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APPLICATION NOTE NO. 11LICOR

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Calculating Calibration Coefficients for LICOR Underwater Type SA PAR Light Sensor *without* Built-In Log Amplifier

This application note applies to a Licor Instruments underwater type SA quantum light sensor. The current output of this sensor is measured through a log amplifier in your CTD (or through the Sea-Bird PN 90310 Log Amp Module) to obtain adequate resolution over the measurement range.

This PAR sensor is compatible with the following Sea-Bird CTDs:

- SBE 16, 16*plus*, 16*plus*-IM, 19, or 19*plus* CTD configured with optional log amplifier and PAR sensor connector. Note: Optional log amplifier and PAR sensor connector are **not** available on V2 SeaCATs (16*plus* V2, 16*plus*-IM V2, and 19*plus* V2)
- SBE 25 CTD configured with log amplifier and PAR sensor connector (standard on current production SBE 25s, optional on older versions).
- SBE 9*plus*, 16, 16*plus*, 16*plus*-IM, 16*plus* V2, 16*plus*-IM V2, 19, 19*plus*, 19*plus*V2, 25, or 25*plus* CTD interfacing with a Sea-Bird PN 90310 Log Amp Module. The Log Amp Module mounts on the CTD or cage, and connects to a single-ended or differential A/D voltage channel on the CTD.

Seasoft computes PAR using the following equation:

$$\text{PAR} = [\text{multiplier} * (10^9 * 10^{(V-B)/M}) / \text{calibration constant}] + \text{offset}$$

Enter the following coefficients in the CTD configuration (.con or .xmlcon) file:

M = slope of log amplifier (Note 2)

B = offset of log amplifier (Note 2)

calibration constant = from the Sea-Bird calibration certificate (Note 2)

multiplier = 1.0 for output units of $\mu\text{Einsteins}/\text{m}^2\cdot\text{sec}$ (Note 3)

offset = 0, typically (Note 4)

Notes:

1. In our Seasoft V2 suite of programs, edit the CTD configuration (.con or .xmlcon) file using the Configure Inputs menu in Seasave V7 (real-time data acquisition software) or the Configure menu in SBE Data Processing (data processing software).
2. Sea-Bird provides two calibration sheets for the PAR sensor in the CTD manual:
 - Calibration sheet generated by Licor, showing Licor's calibration data.
 - Calibration sheet generated by Sea-Bird, showing the parameters needed for entry in Sea-Bird software -
- **Calibration constant** - the *in water* Calibration Constant ($\mu\text{amps}/1000 \mu\text{moles}/\text{m}^2\cdot\text{sec}$) from the Licor calibration sheet. Note that $1 \mu\text{mole}/\text{m}^2\cdot\text{sec} = 1 \mu\text{Einstein}/\text{m}^2\cdot\text{sec}$.
- **M** and **B**.
3. **Do not enter the LI-1000 Multiplier from the Licor calibration certificate as the multiplier.**
The multiplier can be used to calculate irradiance in units other than $\mu\text{Einsteins}/\text{m}^2\cdot\text{sec}$. See Application Note 11General for multiplier values for other units.
The multiplier can also be used to *scale* the data, to compare the *shape* of data sets taken at disparate light levels. For example, a multiplier of 10 would make a $10 \mu\text{Einsteins}/\text{m}^2\cdot\text{sec}$ light level plot as $100 \mu\text{Einsteins}/\text{m}^2\cdot\text{sec}$.
4. Offset may be used to *offset* the data by a constant, if field data indicates sensor drift. To calculate the offset: Enter M, B, calibration constant, and multiplier, and set offset = 0 in the configuration (.con or .xmlcon) file. With the sensor dark (covered), display the *calculated PAR output* in Seasave V7; then enter the negative of this reading as the offset in the configuration (.con or .xmlcon) file.

Application Note Revision History

Date	Description
	Initial release.
September 2001	Previously referred to SEACON in discussions of .con files. Add references to modifying .con file using Configure menu in Seasave or SBE Data Processing in Windows software.
July 2004	Update to correspond to Sea-Bird calibration certificate that is currently shipped with sensor.
June 2005	Provide output in microEinsteins/m ² sec, and refer to Application Note 11 General for conversion to other units.
May 2007	Incorporate Seasave V7, and eliminate discussion of Seasoft-DOS.
March 2008	Update to include V2 SeaCATs (16 <i>plus</i> V2, 16 <i>plus</i> -IM V2, 19 <i>plus</i> V2).
February 2010	<ul style="list-style-type: none">• Change Seasoft-Win32 to Seasoft V2.• Add information on .xmlcon files.• Update address.
October 2012	Update to include SBE 25 <i>plus</i> .