

Profilers **Samplers** Flotation



mclanelabs.com

Remote Access Sampler & McLanePro User Manual

2023 McLane Research Laboratories, Inc., Rev.23.G.06

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Included with the RAS

A new Remote Access Sampler (RAS) includes a USB drive that contains the User Manual and [McLanePro](#), the graphical user interface for samplers built with McLane Research Labs' Gen3 electronics. Each RAS also includes a toolkit. The toolkit and contents are referred to throughout this User Guide, and should remain with the instrument at all times.



The toolkit pictured is only an example.

Actual toolkit contents may vary and are subject to change without notice.

Contact McLane

TELEPHONE SUPPORT	+1 508.495.4000
FAX	+1 508.495.3333
SKYPE	MCLANE_RESEARCH
EMAIL	MCLANE@MCLANELABS.COM
WEBSITE	www.mclanelabs.com
Mailing Address	McLANE RESEARCH LABS 121 Bernard E. Saint Jean Drive, East Falmouth, MA 02536 USA

When contacting McLane for technical support, please provide the following:

- Firmware version and [instrument serial number](#).
- Problem description including files from the onboard MicroSD card, if possible.

Contact mclane@mclanelabs.com with questions about retrieving files.

McLane Research Laboratories is on the Web at <http://www.mclanelabs.com> or via email at mclane@mclanelabs.com.

The [RAS pages](#) on the McLane website contain links to documentation including Technical Bulletins, and papers that describe the development and use of the RAS.

Printable User Manual

Check the [RAS User Manual page](#) on the McLane website for updates and a downloadable RAS & McLanePro User Manual.

Training Videos

McLane has several training videos relating to the RAS. These videos are included on the USB drive that ships with a new sampler and can also be downloaded from the McLane website <https://mclanelabs.com/ras-videos/>

A description of each video and content is provided below for reference.

Video	Content
Battery Replacement with Drop-in Battery Holder	Shows user replaceable 'D' cell alkaline batteries installation in the RAS.
Replacing O-rings	Provides the steps to clean and install O-rings.

Serial Number

A McLane instrument serial number begins with 'ML' followed by five numbers and a dash (-) with two more numbers.

Example: ML12345-01

This information is located in multiple places:

- On a label attached to the controller housing
- On a label on the pump assembly
- Programmed into the electronics and reflected on the McLanePro main display.

The screenshot displays the McLanePro software interface. At the top, the 'McLanePro' logo is on the left, and 'Port COM4' with a 'Refresh' button is on the right. Below this, a status bar shows 'Connected' and 'Disconnect' buttons. The main interface area includes a 'Device' section with 'Remote Access Sampler - [RAS]' and a 'Serial#' field containing '15535-01', which is highlighted with a red rectangle. Other fields include 'Firmware 1.12.11 - [DO NOT Release!]', 'Instrument Date Mar/27/2023', and 'Instrument Time 07:47:29'. A navigation menu below the status bar includes 'Schedule', 'Deployment', 'Offload', 'Manual Operation', 'Admin', 'SD Card', and 'Configuration'. Under 'Deployment', there are buttons for 'Edit Schedule', 'Export', and 'Import'. The 'Deployment Parameters' section contains input fields for 'Available sample ports' (48) and 'Number of events' (48), along with 'Start/Interval' options and a 'Start Date/Time' field set to 'Mar/24/2023 - 11:45:00'. The 'Deployment Event Parameters' section includes an 'Edit Event' dropdown set to 'All Events' and a 'Populate Events' button. Below this, there are three event types: 'Water Flush', 'Sample', and 'Antifouling Flush'. Each event type has a table of parameters:

Event Type	Volume (mL)	Flow Rate (mL/Min)	Min. Flow Rate (mL/Min)
Water Flush	100	125	20
Sample	500	75	20
Antifouling Flush	10	75	20

 The 'Antifouling Flush' section also includes a radio button selection for 'Pre-Sample' (selected) and 'Post-Sample', and an 'Antifouling Soak Time' field set to 1 minute.

McLanePro Introduction

McLanePro is the graphical user interface for samplers built with McLane Research Labs' Gen3 electronics. This section outlines the features and functionality of McLanePro. This information will help with using McLanePro to operate McLane samplers.

McLanePro Introduction topics

[Install McLanePro](#)

[Connecting Battery Power](#)

[Closing the Controller Housing](#)

[Connecting to the RAS](#)

[Setting the Instrument Clock](#)

[The Schedule Tab](#)

[The Deployment Tab](#)

[The Offload Tab](#)

[The Manual Operation Tab](#)

[The Admin Tab](#)

[The SD Card Tab](#)

[The Configuration Tab](#)

[The Help Menu](#)

[The Activity Log](#)

[Offline Mode](#)

Install McLanePro

Installation

McLanePro can be downloaded from the "Software Utilities" section of the McLane website:

<https://mclanelabs.com/software-utilities/>

There will also be a version of McLanePro supplied on a USB drive, included in the toolkit.

Follow the installation wizard instructions to install the program.

McLanePro Updates

McLanePro will detect available updates and prompt the user for installation when starting up the program. Follow the update wizard instructions to install the latest version of McLanePro.

System Requirements

Operating System	Windows 10/11 - 32/64 bit
Disk Space	450 MB
Memory (RAM)	4GB

Connecting the Batteries

Follow these steps to load the drop-in battery holder and connect to the electronics. Always use caution when [opening and closing the controller electronics housing](#).

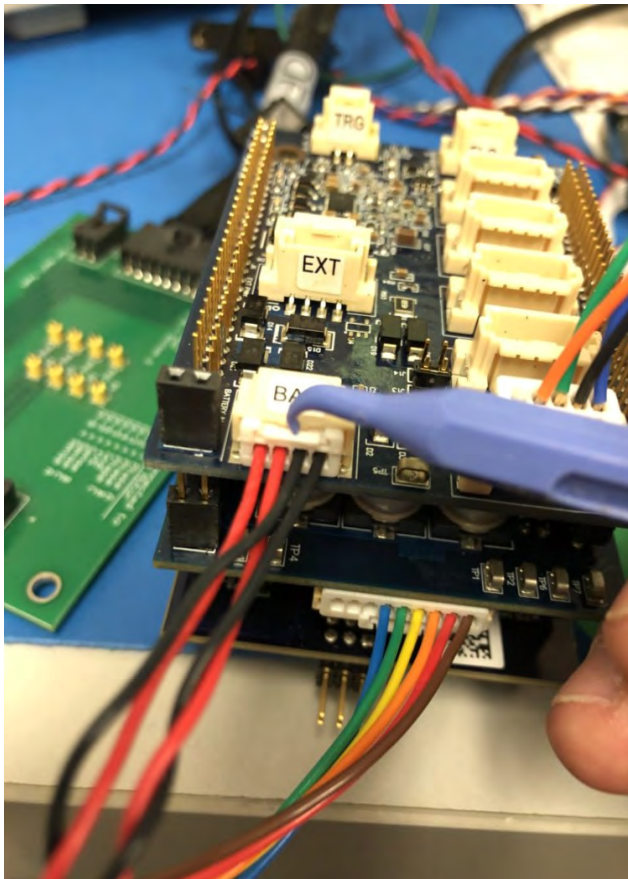
Related topics

[Opening the Controller Housing](#)

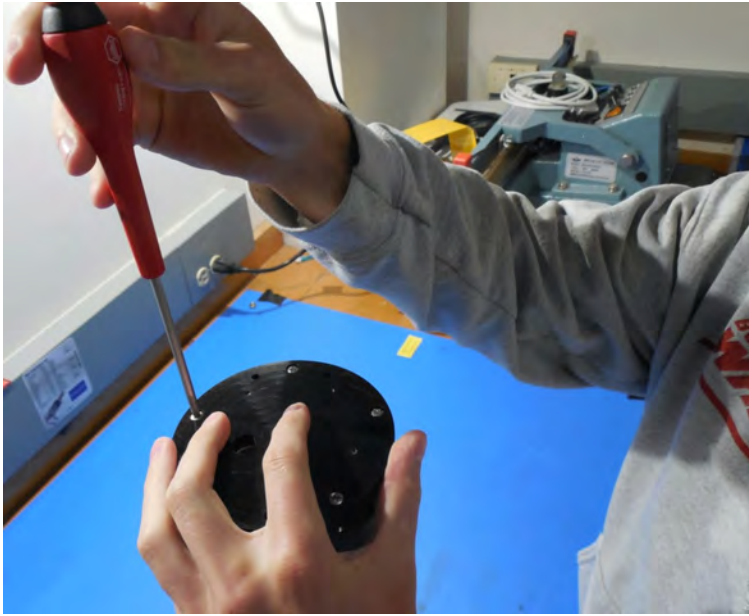
1. Open the controller housing, and remove the electronics, and top end cap from the controller housing tube.
2. Disconnect the battery connector from the electronics.



The battery connector uses a latch to secure the connection. Gently press on the tab to release the connector from the shell.



3. Remove the battery enclosure cap.



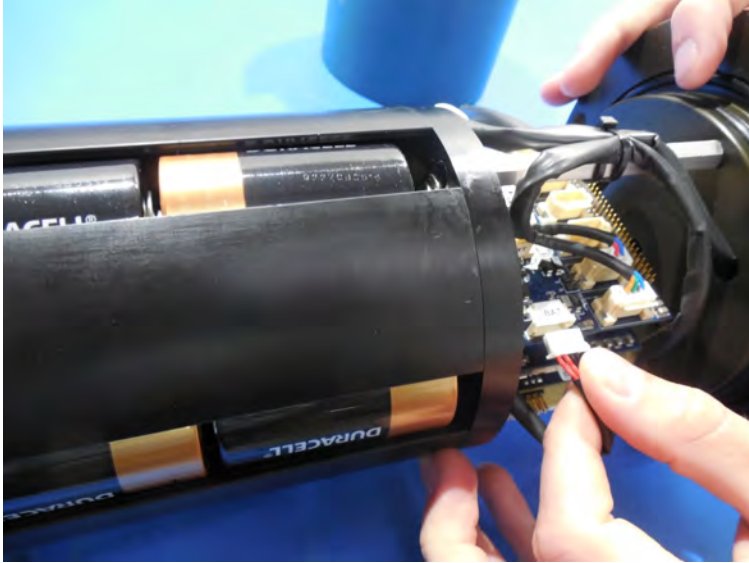
4. Load batteries into the battery holder observing correct polarity.

- A video that explains correct battery placement can be downloaded from the [RAS Videos](#) page on McLane's website.

5. Secure the battery enclosure cap.



6. Reconnect the batteries to the electronics.



Close the Controller Housing

It is important to ensure that the controller housing is sealed correctly before performing operations with the RAS. O-rings and sealing surfaces should be regularly cleaned with isopropyl alcohol. Inspect O-rings for signs of wear and the presence of any foreign material (which can cause leaks). Look for small cracks and feel for grit, sand, or hair. Lubricate with a thin coating of provided Parker O-Lube as necessary. The toolkit has spare O-rings, and additional O-rings may be purchased from McLane.



Keep hard objects such as tools or shackles away from the anodized controller housing. Scratches from these objects will localize galvanic action and can cause deep crevices or pitting.



Use caution to avoid scratching the O-rings, end cap, or the sealing surface of the vessel where the O-rings sit. Scratches could cause leaks.

Once the battery holder has been installed and connected to the RAS electronics:

1. Carefully inspect the O-rings on the end cap for any foreign material or residue. Clean with a lint-free wipe and lubricate as needed.
2. Carefully inspect the O-ring sealing surface on the controller housing tube. Wipe away old or excess lubricant and verify the gland is clean and clear of debris or scratches. Lubricate this surface with a thin film of Parker O-Lube.
3. Replace the internal desiccant, or verify that the desiccant is still absorbent.
4. Slide the controller and end cap into the controller housing, ensuring that the O-rings evenly enter the housing.
5. Gently push on the end cap so the O-rings are completely engaged in the housing and no gap remains between the housing tube and the end cap.
6. Rotate the end cap to align the end cap bolt holes with the controller housing tube.
7. Install the end cap hardware. Ensure that the bolt holes have plastic insulators installed before adding hardware.
8. Secure the end cap bolts and tighten enough that the split lock washers compress under the bolt heads. Be careful not to over-tighten.

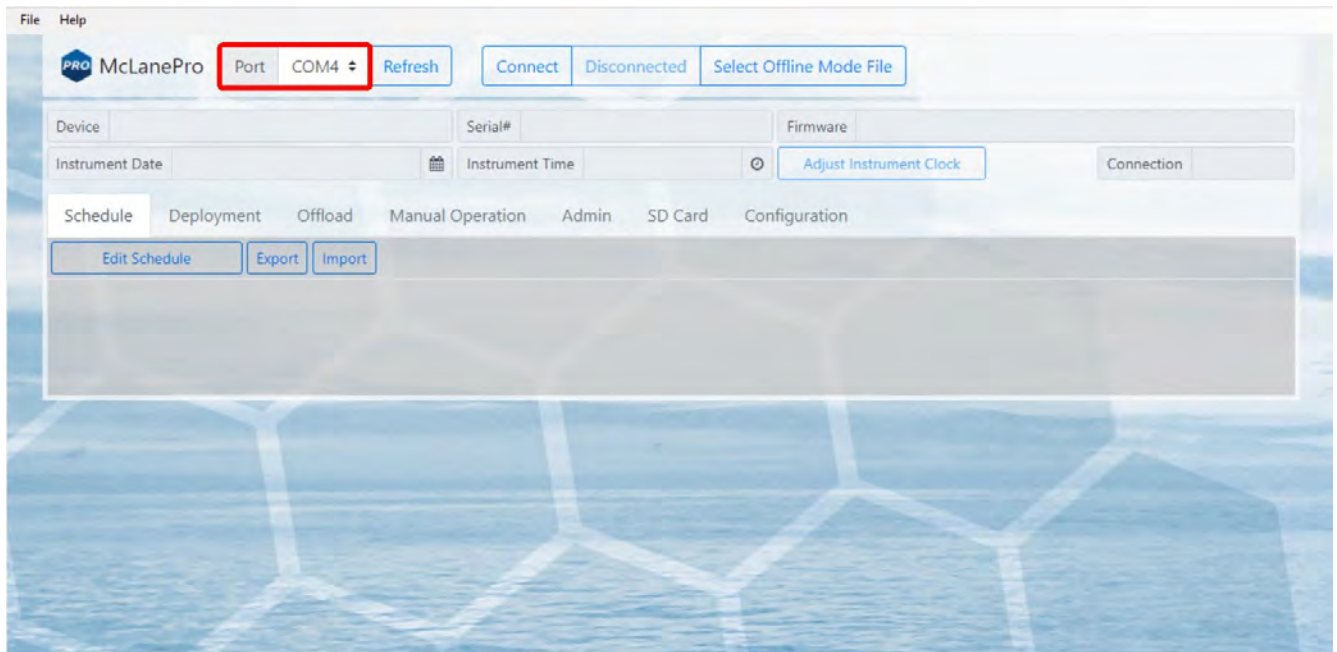
Connecting to the RAS

McLanePro is used to communicate with the RAS. McLane ships a USB cable that connects to the six pin communications connector on the housing end cap. A host computer provides the electronics with USB power, to communicate with the sampler. Battery power is required for operation of external hardware.

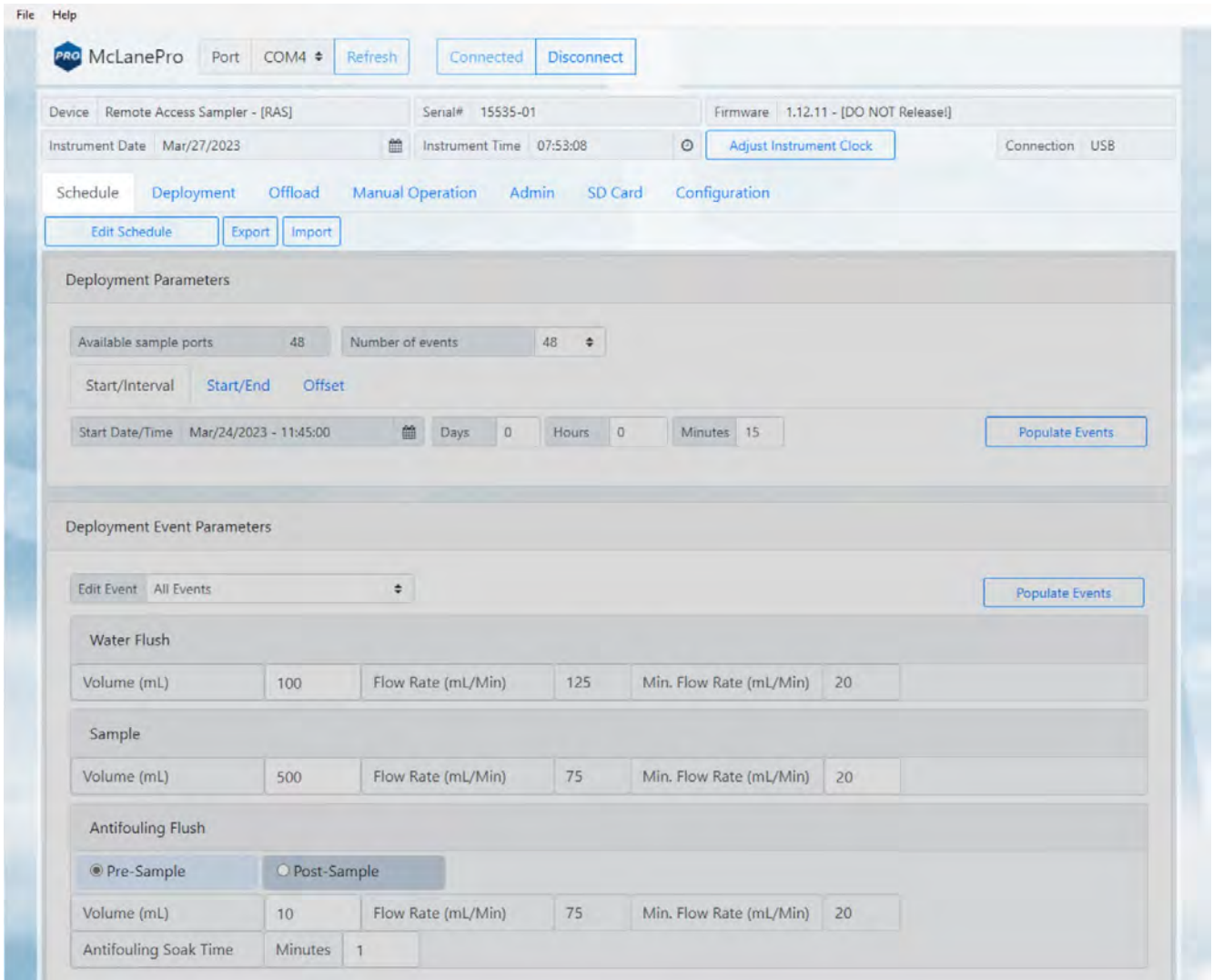


1. Remove the dummy plug from the communication port on the RAS.
2. Plug the USB COM cable onto the COM bulkhead of the RAS. It is important to always plug into the RAS before plugging into the computer.
3. Plug the USB COM cable into a USB port on the host computer.

4. After plugging the USB cable into the host computer, the host computer should recognize the USB connection as a virtual serial port.
5. Open McLanePro.
6. Find and select the communication (COM) port associated with the McLane RAS in the **Port** window.
7. Click **Connect**.

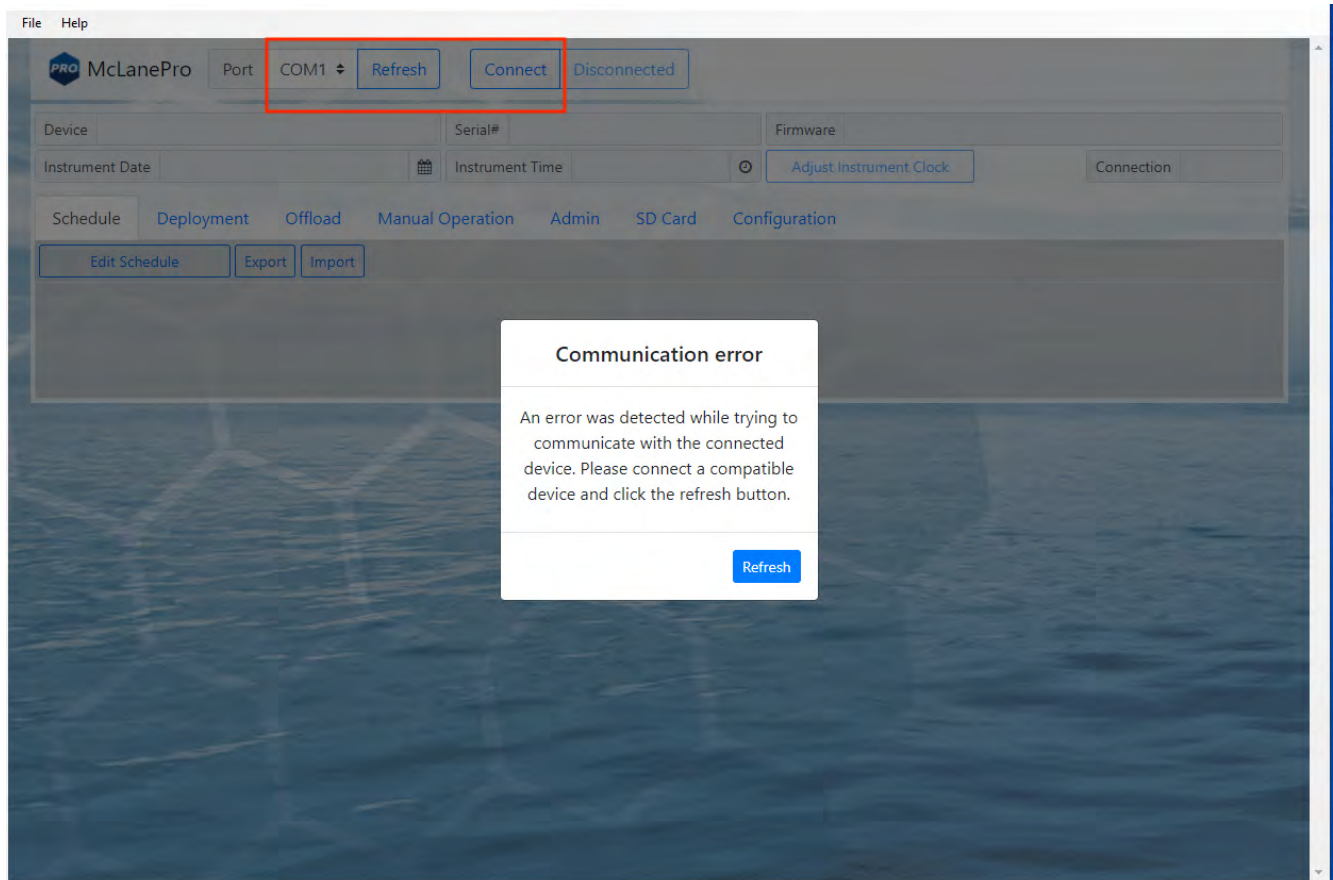


In the above example, the communication port associated with the RAS is COM 4. After successfully connecting to the RAS, McLanePro tabs will display data stored on the instrument such as the schedule (in this example).



Communication Error Message

If a communication error is displayed, click **Refresh** and select a different COM port from the drop-down menu.

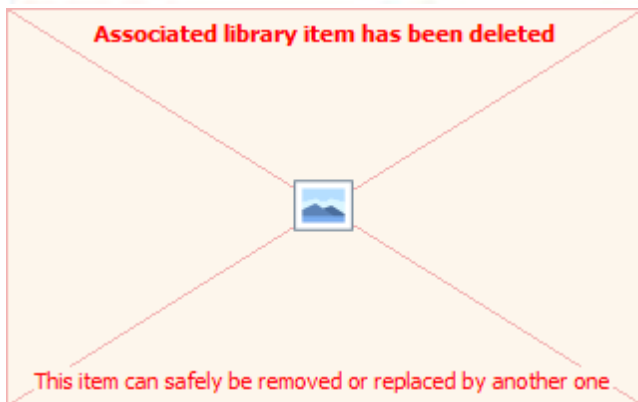
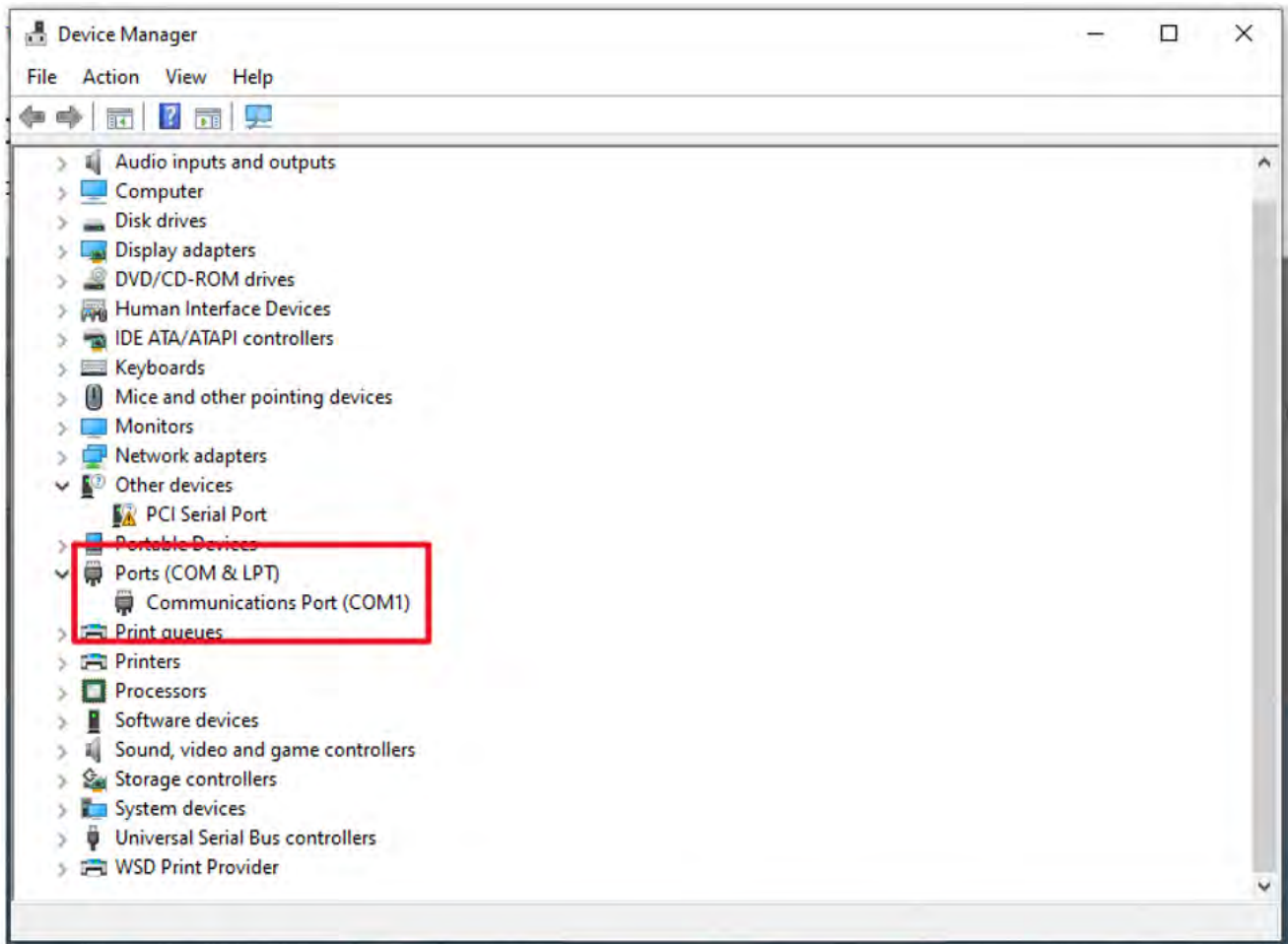


Communication Troubleshooting

If the computer has gone to sleep while connected to the device, McLanePro may need to be closed and reopened in order to reestablish communications.

If no communication ports are responding, or none are listed, check the available COM ports in the Windows Device Manager. Device Manager can be accessed by clicking the Windows start menu and typing "device manager".

Device Manager lists the available COM ports under "Ports."



When plugging and unplugging the device to/from the computer, a port should appear and/or disappear from the Device Manager list of ports. This indicates the COM port that should be selected in McLanePro and that the device should communicate on.

If no COM port appears when connecting to the device, power to the system may need to be reset. Schedule and deployment data will be retained through this process. Refer to the [Connecting the Batteries](#) section of this manual. Disconnect the battery and the USB connection, wait 30 seconds, and reconnect the battery.

If the device remains unresponsive, try disconnecting the device, restarting the computer, and

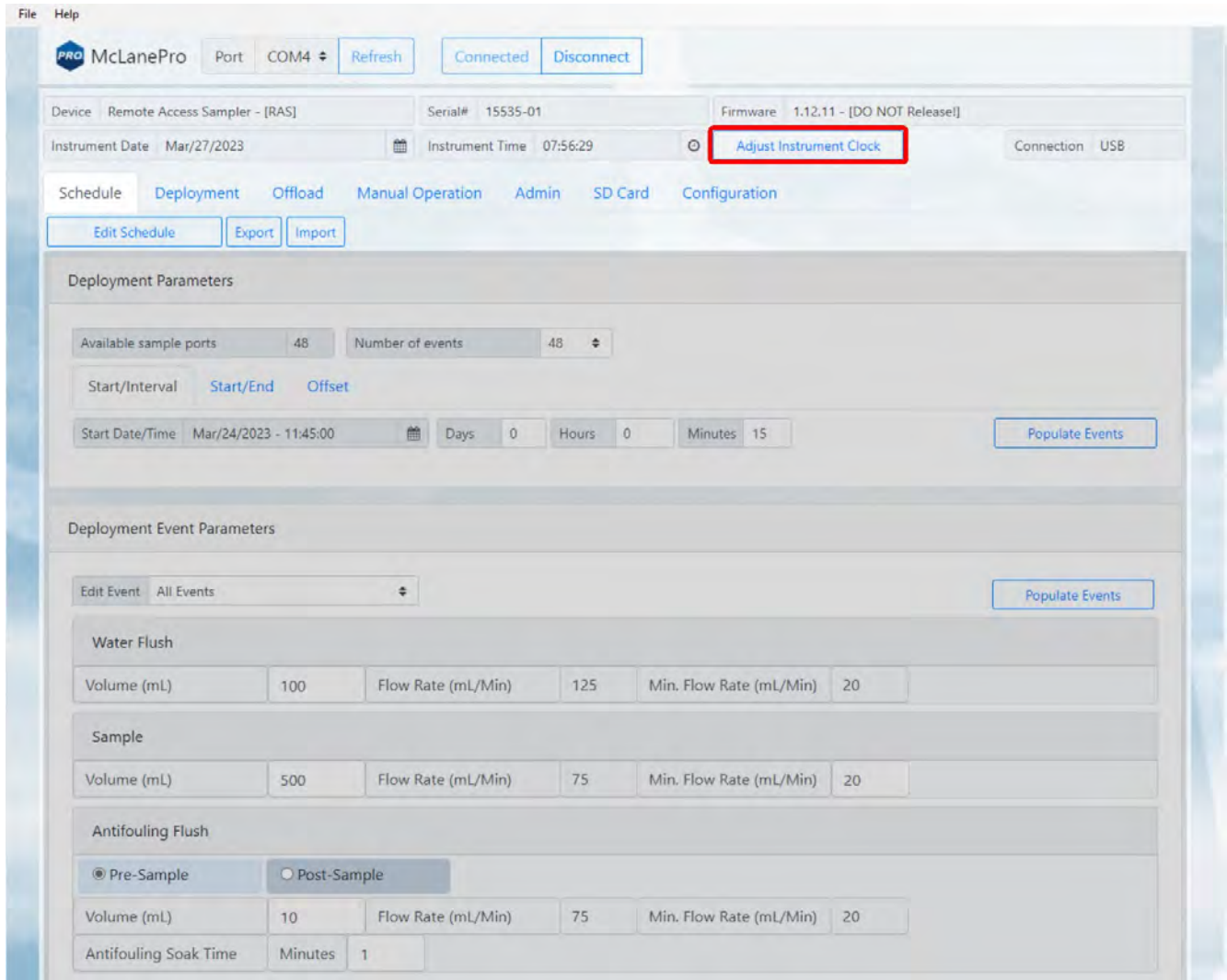
reconnecting.

In rare cases, some computers may have difficulty reliably recognizing the USB COM port and a different computer may be necessary to successfully communicate with the device.

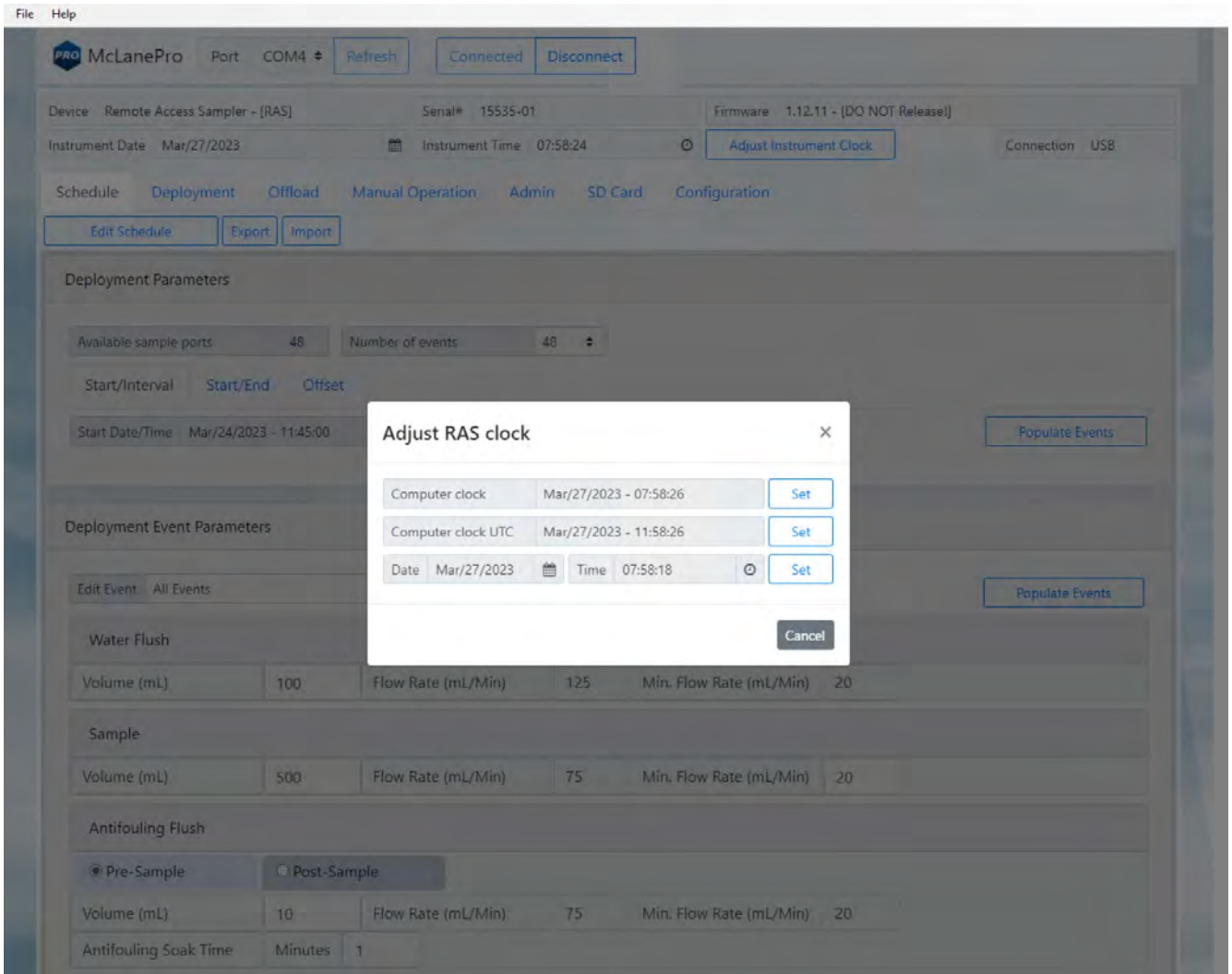
Setting the Instrument Clock

The instrument time is reset if both the USB COM cable and the batteries are disconnected. Always be sure to check the instrument time before deploying the system.

To set the instrument time press the **Adjust Instrument Clock** button.

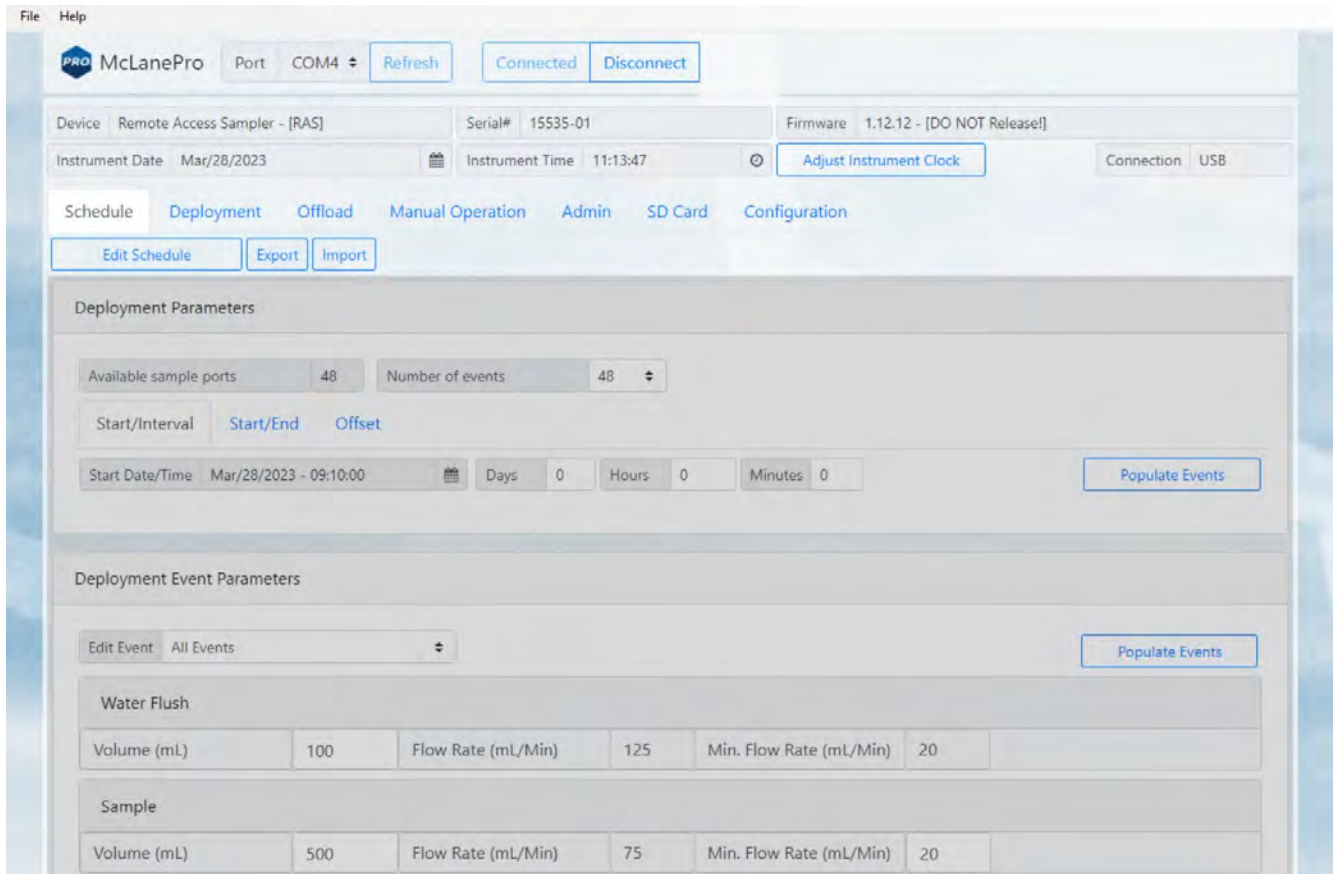


Click the **Set** button to set any of the available time values.



The Schedule Tab

The **Schedule** tab is used to define a deployment schedule before deploying the RAS. The RAS may collect up to 48 individual water samples per deployment.



Schedule a Deployment

Follow these steps to define a deployment.

Before scheduling and deploying the RAS, make sure the instrument time is set!

1. Click the **Schedule** tab.
2. Click the **Edit Schedule** button.
3. Under *Deployment Parameters*, the available sample ports value is displayed.
4. Set the number of sampling events using the *Number of events* box. The number of events can not be set higher than the number of available sample ports.
5. Define a deployment schedule using **Start/Interval**, **Start/End**, or **Offset**.
 1. **Start/Interval** - define a start date for the deployment and an interval to wait between

each of the sample collection events.

2. **Start/End** - the start/end tab allows for scheduling a deployment according to a fixed start time and end time. Events will be scheduled at regular intervals between these two dates and times. The final event will start at the defined end date.
3. **Offset** - apply an offset to all scheduled events. This allows using a pre-programmed schedule as a starting point and applies a time offset to all events.

6. Click the **Start/Interval** tab.

The screenshot shows the McLanePro software interface. At the top, there's a menu bar with 'File' and 'Help'. Below that, the 'McLanePro' logo is visible along with 'Port COM4', 'Refresh', 'Connected', and 'Disconnect' buttons. The main area is divided into several sections:

- Device Information:** Remote Access Sampler - [RAS], Serial# 15535-01, Firmware 1.12.12 - [DO NOT Release!]
- Instrument Date:** Mar/28/2023, Instrument Time 10:45:27, Adjust Instrument Clock button, Connection USB
- Navigation Tabs:** Schedule, Deployment, Offload, Manual Operation, Admin, SD Card, Configuration
- Deployment Parameters:**
 - Available sample ports: 48
 - Number of events: 8
 - Start/Interval (highlighted with a red box), Start/End, Offset
 - Start Date/Time: Mar/28/2023 - 09:10:00, Days: 0, Hours: 0, Minutes: 10
 - Populate Events button
- Deployment Event Parameters:**
 - Edit Event: All Events
 - Populate Events button
 - Water Flush:** Volume (mL): 100, Flow Rate (mL/Min): 125, Min. Flow Rate (mL/Min): 20
 - Sample:** Volume (mL): 494, Flow Rate (mL/Min): 75, Min. Flow Rate (mL/Min): 20
 - Fixative Flush:** Volume (mL): 0, Flow Rate (mL/Min): 75, Min. Flow Rate (mL/Min): 20
 - Incubation Period:** Days: 0, Hours: 0, Minutes: 2
 - Antifouling Flush

7. Click the calendar next to the **Start Date/Time** field to select a start time for the deployment.
8. Click **Populate Events** to apply the schedule to the deployment events.
9. Fill in the deployment parameters:

- *Water Flush*

- **Water flush volume** - set the target volume of water that will be pumped at the home port prior to collecting a sample.
- **Water flush flow rate** - (fixed) define the target flow rate for the water flush procedure.
- **Water flush minimum flow rate** - (fixed) define the minimum acceptable flow rate for the water flush procedure. This setting defines when the event will terminate due to a decreasing flow rate.
 - *Sample*
- **Sample volume** - set the target volume of water that will be processed for a deployment event. Actual volume will depend on filter type, filter porosity and loading characteristics.
- **Sample flow rate** - (fixed) define the target flow rate for sample collection. Flow rate may be automatically adjusted lower if limited by filter loading or battery voltage at any time during the deployment.
- **Sample minimum flow rate** - (fixed) define the minimum acceptable flow rate. The RAS will adjust the flow rate to preserve material on the filter and to prevent damage to the filter or the system. This setting defines when the event will terminate due to a decreasing flow rate.
 - *Fixative (if equipped)*
- **Fixative flush volume** - set the target volume of fixative that will be applied to the filter after collecting a sample.
- **Fixative flush flow rate** - define the target flow rate for the fixative procedure.
- **Fixative flush minimum flow rate** - (fixed) define the minimum acceptable flow rate for the fixative procedure.
- **Incubation Period** - defines the time delay (incubation) between sample collection and application of fixative.
 - *Antifouling*
- **Antifouling flush type** (pre-sample or post-sample) - defines whether the antifouling procedure will be run before or after collecting a sample.
- **Antifouling flush volume** - define the target volume of antifouling fluid to be pumped during the antifouling procedure.

- **Antifouling flush flow rate** - (fixed) define the target flow rate for the antifouling procedure.
- **Antifouling flush minimum flow rate** - (fixed) define the minimum acceptable flow rate for the antifouling procedure.
- **Antifouling flush soak time** - if the antifouling procedure is programmed to run before sample collection (pre-sample), this value defines the time that the antifouling fluid will remain in the RAS plumbing prior to collecting a sample. Be aware that this time will delay the start of sample collection with regard to the event start time.

The screenshot shows the McLanePro software interface with the following configuration sections:

- Water Flush:** Volume (mL) 100, Flow Rate (mL/Min) 125, Min. Flow Rate (mL/Min) 20
- Sample:** Volume (mL) 494, Flow Rate (mL/Min) 75, Min. Flow Rate (mL/Min) 20
- Fixative Flush:** Volume (mL) 0, Flow Rate (mL/Min) 75, Min. Flow Rate (mL/Min) 20. Incubation Period: Days 0, Hours 0, Minutes 2.
- Antifouling Flush:** Pre-Sample (unselected), Post-Sample (selected). Volume (mL) 10, Flow Rate (mL/Min) 75, Min. Flow Rate (mL/Min) 20.

Below the configuration is a schedule table:

Event	Start Date / Time	Flush Volume (mL)	Sample Volume (mL)	Sample Min. Flow Rate (mL/min)	Incubation Period (D:H:M)	Fixative Flush Volume (mL)	Fixative Flow Rate (mL/min)	Antifouling Volume (mL)
1	03/28/2023 09:10:00	100	494	20	0:0:2	0	75	0
2	03/28/2023 09:20:00	100	500	20	0:0:2	20	75	10
3	03/28/2023 09:30:00	100	500	20	0:0:2	20	75	10
4	03/28/2023 09:40:00	100	500	20	0:0:2	20	75	10
5	03/28/2023 09:50:00	100	500	20	0:0:2	20	75	10

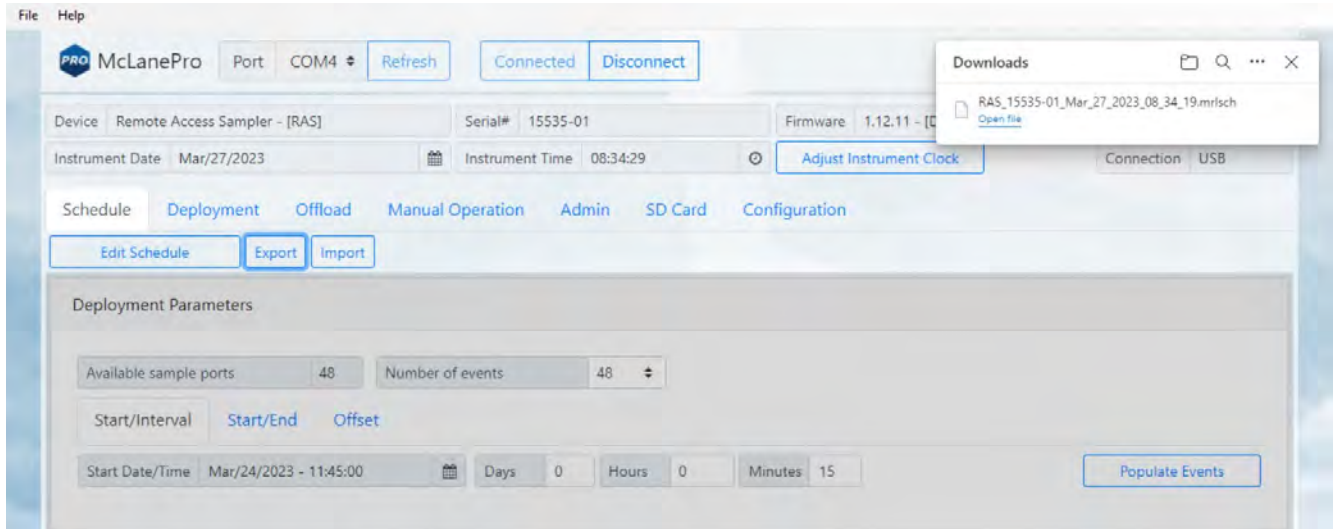
10. Click **Save changes**. The new settings are immediately applied to the RAS.

Exporting a Schedule

Schedules with start conditions may be saved locally by using the **Export** button. Exporting a schedule allows easy programming of multiple instruments, modification for later deployments or simply to keep

as a record (highly recommended).

1. Create a new schedule using **Edit Schedule**.
2. Set the deployment and event parameters.
3. Click **Save changes** to load that schedule onto the RAS.
4. Click **Export** to save the current schedule. The schedule is saved as a *.mrlsch file to a local directory on the host computer.



The current schedule will be automatically downloaded when deploying the RAS. This file is useful for reviewing the deployment parameters and schedule after disconnecting from the RAS.

Importing a Schedule

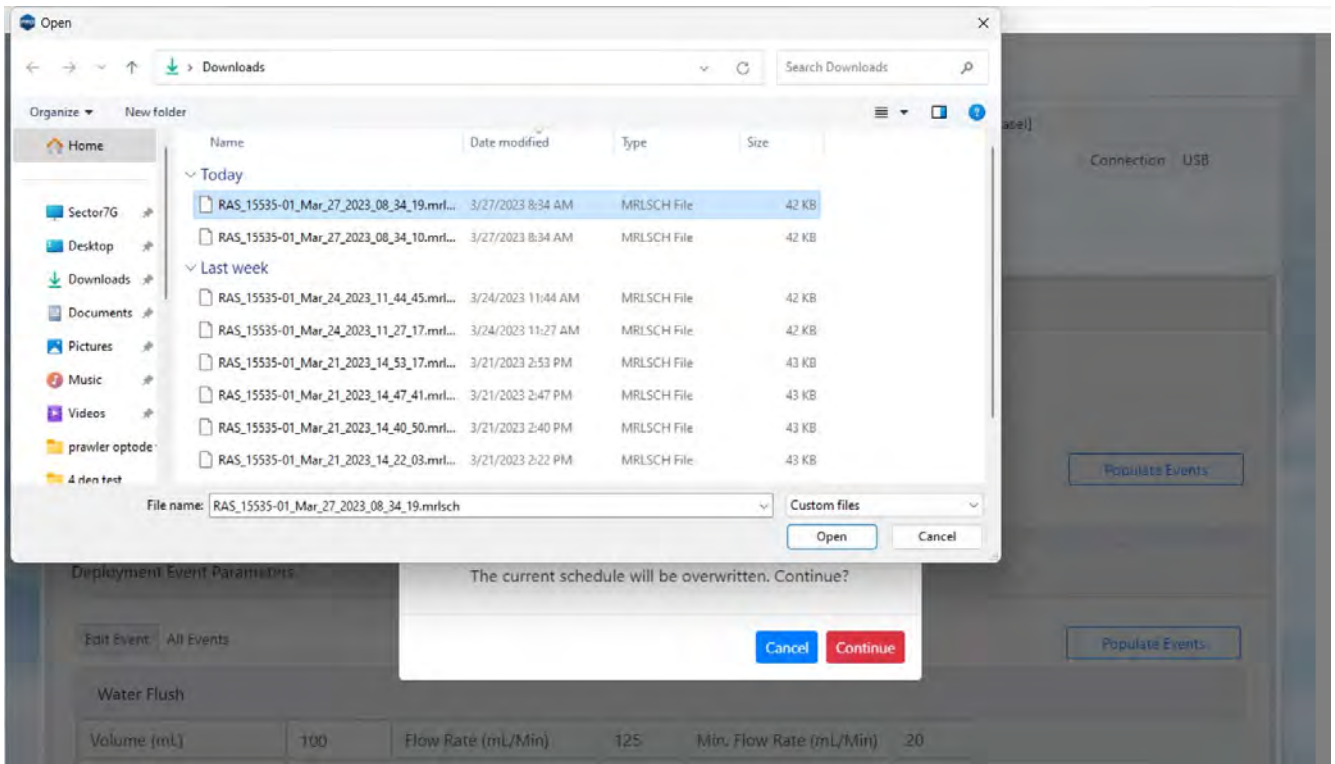
Schedules may be imported for deployment of multiple instruments or for modification and reuse.

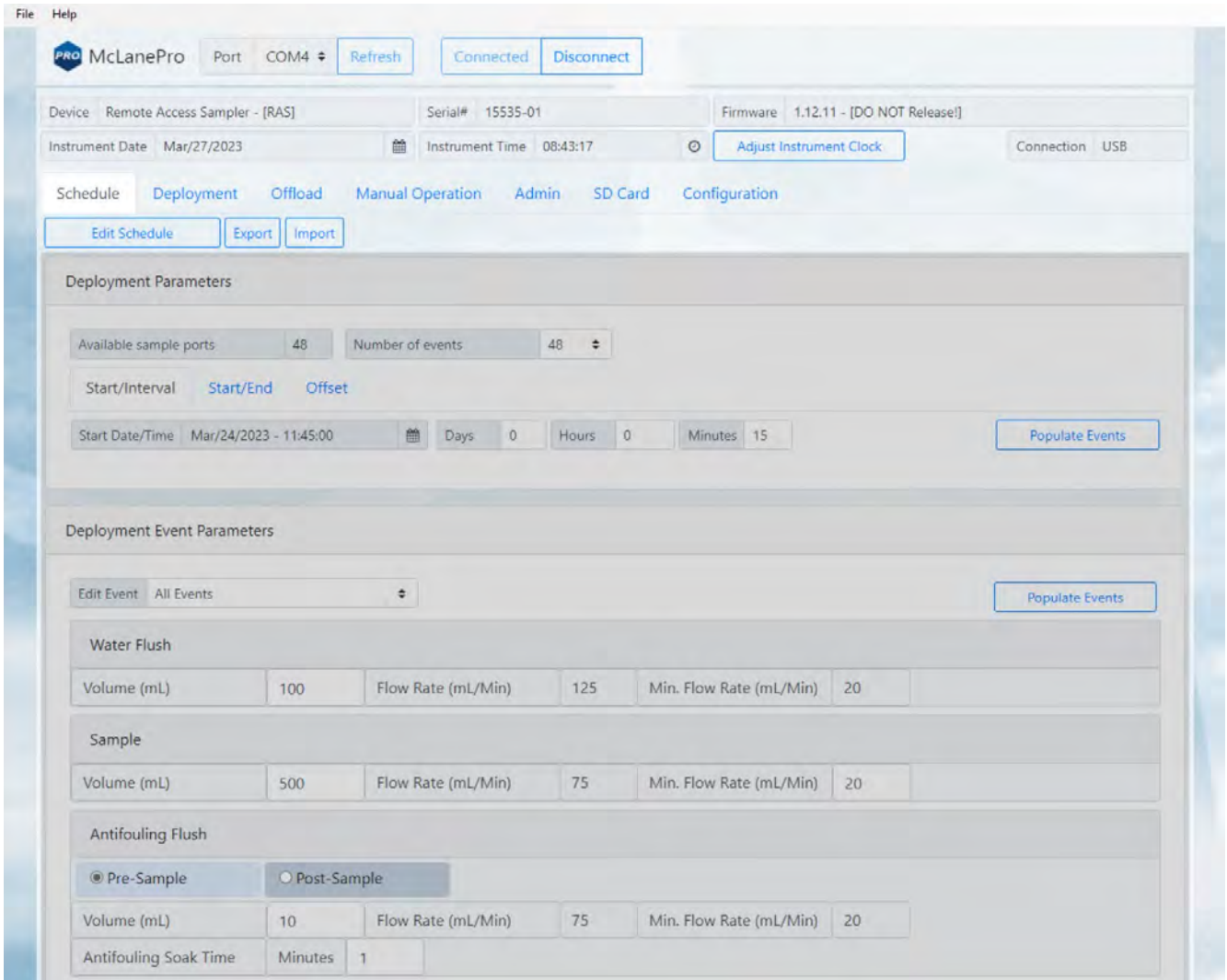
1. Click **Import** to import a saved schedule.
2. A window will open in order to select the schedule to be imported.
3. Select a schedule file and click **Open**.

The RAS will check the schedule to confirm it is compatible with the installed hardware, model number and/or configuration. If it is compatible, the scheduler will load and display new values.



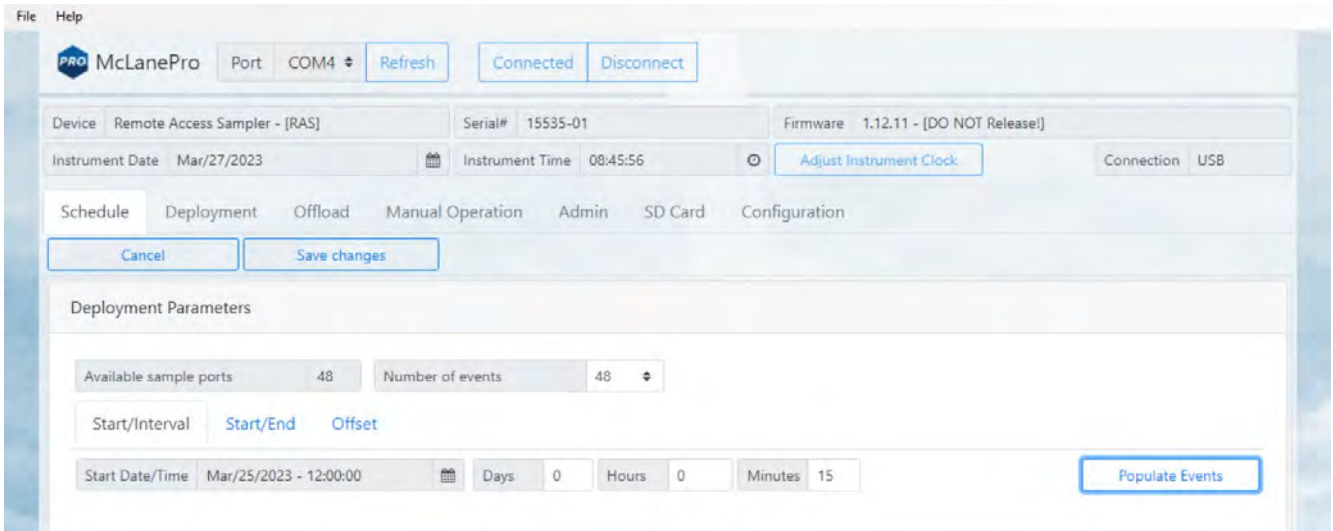
Importing a schedule immediately loads that schedule into memory on the RAS. This is the schedule that will be used when deploying the instrument. Always double check event times before proceeding to deployment preparation.



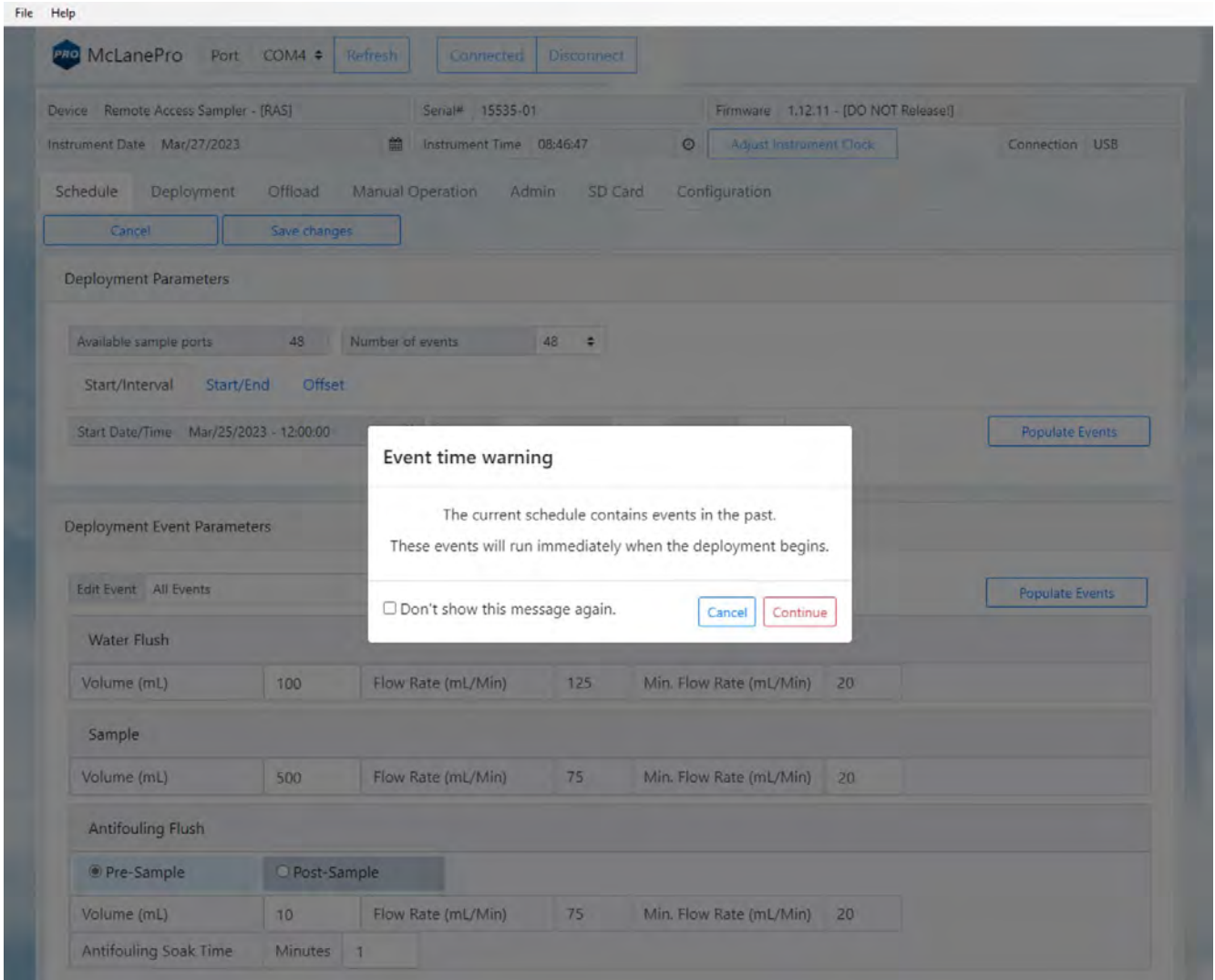


Schedule Errors

Schedules with errors (events in the past) will generate a warning when saving to the RAS.



The user can choose to ignore the warning and continue the schedule even if an event is in the past. These events will be run immediately when the deployment begins.



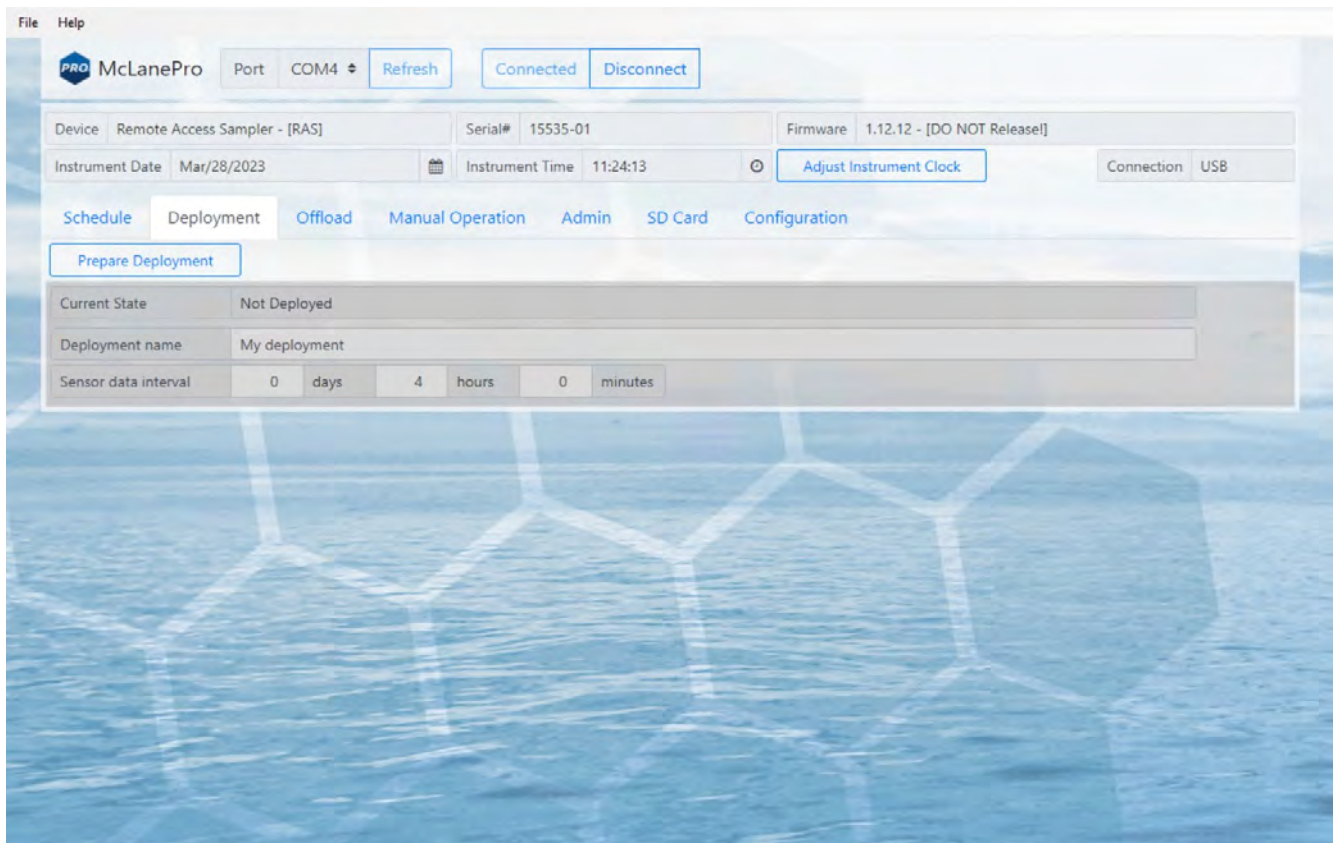
The Deployment Tab

The **Deployment** tab is used to:

- Prepare for a deployment.
- Start a deployment.
- Monitor a deployment (if connected via USB).

Related topic

[Starting a Deployment](#)



Starting a Deployment

Follow these steps to start a deployment using the current schedule.

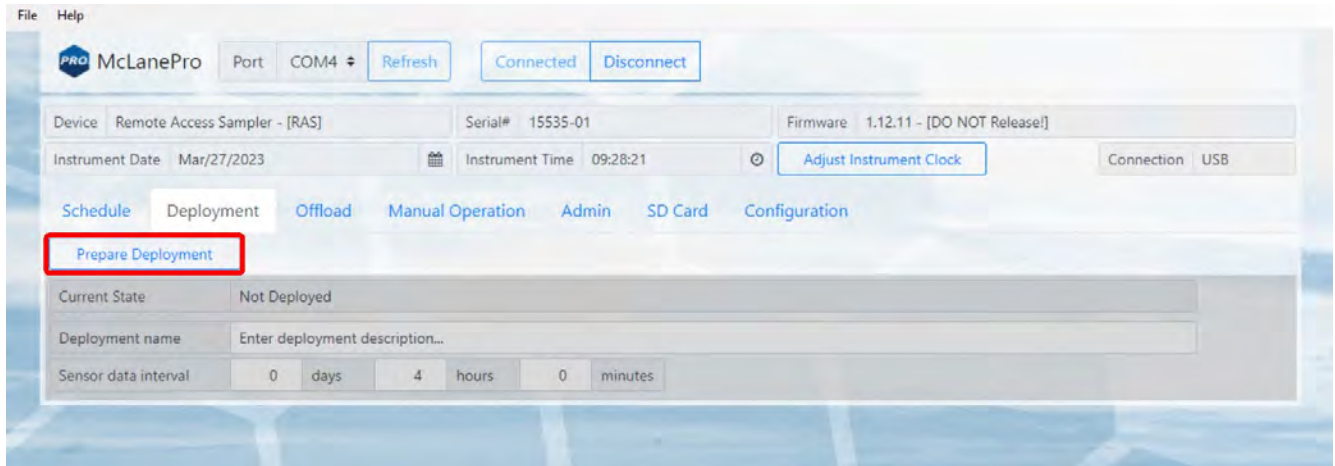
Before scheduling and deploying the RAS, make sure the instrument time is set!

Until the sampler is deployed, the **Deployment** tab contains only the **Prepare Deployment** option.

1. On the **Deployment** tab, click **Prepare Deployment**.

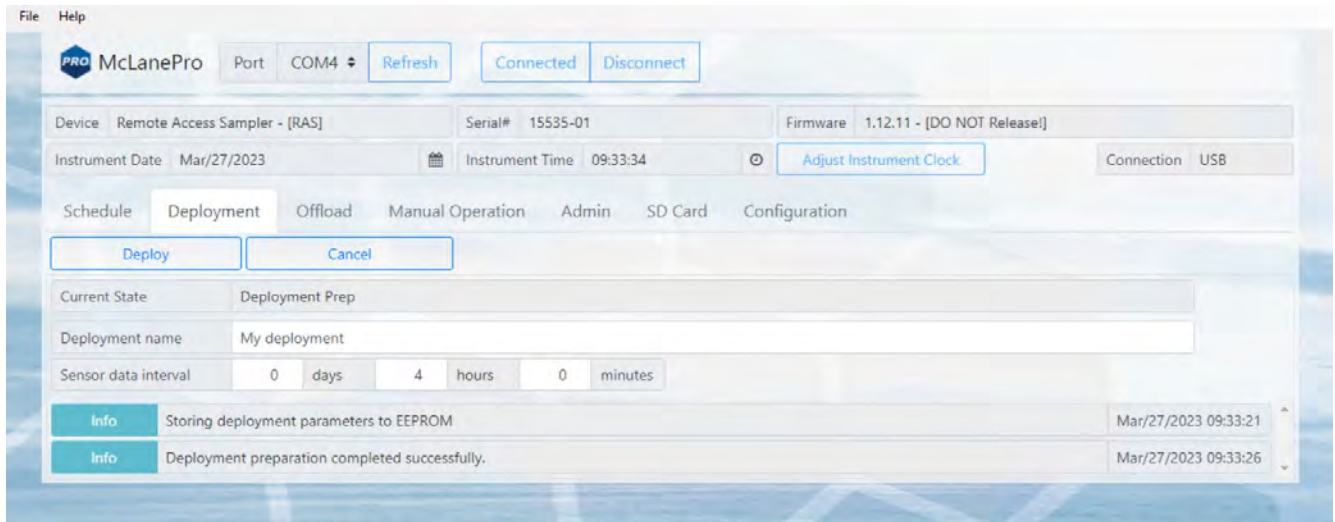
Prepare Deployment will run checks to make sure the RAS is ready for the deployment. If a problem is

detected, errors will be reported. The deployment will need to be canceled in order to fix the problems and attempt to deploy the RAS again. Warnings may also be generated at the time of deployment preparation, but do not prevent deployment.



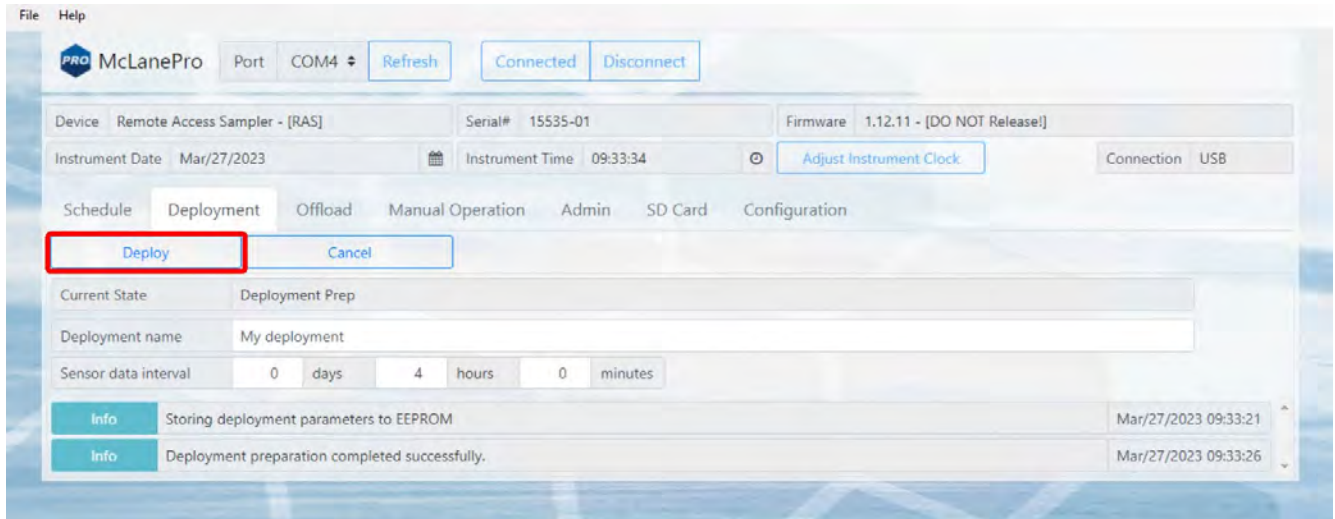
After passing checks, the RAS allows setting of the deployment name, and sensor data interval before deploying.

2. Enter a deployment name or description.



3. Define the sensor data interval. This is the interval at which the system sensors will be queried. Sensor data may include battery voltage and controller internal temperature.

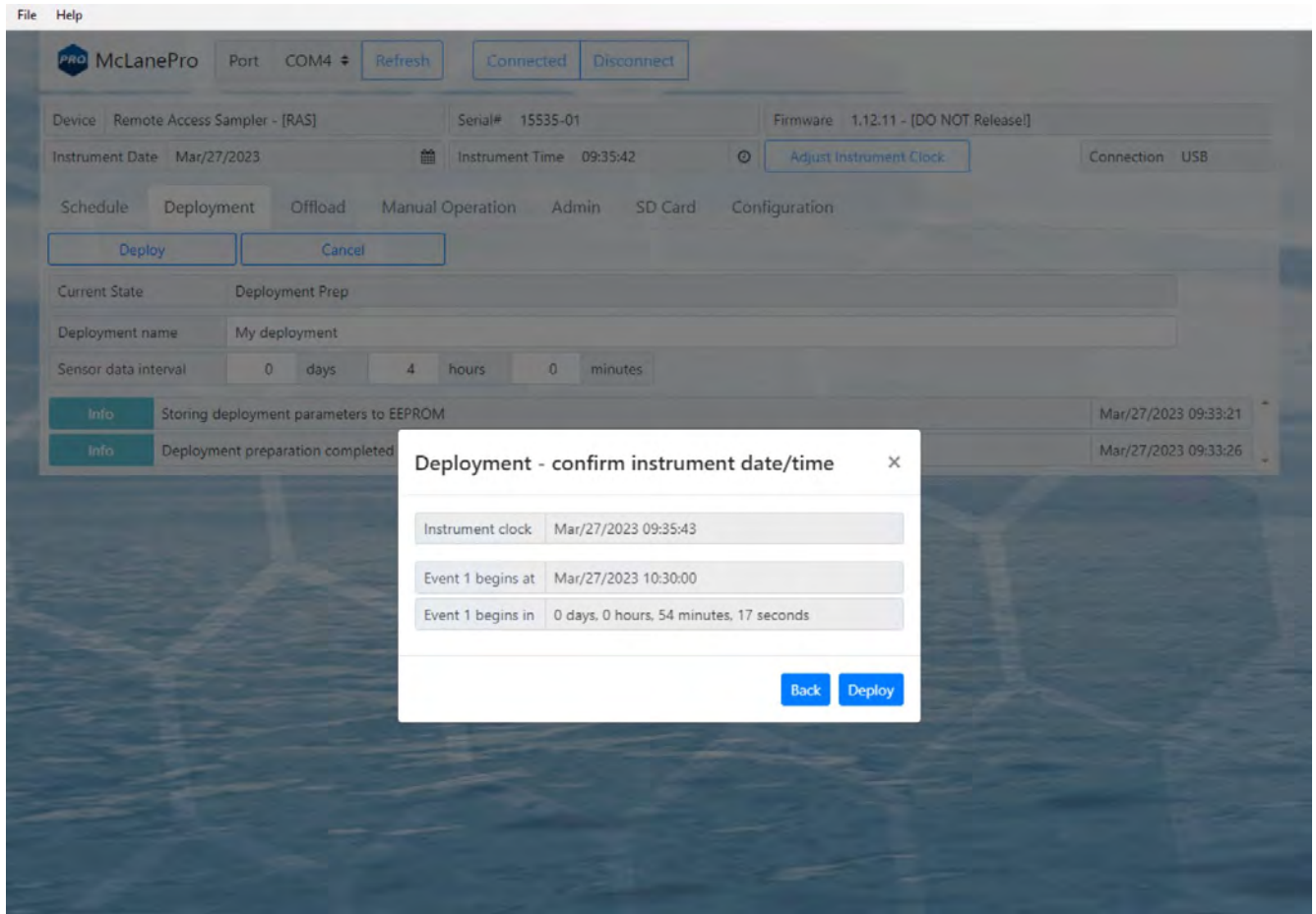
After setting the deployment name and defining the sensor data interval, the RAS may be deployed.



4. Click the **Deploy** button.

After clicking the **Deploy** button, McLanePro displays the scheduled time for the first event, the current time according to the instrument clock, and a countdown timer indicating the amount of time before the first event will start.

The RAS offers a final check of the current time and conditions for starting the deployment.

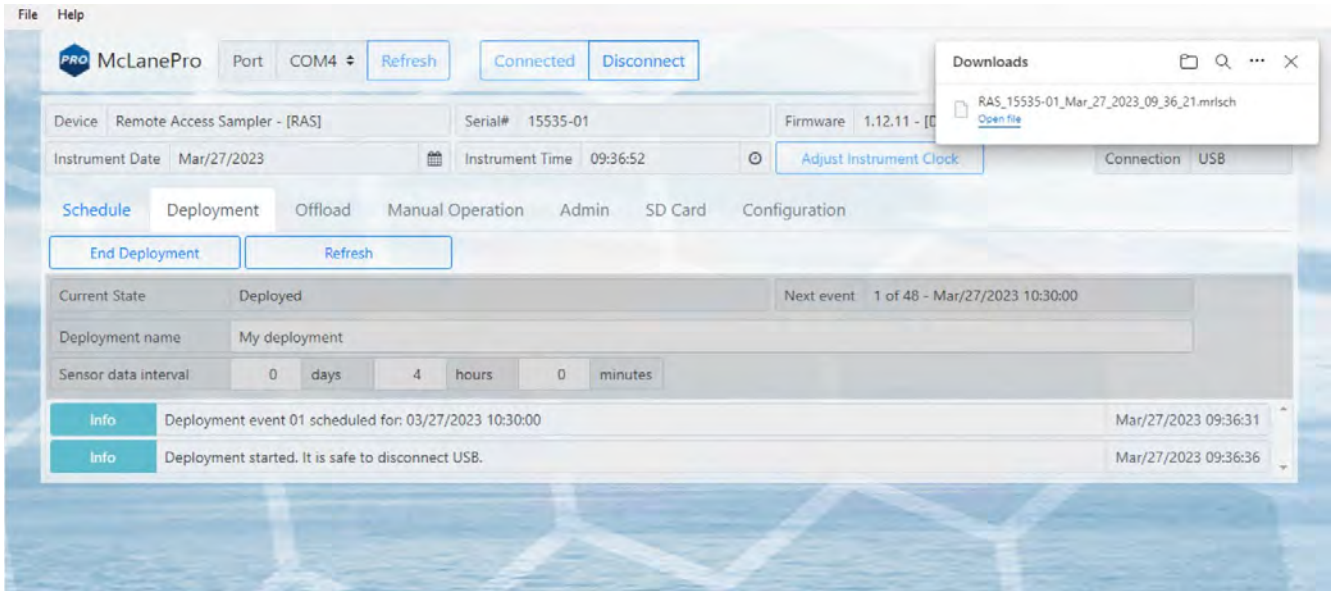


5. Verify the current time is correct and verify the event start time or delay. Click **Deploy** to continue.

*After clicking the **Deploy** button;*

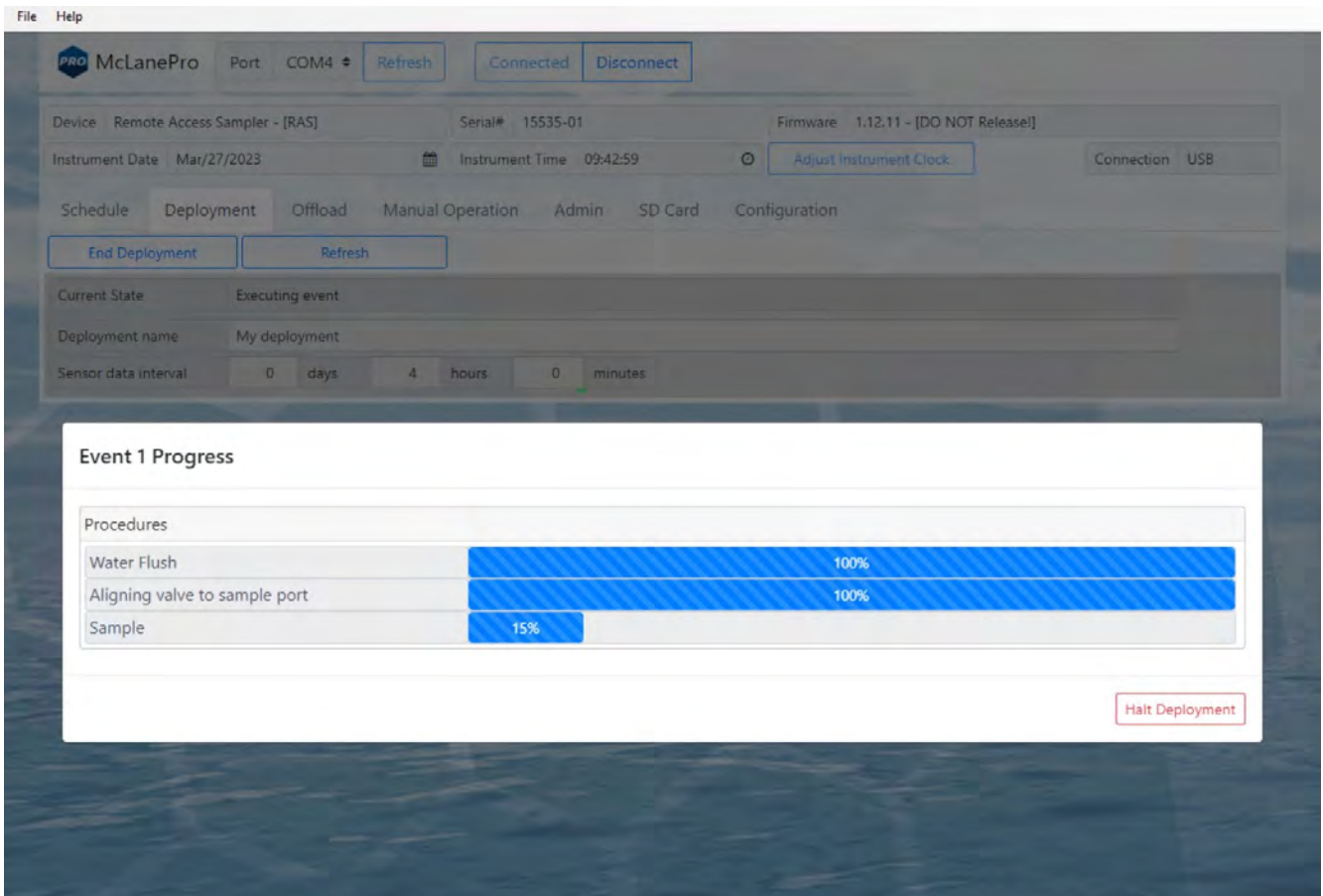
The RAS displays the scheduled time for the first event, and a message that confirms it is safe to disconnect the USB connection.

McLanePro will also automatically download a schedule file to the host computer for reference or archival purposes.



- Remove the communication cable from the end cap and install the communications port dummy plug.

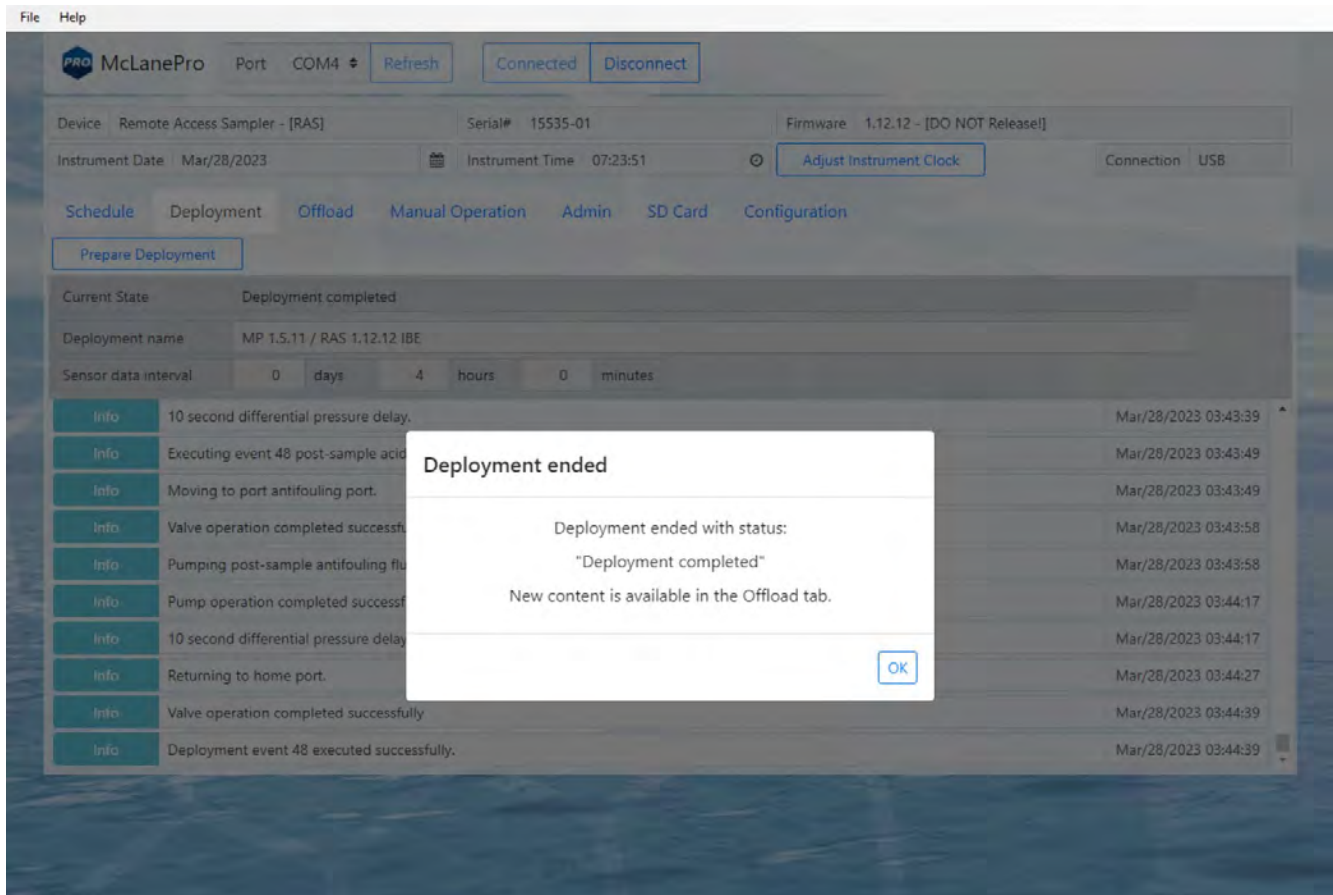
For testing or monitoring deployments, if USB is connected while running a test deployment, an event progress pop-up window reports the progress of the event that is being executed, and the deployment log will be updated as events are executed or completed.



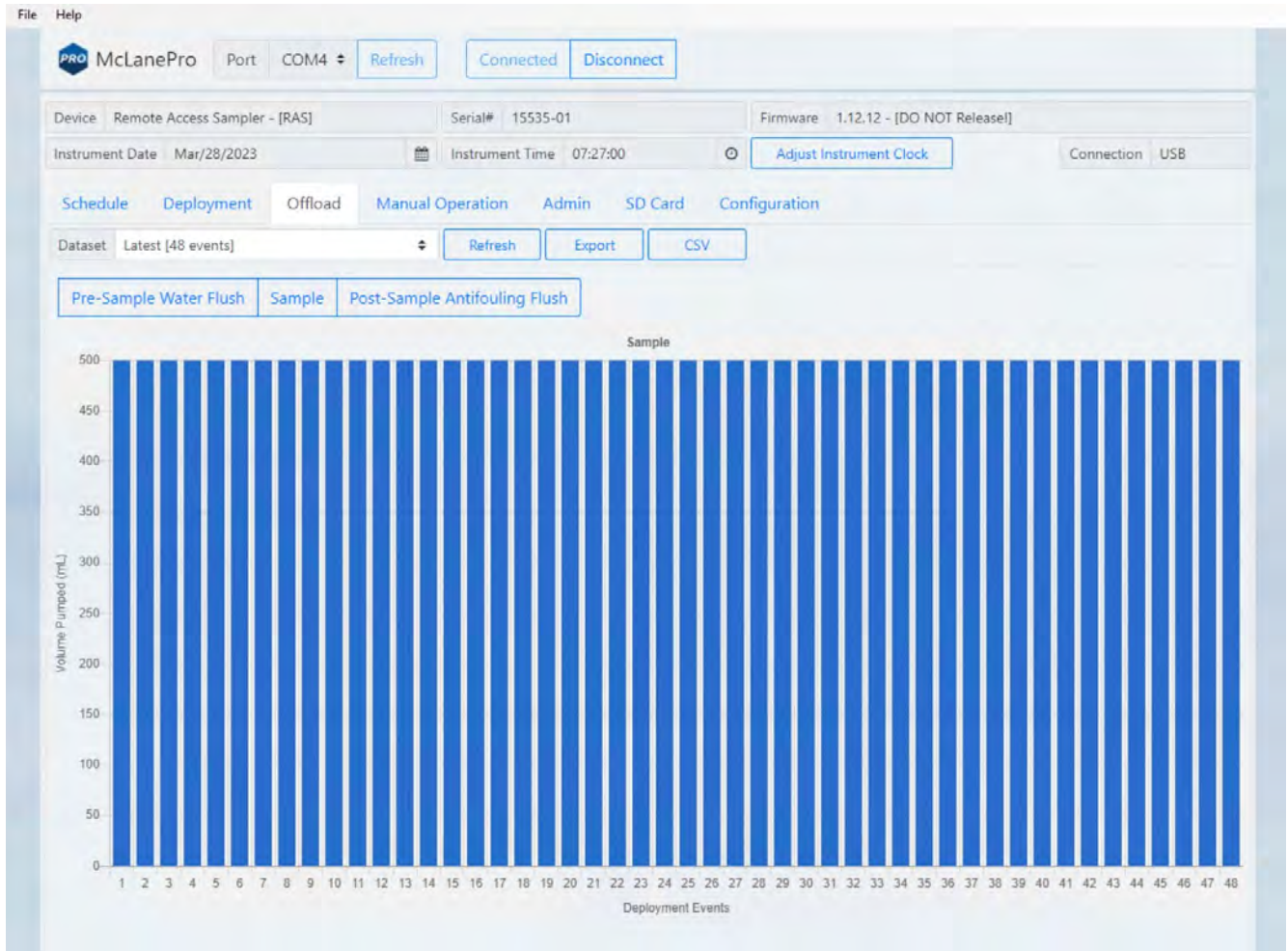
The Offload Tab

The **Offload tab** is used to view and export data collected during a deployment.

When connecting to a RAS that has recently completed a deployment, McLanePro loads the **Offload tab** in order to review collected data.



The **Offload tab** displays a bar chart for all pumping events. This may include pre-sample water flushes, sample events, fixative flushes and pre- or post-sample antifouling flushes. Each bar will display the requested volume and the actual pumped volume. Use the mouse to hover over an event bar to see these data.



Deployment Summary View

The **Offload** tab displays data for all deployment events, including procedure data, details and the deployment log. Sample volume and other pumping related data are visualized in a bar graph on the main Offload tab display. The graph may display pre- or post- antifouling volume, water flush volume and fixative volume pumped (if equipped).

The screenshot displays the McLanePro software interface. At the top, there is a menu bar with 'File' and 'Help'. Below it, the 'McLanePro' logo is followed by a 'Port' dropdown set to 'COM4', a 'Refresh' button, and 'Connected' and 'Disconnect' buttons. The main content area is divided into two event panels, 'Event 1' and 'Event 2'.

Event 1 Summary:

- Scheduled Start Time: 03/27/2023 15:50:00
- Start Time: 03/27/2023 15:50:00
- End Time: 03/27/2023 15:59:32
- Start Temperature (C): 27.9
- End Temperature (C): 30.5
- Start Battery (Vdc): 28.6
- End Battery (Vdc): 28.1

Event 1 Procedures:

Procedure	Volume Requested (mL)	Volume Pumped (mL)	Result
Water Flush	100.0	100.0	Volume reached
Sample	500.0	500.0	Volume reached
Post-Sample Antifouling Flush	10.0	10.0	Volume reached

Below the procedures table are buttons for 'Event 1 Details' and 'Event 1 Sensor Data'.

Event 2 Summary:

- Scheduled Start Time: 03/27/2023 16:05:00
- Start Time: 03/27/2023 16:05:00
- End Time: 03/27/2023 16:14:38
- Start Temperature (C): 28.2
- End Temperature (C): 30.6
- Start Battery (Vdc): 28.6
- End Battery (Vdc): 28.1

Event 2 Procedures:

Procedure	Volume Requested (mL)	Volume Pumped (mL)	Result
Water Flush	100.0	100.0	Volume reached
Sample	500.0	500.0	Volume reached
Post-Sample Antifouling Flush	10.0	10.0	Volume reached

Below the procedures table are buttons for 'Event 2 Details' and 'Event 2 Sensor Data'.

Event data are summarized for each individual event. The exit condition for each procedure are listed in the summary data, along with buttons used to access event details and sensor data.

Event Data

Individual event data are displayed below the bar chart. Each event data panel will display sensor readings taken at the start and end of the event, as well as a listing of procedures performed, and the exit conditions (result) for these procedures.

The screenshot displays the McLanePro software interface. At the top, there is a menu bar with 'File' and 'Help'. Below the menu bar, the software name 'McLanePro' is shown next to a 'Port' dropdown menu set to 'COM4', a 'Refresh' button, and 'Connected' and 'Disconnect' buttons. The main content area is divided into two event logs, 'Event 1' and 'Event 2'. Each event log contains a summary table of key parameters, a table of procedures performed, and sections for 'Event # Details' and 'Event # Sensor Data'.

Event 1 Summary:

Scheduled Start Time	03/27/2023 15:50:00		
Start Time	03/27/2023 15:50:00	End Time	03/27/2023 15:59:32
Start Temperature (C)	27.9	End Temperature (C)	30.5
Start Battery (Vdc)	28.6	End Battery (Vdc)	28.1

Event 1 Procedures:

Procedure	Volume Requested (mL)	Volume Pumped (mL)	Result
Water Flush	100.0	100.0	Volume reached
Sample	500.0	500.0	Volume reached
Post-Sample Antifouling Flush	10.0	10.0	Volume reached

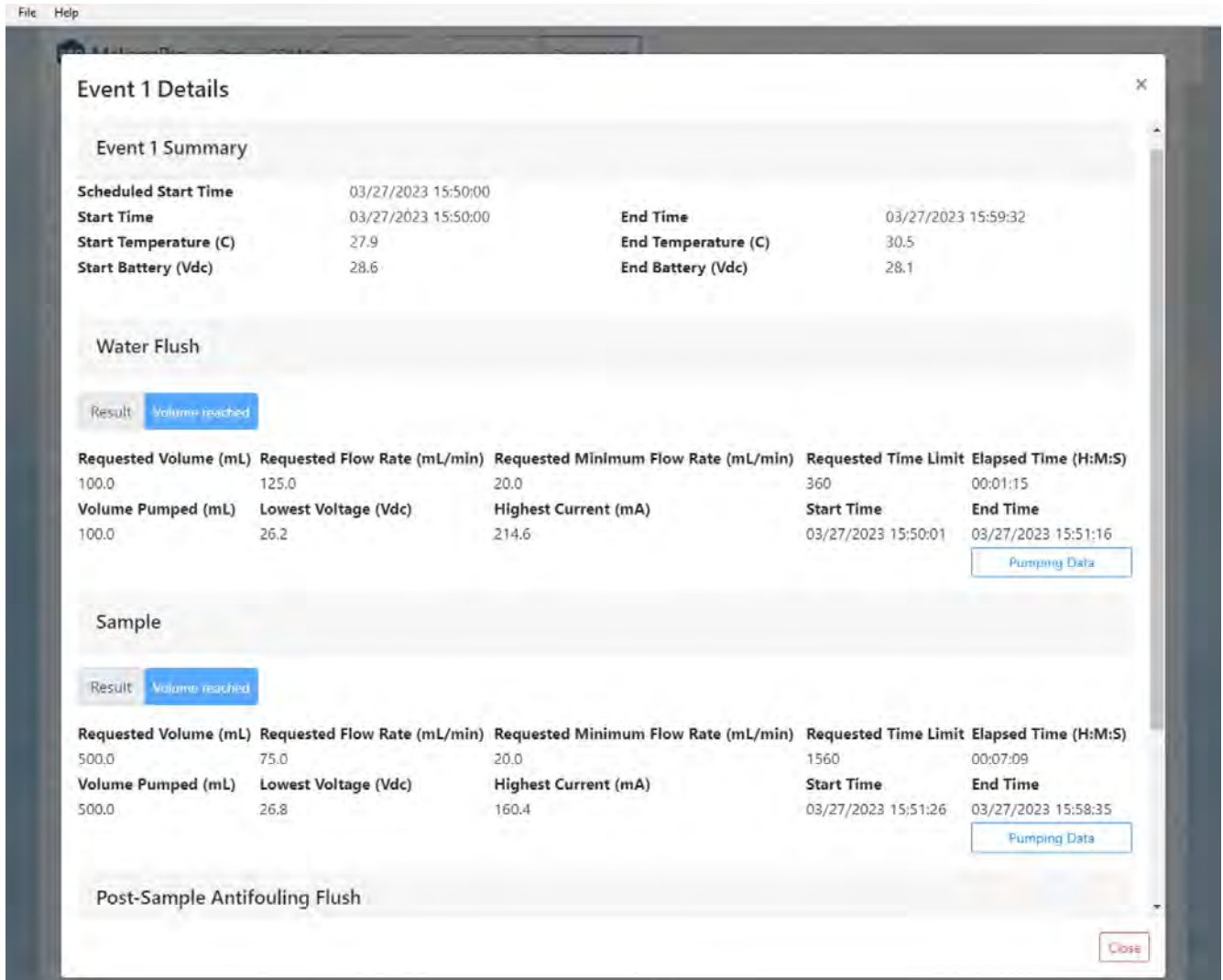
Event 2 Summary:

Scheduled Start Time	03/27/2023 16:05:00		
Start Time	03/27/2023 16:05:00	End Time	03/27/2023 16:14:38
Start Temperature (C)	28.2	End Temperature (C)	30.6
Start Battery (Vdc)	28.6	End Battery (Vdc)	28.1

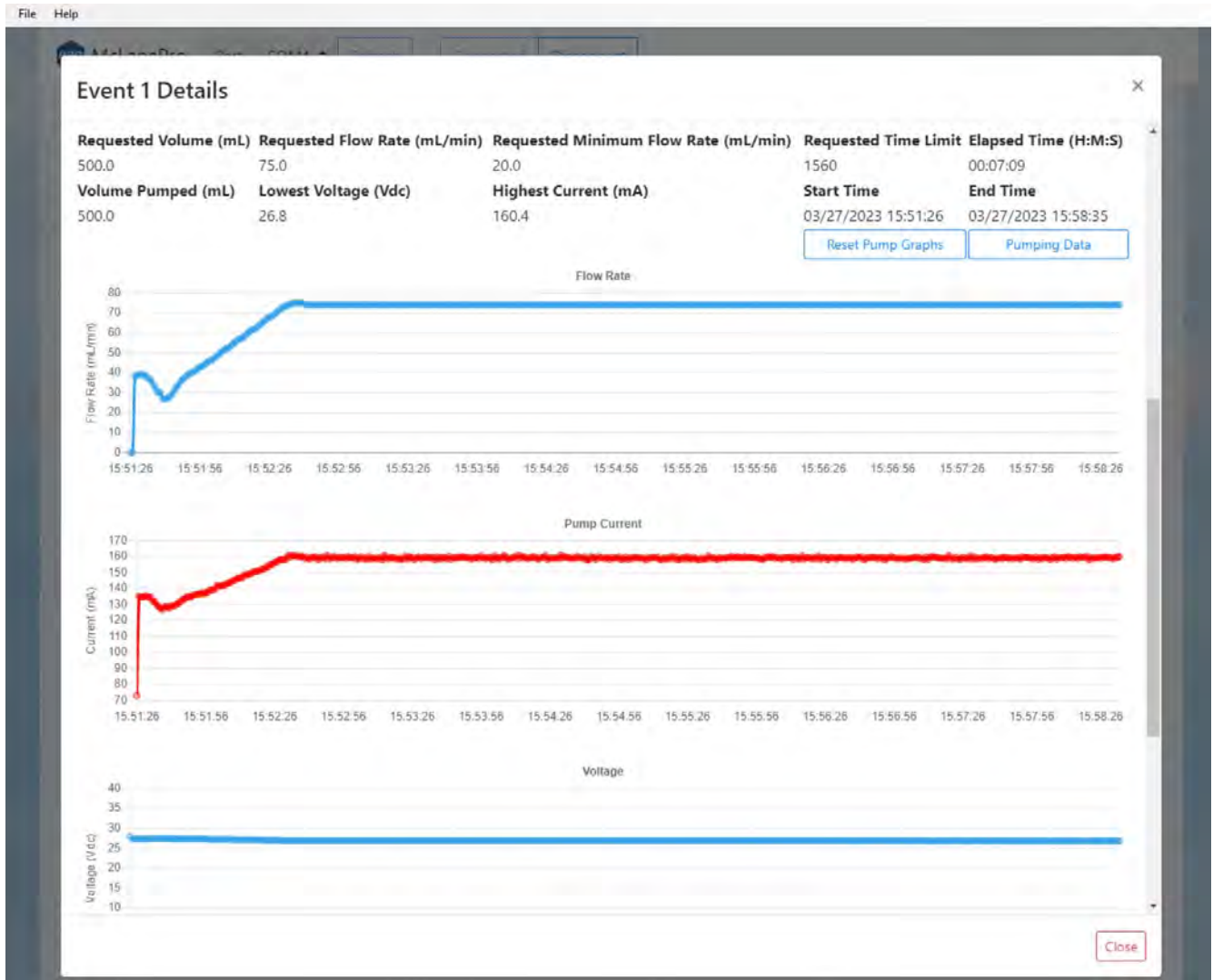
Event 2 Procedures:

Procedure	Volume Requested (mL)	Volume Pumped (mL)	Result
Water Flush	100.0	100.0	Volume reached
Sample	500.0	500.0	Volume reached
Post-Sample Antifouling Flush	10.0	10.0	Volume reached

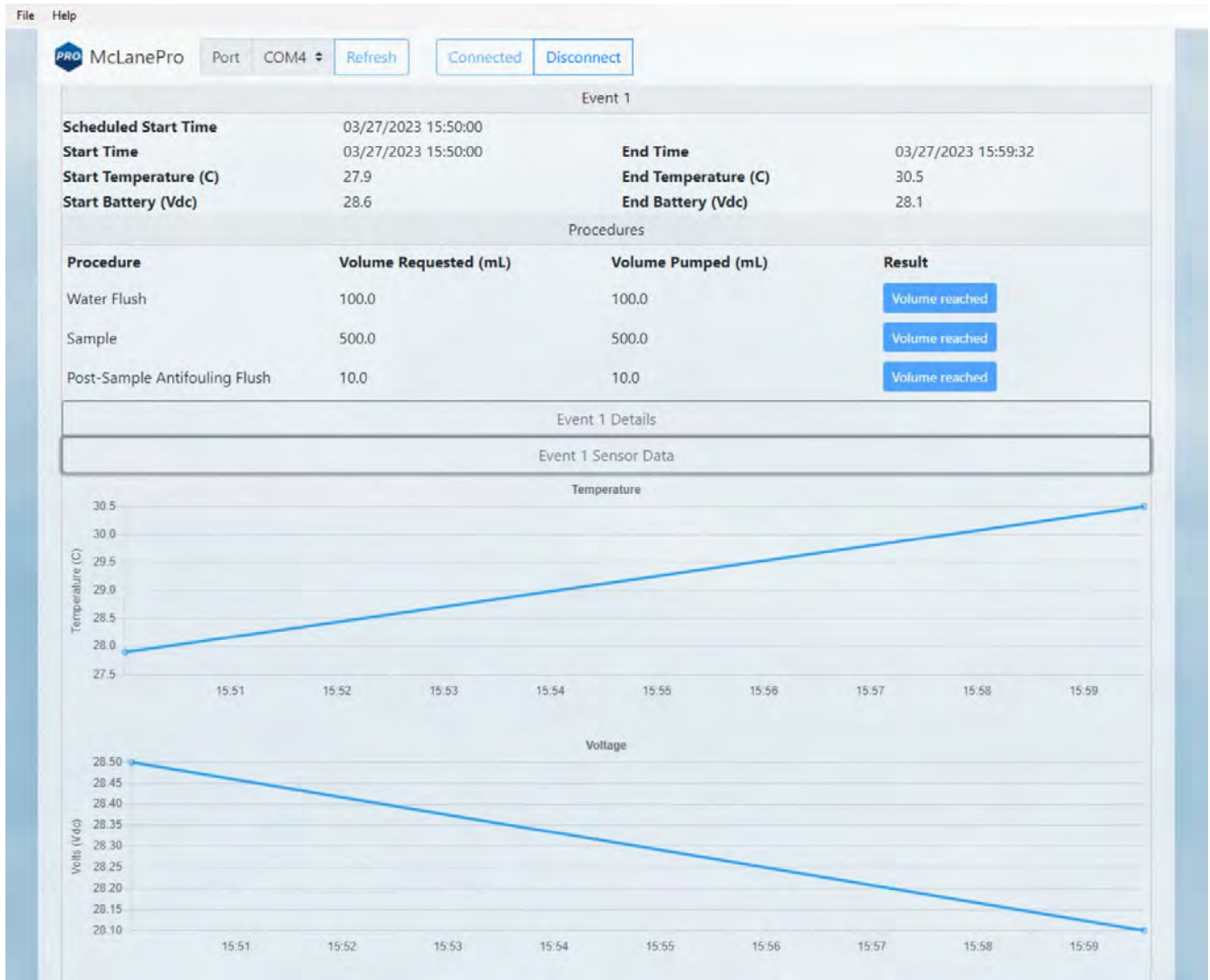
Clicking on the **Event (#) Details** button will launch a new window where more detailed information on each procedure is available for viewing.



Clicking the **Pumping Data** button under the Sample heading displays Event 1 pumping data recorded while the RAS was collecting the sample. Clicking and dragging on a section of the pumping data will zoom in for a more detailed display of the data. Clicking **Reset Pump Graphs** returns the plots to the default view.



Additionally, from the **Offload tab**, clicking on **Event (#) Sensor Data** will expand to display charts of sensor data readings taken during the event. These data may include internal temperature and battery voltage.



Deployment Log

The deployment log shows a summary of deployment information. Errors and warnings are clearly marked with an error tag in the log, and the title bar is highlighted red if errors exist, or yellow if warnings exist in the log.

Description: MP 1.5.11 / RAS 1.12.12 IBE, Log:			
Info	Deployment	Deployment started. It is safe to disconnect USB.	Mar/27/2023 15:48:17
Info	Deployment	Starting event 01.	Mar/27/2023 15:50:00
Info	Deployment	Executing event 01 pre-sample water flush.	Mar/27/2023 15:50:01
Info	Deployment	Pumping pre-sample water flush.	Mar/27/2023 15:50:01
Info	Deployment	Pump operation completed successfully	Mar/27/2023 15:51:16
Info	Deployment	Executing event 01 sample.	Mar/27/2023 15:51:16
Info	Deployment	Moving to port 1.	Mar/27/2023 15:51:17
Info	Deployment	Valve operation completed successfully	Mar/27/2023 15:51:25
Info	Deployment	Pumping sample.	Mar/27/2023 15:51:25
Info	Deployment	Pump operation completed successfully	Mar/27/2023 15:58:35
Info	Deployment	10 second differential pressure delay.	Mar/27/2023 15:58:35
Info	Deployment	Executing event 01 post-sample acid flush.	Mar/27/2023 15:58:45
Info	Deployment	Moving to port antifouling port.	Mar/27/2023 15:58:45
Info	Deployment	Valve operation completed successfully	Mar/27/2023 15:58:55
Info	Deployment	Pumping post-sample antifouling flush.	Mar/27/2023 15:58:55
Info	Deployment	Pump operation completed successfully	Mar/27/2023 15:59:14

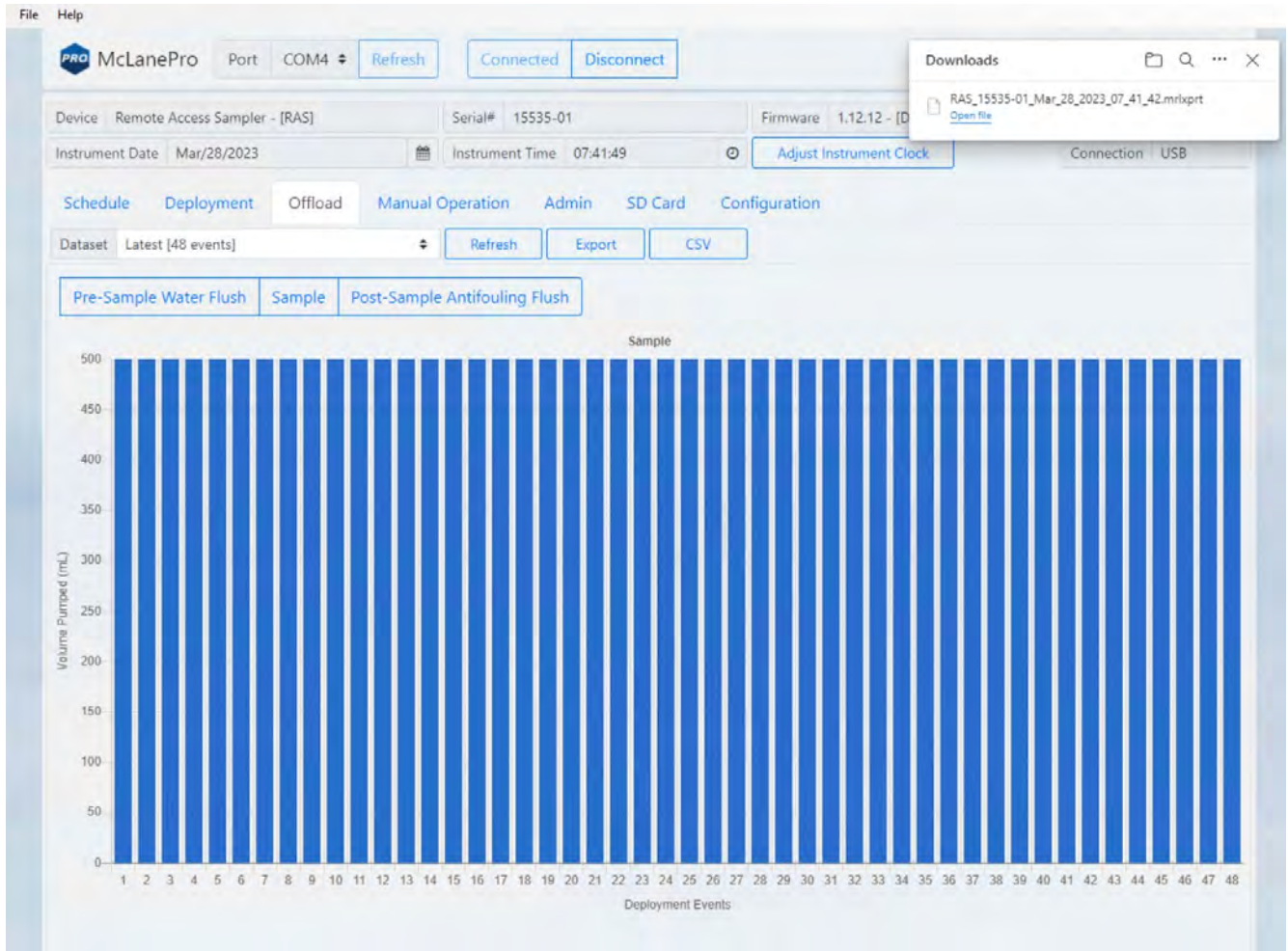
Description: My deployment, Log [contains errors]:			
Info	Deployment	Deployment started. It is safe to disconnect USB.	Sep/07/2022 13:03:07
Info	Deployment	Starting event 01.	Sep/07/2022 13:03:07
Error	Deployment	Event 01 ended with errors.	Sep/07/2022 13:03:17
Error	Deployment	Deployment halted with errors	Sep/07/2022 13:03:18

Description: My deployment, Log [contains warning]:			
Warning	Prep	SYSTEM IS BEING DEPLOYED WITH A SIMULATED PUMP!	Sep/07/2022 12:06:01
Warning	Prep	Deployment start time is in the past. Deployment will begin immediately.	Sep/07/2022 12:06:01
Warning	Prep	Deployment preparation completed with warnings.	Sep/07/2022 12:06:01
Info	Deployment	Deployment event 01 scheduled for: 09/07/2022 09:10:00	Sep/07/2022 12:06:08

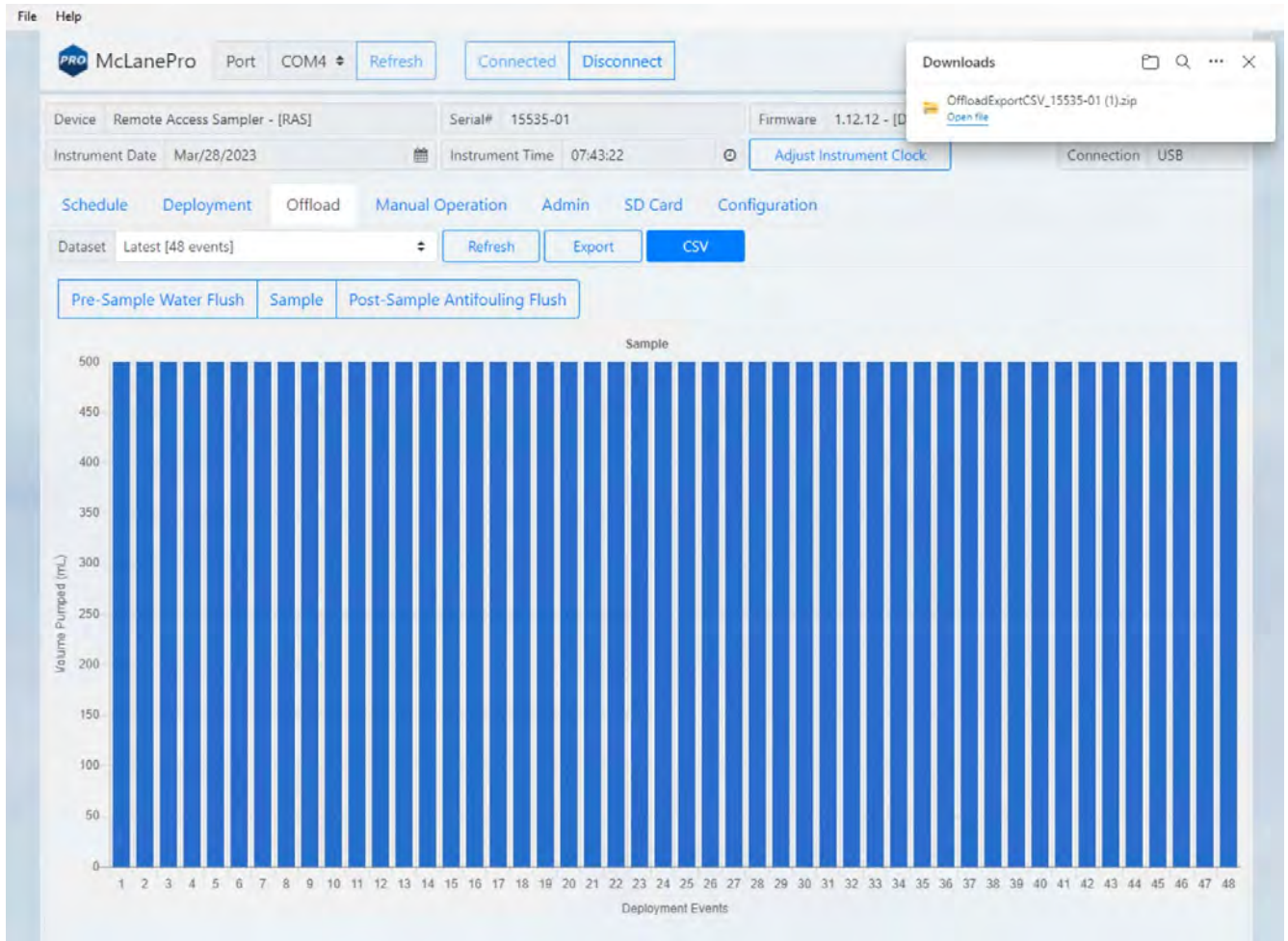
Exporting Deployment Data

Deployment data may be exported using the **Export** button and/or the **CSV** button. It is recommended to offload both file types after a deployment and retain these data in multiple locations. A record of the mechanical flow meter reading should also be stored with the deployment data for reference.

Clicking the **Export** button downloads schedule, configuration and device information in addition to the offload data from the deployment. These data are contained in a *.mrlxprt file that is viewable in McLanePro using [Offline Mode](#).



Deployment data may also be exported in CSV format by clicking the **CSV** button, and automatically downloading the compressed files to the host computer.



CSV files are compressed into a ZIP file and may be extracted for viewing or evaluation outside of McLanePro.

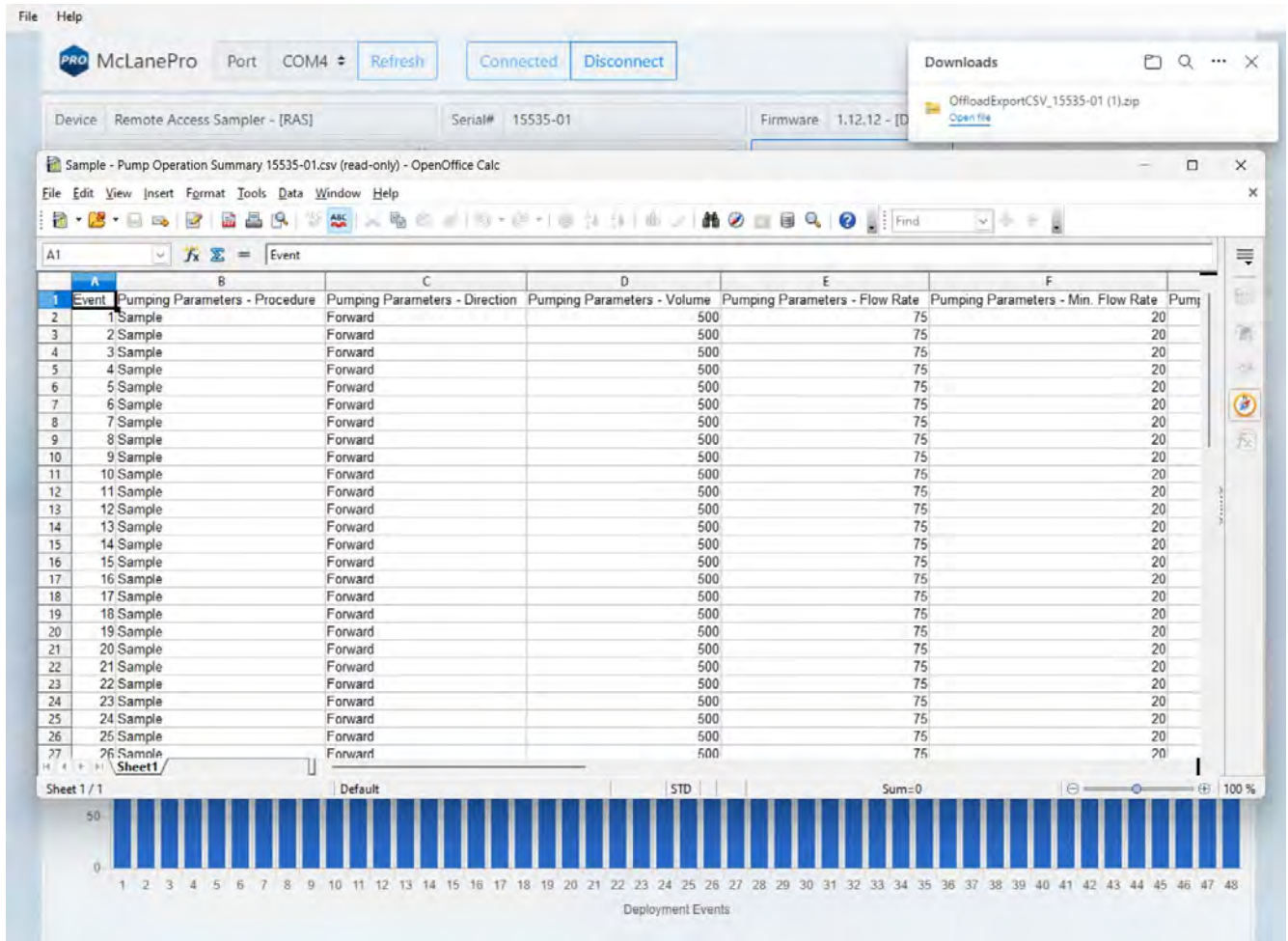
The screenshot displays the McLanePro software interface. At the top, the 'McLanePro' logo is visible along with connection details: 'Port COM4', 'Refresh' button, 'Connected' status, and 'Disconnect' button. Below this, device information is shown: 'Device Remote Access Sampler - [RAS]', 'Serial# 15535-01', 'Firmware 1.12.12 - [D]', 'Instrument Date Mar/28/2023', 'Instrument Time 07:48:55', and 'Adjust Instrument Clock' button. A 'Downloads' window is open in the top right, showing a file named 'OffloadExportCSV_15535-01 (2).zip' with an 'Open file' link.

The main interface features a navigation menu with 'Schedule', 'Deployment', 'Offload', 'Manual Operation', 'Admin', 'SD Card', and 'Configuration'. The 'Offload' menu is currently selected. Below the menu, there are buttons for 'Refresh', 'Export', and 'CSV'. A 'Dataset' dropdown is set to 'Latest [48 events]'. A 'Pre-Sample Water Flush' label is visible above a bar chart.

The bar chart shows 'Volume Pumped (mL)' on the y-axis (ranging from 0 to 500) and 'Deployment Events' on the x-axis (ranging from 1 to 48). The chart displays a series of blue bars, with the first few bars reaching approximately 500 mL and subsequent bars showing lower volumes.

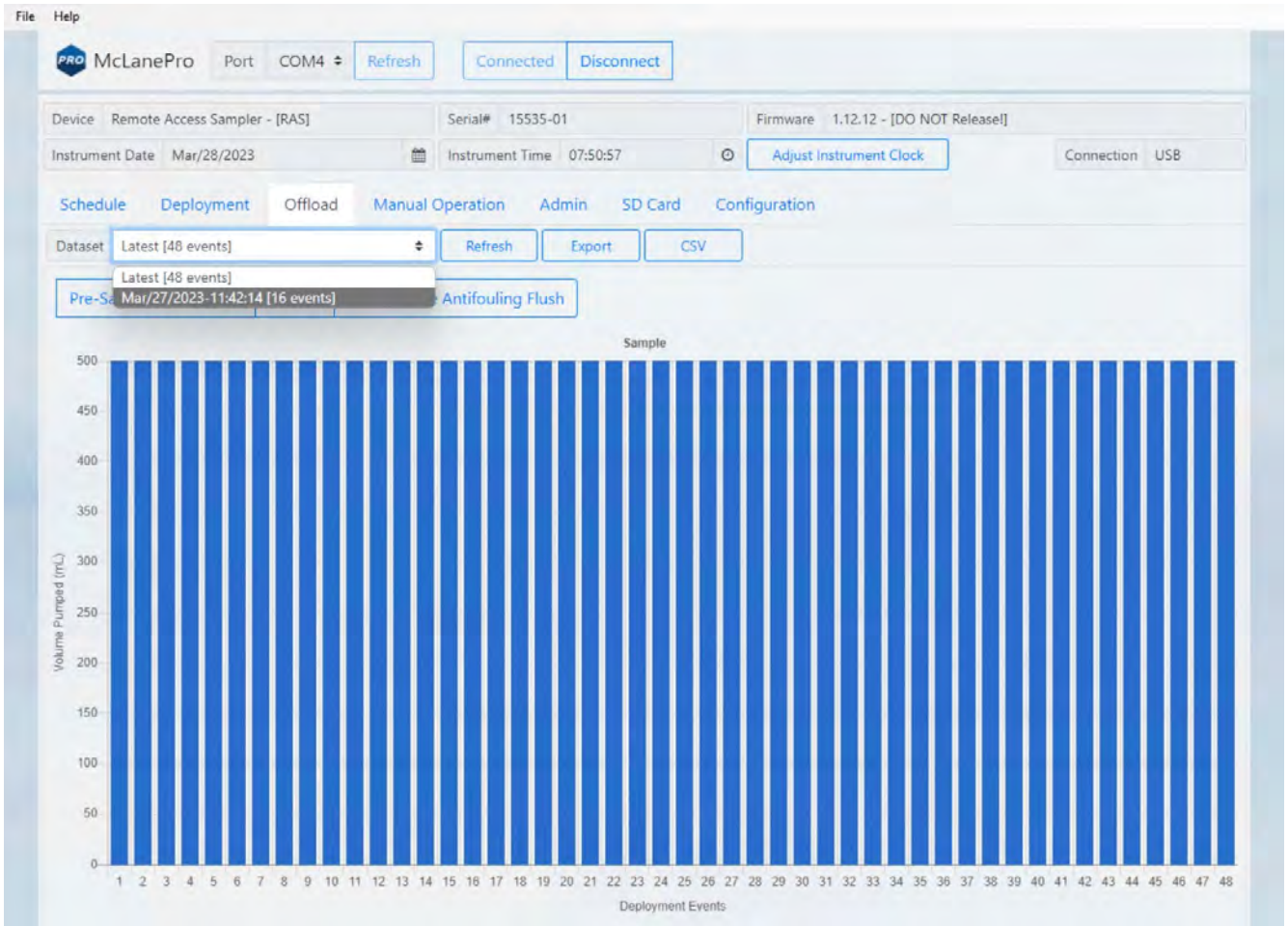
A file explorer window is open in the foreground, displaying the contents of a folder named 'OffloadExportCSV_15535-01 (2)'. The window shows a list of files with columns for Name, Type, Compressed size, Password p..., and Size. The files listed are:

Name	Type	Compressed size	Password p...	Size
Log 15535-01	OpenOffice.org XML 1.0 S...	6 KB	No	69 KB
Sample - Pump Operation Summar...	OpenOffice.org XML 1.0 S...	2 KB	No	6 KB
Sample Details 15535-01	OpenOffice.org XML 1.0 S...	430 KB	No	2,256 KB
Summary 15535-01	OpenOffice.org XML 1.0 S...	1 KB	No	5 KB
System Power Data 15535-01	OpenOffice.org XML 1.0 S...	1 KB	No	3 KB
Temperature Data 15535-01	OpenOffice.org XML 1.0 S...	1 KB	No	3 KB



Viewing and Exporting Data From Previous Deployments

Data from previous deployments may be viewed by selecting a previous data set. To export the data, follow the instructions in [Exporting Deployment Data](#).



The Manual Operation Tab

The **Manual Operation** tab allows operation of the multi-port valve and pump. Additionally, available antifoulant volume may be set on the **Manual Operation** tab.



Preparation for a deployment will require priming of the RAS plumbing with water. This is done using manual controls provided in the **Manual Operation** tab.

The screenshot displays the 'Manual Operation' tab in the McLanePro software. At the top, there are navigation tabs: 'Schedule', 'Deploy', 'Manual Operation' (selected), 'Admin', 'SD Card', and 'Configuration'. Below these are 'Port' (COM4), 'Refresh', 'Connected', and 'Disconnect' buttons.

Valve Operation: Includes 'Status' and 'Direction' dropdowns, a 'Progress' bar, and 'Current port' (0). It has a 'Move to port' dropdown (0 (Home Port)) and 'Move', 'Previous Port', 'Next Port', and 'Find Home' buttons.

Fixative Valve Operation: Shows 'Available Fixative (mL)' (0) with a 'Set' button and a large blue 'Activate Fixative Valve' button.

Antifouling Operation: Shows 'Available Antifouling (mL)' (20) with a 'Set' button.

Pump Operation: Features input fields for 'Volume (mL)' (150), 'Flow Rate (mL/Min)' (75), 'Min Flow (mL/Min)' (50), and 'Time Limit' (0 H 0 M). It includes 'Pump Forward', 'Pump Reverse', and 'Clear Charts' buttons.

Feedback: A table with columns for 'Elapsed Time', 'Pumped Amount', and 'Time Spent'. Below it, 'Pumping Status' is shown, along with 'Volume Pumped (mL)', 'Flow Rate (mL/Min)', 'Vdc', and 'Current (mA)'.

At the bottom, there are two graphs:

- Flow Rate (mL/Min):** A line graph with a blue line showing a steady increase from 0 to approximately 100 mL/Min over time.
- Battery Voltage (Vdc) and Average Motor Current (mA):** A dual-axis graph. The left y-axis is Voltage (Vdc) from 0 to 40. The right y-axis is Average Motor Current (mA) from 0 to 2000. The x-axis for both is 'Seconds'.

Multi-port Valve Operation

All fluid flow within the RAS is routed through a multi-port (50-port) valve. The **Manual Operation** tab allows access to Valve Operation.

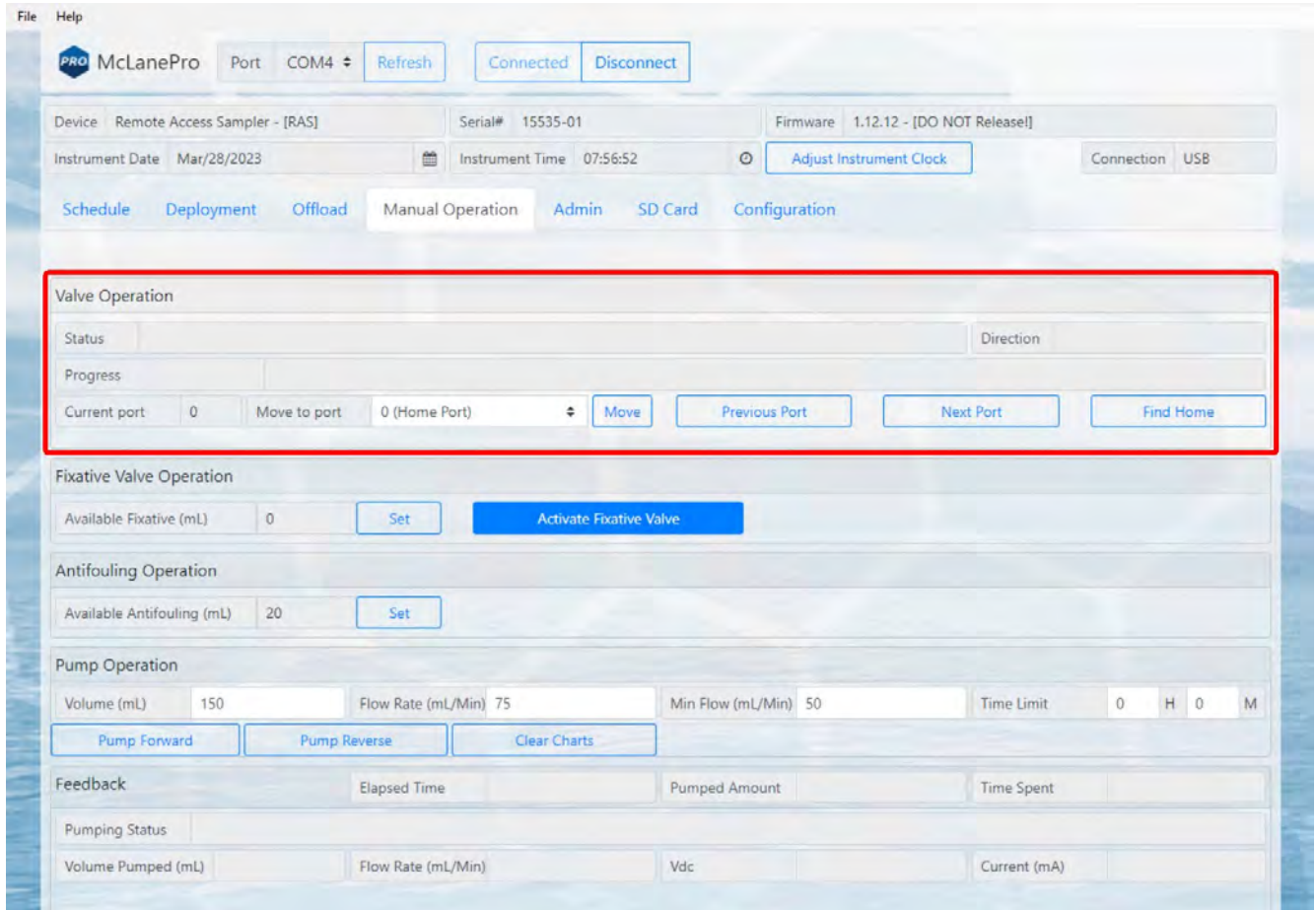
Valve Operation:

Move (to port) - clicking the move button will direct the valve to align to the chosen port in the drop-down menu.

Previous Port - moves the multi-port valve backward by a single port.

Next Port - moves the multi-port valve forward by a single port.

Find Home - commands the multi-port valve to find the home port, port 0.



Pump Operation

McLanePro provides controls for running the pump and viewing feedback data.

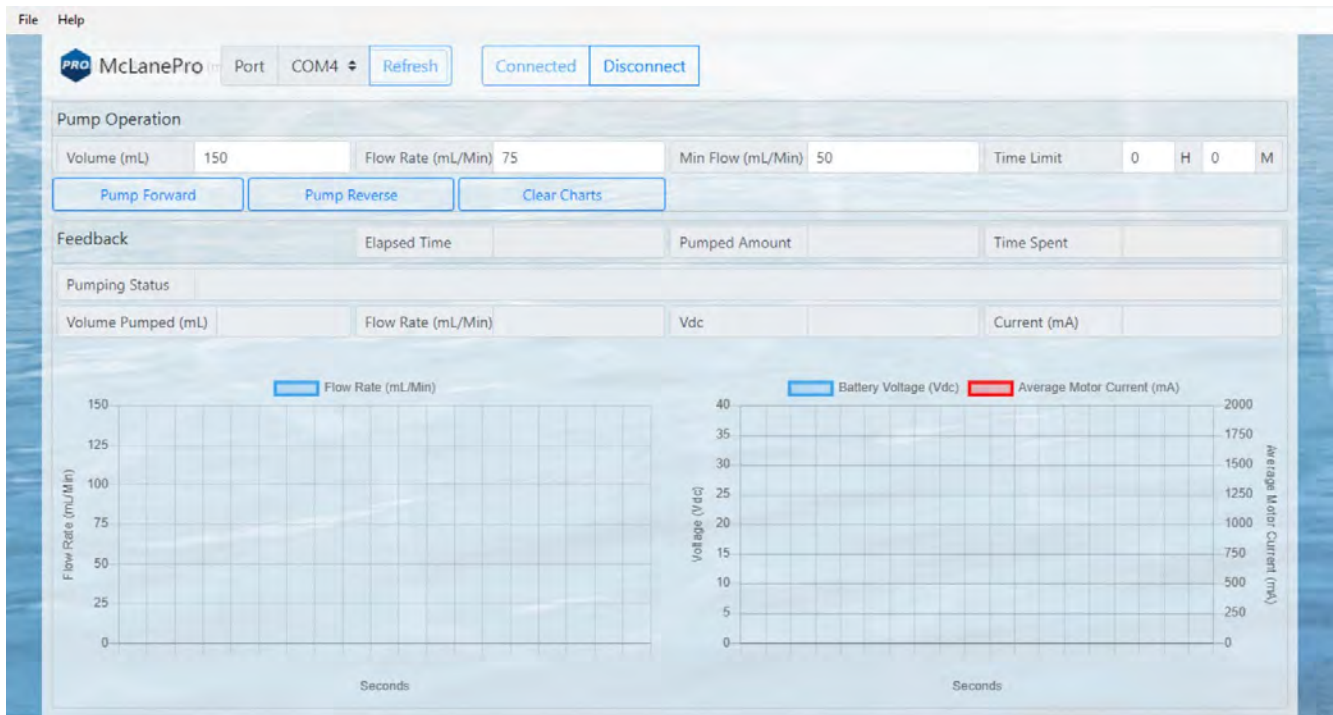
Pump Forward - starts a forward pumping routine according to parameters set in the [Pumping Parameters](#).

Pump Reverse - starts a reverse pumping routine according to parameters set in the [Pumping Parameters](#).

- Feedback values are graphed during pump operations. This includes one chart that displays the flow rate, and a second chart that displays battery voltage and the average system

current.

Clear charts - clears the graphs of any existing feedback data.



Pumping Parameters and Feedback

Forward or reverse pumping will utilize values set in the **Pumping Parameters** fields.

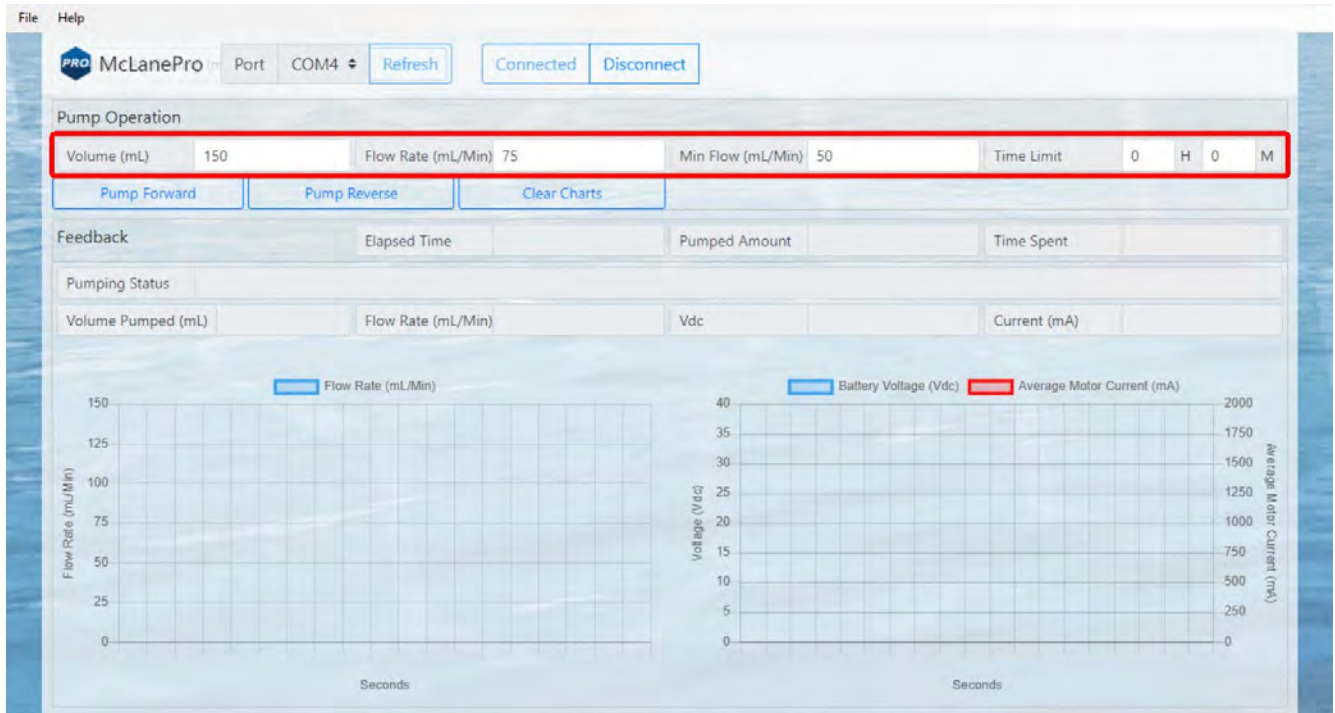
Pumping parameters:

Volume - defines the total requested volume for the manual pumping event.

Flow Rate - sets the target flow rate for the pumping event. Actual flow rate will be adjusted by the RAS based on feedback from the pump.

Min Flow Rate - sets the minimum acceptable flow rate, at which the pumping event will be terminated.

Time Limit - sets a maximum time limit for the pumping event. Setting this value to zero disables the time limit.



When the pump is operating, some or all of the following feedback data will be displayed.

Feedback:

Elapsed Time (HH:MM:SS) - the elapsed time for the current pumping event.

Pumped Amount (%) - the total volume percentage for the current pumping event.

Time Spent (%) - the elapsed time percentage (of the time limit, if used) for the current pumping event.

Pumping Status - the state of the pump and/or limiting conditions.

Volume Pumped - the total volume pumped.

Flow Rate* - the estimated flow rate of the pump, calculated in the firmware.

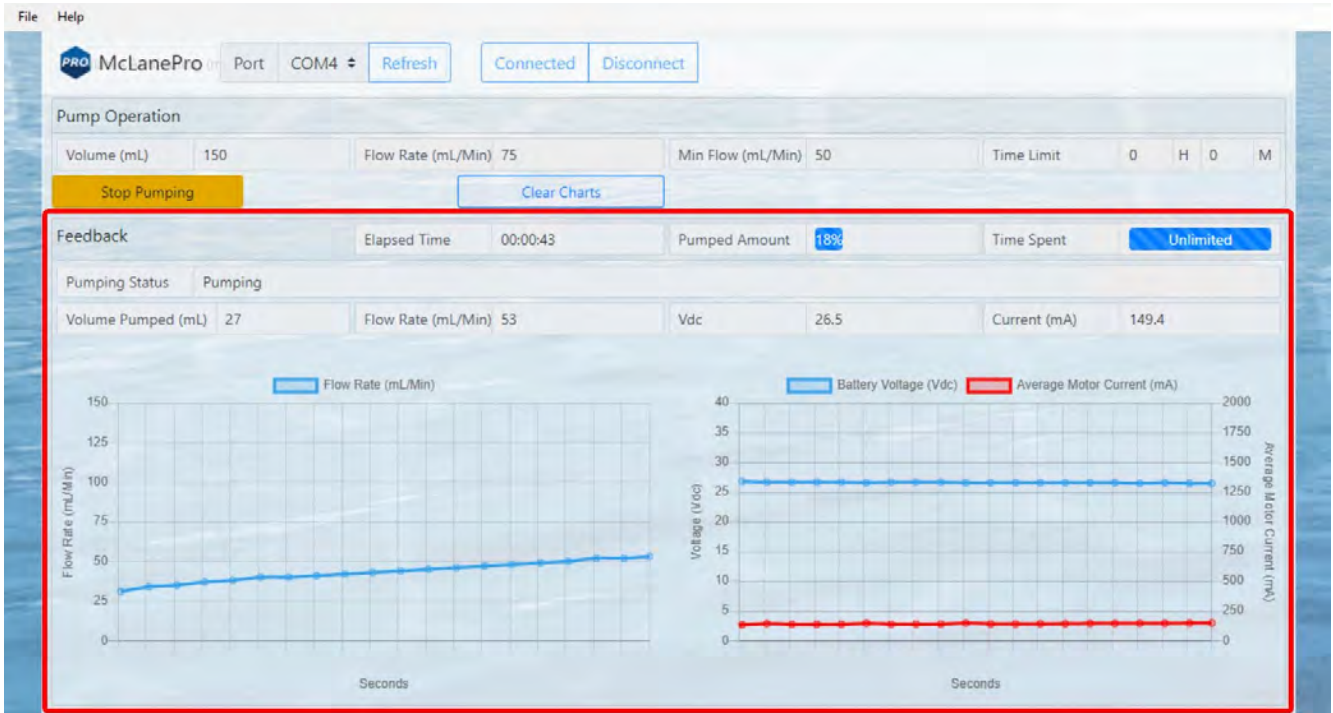
- Actual flow rate varies due to filter selection, differential pressure and environmental conditions.

Vdc - the measured battery voltage while pumping.

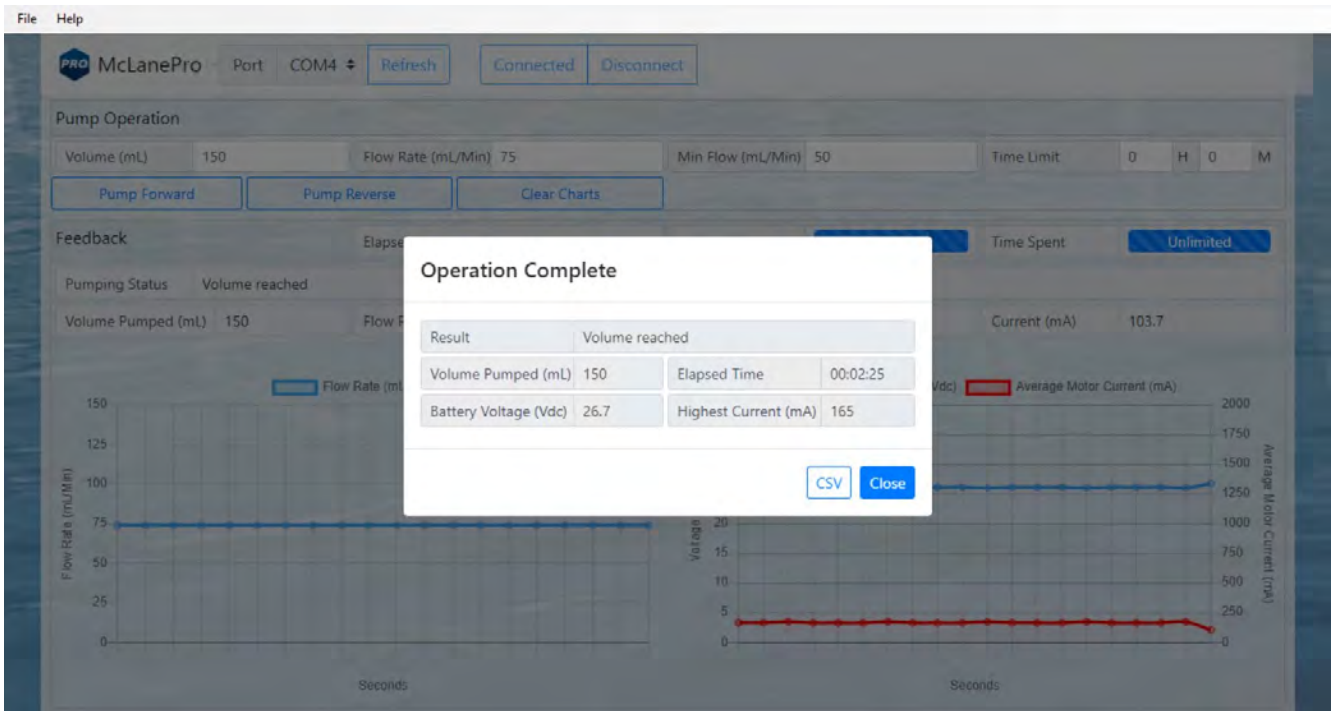
Current (mA) - The measured current while pumping.

Flow rate, voltage and motor current data are plotted during manually operated pumping. Clicking

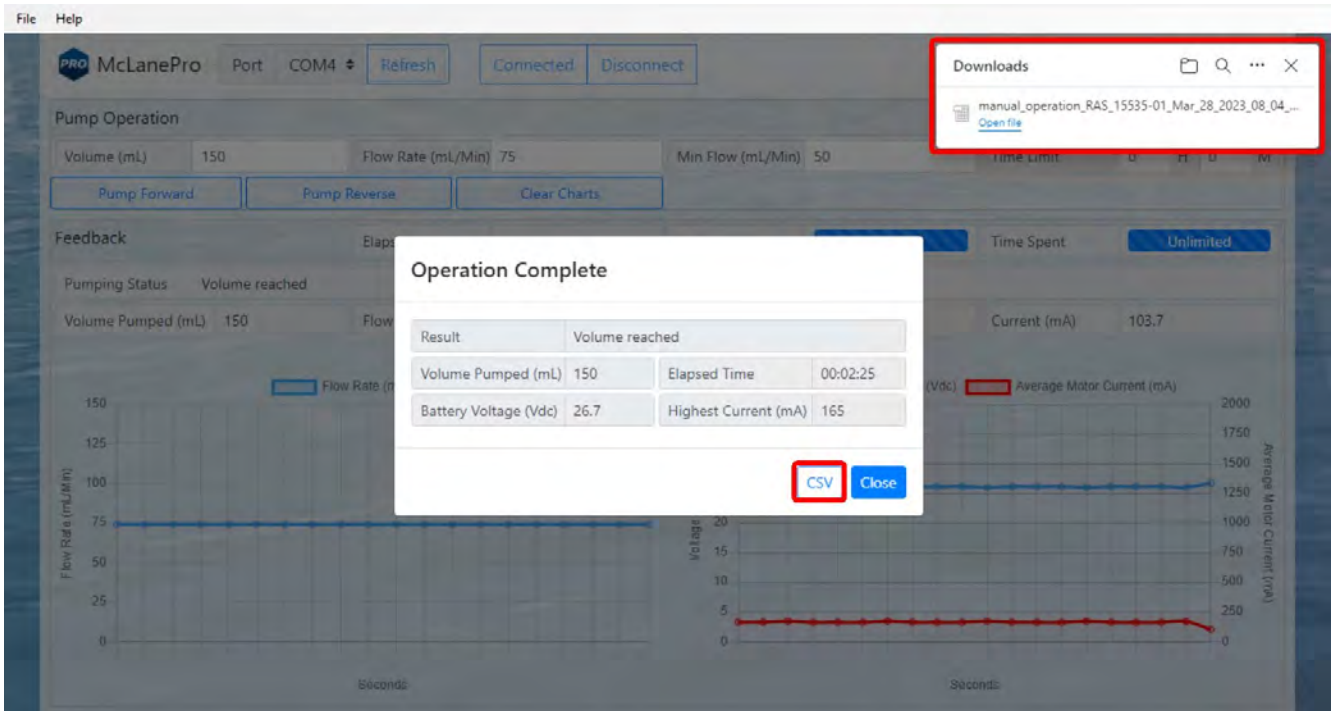
Clear Charts will erase the existing data from the charts.



Upon finishing a manual pumping operation, a summary is provided and data from the operation may be offloaded as a CSV file.

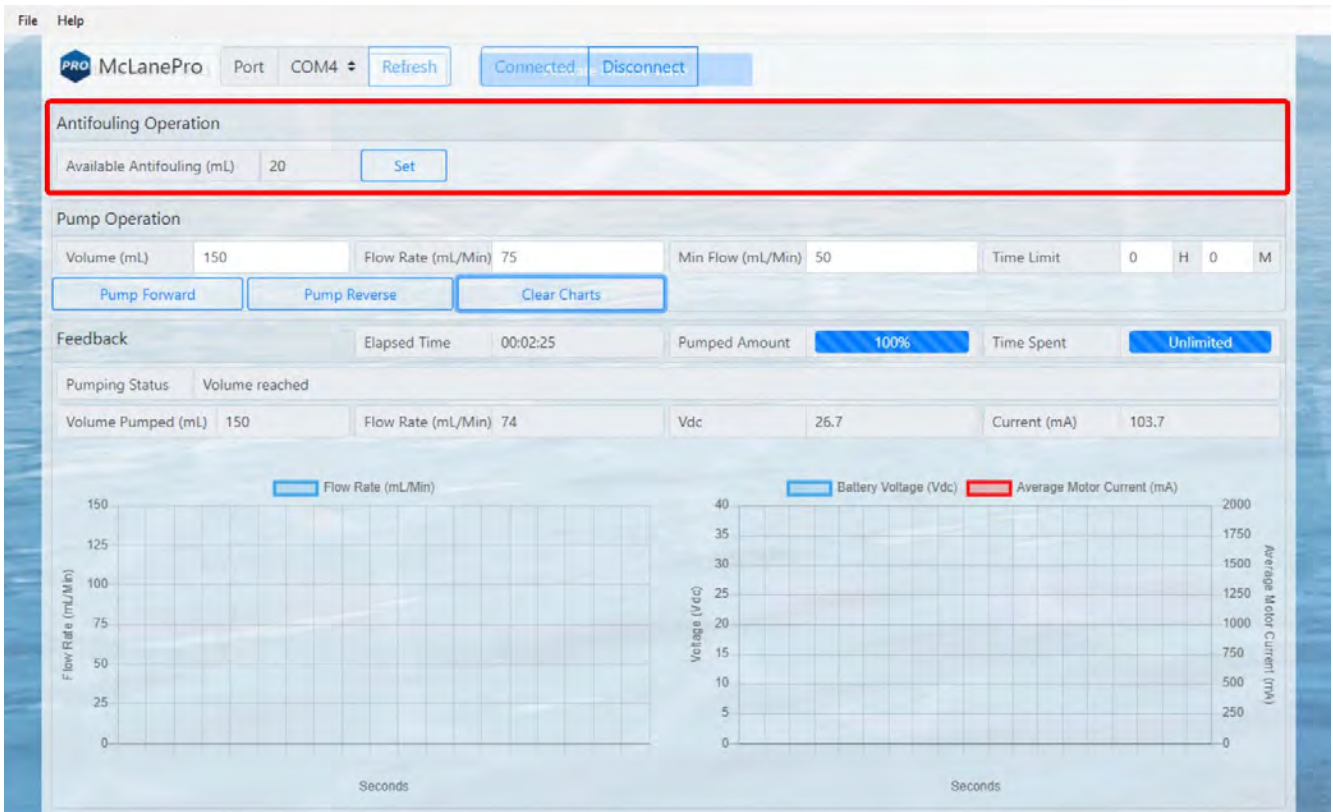


Clicking the CSV button downloads the file to a local computer for review and evaluation.

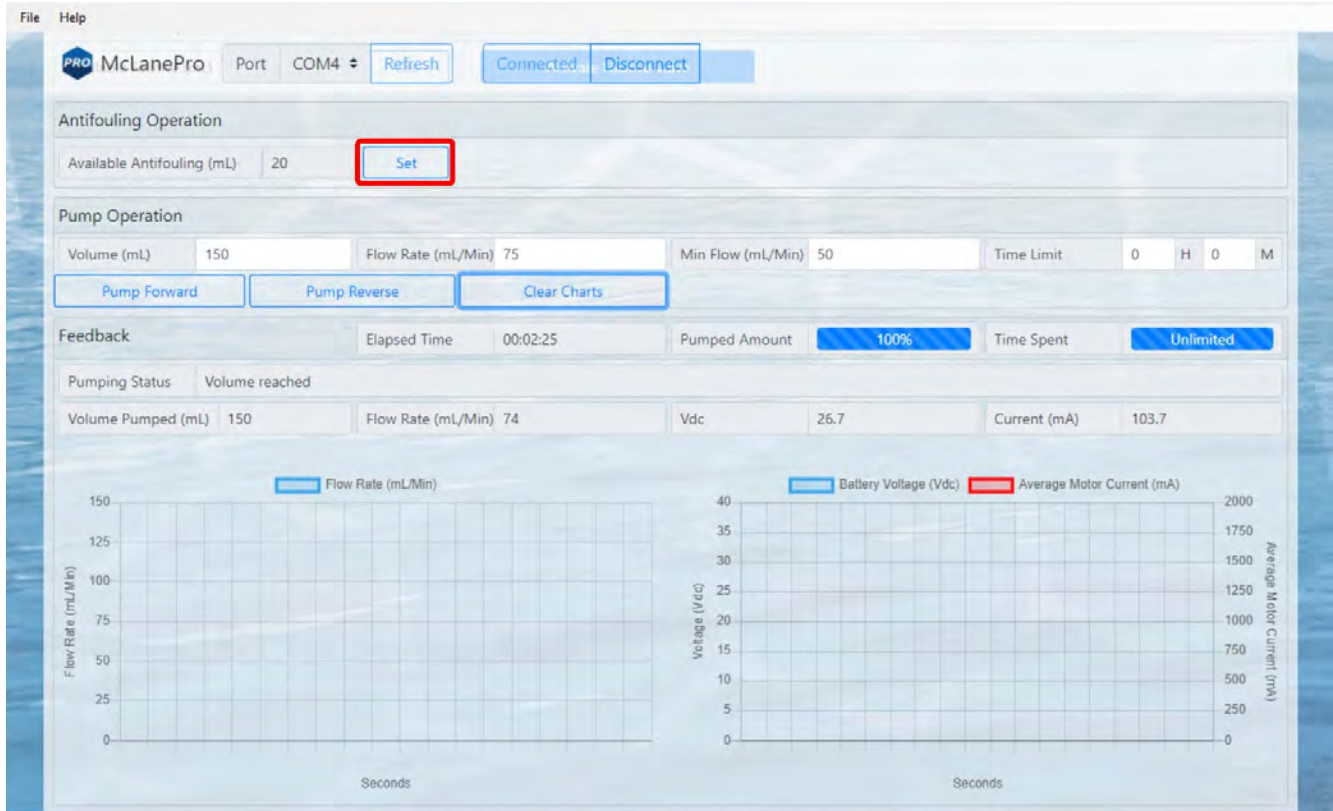


Antifouling Operation

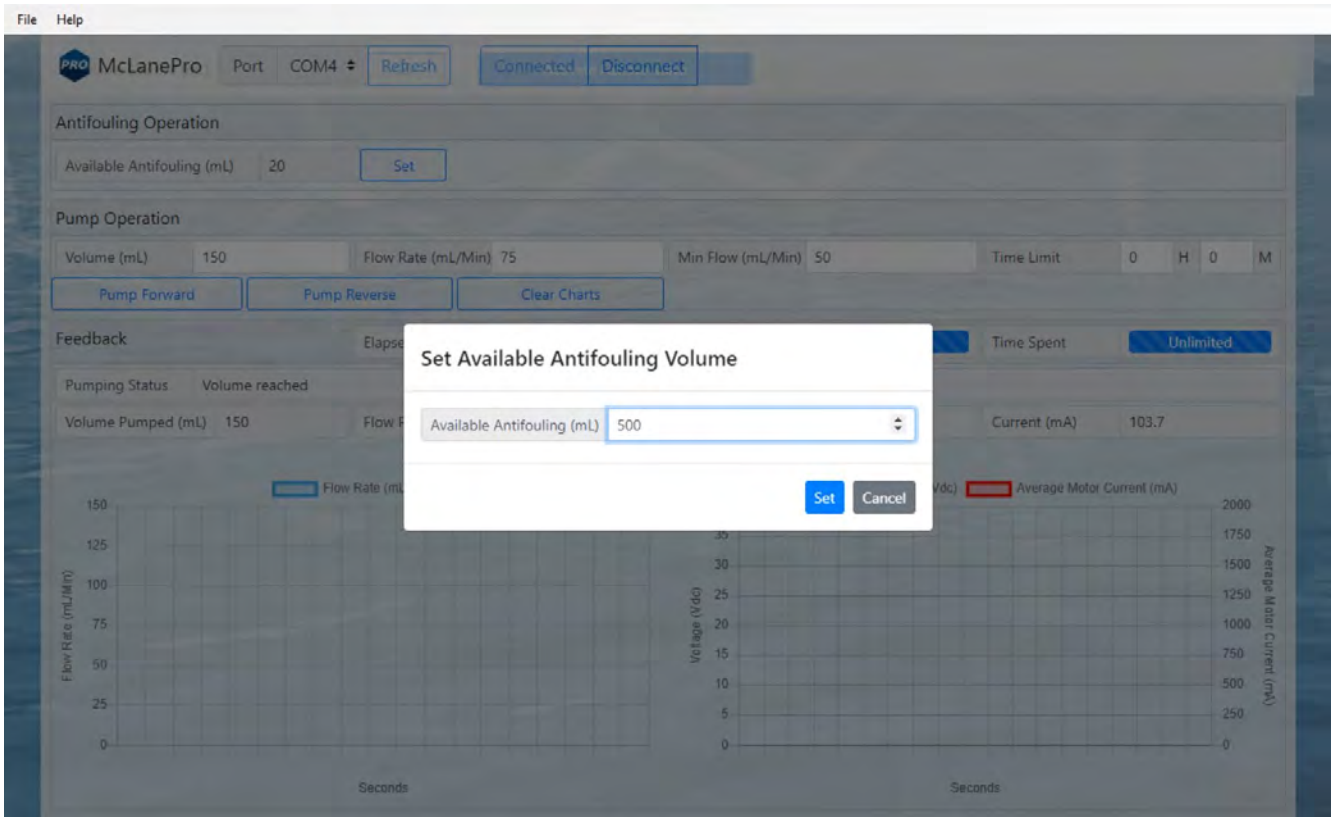
The RAS is equipped with an antifoulant reservoir for preventing contamination of the RAS intake. If this option is equipped, the **Manual Operation** tab allows for setting the available volume stored in the reservoir.



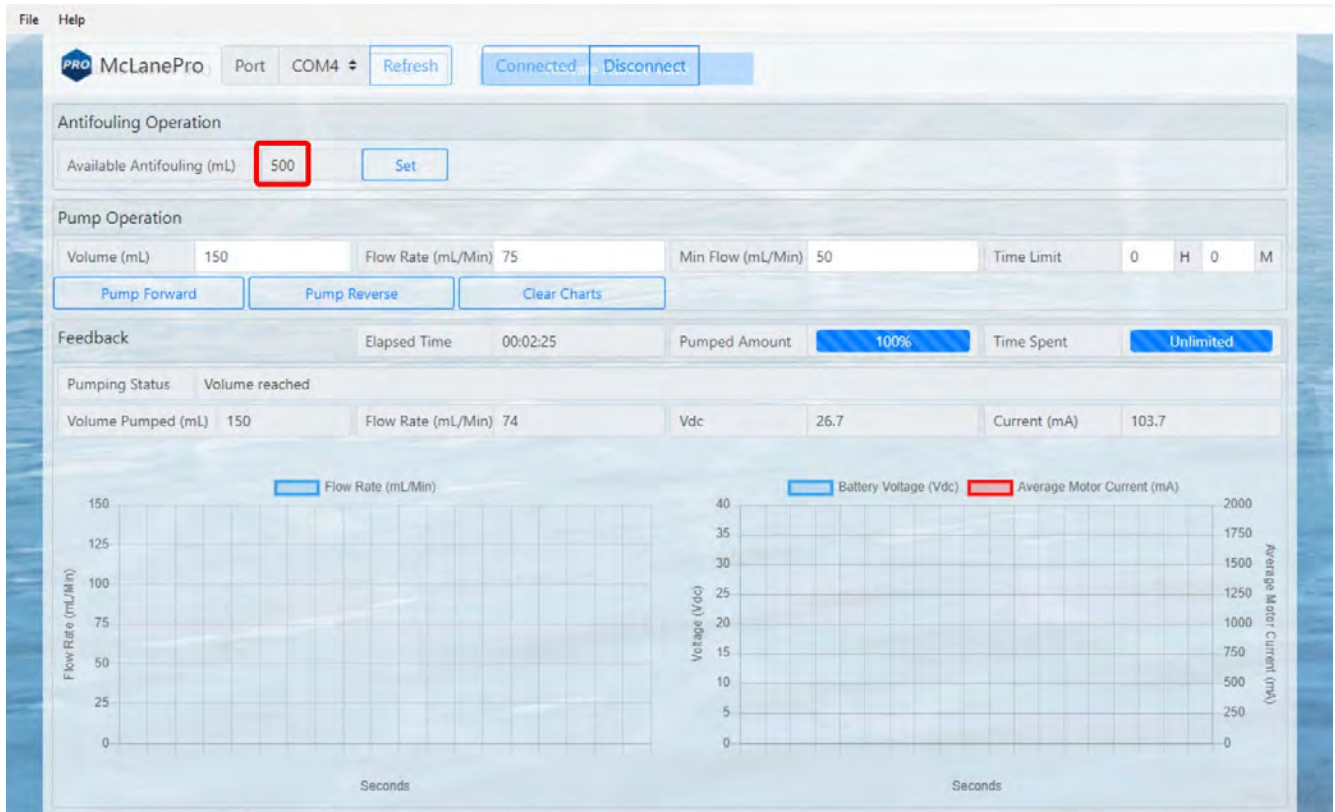
Available antifoulant is displayed for reference. When antifoulant is manually added to the reservoir (bag) this volume needs to be updated by the user. A full bag of antifoulant typically holds 500 mL (or 800 mL, depending on instrument type and configuration). Click the set button to change the available volume.



Enter the volume of antifoulant available in the reservoir and click **Set**.

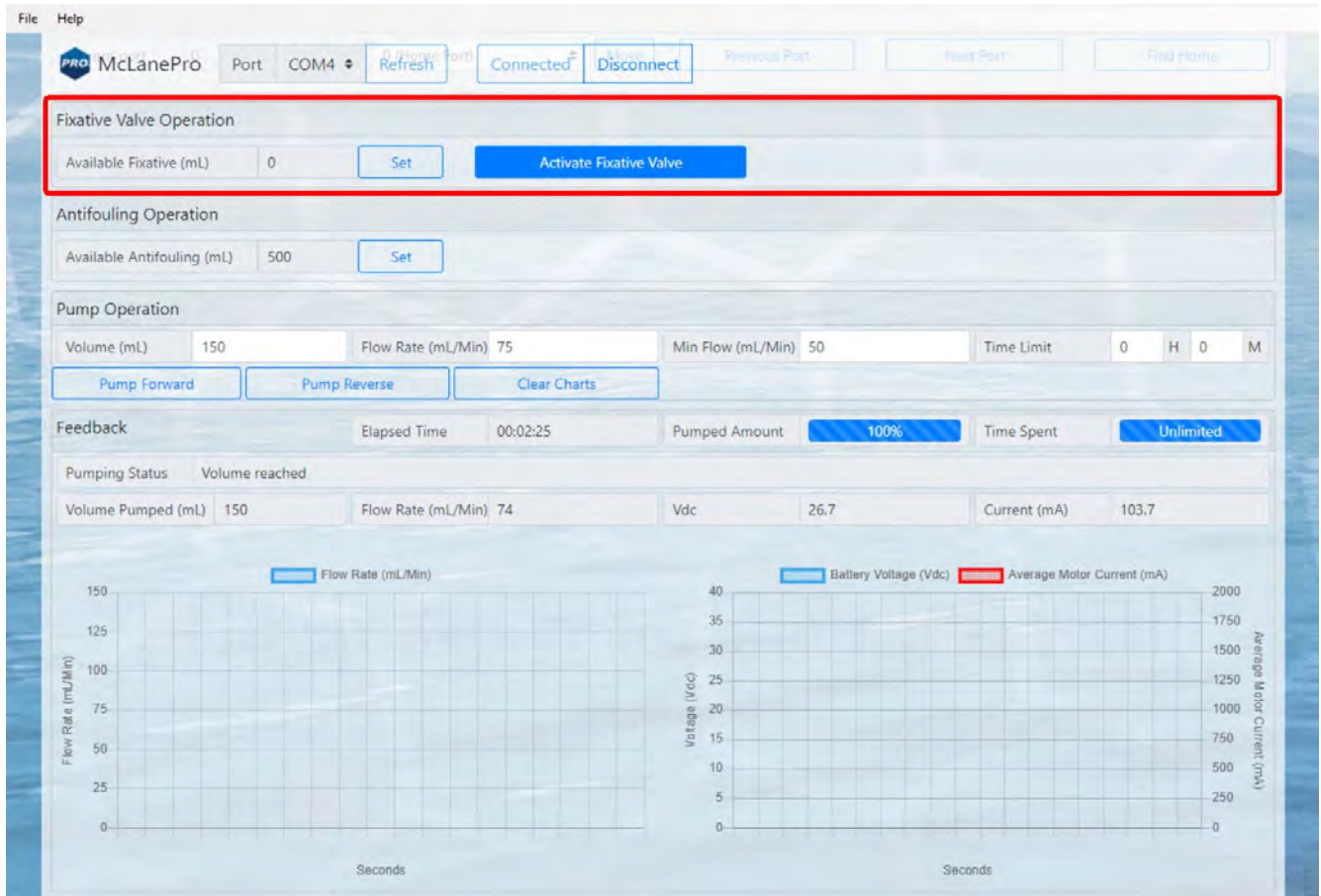


Available antifoulant will be updated and this value will be used when calculating deployment antifoulant usage during RAS deployment preparation.

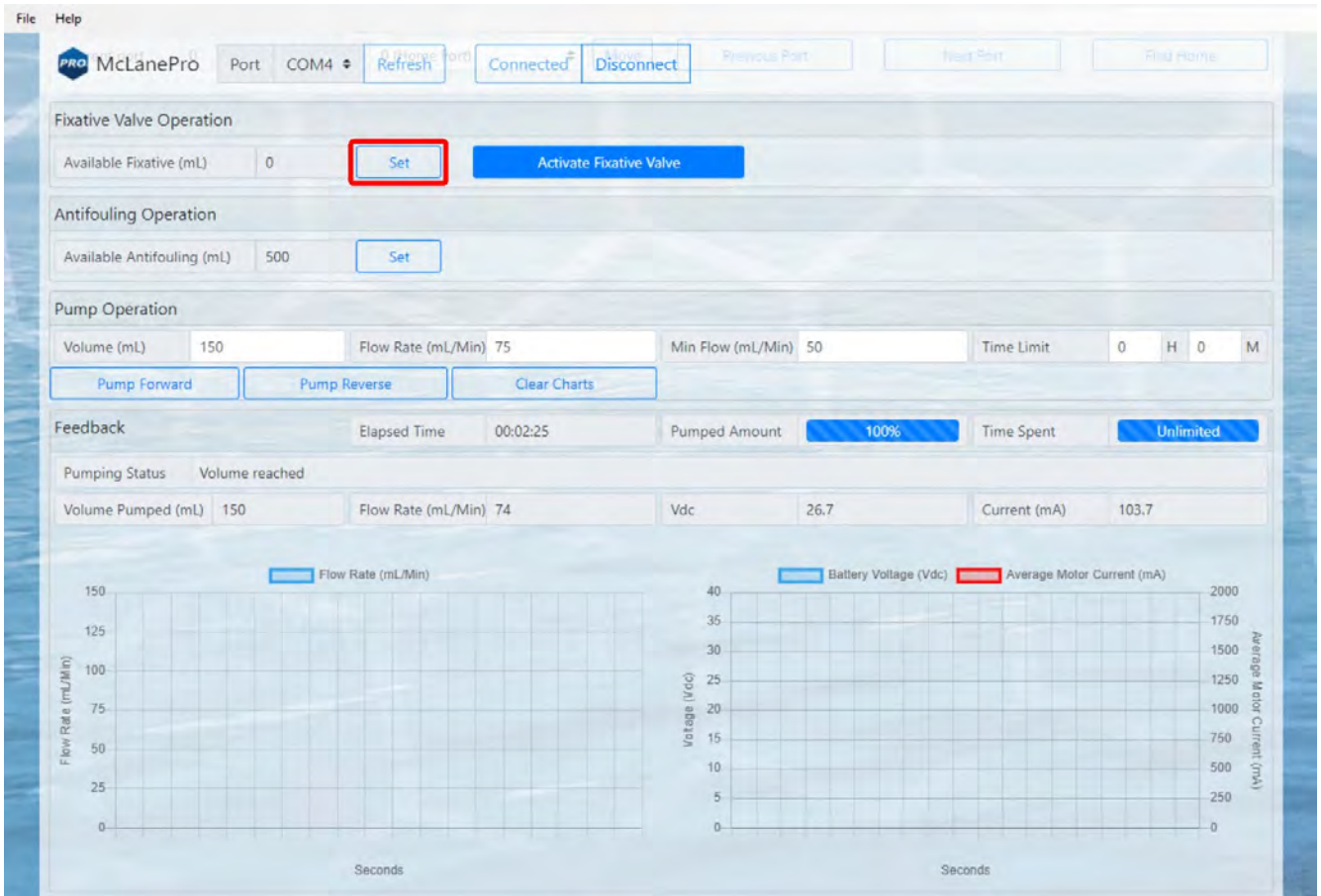


Fixative Operation

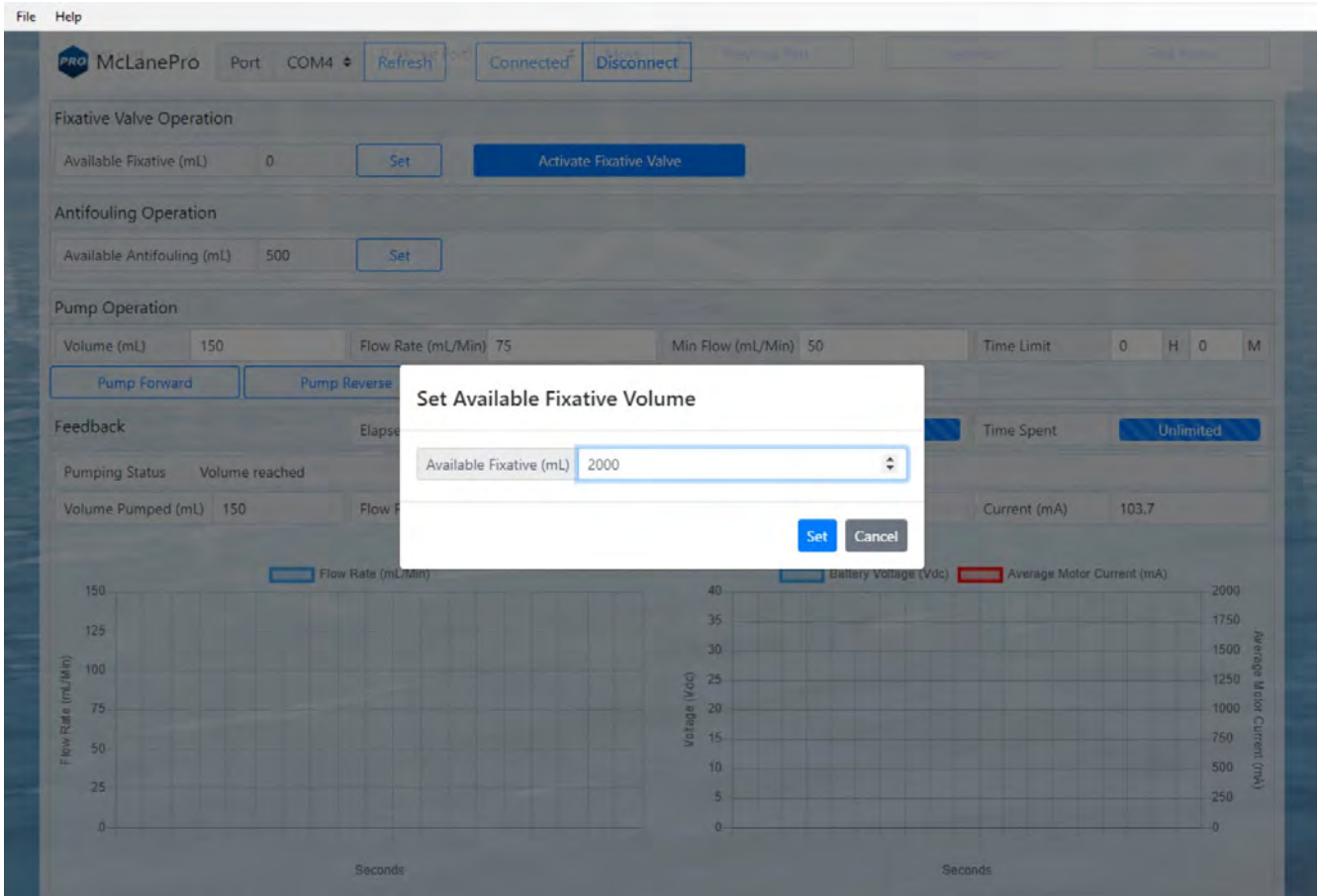
The RAS may optionally be equipped with a fixative valve and reservoir used to add fixative to a sample after collection. If this option is equipped, the **Manual Operation** tab allows for setting the available volume stored in the reservoir. Controls are also provided to activate the fixative valve manually. When activated, the valve directs fixative to the RAS intake; in an inactive state, the valve leaves the intake set to the environment.



Available fixative is displayed for reference. When fixative is manually added to the reservoir (bag) this volume needs to be updated by the user. A full bag of fixative typically holds 2000 mL. Click the set button to change the available volume.



Enter the volume of fixative available in the reservoir and click **Set**.



Available fixative will be updated and this value will be used when calculating deployment fixative usage during RAS deployment preparation.

File Help

McLanePro Port COM4 Refresh Connected Disconnect Previous Page Next Page Find Home

Fixative Valve Operation
Available Fixative (mL) **2000** Set Activate Fixative Valve

Antifouling Operation
Available Antifouling (mL) 500 Set

Pump Operation
Volume (mL) 150 Flow Rate (mL/Min) 75 Min Flow (mL/Min) 50 Time Limit 0 H 0 M
Pump Forward Pump Reverse Clear Charts

Feedback
Elapsed Time 00:02:25 Pumped Amount 100% Time Spent Unlimited

Pumping Status Volume reached
Volume Pumped (mL) 150 Flow Rate (mL/Min) 74 Vdc 26.7 Current (mA) 103.7

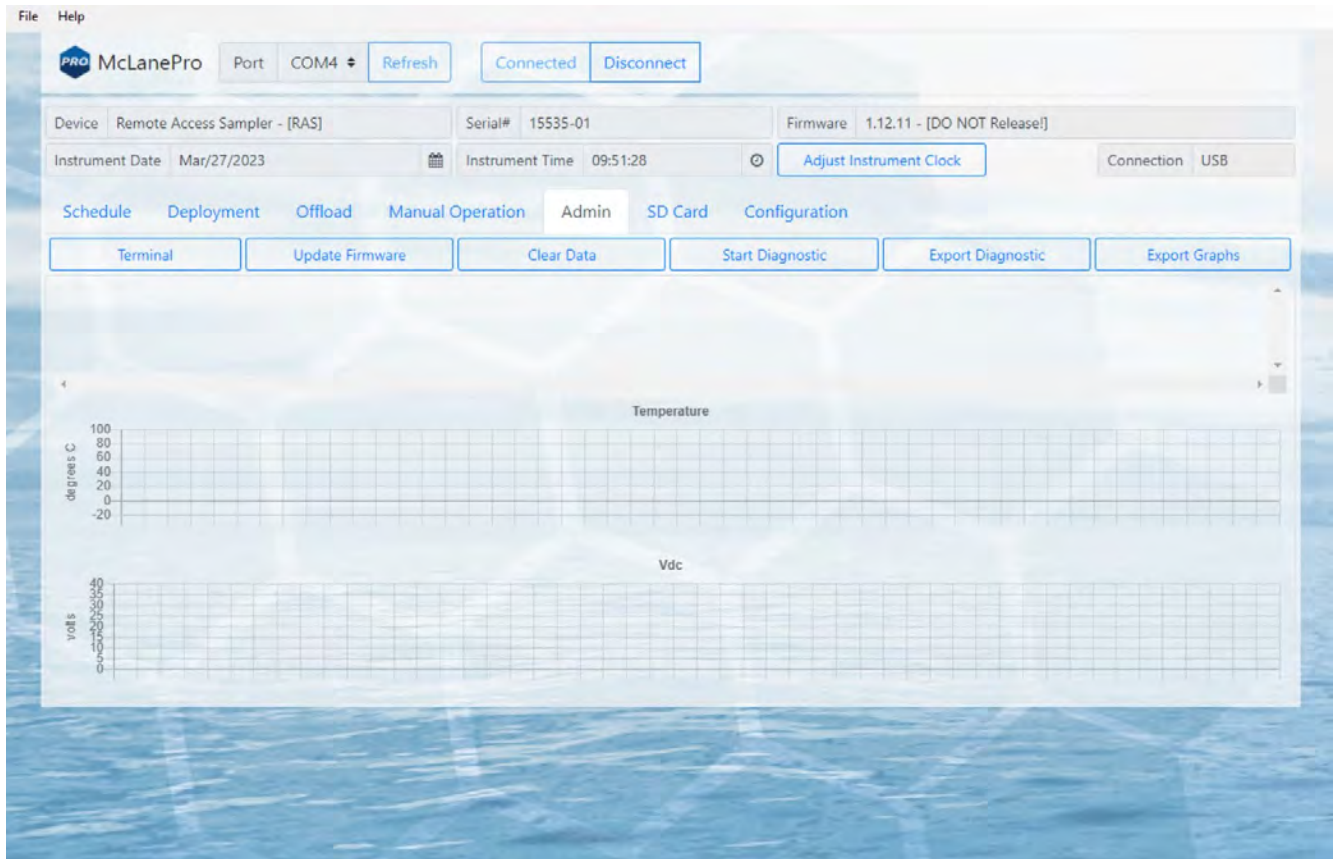
Flow Rate (mL/Min) Chart
Y-axis: Flow Rate (mL/Min) 0 to 150
X-axis: Seconds
Legend: Flow Rate (mL/Min)

Battery Voltage (Vdc) and Average Motor Current (mA) Chart
Y-axis: Voltage (Vdc) 0 to 40
Y-axis: Average Motor Current (mA) 0 to 2000
X-axis: Seconds
Legend: Battery Voltage (Vdc), Average Motor Current (mA)

The Admin Tab

The Admin tab is used to:

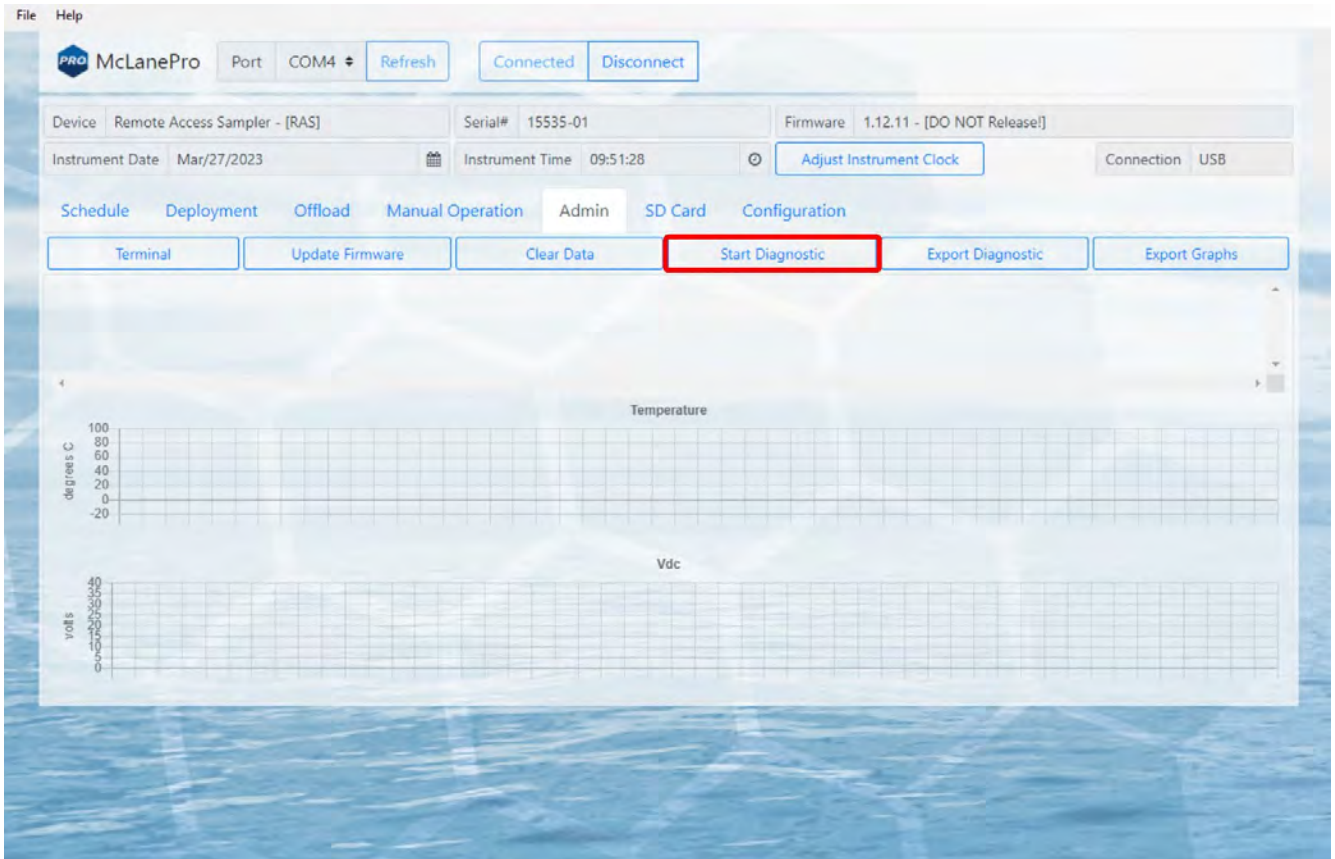
- [Run Diagnostics](#)
- [Update Firmware](#)
- [Communicate to the RAS Using the Terminal](#)



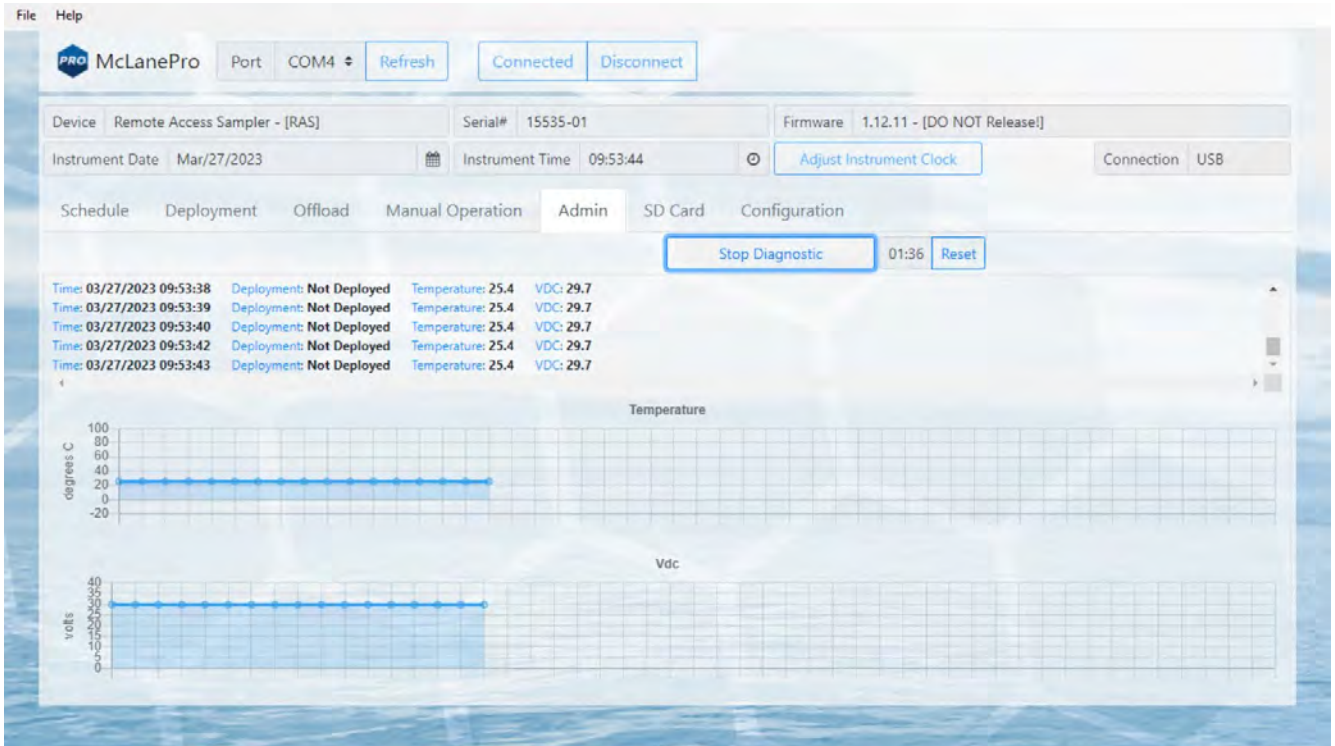
Running Diagnostics

The Admin tab contains a diagnostic utility that provides system state information.

To run diagnostics, click **Start diagnostic**. Data will begin to print to the screen, and graphs will begin to display data.



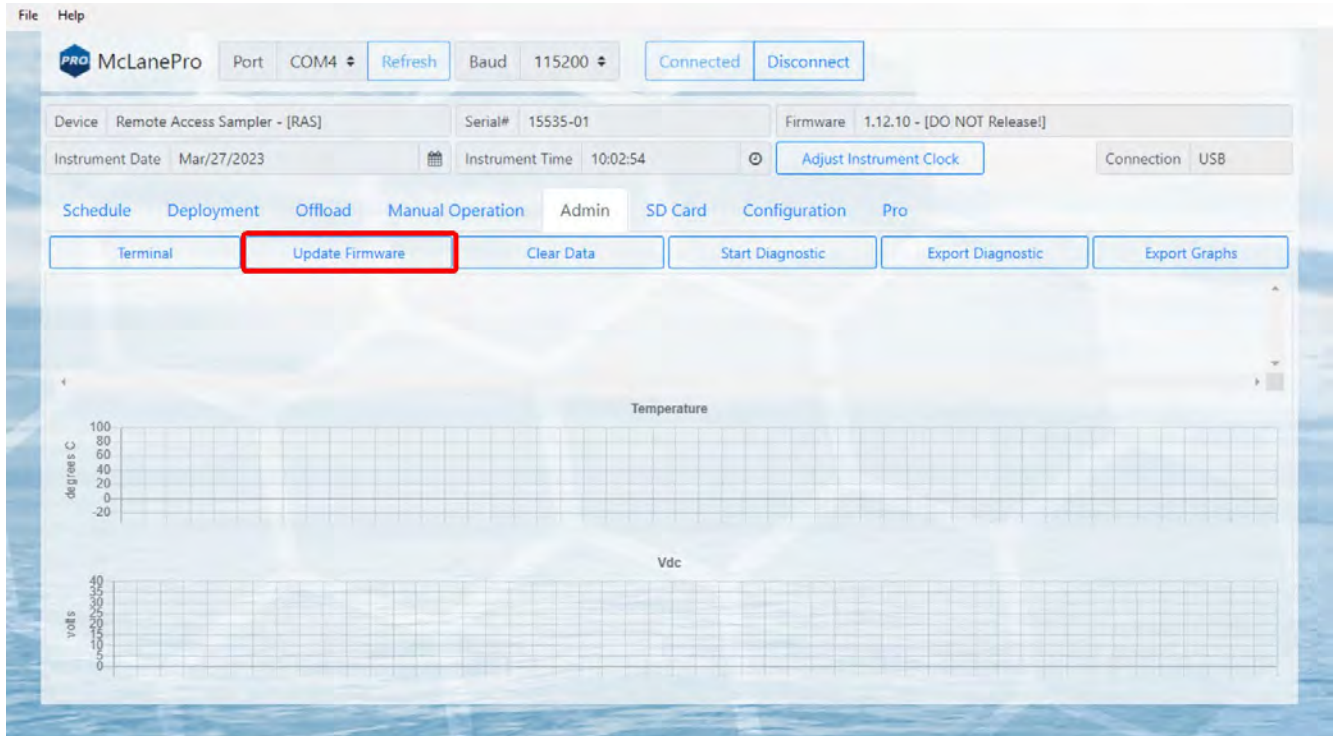
Diagnostics will run for two minutes, otherwise, click Stop diagnostic.



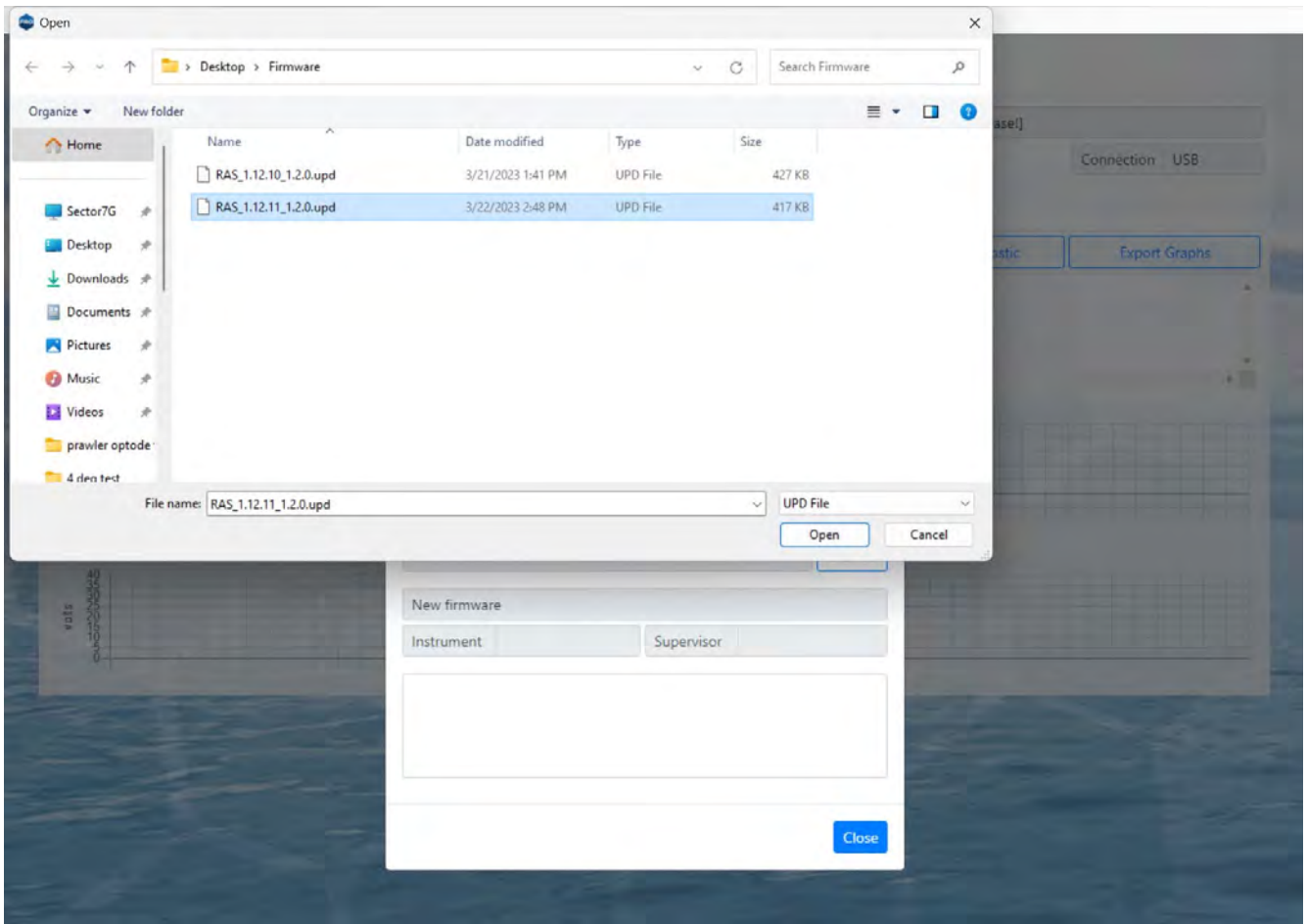
After running diagnostics, clear the data on the **Admin** tab by clicking the **Clear Data** button. Alternatively, diagnostic data and graphs may be exported using the buttons provided.

Update Firmware

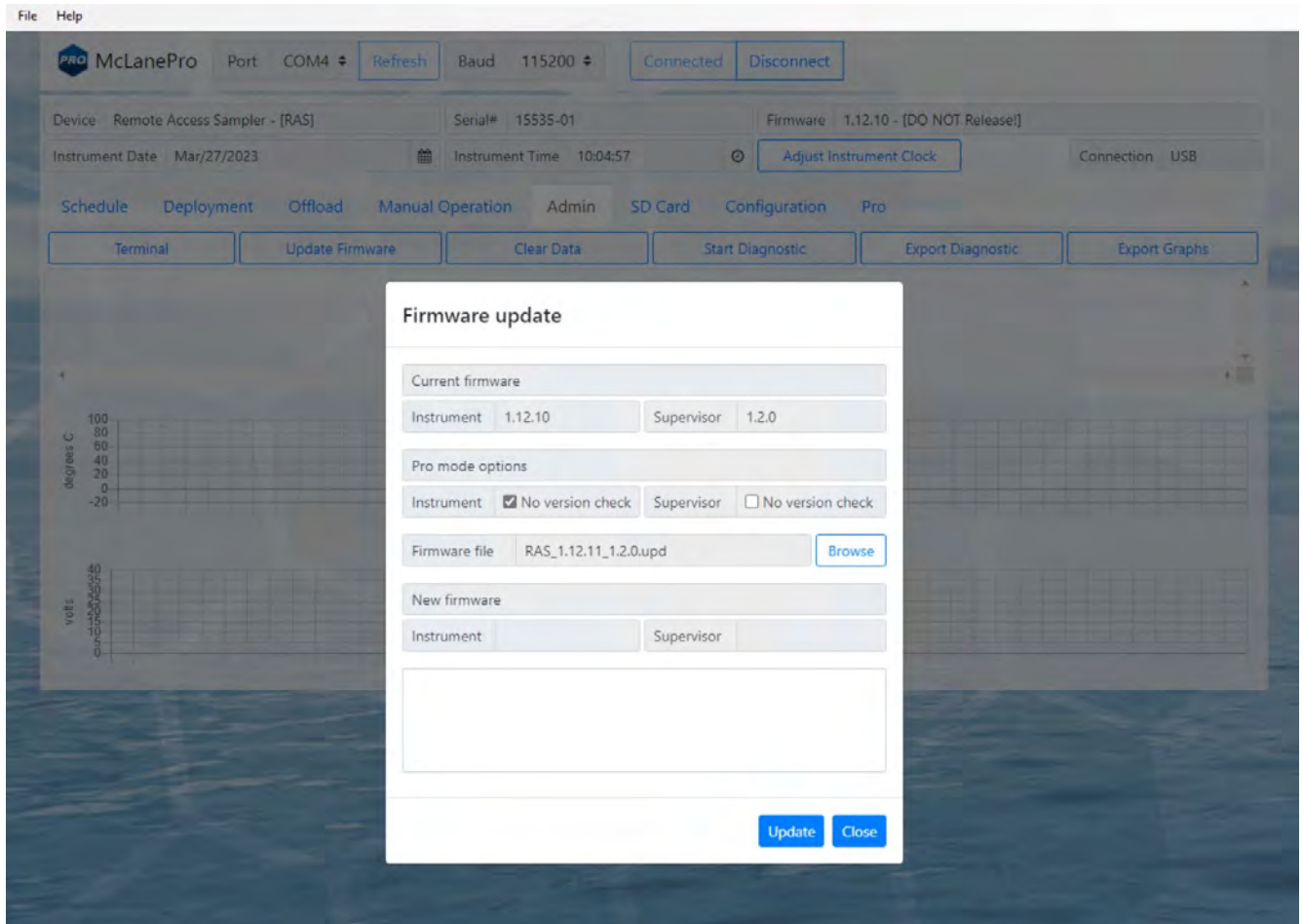
1. To update firmware click the **Update firmware** button on the **Admin** tab.



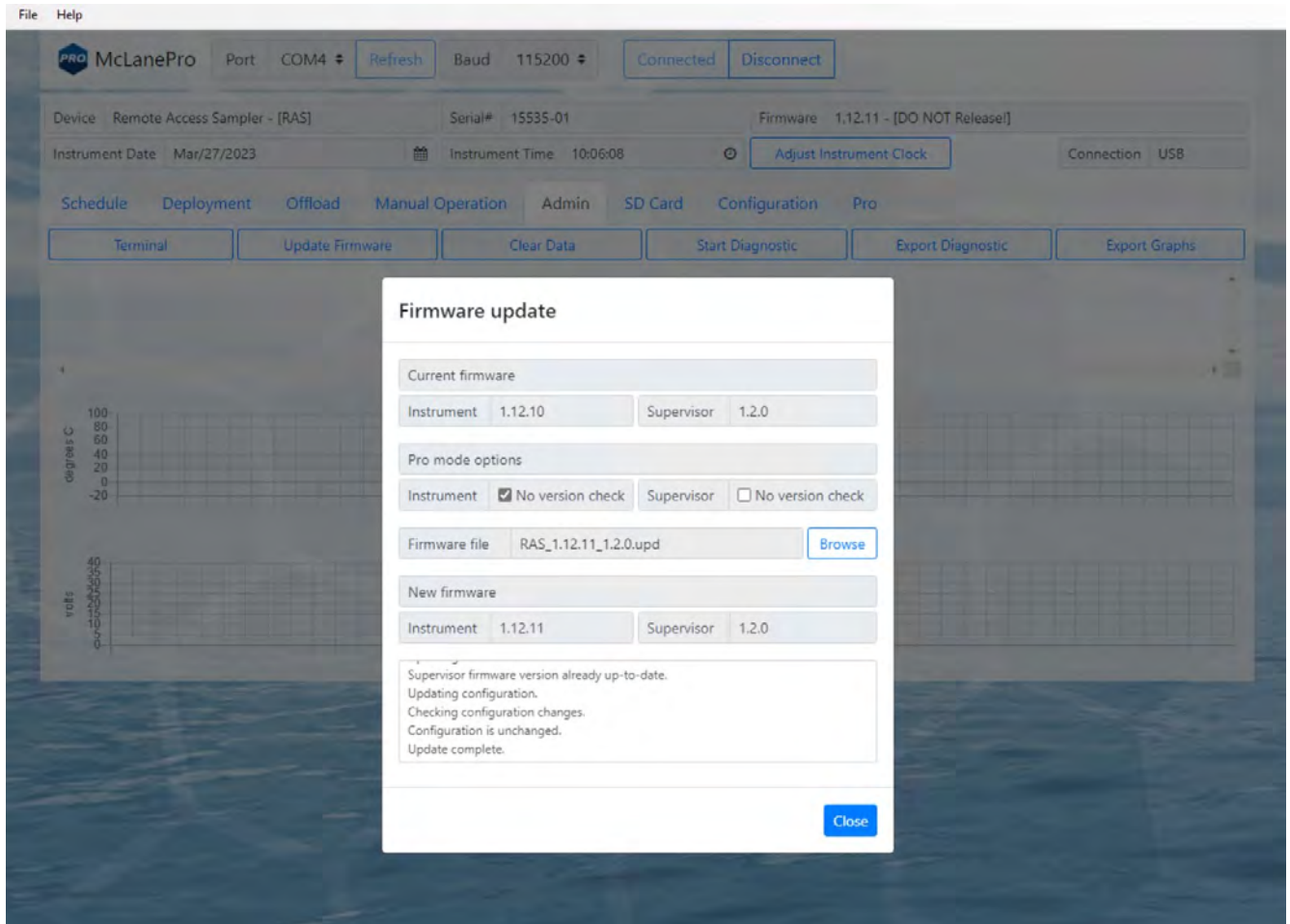
2. Click **Browse**, and select a McLane *.UPD file to upload.



3. Once a *.UPD file is selected, click **Update** to update the RAS firmware.

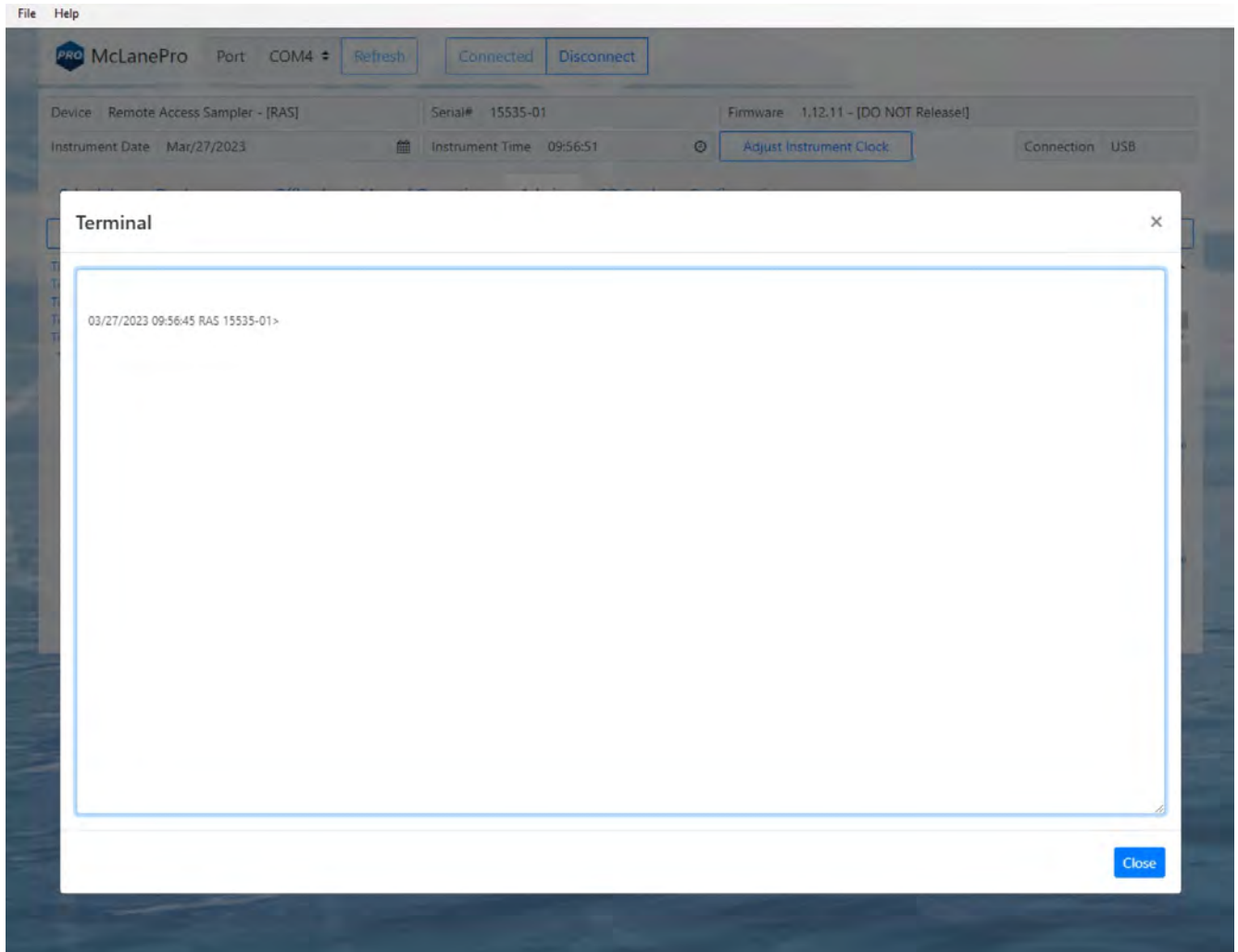


In some cases, a firmware update may revert the RAS configuration to default values. McLanePro detects when this happens, and loads the **Configuration** tab to allow reconfiguration of the instrument after the firmware update is complete. Otherwise, the update will complete and report that the configuration is unchanged.



The Terminal

A command-line interface provides an option for command-driven control over the RAS. Access the terminal interface through the **Admin** tab, or by typing **ALT+T**.



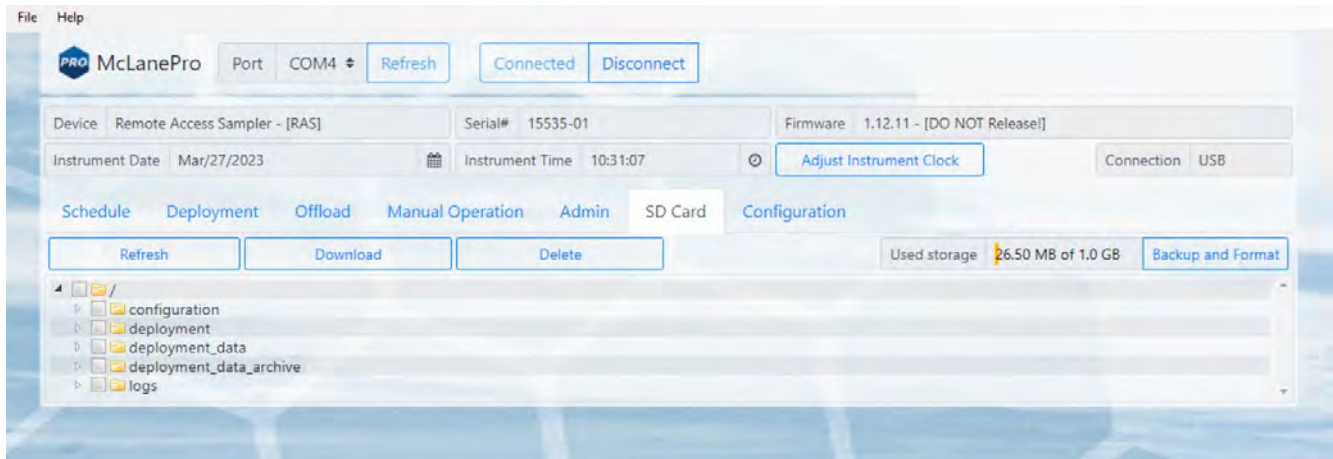
Whenever the terminal is closed, a log of that session is automatically downloaded. Contact mclane@mclanelabs.com for a list of available terminal commands.

The SD Card Tab

The **SD Card** tab allows for file operations on the RAS MicroSD® Card.

The entire card can be downloaded, deleted, or formatted.

Contact mclane@mclanelabs.com before deleting any files or formatting the card.



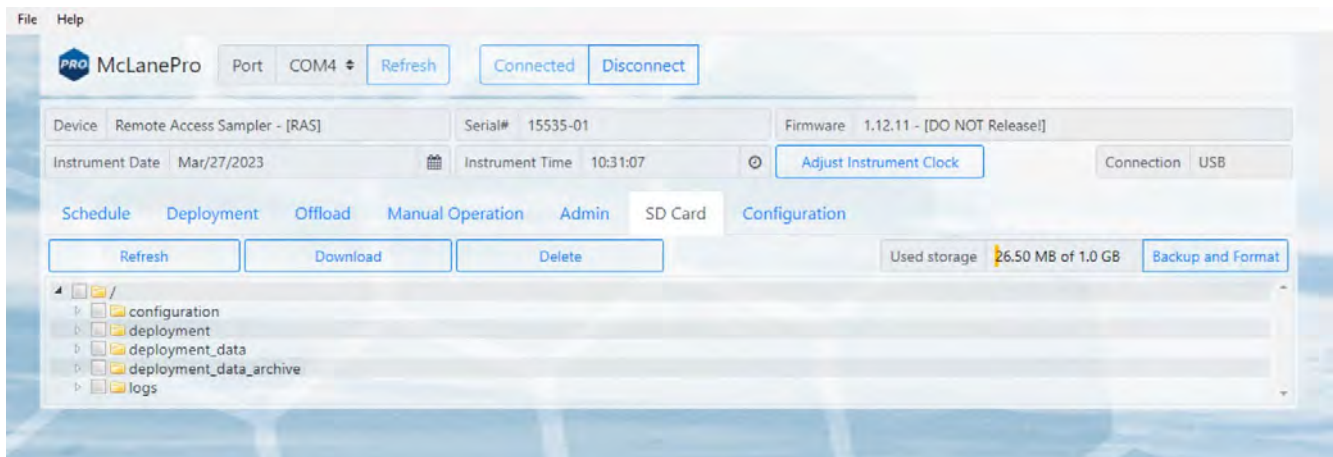
File Operations

The **SD Card** tab provides buttons to execute commands relating to the data files on the installed SD card. Data files may be downloaded, deleted or uploaded. Please do not delete any files unless instructed to do so by the firmware or a McLane representative.

Refresh - clicking **Refresh** will scan the installed SD card and update the directory tree with new data.

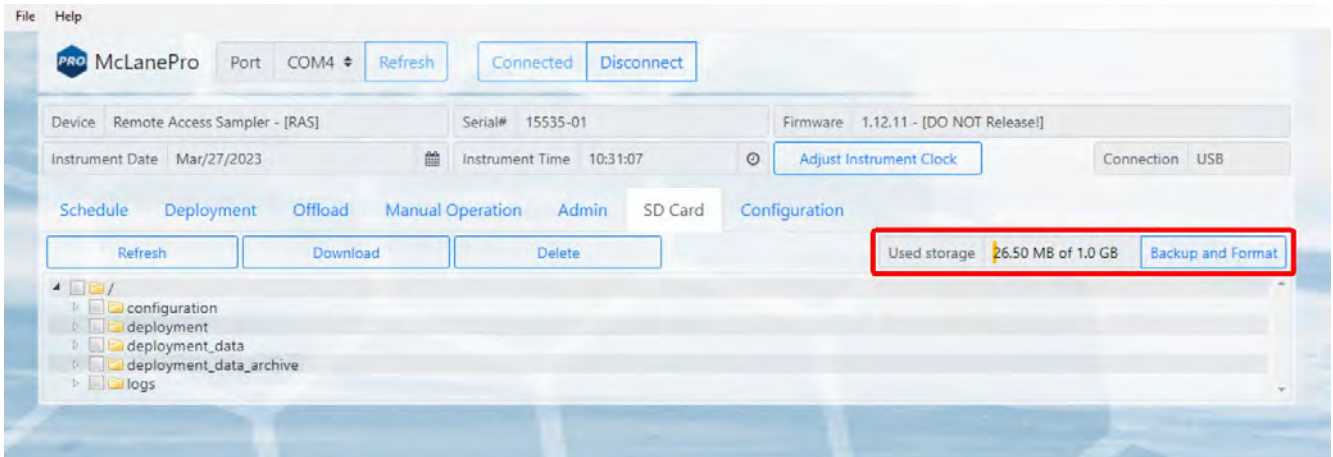
Download - clicking **Download** will compress selected files into a ZIP file that is then downloaded to the connected computer.

Delete - clicking **Delete** will remove the selected files and/or directories. Once data are deleted from the RAS they are not recoverable.

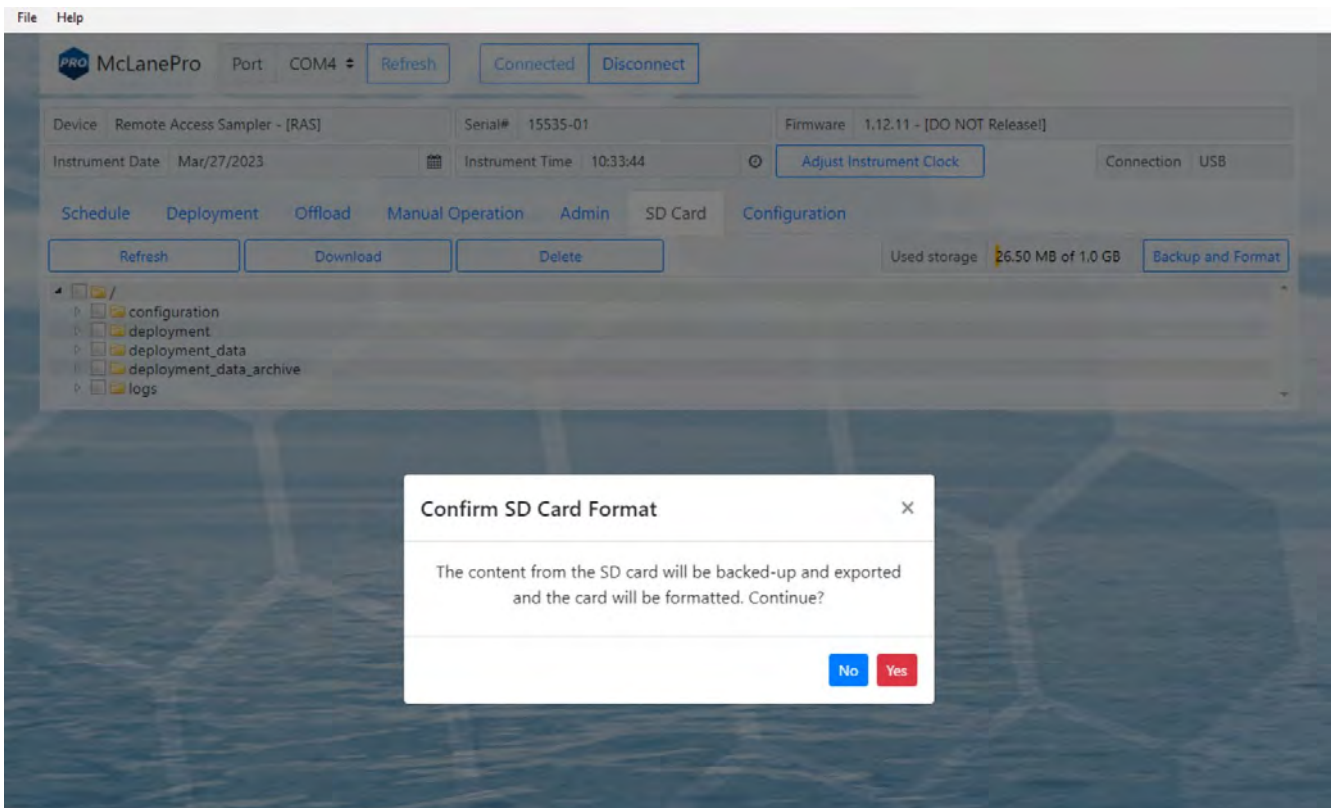


Status of the SD card is provided via the **Used storage** display. Additionally, a **Backup and Format**

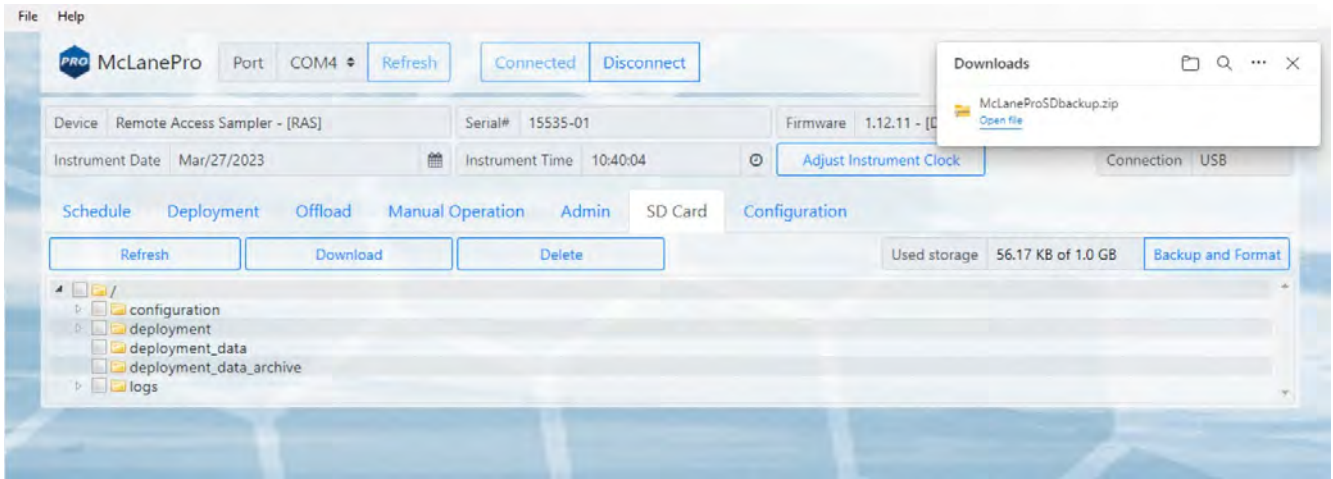
button is provided that allows for the user to download all the data from the SD card and then format the card.



The user must be aware that Backup and Format will delete all archived data sets and any deployment data on the SD card.

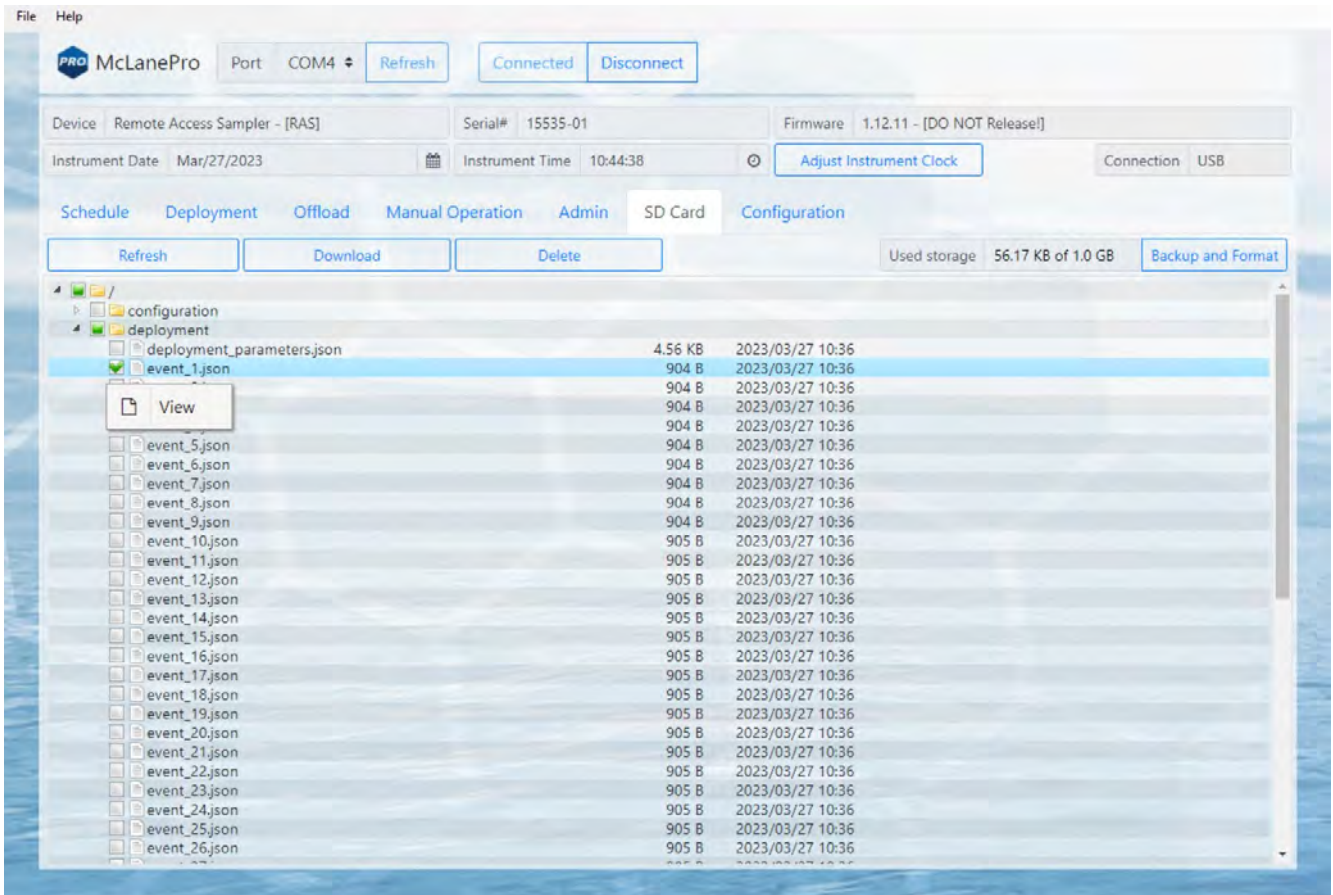


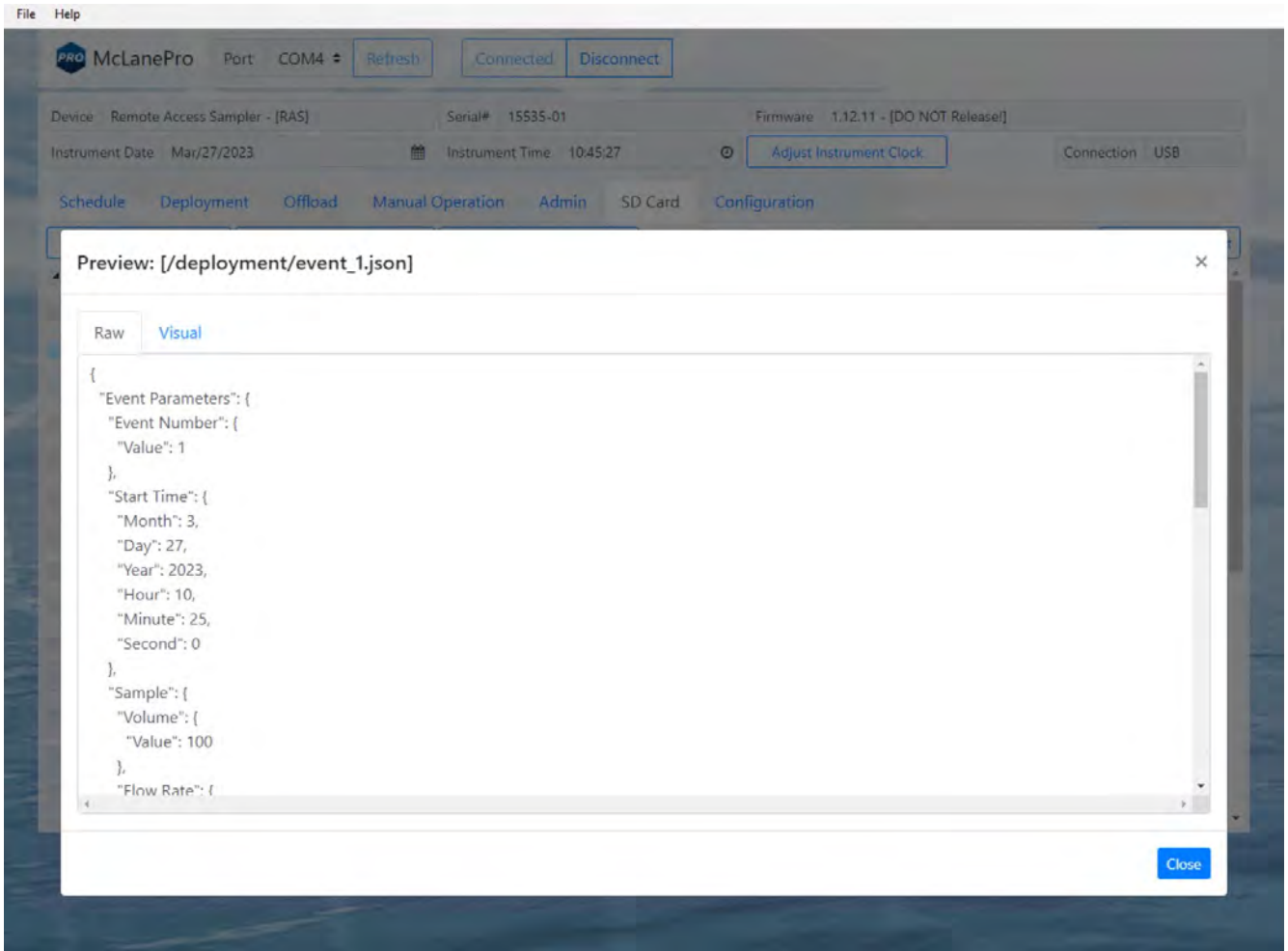
All data from the SD card are compressed into a ZIP file and downloaded before the SD card is formatted.



File preview

The **SD card** tab allows previewing of data files by right clicking a selected file, and then clicking **View**.

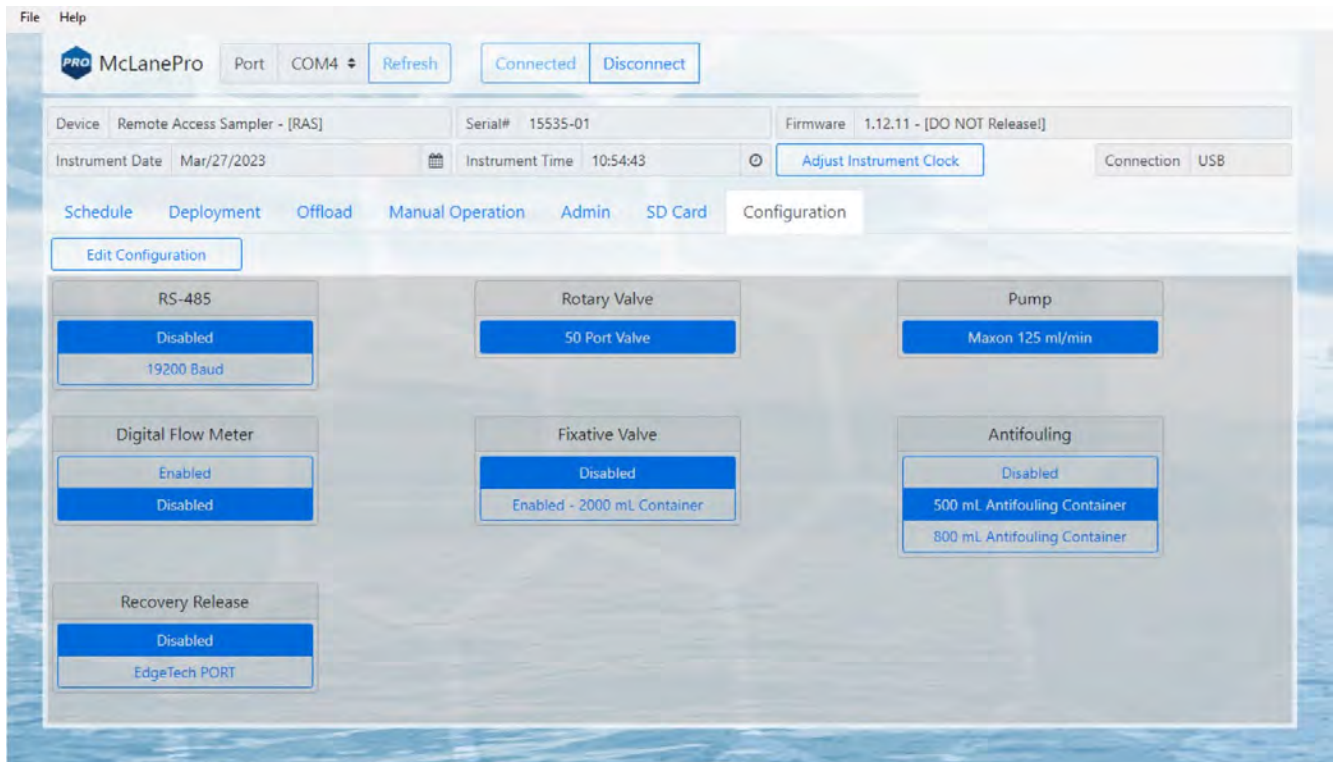




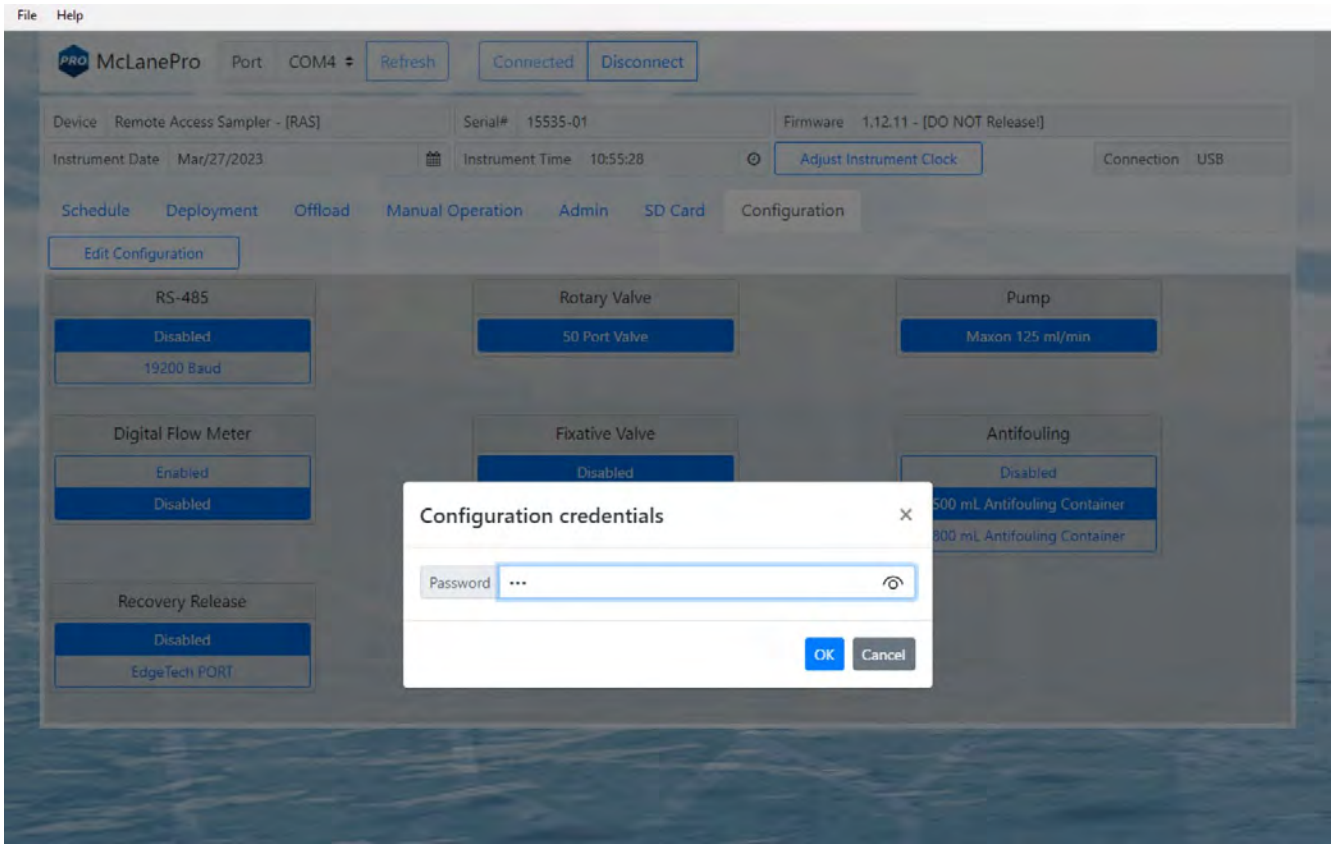
The Configuration Tab

RAS firmware is configured to match the pump head size (and/or additional options) before shipping. The **Configuration** tab is not used often. However, if a firmware update reverts the RAS to default values, the **Configuration** tab is used to change the values.

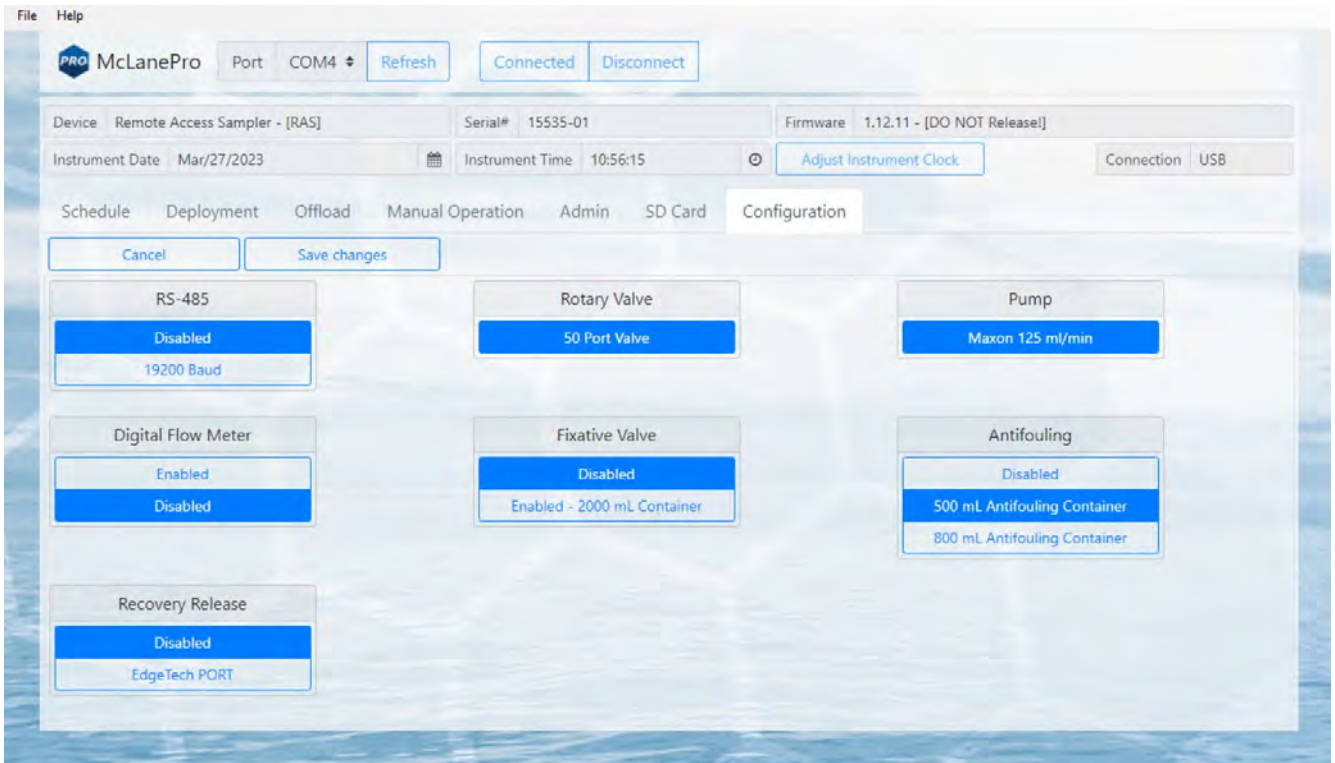
1. To change the RAS configuration, navigate to the **Configuration** tab and select **Edit Configuration**.



2. When prompted for a password, enter "con".

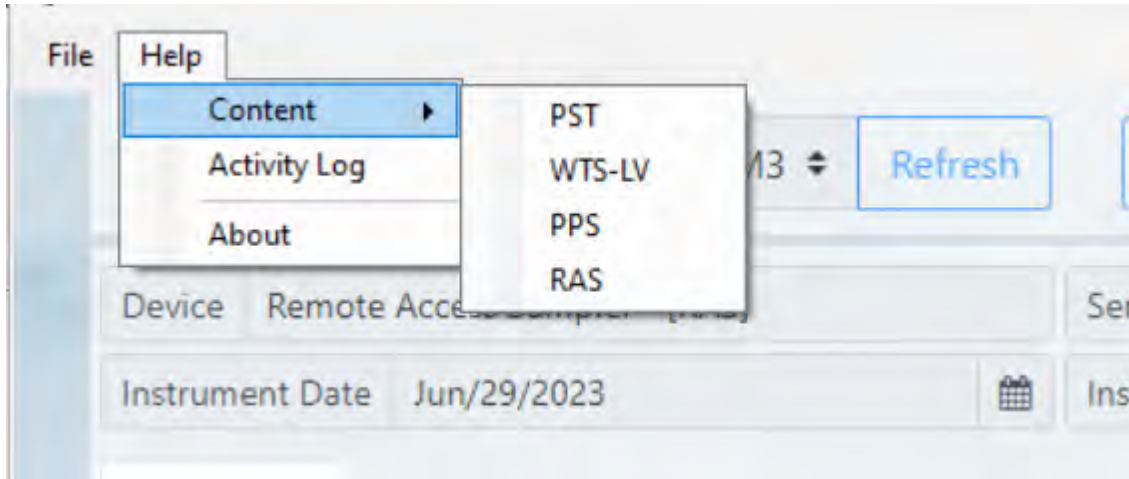


3. Confirm or change the RAS pump configuration, or other available options, and click **Save changes**.

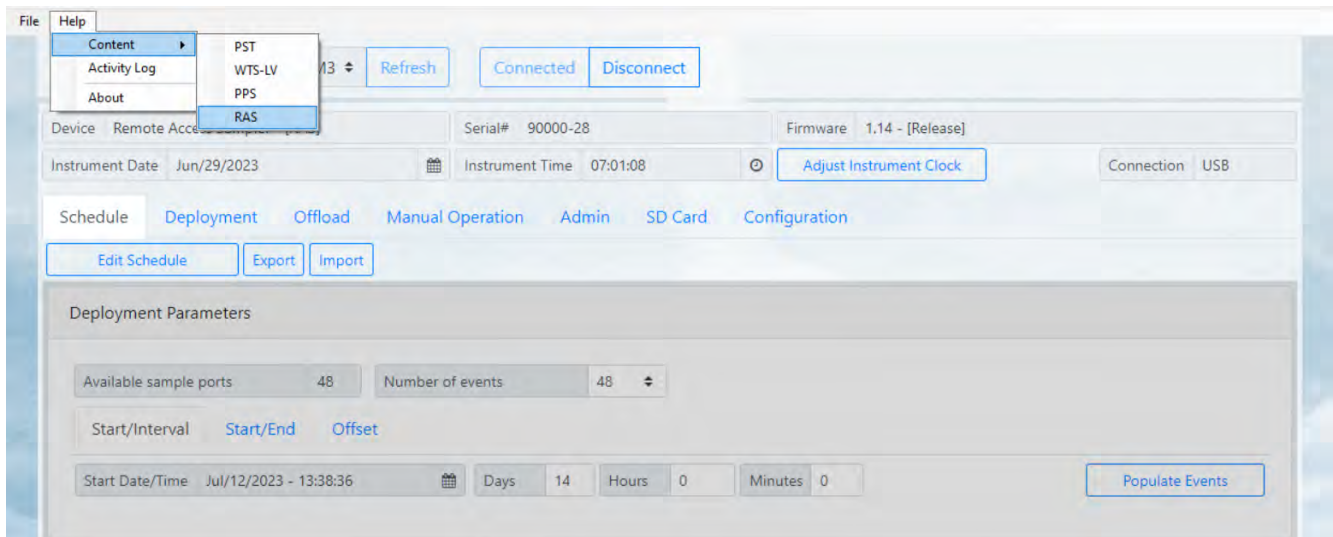


The Help Menu

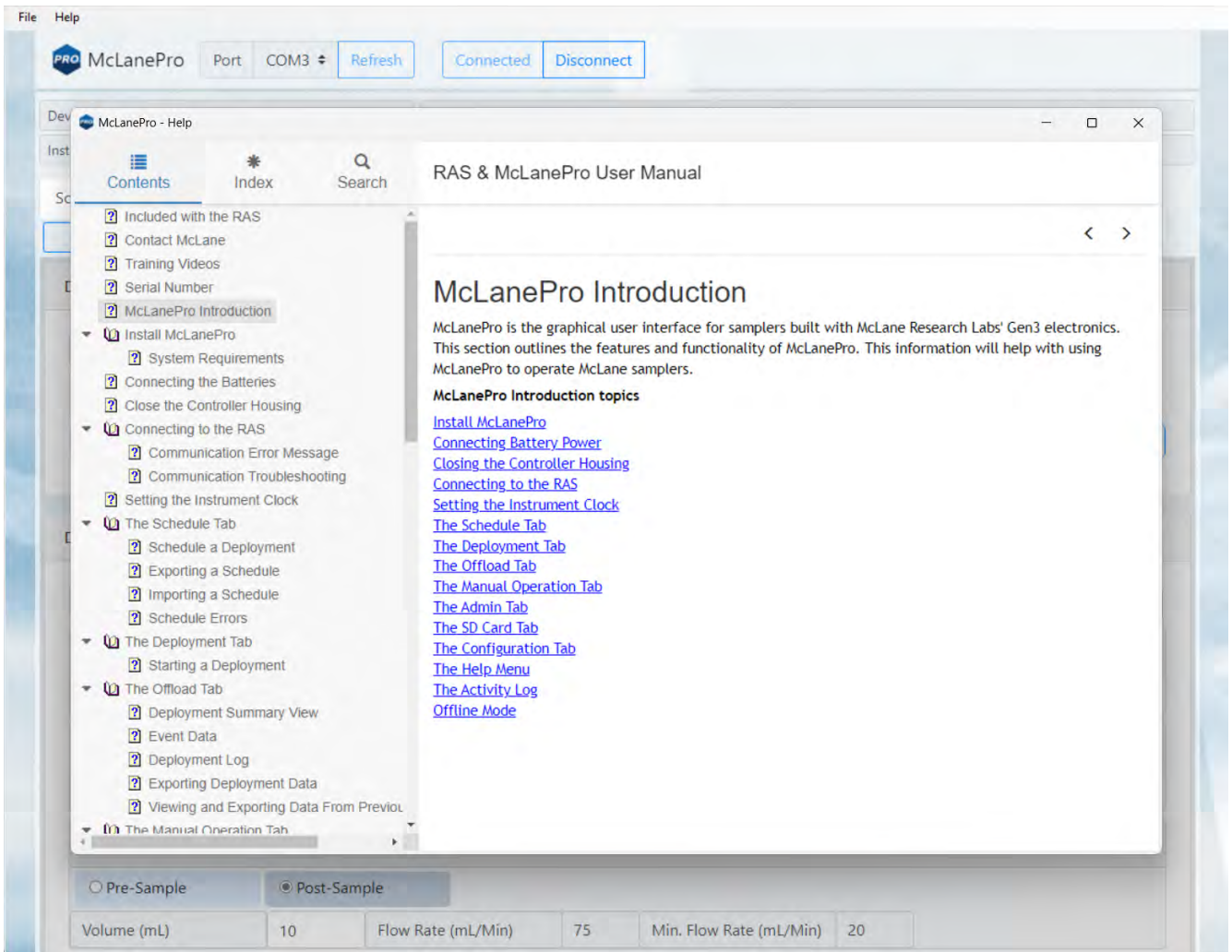
The McLanePro **Help Menu** contains links to device-specific user manuals, as well as McLanePro general information.



Select the appropriate help file for the device connected to McLanePro.

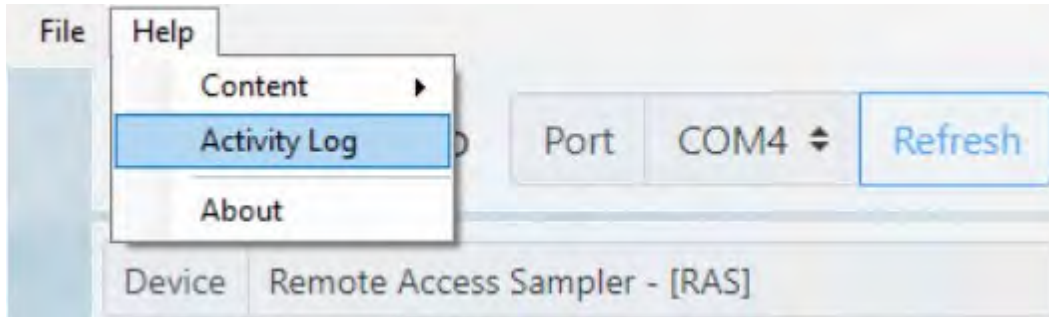


In this example, the device is a sampler with device code RAS. The help file contains user instruction and information on RAS.

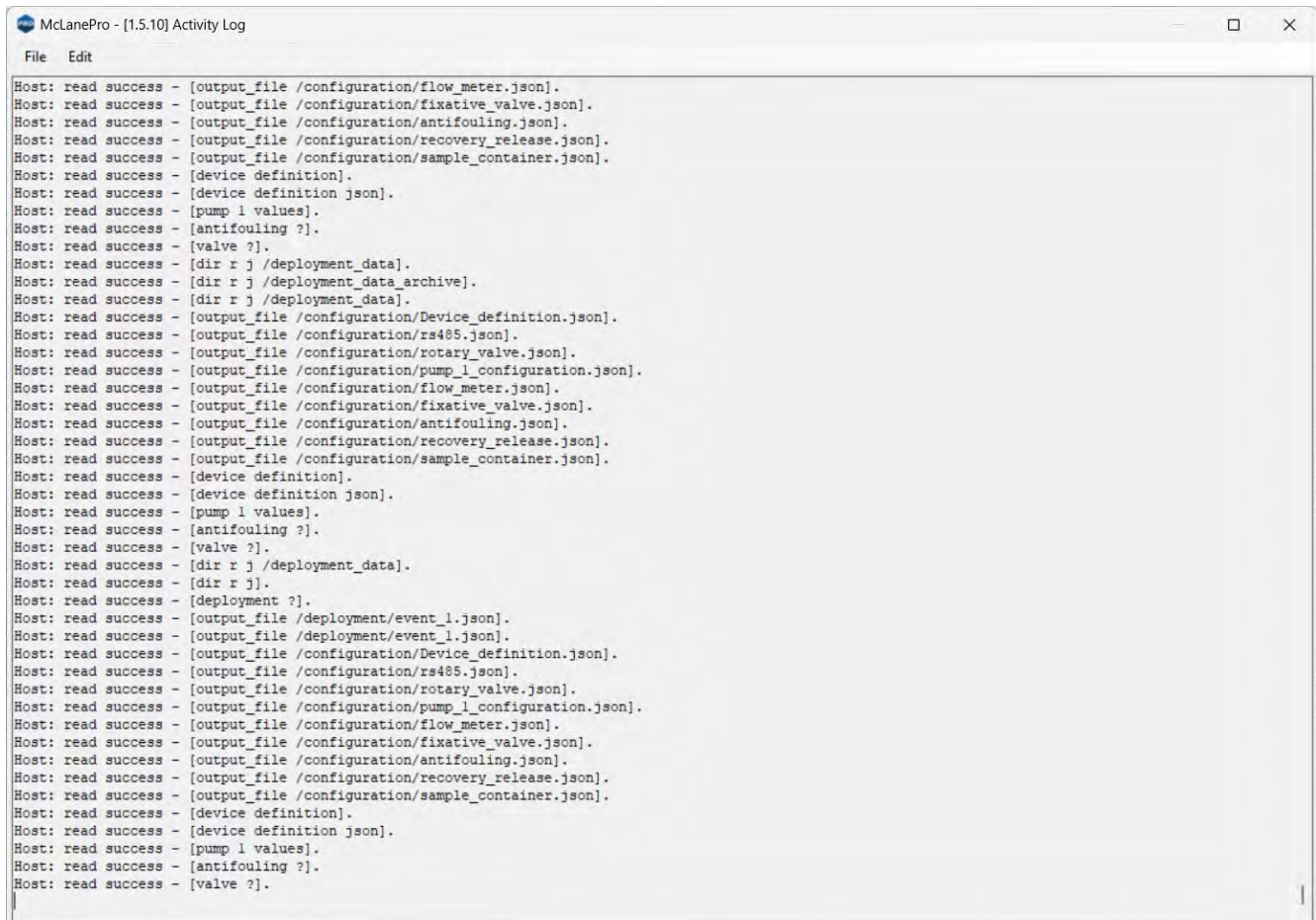


The Activity Log

Communications between McLanePro and the RAS are visible when entering the **Activity Log** from the McLanePro Help Menu.

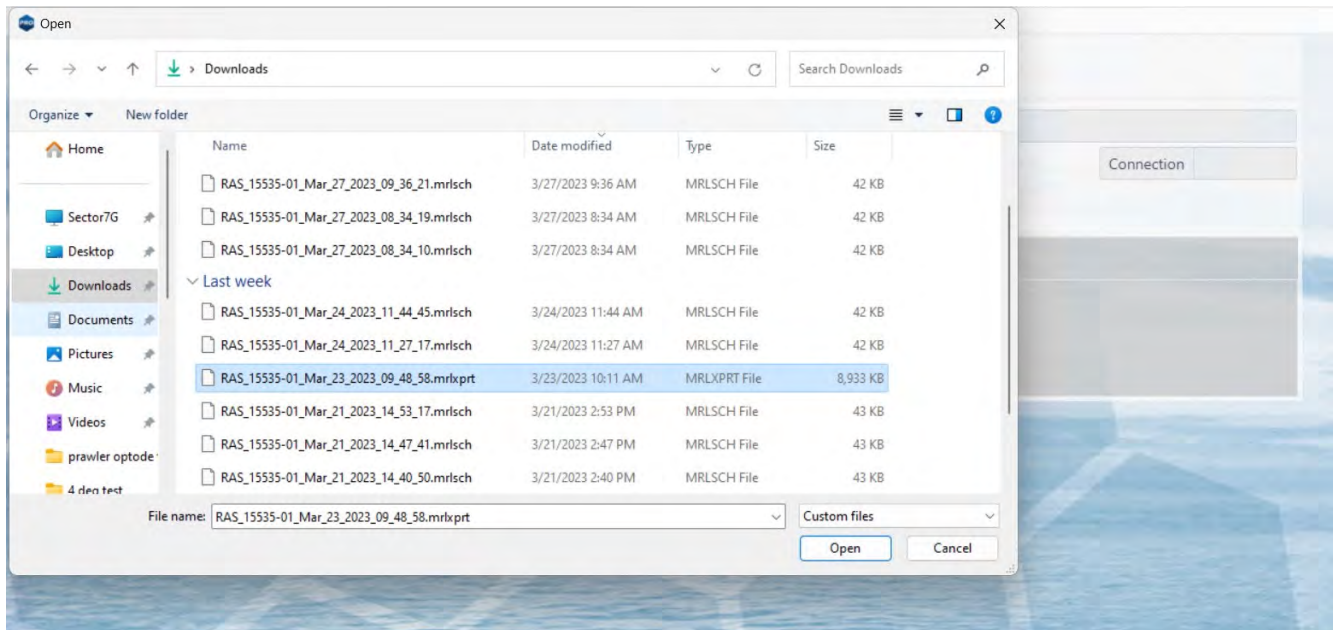
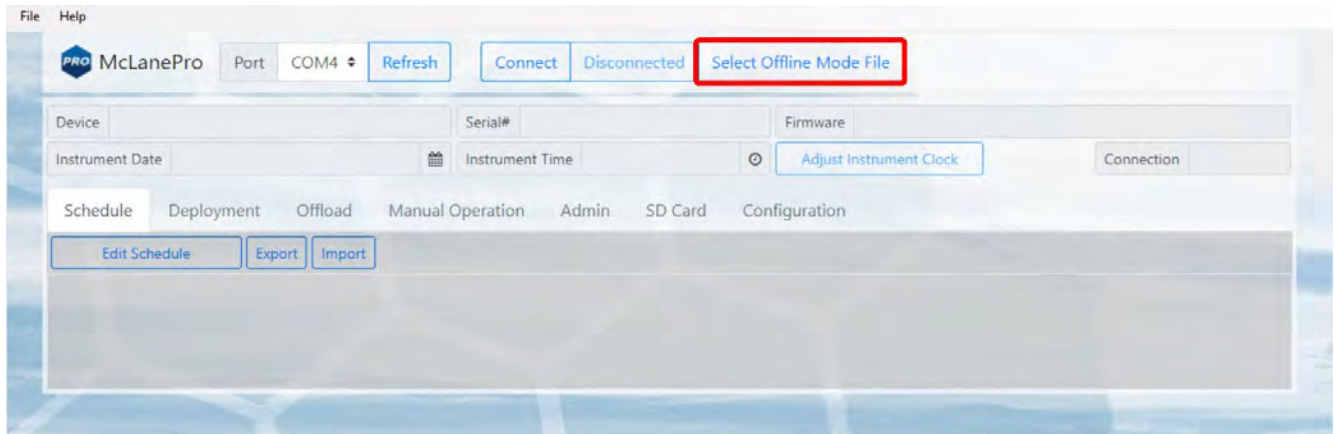


Within the **Activity Log**, there are options to **Save** the log to a text file (using the **File Menu**), or to **Copy** a selection of the **Activity Log** to the clipboard (using the **Edit Menu**).

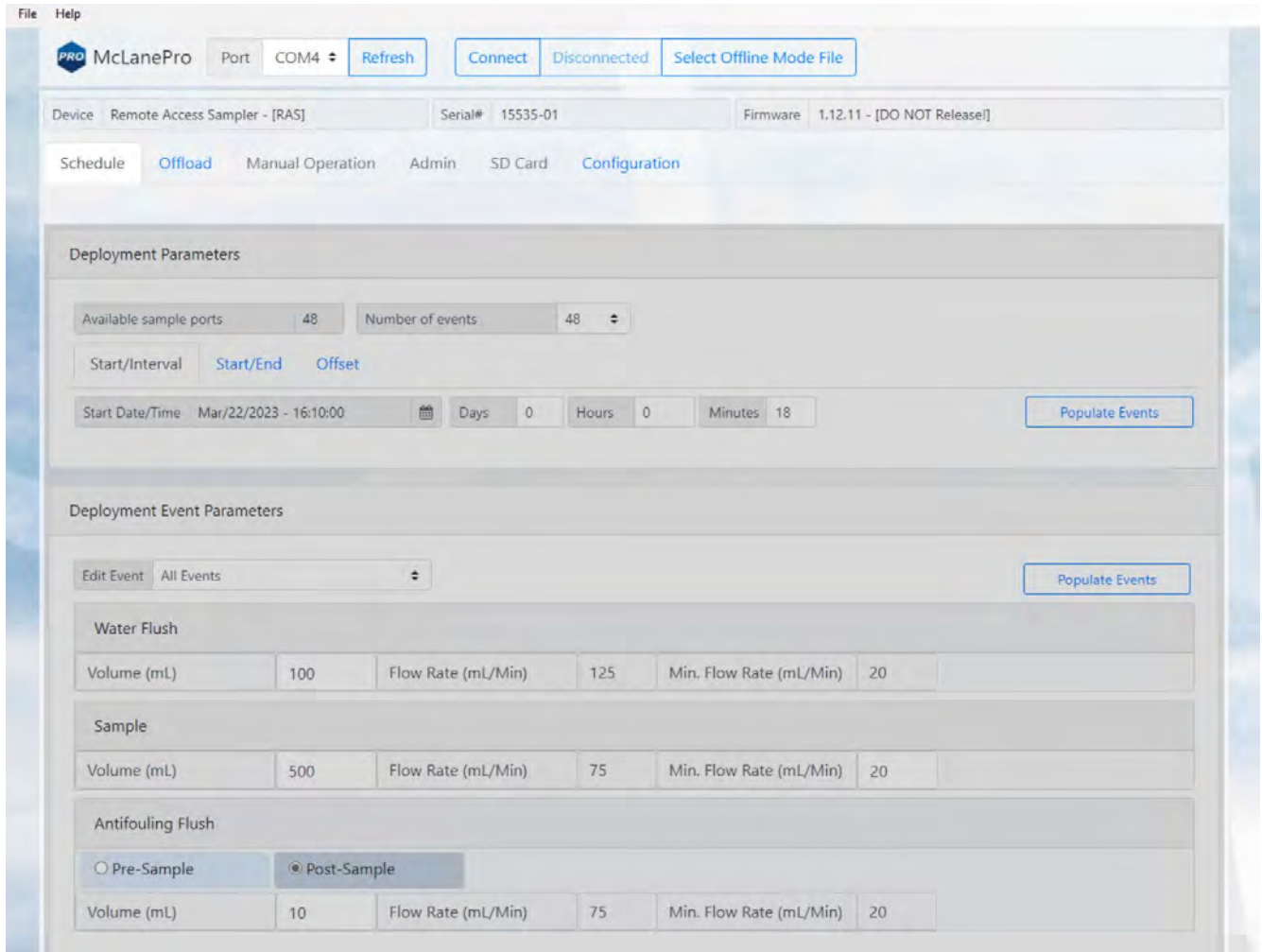


Offline Mode

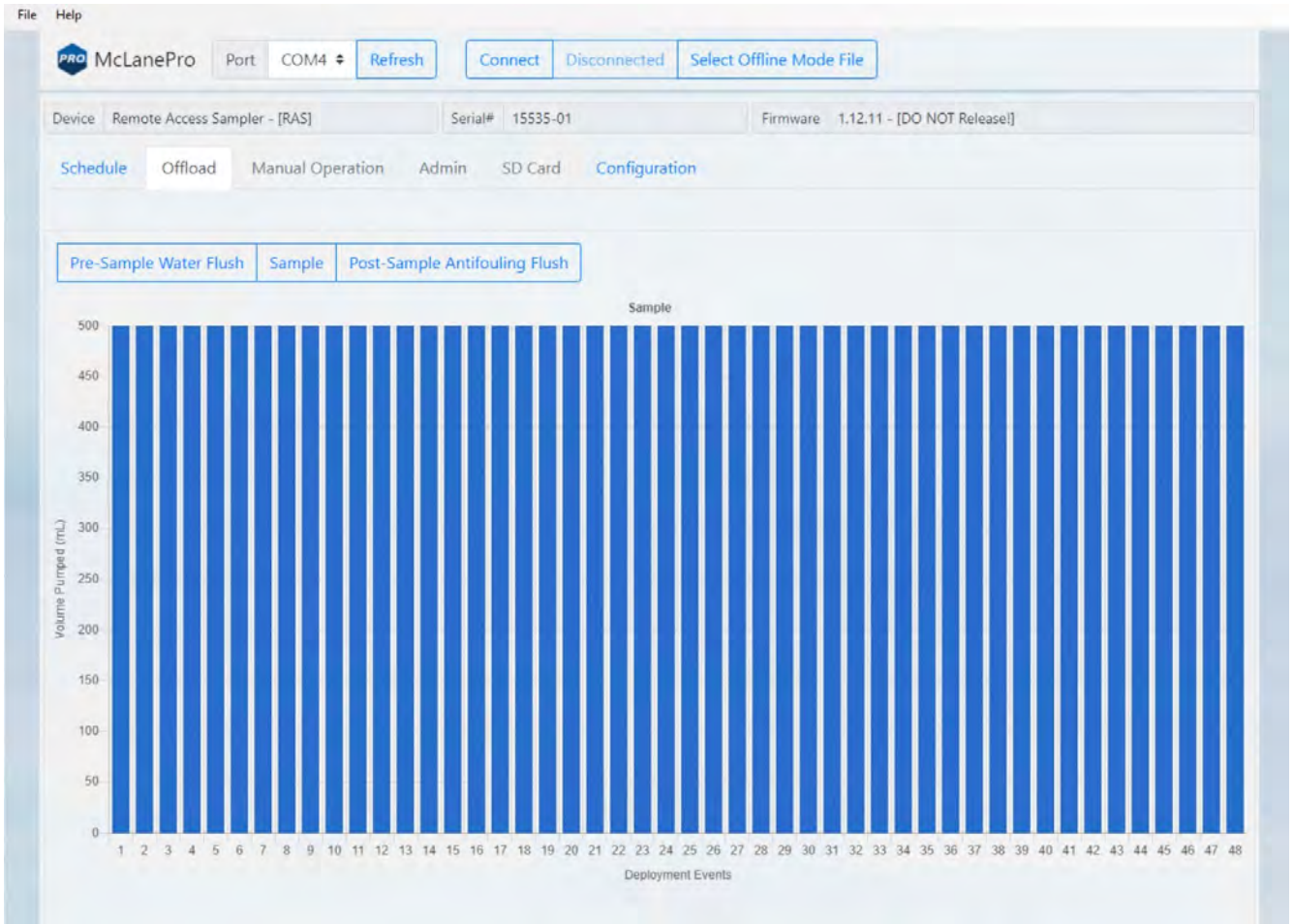
Offline mode is available for browsing schedules or exported data files. A device is not required to be connected in order to view offline files. Click **Select Offline Mode File** to browse for available files. Supported file types are McLane *.mrlsch and *.mrlxprt.



A *.mrlsch file will contain the schedule and device configuration along with the device, serial number and firmware information.



A *.mrlxprt file will contain schedule, configuration, device data, and additionally, offload data from a deployment.



RAS General Information

General information includes short descriptions of RAS models and available options. More detailed specification sheets are available on the McLane website, [RAS product page](#).

RAS General Information topics

[Description & Models](#)

[Sample Tubes & Sample Bag Types](#)

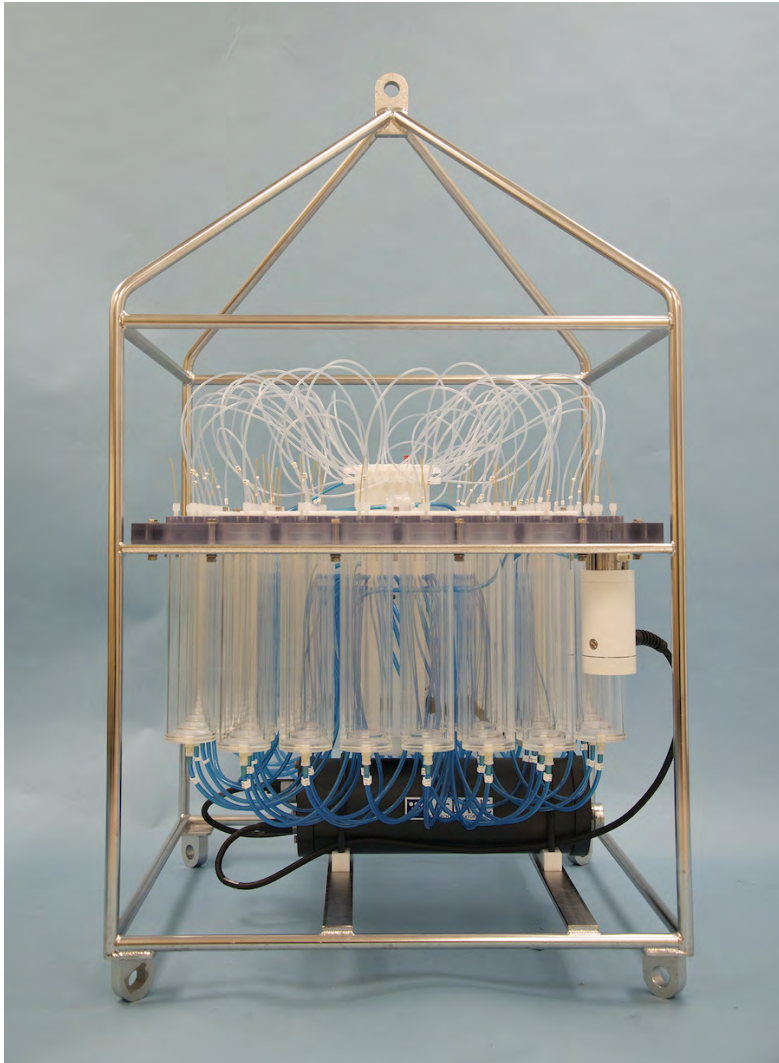
[Optional Filter Holders](#)

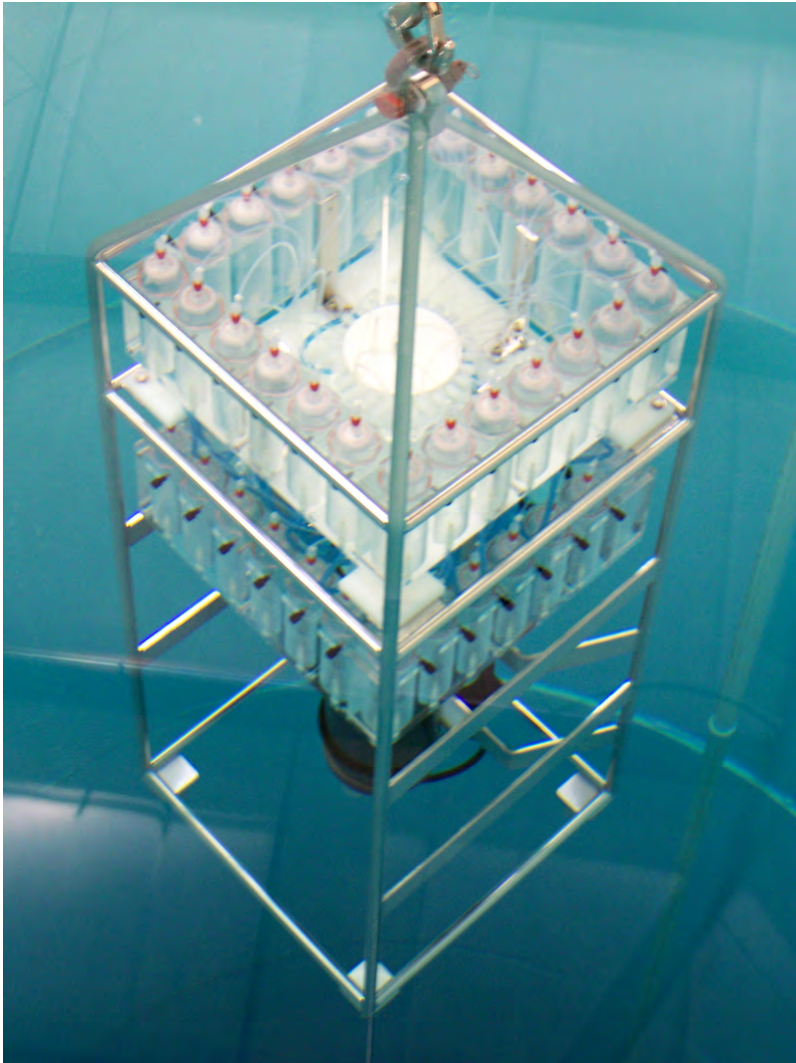
Description & Models

The Remote Access Sampler (RAS) is a time-series instrument that collects up to 48 individual water samples. The RAS can be deployed for up to 18 months. Operating temperature ranges from 0° to +35°C water and maximum depth is 5,500 m. Optional 47mm filter holders on each sample is available for the RAS-500, or 25 mm filter holders for the RAS-100.

Pre and post sample acid cleaning cycles (available in an acid/sample/acid pattern) remove bio-fouling and other contaminants to keep samples pure. The user can program the multi-port valve and displacement pump, acid wash (antifouling), cleaning cycles fluid volume, and sampling schedule.

- RAS-500: The RAS-500 collects up to 48 individual 500 mL water samples. A fixative flush option on the RAS provides a secondary intake and exhaust fluid path to incubate samples immediately (or after a defined incubation period) following sample collection by flooding and sealing each sample bag with reagent solution.
- RAS-100: The RAS-100 collects up to 48 individual 100 mL water samples.





Sample Tubes

The RAS-500 holds 48 individual (+1 acid reservoir) machined acrylic sample tubes. The RAS-100 utilizes machined acrylic sample blocks.

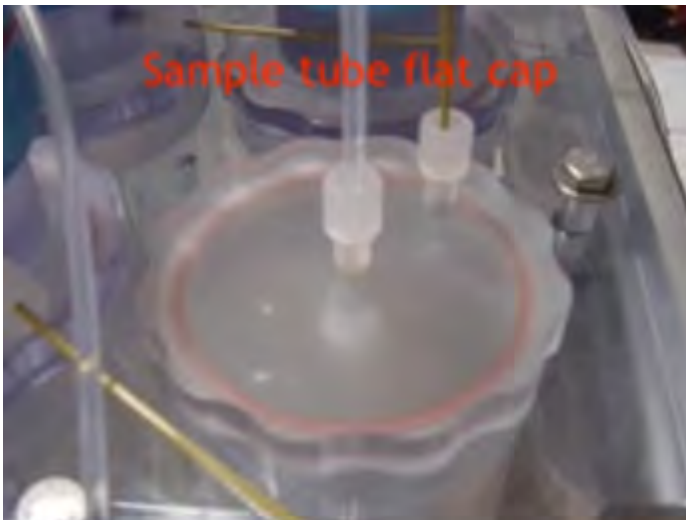
A bleed hole in the tube cap releases air during priming and provides pressure compensation during deployment. Each sample tube is connected in series between the intake head (top half of valve) and the exhaust head (lower half of valve). Each sample tube holds a 500 mL or 100 mL clear or opaque bag attached to the tube cap.

The pump draws water out of the sample tube holding the collapsed sample bag. The pressure gradient drives the flow of ambient seawater through the intake and into the sample bag. After sampling, the multi-port valve returns to the Home Port (port 0), sealing the sample in the bag.



Sample Tube Caps

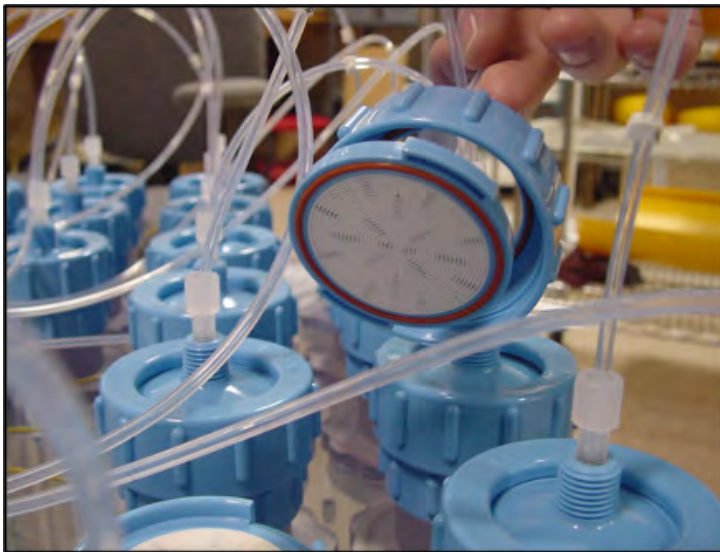
Sample tube caps are either flat, or have integrated [filter holders](#) (47 mm for the RAS-500, or 25 mm for the RAS-100).





Optional Filter Holders

A 47 mm filter holder on each sample is an available option for the RAS-500. A 25 mm filter holder is available for the RAS-100. Membrane or glass fiber filters with a 0.4 micron or greater pore size are recommended. Filters with pore sizes less than 0.4 micron will require testing to confirm proper operation.



For filter holder caps, remove only the blue collar from the filter holder. The cap of the filter holder should remain attached to the top of the sample tube.

Sample Bag Types

Sample bags have a JACO fitting, ferrule, short tubing and threaded male connector. Bag types are:

- Tedlar (clear)
- Mylar laminated (opaque)

- Kynar (clear)

Pumping, Acid & System Flush

Gear Pump

A positive displacement gear pump creates the pressure gradient for sampling. The pump head is type 316 stainless steel and the motor housing is white PVC plastic. The pump head has user-replaceable carbon gears and a replaceable magnet. A brushless, DC, 3-phase servo-motor is magnetically coupled to the pump head. Hall-effect encoders provide feedback to the controller for shaft speed control.

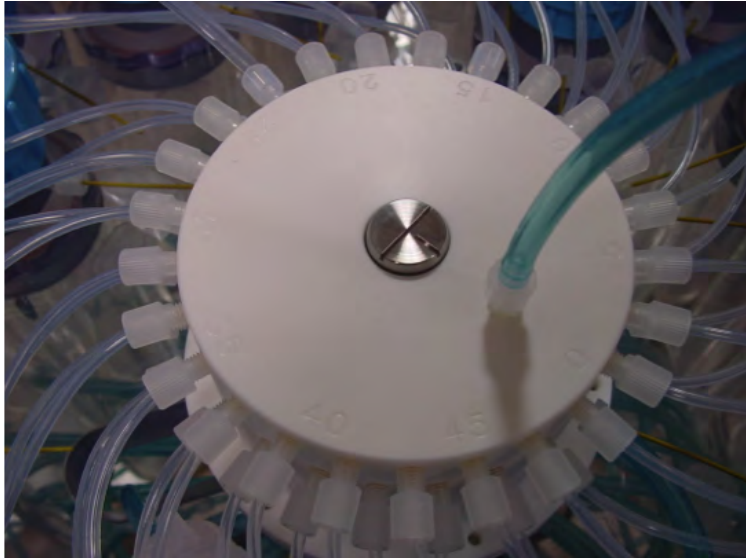


After pumping 100 L of seawater, examine the pump head carbon gears and replace if worn.

Rotary Valve

A dual-head, 50-port rotary valve directs seawater to each sample bag. The top head has a single intake port and 50 exhaust ports; the bottom head has 50 intake ports and a single exhaust port. The valve top shows the port numbers and the tubing is also tagged with numbers to further identify the port and valve connections. The sample containers and water flush filter holder are connected between the two heads of the valve. Only one port is open on each head at one time.

The valve heads pair a HYDEX plastic stator with a Kynar plastic rotor. The stator is held stationary, while a stepper motor with a 100:1 planetary gear head turns the rotor. An optical sensor and slotted disk determine rotor position. The motor, gear head, and optical sensor are in a pressure compensated PVC plastic housing filled with Dow Corning 200 fluid (20 cSt.)



Port Assignments

The Port/Designation table shown next illustrates how the water flush and acid flush keep the intake path clear of contaminants. Sample collection typically occurs in an acid flush/water flush/flush/sample/acid flush order.

PORT NUMBER	DESIGNATION
00/Home	Water Flush
01	Sample #1
02	Sample #2
...	...
47	Sample #47
48	Sample #48
49	Acid Flush (antifouling)

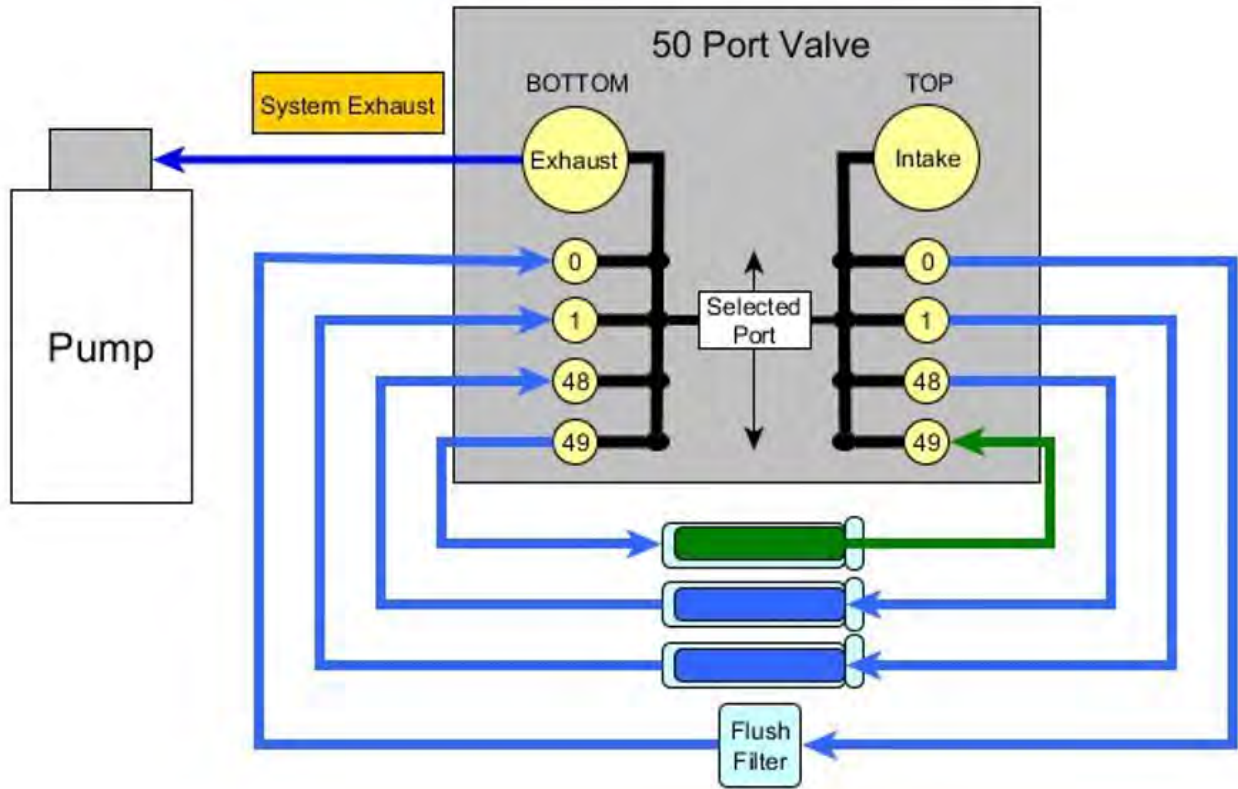
Acid Flush Assembly

Pre- and post sample acid cleaning cycles occur at Port 49. Acid cleaning loosens bio-fouling growth along the intake path for removal by the water flush. The acid flush reservoir is located in the corner of the sample tube assembly. The reservoir contains a sample bag filled with acid or other bio fouling cleaner (antifoulant).



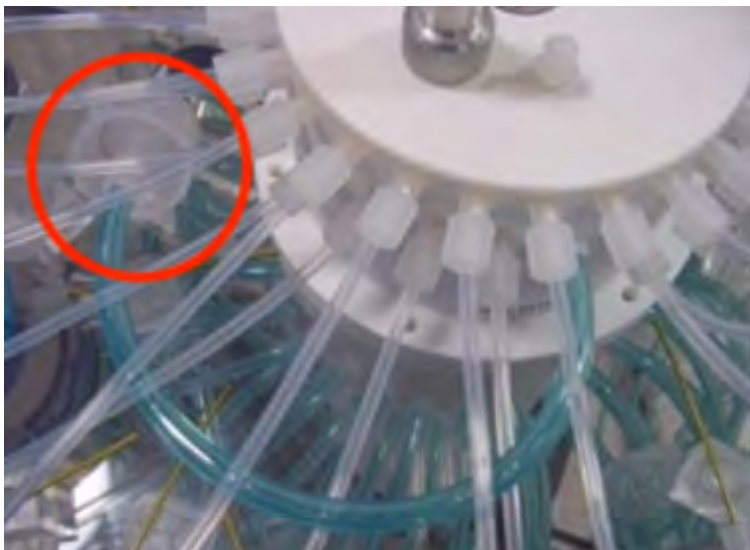
Acid cleaning cycles are user programmable. The pre-sample acid flush can include an acid exposure time delay to leave the acid standing in the valve intake. For details about sampling and flushing parameters, see [RAS Operations](#). The samples and the pump are isolated from each other.

For details about filling the acid reservoir, you can also view the RAS-500 pre-deployment and priming [video](#).



Water Flush Assembly

The water flush occurs at Port 0 before the sample is pumped. This is a forward pumping event. The water flush assembly consists of a 25 mm filter holder (for a filter with pore size of 5.0 to 20 micron) connected to the ‘Home’ port (Port 0) of the multi-port valve. The filter prevents large particles from entering the pump during flushing. Water is flushed from the intake tube, through the top valve stator, 25 mm filter, bottom valve stator and finally, the pump.



RAS Mechanical Information

Mechanical components of the RAS are described in the following sections.

RAS Mechanical Information topics

[Frame](#)

[Controller Housing](#)

[End Caps & O-rings](#)

[End Cap Bulkhead Connectors](#)

Controller Housing

The RAS controller housing is a heat-treated aluminum alloy cylinder. Pressure resistant to 5,500 meters, the controller housing holds a micro-controller, 3-phase pump-motor driver, and a stepper-motor driver (for the multi-port valve). The controller housing has two sacrificial zinc anodes, one attached to each end for galvanic protection from corrosion.

This User Manual contains detailed instructions for [opening the controller housing](#). Follow these instructions and the recommended safety precautions when opening the controller housing.



End Caps & O-Rings

The top end cap seals the controller housing from water intrusion with a face O-ring seal and a radial O-ring seal (with a backup ring). O-ring maintenance and correct placement is critical to prevent water intrusion. Each O-ring set includes three O-rings (2-246, 2-242, 8-242).

See [Maintenance and Storage](#) for details on cleaning the O-rings and proper O-ring positioning when inserting the end cap into the controller housing.

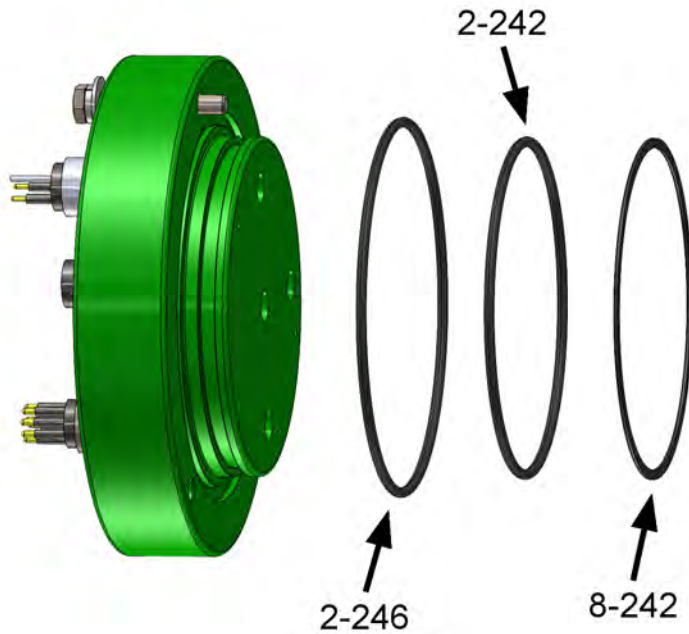
McLane uses O-rings that meet MIL-G 21569 Class 1 standards. We recommend that replacement O-rings meet this standard. Backup rings are Buna-N, Parker material NO300 or equal.

O-RING	SPECIFICATION
2-246	2-246, Buna-N, 70 A Durometer

2-242	2-242, Buna-N, 70 A Durometer
8-242	8-242, Buna-N, 90 A Durometer



O-ring maintenance and correct placement is critical to keep the controller housing sealed from water intrusion. Incorrect o-ring placement results in cracks or splits that could affect the O-ring seal and cause water damage to the controller. Water damage from incorrectly placed or maintained O-rings could void the sampler warranty.



End Cap Bulkhead Connectors

A zinc anode is attached to each end on the controller housing end cap to prevent corrosion. Spare zincs are included in the toolkit.

Do not over-tighten the end cap bolts and do not replace the stainless steel hardware with any other hardware. The toolkit includes spare hardware, otherwise contact mclane@mclanelabs.com.



Frame

The RAS frame is an electro-polished 316 stainless steel welded frame (a titanium frame is optional).

The frame was designed as an inline component on a high-tension (up to 2,200 kg) ocean mooring and has a built-in top bridle and four mooring eyes at the bottom for a chain or cable bridle. Each mooring eye accommodates a 5/8" shackle, and has an insulator to protect the frame from corrosion.

Extra mounting space near the controller housing has room for other instruments. Zinc or steel anodes can be added to the frame when deploying the RAS in a highly corrosive environment.

RAS Electronics Information

The RAS operates on McLane Research Labs' Gen3 hardware consisting of a low-power micro-controller, motor controller, and connector interface board. Gen3 electronics interface with a McLane built graphical user interface (GUI), called [McLanePro](#). Data are stored to a MicroSD[®] memory card, and are accessed using McLanePro software.

Related topic

[McLanePro Introduction](#)

RAS Electronics Information topics

[Opening the Controller Housing](#)

[Main Battery](#)

[Deployment Duration Estimate](#)

Opening the Controller Housing

Take care in maintaining, operating, and opening the pressure housing. A pressure relief valve (PRV) on the controller housing end cap releases automatically at a pressure differential greater than 10 psi. The PRV has a center hole. A pressure release valve screw is included in the toolkit.



WARNING - Turning the release valve adjusts release pressure.



Always use proper care and attention when handling high-pressure vessels after deployment!

Treat the controller housing as pressurized until manually vented by the pressure relief valve.

1. Slowly pull on the pressure relief valve using the supplied pressure release valve tool to release any vacuum or built-up pressure in the housing.
2. Loosen each end cap bolt a few turns at a time in a star pattern. If the end cap moves away from

the housing, this indicates that the housing is still pressurized. In this case, continue venting using the PRV.

3. When pressure is equalized, remove and place the end cap hardware somewhere safe. Typically plastic inserts have a snug fit and will remain in the end cap.
4. Grasp the end cap lip with fingertips and pull the end cap out of the housing. The end cap to housing seal is tight and sometimes difficult to open. Do not use a tool to pull open the housing. The end cap O-rings can be damaged if objects are used to separate the end cap from the housing.

Main Battery

The RAS has a battery holder that accepts 24 user replaceable drop-in alkaline "D" cell batteries providing 10,000 mAh of battery capacity. The batteries do not come installed in a new RAS. New batteries are included either in the [toolkit](#) or in the shipping crate.



Always take standard electrostatic discharge (ESD) precautions when handling the electronics.

Install the batteries with the correct orientation in the holder terminals.

[Connecting the Batteries](#)

An instructional video showing drop-in battery replacement is shown on the RAS video pages at www.mclanelabs.com.

Deployment Duration Estimate

This deployment endurance estimate for RAS drop-in battery holders assumes:

- 24 new alkaline "D" cell batteries. Do not mix old and new batteries.
- A de-rated battery capacity of 10,000 mAh.
- Per-year self-discharge rate of 6%.

Battery life for a planned RAS deployment can be estimated using the instrument current consumption values provided here. These values apply to electronics using the Gen3 microcontroller. The 24 alkaline "D" cells in the drop-in battery holder deliver approximately 10,000 mAh. In addition to pumping time, many other deployment conditions can affect the battery duration. Use this example for estimation only.

- Pre-deployment battery estimate assumes initial setup steps and does not include bench testing or running diagnostics.

- Pumping assumes unrestricted flow.

Pre-deployment	
Controller Electronics (ON) - 3 hours	3 h x 22 mA = 66 mAh
Valve Movement (100 port moves)	100 x 0.0017 h x 192 mA = 32.7 mAh
Pumping (1 hour)	1 h x 121 mA = 121 mAh
	Subtotal = 220 mAh
Deployment	
Controller Electronics (Low Power Sleep) - 1 year	8760 h x 0.058 mA = 508 mAh
Moving Valve (48 port deployment)	1.0081 h x 192 mA = 194 mAh
Pump Acid Flush (48 ports)	48 ports x 0.0023 h x 105 mA = 12 mAh
Acid Exposure Delay (48 ports)	48 ports x 0.0167 h x 0.058 mA = 0.05 mAh
Pump Water Flush (48 ports)	48 ports x 0.0223 h x 105 mA = 113 mAh
Pump Sample (48 ports)	48 ports x 0.1112 h x 105 mA = 561 mAh
Pause to Reduce Pressure Differential (48 ports)	48 ports x 0.0334 h x 0.058 mA = 0.1 mAh
Fixative Flush (48 ports)	48 ports x 0.0089 h x 105 mA = 45 mAh
Pause to Reduce Pressure Differential (48 ports, solenoid ON)	48 ports x 0.0084 h x 187 mA = 76 mAh
	Subtotal = 1,509 mAh
Recovery	
Controller Electronics (ON) - 2 hours	2 h x 22 mA = 44 mAh
Moving Valve (50 ports, single port advance, once around)	50 ports x 0.0017 h x 192 mA = 17 mAh
	Subtotal = 61 mAh
Total Current Consumption	Total = 1,790 mAh

This example shows that the total energy consumed is 1,790 mAh, which will not exceed the 10,000 mAh battery life.

RAS Operations

This section provides guidance for operating the RAS.

RAS Operations topics

Prepare

[Deployment Preparation](#)

Prime

[Preparing for Priming](#)

[Installing the Water Flush Filter](#)

[Installing the Sample Bags](#)

[Preparing the Acid Reservoir](#)

[Securing the Sample Tubes](#)

Deploy

[Programming a Deployment](#)

[Deploying the RAS](#)

Recover

[Recovery and Data Offload](#)

[Recover the RAS](#)

[Remove the Sample Bags](#)

[Connect to the RAS](#)

[Download Deployment Data](#)

Deployment Preparation

The following steps will prepare the RAS for communication and operation when preparing to deploy the instrument.

1. Install the "D" cell alkaline batteries.
2. [Connect battery power.](#)
3. [Close the controller housing.](#)
4. Remove the dummy plug from the communications bulkhead.
5. Connect the USB COM cable.
6. Confirm that McLanePro and the instrument are communicating.

Related topics

[Download McLanePro](#)

[Priming the RAS](#)

[Installing Water Flush Filter](#)

[Installing Sample Bags & Priming](#)

[Preparing the Acid Flush Reservoir](#)

Preparing for Priming

Priming is a critical deployment preparation step. The ultimate priming goal is to clear trapped air from the tubing between the pump and sample bags. Priming always starts at Port 01 and should be performed sequentially at each port. Priming is a wet process. Ensure that the electronics housing is sealed to keep the electronics dry.

The priming steps in this section show photos of RAS-500 sample tubes with and without filter holders installed.

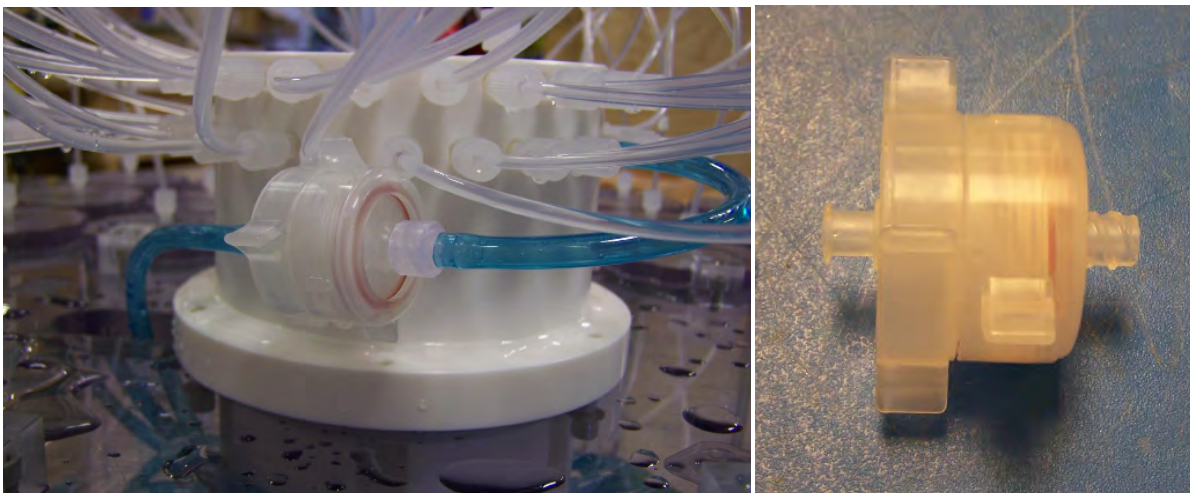
Required tools for priming:

Syringe and exhaust tube (supplied in the toolkit)

1. Prepare a container or bucket of clean water.
2. Using the syringe and exhaust tube supplied in the toolkit, inject clean water into the pump to prime it for operation.
3. After the pump cavity and exhaust are filled with clean water, remove the syringe and submerge the exhaust tube in the clean water container.
4. Navigate to the Home Port using the manual controls provided on the **Manual Operation** tab.
5. Confirm the pump is primed and ready for use by pumping a small amount of water through the home port (100 mL). This will clear any bubbles in the pump and lines and prepares the pump and valve for priming.

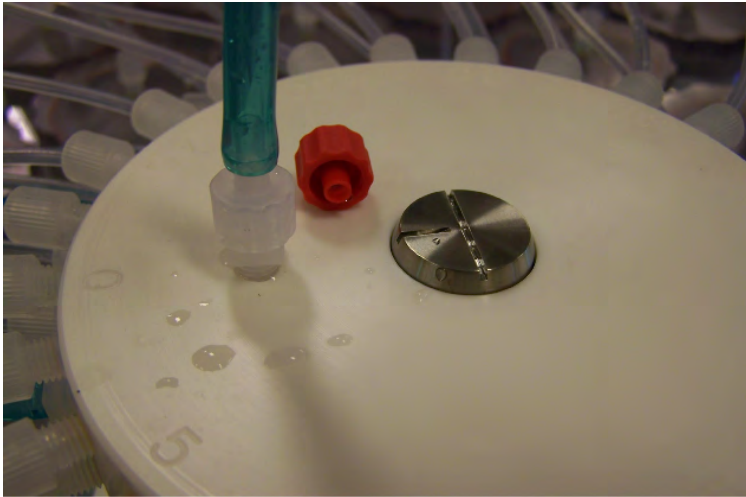
Installing the Water Flush Filter

The water flush filter is placed inline to Home Port (Port 0) and holds a 25mm disc filter with a pore size from 5 to 20 microns. The filter protects the pump from damage by large particles during flushing.

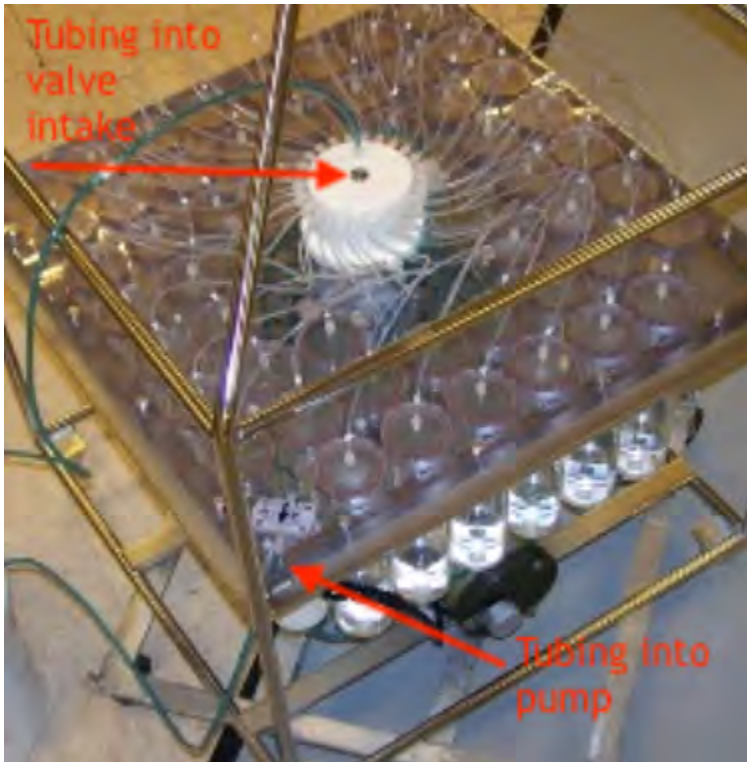


Water flush filter installation:

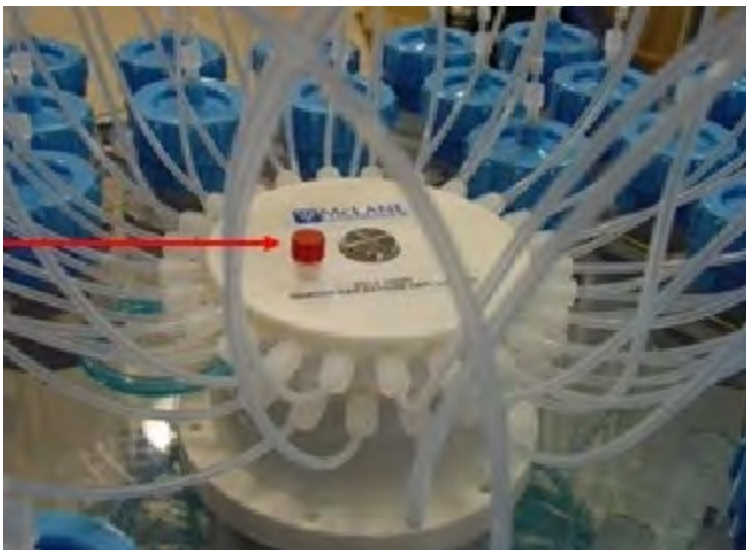
1. Disconnect the Luer Lock fittings at both ends of the water flush filter holder and remove the filter holder from the system.
2. Unscrew the locking ring to disassemble the filter holder halves.
3. Wet the bottom frit of the filter holder and install a 25 mm disc filter (nominal pore size from 5 to 20 microns).
4. Wet the filter with clean water using a wash bottle and replace the top half of the filter holder and locking ring.
5. Reinstall the filter holder by connecting the Luer Lock connectors at both ends.



6. Remove the cap from the valve intake and replace with the supplied intake tube.
7. Place the end of the intake tube into the container filled with clean water.



8. If the valve is not a Home Port (port 0), locate this position by finding home using the controls provided on the **Manual Operation** tab.
9. Run the pump in reverse until water flows through the water flush filter holder, removing any remaining air bubbles.
10. When pumping has finished, remove the valve intake tube and replace the intake cap.

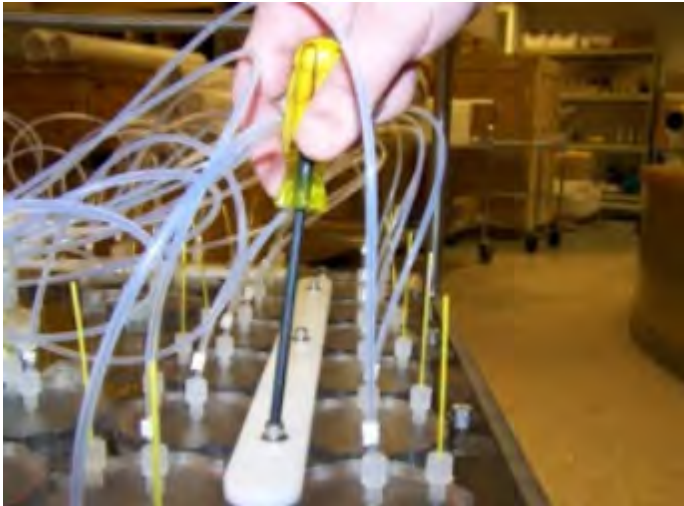




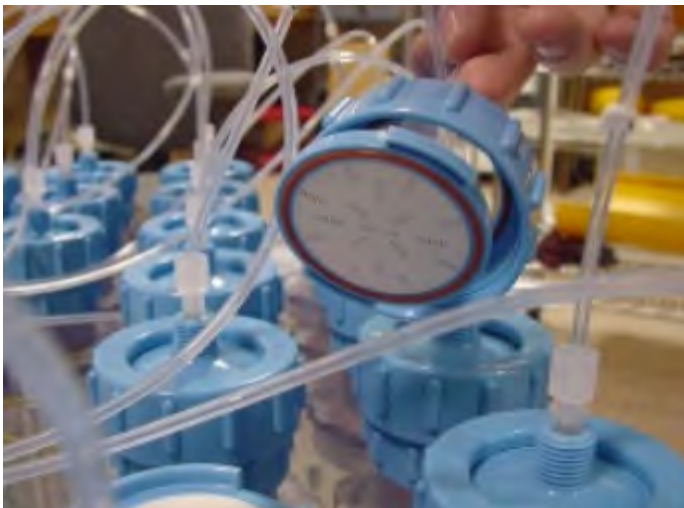
Remove the intake cap from the valve intake just prior to deploying the RAS so that the pump can operate.

Installing Sample Bags & Priming Sample Tubes

1. Before installing sample bags and priming sample tubes, check that the bottom and top tubing is securely connected in the correct order. Tubing is labeled by sample number. Sample numbers should match the numbers on the clear base plate.
2. Remove the screws from the four hold-down brackets and slide the brackets out from in between the sample tube caps. This step provides access to the sample tubes for bag installation.



3. Remove the 8 individual hold-down brackets that secure the four innermost tubes.
4. Priming is sequential and starts at Port 1. At the appropriate sample tube, remove the locking ring. Separate the top half of the filter holder if filters are used.



5. Remove the pressure compensation tube and set it aside.

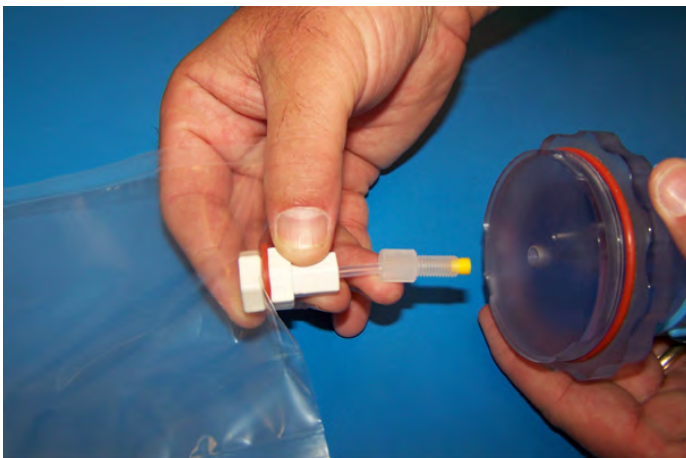


6. Prepare a new sample bag by removing the cap and attaching an empty syringe using the fittings supplied in the toolbox. Confirm there is a ferrule on the JACO bag tubing before use.
7. Draw in in excess air from the sample bag using the syringe.
8. If using a preservative, use a separate syringe to inject the preservative into the bag before installing it into the sample tube.



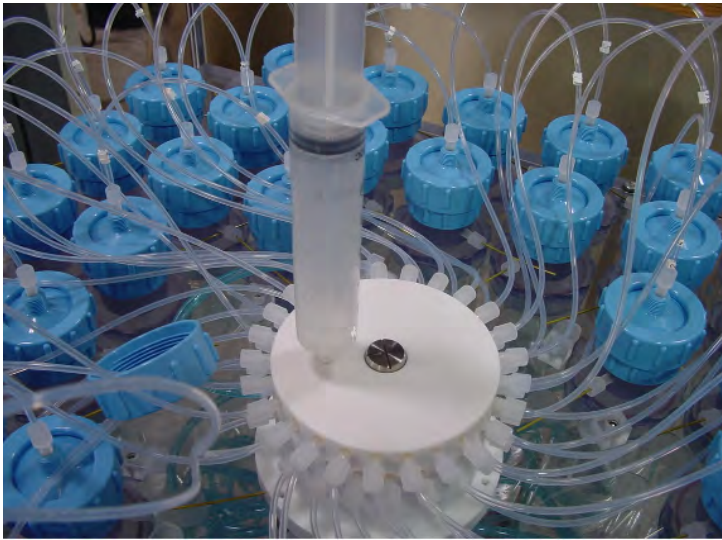
Before adding preservative, confirm the chemical compatibility with bag material.

9. Remove the sample tube cap and attach the prepared sample bag.

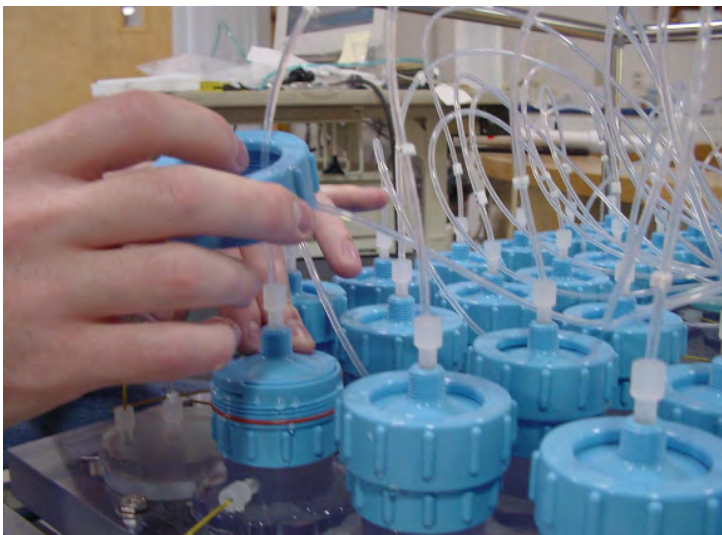


10. Gently fold the sample bag and slide it into the sample tube.
11. Using clean fresh water, fill the sample tube until almost full and secure the cap.
12. Using controls on the **Manual Operation** tab, advance the valve to the port being primed.
13. Reverse pump into the sample tube to purge the remaining volume of air.
14. When water drips from the bleed hole, press the **Stop Pumping** button.

15. After pumping has stopped, reinstall the pressure compensation tube (the fitting can be tightened using the supplied wrench but do not over-tighten).
16. If using filter holders, remove air bubbles from beneath the filter holder frit by forcing water into the frit holes with a wash bottle.
17. Install a 47 mm (or 25 mm for RAS-100) disc filter onto the frit and wet with clean water.
18. Remove the cap from the valve intake and attach a syringe of clean water.
19. Inject clean water into the valve intake until it fills the tubing (and the filter holder top if filter holders are installed). If filter holders are not installed, inject clean water until the top tubing is filled.



20. Carefully secure the top half to the filter holder using the locking ring and push down on the filter cap to displace air bubbles.



21. This completes priming for a single sample tube. Using the **Next Port** button from the **Manual Operation** tab, advance to the next port and repeat this process for each sample tube, ending at

port 48.

Preparing the Acid Reservoir

Acid provides an optional, programmable bio-fouling flush that further cleans the intake tube. Port 49 is the valve position used for acid cleaning. The acid flush reservoir is located in the corner of the sample tube assembly.

Adding acid (or other antifoulant):

After installing sample bags and priming sample tubes, add acid as follows:

1. Using valve controls on the **Manual Operation tab**, advance to Port 49, the position used for acid cleaning.
2. Remove the pressure compensation tube and top tubing from the acid reservoir cap.
3. Remove the acid cap and attach a new sample bag.
4. Gently fold the bag, slide it into the reservoir and secure the cap.
5. Install the supplied 1/4-28 fitting to the acid cap.
6. Fill a clean syringe with an acid solution and inject acid into the bag. The acid bag will hold just over 500 mL of acid, so filling will require multiple injections from the syringe. Keep track of the volume of acid injected. Overfilling could cause the bag to burst.
7. Remove the bag fitting and reconnect the top tubing.
8. Remove the clean water syringe from the valve intake and replace the intake cap.
9. From the **Manual Operation tab**, click **Pump Reverse**. Perform a reverse pump to fill the remaining volume of the acid reservoir with clean water.
10. Filling the entire volume may require a few restarts of the pumping routine.
11. Press **Stop Pumping** to stop the pump manually when water emerges from the bleed hole at the top of the acid cap.
12. Reinstall the pressure compensation tube onto the acid cap.
13. Remove the intake cap and attach a syringe of acid solution.
14. Disconnect the top tubing from the acid cap and inject acid into the intake until the top tubing is filled.

15. Reattach the top tubing to the acid reservoir cap.
16. Remove the acid syringe from the intake and replace the intake cap.

Securing the Sample Tubes

After priming each tube and filling the acid reservoir, secure the sample tubes by reinstalling all hold-down brackets and individual elbow clamps.

Programming a Deployment

Using [McLanePro](#), follow the steps outlined in the [Schedule tab](#) descriptions to program the deployment parameters.

Related topics

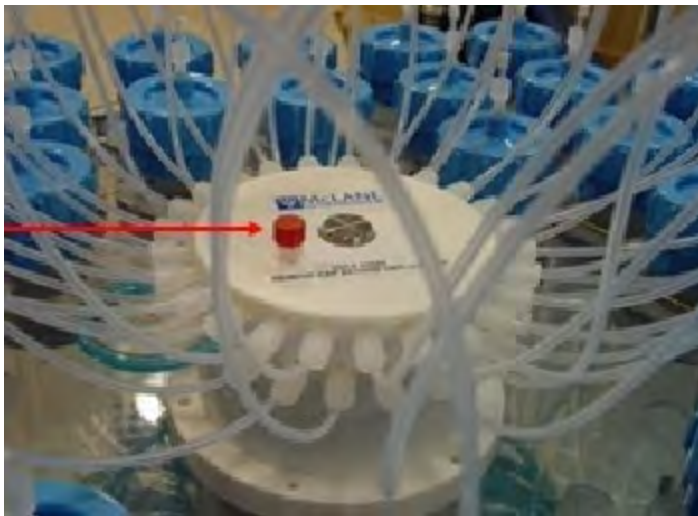
[Deploying the RAS](#)

Deploying the RAS

1. Disconnect the communications cable and attach the dummy plug.



Remove the intake cap used during priming before deploying the RAS. Failure to remove this cap prevents proper sample collection.



2. Follow the steps in [Starting a Deployment](#) to start the deployment.

Recovery and Data Offload

After the deployment is completed, the required steps are:

- Recover the RAS and prepare to communicate with the instrument.
- Remove the sample bags
- Connect to the RAS using McLanePro and download deployment data. See the instructions in the [Offload tab](#) section.

Related topics

[Recover the RAS](#)

[Remove the Sample Bags](#)

[Connect to the RAS](#)

[Download Deployment Data](#)

Recover the RAS

Once the sampling events are completed, the RAS must be recovered in order to retrieve the sample bags (and filters, if used) and to download the deployment data.

1. Recover the RAS from the mooring, wire or other deployment location.
2. If possible, rinse the exterior of the RAS with fresh water.

Remove the Sample Bags

Following instrument recovery, remove the bags for storage and later analysis.

Removal of the sample bags is a wet process. Place the RAS in a location that will allow for draining of the sample tubes.

1. First, remove all the hold down brackets that secure the RAS tubes to the base plate.
2. Remove the bag from Port 1 by twisting the sample tube cap counter-clockwise through one third of a revolution (do not remove the bag by pulling on the cap or the intake tube on the bag). Disconnect the tubing at the bottom of the acrylic sample tube to reduce the force required to remove a full sample (pressure on the bag can cause some of the sample to flow back through the intake tube valve, potentially contaminating the sample).
3. Lift the cap gently and firmly grasp the sample bag just below the bag's intake tube using the thumb and index finger.
4. Gently pull the bag out of the sample container by gripping the bag just below the intake tube.
5. Disconnect the sample bag from the sample tube cap and install a 1/4-28 threaded female cap on the tubing. Store the sample safely and replace the cap on the acrylic sample tube.
6. Repeat steps 1-4 for all sample bags.

Remove Sample Filters

If the optional filter holders are installed on the RAS, they may be removed as part of the procedure

while retrieving the sample bags. After a deployment is complete and the system has been recovered, the filter holders can be removed for sample analysis. If necessary, air may be pushed through the filter holder using a syringe to clear out residual water before opening the filter holder. The details of processing the sample contained in a filter holder will vary from deployment to deployment, and will ultimately need to be decided by the scientist. If fixative was used during the deployment, make sure to follow all safety procedures while handling the filter holders and filters.

Connect to the RAS

1. Wipe away any excess water from the RAS controller end cap.
2. Remove the dummy plug from the RAS communication bulkhead connector.
3. [Connect to the RAS](#) using [McLanePro](#) and prepare to download deployment data.

Related topic

[Download Deployment Data](#)

Download Deployment Data

It is the responsibility of the user to properly download the most recent deployment data in order to keep a record of the deployment. Deployment data will include useful information about the sample event and conditions during the deployment. These data may include event times, sample deployment parameters, pumping data during the event and any exit conditions related to the sample events or deployment.

1. Follow steps listed in [Connecting to the RAS](#) to initiate communication with the instrument.
2. Download the recent deployment data using tools available on the [Offload tab](#).
 1. It is recommended to export data using both the **Export** and **CSV** buttons provided on the **Offload tab**.
3. Check downloaded data to ensure that the correct data set has been offloaded and that there are no problems reported.

RAS Maintenance & Storage

Proper maintenance after every deployment is critical for ensuring smooth operation and long instrument life. This section provides guidance on the maintenance recommendations immediately following the recovery, when the instrument is back from sea, and when preparing for long-term storage or transport.

Steps may include:

- Rinse the RAS.
- Clean the RAS fluid paths and plumbing.
- Remove and dispose of expired batteries.
- Clean and inspect the controller housing.
- Clean and inspect the O-rings.
- Clean and inspect cables and connectors.
- Clean and inspect hardware.
- Reuse the shipping crate for storage and transport.

RAS Maintenance & Storage topics

[Immediately Following Recovery](#)

[Back from Sea](#)

[Storage and Transport](#)

Immediately Following Recovery

After the deployment is completed, the required steps are:

- Connect to the RAS using McLanePro and download deployment data. See the instructions in the [Offload tab](#) section.
- [Remove the sample bags](#) for later analysis and retrieve the filters (if used).
- Rinse the RAS.
- Clean RAS fluid paths and plumbing.
- Remove and dispose of expired batteries.

Rinse the RAS

Rinsing the RAS frame, controller housing, pump head and motor with fresh water immediately following recovery is extremely important for long-term sampler care. Poor or no rinsing directly following deployment affects the condition and future performance of the instrument.

Related topics

[Clear the fluid paths & plumbing](#)

[Flushing the pump head](#)

Flushing the System

After removing bags and flushing the pump head, the RAS should be flushed with fresh water. The **Manual Operation** tab provides controls used to flush the system with fresh water. Flushing after every deployment can prevent salt crystal formation.

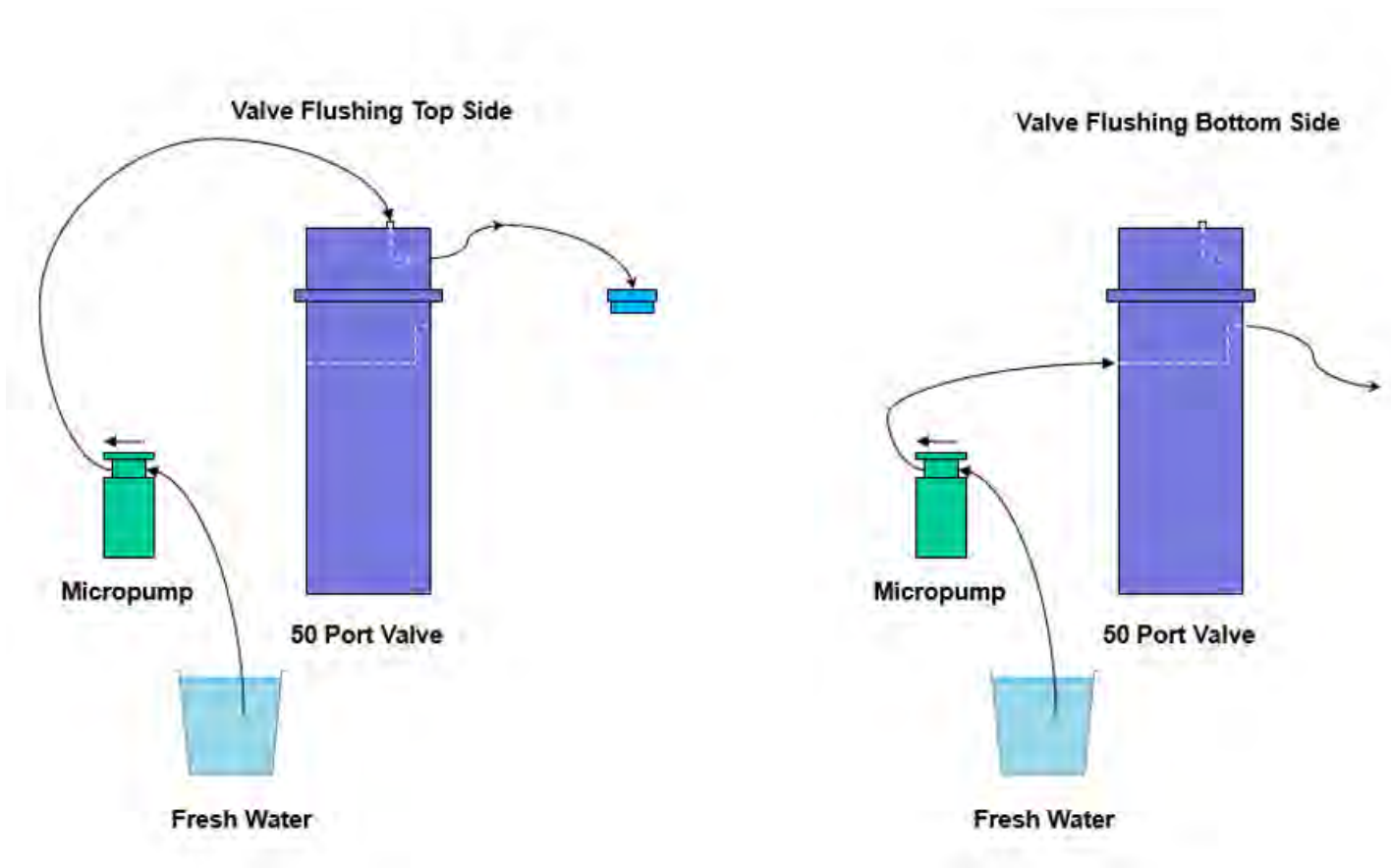
Flushing the system is a two part process. The top and bottom of the valve are flushed in separate operations. This is easiest done with all the sample tubes removed.



Flushing the system is a wet process. Ensure the electronics housing is sealed to keep the electronics dry. Water will overflow during this process. When flushing a port, the system pumps forward, pushing clean water through the valve and tubing.

For flushing the top side of the valve, plumbing will need to be modified to allow for pumping forward through the common intake and out each individual port. See the diagram below. Attach an intake tube to the pump intake and place the end in a container of clean fresh water. Attach another connecting tube from the pump outlet to the common intake at the top of the valve.

For flushing the bottom side of the valve, plumbing will need to be modified to allow for pumping forward through the common intake and out each individual port. See the diagram below. Attach an intake tube to the pump intake and place the end in a container of clean fresh water. Attach another connecting tube from the pump outlet to the common intake at the bottom of the valve.

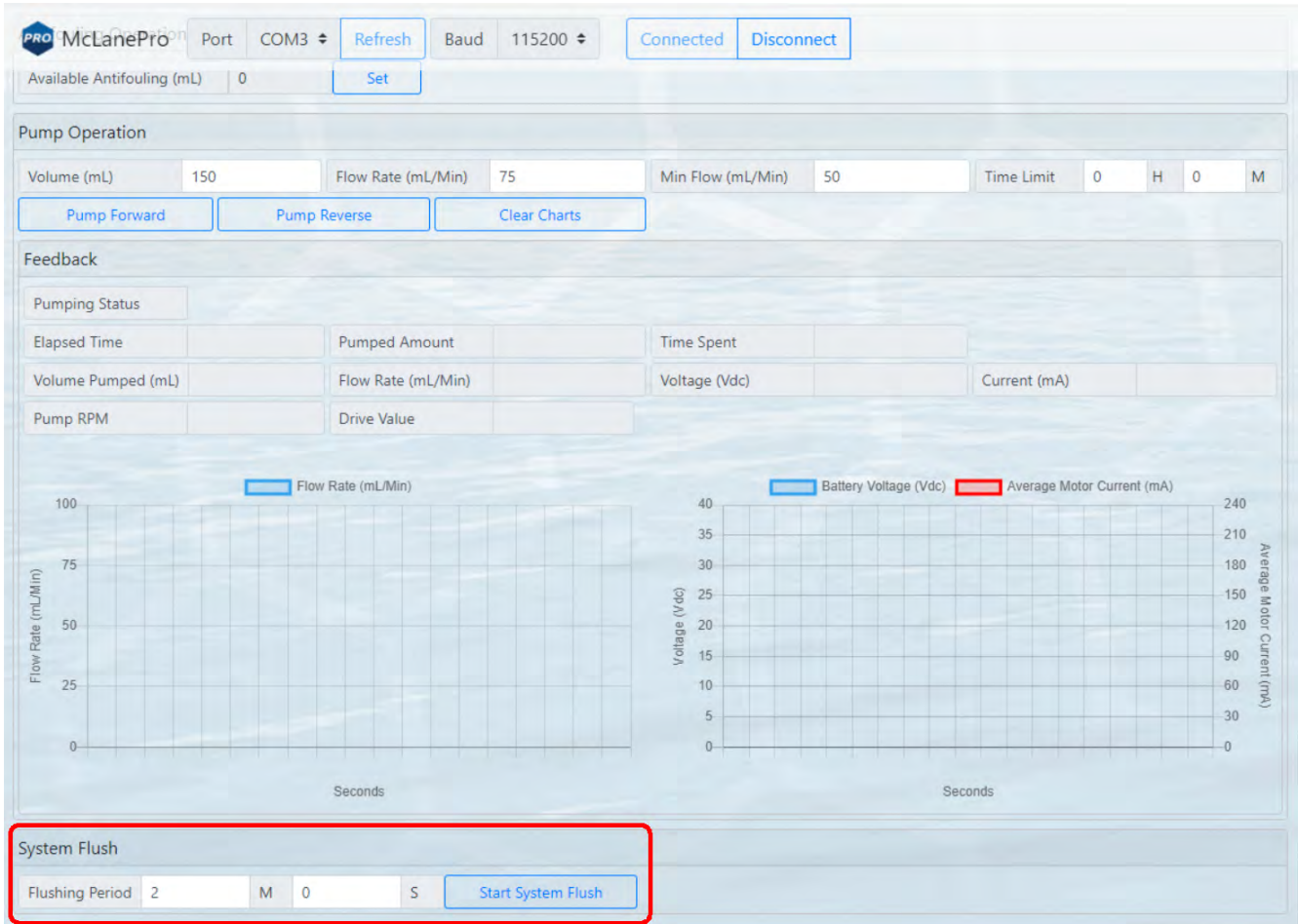


To flush the system, complete the following steps:

1. Power on the computer.
2. Ensure that the controller housing is sealed.
3. Plug the USB COM cable into the RAS controller housing and then connect the USB end to one of

the computer's USB ports.

4. Start McLanePro, and connect to the RAS.
5. Navigate to the **Manual Operation** tab, that contains controls for automatically flushing all ports.
6. To remove standing water from the valve, enter a value of at least 5 seconds into the Flushing Period time selection box.
7. Click **Start System Flush** to start automated flushing.



8. Allow flushing to complete. The RAS will advance through all ports, pumping for the specified time period.
9. Flushing is performed twice, once for the top half of the valve and once for the bottom half of the valve. Plumbing must be adjusted as per the above diagrams for each flushing operation.

Dispose of Used Batteries

Batteries should never be left in the controller housing for extended periods of time. If redeploying the instrument, confirm whether new batteries will be required to achieve successful sample collection. If storing the instrument, remove any batteries and seal the controller housing as normal.

1. Dry the controller housing. Ensure that there is no water remaining on or above the controller housing that could enter the housing when opened.

2. Open the controller housing according to steps listed in [Opening the Controller Housing](#).
3. Disconnect the batteries from the electronics.
4. Open battery holder and remove "D" cells.
5. Recycle or dispose of used batteries according to local laws and regulations.
6. Replace batteries if redeploying.

Back from Sea

Several maintenance steps should be completed in the lab after a deployment and before longer term storage.

- Clean and inspect the controller housing.
- Inspect the O-rings.
- Inspect the underwater cabling and connectors.
- Inspect and/or replace hardware.
- Backup deployment data.

Cleaning & Inspecting the Controller Housing

Before every deployment, inspect, and if necessary, replace the zinc anodes attached to the controller housing end caps. When installing new zinc anodes, use 316 stainless steel hardware and install the included the O-ring.



Keep hard objects such as tools or shackles away from the anodized controller housing. Scratches from these objects will localize galvanic action and can cause deep crevices or pitting.



Use caution to avoid scratching the O-rings, end cap, or the sealing surface of the vessel where the o-rings sit. Scratches could cause leaks.

Related topic

[Controller Housing](#)

Cleaning & Inspecting the O-Rings

O-rings and surfaces should be regularly cleaned with isopropyl alcohol. Inspect O-rings for signs of wear and the presence of any foreign material (which can cause leaks). Look for small cracks and feel for grit, sand, or hair. Lubricate with a thin coating of provided Parker O-Lube as necessary. The toolkit has spare O-rings, and additional O-rings may be purchased from McLane.



Use caution to avoid scratching the O-rings, end cap, or the sealing surface of the vessel where the o-rings sit. Scratches could cause leaks.

Related topic

[O-rings](#)

Cleaning & Inspecting Cables & Connectors

Cables and connectors should be regularly cleaned with a mild detergent solution. Inspect cables for any cuts or scrapes that could cause a failure. Inspect connectors for bent or missing pins, corrosion or rubber delamination. Clean any corrosion off of pins and contacts with isopropyl alcohol. Lubricate connectors with a thin coating of provided connector lubricant as necessary. Replacement cables and connectors are available from McLane if necessary.

Related topic

[End Cap Bulkhead Connectors](#)

Cleaning & Inspecting Hardware

Some deployment environments will cause staining or rusting of fasteners if not rinsed well between uses. Inspect all fasteners for discoloration or signs of failure. Replace any damaged or corroded hardware with replacements provided in the toolkit. Clean and lubricate end cap screws with a thin coating of provided non-metal anti-seize as necessary.

Related topic

[Frame](#)

Backup Deployment Data

It is the responsibility of the user to properly download all recent deployment data in order to keep records of deployments. Deployment data will include useful information about sample events and conditions during the deployment. These data may include event times, sample deployment parameters, pumping data during events and any exit conditions.

The RAS will retain data for a certain number of deployments, but long term storage of data on the instrument is not recommended. It is always good practice to back up important deployment data before storing or transporting the instrument. McLane recommends keeping multiple copies of deployment data stored locally.

1. Follow steps listed in [Connecting to the RAS](#) to initiate communication with the instrument. A battery is not required to communicate with the RAS for data retrieval purposes.
2. Download the deployment data using tools available on the [Offload tab](#).
3. Check downloaded data to ensure that the correct data set(s) have been offloaded, and that there are no problems reported.
4. Once data are retrieved, the RAS may be powered off, and placed in its shipping crate.

Storage and Transport

The shipping crate is a reusable international freight container that is ISPM-15 compliant for international transport. Always use the original shipping crate for transporting the RAS or when storing long term.



Always [disconnect and remove batteries](#) before long term storage or transport.

It is advisable to clear out any water from the RAS plumbing before long term storage of the instrument. This may be achieved by using clean, lab-grade compressed air or nitrogen to clear out all sample lines going to the valve. Apply low-pressure air or nitrogen to the common intake of each (top and bottom) half of the valve and rotate through all the ports to clear any residual water from the RAS plumbing.