SEA·BIRD COASTAL

Water Quality Monitor (WQM)

User manual

12/2013, Edition 1

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Section 1   Specifications

1.1 Mechanical

Diameter	18.5 cm
WQM length	65.4 cm
WQMx length	69.0 cm
Depth rating	200 m
Temperature range	-5–35 °C
Pressure housing	Acetal coploymer, ABS, PVC, titanium, copper
WQM weight in air, water	5.4 kg, 1.8 kg
WQMx weight in air, water	6.25 kg, 1.7 kg
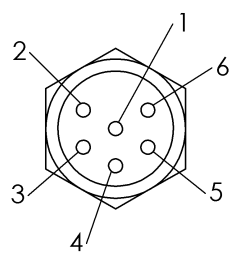
1.1.1 Bulkhead connector

Pin	Function	MCBH-6-MP
1	Ground	
2	RX	
3	Reserved	
4	Voltage in	
5	TX	
6	Reserved	

1.1.1.1   Digital external data port connector

Socket	Function	MCBH-4-FS
1	Ground	
2	Voltage in	
3	RS232 RX	
4	RS232 TX	

1.1.1.2   Analog external data port connector

Socket	Function		MCBH-6-FS
	1 analog	**2 analog**	
1	Ground		
2	Signal 1		
3	Signal 1 ground		
4	Voltage in		
5	No connect	Signal 2	
6	No connect	Signal 2 ground	

1.2 Electrical

Input voltage	9–16 VDC
Current draw, data collection	< 100 mA
Current draw, peak data collection	180 mA
Current draw, BLIS operation	350 mA
Current draw, low power	< 50 µA

1.3 Communications

Transfer standard	RS232
Sample rate	1 Hz

1.4 Optical

Sensor	Parameter	Wavelength	Range, Sensitivity
WQM, WQMx	Chlorophyll	470/695 nm	0–30, 0.015 µg/L
WQM	Turbidity	700 nm	0–25, 0.013 NTU
WQMx	CDOM	370/460 nm	0–375, 0.18 ppb
WQMx	Scattering	700 nm	0–3, 0.002 m^{-1}

1.5 Conductivity, Temperature, Depth, Dissolved Oxygen

Parameter	Range	Accuracy	Resolution
Conductivity	0–9 S/m	0.0003 S/m	0.0005 S/m
Temperature	-5–35 °C	0.002 °C	0.001 °C
Depth (Pressure)	1–100 or –200 m	0.1% full scale	0.002% full scale
Dissolved Oxygen	120% of saturation (150% on request)	2% of saturation	0.035% of saturation 0.003 ml/L at 0 °C, 35 PSU

Section 2 Functional check

> **⚠ CAUTION**
>
> CDOM sensors use UV LED light. Do not look directly at a UV LED when it is on. It can damage the eyes. Keep products that have UV LEDs away from children, pets, and other living organisms. Wear polycarbonate UV-resistant safety glasses to protect the eyes when a UV LED is on.

Functionally, the only difference between the WQM and the WQMx is the optics.

- The WQM has an internal *ECO* chlorophyll fluorometer and turbidity sensor (FLNTUS).
- The WQMx has an internal *ECO* turbidity sensor and chlorophyll and CDOM fluorometers (BBFL2W).

The WQM has configurations of sensors that use the abbreviations listed below.

- WQM—Water Quality Monitor
- CTD—Conductivity, Temperature, Depth
- DO—Dissolved Oxygen
- CDOM—Colored Dissolved Organic Matter

2.1 Pre-deployment check

The user needs the items listed below to make sure that the sensor operates correctly before deployment.

- a clean work bench
- a PC
- a regulated power supply

Manufacturer-supplied:

- test cable
- sensor
- CD with host software
- 5/32" hex key
- 7/64" hex key
- orange fluorescence stick
- blue fluorescence stick

1. Lubricate each of the connectors with pure silicone spray. Let the spray dry. Refer to the section on Bulkhead connector maintenance on page 25 for details about how to care for bulkhead connectors.
2. Select the host software, the file on the CD that ends with ".exe" and move it to the desktop of the host PC.
   The host software is now available on the host PC.
3. Connect the test cable to the PC, the sensor, and the power supply.
4. Start the host software on the PC.
5. Supply power to the sensor.
   The host software tries to identify the COM port and the baud rate.
6. If necessary, select the COM port and the baud rate (19200) from the drop-down menu in the COM Port Setup area of the software.
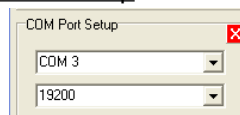
7. Push **Start Sample**, then push **Start WQM Now**.

The sensor does a warm-up for the CTD, DO, and the optics before it starts the **Sample** mode. This sequence takes approximately 35 seconds.
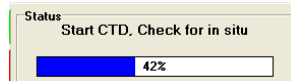
8. Push **Stop WQM Sample**, then push **Yes, Stop WQM Sampling**.
   The sensor goes into **In Standby** mode. The user can now make changes to the sensor setup.
9. Go to the *WQM Setup* tab.
10. Push **Set Date and Time** to make sure the host PC and the sensor show the same date and time.
11. Go to The *WQM Output* tab.
12. Make sure that the boxes listed below are selected:

   a. Conductivity
   b. Temperature
   c. Pressure
   d. Raw dissolved oxygen
   e. Processed dissolved oxygen
   f. Chlorophyll
   g. NTU
   h. CDOM (WQMx only)

   Only those values with selected boxes are stored by the sensor as data. A data value with a box that is not selected is not available in the Data Sidebar area or the *View Data* tab.
13. Push **Send Output Configuration**.
   The selected parameters are stored in the sensor.
14. Push **Start WQM Sample**.
   The sensor starts its warm-up cycle.

2.2 Monitor data

There are three places in the host software to monitor the data that the sensor collects.

- The *Scroll Data* tab.
- The *View Data* tab.
- The Data Sidebar area.

1. Look at the data in the Data Sidebar area.
2. Change the values of the collected data:

   - For chlorophyll: Put an orange fluorescent stick in front of the chlorophyll (blue) light to change the value of the data from the chlorophyll sensor. The value increases toward the maximum output value listed on the sensor's characterization page.
   - For NTU: Put a solid object such as a finger in front of the turbidity (red) light to change the value of the data from the turbidity sensor. The value increases toward the maximum output value listed on the sensor's characterization page.
   - For CDOM (WQMx only): Put a blue fluorescent stick in front of the CDOM (purple) light to change the value of the data from the CDOM sensor. The value increases toward the maximum output value listed on the sensor's characterization page.
3. Make sure that the CTD and DO sensor have the output values as listed below.

   - Conductivity: 0.000 (+0.0005, -0.0001)

- Temperature: current room temperature
- Pressure: 0.00 (±0.5)
- Raw Dissolved Oxygen: 3000–15000 Hz
- Processed Dissolved Oxygen: 3–6.5 ml/L

2.2.1 Scroll data tab

The *Scroll Data* tab shows the data collection, the sensor's status records, and other miscellaneous messages. Sensors that use version 1.5 or newer show data collection at 1 Hz. Older versions show the data collected once every 10 seconds when the sensor is in air, and at 1 Hz when it is in water.

1. Go to the *Scroll Data* tab.
2. Monitor the collected data.

```
WETS_WQMX1001        11        020713  080400  0        1        0        5        4        12.12
WETS_WQMX1001        11        020713  080401  0        1        0        5        3        12.13
WETS_WQMX1001        11        020713  080402  0        1        0        5        2        12.13
WETS_WQMX1001        11        020713  080403  0        1        0        5        1        12.13
WQMX,SN,Date(mmddyy),Time(hhmmss),Temp(C),Pres(dbar),Sal(PSU),DO(ml/l),TURBIDITY(NTU),CHLA(UG/L),CDOM(PPB-QSDE),Volts
WETS_WQMX1001        11        020713  080404  0        1        0        6        129        12.13
WQMX,1001,020713,080404,20.1800,0.01,0.010,1.646,0.665,0.214,-0.270,12.13
WQMX,1001,020713,080405,20.1790,0.01,0.010,1.644,0.671,0.226,-0.090,12.18
WQMX,1001,020713,080406,20.1804,0.01,0.010,1.642,0.659,0.214,0.270,12.17
```

- **WETS_** ...: These lines show the sensor's serial number and the conditions that are used by the sensor in the setup and view controls.
- **WQM,SN,Date(mmddyy),**...:These lines show the column headings for the collected data.
- **WQM,1001,0207013,**...: These lines show data records. These records are transmitted at 1 Hz when the sensor collects data.

2.2.2 Data sidebar area

The Data Sidebar area shows the data and lets the user select the parameters that show in the graph area of the *View Data* tab.

1. Look at the Data Sidebar area on the left side of the host software window to see which parameters will show on the graph in the *View Data* tab.
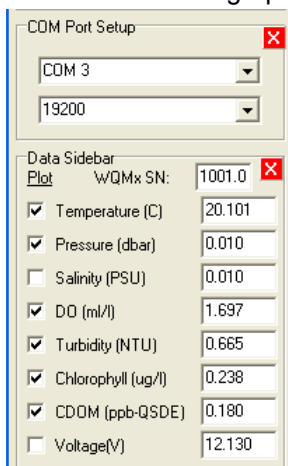
Temperature, Pressure, DO, Turbidity, Chlorophyll and CDOM show in the View Data tab.

2. Select different checkboxes under the Plot heading to see different parameters in the *View Data* tab.
3. Start the sensor.
4. Monitor the data in the *View Data* tab and in the Data Sidebar area.

2.2.3 View data tab

Monitor the collected data in real-time.

1. Go to the *View Data* tab.
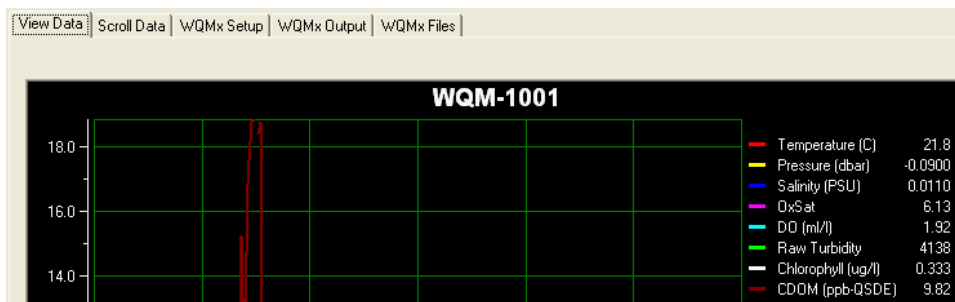
2. The user can change the parameters that show in the plot area of *View Data* tab.

    a. Put the sensor in **In Standby**.

    b. Go to the *WQMx Output* tab.

    c. Select the check boxes for the parameters to be stored in the sensor.

    d. Push **Send Output Configuration**.

    e. Go to the Data Sidebar area and select the parameters to show in the *View Data* graph area.

2.3 Stop sensor

Stop the sensor to finish the functional check.

1. Push **Stop WQM Sample**.

    a. No more data is collected on the *View Data* and *Scroll Data* tabs, or the Data Sidebar area.

    b. The Bio-wiper closes on the WQM. The wiper does not move on the WQMx.

    c. The *Scroll Data* tab shows "status records" that start with "WETS" at 1 Hz.

    d. The sensor is in **In Standby**.

2. Turn off the power supply.

3. Disconnect the sensor from the power supply and the PC.

2.4 Examine and maintain BLIS

⚠ **C A U T I O N**
Sediment and other solids will cause the BLIS intake area to become clogged and it will not function correctly.

⚠ **C A U T I O N**
Do not use any abrasive on the sides of the BLIS intake. Scratches on this surface will prevent the nipple of the bleach reservoir from a proper seal.

The Bleach Injection System (BLIS) uses a Playtex® Premium Nurser baby bottle as a bleach reservoir. This product has a disposable drop-in liner of HDPE plastic and a silicone nipple that can withstand long-term exposure to bleach. DO NOT substitute with another bottle.

Make sure that the BLIS operates correctly. Operate the system with water as a operational check. Only fill the bottle with bleach immediately before deployment.

Supplies

- 7/64" hex key
- 5/32" hex key
- Scotch-Brite™ or equivalent household scrub pad.

1. Use a 7/64" hex key to remove the two screws in the BLIS end cap.

Figure 1   End cap screw removal

2. Twist and pull to lift the end cap to view the bottle.

Figure 2 End cap removal

3. Hold the bottle by the rim and pull gently. There may be a slight suction as the nipple pulls loose from the intake area.

Figure 3 Bottle removal

4. Use a 5/32" hex key to loosen the clamp that holds the CT sensors and BLIS.

Figure 4 Clamp removal

5. Lift the clamp up and off the CT and BLIS protective copper sleeves.

6. Use a 7/64" hex key to remove the two screws at the base of the BLIS sleeve.

Figure 5 Screw removal from bottom of BLIS
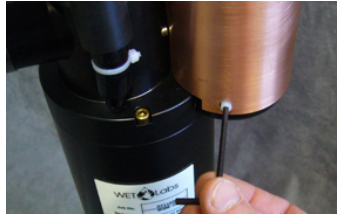
7. Lift the copper BLIS sleeve up and off. Do not twist any more than necessary. Look at the pump intake area.

Figure 6 BLIS pump intake

8. Make sure the intake area is clean.

    a. Do not scrape the sides of the intake.
Scratches on the inside of the intake will prevent the bleach bottle from a correct seal.

    b. If necessary, clean with a lint-free towel or tissue.

    c. Flush carefully with a small amount (~ 2 mL) of de-ionized (DI) or fresh water.

9. Fill the clean intake area with DI water.

10. Connect the sensor to the host PC and power supply.

11. Start the host software.

12. Supply power to the sensor.

13. Push **Stop WQM Sample**, then **Yes, Stop WQM Sampling**.
The sensor is **In Standby**.

14. Go to the **Help** menu and select *Troubleshooting*.

15. Under Select Test Mode, select "Test BLIS."
The sensor status is **Test BLIS Pump**.
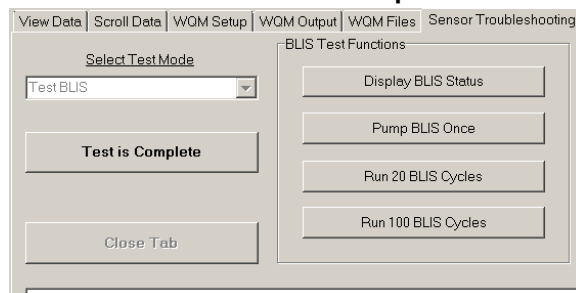
16. Push **Run 100 BLIS Cycles**.
The pump makes a "click" sound each time it operates. The user can see the water level fall in the intake area. The host software shows each pump cycle. Refer to the section Troubleshoot BLIS on page 12" for details about what to do if the water level does not fall.

17. Turn off power to the sensor and disconnect it from the PC and power supply.

18. If necessary, use a Scotch-Brite™ scrub pad to remove any corrosion that "flakes" off.

Figure 7 Clean BLIS sleeve

19. If necessary, clean the BLIS end cap and copper sleeve with fresh water and a towel. These parts must be clean to protect the BLIS intake when the copper sleeve is attached again.

20. Slide the copper BLIS sleeve onto the BLIS. Make sure that the slot in the sleeve lines up with the tube between the BLIS and the CT-DO sensors.

Figure 8 Copper sleeve slot
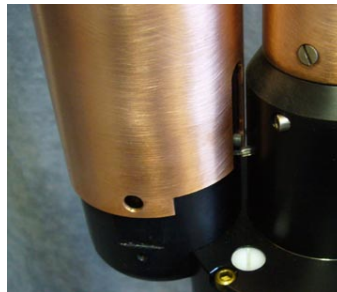
21. Use a 7/64" hex key to install the 6-32 x 3/8" screws at the bottom of the BLIS sleeve.

22. Slide the clamp over the BLIS and CT sleeves approximately 8 cm from the top of the BLIS sleeve.

Figure 9 Clamp installation

23. Use a 5/32" hex key to tighten the screw in the clamp.

24. Prepare the sensor for storage or deployment.

    a. To store the sensor, use the 7/64" hex key to install the screws that hold the top end cap on the copper sleeve.

    b. To complete the preparation of the sensor for deployment refer to the next section,

2.4.1 Troubleshoot BLIS

If the water level in the intake area does not fall while the BLIS is in operation, do the steps below.

1. Make sure the pump has time to operate. The flow rate is approximately 1 mL/min.
2. Listen for the pump to click.
3. Make sure the sensor has power supplied and is in communication with the host software.
4. Check again for blockage at the intake.
5. Push a finger on the top of the intake area to move the water through the pump component.

Section 3   Sensor set up and operation

Make sure that the BLIS system has fresh bleach, and that the host software is set up for the environment in which the sensor will be deployed.

3.1 Set up BLIS for deployment

<table>
<tr><td>⚠ DANGER</td></tr>
<tr><td>Bleach is corrosive and harmful to almost every part of the sensor. Make sure that bleach does not get into the sensor.</td></tr>
</table>

The Bleach Injection System (BLIS) must be filled with bleach and its pump must be primed before deployment. Only put bleach into a BLIS that will be deployed. If the sensor will be put in storage, make sure there is NO bleach in the system.

1. Use a graduated cylinder to measure the bleach. Record the amount used. The capacity of the reservoir is 125 mL nominal or 150 mL to the very top.

Figure 10 Graduated cylinder and bottle

2. Put the bleach into the liner inside the bottle.
3. Tighten the cap and the silicone nipple on the bottle. Do not over-tighten.
4. Push up on the bottom of the liner to remove the air in the bottle.
    Push until liquid comes out the nipple.

Figure 11 Air removal from bottle

5. Put a small amount of clean water on the nipple.
6. Set the bottle into the BLIS.

Figure 12 Bottle set in BLIS sleeve

7. Hold the rim of the bottle, push carefully and turn it back and forth approximately 1 cm to make sure the nipple is against the intake.
8. Put the BLIS end cap into the BLIS sleeve.
    The reservoir compresses and the nipple is sealed in the intake.
9. Align the threaded holes in the end cap with the holes in the sleeve.

Figure 13 BLIS end cap in sleeve

10. Use a 5/32" hex key to install two 6-32 x 3/8" screws in the end cap and protective sleeve.
    Do not use old screws again. Use the screws from the spare parts kit that comes with the sensor.

3.2 Pre-deployment tasks

Make sure that the values for the BLIS, the sensor power, the data files and the pressure sensor are set up correctly before each deployment.

1. Start the host software if necessary.
2. Make sure the sensor has power supplied and is in **In Standby**.
    Refer to Pre-deployment check on page 5 for details.
3. Clear the red background in the clock area if necessary. Go to the *WQM Output* tab and push **Set Date and Time**.
    The time shown on the sensor's clock and on the host PC clock are the same.
4. Go to the **Pre-deployment** menu at the top of the host software window.
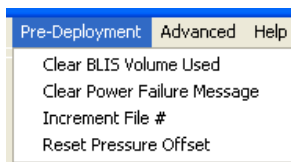
3.2.1 Adjust BLIS calculator

The software counts the number and the volume of bleach squirts and calculates the quantity of the bleach used during a deployment. Make sure that the bleach reservoir is emptied and then filled with 150 mL of 5% fresh bleach before every deployment. Refer to the sensor's hardware user manual for instructions to fill the BLIS.

1. Go to the **Pre-Deployment** menu, then select *Clear BLIS Volume Used*.

2. In the window that opens, push **OK** to set the volume of bleach that has been used to 0.00 mL.

3. Go to the *WQM Setup* tab and push **Send New Setup**.
The "BLIS Volume Used" shows 0.00.

3.2.2 Adjust power failure message

If the supplied voltage falls too low or power is lost, the Uninterruptible Power Supply (UPS) comes on. The host software shows the condition in red.
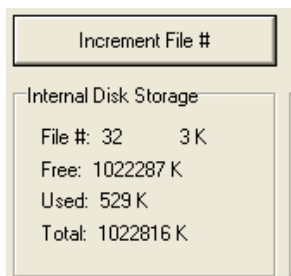Select the "Clear Power Failure Message" to adjust this in the host software.

• The UPS message goes out of view.

3.2.3 Adjust data file number

*Note: This is used in **External Control** mode only.*

In **External Control** mode, the file numbers do not change. This is so that all of the data in a deployment is collected in the same file.

1. View the "File #."

2. Push **Increment File #** to make the file number increase.

3. Push **Get Status**.
The file number increases by one.

3.2.4 Adjust pressure offset

The sensor uses pressure measurements to calculate the depth of the water. As the atmospheric pressure changes, the sensor calculates an offset for the pressure measurement. Set the pressure measurement to 0.00 dbar before a deployment.

1. Select the **Pre-Deployment** menu.

2. Select the *Reset Pressure Offset* menu item.

3. Do the steps in the new window.

a. Put the sensor just above the surface of the water near the location of the planned deployment.

b. Supply power to the sensor.

        c.   Put the sensor in **In Standby**.

        d.   Push **OK** in the **Reset the WQM Pressure Offset** window.

4. Wait for approximately 2 minutes for the sensor to adjust to the atmospheric pressure and altitude.
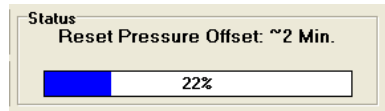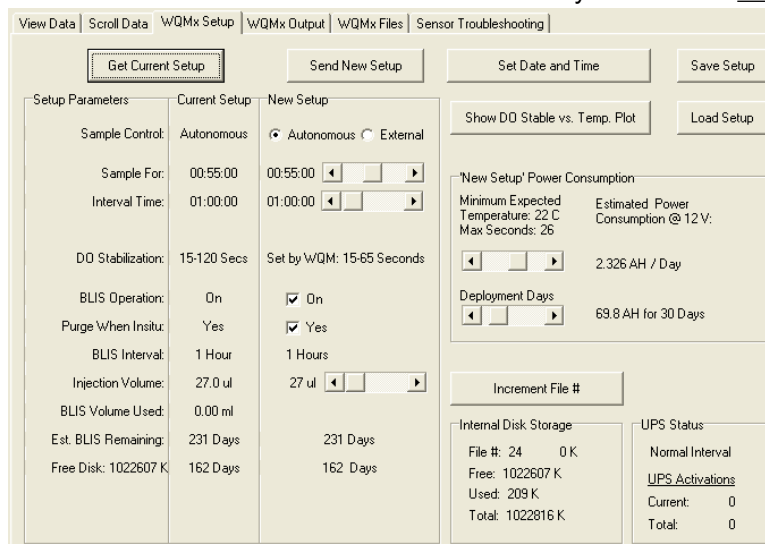
5. The message "Pressure Reset Completed" shows in the *Scroll Data* tab.
The sensor goes into **In Standby**.

6. Remove the power to the sensor.

7. Start the sensor again to make sure that the pressure measurement is 0.00 ±0.01 dbar.

8. Stop the sensor.

9. Remove the power to the sensor.

3.3 Set up sensor for deployment

Use the *WQMx Setup* tab to look at or adjust the parameters that the sensor uses to operate. These include:

- the current time
- the data collected
- the condition of the BLIS
- the condition of the data files
- the condition of the power supply.

1. Start the host software.

2. Supply power to the sensor if it is not already on.

3. Put the sensor in **In Standby**.
Refer to the section on Pre-deployment check on page 5 for details.

4. Push **Get Current Setup**.
Look at the values stored in the sensor. They show in the <u>Current Setup</u> area.

3.3.1 Adjust operation setup

The examples in this section refer to a sensor that is set up for "Autonomous" operation. Refer to the section on External sample control on page 36 for instructions on how to set up the sensor for External Sample Control.

1. View the values in the 'New Setup' Power Consumption area of the host software.
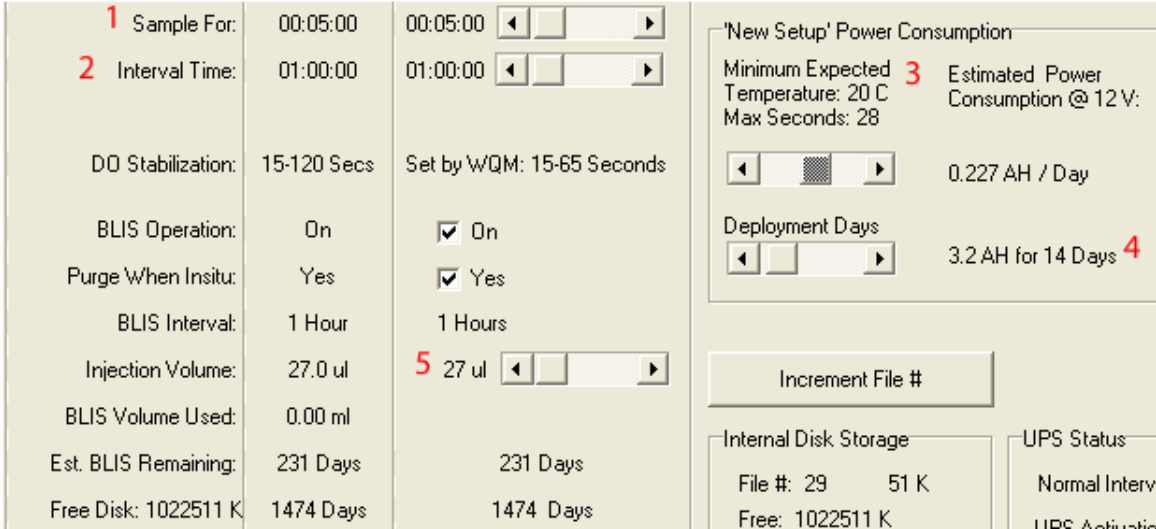
1	The number of hours, minutes or seconds that the sensor actively collects data.	4	The number of days that the sensor will be deployed.
2	The time each "Sample For" in #1 is set to, plus the time in low-power and warm-up.	5	The volume of the bleach solution that is used for each injection.
3	The minimum expected temperature in the water where the sensor is to be deployed.		

2. Adjust the values to see how the Estimated Power Consumption @ 12 V and the Est. BLIS Remaining are affected.
3. Adjust these values for the next deployment.
4. Push **Send New Setup** to store the values in the sensor.
5. Push **Get Current Setup** to make sure that the correct values show.

3.4 Set up data output

1. Make sure that power is supplied to the sensor and it is in **In Standby** mode.
2. Go to the *WQM Output* tab.
3. Push **Get Output Configuration**.
   Look at the parameters stored in the sensor.
4. Look at the parameters that have checkmarks in the boxes next to them.

5. Make the selections for the next deployment.
   These parameters will show in the *Scroll Data* tab.
   Note: Either the <u>Raw ECO</u> or the <u>ECO</u> always has a checkmark.

6. Push **Send Output Configuration** to store the selections in the sensor.
   These parameters will show in the *Scroll Data* tab when the data is being collected.
   Note: Either the <u>Raw ECO</u> or the <u>ECO</u> always has a checkmark.

3.5 External data port (EDP)

All WQM sensors have two bulkhead connectors so that the user can connect an external sensor to the WQM. Either a digital (4-socket) or an analog (6-socket) connection is available.
Digital connections:

- CDOMS
- PARS
- SBE18S pH
- Custom Setup

Analog connections:

- Analog 1
- Analog 1 + 2
- SBE18 pH
- SBE27 pH and redox

1. Go to the **Advanced** menu at the top of the host software screen and select *Setup External Data Port*.
   A new tab, *External Data Port*, shows in the host software.

2. Push **Get EDP Setup from WQM**.
   Look at the setup values stored in the sensor.

3.5.1 Digital EDP set up

The user can adjust the "Signal" values in this tab so that the latest characterization values from a connected sensor are stored in the WQM. Refer to the Custom EDP set up on page 20 to connect a digital sensor that is not listed in the drop-down menu.
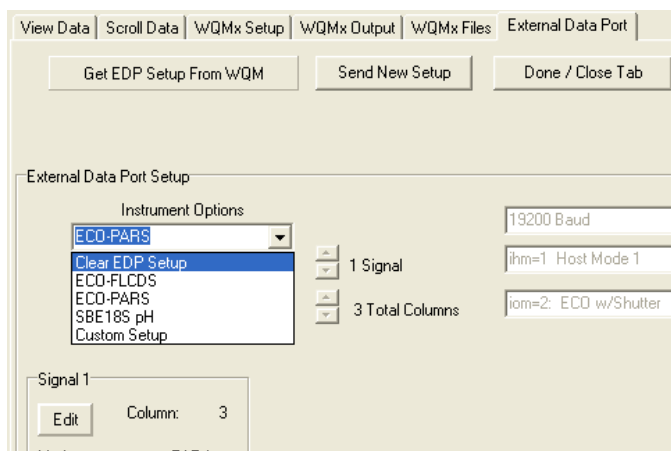
1. Make sure that the external digital sensor is connected to the WQM sensor.
2. Make sure that the sensor is in **In Standby**.
3. Push **Get EDP Setup from WQM**.
   The manufacturer sets up the calibration or characterization values that are specific to an external sensor and these will show in the *External Data Port Setup* tab.
4. If no sensor has been set up, go to the <u>Instrument Options</u> drop-down menu and select the sensor that is connected to the WQM.
5. Make sure that the values on the sensor-specific calibration page for the sensor agree with the information in the <u>Signal 1</u> area.
6. To change the calibration or characterization values, push **Edit** in the <u>Signal 1</u> area.
   The values are the same as the calibration or characterization page, or the most recent application-specific characterization that the user did.
7. Push **Done** in the <u>Signal 1</u> area.
8. Push **Send New Setup**.
   The calibration or characterization values for the external sensor are stored in the WQM.

3.5.2 Analog EDP set up

1. Make sure that the external analog sensor is connected to the WQM sensor.
2. Make sure that the sensor is in **In Standby**.
3. Select the **Advanced** menu, then *Setup Analog*.
4. If no sensor is selected, select the analog sensor that is connected to the WQM from the <u>Instrument Options</u> drop-down menu.
   An example setup for an SBE27 is shown below.

5. Enter the analog sensor's serial number in the SN: text box.

6. Push **Edit** to change the pH Slope or pH Offset in the Analog Signal 1 area.

7. Push **Done.**

8. Push **Edit** to change the ORP M or ORP B in the Analog Signal 2 area.

9. Push **Done.**

10. Push **Send New Setup**.
    The Status area will show "Loading..." until the new setup is stored in the sensor.

11. Push **Done/Close Tab**.

12. Push **Stop WQM Sample**, then **Yes, Stop WQM Sampling**.

13. Remove power to the WQM.
    The sensor is ready to be deployed.

3.5.3 Custom EDP set up

Use the "Custom Setup" function to set up sensors that can collect more than a single "Signal" or parameter of data.

1. Make sure that the external sensor is connected to the WQM.

2. Make sure that the WQM sensor is in **In Standby**.

3. Go to the *External Data Port* tab.

4. Push **Get EDP Setup from WQM**.
    The stored setup values will show in the window. If custom setup values do not show, the user needs to enter them.

5. Select "Custom Setup" in the Instrument Options drop-down menu.

6. Do the procedures below to set up a three-parameter *ECO* sensor as in the example. The user needs the sensor's device file to complete the setup.
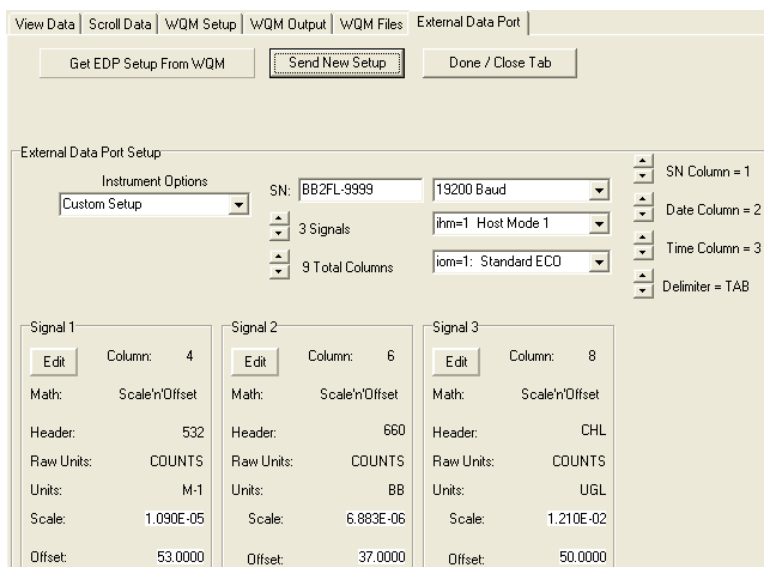
a. Select the serial number ("SN") of the sensor connected to the WQM.
b. Select the number of sampling parameters ("Signals") the sensor has.
c. Select the "Total Columns" of output.
   The host software counts the S/N, Date, Time as columns 1–3. The data format of the external sensor is N/U, Data, N/U, Data, N/U, Data, N/U where N/U is "not used" and the data ("Signal") as the WQM host calculates it is in columns 4, 6, and 8.

d. Select "19200" for the baud rate of the sensor.
e. Select "ihm=1" for a standard *ECO* sensor. Or select "ihm=2" for a Triplet-w.
f. Select "iom=1" for a standard *ECO* sensor. Or, select "iom=2" for an *ECO* sensor with a Bio-wiper. Or, select "iom=3" for a Triplet-w.
g. Select "1" for the SN Column =.
h. Select "2" for the Date Column =.
i. Select "3" for the Time Column =.
j. Select either Comma, or Tab, or Space to separate the columns of the collected data.

7. Do the procedures below to set up each of the three signals as in the example.
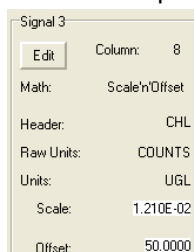
8. Push **Edit** in the Signal 3 area.

   a. Select "8" for the Column:.
   b. Select "Scale'n'Offset:" for the Math:.
      The Header: value is fills in automatically.
   c. Enter "Counts" for the Raw Units:.

      ("DKFOL" means "don't know find out later")

      d. Enter "µg/L," or "scattering" or other appropriate label value for the <u>Units:</u>.

      e. Enter the <u>Scale:</u>, the scale factor of the sensor from the sensor-specific calibration or characterization page.

      f. Enter the <u>Offset:</u>, the offset (dark counts) value from the sensor-specific calibration or characterization page.

9. Push **Done.**

10. Do the step above for <u>Signal 1</u> and <u>Signal 2</u>.

11. Push **Send New Setup**.
    Make sure that the *Status* area at the top of the window shows "Storing EDP Setup" while the setup values are saved to the WQM.

12. Go to the *Sample Output* tab.

13. Select either or both <u>Raw EDP 1</u> and <u>EDP 1</u>.
    "Raw" is output in counts. <u>EDP</u> is processed output such as µg/L, NTU, scattering, etc.

14. Press **Send Output Configuration**.
    The *Status* area shows "Loading Output."

3.5.4 Erase EDP setup

Do these steps to erase the setup that is stored in the WQM sensor.

1. Make sure that the status of the WQM is **In Standby**.

2. Go to the **Advanced** menu at the top of the host software window.

3. Select *Setup External Data Port*.
   The *External Data Port* tab opens.

4. Under the <u>Instrument Options</u> drop-down menu, select "Clear EDP Setup."

5. Push **Send New Setup**.
   The status of the WQM shows **Erasing EDP Setup**.

6. Turn off the power supply and disconnect the sensor that is connected to the external data port.

7. Connect a different sensor.

8. Turn the power supply on.
   The WQM does its warm-up cycle and starts to collect data.

9. Push **Stop WQM Sample**.
   The sensor is in **In Standby**.

10. Go to the **Advanced** menu at the top of the host software window.

11. Select **Setup External Data Port**.

12. Under the <u>Instrument Options</u> drop-down menu, select the sensor that is connected to the WQM external data port.

13. Refer to the Digital EDP set up on page 18 section or the Custom EDP set up on page 20 section to finish the setup of the sensor that is connected to the WQM.

3.6 Monitor data collection

Monitor the data that is collected in the *Scroll Data* tab or the *View Data* tab. Use the selections in the <u>Data Sidebar</u> area to monitor the data in the graph area of the *View Data* tab. Refer to the section Monitor data on page 6 for details.

3.7 Save data

Go to the *WQMx Files* tab to save and erase data from the sensor.
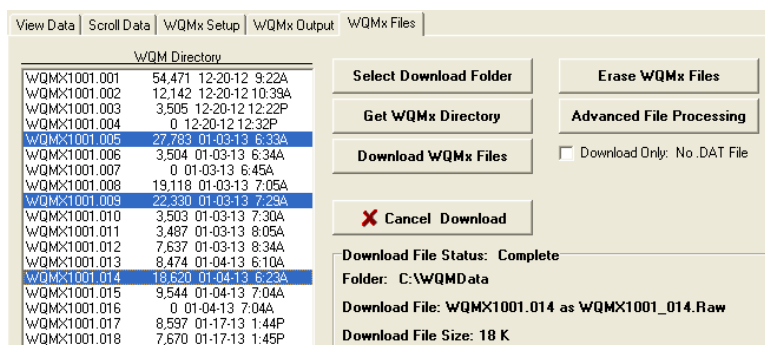
1. Push **Select Download Folder** to select a location on the host PC to save the downloaded data.

2. Push **Get WQMx Directory**.
   A list of the files stored in the sensor shows in the <u>WQM Directory</u> area.

3. Select the file or files to download to the host PC. In the example above, files 005, 009 and 014 from WQMx 1001 are selected.

   The user can adjust the baud rate to 115200 to increase the download speed.

4. Push **Download WQMx Files**.
   The <u>Download File Status</u> shows "Complete" when the last selected file is downloaded.

5. To stop a file or files from being downloaded, push **Cancel Download**.

   • Software version 1.5 and newer: the file transfer will stop immediately.
   • Software version 1.26 and older: the file transfer will complete for the current file, and then stop.

3.7.1 File types

The host software saves both **.raw** and **.dat** files to the host PC.

• The **.raw** file is the data that is stored in the sensor.
• The .dat file has processed data with both raw (counts) and derived values.

To view collected data in counts only, select the box at "Download Only: No .DAT" in the *WQM Files* tab.

To view the data collected in counts and as processed data, ignore the checkbox or select **Advanced File Processing**. Refer to the section on Advanced file processing on page 41 for details. Processed data is saved to the host PC.

3.8 Erase data

The user can erase selected files from the sensor or format the sensor memory card.

1. Go to the *WQMx Files* tab.
2. Push **Get WQMx Directory**.
3. Select the files to erase from the directory.
4. Push **Erase WQM Files**.

   • To erase the selected files, select **Delete the Selected Files**.
   • To erase all of the files on the flash memory card, select **Flash Format the Flash Memory Card**.

5. Push **Erase**.
   The <u>Status</u> area at the top of the window shows the percentage of the selected files that have been erased.

6. Push **Done** to go to the *WQMx Files* tab again.

Section 4   Sensor maintenance

> ## *NOTICE*
> Do not use acetone or other solvents to clean the sensor or the sensor's optical face.

1. After each cast or exposure to natural water, flush the sensor with clean fresh water.
2. Use soapy water to clean any grease or oil on the sensor's optical face. It is made of ABS plastic and optical epoxy and can be damaged if an abrasive cleaner is used.
3. Dry the sensor with a clean soft cloth.

4.1 Bulkhead connector maintenance

Lubricate the mating surfaces of bulkhead connectors at regular intervals with pure silicone spray only. Allow the contacts to dry before they are connected.

Make sure that the pins have no corrosion, which looks green and dull. Make sure that the rubber seals on the pins are not delaminated. Connectors should mate smoothly and not feel "gritty" or too resistant.

The manufacturer recommends 3M™ Silicone Lubricant spray (UPC 021200-85822). Other silicone sprays may contain hydrocarbon solvents that damage rubber.

DO NOT use silicone grease. **DO NOT** use WD-40®. The wrong lubricant will cause the bulkhead connector to fail prematurely and the sensor will flood.

4.2 CT-DO maintenance

> ## ⚠ **CAUTION**
> Do not use Triton® X-100 for long wash periods. Long exposure to Triton® X-100 harms the DO sensor membrane and causes the sensor's calibration to change.

> ## ⚠ **CAUTION**
> Never put undiluted Triton® X-100 or bleach into the sensor.

Note: A stronger solution does not clean better. Do not use stronger solutions or longer wash times than those recommended by the manufacturer.

Clean the conductivity cell and the dissolved oxygen sensor, which are in the CT-DO flow path. Sensors that have marine growth that can be seen are dirty. The user may need to do the steps below up to five times.
Supplies:

- De-ionized or distilled water. If unavailable, use fresh tap water, used with Triton® X-100 or bleach. Do not use shipboard fresh water because it can have traces of oil in it.
- Triton® X-100 mixed 1000:1—The manufacturer supplies Triton® X-100 with each sensor. Triton® X-100 is octyl phenol ethoxylate, a mild, non-ionic detergent. Make sure that any alternative detergent that is used is scientific grade, with no colors, perfumes, glycerins, lotions, etc.
- Bleach mixed 50:1—Household bleach is usually 4–7% (40,000–70,000 ppm) sodium hypochlorite with stabilizers.
- Manufacturer-supplied CT-DO cleaning device.
- 19 liter (5 gal.) container to put water and the sensor in.

1. Bend the exhaust tube assembly to remove the exhaust tube from the lower elbow fitting.

Figure 14 Exhaust tube removed from elbow fitting

Do not remove the screws that attach the elbow fittings to the sensor.

2. Soak the sensor upside down (optics end up) in a container of water at approximately 20 °C for a minimum of 30 minutes.

3. Put the 3/8" ID tubing of the CT-DO cleaning device on the exhaust elbow fitting.

4. Remove the plunger from the syringe.

5. Fill the syringe and the attached hose with DI water.

6. Put approximately 1 liter of DI water into the syringe and tubing.
   This flushes the inside of the sensor.

7. Put the mixed Triton® X-100 solution into the syringe.

Figure 15 Triton® X-100 solution into the CT-DO

8. Put the plunger in the syringe and push the solution into the CT-DO chamber.

9. Push and pull on the plunger quickly to mix the solution.
   Bubbles eject from the intake port.

10. Do steps 6–8 two to three more times.

11. Remove the syringe plunger.

12. Hold the syringe up and fill it with the diluted bleach solution.

13. Put the plunger in the syringe and push the solution into the CT-DO chamber.

14. Push and pull on the plunger quickly to mix the solution.

15. Do steps 10–13 two to three more times.

16. Flush with DI water (refer to step 6) to clean the sensor of bleach and detergent.

4.3 Replace CT-DO anti-fouling devices

⚠ DANGER
AF24173 Anti-foulant devices contain (bis)tributyltin oxide. Handle the devices only with rubber or latex gloves. Wear eye protection. Wash hands with soap and water when the replacement is complete. Read the precautionary information on the product label first. Refer to the section on the AF24173 anti-foulant device on page 45 for details. It is a violation of US Federal Law to use this product in manner that is inconsistent with its labeling.

There are two anti-fouling devices in the CT-Do flow path. One is in the intake and the other is in the exhaust. They are good for approximately one year. The manufacturer replaces these when the user returns the sensor for annual maintenance. The user can get replacement devices from Sea-Bird Electronics company (P/N AF24173).

4.3.1 Replace CT-DO intake anti-fouling cartridge

1. Use a #2 Phillips screwdriver to remove the two screws on opposite sides of the copper sleeve. Do not remove the three screws on the top.

Figure 16 CT-DO end cap removal
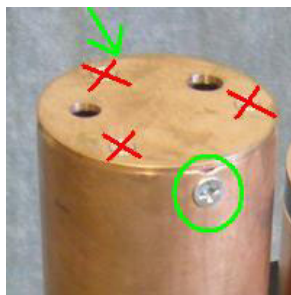
2. Pull the end cap up and off. **Do not twist**.
3. Use a #0 Phillips screwdriver to loosen the four screws that attach the duct top to the base.

Figure 17 Anti-fouling duct screws
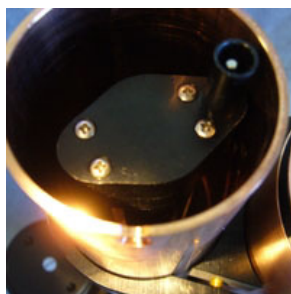
Note that the screws have size 003 O-rings under their heads.

4. Lift the duct top straight up and off.
5. View the anti-fouling cartridge in the duct base.

Figure 18 Anti-fouling cartridge

If necessary, push the size 021 O-ring back in its groove.

6. Use a cotton swab to remove the anti-fouling cartridge from the duct base. To prevent damage to the duct base, do not push the swab all the way through the cartridge.

Figure 19 Removal of anti-fouling cartridge
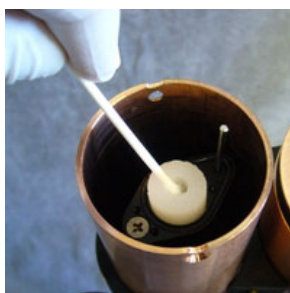
If the cartridge is difficult to remove, use needle-nose pliers to break up the anti-fouling cartridge.

7. Clean the inside of the duct base.

8. Put the used anti-fouling cartridge and the swab into a plastic bag for disposal.

9. Put a new anti-fouling cartridge on a cotton swab and put it in the duct base.

10. Use the end of the swab to make sure the anti-fouling cartridge is in the duct base correctly.

11. Make sure that the O-ring is clean and has no contamination from the swab.

12. Replace the duct top.
Make the four screws snug, not tight. There is no gap between the duct top and the duct base.

13. Put the end cap on the protective sleeve.
The user can view the temperature probe in one of the holes.

14. Install the Phillips screws to attach the end cap to the sleeve.

4.3.2 Replace CT-DO exhaust anti-fouling cartridge

The second anti-fouling cartridge is in a canister in the exhaust tubing.

1. Turn the right-angle hose barbs as necessary to disconnect the tubing and the canister from the hose barbs. It may be necessary to loosen the screws that hold the hose barbs so that they can be turned. **Do not loosen the screws more than 1/4-turn.**

Figure 20 Tube disconnected from bottom elbow

Note that one end of the canister has wrench flats.

2. Use a wrench to unscrew the end of the canister.

Figure 21 Canister end cap removal

3. Use a cotton swab to remove the anti-fouling cartridge.

4. Clean the canister with a lint-free tissue or canned air.

5. Put the new anti-fouling cartridge in the canister.

6. Replace the end cap of the canister.

7. Attach the tubing to the canister.

8. Attach the tubing to the right-angle hose barbs.

4.4 Clean internal *ECO* sensors

The procedures to clean or replace the anti-fouling wipers on the *ECO* sensors in the WQM and the WQMx are similar.

- The WQM has an internal *ECO* two-parameter sensor with a solid Bio-wiper that covers the sensor's optics. The wiper can be cleaned or replaced. Refer to the section on Clean Bio-wiper and faceplate on page 29 for details.
- The WQMx has an internal *ECO* three-parameter sensor with a three-legged wiper. Both the wiper and the wiper motor can be replaced. Refer to the section on Replace the wiper on page 31 for details.

4.4.1 Clean Bio-wiper and faceplate

Sensors that have copper faceplates and copper Bio-wipers need to be cleaned at regular intervals to keep the copper effective as an anti-fouling aid. Remove the Bio-wiper and faceplate from the sensor to clean them.

N O T I C E

Do not twist the Bio-wiper or the Bio-wiper shaft by hand. Push **Open Shutter** and **Close Shutter** in the host software to turn the Bio-wiper. Turning by hand will damage the Bio-wiper motor.

1. Disconnect the sensor from any power source.

2. Use the manufacturer-supplied 3/32" hex key to loosen the screw that holds the Bio-wiper to the sensor.

If necessary, insert the manufacturer-supplied jacking screw into the expander hole to loosen the Bio-wiper. *PAR sensors do not have an expander hole and do not ship with jacking screws.*

Figure 22 Bio-wiper screw holes
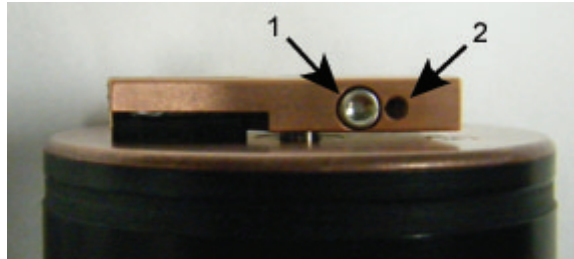
1 the screw in the clamping hole	**2** the expander hole

3. Lift the Bio-wiper off of the faceplate.

4. If used, remove the jacking screw.

5. Use a small Phillips screwdriver to remove the screws that attach the faceplate to the optics face.

6. Keep the screws.

7. Clean the Bio-wiper and faceplate with soapy water.

8. Rinse and dry thoroughly.

9. Use a Scotch-Brite® or similar pad to buff the Bio-wiper and faceplate until they are shiny.

10. Use an isopropyl alcohol-saturated cotton swab to clean the Bio-wiper shaft and the shaft hole.

11. Make sure the Bio-wiper and faceplate dry completely.

12. Attach the faceplate again.

13. Make sure the screw used to attach the Bio-wiper is in good condition.
    The 3/32" hex key must fit into the screw's socket.

14. If the screw is damaged, use a new screw from the spare parts kit that the manufacturer supplies with the sensor.
    These screws are 4-40 x 3/8" 316 stainless steel and are treated with anti-seize.

15. Insert a jacking screw into the expander hole of the Bio-wiper. Turn it slowly until the Bio-wiper goes onto the shaft easily.

16. Put the clean Bio-wiper over the shaft but do not twist the Bio-wiper.

17. Make sure to remove the jacking screw before tightening the 3/32-inch clamping screw.

18. Use the commands in the host software to turn the Bio-wiper into the closed position. The Bio-wiper covers the optics.

19. Set the clearance between the Bio-wiper and the faceplate to approximately 0.6 mm.
    Note: If the Bio-wiper is has too much bend because it is too close to the faceplate, the motor will use too much current. If it is not close enough to the faceplate, the Bio-wiper will not keep the optics clean.

Figure 23 Bio-wiper clearance
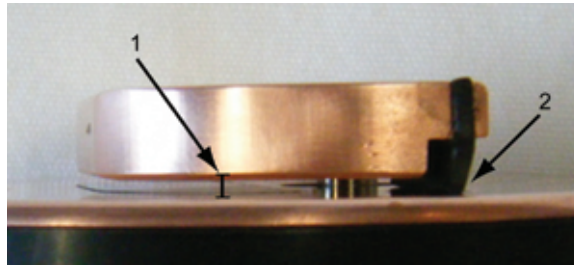
1	Bio-wiper clearance from faceplate	**2**	Bio-wiper flex

20. Use the 3/32" hex key to tighten the screw. Do not over-tighten the screw.

21. Turn on the sensor to make sure that the Bio-wiper rotates correctly.
The Bio-wiper must rotate 180 degrees and uncover the optics before they come on.
The Bio-wiper will then rotate 180 degrees to cover the optics after they come on.

4.4.2 Replace the wiper

Replace the sensor's wiper with a new one from the wiper replacement kit (sold separately).

1. Use a 1/16" hex wrench to loosen the wiper's set screw.

Figure 24 Wiper set screw loosened

2. Lift the wiper off of the wiper motor shaft.

3. Put the new wiper on the motor shaft.

4. Put the wiper height gauge on the faceplate under the wiper and around the motor shaft.

Figure 25 Wiper height gauge inserted

5. Turn the wiper so that the set screw faces the flat on the motor shaft.

6. Push down on the wiper to pinch the wiper height gauge between the wiper and the faceplate and tighten the wiper set screw.

Figure 26 Wiper attached with set screw

7. Remove the wiper height gauge.

4.5 Examine pressure sensor

> **⚠ CAUTION**
>
> Do not use a brush or any object in the pressure sensor. It is easy to break.

Examine the pressure sensor at regular intervals and remove any particles or debris.

Figure 27 Pressure sensor

4.6 Long term storage

The user needs to do several steps to store the sensor for several weeks to several months.

Note: Keep the sensor at or below 25 °C when possible. Temperatures above 40 °C cause an increase in the sensitivity of the sensor. It takes several days for the sensor to return to normal operation.

> **⚠ CAUTION**
>
> Bleach and Triton® X-100 are corrosive. Do not store the sensor with either solution still in the sensor.

1. Clean the sensor in fresh water. Refer to CT-DO maintenance on page 25 for details.
2. Clean the BLIS and make sure there is no bleach in the sensor. Refer to Examine and maintain BLIS on page 8 for details.
3. Shake any excess water out of the sensor. If there is a possibility that the sensor could freeze, store it where temperatures are above freezing and keep the sensor warm before deployment.
4. Cover the intake and the exhaust ports on the CT-DO guard with tape.
The calibration drift is reduced if air does not enter the sensor.

Section 5   Reference topics

5.1 Setup selections

The user can view or adjust the sensor setup values below in the *Setup* tab.

- the internal clock
- the sample parameters
- the Bleach Injection System (BLIS) parameters
- the condition of the BLIS
- the quantity of data storage used
- the condition of the Uninterruptible Power Supply (UPS)

5.1.1 Date and time

The host software shows the date and the time for both the WQM and the host PC. This information has a red background if the clocks are different by more than 5 seconds.

Push **Set Date and Time** to update the date and time in the sensor to the host PC.

5.1.2 Get and send setup information
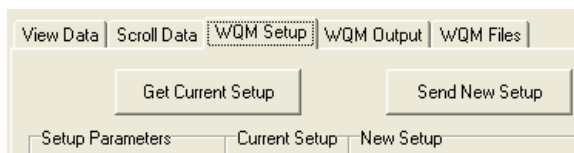
The values that the user can change are listed under the <u>Setup Parameters</u> heading.

Push **Get Current Setup** to get the setup information that is stored in the sensor. This information will show under the <u>Current Setup</u> heading.

Any setup values that the user changes will show under the <u>New Setup</u> heading and have a yellow background. Push **Send Current Setup** to save new values to the sensor. The yellow background goes out of view.

Note: Push Get Current Setup to make sure that the values are stored in the sensor.

5.1.3 Dissolved Oxygen (DO) stabilization time

Push **Show DO Stable vs. Temp. Plot** to see a graph of the relationship between the temperature of the water and the time required to get a stable DO value.
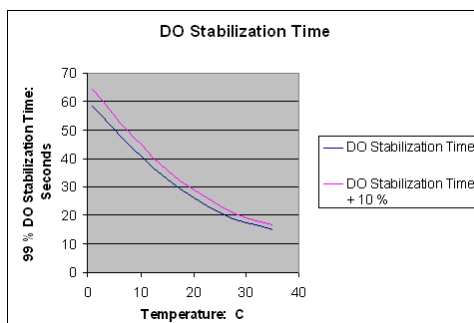
5.1.4 Bleach Injection System (BLIS) operation

The BLIS sends bleach into the pump manifold just below the DO sensor. The bleach prevents biological fouling on the DO sensor membrane.

Adjust the BLIS for the type of environment it will be deployed in.

- **BLIS Operation**—Set to "On." When the conductivity value shows that the sensor is in water, the BLIS sends bleach to the pump manifold after the first sample of every hour.
- **Purge when in situ**—Set to "Yes." When the sensor is in situ, the BLIS pump operates 20 times to remove air or water from the BLIS tubing. This makes sure a sufficient quantity of bleach is available to protect the DO sensor.
- **BLIS Interval**—The BLIS sends the selected quantity of bleach after the first sample of every hour.
- **BLIS Injection Volume**—Select the quantity of bleach to be used in 9 µL increments. The manufacturer recommends a minimum of 36 µL.
- **BLIS Volume Used**—The host software makes a continuous estimate of the quantity of bleach used in relation to the quantity selected by the user.
- **Estimated BLIS Remaining**—The host software makes a continuous estimate of the quantity of bleach in the reservoir. The estimate is in relation to the **Sample Interval**, the **Injection Volume**, and the **BLIS Volume Used**.

5.1.5 Power use estimates

The host software calculates the power required by the sensor to complete a deployment in the 'New Setup' Power Consumption area.

Note: The user should add 10–25 % to the estimates of the host software for factors such as battery chemistry self-discharge.
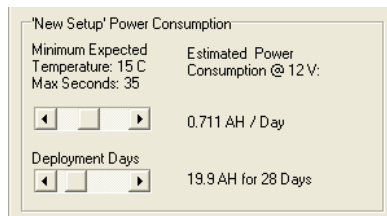
The "Estimated Power Consumption @ 12 V" uses the values from the "Sample For:," the "Interval Time:," and the "DO Stabilization:" time in relation to the user-selected expected water temperature to estimate how much power the sensor will use during 24 hours of data collection.

The total power use for a deployment is the daily power use multiplied by the number of days the user selects in the "Deployment Days" slider.

5.1.6 Sensor internal disk storage

The Internal Disk Storage shows the condition of the memory in the sensor.
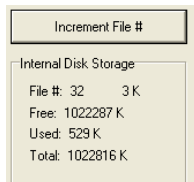
- File #—Shows the current file number and the size of the file.
- Free—Shows the available memory in the sensor.
- Used—Shows the total size of all of the files stored in the sensor.
- Total—Shows the total memory of the sensor.

The Free Disk at the bottom of the Setup Parameters column shows an estimate of the number of days the sensor can store data before the memory is full.

5.1.7 User-specific internal sensor characterization

> ### ⚠ CAUTION
>
> CDOM sensors use UV LED light. Do not look directly at a UV LED when it is on. It can damage the eyes. Keep products that have UV LEDs away from children, pets, and other living organisms. Wear polycarbonate UV-resistant safety glasses to protect the eyes when a UV LED is on.

The manufacturer characterizes the internal *ECO* sensor but the user can replace these values with application-specific values.

1. Make sure that the WQM is in **In Standby**.
2. Go to the **Help** menu and select *Enable Internal ECO Setup*.
3. Go to the **Advanced** menu and select *Setup Internal ECO*.
4. Push **Get Internal ECO Setup from WQM**.
   The characterization values stored in the sensor can be viewed in the ECO Signal 1, ECO Signal 2, and ECO Signal 3 areas of the tab.
   Note: *Not all sensor models have three signals.*
5. Push **Edit** in the ECO Signal area.
   Edit changes to **Done**.
6. Change the "Scale" and "Offset" values.

7. Push **Done**.
8. Push **Send New ECO Calibration**.
   The sensor Status area shows **Loading ECO Calibration**.
9. Push **Done/Close Tab** to hide the *Internal ECO* tab.

5.1.8 Uninterruptible Power Supply (UPS)

The WQM has a UPS that comes on if the sensor loses power while data is being collected. The UPS will supply power to the sensor long enough to save recently collected data, close any files that are open, and store the required operation values. The UPS does not supply power to the internal ECO sensor: the wiper on an FLNTU will stay in an open position and bio-fouling can occur.

If power is supplied to the sensor within 1 second of removal, the sensor will start data collection again.

The UPS has a 9-volt lithium battery. The battery can supply power for thousands of shutdown cycles but it does have a limited time of operation. The manufacturer recommends that the user return the sensor for battery replacement every 3 years. Note that the manufacturer replaces the battery every time the sensor is returned to be calibrated or serviced.
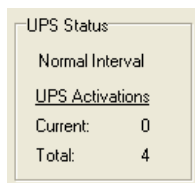
The UPS in the sensor comes on when the voltage falls below 8 V while the sensor is collecting data.

- **Autonomous Control**: The sensor closes its data files, goes into a low power state, and comes on again for the next scheduled data collection.
- **External Control**: The sensor goes to **In Standby**.

UPS conditions

- Normal—The normal condition of the UPS is shown above. The sensor is operating at the normal, user-selected, data collection schedule.
- Red box, "Power Failure Detected" "Normal Interval"—one or two consecutive data collection sequences have been interrupted by a power loss or low voltage. The sensor will try to collect data on its normal schedule.
- Red box, "Power Failure Detected" "1 Hour Interval"—three to five consecutive data collection sequences have been interrupted by a power loss or low voltage. The sensor will try to collect data after a one-hour delay.
- Red box, "Power Failure Detected" "24 Hour Interval"—six or more consecutive data collection sequences have been interrupted by a power loss or low voltage. The sensor will try to collect data after a 24-hour delay.
- Yellow box, "Power Failure Detected" "Normal Interval"—The UPS has come on but the sensor completed the last data collection try.

Clear power failure message

- Go to the *Pre-Deployment* menu at the top of the host software window. Select "Clear Power Failure Message."

5.1.9 Autonomous sample control
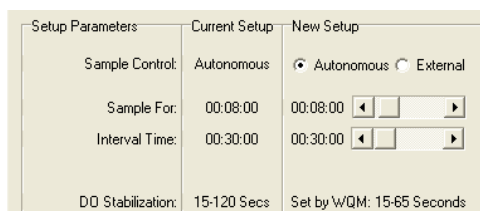
Use the Autonomous Sample Control value when the sensor is connected to a constant power source. The sensor uses the internally stored setup to collect and save data, and to go into a low power state. The file names of the saved data increment each time the sensor is turned on. The file names append when the sensor has power and is collecting data or in a low power state.

In the example above, the sensor is set up to collect data for 8 minutes every 30 minutes.

5.1.10 External sample control
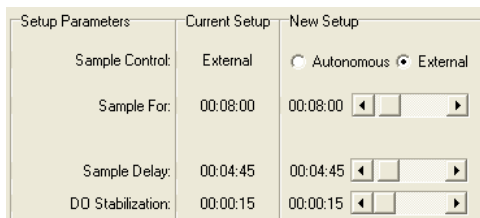
Use the <u>External</u> Sample Control to align the data that is collected by the WQM sensor with the data that is collected from other sensors when they are all connected to an external logger or controller. The WQM is turned on by the external logger at the start of the sample interval. The logger sends a "stop" command to the WQM sensor at the end of the data collection (sample) interval. The external logger turns the power off.

The user can adjust the data collection time, the delay time, and the length of time the sensor will wait for the dissolved oxygen value to become stable.

- <u>Sample For:</u> The maximum length of time the sensor collects data before it stops and goes into a low power state.
- <u>Sample Delay:</u> The user can adjust the length of time the sensor waits to collect data. This helps the user align the start of data collection with sensors that have a longer warm-up time, and decreases the sensor's power consumption.
- <u>DO Stabilization:</u> The user sets the length of time the sensor will wait for a stable DO value.

5.2 Data collection

The sensor can be set up to start data collection at a user-specified time and date.

1. Make sure the sensor is in **In Standby**.
2. Push **Start WQM Sample.**
3. Use the calendar and the slider menu to set a date and time for the sensor to start data collection.
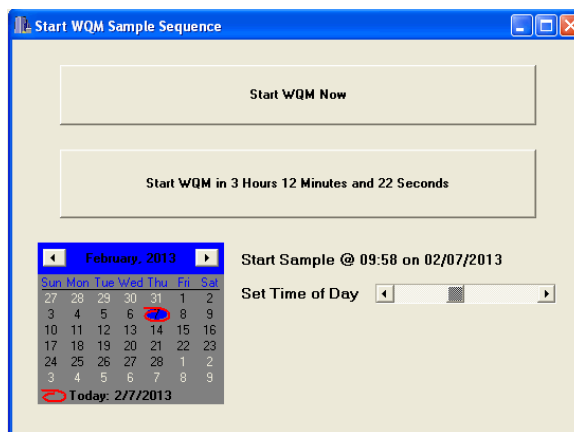
In the example above, the sensor is set up at 6:46 am to start data collection in 3 hours, 12 minutes, and 22 seconds, at 9:58 am.

4. Push **Start WQM in** ... to set a specific start time.

5.3 Data display

The user may want to increase the size of the display in the *View Data* tab so it is easier to see.

1. Go to the area to the <u>Data Sidebar</u> area and select the parameters to monitor in the *View Data* tab.
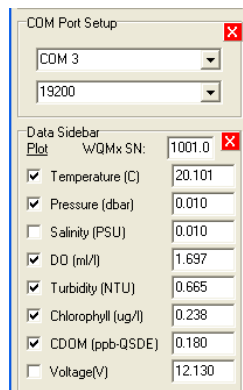
2. Push the red **X** to close the <u>Data Sidebar</u>.
3. Push the red **X** to close the <u>COM Port Setup</u>.
   The *View Data* tab expands.
4. Go to the *Show* menu and select "View Data Setup."
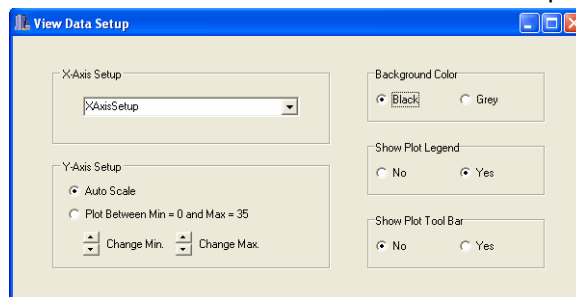
5. If necessary, adjust the <u>X-Axis Setup</u> time frame. This variable assumes data is collected at 1 Hz.
6. If necessary, adjust the *Y-Axis Setup* scale.
7. If necessary, adjust the <u>Background Color</u>, the <u>Plot Legend</u>, or the <u>Plot Tool Bar</u>.
8. To open the <u>Data Sidebar</u> or the <u>COM Port Setup</u> again, go to the *Show* menu.
9. Select *COM Port Setup*, then "Show COM Port Setup."
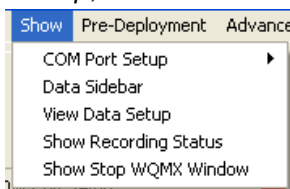
   The <u>COM Port Setup</u> area shows on the left side of the window.
10. Select *View Data Sidebar*.
   The <u>Data Sidebar</u> area shows on the left side of the window below the <u>COM Port Setup</u> area.

5.4 Data storage

Data collected by the sensor can be saved to the host PC if they are connected.

1. Go to the **Show** menu and select *Show Recording Status*.
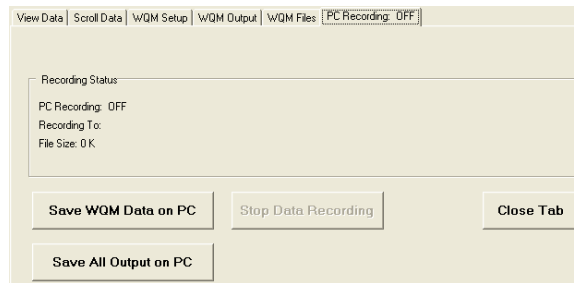
2. To save only collected data, push **Save WQM Data on PC**.
   A new window shows.

3. Make a name and location for the file to save the collected data to.

4. Push **Save.**

5. To save all collected data and debug messages, push **Save All Output on PC**.
   A new window shows.

6. Make a name for the file to save the collected data and other messages to.

7. Push **Save.**

8. The file size will increase as the sensor collects data.

9. Push **Stop Data Recording** when data collection is done.

5.5 Power modes

The sensor enters a low-power mode to increase the life of the battery power that the sensor uses. It is slow to respond to commands when it is in this mode. There are two ways to change the low-power mode to standby mode.

1. Get the current mode of operation and make sure the sensor is still doing data collection.

   • Push **Get Status**. Wait for 2 seconds.
   • Push Get Status.

   The first push changes the mode of the sensor from low power. The second push gets information on the operating condition of the sensor. Note that the second push must happen within 4 seconds of the first push, or the sensor will ignore the second push.

2. Change the mode of operation and stop data collection.

   • Push Get Status.
   • Within 4 seconds push Stop WQM Sample. The sensor is in **In Standby**.

   Or—

   • A window shows. Select the checkbox and push **Yes, Stop WQM Sampling**.
     Data collection stops.
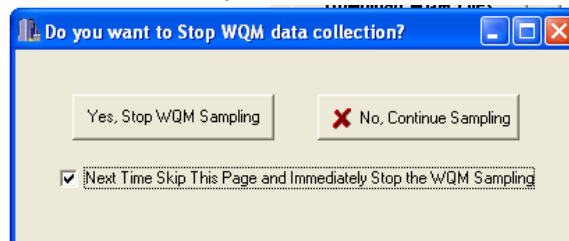
5.6 Missing data

The normal data that is collected by the sensor starts with a row of header information and then data records. Each data record is made of a data field separated by a comma. If a sensor is configured incorrectly, there may be gaps in the data, which show as commas. Missing data shows as a series of commas.

```
SN,State,Date,Time,Cond(S/m),Temp(C),Pres(dbar),RawDO(Hz),Pumped,TURBIDITY(COUNTS),CHLA(COUNTS),CDOM(COUNTS),Volts,PH(VOLTS)

Complete record
1001,4,031213,065547,0.00002,20.3644,0.07,5669.7,0,0,0,0,12.38,0

Missing CDOM record
1001,4,031213,065548,0.00002,20.3639,0.07,5667.7,0,0,0,,,,,,12.38,0
```

5.7 Digital pH sensor (SBE-18S) setup

If necessary, the user sets up external pH sensors to operate with the WQM sensor and makes sure that the data that is collected by the pH sensor can be viewed in the host software.

5.7.1 Connect a pH sensor

1. If necessary, connect the WQM sensor to the host PC and regulated power supply.
2. Connect the pH sensor to the WQM sensor.
3. Supply power to the WQM.
4. Stop the data collection and put the WQM in **In Standby**.
5. Select the **Advanced** menu and then select *Setup External Data Port*.
   The *External Data Port* tab shows.
6. Select "SBE 18S pH" in the Instrument Options drop-down menu.
7. Enter the serial number of the pH sensor in SN: area.
8. Push **Edit** in the Signal 1 area.
9. If necessary, enter the pH Slope and pH Offset values from manufacturer-supplied calibration page.

10. Push **Done** in the Signal 1 area.
11. Push **Send New Setup**.
    The Status area shows **Storing EDP Setup** as the change is saved in the WQM.
12. Go to the **Help** menu and select *Sensor Troubleshooting*.
13. Select "Test External Data Port" from the Select Test Mode drop-down menu.
    The pH sensor starts. Note that it may be necessary to push **Enter** to get the pH sensor to start.

    • If the data is not readable, as in the example below, push **Test is Complete**.
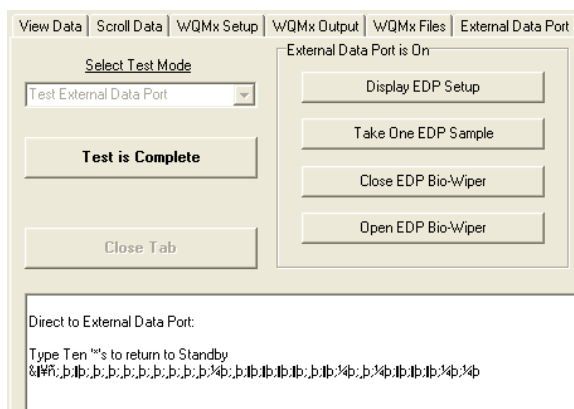
14. Go to the *External Data Port* tab and select "Custom Setup" in the <u>Instrument Options</u> drop-down menu.
15. Select "38400 Baud" or "115200 Baud" in the baud rate drop-down menu.
16. Push **Send New Setup**.
17. The *Status* area shows **Storing EDP Setup** as the change is saved in the WQM.
18. Make sure that the WQM sensor can read the data from the pH sensor.
19. Select the *Sensor Troubleshooting* tab.
20. In the <u>Keyboard Entries</u> area at the bottom of the tab, type **getcd**, then push **Enter.**
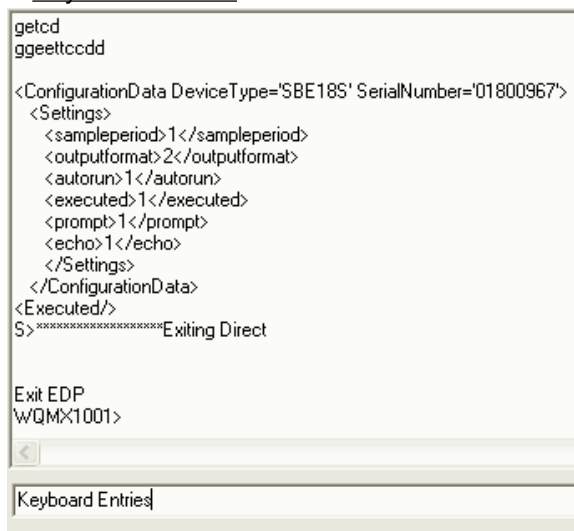
5.8 Advanced file processing

The user can do different operations on the data collected by the sensor. The user can select the values to show in the data that is output, get an average of the data, or get statistics on the data. Do these operations from the Advanced File Processing window.

1. Make sure the sensor is in **In Standby**.
2. Select the *WQMx Files* tab.
3. Push **Get WQMx Directory**.
4. Select the file or files to work with from the list under <u>WQM Directory</u>.
5. Push **Select Download Folder** to make a place on the host PC to store the data file(s).
6. Push **Download WQMx Files**.
   The host software shows the status of the download operation.
7. Push **Advanced File Processing**.

A new window shows.
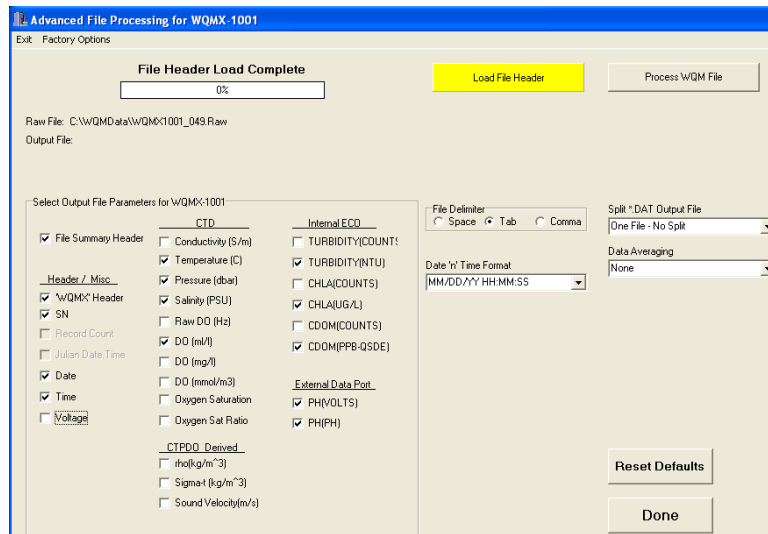
8. Push **Load File Header**.
    The host software has the correct output values based on the content of the *.raw* file.

9. Make sure that the correct file shows in the Raw File: area at the top of the window, and the status message reads **File Header Load Complete**.

10. Select the values for the host software to process from the check boxes in the Select Output File Parameters for WQMx-*xxx* area.

11. Select the file delimiter to use.

12. Select the date and time format to use.

13. Select whether and how the data output file is split.

14. Select the data averaging to use.

    a. "None"—The default.
    b. "Average Last 10 Seconds"—The user selects a period of time at the end of a data file.
    c. "Average Each Sample"—Every data sample collected is averaged.
    d. "Calculate Hourly Sample"—The data from each hour the sensor collected data is averaged.
    e. "Calculate Daily Average"—The data from a 24-hour period from 12:00:01 to 12:00:00 is averaged.
    f. "User Selected Averaging Count"—The user selects up to 60 seconds of a data file to average.

15. Push **Process WQM File**.
    A new window shows.

16. Select the **.Raw** file.
    The file-type changes to **.DAT**.

17. Push **Save**.
    The new file is stored on the host PC in the same folder as the **.Raw** file.

5.9 Functional tests

The user can do tests on the sensors that make up the WQM to make sure that they operate correctly.

1. Make sure the sensor is in **In Standby**.

2. Go to the **Help** menu, then select *Troubleshooting*.

3. Select a sensor to test from the Select Test Mode drop-down menu.
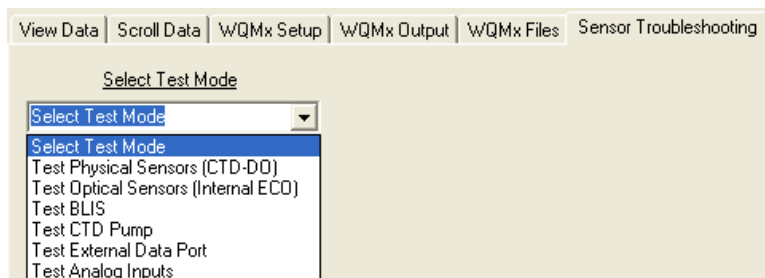
4. Select a test to do from the test area that shows to the right of the sensor drop-down menu.

> ### ⚠ CAUTION
> Do not use the CTD pump out of water.

It must be submerged to do a test.

5. Push **Test is Complete** to go back to the drop-down menu and select a different sensor to test.
6. Push **Close Tab** when tests are done.

5.10 Horizontal deployment

The sensor can be deployed in a horizontal position if necessary. The sensor cannot easily remove air bubbles from the plumbing in this position. Make sure that the intake duct is higher than the exhaust duct. This will aid the pump to fill with water and operate correctly. It may take two or three data collection cycles to remove air bubbles from the sensor's plumbing.

If necessary, a plumbing fitting is available from the manufacturer that will aid in the removal of air bubbles.

5.11 Bio-fouling prevention

Electrical tape, copper foil tape, and anti-fouling paint will decrease the rate of bio-fouling on the plastic parts of sensors. The manufacturer supplies an anti-fouling paint kit with WQM sensors. Instructions for use are detailed below.

Electrical tape

The manufacturer recommends electrical tape such as Scotch® Super 33+ or Super 88. This tape can be used in seawater and can be removed without leaving adhesive residue. Softer bio-foulants will peel off with the tape. The tape can be put on irregular surfaces.

Adhesive-backed copper foil tape

The manufacturer recommends putting a layer of electrical tape under the copper foil tape because the adhesive on the copper foil tape is tacky and difficult to remove from the surfaces of the sensor. One layer of copper foil tape will give good protection for approximately 6 weeks.

Anti-fouling paint kit

The manufacturer supplies an anti-fouling paint kit with each sensor that has ECOMINDER® paint, tape, a brush, and detailed instructions for application. ECOMINDER® is an alternative to copper-based anti-fouling paint.

5.12 Spare parts

The manufacturer supplies the spare parts listed below so that the user can clean and maintain the sensor.

Reference topics

Qty	Item	P/N
1	Playtex® Premium Nurser kit (silicone nipple) with drop-in-liners	XXX-000086 XXX-000087
1	Test cable	CXA-KX0115
1	3/32" hex key for Bio-wiper (WQM)	GXA-SX0050
1	1/16" hex key for Wiper (WQMx)	GXA-SX0059
1	5/32" hex key for BLIS	GXA-SX0109
1	7/64" hex key for CT-BLIS clamp	GXA-SX0093
3	4-40 x 3/8" 316 stainless steel socket-head cap screws for Bio-wiper	GXA-SX0099
8	4-40 x ¼" pan head stainless steel flathead screws	GXA-SX0146
3	4-40 x ¼" flat head Phillips screws	GXA-SX0155
4	8-32 x 5/16" flat head Phillips screws for copper guard ring	GXA-SX0374
4	6-32 x 3/8" stainless socket-head cap screws for BLIS	GXA-SX0067
1	Orange fluorescent stick to test chlorophyll output	MAA-220050
1	Blue fluorescent stick to test CDOM output (WQMx)	MAA-520003
1	Scotch-Brite™ scrub pad to clean copper	XXX-000229
1	Ecominder® anti-fouling paint kit	BAA-003000
1	3/8" right-angle hose barb	RXA-031630
1	Wiper height gauge (WQMx)	MAA-230630
1	50 ml plastic bottle of Triton®X-100	50091
1	CT-DO cleaning device	50431
Installed parts		
1	6-socket dummy plug	EXA-KX0038
1	4-pin dummy plug (digital external data port)	EXA-KX0004
1	6-pin dummy plug (analog external data port)	EXA-KX0183
2	Lock collars	EXA-KX0025

Section 6 General information

6.1 AF24173 anti-foulant device

Replacement AF24173 Anti-foulant devices are supplied in polyethylene bags that have the label shown below.

AF24173 ANTI-FOULANT DEVICE

FOR USE ONLY IN SEA-BIRD ELECTRONICS' CONDUCTIVITY SENSORS TO CONTROL THE GROWTH OF AQUATIC ORGANISMS WITHIN ELECTRONIC CCONDUCTIVITY SENSORS.

ACTIVE INGREDIENT: Bis(tributyltin) oxide 53.0%
OTHER INGREDIENTS 47.0%
Total 100.0%

DANGER
Refer to conductivity sensor manual for the complete label and additional precautionary statements and information on the handling, storage, and disposal of these devices.

Net contents: Two anti-foulant devices   EPA Registration No. 74489-1
Sea-Bird Electronics, Inc.   EPA Establishment No. 74489-WA-1
13431 NE 20th St.
Bellevue, WA 98005

> ### ⚠ DANGER
> Refer to the Precautionary Statements for additional information.

First Aid

On skin or clothes:

- Remove contaminated clothes.
- Rinse skin immediately with water for 15–20 min.
- Call a poison control center or a doctor for treatment advice.

Swallowed:

- Call a poison control center or a doctor for treatment advice.
- Drink several glasses of water.
- Do not induce vomiting.
- Do not give anything by mouth to an unconscious person.

In eyes:

- Hold the eye open and rinse slowly and gently with water for 15–20 min.
- Remove contact lenses, if worn, after the first 5 minutes, then continue to rinse.
- Call a poison control center or a doctor for treatment advice.

Note to physician: Probable mucosal damage may contraindicate the use of gastric lavage.

Refer to the product container or label when a poison control center or physician is called. For more information, call the National Pesticide Telecommunications Network at (NPTN) at 1-800-858-7378.

Net contents: Two anti-foulant devices

Sea-Bird Electronics, Inc.

13431 NE 20th St.

Bellevue, WA 98005

EPA Registration No. 74489-1

EPA Establishment No. 74489-WA-1

PRECAUTIONARY STATEMENTS
HAZARD TO HUMANS AND DOMESTIC ANIMALS

> **⚠ DANGER**
>
> **Corrosive**—Causes irreversible eye damage and skin burns. Harmful if swallowed. Harmful if absorbed through the skin or inhaled. Prolonged or frequently repeated contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling.

USER SAFETY RECOMMENDATIONS FOR PERSONAL PROTECTIVE EQUIPMENT (PPE)

Users should:

- Remove clothes immediately if pesticide gets inside. Then wash thoroughly and put on clean clothes.
- Wear protective gloves (rubber or latex), goggles or other eye protection, and clothes to minimize contact.
- Follow the manufacturer's instructions to clean and maintain PPE. If there are no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.
- Wash hands with soap and water before eating, drinking, chewing gum, using tobacco or using the toilet.

ENVIRONMENTAL HAZARDS

Do not discharge effluent that contains this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent that contains this product to sewer systems without previously notifying the local sewage treatment plant authority. Contact the local State Water Board or Regional Office of the EPA for guidance. This material is toxic to fish. Do not contaminate water to clean equipment or dispose of equipment washwater.

PHYSICAL OR CHEMICAL HAZARDS

Do not use or store near heat or open flame. Avoid contact with acids and oxidizers.

DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. For use only in Sea-Bird Electronics' conductivity sensors. Read installation instructions in the applicable Conductivity Instrument Manual.

STORAGE AND DISPOSAL

PESTICIDE STORAGE: Store in original container in a cool, dry place. Prevent exposure to heat or flame. Do not store near acids or oxidizers. Keep container tightly closed.

PESTICIDE SPILL PROCEDURE: In case of a spill, absorb spills with absorbent material. Put saturated absorbent material into a labeled container for treatment or disposal.

PESTICIDE DISPOSAL: Pesticide that cannot be used according to label instructions must be disposed of according to Federal or approved State procedures under Subtitle C of the Resource Conservation and Recovery Act (RCRA).

CONTAINER HANDLING: The container may not be used again. Do not reuse this container for any other purpose. Offer to recycle if available.

6.2 Warranty

This sensor is warranted against defects in materials and workmanship for one year from the date of purchase. The warranty is void if the manufacturer finds the sensor was abused or neglected beyond the normal wear and tear of deployment.

6.3 Service and repair

The manufacturer recommends that sensors be sent back to the factory annually to be cleaned, calibrated, and for standard maintenance. Do the steps below to send a sensor back to the manufacturer.

1. Contact the manufacturer for a Return Merchandise Authorization (RMA).
    Note: The manufacturer is not responsible for damage to the sensor during return shipment.
2. Remove all anti-fouling treatment from the sensor before sending it back to the manufacturer.
    Note: The manufacturer will not accept sensors that have been treated with anti-fouling compounds for service or repair. This includes tri-butyl tin, marine anti-fouling paint, ablative coatings, etc.
3. Use the sensor's original ruggedized shipping case to send it back to the manufacturer.
4. Write the RMA number on the outside of the shipping case and on the packing list.
5. Use 3rd-day air to ship the sensor back to the manufacturer. Do not use ground shipping.
6. The manufacturer will supply all replacement parts and labor and pay to send the sensor back to the user via 3rd-day air shipping.

6.4 Waste electrical and electronic equipment

Electrical equipment that is marked with this symbol may not be disposed of in European public disposal systems. In conformity with EU Directive 2002/96/EC, European electrical equipment users must return old or end-of-life equipment to the manufacturer for disposal at no charge to the user. To recycle, please contact the manufacturer for instructions on how to return end-of-life equipment, manufacturer-supplied electrical accessories, and auxiliary items for proper disposal.