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## Sensor Checklist

Date: 04/04/2017

S/N: BB2FLVMT-816

Order # 033478

**Contents:**

Description	Qty	Packed
■ ECO sensor	1	X
■ Calibration/Characterization Sheet	1	X
■ Repair/Modification Sheet	1	X
■ Dummy Plug		X
■ Lock Collar		X
■ Anti-Static Shipping Bag	1	X
■ Hard Plastic Protective End Cap	1	X
■ Pigtail with Lock Collar		
■ Spare Parts Card		
■ Dummy Plug Switch		
■ Compact Disc	1	X
■ Test Cable		
■ Vinyl Protective Cap		
■ White Saddle		

Checked by: RG

Comments: \_\_\_\_\_



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## Sensor Checklist

Date: 04/04/2017

S/N: BB2FLVMT-596

Order # 033478

### Contents:

Description	Qty	Packed
■ ECO sensor	1	X
■ Calibration/Characterization Sheet	1	X
■ Repair/Modification Sheet	1	X
■ Dummy Plug		X
■ Lock Collar		X
■ Anti-Static Shipping Bag	1	X
■ Hard Plastic Protective End Cap	1	X
■ Pigtail with Lock Collar		
■ Spare Parts Card		
■ Dummy Plug Switch		
■ Compact Disc	1	X
■ Test Cable		
■ Vinyl Protective Cap		
■ White Saddle		

Checked by: RG

Comments: \_\_\_\_\_



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## Sensor Checklist

Date: 04/04/2017

S/N: BBFL2VMT-671

Order # 033478

### Contents:

Description	Qty	Packed
■ ECO sensor	1	X
■ Calibration/Characterization Sheet	1	X
■ Repair/Modification Sheet	1	X
■ Dummy Plug		X
■ Lock Collar		X
■ Anti-Static Shipping Bag	1	X
■ Hard Plastic Protective End Cap	1	X
■ Pigtail with Lock Collar		
■ Spare Parts Card		
■ Dummy Plug Switch		
■ Compact Disc	1	X
■ Test Cable		
■ Vinyl Protective Cap		
■ White Saddle		

Checked by: RG

Comments: \_\_\_\_\_

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# **ECO Chlorophyll Fluorometer Characterization Sheet**

Date: 3/30/2017

S/N: BBFL2VMT-671

Chlorophyll concentration expressed in  $\mu\text{g/l}$  can be derived using the equation:

**CHL ( $\mu\text{g/l}$ ) = Scale Factor \* (Output - Dark counts)**

<b>Dark counts</b>	52 counts
<b>Scale Factor (SF)</b>	0.0122 µg/l/count
<b>Maximum Output</b>	4130 counts
<b>Resolution</b>	1.0 counts
Ambient temperature during characterization	21.0 °C

**Dark Counts:** Signal output of the meter in clean water with black tape over detector.

**SF:** Determined using the following equation: SF = x ÷ (output - dark counts), where x is the concentration of the solution used during instrument characterization. SF is used to derive instrument output concentration from the raw signal output of the fluorometer.

**Maximum Output:** Maximum signal output the fluorometer is capable of.

**Resolution:** Standard deviation of 1 minute of collected data.

The relationship between fluorescence and chlorophyll-a concentrations in-situ is highly variable. The scale factor listed on this document was determined using a mono-culture of phytoplankton (*Thalassiosira weissflogii*). The population was assumed to be reasonably healthy and the concentration was determined by using the absorption method. To accurately determine chlorophyll concentration using a fluorometer, you must perform secondary measurements on the populations of interest. This is typically done using extraction-based measurement techniques on discrete samples. For additional information on determining chlorophyll concentration see "Standard Methods for the Examination of Water and Wastewater" part 10200 H, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation.

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## ECO CDOM Fluorometer Characterization Sheet

Date: 3/30/2017

S/N: BBFL2VMT-671

CDOM concentration expressed in ppb can be derived using the equation:

$$\text{CDOM (ppb)} = \text{Scale Factor} * (\text{Output} - \text{Dark Counts})$$

**Dark Counts**

Digital

46 counts

**Scale Factor (SF)**

0.1483 ppb/count

**Maximum Output**

4130 counts

**Resolution**

1.0 counts

Ambient temperature during characterization

21.0 °C

**Dark Counts:** Signal output of the meter in clean water with black tape over detector.

**SF:** Determined using the following equation: SF = x ÷ (output - dark counts), where x is the concentration of the solution used during instrument characterization. SF is used to derive instrument output concentration from the raw signal output of the fluorometer.

**Maximum Output:** Maximum signal output the fluorometer is capable of.

**Resolution:** Standard deviation of 1 minute of collected data.

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## Scattering Meter Calibration Sheet

3/30/2017

Wavelength: 650

S/N BBFL2VMT-671

Use the following equation to obtain "scaled" output values:

$$\beta(\theta_c) \text{ m}^{-1} \text{ sr}^{-1} = \text{Scale Factor} \times (\text{Output} - \text{Dark Counts})$$

• **Scale Factor for 650 nm** = 3.654E-06 ( $\text{m}^{-1}\text{sr}^{-1}$ )/counts

• **Output** = meter reading counts

• **Dark Counts** = 47 counts

Instrument Resolution = 1.2 counts      4.35E-06 ( $\text{m}^{-1}\text{sr}^{-1}$ )

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### Definitions:

• **Scale Factor:** Calibration scale factor,  $\beta(\theta_c)$ /counts. Refer to User's Guide for derivation.

• **Output:** Measured signal output of the scattering meter.

• **Dark Counts:** Signal obtained by covering detector with black tape and submersing sensor in water.

Instrument Resolution: Standard deviation of 1 minute of collected data.

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Date 3/30/2017 Customer U of East Anglia

S/N# BBFL2VMT-671 Technician dcm

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### Diagnosis

Evaluated instrument and found no problems.

### Repairs

Standard Service performed.

### ECO Standard Service Definition

The bulkhead connector, pressure housing and window on the instrument are first inspected for possible damage.  
The instrument then is powered on and the current data is checked to determine if the instrument is working properly.  
The instrument pre-service characterization is performed  
The head is next inspected for cracks in the LED, the detector and the motor bores.  
The digital and analog operations are checked.  
The instruments scaling is checked with dye or scatter proxy as determined by the instrument type.  
The firmware version on the instrument is updated as necessary.  
The case seals, desiccant, shaft seal, faceplate, and shaft are replaced as the instrument is reassembled.  
The instrument is rescaled if needed after reassembly.  
Standard testing is performed on the instrument and characterized before being returned to the customer.

### ECO Standard Testing Definition

- Performed noise test: 1 sample/sec for 60 sec
- Performed stability test: 1 sample/sec for 12 hrs as needed
- Performed thermistor calibration if installed
- Performed live 6hr pressure test: 5 samples every 4 minutes as needed
- Pressure-tested unit
- Completed instrument characterization
- Updated unit's characterization sheet and included on CD
- Updated unit's device file and included on CD

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Date 3/30/2017 Customer U of East Anglia

S/N# BB2FLVMT-596 Technician dcm

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### Diagnosis

Evaluated instrument and found no problems.

### Repairs

Standard Service performed.

### ECO Standard Service Definition

The bulkhead connector, pressure housing and window on the instrument are first inspected for possible damage.  
The instrument then is powered on and the current data is checked to determine if the instrument is working properly.  
The instrument pre-service characterization is performed  
The head is next inspected for cracks in the LED, the detector and the motor bores.  
The digital and analog operations are checked.  
The instruments scaling is checked with dye or scatter proxy as determined by the instrument type.  
The firmware version on the instrument is updated as necessary.  
The case seals, desiccant, shaft seal, faceplate, and shaft are replaced as the instrument is reassembled.  
The instrument is rescaled if needed after reassembly.  
Standard testing is performed on the instrument and characterized before being returned to the customer.

### ECO Standard Testing Definition

- Performed noise test: 1 sample/sec for 60 sec
- Performed stability test: 1 sample/sec for 12 hrs as needed
- Performed thermistor calibration if installed
- Performed live 6hr pressure test: 5 samples every 4 minutes as needed
- Pressure-tested unit
- Completed instrument characterization
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## Scattering Meter Calibration Sheet

3/30/2017

Wavelength: 700

S/N BB2FLVMT-596

Use the following equation to obtain "scaled" output values:

$$\beta(\theta_c) \text{ m}^{-1} \text{ sr}^{-1} = \text{Scale Factor} \times (\text{Output} - \text{Dark Counts})$$

- **Scale Factor for 700 nm** = 3.255E-06 ( $\text{m}^{-1}\text{sr}^{-1}$ )/counts
- **Output** = meter reading counts
- **Dark Counts** = 49 counts

$$\text{Instrument Resolution} = 1.3 \text{ counts} = 4.13\text{E-06} (\text{m}^{-1}\text{sr}^{-1})$$

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### Definitions:

- **Scale Factor:** Calibration scale factor,  $\beta(\theta_c)$ /counts. Refer to User's Guide for derivation.
- **Output:** Measured signal output of the scattering meter.
- **Dark Counts:** Signal obtained by covering detector with black tape and submersing sensor in water.

Instrument Resolution: Standard deviation of 1 minute of collected data.

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## Scattering Meter Calibration Sheet

3/30/2017

Wavelength: 470

S/N BB2FLVMT-596

Use the following equation to obtain "scaled" output values:

$$\beta(\theta_c) \text{ m}^{-1} \text{ sr}^{-1} = \text{Scale Factor} \times (\text{Output} - \text{Dark Counts})$$

• Scale Factor for 470 nm	=	1.466E-05 (m <sup>-1</sup> sr <sup>-1</sup> )/counts
• Output	=	meter reading counts
• Dark Counts	=	49 counts
Instrument Resolution	=	1.0 counts 1.47E-05 (m <sup>-1</sup> sr <sup>-1</sup> )

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### Definitions:

- **Scale Factor:** Calibration scale factor,  $\beta(\theta_c)$ /counts. Refer to User's Guide for derivation.
- **Output:** Measured signal output of the scattering meter.
- **Dark Counts:** Signal obtained by covering detector with black tape and submersing sensor in water.

Instrument Resolution: Standard deviation of 1 minute of collected data.

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## **ECO Chlorophyll Fluorometer Characterization Sheet**

Date: 3/30/2017

S/N: BB2FLVMT-596

Chlorophyll concentration expressed in  $\mu\text{g/l}$  can be derived using the equation:

**CHL ( $\mu\text{g/l}$ ) = Scale Factor \* (Output - Dark counts)**

<b>Dark counts</b>	51 counts
<b>Scale Factor (SF)</b>	0.0133 µg/l/count
<b>Maximum Output</b>	4120 counts
<b>Resolution</b>	1.2 counts

### Ambient temperature during characterization

21.0 °C

**Dark Counts:** Signal output of the meter in clean water with black tape over detector

**SF:** Determined using the following equation: SF = x ÷ (output - dark counts), where x is the concentration of the solution used during instrument characterization. SF is used to derive instrument output concentration from the raw signal output of the fluorometer.

**Maximum Output:** Maximum signal output the fluorometer is capable of

**Resolution:** Standard deviation of 1 minute of collected data

The relationship between fluorescence and chlorophyll-a concentrations in-situ is highly variable. The scale factor listed on this document was determined using a mono-culture of phytoplankton (*Thalassiosira weissflogii*). The population was assumed to be reasonably healthy and the concentration was determined by using the absorption method. To accurately determine chlorophyll concentration using a fluorometer, you must perform secondary measurements on the populations of interest. This is typically done using extraction-based measurement techniques on discrete samples. For additional information on determining chlorophyll concentration see "Standard Methods for the Examination of Water and Wastewater" part 10200 H, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation.

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## Scattering Meter Calibration Sheet

3/30/2017

Wavelength: 470

S/N BB2FLVMT-816

Use the following equation to obtain "scaled" output values:

$$\beta(\theta_c) \text{ m}^{-1} \text{ sr}^{-1} = \text{Scale Factor} \times (\text{Output} - \text{Dark Counts})$$

- **Scale Factor for 470 nm** = 1.565E-05 ( $\text{m}^{-1}\text{sr}^{-1}$ )/counts
  - **Output** = meter reading counts
  - **Dark Counts** = 57 counts
- Instrument Resolution = 1.3 counts      2.09E-05 ( $\text{m}^{-1}\text{sr}^{-1}$ )

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### Definitions:

- **Scale Factor:** Calibration scale factor,  $\beta(\theta_c)$ /counts. Refer to User's Guide for derivation.
- **Output:** Measured signal output of the scattering meter.
- **Dark Counts:** Signal obtained by covering detector with black tape and submersing sensor in water.

Instrument Resolution: Standard deviation of 1 minute of collected data.

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## ECO Chlorophyll Fluorometer Characterization Sheet

Date: 3/30/2017

S/N: BB2FLVMT-816

Chlorophyll concentration expressed in  $\mu\text{g/l}$  can be derived using the equation:

$$\text{CHL } (\mu\text{g/l}) = \text{Scale Factor} * (\text{Output} - \text{Dark counts})$$

	Digital
Dark counts	43 counts
Scale Factor (SF)	0.0121 $\mu\text{g/l}/\text{count}$
Maximum Output	4130 counts
Resolution	1.4 counts
Ambient temperature during characterization	21.0 °C

**Dark Counts:** Signal output of the meter in clean water with black tape over detector.

**SF:** Determined using the following equation:  $SF = x / (\text{output} - \text{dark counts})$ , where  $x$  is the concentration of the solution used during instrument characterization. SF is used to derive instrument output concentration from the raw signal output of the fluorometer.

**Maximum Output:** Maximum signal output the fluorometer is capable of.

**Resolution:** Standard deviation of 1 minute of collected data.

The relationship between fluorescence and chlorophyll-a concentrations in-situ is highly variable. The scale factor listed on this document was determined using a mono-culture of phytoplankton (*Thalassiosira weissflogii*). The population was assumed to be reasonably healthy and the concentration was determined by using the absorption method. To accurately determine chlorophyll concentration using a fluorometer, you must perform secondary measurements on the populations of interest. This is typically done using extraction-based measurement techniques on discrete samples. For additional information on determining chlorophyll concentration see "Standard Methods for the Examination of Water and Wastewater" part 10200 H, published jointly by the American Public Health Association, American Water Works Association, and the Water Environment Federation.

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Date 3/30/2017 Customer BB2FLVMT-816

S/N# BB2FLVMT-816 Technician dcm

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### Diagnosis

Evaluated instrument and found no problems.

### Repairs

Standard Service performed.

### ECO Standard Service Definition

The bulkhead connector, pressure housing and window on the instrument are first inspected for possible damage.  
The instrument then is powered on and the current data is checked to determine if the instrument is working properly.  
The instrument pre-service characterization is performed  
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The instrument is rescaled if needed after reassembly.  
Standard testing is performed on the instrument and characterized before being returned to the customer.

### ECO Standard Testing Definition

- Performed noise test: 1 sample/sec for 60 sec
- Performed stability test: 1 sample/sec for 12 hrs as needed
- Performed thermistor calibration if installed
- Performed live 6hr pressure test: 5 samples every 4 minutes as needed
- Pressure-tested unit
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## Scattering Meter Calibration Sheet

3/30/2017

Wavelength: 700

S/N BB2FLVMT-816

Use the following equation to obtain "scaled" output values:

$$\beta(\theta_c) \text{ m}^{-1} \text{ sr}^{-1} = \text{Scale Factor} \times (\text{Output} - \text{Dark Counts})$$

- Scale Factor for 700 nm = 3.383E-06 ( $\text{m}^{-1}\text{sr}^{-1}$ )/counts
- Output = meter reading counts
- Dark Counts = 46 counts

Instrument Resolution = 1.4 counts 4.59E-06 ( $\text{m}^{-1}\text{sr}^{-1}$ )

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Definitions:

- **Scale Factor:** Calibration scale factor,  $\beta(\theta_c)$ /counts. Refer to User's Guide for derivation.
- **Output:** Measured signal output of the scattering meter.
- **Dark Counts:** Signal obtained by covering detector with black tape and submersing sensor in water.

Instrument Resolution: Standard deviation of 1 minute of collected data.