Laboratory 150/046

Standard Operating Procedure
SM013
Issue 1

Requires Bench Test

Calibration of a LI-COR 192SA Radiation Sensor with an ESM-2 logger

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Issue and Validation

Production summary

	Name	Date
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Bench tested By		
Issue Authorisation Position		
Seen by QA		
Facilities Management Approval for GLP		

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History of Procedure

Issue	Date Issued	Changes
1	August 2008	
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10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

Calibration of a LI-COR 192SA Radiation Sensor with an ESM-2 logger

: Issue 1

1   Introduction

Measurements of the underwater light regime enable measurements of downwelling photosynthetically active radiation (PAR) to be calculated. This provides a measure of how rapidly light is attenuated in the water column primarily due to the presence of suspended inorganic material, chlorophyll and dissolved organic material.

The ESM-2 is a CEFAS-built logger which controls the operation of and stores data from 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 LI-COR 192SA sensor unit. It does not detail the procedure for calibrating the electronics board.

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 instruction manual for the 1800-02 Optical Radiation Calibrator (publication number 8508-44) and the LI-COR Radiation Sensors Instruction Manual. The operator must 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

Instruction manual for the 1800-02 Optical Radiation Calibrator (publication number 8508-44)

LI-COR Radiation Sensors Instruction Manual.

6   Equipment /Apparatus

1. Dedicated ESM2 calibration logger with battery greater than 8V and ulog.ini used for calibration uploaded
2. ESM2 communication cable
3. Laptop with HyperTerminal installed
4. LI-COR 192SA radiation sensor
5. LI-COR 1800-02 Optical Radiation Calibrator
6. Networked PC with SmartBuoy Data Management System loaded.
7. Calibrated digital voltmeter
8. Power supply

7   Ingredients/Reagents/Media

none applicable

8   Procedure

Note: This procedure must be undertaken after the electronic board in the sensor has been calibrated, not before. The electronic board should be recalibrated every 12 months. Calibration records are maintained in LiCor cals.xls which is in the networked drive Smartbuoyops$\Sensors and Instruments\ Licor.

Clean the diffuser on the LI-COR 192SA sensor carefully with water or a mild detergent. Clean off any dirt on the painted surfaces with a soft bristle brush to avoid reflections during calibration. Check the black painted surfaces for scratches. These should be painted with matt black paint before proceeding to avoid reflections, which interfere with the calibration process.

Optical Radiation Calibrator warm up and checks

1. Ensure that the LI-COR 1800-02 has been set up according to section 3 of the manual.
2. Switch on the power to the Calibrator using the ON/OFF switch on the control panel and allow to warm up. The POWER indicator will light up to indicate that the instrument is receiving power.
3. The "ready" indicator on the left hand side of the control panel will light up when the power reaches the correct level. Allow a further 5 minutes for the lamp to reach thermal equilibrium before continuing.
4. The voltage and current supplied to the lamp in the calibrator should be checked every occasion the instrument is used and recorded on the log, which is kept with the instrument.
5. Attach a voltmeter to the LAMP CURRENT test sockets on the left hand side of the control panel. Lamp current can be calculated by measuring the voltage across the test jacks where 0.2 volts = 2 Amps

6. Warning: HIGH VOLTAGE – for this measurement, ensure that the test leads are plugged into the multimeter before connecting to the calibrator sockets. ALWAYS use the red and black test leads with the in-line safety plugs fitted each end and labelled for use with the LiCor calibrator. If the leads are not available do not proceed with the calibration before locating them. Attach a voltmeter to the LAMP VOLTAGE test sockets on the left hand side of the control panel. Lamp voltages range from 112 to 118 V. Important - disconnect the leads from the calibrator before disconnecting from the multimeter and leave the leads with the calibrator in the storage pocket provided.

7. Leave the light box switched on for use in step 11.

8. Calculate the lamp power by multiplying the lamp current by the lamp voltage. Lamp power is one of the four values selected by the power jumper as shown below:
   1. 175.9
   2. 183.5
   3. 191.5
   4. 199.8

9. The measured power value should be within ± 0.1% of the jumper setting for the lamp installed. If it is more than ± 0.2 % different follow the guidance in Section 10.4 of the instruction manual. Make a note of the lamp current, voltage and power on the log sheet.

10. Calculate the lamp resistance (voltage/current). If this has changed by 2% whilst the power values remain acceptable check the lamp base contacts. If the problem persists, the lamp is likely to be near the end of its life. Lamps are rated to hold the initial calibration values and tolerances to ± 1% for 50 hours operation. For best accuracy change the lamp after 50 hours use. Keep a record of lamp use on the log sheet to ensure lamp is replaced periodically.

11. Install the LI-COR 192SA sensor in the sensor port on the light box. Connect pins 1 (ground) and 2 (positive) on the licor to the calibrated DVM and connect pins 3 (ground) and 4 (supply) to the power supply. Ensure power supply is switched off when connecting.

12. Set power supply to 12 volts and current limit of 50 mA.

13. Record details of licor serial number, electronics board serial number, and voltage from DVM and serial number of ESM-2 logger used in step 14.

Upload sensor definition file to logger

14. Connect logger to the serial port of the laptop using the ESM2 communication cable.

15. Open HyperTerminal ESM2 on the laptop (COM1, 9600, 8, none, 1, none).

16. 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.

17. 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.

18. Select "m" (main menu)

19. Select "x" (exit to PicoDOS).

Run ESM diag

20. 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.
21. Ensure that the sensor port is installed in the calibrator.
22. Install the LI-COR 192SA sensor in the sensor port and attach to the ESM2 logger using the appropriate cable.
23. Type "x" to exit picodos
24. Type "ESM diag"
25. Type "2" (high level) then type "1" (sensors)
26. Create a new txt document on the desktop of the laptop called "LiCor xx cal (yymmdd)" where xx is the serial number of the LiCor.
27. 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.
28. Type "e5" then press return to exercise channel 5.
29. Set rate to 1 then press return.
30. Log data for one minute then press any key to stop the logging. Save the captured text. The values recorded by the logger are in hexadecimal.

Data manipulation

1. Open 'Electronics Lab LiCor amplifier & DVM record' from *Smartbuoyop$/Sensors and Instruments/Electronics lab LiCor amplifier and DVM calibration record.* LiCors that have been calibrated by Electronics Lab will be in red type. These will need to have the calibration data updated.
2. Open 'Licor cal (template)' from *Smartbuoyop$/Sensors and Instruments/licor.* Save in the folder for the relevant Licor number in *Smartbuoyop$/Sensors and Instruments/licor* using the name format Licor (no.) cal (YYMMDD) using the date of calibration from 'Electronics Lab LiCor amplifier & DVM record' in column 'L'
3. Copy and paste the DVM reading from 'Electronics Lab LiCor amplifier & DVM record' column N to the file created in step 2, cell F2
4. Open 'LiCor calibration coefficient history' from *Smartbuoyop$/Sensors and Instruments/licor.*
5. Locate the column relevant to the LiCor and unhide any hidden columns to the left of this column.
6. Insert a column to the right of the column and copy the information from the left column to the right column.
7. Insert date of calibration from 'Electronics Lab LiCor amplifier & DVM record' in column 'L' into row 13 and row 21 of new column
8. In column 'J' of 'Electronics Lab LiCor amplifier & DVM record' (Electrical Calibration (factor 2 and offset)) the calibration is in the format y='nnnnn'e'mmmmm'x where 'nnnnn'/1000 is factor2 and 'mmmmm' is the offset.

9. Copy and paste the value 'nnnnn' to row 15 of the new column in 'LiCor calibration coefficient history'. Divide this value by 1000 in this cell.
10. Copy and paste the value 'mmmmm' to row 16 of the new column in 'LiCor calibration coefficient history'
11. Copy and paste the value in step 9 to the file created in step 2 cell i3
12. Copy and paste the value in step 10 to the file created in step 2 cell i4
13. Open the original calibration certificate from the LiCor (no) folder. This will be in either jpeg or pdf format.
14. Copy 'calibration constants in Air' from the certificate to the file created in step 2 i6
15. Copy 'calibration constants in Water' from the certificate to the file created in step 2 i7
16. The new calibration constants for in Air and in Water are now calculated in Cells F6 and F8 of the file created in step 2
17. Copy the value in F6 to row 23 of the new column in 'LiCor calibration coefficient history'
18. Copy the value in F8 to row 29 of the new column in 'LiCor calibration coefficient history'
19. Compare the readings in these rows to previous reading for the same licor. If the values fluctuate wildly then refer to Naomi Greenwood or Dave Pearce for further guidance.
20. Hide the columns showing previous calibration data for this licor.
21. Open the SmartBuoyops database
22. Open the sensor record for the relevant Licor, select the parameters tab and click on 'PAR irradiance' Click on the 'Calibration button' Click 'Change calibration'
23. Enter the date of calibration (Step 7)
24. If the LiCor is in current use, apply the Calibration Coefficients relevant to use (in Air or in Water) If the LiCor is not in current use apply the 'in Water' Calibration coefficients
    Factor 1 from the new column in 'LiCor calibration coefficient history', row 32 for 'in Water', row 26 for 'in Air'
    Offset from from the new column in 'LiCor calibration coefficient history', row 332 for 'in Water', row 27 for 'in Air'
25. Click 'Add', 'OK' and 'Apply'
26. Check that new calibration has been added to the sensor record.
27. In 'Electronics Lab LiCor amplifier & DVM record' change the text to black to indicate that the calibration data has been updated.

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)