



## ISUS V3 Sampling Tips

### Overview

This guide is **not** intended to replace the ISUS Operation Manual. Please read and understand the ISUS Operational Manual before powering the sensor for the first time. This guide is provided to help the first time user prepare an ISUS for deployment. To learn how to begin communicating with the ISUS, please refer to the Quick Start Guide in the ISUSCom Manual.

### Tips for Mooring ISUS

To prepare your ISUS for mooring deployment:

- Ø Connect the ISUS to your computer using the USB cable
- Ø Start the ISUSCom application and wait for the Connection Mode to turn green and read "SetUp"
- Ø Click on Update Schedule, set the desired sample frequency and click "Save"
- Ø Click on ISUS Settings and change the operational mode to "SCHEDULED"
- Ø Set the Log file in Scheduled Mode to "DAILY"
- Ø Click Save; this will reboot ISUS and ensure the firmware settings are saved
- Ø Clean the probe tip with isopropanol and Q-tips
- Ø Mount ISUS on mooring in horizontal position with gap in probe tip open vertically (see below)
- Ø Install bio-fouling guard with the guard and probe tip both flooded if possible (this reduces the possibility of trapping air in the probe tip)

### Mooring Data

The main issues effecting mooring data quality are bio-fouling and sediment buildup. To mitigate the effects of these two factors, we recommend users install the anti bio-fouling guard and:

- Ø Mount the ISUS in the horizontal position with the gap in the probe tip open vertically (i.e. opening up for air to escape and opening down for sediment to sink) to reduce the possibility of sediment collection on the probe mirror. Anything that interferes with the light path may adversely affect the data.
- Ø Experiment with different mesh sizes in the anti bio-fouling guard. The standard mesh size is 100µm, but 50µm and other sizes are also available. Depending on the type of environment, users have to balance the trade offs between keeping bugs and debris out and clogging the filter and reducing water flow. In high sediment areas, some users have found using no mesh works better, since the smallest particles pass through the mesh and accumulate inside. In this case the mesh can act like a trap and keep sediment in.
- Ø In areas with robust biological activity, fouling may occur in spite of the copper ions released by the guard. In this case, we recommend a more intense sampling schedule to increase the UV radiation passing through the probe tip. Because the ISUS outputs short wavelength UV, the more you sample, the cleaner the tip will stay. The tradeoff here is that power is always an issue and the sampling schedule is always constrained by power. Keeping this in mind, users should opt for the most aggressive sampling schedule that the power budget and memory will allow.
- Ø In static areas with low water flow, various low power pumps can be used to flush the probe tip area with sample water prior to obtaining data. Flushing the probe helps reduce bio-fouling



and extend the length of useful deployments. In-line filters may also be used in conjunction with pumps, but clogging can become an issue in highly turbid waters. Users must weigh the benefits of filtering vs. the consequences of clogging.

## Tips for Profiling with ISUS

- Ø Set the ISUS operating mode to CONTINUOUS
- Ø Clean the probe tip with alcohol and Q-tips prior to each deployment
- Ø Let the ISUS warm up for 8-10 minutes prior to each cast. Normal operation of a CTD profile usually calls for surface soak of a couple of minutes to let the pumps start up and instruments equilibrate. We find we get the best results when we apply power to the ISUS 8-10 minutes prior to putting the package in the water. This provides enough time to let the lamp output stabilize.
- Ø Once a day, check instrument stability by measuring nitrate in a pure water sample (e.g. Millipore DIW) as described in the "Long-Term Drift" section below.

## Compensating for Instrument Offset

Two types of instrument offsets are possible with ISUS nitrate sensors. One is associated with a long-term drift in the instrument response caused by changes in the transmission properties in the internal optical components and the other is associated with interfering species present in the water.

### Long-Term Drift

To check your instrument for long-term drift, turn on the ISUS, let it warm up for 8-10 minutes and measure a sample of ultra-clean de-ionized water (DIW). If the nitrate reading is  $>-2$  or  $<+2$ , the instrument response has not drifted. If it has drifted, you can remove the drift by updating the reference spectrum in the cal file. This is done using the Update Calibration function in ISUSCom and a log file containing data collected from the DIW sample (can use same data logged when checking for drift). This function creates a new cal file using the original extinction coefficients and a new reference spectrum. This new cal file is then uploaded to the instrument. It is a good idea to run another DIW with the new cal file to make sure the procedure has worked. Please see the operation manual provided with the ISUSCom program for full details.

### Interfering Species

Various dissolved and particulate substances in the water can interfere with the UV spectra sampled for nitrate analysis. Particulate matter, if suspended in the water column (i.e. not settled on the probe tip), generally has the effect of increasing noise slightly with little reduction in accuracy. Because the spectral signature of many particulate sediments between 200 and 240nm is relatively flat, as long as a significant signal is still reaching the spectrometer, the results are generally good.

CDOM on the other hand does have a spectral component to its absorption curve and thus may have a greater effect on the end calculation of nitrate concentration. We are currently investigating methods of incorporating a third extinction coefficient to compensate for CDOM absorption, but have not yet obtained significant improvements. CDOM absorption is rarely an issue in the ocean, but can have an effect in fresh water systems.