

CEFAS SMARTBUOY OPERATIONS STANDARD OPERATING PROCEDURE (SOP)	
S.O.P. No. EQ-SBO-009	Issue: 1 Page 1 of: 6

Linearity check of a Seapoint Turbidity Meter on an ESM-2 logger

Production Summary

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Introduction

Measurements of turbidity are useful in describing the underwater light climate. The turbidity of a seawater sample may be measured by quantifying the light scattered by the suspended particles in the water. High frequency measurements of turbidity can be obtained using the Seapoint Turbidity Meter. Subsequent calibration of the sensor using particles from the site of interest allows the determination of suspended particulates to be made which are an important part of calculating transport and fate of contaminants. The ESM-2 is a CEFAS-built logger which controls the operation of and stores data from the sensors. With the ability to have data telemetered back to the laboratory, data can be obtained in near-real time.

Scope

This SOP describes the procedure for determining the functionality of a Seapoint Turbidity Meter. It does not include calibrating the sensor using particles from the site of interest.

Training

The operator must be trained thoroughly in GLP (good laboratory practice). Before using this SOP the operator should familiarise themselves with the user manual (TM8400B). The operator must also have a working knowledge of Excel, HyperTerminal. Operators must read the COSHH assessment for this procedure.

Apparatus

1. ESM2 Logger with Seapoint Turbidity Sensor attached
2. ESM2 communication cable
3. Steel frame designed to hold two loggers (kept in Electronics)
- 3.4. Networked PC with SmartBuoy Data Management System loaded
- 4.5. Laptop with HyperTerminal configured to communicate with an ESM-2
6. Hexamethylenetetramine
7. Hydrazine sulphate
8. Ultrapure water
9. Repetitive pipettes
10. 500ml volumetric flasks
11. Black plastic container 7cm deep
12. Gloves
13. Safety glasses
14. Lab coat
15. Dust mask
16. Laboratory jack

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Procedure

Preparation of formazine standards

1. Prepare the formazine primary standard 4000 NTU according to Appendix A
2. Make a series of dilutions of between 4 and 750 FTU from the primary standard as shown in Appendix A.

Run Live Acquire

3. Connect logger to the serial port of the laptop using the ESM2 communication cable.
4. Open HyperTerminal ESM2 on the laptop (COM1, 9600, 8, none, 1, none).
5. Press the “wake up” button on the comms box until “RXD is active, awaiting rxd inactive...” appears then release button to obtain the main menu.
6. Select “s” (set-up) and “c” (check clock). Check that the clock is set correctly to GMT on the ESM-2. If not, set the correct time.
- 14.7. Select “m” (main menu).
- 15.8. Select “d” for diags. Check the battery voltage is greater than 8V by selecting “v”
- 16.9. Type “r ulog.ini” to run the programme.
- 17.10. Create a new txt document on the desktop of the laptop called “OBS xxx cal (yymmdd)” where xxx is the serial number of the turbidity sensor.
- 18.11. Select “capture text” under the “transfer” drop down menu. Select the file you have created on the desktop to save the data to that file.
- 19.12. Using the ESM2 bracket designed for this purpose, place the turbidity sensor in the beaker containing UPW. It is important to ensure that the turbidity sensor is central in the beaker to avoid reflections from the glass walls. Type “l” which will start logging and capture data for 70 seconds (700 tick counts = 70 readings). To end data capture press the space bar. The values recorded by the logger are in hexadecimal
- 20.13. Repeat step 19 for all the calibration standards prepared within the range of the turbidity meter. Make a note of the order in which standards have been run. Once the last standard has been analysed, save the data file by ending the text capture.
14. Select “m” (main menu).
15. Select “t” (put logger on standby).

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Data manipulation

16. Copy the file created in step 13 to the SmartBuoy network drive (\\Data\\ESM2_Calibrations\\OBS)
17. Open Excel on the computer. Open the file saved in step 16 using “all files” under file type.
18. Chose “fixed width” on the first window and select column markers to separate reading for channel 0 into two columns; one for sub-channel number and the other containing the three digits for the reading. Then select finish to open the file.
19. Open OBS cal (template).xls in \\Data\\ESM2_Calibrations\\OBS and save as a new Excel file using the same filename as in step 10.

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20. Activate Autofilter on the row above the first line of data. Filter to show readings for channel 0.
21. Copy across readings for channel 0 into column headed "OBS" under "Standard 1" in the calibration template.
22. Remove the Autofilter from the data file and scroll down to the next set of data for the second standard analysed. Repeat steps 20 and 21 for each of the standards analysed, copying over the data into the column appropriate for each standard analysed.
23. In the calibration template, fill in details of the concentration of each turbidity standard.
24. The graph for each range will automatically update as data is added to the template.
Check that the regression coefficient (r^2) is greater than or equal to 0.99 for each range.
25. Check that the ratio of the slopes for 200x gain:40x gain:10x gain:2x gain is 200:40:10:2.
26. If the regression coefficient is less than 0.99 and/or if any ratio in step 25 differs by more than 5%, the turbidity sensor should be inspected carefully for damage and sent for inspection/repair by the manufacturer.

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Appendix A Preparation of Formazine standards

Preparation of primary standard

Solution A:

Weigh 25g hexamethylenetetramine into a 250ml glass beaker. Dissolve in ultra pure water (UPW) and make up to 200ml with UPW.

Solution B:

Weigh 2.5g hydrazine sulphate into a 250ml glass beaker. Dissolve in ultra pure water (UPW) and make up to 200ml with UPW.

Place solutions A and B in a 500ml amber glass volumetric flask and mix carefully. Avoid shaking the flask too vigorously to minimise bubble formation. Make up to 500ml mark with UPW. Allow to stand at $25 \pm 3^{\circ}\text{C}$ for 24 hours for polymer structure to form. This standard is 4000 NTU.

Preparation of secondary standards

Mix the primary standard before using as it separates out when left to stand. Prepare the secondary standards according to the table below. All dilutions must be made using UPW and mixed carefully to minimise bubble formation.

Concentration of standard (NTU)	Volume primary standard (ml)	Make up to volume (ml)
4	0.5	500
8	1.0	500
10	1.25	500
15	1.88	500
25	3.13	500
50	6.25	500
75	9.38	500
100	12.5	500
125	15.6	500
150	18.8	500
200	25	500
300	37.5	500
400	50	500
500	62.5	500
600	75	500
750	93.8	500
Total	415	

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Stability of standards

The primary standard is stable for 4 weeks if stored in the dark at $25 \pm 3^{\circ}\text{C}$. Secondary standards are only stable for approximately one week under these conditions. Heat and light tend to accelerate the decomposition of the polymer structure. Standards settle with standing and must be mixed well before use.

Precautions

Wear safety glasses, lab coat, gloves and dust mask when weighing out chemicals for solutions A and B.