



SEA-BIRD
SCIENTIFIC

Quick Start Guide

Release Date: 08/15/2016

SBE Sea-Bird
Electronics



SeapHOx™

Satlantic SeaFET™ pH Sensor integrated with
Sea-Bird Electronics SBE 37-SMP-ODO MicroCAT
CTD + DO Recorder

Quick Start version
Firmware versions

Software version

- #002
- SeaFET v 3.6.3 and later
- MicroCAT v 2.0 and later
- SeaFETCom V 1.2.4 and later



Sea-Bird Electronics
13431 NE 20th Street
Bellevue, Washington
98005 USA

Tel: +1 425-643-9866
seabird@seabird.com
www.seabird.com

Table of Contents

Section	Page
1. Introduction	3
2. Unpacking SeapHOx	3
3. Preparing SeapHOx for Deployment	4
4. Recovering SeapHOx	5
5. Instrument Configuration (reference)	6
6. Cabling (reference)	6
7. FAQs/Troubleshooting (reference)	7

Introduction

The Sea-Bird Scientific SeapHOx™ combines a Satlantic SeaFET™ pH sensor with a Sea-Bird Electronics SBE 37SMP-ODO MicroCAT CTD+DO sensor. The SeapHOx package provides integrated data collection of pH along with temperature, salinity, and oxygen, and also allows for real-time temperature and salinity corrections of the pH measurements. The SeapHOx is intended for moored applications to 50 m depth. The SeapHOx integration approach was originally developed by Dr. Todd Martz of Scripps Institution of Oceanography.

CAUTION! The SeaFET is intended for use in seawater. Do not use it or rinse the sensing element in fresh water.

The SeaFET controls the MicroCAT to collect CTD (conductivity, temperature, pressure), and dissolved oxygen (DO) samples. **Interface with the SeapHOx is through the SeaFET**, using Satlantic's SeaFETCom software package and the SeaFET USB programming cable.

Integration with the MicroCAT is available in the following SeaFET operational modes:

- SeaFET's **periodic** mode - for stand-alone deployment
- SeaFET's **polled** mode - for logger-controlled deployment

The SeaFET periodically polls for CTD data and uses it to calculate pH, applying real-time temperature and salinity corrections to the pH data. The SeaFET stores the MicroCAT data (temperature, salinity, pressure, and oxygen) along with the pH data. Because the MicroCAT runs its pump before taking a measurement, it takes approximately 40 seconds* after a sampling event starts before the MicroCAT can output data for the SeaFET to use in the pH calculation. Therefore, SeaFET output frames will not appear at the telemetry port until 40+ seconds have elapsed. Also note that power consumption in the SeaFET is increased due to the extended time the SeaFET needs to be active for each measurement. See the *Battery Endurance* section in the SeaFET manual for an example of how integration with the MicroCAT impacts power consumption.

** Note: With a typical oxygen sensor response time of $OxTau_{20}=5.5$ seconds and pump time multiplier $OxNTau=7$, the pump time is 38.5 seconds ($OxNTau * OxTau_{20} = 7 * 5.5 = 38.5$) before each measurement. See the MicroCAT manual for details.*

Unpacking SeapHOx

The SeapHOx ships from the factory with the mounting hardware installed. Also included in the shipment:

- Lithium cells - twelve 3.6-volt AA lithium cells to power the MicroCAT, in a heat-sealed plastic bag placed in bubble wrap and a cardboard box.
Warning! Do not ship the instrument with the battery pack installed. See the MicroCAT manual for shipping details.
- SeaFET USB programming cable for interfacing with the SeapHOx
- 2.4 meter interface cable for testing MicroCAT
- Y-cable for connecting SeaFET to MicroCAT and to computer
- CD, which includes software and user manuals
- SeaFET flow cell
- SeaFET flow cell fittings

Preparing SeapHOx for Deployment

Configuration

SeaFET (see *SeaFET Deployment* in the SeaFET manual)

Use SeaFETCom to configure the SeaFET Operational Mode and other desired settings. Refer to the *CTD Settings* section in the SeaFET manual for further details.

MicroCAT (see MicroCAT manual)

1. Install the lithium cells in the cell holder; see Battery Pack Installation in the MicroCAT manual for details.
Note: Sea-Bird supplies twelve 3.6-volt AA lithium cells to power the MicroCAT, shipped with the instrument in a heat-sealed plastic bag placed in bubble wrap and a cardboard box. The empty cell holder is installed inside the MicroCAT for shipment.
2. **If necessary**, configure the MicroCAT for compatibility with the SeaFET.
Note: When delivered as part of a SeapHOx, the MicroCAT is configured at the factory for integration with the SeaFET. If you replace the MicroCAT in the field, see Instrument Configuration at the end of this document for the required MicroCAT settings, and see the MicroCAT manual for instructions on using Seaterm V2 to program the MicroCAT.

Deployment

1. Remove the yellow protective label installed over the MicroCAT intake and exhaust.
2. Verify that the Anti-Foulant Devices are installed in the MicroCAT.
3. Using a 5/32" hex driver, remove the three screws that retain the SeaFET's wet cap/flow cell (Figure 1). The wet cap filling (artificial seawater) will spill.

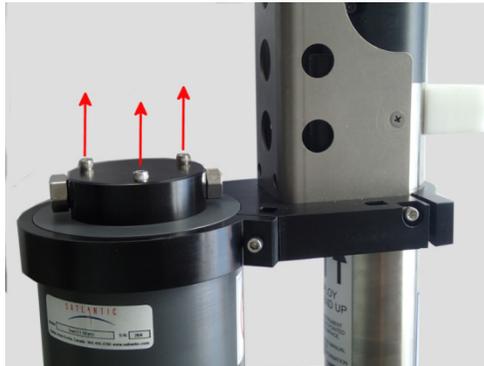


Figure 1

4. Remove the two hex plugs and install the fittings on the flow cell (Figure 2).



Figure 2

5. Re-install the flow cell, ensuring that the fitting mates with the MicroCAT conductivity cell exhaust (Figure 3).

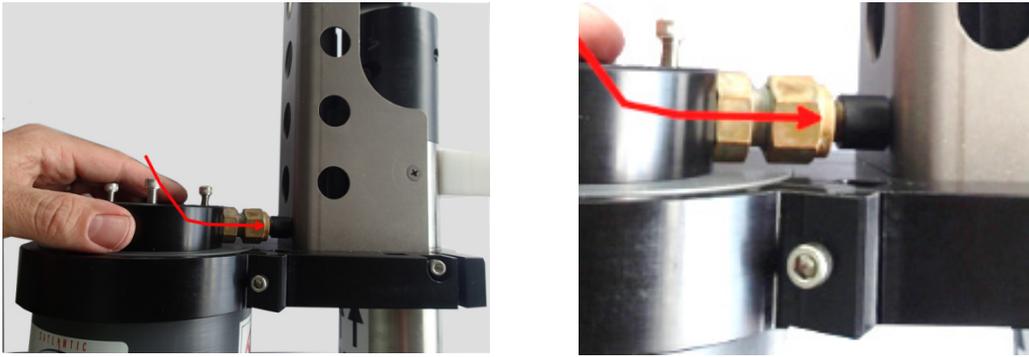


Figure 3

6. Using a 5/32" hex driver, reinstall the 3 screws in the flow cell (Figure 4).

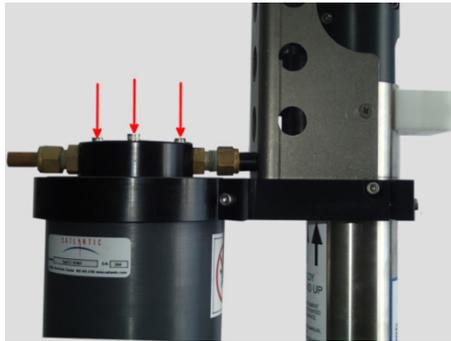


Figure 4

7. Connect the Y-cable to the MicroCAT and SeaFET. If the power/telemetry branch of the cable is not going to be used, install a dummy plug.
8. Activate the SeaFET battery pack with the magnetic switch that ships with the SeaFET toolkit. See the SeaFET manual for details.

Deployment Orientation

Sea-Bird Scientific's general recommendation is to deploy the SeapHOx so that the MicroCAT's plumbing is in an inverted U-shape (i.e., connector end down). Detailed guidelines are provided in *Optimizing Data Quality / Deployment Orientation* in the MicroCAT manual.

Recovering SeapHOx

1. If the SeapHOx is not going to be used in the short term, de-activate the SeaFET battery pack to preserve their charge.
2. Remove the SeaFET flow cell, uninstall the fittings, and reinstall the hex plug that is closest to the MicroCAT (the one shown on the right in Figure 2).
3. If needed, clean the SeaFET sensors following instructions in the SeaFET manual. **Do not expose them to fresh water.**
4. Reinstall the SeaFET wet cap/flow cell. Fill the wet cap with sterilized natural or artificial seawater. Install the second hex plug.
5. With the SeaFET sensing elements protected by the wet cap, rinse the SeapHOx with fresh water.
6. Rinse the conductivity cell with fresh water; clean and store as described in *Routine Maintenance and Calibration* in the MicroCAT manual.
7. Re-install the yellow protective label over the MicroCAT intake and exhaust, to keep dust and dirt out of the conductivity cell.

Instrument Configuration (reference)

As part of the SeapHOx integration, both the SeaFET and MicroCAT were configured and tested at the factory to ensure proper operation together. The SeaFET and MicroCAT settings are provided below for reference only (customers should not changes these settings).

SeaFET

Integration with the MicroCAT is available in the following SeaFET operational modes:

- SeaFET's **periodic** mode - for stand-alone deployment
- SeaFET's **polled** mode - for logger-controlled deployment

MicroCAT

The MicroCAT was configured to communicate with and provide data in formats that are compatible with the SeaFET. The MicroCAT pumping time was also adjusted to accommodate the transient response of the flow-cell/sensor system. The following MicroCAT settings ensure proper SeapHOx operation:

- Set baud rate for communication with SeaFET: **BaudRate=9600**
- Output data in XML format: **OutputFormat=2**
- Enable temperature output: **OutputTemp=Y**
- Set temperature units to °C: **SetTempUnits=0**
- Enable salinity output: **OutputSal=Y**
- Enable oxygen output: **OutputOx=Y**
- Set oxygen units to mg/l: **SetOxUnits=1**
- Enable pressure output: **OutputPress=Y**
- Set pressure units to dbar: **SetPressUnits=0**
- Set pumping parameters: **AdaptivePumpControl=N, OxNTau=7**
*Note: With a typical oxygen sensor response time of $OxTau20=5.5$ seconds, this results in a pump time of 38.5 seconds ($OxNTau * OxTau20 = 7 * 5.5 = 38.5$) before each measurement.*

Cabling (reference)

The SeapHOx ships from the factory with the appropriate cabling between the SeaFET and the MicroCAT. If you need to replace the cable in the field, see the pinout descriptions below.

SeaFET (MCIL-8FS)		MicroCAT (MCIL-4FS or RMG-4FS)		Computer / Controller (MCIL-8MP)	
Pin	Description	Pin	Description	Pin	Description
1	VIN (External DC Power Supply, 6 – 18 VDC)	-	-	1	External power V+
2	V-/SG (Power Supply Return / Signal Ground)	1	Ground/Common	2	Ground
3	USB V+ (USB 5V Power)	-	-	3	USB 5V
4	CTD/Pump V+ (CTD or Pump Power)	4	9-24 VDC External Power	4	-
5	TXD / D+ (RS-232 Transmit / USB D+)	-	-	5	Tx from SeapHOx
6	RXD / D- (RS-232 Receive / USB D-)	-	-	6	Rx to SeapHOx
7	CTD TXD (CTD RS-232 Transmit)	2	RS-232 Data Receive	7	-
8	CTD RXD (CTD RS-232 Receive)	3	RS-232 Data Transmit	8	-

FAQs/Troubleshooting (reference)

What is the fastest recommended sampling rate?

The fastest sampling rate the instrument package can be used at is dictated by the MicroCAT pumping time and the SeaFET response time. Combined, these times add up to more than 1 minute. Therefore, the fastest recommended sampling interval is every 2 minutes.

When should the SeaFET 'Power CTD' option be enabled?

Enabling this option could reduce substantially the SeapHOx deployment duration. It should only be enabled when the projected battery life of the MicroCAT is not sufficient for the deployment. When it is enabled, the SeaFET **must** be powered from an external power supply in addition to having its internal batteries installed.

How should the SeaFET 'Sample Delay' setting be used?

The 'Sample Delay' option allows for the pH measurement to stabilize after a new sample of water is pumped in. Based on the typically observed response time, the delay is factory set to 30 seconds. Decreasing the delay may improve deployment duration, but with a loss of accuracy. Our typical recommendation is to **not** change the delay from the factory-set value.

How can I verify that both instruments are working?

To verify that the SeaFET is correctly retrieving data from the MicroCAT, immerse the package in seawater (a bucket will suffice). Configure the package to sample every 2 minutes (Figure 5) and start sampling from SeaFETCom. Enable the CTD data visualization by clicking on 'Select Sensors' and checking the CTD variables (Figure 6). Every 2 minutes the plot should show new CTD data. CTD communication problems usually manifest as missing points in the plots. If CTD data is not displayed, check the MicroCAT and SeaFET configuration. Also, verify that the Y-cable is properly connected.

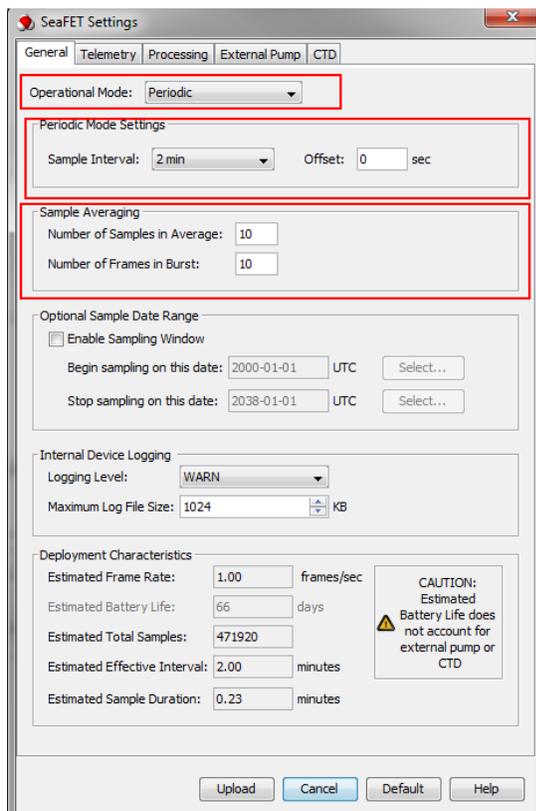


Figure 5

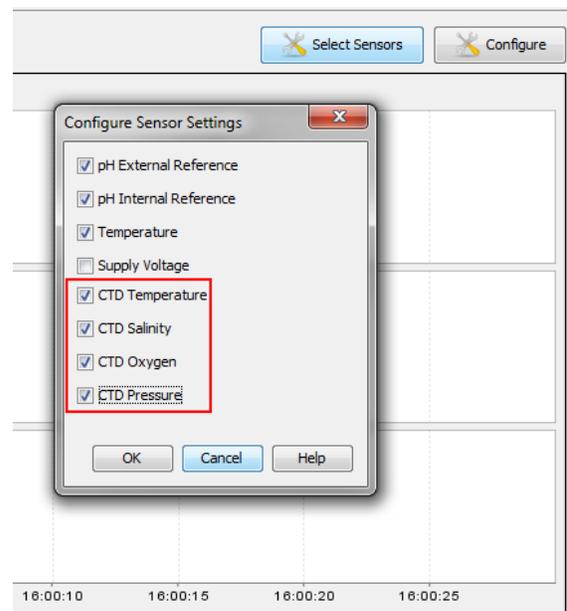


Figure 6