RUSKIN
USER GUIDE

RBR*solo*³ RBR*duet*³

rbr-global.com

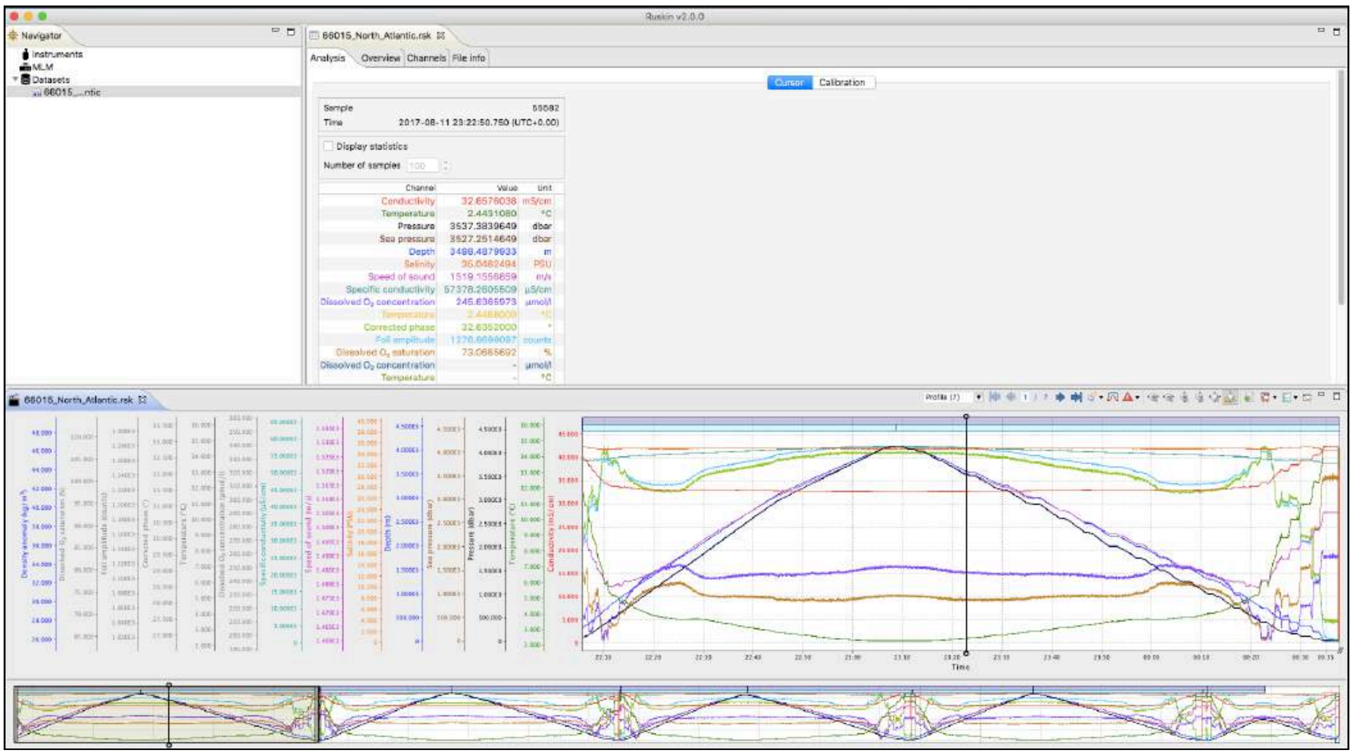
1 Table of Contents

2 Ruskin

Ruskin is the RBR software that manages your RBR loggers to provide all the data necessary to do your work. Ruskin provides a graphical user interface that makes using the loggers easy. You can use Ruskin to do the following:

- Configure, schedule, and enable multiple loggers.
- Download data after logging.
- View data sets graphically.
- Export data in various formats.
- Change the calibration coefficients for your logger.

Ruskin can be used on PC and Mac.



3 Revision history

Revision No.	Release Date	Notes
1.0	01-Sep-2012	Original
2.0	01-Oct-2014	Adding RBR*solo* D and DO and RBR*duet* support
B	12-Sept-2017	Final revision for compact loggers
D	12-Dec-2018	Updated installation details, screenshots, added auto-deploy features
E	13-Mar-2019	Updated plotting information, firmware upgrades, and screenshots
F	06-Jun-2019	Updated introduction, and screenshots
G	04-May-2020	Updated screenshots, RBRcoda T.ODO customer calibration, and removal of Logger hardware
H	18-Aug-2020	Updated firmware upgrade procedure, added annotation collapsing/expanding, and GPS plotting

CE

4 Warranty statement

All data loggers manufactured by RBR are warranted against defects in workmanship or original parts and materials for one year. Third party sensors (not manufactured by RBR) are limited to the warranty provided by the original manufacturer.

Units suffering from such defects will be repaired or replaced at the discretion of RBR, provided that the problem has appeared during normal use of the instrument for the purpose intended by us. The liability of extends only to the replacement cost of the instrument. The customer will bear all costs of shipment to us for repair; all other costs, including return shipment, will be borne by RBR.

This warranty does not cover consumables or normal wear and tear, nor does it cover damage caused by negligent use or mishandling. Attempted modification or repair of any unit without the prior consent of RBR will immediately void any warranty in force.

Users are expected to maintain a regular program of calibration.

We reserve the right to grant or refuse warranty repairs at our discretion if we consider that there are reasonable grounds for doing so.

5 Introduction

This document introduces you to Ruskin and helps you to use it effectively from the start. It is specifically written for the RBR*solo*^{3} and RBR*duet*^{3} loggers - our smallest one and two channel loggers.

You can access the Ruskin User Guide on the USB data stick provided when you purchase a logger, from the Help menu in Ruskin, and on the RBR web site, at www.rbr-global.com.

Release notes are automatically displayed each time you install an updated version of Ruskin. The most recent release notes are also available from the Help menu in Ruskin. For information about operating and maintaining your data logger, see the Logger Hardware section. It helps explain how to change the battery and change desiccant, including other useful information, such as inspecting and replacing O-rings.

6 Installation

6.1 Install Ruskin on a PC

You can install Ruskin on a PC that runs the Windows 7, 8, 8.1, or 10 operating system.

The minimum requirements for Ruskin are:

- OS = Windows 7
- Processor speed = 1.4GHz
- RAM required = 2GB
- Display resolution = 1024x768 recommended
- HDD space for installation = 500MB

Steps

1. Connect the data stick included with your instrument to a USB port.
2. Navigate to the folder Ruskin Installation and double click on the file `RuskinSetup.exe`.
3. Follow the installation wizard. By default, Ruskin will be installed to `C:\RBR`.
4. The logger uses a USB interface to communicate with Ruskin.
   At the end of the installation, a prompt will appear asking, "Would you like to install the logger driver at this time?"
5. Click **Yes** to install the drivers.

> ⚠ You may need to run the setup application as an administrator to install the driver correctly.

A shortcut to Ruskin appears on the desktop and in a **Start** menu folder called Ruskin.

> ⚠ Please note that the most recent version of Ruskin can be found at https://rbr-global.com/products/software

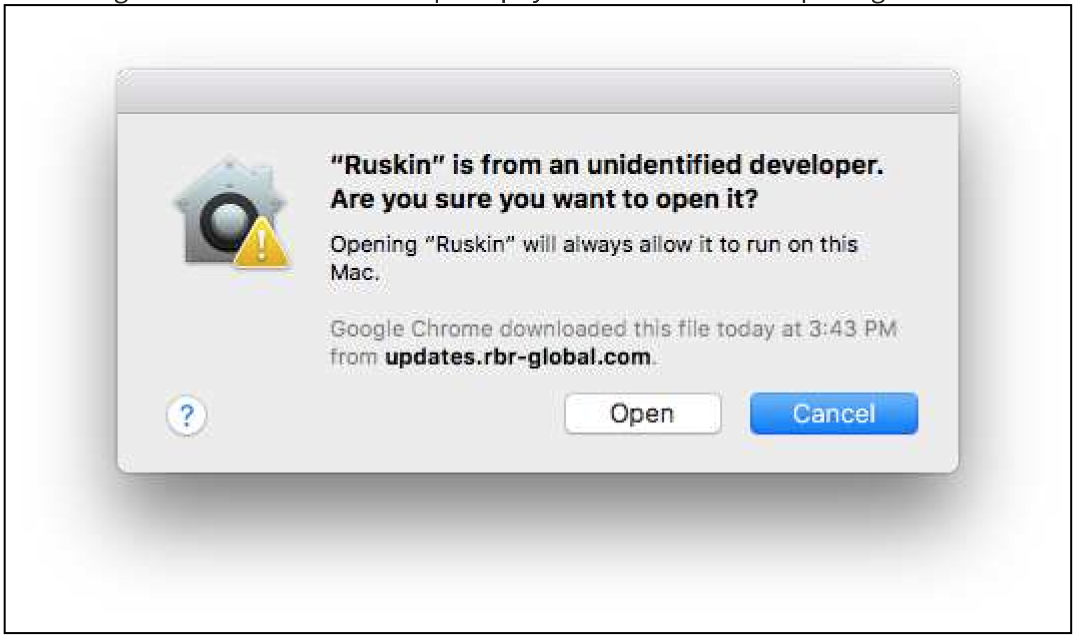
6.2 Install Ruskin on a Mac

You can install Ruskin on a Mac running OS X 10.12 (Sierra) or later.

Steps

1. Connect the data stick included with your instrument to a USB port.
2. Navigate to the folder OSX and double click on the file `Ruskin.dmg`.
3. When the disk image window opens, drag the Ruskin icon into the applications directory and wait for the copy to complete.
4. To open Ruskin for the first time navigate to your applications directory, locate Ruskin, right click on the icon, and select **Open**.

5. The dialogue box shown below will prompt you to authorize the opening of Ruskin.



It may be required that you navigate to **System Preferences** > **Security & privacy** to allow apps downloaded from "**Anywhere**" to complete the installation.

Although you can specify a different folder for the working directory for the software, we recommend that you use the default **Applications** folder.

An application named Ruskin appears in the **Applications** folder.

You may want to drag the Ruskin.app application to the **Dock**.

6.3 Update Ruskin

To take advantage of new features and bug fixes, ensure that you are using the most recent version of Ruskin.

It is not necessary to uninstall an older version of Ruskin before installing a newer version. The installation program deletes the older files before installing the newer ones. It does not delete any Ruskin data files or log files.

The most recent version of Ruskin is always available on the RBR website (www.rbr-global.com). However, if you already have an older version of Ruskin installed, Ruskin automatically notifies you that a newer version is available when you start Ruskin. You can check to see if a new version is available from within Ruskin navigating to the menu **Hel p** > **Check for updates**. If you have a broadband connection, we recommend that you follow the installation instructions that appear on your computer. Otherwise, request a USB stick from RBR.

If you do not have a broadband connection and/or are unable to install the Ruskin updates, update notifications are available via email. To receive these notifications, send an email to: support@rbr-global.com subject: "Ruskin update request".

6.4 Uninstall Ruskin

If you no longer need to manage RBR instruments from your computer, you can uninstall Ruskin.

> ⚠ Removing Ruskin will not delete your data files or your diagnostic logs.

It is not necessary to uninstall an older version of Ruskin before installing a newer version. The installation program deletes the older files before installing the newer ones. For more information, see Update Ruskin.

Windows 7, 8, 8.1, or 10

Go to **Start** > **Control Panel** > **Programs**, and under **Programs and Features**, click **Uninstall a program**. In the list, locate **Ruskin** – click **Ruskin** to highlight it, and then click **Uninstall**.

OS X 10.5 or later

Move the Ruskin application from **Applications** to the **Trash**.

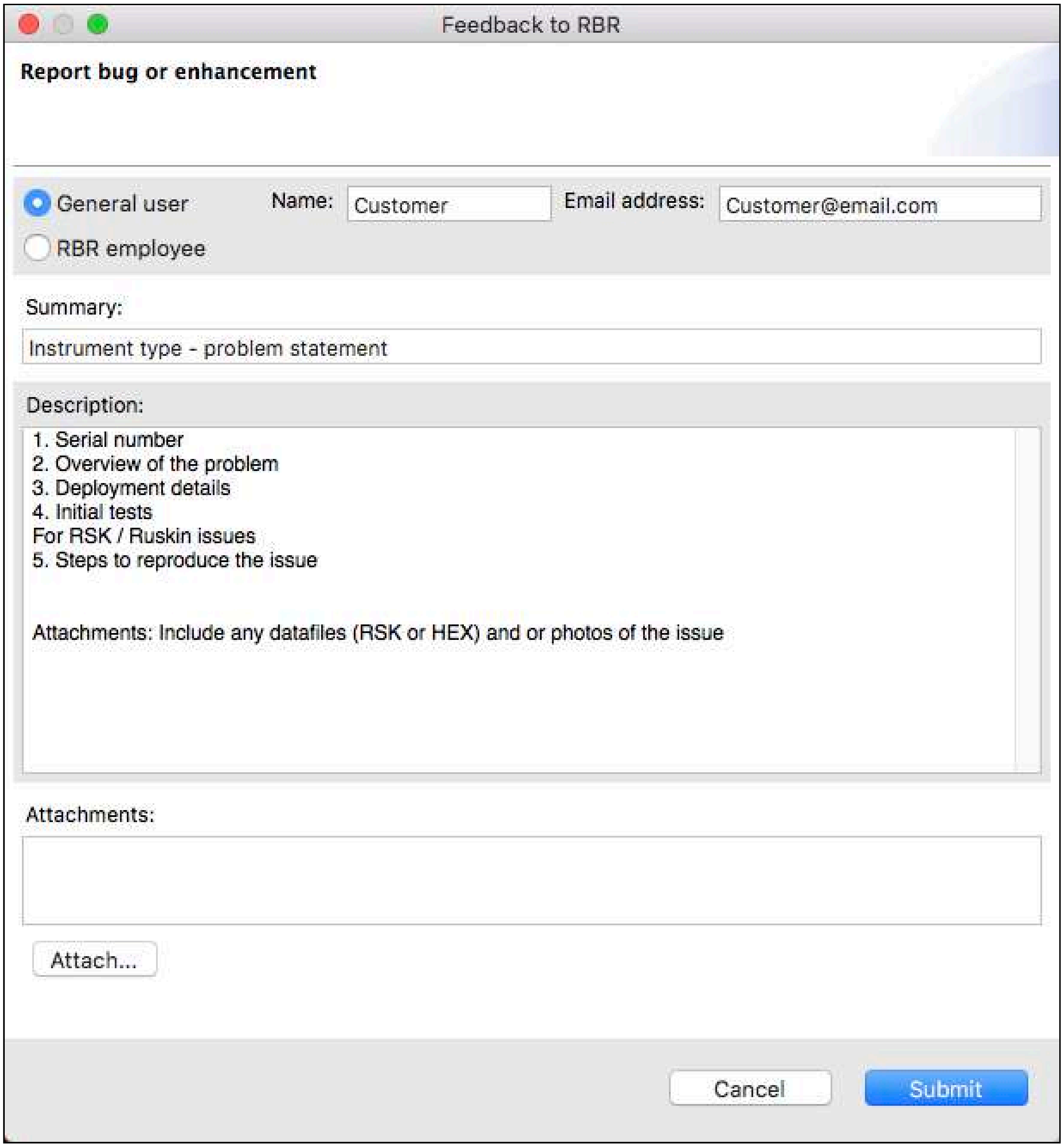
7 Provide your feedback

You can get in touch with RBR in several different ways:

- Send us an email. For a technical question, write to support@rbr-global.com. For general inquiries, use info@rbr-global.com.
- Send us a bug report from within Ruskin itself. Use the **Help** menu > **Comment on Ruskin**.
  This allows you to include the diagnostic logs, and any other files (RSK datasets, screenshots) that will help us reproduce the problem and help you as quickly as possible.

Steps

1. From the **Help** menu, click **Comment on Ruskin**.
   The Feedback to RBR dialog box appears.
2. Enter your identification information, for example, email address and name, and then summarize your comments.
3. Provide a detailed description and add any attachments, if required.
4. Click **Submit** to submit the report.


Feedback to RBR
Report bug or enhancement
General user
RBR employee
Name:
Customer
Email address:
Customer@email.com
Summary:
Instrument type - problem statement
Description:
1. Serial number
2. Overview of the problem
3. Deployment details
4. Initial tests
For RSK / Ruskin issues
5. Steps to reproduce the issue
Attachments: Include any datafiles (RSK or HEX) and or photos of the issue
Attachments:
Attach...
Cancel
Submit

8 Quick start

8.1 Deploy an instrument

Before you begin using your RBR loggers, you may want to experiment with the simulated loggers that are included in Ruskin. For instructions on simulating a logger, see Simulating an RBRsolo/duet.

When you are ready to use your own RBR loggers, we recommend that you follow the following steps to ensure that you measure exactly what you want on the first attempt.

Steps

- To establish communication between the RBR*solo*[3] or RBR*duet*[3] and a computer, open the instrument (see 'Opening and closing the logger' in the RBR instrument guide for more details) and remove the housing. There is a USB-C connector located on the back side of the logger. The supplied interface USB-C cable is plugged into this connector and the other end is attached to the USB port on your computer.
- The logger should appear in the **Navigator** view after a few seconds.
- If you are using the logger for the first time, you can use either the default preferences or specify your preferences to apply to all your loggers. For more information, see Preferences. You can change these preferences at any time.
- Click the logger that you want to use. Ensure that it contains the sensors you expect to find on the logger by viewing the **Information** tab in the **Properties** view on the right side of the Ruskin window. For more information, see View information about a logger.

If you want to see live data sampled every few seconds but not saved, select the fetching ( ) button in the toolbar located above the **Plot** view. The **Plot** view is located at the bottom of the Ruskin window.

> You must specify your preferences regarding these features before you enable the schedule. For more information, see Configure a logger.

- If you want to view or modify calibration coefficients, click the **Calibration** tab. For more information, see Calibration tab.
- Click the **Configuration** tab > **Sampling** section to schedule the logger to take samples when and as often as you want within the limits of your logger.
  For more information, see Scheduling a RBRsolo/duet.

Ruskin prevents you from enabling a schedule that exceeds the memory capacity of the logger. Ruskin also shows the estimated battery usage required to use your logger as scheduled. You should seriously consider this information before you enable the schedule.

- If you want to download data, click the **Download** button from the **Configuration** tab to download all the data saved since your schedule was enabled. For more information, see Download. The focus changes to the new dataset in the **Navigator** view, and the static data appears in the **Plot** view. You can now export the downloaded data to a file in Excel or text. You can also save the image as a PDF or PNG file for viewing outside Ruskin.

8.2 Batteries

RBR dataloggers can use most chemistries of AA battery.

We estimate the deployment time based on a capacity calculated from the nominal voltage and miliamp hours (mAh)

Name	Chemistry	Model	Voltage (V)	mAh
Lithium thionyl chloride	$LiSOCL_2$	Tadiran TL-4903S	3.7	2400
Lithium	$Li\text{-}FeS_2$	Energizer L91AA	1.5	3500
Alkaline	$Zn\text{-}MnO_2$	Rayovac AL-AA	1.5	2500
Li-ion	LiNiMnCo	BatterySpace LC14500	3.6	750
NiMH	NiMH	Duracell DX1500B4N	1.2	2400

Lithium thionyl chloride batteries are only recommended for T, D, T.D, and C.T.D instruments. Sensors with high in rush current will not work correctly on this type of battery.

The different chemistries affect the deployment time, so ensure you have selected the appropriate battery chemistry in the power section of the **configuration** tab when using the autonomy engine to get the most accurate deployment estimate.

Mixing batteries of different chemistries, brands, and age will reduce performance and potentially damage the instrument. Batteries that are not matched properly can become overheated, causing them to leak and potentially explode.

8.3 Simulating an RBRsolo/duet

Ruskin can simulate most logger types that RBR produces, including the RBR*solo*[3] and RBR*duet*[3]. We recommend that you experiment with your type of simulated logger before enabling a schedule for your actual RBR logger. This practice will probably save you time in the long run by ensuring you are familiar with the options available.

Steps

1. From the **Instruments** menu, click **Simulate instrument**. The Configure Simulated Instrument dialog box appears.
2. Under Logger type, select the **Compact Instruments** tab and select the appropriate options.
3. Click **OK**. The simulated logger appears under Instruments in the **Navigator** window.
4. Click the new simulated logger. You can work with this logger the same way as you would a real RBR logger, including: configuring, calibrating, logging, and downloading data. Multiple loggers, both real and simulated, are listed in your **Navigator** window.

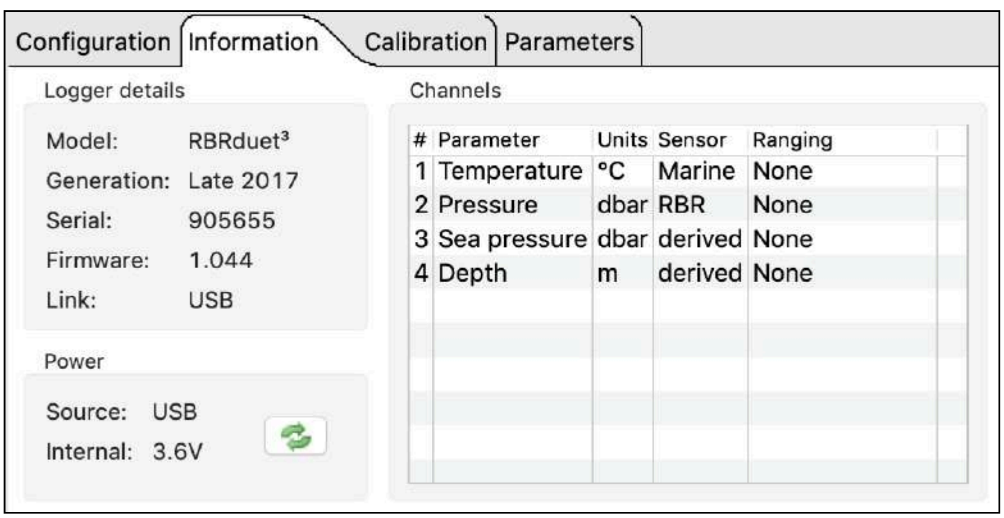
If you want to remove a simulated logger, right-click it and click **Disconnect from instrument**. You can also use the **Instruments** menu.

8.4 View information about a logger

You can view static information about a logger at any time as follows:

In the **Navigator** view, click the appropriate logger.

The **Information** tab in the **Properties** window on the right side of Ruskin identifies the logger. Its general information such as model, serial number, generation, firmware version, battery status, and the channels.



8.5 Recover an instrument and download data

When the deployment is complete recover your instrument and follow these steps to download your data.

> Flooded loggers may be under pressure and opening a logger may be dangerous - take precautions when opening a logger

Steps

1. Start Ruskin.
2. Carefully open the logger by unscrewing the pressure housing.
3. Insert the USB-C connector into the logger and connect the cable to your computer.
4. The logger appears in the navigator window and then navigate to the **Configuration** tab and select **Download...** (see Download).
5. Save the file to a preferred location.
6. Evaluate your data (see Analysis).

9 Configure a logger

Before you enable a logger schedule, you can configure the logger to suit your requirements.

The instructions to configure a tide or wave logger are different than the standard loggers and can be found in Tides and waves.

If your logger schedule is already enabled when you decide to change the configuration you must stop running the schedule, make your changes, and enable the schedule again. However, any data stored so far on the logger will be lost.

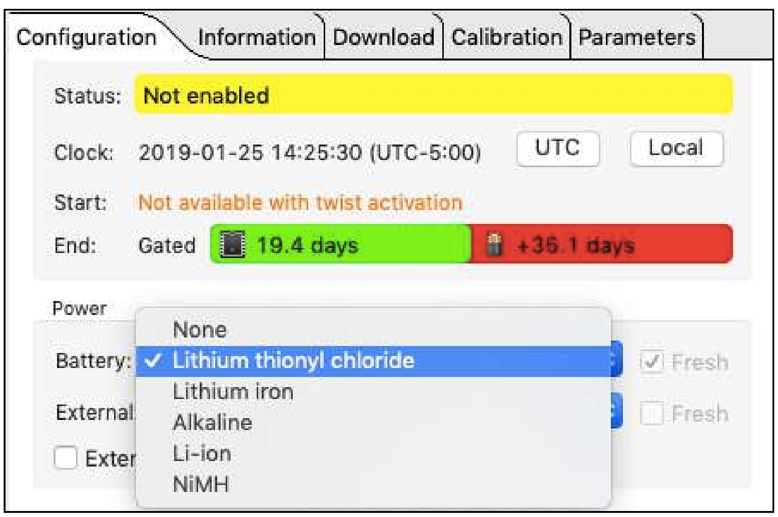
> You can preserve the data by downloading it to a file before you enable the schedule again.

The **Configuration** tab contains the **Enable**, and **Use last setup** buttons. When you click **Enable**, the logger setup parameters are stored to the logger and the schedule is enabled.

Use last setup is intended for configuring multiple loggers using the same schedule. For example, to set up three |tide loggers with exactly the same parameters, set one logger up and enable it; connect the second and third logger and when you click **Use last setup** button, these two loggers will be set up with the same parameters as the first logger. This includes the logger clock time, start and end logging times, sampling period (or rate), gating condition, and tide or wave sampling parameters for |tide or |wave loggers.

9.1 Autonomy engine

The estimated battery life for the selected deployment is shown in Ruskin's Autonomy Engine in the **Configuration** tab:



9.1.1 When to replace the batteries

Compared to the cost of deployment, the cost of a new set of batteries is close to negligible. We highly recommend that the batteries be replaced before every deployment unless there is no doubt that they have sufficient capacity.

Battery voltage does not decrease linearly and is therefore not an accurate indicator of battery capacity. However, if the logger software indicates a yellow or red battery icon on the setup screen, the batteries should be replaced.

> When in doubt, replace the batteries.

9.1.2 Predicting battery life

Battery life prediction is a complicated issue. In RBR loggers, battery life is a strong function of the type of logger, the type and number of sensors attached, the sampling scheme (sampling period and the use of: thresholding, real-time data collection and averaging), and the temperature of the water during the deployment. Manufacturers' data for the batteries do not provide information that can be directly related to way the batteries are used in RBR loggers.

The Ruskin software calculates the expected battery usage (in mA hours - mAh) for the logger during setup . The nominal capacity of each type of battery is described in the batteries section and is given in mAh at room temperature. The software will warn the user if the expected battery usage for a particular deployment scenario is approaching the theoretical potential mAh. The software will not prevent a logger from being started even if a warning is given. In tests at RBR Ltd. of multiple examples of various brands of batteries at 6°C, all examples were able to provide the threshold capacity defined in our batteries section. The user should view these predictions and further de-rate the batteries if the expected deployment is in cold water.

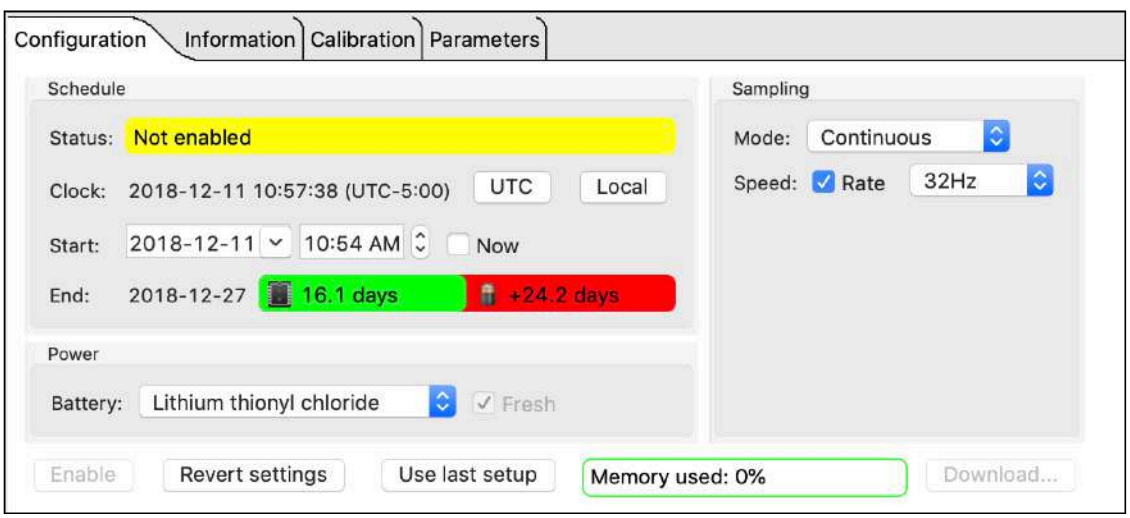
RBR continues to characterize battery life in its loggers and will continue to improve the battery life calculator in future versions of Ruskin.

9.2 Scheduling a RBRsolo/duet

You can schedule your RBR*solo*[3] *or* RBR*duet*[3] to start at a specified time and sampling rate. Ruskin indicates any unattainable conditions in the defined schedule at the bottom of the **Configuration** tab, and the **Enable** button is grayed out.

Steps

1. Connect your logger locally to the computer's USB port. The logger should appear in the **Navigator** view after a few seconds.
2. While the logger you want is highlighted in the **Navigator** view, click the **Configuration** tab in the **Properties** view.



3. Click either **UTC sync** to synchronize the logger with Coordinated Universal Time, or **Local sync** to synchronize the logger with your local PC clock.
4. In the **Start** boxes, specify the date and time that you want to start running the schedule or select the **Now** checkbox to populate the current date and time.

If you select and then clear the **Now** checkbox, you can then manually modify the current date and time instead of the original values.

5. Specify the interval between samples using the **Speed** option. If the **Rate** box is not selected you have the ability to set the sampling interval in units of seconds. The **Rate** option allows you to select between 2,4,8,16,24 and 32Hz frequencies.

   All profiling loggers (known as |fast) have the ability to sample faster than 2Hz. For example |fast32 loggers sample at rates of 2,4,8,16,24 or 32Hz. All |tide loggers can average at rates of 2,4,8 or 16Hz. All | wave loggers can sample at rates of 2,4,8 or 16Hz

6. An estimated end logging is shown at the bottom of the **Configuration** tab based on the sampling interval set. Check to ensure this date is beyond the end date of your planned deployment. The green and red bars next to the End date shows whether memory or battery is the limiting factor for the deployment. For the above instrument, it can log for 16.1 days based on memory, with a further 24.2 days of battery capacity remaining.
7. If the logger you are scheduling has had a fresh battery inserted, select the **Fresh battery** box. Ruskin has the capability to calculate the remaining battery life available for a used battery based on the number of samples that have been taken. The RBR*solo*^{3} and RBR*duet*^{3} keep track of the number of previously stored samples to determine the battery use. Selecting and deselecting the **Fresh Battery** checkbox allows you to see the difference between a fresh battery and a used battery.

   If you select the **Fresh battery** box and enable the logger the previously stored sample count is reset. In this case, it is assumed that a fresh battery is installed.

8. To enable the logger to start sampling immediately or in the future click **Enable**. A message appears informing you that the memory will be erased.
9. Select **Cancel** if you need to download the previously sampled data or press **Erase and enable logging** to enable the logger.

9.3 Stop logging

Logging stops on its own when one of the following occurs:

- The end logging time is reached.
- The gating condition is no longer met.
- The power is removed or depleted.
- The logger memory is filled.

To manually stop the logger, highlight the logger in the navigator, click the **Configuration** tab and select **Stop.**

9.4 Tides and waves

9.4.1 Tides

This section applies to loggers with the |tide16 or |wave16 feature

Tide is a sampling mode which collects data at a certain rate then averages those samples to produce a single value which is stored in the logger memory. This mode uses averaging to remove wave data from the pressure measurements.

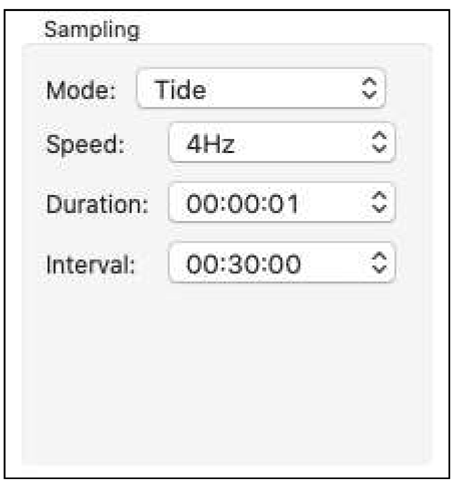
There are three main parameters required to be configured for averaging mode:

1. **Speed**: Specifies the rate at which samples will be collected.
2. **Duration**: Specifies the time range over which to average.
    - The **Duration** must always be longer than the sampling **Speed**.
3. **Interval**: The repetition period for performing the averaging.
    - The **Interval** must always be longer than the **Duration**.

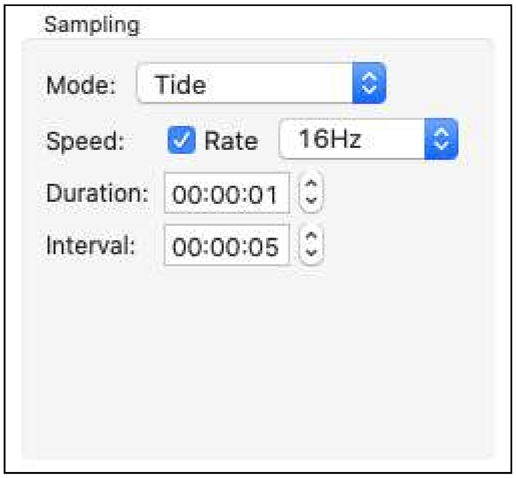
This sampling mode can be activated by selecting **Tide** in the **Mode** drop down menu in the **Sampling** section on the **Configuration** tab

There are two versions of the **Tide Sampling** section that can be used, either simple or advanced. This option can be set in Preferences.

Simple form:



Advanced form:



In the example above, 1 minute of 8 Hz (8 times a second) samples are taken and averaged. This cycle repeats every 5 minutes.

> A single averaged sample is recorded at the **Interval** rate. All other samples used to perform the average operation are discarded.

9.4.2 Waves

> This section applies to loggers with the |wave16 feature

Wave is a sampling mode which collects a specified number of samples at a specified rate and repeats this operation at a specified interval. This mode records both wave and tide information. For additional information on planning a wave deployment, please refer to |wave deployment planning.

> All |wave loggers automatically calculate tide data by averaging the wave burst data. There is no setup required to determine tide information with the wave logger.

There are three main parameters required to be configured for averaging mode:

- **Speed**: Specifies the rate at which samples will be collected.
- **Duration**: Specifies the number of samples to record.
    - The range is between 512 and 32768 samples.
- **Interval**: The repetition period for performing the burst.
    - The **Interval** must always be longer than the time it takes to obtain the specified number of samples.

Wave bandwidth statistics can be generated by specifying two other parameters:

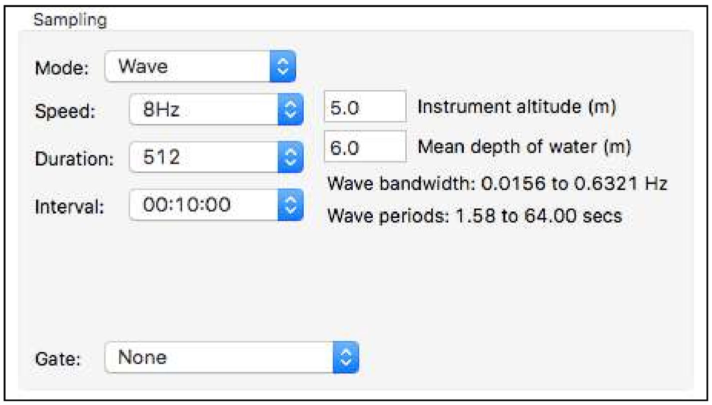
- **Instrument altitude**: Specifies the number of meters above the sea or river bed where the logger will be mounted.
- **Mean depth of water**: Specifies the total expected depth of the water in which the logger will be deployed.

> ⚠ The **Mean depth of water** parameter is not stored on the logger. It is only used to compute wave bandwidth statistics for pre-deployment analysis.
>
> The **Instrument altitude** parameter is stored in the logger and is used to calculate wave statistics. This parameter can be adjusted post-deployment through the RSK file.

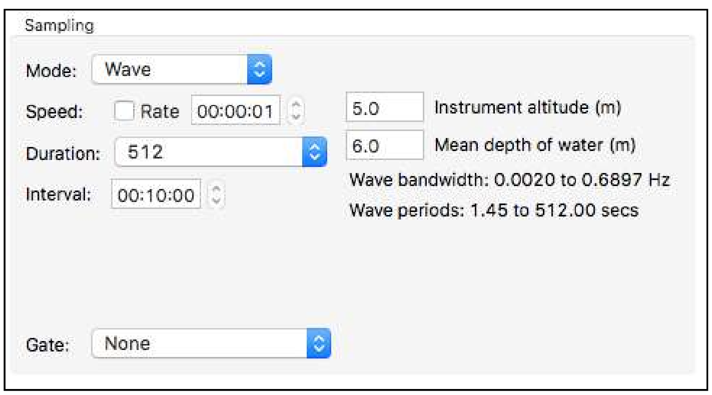
This sampling mode can be activated by selecting **Wave** in the **Mode** drop-down menu in the **Sampling** section on the **Configuration** tab

There are two versions of the **Wave Sampling** section that can be used, either simple or advanced. This option can be set in Preferences.

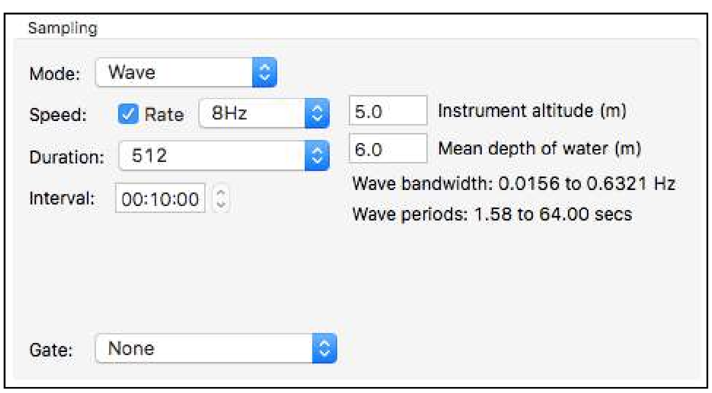
Simple form:



Advanced form - sampling at one second or slower:



Advanced form - sampling at 2, 4, 8, and 16 Hz



The timestamp of the burst for both a Tide and Wave datasets is the beginning of the burst.

9.4.3 |wave deployment planning

The following provides a guideline to establish a coherent deployment for |wave loggers.

The |wave logger should be fixed to a suitable support below the surface of the water, such as a dock or other rigid mooring. The logger must not be able to move in the water. The figure below offers a view of the logger fixed to a dock with a definition of the different water heights.

- **Mean depth of water:** an estimate of the average water depth, used for the initial prediction of expected wave frequencies that can be detected. Ruskin will use the actual depth measured by the logger for its calculations.
- **Instrument altitude**: The actual height of the logger above the seabed. This is defined by the deployment, and the logger must be physically affixed at this height during the installation.

Given the height of the logger above seabed and the depth of logger as measured during the deployment, the total depth of water can be calculated.

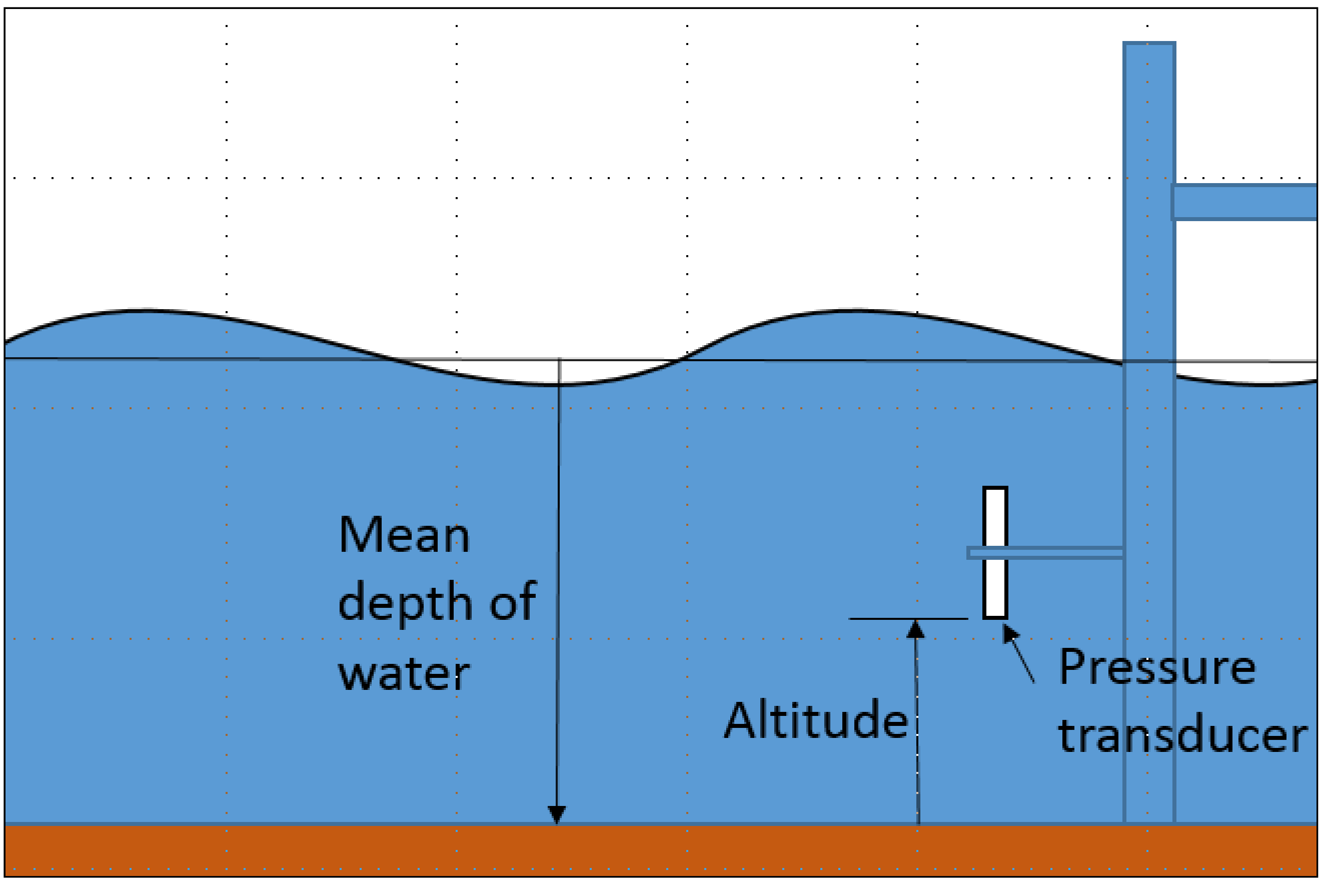


Figure 1. Logger positioning

|wave logger positioning

For deployment planning, refer to Figure 1. Ruskin needs to know the expected mean depth of water (in metres) and the expected altitude (height) of the logger above the seabed to provide an estimate of the frequencies and periods of the wave that the logger is able to measure. The logger measures water depth/pressure by means of a pressure transducer. The physics of what a pressure transducer can 'see' at depth depends on the height of water above the transducer as well as the amount of water below the transducer. High frequencies attenuate very quickly with depth. Figure 2 shows the attenuation with depth as a function of wave period in seconds (*period = 1/frequency*). This graph demonstrates that the placement of the logger is critical in determining frequencies/periods of the wave data to be captured by the logger. The pressure transducer may be placed in any orientation.

The basic rule is to place the logger as close to the surface of the water without the possibility that the logger will emerge from the water either because of large waves or low tides.

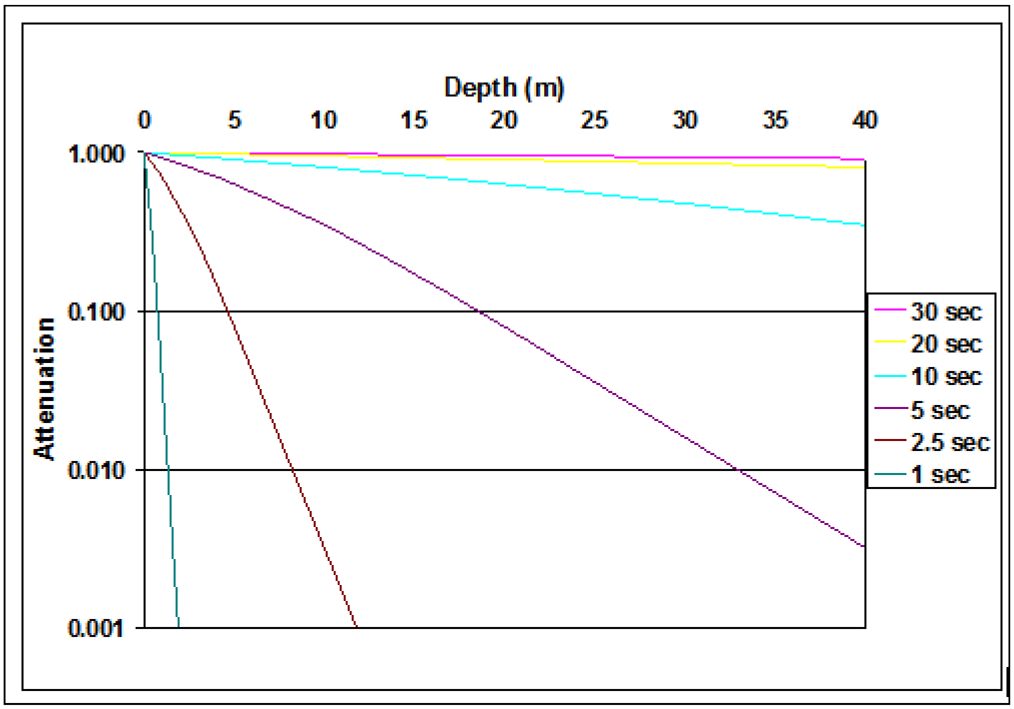


Figure 2. Wave attenuation as a function of depth for various wave periods.

This step in the deployment configuration requires that the 'expected mean depth of water', that is the total depth of water known from experience with the measurement site, and the 'expected altitude of the logger above seabed', a definition to be given to the diver, be entered. Note that on data retrieval the second value will be added to the measured depth of water above the logger when performing all wave calculations.

When waves are enabled, the logger takes multiple pressure readings in a burst which allows for the reconstruction of the surface wave time series. There are three parameters which define the wave data:

1. Measurement speed: this defines the sampling rate or period for individual pressure readings used.
    a. The rate possibilities are 2, 4, 8, and 16Hz
    b. The sampling rate defines several elements of the data capture:
        i. The highest possible frequency visible in the data is limited to ½ the sampling frequency. However, this mathematical limit can not usually be achieved because of the attenuation characteristics shown above.

ii. The sampling frequency defines the resolution of the frequency spectrum which can be calculated from the wave data.
iii. The sampling frequency, together with the burst length, define the lowest frequency which can be assessed in a wave burst.

2. Wave measurement period: this defines how often wave bursts are collected.

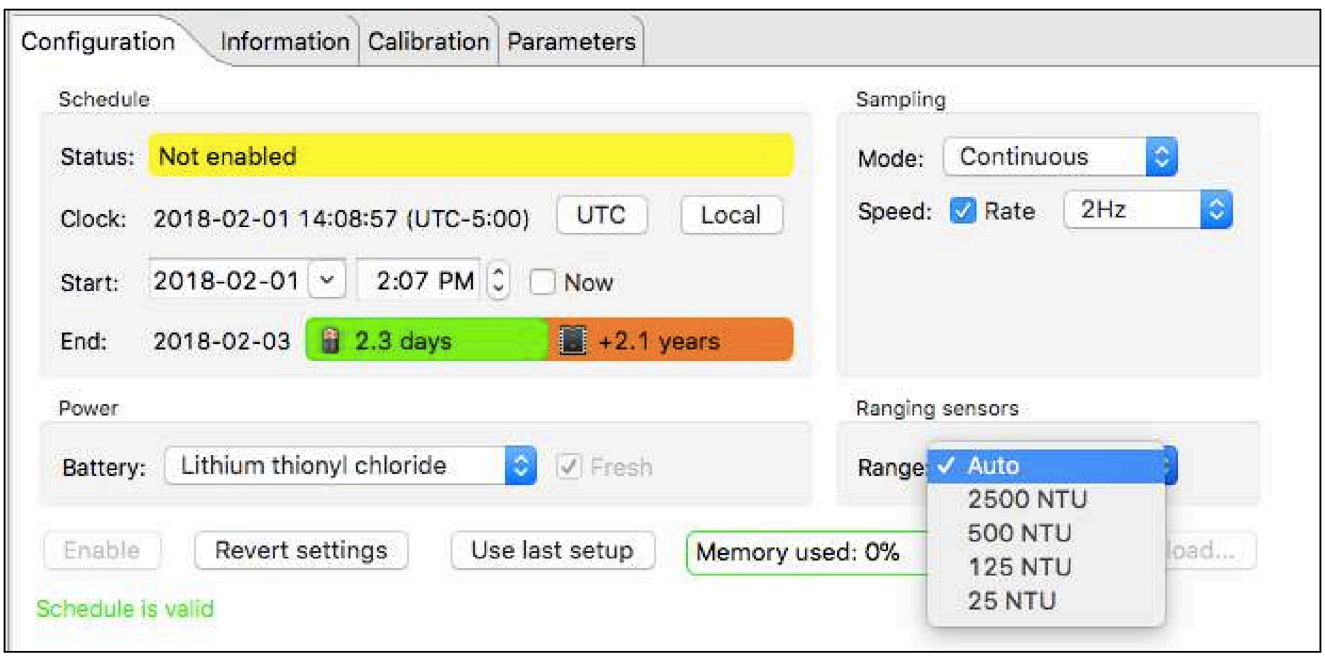
3. Burst Length: this defines the number of samples in a wave burst. It must be a power of 2 and is chosen from the list: 512, 1024, 2048, 4096, 8192, 16384, and 32768. The longest wave period to be assessed is defined by: burst length/sampling frequency

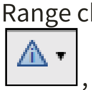
The wave parameters work together to define the range of wave information which can be calculated as well as the memory and battery usage.

9.5 Autoranging and fixed gain

Turbidity sensors are capable of autoranging. The logger can change the gain setting on the front-end amplifiers in order to select the most appropriate range based on the environment being measured. The logger can also set the gain on the sensor to a fixed value selected by the user, rather than allowing the logger to select the gain as it measures.

From the **Configuration** tab under logger details there is a drop down menu where the **Range** of the sensor can be specified. Seapoint turbidity sensors are capable of autoranging (automatic gain setting) or having a fixed range of 2500, 500, 125 or 25 NTU.

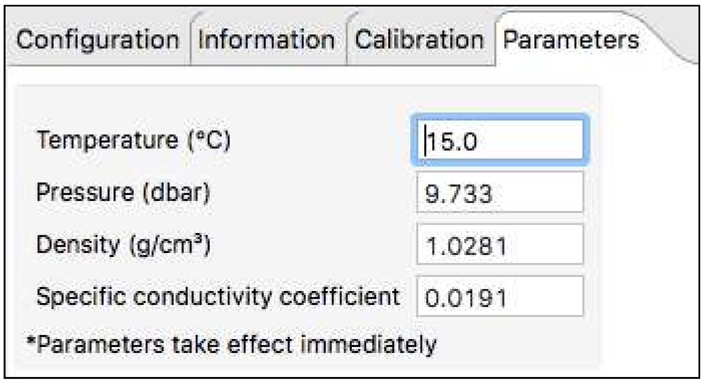


Range change events are displayed in the **Plot** view when the **Display diagnostic** is selected from the **Events** button, , located in the **Plot** view toolbar. Range change events are displayed as RANGE XX Units where XX indicates the current range and units are the units of the sensor – typically NTU for turbidity sensors and µg/l for fluorometers. For | fast sampling where the change may be occurring over a number of samples the event is displayed as RANGE CHG and is followed by the final range event.

9.6 Derived channel parameters

When configuring your logger, you can change the default values of parameters that are used to calculate derived channels. These values are stored in the logger itself and are used in place of the values in **Options** menu > **Preferences** > **Derived channels**.

In the **Parameters** tab, you can configure the parameters which are used to calculate derived channels on a logger that supports derived channels.



9.7 Deployment

Once you have ensured that the batteries are fresh, inspected the O-rings, and programmed the logger (see Configure a logger), the instrument is ready to be deployed.

There are four precautions you should take to avoid damaging the logger and maximize the deployment autonomy:

1. Pay attention to the maximum pressure rating. All loggers with pressure sensors are individually rated to a maximum depth/pressure. This is indicated by the label which is placed on the logger's sensor end cap. Loggers that do not have a pressure sensor do not have this label but are limited by the maximum depth/pressure rating of either the logger housing itself or of the sensors.
2. Avoid physical stress to the logger. Any type of clamp or bracket which concentrates the stress to the logger body is not recommended for use in logger mooring, mounting, and/or other deployments. Stress due to improper mounting may cause the logger to leak, resulting in the loss of valuable data or permanent damage to the electronics. RBR can provide proper mooring and mounting clamps suited to your specific application.
3. Use desiccant. If the logger is closed up in a warmer environment than the deployment environment, internal condensation can result. Since condensation may cause the circuitry to malfunction, the installation of desiccant prior to deployment is strongly advised.
4. Be careful of the orientation on a mooring. Due to battery capacity potentially being sensitive to cell orientation, it is best to mount the logger with the sensor end facing down when deployed. Even if batteries that are minimally sensitive to cell orientation are used (e.g. Tadiran), it is always good practice to mount the loggers in this manner in the event that any brand of battery is employed.

9.8 Automatic tasks

When working with a large number of similar instruments, Ruskin offers various automatic tasks, which can be toggled on and off from the Instruments menu, or by right-clicking the "Instruments" group in the navigator view. Icons indicating the current state will be displayed on the "Instruments" group. Since these tasks can change the state of the logger, the on/off state defaults to off each time Ruskin is run.

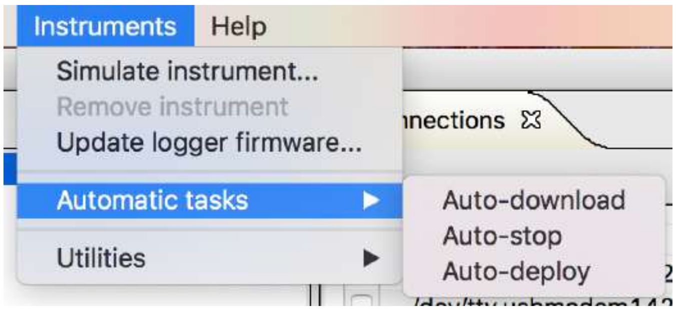


Figure 1. Instruments menu showing automatic tasks options. If a task is enabled, it will show a check mark.

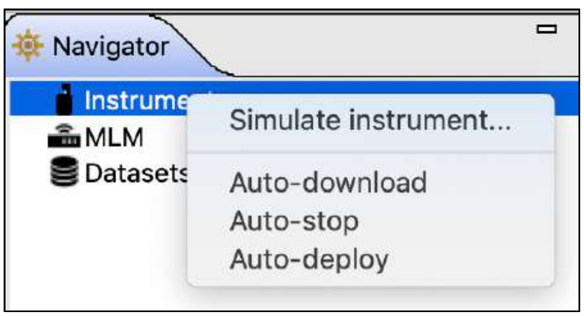


Figure 2. Right-clicking on the "Instruments" group of the navigator view will show the automatic tasks. If a task is enabled, it will show a check mark.

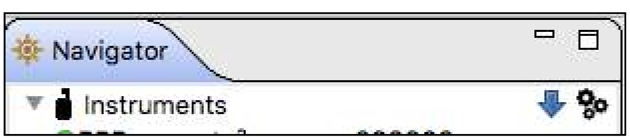


Figure 3. "Instruments" group of the navigator view with icons indicating that auto-download and auto-deploy are enabled.

9.8.1 Auto-download

When an instrument is detected, it will automatically start a download process and store the file using the common logger download naming scheme (serial number, date and time of download) in the last "save to" directory chosen. Other than possibly creating unwanted files, this option is safe since it does not alter the state of the logger.

9.8.2 Auto-stop

When an instrument is detected, it will automatically stop the instrument if the instrument was previously enabled. If auto-download is not also selected, a warning will be displayed about downloading the instrument data. It is not possible to re-enable the instrument without erasing the instrument's memory, so it is advised to also use the auto-download feature at the same time, or ensure that the data is downloaded prior to re-enabling the instrument.

9.8.3 Auto-deploy

When an instrument is detected, the instrument will be stopped and then reprogrammed with the last known configuration settings. It is highly recommended to also use auto-download with this setting since the instrument memory will be erased during the deployment set up. To use this feature, first connect an instrument that will act as the model and configure that instrument with the desired settings and then turn on auto-deploy. Each instrument connected, if it supports the same capabilities of the model instrument, will be configured to match the scheduling of the model instrument. Auto-deploy implies auto-stop since the instrument must be stopped to update it with the new schedule information.

10 Download

10.1 Download data from the logger

You can download data from a logger at any time. If you stop running a schedule, you must download the data before you restart the schedule to prevent the data stored so far from being lost. It is not possible to start logging without erasing the memory contents.

Steps

1. From the **Configuration** tab select **Download**.
   The **Save as RSK** dialog box appears.
2. Specify a location and a name for the data file.
   By default, the RSK file name uses the Ruskin file naming convention. For more information about the naming convention, see File naming convention below.
3. The name of the new dataset appears and is highlighted automatically in **Navigator** view > **Datasets**.
   The **Properties** view changes to the new dataset and contains the following tabs: **Analysis**, **Overview**, **Channels**, and **File Info**. All the data that was stored on the logger at the time of the download is automatically plotted in the **Plot** view.

> Downloading data again while the same schedule continues to run, picks up the same data plus any data stored since the last download.
>
> You can add a comment after downloading a dataset.

10.2 File naming convention

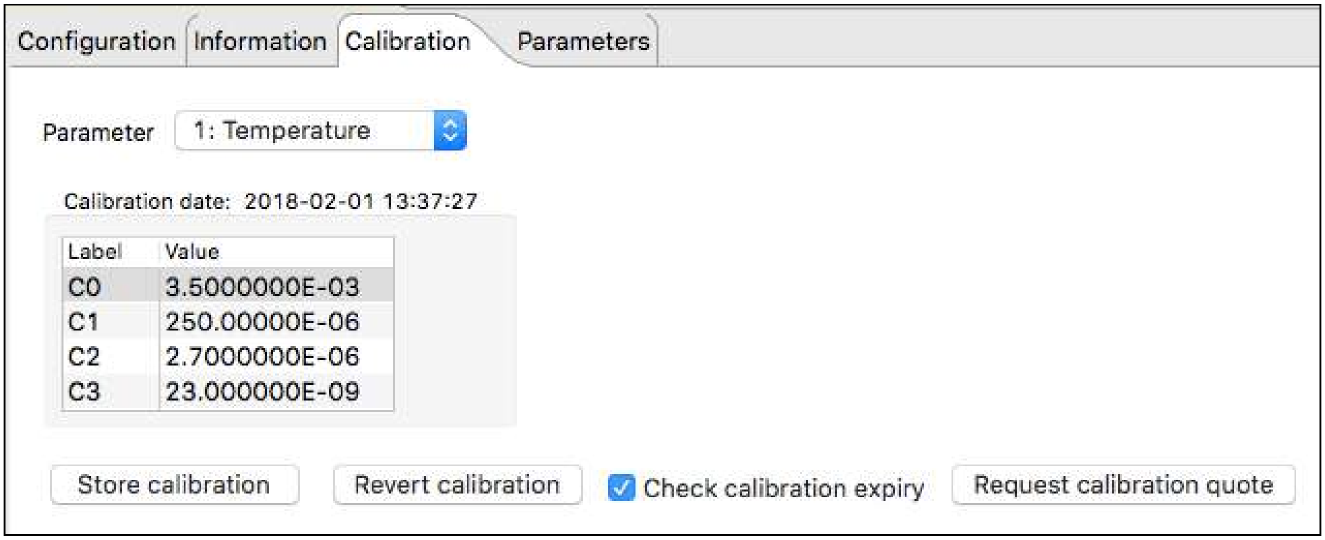
In Ruskin, by default, the name of a data file is composed of the following information:

- The first six digits represent the logger serial number.
- The next eight digits represent the current year, month, and day.
- The next four digits represent the current time to the minute.
- The file extension indicates the file format and should not be changed. If you change it, the file extension that you specify becomes part of the name, and the required extension is appended.

For example, the file named 911936_20090522_1613.rsk contains data for a logger with a serial number of 911936 whose data was downloaded in 2009 on May 22 at 4:13 pm.

11 Calibration tab

The **Calibration** tab displays the calibration coefficients for each parameter (sensor) present and the date and time of the last calibration. Selecting the sensor from the dropdown menu **Parameter** toggles between the calibrations for the different sensors on the unit.

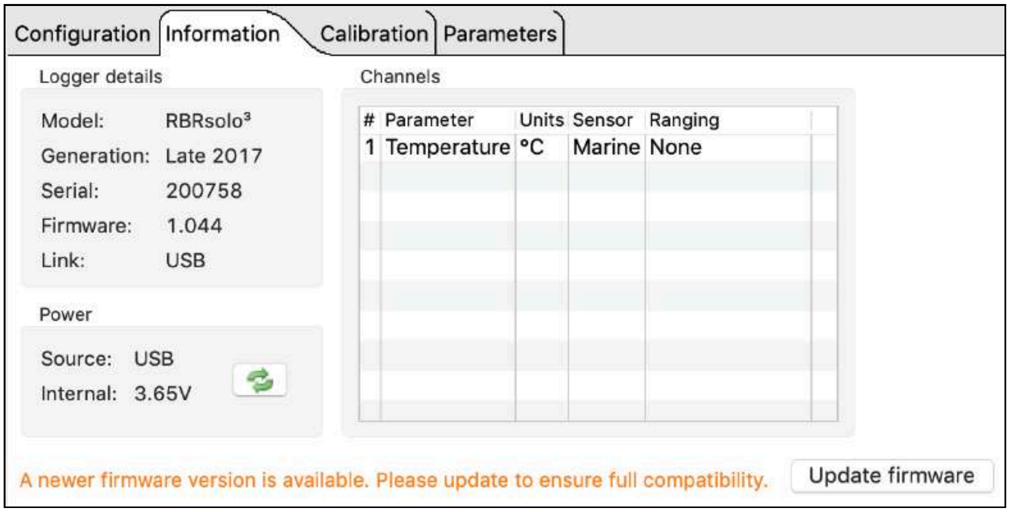


You can request a calibration quote for your logger by selecting **Request calibration quote** and sending the information directly to RBR Ltd. In the **Calibration** tab, click **Request calibration quote**, and when the **Request calibration** dialog box appears, enter the appropriate information. Make sure to verify that all information is correct before sending the request. You can edit any of the coefficients and use **Store calibration** to save the new coefficients to the logger. Use **Revert calibration** to recover to the original coefficients if you have not already selected **Store calibration**.

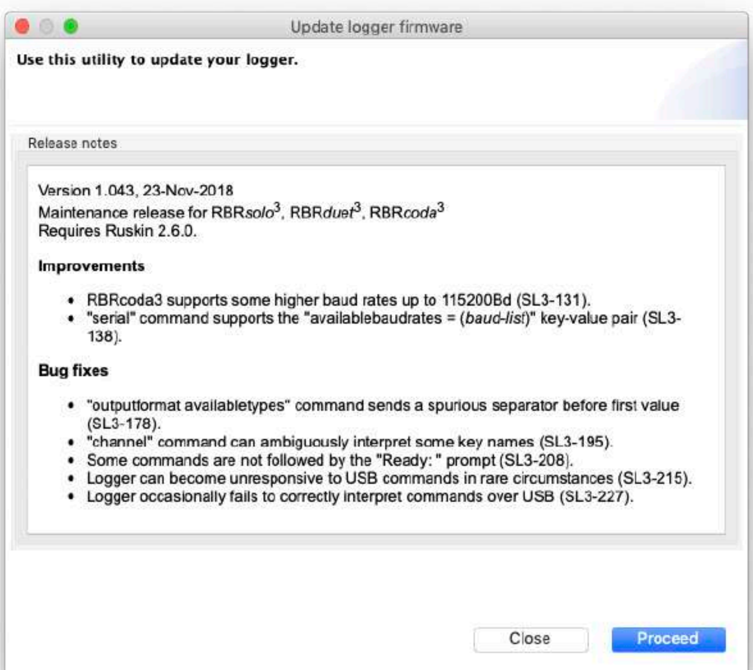
Calibration coefficients are calculated for each sensor, and the coefficients are stored in the logger. Calibration certificates are provided for each sensor and contain both the calibration equation and the coefficients. Hard copies are provided with each shipment, and the documents are contained inside the shipping box. Please refer to the calibration certificates for the coefficients and residuals. RBR can replace lost or misplaced calibration certificates.

12 Update firmware

Instrument firmware upgrades can be performed from within Ruskin without having to return the instrument to the factory. Ruskin automatically checks to see if a newer version of firmware is available and displays a message in the **Information** tab.



Click the **Update firmware** button to upgrade the logger firmware. The following screen will appear:

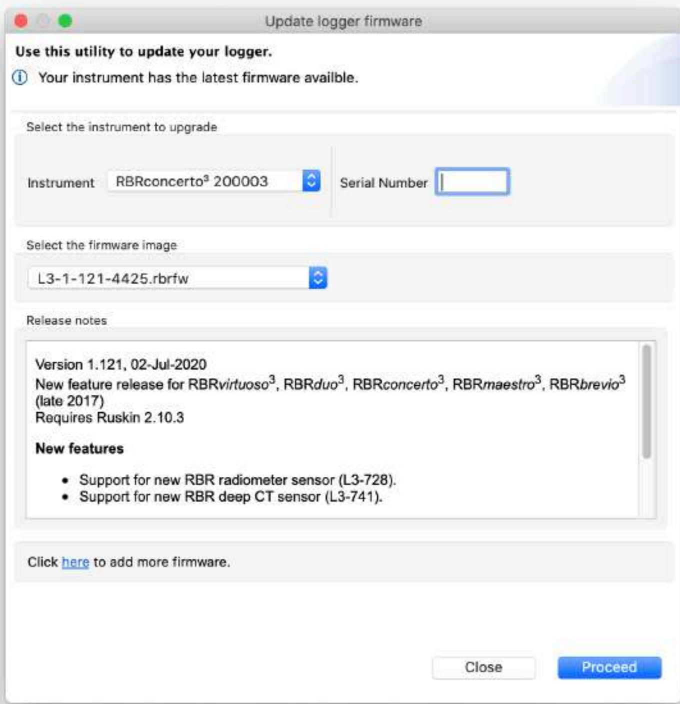


> Do not disconnect the logger until the process is fully completed. Disconnecting the logger during this process may render the logger inoperable.

If for some reason RBR needs to supply a version of firmware, the following method is used to manually update the logger firmware.

> Contact RBR for instructions before proceeding. This method of updating the firmware should only be attempted with the assistance of RBR.

Click the **Instruments** menu > **Update instrument firmware**.



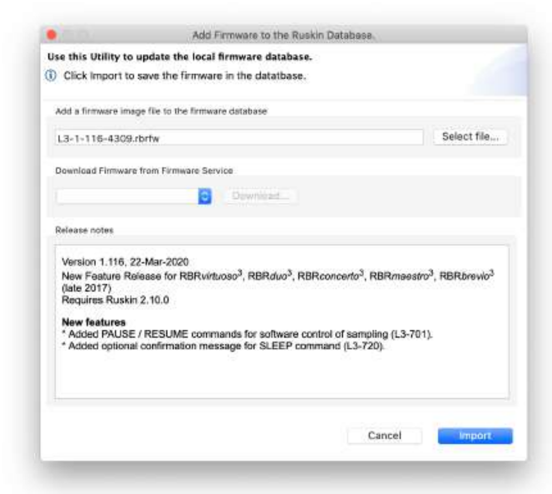
Steps

1. In the **Instruments** menu, click **Update instrument firmware.**
   The Update logger firmware dialog box will appear.
2. Click the instrument drop down to select the instrument you wish to upgrade.
   a. A default firmware image will be selected for your instrument.
   b. If RBR supplied a firmware file see **Manually adding a firmware image to Ruskin**
3. Click **Proceed** to start the firmware upgrade.
   A progress bar shows the status of the upgrade. Once the firmware upgrade is complete, the message *Update completed successfully* appears at the top of the dialog box.
4. If the upgrade doesn't complete successfully, click **Proceed** again to retry until successful.

> ⚠ Occasionally the logger will not reappear in the **Navigator** view following a successful upgrade. If this occurs, disconnect your logger from the USB port and then reconnect to re-establish communication.

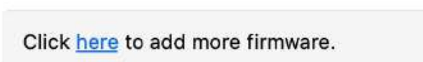
5. Click **Close**.

12.1 Manually adding a firmware image to Ruskin



If for some reason RBR needs to supply a version of firmware, the following method is used to manually add that firmware image to Ruskin.

1. Click the link at the bottom of the **Update instrument firmware** dialog.



2. Click the **Select file** button and browse to the location of the firmware update file provided. The file will have the extension .rbrfw.
3. Click **Import.**
4. Click **Close**.

13 Datasets

13.1 Open a stored dataset

You can open any stored dataset to explore its contents.

Steps

1. Click **File** menu > **Open dataset**.
2. Double-click the .rsk file that contains the data that you want to view.
3. The name of the dataset appears and is highlighted automatically in the **Navigator** view. The **Properties** view changes to the dataset. The data in the file is automatically plotted in the **Plot** view.

To close a dataset, right-click its name in the **Navigator** view and click **Close dataset**. Or use **File** > **Close dataset**

Ruskin performs an integrity check that is intended to make sure that older data files are compatible with newer versions of Ruskin software. This information is displayed in File info**. If the file requires updating the message indicates the issue with the file, and how long an update will take.**

RBR strongly recommends that all files that have issues be updated.

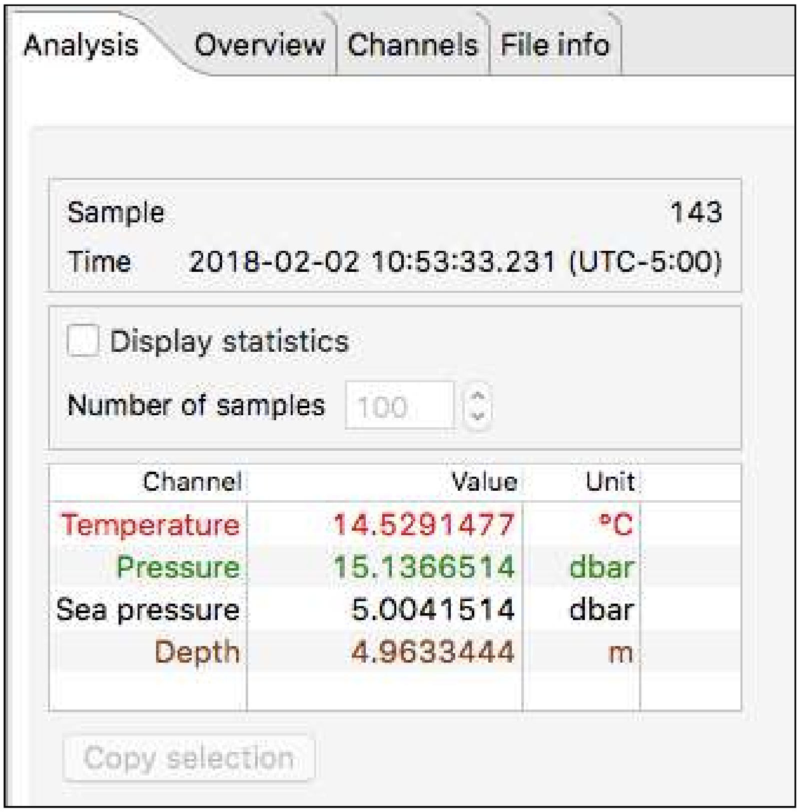
13.2 Analysis

13.2.1 Analysis tab

The **Analysis** tab contains information and settings for configuring the calibration information and to display statistical information. You must already have an open dataset to view and configure these settings. For information about how to open a dataset, see Download.

Cursor tab

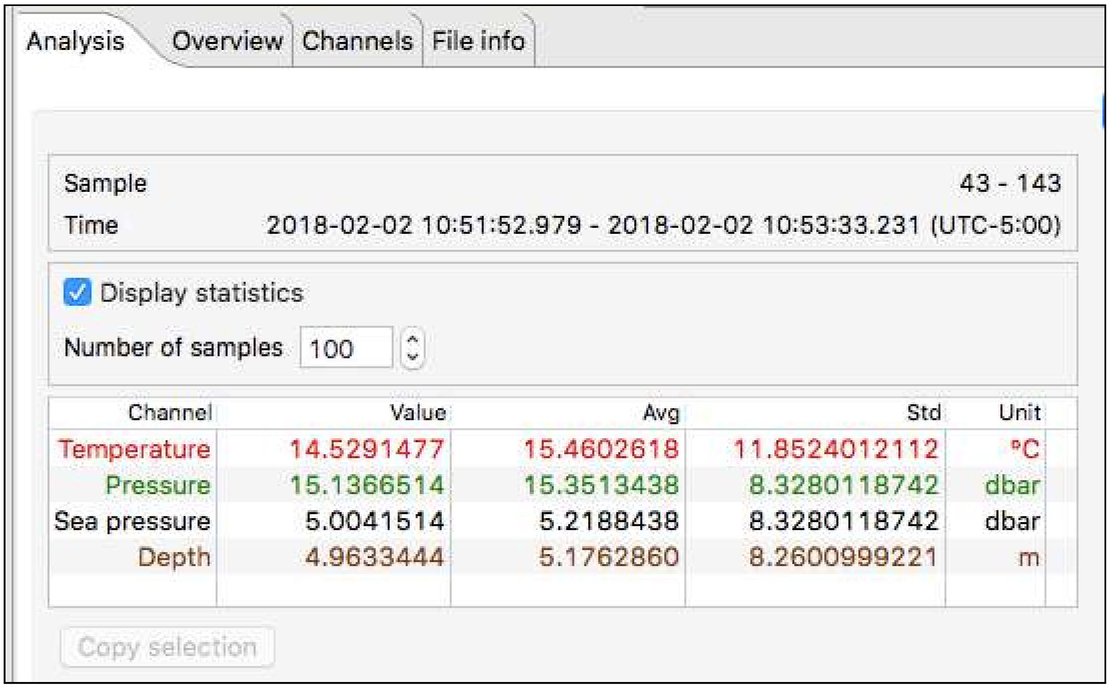
When a file is selected and plotted, the **Analysis** tab can be selected to display information about the dataset channels and their values.



This table reports the value at each sample number when selected in the plot referenced to the vertical black cursor.

The sample number and time of the sample are displayed.

Selecting **Display statistics** gives you the ability to determine the average value and standard deviation over a range of samples. Change the number of samples in the average by using the spin buttons. The grey bar that appears on the plot view is the range of the samples in the average.

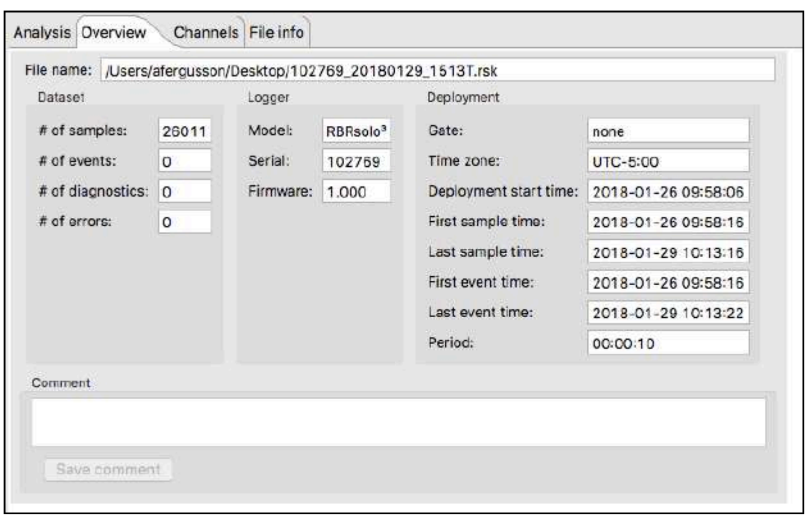


Calibration tab

When a file is selected and plotted for re-calibration the **Calibration** tab can be selected to assist with calculating calibration coefficients, see User calibration .

13.3 Overview

When a file is selected and plotted the **Overview** tab can be selected to display general information about the dataset.



This is also the form on which you can enter a comment for the dataset and then press **Save comment** to save it.

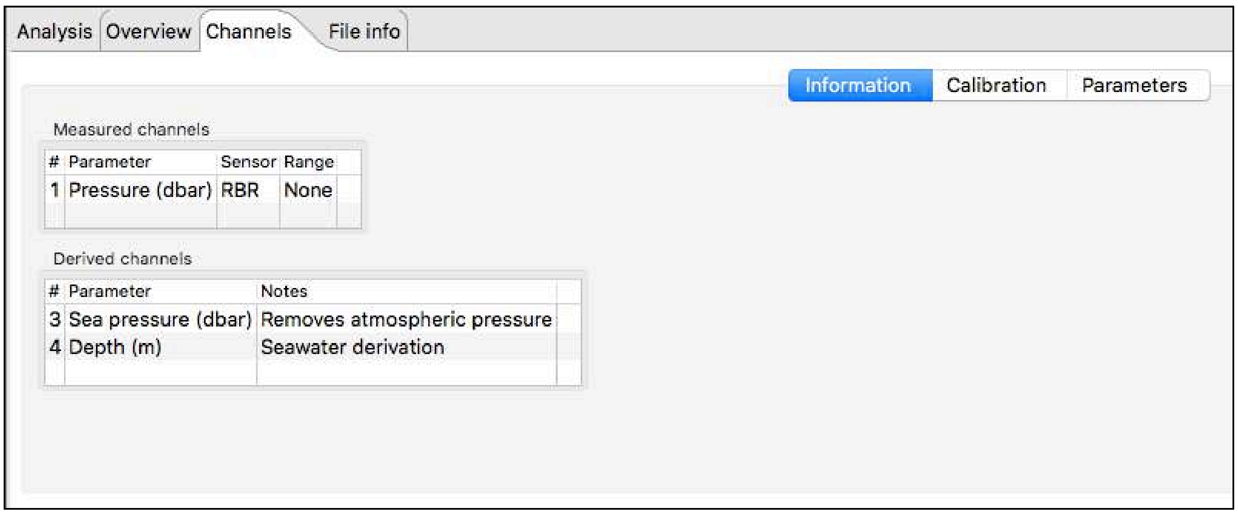
13.4 Channels

The **Channels** tab displays three additional tabs: **Information**, **Calibration**, and **Parameters**.

1. The **Information** tab displays the measured parameter, the sensor manufacturer and the range setting. The type of derived channels and how it is calculated is displayed in a separate table.
2. The **Calibration** tab displays the calibration coefficients for each sensor.
3. The **Parameters** tab displays the values of the parameters, default values if other required parameters are required and the method used to calculate the derived channels.

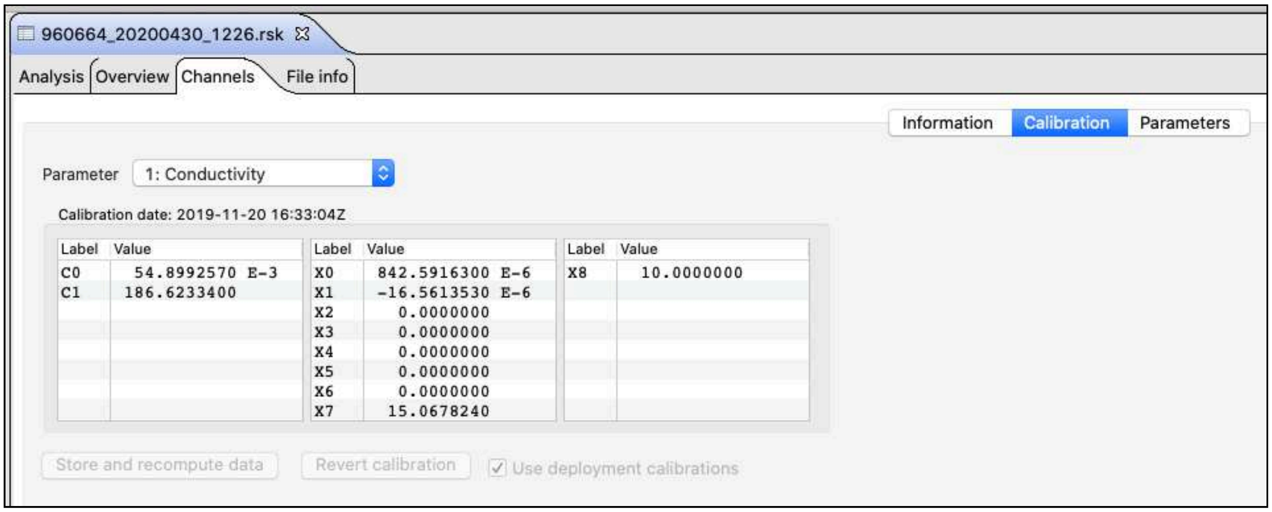
13.4.1 Information tab

The **Information** tab displays the measured parameters, the sensor manufacturer and the range setting (if applicable). It also shows any derived channels that are available and a description of the methodology used in the calculation of that derived parameter.



13.4.2 Calibration tab

The **Calibration** tab displays the calibration coefficients and temperature correction coefficients (as applicable) for each channel (sensor) and the date and time of the last calibration.



You can edit any of the coefficients and use **Store and recompute data** to recalculate the dataset. Use **Revert calibration** to recover to the original coefficients if you have not already selected **Store and recompute data**. To recover the original calibration coefficients edit one of the values and click in another cell. The **Use deployment calibrations** checkbox then becomes active and unchecked. Check this checkbox to restore the coefficients used by the logger and then press **Store and recompute data** to save the coefficients.

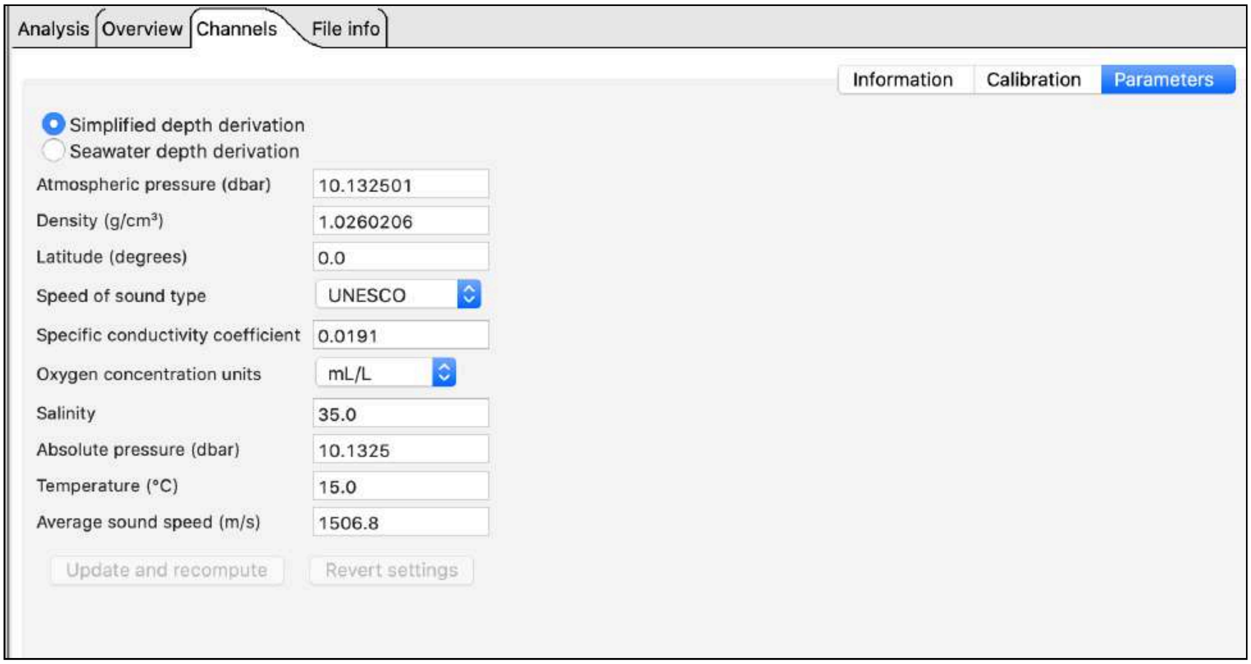
13.4.3 Parameters tab

When a file is selected and plotted, the **Parameters** tab can be selected to display the parameters used to calculate any applicable derived channels.

The tab reports the relevant derived channel information for the sensors on the logger. The parameters can be edited to change the derived channel calculation. Once a parameter is modified, the **Update and recompute** and **Revert settings** buttons become active.

Revert settings rereads the RSK file and populates the form with the parameters from the file. **Update and recompute** writes the new parameters to RSK file and re-displays newly calculated data.

The following example is for a CTD and dissolved oxygen logger where you can change the calculation parameters to calculate the derived channels:



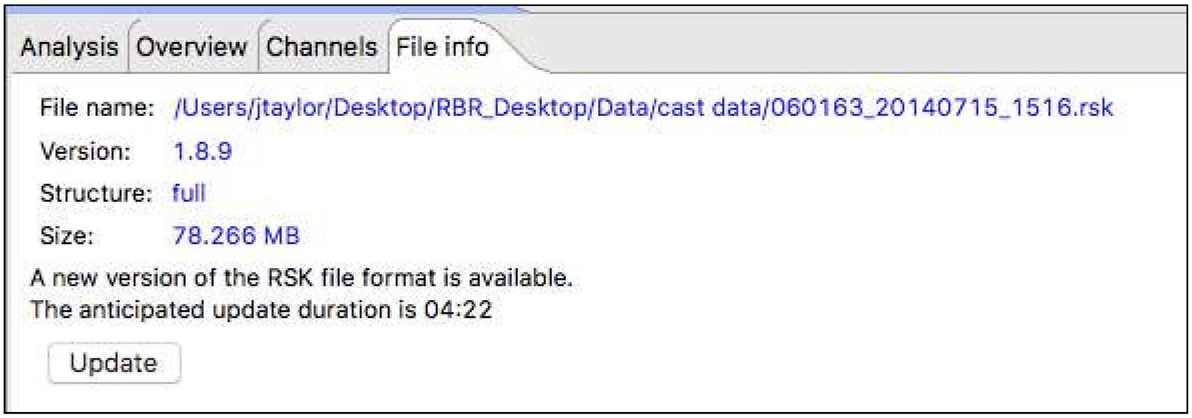
Selecting the **Seawater derivation** in the **Parameters** tab results in a depth calculation based on UNESCO Technical paper 44.

The depth derivation equations can be found under the menu item **Options** menu > **Preferences** > **Derived Channels** > **Depth** tab.

For |wave loggers, you can change the wave calculation by adjusting how the depth is calculated and by adjusting the instrument altitude. This function is available in the **'Configuration**' tab and under the **'Sampling'** tab.

13.5 File info

When a file is selected and plotted the **File info** tab can be selected to display information about the file.



Files created by older versions of Ruskin must be updated to ensure compatibility. Failing to do so may result in odd graphical display and incorrect reporting of the sample values.

If the message *A new version of the RSK file format is available.* appears, click **Update**. The update process may take some time, however, Ruskin does estimate the time with the message *The anticipated update duration is <time period>*.

13.6 Plot view

You can use the **Plot** view to view a graphical display of data in datasets or live data. When viewing live data, the logger must still be attached.

A toolbar at the top of the **Plot** view contains various buttons to help you customize, explore, and export the graphical display.

Each channel appears as a different colour in the graphical display. These colours are specified for all graphical displays in **Options** menu > **Preferences** > **Plotting** and can be changed there only. You can also change other defaults affecting the **Plot** view in **Preferences**. For information, see Specifying plotting preferences

Scaling of the data is based on the minimum and maximum value sampled for each channel - sometimes there are erroneously high or low values that may make the real data appear incorrect. Use the vertical zoom  to increase the scale of the data displayed.

You can click a particular time (location) in the plot to view each channel value and related statistics at that time. A "double lollipop" vertical black line marks the place. The **Cursor** tab panel above (or on the side of the plot for live data) displays the channel values, units, the sample number, and the time that the data was measured.

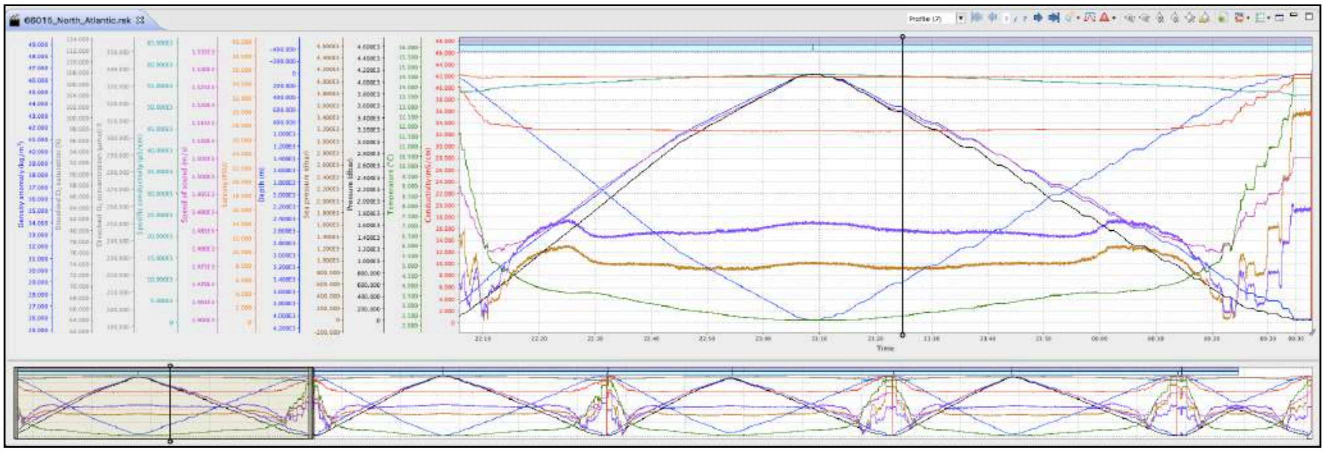
For datasets only, you can select the **Display statistics** checkbox to view the average value and standard deviation for each channel based on the number of samples that you specify.

If you want to copy the data to the clipboard and then paste it into another application, select a row, a column, a cell or click on the word channel for the entire table and then click **Copy**.

The graphical display for each dataset appears on its own tab in the **Plot** view. The dataset file name appears at the top of the tab.

13.6.1 Thumbnail view

A downsampled representation of the dataset appears in a thumbnail view, along with an indicator of the current plotted time range. The indicator can be positioned on the thumbnail view by clicking on the thumbnail view or dragging the indicator. The indicator can be resized by dragging the edges, which will zoom the plot along the time domain to match the new indicator size. The thumbnail always shows time-domain data, even if the plot is switched to depth-domain mode.



13.6.2 Live data

You can use the **Plot** view to view a graphical display of logger sampling. The data can come from one of two sources: fetching or streaming. Fetching can be used on a logger that is either not enabled or enabled without a streaming option. Streaming can be used on a logger that has been enabled. If fetching is used on a logger with streaming selected and the logger is enabled, the current file used for the fetching data will be closed and a new file started for the streaming data; fetching will be disabled.

The graphical display for live data for each logger appears on its own tab in the **Plot** view. The logger model and serial number appear at the top of the tab.

> Live data collection support in Ruskin is intended for debugging, development, and schedule trial purposes only and is not intended as a robust data collection solution. The performance will degrade significantly if large (>50-100K samples, depending on hardware) data collections are performed, especially if there are a large number of events being reported.

13.6.3 Plot Tools

Dataset toolbar

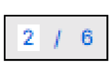
Live plot toolbar

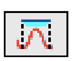
The live plot toolbar appears to the right of the dataset toolbar.

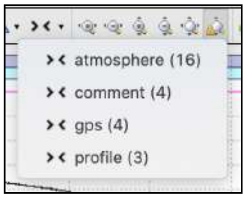
Tools for datasets and live data

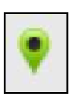
Button	Purpose	Use

	Filter	Changes the type of annotation for the navigation buttons
		
		• If an annotation is selected, switching filters zooms the view to the newly selected annotation.
		• If no annotation is selected and switching filter from one profiling annotation type to another (profile, upcast, downcast), the view does not change.
		• If no annotation is selected and switching filter between categories (profile, upcast, downcast to any other non-profiling annotation type, or any non-profiling annotation type to any other annotation type), the view moves to the first annotation of the new category.
		  • Comment → Profile moves to the first profile
		  • Profile → Comment moves to the first comment
		  • Comment → Downcast moves to first downcast
		  • Profile → Downcast does not move.

	Move to first, previous, next, and last	Move to the first, previous, next, and last annotation of the filter type If the annotation is selected also moves the selection
	Index	The current annotation index, which can be edited. If the currently selected annotation matches the time domain extent the text will appear blue, otherwise the text will be red Click the middle of the index (the '/') to zoom to the annotation.

Button	Purpose	Use
 	Create annotation	Select the type of annotation to create. After selection, click and drag left/right on the main plot to create the annotation. When the click is released the annotation will be created as a temporary annotation, selected, and show its editable tooltip. Profiles or geodata cannot overlap the same type - new annotations will fill the available space between existing profiles. ⚠ The annotation must be **edited** (such as adding a title or description, or, in the case of profiles, by adding an up or downcast) and **saved** (press ENTER/Return, or click the green checkmark on the tooltip) before it will be saved in the RSK file. ⚠ Only available in the time domain
	Cast detection	Runs a cast detection algorithm based on depth and conductivity to automatically generate profiles and casts ❗ Overwrites logger generated cast events and profiles
	Event visibility	Turn on and off the visibility of the various levels of events (error, warning, information, and diagnostic)

Button	Purpose	Use
 	Annotation collapse	Toggles the annotations collapse or expanded state for an entire category of annotation. In the expanded state all data within the time bounds of the annotation will be displayed. In the collapsed state all data within the time bounds of the annotation will be hidden and a time break marker will be visible on the time axis. The annotation marker will appear as a point annotation. Individual annotations can be collapsed or expanded from the toolbar in the annotation bubble.
	Zoom control	Zoom in/out horizontally, vertically, and reset the zoom to display the maximum extent of each axis Zooming the range will centre the data on the currently selected sample.
	Auto-ranging	Toggles the auto-ranging of the channel axes ⓘ Disabling the auto-ranging of the axis can be useful for looking at trends in data
	Export plot	Exports the current view of the main plot to pdf or png

Button	Purpose	Use
	Data rendering type	Choose lines, shapes, or lines and markers for the trace lines If no data appears in the **Plot** view, try changing the rendering to "Display Markers". Time spans that are larger than expected will cause breaks between data points and lines will not be drawn connecting those points, whereas markers draw at each individual point.
	Toggle channel visibility	Turn on or off channels to be visible in the plot view Toggle on raw values removes the calibration equation from the sensor value
	Plot by depth	Toggles between plot by time and plot by depth If there is no depth channel the plot would then use the next pressure or pressure derived channel starting from the bottom of the channel list
	Show GPS map	Launches a map which plots all the GPS location annotations in the dataset. The map will infer track lines based on the timestamps of the acquired locations.

Tools for live data

Button	Purpose	How to use
	Toggle the side data panel	The side data panel appears beside the charts and shows the file location that will be used to capture samples, the number of samples collected, the values of the last received sample, and the currently selected sample. The side panel can be toggled on and off with this button.
	Live plot time range selection	Click the button to display a drop-down list of time span options to display the data by time period. For example, display 2 minutes of data. You can also choose to display all of the data collected.
	Start or pause fetching	The logger supports either streaming or fetching data. Fetching is the action of asking the logger to take a reading and report it. Ruskin displays the fetched data every 1-2 seconds. Fetching is disabled if the logger is enabled and has streaming turned on.

13.6.4 Shortcuts / Controls

- Data cursor:
  - Click on the main plot to set the data cursor (double lollipop indicator).
  - Move to the previous/next data sample: Left/Right Arrow Key
    - To move by hundreds of samples, use Shift - Arrow
    - To move by ten thousands of samples, use Alt - Arrow
    - To move by millions of samples, use Shift - Alt - Arrow
- Annotations
  - Double click on an annotation bar to zoom in to the range of the annotation.
  - Click and drag on the edge of an annotation bar to resize the annotation, if the annotation is resizeable (CELL GPS annotations are not).
  - Click and drag on the annotation bar to move the annotation, if the annotation is moveable (CELL GPS annotations are not).
- Main Plot
  - Double click on the plot to reset to fully zoomed out.
  - Shift-click and drag on the plot to select a zoom region. The zoom region will be denoted by a rectangle. Make sure to press shift before clicking.
  - Control-click and drag on the plot to pan the plot. Make sure to press control before clicking.
  - The mouse wheel will zoom the plot in/out based on the current mouse position.
- Main Plot Axes
  - Double-click on an axis to set the axis to auto-range (show the full range of data).

    - Click and drag an axis to pan the axis.
    - Shift-click and drag an axis to zoom the axis in or out.
    - The mouse wheel will zoom the axis in/out based on the current mouse position.
- Thumbnail
    - To resize the viewable range, click and drag on the handles (grey bars) on or use the mouse wheel within the viewable range indicator.
    - Click and drag the viewable range indicator to pan
    - Click on a region not covered by the viewable range indicator to centre the viewable range at that location.

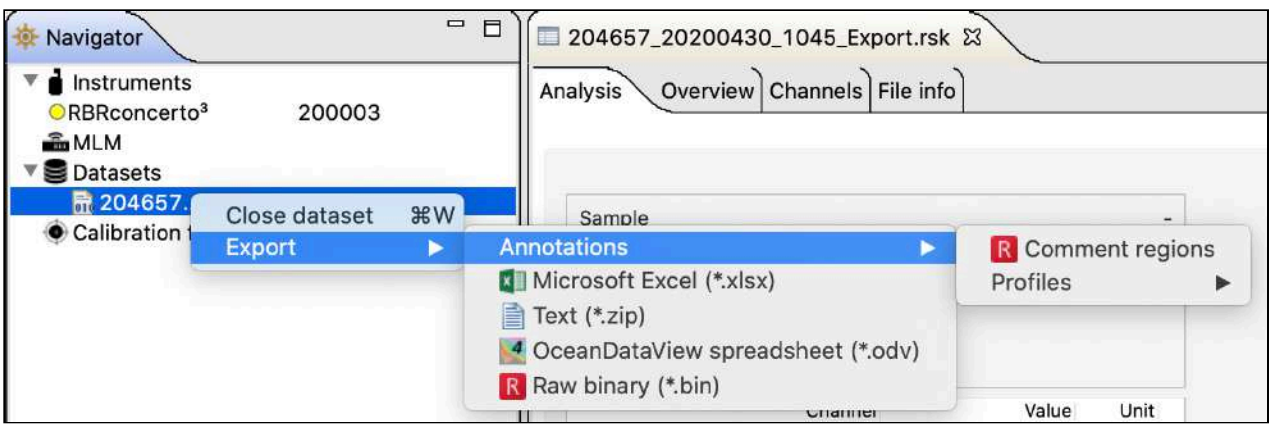
13.7 Exporting datasets

You may want to share your data with others or analyse your data using other software. You can export data as a text file, which can then be imported into many applications, or export it in a particular format for analysis such as Microsoft Excel or OceanDataView.

You must already have downloaded the data to a dataset or opened an existing dataset.

Steps

1. Right-click the dataset whose data you want to export, and hover to **Export as** to open a submenu, or use **File** menu > **Export dataset**.



2. Select the appropriate export format (Excel, Text, OceanDataView or Bin).

> ⓘ Annotations can be exported to individual files by selecting the annotation category you would like to export.

> ⓘ RSK files can be imported directly into Matlab with our toolkit RSKtools that is available for download from our website at www.rbr-global.com. The RSK file is a single file database based on SQLite that allows us to have very large files with high-speed access to any part of the dataset.

3. Specify a location and a name for the data file.
4. Click **Save**.

14 User calibration

Change calibration coefficients

Sensors such as the dissolved oxygen sensor that can be field calibrated will require you to update the calibration coefficients for these channels periodically. You may also need on occasion to manually enter new coefficients, although this is not recommended for factory calibrated sensors (for example T or D) unless instructed by RBR.

Steps

You can view static information about an instrument at any time as follows:

1. In the **Navigator** view, under the **Instruments** list, click the appropriate logger.
2. Click **Analysis** tab > **Calibration** tab to show the current calibration coefficients.
3. To manually change a coefficient, click on the appropriate entry in the table (C1, C2, C3, etc.). The current entry will be highlighted, and the new value can be typed.
4. If a two point calibration has been performed, and calculated coefficients have been copied, right click on either the **Time** or **Parameter** entry for the parameter you wish to modify. Select **Paste to selected row** from the drop down menu.
5. Click **Store calibration** to write the calibration coefficients to the logger.
6. If you need to revert to previous coefficients, click **Revert calibration**.

> If you do not click **Store calibration**, the coefficients will not be written to the instrument, and will be lost once your session is closed.

14.1 N-Point calibration

Sensors such as Dissolved Oxygen (Oxyguard) or turbidity generate a voltage output that is proportional to the value of the parameter being measured. To calibrate these sensors, Ruskin offers an N-point calibration method to generate calibration coefficients.

14.2 Oxyguard DO calibration

> The Oxyguard DO sensor has a true zero point and therefore it can be calibrated using the single-point calibration method using a reading at 100% oxygen concentration only. The 100% calibration should be performed at the expected temperature and salinity of the deployment environment.
>
> If the logger has a pH/ORP sensor and Oxyguard DO sensor, it is advisable to ensure that the pH/ORP and Reference sensors are submerged in the water during measurement.

Equipment and Materials

1. Two Large mouth beakers.
2. Sodium sulphite Na_2SO_3
3. Aquarium air pump.
4. Magnetic stirrer.

5. Water

Preparing solutions

Reference Point 1 solution – Oxygen saturated solution at expected temperature and salinity of deployment environment

1. Fill the large beaker with 2 L of water and install magnetic stirrer.
2. Bubble air through the water using an air pump (an aquarium air pump would work).
3. Switch ON the air-pump and the magnetic stirrer.

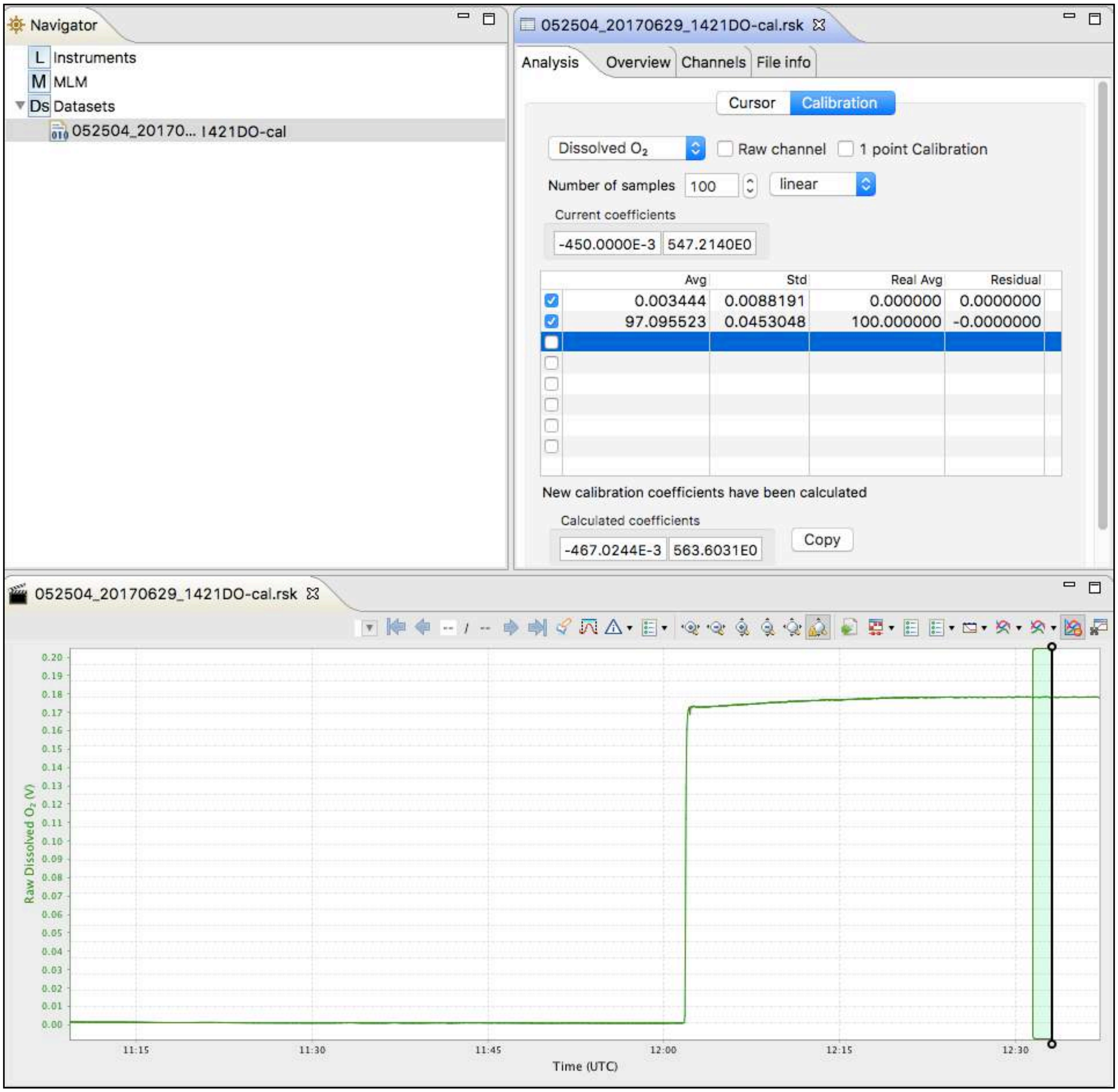
Reference Point 2 solution – Dissolved oxygen concentration of zero

1. In a beaker, dissolve approximately 5 tsp of sodium sulfite (Na_2SO_3) into 500 mL tap water.
2. Mix the solution thoroughly with a magnetic stirrer. The solution will be oxygen-free after 15 minutes.

Steps

1. In Ruskin, configure the instrument to sample at a fast rate, between 6 Hz and 3 seconds.
2. Use **Sync to PC** to ensure the logger clock is synchronized to the PC clock, and ensure the end time is set so that the logger will keep sampling until calibration is complete.
3. Submerge the dissolved oxygen sensor in the Reference Point 1 solution for at least 15 minutes near the stirrer so that it is in the best mixed area of the bath.
4. Take sample readings for at least 15 minutes for the 100% calibration point, making note of the time that the sample is being measured.
5. Submerge the dissolved oxygen sensor in the Reference Point 2 solution for at least 15 minutes for the 0% calibration point, making note of the time that the sample is being measured.
6. Retrieve the data from the data logger as per the steps in Download.
7. The calibration data should now be displayed in the **Plot** view. In the **Properties** view, go to **Analysis** tab > **Calibration** tab.
8. Select the dissolved oxygen sensor type from the drop down list.
9. The **Number of Samples** spinner box is automatically set to **100**.

   This value is the number of sample points Ruskin will average the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.
10. Click on a stable point in the **Plot** view corresponding to 100% oxygen. In the table in the first row, under **Real Avg**, enter 100 and press enter.
11. Select the check box in the second row in the table, then click on a stable point in the **Plot** view corresponding to 0% oxygen. In the table in the second row, under **Real Avg**, enter 0 and press enter.
12. Ruskin automatically calculates the calibration coefficients, and these values appear in **Calculated coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.
13. Follow the steps in Change calibration coefficients to update the coefficients for this sensor in the data logger.



14.3 Turbidity calibration

The Seapoint turbidity sensor is calibrated by RBR with a two-point calibration technique. We recommend doing a two-point calibration performed under fluorescent lighting.

Alternatively, one can do a single point calibration. If doing a single "0" point calibration in distilled water the calibration will only correct the coefficients for an offset. If only a single non zero point is performed the calibration will recompute the slope coefficient. We recommend to only perform a "0" point calibration unless you are confident on your non zero standard.

14.3.1 Two-point calibration

Equipment (entire logger submerged)

- 4000-FTU Formazin standard – 500ml
- Distilled water – 5 L
- Black-walled, wide-mouth container (large enough to hold the logger)
- Volumetric flask 1000 ml, class A
- Volumetric flask 200 ml, class A
- Stir stick

> ⚠ If you plan to submerge only the sensor, you can decide on the container volume and adjust the solution volumes appropriately.

Steps (preparing solutions)

1. In Ruskin, configure the data logger to sample using a 10-second sampling interval and set the sensor to autoranging - see Autoranging and fixed gain.
2. Use **Sync to PC** to ensure the logger clock is synchronized to the PC clock, and ensure the end time is set so that the logger will keep sampling until calibration is complete.
3. Flush the sensor, container and glassware with distilled water and dry them.
4. Fill the black wall container with 5000 ml distilled water using the large volumetric flask.
5. Set the sensor in the container until the sensor is fully submerged in the distilled water.

   > ⚠ The distance from the sensor's windows to the container wall must be at least 20 cm. If possible, place a dark cover on the calibration container and avoid direct light on the container.

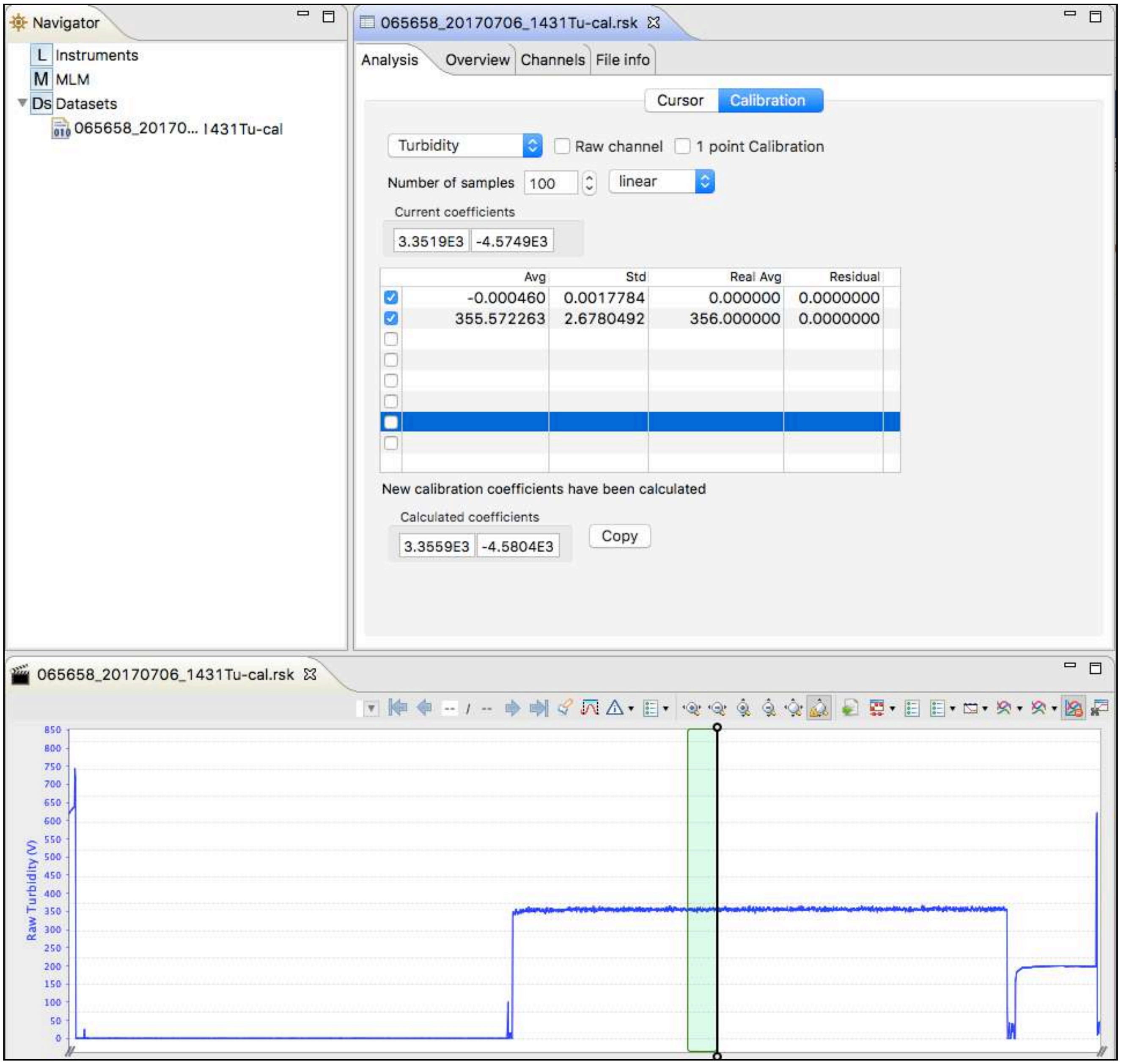
6. Record the data in distilled water for five minutes.
   This is the zero-turbidity calibration point.
7. Fill the 500 ml volumetric flask with Formazin Standard. Remember to gently shake the bottle before opening the Formazin solution.
8. Add 500 ml Formazin Standard to the black wall container with distilled water, and gently mix the solution with a stirring stick.
9. Calculate the value of the standard turbidity solution at calibration point according to the following formula:

   > Calculating dilution
   >
   > $Tu_{STD} = Tu_{STK}*V_{TOT}/(V_{DW}+V_{TOT}) = 363.63$ FTU
   > Where:
   > Tu_{STD} = turbidity of the standard solution (FTU)
   > Tu_{STK} = 4000FTU – turbidity of the stock solution
   > V_{TOT} = 500 ml volume of stock solution at calibration point (ml)
   > V_{DW} = 5000 ml - initial volume of distilled water

10. After five minutes, remove the logger from the calibration container and wash the sensor head under regular tap water.
11. Retrieve the data from the data logger as per the steps in Download.
12. The calibration data should now be displayed in the **Plot** view. In the Properties view, go to the **Analysis** tab > **Calibration** tab.

13. Select the **Turbidity sensor** type from the drop-down list.
14. The **Number of Samples** field is automatically set to **100**.
    This value is the number of sample points Ruskin will average to calculate the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.
15. Click on a stable point in the **Plot** view corresponding to 0 NTU. In the table in the first row, under **Real Avg**, enter 0 and press enter.
16. Select the checkbox in the second row in the table, then click on a stable point in the **Plot** view corresponding to the reading of your turbidity solution. In the table in the second row, under **Real Avg**, enter the value of your turbidity solution and press enter.
17. Ruskin automatically calculates the calibration coefficients, and the values appear in **Calculated coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.
18. Follow the steps in Change calibration coefficients to update the coefficients for this sensor in the data logger.

> ⚠ By using the above formula and changing the volume of distilled water and Formazin solution, you can prepare different calibration points or different volumes for checking the linearity of the turbidity sensor or getting close to real turbidity value of standard turbidity solution.



14.3.2 One-point calibration

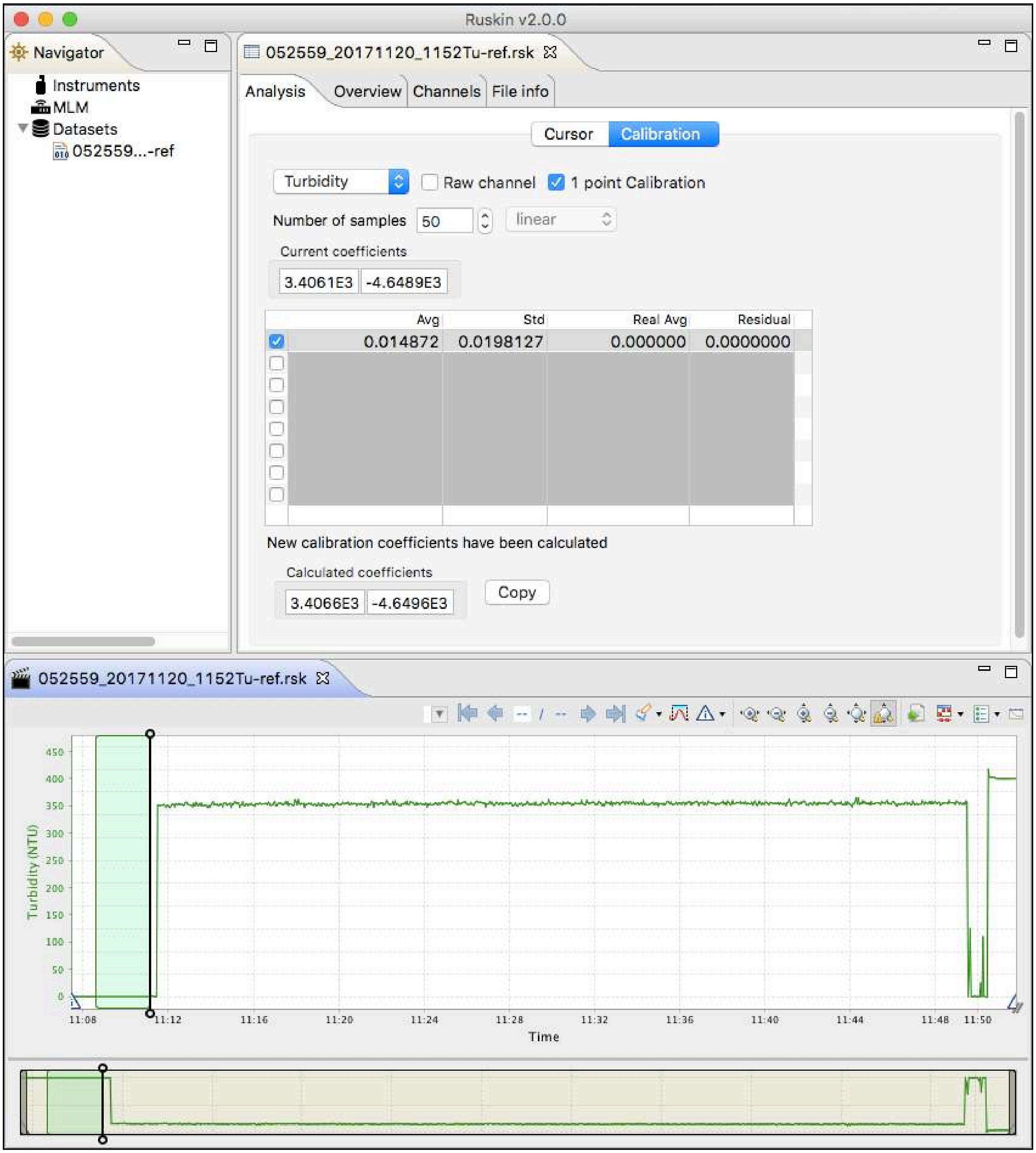
Using the same procedure as in the 2-point calibration, one can use only the distilled water or formazin standard to generate new coefficients from a single point.

RBR suggests using the one-point calibration for establishing a new "0" value only, as unless one is very confident on their non zero point they may put the unit out of specification.

After you have generated a dataset of your single point as described in the procedure above follow the steps below:

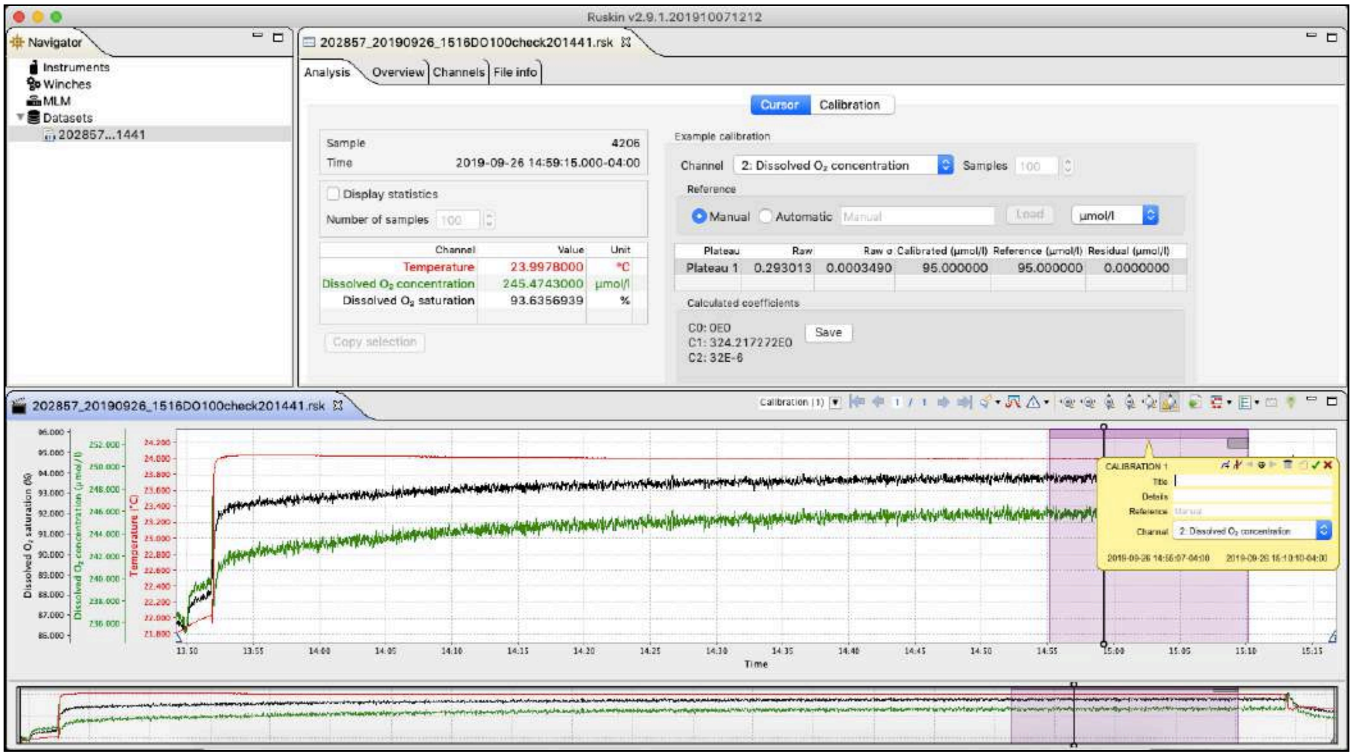
1. Retrieve the data from the data logger as per the steps in Download.

2. The calibration data should now be displayed in the **Plot** view. In the Properties view, go to **Analysis** tab > **Calibration** tab.
3. Select the **Tu sensor** type from the drop-down list.
4. The **Number of Samples** field is automatically set to **100**.
   This value is the number of sample points Ruskin will average to calculate the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.
5. Click on a stable point in the **Plot** view corresponding to 0 NTU. In the table in the first row, under **Real Avg**, enter 0 and press enter.
6. Ruskin automatically calculates the calibration coefficients, and the values appear in **Calculated coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.
7. Follow the steps in Change calibration coefficients to update the coefficients for this sensor in the data logger.



14.4 RBRcoda T.ODO - User calibration

Ruskin uses a different calibration method for the RBRcoda T.ODO User calibration than the other DO sensors. This document outlines the process to complete a calibration using the plot window method.



14.4.1 Collecting a calibration file

Please refer to the User Guide section 14 (http://files.rbr-global.com/upload/files/Ruskin_User_Guide_Standard_loggers_.pdf) for information on collecting data for the dissolved oxygen saturation of 0% and 100%. This method can be used to do a one-point or two-point calibration. The 100% point, or a reference value as close as possible to 100%, is our recommendation for the one-point calibration.

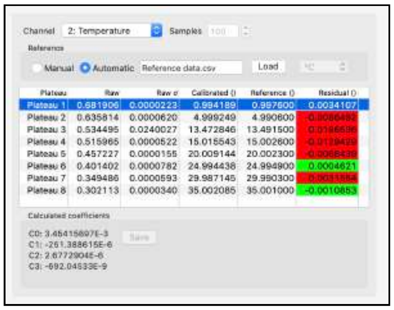
When doing a second point at 0% using sodium sulphite we recommend rinsing the sensor immediately after and then leaving it in a saturated bath until it reaches a plateau. This will reduce the possibility of residual being left under the foil and keep the solution from affecting the sensor's next samples.

14.4.2 Performing a calibration

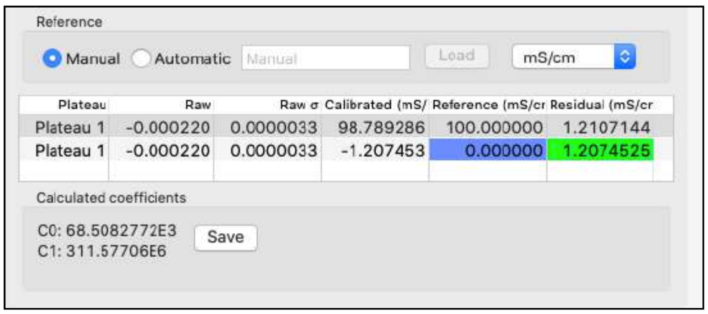
Performing a calibration requires that a calibration region be defined which contains a set of plateau markers. See **Crea ting a calibration region** and **Plateau detection** sections for information on how to generate these items. Once this has been complete, reference data must be entered. See the **Reference data entry** section for details on how to enter in reference data. The data for the calibration is summarized on the **Cursor** tab on the **Analysis** page.

Ruskin will automatically calculate new coefficients each time data is altered whether it be an alteration of the plateau location or changes to reference data.

If there are residuals that are highlighted in red it may mean that a plateau marker is not seated correctly on the actual data of the plateau. Each plateau can be moved into the correct position by clicking on the marker and dragging the mouse left or right.

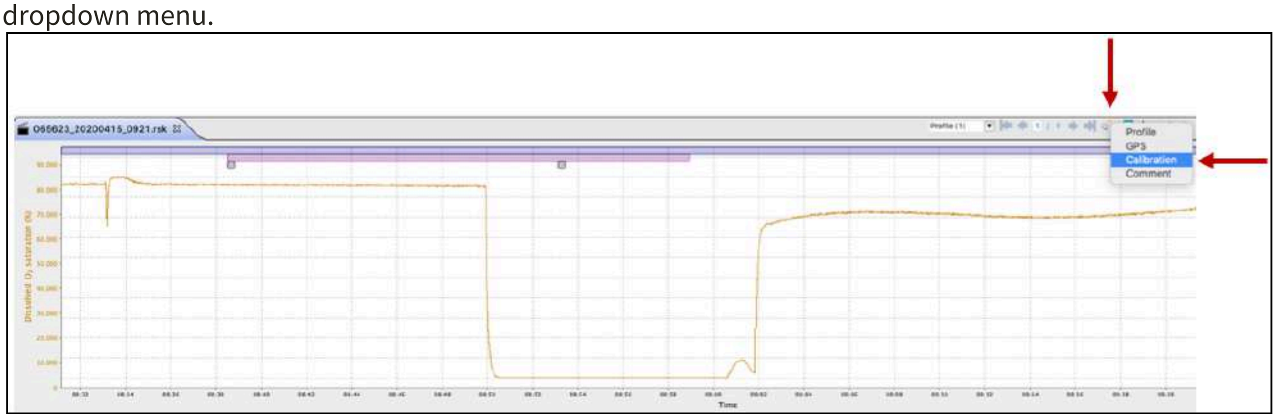


The **Save** button will be enabled, and the calibration will be completed once all of the plateau residuals are valid, indicated by being highlighted in green colour. Saving the calibration performs two operations; stores the newly generated coefficients into the RSK file and recalculates the data and stores the new coefficients into a connected instrument with the same serial number. The connected instrument must be stopped to update the coefficients.



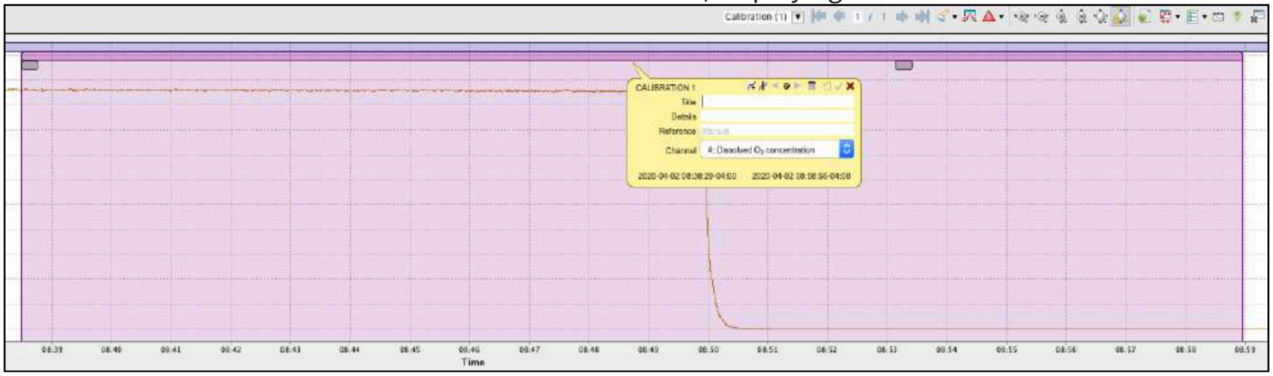
14.4.3 Creating a calibration region

1. Open a dataset containing the calibration data
2. From the plot toolbar select the annotation creation button. Select the **Calibration** option from the dropdown menu.

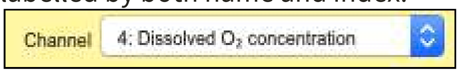


3. Move the mouse pointer to the first data point, hold down the left mouse button, and move the pointer to the last data point, then release the mouse button.

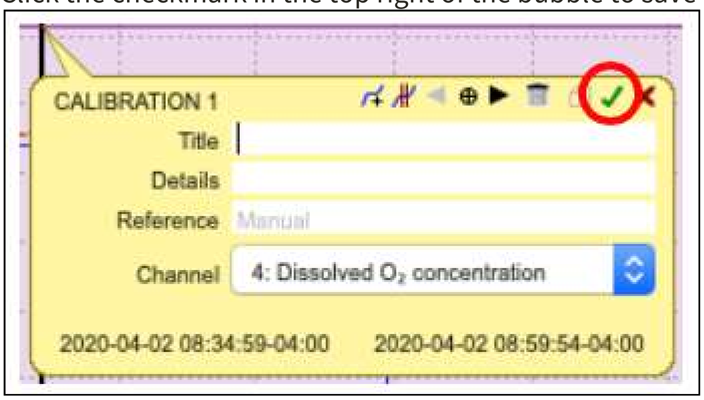
A calibration annotation will now be created and selected, displaying the information bubble.



4. Filling in the title and details fields are not necessary; however, they may come in handy if there are multiple calibration regions in the same file.
5. From the Channel selection widget, select the channel for which you want to calibrate. Channels are labelled by both name and index.



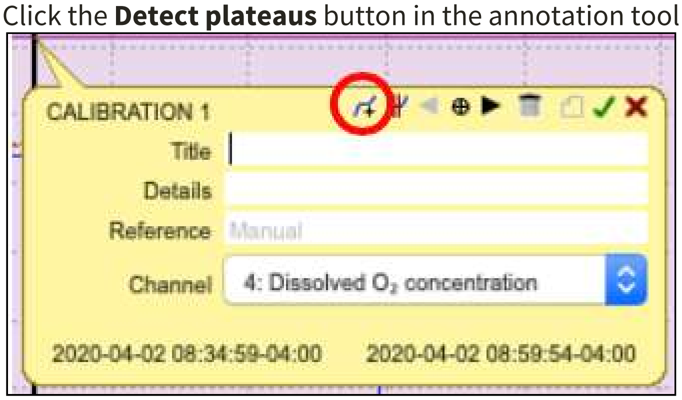
6. Click the checkmark in the top right of the bubble to save the changes.



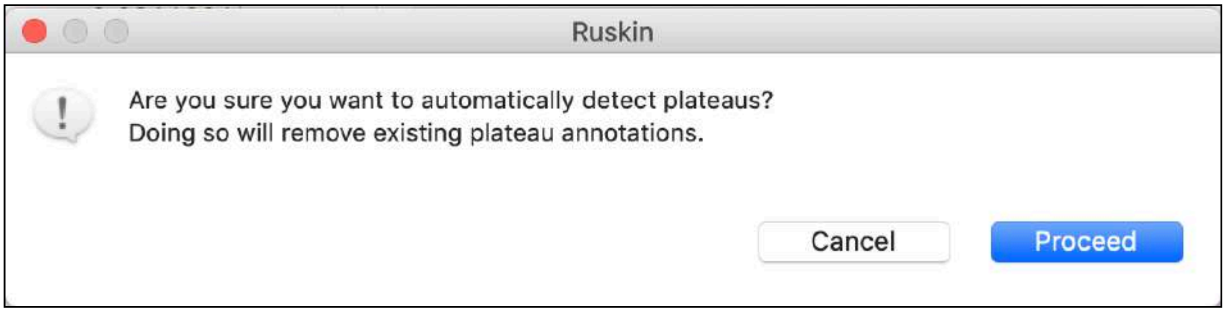
14.4.4 Plateau creation

Automatic

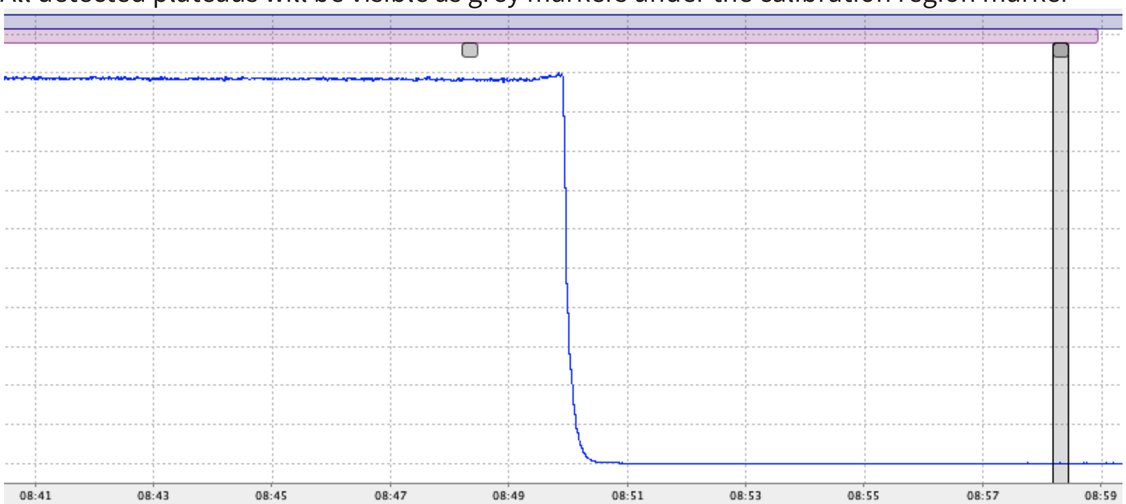
1. Click the **Detect plateaus** button in the annotation toolbar.



2. If there are existing plateaus, a warning dialogue will pop up, indicating that all existing plateau markers will be removed. Click 'Proceed' to continue.



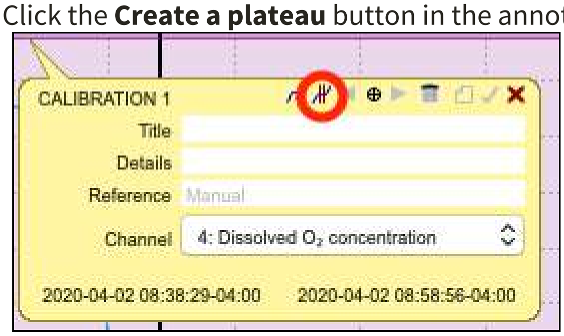
3. All detected plateaus will be visible as grey markers under the calibration region marker



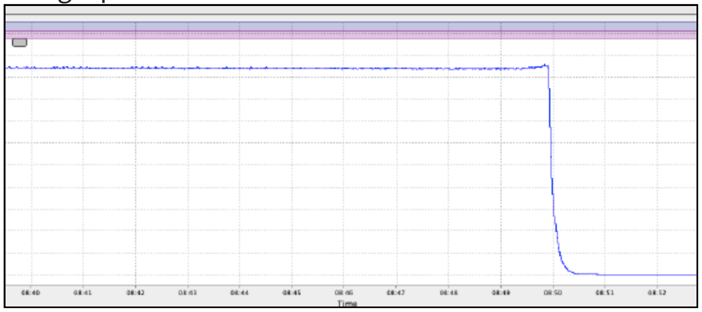
4. Plateaus that should not be used can be deleted. See **Plateau deletion**

Manual

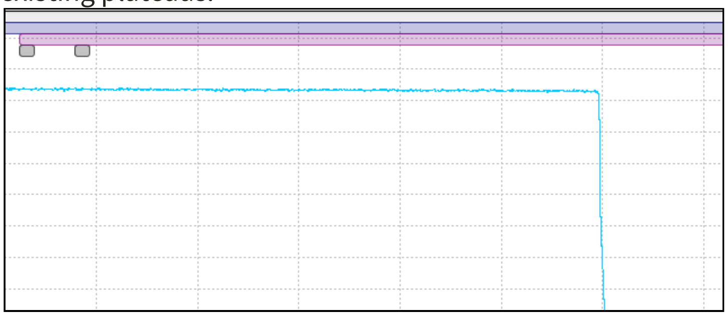
1. Click the **Create a plateau** button in the annotation toolbar.



2. A single plateau marker will be added to the start of the calibration region.

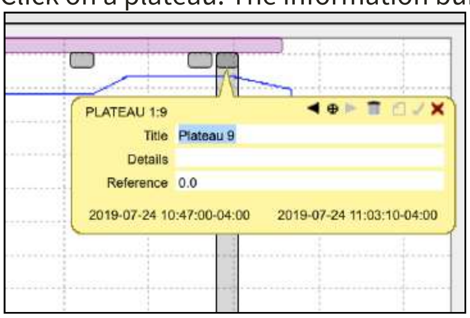


3. Clicking the **Create plateau** button a second time will create a new plateau marker to the right of any existing plateaus.

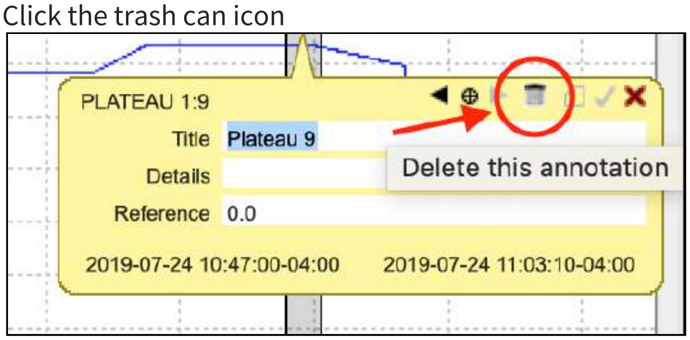


14.4.5 Plateau deletion

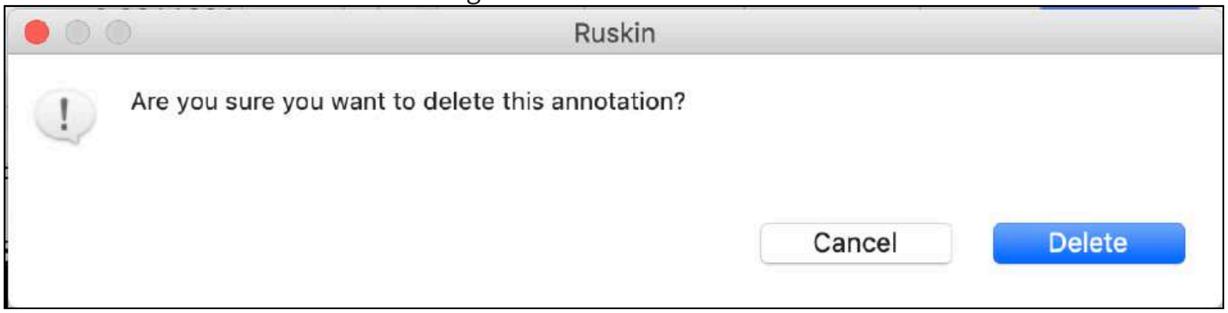
1. Click on a plateau. The information bubble will appear, and the marker will highlight.



2. Click the trash can icon



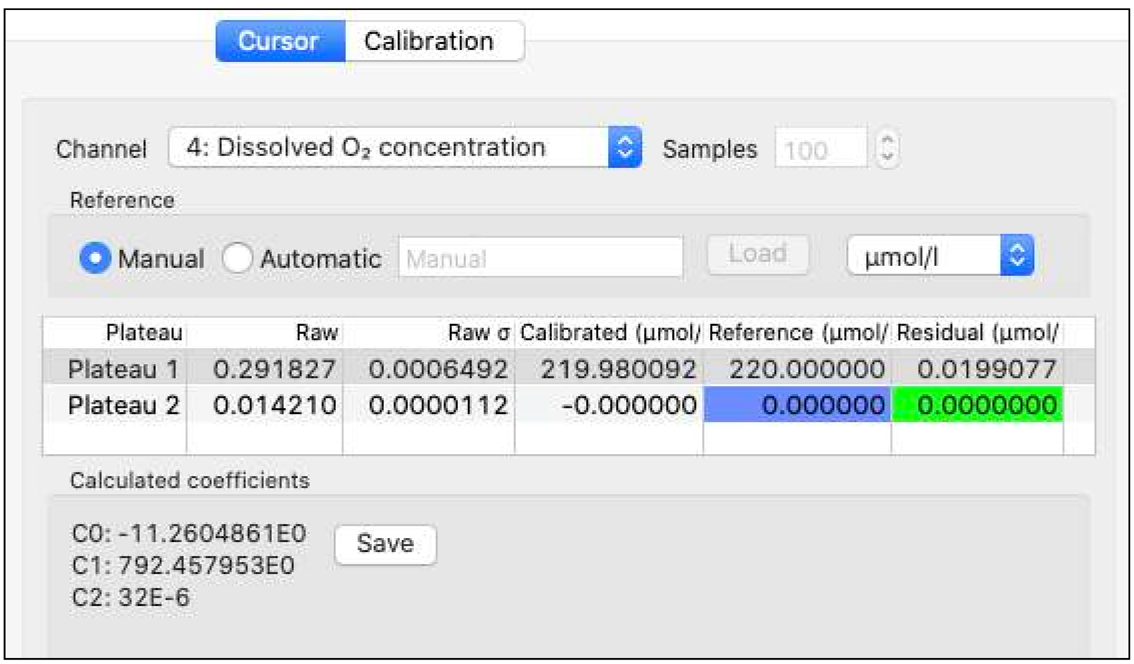
3. Click **Delete** on the confirmation dialogue



14.4.6 Reference data entry

Reference data can be entered either manually or automatically. The manual process requires that the operator enters a reference value for each plateau. The automatic functionally allows the operator to upload a CSV file containing the reference data. By default, the calibration is set to **Manual** entry mode.

The reference can be edited in units of % or µmol/l by selecting the preferred unit in the drop-down menu.

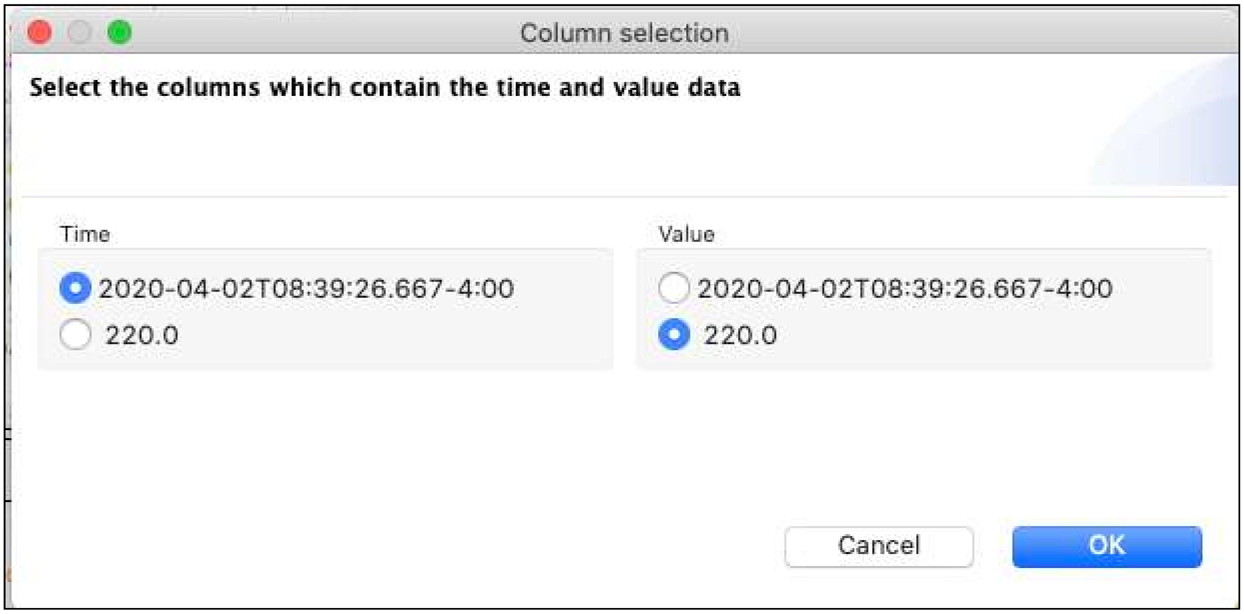


Automatic

The CSV file for the automatic data entry must have two columns; time (in ISO 8601 format), and data (in float/double format). For example:

```
2020-04-02T08:39:26.667-4:00, 220.0
2020-04-02T08:58:16.333-4:00, 0.0
```

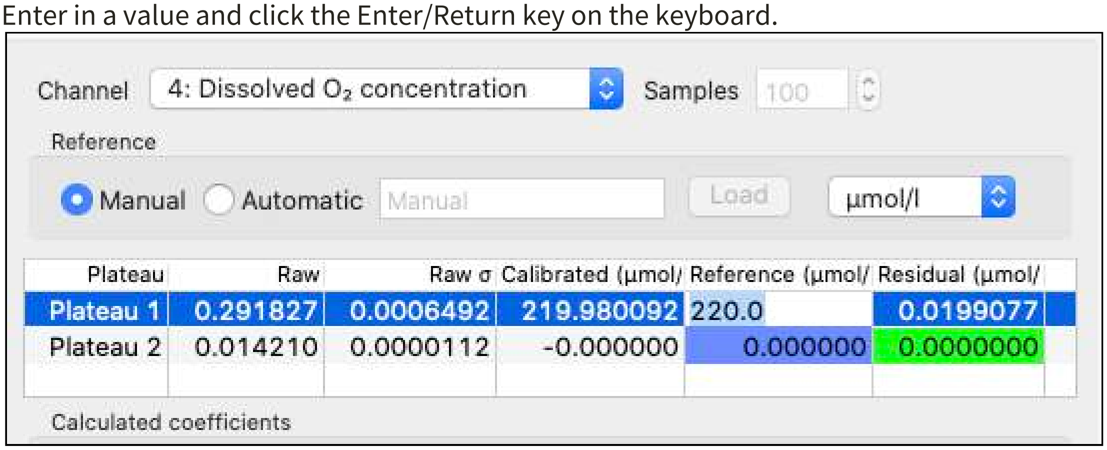
Once the file has been selected, a dialogue box will appear asking for you to define the column which contains the time and which one contains the reference data:



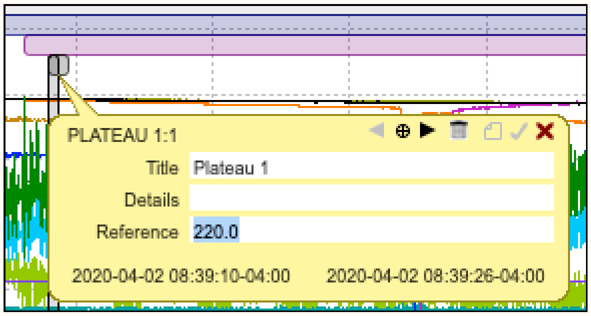
> **Time**
>
> The time in the CSV file will need to be a value that falls within the region of the plateau, however, the CSV file can hold additional rows with times that are outside of the plateau region.

Manual

1. Click the **Manual** option.
2. Click the **Reference** cell on the plateau to be edited.
3. Enter in a value and click the Enter/Return key on the keyboard.



4. Complete these previous steps for all points in the calibration

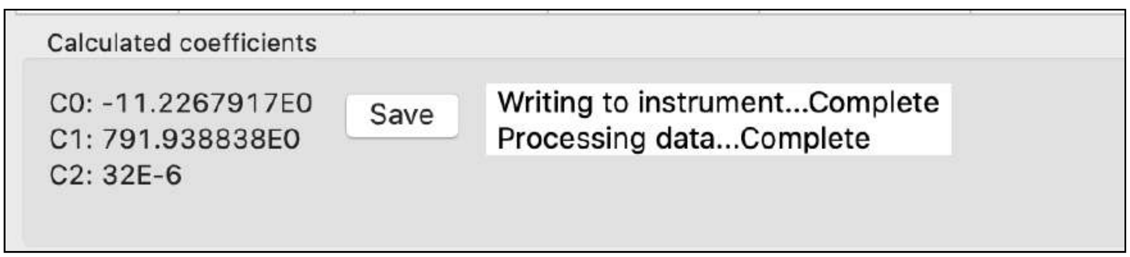
> **Annotation - Reference entry**
>
> Alternatively, the reference value can be entered on the annotation for the plateau:
>
> 
>

Saving coefficients

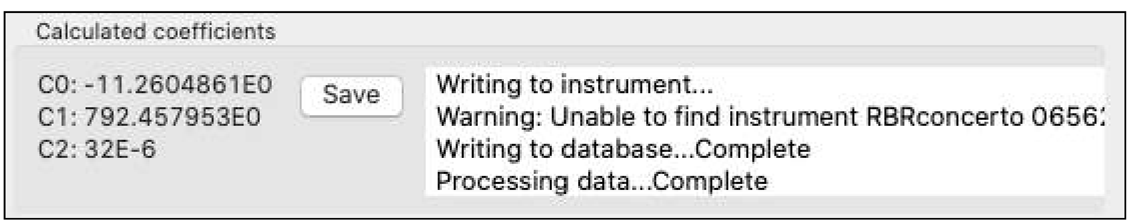
If the residuals are within an acceptable range (highlighted in green) the save button will appear in the **Calculated coefficients** section:

When the **Save** button is selected Ruskin will try to write the coefficients to the instrument if it is connected:

If it is successful it will display **Writing to instrument...Complete**



If it is not successful it will display **Warning: Unable to find Instrument RBRconcerto #######**



15 Preferences

Ruskin sets global preferences that require no changes in many situations. However, as you learn more about what Ruskin can do, you may want to change some of these defaults to better suit your requirements. The global preferences include:

- Where to store output files
- Plotting preferences
- Configuring derived channels
- Calculating derived channels when sensors are missing

You can change these preferences at any time.

15.1 Specify location for data files

You can control where data files are stored by default. Specify these locations before downloading any data.

Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **General**.
3. In **File location**, type a directory name in the **Directory for RSK files** text box, or click **Browse** to locate the directory where you want to store data files.
4. Click **Apply** or **OK**.

You can change where future data files are stored by default at any time. The change takes effect immediately.

15.2 Specify location for realtime data files

You can control where realtime files are stored by default. Specify these locations before connecting any instrument.

Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **General**.
3. In **File location**, type a directory name in the **Directory for realtime RSK files** text box, or click **Browse** to locate the directory where you want to store data files.
4. Click **Apply** or **OK**.

You can change where future data files are stored by default at any time. The change takes effect immediately.

> ⚠ Realtime files are generated when a connected instrument is streaming or when the user enables fetching mode on the instrument.

15.3 Specify location for log files

You can control where log files are stored by default. Specify these locations before downloading any data.

Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **General**.

3. In **File location**, type a directory name in the **Directory for log files** text box, or click **Browse** to locate the directory where you want to store log files.

   Log files are used when you request RBR support.

4. Click **Apply** or **Close**.

You can change where future log files are stored by default at any time. The change takes effect immediately.

15.4 Specify Language selection

Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **General**.
3. In **Language selection**, select a language from the list.
4. Click **Apply** or **OK**.

15.5 Using advanced sampling controls

Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **General**.
3. In **Sampling control**, select **Enable advanced sampling controls** check box to change from the simple control.
4. Click **Apply** or **OK**.

Simple control: provides a default list of fixed values.

Advanced control: provides the user the ability to enter any values.

15.6 Using advanced calibration controls

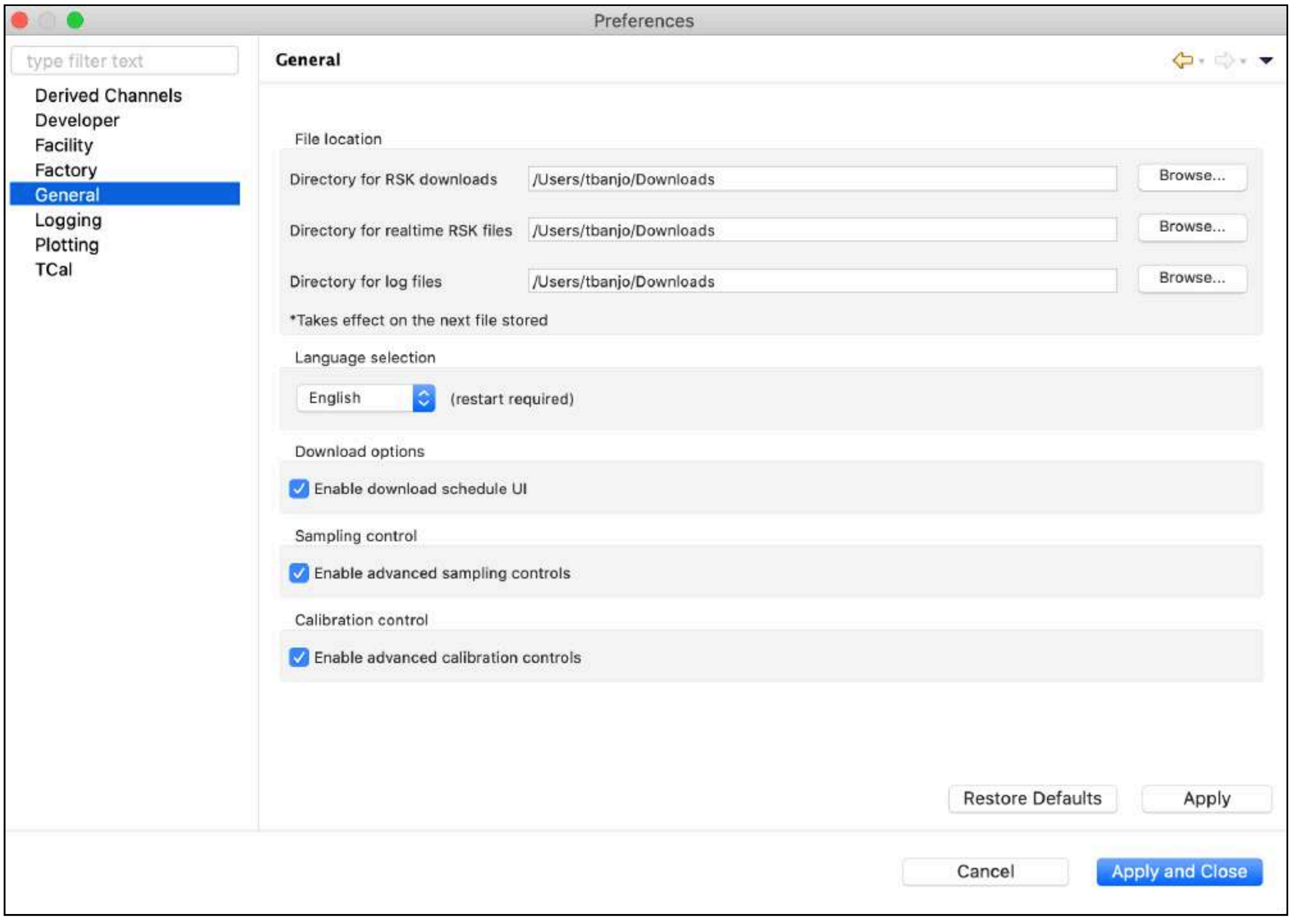
Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **General**.
3. In **Calibration control**, select **Enable advanced calibration controls** check box to change from the simple control.
4. Click **Apply** or **OK**.

Simple control: provides the user the ability to view and edit the main coefficients (C) for any channel.

Advanced control: provides the user the ability to view and edit all main and dependency calibration coefficients (C,X) for all channels.

The Preferences dialogue box is shown below:



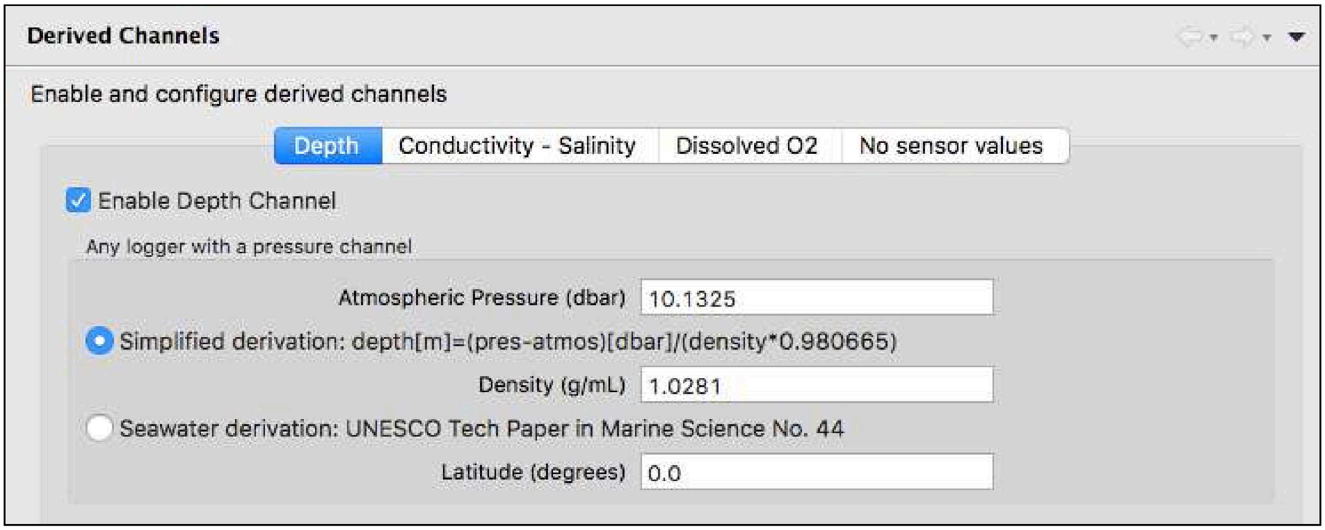
15.7 Derived channels RBRsolo/duet

⚠ Ruskin calculates all the possible derived channels for that specific logger.

The RBR*solo*[3] D and RBR*duet*[3] T.D measure pressure and from that sea pressure and depth is derived. The RBR*solo*[3] DO measures percent dissolved oxygen saturation and from that dissolved oxygen concentration may be derived.

15.7.1 Depth channel

To set up the initial values to derive depth and sea pressure select the menu item **Options,** then select **Preferences,** then select **Derived channels** and select the **Depth** tab. Enable the depth channel and select the appropriate calculation methods and edit the default parameters.

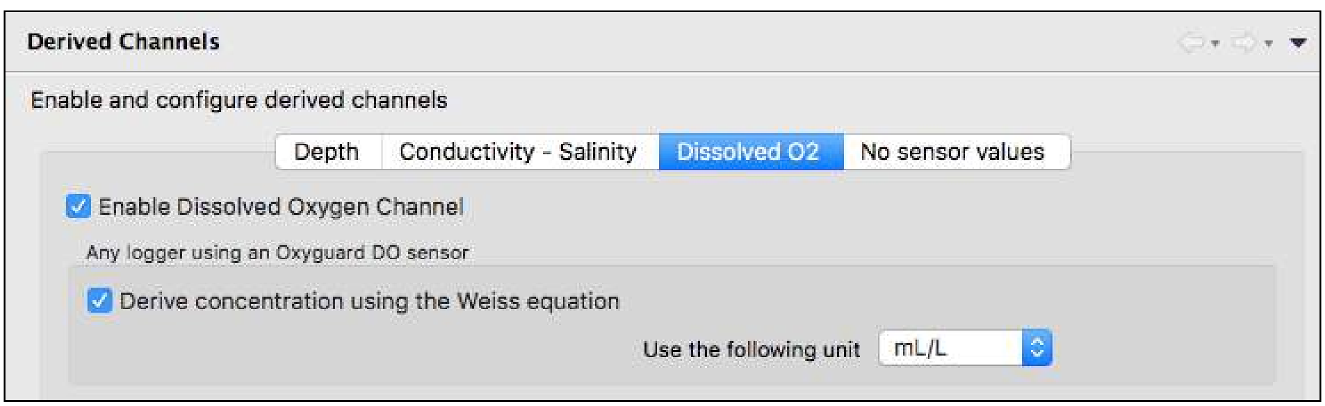


Enter the average expected Atmospheric pressure and the expected density of the water (default values are populated). There are two methods to calculate depth - select the appropriate method using the radio buttons. Sea Pressure is calculated by subtracting the Atmospheric pressure.

⚠ For downloaded files, use the dataset Parameters tab to edit the parameters to derive the channel.

15.7.2 Dissolved Oxygen concentration

To set up the initial values to derive dissolved oxygen concentration select the menu item **Options,** then select **Preferences,** then select **Derived channels** and select the **Dissolved 02** tab. Enable the Dissolved Oxygen channel and select the desired concentration units (µMol/L, mg/L or mL/L) from the drop down list.



⚠ For downloaded files, use the dataset Parameters tab to edit the parameters to derive the channel.

15.8 Specifying plotting preferences

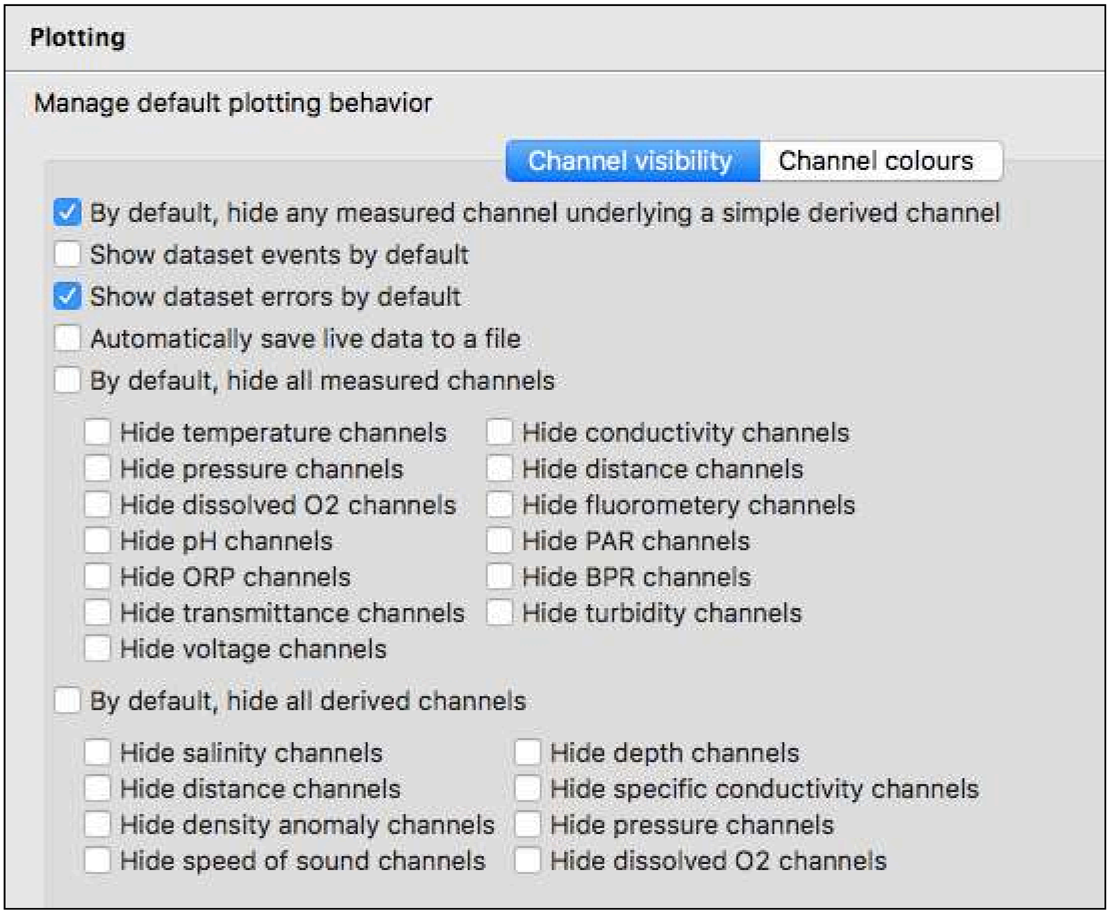
You can specify how you want the graphical display in the **Plot** view to behave by default. With the exception of choosing colours for each channel, these preferences can be overridden for a particular graphical display in the **Plot** view.

You can click **Apply** to save your changes without closing the dialogue box.

15.8.1 Channel visibility tab

The **Channel visibility** tab displays many options to hide or show specific information in the **Plot** view. These settings are applied when displaying a dataset in the **Plot** view. Some information in this tab is enabled by default. When you select any of the checkboxes in this tab, the action is immediate.

Channel visibility tab with default settings



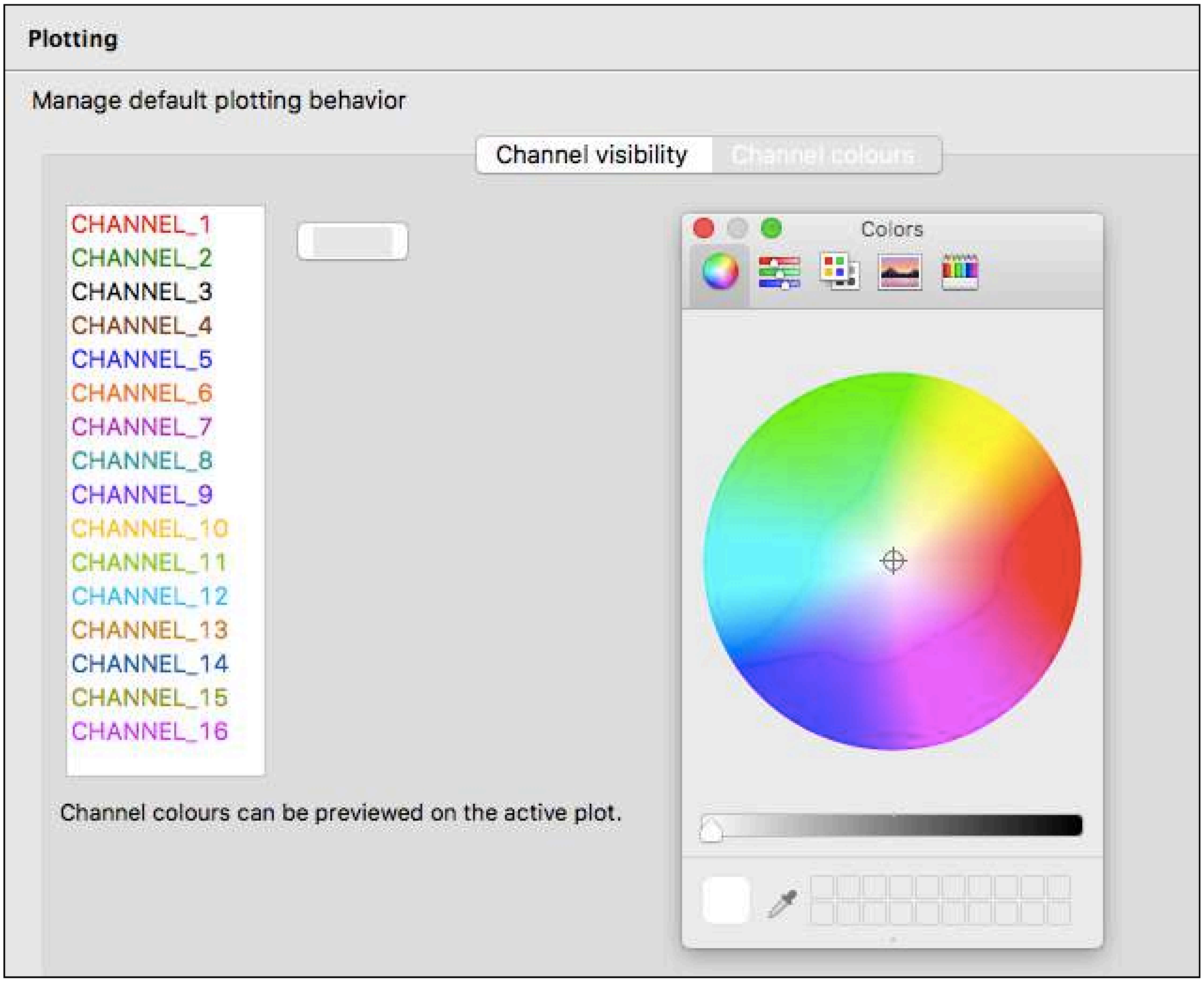
Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **Plotting**.
3. On the **Channel visibility** tab, select the checkbox for the information you want hidden.
   Events appear at the x-axis as a vertical grey line with a brief text to indicate the type of event, such as STP for a stop event in a dataset.
4. To hide all measured channels, select **By default, hide all measured channels** checkbox.
5. To hide all derived channels, select **By default, hide all derived channels** checkbox.
6. To show information, clear the checkbox beside the information you want to be shown.

15.8.2 Channel colours tab

The **Channel colours** tab allows you to choose a different colour for each channel that is shown for information currently running in **Plot** view, or from an opened dataset. If there is no colour available that you like, you can create your own colour. When you select a colour, the new colour is immediately updated by Ruskin.

Channel colours tab with the **Colour** dialogue box to customize a colour for a channel



Steps

1. From the **Options** menu, click **Preferences**.
2. In the list on the left side, click **Plotting**.
3. Click the **Channel colours** tab.
4. In the channels listed, click the channel you want to change the colour for.
5. Click the colour box that appears beside the channel list.
6. With the colour dialogue box open, select a colour from the **Basic colour** area.
7. Select **OK** to apply the colour to the channel.
8. To create a custom colour:
    a. Repeat steps 4 and 5.

b. Click **Define Custom Colours** and then choose a colour.
c. Click **Add to Custom Colours** to add the new colour to **Custom colours**.
d. Click **OK** to apply the new custom colour to the channel.