SEA-BIRD COASTAL

ECO Triplet-w

User manual

05/2013, Edition 1

Table of Contents

Section 1 Specifications

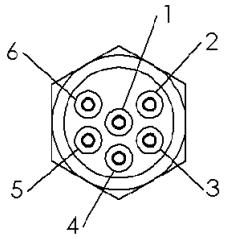
ECO sensors measure different parameters of the Earth's natural waters. The sensors are available in several models and with a variety of optional features.

Standard (**Std**)	Output is digital. Optical face has wiper. Has low power mode. Stores data.
Battery (**B**)	Standard, and with internal batteries for autonomous operation.

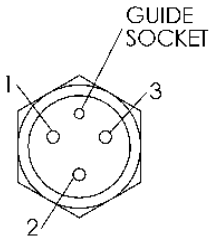
1.1 Mechanical

	Std	B
Diameter	8.08 cm	
Length	22.1 cm	33.34 cm
Depth rating	600 m	
Temperature range	0–30 °C	
Weight in air, water	1.28 kg, 0.29 kg	2.1 kg, 0.43 kg

1.1.1 Bulkhead connectors

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

Note: *Three-parameter sensors have no analog output. Pin 6 is reserved.*

Additional bulkhead connector on sensors with internal batteries		
Socket	**Function**	**Diagram of MCBH-3-FS**
1	Voltage in	
2	No connect	
3	Battery out	

1.2 Electrical

Input	7–15 VDC
Current draw, typical	60 mA
Current draw, standby	140 µA
Current draw, active wiper	200 mA
Linearity	99%

1.3 Communications

Sample rate	to 4 Hz
Data storage	67,000 samples
RS232 output rate	19200 baud
Output resolution	12 bit
Digital output maximum	4130 ±30 counts

1.4 Optical

Parameter	Wavelength EX/EM	Range, Sensitivity
Chlorophyll (Chl)	470/695 nm	0–30, 0.015 µg/L
		0–50, 0.025 µg/L
Colored Dissolved Organic Matter (CDOM)	370/460 nm	0–375, 0.184 ppb
Uranine (UR)	470/530 nm	0–300, 0.073 ppb
Phycocyanin (PC)	630/680 nm	0–175, 0.086 ppb
Phycoerythrin (PE)	540/570 nm	0–175, 0.086 ppb

Parameter	Wavelength	Range, Sensitivity
Scattering	412 nm, 470 nm, 532 nm, 650 nm, 880 nm	0–5, 0.003 m^{-1}
	700 nm	0–3, 0.002 m^{-1}
		0–5, 0.003 m^{-1}

Section 2 Operation

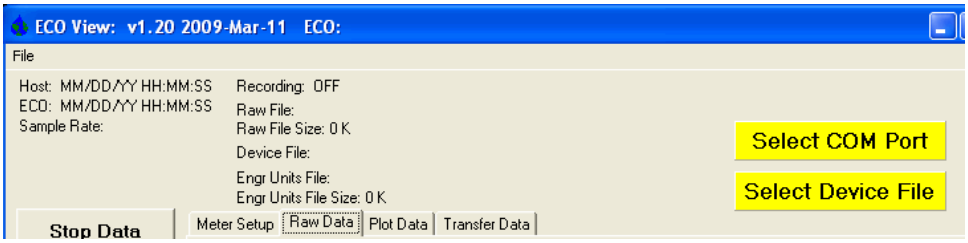
2.1 Functional check

⚠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.

Make sure that the sensor operates before further setup and deployment.

1. Connect the 6-socket connector on the optional test cable (refer to the section on the Test cable on page 17 for details) to the sensor.
2. Remove the cap that protects the sensor's optical face.
3. Connect the battery connectors on the test cable to a regulated power supply set at 12 VDC or a 9 V battery.
   Note: *For UV LEDs, put the blue fluorescent stick in front of the optical face to check the light. It is violet.*
4. Turn on the power supply.
5. The sensor comes on.
6. Put the CD that ships with the sensor into the host PC.
7. Select the file that ends in ".exe" to start the ECOView host software from the CD.



Note that only the top part of the host software window is shown above.

8. Push **Select COM Port**.
9. Select the COM port.
   - The COM port can also be selected from the drop-down menu at the lower left corner of the ECOView window.
10. Push **OK**.
11. Push **Select Device File**.
12. Select the device file from the CD. Its file extension is **.dev**.
13. Push **Open**.
    - The device file can also be selected from the **File** menu at the top of the host software screen.
14. Turn on the regulated power supply (or connect the 9V battery) if necessary.
15. Push **Start Data**.
16. Data will show in the *Raw Data* tab.

2.2 Pre-deployment check

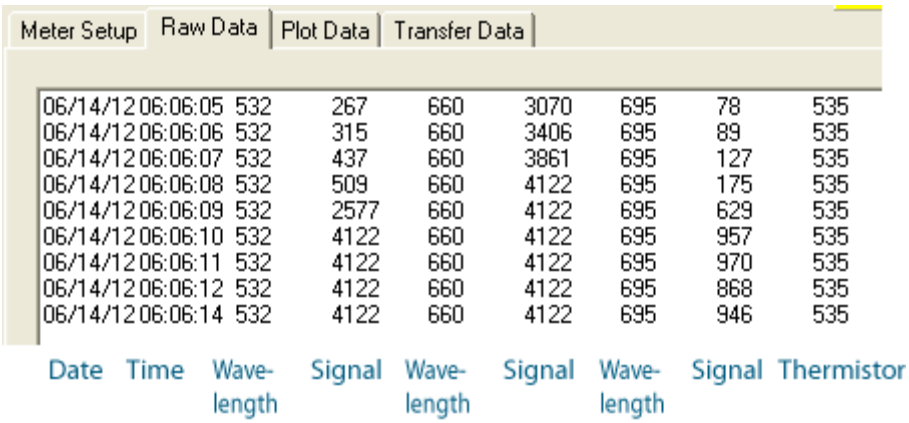
1. Make sure that the host software is open and that the baud rate and device file are selected.
2. Make sure that the sensor is connected to a power source (or 9V battery) and that the power source is on.
3. Remove the protective cap from the sensor if necessary.

4. Hold a finger, the protective cap, or fluorescent stick if the sensor is a fluorometer, 1–4 cm away from the sensor's optics face.
   The value of the incoming data will increase toward the saturation value specified for the sensor.
   - Use a blue fluorescent stick to saturate the CDOM parameter.
   - Use an orange fluorescent stick to saturate the chlorophyll or phycoerythrin parameters.
   - Use a yellow fluorescent stick to saturate the uranine or phycocyanin parameters.
5. Push **Stop Data**.
   If the sensor has a Bio-wiper, the wiper closes. Note that if the power is turned off in mid-cycle, the Bio-wiper starts at the beginning of the cycle when power is supplied again.

2.2.1 Monitor data

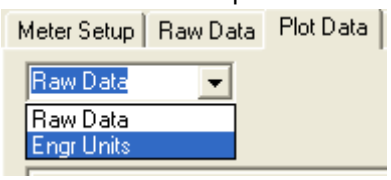
Monitor the data from the sensor in counts. The number of "Signal" columns will vary depending on whether the user has a one-, two-, or three-parameter sensor.

1. Make sure the sensor has power supplied and is turned on.
2. Push **Start Data**.
3. Go to the *Raw Data* tab.

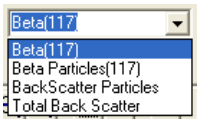


2.2.1.1 Monitor engineering units output

1. Go to the *Plot Data* tab.
2. Select "Engr Units" from the drop-down menu near the top of the tab.



3. Select the type of units to see.



The host software calculates the engineering units for the *Plot Data* tab.

Note: *Data is saved in counts, not engineering units.*

2.2.2 Save data

Save the data collected by the sensor in the sensor's memory (if so equipped), on the host PC, or both.

Note: *RT and puck sensors do not store data. Save the data from these sensors in real-time to the host PC or to a data logger.*

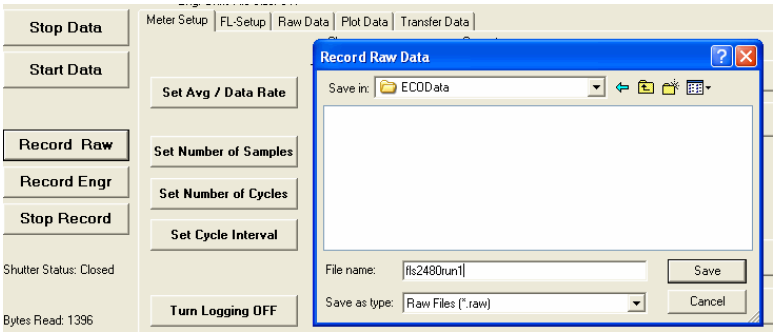
2.2.2.1 Save data to sensor

1. Stop the sensor if it is on.
   This puts the sensor in standby mode.
2. Push **Turn Logging ON/OFF**.

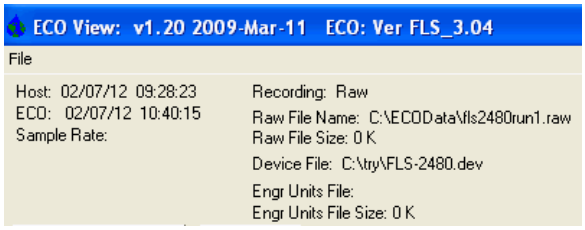
   This turns on the logging, or data storage, in the sensor.
3. Push **Store to Flash**.
   The yellow **Setup not Stored** warning will no longer show. The sensor will save data internally the next time the user turns it on.

2.2.2.2 Save data to host PC

To save data to the host PC in counts, push **Record Raw**. To save data in engineering units, push **Record Engr**. Data collected by the sensor is saved in real-time to the host PC.



1. Push **Record Raw**.
   The *Record Raw Data* window shows in the host software.
2. Select a location on the host PC to store the data.
3. Type a file name.
4. Push **Save**.
5. Push **Record Engr**.
   The *Record Engineering Data* window shows in the host software.
6. Select a location on the host PC to store the data.
7. Type a file name.
8. Push **Save**.
9. Make sure the PC is configured to save data.
   - The file names from step 3 and step 7 will show in the host software.



10. Push **Start Data**.
    The host software will show the host PC file sizes.

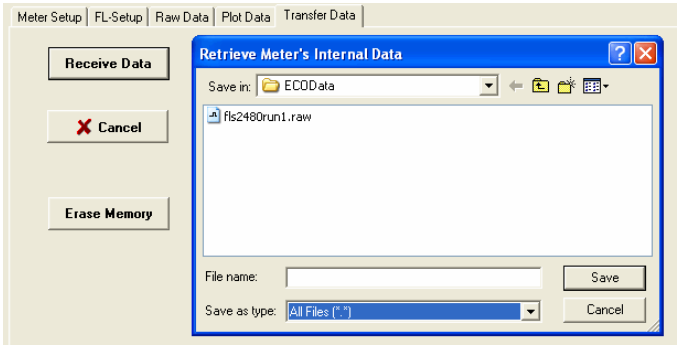
2.2.3 Get data from sensor

⚠CAUTION

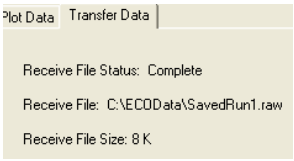
Do data transfers away from harsh environments such as strong electric fields or electrostatic discharge sources. Electrostatic Discharge (ESD) sources may temporarily disrupt data transfer. If this occurs, move the sensor away from the ESD source. Turn the power off and then on and continue operation.

Get the data from the sensor to the host PC for more processing.

1. Make sure that the sensor is not collecting data but has power supplied to it.
2. Select the *Transfer Data* tab in the host software.
3. Push **Receive Data**.



4. Select a location on the host PC to store the data.
5. Type a file name in the *Retrieve Meter's Internal Data* window.
6. Push **Save**.
   The host software saves the sensor's internal data to the host PC.
7. Make sure that the data transfer is complete.



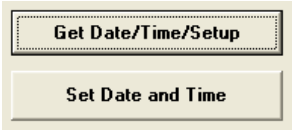
8. Open the data file to make sure the data is on the host PC.
   The manufacturer has spreadsheet templates for many *ECO* sensors. Contact support@wetlabs.com for these.
9. To erase the data from the sensor's memory, Push **Erase Memory**.

2.3 Additional operations

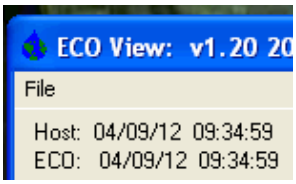
2.3.1 Set date and time

Make sure that the sensor is connected to a power supply that is turned on. Make sure that the host software program is open.

1. If the sensor is in operation, push **Stop Data** to stop the sensor.
2. Push **Set Date and Time** in the host software.
   The host software adjusts the sensor's time to agree with the host PC.



3. Push **Get Date/Time/Setup** to make sure that the sensor and the host PC show the same current time.

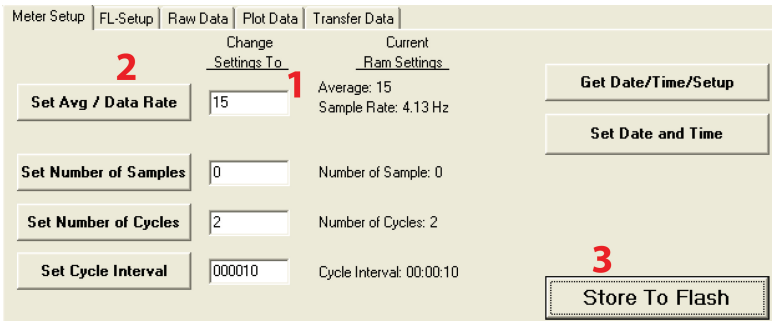


2.3.2 Setup selections

The manufacturer builds the *ECO* sensors to operate at approximately 1 Hz, with the internal data storage turned on.

Adjust any of the data collection options in the *Meter Setup* tab.

Set Avg/Data Rate	Adjust from 1 to 65535. A higher number is a slower data rate. For example, 55 = ~1 Hz; 25 = ~2 Hz
Set Number of Samples	Adjust from 1 to 65535. Use 0 for continuous operation.
Set Number of Cycles	Adjust from 1 to 65535. Select the number of sample groups that the sensor will collect between low-power states.
Set Cycle Interval	Adjust the time interval between sample cycles. Do not type the colons. The minimum is 5 seconds.
Turn Logging ON	Push to turn data storage off or on.



1 Enter the new setting into the variable box.	**2** Push **Set Avg/Data Rate** that is to the left of the variable box.	**3** Push **Store to Flash**. The new setting will be in the column Current Ram Settings.

Table 1 Data collection examples

Collect moored data	**Collect profiling data**
Set Avg/Data Rate = 55 (~ 1 Hz)	Set Avg/Data Rate = 55
Set Number of Samples = 50	Set Number of Samples = 0
Set Number of Cycles = 24	Set Number of Cycles = N/A
Set Cycle Interval = 006000	Set Cycle Interval = N/A
Turn Logging ON/OFF = ON	Turn Logging ON/OFF = ON
The sensor will collect ~ 1 sample per second, once every 60 minutes for 24 hours, internally storing data.	The sensor will collect ~ 1 sample per second and internally store data until the power is turned off.

If the sensor is set up to collect data intermittently, as for a moored deployment, it may be in a low-power condition. It is not possible to communicate with the sensor in this condition.

1. To start communication again, disconnect the sensor's power supply for one minute.
2. Connect the power again and push **Stop Data** several times.
3. Select the *Meter Setup* tab. Refer to Setup selections on page 9.
4. Type **0** into the **Number of Samples** variable box.
5. Push **Set Number of Samples**.
6. Push **Store to Flash**.
   The sensor will now run continuously.

Make sure that the sensor operates continuously.

1. Select the *Raw Data* tab.
2. Push **Start Data**.
3. Let the sensor operate for 10 samples or more.
4. Push **Stop Data**.

2.3.3 Adjust views in plot data tab

The *Plot Data* tab in the host software lets the user see the data that the sensor has collected.

Button	Function	Description
1	Resume	Push to start or stop the scrolling data
2	Pause	The x-axis will stop scrolling.
3	Axes scroll	Move either axis up or down, or right or left.
4	Axes zoom	Move either axis up or down, or right or left.
5	Zoom out	Decrease the detail by 2x.
6	Zoom in	Increase the detail by 2x.
7	Zoom box	Draw a box around the data area to zoom all axes.
8	Cursor	Move the cursor bar to a certain data point.
9	Copy	Copy the current data plot to the host PC clipboard.
10	Save	Save an image of the current data plot to the host PC.
11	Print	Send a snapshot of the current data plot to a printer.

View the data in either counts or in processed units (µg/L, ppb, scattering, etc.). Select the type of output from the drop-down menu above the view area.

2.4 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.

2.4.1 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.

2.4.2 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.

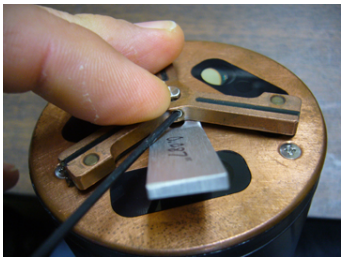
Figure 1 Wiper set screw loosened

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 2 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 3 Wiper attached with set screw



7. Remove the wiper height gauge.

2.4.3 Replace the wiper motor

Replace the wiper motor with a new one from the motor replacement kit (sold separately).

1. Remove the wiper from the sensor.
2. Use a #2 Phillips screwdriver to remove the three faceplate screws. Keep these screws to use again.
3. Lift the copper faceplate off the sensor.
4. Hold the motor shaft and pull straight up. It may be necessary to use pliers to carefully hold the shaft.

Figure 4 Wiper motor pulled from the sensor

5. Flush the wiper motor cartridge bore with fresh water two or three times.
6. Dry the wiper motor cartridge bore with canned compressed gas.
7. Flush the wiper motor cartridge bore with isopropyl alcohol to remove any remaining water.
8. Dry the wiper motor cartridge bore with canned compressed gas again.
9. Put the new wiper motor cartridge into the bore until it is flush with the optics face. Note that the wiper motor cartridge may not stay flush until the copper faceplate is attached again.
10. Align the dowel holes on the wiper motor cartridge and bore, and insert the plastic alignment dowel again.
11. Attach the faceplate to the optical face again with the faceplate screws.
12. Put the wiper on the motor shaft. Refer to Replace the wiper on page 11.

Figure 5 Copper faceplate attached to optical face

The faceplate will fit on the optical face only one way.

Section 3 Reference topics

3.1 Delivered items

- the *ECO* sensor
- a dummy plug with a lock collar
- a plastic protective cover for the optics face
- a model-specific spare parts kit
- **On the CD:**
- this user manual
- the ECOView host software
- the sensor's device file or files
- the sensor's characterization or calibration page

3.2 Calibration

The manufacturer calibrates all scattering sensors to make sure that the data that is collected meets the sensor's specifications. This information is on the sensor-specific calibration page that comes with the sensor.

3.3 Characterization

The manufacturer characterizes all fluorescence sensors using a fluorescing material to make sure that the data that is collected meets the sensor's specifications. This information is on the sensor-specific characterization page that ships with the sensor.

3.3.1 Field characterization

The manufacturer recommends that the user perform a field characterization on fluorometers to make sure that the data is as accurate as possible for the user's application. The scale factor and the dark counts values can vary depending on the natural water, temperature, length of the cable, the power supply, and other factors.

Do the steps below to field-characterize the sensor.

- ***x*** = a solution of a known concentration in volts or counts.
- **output** = the measured sample of interest in volts or counts.
- **dark counts** = the measured signal output in volts or counts of the sensor in clean water with black tape over the detector.
- **scale factor** = the multiplier in µg/L/volt, ppb/L/volt, OR µg/L/count, ppb/L/count.

1. Get a solution of a known concentration, ***x***.
2. Measure and record this solution using the sensor.
   This value is the **output** in volts or in counts.
3. Measure and record the sensor's **dark counts**.
4. Use this equation to determine the sensor's **scale factor:**
   Scale factor = x ÷ (output - dark counts).
5. Use the scale factor to determine the concentration of the sample of interest:
   (output counts - dark counts) × scale factor = concentration of solution.
6. Store the scale factor and dark counts (offset) in the device file for the sensor, the internal memory of the sensor, or both.

3.3.2 Store field characterization values in device file

The host software uses a device file to process data. An example is shown below.

```
BCO BBFL2W-933
Created on: 01/22/12

Columns=9
N/U=1
N/U=2
N/U=3
Lambda=4    3.274e-06   50    700   700
N/U=5
chl=6       0.0121      51
N/U=7
cdom=8      0.091       49
N/U=9
```

1. Edit columns 6 and 8 of this device file to include the field characterization values.
2. Save this device file with a new name.
3. Open this device file in the host software under the *File* menu.

3.4 Device files

The host software uses a sensor-specific device file to show the data in the *Plot Data* tab and to calculate the data output in engineering units. Each device file has three necessary elements. The device file is not necessary to use the host software to set up and move data from a sensor.

1. The heading for the *Plot Data* tab.
2. The number of columns in the device file.
3. A description of the contents in each column.

***Plot Data* tab heading**
The first line of the device file shows the model number and the serial number of the sensor. This information appears on the top of the Plot Data tab in the host software.

Number of columns
The column count shows how many columns of data output to process in the host software. The format is COLUMNS=x.

Description of columns
Each column of the sensor's data output comes from a description in the device file.

Number of columns=x

Date=x MM/DD/YY

Time=x HH:MM:SS

N/U=x not used

sc=scale factor

off=offset

IENGR=x

mw=measurement wavelength of the sensor

dw=display wavelength of the sensor

Example of a three-parameter device file	
lambda (scattering wavelength) = x sc off mw dw **Column 4** = scale factor (sc), offset (off), measurement wavelength (mw), display wavelength (dw). **Column 6** = scale factor (sc) offset (off). **Column 8** = scale factor (sc) offset (off).	ECO BBFL2W-933 Created on: 01/22/12 Columns=9 N/U=1 N/U=2 N/U=3 Lambda=4 3.274e-06 50 700 700 N/U=5 chl=6 0.0121 51 N/U=7 cdom=8 0.091 49 N/U=9

3.5 Terminal program communication commands

Use Windows HyperTerminal® or other terminal program to communicate with *ECO* sensors as an alternative to the host software.

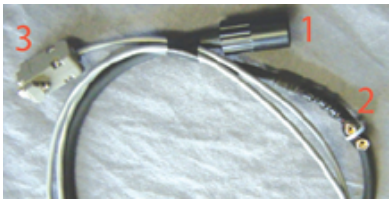
Interface settings				
baud rate: 19200	stop bits: 1	data bits: 8	flow control: none	parity: none

Command	Parameters	Description
!!!!!	none	Stops data output. Allows the user to input setup parameters. (If the sensor is in a low-power state, turn the power supply off for one minute, then turn the power on and keep the "!" key pressed at the same time.)
$ave	1–255	The number of measurements that make up each row of output.
$clk	24-hour time	Sets the time in the internal memory in the format hhmmss.
$date	date	Sets the date in the internal memory in the format mmddyy.
$emc	—	Clears the internal memory.
$get	—	Reads data from the internal memory. Prints **etx** when it is complete.
$int	24-hour time	Sets the time interval between sets of measurements the format hhmmss.
$mnu	—	Prints the menu of available settings to the host PC screen.
$mvs	1 = ON; 0 = OFF	1 = the Bio-wiper is open. 0 = the Bio-wiper is closed.
$pkt	0–65535	Sets the number of rows of data that are output between the selected time intervals.
$rec	1 = ON 0 = OFF	1 = Turns on the sensor's internal memory. 0 = Turns off the sensor's internal memory.
$rls	—	Loads the settings from the flash memory.
$run	—	Uses the current settings to operate.
$set	0–65535	Sets the number of rows of data that are output between low-power states.
$sto	—	Stores the desired settings to the sensor's flash memory.

Section 4 Optional equipment

4.1 Test cable

Use a test cable to set up and test the sensor before deployment.



1 six-contact connector	**3** db-9 serial port connector
2 9-volt battery connector	

1. Connect the six-contact connector into the sensor.
2. Connect the 9-volt connector to a 9-volt battery. As an alternative, it can be connected to a regulated power supply.
3. Connect the db-9 connector to the host PC. Use a USB-to-RS232 adapter cable if necessary.

4.2 Internal batteries

Six 9-volt lithium batteries supply power to sensors that have batteries. The sensors can also use alkaline or lithium manganese dioxide ($LiMnO_2$) batteries. Alkaline batteries supply about 1000 mA-hours of power. $LiMnO_2$ batteries supply more than 2000 mA-hours of power.

Note: *The nominal water temperature, sequence timing, sample periods, and other variables will change the use time of the sensor's internal batteries.*

4.2.1 Replace batteries

⚠WARNING

The pressure housing of the *ECO* sensor must be opened to replace the batteries. If done improperly, it could result in personal injury or death due to abnormal internal pressure as a result of flooding. It may not be possible to repair flooded sensors.
The manufacturer disclaims all product liability from the use or service of this equipment. The manufacturer cannot control the use of these sensors or choose qualified personnel to operate them, and therefore cannot take steps to comply with laws pertaining to product liability, including laws that impose a duty to warn the user of any dangers involved with the operation and maintenance of the sensors. Acceptance of this equipment by the customer shall be conclusively deemed to include a covenant by the customer to defend and hold the manufacturer harmless from all product liability claims arising from the use and servicing of this equipment. Flooded instruments will be serviced at the discretion of the manufacturer.

Flooded sensors are usually not serviceable. There is a small chance that the manufacturer can get the data that is stored in the sensor. Contact service@wetlabs.com for more information about flooded sensors.

1. Clean any debris from the end flange.
2. Dry the sensor thoroughly.
3. Remove the dummy plugs if necessary.

⚠CAUTION

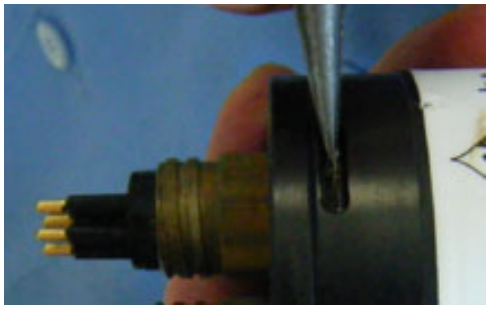
The sensor may be under pressure. Do not point it toward any part of the body when removing the vent plug or end flange.

⚠ CAUTION

Replace the batteries in a clean and dry environment. Gases in the sensor can expand and push the pressure relief plug open. This will flood the sensor. Do not replace batteries in a cold environment and then deploy the sensor in a hot environment.

4. Point the connector end flange down, away from the face.
   a. Pull the vent plug loose.
   b. If the sensor has an external thermistor, pull it loose.
5. Dry the vent plug (and the thermistor, if applicable).
6. Use needle-nose pliers to remove the monofilament from the end flange.

Figure 6 Pull monofilament from end flange

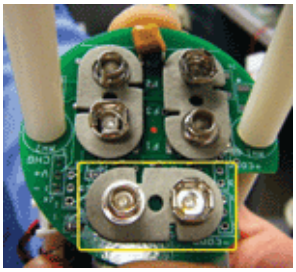


7. Remove the end flange from the pressure housing.
   The jacking screws supplied as spare parts can be used to push the end flange off of the pressure housing, and then be removed.
8. Gently disconnect each Molex® connector.
9. Remove the screw that holds the vent plug in the end flange.
10. Dry the end flange and the pressure housing seal areas.
11. Examine the O-rings on the vent plug and thermistor (if applicable).
    Remove any O-ring that is damaged.
12. Apply a light coat of vacuum grease on a new 010 O-ring and put it on the vent plug or thermistor.
13. Put the vent plug into the top of the end flange.
14. If applicable, insert the thermistor into the end flange again.
15. Put the screw for the vent plug in the inside of the end flange.
    The screw holds the vent plug in the end flange.
16. Carefully pull the white plastic loop to remove the battery pack from the pressure housing.
17. Remove the black plastic protectors from the ends of the long screws securing the batteries.
18. Loosen, but do not remove, the retaining screws using a 1/4-inch slotted driver.
    Do not remove both screws. Removing both of the retaining screws will result in a pile of parts and will complicate the replacement process.

Figure 7 Both retaining screws removed

19. Disconnect each of the six batteries.
20. Tilt the battery board enough to connect the first battery in the contacts that are perpendicular to the other two.

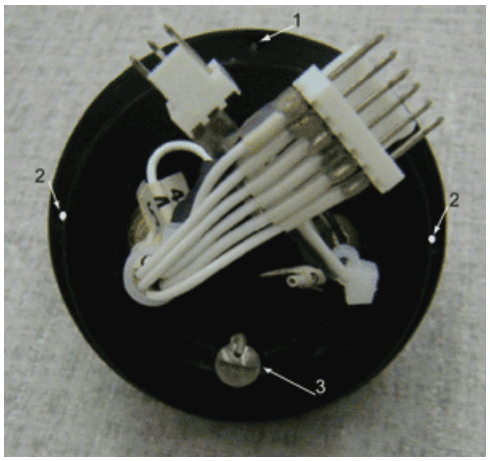
Figure 8 Connect the first battery



21. Pivot the boards in the opposite direction to connect the other two batteries.
22. Connect the second set of the batteries.
23. Hold the assembly plates on top and bottom and tighten the screws.
    The bottoms of the batteries may splay out. Make sure that the batteries do not stick out beyond the circuit boards. If they do, the battery pack will scratch the sealing surface when it is put into the pressure housing again.
24. Install the bottom neoprene pad and the black plastic protective covers on the ends of the screws.
25. Remove and examine the 224 O-ring on the pressure housing for damage.
26. Use a new O-ring if necessary.
27. Apply a light layer of grease such as Dow Corning® High Vacuum Grease on the O-ring.
28. Put the battery pack into the pressure housing.
29. Attach the Molex® connectors.

    Note that the dowel pin may be in the end flange or in the pressure housing.

Figure 9 Inside of end flange



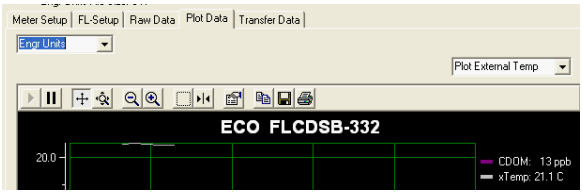
1 dowel hole	**2** through-holes for jacking screws	**3** vent plug screw

30. Put the end flange onto the housing so that the wires are out of the way.
31. Align the dowel pin with the dowel hole in the end flange, not the jack screw holes, which go through the end flange.
32. Make sure that the wires are not pinched between the end flange and the pressure housing.
33. Make sure that the end flange is attached to the pressure housing.
34. Install the monofilament in the end flange.

4.3 External thermistor

The calibration coefficient value for the thermistor is on the sensor's characterization page that ships with the sensor. The thermistor gives temperature output in counts. Do one of the methods below to change counts to engineering units.

1. Use the drop-down menu in the host software to see the thermistor output in °C.

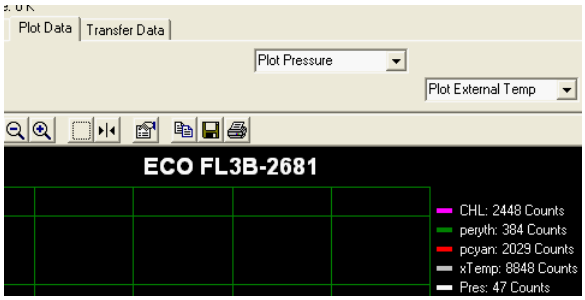


2. Use MATLAB, MS Excel or other software to solve for:
Temperature, °C = (Output × Slope) + Intercept

4.4 Pressure sensor

The calibration coefficient value for the pressure sensor is on the calibration page that ships with the sensor. The pressure sensor gives pressure output in counts. Do one of the methods below to change counts to engineering units.

1. Use the drop-down menu in the host software to see the pressure sensor output in dbar.



2. Use MATLAB, MS Excel or other software to solve for:
   relative pressure, dbar = (output × slope) + intercept
3. Calculate the absolute pressure:
   absolute pressure, dbar = relative pressure, dbar - relative pressure at atmospheric-water interface, dbar

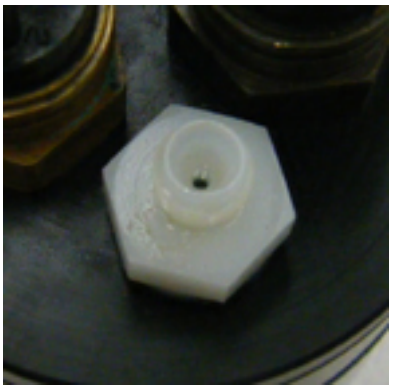
Pressure sensors need to be set at zero for each deployment. Do not deploy the pressure sensor deeper than the depth rating on the calibration page.

4.4.1 Maintain pressure sensor

The plastic fitting filled with silicone oil is a buffer between the pressure transducer diaphragm and seawater. Add silicone oil to the reservoir on top of the transducer at regular intervals.

1. Make sure the top of the sensor is clean.
2. Use a 9/16-inch wrench to hold the white nylon Swagelok® fitting.
3. Use a 7/16-inch wrench to loosen the cap on top of the fitting.
4. Remove the cap.
5. Use a wire or toothpick to clean the hole in the cap.
   Do not blow compressed air into the fitting. It will make a mess.
6. Add Dow Corning® 200 Silicone Oil to the reservoir until the oil is visible.

Figure 10 Pressure sensor cap



7. Replace the cap. Make sure not to tighten the cap too much.
8. Clean any excess oil from the end flange of the sensor.

Section 5 General information

Revised editions of this user manual are on the manufacturer's website.

5.1 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.

5.2 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.

5.3 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.

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