Laboratory 046

Standard Operating Procedure
SM014
Issue 1

Requires Bench Test

Calibration of an OEM Temperature Sensor on an ESM-2 logger

Lowestoft Laboratory
Pakefield Road
Lowestoft
Suffolk
NR33 0HT

Issue and Validation

Production summary

	Name	Date
Author(s)	Naomi Greenwood/ David Pearce	21/09/2007
Bench tested By		
Issue Authorisation Position		
Seen by QA		
Facilities Management Approval for GLP		

Distribution of copies

Copies Issued to	Number
Master to Archivist	**1**
	2
	3
	4
	5
	6
	7
	8
	9
	10
	11
	12
	13

Copy receipt record

Copy No:	Name:	Signature:	Date:

History of Procedure

Issue	Date Issued	Changes
1	September 2007	
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Calibration of an OEM Temperature Sensor on an ESM-2 logger:

Issue 1

1   Introduction

Sea Surface temperature is one of the most widely made routine oceanographic measurements. High frequency (1Hz) measurements of seawater temperature may be made using the OEM Temperature sensor in conjunction with the ESM-2 logger. 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.

2   Scope

This SOP describes the procedure for calibrating the OEM temperature sensor unit. It does not include instruction for calibrating the conductivity sensor which must be returned to the manufacturer for calibration.

3   Training (Identify any specific training linked to the SOP)

This procedure may only be carried out by staff who have received training in this SOP. The operator must be trained thoroughly in GLP (good laboratory practice). Before using this SOP the operator should familiarise themselves with the user manual OEM CT-Sensor Operation Manual. The operator must also have a working knowledge of Excel, HyperTerminal and the SmartBuoy Data Management System.

   Training records must be maintained and archived accordingly.

4   Safety Precautions

   Before performing this procedure staff should have read and understood the following COSHH & risk assessments.

4.1 COSHH

4.2 Risk Assessments

5   References/Associated documents

   OEM CT-Sensor Operation Manual

6 Equipment /Apparatus

1. Operationally ready ESM2 Logger (sensor definitions and ulog.ini already loaded) with OEM temperature Sensor on sensor endcap, and a minimum of 8V battery
2. ESM2 communication cable
3. Laptop with HyperTerminal installed
4. SiS controlled temperature bath (located in Electronics Department)
5. Platinum resistor thermometers (located in Electronics Department)
6. Networked PC with SmartBuoy Data Management System loaded

7 Ingredients/Reagents/Media

None applicable

8 Procedure

Procedure

Before starting the calibration procedure check with staff in the electronics department that the Platinum Resistor Thermometers used in step 2 have current calibrations.

Preparation of water bath
1. Set the temperature of the controlled temperature water bath to 4°C and leave overnight for water temperature to stabilise. The water bath temperature is displayed on the digital display.
2. Two Platinum Resistor Thermometers (PRT) are used to verify that the temperature is as displayed. Place each PRT in the holder on the left end of the bath and secure. Connect the two PRTs to the bridge, check that the switch is set to PRT 3 and switch the power on. Allow the needle of the bridge to stabilise (approx 30 mins) and make a note of the reading for PRT 3. Set the switch to PRT 6 and note down the reading. Use the spreadsheet PRT calculations.xls to calculate the temperature according to the PRT and note for use in calculations.
3. Using the bracket designed, set the logger up in the water bath, checking that the temperature probe is fully immersed. Allow the water bath temperature to stabilise again for 30 minutes before proceeding.

Run Live Acquire
4. Connect logger to the serial port of the laptop using the ESM2 communication cable.
5. Open HyperTerminal ESM2 on the laptop (COM1, 9600, 8, none, 1, none).
6. 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.
7. 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.
8. Select "m" (main menu). Note: If the calibration is to be performed on an operationally ready logger, it should have appropriate sensor definitions

loaded and a useable INI file, named ulog.ini. If this is the case, ignore steps 9 to 15 and go straight to step 16.

16.9.   Select "d" for diags. Check the battery voltage is greater than 8V by selecting "v"

17.10. Type "r ulog.ini" to run the programme.

18.11. Create a new txt document on the desktop of the laptop called "xxxx FSI temp cal (yymmdd)" where xxxx is the serial number of the temperature sensor.

19.12. 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.

20.13. Type "l" which will start logging and capture data for 1 minute (600 tick counts = 60 readings). To end data capture press the space bar and save the captured text. The values recorded by the logger are in hexadecimal.

14. Select "m" (main menu).

15. Select "t" (put logger on standby).

16. Remove the logger. Set the temperature of the water bath to 10°C and leave for approximately 2 hours for the water temperature to adjust and settle at the new setting. Repeat steps 2 to 3 and 15 to 22, adding the new data to the existing data file created in step 17. Save the data file by ending the text capture.

17. Repeat step 16 at water bath temperatures of $16\,^{\circ}$C, $22\,^{\circ}$C and $28\,^{\circ}$C.

18. Select "m" (main menu).

19. Select "t" (put logger on standby).

Data manipulation

20. Save the LiveAcquire file created in step 16 to the SmartBuoy network drive (*Smartbuoyops$\Sensors and Instruments\FSI\FSI nnnn\yymmdd*) and save the e-mail generated by electronics which contains the information about the temperatures run in the water bath into the same folder.

21. Open Excel on the computer. Open the file saved in step 19 using "fixed width" under original data type.

22. Select "next" when prompted to change the width of the columns

23. Select "finish" on the next screen to open the data file.

24. The data file will contain data in columns A to F. The data in columns D to F is the data for temperature, ref_lo and ref_hi respectively. The data will appear in several blocks, according to the number of temperatures run.

25. Open FSI temp cal (template).xls in *Smartbuoyops$\Sensors and Instruments\FSI\calibration templates\temperature* and save as a new Excel file in the sensor folder in *Smartbuoyops$\Sensors and Instruments\FSI\FSI nnnn\yymmdd* using the filename FSI *nnnn* temp cal (*yymmdd*).

26. Select the LiveAcquire file and select data in columns D to F for the first block of data. Copy into columns E to G in the "*linearity check*" sheet of the calibration template. Select columns D to F of the next block of data in the LiveAcquire file and copy into columns L to N in the "*linearity check*" sheet of the calibration template. Repeat for all blocks of data in the LiveAcquire file.

27. Enter the actual temperature values of the water bath from the e-mail sent by electronics in cells AK3 to AK7 in the "*linearity check*" sheet of the calibration template.
28. Ensure that the linearity check graph in the "*linearity check*" sheet of the calibration template is displaying the correct data and that the r^2 of the regression line is at least 0.999.
29. Copy the data fro temp, ref_lo and ref_hi for the lowest and highest temperatures run into columns E to G and L to N in the "*calculations*" sheet of the calibration template. Enter the actual temperatures run into Q3 and Q7 (T1 and T2).
30. The values for the new calibration coefficients To and Tf will be displayed in cells Q14 and Q17.
31. Open FSI delta T (template).xls in *Smartbuoyops$\Sensors and Instruments\FSI\calibration templates\temperature* and save as a new Excel file in the sensor folder in *Smartbuoyops$\Sensors and Instruments\FSI\FSI nnnn\yymmdd* using the filename FSI *nnnn* delta T (*yymmdd*).
32. Copy the new values for T0 and Tf into cells B2 and B3 of the file called FSI *nnnn* delta T (*yymmdd*).
33. Open the sensor record for the FSI on the SmartBuoy User Interface. Select the parameters tab on the record and click on the button called "FSI calibration".
34. Copy the current values for To and Tf into cells F2 and F3 respectively in the file called FSI *nnnn* delta T (*yymmdd*).
35. The change in temperature (dt) due to the new calibration coefficients will be displayed in cell I11. This change should be less than 0.1 ^{o}C if the FSI was calibrated approximately 1 year before. If the previous calibration was a long time ago, dt may be quite large (e.g. up to 0.1 ^{o}C per year since it was last calibrated). If there is a large value of dt, suspect a problem and contact electronics to discuss.
36. If dt value is within limits, update FSI calibration on the sensor record with the new values of To and Tf.

9   Review

This procedure will be reviewed as a minimum on the time scales given in the review / amendment programme. A record of the review will be made on a separate Review / Amendment Sheet which will be added to the Master Copy file of this SOP. Any amendments arising from such review or from operating requirements will result in the issue of the entire amended procedure as a new Issue.

10   Records

This procedure, its review sheets and its subsequent revisions constitute records in themselves and each master copy will be retained in a file as arranged by the Quality Manager. Records will be retained for a minimum of five years unless otherwise specified.

(List specific record sheets/books)