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Using Biospherical Instruments Surface PAR Light Sensor
with SBE 33 or SBE 36 Deck Unit

If the SBE 33 or 36 Deck Unit includes an A/D converter, it can acquire the output of a Biospherical Instruments Surface PAR sensor and integrate this into the CTD data stream (A/D converter in Deck Unit was optional prior to 2012; now standard). This application note applies to the following Surface PAR sensors (the corresponding underwater PAR sensor, mounted on the CTD or cage, is also shown):

Surface PAR Sensor	Corresponding Underwater PAR Sensor(s)	
	If underwater PAR sensor connected directly to CTD A/D voltage channel	If underwater PAR sensor: • **Connected directly to CTD PAR connector, or** • **Interfacing to PN 90310 Log Amp Module (which is connected to CTD A/D voltage channel)**
QSR-240 or QSR-2200	QSP-200L, QSP-2300L, or QSP-2350L	QSP-200(PD) or QSP-2200(PD)
QCR-240 or QCR-2200	QCP-200L, QCP-2300L, or QCP-2300L-HP	QCP-2200(PD)

Notes:
- QSR-240, QCR-240, QSP-200L, QSP-200(PD), and QCP-200L are no longer in production by Biospherical.
- See Application Note 11 QSP-L for details on the QSP-200L, QCP-200L, QSP-2300L, QSP-2350L, QCP-2300L, and QCP-2300L-HP underwater PAR sensors.
- See Application Note 11 QSP-PD for details on the QSP-200(PD), QSP-2200(PD), and QCP-2200(PD) underwater PAR sensors.

Our Seasoft V2 software fully supports the acquisition and display of the data from these surface reference PAR sensors and the corresponding underwater PAR sensor.

1. SBE 33 OR 36 DECK UNIT CONFIGURATION

A. Set up the Deck Unit to add Surface PAR voltage to the end of the CTD data stream, increasing the number of Hex data bytes by three. Setup varies, depending on the Deck Unit firmware version (refer to the Deck Unit manual).
   - **Deck Unit firmware < 3.0:** Locate the NMEA Interface PCB with optional A/D converter under the bottom cover panel of the Deck Unit. Verify that dip switch S1 position 8 is in the OFF position.
   - **Deck Unit firmware ≥ 3.0:** In Seaterm, verify that the SBE 33/36 status message on power-up shows `Surface PAR enabled`. If it does not, type @ to access the setup menu, and then type 6 and press the Enter key to enable Surface PAR acquisition.
B. Plug the cable connected to the Surface PAR sensor into the 4-pin MS connector labeled *PAR Input* on the back of the Deck Unit. A spare 4-pin MS-style connector (MS3106A14S-2P) was supplied if a cable was not provided. The Surface PAR bulkhead connector on the back of the Deck Unit is an MS3102A14S-2S.

Deck Unit	Function	Biospherical Surface PAR Sensor with Switchcraft Connector
Pin A	Signal (ground)	Pin 3
Pin B	Power (+12 volts)	Pin 4
Pin C	Power (ground) -- Deck Units with NMEA PCB Assembly 40785b/40786b or greater use Pin C. All previous versions do not use Pin C.	Pin 1
Pin D	Signal	Pin 2
-	-	Pin 5

Note: Biospherical sold the Surface PAR sensor with other connector types in the past. See the appropriate drawing for pinout details if your sensor does not have a Switchcraft connector.

2. SOFTWARE CONFIGURATION

Set up the configuration (.con or .xmlcon) file for the appropriate CTD (SBE 16/16*plus*/16*plus* V2/19/19*plus*/19*plus* V2/25/25*plus*/49). Enable the recording of the Surface PAR sensor by selecting *Surface PAR voltage added*. This alters the display by adding two additional external voltages. The highest numbered voltage is labeled **SPAR/surface irradiance**. Enter the surface light **conversion factor** and the **ratio multiplier** in the configuration file.

Note: 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).

Seasoft calculates surface light as:

   surface light (μEinsteins/m^2·sec) = volts * conversion factor

To compute the **conversion factor**, calculate the output of the Surface PAR sensor in μEinsteins/m^2·sec/volt using the data from the Surface PAR calibration sheet that was provided by Biospherical (located in the CTD manual).

   Conversion factor = Output in Air / Probe Net Response

For example, if Probe Net Response = 85.6 mV (0.0856 volts) and Output in Air = 0.01384 μEinsteins/cm^2·sec:
Conversion factor = (0.01384 μEinsteins/cm^2·sec) * (10000 cm^2·/m^2) / 0.0856 volts = 1851 μEinsteins/m^2·sec/volt

Seasoft calculates corrected PAR as:

   corrected PAR = 100 * ratio multiplier * underwater light / surface light
        (underwater light is the calculated light output from the underwater sensor)

To compare the *shape* of data sets taken at disparate light levels, the **ratio multiplier** can be used to *scale* the data. For example, a ratio multiplier of 10 would make a 100 μEinsteins/m^2·sec light level plot as 1000 μEinsteins/m^2·sec. **The ratio multiplier should be set to 1 for normal operations.**

Notes:

- **Do not enter the Conversion factor from the Biospherical calibration sheet as the Conversion factor in Seasoft.**

- To output Surface PAR in units other than μEinsteins/m^2·sec, multiply the calculated Conversion factor to obtain the desired units. See Application Note 11General to convert units.

- See Application Note 11 QSP-L or 11 QSP-PD, as applicable, for instructions on entering the underwater PAR sensor coefficients.

Application Note Revision History

Date	Description
1995	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.
October 2004	• Update with new (2003) Biospherical PAR sensor part numbers. • Update Surface PAR sensor connector information. • Expand/rewrite/reorganize text.
June 2005	Provide output in microEinsteins/m^2 sec, and refer to application note 11General for conversion to other units.
May 2007	Incorporate Seasave V7, eliminate discussion of Seasoft-DOS.
May 2008	Add applicability to V2 SeaCATs (16plus V2, 19plus V2).
March 2010	• Add information on QSP-2350L (same functioning as QSP-2300L, just a different connector) and QCP-2300L-HP (same functioning as QCP-2300L, just higher depth range), which are on current price list. • Update description of configuring SBE 33 or 36 – no dip switches in new version (3.0). • Change Seasoft-Win32 to Seasoft V2. • Add information on .xmlcon. • Update address.
October 2012	• Update for SBE 25*plus*.
February 2014	• Add applicability to SBE 49 (compatible with Seasave 7.23.2 and later). • Update to indicate that Surface PAR capability standard in SBE 33 and 36 Deck Units sold in 2012 and later.