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**APPLICATION NOTE NO. 81**

**Revised October 2010**

**Entering Calibration Coefficients for Campbell Scientific/D&A OBS-3+ Optical Backscatter Sensor**

*Note: See Application Note 16 for the OBS-3 (not +) sensor.*

The OBS-3+ measures turbidity by the optical backscatter method. A light source illuminates a water sample, and a photodetector converts the radiated light to photocurrent; the amount of photocurrent depends mainly on the area of the illuminated particles, but also on particle size, shape, and reflectivity. The signal is processed, generating an output voltage related to NTUs.

The OBS-3+ is available in 4 measurement ranges/models. Within each model, range is determined by connection to the appropriate bulkhead connector pin – pin 5 for the 1X range or pin 4 for the 4X range. A jumper cable may be purchased from Sea-Bird to allow the range to be changed by inserting the jumper cable in line with the original cable purchased. Note that by connecting to both pins 4 and 5 (using 2 A/D channels on your CTD), you could use the OBS-3+ to simultaneously monitor both the 1X and 4X ranges, which may be useful for applications where you expect to encounter both low and high turbidity.

Model	Range [NTU]	
	1X Range (pin 5)	4X Range (pin 4)
250/1000	0 - 250	0 - 1000
500/2000	0 - 500	0 - 2000
1000/4000	0 - 1000	0 - 4000
2000/4000 *	0 - 2000	0 - 4000

*\*Capable of 0 – 2000 and 0 – 8000 NTU. However, 0 – 8000 NTU is only calibrated to 0 – 4000 NTU.*

Select the *OBS, D & A OBS 3+ OBS/Nephelometer* when setting up the configuration (.con or .xmlcon) file in Sea-Bird software. The software prompts for A0, A1, and A2, and calculates turbidity as:

$$NTU = (A2 * V^2) + (A1 * V) + A0$$

where:

V = voltage from sensor (**milliVolts**)

A0, A1, and A2 = calibration coefficients from Campbell Scientific/D&A calibration sheet

*Example:* From the Campbell Scientific/D&A Calibration Certificate for a 1000/4000 NTU sensor, at 1x -

$$NTU = (8.07146 \times 10^{-6} * V^2) + (0.191247 * V) - 0.160 = (A2 * V^2) + (A1 * V) + A0$$

$$A0 = -0.160 \qquad A1 = 0.191247 \qquad A2 = 8.07146 \times 10^{-6}$$

**Notes:**

- 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).
- NTUs are relative and arbitrary units. All the NTU value means is that a particular turbidity meter responds to a particular water sample as if it contained a certain amount of the turbidity standard (by interpolation) used for its calibration. The NTU value has no relation to the physical and optical properties of the suspended particulate matter in the water sample that caused the response, unless one was establish by an independent calibration with the field material. In other words, the NTU value for a water sample will depend on the meter used, because there are not standard designs like for transmissometers, and also on the standard used for the meter’s calibration. For example, you might measure 15 NTU in a well-mixed lake with a Seapoint sensor, 19 NTU with an OBS sensor, and 11 NTU with a YSI sensor. Consult Campbell Scientific (<http://www.campbellsci.com/>) for discussions of turbidity.
- The OBS-3+ is adjusted at the factory for a nominal range and sensitivity for a given gain setting. Sensor sensitivity is dependent upon the characteristics of the particles that are being measured in the water. As a result, the sensor should be calibrated before and after use in different water types, using samples of the type of water being studied. Consult Campbell Scientific (<http://www.campbellsci.com/>) for the correct calibration procedures.

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## Application Note Revision History

Date	Description
October 2005	Initial release.
October 2005	<ul style="list-style-type: none"><li>• Add information that OBS-3+ now supported by Seasave / SBE Data Processing (version 5.37), do not need to use User Polynomial to define.</li><li>• Add information about NTU value being dependent on the meter used, with different readings from different meters.</li></ul>
May 2007	Incorporate Seasave V7; eliminate discussion of SEASOFT-DOS.
February 2010	<ul style="list-style-type: none"><li>• Add note referencing application note 16 for the older OBS-3 (not +).</li><li>• Add Campbell Scientific to title, and change reference to consult D&amp;A to Campbell Scientific instead.</li><li>• Change Seasoft-Win32 to Seasoft V2.</li><li>• Add information on .xmlcon configuration file.</li><li>• Update address.</li></ul>
October 2010	Rearranged equation to $NTU = (A2 * V^2) + (A1 * V) + A0$ instead of $NTU = A0 + (A1 * V) + (A2 * V^2)$ , to match Campbell Scientific calibration sheet and eliminate customer confusion.