

Timbers protocol for the LISST-200X: settings & deployment

This protocol is largely based on the LISST- 200X User Manual (vs1.3B), information from Sequoia Scientific Inc. (website), personal communication with Sequoia Scientific Inc. (Chuck Pottsmith, David Dana) and advice from wide range of experts (Heidi Dierssen, Karline Soetaert, Dieter Vansteenwegen, Jeroen Vercruysse) and papers. For the preparation of this protocol, the LISST-200X (SN2028 and SN2029) from the Flanders Marine Institute in Ostend, was used. For more information regarding this protocol, contact Nore Praet.

1. Pre-campaign checks

Step 1: Check for clean windows

- Check the optical windows (**receive** or large and the **transmit** or small window) to make sure that they are **clean**.
- The best way to check the windows is by using a **flashlight**. By shining light from one side and viewing from the other the surface of the windows can be easily checked for cleanliness.



- **Cleaning:** “Treat the windows as you would an expensive camera lens”. Use lukewarm water, a mild soap solution or soft cloths or glass cleaners. Do not use strong solvents.

Step 2: Attach communication and power cable

- Use the **Communications Cable** (i.e. 3-meter cable with the USB connector on one end and the 5-pin underwater connector on the other)

Step 3: Install Background Test Chamber

- Check windows for cleanliness
- The instrument should be placed horizontally on the supplied white plastic supports
- Slip the one-piece chamber between the optical windows of the instrument such that the space between the windows can be filled with water for testing or calibration.



Fill chamber with (clean, particle-free) water, **optical quality filtered Milli-Q water (18.2°)** is ideal.

- ➔ Reflush the chamber multiple times to remove particles
- ➔ Let the water stand for a while to remove bubbles (and to stabilize temperature)

Step 4: Install/Start LISST-SOP200X Software

Step 5: Establish Communication between PC and LISST200X

- The LISST-200X does **not** have an **internal battery**
 - ➔ When using the USB cable, no other power source is required
 - ➔ When using an external battery, the serial communication passes through the battery pack. However, the power from the USB is not used to power the instrument. Power will be drawn from the battery only.

- **Open a communication port with the instrument**

< Communication- Connect >



- **Wake up the instrument**

< LISST- Wake Up LISST >



Step 6: Background measurement

- **General guideline:** The lower the background values, the better the background. The goal is to get values that are at the same values as factory line. However, as the instrument is used, the background may increase due to small scratches and slight alignment changes. It may not be possible to get the background down to the original factory values.

- **Collect Background:**

Before measurement:

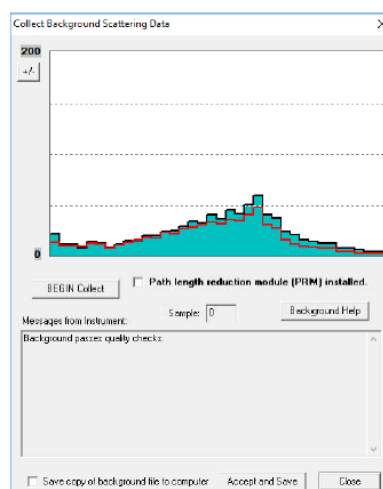
- Check if the test chamber is still completely filled with water (this may leak)
- Be sure to remove any bubbles from the windows before acquiring a background. Use a squirt bottle or pipette to blow the bubbles off the window.

< LISST- Collect Background Scatter Data >



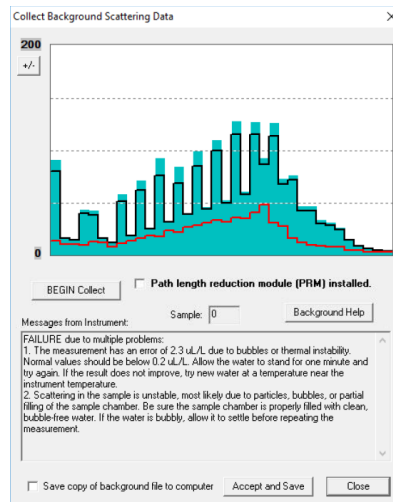
The factory background file will be automatically acquired from the instrument and displayed as a red line on the screen.

- ➔ When the *BEGIN Collect* button is pressed 20 samples will be displayed on the screen as they are acquired.
- ➔ The graph shows the value of the 36 light scattering detectors. The red line is the factory values, the black line is the current measurement and the solid bars are the average of all 20 measurements.
- ➔ If the background is close to factory levels the message displayed will indicate a pass or acceptable background.



⇒ Accept and Save

- ➔ If the water or windows are not clean and/or there is a problem with the instrument error messages and suggestions will appear:



- ⇒ After performing the suggested actions: update the background by pressing the *BEGIN Collect* button again.

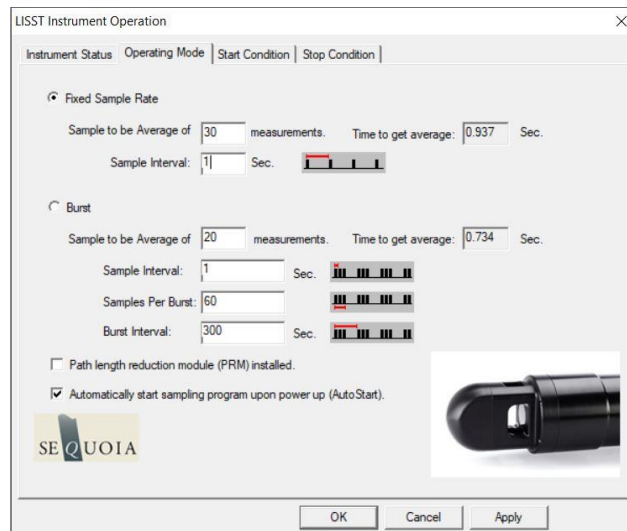
- If the values are acceptable the values can be **saved** both onboard the instrument and to a file on your computer.
- 'Save copy of background to computer' (optional)
 - ➔ Store and compare these files over time for Timbers Project
 - ➔ Give name: 'Lisst 2028 background Date'

Step 7: Configuring Sampling Program

< LISST- Configure Sampling Program >



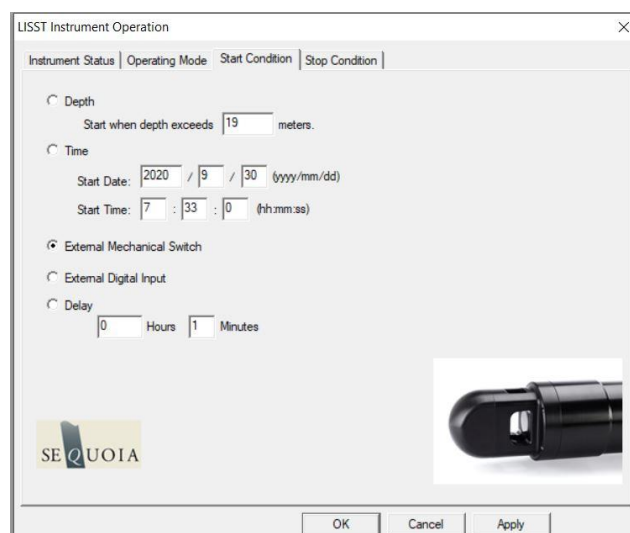
- The **LISST Instrument Operation window** has four tabs: Instrument Status, Operating Mode, Start Condition, and Stop Condition.
- **Operating Mode:**



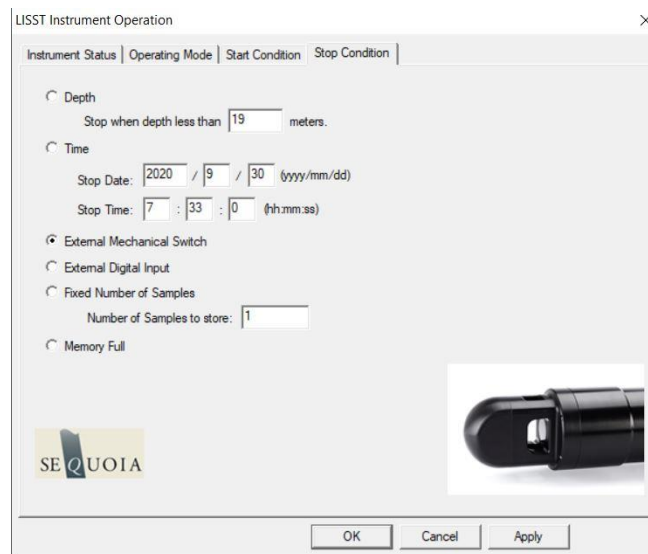
- The type of sampling for profiles: **Fixed Sample Rate**
- Sample to be average of: (default) 10 / (Timbers) **30**
- Sample Interval: **1 Sec.**
- Time to get average: **0.937 Sec.**

Note: The software automatically checks the values entered to make sure that there is no conflict. For example, when a 'Sample to be Average of' value is entered, the minimum sample interval is computed. If this value is less than the minimum permitted the value will be changed to the minimum and the text will turn red.

- **Uncheck PRM check box** (default)
 - **Check AutoStart** check box is selected: the LISST-200X will start the sampling program when power is applied to the instrument.
- **Start Condition: External Mechanical Switch**



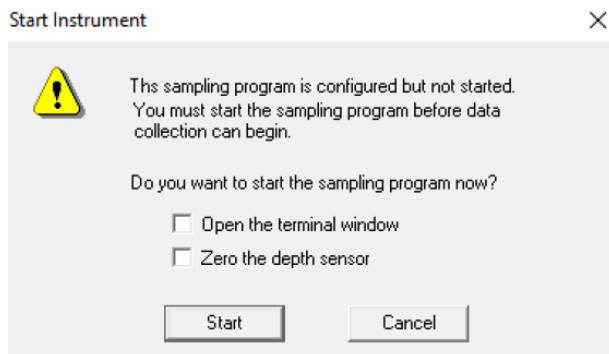
- **Stop Condition: External Mechanical Switch**



- **Apply all settings**
 - ➔ “APPLY”: This will transfer the settings to the instrument.
 - ➔ Check Status Bar (bottom main window): It may take several seconds to configure the sampling parameters on the LISST-200X.
 - ➔ The status bar will return to ‘Ready’ when the process is completed
- Go back to **Instrument Status Tab**
 - ➔ Check if Summary of the selected settings is correct
 - ➔ These settings can be saved in a LISST Operation Procedure (LOP) File for later use by “Save Configuration as “.LOP File” (not really necessary for Timbers project).
- **Complete Configuration: “OK”**

Step 8: Start the instrument

<LISST-Start Sampling Program>



- Check **“Zero the depth sensor”** (ideally on the day of the measurement)
- **“START”**: the sampling program that you configured will start
 - ➔ LED double blinks every few seconds to indicate that the instrument is running but not yet sampling

Notes:

- Starting the instrument sampling program is NOT the same as starting sampling
- If you checked **“AutoStart”**: the sampling program starts when it receives power

Step 9: Disconnect the instrument

Disconnect Communications Cable and install cap on 5-pin connector.

2. Deployment

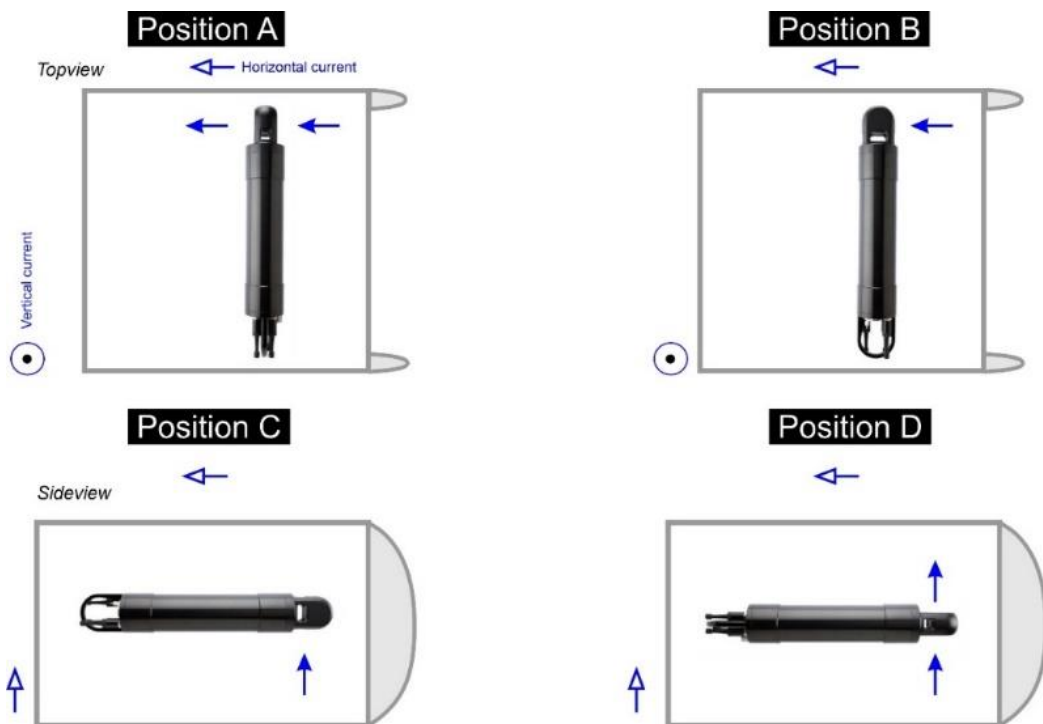
2.1 Mounting

For the Timbers project **vertical profiles** of the water column will be taken. Hence, the LISST-200X will be mounted on the (VPR) frame.



- **In-water orientation**

The LISST was oriented to not obstruct the horizontal water current, which would create unwanted bubbles and vortexes in the measurement chamber (**position A**) for the Timbers project. Furthermore, it is also reasonable that the water flow is as unobstructed as possible through the optics end of the instrument, so ideally no other instruments or wires are positioned in the immediate surroundings of the measuring chamber.



- **Battery pack**

For the Timbers project: use the **Small External Battery Pack**, which lasts approx. 12 hours.

Note: In order to make sure that the batteries are not empty by the start of the campaign, put the batteries only in the package at start of campaign. Then establish connection battery and LISST. Moreover, don't tighten the thumb screws too much.

- **Electrical Isolation**

When mounting the instrument, it is paramount that the instrument is electrically isolated from all other metal, because contact with other metal can greatly increase the rate of corrosion. This can be achieved by putting rubber or plastic between LISST and other metal (frame, jubilee clips, clamps, ...). Furthermore, a zinc anode is attached to the Connector endcap to reduce the corrosion of the aluminum parts, however, this anode is only effective when it is exposed to the water.

2.2 Profile casting

- **Start sampling**

First check if instrument is receiving power from battery or CTD (the LED of the instrument blinks). Then move the white plastic lever to the "1" position. Sampling will start and the LED will start to blink with the same rate as the sampling rate (e.g. every 1 sec.).

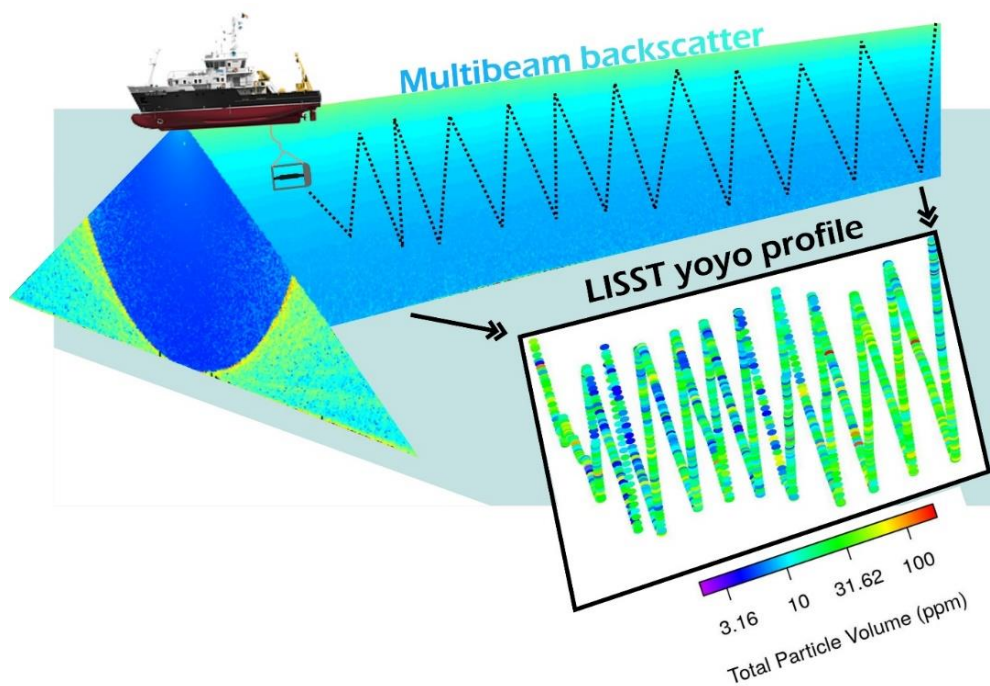
- **Thermal adjustment**

Before casting starts, let the instrument hang in the water for a few minutes at a few meters depth, then pull it up to the water surface and start the downcast.

- **YOYO casting**

For the Timbers project, in which we simultaneously collect multibeam and in-situ sensor data, it is recommended to take LISST measurements while the boat is **sailing**, as this will be the easiest procedure to collocate and compare data from all sensors afterwards, especially in dynamic natural waters. Furthermore, this strategy is also the best regarding minimizing acoustic artefacts.

For the Timbers project, we use the following procedure: the frame is lowered until a few meters above the bottom and then pulled back up (same low speed: ~ 0.2 m/s) whilst the ship is moving at lowest speed possible (< 3 knts). As a result, the LISST frame makes an undulating “Yoyo” movement through the water column. Both **up- and downcast** data is thus used.



This procedure allows for a good correlation with the multibeam data (same time). However, this measuring approach is not standard and the results significantly differ from the normal vertical deployment. Furthermore, an offset between the sensor data and the boat needs to be considered.

- **Profiling speed**

In the Timbers project we use the lowest (descent/ascent) rate that is possible for the winch on the RV Simon Stevin, i.e. around **0.2 m/s**.

- **Sailing speed**

During the Timbers campaigns, we try to limit the speed below **3 knts** (and ideally 2 knts). However, this is not always possible due to strong currents and/or winds.

- **Stop sampling**

LISST measurements are stopped when the white plastic lever is manually switched to the “0” position. Then the LED will still blink but not with the same rate as the sampling rate (1 Sec.)

3. After deployment

- **Cleaning**

- Thoroughly clean and rinse **instrument** with fresh water and allow to dry before storing.
- Clean the **optical windows**. As the condition of the windows is critical to the performance of the LISST-200X, care must be taken when cleaning those windows.

- **Batteries**

- When using the **Large External Battery Pack**, remove dead alkaline batteries from the case. It is possible to store fresh alkaline batteries in the Large External Battery Case without loss of capacity.
- When using the **Small External Battery Pack**, remove NiMH batteries from the case. The batteries should not be left in the case during storage. It is advised to always fully charge NiMH batteries before storage for maximum life.

- **Storage**

The LISST-200X is a sensitive instrument. Hence the instrument should always be stored in its shipping case, when not in use.