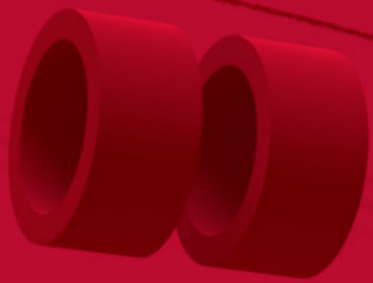
RUSKIN
USER GUIDE

RBR*coda*^{3} RBR*tridente*
RBR*coda* RBR*quadrante*



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1 Ruskin software

Ruskin is the only tool you need to manage all your RBR instruments and measurement data. It is available for Mac® and Windows® PC.

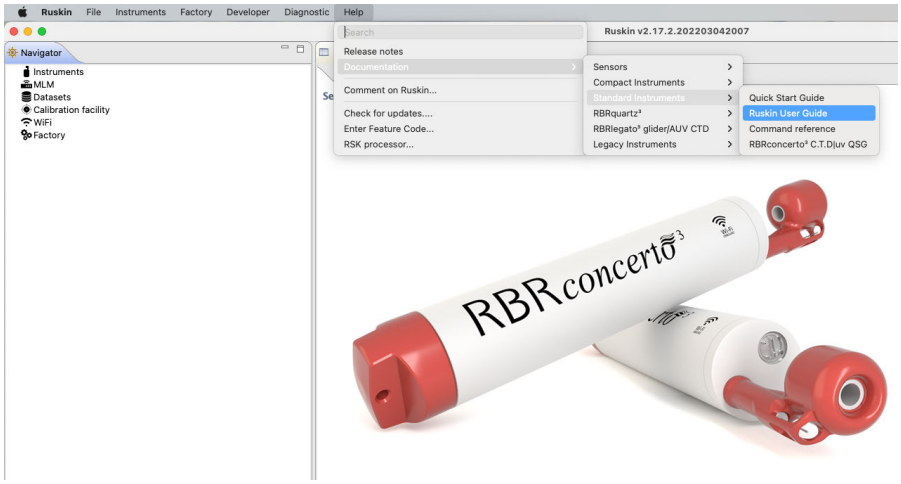
Use the Ruskin software to do the following:

- Configure and enable multiple sensors
- View your datasets graphically
- Export your data in various formats
- Analyse your data
- Change the calibration coefficients
- Perform user calibration
- Contact RBR

RSK files generated by Ruskin contain raw measurement data, firmware and software versions, dates and times, sampling settings, power settings, measured and derived parameters, errors and events, other diagnostic information. They can be read directly in Matlab, or exported to Excel, OceanDataView®, or text files.

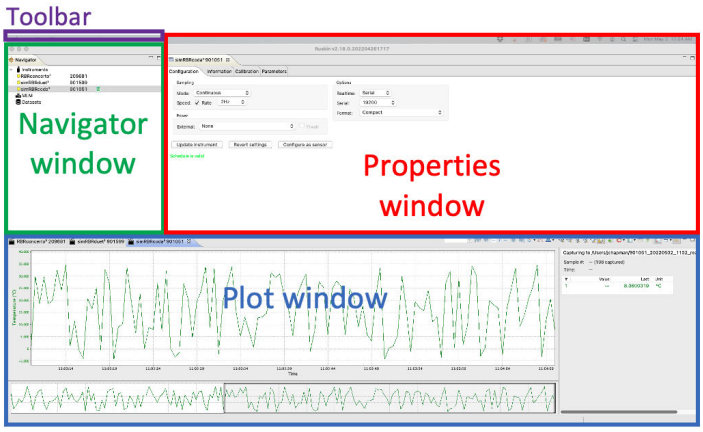
Find Ruskin software for Mac and PC on the USB stick included with your instrument, or visit the RBR website to download the latest version.

The most recent software updates, release notes, Ruskin user guides, instrument guides, and quick start guides are available from the **Help** menu in Ruskin.



2 Ruskin interface

Ruskin software has a user-friendly interface which consists of a **Toolbar** and three main windows: **Navigator**, **Properties**, and **Plot.**



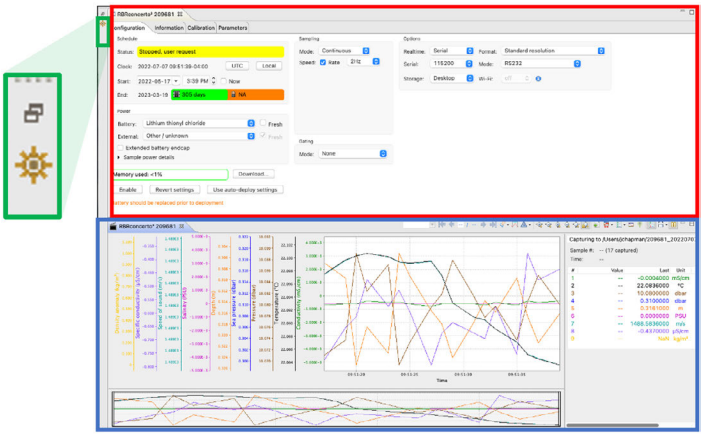
In the **Navigator** window, you will find the list of instruments connected to Ruskin, as well as MLM and winches (if applicable), and datasets.

When an instrument on the list is selected, the **Properties** window displays four tabs with information related to this instrument: **Configuration**, **Information**, **Calibration**, and **Parameters**. Use these tabs to configure your deployment, check the calibration certificates, and verify your parameters.

The data plot will appear in the **Plot window** below if the realtime option is available and selected for this instrument, or if you click the **Fetch** button (green triangle on the far right of the toolbar).

Click-and-drag window tabs to rearrange the windows within Ruskin, or move a window outside of Ruskin. Hover over a side of a window, and when the cursor becomes a two-way arrow, move it to adjust the window size.

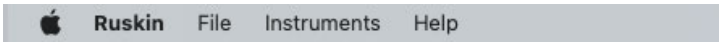
Click the **Minimise** button in the top right corner to minimse a window. For example, you can close the **Navigator** window to have a better view of the **Properties**. The closed window icon will appear on the sidebar. Click the **Maximise** button above the closed window icon to re-open it.



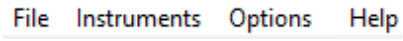
Double-click a window tab to maximise that window, and double-click the tab again to return it to the original size. Alternatively, use the **Minimise** and **Maximise** buttons.

When you restart Ruskin, it returns to its original layout.

The **Toolbar** at the top left above the **Navigator** window has four dropdown menus. If you are using a Mac computer, it appears as follows:



On a Windows PC, the **Toolbar** looks slightly differently:



The rest of the interface is the same between the two systems.

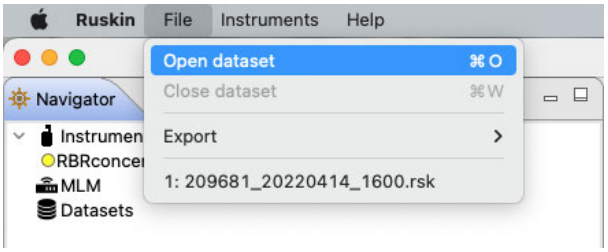
2.1 Ruskin / Options

On your Mac, go to the **Ruskin** dropdown menu to access information on current software version, set up your preferences, or quit Ruskin. Note that the rest of the options on this dropdown menu depend on your operating system and are external to Ruskin.

On your Windows PC, use the **Options** dropdown menu to set up your preferences.

2.2 File

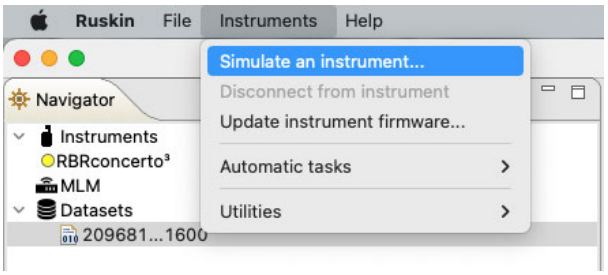
Go to the **File** dropdown menu to open or close a dataset, export your data, and see the list of available datasets. The **Datasets** menu in the **Navigator** windows duplicates some of these options for convenience.



2.3 Instruments

Go to the **Instruments** dropdown menu to simulate an instrument or update your firmware, or take advantage of the utilities.

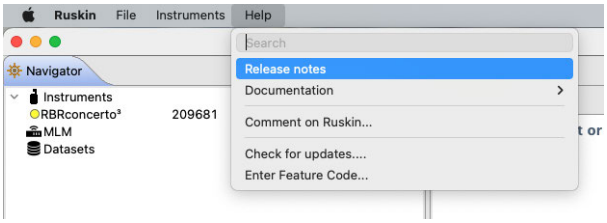
The **Instruments** menu in the **Navigator** windows duplicates some of these options for convenience.



Automatic tasks and **Utilities** are not applicable for sensors.

2.4 Help

Go to the **Help** dropdown menu to access the latest release notes and technical documentation, provide your feedback, check for updates, or to add a beta feature. On Mac, you can also use the Search option.



3 Installation

Ruskin is the only piece of software you need to operate your RBR instruments. RBR releases Ruskin software versions compatible with Mac and PC (Ruskin Desktop), as well as with iOS® and Android™ (Ruskin Mobile).

Install the Ruskin Mobile app on your mobile device by going to the Apple App store or Google Play.

Follow the steps below to install Ruskin Desktop on your computer.

3.1 Install Ruskin on 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 = 2GB

The instruments use a USB interface to communication with Ruskin.

Steps

> Realtime sensors will not require USB drivers to operate, they are only required for our standard and compact instruments.

1. Connect the USB stick included with your instrument to a port on your computer.
2. Navigate to the **Ruskin Installation** folder and double click on the file `RuskinSetup.exe`.
3. Follow the installation wizard. By default, Ruskin will be installed to `C: \RBR`
4. At the end of the installation, you will see a prompt 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 will appear on the desktop and in a **Start** menu folder.

> The most recent version of Ruskin software can be found at https://rbr-global.com/products/software.

3.2 Install Ruskin on Mac

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

Steps

> ⚠ Always use the default **Applications** folder as the working directory.

1. Connect the USB stick included with your instrument to a port on your adaptor.
2. Navigate to the "OSX" folder 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. An application named "Ruskin" will appear in the **Applications** folder.
4. Right-click on the icon, and select **Open**.
5. A dialogue box will prompt you to authorise the opening of Ruskin.

> ⚠ You may need to navigate to **System Setting** > **Privacy & Security** to **Allow applications from** “App Store to Known Developers” to complete the installation.

6. Drag the `Ruskin.app` application to the **Dock**

3.3 Update Ruskin

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

- Find the most recent version of Ruskin at https://rbr-global.com/products/software.
- Receive an automatic notification about a new release when you start the application.
- Check from within Ruskin by navigating to **Help** > **Check for updates**.
- Send an email to support@rbr-global.com, subject: "Ruskin update request", and ask us to add you to the mailing list. You will receive an email as soon as the new version is released.

If you have a broadband connection, simply follow the installation instructions on your computer. Otherwise, request a USB stick from RBR.

> ⚠ It is not necessary to uninstall the older version of Ruskin before installing the 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.

3.4 Uninstall Ruskin

Uninstall Ruskin only if you no longer need to manage RBR instruments from your computer.

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

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

Uninstall Ruskin on a PC, Windows 7, 8, 8.1, or 10

1. Go to **Start** > **Control Panel** > **Programs**.
2. Under **Programs and Features**, click **Uninstall a program**.
3. Find **Ruskin** on the list.
4. Click **Ruskin** to highlight it.
5. Click **Uninstall**.

Uninstall Ruskin on a Mac, OS X 10.12 or later

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

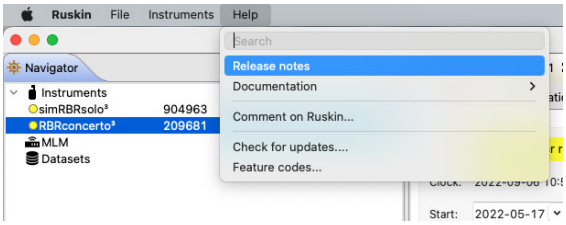
4 Support

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

- Send us an email. For technical questions, use support@rbr-global.com, and for general inquiries, info@rbr-global.com.
- Contact us via the website at https://rbr-global.com/about-rbr/contact-rbr.
- Call us at +1 (613) 599-8900.
- Send us a bug report from within Ruskin itself.

> When experiencing an issue, look for a solution under the **Help** menu before contacting RBR.

The **Help** menu on Ruskin offers access to technical documentation, feedback forms, and software updates. On Mac, you can also search for Ruskin menu options.

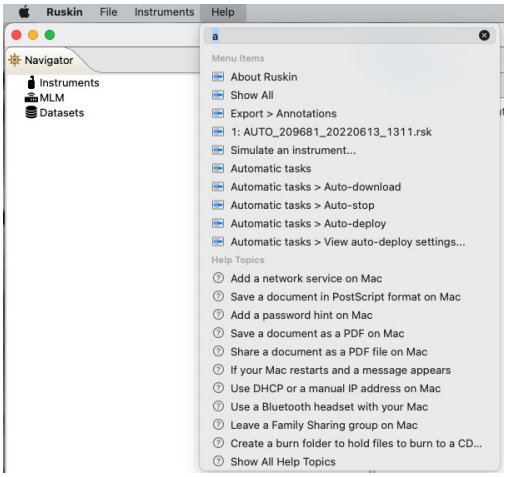


4.1 Search on Mac

If using a Mac computer, you can take advantage of the **Search** option.

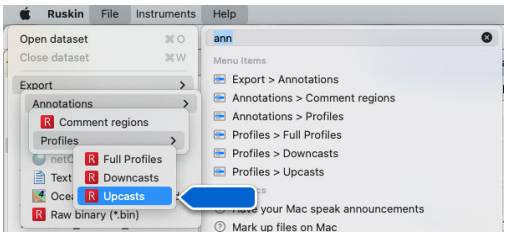
In the **Search** field under **Help**, type in a word, part of the word, or even a single letter to open a list of matching items.

The top half of the list pertains to Ruskin, while the bottom part comes from the Mac environment.



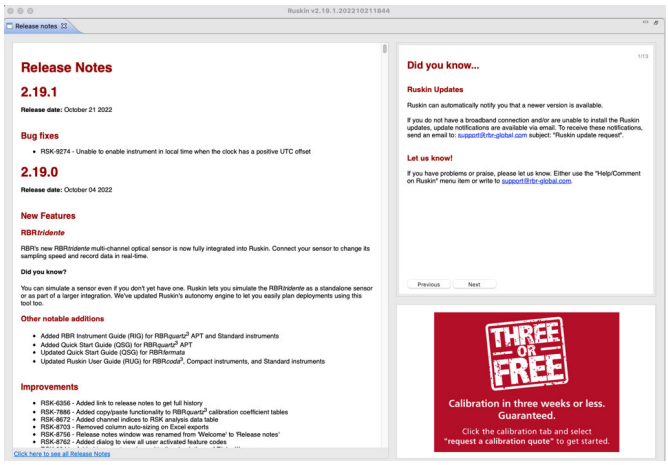
Scroll down the Ruskin list and select an item to locate. Ruskin will open the toolbar menu and point to the option in the dropdown menu.

You can execute the located option right away.



4.2 Release notes

Click on **Help > Release notes** to open the **Welcome** window. It will outline new features, improvements, and bug fixes associated with each release version.



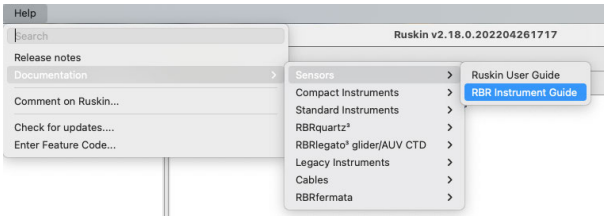
Click the link at the bottom left to see the full history of the release notes. The link will take you to the RBR support page.

Alternatively, scroll down to see brief recaps of the release notes from all previous versions.

Click the **x** to close the **Release notes** window and return to the **Navigator** mode.

4.3 Documentation

Click on **Help > Documentation** to open the menu tree. Browse through a variety of guides available for instruments and accessories.



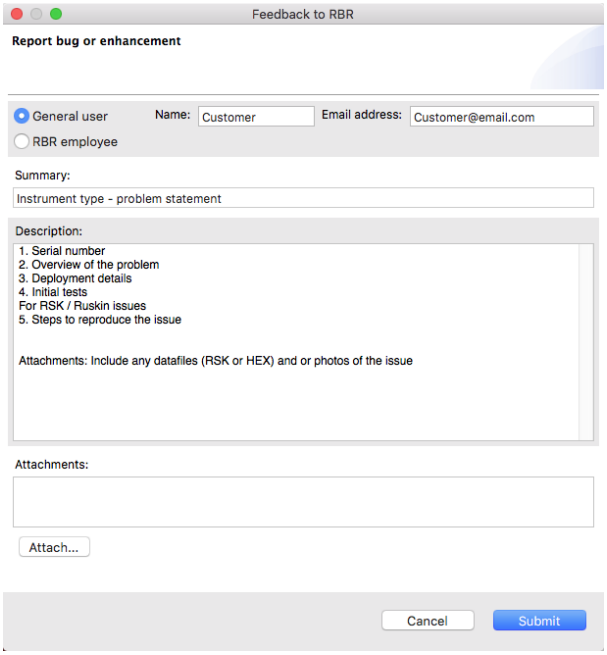
Please note that you can always access the most current revisions of RBR documents on the RBR website.

4.4 Comment on Ruskin

There is an advantage to sending a bug report from within Ruskin because this allows you to include the diagnostic logs, RSK datasets, screenshots, and any other files that could help us reproduce the problem and find the solution as quickly as possible. Follow the steps below.

Steps

1. Click on **Help > Comment on Ruskin...** . The **Feedback to RBR** form will appear.
2. Enter your identification information.
3. Enter a brief summary of the problem.
4. Provide a detailed description (serial number for the instrument, overview of the problem, deployment details, initial tests, and, for software bugs, steps to reproduce the issue)
5. Include any attachments, if required.
6. Verify all the information entered and click **Submit**.



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4.5 Check for updates

Click on **Help > Check for updates** to search for the latest software version.

If your software is up-to-date, no further action will be required.

If an update is found, Ruskin will offer to install it. Follow the prompts. Restart Ruskin for the updates to take effect.

4.6 Feature codes

Sometimes, RBR may release new features to certain users only, as a beta trial. This includes:

- Features in early development
- Features supporting a new product, in preparation for the product launch
- Features requested by a specific customer

Usually, the goal is to get feedback and improve the feature before its official release. Contact your sales representative or RBR support team at support@rbr-global.com if you have questions about your feature code.

Steps

1. Click on **Help > Feature codes..**.
   The **Feature codes** window will appear.
2. Enter the feature code provided by RBR.
3. Click **ADD**.

If the code is correct, Ruskin will save the feature in the local database and enable it. In most cases, you will have access

to the new feature immediately, without restarting Ruskin. Otherwise, you will receive any additional instructions at the time when you receive the feature code.

Errors

1. The feature code is not valid.
   This error may indicate the code was entered incorrectly or it is not compatible with the current version of Ruskin.
2. The feature code is already enabled.
   This error may occur when another user has already activated this code.

5 Quick start - Ruskin Desktop

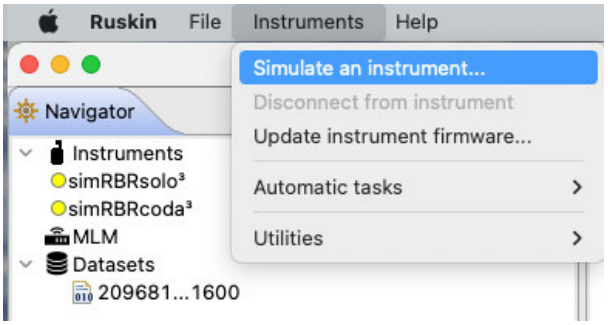
Ruskin Desktop version is designed for computers and laptops. It generates dataset files which include raw measurement data, firmware and software versions, dates and times, sampling settings, power settings, measured and derived parameters, errors and events, calibration coefficients, and diagnostic information, offering the fullest Ruskin experience.

5.1 Simulate an instrument

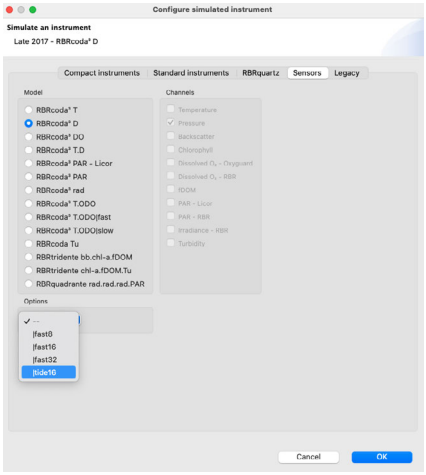
Ruskin can simulate most instruments and sensors that RBR produces. We recommend that you experiment with different simulated options before enabling a schedule for your actual deployment. This practice will also help you become more familiar with how an RBR instrument interacts with Ruskin and how to configure its settings and features. Work with simulated instruments the same way as you work with a real RBR instrument, configuring, calibrating, and fetching data.

Steps

1. From the **Instruments** menu, click **Simulate an instrument**.
   The **Configure simulated instrument** dialog box will appear.

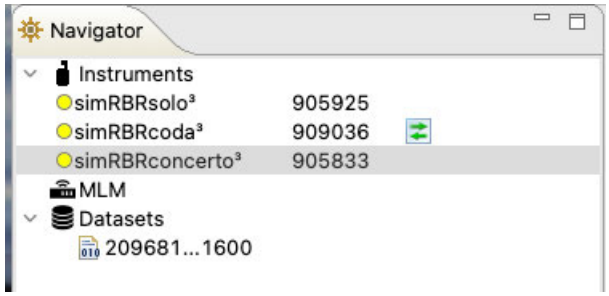


2. Click your instrument family and make your selections.



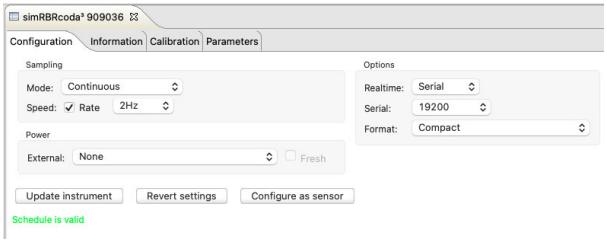
Depending on the instrument selected, the **Options** dropdown menu may contain | fast sampling rates, | tide and | wave variants, tilt, or no options at all (in that case, the menu will be greyed out).

3. Click **OK** to proceed.
4. Your instrument will appear under **Instruments** in the **Navigator** view. Simulated instruments will have a prefix "sim" in the front of their name.



The instrument properties will be displayed on the right, under four tabs.

- The **Configuration** tab displays sampling mode and speed, serial connection details, and external power options
- The **Information** tab includes general details, such as the instrument model, generation, serial number, firmware version, power source, and the channels
- The **Calibration** tab allows access to the current calibrations for each channel in the instrument
- The **Parameters** tab outlines default values used by the sensor when performing computations and derivations



5. Familiarise yourself with the instrument by changing configuration options and comparing deployment estimates. Select the desired configuration using the dropdown options or entering the values manually in the fields provided. The data plot will appear at the bottom of the screen.
6. Manage multiple instruments by switching between them in the **Navigator** window.

> To remove a simulated instrument from Ruskin, right-click it in the **Navigator** window, and select **Disconnect from instrument**. You can also use the **Instruments** menu.
>
> Alternatively, simply close its **Plot** tab by clicking the **X.** The instrument will disappear from the list.

5.2 Deploy an RBR sensor

Before using your RBR sensors, you may want to experiment with different options by simulating your instrument on Ruskin. When you are ready to use your physical RBR instrument, follow the steps below to ensure that you measure exactly what you want on the first attempt.

The only two parameters needed to operate your sensor in streaming mode are the streaming speed, and the serial baudrate. The sensor will begin streaming data as soon as power is provided.

- The factory streaming speed is the fastest that the sensor is rated for, e.g. | fast32 will be set to 32Hz.
- The factory baudrate is 9600.

> Ruskin supports connection baudrate options from 1200 to 115200.

These baudrates do not need to be set in Ruskin for Ruskin to detect an instrument. Ruskin scans all available ports with available baudrates to identify RBR instruments.

Steps

1. Connect your RBR sensor to your computer using a serial interface or a serial-to-USB adaptor.
   The instrument will appear in the **Navigator** view after a few seconds.
2. Click on the instrument.
   Its properties will appear to the right, grouped under four tabs:
   - The **Configuration** tab displays sampling mode and speed, serial connection details, and external power options
   - The **Information** tab includes general details, such as the instrument model, generation, serial number, firmware version, power source, and the channels
   - The **Calibration** tab allows access to the current calibrations for each channel in the instrument
   - The **Parameters** tab outlines default values used by the sensor when performing computations and derivations
   - The **Plot** window located at the bottom of the screen will display realtime data streaming from the sensor.
   - Change the parameters using the on-screen controls and they take effect immediately.
   - All settings persist over power cycles.
   - RBR realtime sensors will begin streaming data as soon as power is provided.

The RBR realtime sensors can operate in streaming or polled modes. To set up the polled mode, you will need to communicate with your instrument using a serial terminal. See the **OEM commands reference** section for details.

Ruskin automatically saves the data streamed or fetched from your sensor.

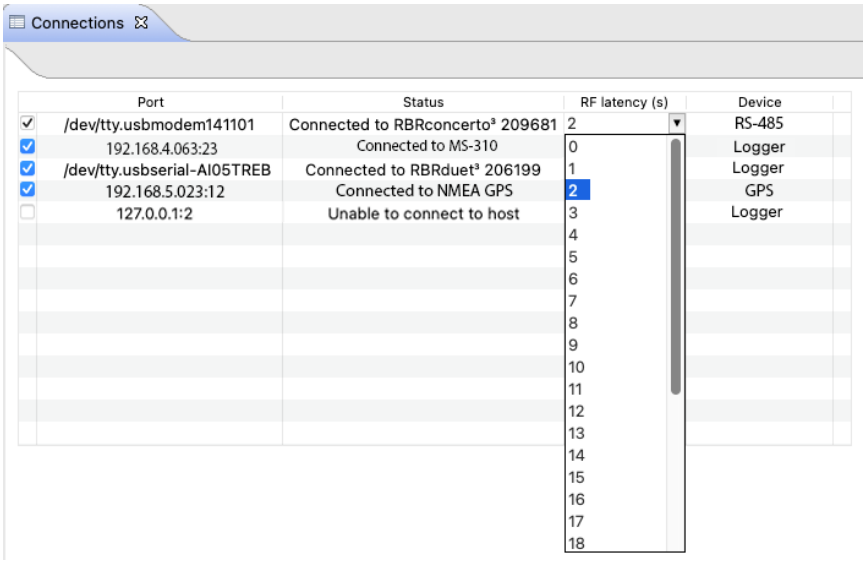
Go to **Preferences** (under **Options** menu) to change your default location for RSK files.

See **RSK files** for the file naming conventions.

6 Connections

Use the **Connections** tab to view and manage devices connected to your computer via physical ports or Ethernet.

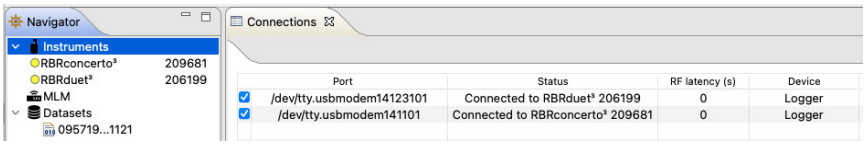
In the **Navigator** window, click **Instruments.** The **Connections** tab will open on the right. The table will include ports, statuses, RF latency selections, and the device type for each connected device. .



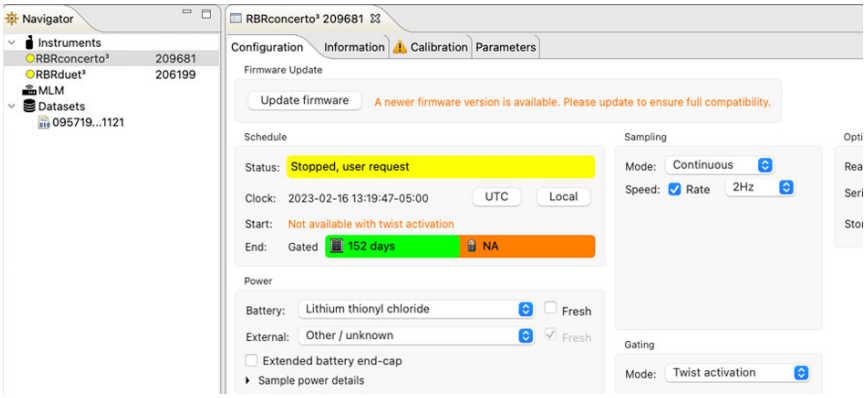
Column	Information
Port	If your instrument is plugged in to your computer, this column will identify the physical port by name, such as "**COM5**" (if using Windows) or by its address, such as "**/dev/tty.usbmodem141101**" (if using MAC OS).
Status	The column will display a success message, such as "**Connected to RBRconcerto³ 209681**", or an error message, such as "**Unable to connect to host**".
RF latency (s)	From the dropdown menu, select a value up to **29** seconds. The selected value will extend the allowable time for an instrument to respond to a command. Use this option when on a long cable or slow Wi-Fi connections.
Device	The column will display the device type for each connected device: **Logger**: Instruments connected via USB, serial (RS-232), or TCP connections • **RS-485**: Instruments connected via serial (RS-485) connections • **GPS**: NMEA streaming devices

Connect your RBR sensor to your computer using a serial interface or a serial-to-USB adaptor.

As soon as you plug in an instrument, Ruskin will detect it and add it to the list. .

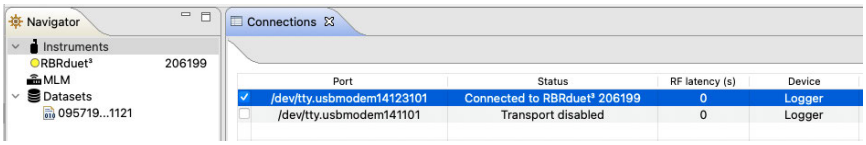


Click on one of the instruments to switch to its **Configuration** tab.



If you unplug an instrument, the port will remain enabled as long as the port checkbox remains selected. Ruskin will automatically reconnect to the instrument when it is plugged back in.

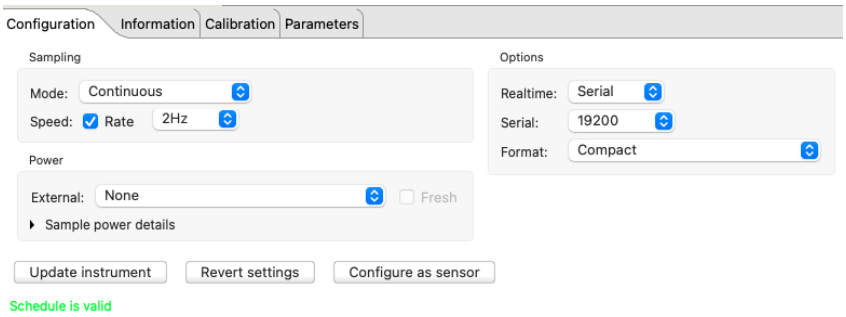
Deselect the checkbox next to your instrument to disable transport to its port. After this, Ruskin will not detect any instrument plugged into this port..



To restore transport, reselect the checkbox. Your instrument will re-appear in the **Navigator** window.

7 Configuration

Use the **Configuration** tab to set up your deployment parameters.



After adjusting any parameters during deployment, verify that they meet your requirements. To return to previous settings, click **Revert settings**.

To save new settings, click **Update instrument.** New values will replace all previously set deployment parameters.

> You cannot use **Revert settings** after clicking **Update instrument.** Once the settings are saved to the instrument, you will need to restore old values manually and update the instrument again.

If you disconnect an integrated sensor from the host instrument to use independently, click **Configure as sensor** before reintegrating, to set up compatible baudrate and sampling speed. To return to previous settings, click **Revert settings.**



7.1 Update firmware

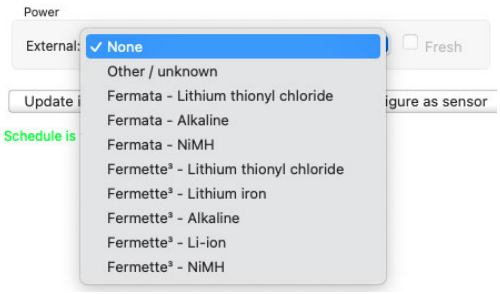
Ruskin automatically checks if your instrument firmware is up-to-date. Updates may be critical, routine, or customised.

If a newer version is available and this update is critical, the **Update firmware** button and a warning message will appear at the top of the **Configuration** tab.

See **Critical firmware updates** for details.

7.2 Power

The **Power** section includes external power options for the RBR realtime sensors. These include RBR*fermata* and RBR*fermette*[3] underwater battery canisters with various battery chemistries available. The RBR*fermata* uses D-type batteries, and the RBR*fermette*[3] uses AA cells.



AA-type batteries (RBR*fermette*[3])

Name	Chemistry	Voltage (V)	mAh*
Lithium thionyl chloride	Li-$SOCl_2$	3.6	2700
Lithium iron	Li-FeS_2	1.5	3500
Alkaline	Zn-MnO_2	1.5	2500
Li-ion	Li-NiMnCo	3.6	750
Nickel metal hydride	Ni-MH	1.2	2400

*The nominal capacity of each type of battery is given at room temperature.

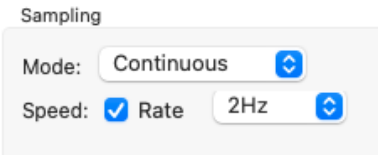
D-type batteries (RBR*fermata)*

Name	Chemistry	Voltage (V)	mAh*
Lithium thionyl chloride	Li-$SOCL_2$	3.6	18400
Alkaline	Zn-MnO_2	1.5	16000
Nickel metal hydride	Ni-MH	1.2	10000

*The nominal capacity of each type of battery is given at room temperature.

7.3 Sampling

The **Sampling** section includes three fields: **Mode**, **Speed**, and **Rate**, as well as several optional fields available with certain sampling modes.



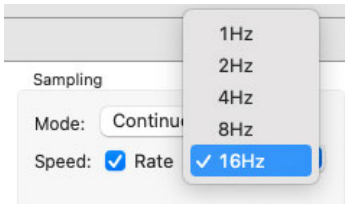
Mode

Most RBR realtime sensors can only operate in **Continuous** sampling mode. However, the RBRcoda3 D | tide16 and RBRcoda3 T.D | tide16 also support **Tide** sampling mode, whereas the RBRcoda Tu, RBRtridente, and RBRquadrante support **Aggregate** sampling mode.

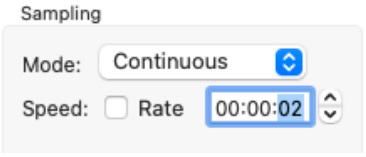
Speed and Rate

These are the only two parameters you need to configure **Continuous** sampling mode.

Check **Speed** to select the sampling **Rate** in Hz from the dropdown menu. The default option is always the highest instrument rating. For example, | fast16 will default to 16Hz.



Uncheck **Speed** to enter the sampling **Rate** manually in hours, minutes, and seconds (HH:mm:ss format). The fastest rate to enter manually is 1s. Type the numbers in, or use the up and down arrows.



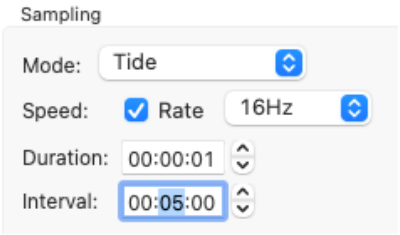
Duration and Interval

When operating in **Tide** sampling mode, you need to configure two more parameters: **Duration** and **Interval**.

The RBR*coda*^{3} D | tide16 and RBR*coda*^{3} T.D | tide16 sensors average a burst of pressure readings and stream only the resulting average.

Duration specifies the time range over which to average. It must always be longer than **Speed**.

Interval is the repetition period for performing the averaging. It must always be longer than **Duration**.



In the example shown, the sampling rate selected is 16Hz (16 samples per second). The instrument will be sampling for a duration of one second, then pause and average the sixteen samples collected.

The sensor will stream only one sample, averaged over the sixteen samples collected during the period of the **Duration** (one second) and remain paused for the time of the **Interval** (five minutes).

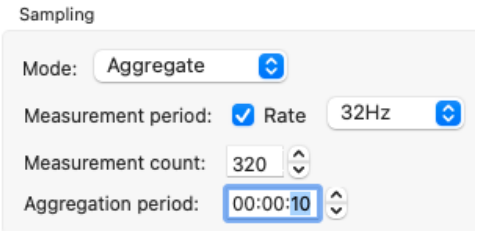
After the interval ends, the sensor will start sampling again, repeating the same cycle.

> At every **Interval**, the instrument records only one sample, averaged over all samples collected during the period of **Duration**. The rest of the samples are discarded after averaging is performed.

Measurement period, **Measurement count**, and **Aggregation period**

When operating in **Aggregate** sampling mode, a set number of measurement (a measurement burst) are taken at each period. Thus, you need to configure **Measurement period**, **Measurement count**, and **Aggregation period**.

Measurement period sets the internal sampling rate of your sensor. **Measurement count** is the number of measurements within the burst, with its maximum being 320 regardless of the sampling rate. Thus, at 32Hz, the maximum **Aggregation period** is 10s.

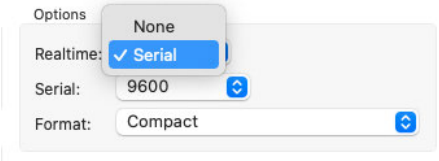


The sensor will collect data at the specified rate over the specified **Aggregation period**, until the number of collected samples reaches **Measurement count**, and then average those samples to produce a single value to store on the instrument. In the example shown, the RBR*tridente* will sample at 32Hz and collect 320 samples in 10s, average these 320 samples to produce a single value, and immediately start sampling again. There is no gap between the bursts.

7.4 Options

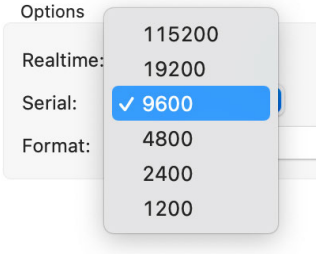
Three dropdown menus are available for the RBR sensors in the **Options** section: **Realtime**, **Serial**, and **Format**.

Realtime specifies your external streaming connection. Select **Serial** to stream live data over RS-232. Sensors will begin streaming data as soon as power is provided.



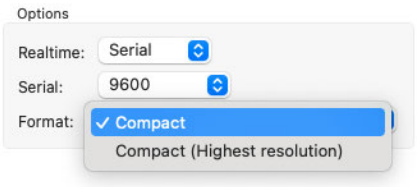
Otherwise, select **None** and use the fetching feature.

Serial offers possible baudrate options for your serial connection. The factory baudrate is 9600.



Select the output format for the realtime data from two dropdown options.

- **Compact**
  All values are shown to four decimal places, with no units displayed.
- **Compact (Highest resolution)**
  All values are shown to the number of decimal places required to adequately represent them (not limited to four decimal places), with no units displayed.

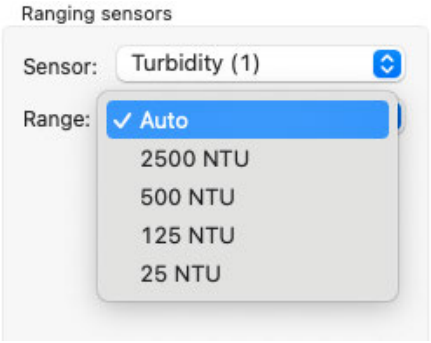


Ruskin automatically saves the data streamed from your sensor. Go to **Preferences > General** to change your default location for RSK files. See RSK files for the file naming conventions.

7.5 Ranging sensors

The **Ranging sensors** section has two dropdown menus, **Sensor** and **Range**.

Sensor displays the name and index of the channel, which for the RBR*coda* Tu is **Turbidity (1)** and **Turbidity (2)**. The latter specifies the gain level used for the deployment. The units of measurement are NTU (Nephelometric Turbidity Units).



Set **Range** to **Auto** to enable the auto-ranging setting. Your instrument will change the gain setting on the front-end amplifiers to the range most appropriate for its environment. To display the range change events, select **Diagnostic** from the dropdown under the **Events** button (blue triangle) in the **Plot** window toolbar.

Range change events are displayed as "RANGE XX Units" where XX indicates the current range and units are the units of measurement, for example: RANGE 500 NTU. For | fast sampling, where the change may be occurring over a number of samples, the label will read, "RANGE CHG", followed by the final range change event.

Alternatively, select a fixed gain setting to maintain the same setting throughout your deployment.

7.6 Configure as sensor

All RBR realtime sensors may be integrated with a standard RBR instrument, such as the RBR*concerto*^{3} or RBR*maestro*^{3}, provided it has a channel set up for that particular RBR sensor. This configuration is determined at the time of order and cannot be changed post-production.

Typically, RBR multi-sensor instruments are shipped with all sensors already installed and ready to use. There may be situations when you remove a pre-installed sensor from the RBR*concerto*^{3} or RBR*maestro*^{3} and use it independently, changing its setting while doing so. In this case, do not re-install the sensor back on the host instrument immediately after you are done. First, ensure its baudrate and sampling speed are compatible with integration. To do so, click the **Configure as sensor** button.



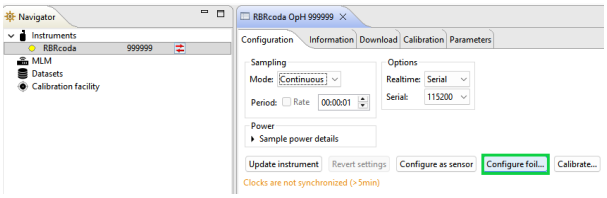
Failing to perform this operation prior to attaching the sensor to the host instrument may yield poor results as the host instrument will be unable to communicate with the sensor.

7.7 Configure RBRcoda OpH foil

Every foil for the RBR*coda* OpH sensor comes with its own set of calibration numbers. The instrument needs those numbers to report pH correctly, the **Foil Configuration** dialog is where you load them.

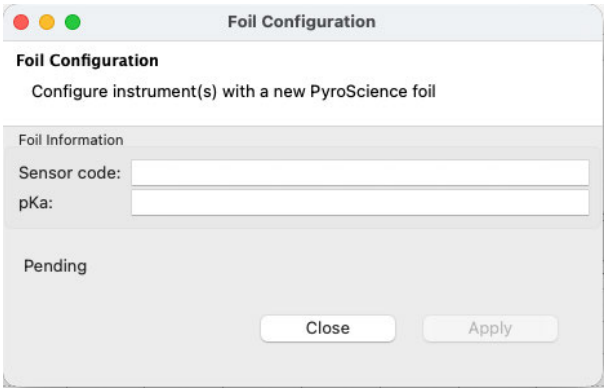
Configuring a foil

1. Connect your RBR*coda* OpH instrument so it appears in the **Navigator** tab on the left.
2. Select the **Configure foil…** button or right-click the selection and choose **Configure foil…** from the menu.



The menu item only appears when the selected item is an RBR*coda* OpH. If you select a different instrument type, the option is hidden.

3. Input the **Sensor code** and **pKa**
4. Select **Apply**



Apply stays disabled until the dialog has everything it needs i.e., **Sensor code** and **pKa.**

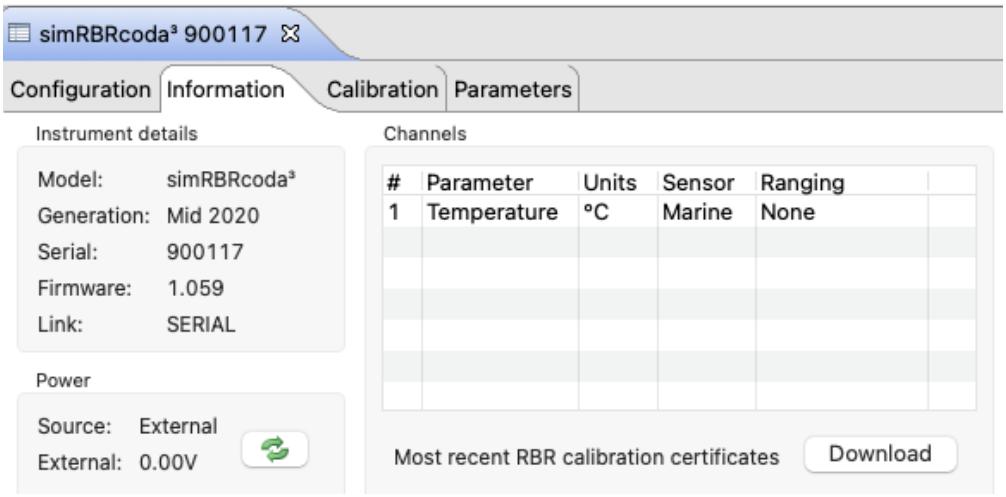
Configuring a foil always clears the instrument's pH calibration; therefore the instrument cannot measure pH again until it is recalibrated. Ruskin warns you about this and asks you to confirm before it writes anything.

5. Once the foil has configured, select **Close**.
6. Calibrate your instrument. See RBR*coda* OpH sensor calibration for details.

After a foil configuration the instrument must be calibrated before the pH and corrpH outputs will resume. The error message ERR-0 will output if an instrument is waiting to be calibrated.

8 Information

Use the **Information** tab to view general information for each of your instruments, such as model, generation, serial number, firmware version, power source, and the channels.



In the **Instrument details** section, find the model, generation, and serial number for your instrument, as well as the firmware version installed and link used.

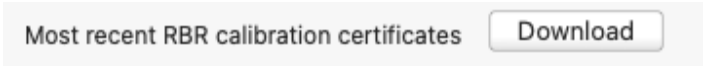
Refer to the **Power** section for the power source, power type (internal or external), and voltage.

Under **Channels**, confirm measured and derived parameters for your instrument.

If you see a warning sign on the **Calibration** tab, certificates for one or more sensors are out of date.



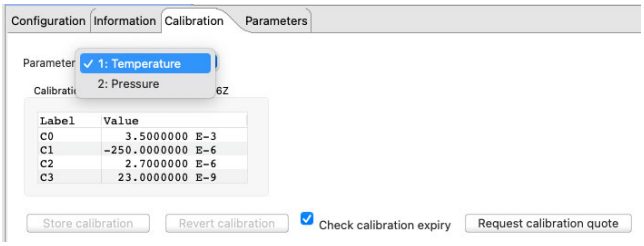
Click **Download** to obtain the PDFs of the most recent calibration certificates for each channel. This only works if you are online.



9 Calibration

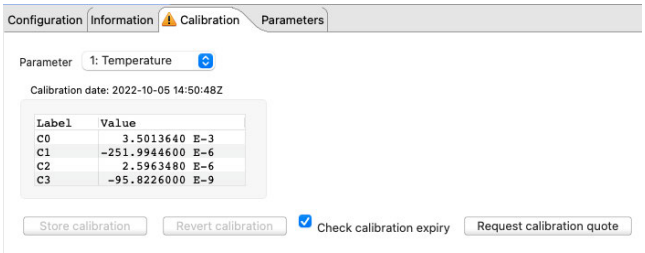
The **Calibration** tab displays calibration coefficients for each parameter, and the date and time of the last calibration.

Select a sensor from the **Parameter** dropdown menu to display its calibrations.



RBR calibration certificates contain calibration equations, coefficients, and residuals for each sensor.

The date of the latest calibration is always displayed. As an extra reminder, you can select the **Check calibration expiry** checkmark. A warning sign will appear when your calibration certificate is out of date.

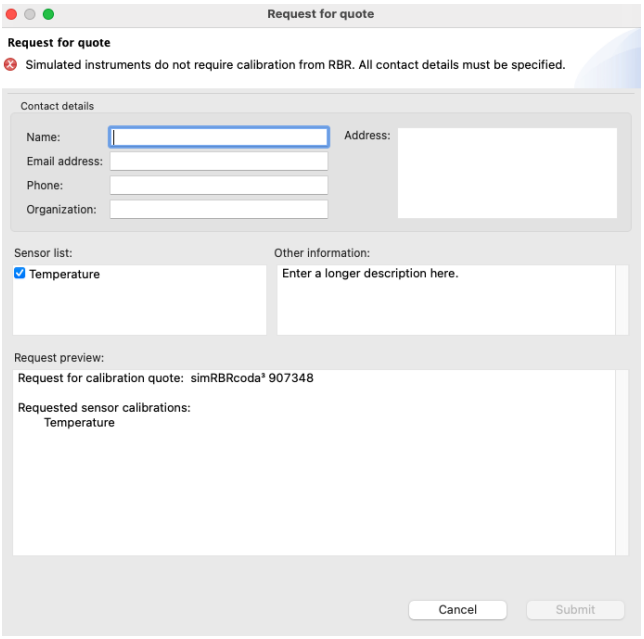


RBR recommends calibrating your instrument before any critical deployment, periodically once a year, or if you suspect the readings to be out of specifications.

Discuss your calibration requirements with RBR. In some cases, the instrument may need to be returned to RBR to have it checked and recalibrated.

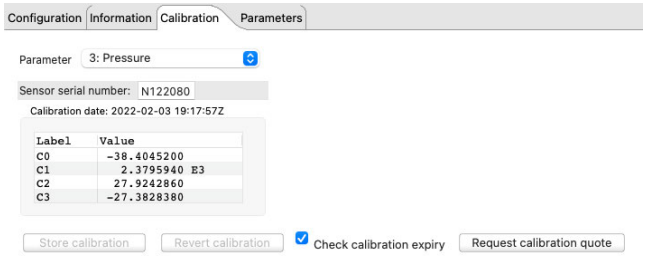
To contact RBR for our current calibration fees, click **Request calibration quote**. A **Request for quote** dialog box will appear.

Verify that all information is correct and click **Submit**.



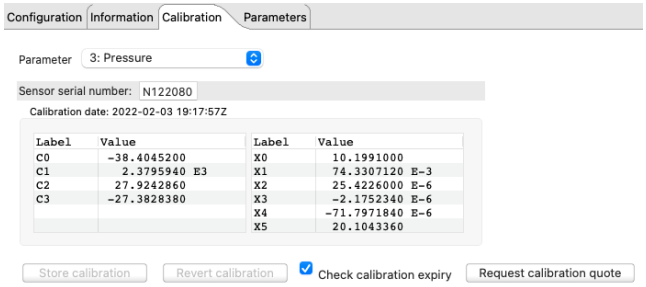
Simple calibration controls

When using the simple version, you will be able to view and edit only the main calibration coefficients, displayed as "C" values: C0, C1, C2, C3.

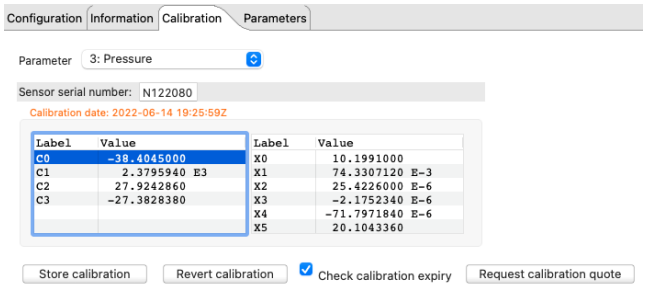


Advanced calibration controls

When advanced calibration controls are enabled in **Preferences > General**, you will be able to view and edit both main and dependent coefficients. Dependent coefficients are displayed as "X" values: X0, X1, X2, etc.



You can edit the coefficients. As soon as you make a change and move to another cell, a new calibration date will be displayed. Also, **Store calibration** and **Revert calibration** buttons will become active.



Use **Store calibration** to save the new values.

> Always click **Store calibration** to save new coefficients on the instrument. Otherwise, all changes will be lost once your session is closed.

Use **Revert calibration** to recover to the original coefficients if you have not already saved your changes to the instrument.

> You cannot use **Revert calibration** after clicking **Store calibration**. Once the coefficients are saved to the instrument, you will need to restore old values manually and save them again.

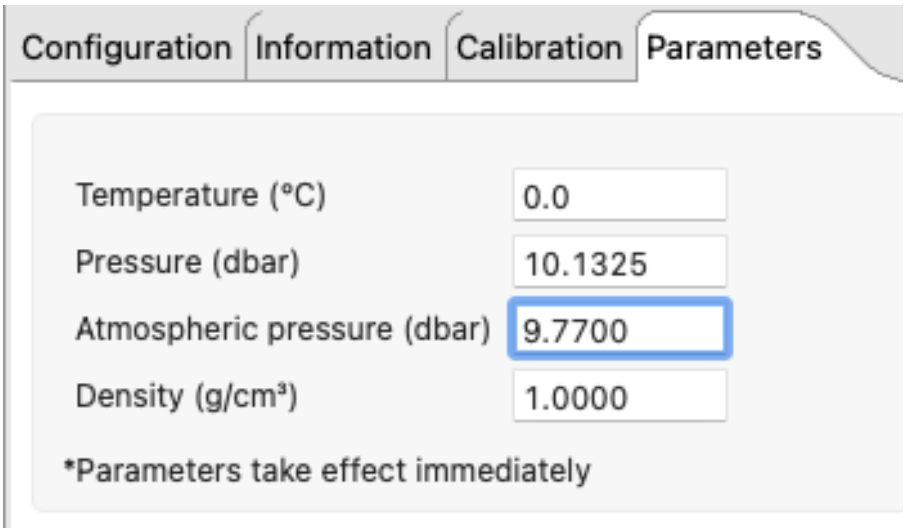
10 Parameters

The **Parameters** tab displays all the parameters the RBR instrument may need for calculating derived channels.

If your instrument can measure a parameter, it will use the measured value. Otherwise, you can enter the necessary values manually, and they will take effect immediately.

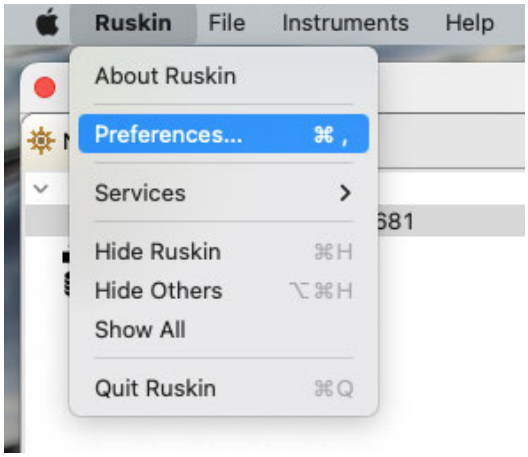
For example, you always need atmospheric pressure and water density for derivation of depth. Default values in Ruskin correspond to sea level and sea water. Therefore, it is especially important to adjust these parameters when working at high altitudes in fresh water.

Enter atmospheric pressure (in dbar) and water density (in g/cm^3) manually in the table under the **Parameter** tab. If not entered, default values of 10.1325dbar and 1.0281g/cm^3 will be used.

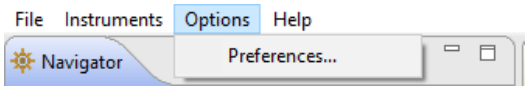


11 Preferences

On your Mac, access **Preferences** from the **Ruskin** dropdown menu in the top toolbar.



On your Windows PC, use the **Options** dropdown menu to set up your **Preferences**.

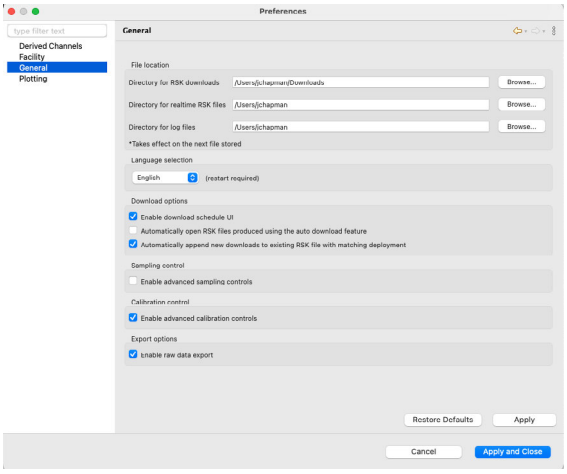


Factory-set global defaults require no changes in most situations. However, as you learn more about what Ruskin can do, you may want to change some of these settings to better suit your requirements. The global preferences include:

- Derived channels (applies to some legacy instruments)
- Facility (authorised users only, requires login)
- General (download locations and options, sampling and calibration controls, export options)
- Plotting (channel visibility and channel colours)

11.1 General

Use the **General** preference page to set up file locations, language, download options, sampling and calibration controls, and dataset conversion options.



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

File location

You can control where RSK files, realtime RSK file, and log files are stored by default.

Specify these locations before downloading any data by typing in a directory name or by browsing.



RSK files are the datasets obtained from your instrument.

Realtime RSK files are generated when a connected instrument is streaming or when you enable fetching mode on the instrument.

Log files are generated by Ruskin and help when diagnosing issues. These files are automatically attached to issues generated using the **Comment on Ruskin** feature.

> ⚠ RBR recommends storing your datasets on a local drive rather than a network storage drive. Cloud storage options such as GoogleDrive and Dropbox may extend download times.

You can change where future files are stored by default at any time. When done, click **Apply** or **Apply and close**. The changes will take effect immediately.

Language selection

Ruskin is available in six languages: English, French, Spanish, Simplified Chinese, Korean, and Japanese.

Select your language from the dropdown menu and click **Apply** or **Apply and close**. Ruskin will need to restart for the changes to take effect.

Download options

Select the appropriate checkboxes to change your download preferences.

> ⚠ The **Enable download schedule UI** checkbox is only for legacy instruments.

When done, click **Apply** or **Apply and close**. The changes will take effect immediately.

Sampling control

Select the checkbox to enable advanced controls when setting up your sampling options.

With simple controls, you will select **Speed**, **Duration**, and **Interval** from pre-defined options in three dropdown menus. When advanced controls are enabled, you will be able to enter these parameters manually and achieve a more precise setting.

When done, click **Apply** or **Apply and close**. The changes will take effect immediately.

Calibration control

Select the checkbox to enable advanced controls when setting up your calibration options.

With simple controls, you will be able to view and edit only the main coefficients ©. When advanced controls are enabled, you will be able to view and edit all main and dependent calibration coefficients (C, X) for any channel.

When done, click **Apply** or **Apply and close**. The changes will take effect immediately.

Export options

Select the checkbox to enable raw data export. Use this option for downloading your RSK file when storage space is limited or expensive. The dataset will be exported in the most compact raw binary format.

When done, click **Apply** or **Apply and close**. The changes will take effect immediately.

11.2 Plotting

Adjust default settings for the graphical display in the **Plot** view. Manage selections in **Channel visibility** and **Channel colours**, and apply them globally.

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

Channel visibility

The **Channel visibility** tab displays many options to hide or show specific information.

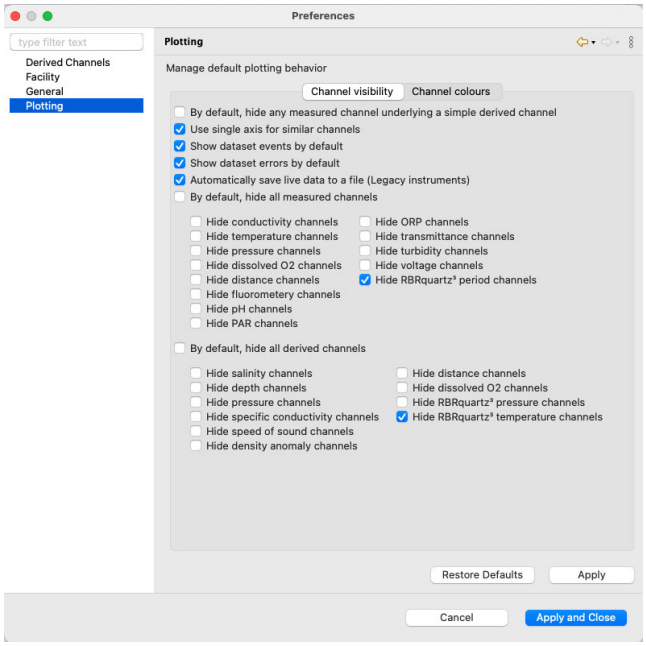
Opt for displaying errors and events for a more informative graph, or hide them for a cleaner view.

Select the **By default, hide all measured channels** checkbox to display only derived channels.

Select the **By default, hide all derived channels** checkbox to display only measured channels.

Otherwise, pick and choose channels to display or hide.

When done, click **Apply** or **Apply and close**. The changes will take effect immediately.



> You can override visibility preferences in the **Plot** view for any particular graphical display.

Channel colours

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. Select from the list of pre-defined options or create your own colour.

When done, click **Apply** or **Apply and close**. The changes will take effect immediately.

12 RSK files

The RSK file is a single file database based on SQLite that allows us to have large files with high-speed access to any part of the dataset. RSK files have different types and versions, which reflect historical changes to the underlying dataset structure. To upgrade the version of an older RSK file, go to **File info** tab.

RBR provides open-source RSKtools toolboxes for both Matlab (RSKtools) and Python (pyRSKtools) to read, post-process, visualise, and export RSK files.

RSK files can be exported to Excel, OceanDataView®, or text files.

RSK files contain raw measurement data, firmware and software versions, dates and times, sampling settings, power settings, measured and derived parameters, errors and events, other diagnostic information.

- Datasets in the **Desktop** storage format allow changes to calibration coefficients. GPS mapping for full RSK files relies on manually added location points.
  This file format is available for RBR standard and compact instruments.
- Datasets in the **Mobile** storage format support charting and GPS tracking. They do not allow changes to calibration coefficients.
  This file format is only available for RBR standard instruments.
- For datasets obtained via streaming or fetching, the RSK format is **Realtime**. Their names contain the "realtime" label.
  This file format is available for RBR standard instruments and RBR realtime sensors when in streaming mode, and for all instruments when fetching.

To identify the type of the RSK file, go to the **File info** tab.

File naming convention for realtime datasets

By default, realtime dataset names are composed of the following information:

- The instrument serial number: six digits
- The date of the download (YYYY-MM-DD): eight digits
- The time of the download (HH-MM in the 24-hour format): four digits
- The "realtime" label, indicating the data were streamed or fetched from the instrument

For example, the file named 209682_20220531_1408_realtime.rsk contains the dataset for a streaming instrument with a serial number of 209682; the data were saved on May 31, 2022 at 14:08 (02:08pm), local time.

The data streamed or fetched from your instrument are automatically saved to your computer. Go to **Preferences > General** to change your default location for realtime RSK files.



The file extension is .rsk; it indicates the Ruskin file format and must not be edited. If you change it, your new file extension will become part of the dataset name, and the .rsk extension will be appended.

13 Realtime data format

Sensors will begin streaming data as soon as power is provided. Below are example strings of data from each variety of the RBR sensors:

Instrument	Example data	Channels list
RBR*coda*^{3} T.ODO	`29000, 23.2868, 200.4000, 93.0000, 245.0000, 29.6900`	Timestamp (ms), Temperature (°C), concentration compensated for salinity (µmol/L), saturation (%), concentration uncompensated for salinity (µmol/L), phase (°)
RBR*coda*^{3} T	`29000, 23.2868`	Timestamp (ms), Temperature (°C)
RBR*coda*^{3} D	`29000, 10.2484`	Timestamp (ms), Pressure (dbar)
RBR*coda*^{3} DO	`29000, 98.8754`	Timestamp (ms), Saturation (%)
RBR*coda*^{3} T.D	`29000, 23.2868, 10.2484`	Timestamp (ms), Temperature (°C), Pressure (dbar)
RBR*coda*^{3} PAR, RBR*quadrante*	`1250, 38.6671142`	Timestamp (ms), PAR (µmol/m^2/s)
RBR*coda*^{3} rad, RBR*quadrante*	`1250, 22.0217241`	Timestamp (ms), Irradiance (µW/cm^2/nm)
RBR*tridente* ^{3}	`3550, 2.6534132, 22.0217241, 1.9596633`	Timestamp (ms), backscatter (m^{-1}), chlorophyll *a* (µg/L), fDOM (ppb)
RBR*coda*^{3}Tu	`29000, 35.6674542`	Timestamp (ms), Turbidity (FTU)
RBR*coda* chl-*a*	`29000, 5`	Timestamp (ms), Chlorophyll (µg/L)

The timestamp is the number of milliseconds since the time of the first sample, and so the first sample is always timestamped as zero. The timestamp will restart any time the CPU resets or if the following sample parameters are changed:

- Changing the sampling period
- Changing the sampling mode
- Changing the burst length or burst interval
- Turning a channel on/off (advanced users only)

The values following the timestamp are all the enabled channels. To identify which channels are enabled and their order in the string you can use the command **outputformat channelslist**.

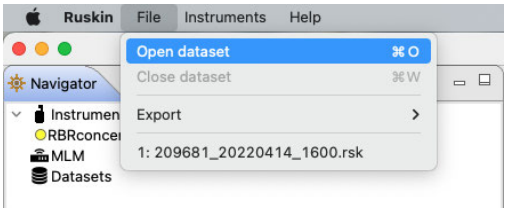
Example

```
>> outputformat channelslist
<< outputformat channelslist = temperature (C), O2_concentration (umol/L),
O2_air_saturation (%), uncompensated_O2_concentration (umol/L)
```

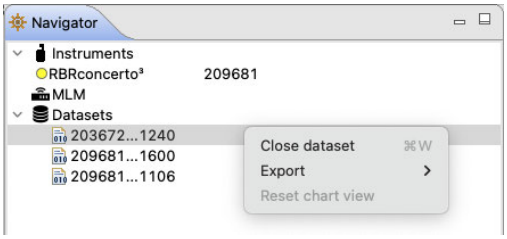
14 Datasets

Datasets are RSK files generated by Ruskin and have an .rsk extension. You can view and analyse your data using the options below.

Go to the **File** dropdown menu to open or close a dataset, export your data, and see the list of available datasets.



The **Datasets** context menu in the **Navigator** windows duplicates some of these options for convenience.



Explore the contents of your datasets in the **Properties** window.



When a dataset on the list is selected, the **Properties** window displays four tabs with information related to this dataset.

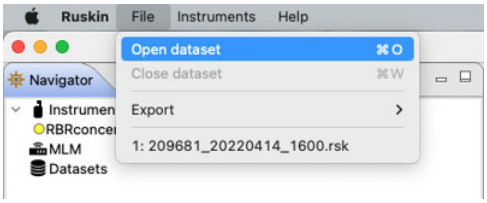
Use these tabs to analyse your data, check the calibration certificates, and verify your parameters.

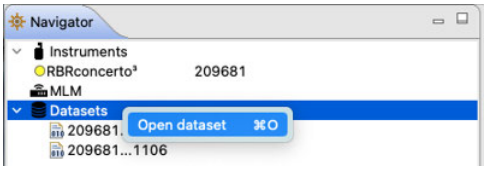
14.1 Open dataset

Open any stored dataset from the **File** menu in the top toolbar or from the **Datasets** menu in the **Navigator** view.

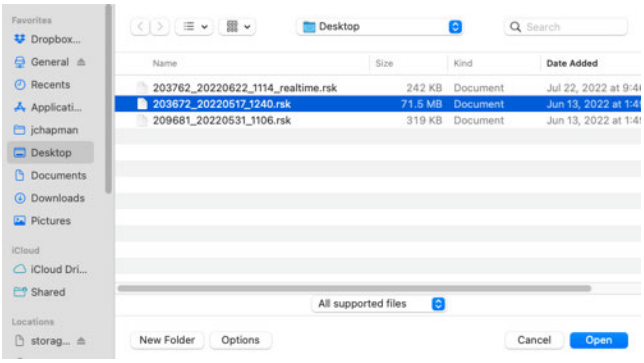
Steps

1. Click **File** > **Open dataset**.
   Alternatively, right-click **Datasets** in the **Navigator** view and select **Open dataset**.

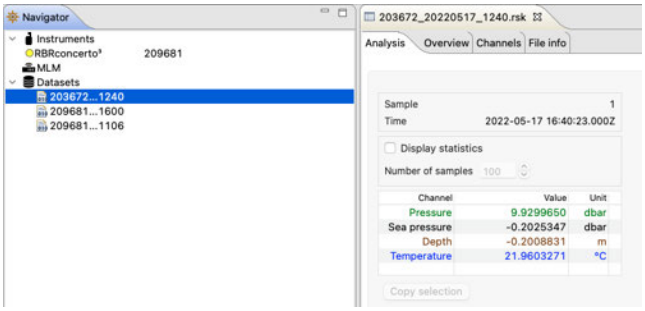




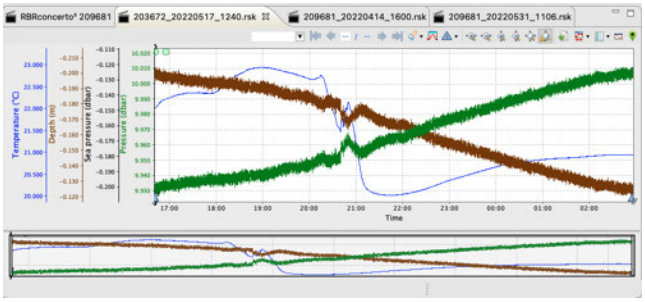
2. A browsing window will appear. Double-click the .rsk file you want to view, or select the file and click **Open**.



3. The name of the dataset appears and is highlighted automatically in the **Navigator** view. The **Properties** view changes to the dataset, with four tabs: **Analysis**, **Overview**, **Channels**, and **File info**.



4. The data in the file will automatically appear in the **Plot** view.



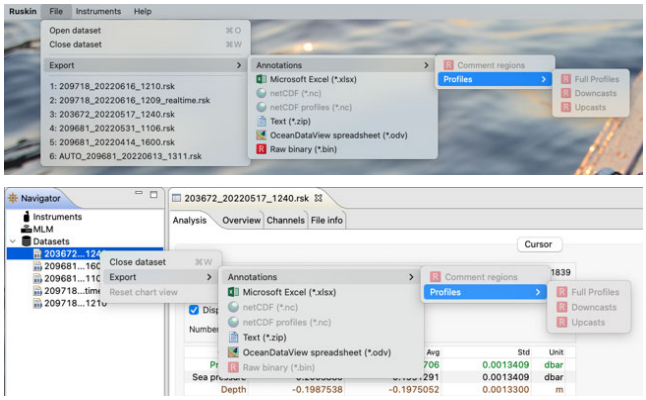
To close a dataset, go to **File** > **Close dataset**. Alternatively, right-click the dataset name in the **Navigator** view and select **Close dataset**, or simply close its **Plot** tab by clicking the **X.** The dataset will disappear from the list.

14.2 Export

Use the **Export** option to share your data with others or analyse your data using other software. Datasets can be read directly in Matlab with our toolkit RSKtools, or exported to Excel, OceanDataView®, or text files.

Steps

1. **File** menu > **Export**, then hover to open a set of submenus.
   or right-click the dataset in the **Navigator** window, then hover to open a set of submenus.



2. Select the appropriate export format (**Microsoft Excel**, **netCDF**/**netCDF profiles**, **Text**, **OceanDataView spreadsheet**, or **Raw binary**).

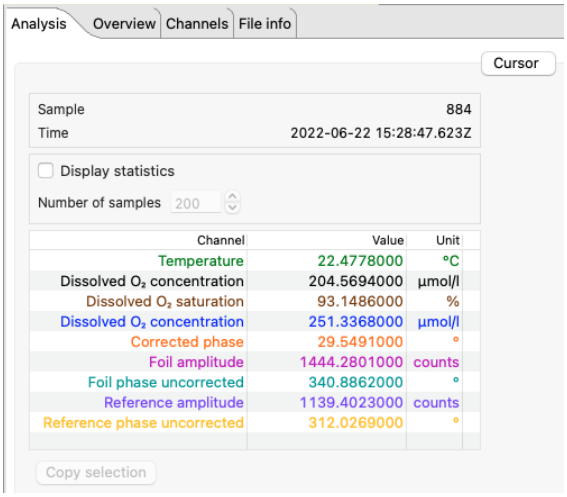
> For realtime RSK files, the **Raw binary** export format is not available.

3. If exporting annotations, select the category: **Full profiles**, **Downcasts**, or **Upcasts**.
4. Specify a location and a name for the data file.
5. Click **Save**.

14.3 Analysis

Select a dataset in the **Navigator** view. The **Properties** view will change to dataset properties, with four tabs: **Analysis**, **Overview**, **Channels**, and **File Info**.

For most realtime datasets, the **Analysis** tab will only have the **Cursor** option. For Oxyguard DO and RBRcoda OpH sensors, the **Calibration** option will also be available.

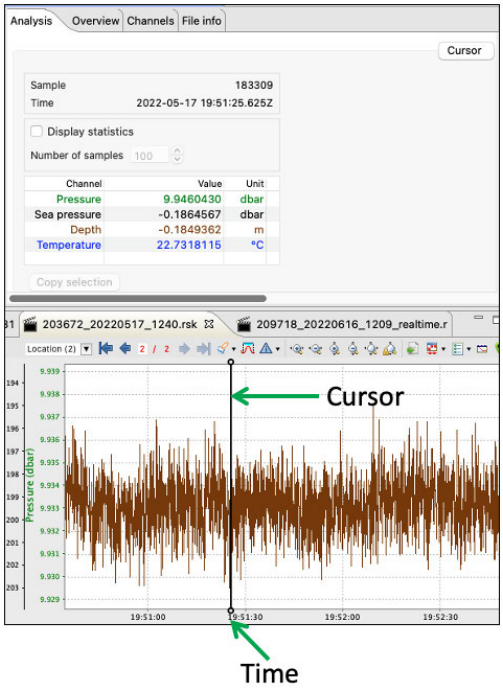


The **Cursor** view contains statistical information about deployment, as well as information about the dataset channels and their values.

The colour-coding of the channel table matches that of the traces in the **Plot** window. To change the colour settings for your chart, go to **Preferences > Plotting > Channel colours**.

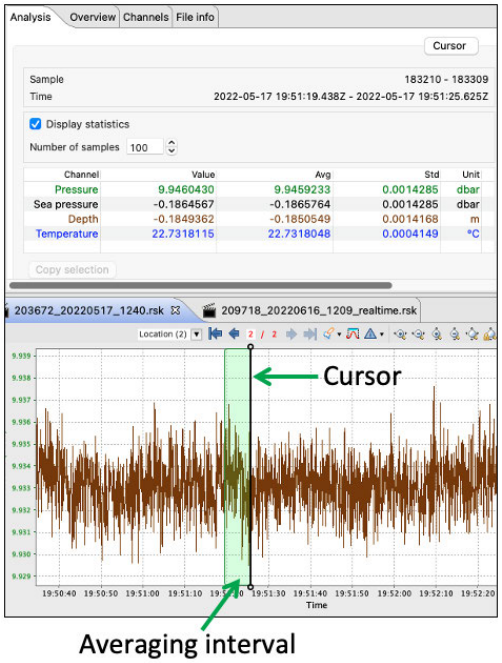
Move the black cursor ("double lollipop") in the **Plot** window to display parameter values for each sample selected.

Every time you move the black cursor, going from sample to sample, the table above the plot will display the information for this particular sample.



Select **Display statistics** checkbox to determine the average value and standard deviation over a range of samples. Change the number of samples to average using the up and down arrows.

The table will display the averaging data. The averaging interval will be highlighted in the plot.

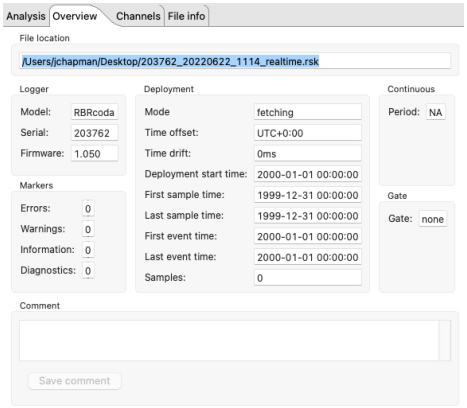


When the **Calibration** view is available, you can recalculate your coefficients for the DO channel. See **User calibration**.

14.4 Overview

Use the **Overview** tab to view general information for each dataset, such as instrument details and deployment events.

To make a note about this dataset, enter your comment in the field provided and click **Save comment**.



14.5 Channels

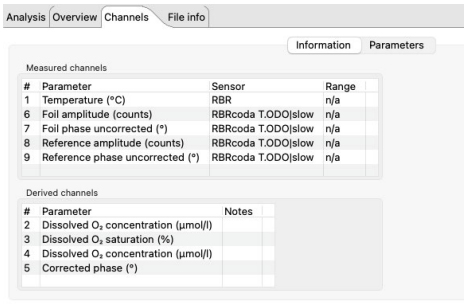
The **Channels** tab has two options: **Information** and **Parameters**.

Information

The **Information** page displays two tables: **Measured channels** and **Derived channels**.

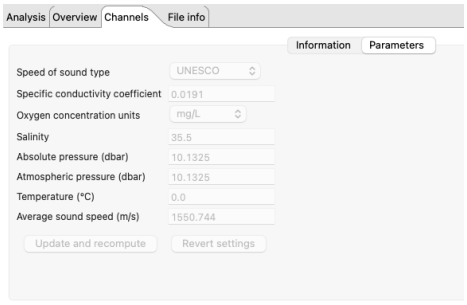
Measured channels include measured parameters with their units of measurement, the sensor manufacturer, and the range setting (if applicable).

Derived channels include all available derived parameters with their units of measurement and the methodology used to calculate them.



Parameters

The **Parameters** tab displays parameters necessary to calculate derived channels and the method used for the calculation.



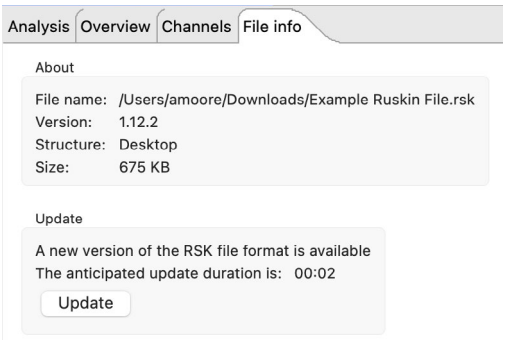
14.6 File info

The **File info** page displays the dataset name and download location, Ruskin version used when it was obtained, file structure, and size.

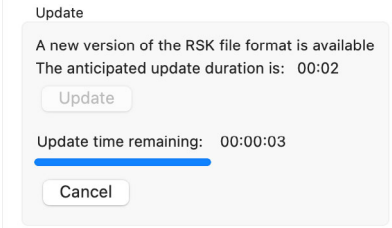
The **Structure** label reflects the RSK file format, which can be **Desktop**, **Mobile**, or **Realtime**.

The RBR smart streaming sensors generate RSK files in the **Realtime** storage format only.

Ruskin checks the dataset for compatibility with the newest version of Ruskin software. If the file requires updating, a warning message and an **Update** button will be displayed.



Click **Update**. It may take several minutes for it to complete. RBR strongly recommends that all datasets are updated and meet compatibility requirements.

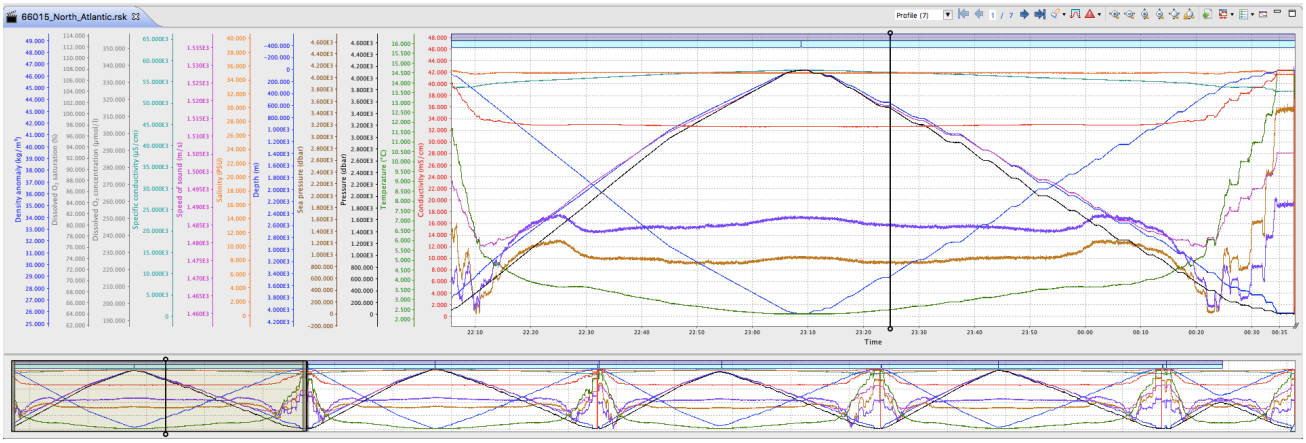


Failing to update your dataset may result in odd graphical displays and incorrect reporting of the sample values.

15 Plot window

Use the **Plot** window to view graphical displays of your datasets or live data. When viewing live data, the instrument must be attached.

Each channel appears as a different colour in the plot. These colours are specified under **Preferences** > **Plotting** and can be changed only there.

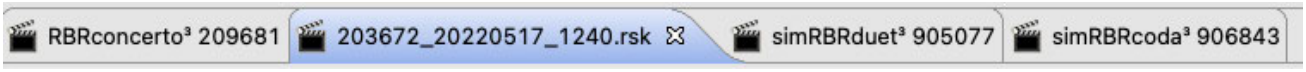


Move the black "double lollipop" cursor from one sample to the next to display parameter values for each sample selected. Drag it with your mouse, or use the arrow keys on your keyboard as follows:

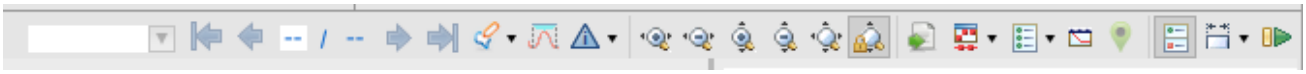
- To move by one data sample, press **right** or **left arrow**
- To move by a hundred of samples, press **Shift + right arrow** or **Shift + left arrow**
- To move by ten thousand of samples, press **Alt + right arrow** or **Alt + left arrow**
- To move by millions of samples, press **Shift + Alt + right arrow** or **Shift + Alt + left arrow**

For the datasets, these values will appear in the **Properties** window above (see **Analysis**). For live data, they will be on the side of the plot.

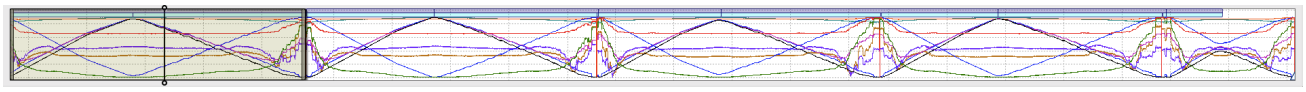
The graphical display for each dataset or instrument will be in its own tab. The dataset file name or the instrument model and serial number will appear at the top of the tab. Simulated instruments will have "sim" in front of their name.



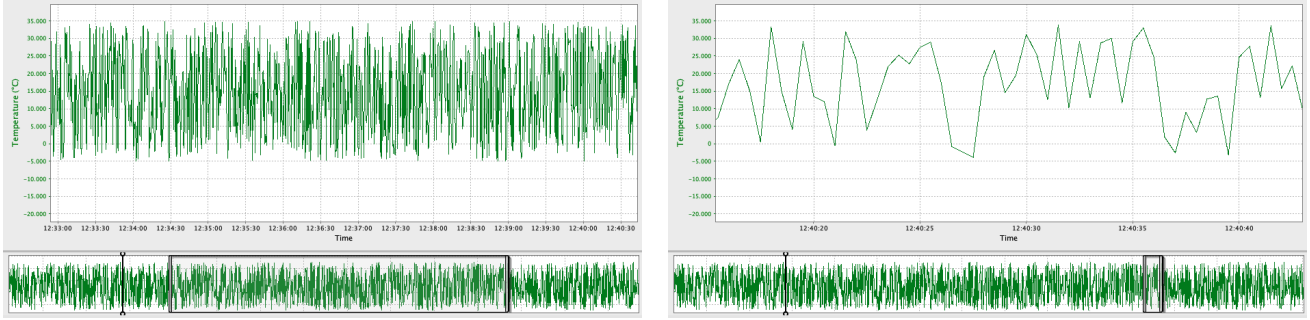
A toolbar at the top right of the **Plot** window contains various buttons to help you customise, explore, and export the graphical display. The buttons selection changes depending on what is displayed in the tab. Hover over a button to display its name and function.



A downsampled representation of the dataset appears in the thumbnail view, along with an indicator of the current plotted time range.



Position the indicator by clicking on the thumbnail view and dragging the indicator. Resize the indicator by dragging the edges left and right. It will zoom the main plot along the time domain to match the new indicator size. See **Zoom controls** for more scaling options.



The thumbnail view always shows the plot-by-time data, even if the plot is switched to the plot-by-depth mode.

When you close and re-open a dataset, it will retain your latest settings (channel visibility, zoom, plot style (plot-by-time or plot-by-depth), annotation selection, and display style (lines or markers). Double-click anywhere on the main plot to return to the full-chart view.

Go to **Appearance controls** to change your selection of lines and markers. .

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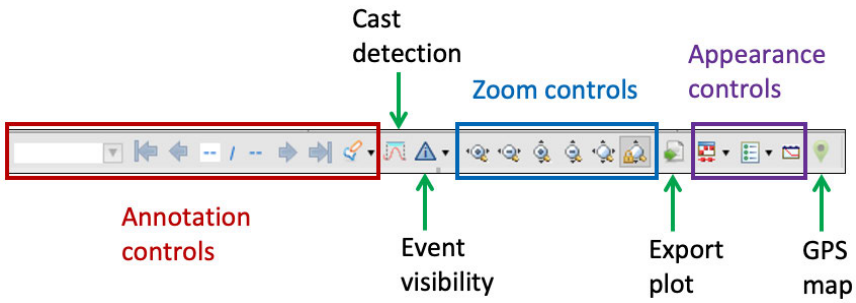
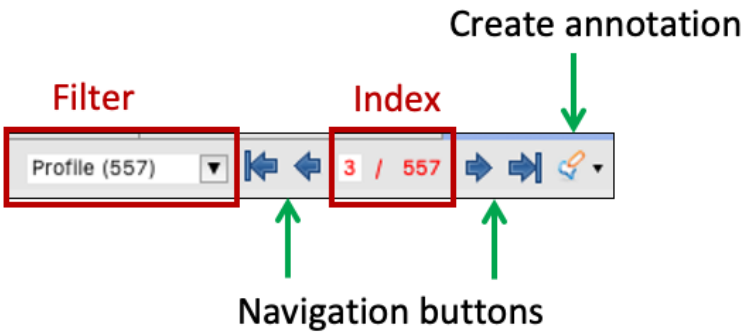
16 Dataset plot toolbar

Use the plot toolbar to adjust the display of an open dataset.



16.1 Annotation controls

Annotations are information messages added either by users or by the instrument.

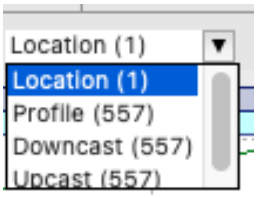


16.1.1 Select annotation type

Annotation types are divided in two categories: profiling (**Profile**, **Downcast**, or **Upcast**) or non-profiling (**Comment**, **Exclusion**, **Location**, or **Calibration**). Use annotation controls to manage this information and to navigate the plot.

Type	Function
Profile, Downcast, Upcast	Identify profiling
Comment	Add a note to your data
Exclusion	Remove a non-representative interval from analysis
Location	Add in latitude/longitude coordinates for RSK files to track locations of data logging
Calibration	Calibrate the ODO sensor

Open the **Filter** dropdown menu to select the annotation type to display. The number of annotations for each type will be indicated.



Select an annotation type. The plot will centre on the first item in the selected category. For example, when you select **Profile**, the plot will move to the first profile.

If you switch the filter to another annotation type within the same category (for example, **Profile** to **Upcast**), the plot will not change. If you switch to a type from another category (for example, from **Profile** to **Comment**), the plot will move to the first annotation in the new category (for example, to the first comment).

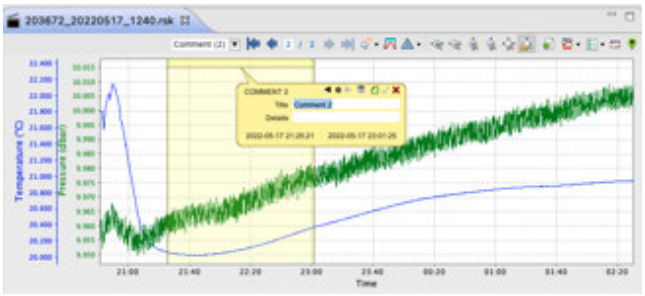
16.1.2 Navigate between annotations

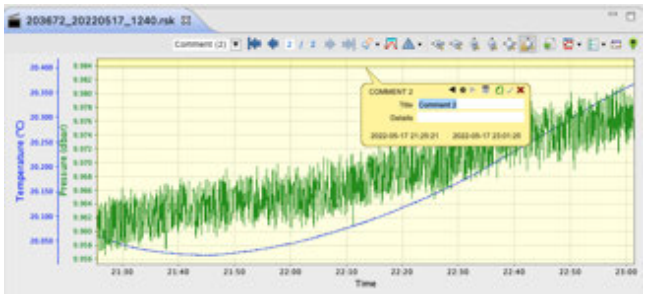
Use the **Navigation** buttons to navigate between items within the selected category.

> The navigation buttons will be activated if there is more than one item in the selected annotation type. Otherwise, the plot will centre on the only item available.

Navigation controls

- Move from one annotation to another by clicking the **left** and **right** arrows.
- Jump all the way to the beginning or end of the list by using the **end-left** and **end-right** arrows.
- Alternatively, manually enter the number in the **Index** field to go to that particular annotation.
- Double-click an annotation to centre and zoom in the plot at that particular area. .





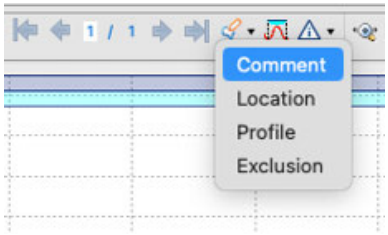
> Double-click anywhere on the main plot to return to the full-chart view.

16.1.3 Create new annotation

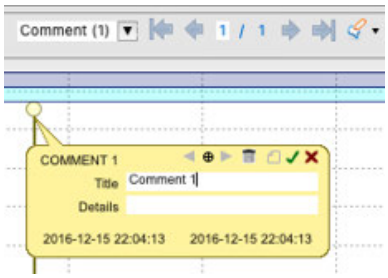
Click the **Create annotation** button and follow the steps below.

Steps

1. Select the type of annotation to create, for example, **Comment.** The cursor in the **Plot** window will become a two-way arrow.

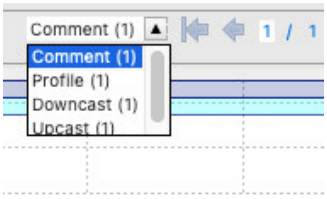


2. Click on the main plot to identify a single point to comment, or click and drag the cursor left or right to select an interval. When you release the click, an editable tooltip will open.



The tooltip controls include **Left** and **Right** arrows, **Delete**, **Export region**, **Save**, and **Close**. The **Profile** tooltip also features **Up** and **Down** arrows for adding upcast and downcast profiles.

3. Enter the necessary information into the fields and save by pressing **Enter** on your keyboard or by clicking **Save** on the tooltip. Your new comment will appear in the dropdown list.

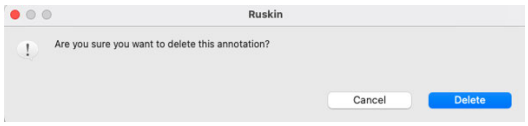


Clicking **Close** or pressing **Esc** on the keyboard will close the tooltip without saving.

> Edit at least one detail in the tooltip before saving. Otherwise, the annotation will be deleted when deselected. Moving or resizing the annotation counts as editing and saving.

4. Click the **arrows** on the tooltip to move to the next annotation within the same category.
5. Double-click on the annotation bar to zoom in to the range of the annotation.
6. Click and drag on the annotation bar to move the annotation.
7. Click **Delete** on the tooltip to delete the annotation.

A warning message will appear.
Click **Delete** to proceed. This action cannot be undone.

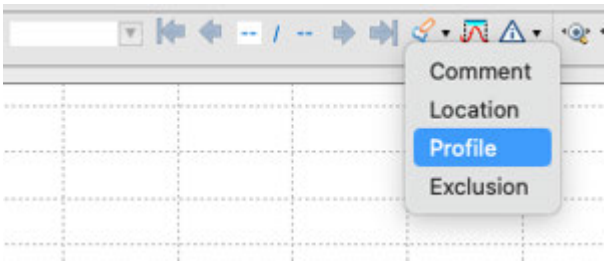


16.1.4 Add profiles

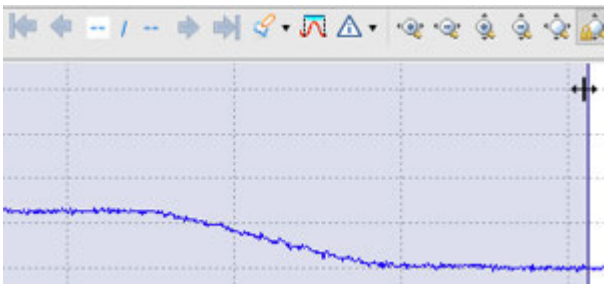
Use the **Annotation** function to manually add profiles to your dataset.

Steps

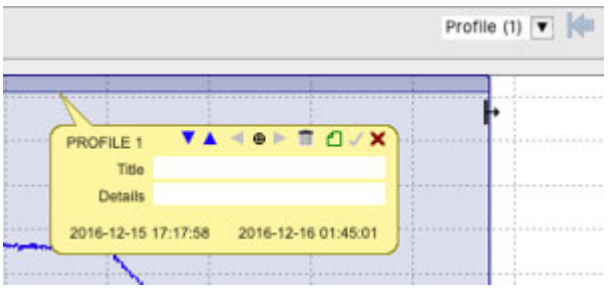
1. Click the **Create annotation** button and select **Profile** from the dropdown menu.



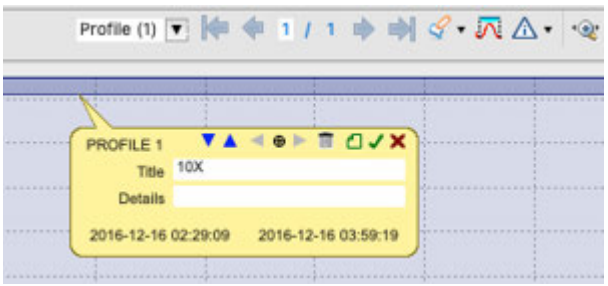
2. Click and drag the cursor to select a region.
   As soon as you let go, an editable tooltip will open and a band of a darker colour will appear above the selection, indicating that a new profile has been added.



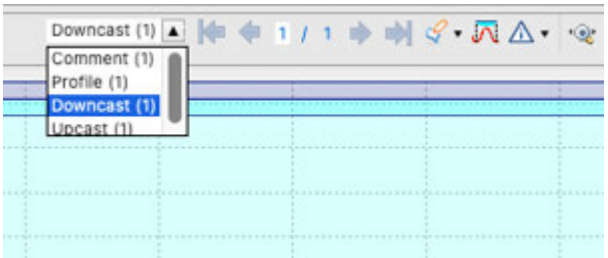
3. Place the cursor on the edge of this new profile and move it left or right to adjust the size.



4. Add a name and click **Save** on the tooltip.

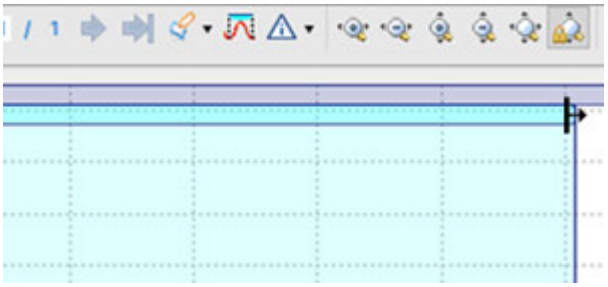


5. Use the **Up** and **Down** arrows on the tooltip to identify upcast and downcast regions.
   The upcasts and downcasts you added will be displayed in the dropdown menu and highlighted on the plot under the parent profile.

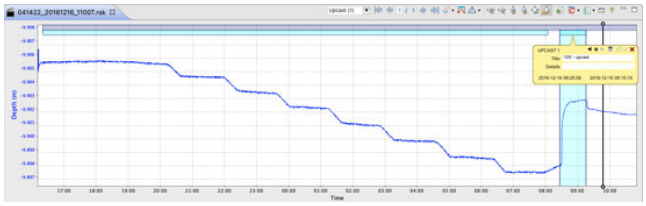


Only the **Profile** tooltips have the **Up** and **Down** arrows.

6. Place the cursor at the edge of the added region and adjust its size.



7. Click on a profile/upcast/downcast to open its tooltip.



8. Name each region and save the settings.
9. If desired, export your profile to a separate RSK file. To do that, click **Export region** on the **Profile** tooltip and follow the steps.

The **Export region** option is not available on **Upcast** and **Downcast** tooltips. To generate an RSK file for an upcast or downcast section only, use the **Comment** annotation to clip the dataset before exporting.

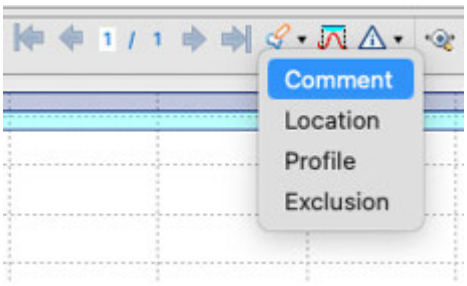
16.1.5 Export region

The **Export region** option is only available for **Comment** and **Profile** annotations.

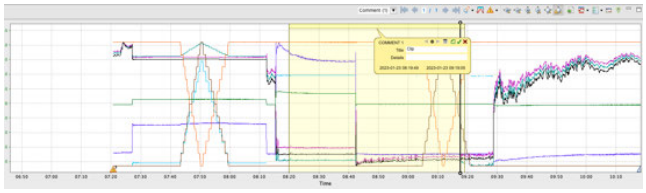
Follow the steps below to clip your dataset and export a subset of your data. This function may be useful when you need to exclude certain regions. For example, a dataset may contain several deployments if sampling was not paused/stopped before the new deployment was started.

Steps

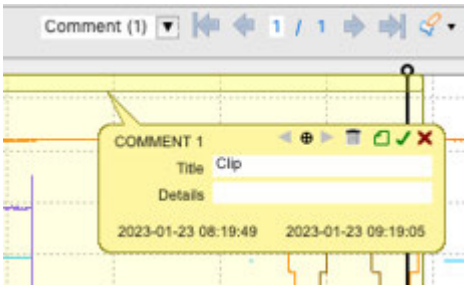
1. Click the **Create annotation** button and select **Comment** from the dropdown menu.



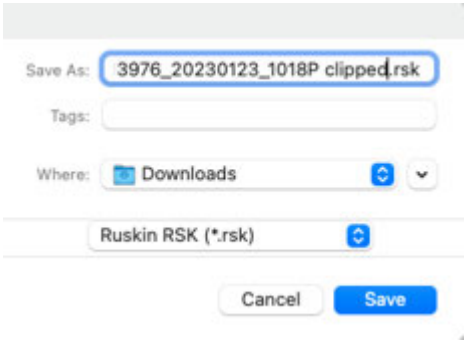
2. Click and drag the cursor to select a subset.



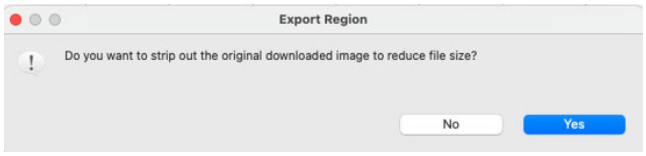
3. Enter a name in the **Title** field on the tooltip and click **Save**.



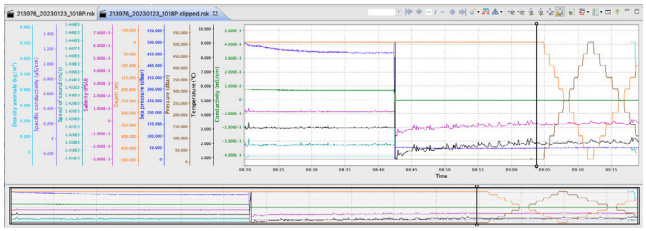
4. Select **Export region** on the tooltip. A dialogue box will open.



5. Adjust the name and location for the new dataset file and click **Save**. An **Export region** message will appear.



6. Select **No** to maintain the full binary values and retain the option of recalibration in the future. The clipped dataset will open in a new tab in the **Plot** window.



16.2 Cast detection

Ruskin automatically enables profile detection on instruments when a deployment is enabled. There are several criteria for enabling this feature.

- The instrument must support the `castdetection` setting
- The instrument must have a pressure sensor
- The deployment must be configured for | fast sampling (2Hz and up)
- The deployment mode must be configured as either continuous or directional

It is possible to recalculate the casts in a dataset using the cast detection feature in the **Plot** view.

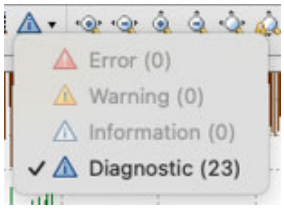
Click the **Cast detection** button to run a cast detection algorithm based on depth and conductivity to automatically generate profiles and casts. A warning message will appear.

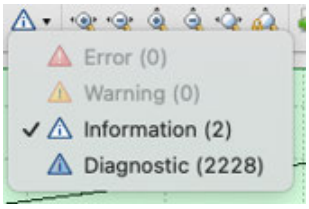
If you proceed, Ruskin will find peaks, collect events, and overwrite profiles recorded by the instrument. .

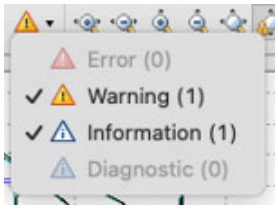
> Double-click anywhere on the main plot to return to the full-chart view.

16.3 Event visibility

Click the **Event visibility** button to turn on and off the visibility of the various levels of events: **Error**, **Warning**, **Information**, and **Diagnostic**. Its colour will reflect the highest level of event severity reported.

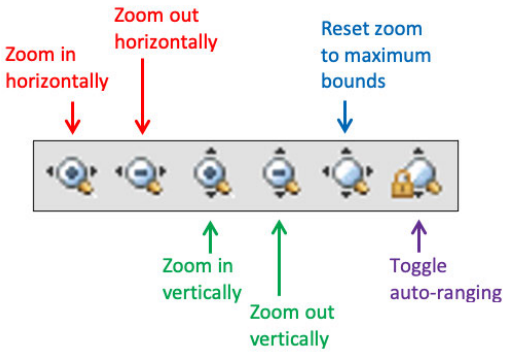






16.4 Zoom controls

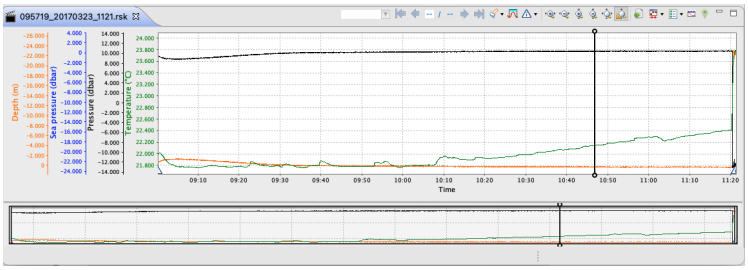
Default scaling of the plot is based on the minimum and maximum values sampled for each channel. Use zoom controls to adjust it as needed.



> Double-click anywhere on the main plot to return to the full-chart view.

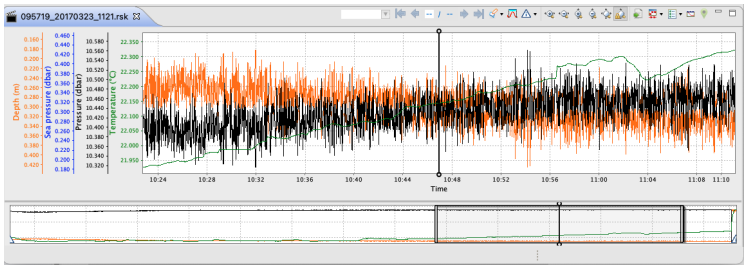
16.4.1 Horizontal zoom

Horizontal scale options may be helpful to increase or decrease the time range displayed. It is convenient when the dataset is long and thus losing resolution when displayed in the **Plot** window in its entirety, like in this example.

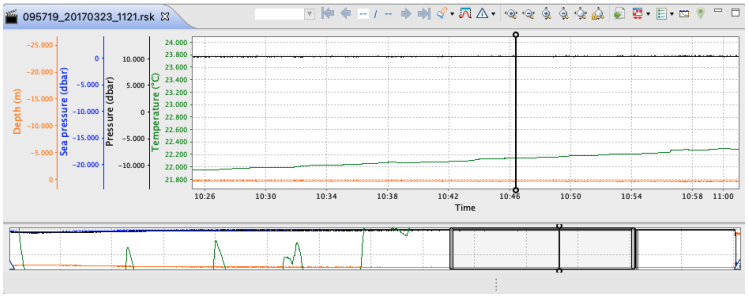


There are three ways to apply changes to the horizontal scale. The first two will auto-range your chart, ensuring the entire vertical domain is visible. The third approach will retain the latest vertical scaling of the original interval.

1. Use the **Zoom in horizontally** and **Zoom out horizontally** buttons.
   OR
2. Click on the thumbnail view and resize the indicator.
   The vertical scale will automatically adjust to fit the new range.



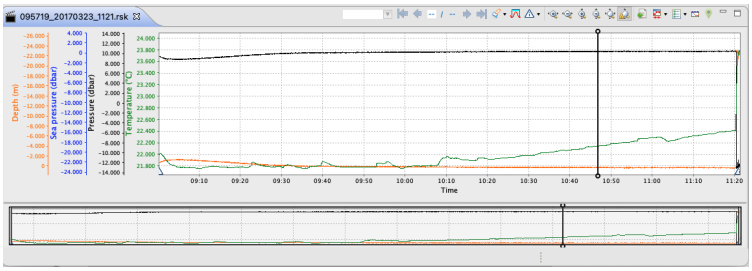
3. Hover your mouse over the X-axis, then hold **Shift** + **left click.**
   The cursor will change to a two-way arrow. Drag it right to zoom in or left to zoom out the time domain, without changing the data resolution.



Click **Reset zoom to maximum bounds** or **double-click** anywhere on the chart to restore the original appearance.

16.4.2 Vertical zoom

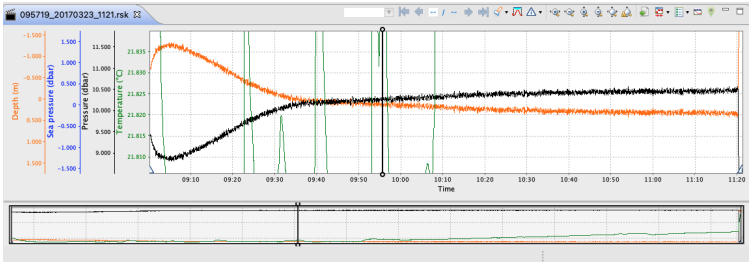
Vertical scale options may be helpful when there are erroneously high or low values that make the real data appear incorrect, or when there is significant difference in scale between the displayed parameters.



Entire chart

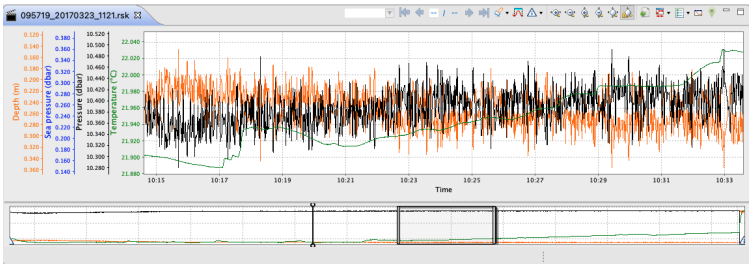
Depending on the zooming method, you may change the scale only vertically, or both vertically and horizontally.

- Use the **Zoom in vertically** and **Zoom out vertically** buttons to increase or decrease the resolution of the data displayed.
  The resulting display will retain the same horizontal scale.



  OR

- Hover the cursor and scroll your mouse wheel up and down to change the scale.
  In this case, the horizontal scale will also change (as seen from the thumbnail indicator). The plot will centre where the mouse cursor initially was.



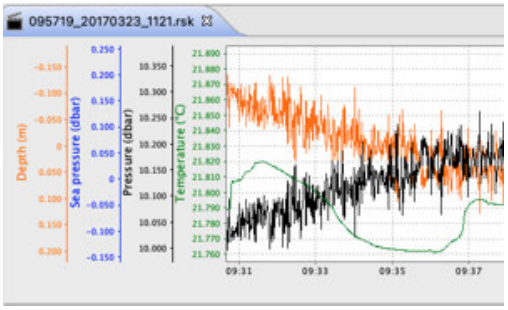
Individual channel

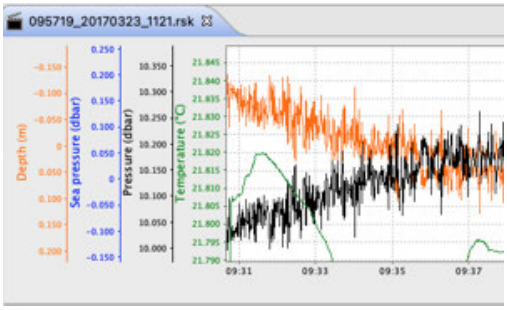
There are two ways to apply changes to the vertical scale of one channel only, which yield the same results.

- Hover the cursor over the Y-axis for this channel and scroll your mouse wheel up and down.
  OR
- **Shift** + **click** the Y-axis for this channel and move your mouse up and down.

This particular channel will zoom in and out (in the example below, temperature). Double-click on the same vertical axis

to reset this parameter.



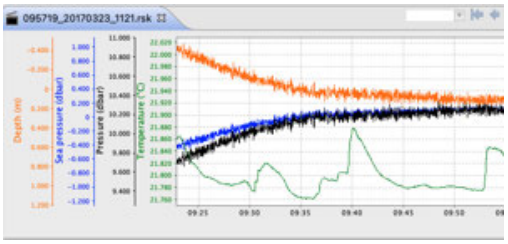


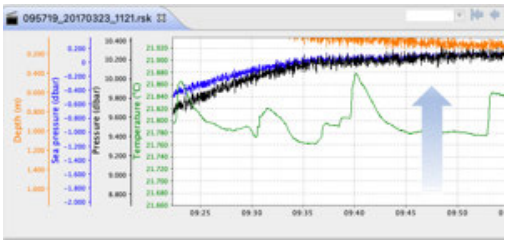
Click **Reset zoom to maximum bounds** or **double-click** anywhere on the chart to restore the original appearance.

16.4.3 Navigation options

After you change the scale, some parts of your chart may end up outside the **Plot** window. There are several options available to navigate it.

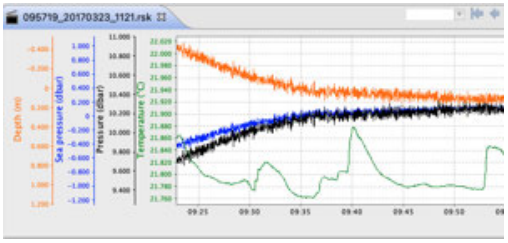
1. To pan the entire chart horizontally, hold **Ctrl** + **left click** and move your mouse left and right.

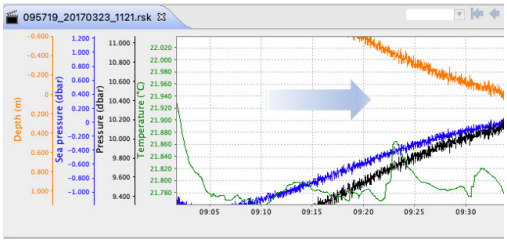




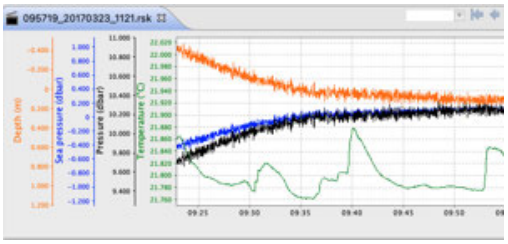
This action is only possible after already applying some horizontal zoom to the chart.

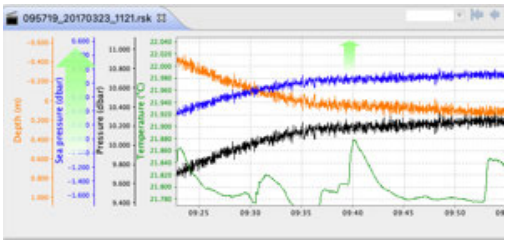
2. To pan the entire chart vertically, hold **Ctrl** + **left click** and move your mouse up and down.





3. To pan one of the channels vertically, click a value on the vertical axis for that parameter (in the example below, sea pressure) and move your mouse up and down.



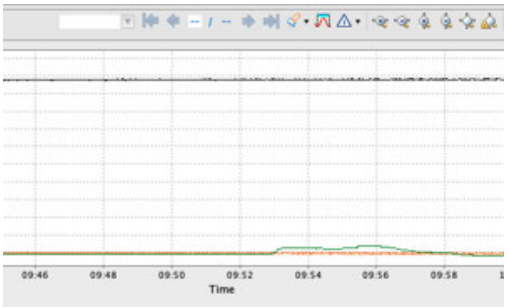


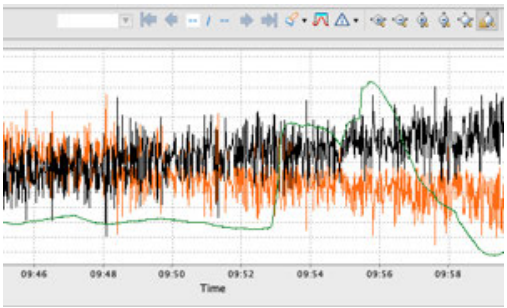
Double-click on the same vertical axis to reset this parameter.

4. To freely select any part of the chart, hold **Shift** + **left click** and draw the rectangle. The chart will zoom in on the selected area, both horizontally and vertically.



5. To keep all your data within the viewing window, click the **Toggle auto-ranging** button. When it is on, all profiles within the selected time section maintain their optimal vertical zoom.





Click again to disable. Disabling the auto-ranging of the axis can be useful for looking at trends in data. Zooming in or out of an individual channel will disable auto-ranging for that channel.

6. To zoom in to the range of an annotation, double-click on the annotation bar.

> Click **Reset zoom to maximum bounds** or **double-click** anywhere on the chart to restore the original appearance.

16.4.4 Advanced axis controls

Some RBR instruments have multiple parameters of the same type. For example, your RSK file from the RBR*concerto*^{3} Tx could have 12 or 24 temperature channels and from the RBR*quadrante*, up to four irradiance channels.

By default, Ruskin will use a single axis to display similar channels. To display each similar channel on its own axis, go to **Preferences > Plotting > Channel visibility**. Deselect the **Use single axis for similar channels** checkbox.

Click **Apply and close**. These changes will automatically apply to every new dataset. To apply your changes to an active dataset, close it and then re-open.

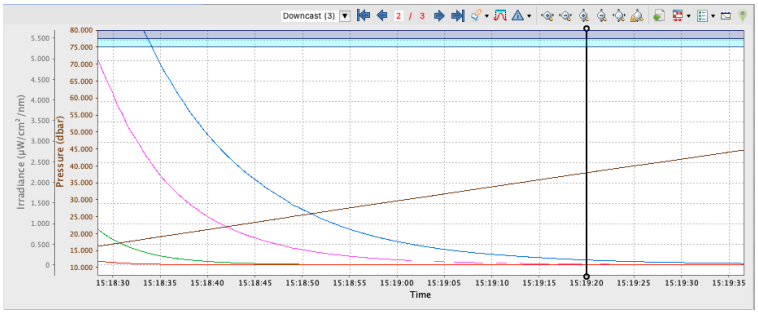
Both views have their advantages. Below, compare the two displays of the same dataset obtained using an RBR*quadrante* .

Default settings: single axis

The chart displays four irradiance channels and one irradiance axis. The axis is grey, while the traces related to this single axis remain colour-coded.

With the axis panel collapsed, you have a broad view of the chart.

All four channels have the same scale, which in the example below is 0-5.500µW/cm^2/nm. Vertical zoom controls, if used, are applied to all these traces as a group.

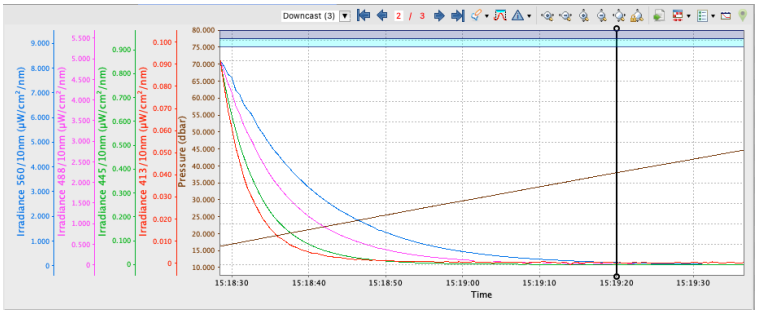


Customised settings: multiple axes

The chart has four irradiance channels and four axes, each identified with the same colour as the trace. The corresponding wavelength and FWHM will also be displayed; in this example: **560/10**, **488/10**, **445/10**, and **413/10**.

Each channel has its optimal vertical scale. In the example below, the scale for the **560/10** is **0-9.000µW/cm²/nm**, while for the **413/10** it is **0-0.100µW/cm²/nm** .

To adjust the vertical scale for each channel individually, hover the cursor over an axis and scroll your mouse wheel up and down. See **Vertical zoom** for other ways to adjust the scale.



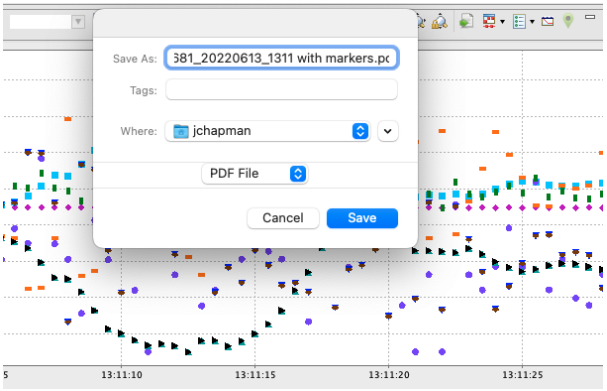
Regardless of the view (single axis or multiple axes), the channel table in the **Analysis** tab retains individual colours for all channels, matching the colour-coding of the traces in the **Plot** window.

7	Irradiance 413/10nm	4.9941950	µW/cm²/nm
8	Irradiance 445/10nm	11.2594115	µW/cm²/nm
9	Irradiance 488/10nm	18.3235068	µW/cm²/nm
10	Irradiance 560/10nm	15.9567764	µW/cm²/nm

To change the colour-coding settings for your chart, go to **Preferences > Plotting > Channel colours**.

16.5 Export plot

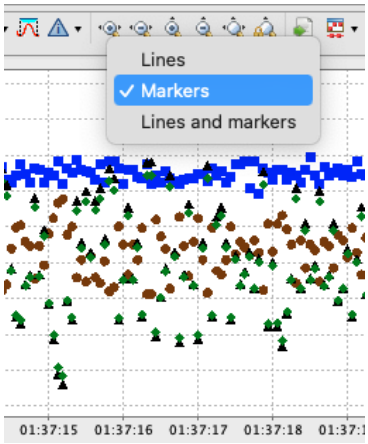
Click the **Export plot** button and select file name and location to save the current view of the main plot to a PDF or PNG file. The exported file will contain the graph only and retain all the changes to display active at the moment of export: zoom, lines and markers, visible events and annotations, and plotting by depth or time.

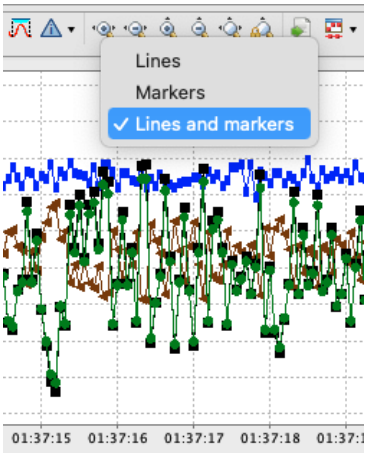


16.6 Appearance controls

Select your data rendering type from the **Change line type** dropdown menu: **Lines**, **Markers**, or **Lines and markers**.



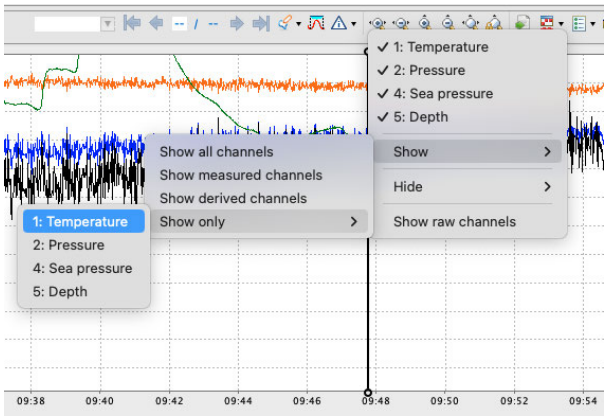




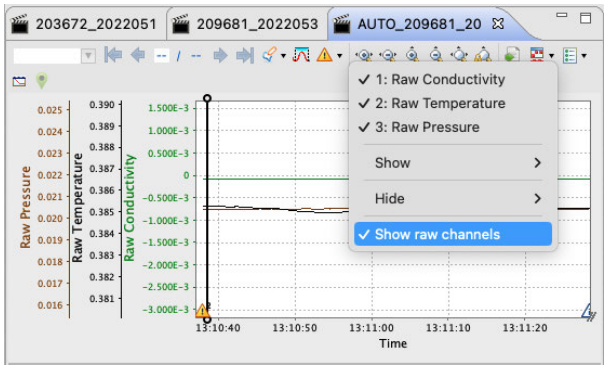
If no data appears in the **Plot** view, try changing the rendering to **Markers**. Time spans that are larger than expected will cause breaks between data points and lines will not be drawn connecting those points,

whereas markers draw at each individual point.

Use the **Toggle channel visibility** button to open the dropdown menu with the list of available channels and options. Check and uncheck channels to display as desired, or select groups to show and hide.

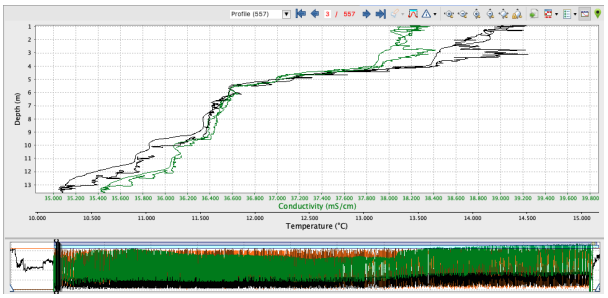


Select **Show raw channels** to display measured data with no calibration equations applied. .



By default, the data are plotted by time. Use the **Toggle depth plot** button to switch to the plot-by-depth mode.





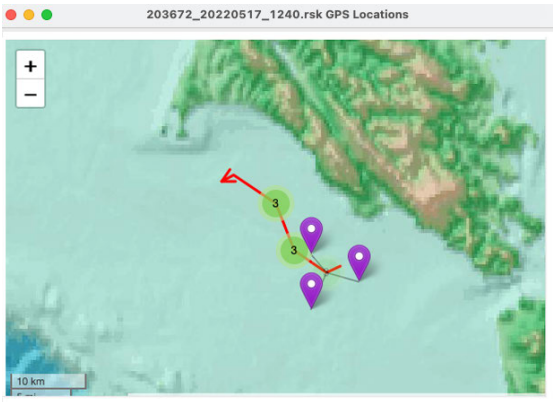
The thumbnail view will continue to display the plot-by-time data.

If there is no depth channel, the plot will use the next pressure or pressure-derived channel starting from the bottom of the channel list.

16.7 GPS map

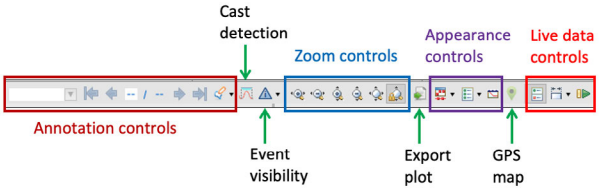
The **Show GPS map** button opens a pop-up window with the GPS map for the plot. Click on the map to display all the GPS location annotations recorded in the dataset.

GPS mapping for Desktop RSK files relies on manually added location points (see **Annotation controls**). All location points you added using the **Annotations** feature are stored in the dataset file and can be displayed in Ruskin via the mapping functionality.

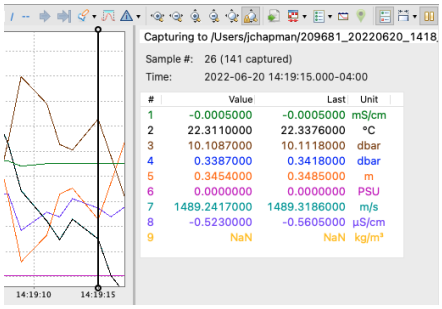


17 Live data plot toolbar

You can use the **Plot** window to view a live graphical display of your instrument sampling. All options described in the **Dataset plot toolbar** section apply to live data display. Additionally, three live data buttons appear at the right end of the toolbar: **Side data panel**, **Live plot time range**, and **Fetch**.



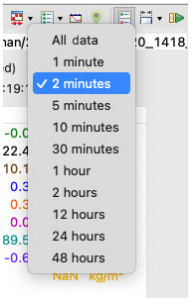
Click the **Side data panel** button to toggle on and off the data panel to the right of the plot. It shows the file location that will be used to capture samples, the number of samples collected, the values of the last received sample, and the currently selected sample.

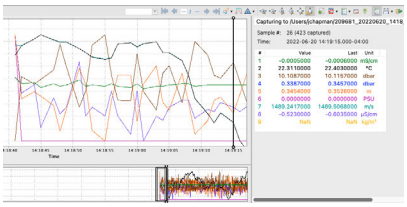




Click the **Live plot time range** button to open a dropdown list of time span options. For example. select **2 minutes** to display the data in the thumbnail view and on the side panel by two-minute time periods.

You can also choose to display all of the data collected.





Fetching

Live data can come from one of two sources: streaming or fetching. Fetching is the action of asking the instrument to take a reading and report it.

To start fetching, disable the streaming option. Go to **Options** under the **Configurations** tab and set **Realtime** to **None**. Click the **Fetch** button to start fetching data. The button will change to **Pause**. Click the **Pause** button to stop fetching.



If streaming is selected (**Realtime** is set to **Serial**), clicking the **Fetch** button will have no effect on the plot.

18 Firmware updates

Ruskin automatically checks if your instrument firmware is up-to-date. Updates may be critical, routine, or customised.

18.1 Critical firmware updates

If a newer version is available and this update is critical, the **Update firmware** button and a warning message will appear at the top of the **Configuration** tab.



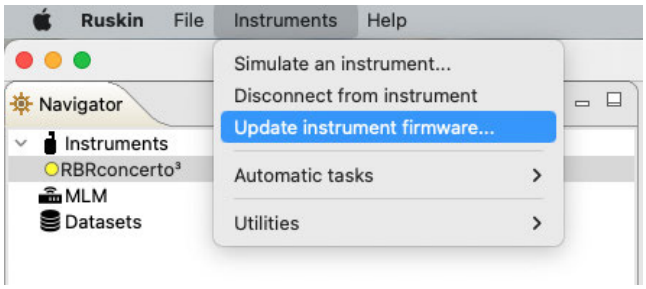
Steps

1. Click **Update firmware**.
   The **Update logger firmware** window will appear. It will contain **Release notes**, outlining the new version number, its release date, improvements, and bug fixes associated with this release, and two standard buttons at the bottom of the window: **Close** and **Proceed**.
2. Click **Proceed** to initialise the update.
   The instrument will disappear from the **Navigator** window during the upgrade. Watch the progress bar at the bottom of the window for the status.



Do not disconnect the instrument until a confirmation message is displayed. Disconnecting during the update process may render the instrument inoperable.

If the upgrade does not complete successfully, go to the **Instruments** menu and launch the update dialogue.



The **Update logger firmware** window will appear. Click **Proceed** again to retry.

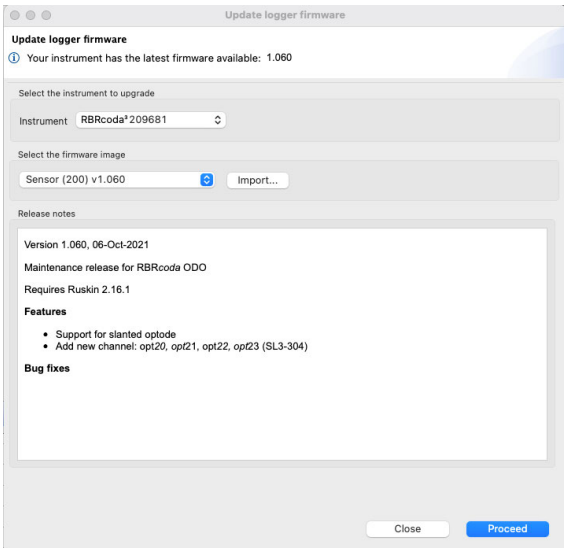
If the instrument does not reappear in the **Navigator** window after a firmware update, disconnect your instrument from the USB port and then reconnect to establish communication.

18.2 Routine firmware updates

If the latest update is not critical, Ruskin will not display any warning message. However, you can always check manually if a newer firmware version is available.

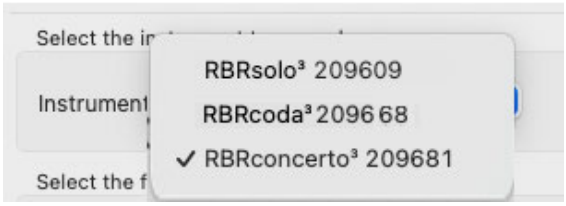
Go to **Instruments** > **Update instrument firmware.**

The **Update logger firmware** dialog box will appear. In addition to the new version number, its release date, improvements, and bug fixes, there will be two additional sections: **Select the instrument to update** and **Select the firmware image**.

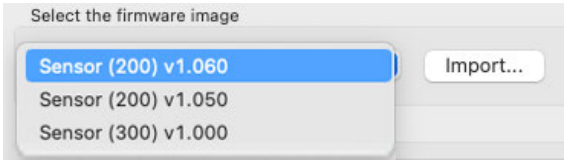


Steps

1. From the I**nstrument** dropdown, select the instrument you wish to upgrade.



2. From the next dropdown, select the latest firmware image.



3. Click **Proceed** to initialise the update.
   The instrument will disappear from the **Navigator** window during the upgrade. Watch the progress bar at the bottom of the window for the status.

> Do not disconnect the instrument until a confirmation message is displayed.
> Disconnecting during the update process may render the instrument inoperable.

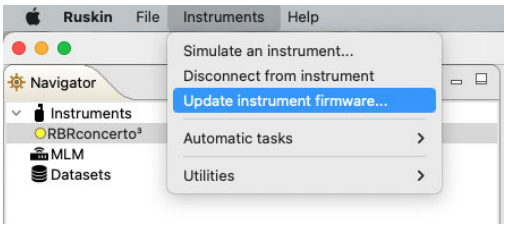
If the upgrade does not complete successfully, click **Proceed** again to retry.

If the instrument does not reappear in the **Navigator** window after a firmware update, disconnect your instrument from the USB port and then reconnect to re-establish communication.

18.3 Manual firmware updates

In certain cases, RBR may supply a customised firmware version, which will not be on the dropdown list.

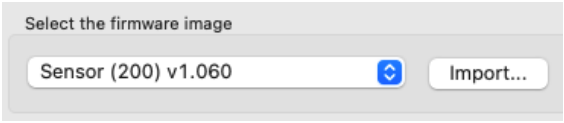
Go to the **Instruments** menu and launch the update dialogue.



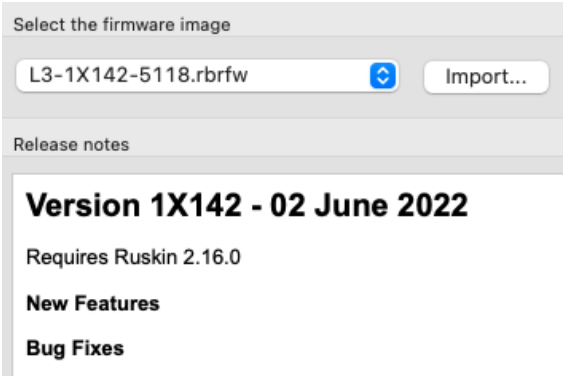
The **Update logger firmware** dialog box will appear. Follow the steps below to import the firmware image provided by RBR and update your firmware.

Steps

1. In the **Update logger firmware** dialog box, click **Import**.



2. Browse to the location of the firmware update file.
   The file will have the extension .rbrfw.
3. Select the file and click **Open.**
   The file will appear on the dropdown list.



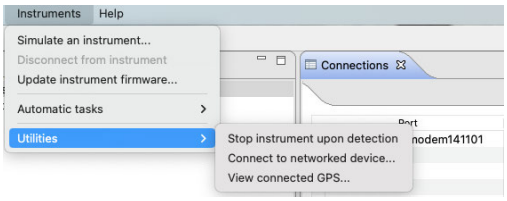
4. Click **Proceed** to initialise the update.
   The instrument will disappear from the **Navigator** window during the upgrade. Watch the progress bar at the bottom of the window for the status.

> Do not disconnect the instrument until a confirmation message is displayed. Disconnecting during the update process may render the instrument inoperable.

19 Utilities

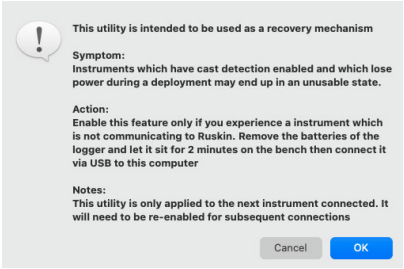
The **Utilities** option is a support tool. Contact RBR before using it.

From the **Instruments** menu, click **Utilities**. A dropdown menu will open.



Stop instrument upon detection

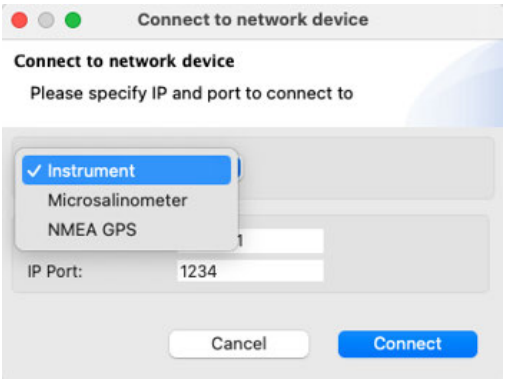
This is an emergency utility which provides a solution to a rare issue with some legacy instruments. Do not use unless instructed by RBR.



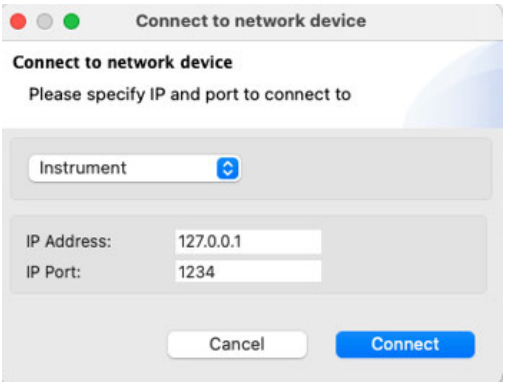
Connect to networked device...

This utility allows a device with serial output to connect to your network via Ethernet. This feature supports remote management and monitoring of your instruments from anywhere in the world.

1. Select your network device from the dropdown list.

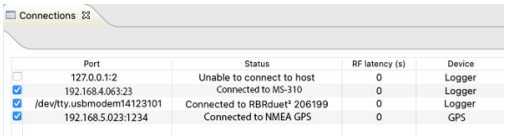


2. Specify the IP address and port.



For the microsalinometer, the port number must be **23**.

3. Click **Connect**.
   The **Connections** tab will display instruments and salinometers connected via Ethernet, alongside with the instruments physically plugged in to your computer. Their IP address and port will appear in the **Port** column. If an attempt to connect was unsuccessful, Ruskin will report an error in the **Status** column.



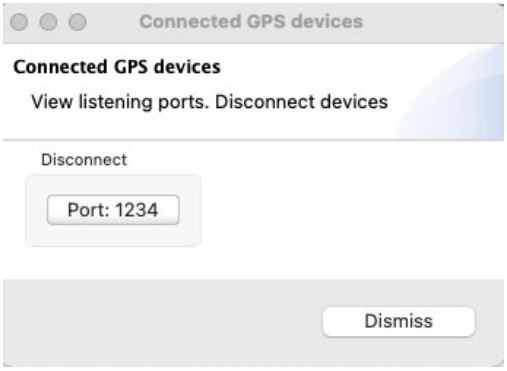
To view connected GPS devices, go to the next utility.

View connected GPS...

This feature allows you to track your instruments during towed deployments. Attach a NMEA GPS to your computer and connect to it as described above. Alternatively, connect to one of the boat tracking devices if it has an IP address.

Typically, only one GPS is necessary to track your deployment. Using more than one GPS may bring confusion into your data. Click **View connected GPS...** to see all listening ports. Click the **Port** button to disconnect.

.



20 User calibration

Factory calibration coefficients are calculated for each sensor, and the coefficients are stored on the instrument.

RBR calibration certificates contain calibration equations, coefficients, and residuals for each sensor.

Calibration certificates are available for download:

- If using Ruskin, connect your instrument and go to **Information**, then select **Download**.
- For OEM instruments, go to https://oem-lookup.rbr-global.com, select **OEM lookup by serial number**, and search by the serial number and authorisation key.

RBR recommends calibrating your instrument before any critical deployment, periodically once a year, or if you suspect the readings to be out of specifications.

Discuss your calibration requirements with RBR. In some cases, the instrument will need to be returned to RBR to have it checked and recalibrated.

Please contact RBR for current calibration fees.

View current calibration coefficients for your sensors under the **Calibration** tab in the **Properties** window.

Dissolved oxygen sensors can be field-calibrated. Update the calibration coefficients for these channels periodically. On occasion, you may need to manually enter new coefficients, although this is not recommended for factory-calibrated sensors (for example, T or D) unless instructed by RBR.

To calibrate a sensor, you need to let it sample in a known environment and then compare the result to the established value. The difference will be used to generate calibration coefficients. With the **N**-point method, the known environment is changed **N** times. The higher the **N**, the more accurate are calibration coefficients.

Use the **Calibration** button under the **Analysis** tab to calibrate galvanic dissolved oxygen sensors (the RBR*coda*^{3} DO).

Use the **Plot** window to calibrate RBR optical dissolved oxygen sensors (the RBR*coda*^{3} T.ODO) and RBR turbidity sensors (the RBR*coda* Tu).

When performing a one-point calibration, Ruskin will adjust the coefficients as follows.

Zero-point calibration:

$$C0new = C0orig - measured\ value$$

Non-zero point calibration:

$$C1new = C1orig * \frac{reference\ value}{measured\ value}$$

20.1 Dissolved oxygen sensor calibration

RBR streaming sensors with dissolved oxygen sensors include the RBR*coda*^{3} T.ODO, with optical dissolved oxygen sensors manufactured by RBR, and the RBR*coda*^{3} DO with galvanic dissolved oxygen sensors manufactured by OxyGuard.

For dissolved oxygen sensors, RBR recommends user calibration using the **N**-point method, with **N** = 2, which will include a **zero reference point** and a **non-zero reference point**. It is, however, acceptable to perform a one-point calibration.

20.1.1 Dissolved oxygen data collection

The steps to obtain the calibration dataset are the same for DO and ODO sensors. The only difference is that optical sensors must be hydrated before use. Thus, if you store it with a wet storage cap on, your instrument is ready for calibration any time. However, if you store it dry, rehydrate your sensor for five days. It takes at least three days for a dry ODO sensor to equilibrate after being placed in water. Insufficient hydrating time may lead to unreliable data. .

See "RBR ODO sensor care and maintenance" section in the RBR Sensors Instrument Guide for more details. The Guide is available on Ruskin under **Help** > **Documentation**.



Rehydrate the RBR*coda*^{3} T.ODO for five days before collecting data.

The RBR*coda*^{3} DO instruments with galvanic dissolved oxygen sensors manufactured by OxyGuard do not need hydrating.

Equipment and materials

- A wide-mouth, black-walled container with a cover
- A small container or beaker
- Air pump (for example, an aquarium air pump with a stone bubbler)
- Magnetic stirrer
- Sodium sulphite Na_2SO_3
- Distilled water

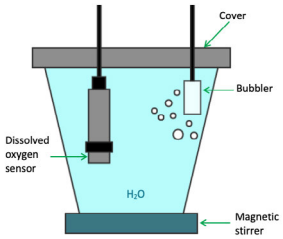
Ruskin configuration

1. Go to **Configuration**.
2. Select **UTC** or **Local**, depending on your preferences, to synchronise the instrument clock with your computer.
3. Set the sampling rate at 1s (1Hz).
4. Enable your schedule.



The instrument must be logging throughout the calibration procedure.

Non-zero reference point

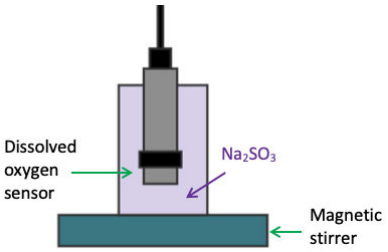


1. Fill the black-walled container with distilled water.
2. Install the magnetic stirrer.
3. Install the air pump.
4. Switch on both the air pump and the magnetic stirrer.
5. Leave them on overnight, or for at least 3-4 hours, to achieve saturation.
6. Submerge the dissolved oxygen sensor in the solution, going in at an angle and stirring to avoid bubble buildup on the sensor window.
   Leave some space between the sensor and the beaker walls.
7. Position the sensor near the stirrer but not directly in the bubbles.
   The bubbler should be shallower than the sensor.
8. Record the data for at least 30 minutes.
   This is the 100% oxygen concentration calibration point.

Zero reference point

Omit this step when performing the one-point calibration.

If you calibrate your dissolved oxygen sensor using the one-point calibration method at 100% oxygen concentration only, calibration should be performed at the expected temperature and salinity of the deployment environment.



1. In a small container or beaker, prepare a 0.1% solution of sodium sulphite (0.25g of Na_2SO_3 for 250mL tap water).
2. Mix the solution thoroughly with a magnetic stirrer. The solution will be oxygen-free after 15 minutes.
3. Submerge the dissolved oxygen sensor in the solution, going in at an angle and stirring to avoid bubble buildup on the sensor window.
   Leave some space between the sensor and the beaker walls.
4. Record the data for at least 30 minutes.
   This is the 0% oxygen concentration calibration point.

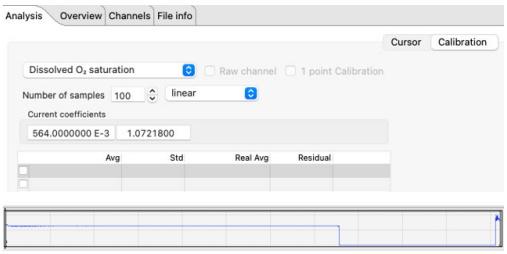
This Na_2SO_3 solution has a limited lifespan and should not be used for more than a day.

20.1.2 DO calibration in Analysis tab

For DO sensors, RBR recommends a two-point user calibration, which includes a **zero reference point** and a **non-zero reference point**. It is, however, acceptable to use a one-point calibration.

Two-point calibration steps on Ruskin

1. Stop the deployment.
2. Download the dataset.
3. Open the dataset on Ruskin. The **Properties** windows will change to dataset properties, with the **Analysis** tab displayed.
4. Click **Calibration**.
5. Select **Dissolved O_2 saturation** from the dropdown list.



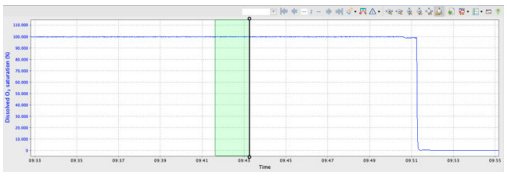
By default, the **Number of samples** is set to **100**, which means Ruskin will average the calibration coefficients over a hundred sample points. Typically, this value should be in the range from 50 to 100 samples.

The **Raw channel** box is unchecked, and thus the true DO values will be displayed in the plot below. To see the raw voltage values, check this box.

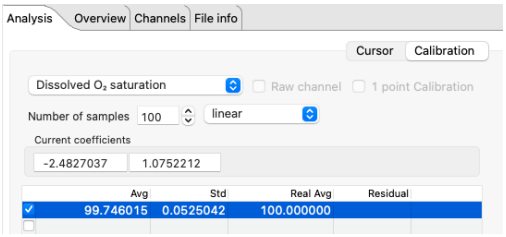
A downsampled representation of the dataset will appear in the thumbnail view, with two distinct plateaus corresponding to 100% and 0%. Irregular readings in-between mark the times when you changed from distilled water to sodium sulphite solution and reassembled the setup.

6. Click on a stable point in the **Plot** view corresponding to 100% oxygen.

   The interval of 100 samples will be highlighted. The average value (**Avg**) and standard error (**Std**) for this interval will appear in the table above.

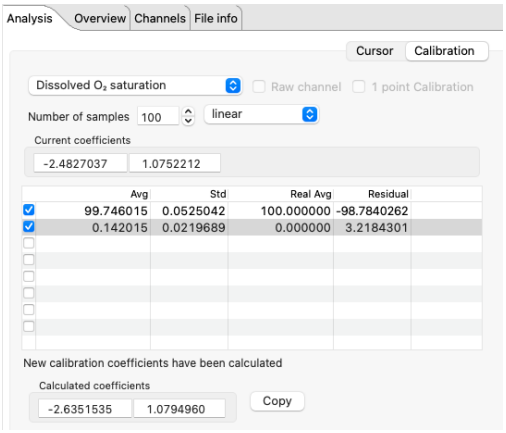


7. Under **Real Avg** in the first row, enter **100**.



8. Repeat the same steps for the second plateau, entering **0** under **Real Avg.**

9. Ruskin automatically calculates the calibration coefficients, and the values appear in **Calculated coefficients**.



10. Click **Copy** to save the new calibration coefficients to the clipboard, or write them down.
11. In the **Navigator** view, find your instrument.
12. Click **Calibration** and select **Dissolved O_2 saturation** from the dropdown list.
13. Click **C0** to select the entry field and type in the new value (in this example, **-2.6351535**).
14. Click **C1** to select the entry field and type in the new value (in this example, **1.0794960**).
15. Click **Store calibration** to save the new coefficients.

> ⚠ Always click **Store calibration** to save new coefficients on the instrument. Otherwise, all changes will be lost once your session is closed.

One-point calibration steps on Ruskin

> ⚠ If you calibrate your dissolved oxygen sensor using the single-point calibration method at 100% oxygen concentration only, calibration should be performed at the expected temperature and salinity of the deployment environment.

1. Stop the deployment.
2. Download the dataset.
3. Open the dataset on Ruskin. The **Properties** windows will change to dataset properties, with the **Analysis** tab displayed.
4. Click **Calibration**.
5. Select **Dissolved O_2 saturation** from the dropdown list.
6. Check the **1 point calibration** box.
7. Click on a stable point in the **Plot** view corresponding to 100% oxygen.
   The interval of 100 samples will be highlighted. The average value (**Avg**) and standard error (**Std**) for this interval will appear in the table above.
8. Click the **RealAvg** column and select **100** from the dropdown.
9. Click **Copy** to save the new calibration coefficients to the clipboard, or write them down.
10. In the **Navigator** view, find your instrument.
11. Click **Calibration** and select **Dissolved O_2 saturation** from the dropdown list.
12. Click **C0** to select the entry field and type in the new value.

13. Click **C1** to select the entry field and type in the new value.
14. Click **Store calibration** to save the new coefficients.

> Always click **Store calibration** to save new coefficients on the instrument. Otherwise, all changes will be lost once your session is closed.

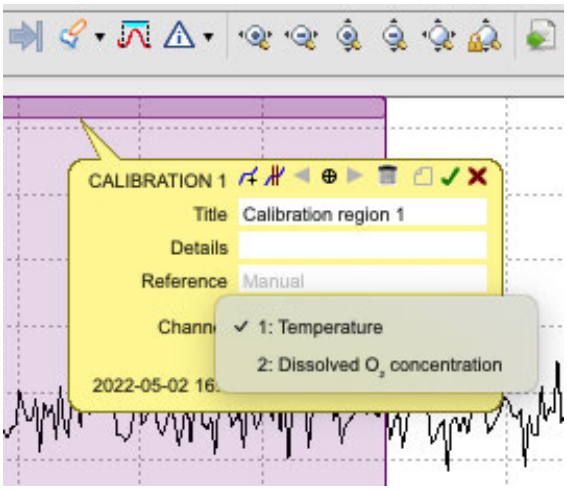
20.1.3 ODO calibration in Plot window

> Optical dissolved oxygen sensors manufactured by RBR are calibrated using the **Plot** window. Clicking the **Calibration** button under the **Analysis** tab will result in an error message.

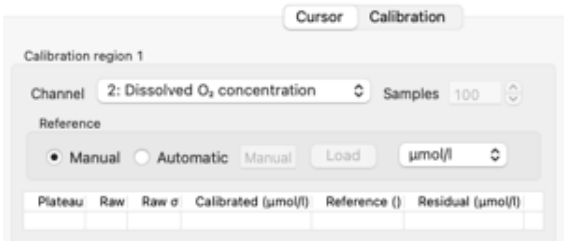
Plot calibration steps on Ruskin

Use the **Plot** window on Ruskin to calibrate your RBR*coda*^{3} T.ODO. You can choose a one-point (100% O_2) or a two-point (100% and 0% O_2) method.

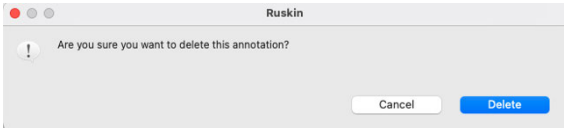
1. Create a new calibration region.
   a. Obtain the calibration dataset as described above and open it in Ruskin.
   b. Click **Create annotation** and select **Calibration** from the dropdown menu. The cursor in the **Plot** window will become a two-way arrow.
   c. Click and drag left or right to select the calibration region.
   The interval will be highlighted and a tooltip will open.
   d. Enter the title for the region and select **Dissolved O_2 concentration** from the dropdown menu.



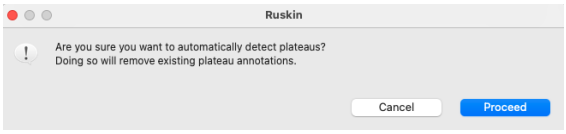
   e. Press **Enter** on your keyboard or click **Save** on the tooltip to save the calibration region. A section for this calibration region will open under **Cursor**.



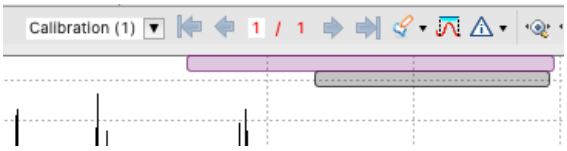
   f. To delete a calibration region, click **Delete** on the tooltip. A warning message will appear.



2. Create plateaus.
    a. Click **Detect plateaus**. If there are existing plateaus, a warning message will appear.

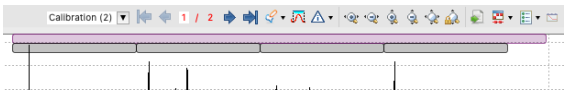


b. Click **Proceed** to continue. All detected plateaus will be visible as grey markers under the calibration region marker.

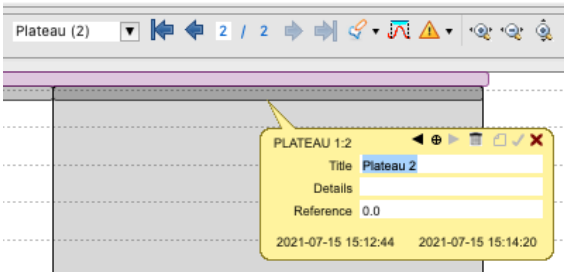


c. To create a plateau manually, click **Create plateaus.**

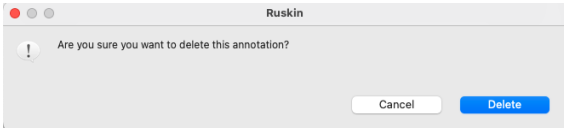
    A new plateau will appear as a grey marker at the start of the calibration region marker. Each new click will add another plateau to the right of the existing one.



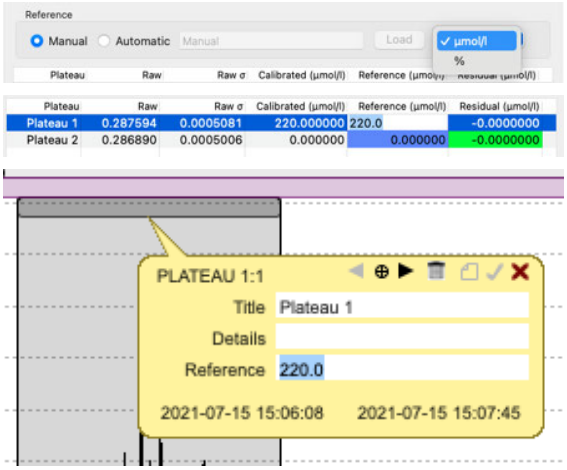
d. Click a plateau to open its tooltip. You can now edit the title and add reference values.



e. To delete a plateau, click **Delete** on the tooltip. A warning message will appear.



3. Enter reference data.
    a. By default, **Reference** is set to **Manual** entry mode, with in units of % or µm ol/L available in the dropdown menu.
    Enter the reference value for each plateau manually in the **Plateau** table under **Cursor,** or in the **Plateau** tooltip.



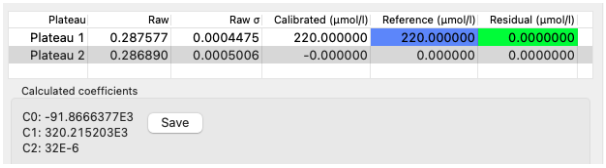
b. Alternatively, enter reference values from the CSV file. The CSV file for the automatic data entry must have two columns: time (in ISO 8601 format) and data (in float/double format).

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

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

> 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.

4. Save the coefficients.
   a. Verify that the calibration was successful. If the residuals are within an acceptable range, they will be highlighted in green, and the **Save** button will appear in the **Calculated coefficients** section.
   b. Click **Save** to write the coefficients to the instrument. The instrument must be connected to Ruskin.



If successful, a success message will appear.

If not, a warning message will appear instead.

> Calibration coefficients are stored on the instrument and not the sensor. Recalibrate your sensor if you move it to a different instrument.

20.2 Turbidity sensor calibration

Turbidity sensors manufactured by RBR are available as the RBR*coda* Tu.

RBR factory-calibrates the turbidity sensors using the **N**-point method, with **N** = 2. For user calibration, we also recommend using the two-point method (**N** = 2) performed with protection from ambient light.

20.2.1 Tu data collection

Follow the steps below to obtain the calibration dataset for your Tu sensor.

> The RBR*coda* Tu has two channels, turbidity and optical backscatter. It is not mandatory to calibrate both if you are only using one. However, if you are using the OBS channel and need to calibrate it, use two **non-zero** reference points.

Equipment and materials

- A wide-mouth, black-walled container (large enough to hold the instrument 15-20cm away from the walls)
- Secure black lid for the container with an orifice for the instrument
- Small black lid or any light-blocking material to cover the orifice during calibration
- 1000FTU Formazin standard (800-1000FTU will work)
- Optional: 4000FTU Formazin standard (for the optical backscatter channel - RBR*coda* Tu only)
- Distilled water
- Large magnetic stirrer
- Rubbing alcohol
- Soft cloth

Ruskin configuration

1. Go to **Configuration**.
2. Use **Local** on Ruskin to synchronise the instrument clock with your computer.
3. Set the sampling rate to 4Hz.
4. Enable your schedule.

Sensor preparation

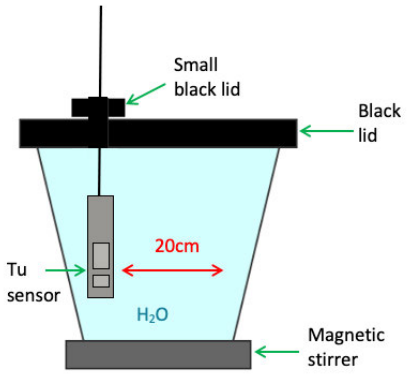
1. Wash the sensor and container with distilled water and dry them with a soft cloth.
2. Check the turbidity window for stains and scratches.

> Do not proceed with calibration if there are serious scratches.

3. Wipe the turbidity window with alcohol to remove all stains.

Zero reference point

1. Fill the black-walled container with distilled water.
2. Turn on the magnetic stirrer and adjust the RPM to ensure no vortex appears.
3. Place the black lid on the container and avoid direct light on the container.
4. Submerge the sensor though the orifice in the lid, vertically along the wall, with the turbidity window facing the larger water volume.



The distance from the turbidity window to the container wall must be 15-20cm.

5. Cover the orifice with the smaller black lid or light-blocking material, like a thick plastic bag.
6. Record the data in distilled water for at least 15min, up to 45min. This is the zero-turbidity calibration point.

Non-zero reference point

Repeat the steps for the **zero reference point,** replacing distilled water with 1000FTU Formazin standard.

If a non-zero reference solution is produced by diluting concentrated Formazin, stir until stable.

This is the 1000NTU calibration point.

If you are calibrating the OBS channel (RBR*coda* Tu), repeat these steps for one more non-zero point (4000FTU). Thus, you will have two non-zero points (1000FTU and 4000FTU), but no zero points.

As each reference point takes 15 minutes to an hour, the entire procedure may take up to two hours.

After completing the procedure for both reference points (or for a single reference point, if using the one-point method), proceed to calibration on Ruskin.

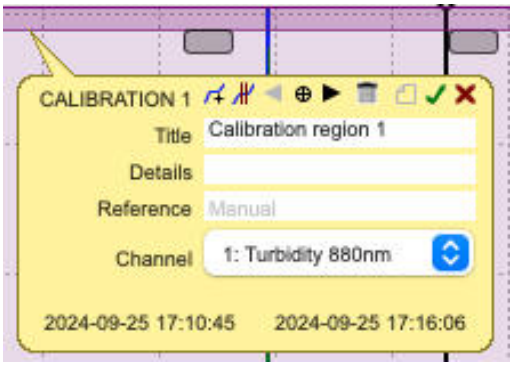
20.2.2 Tu calibration in Plot window

Turbidity sensors manufactured by RBR are calibrated using the **Plot** window. Clicking the **Calibration** button under the **Analysis** tab will result in an error message.

Plot calibration steps on Ruskin

Use the **Plot** window on Ruskin to calibrate your RBR*coda* Tu. You can choose a one-point (1000FTU) or a two-point (distilled water and 1000FTU) method.

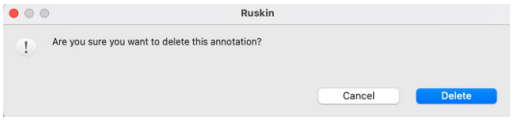
1. Create a new calibration region.
   a. Obtain the calibration dataset as described above and open it in Ruskin.
   b. Click **Create annotation** and select **Calibration** from the dropdown menu. The cursor in the **Plot** window will become a two-way arrow.
   c. Click and drag left or right to select the calibration region. The interval will be highlighted and a tooltip will open.
   d. Enter the title for the region and select the channel to calibrate from the dropdown menu: **Turbidity 880nm** or **Turbidity OBS 880nm**.



   e. Press **Enter** on your keyboard or click **Save** on the tooltip to save the calibration region.
   A section for this calibration region will open under **Cursor**.

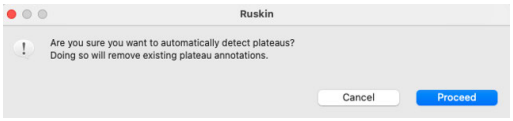


f. To delete a calibration region, click **Delete** on the tooltip.
A warning message will appear.

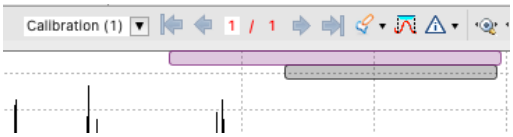


2. Create plateaus.
   a. Click **Detect plateaus**

      If there are existing plateaus, a warning message will appear.

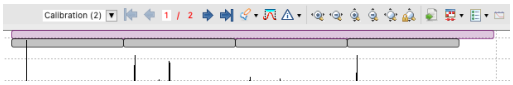


b. Click **Proceed** to continue.
All detected plateaus will be visible as grey markers under the calibration region marker.

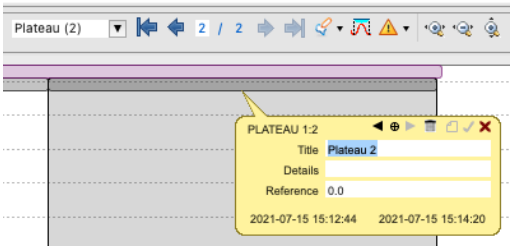


c. To create a plateau manually, click **Create plateaus**

A new plateau will appear as a grey marker at the start of the calibration region marker. Each new click will add another plateau to the right of the existing one.

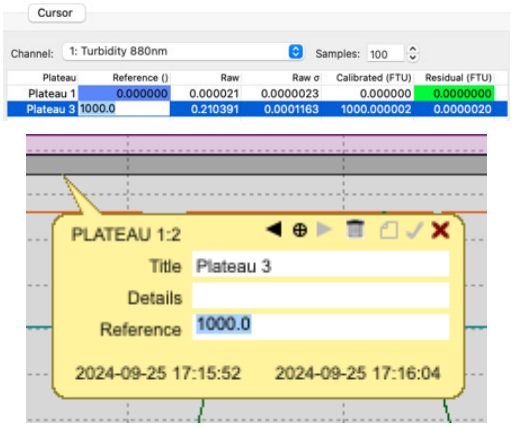


d. Click a plateau to open its tooltip. You can now edit the title and add reference values.



e. To delete a plateau, click **Delete** on the tooltip.
A warning message will appear.

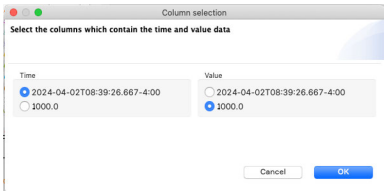
3. Enter reference data.
   a. By default, **Reference** is set to **0.0** entry mode. Enter the reference value for each plateau manually in the **Plateau** table under **Cursor**, or in the **Plateau** tooltip



b. Alternatively, enter reference values from the CSV file. The CSV file for the automatic data entry must have two columns: time (in ISO 8601 format) and data (in float/double format).

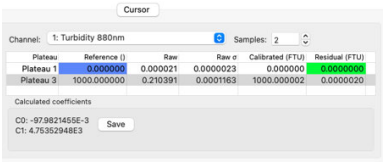
```
2024-04-02T08:39:26.667-4:00, 1000.0
2024-04-02T08:58:16.333-4:00,    0.0
```

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



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.

4. Save the coefficients.
   a. Verify that the calibration was successful. If the residuals are within an acceptable range, they will be highlighted in green, and the **Save** button will appear in the **Calculated coefficients** section.
   b. Click **Save** to write the coefficients to the instrument. The instrument must be connected to Ruskin.



If successful, a success message will appear.

If not, a warning message will appear instead.

20.3 RBRcoda OpH sensor calibration

RBR standard instruments support the RBR*coda* OpH sensor.

Calibration time is approximately 45 minutes.

For RBRcoda OpH sensors, RBR recommends calibrating the instrument before each deployment.

Ensure the optical pH units have been hydrated for at least 12 hours before starting this calibration.

For the highest accuracy, calibration should be done immediately prior to deployment, and the sensor remains hydrated between calibration and deployment. A known hydration drift rate of ~1.5 mpH/day at 20 °C is expected.

20.3.1 RBRcoda OpH data collection

Follow the steps below to obtain the calibration dataset for your pH sensor.

Data can be collected with a standalone RBR*coda* OpH using a patch cable connection or with the sensor attached to a standard logger.

Equipment and materials

- RBR*coda* OpH sensor
- Computer with Ruskin
- Serial connection to the sensor
- Power supply (12V, 1.0A)
- Retort stand and clamp
- Stir plate & 2x stir bars
- 2x 150 mL beakers
- Analytical balance (±0.1 g accuracy or better)
- 2x weigh boat or weigh paper
- Scoopula or spatula

Chemicals Required

- Citric Acid (2-hydroxypropane-1,2,3-tricarboxylic acid)
- Sodium Carbonate
- Sodium Chloride
- DI water

Calibration Solution Preparation

Prepare the two calibration solutions that provide the low and high pH points for calibrating the RBR*coda* OpH.

Citric acid produces a stable acidic solution (approximately pH 2.1), and sodium carbonate produces a stable basic solution (approximately pH 11.7); together, these two points span the response range of the optical sensing element.

Sodium chloride is added to both solutions to raise the dissolved ion concentration to approximately 36 g/L, a value representative of seawater, so the sensor is calibrated under oceanographically relevant conditions.

1. Obtain two 150 mL beakers. Label one beaker “Acidic” and one beaker “Basic”.
2. Fill each beaker with 100 mL of DI water.
3. Make the **acidic** calibration solution by weighing:
    - 1.5 g ± 0.1 g citric acid (2-hydroxypropane-1,2,3-tricarboxylic acid)
    - 3.5 g ± 0.1 g sodium chloride

    then add to the beaker labelled “Acidic”.
4. Add a stir bar to the acidic solution and place it on a stir plate, on a low-medium setting, for 10 minutes or until fully dissolved.
5. Make the **basic** calibration solution by weighing:
    - 1.5 g ± 0.1 g sodium carbonate
    - 2.1 g ± 0.1 g sodium chloride

    then add to the beaker labelled “Basic”.
6. Add a stir bar to the **basic** solution and place on a stir plate, on a low-medium setting, for 10 minutes or until fully dissolved.

> The target ion concentration of 36g/L corresponds to a nominal salinity of 35PSU using the standard seawater conversion (35PSU = 35.165g/kg of solution, at a seawater density of 1025kg/m^3). This conversion is strictly valid only for seawater: practical salinity is defined by conductivity for seawater’s fixed ionic composition, and these synthetic solutions contain citrate and carbonate ions that conduct differently than sea salt. Therefore, 35PSU is an approximation, and a conductivity-based measurement of

these solutions would report a slightly different value. This does not affect the quality of the calibration.

Connect to Ruskin

- Connecting directly to RBR*coda* OpH
  a. Connect your sensor to the computer via RS-232, supply power (12V, 1.0A), and open Ruskin.
  b. Ensure data is streaming, and note the file path where your data is captured.
- Using an RBR standard logger
  a. Connect to your instrument via USB-C and enable logging.

Data Collection: Low pH Calibration Point

1. Move the sensor to DI water and soak for 1 minute.
2. Set the acidic solution on a stir plate and begin stirring.
3. Using a retort stand and a clamp, lower the sensor into the acidic solution.
4. You should see an increase in optical signal when the sensor is placed in the acidic solution.
5. Let it soak for 15 minutes, then move on to the next step.

Data Collection: High pH Calibration Point

1. Move the sensor to DI water and soak for 1 minute.
2. Set the basic solution on a stir plate and begin stirring.
3. Using a retort stand and a clamp, lower the sensor into the basic solution.
4. You should see a decrease in optical signal when the sensor is placed in the basic solution.
5. Let soak for 15 minutes, then finish data capturing.
6. Place the unit in DI water, and move to RBR*coda* OpH calibration in Analysis tab. Do not disconnect the instrument.

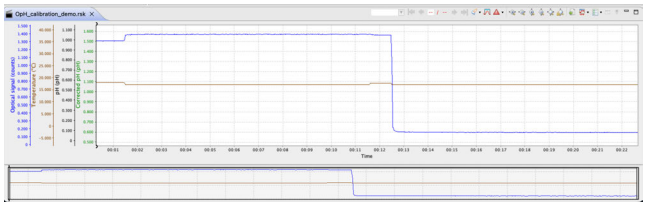
20.3.2 RBRcoda OpH calibration in Analysis tab

For RBR*coda* OpH calibration, you will use Ruskin to identify the two calibration plateaus, derive the calibration coefficients, and write them to the instrument.

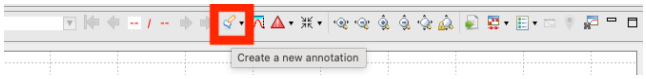
Calibration steps in Ruskin

1. Open your data file.
   a. Connecting directly to RBR*coda* OpH:
   With your RBR*coda* OpH still connected, load the “realtime” .rsk file with your calibration data.
   b. Using an RBR standard logger:
   With your logger still connected, download and open the data file.

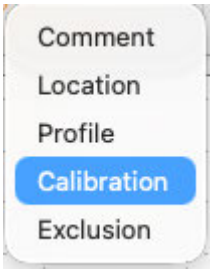
2. Expand the plot window to display the entire data collection. The data file should have 2 clear plateaus corresponding to the two data collection stages from RBR*coda* OpH data collection.



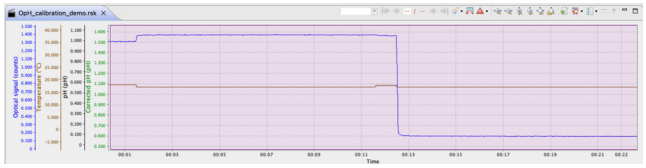
3. In the plot menu bar, click the **Create a new annotation** drop-down.



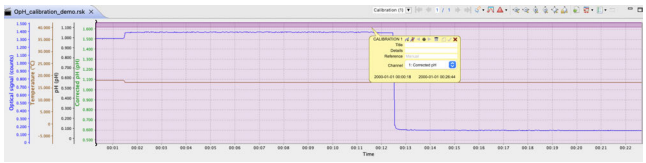
4. Click on **Calibration**.



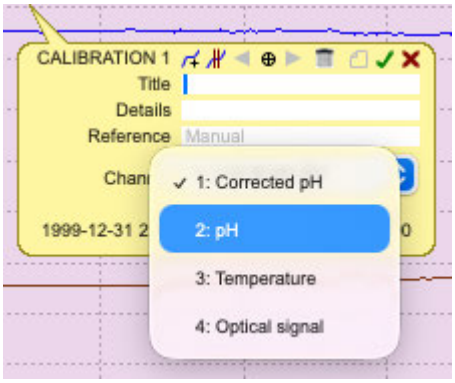
5. A selection cursor will appear. In the plot window, select the regions that correspond to the data collected in the two data collection stages.



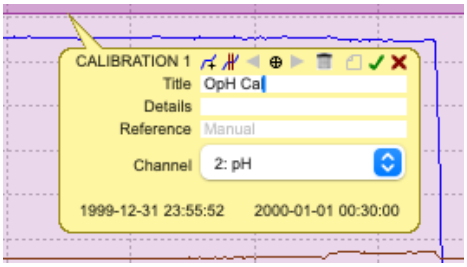
6. A calibration dialogue will open.



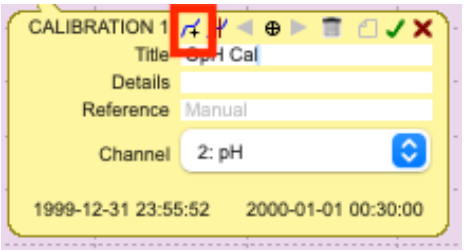
7. Select channel **2: pH**.



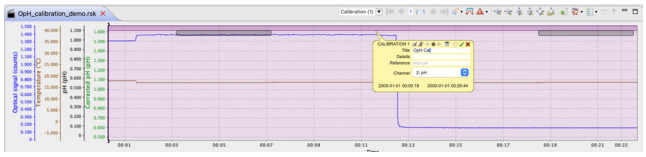
8. Give your calibration a title.



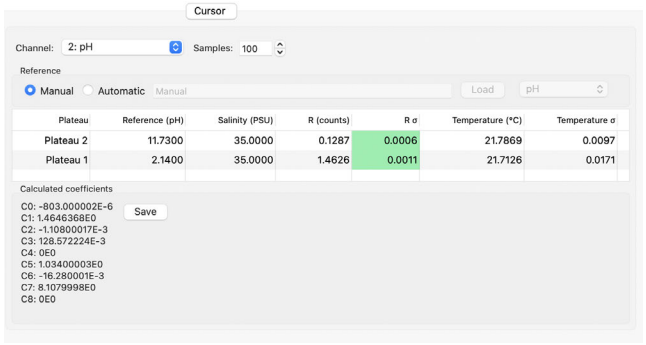
9. Select **Automatic plateau detection**.



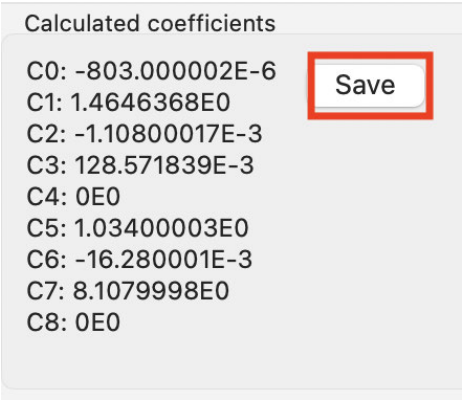
10. Two plateau regions should be detected, again corresponding to the two calibration data stages. Click on these plateaus and label them if desired.



11. Above the plot window should also change to show you a screen with information on the calibration, and coefficients derived from this calibration.



12. Next to the coefficients, click **Save** to write the coefficients to the instrument.



21 Revision history

Revision No.	Release Date	Notes
1.0 - H	2011-2020	Various
J	31-August-2022	Restructured the user guide to reflect Ruskin interface, added a dedicated page for RSK files, edited existing instructions for clarity, removed outdated sections and screenshots. Added RBR*tridente* to Realtime output format and OEM command reference (channel types).
K	31-December-2022	Added a section on the Search option under Support (for Mac users). Updated the RSK files and File info sections to reflect new file structure labels. Enhanced Plot window instructions. Updated the Power section. Added RBR*quadrante,* RBR*coda* Tu to Realtime output format and OEM command reference (channel types). Added the config command (restoring factory configuration) for the RBR*tridente.* Corrected typos in the User calibration section.
L	31-March-2023	Added/updated screenshots in several sections (Ruskin interface, Simulate an instrument, Configuration, and Appearance controls) for clarity. Added information on synchronising the instrument clock in the Schedule section. Added the Connections page. Corrected a typo in the Tide section. Added Ranging sensors (RBRcoda Tu). Updated the Analysis, Annotation controls, and Zoom controls sections. Added the Utilities page.
M	31-May-2023	Updated the Configure as sensor section.
N	31-October-2023	Updated the Information section to include guidance on downloading the latest calibration certificates. Updated the list of Supported channel types for the new RBR*tridente* channels.
P	31-December-2024	Added aggregate mode to Sampling. Added user calibration instructions for the RBR*coda* Tu. Removed the OEM command reference section (now available as a separate document, "Sensor Command Reference").
Q	24-November-2025	Added RBR*coda* chl-*a* to Realtime data format
R	28-July-2026	Added a Configure RBRcoda OpH foil page and RBcoda OpH sensor calibration section

CE