

Measuring Salinity Samples during MOSAiC on board Polarstern

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In this document we describe how you prepare your salinity samples to be measured with the Optimare Precision Salinometer (OPS) and how this measurement is done. There are videos, which illustrate nicely what you need to do. You should watch at least *OPS_intro_video* and *OPS_user_interface*. Comments and feedback for improving this document are very welcome.

In case you want to know more you can go through the documents *bubbles_zitate_plus_beispiel.pdf*, *faq-ops-withpics.pdf*, *manual OPS_OM_B00.pdf*, and *why_use_salinometer_v2.pdf*.

Seawater samples contain a certain amount of gases. If water from deeper layers is brought to the surface, outgassing takes place (the solubility of gases generally decreases with increasing temperature and increases with increasing pressure). This outgassing creates micro-bubbles, which contaminate the measurement. To get the micro-bubbles out of the sample, you need to warm them slightly and release the overpressure from the bottles. Talk to the Labor-Elo first. He will show you the Salinometer room and all the instruments that you need.

It is recommended to measure several samples in one session, i.e. 10 to 20 samples in a day. The **day before you want to actually measure** the samples, you start with preparing them:

- ❑ Place the samples into the ultrasonic bath in the Salinometer room
- ❑ Fill it with warm water and heat it to 30°C
- ❑ Let the samples sit there for at least 1 hour
- ❑ Take each bottle and flip it once so that the rubber-cap is flushed. Slightly open the alu-cap and put an injection-needle through the rubber lid to release the overpressure. Do not stick the needle into the water. Mark the rubber lid with a dash and use it only until it has three holes.
- ❑ Take the needle out (to reduce evaporation), switch off the heating of the bath, and let the samples cool down. This takes several hours and can be done over night.
- ❑ Shake the bottle. This is done to overcome stratification in the bottle and to get condensed water back into the sample.



What ever you do, be very(!) careful to touch only the outside of the bottle and the outside of the lid. It will be seen in the data if you touch parts of bottle and lid that you should not touch. Contamination by grease, oil or particles is critical. So do not waist you time on producing data that cannot be used... work concentrated and clean.

Flushing the Optimare Precision Salinometer when not in use

The instrument needs to be flushed from time to time to keep everything in a good shape. When the instrument is not used daily for real measurements, fake measurements are performed for flushing. For this, the OPS is set to do 20 measurements in a row. The water that is measured, is pumped back into the same container as it was coming from, to form a closed loop. The labor-Elo starts these fake measurements once a day. If this is not the case, talk to the Labor-Elo and find out why.

If you want to set the Salinometer to be flushed:

- ❑ Close the pumping loop by putting the wastewater tube into the container where the water is pumped out off.
- ❑ Cover the container with Parafilm so that evaporation is reduced and nothing can fall into the bottle (particles, dust).
- ❑ Go to Main Menu -> Options -> turn up the measurements to 20
- ❑ Start a new sample and let the instrument run
- ❑ Next day you start a new sample, again the next day,... and so on

The instrument is in a good shape, if the measurements are smooth and slightly increasing (this is due to evaporation through the tube walls inside the OPS)

Measuring with the Optimare Precision Salinometer

Start a new protocol for each measurement.

Main Menu -> Header -> New Protocol

1. Go to Main Menu -> Options -> turn measurements down to 3 again
2. Start with standardising the Salinometer using standard Seawater. Use a new bottle of standard Seawater for each measurement session (which is why you should measure 10 to 20 samples in a row).
 - a. Go to Main Menu -> Standardising -> type in the Batch number and the K15 value -> start the Standardising -> save and use the value.
 - b. Close the bottle with the original(!) rubber lid and keep it for the end of the session.
3. Shake each sample bottle vigorously before the measurement to overcome potential stratification. Wait about 3-5 minutes in order to allow gas makro-bubbles to leave the liquid. There is a shaker on board now. I never used it so get the introduction on how to use it from the Labor-Elo.
4. If your sample is ready, go to Main Menu -> Measurement -> New Measurement
The pump-intake will lift up, so that you can put the sample in. Clean the intake using a fuzz-free paper wipe.
5. Check the sample for impurities. If a sample is contaminated, do not measure it. It will contaminate the Salinometer and it is difficult to clean it.
6. Open the bottle, place it under the pump intake and start the measurement
7. Proceed like this for all salinity samples
8. At the end of a session use the standard Seawater that you used for standardising the salinometer and measure it again. The value is allowed to increase slightly (less than 1/1000), but not to decrease. If the value decreased, there might have been some contamination. In that case contact the labor-elo and solve the issue together. If you cannot resolve the issue, contact Gereon.Budeus@awi.de and Sandra.tippenhauer@awi.de.
9. Keep the leftovers of the standard Seawater for flushing the salinometer and the CTD-sensors. If you are not using the Salinometers for more than a day, put it back to the state described above **Flushing the Optimare Precision Salinometer when not in use.**

10. Copy the protocol (long and short) from the salinometer to an USB-stick and upload it to the public server. Also save them on your computer and send them to Gereon.Budeus@awi.de and Sandra.tippenhauer@awi.de at the end of your leg or when you are back home.

Comments:

- ❑ If a measurement looks strange, repeat it. In worst case, use all of the water in the bottle. But stop the measurement before the bottle it is empty.
- ❑ If you have strange measurements you most likely have air or dirt in the system. The solution is pumping. Go to Main Menu -> Actions -> Rinse. If necessary use clean Seawater or Standard Seawater leftovers for rinsing. It is helpful to make many measurements in a closed loop setup (similar to 'Flushing when not in use') until values are reasonable. If you have stable, slightly increasing salinity readings, continue the measurement of your sample.
- ❑ Write a protocol and start a new protocol for each session.
- ❑ A normal measurement consist of 1 x flushing, 3 x blind measurements, 3 x measurements.
- ❑ The green vertical bar in the *Advanced* -> *Salinity* tab marks the beginning of a registered measurement time interval, the red one marks its end.
- ❑ If the small indicator near the bottom of the screen turns red, do not work. This means that the temperature drift is too high (pre or main bath). Wait some minutes. If it does not go back to normal, talk to the Labor-Elo and contact Gereon.Budeus@awi.de and Sandra.tippenhauer@awi.de.
- ❑ Measure the samples every 2 to 3 weeks if possible. In this way you make sure to realize, if your sensors on the CTD have issues.

Bottle handling:

After you measured the salinity samples:

- ❑ empty the bottles
- ❑ rinse them 2 x with fresh water
- ❑ rinse them 1x with distilled water (milli-Q)
- ❑ strike out remaining water drops
- ❑ let them dry
- ❑ keep bottles dry and clean (i.e. apply rubber lid and avoid condensation inside)
- ❑ store them in grey plastic boxes in the salinometer room

If this is for some (good) reason not possible

- ❑ store them with the rest of the sample water inside

In case the bottles are dirty, clean them with Triton X. You may want to talk to someone about where to dispose the Triton X dirt water.

Bottles info:

Bottles are made from hydrolyse class 1 glass quality to minimize exchange between glass and sample water.

Stoppers are butyl and secured by aluminium crimp caps