USER GUIDE

RBR*virtuoso*   RBR*duo*

RBR*concerto*   RBR*maestro*

rbr-global.com

Table of Contents

1 Ruskin

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

- configure, schedule and enable multiple loggers
- download data after logging
- graphically view data sets
- export data in various formats
- change the calibration coefficients for your logger

Ruskin can be used on Microsoft Windows (XP, Windows 7, and Windows 8), and on the Apple Mac running OS X (10.5 Leopard or later).
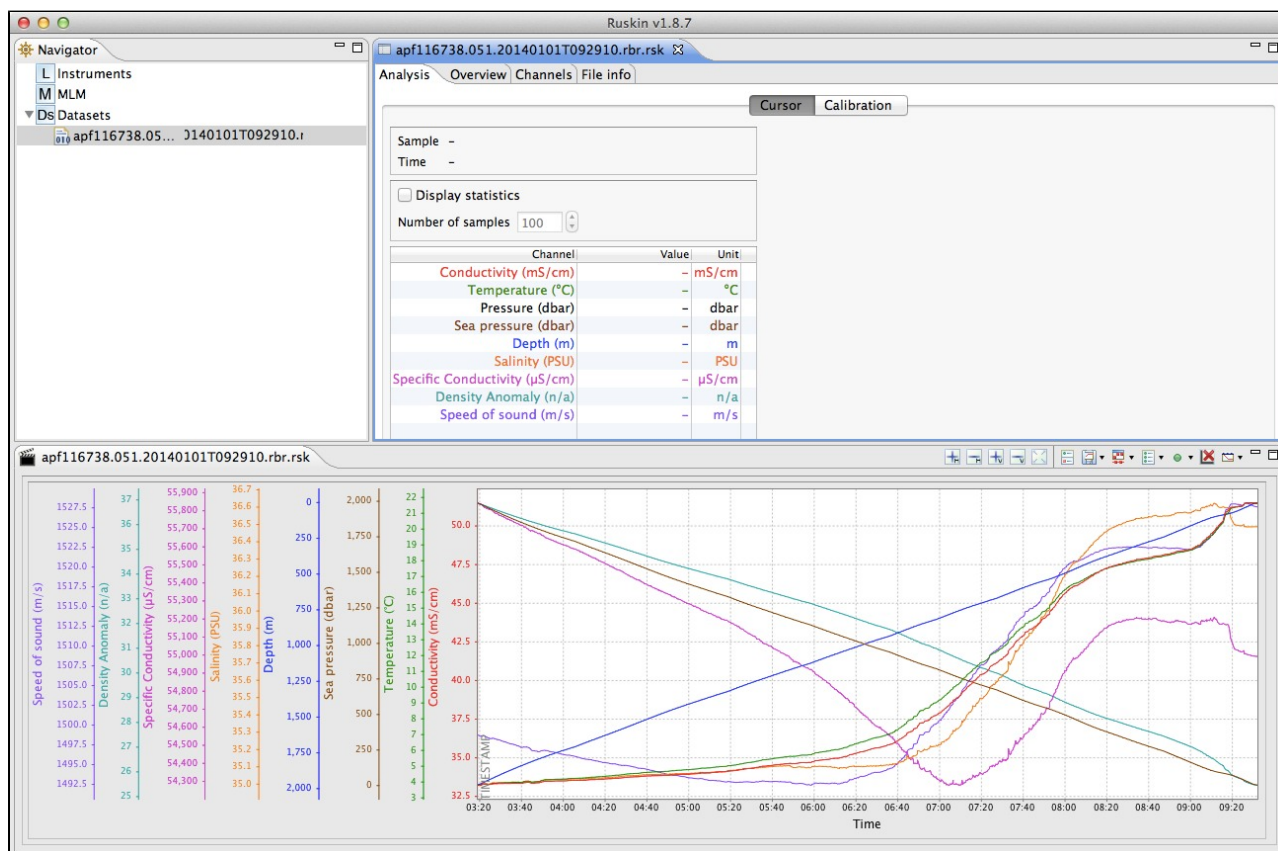
2 Revision history

Revision No.	Release Date	Notes
1.0	7-Oct-2011	Original
2.0	15-Oct-2012	Adding RBRvirtuoso and RBRconcerto, and new features
2.1	28-Jan-2013	Adding thresholding and AMT pH calibration, editing autoranging, thumbnail view, parameters tab, file export, event button, and calibration
3	26-Jun-2013	Initial controlled release, new part #, no other changes
4	22-Jul-2013	Ruskin v1.8.3 additions
5	02-Sep-2014	Migrated to new editing system, updated for Ruskin v1.8.20

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3 Warranty Statement

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

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

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

Users are expected to maintain a regular program of calibration.

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

4 Introduction

The Ruskin User Guide introduces you to Ruskin and helps you to use it effectively from the start. It is specifically written for our next generation loggers; RBR*virtuoso*, RBR*duo*, RBR*concerto*, and RBR*maestro*. To simplify logger naming in this manual, the next generation loggers are referred to collectively as Logger2.

The guide shows you the overall processes that we suggest you use. The process includes links to step-by-step procedures that are easy to follow. The guide also provides some conceptual information. Since we assume that you will use this guide while you are using Ruskin, the guide does not tell you what you can see for yourself in the Ruskin window.

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

Release notes are automatically displayed each time you install an updated version of Ruskin. The most recent release notes are also available from the Help menu in Ruskin.

For information about operating and maintaining your RBR*virtuoso*, RBR*duo*, RBR*concerto*, and RBR*maestro* series of data loggers, see the Logger Hardware (page 83). It helps explain how to change the battery and change desiccant, including other useful information, such as inspecting and replacing O-rings.

5 Installation

5.1 Install Ruskin on a PC

You can install Ruskin on a Windows computer that uses the XP or Windows 7 operating system. For Windows 8 installations see below.

Steps

1. Insert the USB data stick in the appropriate USB port.

2. Navigate to the folder PC Ruskin and double click on the file RuskinCompleteSetup.exe.

3. Follow the installation instructions. You can specify a different name and location for the working directory for the software, which is C:\Program Files\RBRRuskin by default.

4. The logger uses a USB interface to communicate with Ruskin.
   A dialog window will appear asking, *Would you like to install the logger driver at this time?*

5. Click **Yes** to install the drivers.

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

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

> ⚠️ For Windows 8 installations requiring Unsigned driver support use the following steps.

Installing Ruskin on Windows 8 systems – unsigned USB driver

1. Install Ruskin – do not connect an instrument - and close Ruskin.

2. Go to the right bottom corner of the desktop and wait for the side menu to appear. When it's there click on the gear icon with the title "Settings".

3. Hold the shift key while clicking on Restart

4. Select Troubleshoot > Advanced Options > Startup Settings > Restart

5. Wait for the restart to happen

6. Choose option #7 (enables unsigned driver support)

7. Wait for the restart to finish

8. Run Ruskin

9. Connect an Instrument – it will not appear in Ruskin

10. Go to Control Panel\All Control Panel Items\System and select Device Manager

11. In Device Manager select the com port of the logger
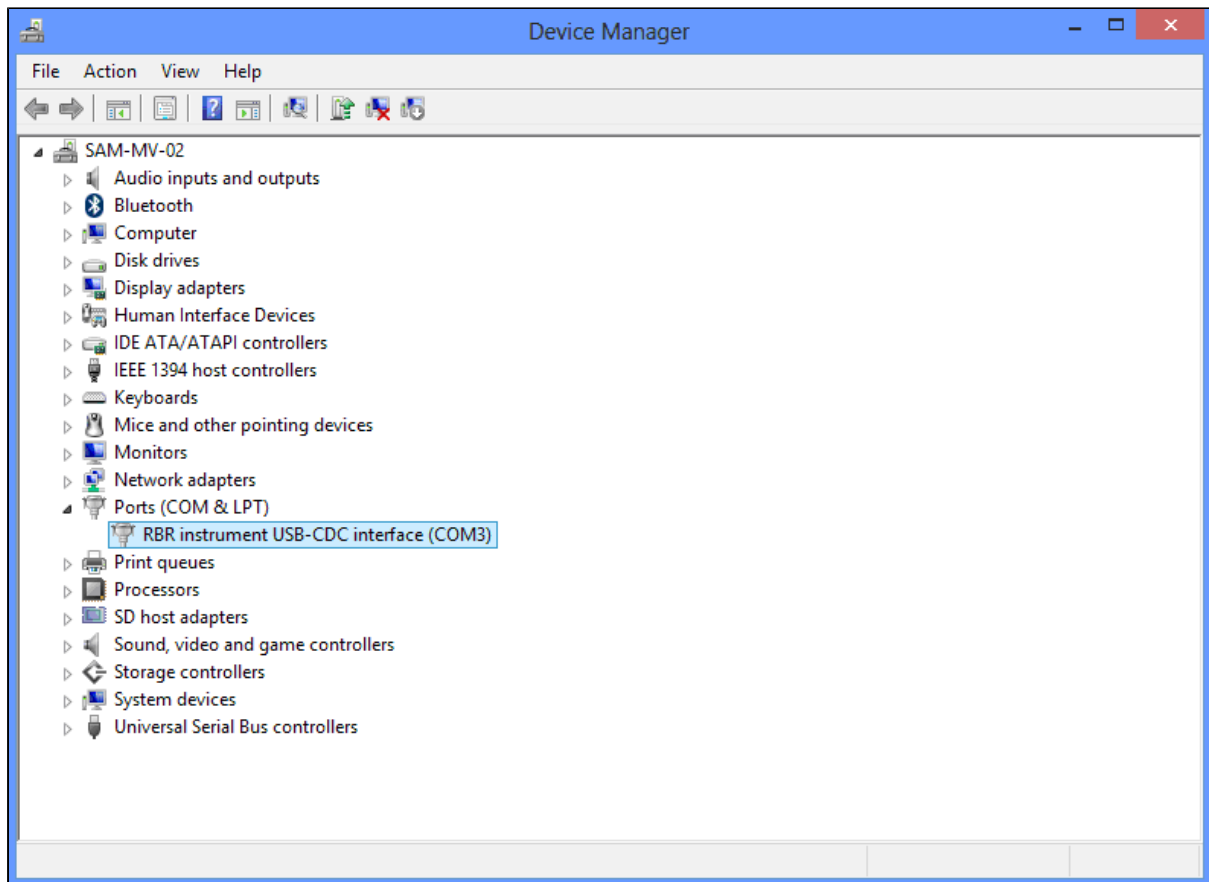
This screen capture is of a properly installed driver - the text will be different

12. Right click on the highlighted instrument and select Update Driver software

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13. Select Browse my computer
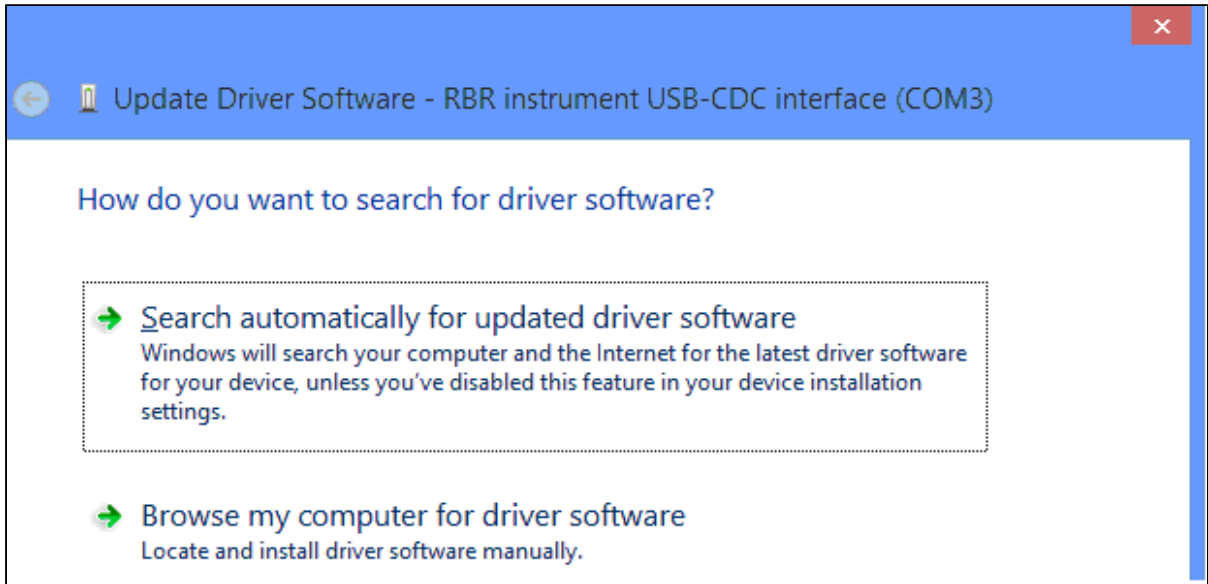
14. and go to RBRRuskin\L2driver and press next
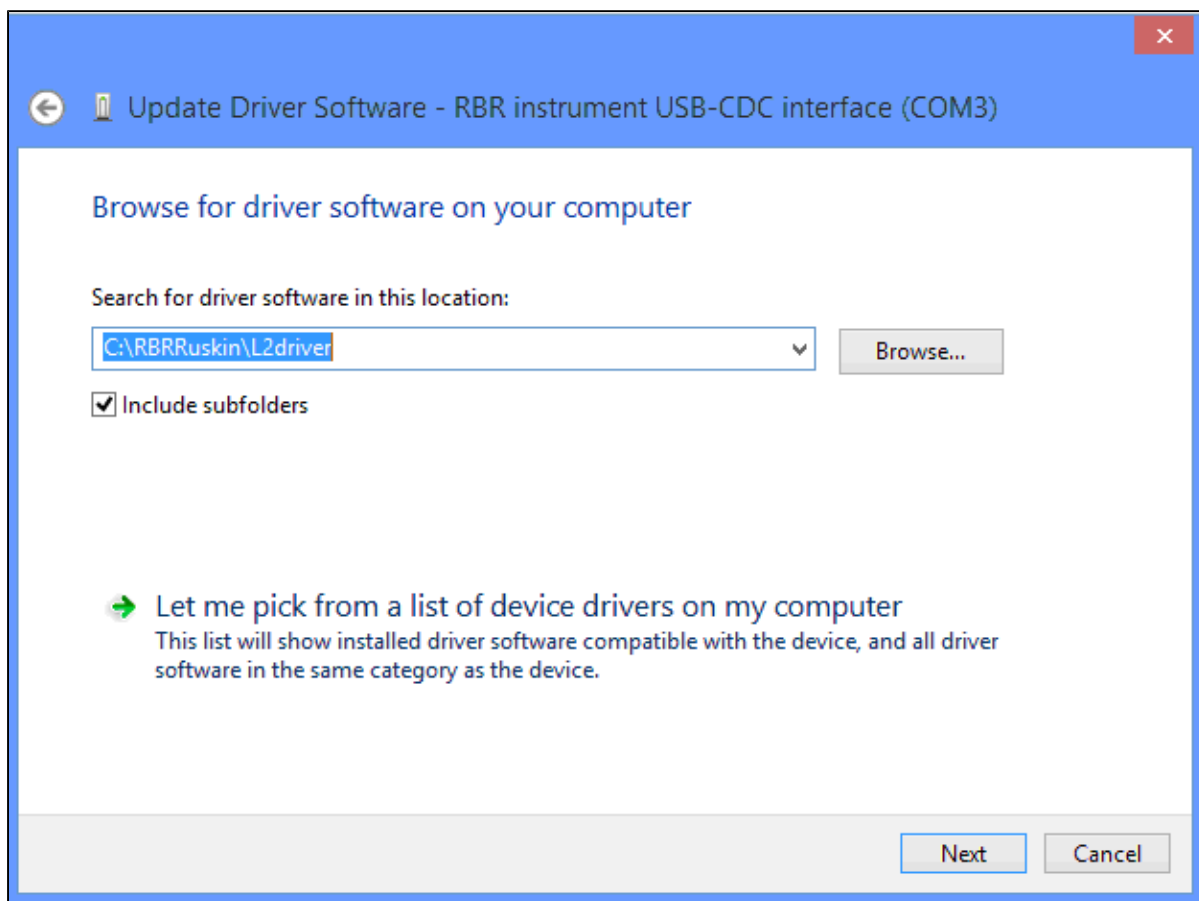
15. A message will appear indicating that you are trying to install and unsigned driver – select yes or OK

16. Once the USB driver is installed, close and reopen Ruskin and the instrument will appear in Ruskin.

5.2 Install Ruskin on a Mac

You can install Ruskin on the Apple Mac running OS X (10.5 Leopard or later).

Steps

1. Insert the USB data stick in the appropriate USB port.

2. Navigate to the folder Mac Ruskin and double click on the file Ruskin.dmg.

3. Follow the installation instructions.

> ⚠ It is possible to keep your security level as it is, but also open unsigned applications without going into the Security & Privacy preference pane to change the system-wide setting.
> Right-click or Control-click the Ruskin application you've downloaded and choose Open from the contextual menu.
> Mountain Lion asks you to confirm that you want to open the file; click the Open button. This is necessary only the first time you open an application.

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

A folder named RBRRuskin appears in the Applications folder.

5.3 Update Ruskin

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

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

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

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

5.4 Uninstall Ruskin

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

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

It is not necessary to uninstall an older version of Ruskin before installing a newer version. The installation program deletes the older files before installing the newer ones. For more information, see Update Ruskin (page 14).

Windows XP

On the **Control Panel**, use the **Add/Remove** utility and click **Ruskin**.

Windows 7 or 8

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

OS X (10.5 or later)

Move the RBRRuskin folder from **Applications** to the **Trash**.

6 Provide your feedback

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

- Send us an email. For a technical question, write to support@rbr-global.com. If it is a general inquiry, use info@rbr-global.com.

- Send us a bug report from within Ruskin itself. Use the **Help** menu > **Comment on Ruskin**. This allows you to include the diagnostic logs, and any other files (RSK datasets, screenshots) that will help us reproduce the problem and help you as quickly as possible.

Steps

1. From the **Help** menu, click **Comment on Ruskin**.
   The Feedback to RBR dialog box appears.

2. Enter your identification information, for example email address and name, and then summarize your comments.

3. Provide a detailed description and add any attachments, if required.

> ⚠ Always verify that the **Attach Ruskin logs** check box is selected. If it's not selected, your submission will not include the logs.

4. Click **OK** to submit the report.

7 Quick start

7.1 Deploy an instrument

Before you begin using your RBR loggers, you may want to experiment with the simulated loggers that are included in Ruskin. For instructions on simulating a logger, see Using a simulated logger (page 18)

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

Steps

- If you are using the logger for the first time, you can use either the default preferences or specify your preferences to apply to all your loggers. For more information, see Preferences. You can change these preferences at any time.

- Connect your logger locally through your computer's USB port. The logger should appear in the **Navigator** view after a few seconds.

- Click the logger that you want to use. Ensure that it contains the sensors you expect to find on the logger by viewing the **Information** tab in the **Properties** view on the right side of the Ruskin window. For more information, see View information about a logger (page 19).

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

- Click the **Setup** tab > **Basic Configuration** tab to specify streaming**.**

  > ⊘ You must specify your preferences regarding these features before you enable the schedule. For more information, see Configure a logger (page 20).

- If you want to view or modify calibration coefficients, click the **Calibration** tab. For more information, see Calibration tab (page 43).

- Click the **Setup** tab > **Schedule** tab to schedule the logger to take samples when and as often as you want within the limits of your logger. For more information, see Schedule a logger (page 23).

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

- On the **Setup** tab, click **Enable** to take samples according to the schedule that you specified. If you enabled streaming data, you can use the **Live plot mode** button in the **Plot** view toolbar to choose whether to view samples taken at the default speed for your logger type (**Fetching** mode) or samples taken at the speed that you specified in the **Measurement speed** row (**Streaming** mode) (**Properties** view > **Schedule** tab).

- If you want to download data, click the **Download** tab to download all the data saved since your schedule was enabled. For more information, see Download (page 41). The focus changes to the new dataset in the **Navigator** view, and the static data appears in the **Plot** view. You can now export the downloaded data to a file in Excel, Matlab, engineering text, or raw text formats. You can also save the image as a PDF or PNG file for viewing outside Ruskin.

7.2 Using a simulated logger

Ruskin can simulate most logger types that RBR produces. We recommend that you experiment with your type of simulated logger before enabling a schedule for your actual RBR logger. This practice helps you become more familiar with how an RBR data logger interacts with Ruskin and how to configure the settings and features within Ruskin.

Configuring a simulated logger

1. From the **Instruments** menu, click **Simulate instrument**.
   The **Configure Simulated Instrument** dialog box appears.

2. Click on the tab that correlates to your logger's family type.
   For example, if simulating an RBR *virtuoso*, you would select the **Logger2** tab.

3. Select from the information provided within the logger's tab.

4. Click **OK**.
   The simulated logger appears under **Instruments** in the **Navigator** view.

5. Go to the **Navigator** view and click the new simulated logger to see the general information and configuration settings in the **Properties** view.

You can now work with this logger the same way as you work with a real RBR logger, including configuring and calibrating it and logging and downloading data. For more information, see Deploy an instrument (page 17).

Multiple loggers, both real and simulated, can be listed in your **Navigator** view.

⊘ If you want to remove a simulated logger, in the **Navigator** view, right-click the logger and click **Remove simulated instrument**. You can also use the **Instruments** menu.

7.3 View information about a logger

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

In the **Navigator** view, click the appropriate logger. The **Information** tab in the **Properties** view on the right side of the Ruskin window identifies the logger, its general information such as serial number and firmware version, and the measured channels and the derived channels that are calculated from the measured channels.

7.4 Recover an instrument and download data

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

⊕

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

Steps

- Start Ruskin

- Carefully open the battery end cap of the logger

- Insert the 30pin usb cable into the logger (see Communicating with the logger (page 23)) and connect the the end of the cable to your computer

- The logger appears in the navigator window and select the download tab and select download (see Download (page 41))

- Save the file to a preferred location

- Evaluate your data (see Analysis (page 49))

8 Configure a logger

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

The instructions to configure a |tide or |wave logger are different than the standard loggers, and can be found in Tides and Waves (page 29).

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

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

All tabs within the **Setup** tab contain the **Enable**, **Revert settings** and **Use last setup** buttons. When you click **Enable**, the logger setup parameters are stored to the logger and the schedule is enabled. When you click **Revert settings**, you set the logger configuration back to previous settings.

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

8.1 Overview of the Setup tabs

Tab	Explanation
Schedule	You can configure multiple settings that include when the logger starts and stops logging, what type of sampling regime takes place, and the type of measurements speed. For more information about scheduling a logger, see Schedule a logger (page 23) .

Tab	Explanation
Gating condition	You can enable twist activation for your logger, or configure threshold settings. You can also make sure that no gating condition is set. Optionally Logger2 data loggers (factory configured) can have the feature of twist activation, which allows you to turn the logger on or off using the battery end cap. For information about enabling twist action, see Twist Activation (page 36). For information about configuring threshold settings, see Threshold gating (page 34).
Basic configuration	You can configure settings for obtaining real time data from your logger (provided it is equipped with an external data port). You can select one of the four live data output formats. For iOS devices you can enable iOS compatible data storage which improves the download speed over WiFi enabled loggers. For more information about real time data configuration, see Fetching and streaming (page 37). For more information about configuring the iOS compatible data storage, see iOS settings (page 38).
Advanced configuration	You can configure settings for autoranging, fixed gain, BPR parameters, and voltage channel parameters for your logger. For information about autoranging and fixed gain, see Autoranging and fixed gain (page 38). For information about BPR parameters, see Setting BPR parameters (page 39). For information about voltage channel parameters, see Voltage channel parameters (page 40).
Parameters (only appears on specific loggers)	This tab is only available for specific loggers and appears only when those loggers are connected to Ruskin. If your logger supports this feature, you can configure derived channels. These changes take effect immediately. Fore more information, see Derived channel parameters (page 40).

8.2 Communicating with the logger

To establish communication between the logger and a computer, remove the battery end cap and locate the 30 pin connector, just below the battery cover.

The supplied interface cable is plugged into this connector. The 30 pin connector is typically labeled on one side. To have the correct 30 pin connector orientation the labeled side should face (up) toward the battery door.

> ⚠ The logger connector on the interface cable can only be inserted in one orientation. Please do not force the connector - if it will not plug in easily, flip the connector over and reinsert.

8.3 Schedule a logger

You can schedule your loggers to start and stop logging readings when you want, and at the sampling rate you specify for the sampling period. Ruskin indicates any unattainable conditions in the defined schedule at the bottom of the **Schedule** tab, and the **Enable** button is grayed out.

Before you enable your logger, you should verify the available settings found in the following tabs: **Gating condition**, **Averaging**, **Tide sampling**, **Wave sampling**, **Advanced configuration** and **Parameters**.

> ⚠ The display of the above tabs are based on the logger capability. Not all tabs are visible.

Steps

1. While the logger you want is highlighted in the **Navigator** view, click the **Setup** tab > **Schedule** tab in the **Properties** view.

2. Click **Sync to PC Clock**. This will set the logger time to your computer time.

3. In **Start Logging**, specify the date and time you want to start running the schedule, or select the **Start immediately** check box.

> ⊘ If you select and then clear the **Start immediately** check box, you can then manually modify the current date and time instead of the original values.

> ⚠ If the gating condition is other than **None**, then the **Start logging** and **End logging** cannot be set.

4. In **End logging**, specify the date and time that you want logging to stop.

> ⊘ Use the the **Battery** icon to optimize the **End logging** date and time end based on the battery capacity, the **Start logging** (date and time) and the **Measurement speed**.
>
> Use the the **Memory** chip icon to optimize the **End logging** date and time end based on the memory capacity, the **Start logging** (date and time) and the **Measurement speed**.

5. In **Sampling regime** select the type of sampling required, **Continuous**, **Average**, **Tide** or **Wave** (as applicable).

> ⊘ Average (page 26), Tide and Wave (page 29) sampling are set from their respective tabs.

6. In **Measurement speed** select either a period (one second or longer) or a rate (rate is for |fast loggers only).

> ⊘

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⊘ Use the the **Battery** icon to optimize the **Measurement speed** based on the **Start logging** (date and time), the **End logging** (date and time) and the battery capacity.

Use the the **Memory** based on the **Start logging** (date and time), the **End logging** (date and time) and the memory capacity.

7. Click **Enable** configure the logger to sample.

⊘ If the battery bar indicator is green but shows that you are close to capacity and you know that your logger will be operating under very cold conditions, you may want to lower the demands on the battery. You can either shorten your logging duration or lengthen your sampling period.

⚠ An error message appears at the bottom of the **Schedule** tab if the sampling period is too fast for your logger. This typically means that one of the sensors has a long latency.

⚠ If the **Enable** button is grayed out, an error message appears.

If you enable the logger, and it is not your first schedule, you will see the warning *The contents of memory will be erased!* Before proceeding, you should download the data from the logger (see Download (page 41)). If you are sure that the information is stored, then click **Erase and enable logging**.

8.3.1 Profiling

All profiling loggers (known as |fast) have the ability to sample faster than one second, and to threshold (page 34).

Selecting **Rate** for a **Measurement speed** enables sampling speeds of 1 Hz or faster.
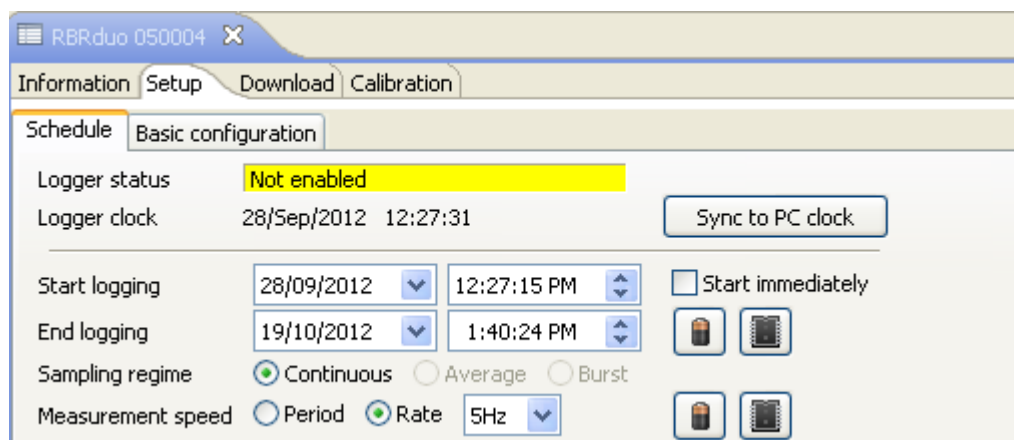
8.4 Stop logging

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

- The end logging time is reached.
- The power is removed.
- The logger memory is filled.
- The logger battery is depleted.

In the **Properties** view, click **Setup** tab > **Schedule** tab and then click **Stop**.

⚠ Whether or not you make any changes to the schedule or the configuration, before running the schedule again, a warning appears that the contents of memory will be erased. If you want to save the data stored so far on the logger, you must download the data to a file before proceeding. You can do this from **Setup** tab > **Download** tab. For more information about downloading a file, see Download (page 41).
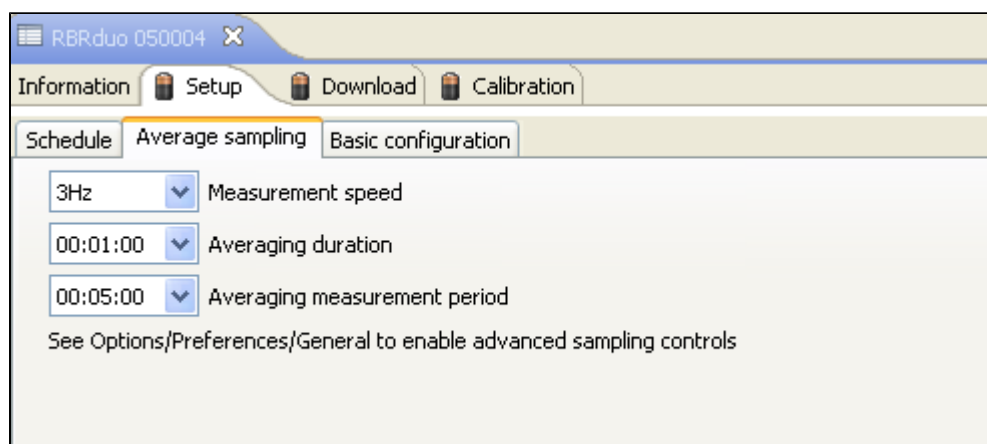
8.5 Averaging

To set up a logger to average at sub-second rates (Hz) or with periods one second or greater, click **Setup** tab > **Schedule** tab, and then **Average** in the **Sampling regime** row. The message *Set from the Average sampling tab* will appear. When the **Average sampling** tab appears, go there to configure average sampling settings.
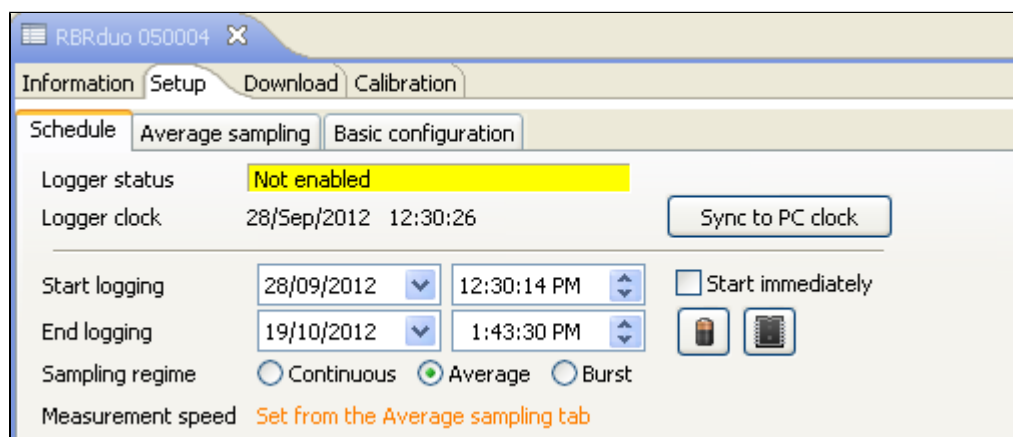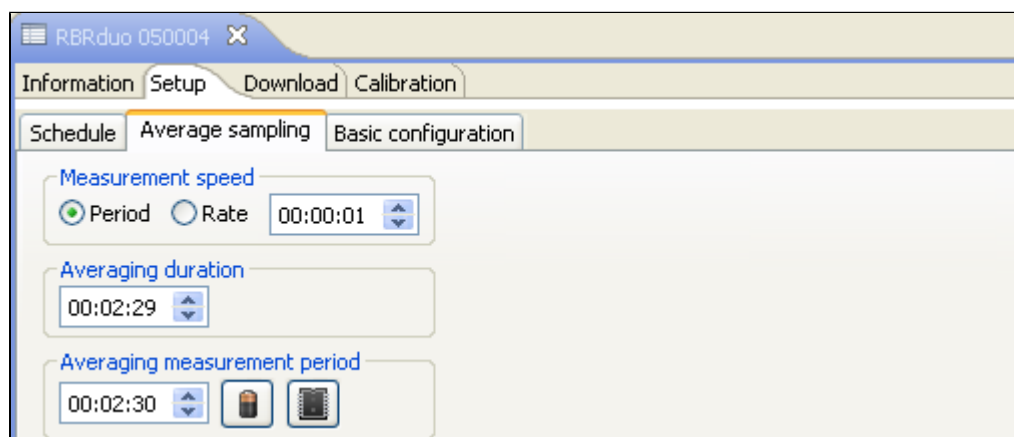
There are two versions of the **Average sampling** tab that can be used, either simple or advanced. This option can be set in Preferences (page 76).

Simple form:

In the simple form only pre-defined selections can be made. A more complex setup can be set by using the advanced version as follows.

Advanced mode:

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To set how fast the individual samples are taken for the averaging calculation, select **Period** to enter a sampling period equal to one second or greater; or the **Rate** button for periods less than one second. If a sub-second sampling speed is to be used, select the required rate from the **Rate** drop-down list. To set the length of time of the averaging, enter the duration in **Averaging duration** spin box.

To set how often the average reading is calculated, enter the value in the **Averaging measurement period** spin box.
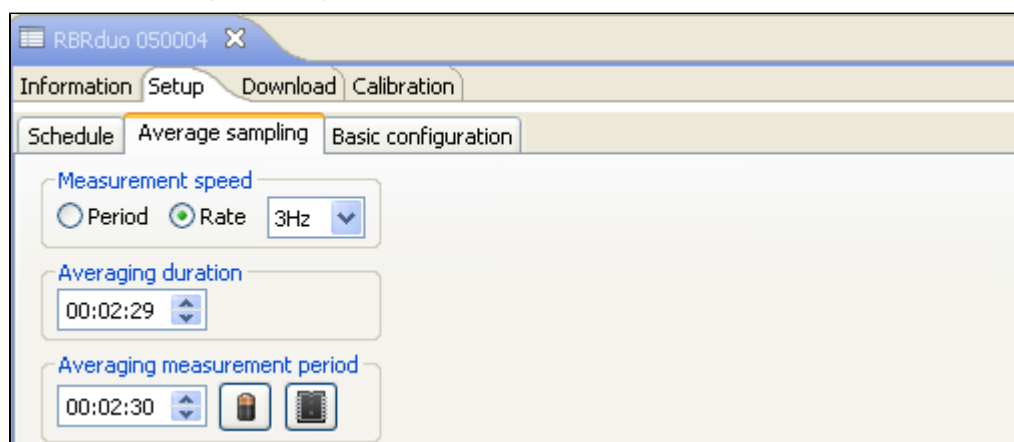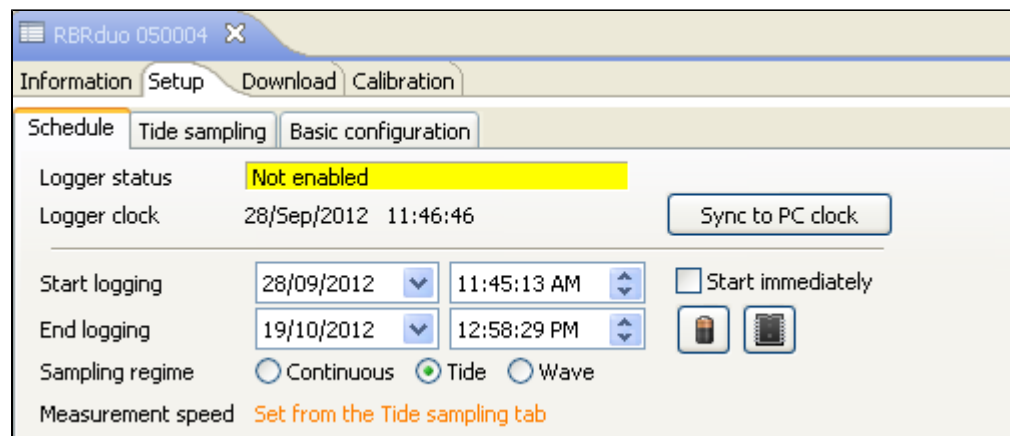

In the first example above, 2 minutes and 29 seconds of one second readings are taken and averaged, while in the second example, 2 minutes and 29 seconds of 3 Hz (3 times a second) readings are taken and averaged. In both cases, the cycle repeats every two and a half minutes and the average values are reported every 2.5 minutes.

8.6 Tides and Waves

8.6.1 Tides

Tide loggers use averaging to remove wave data from the pressure measurements, and the method for setting up the logger is the same as described for Averaging (page 26).
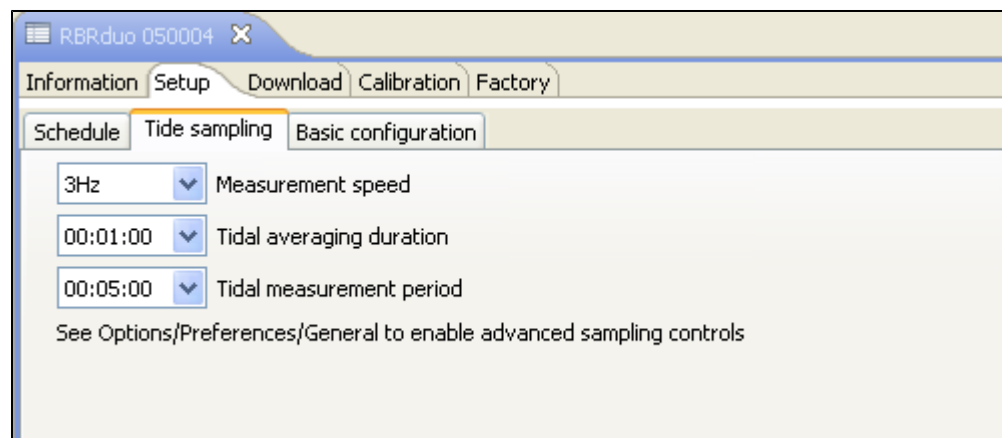
From the **Setup** tab > **Schedule** tab, select the **Tide** radio button, and when the **Tide sampling** appears, select it to configure these settings.

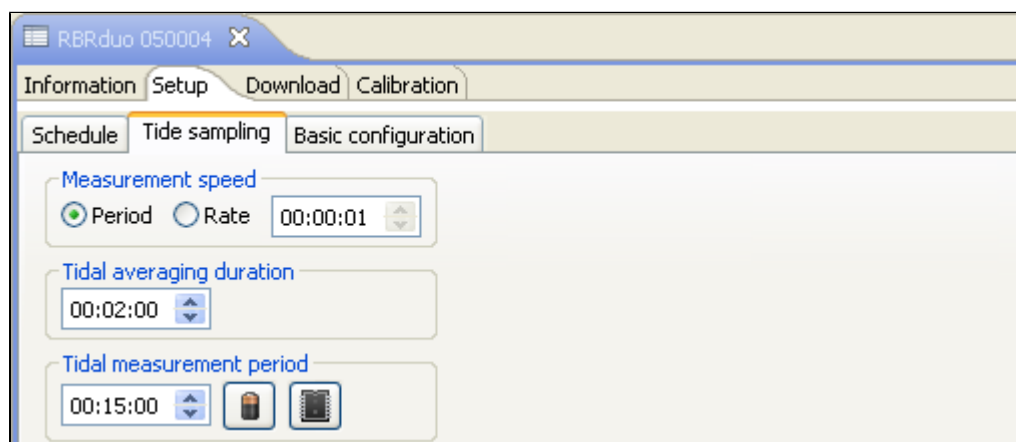

There are two versions of the **Tide sampling** tab that can be used, either simple or advanced. This option can be set in Preferences (page 76).

Simple form:

Advanced form:

8.6.2 Waves

A |wave logger records wave and tide information, and the configuration is different from other loggers.For additional information on planning a wave deployment, please refer to Appendix D - |wave deployment planning (page 95).

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

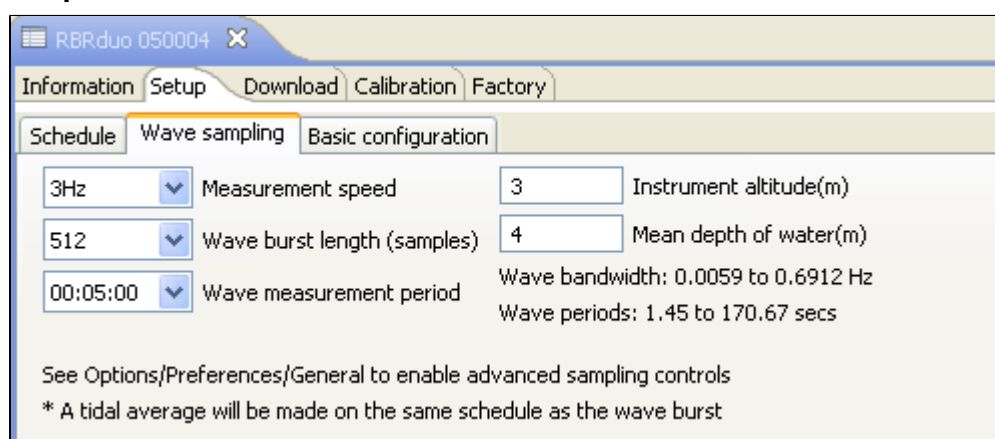> ⊘ You can preserve the data by downloading it to a file before you restart the logger.

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

From the **Schedule** tab, select the **Wave** radio button and when the **Wave sampling** tab appears, select it to configure these settings:
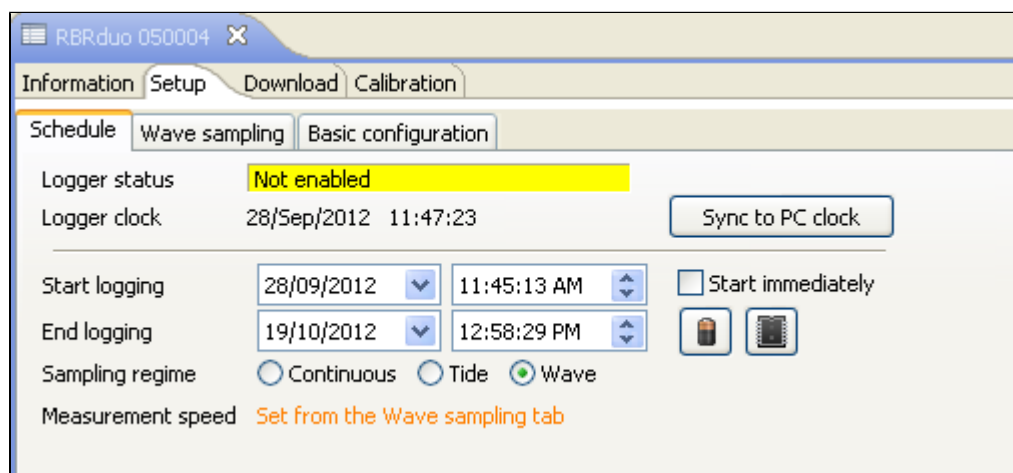
There are two versions of the **Wave sampling** tab that can be used, either simple or advanced. This option can be set in Preferences (page 76).

Simple form:

- In **Measurement speed**, specify how fast you want pressure readings to be taken. In the simple form, you can select from the options in the drop-down list. In the advanced form, you can either set the period in multiples of seconds, or you can set a sub-second rate, depending on the radio button selected.

- In **Wave burst length (samples)**, select the number of samples that you want to take during a wave burst. The range is between 512 and 32768 samples.

- In **Wave measurement period**, enter the interval between the bursts.

- In **Instrument altitude (m)**, enter the number of meters above the sea or river bed where the logger will be secured in place. This value is used when making wave parameter calculations.

- In **Mean depth of water (m)**, enter the total expected depth of the water where the logger will be deployed. This value is used to calculate the range of wave frequencies that can be measured, and those values will be displayed, in both bandwidth and period. Ruskin will calculate the actual depth from the measured pressure data post-deployment.

To configure advanced settings for wave sampling, go to **Options** menu > **Preferences**, and select **General**. On the **General** page, select the **Enable advanced sampling controls** check box under **Sampling control** – make sure to click **OK**.

Advanced form - sampling at one second or slower:

Advanced form - sampling between 1 and 6 Hz

-
  - In **Measurement speed**, specify how fast you want pressure readings to be taken. In the simple form, you can select from the options in the drop-down list. In the advanced form, you can either set the period in multiples of seconds, or you can set a sub-second rate, depending on the radio button selected.

- In **Wave burst length (samples)**, select the number of samples that you want to take during a wave burst. The range is between 512 and 32768 samples.

- In **Wave measurement period**, enter the interval between the bursts.

- In **Instrument altitude (m)**, enter the number of meters above the sea or river bed where the logger will be secured in place. This value is used when making wave parameter calculations.

- In **Mean depth of water (m)**, enter the total expected depth of the water where the logger will be deployed. This value is used to calculate the range of wave frequencies that can be measured, and those values will be displayed, in both bandwidth and period. Ruskin will calculate the actual depth from the measured pressure data post-deployment.

- Selecting the battery icon will set the wave measurement period, based on battery capacity and the start and end logging times.

- Selecting the memory icon will set the wave measurement period, based on memory capacity and the start and end logging times.

8.7 Gating Condition

Gating is a method to enable the logger based on a condition that may not be time based. The logger can be made to start and stop sampling based either on a condition that a sensor measures (threshold gating) or by a mechanical activation (twist activation). For more information about threshold gating, see Threshold gating (page 34). For more information about how the twist activation works, see Twist Activation (page 36).
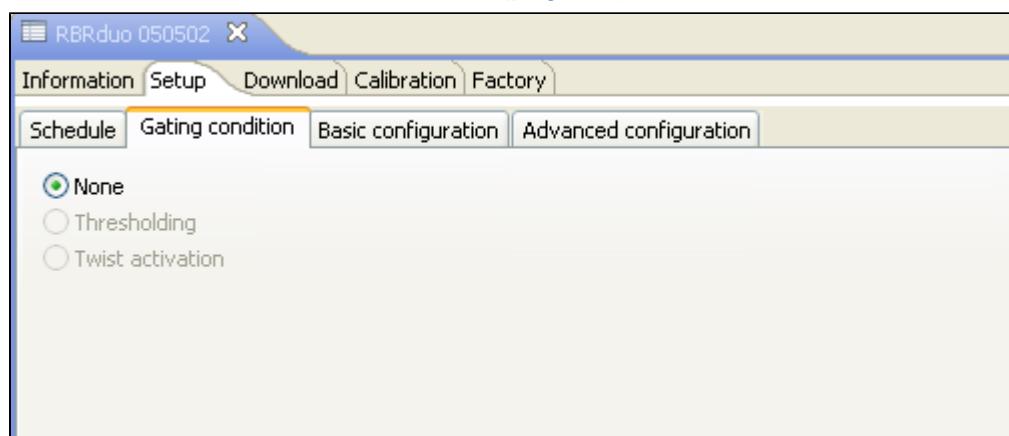
If the gating option is available on your logger select the appropriate radio button. To enable the logger based on a measurement, select **Thresholding**. To enable the logger by twist activation select **Twist activation**. If the logger is to be enabled based on a specific start time, which is set in the Schedule tab, select **None**.

8.7.1 Threshold gating

Thresholding is the term used to enable a logger to log when a specific channel measurement is above or below a specified value. When thresholding is activated, which displays the **Thresholding parameters** settings, the logger can be in one of two states: checking gated condition or logging in progress. The checking gated condition (configured in **Condition**) is the state wherein the logger is sleeping and checks the threshold condition at the specified interval selected in the **Check every** drop-down list.

You can enable thresholding when configuring a logger from **Properties** view > **Setup** tab > **Advanced configuration** tab. By thresholding, you avoid storing data when conditions are not of interest. This feature saves battery power and consumes less memory. It is typically used when profiling.

Sensors may be selected for the threshold check from the **Sensor** drop-down list in **Thresholding parameters**. In **Condition**, select either **Above** or **Below** and enter the value next to it. From the **Check every** drop-down list, select how often the condition is to be tested. The options are: 1 second, 15 seconds, 1 minute, 3 minutes, 5 minutes, 15 minutes, or 1 hour.

In the example above, the Turbidity channel is checked every 15 seconds and if the reading is above 150 NTU, the logger is placed into the logging in progress state. If the condition is not met (false) the logger remains in check gating condition. While in the check gating condition state, the logger sleeps for the interval selected and then measures the specified channel and performs a check. While the logger is logging, the threshold channel is evaluated each time a sample is taken. If the threshold channel does not meet the set condition, the logger will continue to sample for an additional ten seconds. The logger always begins in the check gating condition state and if you have a long duration for the check interval, the logger may not start logging right away even if the condition is met. For example, if the check time is one hour, it will take up to one hour before the logger checks the channel condition and enables.

The following is an example of a logger which is programmed to check every 15 seconds whether the temperature sensor registers less than 20°C and, if so, to take readings from all the sensors every two seconds.

Here is what happens:

| Time lapsed (seconds)	Temperature	Logger action
15	20.9°C	Reads temperature and then waits 15 seconds (checking gated condition state)
30	19.8°C	Reads temperature and then begins storing all sensor values every 2 seconds (logging in progress state)
42	20.1°C	Reads temperature and then samples for an additional 10s (logging in progress state)
52	20.5°C	Reads temperature and then waits 15 seconds (checking gated condition state)

When the check rate is faster than the measurement period, for example check every one seconds and sample every 15 seconds, the, the logger will check every one second and if at any time during the check the condition is true, the logger will enable and begin logging at the next measurement

interval. If at the next interval the condition is false then the logger will continue sampling for ten seconds and then enter into the checking gated condition state.

By default, the threshold start event THRESH START is displayed in the plot view – this is the time when the logger is set to the state logging in progress. To see the diagnostic stamp that indicates when the logger is placed in to the checking gated status state, THRESH PAUSE, in the **Plot** view toolbar click the **Events** icon and then select **Display diagnostics**.

8.7.2 Twist Activation

If this option is available and selected, the logger starts or stops sampling based on the action of closing or opening the battery end cap.
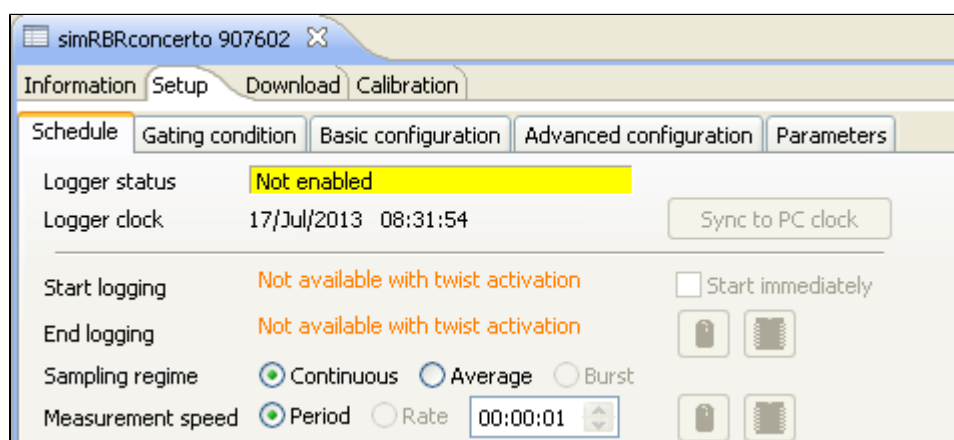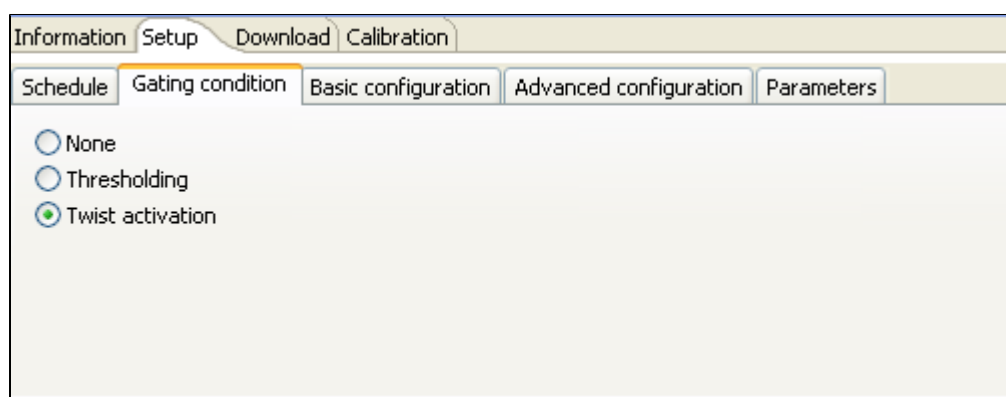
When this option is selected, the logger starts to sample based on the Twist ON/OFF position rather than a schedule. To start sampling, close the battery end cap to the ON position. To pause the sampling, turn the battery end cap to the OFF position. The logger will vibrate to indicate if it is sampling or paused. A long vibration indicates that the logger is sampling and three short vibrations indicate that the logger is paused.

8.8 Fetching and streaming

The logger is capable of fetching measurements from the logger when connected over USB from the internal port, or, if an external connector is available, over USB or RS-232/485.
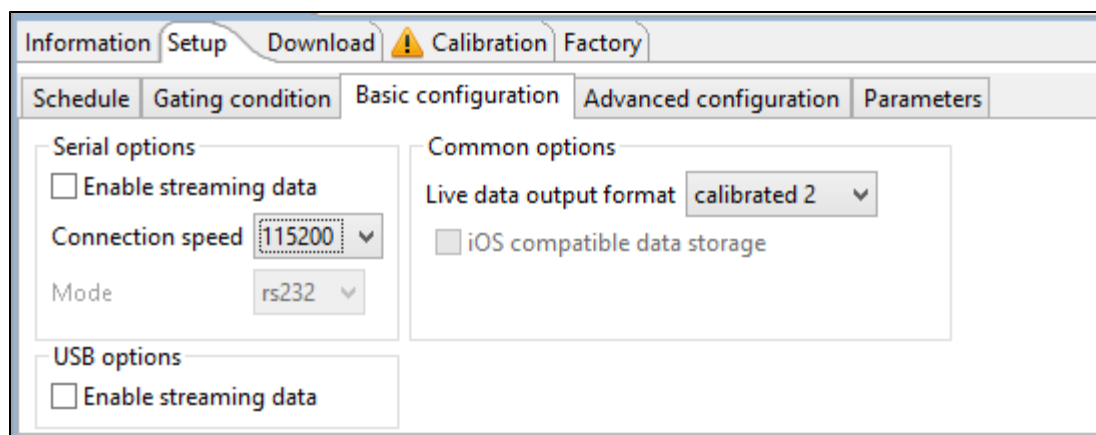
If you are still connected to the logger via USB, you can click **Start live plot** in the **Plot** view toolbar. A graphical display appears of the samples fetched from the logger at the default speed for the logger type rather than of the samples that are scheduled and being stored on the logger.

> ⚠ If you have an underwater RS-232 interface, configure **Serial Options** settings and if you have an underwater USB interface, configure **USB options** setting. Normally, only one option is selected.

Steps

1. Click **Setup** tab > **Basic configuration** tab.

2. If you have an RS-232 interface, In **Serial options** select **Enable streaming data** check box, if you have an underwater USB interface, select USB options Enable streaming data check box.

3. For an RS-232 connection, select a connection speed from the **Connection speed** drop-down list.

4. In **Common options**, select the data format from the **Live data output format** drop-down list.

After the logger setup is complete and the schedule is enabled, the logger will automatically output as sample reading at the set sampling rate.

8.9 iOS settings

If you have an iOS device, you can use it to configure, download, view data from a WiFi-capable Logger2 data logger. The Ruskin app is available on the Apple App store.

If you intend to use the Ruskin app you are advised to enable the iOS compatible data storage on the logger. Do not enable it for non-WiFi capable loggers. For additional information about the WiFi module, see Appendix E - WiFi module (page 98) .

With iOS compatible data storage selected, the logger data is parsed differently so that the download is faster over WiFi and a feature called cast detection is activated. The cast detection feature separates each profile into groups of down and up casts to make viewing of the profiles easier on the iOS device.

To enable compatible storage for iOS devices in Ruskin, connect the data logger to a computer running Ruskin (not an iOS device) and go to **Setup** tab > **Basic configuration** tab - in **Common Options**, select the **iOS compatible data storage** check box.

8.10 Autoranging and fixed gain

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

Steps

1. Click **Setup** tab > **Advanced configuration** tab.
2. Any sensors present capable of autoranging are shown in **Sensor**. Select the sensor you want to configure from the list provided.
3. Select the required gain value from the available selections in **Range**.
4. Repeat the above steps for the next available autoranging sensor.

Fixed gain:

Autoranging (Automatic gain setting):

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

8.11 Setting BPR parameters

In the **Advanced configuration** tab, you can set the settling time and integration time of each BPR sensor on your BPR data logger by selecting the sensor, entering the settling time, and entering the integration time. Both the settling time and integration time is in milliseconds.

8.12 Voltage channel parameters

In the **Advanced configuration** tab, you can set the sensor parameters for the sensor attached to the voltage channel. Select the appropriate voltage channel and enter the sensor latency and the sampling current. These parameters are used in the deployment time calculation (battery use) and for determining minimal sampling intervals.

> ⚠ You must enter these parameters for sensors not supplied by RBR.

8.13 Derived channel parameters

When configuring your logger, you can change the default values of parameters that are used to calculate derived channels. For example, if you are measuring in freshwater, you can set the water density to 1.0 rather than 1.026. Theses values are stored in the logger itself and are used in place of the values in **Options** menu > **Preferences** > **Derived channels**.

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

8.14 Deployment

Once you have ensured that the batteries are fresh, inspected the O-rings and programmed the logger (see Configure a logger (page 20)), the instrument is ready to be deployed.

There are three precautions you should take to avoid damaging the logger and maximise the deployment autonomy:

1. Pay attention to the maximum pressure rating. All loggers with pressure sensors are individually rated to a maximum depth/pressure. This is indicated by the label which is placed on the logger's sensor end cap. Loggers which do not have a pressure sensor do not have this label, but are limited by the maximum depth/pressure rating of either the logger housing itself or of the sensors.

2. Avoid physical stress to the logger. Any type of clamp or bracket which concentrates the stress to the logger body is not recommended for use in logger mooring, mounting, and/or other deployment. Stress due to improper mounting may cause the logger to leak, resulting in the loss of valuable data or permanent damage to the electronics. RBR can provide proper mooring and mounting clamps suited to your specific application.

3. Use desiccant. If the logger is closed up in a warmer environment than the deployment environment, internal condensation can result. Since condensation may cause the circuitry to malfunction, the installation of desiccant prior to deployment is strongly advised.

9 Download

9.1 Download data from the logger

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

> ⚠ When downloading from the **Download** tab, the battery is being used as indicated by the battery icon on the tab and the animated battery icon in the **Navigator** view. You can click the **Information** tab to save power.

Steps

1. Click the **Download** tab and click **Download**.
   The **Save as RSK** dialog box appears.

2. Specify a location and a name for the data file.
   By default, the RSK file name uses the Ruskin file naming convention. For more information about the naming convention, see File naming convention below.

3. The name of the new dataset appears and is highlighted automatically in **Navigator** view > **Datasets**.
   The **Properties** view changes to the new dataset and contains the following tabs: **Analysis**, **Overview**, **Channels**, and **File Info**. All the data that was stored on the logger at the time of the download is automatically plotted in the **Plot** view.

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

9.2 File naming convention

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

- The first six digits represent the logger serial number.

- The next eight digits represent the current year, month, and day.

- The next four digits represent the current time to the minute.

- The file extension indicates the file format and should not be changed. If you change it, the file extension that you specify becomes part of the name, and the required extension is appended.

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

10 Calibration tab

The Calibration tab displays the calibration coefficients for each channel (sensor) and the date and time of the last calibration.

Time	Parameter	C0	C1	C2	C3
2014 Feb 12 12:30:28	Conductivity	46.600000E–03	151.79269E+00		
2014 Feb 12 12:30:28	Temperature	3.3664490E–03	–255.91400E–...	2.4094050E–06	–66.615476E–...
2014 Feb 12 12:33:13	Pressure	–958.63002E...	1.8458420E+03	179.90101E+00	13.709000E+00

Information | Setup | Download | Calibration

Store calibration   Revert calibration   ☑ Check calibration expiry   Request calibration quote

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

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

11 Update firmware

By using Ruskin, it is possible to update the firmware on your logger without having to return the instrument to the factory. Ruskin automatically checks to see if a newer version of firmware is available and displays a message in the Information tab

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

45

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

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

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

Click the **Instruments** menu > **Update logger firmware**.
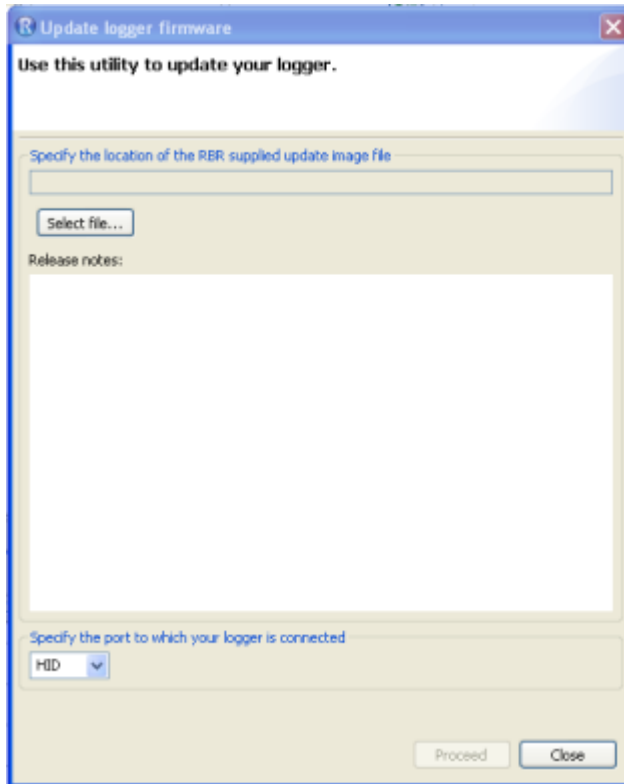
⊕ Do not use the HID port to upgrade your logger firmware. Use the COM port instead.

Steps

1. In the **Instruments** menu, click **Update logger firmware.**
   The Update logger firmware dialog box will appear.

2. Click **Select file** and browse to the location of the firmware update file provided by RBR.
   The file will have the extension .rbrfw.

3. Use the drop down list to select the COM port of the logger.
   If you have multiple instruments connected and do not know the correct COM port to use, in the **Navigator** view click **L Instruments**. The **Connections** view appears and you can see the port being used in the Port column of the table. To close the **Connections** view, select the X.

4. Click **Proceed** to start the firmware upgrade.
   A progress bar shows the status of the upgrade. Once the firmware upgrade is complete, the message *Update completed successfully* appears at the top of the dialog box.

5. If the upgrade doesn't complete successfully, click **Proceed** again to retry until successful.

> ⚠ Occasionally the upgrade will succeed but the logger disappears from the **Navigator** view. If this occurs, disconnect your logger from the USB port and then reconnect to re-establish communication.

6. Click **Close**.

12 Datasets

12.1 Open a stored dataset

You can open any stored dataset to explore its contents.

Steps

1. Click **File** menu > **Open dataset**.

2. Double-click the .rsk file that contains the data that you want to view.

3. The name of the dataset appears and is highlighted automatically in the **Navigator** view. The **Properties** view changes to the dataset. The data in the file is automatically plotted in the **Plot** view.

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

> ⊘ **Ruskin performs an integrity check that is intended to make sure that older data files are compatible with newer versions of Ruskin software. This information is displayed in** File info (page 55)**. If the file requires updating the message indicates the issue with the file, and how long an update will take.**
>
> **RBR strongly recommends that all files that have issues be updated.**

12.2 Analysis tab

The **Analysis** tab contains information and settings for configuring the calibration information and to display statistical information. You must already have an open dataset to view and configure these settings. For information about how to open a dataset, see Download (page 41).

12.2.1 Cursor tab

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

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

The sample number and time of the sample are displayed.

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

Channel	Value	Avg	Std	Unit
Conductivity	32.0172122	32.1438381	0.0539864	mS/...
Temperature	8.1858832	8.2472967	0.0194351	°C
Pressure	53.1097387	60.0175605	3.6133551	dbar
Chlorophyll a	215.3816353	215.3815260	0.0006991	µg/l
Voltage	2.1536650	2.1536652	0.0000054	V
Sea pressure	42.9772387	49.8850605	3.6133551	dbar
Depth	42.6267747	49.4782657	3.5838895	m
Salinity	30.3501533	30.4268371	0.0406331	PSU
Specific Conductivity	47163.8723410	47268.7012995	57.4388006	µS/cm
Density Anomaly	23.7956591	23.8786469	0.0461375	n/a
Speed of sound	1478.1301930	1478.5716294	0.1741334	m/s

12.2.2 Calibration tab

When a file is selected and plotted for re-calibration the calibration tab can be selected to assist with calculation calibration coefficients, see User calibration (page 63) .

12.3 Overview

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

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

12.4 Channels

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

The **Information** tab displays the measured parameter, the sensor manufacturer and the range setting. The type of derived channels and how it is calculated is displayed in a separate table.

The **Calibration** tab displays the calibration coefficients for each sensor.

The **Parameters** tab displays the values of the parameters, default values if other required parameters are required and the method used to calculate the derived channels.

12.4.1 Information tab

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

12.4.2 Calibration Tab

The Calibration Tab displays the calibration coefficients for each channel (sensor) and the date and time of the last calibration.

You can edit any of the coefficients and use "Store and recompute data" to recalculate the dataset. Use "Revert calibration" to recover to the original coefficients is you have not already selected "Store and recompute data". To recover the original calibration coefficients edit one of the values

and click in another cell the "Use deployment calibrations" check box becomes active and unchecked, check the checkbox to restore the coefficients used by the logger and then press "Store and recompute data" to save the coefficients.

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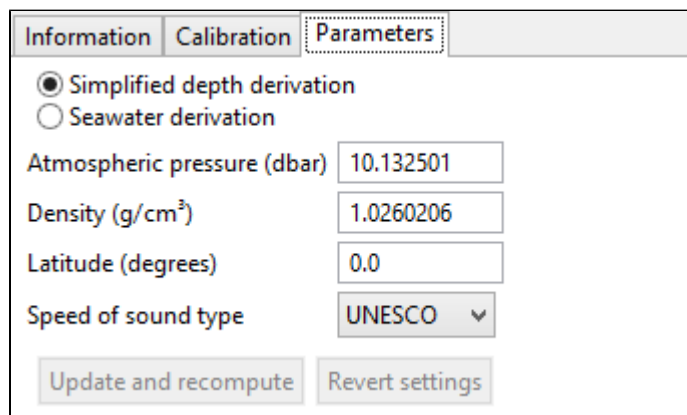
When a file is selected and plotted, the **Parameters** tab can be selected to display the parameters used to calculate any applicable derived channels.

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

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

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

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

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

For |wave loggers you can change the wave calculation by adjusting how the depth is calculated and by adjusting the instrument altitude.

12.5 File info tab

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

Analysis	Overview	Channels	File info

File name: C:\RBRRuskin\065578_20140430_2116.rsk

Version: 1.8.0

Structure: full

Size: 665.000 KB

A new version of the RSK file format is available.
The anticipated update duration is 00:15
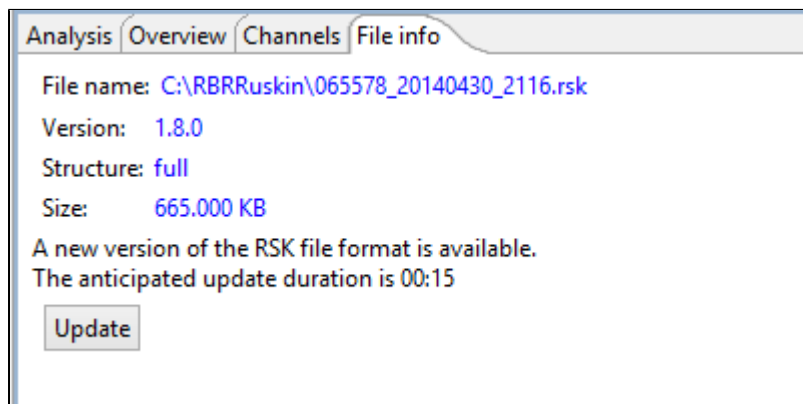
Update

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

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

12.6 Plot view

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

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

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

⚠

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

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

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

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

The graphical display for each dataset appears on its own tab in the **Plot** view. The dataset file name appears at the top of the tab. The icons differentiate at a glance the live data from the datasets.

If a graphical display does not appear, click the **Line style** button and ensure that either **Draw lines** or **Draw markers** is selected.

12.6.1 Thumbnail view

Large data sets can take a long time to display on older systems, and to facilitate data viewing, large files may be down sampled and displayed in a thumbnail view. This view is presented below the main **Plot** view and contains a sliding window. The data within the window is displayed in the **Plot** view. This window may be re-positioned by using the next and previous keyboard arrow keys, or dragging it using the mouse, or double-clicking to position the window in the appropriate location in the thumbnail view. The sliding window reports the date and time at the center of the window when selected and moving. The **Plot** view for large files is limited to displaying about 20,000 samples.
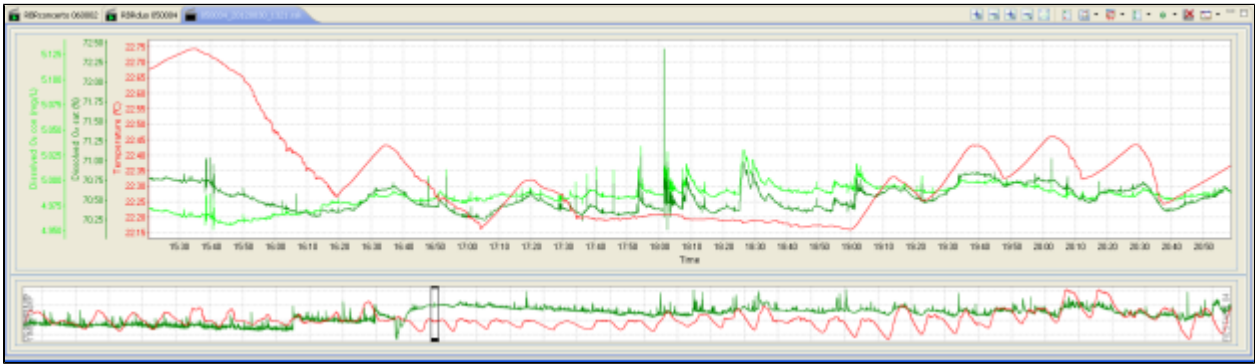
12.6.2 Live data

You can use the **Plot** view to view a graphical display of samples being fetched at the default speed for your logger type.

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

> ⊘ If a graphical display does not appear, click the **Start live plot** or **Resume live plot** button. If the graphical display still does not appear, click the **Line style** button and ensure that either **Draw lines** or **Draw markers** is selected.

12.6.3 Plot Tools

Zoom tools for datasets and live data

Purpose	Button	How to use
Compress or expand data horizontally	Horizontal zoom in Horizontal zoom out	Click the appropriate button to zoom in or out. The expansion or contraction is centered on the vertical black line in the plot. If no line exists, the focus is in the center.

Purpose	Button	How to use
Compress or expand data vertically	Vertical zoom in Vertical zoom out	Click the appropriate button to zoom in or out. The expansion or contraction is centered on the vertical black line in the plot. If no line exists, the focus is in the center.
Return to the original view	Reset zoom	Click the button to return to the original view of the graphical display.

Other tools for datasets and live data

Purpose	Button	How to use
Show or hide a legend in the plot	Show legend /Hide legend	Click this button to toggle between showing and hiding a legend at the bottom of the plot.
	Export plot	Click the button and then specify a file type (**PDF** or **PNG**), location, and name for the file that will contain an image of the graphical display currently in the **Plot** view. If you want the legend to be included, first click the show legend button.
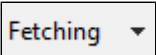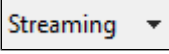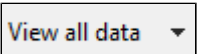
Purpose	Button	How to use
Save an image of the graphical display to a file		
Show lines or markers for each channel	Line style	Click the button and then click **Draw lines**, **Draw markers**, or both. If you click neither, no graphical display appears in the **Plot** view.
Show lines or markers for each channel	Show/hide channels	Click the button and select which channels to show in the **Plot** view. You can choose to show or hide specific channels used by your logger, or all the channels of a particular type, such as measured, derived, depth, or temperature. Tip: If you want to view the uncalibrated data for measured channels in the form of a voltage ratio instead of as engineering units, select **Toggle raw channels**.
Show events, diagnostic events and errors in the graphical display	Display any dataset events or errors	Click the button and select **Display dataset events**, **Display diagnostic events** or **Display dataset errors**. A green icon indicates no errors, and a red icon indicates error events exist and a yellow icon indicates that diagnostic events exist. Refer to Appendix C - Event and Error Stamps (page 94) for a description of the events and errors. Dataset events appear on the x-axis as a vertical gray line with a stamp to indicate the type of event, such as STP for a stop event in a dataset.
Show or hide axes	Show/hide axes	Click the button to toggle between showing and hiding the vertical axes to the left of the plot.

Purpose	Button	How to use
Show or hide data panel (streaming and fetching - live data)		Click to hide the tab called **Main** that is referred to as the **Data panel**. This tab shows how many samples the logger has collected, the time and date, and a table that helps to easily view the information collected. If you select a row in the table, you can copy that row using the **Copy row** button. The row is saved to the clipboard where you can then paste the row into a text editor or word processing program. If you want to copy just one cell, click the cell you want to copy, and click the **Copy cell** button. Note: The **Copy row** button changes to **Copy cell** when you select a cell in the table.
Minimize the Plot view		Click the button to place the **Plot** view as an unopened view in the margin of the Ruskin window. Tip: To restore the **Plot** view to its former size, click the restore button in the margin.
Maximize the Plot view		Click the button to expand the **Plot** view to the full size of the Ruskin window. Tip: To restore the **Plot** view to its former size, click the **Restore** button in any margin that contains an unopened view.

Tools only for datasets

Purpose	Button	How to use
Select a channel to place on the y-axis	Set domain axis	Click the button to reorganize the graphical display so that the selected channel from the drop down menu becomes the vertical, or y-axis, and all other channels are plotted along the horizontal, or x-axis. Tip: Click the maximize button to more easily view the graphical display.

Tools for live data

Purpose	Button	How to use
Toggle between fetching samples at the default speed and viewing streamed data	Live plot mode Fetching ▼ Streaming ▼	The logger supports either streaming or fetching data. Fetching is the action of asking the logger to take a reading and report it. Ruskin displays the fetched data every 1-2 seconds. Fetching is disabled if the logger is enabled. In streaming mode, Ruskin receives streamed data from the logger at the sampling rate set during the logger configuration.
Start, stop, or restart the flow of data in the Plot view	Resume live plot Suspend live plot	Click the button to start, stop, or restart the flow of data in the **Plot** view. If you click the **Suspend live plot** button, the graphical display is frozen. If you click the **Resume live plot** button, the flow of current data resumes. In the **Plot** view, data is not recorded during the time that the live plot is suspended. However, data continues to be stored on the logger as scheduled.
View chart display by time or all data	View all data View all data ▼	Click the button to display a drop down list of time span options to display the data by time period. For example, display 2 minutes of data. You can also choose to display all of the data collected.
Delete the data in the Plot view	Clear plot	Click the button if you want to delete all the data in the **Plot** view for all channels. Note: Any data stored on the logger is preserved.
Save the data in the live plot	Save live plot	Click the button to save the data in the plot.

12.6.4 Keyboard Shortcuts

To navigate in the plot a number of keyboard shortcuts are available.

- Move to the next sample: Arrow Right (Next arrow)

- Move to the previous sample: Arrow Left (Previous arrow)

- Zoom a region: Press and hold shift key and then click the left mouse button and drag the window that appears.

- Pan: Press and hold the Ctrl key and then and then click the left mouse button and drag the mouse left or right or up or down across the plot.

12.7 Exporting datasets

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

The Raw, Engineering and Pressure burst file format depend on the logger type and sensors in use.

The Raw format contains decimal voltage ratios which un-calibrated readings. The Engineering format contains the data in the units of the sensor, these are calibrated sensor readings. The Pressure burst is the file of pressure burst readings and is only applicable to |wave loggers. The Engineering file contains all the data presented in the **Plot** view and in the case of |wave loggers the wave analysis data as well. In a |wave Engineering file there are two parts to this file – the plot view data and the wave analysis.

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

Steps

1. Right-click the dataset whose data you want to export, and hover to **Export as** to open a submenu, or use **File** menu > **Export dataset**.
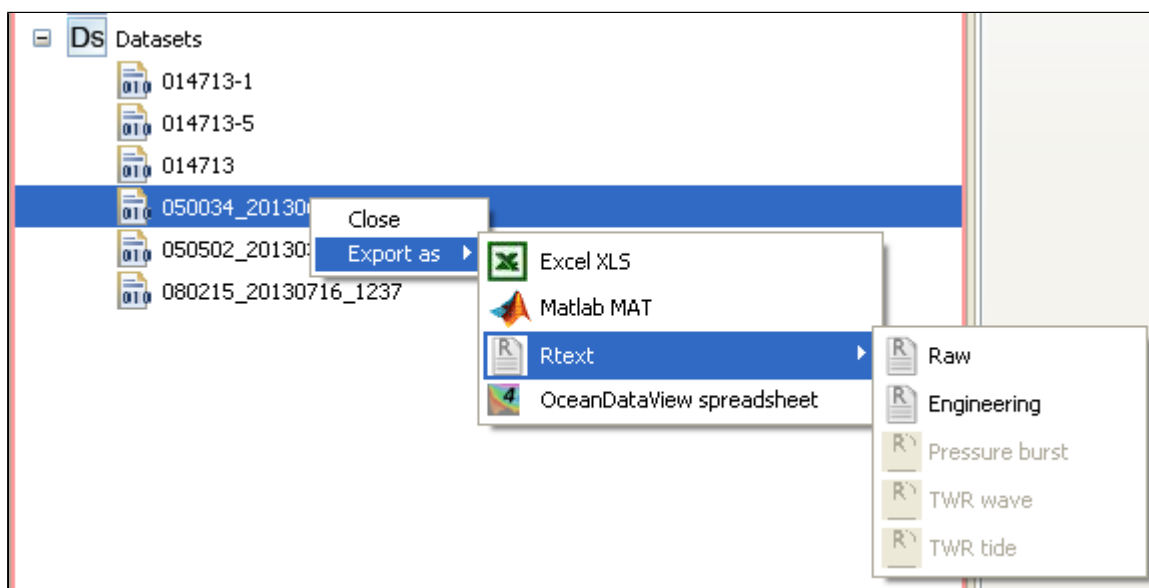
2. Select the appropriate export format (Excel, Matlab, Rtext or OceanDataView). Select either **Raw**, **Engineering** or **Pressure burst** for Rtext file export.
    TWR file formats apply to the older loggers and are not available for Logger2.

> ⊙ Exports to Matlab may fail if the RSK file size exceeds 20MB. To assist you with this export there is a toolkit called RSKtools that is available for download from our website at www.rbr-global.com. The RSK file is a single file database based on SQLite that allows us to have very large files with high-speed access to any part of the dataset.

> ⚠ Large files may not export completely into any of these formats. Large files should be converted to .txt and processed after the fact. The Excel export is limited to 65000 rows

3. Specify a location and a name for the data file.

4. Click **Save**.

13 User calibration

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

13.1 Change calibration coefficients

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

Steps

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

1. In the **Navigator** view, under the **Instruments** list, click the appropriate logger.

2. Click **Analysis** tab > **Calibration** tab to show the current calibration coefficients.

3. To manually change a coefficient, click on the appropriate entry in the table (C1, C2, C3, etc.). The current entry will be highlighted, and the new value can be typed.

4. If a two point calibration has been performed, and calculated coefficients have been copied, right click on either the **Time** or **Parameter** entry for the parameter you wish to modify. Select **Paste to selected row** from the drop-down menu.

5. Click **Store calibration** to write the calibration coefficients to the logger.

6. If you need to revert to previous coefficients, click **Revert calibration**.

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

13.2 N-Point calibration

Sensors such as pH (page 74), Dissolved Oxygen (Oxyguard (page 65) or Rinko (page 67)) or turbidity (page 70) generate a voltage output that is proportional to the value of the parameter being measured. To calibrate these sensors, Ruskin offers an N-point calibration method to generate calibration coefficients.

13.3 Oxyguard DO calibration

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

Equipment

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

Preparing solutions

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

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

Reference Point 2 solution – Dissolved oxygen concentration of zero

1. In a beaker, dissolve approximately 5 tsp of sodium sulfite (Na2SO3) into 500 mL tap water.

2. Mix the solution thoroughly with a magnetic mixer. The solution will be oxygen-free after 15 minutes.

Steps

1. In Ruskin, configure the logger to sample at a fast rate, between 6 Hz and 3 seconds.

2. Use **Sync to PC** to ensure the logger clock is synchronized to the PC clock, and ensure the end time is set so that the logger will keep sampling until calibration is complete.

3. Submerge the dissolved oxygen sensor in the Reference Point 1 solution for at least 15 minutes near the stirrer so that it is in the best mixed area of the bath.

4. Take sample readings for at least 15 minutes for the 100% calibration point, making note of the time that the sample is being measured.

5. Submerge the dissolved oxygen sensor in the Reference Point 2 solution for at least 15 minutes for the 0% calibration point, making note of the time that the sample is being measured.

6. Retrieve the data from the data logger as per the steps in Download (page 41).

7. The calibration data should now be displayed in the **Plot** view. In the **Properties** view, go to **Analysis** tab > **Calibration** tab.

8. Select the dissolved oxygen sensor type from the drop-down list.

9. The **Number of Samples** spinner box is automatically set to **100**.
This value is the number of sample points Ruskin will average the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.

10. Click on a stable point in the **Plot** view corresponding to 100% oxygen. In the table in the first row, under **Real Avg**, enter 100 and press enter.

11. Select the check box in the second row in the table, then click on a stable point in the **Plot** view corresponding to 0% oxygen. In the table in the second row, under **Real Avg**, enter 0 and press enter.

12. Ruskin automatically calculates the calibration coefficients, and these values appear in **Calculated coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.

13. Follow the steps in Change calibration coefficients (page 63) to update the coefficients for this sensor in the data logger.

13.4 Rinko optode calibration

The Rinko optode can be calibrated using Ruskin N-point calibration.

Equipment

1. Two Large mouth beakers

2. Sodium sulphite Na_2SO_3

3. Aquarium air pump

4. Magnetic stirrer

Preparing solutions

Reference Point 1 solution – Oxygen saturated solution at expected temperature and salinity of deployment environment
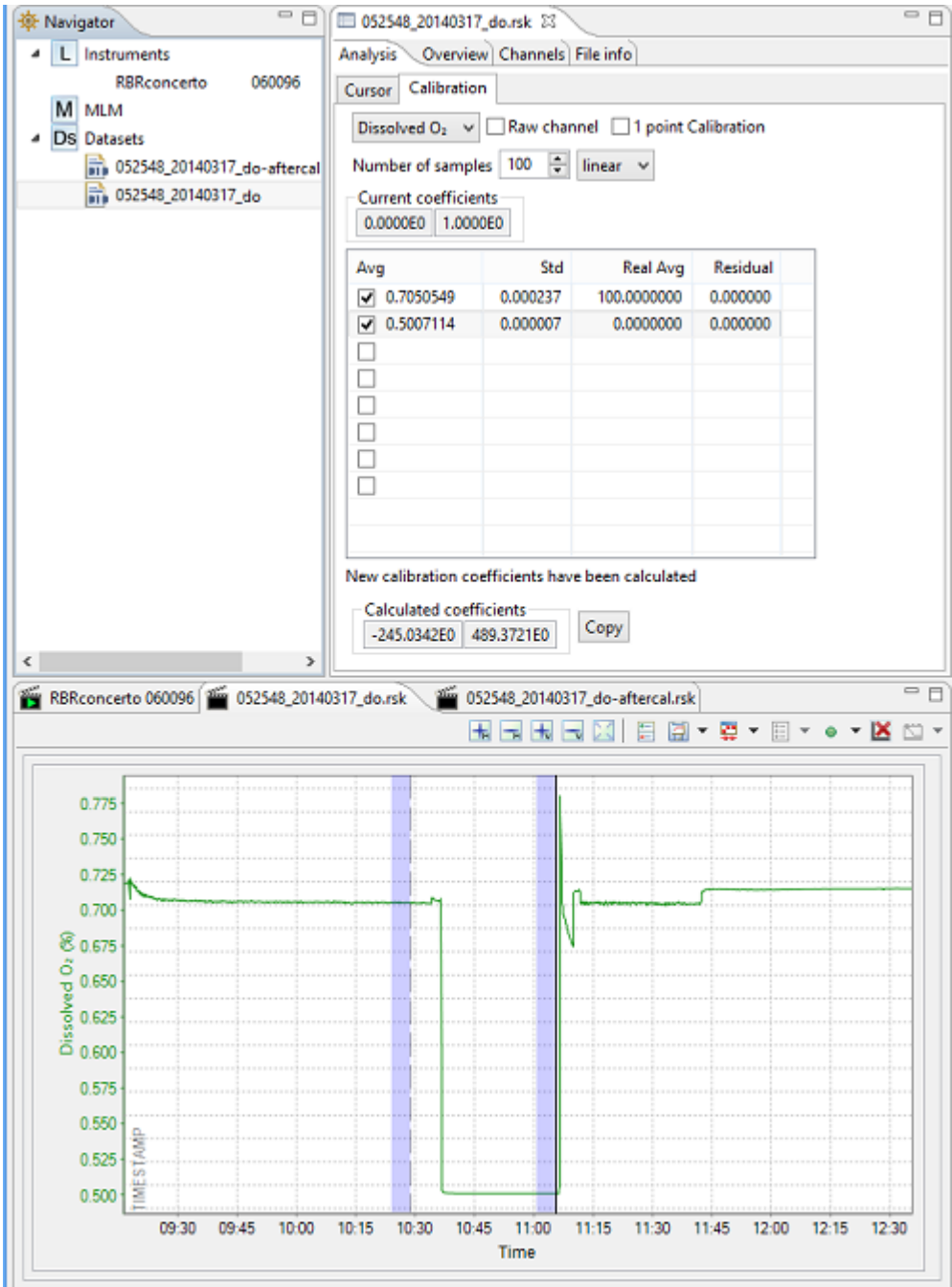
1. Fill the large beaker with water 2 L, and install magnetic stirrer.

2. Bubble air through the water using an air pump (an aquarium air pump would work).

3. Switch ON the air-pump and the magnetic stirrer.

Reference Point 2 solution – Dissolved oxygen concentration of zero

- In a beaker, dissolve approximately 5 tsp of sodium sulphite (Na2SO3) into 500 mL tap water. Mix the solution thoroughly with a magnetic mixer. The solution will be oxygen-free after 15 minutes.

Steps

1. In Ruskin, configure the logger to sample at a fast rate, between 6 Hz and 3 seconds.

2. Use **Sync to PC** to ensure the logger clock is synchronized to the PC clock, and ensure the end time is set so that the logger will keep sampling until calibration is complete.

3. Submerge the dissolved oxygen sensor in the Reference Point 1 solution for at least 15 minutes near the stirrer so that it is in the best mixed area of the bath.

4. Take sample readings for at least 15 minutes for the 100% calibration point, making note of the time that the sample is being measured.

5. Submerge the dissolved oxygen sensor in the Reference Point 2 solution for at least 15 minutes for the 0% calibration point, making note of the time that the sample is being measured.

6. Retrieve the data from the data logger as per the steps in Download (page 41).

7. The calibration data should now be displayed in the **Plot** view. In the **Properties** view, go to **Analysis** tab > **Calibration** tab.

8. Select the dissolved oxygen sensor type from the drop-down list.

9. The **Number of Samples** spinner box is automatically set to **100**.
   This value is the number of sample points Ruskin will average the calculate the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.

10. Click on a stable point in the **Plot** view corresponding to 100% oxygen. In the table in the first row, under **Real Avg**, enter 100 and press enter.

11. Select the check box in the second row in the table, then click on a stable point in the **Plot** view corresponding to 0% oxygen. In the table in the second row, under **Real Avg**, enter 0 and press enter.

12. Ruskin automatically calculates the calibration coefficients, and the values appear in **Calibration coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.

13. Follow the steps in Change calibration coefficients (page 63) to update the coefficients for this sensor in the data logger.
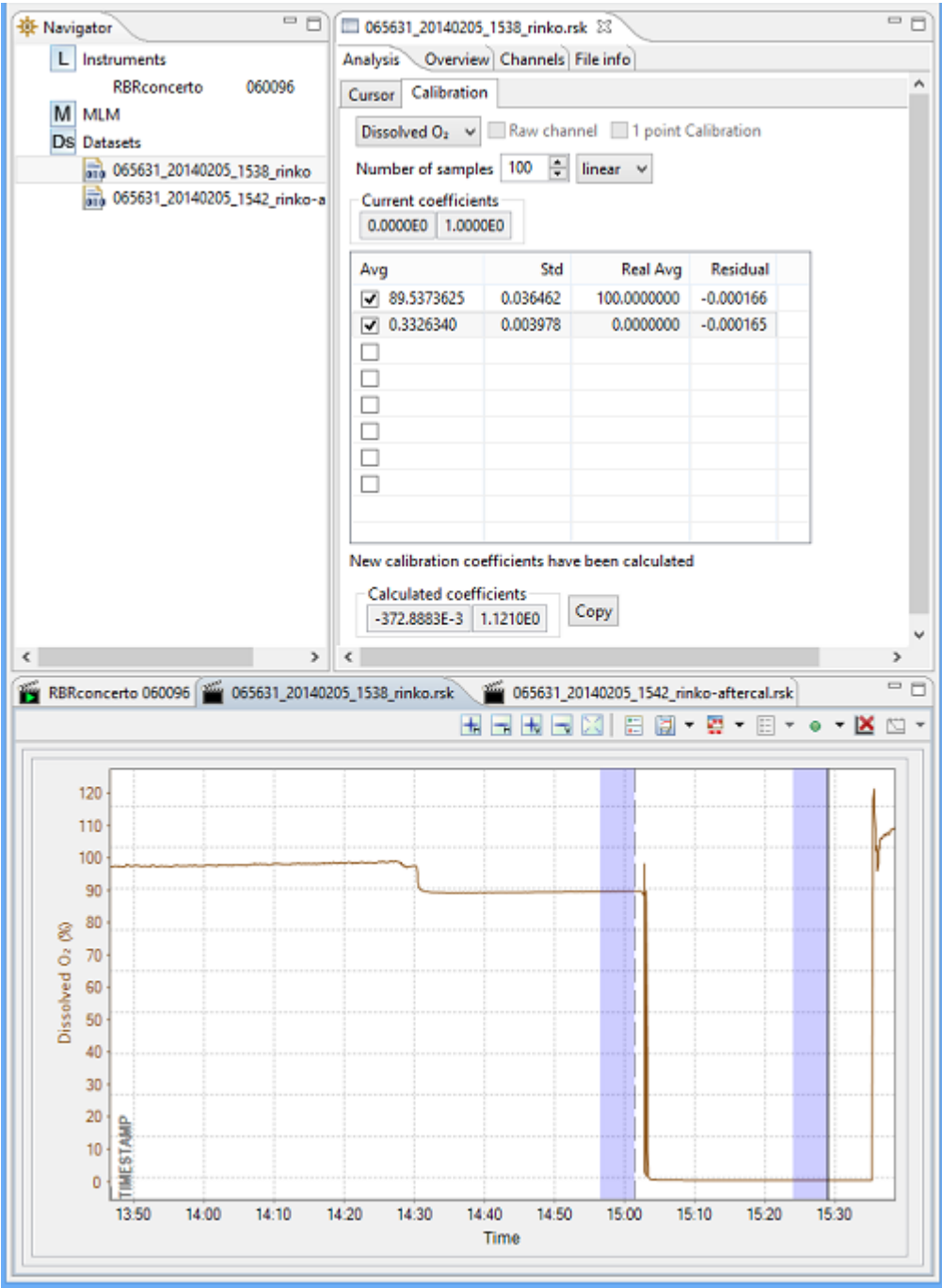
13.5 Turbidity calibration

The Seapoint turbidity sensor is calibrated with a two-point calibration technique. The calibration should be performed under fluorescent lighting.

Equipment (entire logger submerged)

- 4000-FTU Formazin standard – 500 ml

- Distilled water – 5 L

- Black-walled, wide-mouth container (large enough to hold the logger)

- Volumetric flask 1000 ml, class A

- Volumetric flask 200 ml, class A

- Stir stick

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

Steps (preparing solutions)

1. In Ruskin, configure the data logger to sample using a 10 second sampling interval and set the sensor to autoranging - see Autoranging and fixed gain (page 38).

2. Use **Sync to PC** to ensure the logger clock is synchronized to the PC clock, and ensure the end time is set so that the logger will keep sampling until calibration is complete.

3. Flush the sensor, container and glassware with distilled water and dry them.

4. Fill the black wall container with 5000 ml distilled water using the large volumetric flask.

5. Set the sensor in the container until the sensor is fully submerged in the distilled water.

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

6. Record the data in distilled water for five minutes.
   This is the zero-turbidity calibration point.

7. Fill the 500 ml volumetric flask with Formazin Standard. Remember to gently shake the bottle before opening the Formazin solution.

8. Add 500 ml Formazin Standard to the black wall container with distilled water, and gently mix solution with a stirring stick.

9. Calculate the value of the standard turbidity solution at calibration point according to following formula:

⊘ Calculating dilution

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

---

10. After five minutes, remove the logger from the calibration container and wash the sensor head under regular tap water.

11. Retrieve the data from the data logger as per the steps in .

12. The calibration data should now be displayed in the **Plot** view. In the Properties view, go to **Analysis** tab > **Calibration** tab.

13. Select the **Tu sensor** type from the drop-down list.

14. The **Number of Samples** field is automatically set to **100**.
    This value is the number of sample points Ruskin will average calculate the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.

15. Click on a stable point in the **Plot** view corresponding to 0 NTU. In the table in the first row, under **Real Avg**, enter 0 and press enter.

16. Select the check box in the second row in the table, then click on a stable point in the **Plot** view corresponding to reading of your turbidity solution. In the table in the second row, under **Real Avg**, enter the value of your turbidity solution and press enter.

17. Ruskin automatically calculates the calibration coefficients, and the values appear in **Calculated coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.

18. Follow the steps in to update the coefficients for this sensor in the data logger.

⚠

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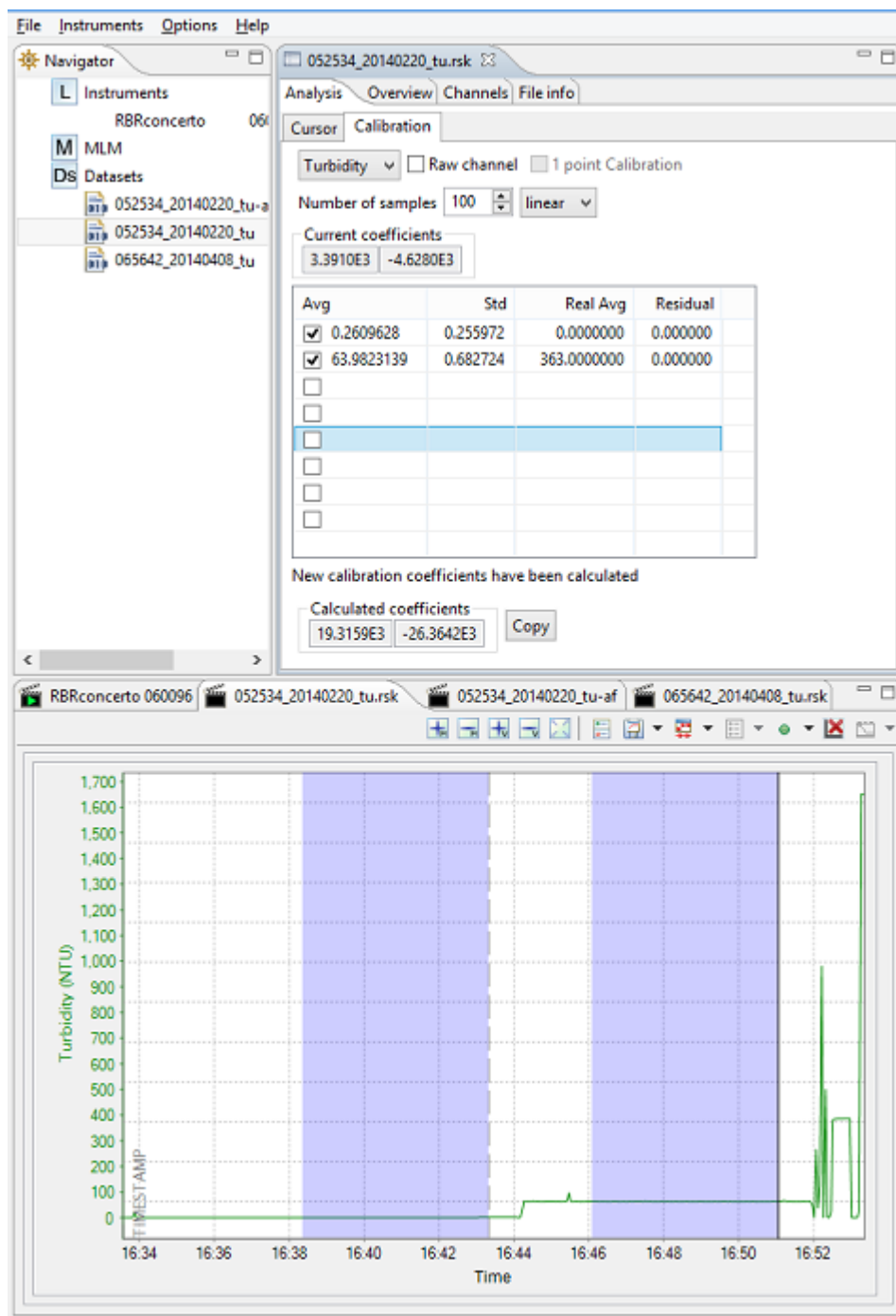
13.6 Idronaut pH calibration

Calibration of the pH sensor should use two or more pH buffers, and should be carried out every day that the electrode is used for optimum accuracy. It is recommended that a pH 7 buffer be used to check the zero point and an acid and an alkaline buffer used to set the slope. RBR uses pH 4 and pH 10 to measure the slope.

Steps

1. In Ruskin, configure the logger to sample at a fast rate, between 6 Hz and 3 seconds.

2. Use **Sync to PC** to ensure the logger clock is synchronized to the PC clock, and ensure the end time is set so that the logger will keep sampling until calibration is complete.

3. Submerge the pH sensor in the pH 4 buffer solution for at least 15 minutes near the stirrer so that it is in the best mixed area of the bath.

   > ⚠ Ensure that the pH sensor is rinsed with clean water between each sample reading to avoid contamination between buffer values.
   >
   > Ensure that both the pH and Reference electrode are submerged in the same solution.
   >
   > If the logger has a pH/ORP sensor and an Oxyguard DO sensor, it is advisable to ensure that the DO sensor is submerged in the buffer during measurement.

4. Submerge the pH sensor in the pH 7 buffer solution for at least 15 minutes near the stirrer so that it is in the best mixed area of the bath.

5. Submerge the pH sensor in the pH 10 buffer solution for at least 15 minutes near the stirrer so that it is in the best mixed area of the bath.

6. Retrieve the data from the data logger as per the steps in Download (page 41).

7. The calibration data should now be displayed in the **Plot** view. In the **Properties** view, go to **Analysis** tab > **Calibration** tab.

8. Select the pH sensor type from the drop-down list.

9. The **Number of Samples** spinner box is automatically set to **100**.
   This value is the number of sample points Ruskin will average the calibration coefficients for the sensor. Typically, this value should be in the range of 50 to 100 samples.

10. Click on a stable point in the **Plot** view corresponding to the pH 4 . In the table in the first row, under **Real Avg**, enter 4 and press enter.

11. Select the check box in the second row in the table, then click on a stable point in the **Plot** view corresponding to pH 7. In the table in the second row, under **Real Avg**, enter 7 and press enter.

12. Select the check box in the third row in the table, then click on a stable point in the **Plot** view corresponding to pH 10. In the table in the third row, under **Real Avg**, enter 10 and press enter.

13. Ruskin automatically calculates the calibration coefficients, and the values appear in **Calculated coefficients**. Clicking the **Copy** button saves the new calibration coefficients to the clipboard.

14. Follow the steps in to update the coefficients for this sensor in the data logger.
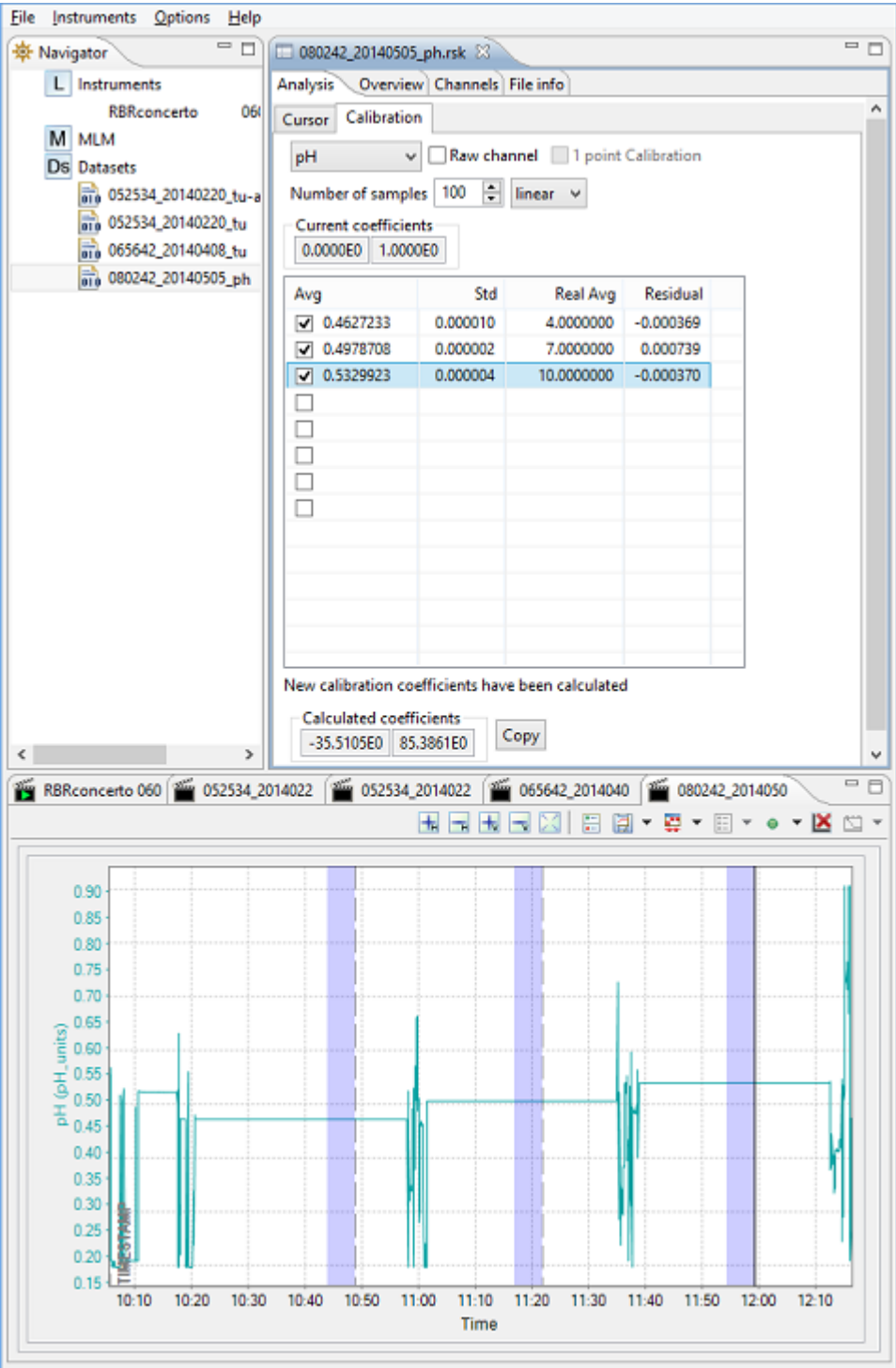
14 Preferences

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

- where to store output files
- plotting preferences
- configuring derived channels
- calculating derived channels when sensors are missing

You can change these preferences at any time.

14.1 Specify location for log files

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

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side, click **General**.

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

> ⚠ Log files are used when you request RBR support.

4. Click **Apply** or **OK**.

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

14.2 Specify Language selection

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side, click **General**.

3. In **Language selection**, select a language from the list.

4. Click **Apply** or **OK**.

14.3 Using advanced sampling controls

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side, click **General**.

3. In **Sampling control**, select **Enable advanced sampling controls** check box to change from the simple control.

4. Click **Apply** or **OK**.

> ⚠ Simple control: provides a default list of fixed values
>
> Advanced control: provides the user the ability to enter any values.

14.4 Derived channel preferences

> ⚠ The derived channels settings in **Preferences** was originally intended for XR(X),1060, 2050, and 1050 RBR data loggers. It does not apply to Logger2.
>
> Logger2 calculates all the possible derived channels for that specific logger.
>
> Use the Parameters tab (page 40) (located in the **Setup** tab) to set up initial derived channel parameters.
>
> For downloaded files, use data set Parameters tab (page 52).

Derived channels contain calculated data based on data from measured channels. In the Derived Channels section of the Preferences dialog box, you can choose additional channels derived from measured channels. You can also set the salinity, pressure, and temperature values used to calculate the derived channels when a sensor is not available.

> ⚠ If you suspect that the derived channel value is incorrect check to make sure that the **no sensor present** values are correct. For example, if a Dissolved Oxygen saturation measurement is made in lake at 8 degrees but the **no sensor present** salinity value is 35 and temperature is 15 degrees the concentration reported will be incorrect. Adjust the **no sensor present** values and re-compute.

Derived channels are included by default in the **Plot** view and in datasets.

14.4.1 Add depth as a derived channel

If your logger has a pressure channel, you can use its measurements to derive a depth channel. The data calculated for this derived channel appears along with measured channels in the Plot view and in datasets.

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side of the **Preferences** dialog box, click **Derived Channels**.

3. On the **Depth** tab, select the **Enable Depth Channel** check box.
   For new loggers, all derived channels are calculated regardless of the check box status.

4. In the **Atmospheric Pressure** box, type a deciBar value for the atmospheric pressure on the logger or use the default value. This value corrects the pressure measurements during the depth calculation.

5. Click either **Simplified calculation** or **Seawater calculation**, which is a calculation based on a UNESCO technical paper:

   a. If you want to use the simplified calculation, type the actual water density or use the default value. Note that for freshwater, the density should be set to 1.0.

   b. If you want to use the UNESCO seawater calculation, specify the latitude of the data collection in degrees and minutes.

14.4.2 Add dissolved oxygen as a derived channel

You can derive a dissolved oxygen channel that measures the oxygen saturation as a percentage. The data calculated for this derived channel appears along with measured channels in the Plot view and in datasets.

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side of the **Preferences** dialog box, click **Derived Channels**.

3. Click the **Dissolved O2** tab and select the **Enable Dissolved Oxygen Channel** check box. For new loggers, all derived channels are calculated regardless of the check box status.

4. If any of your loggers use the Oxyguard DO sensor to measure oxygen saturation and you want to use the Weiss equation, select the **Calculate concentration using the Weiss equation** check box and select the output unit, one of µMol/l, mg/l or ml/l.
   The Weiss equation requires values for temperature and salinity. If your logger does not measure these things, you can specify standard values on the **No sensor values** tab.

5. If any of your loggers use the Aanderaa Optode DO sensor to measure oxygen concentration, select the **Calculate concentration** check box and select the output unit, either mg/l or ml/l.

6. If any of your loggers use the Aanderaa Optode DO sensor to measure oxygen saturation, select the **Calculate saturation using the Garcia and Gordon equation** check box.
   The Garcia and Gordon equation requires values for temperature and salinity. If your logger does not measure these things, you can specify standard values on the No sensor values tab.

14.4.3 Calculate derived channels when sensors are missing

When your sensors do not provide the salinity, pressure, or temperature values needed to calculate derived channels, you can specify actual values to use instead.

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side of the **Preferences** dialog box, click **Derived Channels**.

3. Click the **No sensor values** tab.

4. In the boxes provided, specify the values that you want to use when actual values are not provided by your sensors.

14.5 Specifying plotting preferences

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

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

14.5.1 Channel visibility tab

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

Channel visibility tab with default settings

Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side, click **Plotting**.

3. On the **Channel visibility** tab, select the check box for the information you want hidden. Events appear at the x-axis as a vertical gray line with brief text to indicate the type of event, such as STP for a stop event in a dataset. Refer to Appendix C - Event and Error Stamps (page 94) for a list of the event types.

4. To hide all measured channels, select **By default, hide all measured channels** check box.

5. To hide all derived channels, select **By default, hide all derived channels** check box.

6. To show information, clear the check box beside the information you want shown.

14.5.2 Channel colours tab

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

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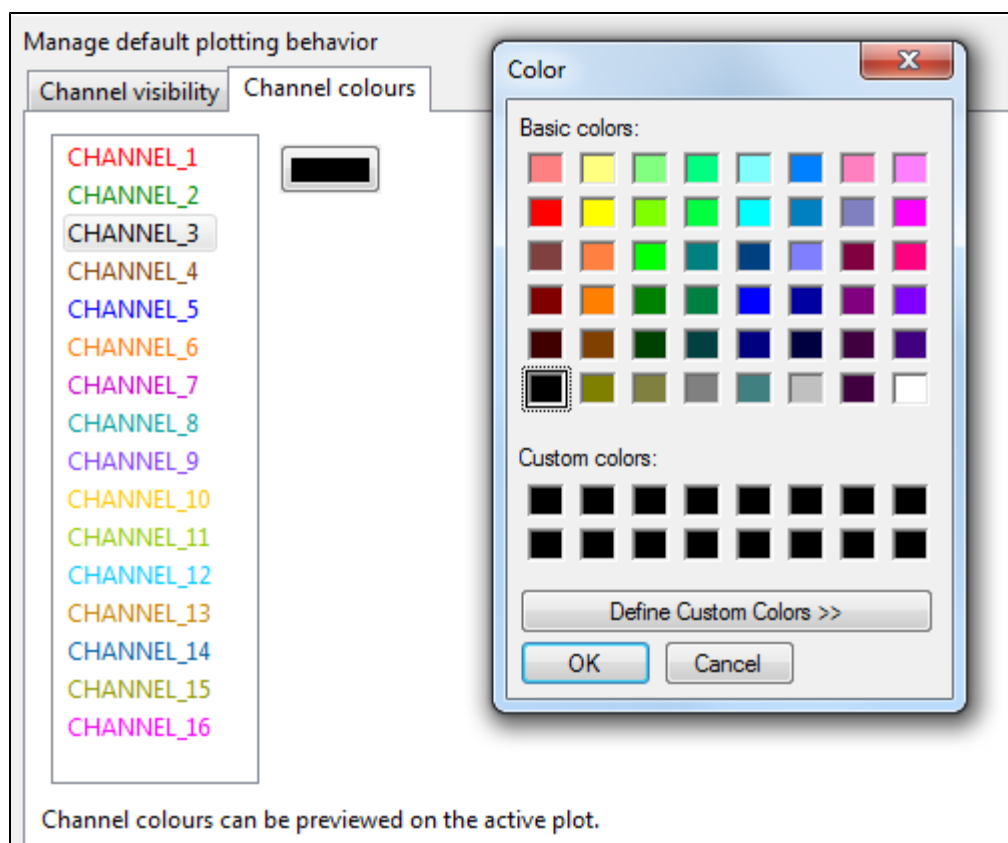
Steps

1. From the **Options** menu, click **Preferences**.

2. In the list on the left side, click **Plotting**.

3. Click the **Channel colours** tab.

4. In the channels listed, click the channel you want to change the colour for.

5. Click the colour box that appears beside the channel list.

6. With the colour dialog box open, select a colour from the **Basic colour** area.

7. Select **OK** to apply the colour to the channel.

8. To create a custom colour:

   a. Repeat steps 4 and 5.

   b. Click **Define Custom Colours** and then choose a colour.

   c. Click **Add to Custom Colours** to add the new colour to **Custom colours**.

   d. Click **OK** to apply the new custom colour to the channel.

15 Logger Hardware

15.1 Opening and closing the logger

Loggers have two end caps: the sensor end cap houses the sensors, and the battery end cap covers the data port and battery cover plate. Access to the data port and the battery cover is gained by removing the end cap opposite the sensor end of the logger. It may be unscrewed by hand or by using a rod inserted into the mooring line hole for leverage. The end cap does not unscrew completely until the O-ring is clear of its mating surface in the body. This ensures that it will not eject at high speed should the interior of the logger become pressurized.
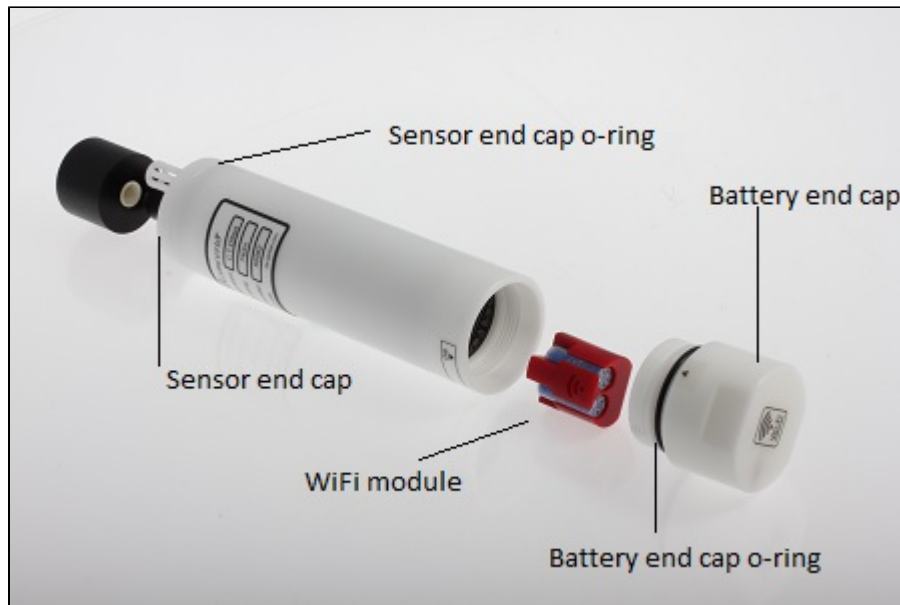
Closing the logger is exactly the reverse of opening it. Remember to keep the O-rings clean and avoid scratching the O-ring mating surfaces. Carefully inspect the O-rings, as described in the Inspecting the O-rings section (p.10), before deploying the logger. Do not use excessive force when tightening the end cap; hand-tight is quite sufficient, as the seal depends upon the O-rings, not the end cap tightness.

15.2 Changing the batteries

Loggers are powered by eight or sixteen 2/3A size 3V lithium cells. These are standard camera batteries, and may be obtained from retail photographic or hardware outlets (see the following chart for model numbers).

Energizer	Kodak	IEC	Procell	Duracell	Rayovac	Panasonic	Varta
EL123A	K123LA	CR17345	PL123A	DL123A	RL123A	CR123A	CR123A

Steps

1. Remove the battery end cap from the logger.
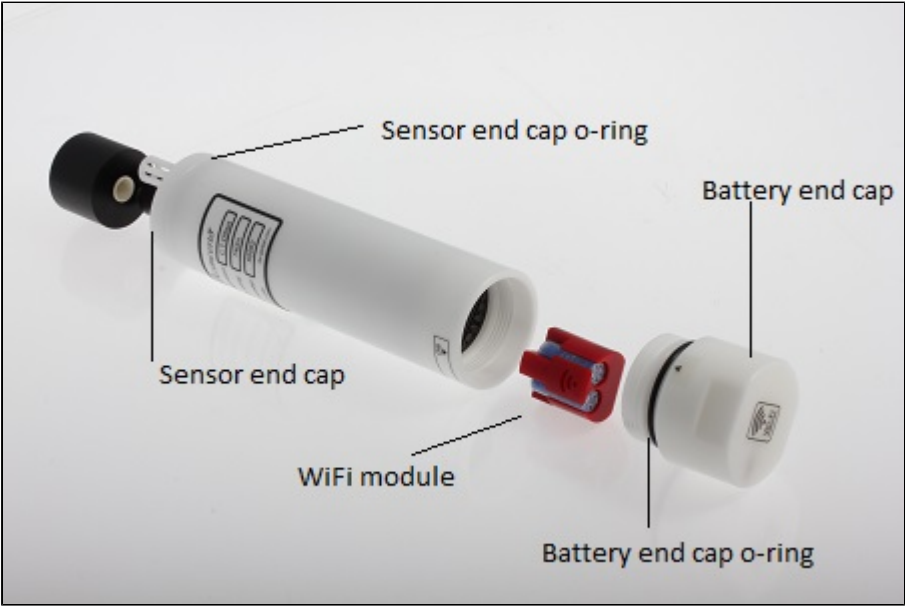
2. Using both thumbs, press down on the "+" symbols on the battery cover and slide in the direction of the arrow. The battery cover can then be folded up.

3. Invert the logger to allow the batteries to slide out of the battery carriage.

4. Insert fresh batteries into the battery carriage with the negative terminals pointing inwards, four (4) batteries per channel.

5. Close the battery cover by folding down and then pressing with both thumbs on the "+" symbols and sliding in the opposite direction of the arrow.

6. Replace the battery end cap.

15.3 Installing desiccant

The logger has a dedicated location for placement of desiccant in the battery end cap, which will accommodate four (4) Dricap desiccant capsules (part # 33AG41).

Steps

1. Remove the battery end cap from the logger - see Opening and closing the logger (page 84) .

2. Inside the battery end cap, there are four recessed sockets. Insert a desiccant capsule into each socket, ensuring that each is securely placed.
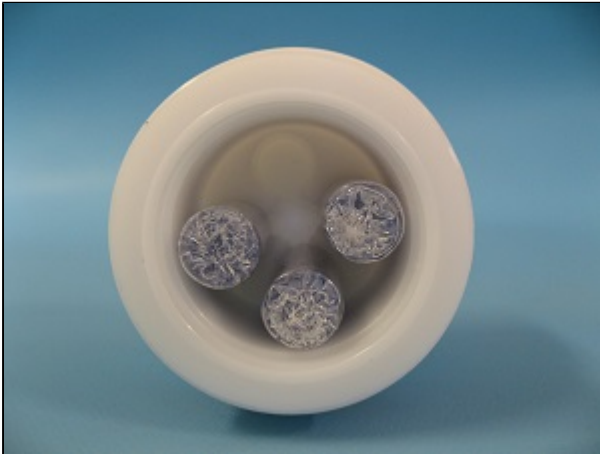
3. Replace battery end cap.

15.4 Twist activation option

Loggers purchased with this option can be enabled without a schedule by activating Twist Activation (see Gating Condition (page 33)). You must first enable this mode and enable the logger. Closing the battery end cap enables the logger. When enabled by twist activation the logger will vibrate for a few seconds. To stop the logger, open the battery end cap one quarter turn. When the logger is stopped it will vibrate for a few seconds to provide positive feedback.

16 Maintenance and repairs

16.1 Calibrations

We recommend that you verify the calibration of your data logger before any critical deployment, periodically once a year, or if you suspect the calibration to be out of specifications. Discuss your calibration needs with RBR. In some cases, you will be recommended to return the instrument to RBR to have it checked and re-calibrated. Please contact us for our current calibration fees.

16.2 O-rings L2

The single most important item of maintenance on any RBR submersible data logger is care of the O-rings. Any kind of water leak can damage the circuitry beyond repair and cause complete data loss. Every logger's seal depends upon its O-rings, not the end cap tightness. Proper O-ring maintenance, therefore, is crucial.

> ⊙ O-rings may lose elasticity over time due to pressure, even when the logger is not deployed. We strongly suggest that the O-rings be replaced regularly, for example, before every deployment, or after change of batteries, or at least once a year.

Please see Appendix B - O-ring specifications (page 94) for O-ring specifications for each logger.
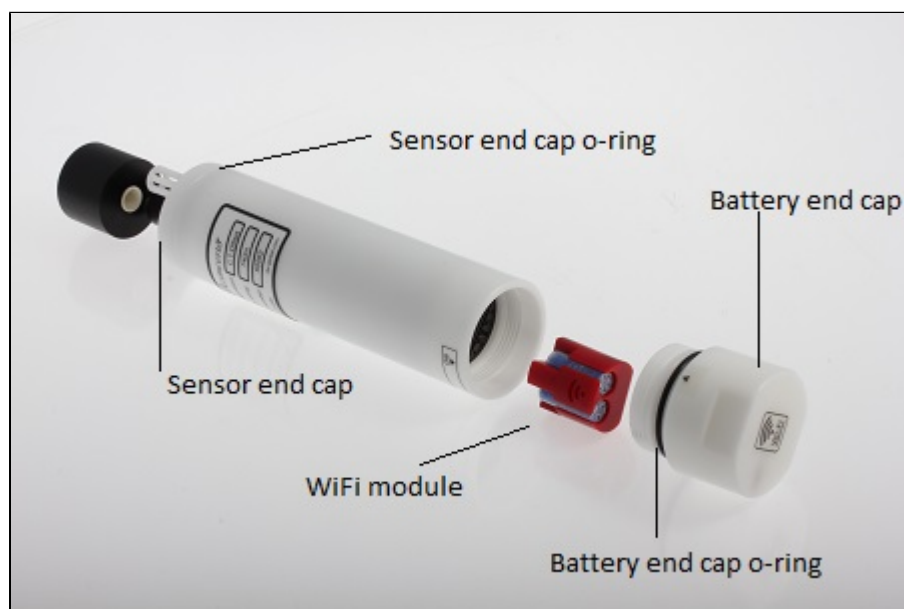
16.2.1 Inspecting O-rings

Pay attention to the following areas:

- The surface of the O-ring itself
- The mating surface on the inside of the case between the threads and the open end
- The inner surfaces of the groove in the end cap where the O-ring sits

Any dirt present should be removed by wiping thoroughly with a soft, lint-free cloth. When cleaning, never use any material or tool which could scratch the O-ring or any of its mating surfaces. If any dirt is present in the O-ring groove, then the O-ring should be removed as described below to allow thorough cleaning of the groove. If an O-ring needs to be removed for any reason, it should be replaced.

If the O-ring is scratched, cut, distorted, perished or defective in any other way it must be replaced. If any of the surfaces of the O-ring groove are scratched, pitted or otherwise damaged, the logger may need to be returned to RBR for refurbishment: please contact us for advice.

16.2.2 Replacing an O-ring

1. Lever the O-ring from its groove. Use a soft plastic or wood tool; do not use a metal screwdriver or any other tool which may scratch the surfaces of the O-ring groove: doing so will probably render the end cap useless. Slide the O-ring out of its groove and off the logger. The O-ring may need to stretch quite a bit as it is pushed off; this requires some effort but can be done by hand.

2. Thoroughly clean the O-ring groove, taking great care not to scratch or damage it in any way. Inspect it carefully, and contact us for advice if it appears damaged. Apply a light film of silicone grease (part #10-568) to all three inside surfaces of the groove, being careful not to trap any dirt, hairs or lint.

3. Select the proper O-ring, see Appendix B - O-ring specifications, and make sure it is not damaged. Lubricate it with a very light film of silicone grease to ease its installation.

4. Install the new O-ring by pushing it into place and popping it into its groove.

5. When the new O-ring is in place, inspect it once more for scratches and dirt, and wipe away any silicone grease deposited on the end cap.

Most experienced users of oceanographic equipment replace all O-rings before every deployment as a matter or routine. The cost of an O-ring is negligible compared with the cost of the instrument and its deployment. Routine replacement of O-rings, therefore, is cheap insurance.

16.3 Repairs

We support all instruments and software that we manufacture. First line support is always available by phone, fax or e-mail. Please contact us immediately if you are experiencing problems with your RBR product. It is very important to contact us before returning your instrument, as some difficulties can be easily solved on-site by the user. Please have the model and serial number of the unit handy when you contact us at support@rbr-global.com.

There are no user-repairable parts of the logger. Any attempt at repair, whether successful or not, without prior authorization from RBR Ltd. will void the warranty. If it is necessary to return the product to RBR for an upgrade, repair, or calibration; please review the detailed shipping information on our website www.rbr-global.com before returning the unit.

In the unlikely event of an instrument requiring service at RBR, contact us for an RMA number and please use the following shipping address:

RBR Ltd
95 Hines Road Unit 5
Kanata, Ontario
CANADA K2K 2M5

Telephone +1 (613) 599-8900

For those who are shipping from outside of Canada, you will need to clearly mark the waybill and any other customs paperwork with the following:

"Canadian goods being returned to manufacturer for repair. NOT A SALE."

Please state the instrument value on the waybill as closely as possible to the current market value based on the original purchase price less depreciation. Please contact RBR if you have any questions about the instrument value. Send the unit using your own preferred method (prepaid). However, we suggest that you do not use Ground Service, since customs brokerage charges will be billed incorrectly.

Units repaired under warranty will be returned prepaid by RBR. Warranty repairs are decided on a case by case basis.

Standard Repair Charges (Non-warranty)

Our minimum repair charge is $150 CAD. This charge covers a comprehensive initial check, including verification calibration and sensor functionality. Minor repairs are also covered by this basic fee. If further repair work or re-calibration is necessary, a quotation will be issued to the customer. Once we have received authorization to proceed, the repair shall be completed and the instrument returned as soon as possible.Please note that any units returned with low (or no) batteries will have new batteries installed, and the costs will be added to the repair invoice.

16.4 Support kits

To simplify maintenance of your data logger, RBR sells support kits with enough O-rings, and silicone grease for 5 deployments. Please contact RBR for more information or to place an order.

17 Appendices

17.1 Appendix A - Battery life calculation

17.1.1 When to replace the batteries

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

Battery voltage does not decrease linearly and is therefore not an accurate indicator of battery capacity. However, if the logger software indicates that the batteries have less than 11 V remaining, the batteries should be replaced.

> ⊙ When in doubt, replace the batteries

17.1.2 Predicting battery life

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

The Ruskin software calculates the expected battery usage (in mA hours - mAh) for the logger during setup . The nominal capacity of each battery is 1300 mAh at room temperature. The software will warn the user if the expected battery usage for a particular deployment scenario is above 1000 mAh. The software will not prevent a logger from being started even if a warning is given. In tests at RBR Ltd. of multiple examples of various brands of batteries at 6°C, all examples were able to provide the threshold capacity of 1000 mAh. The user should view these predictions and further de-rate the batteries if the expected deployment is in cold water.

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

17.2 Appendix B - O-ring specifications

Each logger has one user replaceable O-ring located in each end cap above the thread.

> ⊘ We strongly recommend that the O-rings be replaced regularly: before every deployment, after changing batteries, or at least once a year.

Plastic bodies: #2-225 N70 o-ring

Titanium bodies: #2-225 N70 o-ring, #8-225N90 backup ring

17.3 Appendix C - Event and Error Stamps

The following is a list of event/error stamps that may be displayed in the data set.

TIMESTAMP - Time synchronization event, is used to ensure timing synchronization, whenever there is a possibility that the actual date/time of a sample according to the logger's internal calendar/clock does not match what is expected in the normal sampling sequence.

USER STOP - Sampling stopped by user, is used to indicate that a command to stop sampling occurred.

UNKNOWN - An unknown error has occurred, is used to indicate that the error has occurred in the logger and the cause of the error is unknown.

ERROR ## - Change event (system restart where logger clock is no longer valid), is used to indicate an internal error has occurred in the logger.

RESTART ## - Warm startup event (clock and programmed parameters are valid/unharmed), indicates a system restart, in which all programmed parameters are valid.

GAIN### - gain change event

Below is a description of all the different event stamp types ## which could be encountered. Some of these are quite common, while others indicate very rare fault conditions. Some may also occur together in various combinations, with no sample data between them.

Error##	code	comment
00	eDATA_ERROR_CATCH_ALL	generic/unknown/unexpected error

| 01	eDATA_ERROR_EOC	A/D *EOC bit was set (should always = 0)
02	eDATA_ERROR_DMY	A/D *DMY bit was set (should always = 0)
03	eDATA_ERROR_MODULE_ADDR	invalid address used for RBR channel
04	eDATA_ERROR_OVERFLOW	too much data to send to front end
05	eDATA_ERROR_BUS_BUSY	access to internal bus denied
06	eDATA_ERROR_TX_FAIL	timeout sending command
07	eDATA_ERROR_RX_TIMEOUT	timeout receiving response
08	eDATA_ERROR_PARSING	generic failure to interpret response
09	eDATA_ERROR_NO_SAMPLE	no sample was started
10	eDATA_ERROR_IN_PROGRESS	sample acquisition still in progress
11	eDATA_ERROR_FAILED	sample process failed somewhere
12	eDATA_ERROR_AVERAGE	average computation error (no valid samples)
13	eDATA_ERROR_REPLY_SHORT	front end reply contains fewer characters than expected
15	eDATA_ERROR_UNABLETOCOMPUTE	unable to compute derived/cross channel

17.4 Appendix D - |wave deployment planning

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

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

- Mean depth of water: an estimate of the average water depth, used for the initial prediction of expected wave frequencies that can be detected. Ruskin will use the actual depth measured by the logger for its calculations.

- Instrument altitude: The actual height of the logger above the seabed. This is defined by the deployment, and the logger must be physically affixed at this height during the installation.

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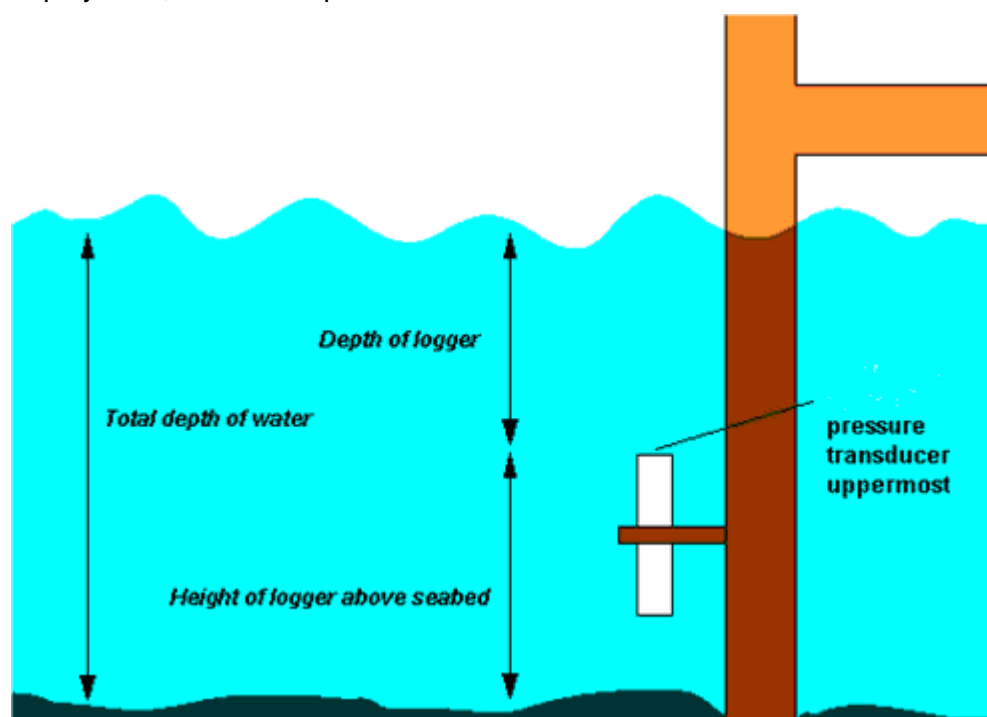
17.4.1 |wave logger positioning

For deployment planning, Ruskin needs to know the expected mean depth of water (in metres) and the expected altitude of the logger above the seabed to provide estimates of what the logger will be able to measure about the surface waves. The logger measures water depth by means of a pressure transducer. The physics of what a pressure transducer can 'see' at depth depends on the height of water above the transducer *as well as* the amount of water below the transducer. High

frequencies attenuate quickly with depth. Figure 1 shows the attenuation with depth as a function of wave frequency expressed as the wave period in seconds (*period* = *1/frequency*). What Figure 3 demonstrates is that the placement of the logger is critical in defining the nature of the wave data to be captured by the logger.

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

Fig. 1 Wave attenuation as a function of depth for various wave periods.

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

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

Measurement speed : this defines the sampling rate or period for individual pressure readings used

Wave calculations. The rate possibilities are 1Hz, 2Hz , 3Hz, 4Hz, 5Hz and 6Hz

The sampling rate defines several elements of the data capture:

1. The highest possible frequency visible in the data is limited to ½ the sampling frequency. However, this mathematical limit can not usually be achieved because of the attenuation characteristics shown above.

2. The sampling frequency defines the resolution of the frequency spectrum which can be calculated from the wave data;

3. The sampling frequency, together with the burst length, define the lowest frequency which can be assessed in a wave burst.

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

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

The wave parameters work together to define the range of wave information which can be calculated as well as the memory and battery usage. As the parameters are varied, you will see changes to the estimates at the bottom of the window.

17.5 Appendix E - WiFi module

If you have a wifi-capable logger and an iOS device, you can connect and view data from the logger on the iOS device. The following explains how to set up your logger, connecting to the iOS device using wifi, and what information you can view from the iOS device. You must install the Ruskin app from the App store in order to view the logger's information.

> ⚠ You can connect to a WiFi logger with Ruskin (not Ruskin App) on your computer by connecting to the logger WiFi network. Ruskin will automatically detect the logger. Many of the details discussed below are applicable to communicating with you logger over WiFi with Ruskin

17.5.1 Setting up your logger

You must set up your data logger first, before connecting it to the iOS device.

All tabs within the **Setup** tab contain the **Enable**, **Revert settings** and **Use last setup** buttons. When you click **Enable**, the logger setup parameters are stored to the logger and the schedule is enabled. When you click **Revert settings**, you automatically revert the logger configuration back to previous settings.

Use last setup is intended for configuring multiple loggers using the same schedule. For example, to set up three |tide loggers with exactly the same parameters, set one logger up and enable it; connect the second and third logger and when you click **Use last setup** button, these two loggers will be set up with the exact same parameters as the first logger.

Steps

1. Connect the logger to the computer and then open Ruskin.
2. In **Setup** tab > **Gating condition** tab, select **Twist activation**.
3. In **Setup** tab > **Basic Configuration** tab, select iOS compatible data storage (page 38) check box.
4. In **Setup** tab > **Schedule** tab, set the sampling regime and measurement speed. See Schedule a logger (page 23).
5. Click **Enable**.
6. Disconnect the logger from your computer.

7. Insert the Wifi module

8. Close the battery end cap.

> ⚠️ If you don't want the logger to sample immediately turn the battery end cap to the Off position. See Twist Activation (page 36) for more details.

17.5.2 Connecting over WiFi to iOS device (or Ruskin)

Install the Ruskin App on your iOS device by going to the Apple App store and download the Ruskin App.

Steps

1. Twist ON/Off the logger to activate the wifi.
   You may need to Twist the logger either to the ON position or OFF position to activate the WiFi, remember to twist to the Off position to pause the logger.

   > ⊘ The twist activation is intended to start sampling or pause sampling, however twisting On or Off also enables the WiFi module to transmit. This is the method to activate the WiFi if it is not active.
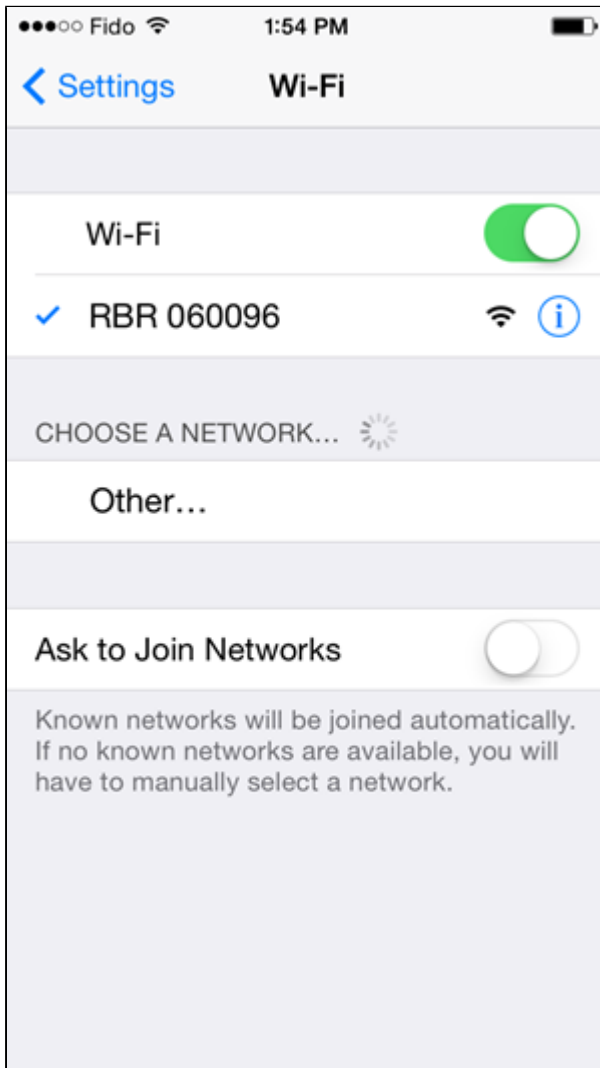
2. On the iOS device, select **Settings** > **WiFi**. Or on your computer search for a new network. The logger should appear automatically under "Choose a network". The name appears as the RBR serial number of the logger. Tap it to connect to it.

   > ⚠️ The Wifi is disabled after 60 seconds of inactivity. Twist the logger ON or OFF to activate the WiFi.
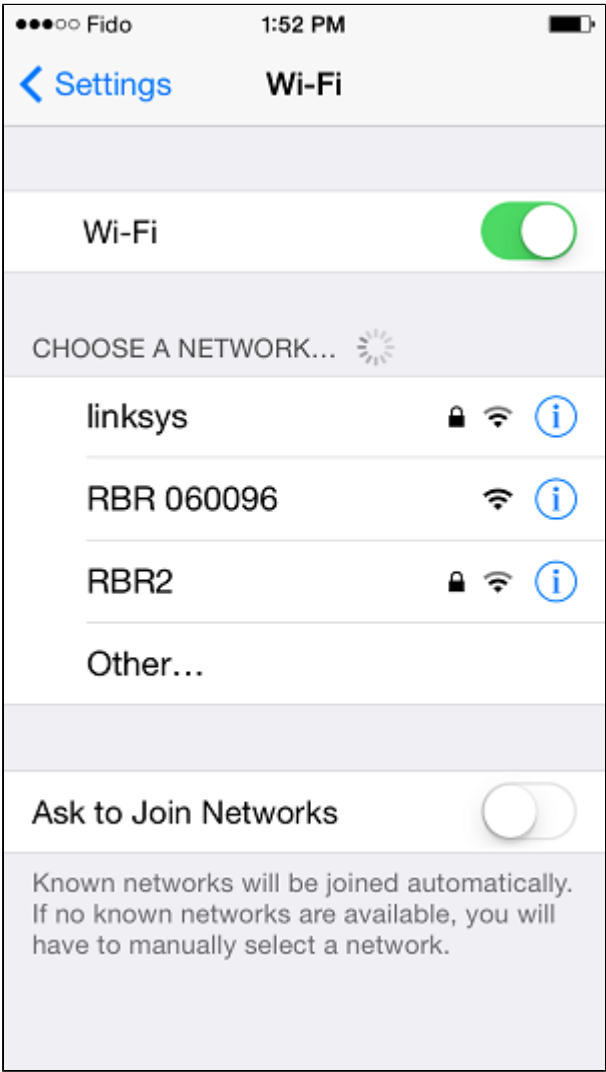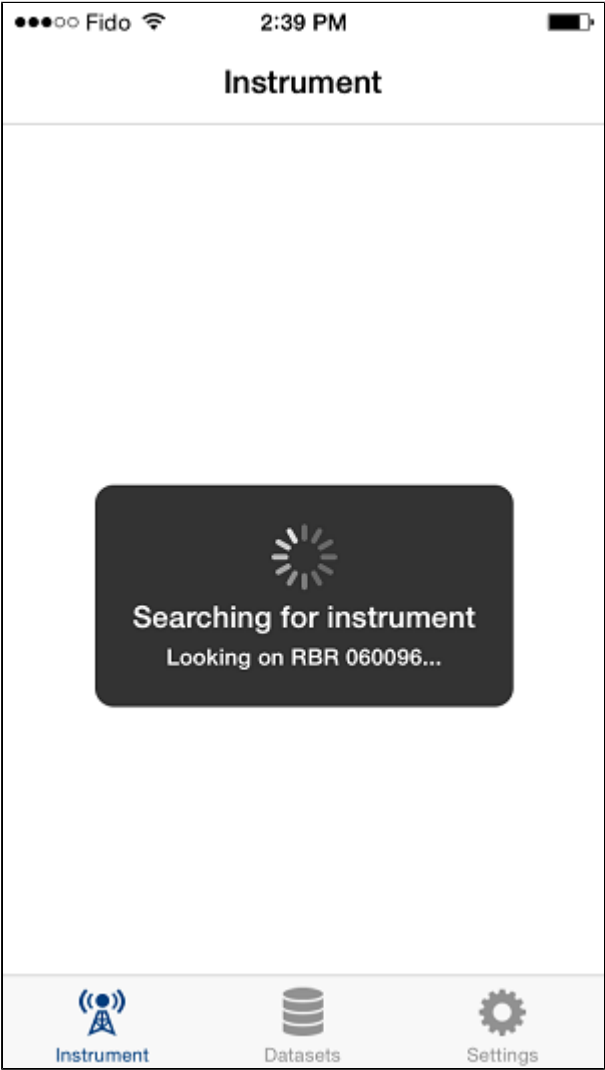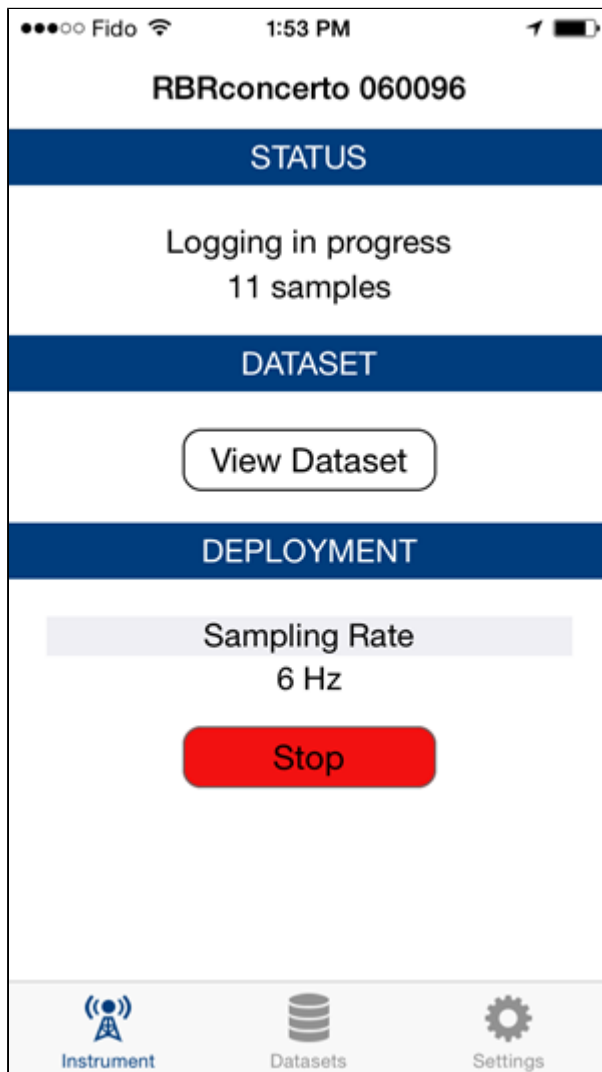
Choose a network

WiFi selected

3. Exit Settings to return to the Home screen.

4. From the Home screen, tap the Ruskin App (the App will automatically search for the logger and connect to it).

Searching for a logger

Connected

After connecting to the logger, you are automatically in the **Instrument** view of the app. The different views you can go to are **Instrument**, **Datasets** and **Settings**, located at the bottom of the screen. Tap **Datasets** to view local datasets or datasets you have stored in a Dropbox account. You can only view local datasets if the logger has collected information. Tap **Settings** to change or archive datasets using a Dropbox account, and to change the how the instrument synchronizes its clock time. You can choose **Local time**, **UTC time**, or not to synchronize time at all, **Don`t sync**.

17.5.3 Instrument

When viewing the information from the logger, in Instrument view, you can see the status of the logger (indicating whether it is logging data or not and how many samples it has taken), as well as the ability to view the dataset, and what type of deployment method is currently being used. For example, under Deployment, a sampling rate of 6 Hz is configured. You can easily sample at different rates when you touch **Sampling Rate** under **Deployment**.

Instrument	Explanation
STATUS	The logger's state and how many samples it currently has logged.
DATASET	Tap **View Dataset** to view the measured data on the data logger. When you first start the logger, it will show *Synchronizing* and a progress bar appears - during this process the logger downloads the stored data. This occurs each time you connect to the logger. You may also see **No dataset** for a few seconds as the logger starts up. This is normal.
DEPLOYMENT	The current **Sampling rate** is displayed. To change the sampling rate stop the logger and Tap **Sampling Rate** to configure a different sampling rate. Under Sampling Rate, when the logger is stopped, the following appears: *Twist activation has been selected on this logger via Ruskin Desktop*. This indicates that twist activation is currently enabled on the logger.
START	Tap to enable the logger. A warning appears, *Enabling the instrument will erase all data on the instrument*. Tap **Erase** to continue. The logger may be paused if Twist is Off and will not sample. Twist the logger On to start sampling.
STOP	Tap to stop sampling. A warning appears, *Are you sure to want to stop the current deployment?*. Tap **Stop** to stop the logger.
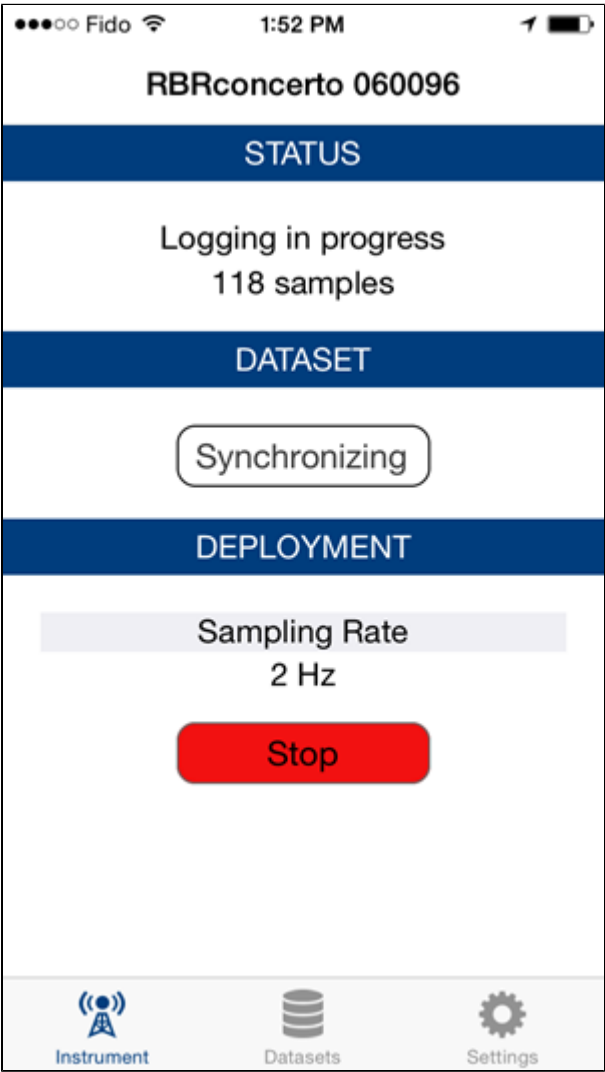
Logger sampling (Twist mode on)
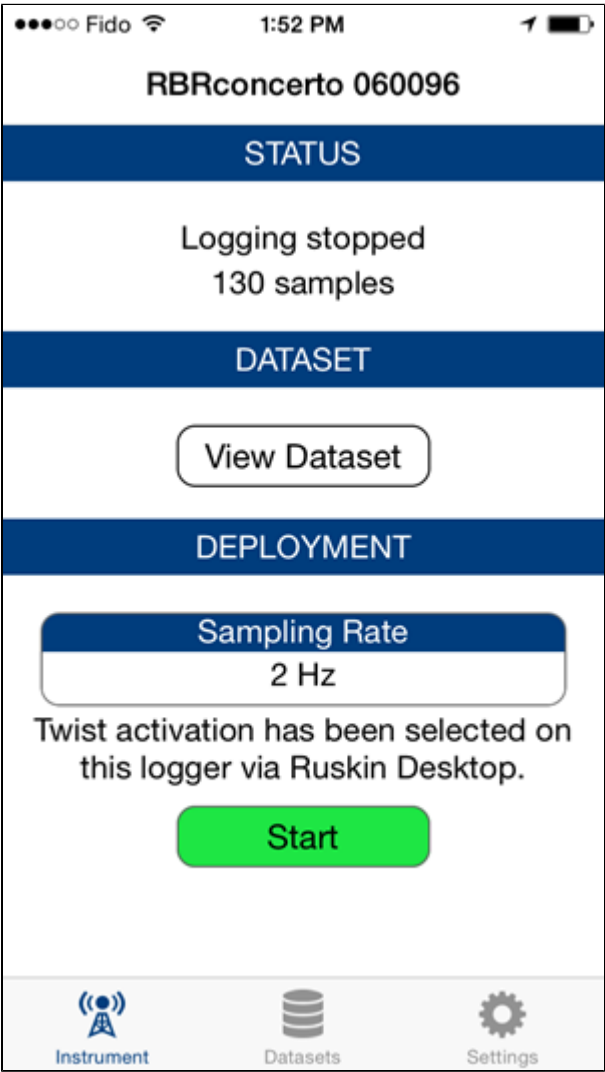
Logger stopped
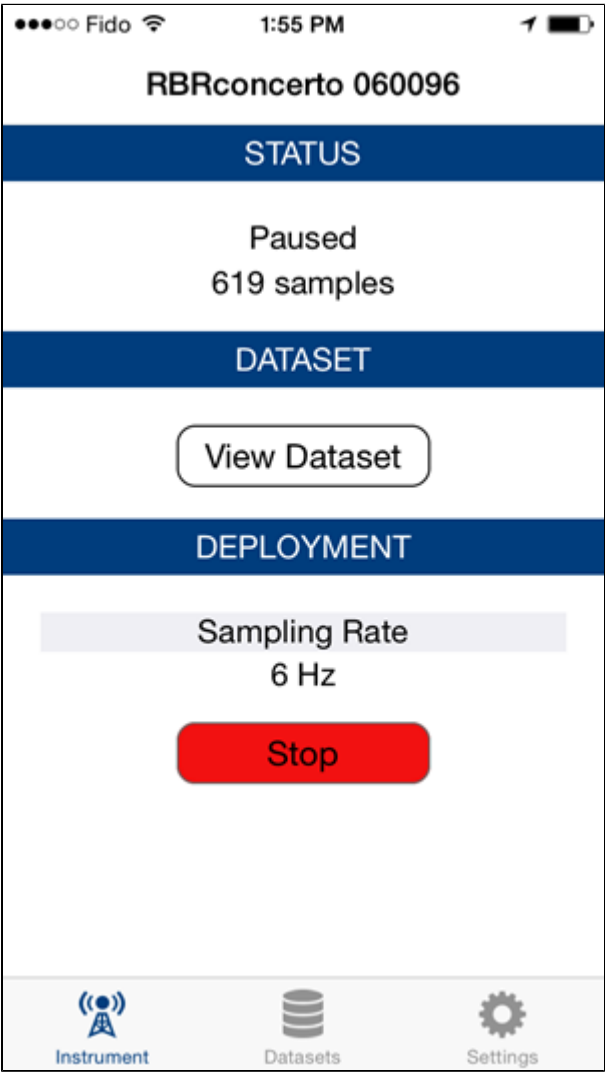
Logger Paused (Twist mode off)

17.5.4 Accessing other datasets

You can view datasets currently local on your device (you cannot see datasets archived in your Dropbox) from within the Ruskin app. When you tap Datasets (located at the bottom of Ruskin App), a list of datasets are displayed.

| Datasets	Explanation
Datasets	Lists all datasets available locally from the iOS device. Tap a dataset to view its information.

| Datasets	Explanation
	If you have an account for Dropbox, you can see the list of archived datasets. If you want to archive datasets tap **Archive**.
Archive	Tap Archive to move the local data to Dropbox. While connected to the logger WiFi, Archive is grayed out. When you Archive, all the datasets are archived and can no longer be viewed in the App.
Details	Tap to view the instrument information and the deployment information for the dataset. You can use pan and zoom gestures inside the **Plot** view.
Vertical and Horizontal view	It may be easier to view the dataset's information by turning your iOS device horizontally. Datasets display as a time series horizontally and as profiles vertically.
Zooming and scrolling	Use the same zooming and scrolling gestures you would use in any other app.
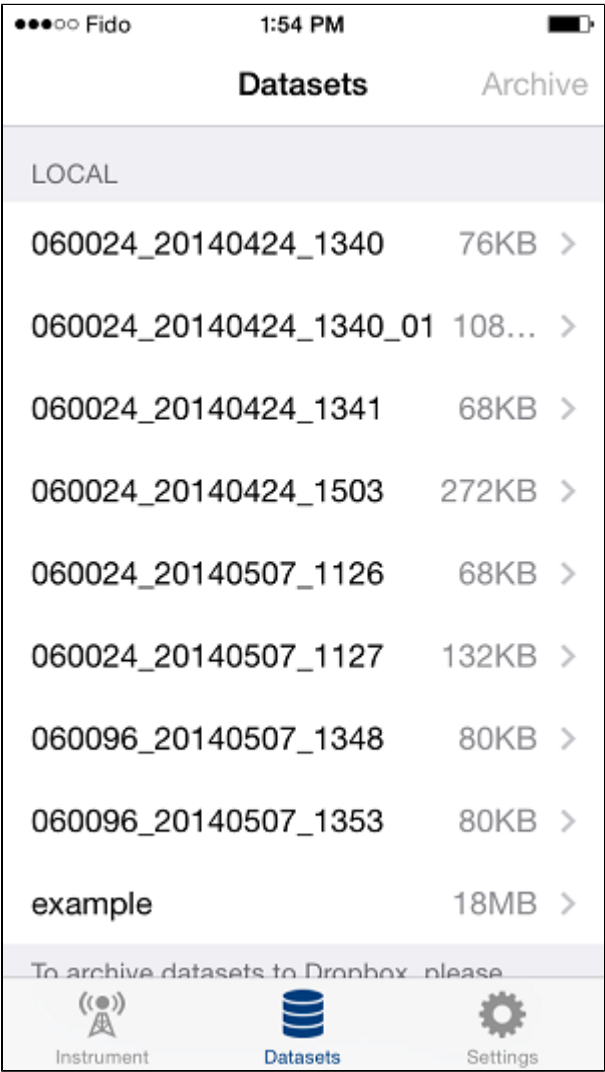
Datasets
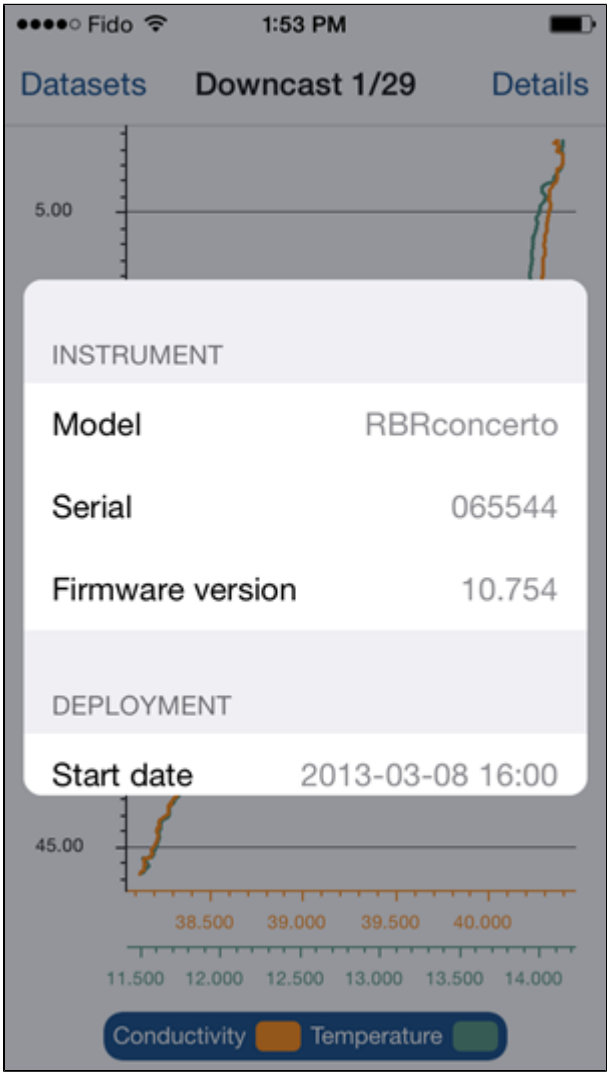
Details
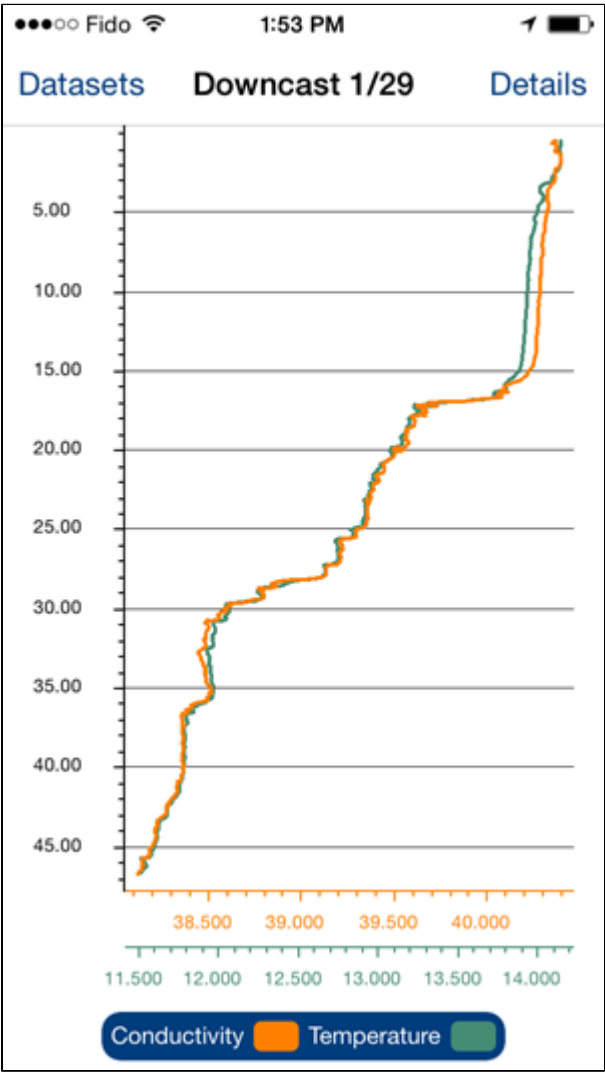
Profile
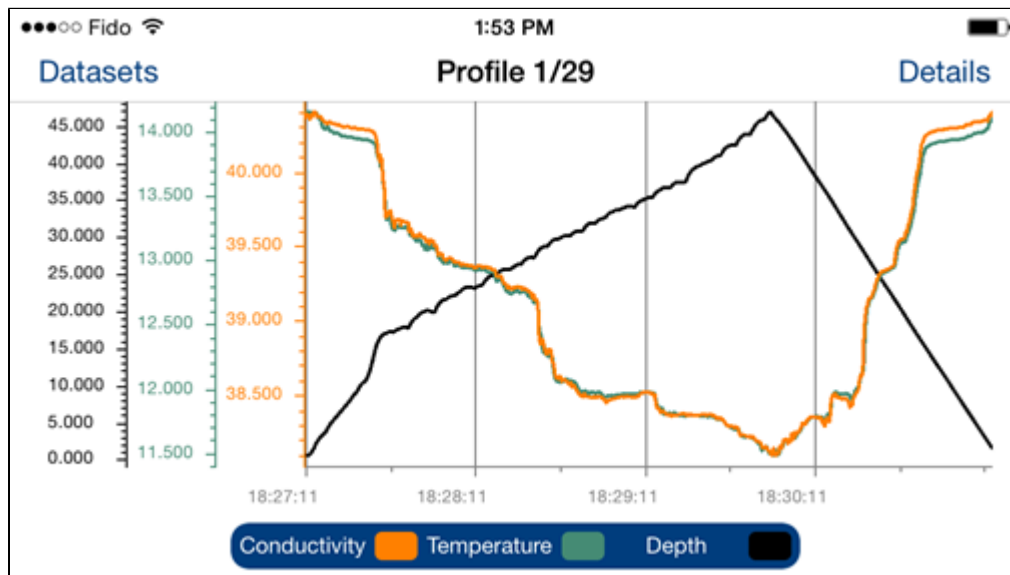
Time series

17.5.5 Settings

From **Settings**, you can access your Dropbox account or accounts, and synchronize the time for the instrument itself. Tap **Account** to connect/disconnect a Dropbox account. Tap **Clock sync** to change the time to either **Local time**, **UTC time** or **Don't sync**.
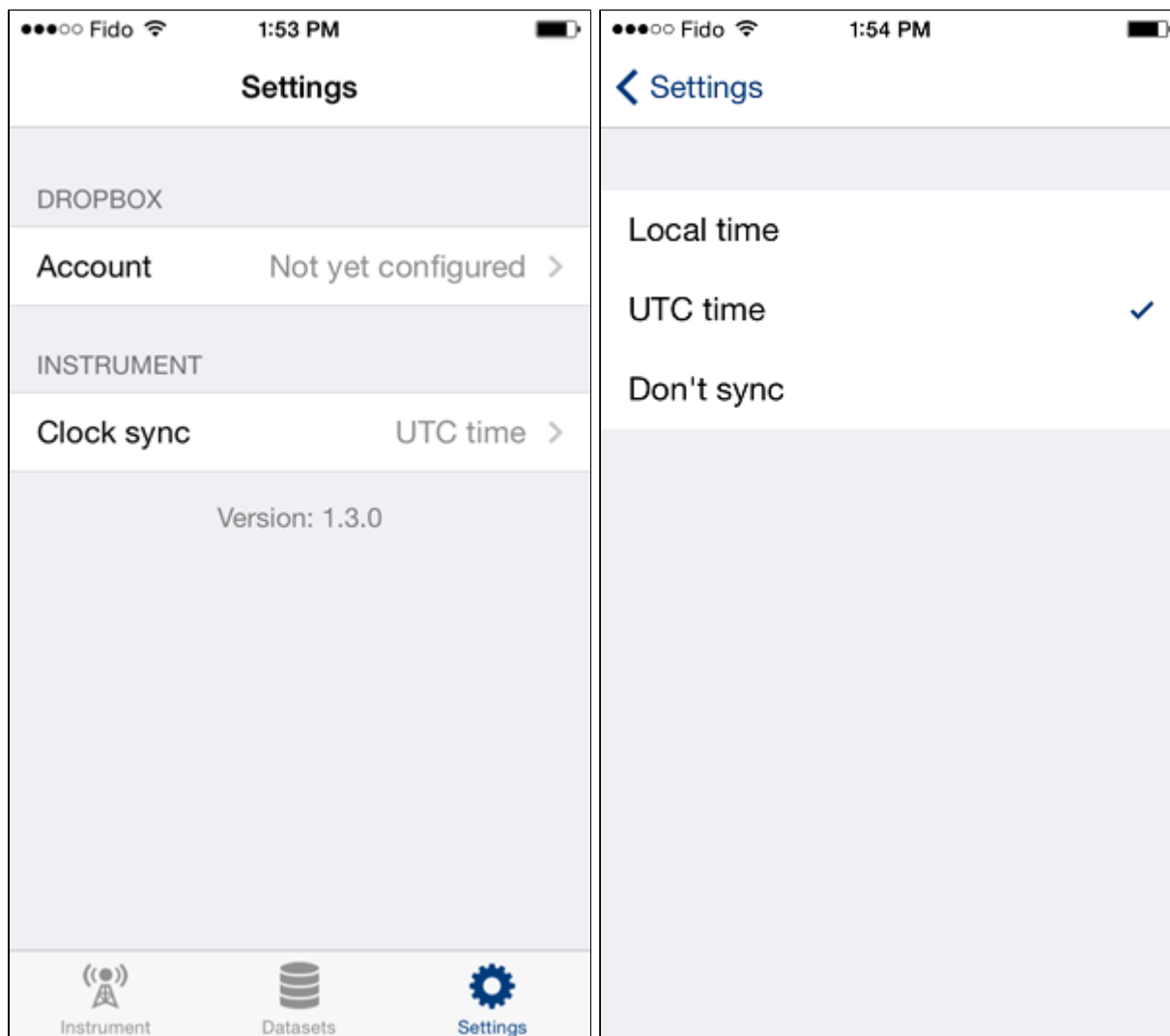
⊙ When you Start sampling from the iOS device the clock time in the logger is based on Clock sync settings. Select Don't sync if you don't want to change the original setting.