



Field Service Bulletin 27

October 2014

SBE 37 MicroCATs with Optical Dissolved Oxygen (ODO)

Equipment Affected

This field service bulletin applies to all SBE 37-SMP-ODO and 37-IMP-ODO MicroCATs. These instruments include an Optical Dissolved Oxygen sensor (SBE 63).

Description of Problem

Sea-Bird has recently been informed that customers working in warm waters (temperatures > 25 °C) have noted that oxygen data from the SBE 37-ODO MicroCATs may not be measuring the fully equilibrated maximum and minimum oxygen concentrations. The underreported oxygen values are due to an error in the factory default settings for using adaptive pump control.

The MicroCAT manual describes the pump time multiplier **OxNTau** as set to a factory default value of 7.0. However, MicroCATs have been recently leaving the factory with an incorrect default setting of 4.0. If the factory set **OxNTau=4** was not reset to the recommended setting of 7 before deployment, and the instrument was deployed in warm waters (temperatures > 25 °C) in a region of rapidly changing oxygen concentrations, the oxygen sensor might not have captured actual maximum and minimum oxygen values during the deployment.

If using a fixed pump time setting (adaptive pump control is disabled), **OxNTau=4** provides a pumping time of 22 sec, which is close to the minimum time required for the oxygen sensor to reach its equilibrated value. If using adaptive pump control (recommended for most applications), as the water temperature increases, the pump time becomes even shorter (~ 14 sec at 30 °C). This short period does not allow the sensor adequate response time before the oxygen measurement is made.

The setting **OxNTau=4** does not appear to have posed a problem for users using adaptive pump control at water temperatures less than 15 °C. However, for all applications, we are recommending that users check their **OxNTau** settings and reprogram that value to be 7, as recommended in the manual.

Background Information

The pump runs before and during sampling, providing flushing of the system consistent with the calibration of the oxygen sensor at our factory. If *Adaptive Pump Control* is enabled (**AdaptivePumpControl=Y**), the MicroCAT calculates the pump time before each sample as a function of the temperature and pressure of the previous sample (temperature and pressure influence the oxygen sensor time constant). **Pump time increases with increasing pressure and decreasing temperature**. The purpose of the Adaptive Pump Control algorithm is to optimize oxygen data while reducing power requirements for deployments that experience variable temperature conditions.

The *Adaptive Pump Control* algorithm and operation is summarized below.

pump time = OxNTau * tau

where

- OxNTau = pump time multiplier (**OxNTau=**)
- tau is a function of the oxygen sensor response time (**OxTau20=**) and the measured temperature and pressure of the previous sample

Based on recent customer experiences, we recommend that deployments in water temperatures exceeding 25 °C have slightly longer pumping times (> 30 sec). We will provide an additional update in the near future, with further information on this optimization.

Solutions

Look at the setting for **OxNTau=** in your MicroCAT. A portion of an example **GetCD** response is shown below (the line documenting the OxNTau value is shown in bold; it is listed as ‘nTau’):

```
GETCD
<ConfigurationData DeviceType = 'SBE37SMP-ODO-RS232' SerialNumber = '03710103'>
  <PressureInstalled>yes</PressureInstalled>
  . . . . .
  <AdaptivePumpControl>yes</AdaptivePumpControl>
  <b>nTau>7.0</b>
</ConfigurationData>
```

We make the following recommendations:

1. Set **OxNTau=7** in your SBE 37 ODO, regardless of the temperature in the deployed environment.
2. If using the adaptive pump control (**AdaptivePumpControl=Y**) as recommended in the manual, adjust **OxNTau** with consideration to pump time and estimated endurance according to *Table 1*. When working in warmer water temperatures, we recommend longer pump times (> 30 sec).
3. If not using adaptive pump control (**AdaptivePumpControl=N**), set **OxNTau=7** and **OxTau20=5.5**, which are factory defaults. This will pump the sensor for a fixed time of 38.5 sec before each sample regardless of the temperature, and should provide an estimated endurance of about 285 days.

Table 1. Examples of pump times and battery endurance for an SBE 37-SMP-ODO with pressure sensor, with RS-232 telemetry, autonomous deployment (no real-time data) at 5 dbar with a sample rate of 10 minutes, with adaptive pump control enabled (AdaptivePumpControl=Y).

Water Temperature	OxTau20	OxNTau * (see note 2)	Pump time	Estimated Battery Pack Endurance (days)
30 °C	5.5	4	14 sec (not long enough)	587
	5.5	7	25 sec	408
	5.5	9	32 sec	337
	5.5	10	36 sec	302
25 °C	5.5	7	30 sec	356
	5.5	8	34 sec	319
	5.5	9	38sec	289
18 °C	5.5	7	41 sec	271

Notes:

1. All commands shown in this Field Service Bulletin are for MicroCATs that communicate via RS-232. For RS-485 or Inductive Modem telemetry, use the #ii prefix (where ii = instrument ID).
2. The SBE Deployment Endurance Calculator used to estimate battery lifespan does not allow the user to change OxNTau (the Calculator assumes a constant value of 7). However, the response time constant OxTau20 can be varied. Values in Table 1 were estimated using ratio variations of OxTau20 in combination with OxNTau=7 to get the battery endurance values for tabulated settings and pump times.
3. The SBE Deployment Endurance Calculator assumes that adaptive pump control is enabled. If adaptive pump control is disabled (AdaptivePumpControl=N), the pump runs for OxNTau * OxTau20 (for typical values of OxNTau and OxTau20, this is 7 * 5.5 = 38.5 sec). This would be equivalent to a deployment temperature and pressure of 19 °C and 1 dbar entered in SBE Deployment Endurance.
4. The MicroCAT manual provides example calculations for hand-calculating pump time and battery pack endurance.