**: The software calculates "Battery Endurance" for new batteries only. Deployment time decreases for used batteries.

11. Push **Next**.

12. **Deployment Setup** step 8 (optional): make a Deployment Report.

- Enter the "Operator Name."
- Enter any text in the "Comments" area.
- Push **Browse** to change the location at which the report is saved on the PC.
- Put a check in the box next to "Overwrite if Existing" to save the new report only.

13. Push **Finish.** The sensor disconnects from the software.

- If the sensor was set up in a logger-controlled or "polled" mode, use the controller unit to control the collection of data.
- If the sensor was set up in an autonomous mode and there is a check in the "Transmit in Real Time" box from Step 2 of the **Deployment Setup**, start a terminal program to monitor data in real time.

14. When the deployment is complete, the user can connect to the software again and push **Transmit Data** in the <u>Dashboard</u> to move the data that is saved in the sensor to the PC.

## 4.3 Performance checks

4.3.1 Temperature check

1. Push **Temperature Check** in the <u>Dashboard</u> area.
2. Push **Next** to start the check.
3. Enter the water temperature in °C in the "Temperature" area.
4. Push **Start**.
   The software takes a few minutes to collect data for the test. The results show in the "Status" area.
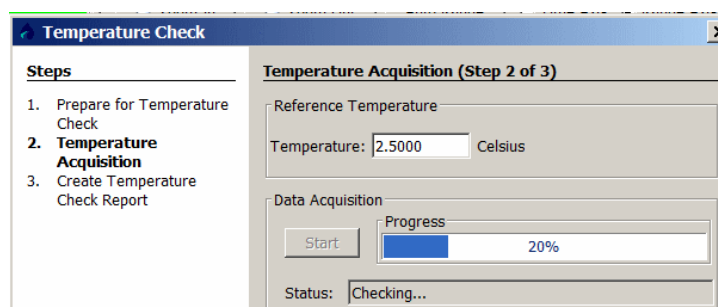
5. Push **Next**.

6. Push **Next**.
    The software saves a .pdf report in the user-specified location on the PC.

7. Push **Finish**.
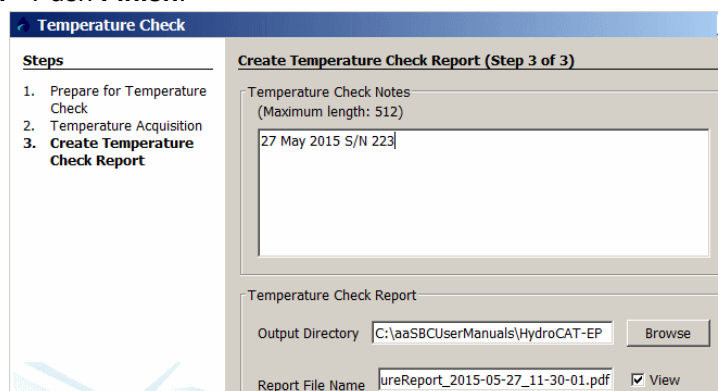
The **Temperature Check** window closes and the .pdf report shows if the "View" box has a check in it.

4.3.2 Conductivity check

The software lets the user do both a zero conductivity check and a check to a user-supplied conductivity standard.

1. Push Conductivity Check in the Dashboard.

2. Push **Next** to start the check.

3. At step 2 of 6, "Zero Conductivity Frequency Check": enter the first value from the "INST FREQ" column on the calibration page supplied by the manufacturer.

4. Push **Start**.

5. Push **Next**.
    The software shows the steps to complete the check for the user-supplied conductivity standard.

6. Push **Next**.

The software is ready to do the check of the user-supplied conductivity standard.

7. Enter the value of the conductivity standard in step 4.

8. Push **Start**.

9. The user can make a report.

   - Enter any text in the "Notes" area.
   - Push **Browse** to change the location where the report is saved on the PC.
   - Change the "Report File Name."
   - Put a check in the "View" box so that the report automatically opens when it is completed.
   - Put a check in the "Overwrite file if it already exists" box to save only the new information.

10. Push **Finish**.
    The Conductivity Check window closes and the report opens if the "View" box has a check in it.

4.3.3 pH check

Make sure that the pH values of the sensor agree to ±0.05 pH with the manufacturer-supplied calibration values. Refer to the sensor user manual for details to prepare the sensor for this check.

1. From the <u>Dashboard</u>, push **pH Calibration**.
2. Do the steps for each pH standard of 4, 7, and 10.
3. Optional: make a pH calibration report.

4.3.4 Optics check

Make sure that the optical values of the optional optical cap agree to within 20% of the manufacturer-supplied calibration values of the sensor.

1. To "pair" a new check cap with the optics:

   a. Go to the **Sensor** menu, then *HydroCAT-EP*, *Advanced*, then *Pair Optics Cal Cap*.
   b. Enter the serial number of the new calibration cap, then push **OK**. The software updates the reference values in the sensor.
   c. Push **OK** to finish.

2. Do the steps below to do a check with a currently owned optical check cap.
3. Push **Optics Check** in the <u>Dashboard</u> area.
4. Push **Next**.
5. Push **Start**.
   The software looks at the calibration values saved in the sensor. This will take approximately 2 minutes.
6. Push **Next**.

The **Create Optics Check Report** window shows.

7. The user can make a report.

    - Enter any text in the "Notes" area.
    - Push **Browse** to change the location where the report is saved on the PC.
    - Change the "Report File Name."
    - Put a check in the "View" box so that the report automatically opens when it is completed.
    - Put a check in the "Overwrite file if it already exists" box to save only the new information.

8. Push **Finish**.
    The window closes and the report opens if the "View" box has a check in it.

4.4 Transmit data

1. Push **Transmit Data** in the <u>Dashboard</u> area.
    The **Transmit Data** window shows.

    - Information in the <u>Memory Summary</u> lets the user see the available data storage in the sensor.

        - "Bytes" is the amount of memory in use.
        - "Samples" is the number of samples the sensor has collected and stored.
        - "Free Samples" is the number of samples the sensor can store.
        - "Sample Length" is sensor-specific and shows the length of each data record that the sensor stores.

2. In the "Transmit Type" drop-down menu in the <u>Data Transmit Options</u> area, select either "All Data" or "Block size (bytes)."

    - "All Data": all data stored in the sensor is transmitted to the PC in both .csv and .sbsdat file types.
    - "Sample Number Range": a user-specified range of samples. Select the specific samples in the <u>Sample Number Range</u> area.

3. In the <u>Data Transmit</u> area, the software automatically selects the fastest baud rate to use to transmit data, which is 115200.
    The software temporarily increases the sensor's baud rate to upload data more quickly. After the transmission is complete, the software changes the baud rate to the default for the connected sensor.

4. In the <u>Output CSV Data File</u> area, type a new file name or use the automatically generated file name.

5. Optional: change the time stamp to UTC.

6. Push **Transmit**.

    - The data is copied to the PC.
    - The software uploads a raw **.sbsdat** file and automatically converts the data to a readable **.csv** file type.
    - The **Transmit Progress** window shows the status of the file transmission and conversion.
    - The default is a check in the boxes for "Show Data when Conversion Completed" and "Close this Dialog when Conversion Completed."

Section 5 SeaFET V2 and SeapHOx V2

5.1 Settings tabs

Push [*Sensor*] **Settings** to change the settings of a connected sensor to verify sensor function or set up for deployment.

5.1.1 Set up output format

This tab shows the order of the data from the sensor.

5.1.2 Set up data collection

Select the values for data collection frequency, how it is transmitted, and the reference salinity.

1. In the "Data Collection" area, enter a value between 10–21600.
2. Put a check in the "Transmit Data in Real Time" box so that the sensor will send measurements to a connected PC in real time.
3. In the "Reference Salinity" area, enter a value between 0–50.0.
4. Push **Apply**.

5.1.3 Pump settings

If the sensor has an external pump attached, set the amount of time the pump operates.

1. Enter a value between 0–255 in the "Pumping Duration" area. Note that 0 = continuous pump operation.
2. Push **Apply**.

5.2 Configure sensor with deployment wizard

The deployment wizard in the UCI software makes it easy to set up and configure the sensor for a specific deployment.

With the sensor connected to a power supply (or internal batteries if so equipped) and a PC that has the UCI software installed, start the software, turn on the power supply, start communication with the sensor and push **Deployment Wizard** in the Dashboard.

Autonomous operation mode

1. Push **Synchronize SeaFET clock to computer**. The sensor and the PC show the same time. Put a check in the box to erase all of the data stored in the sensor and set the event counter to 0 when the deployment starts.
2. Set the date and time for the sensor to start data collection.
3. Transmission: put a check in the box to send collected data in real time to a connected controller. Data is still stored in the sensor if this box does not have a check in it.
4. **Pump Settings**: put a check in the box to enable operation of an external pump. Values can be between 0–255. If set to 0, the pump will operate continuously.
5. Calculate **Battery Endurance**. This calculation uses an estimate of the voltage of new batteries. It does not measure voltage directly.
   a. Enter the temperature of the water in which the sensor will be deployed.
   b. Enter the sample interval (40–21600).
6. Make a deployment report to see sensor statistics, calibration values, and settings.

Polled (controlled) operation mode

1. Push **Synchronize SeaFET clock to computer**. The sensor and the PC show the same time. Put a check in the box to erase all of the data stored in the sensor and set the event counter to 0 when the deployment starts.
2. Current Output Format shows the order of the data values from the sensor.
3. Calculate **Battery Endurance**. This calculation uses an estimate of the voltage of new batteries. It does not measure voltage directly.

   a. Enter the temperature of the water in which the sensor will be deployed.
   b. Enter the polled interval (1–86400).
4. Make a deployment report to see sensor statistics, calibration values, and settings.

5.3 Transmit data

1. Push **Transmit Data** in the Dashboard area.
   The **Transmit Data** window shows.

   - Information in the Memory Summary lets the user see the available data storage in the sensor.

     - "Bytes" is the amount of memory in use.
     - "Samples" is the number of samples the sensor has collected and stored.
     - "Free Samples" is the number of samples the sensor can store.
     - "Sample Length" is sensor-specific and shows the length of each data record that the sensor stores.
2. In the "Transmit Type" drop-down menu in the Data Transmit Options area, select either "All Data" or "Block size (bytes)."

   - "All Data": all data stored in the sensor is transmitted to the PC in both .csv and .sbsdat file types.
   - "Sample Number Range": a user-specified range of samples. Select the specific samples in the Sample Number Range area.
3. In the Data Transmit area, the software automatically selects the fastest baud rate to use to transmit data, which is 115200.
   The software temporarily increases the sensor's baud rate to upload data more quickly. After the transmission is complete, the software changes the baud rate to the default for the connected sensor.
4. In the Output CSV Data File area, type a new file name or use the automatically generated file name.
5. Optional: change the time stamp to UTC.
6. Push **Transmit**.

   - The data is copied to the PC.
   - The software uploads a raw **.sbsdat** file and automatically converts the data to a readable **.csv** file type.
   - The **Transmit Progress** window shows the status of the file transmission and conversion.
   - The default is a check in the boxes for "Show Data when Conversion Completed" and "Close this Dialog when Conversion Completed."

5.4 Process data with temperature and salinity corrections

FrameSync	DateTime (UTC-07:00)	Sample Number	Error Flags (#)	External pH, pH	Internal pH, pH	External pH, V	Internal pH, V	pH Temp, C	Relative Humidity, %	Internal Temp, C
SEAFET00460	12/12/2019 12:14	1	0	5.0443	3.4901	-1.01045	-1.14948	22.0552	7.2	22.6
SEAFET00460	12/12/2019 12:15	2	0	5.0443	3.4898	-1.01045	-1.1495	22.0598	7.3	22.6
SEAFET00460	12/12/2019 12:16	3	0	5.0438	3.4899	-1.01048	-1.1495	22.063	7.3	22.7
SEAFET00460	12/12/2019 12:17	4	0	5.0442	3.4902	-1.01046	-1.14949	22.0674	7.2	22.6

After the data is transmitted to the PC and converted to a .csv file type, it can be further processed with temperature and salinity corrections.

1. Select the **Data** menu, then *SeaFET*, and *SeaFET Data Processing*. The *Dashboard* shows.

2. In the "SeaFET Binary Logged Data File" area, select a data file that was transmitted to the PC.
   It has a .sbsdat file type.

3. Select "Specify Temperature Salinity Data" to see the options for temperature and salinity.

4. If an external temperature-salinity file is available:

   a. Enter the file name in the "Temperature-Salinity External File" area.
   b. Select "Temperature from External File" in the "Temperature Options" area.
   c. Select "Salinity from External File" in the "Salinity Options" area.

5. If there is no external temperature-salinity file available, use the internal temperature value stored in the sensor, and a static salinity value.

6. Put a check in the "Offset" box and enter the time in the "Time-Stamp Options" area for the software to calculate the offset.

7. Select the "Output Directory" for the processed data.

8. Push **Process File**.

Section 6 Software reference

6.1 UCI menu

The user can set up the way that the software saves information about the operation of the sensor and change the way that the data looks from the *Preferences* menu.

6.1.1 General

Go to the **UCI** menu, then *Preferences*, to select the *General* settings for the sensor.

1. Set the <u>Connection Settings</u>:

    -   Enter the "Maximum Wakeup Attempts" for the number of times the software will try to connect to a sensor. Range: 5–15.
    -   Enter the "Response Timeout" for the interval of time of communication between the sensor and the software. Range: 5–10.

2. Enter the <u>Default Data Directory</u>:

    -   Enter the file path or push **Browse** to find the directory in which to save data from the sensor.
    -   If the "Prompt at startup" box has a check in it, the user can change the directory that the data is stored in every time the software starts.

3. Push **Apply**.

4. Push **OK** to save the settings.

6.1.2 Display tab

Note: The software operates faster if the user selects less data and only one or two graphs.

Data that is collected by the sensor shows in the user-selected graphs in the <u>Performance Optimization Settings</u> area of the *Display* tab.
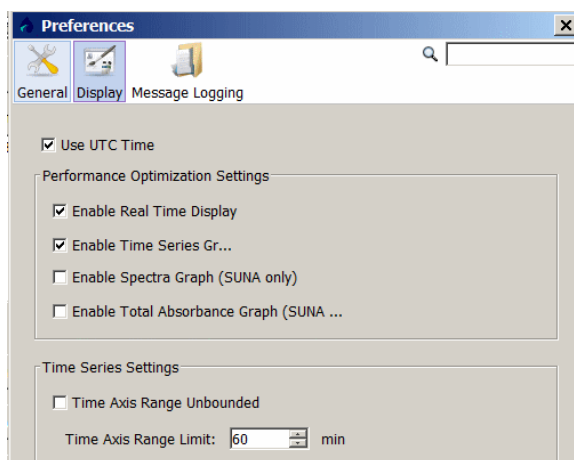
-   RS232 only: "Enable Real Time Display"—Put a check in this box to see the data as it is collected in either the software, or if deployed, a terminal program.
-   "Enable Time Series Graph"—Put a check in this box to see user-selected data. Remove the check in the box to so that the graph is disabled and the data does not show.
-   SUNA only: "Enable Spectra Graph"—Put a check in this box to see both dark and light data in raw counts. Refer to Monitor data in spectra graph on page 34 for details.
-   SUNA only: "Enable Total Absorbance Graph"—Put a check in this box to see the calculated absorbance. Refer to Monitor data in absorbance graph on page 35 for details.

<u>Time Series Settings</u>—The default is a check in the box for continuous data collection that is not limited to a specified amount of time. Remove the check in the box to enable

the "Time Axis Range Limit" of 60 minutes (default value). Only the most recent hour of data will show in the *Time Series Graph*. The user-selectable range is 1–1440 minutes.

6.1.3 Message tab

The software automatically saves files that have information about sensor use, data collection, and software operation over time. This information helps the user and Customer Support find problems and troubleshoot.

When the "Display Dialog for Error Level Messages" box has a check in it, the software saves one of five levels of error messages.

- **INFO**—The default level. All high-level operations are saved.
- **ERROR**—Minimum level. Only errors that need to be examined by the user or Customer Support are saved.
- **WARN**—Low level. The files that are saved do not have enough information for the user to make an analysis of how the sensor is used and set up.
- **DEBUG**—High level. Used to troubleshoot. **DEBUG** and **TRACE** files are very large.
- **TRACE**—The highest level. Used only to troubleshoot.

"Daily Files"—all messages from a single day are saved in one file.

"Rolling Files"—all messages are saved in one file until it is the maximum size specified by the user. The messages are then saved to a new file. The user specifies the number of files to keep. The oldest files are erased first.

"Save Lost Bytes"—if this box has a check in it, the software saves all of the unexpected output from the sensor to a file.

"File Location"—the operating system of the PC determines where these files are saved.

6.2 Sensor menu

The **Sensor** menus have options for each sensor with which the software communicates. Refer to the sections on Sensor dashboards on page 3 for more information about these items.
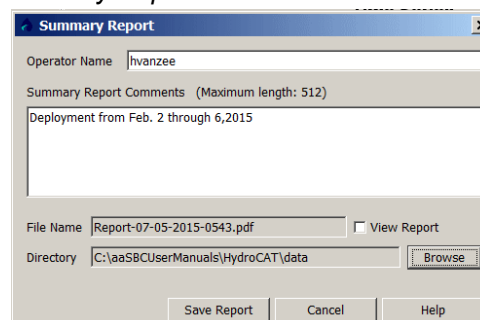
Advanced Sensor menu items

Common

- *Erase Data* lets the user erase all of the data stored in the sensor.
- *Summary Report* lets the user get a summary of the settings stored in the sensor.
- *Set Clock* lets the user synchronize the time between the PC and the sensor.
- *Collect Diagnostics* is helpful for troubleshooting.

6.2.1 Make summary report

Get a summary of the settings saved in the sensor.

1. Select *Summary Report*.

2. Enter any comments about the report (optional).
3. Put a check in the "View Report" checkbox to see the report after it is created.

4. Push **Browse** to go to the directory in which to save the report.

5. Push **Save Report**.
   The software makes a .pdf of the summary report.

6.2.2 Collect diagnostics

Use the diagnostic results to look at the current settings and commands sent to the sensor that are saved as .log files. They are helpful for troubleshooting.

1. Go to the **Sensor** menu, select the connected HydroCAT, then select *Collect Diagnostics*.

2. If necessary, push **Browse** to change the location on the PC to which the .zip file is saved.

3. Push **OK**.
   The **Diagnostics Created** window shows. Push OK to close the window.

4. Go to the .zip file on the PC and extract the files. There are three folders:

   - *console* contains a summary of the operation, calibration, and device configurations, and the event counter saved in the sensor.
   - *event log* contains .log files useful for troubleshooting.
   - *reports* contains the summary report referred to in Make summary report on page 26.

6.2.3 SUNA

- *Edit Data File Headers* lets the user put labels on data files.
- *SUNA Self Test*—the software does a test of the sensor function. The output shows in the *Instrument Console* tab.
- *DAC Calibration* lets the user do a digital-to-analog calibration (does not apply to coastal deployments).
- *Upload Firmware File* lets the user update the firmware in the sensor.
- *Administrative Settings* is used only by the manufacturer.
- *Upload Instrument XML File* is an .xml file necessary for the sensor to process data.

6.2.4 HydroCAT-EP

- *Pair Optics Cal Cap* (HydroCAT-EP) lets the user enter the serial number of a new check cap to connect, or "pair" it with the sensor.
- *Upgrade Firmware* (HydroCAT-EP) lets the user install the latest firmware from the manufacturer.

6.2.5 SeaFET, SeapHOx

- *Erase Saved Data* lets the user erase all of the data saved in the sensor.
- *Edit Data File Headers* lets the user put labels on data files.
- *Upgrade Firmware* lets the user install the latest firmware from the manufacturer.
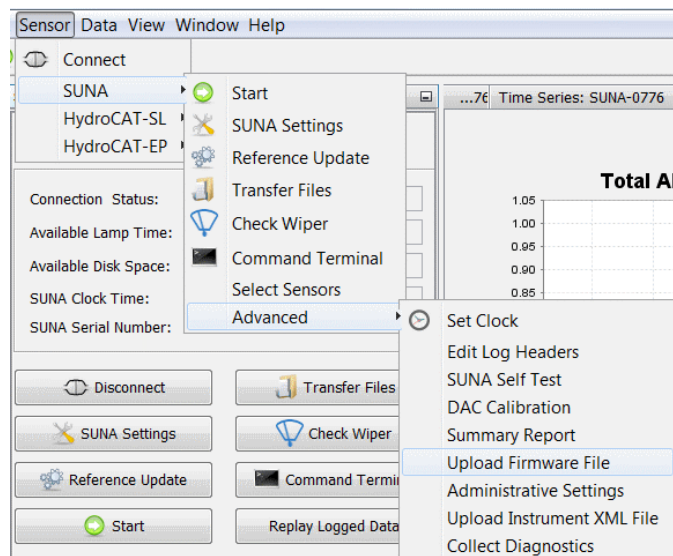
6.2.6 Update firmware

The user can update the firmware in supported sensors with firmware from the manufacturer's website.

6.2.6.1 Update SUNA firmware

At regular intervals, make sure that the current firmware is installed in the sensor.

1. Go to the manufacturer's web site to get the current firmware for the sensor.

2. Save the firmware to the PC.
   The firmware is an ".sfw" file.

3. Make sure that the sensor is connected to the PC and a power supply.

4. Push **Connect**.

5. Go to the **Sensor** menu and select *SUNA*, then *Advanced*, then *Upload Firmware File*.

6. Push **Browse** to find the firmware file that is saved on the PC.

7. Push **Open**.

8. Push **Upload**.
   It takes approximately 2 minutes for the software to be updated. The software disconnects the sensor.
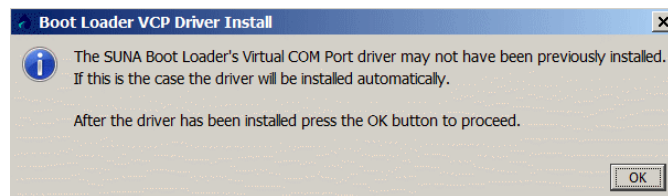
6.2.6.2 Update HydroCAT-EP firmware

Update the firmware for the sensor in the software program as necessary. The most recent version is available on the manufacturer's website.

1. Go to the **Sensor** menu, select *HydroCAT-EP*, select *Advanced*, then select *Upgrade Firmware*.

2. A **Select Firmware File** window shows.

3. Select the file with the **.txt** suffix.

4. Push **Open**.

5. The software updates the firmware in the sensor.
   This process will take several minutes. When process is complete, the software will show the version and build of the new firmware installed in the sensor.

6. Push **OK**.

6.3 Data menu

The **Data** menu has sensor-specific options to look at data that has been saved to a PC.

6.3.1 Export data to .csv or MS Excel format

Data from the sensor can be saved to either a comma-separated (.csv) file or a Microsoft® Excel file with a local or UTC time stamp. Use the software to transmit data from the sensor and then export that data to a human-readable format.

1. From the **Data** menu, select *Export Stored Data*.
2. Push **Browse** to find the file to export.
3. Select the file from the list.
4. Push **Open**.
5. Push **Next**. The current output format shows (all sensors but SUNA).
6. Push **Next**. Select the options for the file to export:

    a. Select either "Excel Workbook" or "Comma Separated Values" in <u>Export File Format</u>.
    b. Select either the "UTC" or "Local" time stamp in <u>Format Options</u>.
7. Push **Browse** to select the directory in which the exported data will be saved.
8. Push **Finish**.

6.3.2 Show data from multiple sensors

The software lets the user show data that has been saved on the PC from each supported sensor. The user can select up to 12 parameters to look at.

1. Go to the **Data** menu, then *Show Data from Sensor*.
2. Go to the area of the first supported sensor and push **Browse** to go to the .csv file-type.
3. Select the file, then push **Open**.
4. Push **Select Sensors to Show**.
5. Put a check in the box of each parameter to look at in the *Time Series* graph.
6. Push **OK**.

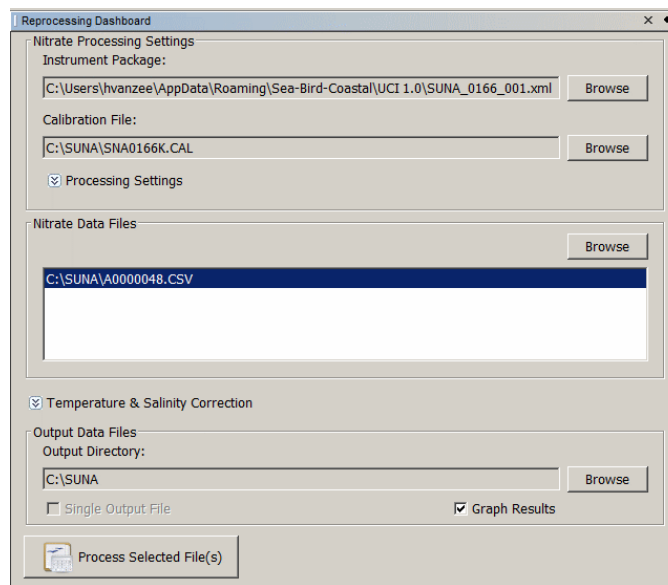## 6.3.3 SUNA data menu options

6.3.3.1 Reprocess SUNA data

The user may find that it helps to use the *Reprocess Data* option under some conditions.

- The settings for the sensor were incorrect. Use the "Reprocess" option to correct for this, such as when a sensor was deployed in seawater, but set up for fresh water.
- The data that is collected has changed over an extended deployment. Data is processed with an updated reference spectrum file, and compared to the original reference.
- Water temperature and salinity data are collected. These can be put together with the spectral data from the sensor to get more accurate nitrate data (Sakamoto et al. 2009).

Note that the data files collected with SDI-12 (standard sensor) do not contain spectral data and cannot be reprocessed.

1. If necessary, start the software and supply power to the sensor.
2. Go to the **Data** menu, then select *SUNA*, then *Reprocess Data*.
   The <u>Reprocessing Dashboard</u> shows.

3. Push **Browse** to find the package file, the reference file, and the data file. All are required to reprocess the data.

- • "Instrument Package File" is an .xml file that describes the data from the sensor.
- • "Calibration File" is for the reference spectrum and the extinction coefficients of the chemical species. Use the calibration file that matches the time during which data was collected. Calibration files are stored in the sensor unless the user erases them.
- • "Nitrate Data Files" will show in the dashboard and the user can select some or all to process. Spectral data, which is recorded in full ASCII, full and reduced binary, and APF frames, is required to process nitrate data. Use the reduced binary and APF frames to reprocess data from seawater deployments. Note that the APF frames only let the user reprocess data that was collected with the "integration time adjustment" turned off.

4. The user can change the "Output Directory" if necessary.

5. The reprocess operation will be faster if there is no check in the "Graph Results" box.

6. Push **Process Selected File(s)**.
The software starts to reprocess the data.

7. Open the files on the PC.

6.3.3.1.1 Nitrate reprocessing details

Settings in "Processing Settings" and the "Temperature & Salinity Correction" areas do not show until selected by the user. The user can change these settings as necessary to get better quality data.

Processing settings
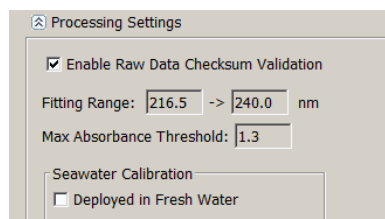
- • The default "Enable Raw Data Checksum Validation" is on, with a check in the box. If it is turned off, raw data can be processed even when the checksum values have changed after data is collected.

- The default "Fitting Range" is 216.5–240 nm. If the wavelength is shorter, seawater typically causes extinction, and a poor signal-to-noise ratio. If the wavelength is longer non-characterized materials can be absorbed, which causes a bias in the processed concentrations.
- The default "Max Absorbance Threshold" is 1.3. The precision of the measured absorbance starts to decline at this value. At 2.5 absorbance units, the precision is at the "noise floor." The precision of the processed data is better when the low-quality parts of the "fitting range" are not processed.
- The default <u>Seawater Calibration</u> has no check in the box at "Deployed in Fresh Water." Put a check in this box if the sensor was calibrated for seawater but deployed in fresh water. Data that was collected in seawater with a check in the "Deployed in Fresh Water" box gives incorrect nitrate concentrations.

Temperature and salinity correction

Seawater has a temperature-dependent absorption rate. Make sure to consider this so that imprecision does not affect the nitrate concentration that is measured. To mitigate this effect, use the sample temperature and salinity values in the nitrate calculation in the host software for post-processing. Note that spectra and related temperature and salinity data is necessary. The temperature-salinity correction comes from MBARI (cf. Carole M. Sakamoto, Kenneth S. Johnson, and Luke Coletti, Limnol. Oceanogr.: Methods 7, 2009.)

"Temperature and Salinity Correction" is available if the sensor is calibrated for seawater and water temperature and salinity data ("T-S data") are collected. This data can come from frames if the sensor operates in APF mode (SUNA V2 deep only), or from an external file.

1. The default "Activate Temperature & Salinity Correction" has no check in the box. Put a check in this box to add T-S data correction information.
2. Select either "CTD Data from SUNA APF Mode Frames" or "Data from External File" to get T-S data from an external file. The required ASCII format is "YYYY-MM-DD hh:mm:ss, Temperature (c), Salinity (PSU)" e.g. 2012-11-10 90:08:06,12.3,34.567.
3. Push **Browse** to find the file. For "External Files": at the bottom of the new window choose either "Sea-Bird CNV Data File" or "CSV Data File" in the "Files of type:" area. Push **Open**. A green check will show in the T-S Correction area of the software when the data is loaded.
4. The data files must have the same time stamp if more than one is selected. If necessary, put a value in the "Time Offset" area to align the time stamps.
5. Put a check in either the "Single Output File" box or the "Graph Results" box in the <u>Output Data Files</u> area of the dashboard.

   - If the user processes more than one file, the output can be directed to a single file of output. Otherwise, each file that is input to process will have one file of output.

6. Push **Process Selected File(s)**.

   - A graph of the processed data shows in the Reprocessed Nitrate Graph. The upper area shows how the chemical species combine to show measured absorbance. The lower area shows a timeline of the original and reprocessed nitrate concentrations. Use the slider under the timeline to select one measurement and see the concentration to the left.

6.3.3.2 Show SUNA data

Use **Show Data form Sensor** to see the data that has been saved on the PC.
The SUNA uses the files below to process data:

- The .xml instrument package file. For Windows, this is C:\Users\%USERNAME\My Documents\Sea-Bird-Scientific\SUNA. For Mac OS X, this is /Users/Home/Sea-Bird-Scientific/SUNA.
- The raw data file to process.
- The calibration file for the sensor.

1. Push **Show Data from Sensor**.
2. If necessary, push **Browse** to find the .xml "Instrument Package File" that is saved on the PC. A typical file is "SUNA_*xxx*_001.xml, where *xxx* is the serial number of the sensor.
3. Push **Browse** to find the "SUNA Raw Data File" to see the data that is saved on the PC.
4. Push **Browse** to find the current "SUNA Calibration File" on the PC. A typical file is SUNA_*xxxn*.CAL, where *xxx* is the serial number of the sensor, and *n* is the calibration version.
5. Push **Finish**.
   The saved data shows in the *Time Series* tab.

6.3.3.3 Convert SUNA raw data

The Convert SUNA raw data function has been replaced with "Transmit Data from Sensor" in the software. Go to the **Data** menu and select *Export Data* to transmit the data from the SUNA. Refer to Export data to .csv or MS Excel format on page 28 for details.

6.3.3.4 Convert APF data

The user can convert the Autonomous Profiling Float (APF) data from a deep-rated SUNA sensor into Full_ASCII so that data can be re-processed.

1. Go to the **Data** menu, then *SUNA*, then *Convert APF Data.*
2. If necessary, find the "Instrument Package File."
3. Push **Browse** to find the "Raw Data Files" to convert.
4. If necessary, push **Browse** to change the "Output Directory" for the data.
5. Push **OK**.
   The converted data shows in the software.

6.3.3.5 Compare reference spectrum files

Compare the change between two reference spectrum files. The amount of change is related to the time interval between the updates and the amount of lamp use during that time.
Note that this procedure is done automatically by the software when the user updates the reference spectrum for the sensor. Refer to Update reference for more information.

1. From the Data menu, select *SUNA*, then *Compare Calibration*.
2. Push **Browse** to find the first calibration, or reference file, to compare.
3. Push **Browse** to find the second file to compare. Note that the files must be from the same sensor.
4. Push **Compare**.
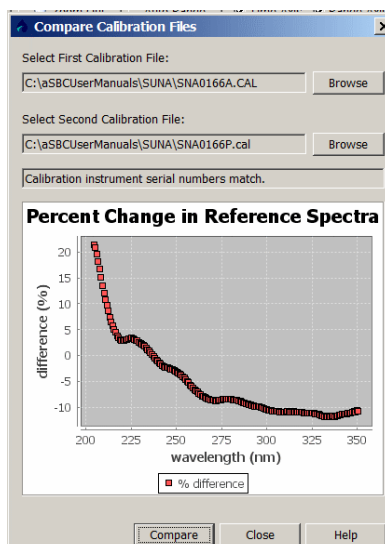
A typical update interval of 3–6 months with no more than 100 hours of lamp use should cause a change of no more than 10% in the 215–240 nm interval.

Below 215 nm, larger relative changes are normal.

Above 240 nm, the change is smaller than at the 215–240 nm range.

If there is a large change, do several reference updates 12–24 hours apart to monitor the stability of the reference spectrum.

6.3.4 Process SeaFET data

The software can process the binary raw .xml data from the sensor. The processed file is a comma-separated file with header information. The file name is appended with "_pro."

1. From the **Data** menu, go to *SeaFET*, then *SeaFET Data Processing*.
2. Push **Browse** to find the binary data file to process.
3. Optional: push the down-arrows next to "Specify Temperature Salinity Data" to select options.

   • Push **Browse** to find the Temperature-Salinity External File (if collected).
   • Optional: select the Time Stamp Option.
   • Select the Temperature Option and enter any offset.
   • Select the Salinity Option.
4. Push **Browse** to select the "Output Directory" for the data.
5. Push **Process File**.

6.4 View menu

*Dashboards—*Go to the **View** menu and *Dashboards* to select the dashboard for a specific sensor.

Graphs

• Time Series Graphs—all supported sensors.
• SUNA—Spectra, Absorbance, or Reprocessed Nitrate.
• SeaFET—Processed pH graph.

• SUNA Spectra graph: the user can push **Configure** to change the number of graphs to view. The "Graph History Limit" range is 1–2147483647. Put a check in the "Graph History Unbounded" box to see the total number of graphs. Default value: no check in the box and a "Graph History Limit" of 1.
• SUNA Absorbance graph: the user can change the "Min. Wavelength Cutoff" to between 150–400 nm to change the scale of the graph. The user can push

Configure to change the number of graphs to view. The "Graph History Limit" range is 1–2147483647. Put a check in the "Graph History Unbounded" box to see the total number of graphs. Default value: no check in the box and a "Graph History Limit" of 1.

• SUNA Reprocessed Nitrate graph: the user may find that it helps to reprocess data under some conditions.

Output—Go to the **View** menu and select *Output*, then any of the three options:

• *Instrument Console*: the current settings in the sensor
• *Processing Console*: the data collected by the sensor in a comma-delimited format
• *Application Console*: the commands sent to the sensor from the software.

Real Time Data—Go to the **View** menu and select *Real Time Data* to select the parameters that the specific sensor will use for data collection.

Data Collection—Go to the **View** menu and select *Data Collection* to select the location on the PC in which the collected data is saved.

Acquisition Monitor—Used by the manufacturer for troubleshooting.

Message File—Used by the manufacturer for troubleshooting.

6.4.1 Time series graph

**1.** Look at the data in the *Time Series* graph. The user can look at data in real-time for each sensor that has power supplied, is connected and is in communication with the software.

• Put a check in the box next to "Time Axis" to push **Zoom In** and **Zoom Out** to change the scale of time.
• Put a check in the box next to "Range Axis" to push **Zoom In** and **Zoom Out** to change the scale of the data.
• To move the data in any direction, push the "Ctrl" key on the PC keyboard and the left button of the mouse pointer at the same time.
• To select a specific part of the data to zoom in on, pull the mouse pointer diagonally.
• Push **Auto Range** to see the data for each selected parameter. The software adjusts the scale so that the data will always show.
• Push **Default Ranges** to go back to the manufacturer-set default scale for each parameter.
• Put a check in the box next to "Show Data Points" to see the value of the collected data when the mouse moves over each point.
• Push **Select Sensors To Display** to change the parameters to look at in the *Time Series* graph.

6.4.2 Monitor data in spectra graph

The *Spectra* graph shows both the dark and light data in raw counts.
The dark counts are from thermal noise. The light counts are the measured output minus the dark counts.

The measured spectrum is always flat below 200 nm, and then has four or five peaks. The peaks are approximately 25 nm apart in the lower wavelength range and up to 50 nm apart in the upper range.
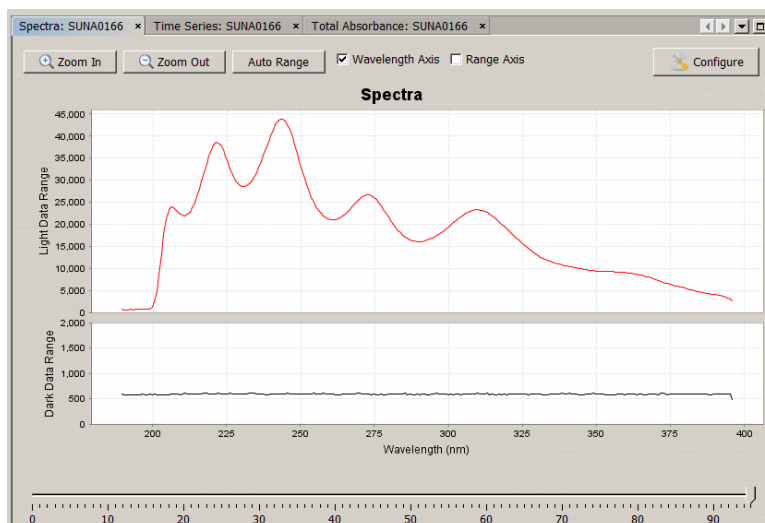
6.4.3 Monitor data in absorbance graph

The *Total Absorbance* graph shows the calculated absorbance from 210 to 370 nm. This graph is an alternative to the *Spectra* graph. The absorbance graph should be flat when a sample of DI water is collected. The absorbance increases as absorbing species such as nitrate and bromide are added to samples.
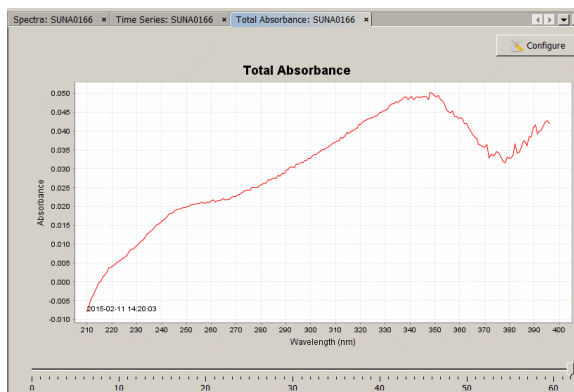
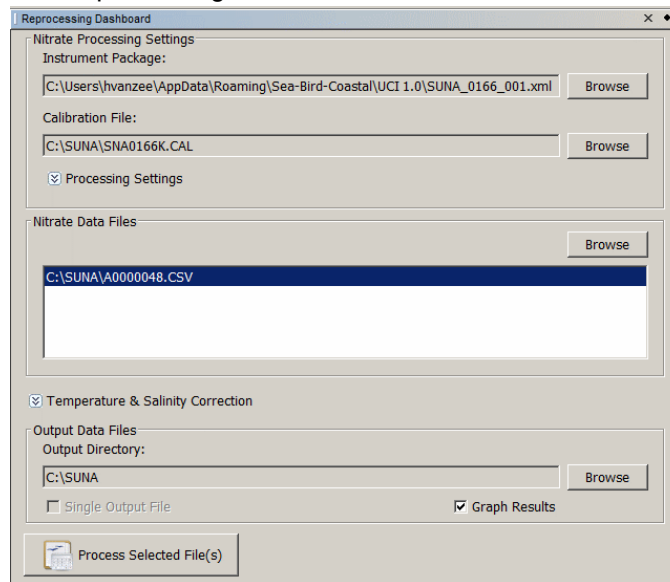If necessary, push **Stop**.

6.4.4 Reprocess SUNA data

The user may find that it helps to use the *Reprocess Data* option under some conditions.

• The settings for the sensor were incorrect. Use the "Reprocess" option to correct for this, such as when a sensor was deployed in seawater, but set up for fresh water.
• The data that is collected has changed over an extended deployment. Data is processed with an updated reference spectrum file, and compared to the original reference.
• Water temperature and salinity data are collected. These can be put together with the spectral data from the sensor to get more accurate nitrate data (Sakamoto et al. 2009).

Note that the data files collected with SDI-12 (standard sensor) do not contain spectral data and cannot be reprocessed.

1. If necessary, start the software and supply power to the sensor.
2. Go to the **Data** menu, then select *SUNA*, then *Reprocess Data*.

The <u>Reprocessing Dashboard</u> shows.

3. Push **Browse** to find the package file, the reference file, and the data file. All are required to reprocess the data.

   - "Instrument Package File" is an .xml file that describes the data from the sensor.
   - "Calibration File" is for the reference spectrum and the extinction coefficients of the chemical species. Use the calibration file that matches the time during which data was collected. Calibration files are stored in the sensor unless the user erases them.
   - "Nitrate Data Files" will show in the dashboard and the user can select some or all to process. Spectral data, which is recorded in full ASCII, full and reduced binary, and APF frames, is required to process nitrate data. Use the reduced binary and APF frames to reprocess data from seawater deployments. Note that the APF frames only let the user reprocess data that was collected with the "integration time adjustment" turned off.

4. The user can change the "Output Directory" if necessary.
5. The reprocess operation will be faster if there is no check in the "Graph Results" box.
6. Push **Process Selected File(s)**.
   The software starts to reprocess the data.
7. Open the files on the PC.

6.5 Window and Help menus

The user can change how the software shows different windows and tabs.

- *Close Current Window*—closes the selected tab (highlighted in blue).
- *Close all Windows*—closes all tabs except the <u>UCI Dashboard</u>.
- *Configure Window*—
  Maximize: increases the size of the selected tab to fill the software screen size.

  Float: unlocks the selected tab from the software screen so that the user can move it to other locations on the PC screen.

  Float Groups: the same as *Float* above, but all tabs that are open are unlocked so that the user can move them to other locations on the PC screen.

  Minimize: minimizes the selected tab and moves it to the side of the software screen.

  Minimize Group: minimizes the open tabs in the "Console," "Dashboard," or "Graph" areas of the software.

Dock: locks the tab that the user selected to "float" back to its previous position in the software window.

Dock Group: the same as *Dock* above, but all tabs that are open are locked back into their previous position in the software window.

Go to the **Help** menu to see the .pdf version of the user manuals for supported sensors and this software reference. Go to *Sea-Bird.com* to go to the manufacturer's web site.