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# APPLICATION NOTE NO. 72-V2 Revised April 2014

# Setting Up WET Labs ECO Sensor with Bio-Wiper™ for integration with SeaCAT*plus* V2 CTDs (SBE 16*plus* V2, 16*plus*-IM V2, 19*plus* V2)

*Notes:*
- *See Application Note 72 for integration with older SeaCATplus (16plus, 16plus-IM, 19plus).*
- ***DelayAfterSampling=** command was implemented in the SBE 16plus V2 firmware 2.5; we recommend that you update your firmware if using the CTD with a WET Labs ECO sensor.*
- ***DelayAfterSampling=** command was implemented in the SBE 19plus V2 firmware 2.5; we recommend that you update your firmware if using the CTD in moored mode with a WET Labs ECO sensor.*
- ***#iiDelayAfterSampling=** command was implemented in the SBE 16plus-IM V2 firmware 2.5.2; we recommend that you update your firmware if using the CTD with a WET Labs ECO sensor.*

This application note applies to the following models of the WET Labs ECO sensor with Bio-Wiper:
- **ECO-FLNTUS** chlorophyll and turbidity sensor
- **ECO-FLS** chlorophyll sensor
- **ECO-FLCDS** CDOM sensor

The ECO sensor can be configured to operate in Profiling or Moored mode:
- **Profiling mode** – The ECO opens the Bio-Wiper when power is applied and keeps it open continuously, even when power is removed. It samples continuously when powered, and outputs a voltage that changes as the data changes.
- **Moored mode** – The ECO opens the Bio-Wiper when power is applied, takes one or more samples, outputs voltage(s), closes the Bio-Wiper, and holds the last voltage until power is removed.

When Sea-Bird integrates the ECO with one of our CTDs, we set up the ECO to operate in the mode appropriate for the CTD. However, you may want to change the mode in the future, if:
- You purchased the ECO for use with an SBE 19*plus* V2, which can be field configured to operate in either profiling or moored mode.
- You want to use the ECO in the future with another CTD; for example, you purchased the ECO for use with an SBE 25*plus* profiling CTD and now want to use it with an SBE 16*plus* V2 moored CTD.

## Definitions

**WET Labs ECO Setup**
- $pkt is the number of packets sent by ECO per set (defines ECO sampling duration).
- $set is the number of sets of packets sent by ECO before shutting down (0 = continuous).
- $int is the interval between sets of ECO packets.

**Sea-Bird SeaCAT*plus* V2 Setup**
- **BioWiper=Y** defines that the CTD is integrated with a WET Labs sensor with Bio-Wiper; affects length of time that CTD is powered for status command (**DS** or **GetSD**), to allow time for Bio-Wiper to close.
- **NCycles=** measurements for SeaCAT*plus* V2 to average per sample (requires 0.25 sec/measurement). Applies to SBE 16*plus* V2, 16*plus*-IM V2, and moored mode for 19*plus* V2.
- **DelayBeforeSampling=** seconds to wait after applying power to auxiliary sensors and pump before sampling begins.
- **DelayAfterSampling=** seconds to wait after sampling is completed, before powering down auxiliary sensors and pump.
- **ParosIntegration=** seconds to integrate (optional) Paroscientific Digiquartz pressure sensor readings per sample. Not applicable to 19*plus* V2.

**Note:** Use the **#ii** prefix (ii = instrument ID) when sending commands to the SBE 16*plus*-IM V2 (for example, **#01BioWiper=Y** sends **BioWiper=Y** to the 16*plus*-IM V2 with ID=01).

## Changing ECO Setup (see www.wetlabs.com for details)

Connect the ECO **directly** to the computer and a 12 V power source, using the cable supplied by WET Labs. Configure the ECO using a terminal program or WET Labs' ECOView program.

The required comm port settings are: 19200 baud, 8 data bits, no parity.

| ***Configure ECO for Profiling Mode (continuous operation)*** | ***Configure ECO for Moored Mode (interval operation)*** |
|---|---|
| Send following commands:<br>!!!!!!<br>$pkt 0<br>$set 0<br>$sto | Send following commands:<br>!!!!!!<br>$pkt 1 (adjust based on CTD timing and number of ECO samples desired; see *Setting Up/Using CTD in Moored Mode*)<br>$set 1<br>$int **hhmmss** (recommended value >> SeaCAT*plus* V2 total on-time/sample. For example, send $int000500 for a 5-minute delay between sets.)<br>$sto |

*Notes:*

1. Six exclamation points (!!!!!!) accesses the ECO command set.
2. For commands that set a value for a parameter, the space between the command and the number is important. For example, make sure that there is a space between $set and 0 or 1 ($set 0 is correct; $set0 is incorrect).
3. The $sto command stores the settings in memory. If you omit this command, the ECO defaults to its last stored settings.
4. The default data rate for the ECO is approximately 1 Hz. If desired, this can be adjusted to a faster data rate for use in profiling mode. See the ECO manual for details.

After you configure the ECO for your CTD, reconnect the ECO to the CTD.

## Setting Up / Using CTD in Moored Mode

**Note:** Use the **#ii** prefix (ii = instrument ID) when sending commands to the SBE 16*plus*-IM V2 (for example, **#01BioWiper=Y** sends **BioWiper=Y** to the 16*plus*-IM V2 with ID=01).

### *Moored Mode Setup - General*

**Enabling the Bio-Wiper** command ensures that the Bio-Wiper automatically closes after sending a status command:

| Command | Description |
|---|---|
| **BioWiper=x** | **x=Y**: Configuration includes WET Labs sensor with Bio-Wiper. CTD is powered longer (total of 8 sec) for status command (**DS** or **GetSD**), providing 4 sec for Bio-Wiper to open and then shut again if in Moored mode.<br>**Note:** 4 sec for the Bio-Wiper to open and shut is sufficient for the typical application, with the ECO set up to take a single measurement for each sample. However, the ECO can be user-programmed to take and average a number of measurements for each sample; **if averaging multiple measurements, 4 sec may not provide sufficient time for the Bio-Wiper to close**. For those applications, use the **TV**, **TVR**, or **TS** command after the status command, and then wait at least 10 sec to cycle the Bio-Wiper open/close; **verify that the Bio-Wiper has closed before deploying**.<br>**x=N** (default): Configuration does not include WET Labs sensor with Bio-Wiper. |

**Delay before sampling** (**DelayBeforeSampling=**) sets the amount of time to wait after switching on external voltages before sampling. The ECO requires approximately 2 to 4 sec to provide time for the sensor to open the Bio-Wiper before sampling (sensor dependent; see WET Labs documentation). Set delay before sampling as follows:

- If $pkt is set to 1: **DelayBeforeSampling=4**
- If $pkt is set to >1: See *Moored Mode Setup when Multiple ECO samples are Desired* below.

**Delay after sampling** (**DelayAfterSampling=**) sets the amount of time to wait after sampling is completed, before turning off power to external sensors. The ECO requires approximately 2 to 4 sec to provide time to shut the Bio-Wiper after sampling is complete. Therefore, set **DelayAfterSampling=4**.

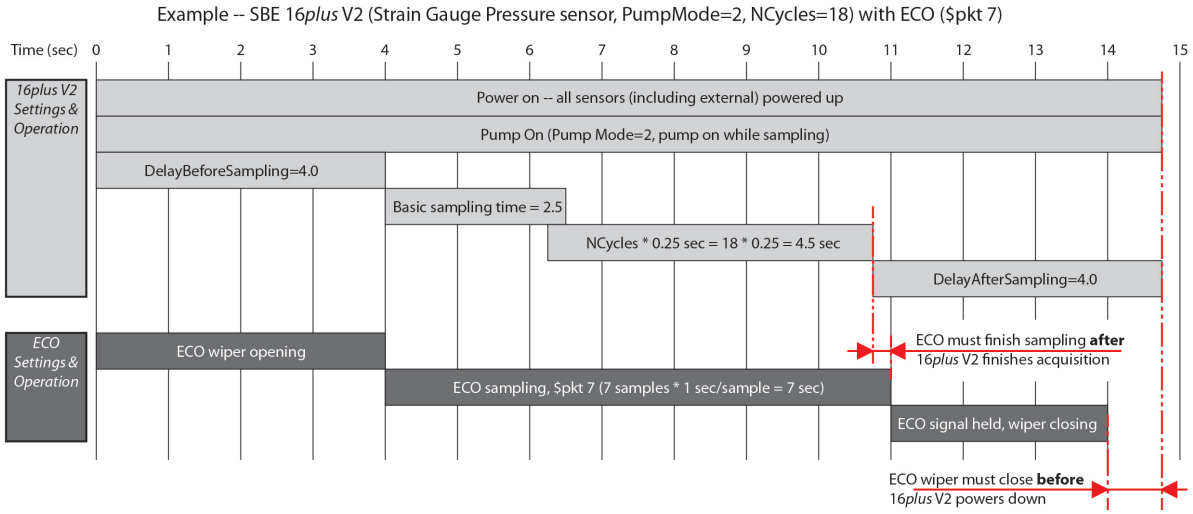
## *Moored Mode Setup when Multiple ECO samples are Desired ($pkt > 1)*

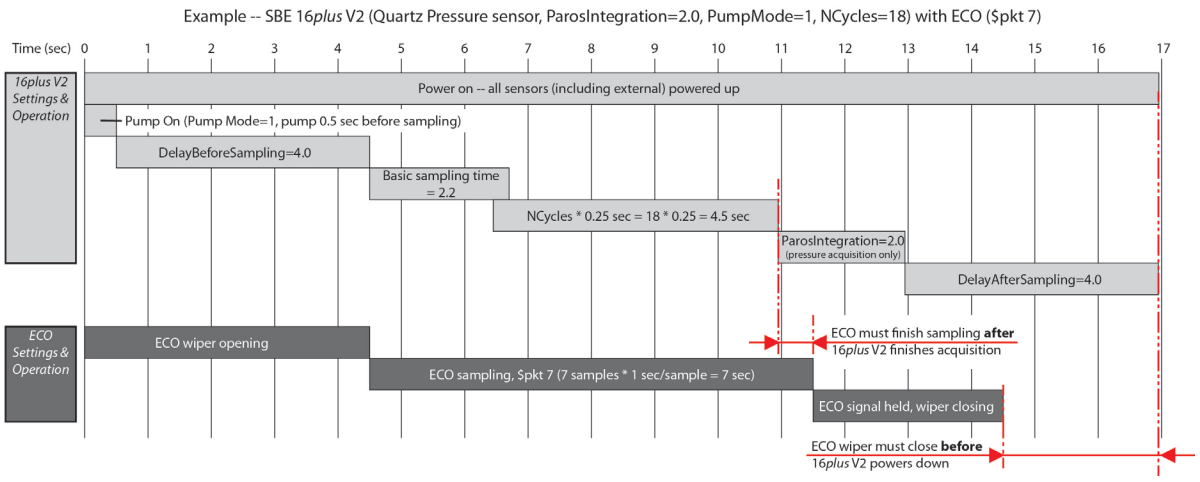
As described above, $pkt is the number of samples sent by the ECO per interval cycle (set). The ECO provides a sample at 1 Hz (1 sample /sec), and then holds the final output voltage until power is removed. The SeaCAT*plus* V2 averages all of the ECO data received during its own sampling cycle. Consequently, if the SeaCAT*plus* V2 is still sampling when the ECO has finished, the final ECO voltage (which is held until power is removed) will bias the average toward the value of the last ECO sample. Therefore, if $pkt > 1, a careful timing analysis is required to **ensure that the ECO sampling length extends beyond the end of the SeaCAT*plus* V2 acquisition**. This can be accomplished by modifying **NCycles=** (number of A/D/ acquisition cycles, each at 0.25 sec) in the SeaCAT*plus* V2.

Two examples are shown below:

- SBE 16*plus* V2 with strain-gauge pressure sensor and **PumpMode=2** (pump during sampling),
- SBE 16*plus* V2 with Quartz pressure sensor (integrated for 2 sec) and **PumpMode=1** (pump for 0.5 sec before sampling).

The examples assume that the ECO wiper takes 4 sec to open or close. If estimating shorter open/close time, increase the number of ECO samples accordingly. For example, use the setting $pkt 9 for a 2-sec wiper open/close time. For most ECOs, the wiper typically takes 2 sec to open/close in the air and at the ocean surface. The wiper motion cycle time can also be impacted by pressure at depth. If desired, determine the best $pkt value for your application. Provide a margin of safety for the wiper to close completely prior to powering down the SeaCAT*plus* V2 between samples (**DelayAfterSampling** ≥ 4 sec).



## Application Note Revision History

| Date | Description |
|---|---|
| May 2013 | Initial release of separate application note specific to V2 SeaCAT*plus*, incorporating information on sample timing and **DelayAfterSampling=** command. See Application Note 72 for earlier versions of SeaCAT*plus*. |
| April 2014 | • Update for 16*plus*-IM V2 firmware 2.5.2 that incorporated **#iiDelayAfterSampling=** command.<br>• Update settings recommendations. |