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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, or 25 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.