Profilers Samplers Flotation

mclanelabs.com

Robotic Cartridge Sampling Instrument & McLanePro

User Manual

2025 McLane Research Laboratories, Inc., Rev.25.F.12

Tel: +1 (508) 495-4000
mclane@mclanelabs.com www.mclanelabs.com

Table of contents

Included with the RoCSI 5
Contact McLane 6
Serial Number 7
McLanePro Introduction 8
Install McLanePro 9
System Requirements 9
Connecting to the RoCSI 10
Communication Error Message 11
Communication Troubleshooting 12
Setting the Instrument Clock 14
The Schedule Tab 15
Schedule a Deployment 15
Exporting a Schedule 21
Importing a Schedule 22
Schedule Errors 22
The Deployment Tab 25
Starting a Deployment 25
The Offload Tab 29
Deployment Summary 30
Event Data 31
Deployment Log 35
Exporting Deployment Data 36
Viewing and Exporting Data From Previous Deployments 38
The Manual Operation Tab 40
Cartridge Operation 41
Available Reagents 42
Pump Operation 44
Pumping Parameters and Feedback 45
Digital Flow Meter 47
Filter Pressure Sensor 48
The Admin Tab 49
Running Diagnostics 49
Update Firmware 51

The Terminal 52
The SD Card Tab 54
File Operations 54
File preview 56
The Configuration Tab 58
The Help Menu 60
The Activity Log 61
Offline Mode 62
RoCSI General Information 65
Description & Models 65
Optional Moored System 66
RoCSI Specifications 68
Physical Specifications 68
Electrical Specifications 69
Communication Cable Specifications 69
Controller Housing End Cap Diagrams 70
Bulkhead Connectors 71
Sterivex™ Filter Cartridge Specifications 72
Fluidic System Schematic 74
RoCSI Electronics Information 75
RoCSI Operations 76
Pre-Deployment Checklist 76
Mounting the Sampler 77
Installing the Bench Stand 77
Assembling New Filter Cartridges 78
Incorrect Filter Cartridge Assembly 83
Loading the Cartridge Chain 83
Hopper 89
Installing the Hopper 91
Filling Reagent Bags 94
Priming the Pumps 96
Priming Sample, Stabilization and Cleaner Lines 99
Priming Cartridges 100
Sampling 101
Setting the Flow Volume & Maximum Pressure 101

Configuring Stabilization & Cleaning 102
Configuring the Sample Schedule 102
Deployment Exit Conditions 103
Sample Viability 103
Sample Time Outs 103
Advanced Software Settings 103
Calibrating the Cartridge Loader 104
Calibrating the Injectors 107
Calibrating the Pressure Sensor 114
Calibrating the Flow Meter 117
Recovery and Data Offload 119
Recovery 119
Unloading the Cartridge Chain 119
Data Offload 121
RoCSI Maintenance & Storage 122
Changing Peristaltic Tubing 122
Changing Out Check Valves 124
Storage and Transport 125
Post-Deployment Cartridge Processing 125
Appendix 127
Moored Configuration 127
External Battery 127

Included with the RoCSI

A new Robotic Cartridge Sampling Instrument (RoCSI) includes a USB drive that contains the User Manual and McLanePro interface software.

Each RoCSI also includes a toolkit. The toolkit and contents are referred to in 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
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, GUI version (McLanePro) and instrument serial number.
- Problem description.

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.

Printable User Manual

Check the RoCSI User Manual page on the McLane website for updates and a downloadable RoCSI User Manual.

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 on a label attached to the controller housing:

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 to the RoCSI
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

When connected the Internet, 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.

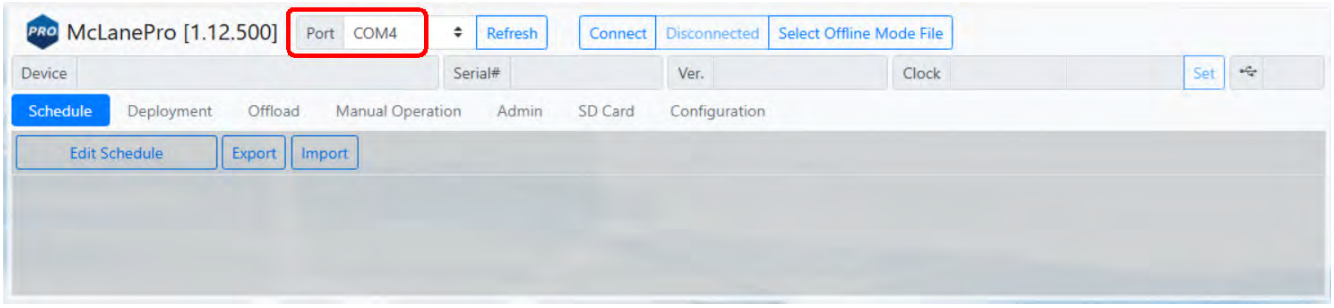
System Requirements

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

Connecting to the RoCSI

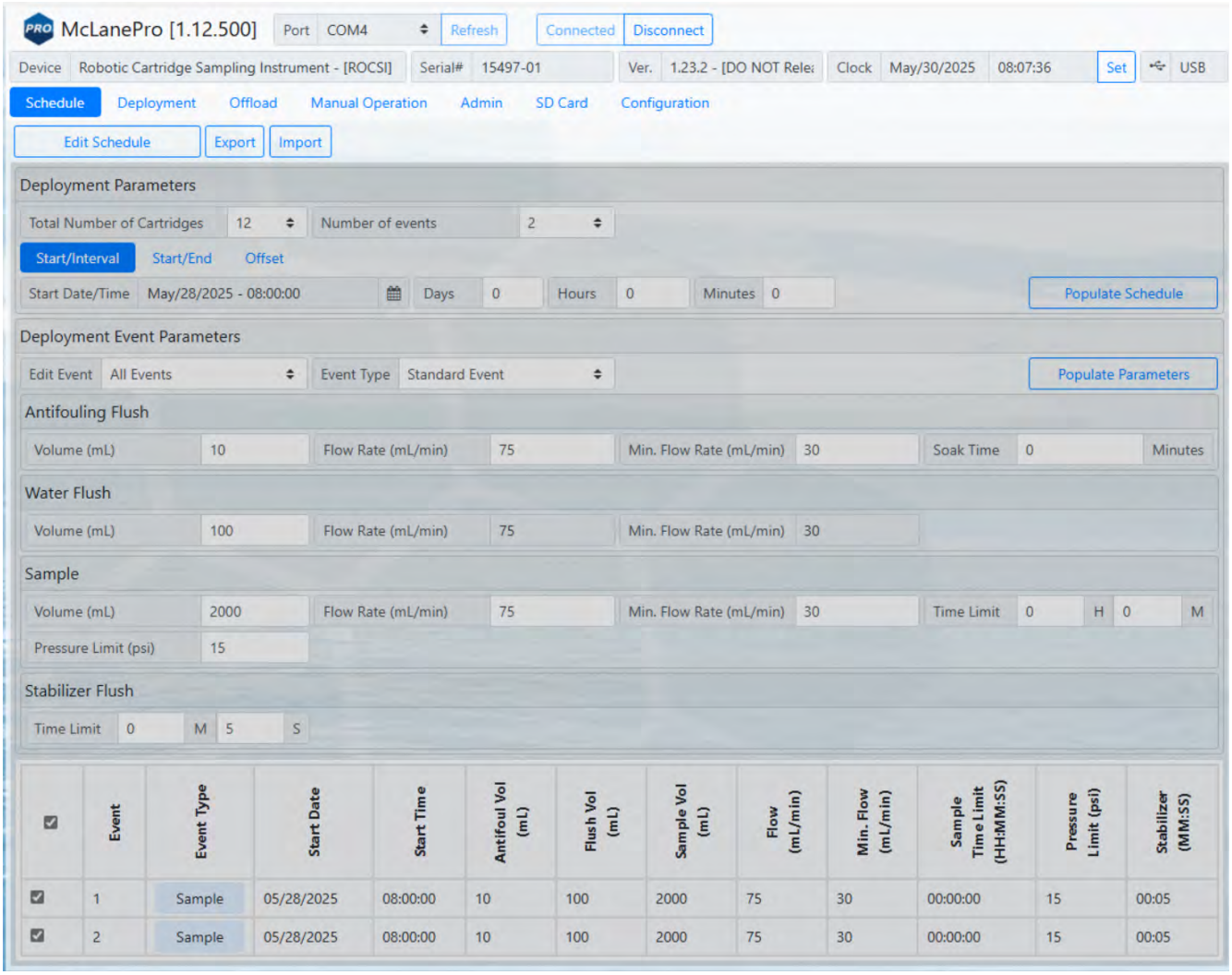
McLanePro is used to communicate with the RoCSI. McLane ships a USB cable that connects to the eight-pin communications connector on the housing end cap. A host computer provides the electronics with USB power, to communicate with the sampler. Battery or external power is required for operation of external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

1. Remove the dummy plug from the communication port on the RoCSI.
2. Plug the USB COM cable onto the COM bulkhead of the RoCSI.
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 computer should recognize the USB connection as a virtual serial device.
5. Open McLanePro.
6. Find and select the communication (COM) port associated with the McLane RoCSI in the **Port** window.
7. Click **Connect**.



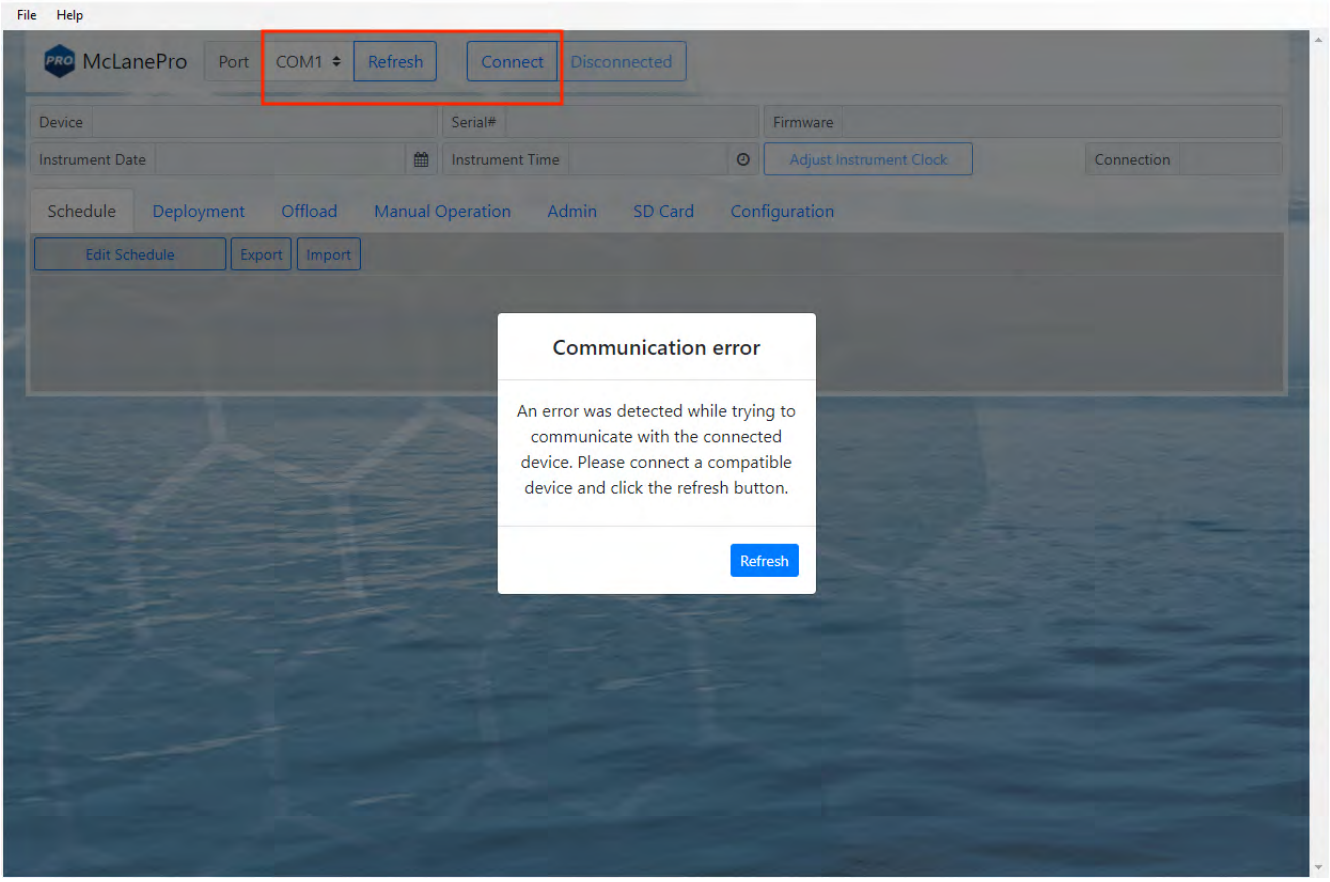
In the above example, the communication port associated with the RoCSI is COM 4.
After successfully connecting to the RoCSI, McLanePro tabs will display data stored on the

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.

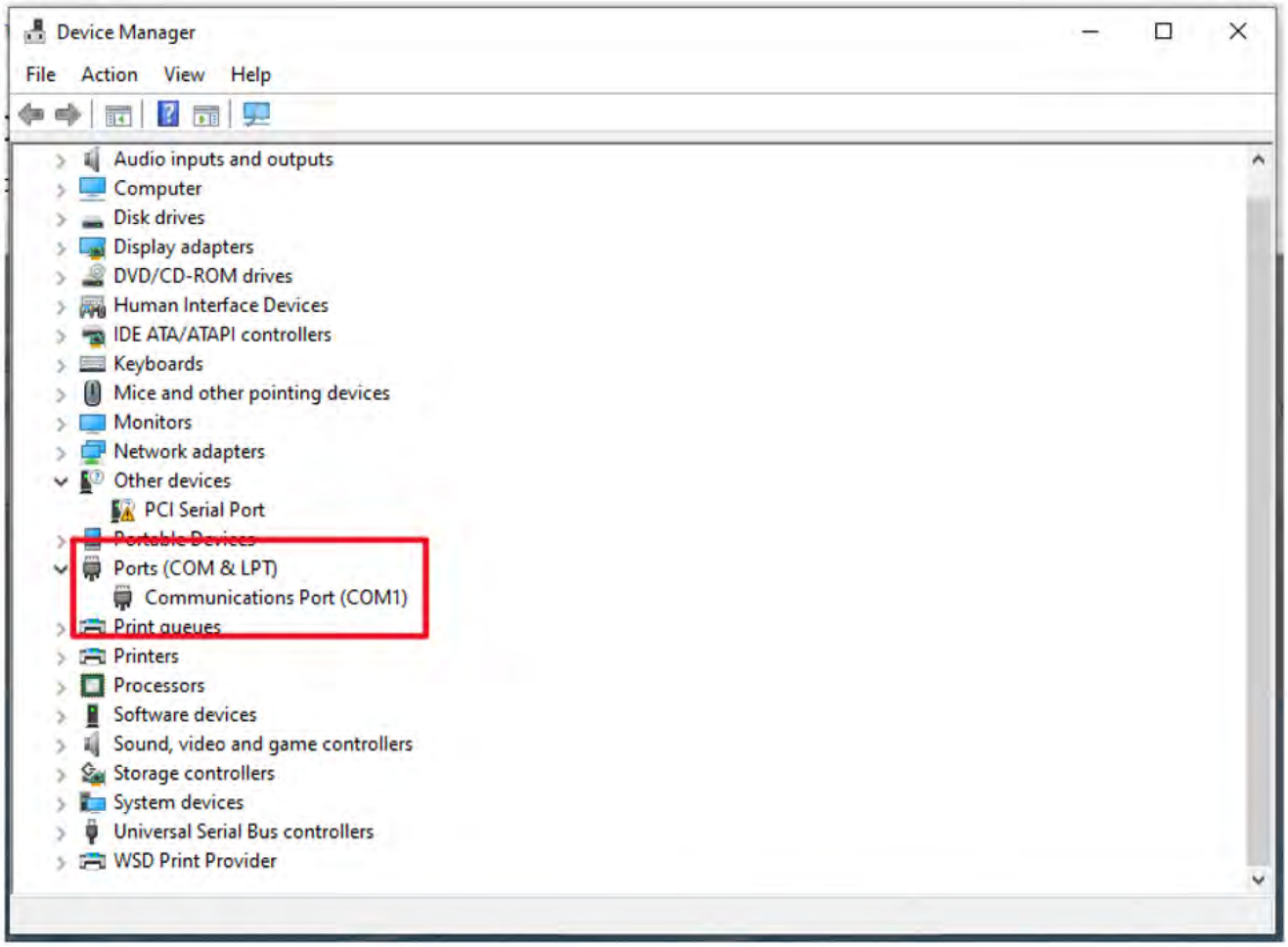


Communication Troubleshooting

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. Disconnect the mains power and the USB connection, wait 30 seconds, and reconnect the mains.

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

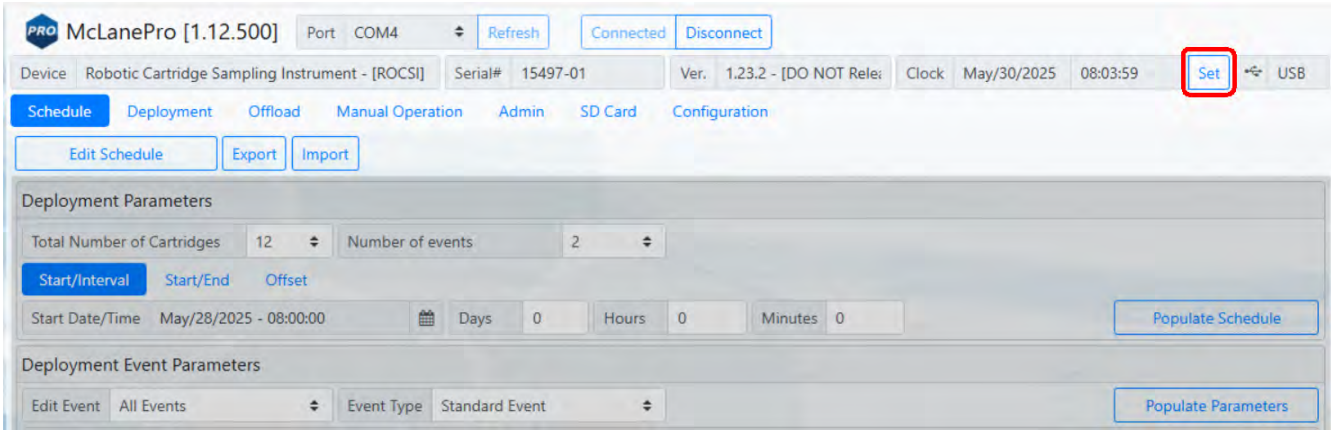
In rare cases, some computers may have difficulty reliably recognizing the USB COM port and a different computer may be necessary to successfully communicate with the device.

Setting the Instrument Clock

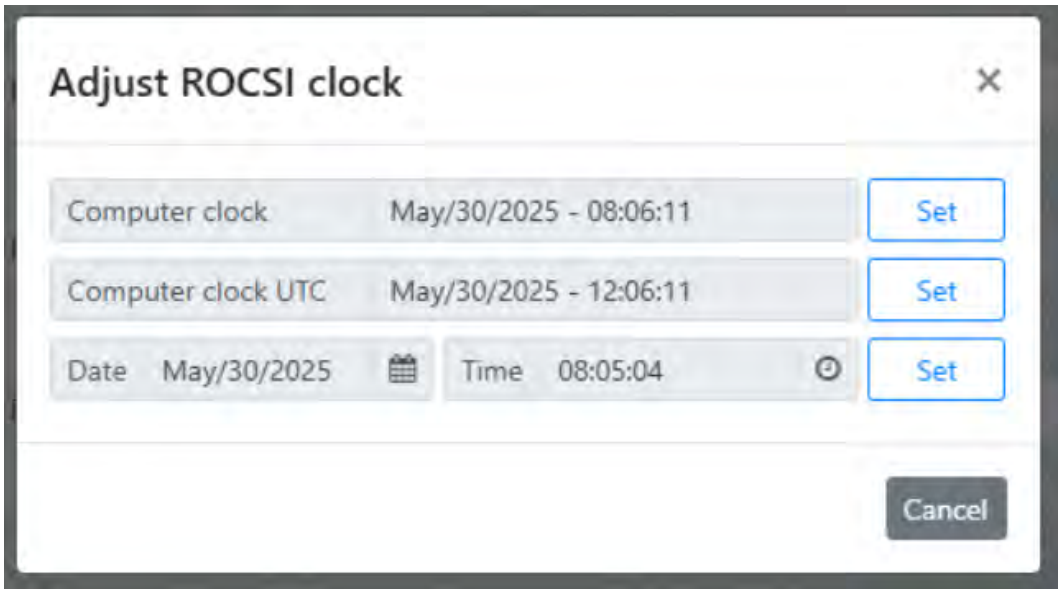
The instrument time is reset if both the USB COM cable and the batteries are disconnected for longer than 24 hours.

Always be sure to check the instrument time before deploying the system.

To set the instrument time press the **Set** button.

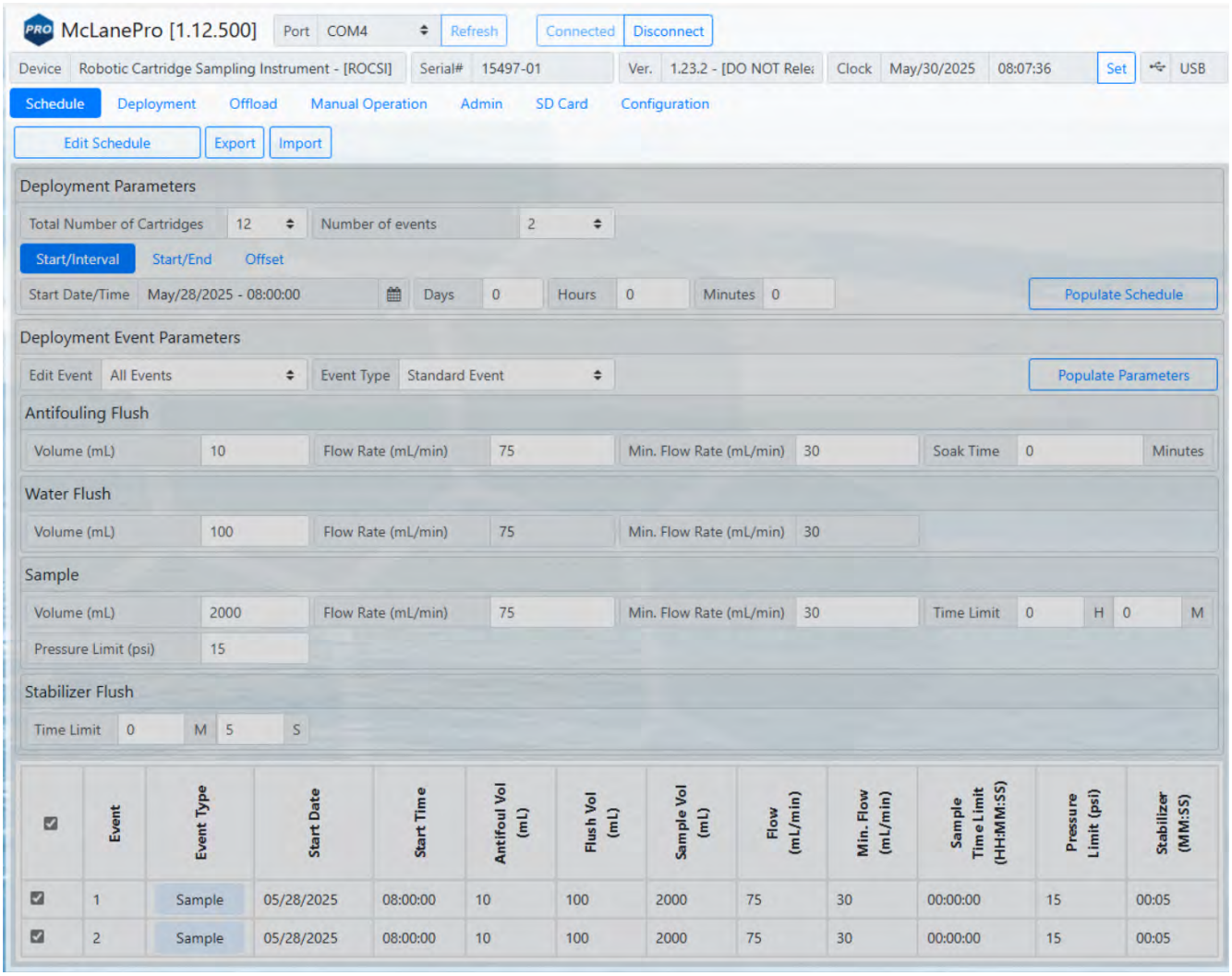


Click the **Set** button to set any of the available time values.



The Schedule Tab

The **Schedule tab** is used to define a deployment schedule before deploying the RoCSI.

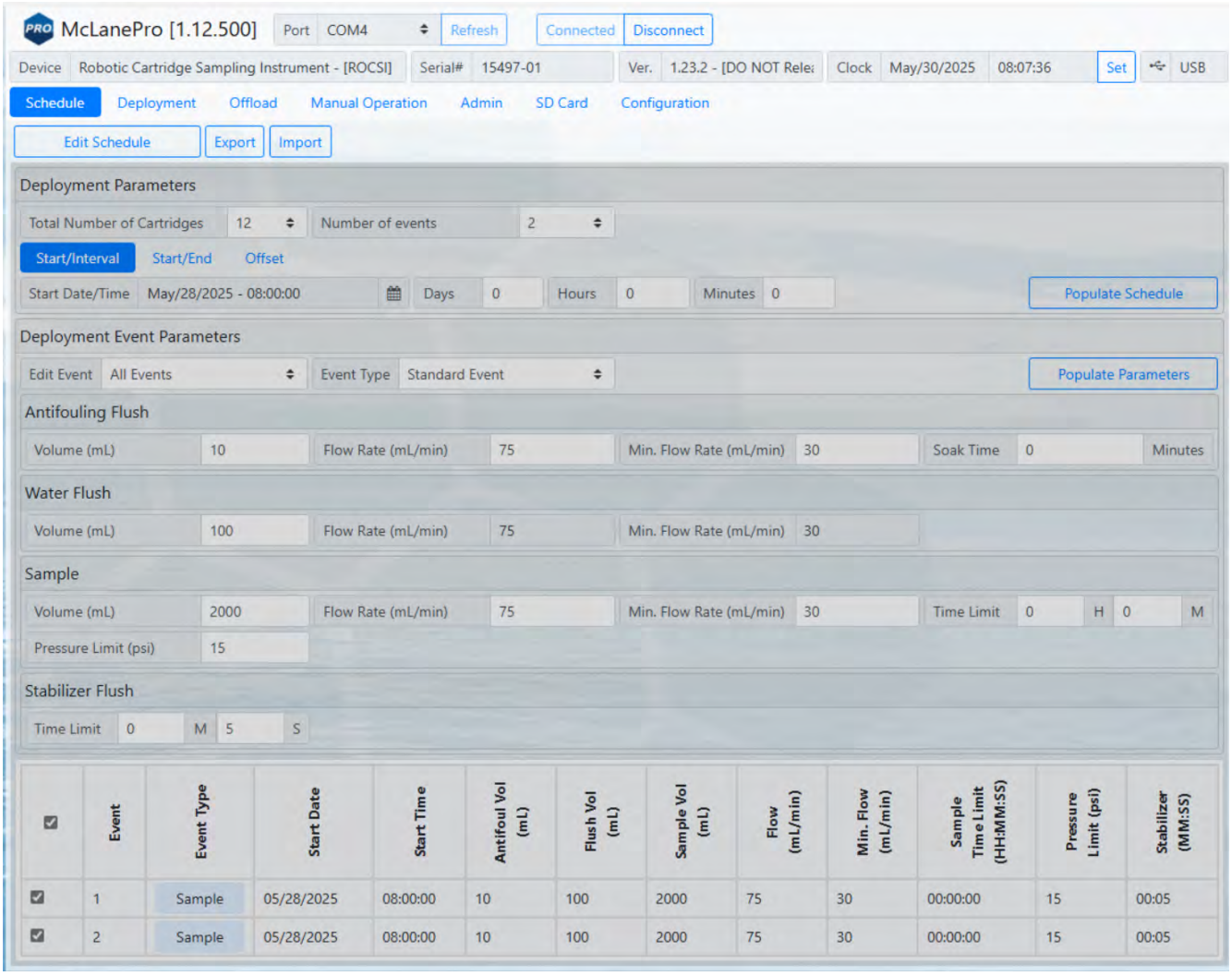


Schedule a Deployment

Follow these steps to define a deployment using a scheduled start date and time.

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

1. Click the **Schedule tab.**
2. Click the **Edit Schedule** button.

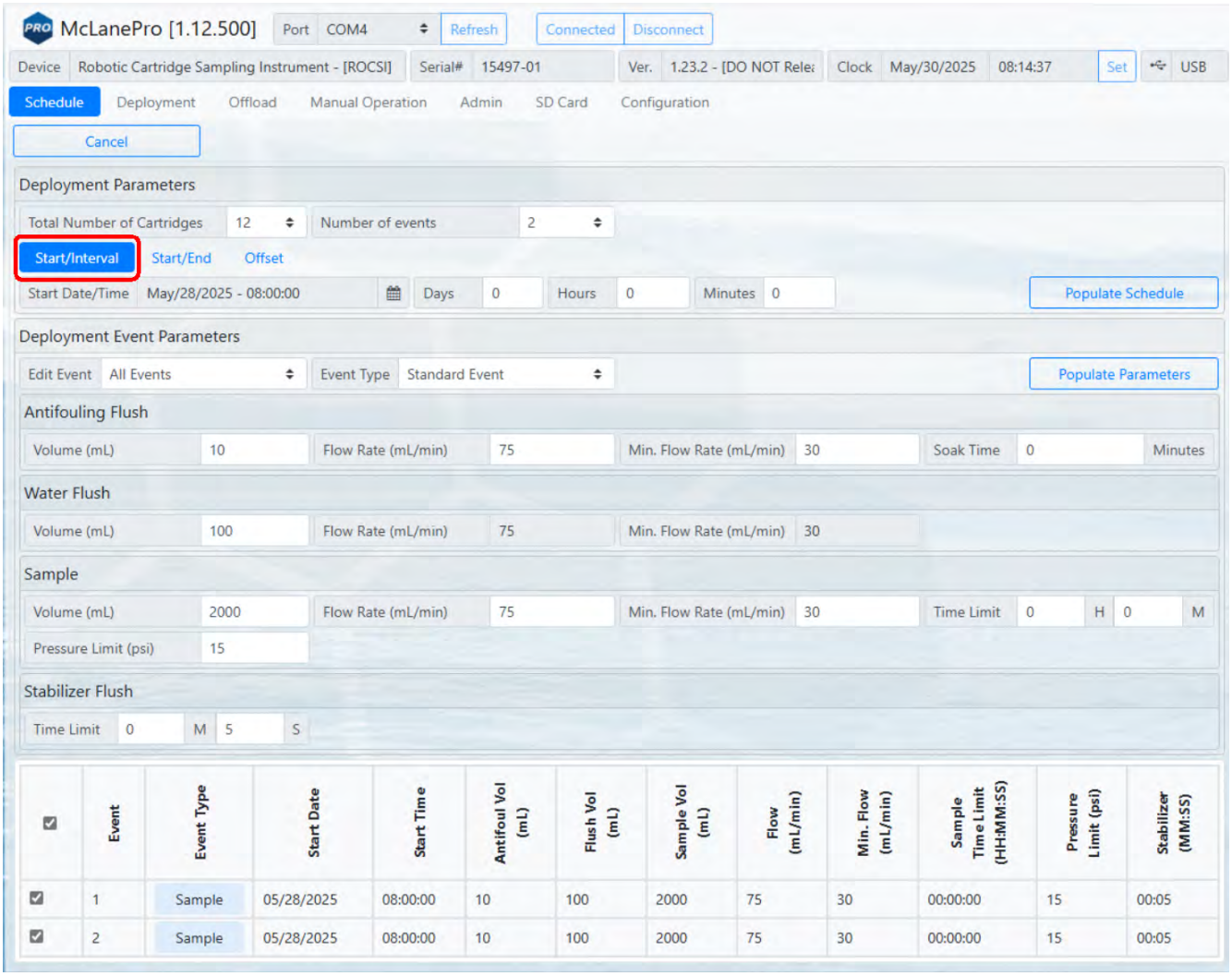


There are two sections used to set up a deployment. The first section, Deployment Parameters, allows for setting of the schedule type or modifying an existing schedule. The second section, Deployment Event Parameters, allows for setting all or individual event parameters related to RoCSI sampling operations.

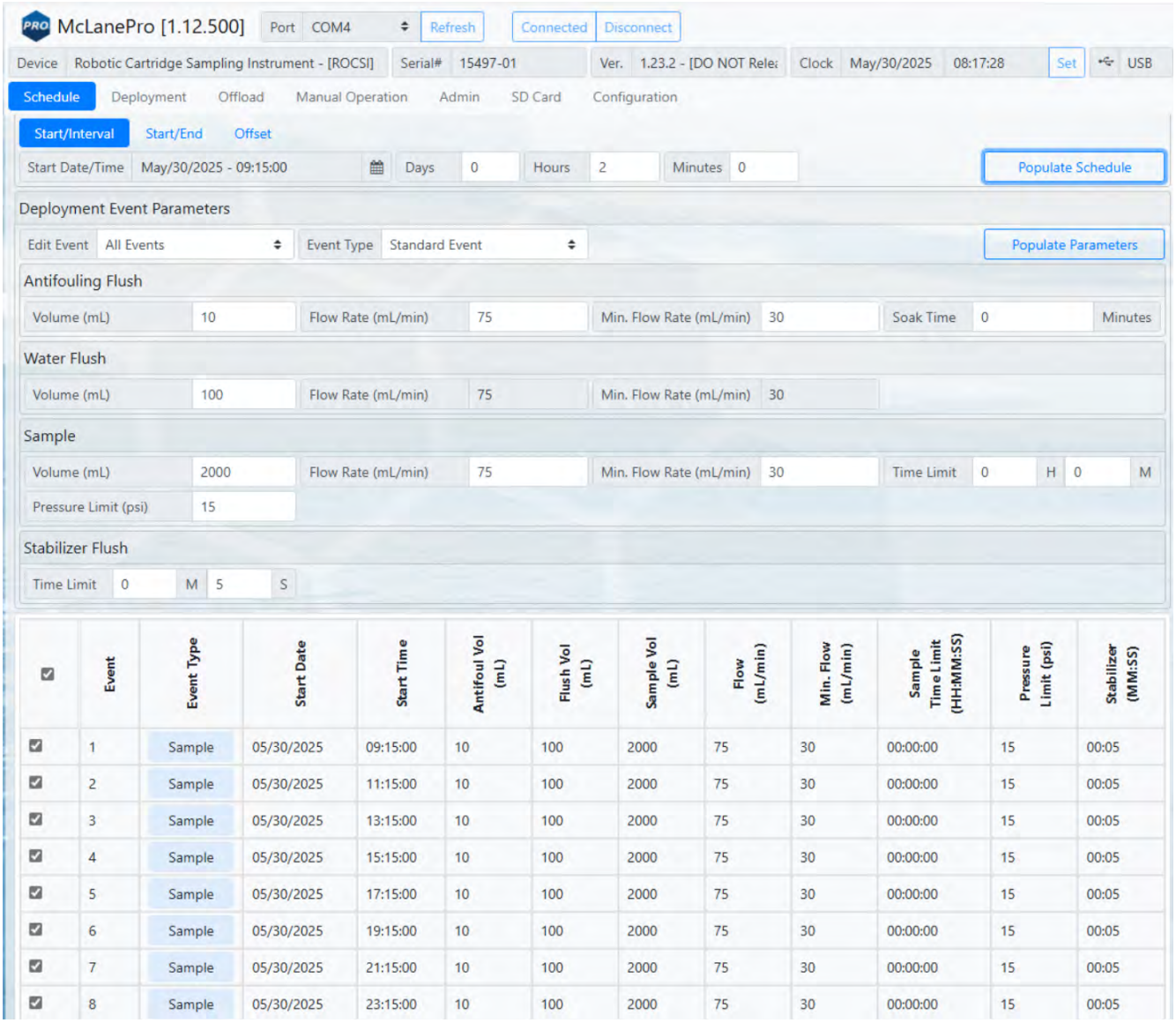
- *Deployment Parameters*

  - **Total Number of Cartridges** - displays the maximum available sample cartridges that may be used for a deployment. Editing this value will reconfigure the instrument with a new chain length.
  - **Number of events** - defines the number of RoCSI samples to be collected during the deployment. This may not exceed the total number of cartridges value.
  - **Start/Interval** - the start/interval tab allows for scheduling a deployment according to a fixed start time and interval between sample events.

- **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.
- **Offset** - the offset tab allows for applying an offset time to the existing schedule. This preserves the timing between samples, but allows for updating the time schedule according to the defined offset.



3. Click the **Start/Interval** tab.
4. Click the calendar next to the **Start/Interval** field to select a start time for the deployment.
5. Define an interval with which to schedule sample collection.
6. Click **Populate Schedule** to apply the schedule to the deployment events.



7. Fill in the Deployment Event Parameters:

    - *Deployment Event Parameters*

    - **Edit Event** - displays or selects a single event or range of events to apply parameters.
    - **Event Type** - define the event type for the selected event or range of events.
        - **Standard Event** - allows for full control of antifouling, flushing, sampling and stabilization. Please note that for a standard event, antifouling and water flushes are performed without a cartridge engaged, **expelling waste to the environment from the sample injector**.

- **Sacrificial Flush** - allows for cleaning of the intake and sample path, with all cleaning and flushing fluids directed to the waste exhaust through a cartridge. Please note that this event type consumes a sample cartridge for flushing,
- **Negative Control** - allows for stabilization of an unused cartridge. No sample collection is performed. Cartridge is stabilized only.

o **Antifouling Flush** - parameters related to pumping cleaning agent out of the system intake.

- **Volume** - volume to pump from the cleaner bag through the RoCSI intake line. Set volume to zero to disable the antifouling flush.
- **Flow Rate** - desired flow rate for the antifouling flush procedure.
- **Minimum Flow Rate** - define the minimum acceptable flow rate for the antifouling flush procedure. This setting defines when the event will terminate due to a decreasing flow rate.
- **Soak Time** - sets the residence time for the cleaning agent to sit in the intake line before being flushed out.

o **Water flush** - parameters related to pumping sample water through the intake prior to sampling.

- **Volume** - volume of water to pump through the intake prior to sampling. Set volume to zero to disable the water flush.
- **Flow Rate** - desired flow rate for the water flush procedure.
- **Minimum Flow Rate** - 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.

o **Sample** - parameters related to sample collection.

- **Volume** - sets the desired sample volume.
- **Flow Rate** - sets the desired flow rate for sample collection.
- **Minimum Flow Rate -** define the minimum acceptable flow rate for sample collection. This setting defines when the event will terminate due

to a decreasing flow rate.

- **Time Limit** - sets a time limit for the event. If the event has not terminated by the time limit, sample collection will be terminated and stabilization attempted (if programmed).
- **Pressure Limit** - sets the maximum differential pressure across the filter membrane. Higher thresholds will allow collection of more material but may damage biology if set above 10 to 15 psi. The maximum system pressure is 30 psi. Sample collection slows and eventually terminates on minimum flow rate when the maximum pressure threshold is reached.

o **Stabilizer Flush** - parameters related to pumping stabilizing agent into the sample cartridges.

- **Time Limit** - sets the fixed time to apply stabilizer (at a fixed flow rate). Typically, 3 to 6 seconds is appropriate to flood the capsule. Set volume to zero to disable stabilization.

7. Once settings have been made for the Deployment Event Parameters, click **Populate Parameters** to apply these settings to one or more events in the schedule.
8. Check the list of events to be sure that the schedule and event parameters are set correctly. Individual or groups of events may be further modified if necessary.

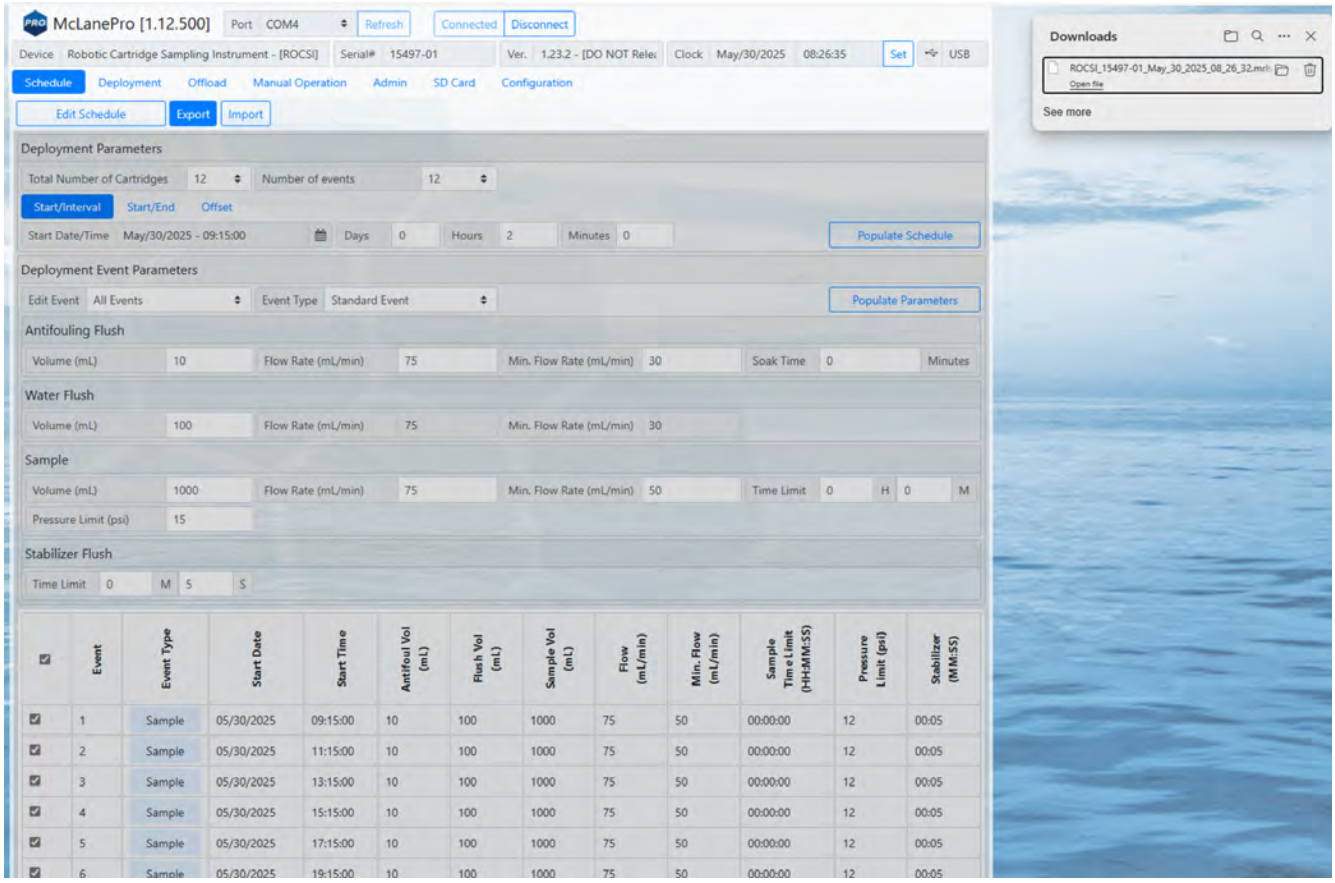
☑	Event	Event Type	Start Date	Start Time	Antifoul Vol (mL)	Flush Vol (mL)	Sample Vol (mL)	Flow (mL/min)	Min. Flow (mL/min)	Sample Time Limit (HH:MM:SS)	Pressure Limit (psi)	Stabilizer (MM:SS)
☑	1	Sample	05/30/2025	09:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	2	Sample	05/30/2025	11:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	3	Sample	05/30/2025	13:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	4	Sample	05/30/2025	15:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	5	Sample	05/30/2025	17:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	6	Sample	05/30/2025	19:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	7	Sample	05/30/2025	21:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	8	Sample	05/30/2025	23:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	9	Sample	05/31/2025	01:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	10	Sample	05/31/2025	03:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	11	Sample	05/31/2025	05:15:00	10	100	1000	75	50	00:00:00	12	00:05
☑	12	Sample	05/31/2025	07:15:00	10	100	1000	75	50	00:00:00	12	00:05

9. Click **Save changes**. The new settings are immediately applied to the RoCSI.

Exporting a Schedule

Schedules 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, and/or change the start condition, using **Edit Schedule**.
2. Set the deployment parameters.
3. Click **Save changes** to load that schedule onto the RoCSI.
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 RoCSI. This file is useful for reviewing the deployment parameters and schedule after disconnecting from the RoCSI.

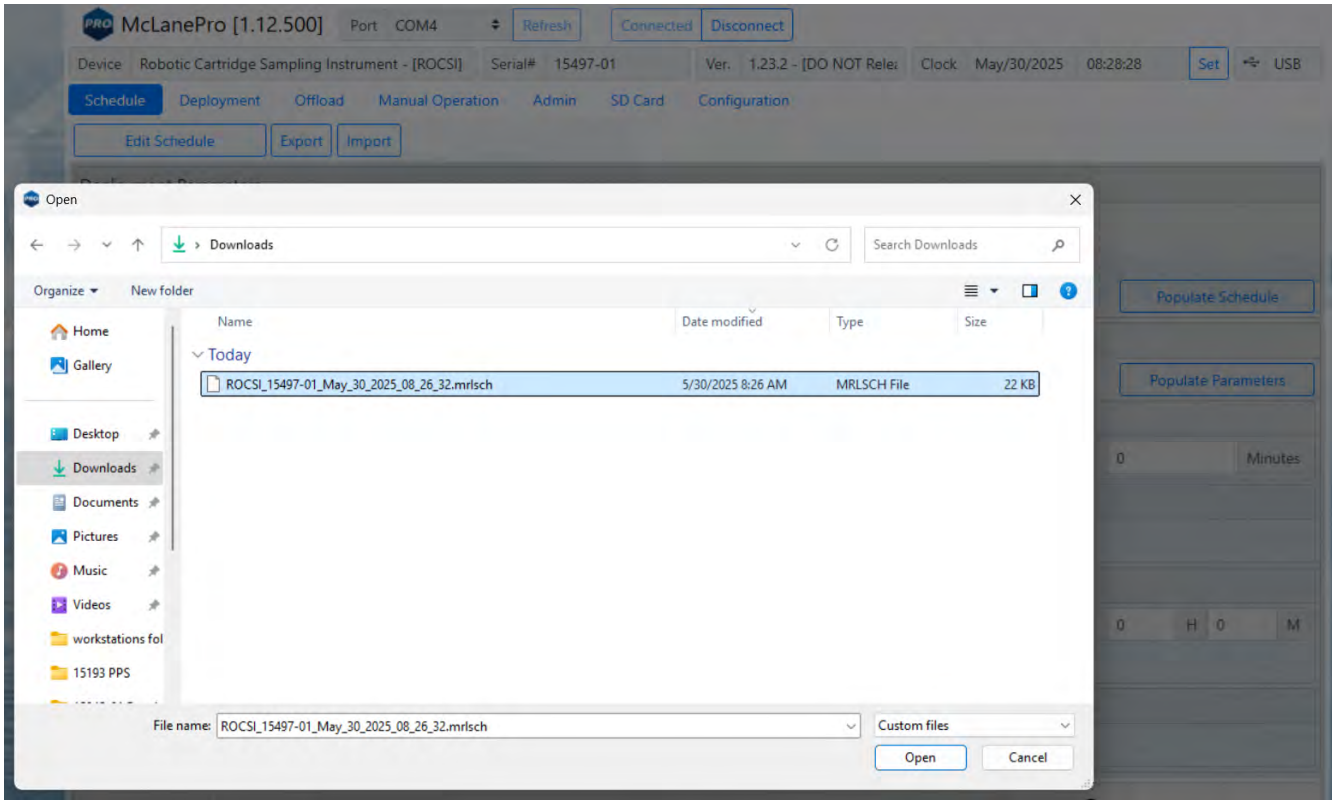
Importing a Schedule

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**.

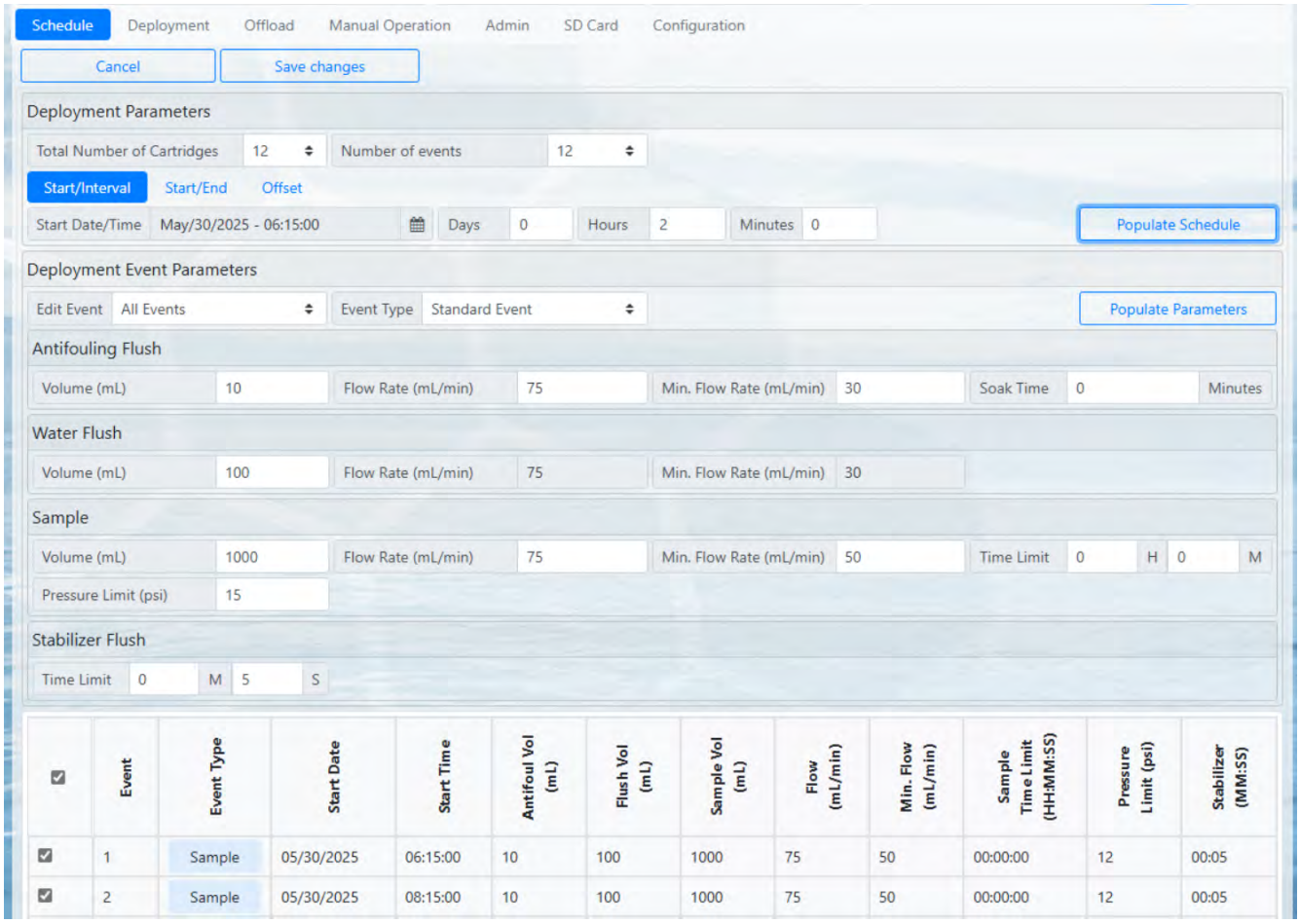
The RoCSI will check the schedule to confirm it is compatible with the installed hardware, model number and/or configuration. If it is compatible, the scheduler will load and display new values.

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

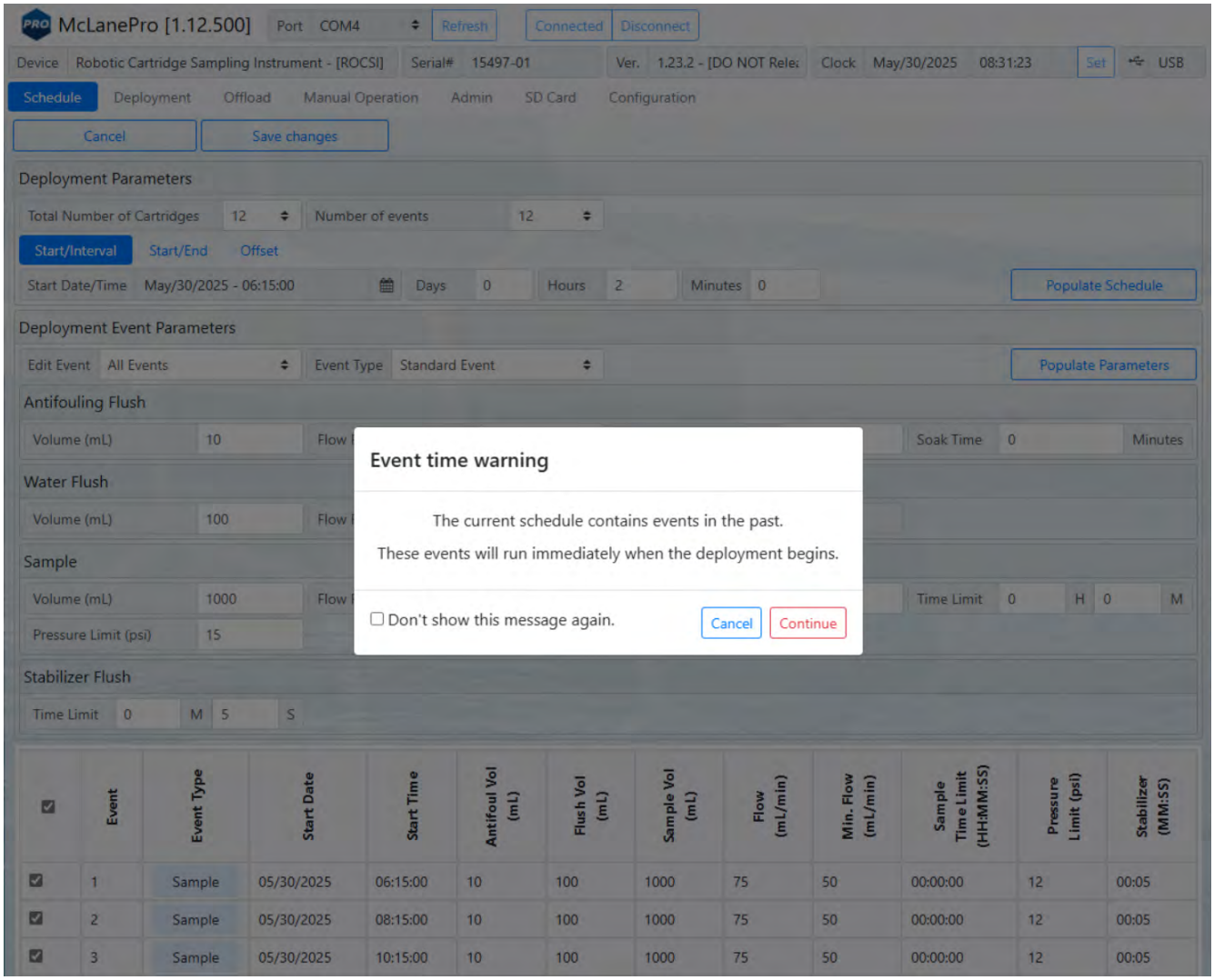


Schedule Errors

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



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

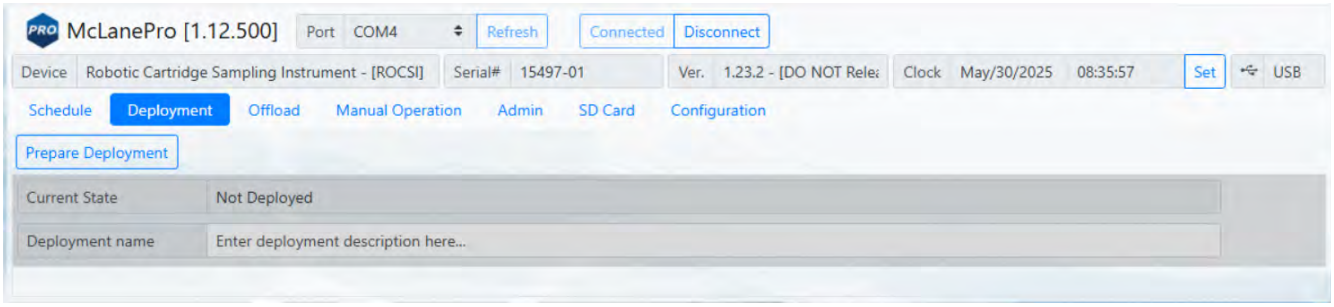

McLanePro [1.12.500]
Port COM4
Refresh
Connected
Disconnect
Device Robotic Cartridge Sampling Instrument - [ROCSI]
Serial# 15497-01
Ver. 1.23.2 - [DO NOT Rele
Clock May/30/2025 08:31:23
Set
USB
Schedule
Deployment
Offload
Manual Operation
Admin
SD Card
Configuration
Cancel
Save changes
Deployment Parameters
Total Number of Cartridges 12
Number of events 12
Start/Interval
Start/End
Offset
Start Date/Time May/30/2025 - 06:15:00
Days 0
Hours 2
Minutes 0
Populate Schedule
Deployment Event Parameters
Edit Event All Events
Event Type Standard Event
Populate Parameters
Antifouling Flush
Volume (mL) 10
Soak Time 0 Minutes
Water Flush
Volume (mL) 100
Sample
Volume (mL) 1000
Pressure Limit (psi) 15
Time Limit 0 H 0 M
Stabilizer Flush
Time Limit 0 M 5 S
Event time warning
The current schedule contains events in the past.
These events will run immediately when the deployment begins.
Don't show this message again.
Cancel
Continue
Event
Event Type
Start Date
Start Time
Antifoul Vol (mL)
Flush Vol (mL)
Sample Vol (mL)
Flow (mL/min)
Min. Flow (mL/min)
Sample Time Limit (HH:MM:SS)
Pressure Limit (psi)
Stabilizer (MM:SS)
1 Sample 05/30/2025 06:15:00 10 100 1000 75 50 00:00:00 12 00:05
2 Sample 05/30/2025 08:15:00 10 100 1000 75 50 00:00:00 12 00:05
3 Sample 05/30/2025 10:15:00 10 100 1000 75 50 00:00:00 12 00:05

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

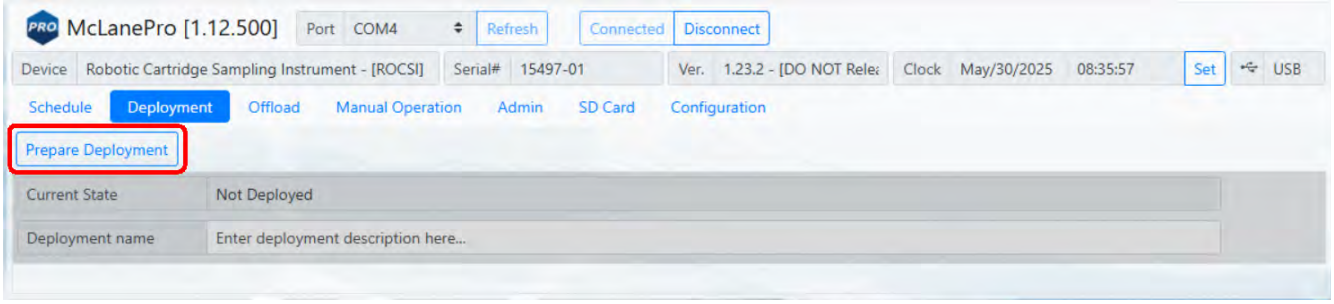
Follow these steps to start a deployment using the currently loaded schedule.

Before scheduling and deploying the RoCSI, make sure the instrument time is set!
*Also, be sure to update the available stabilizer and antifoulant/cleaner volumes. Use the controls provided on the **Manual Operation tab** to set these volumes.*

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

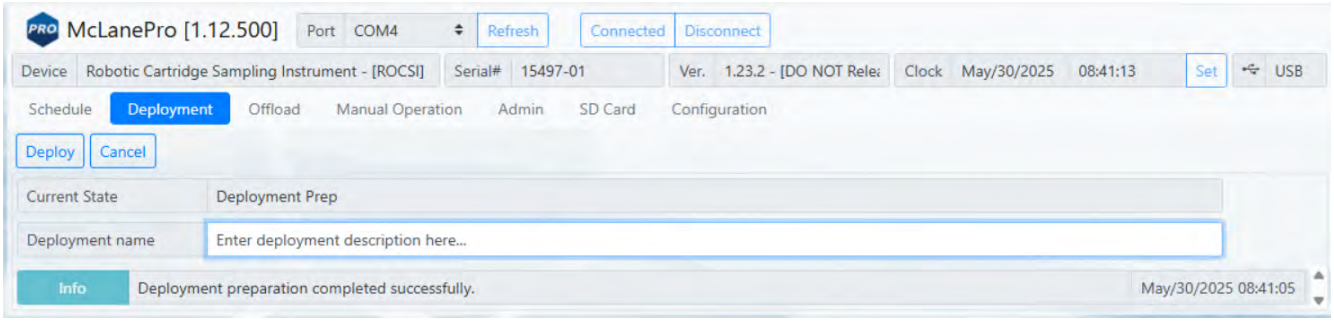
1. On the **Deployment tab**, click **Prepare Deployment**.

Prepare Deployment will run checks to make sure the RoCSI 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 RoCSI again. Warnings may also be generated at the time of deployment preparation, but do not prevent deployment.

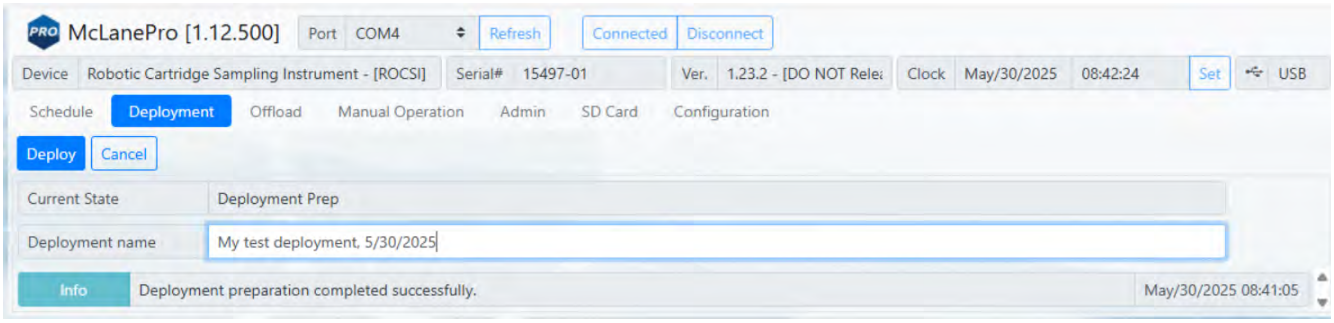


After passing checks, the RoCSI allows setting of the deployment name before deploying.

2. Enter a deployment name or description.

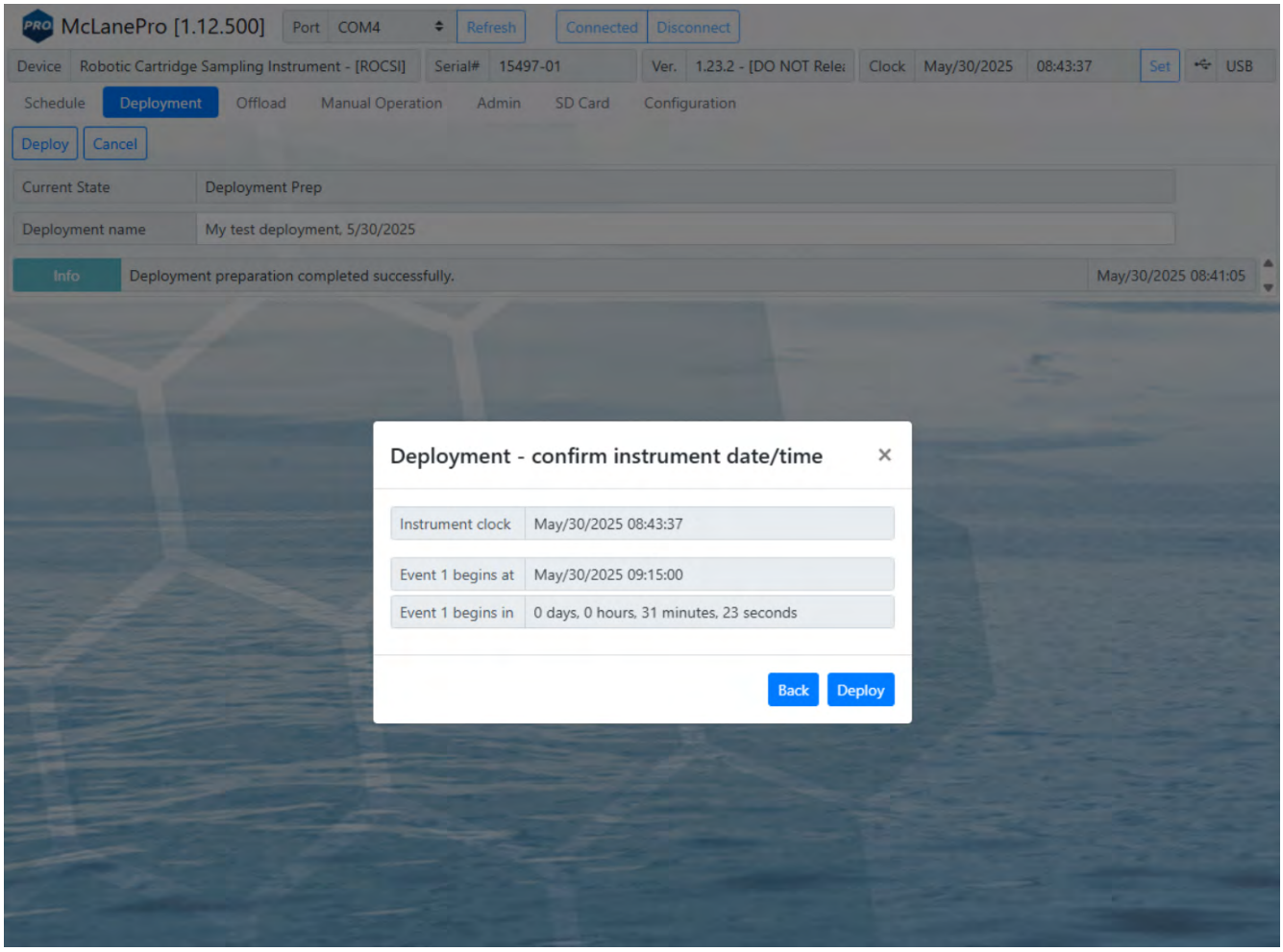


After setting the deployment name, the RoCSI may be deployed.



4. Click the **Deploy** button.

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

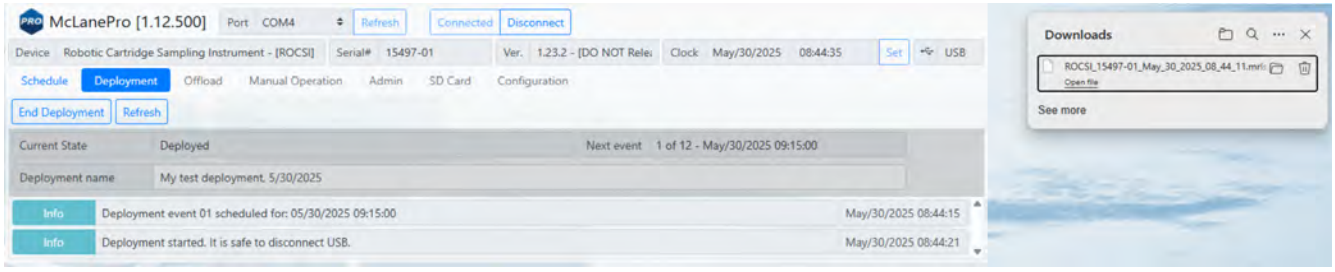


5. Verify the current time is correct and verify the event start time or delay. Click **Deploy** to continue.

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

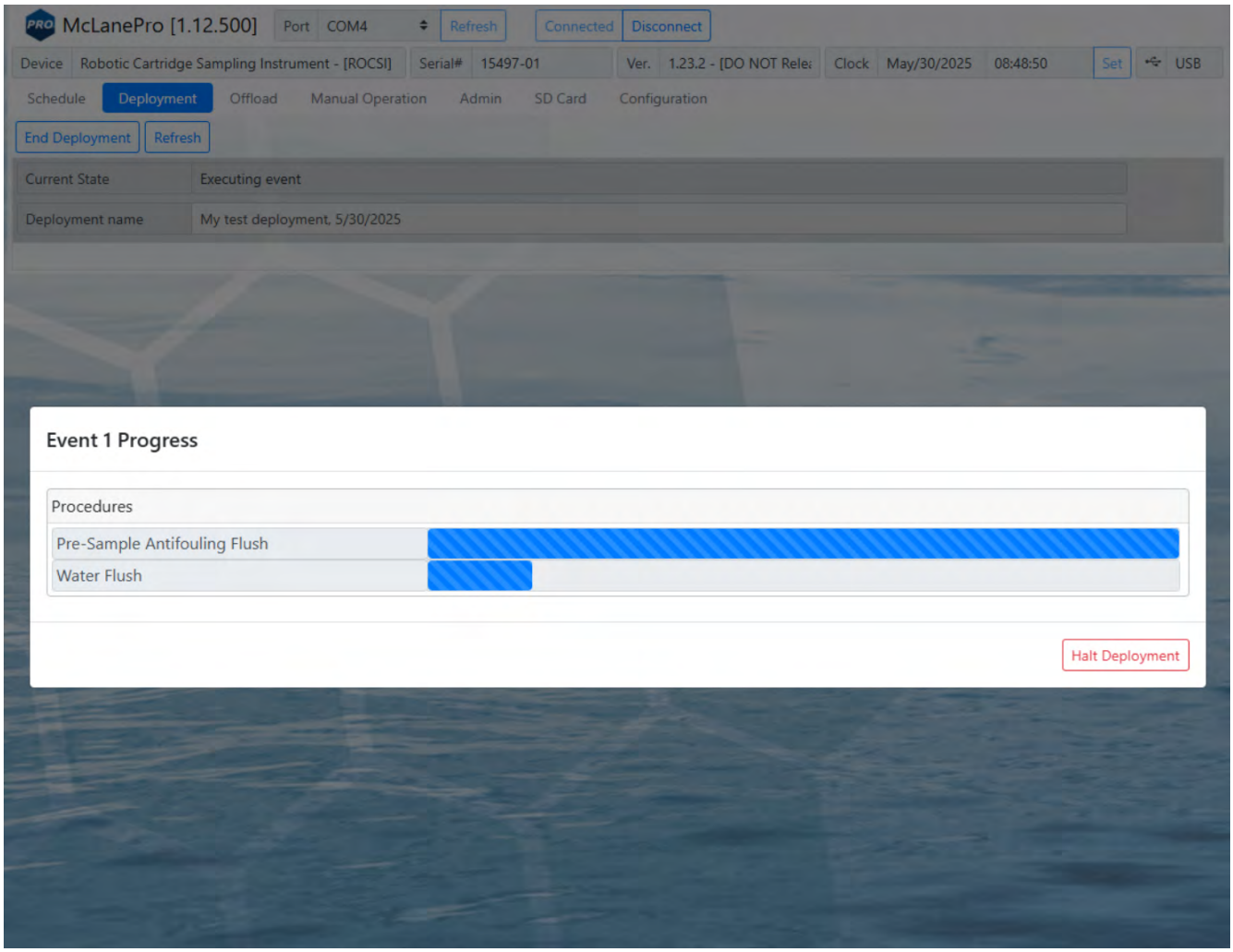
The RoCSI displays the scheduled time for the first event, and a message that confirms it is safe to disconnect the USB connection.

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



6. Remove the communication cable from the host computer first, then at the RoCSI end cap; and reinstall the communications port dummy plug.

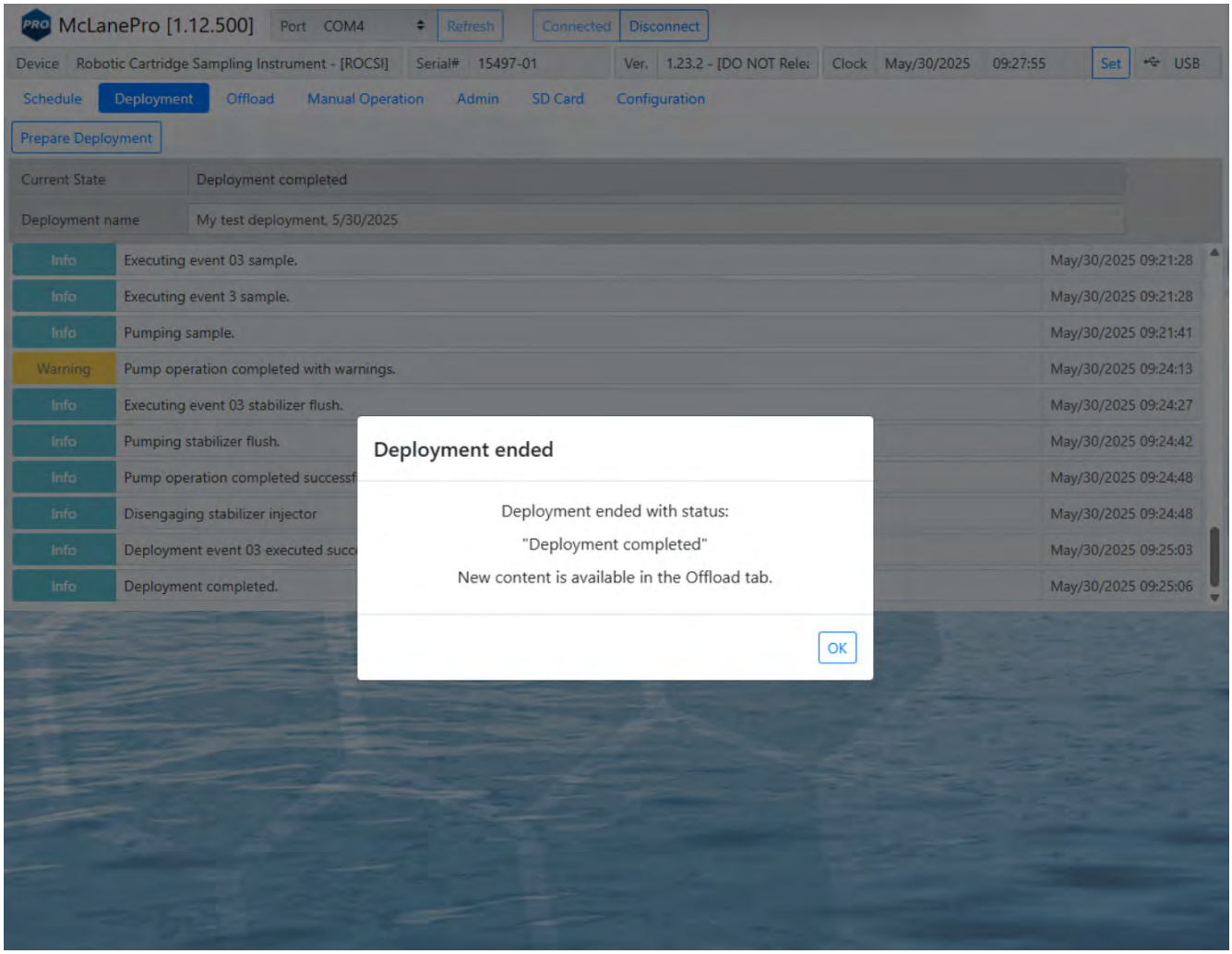
For testing or monitoring deployments, if USB is connected while running a test deployment, an event progress pop-up window reports the progress of the event that is being executed, and the deployment log will be updated as events are executed or completed.



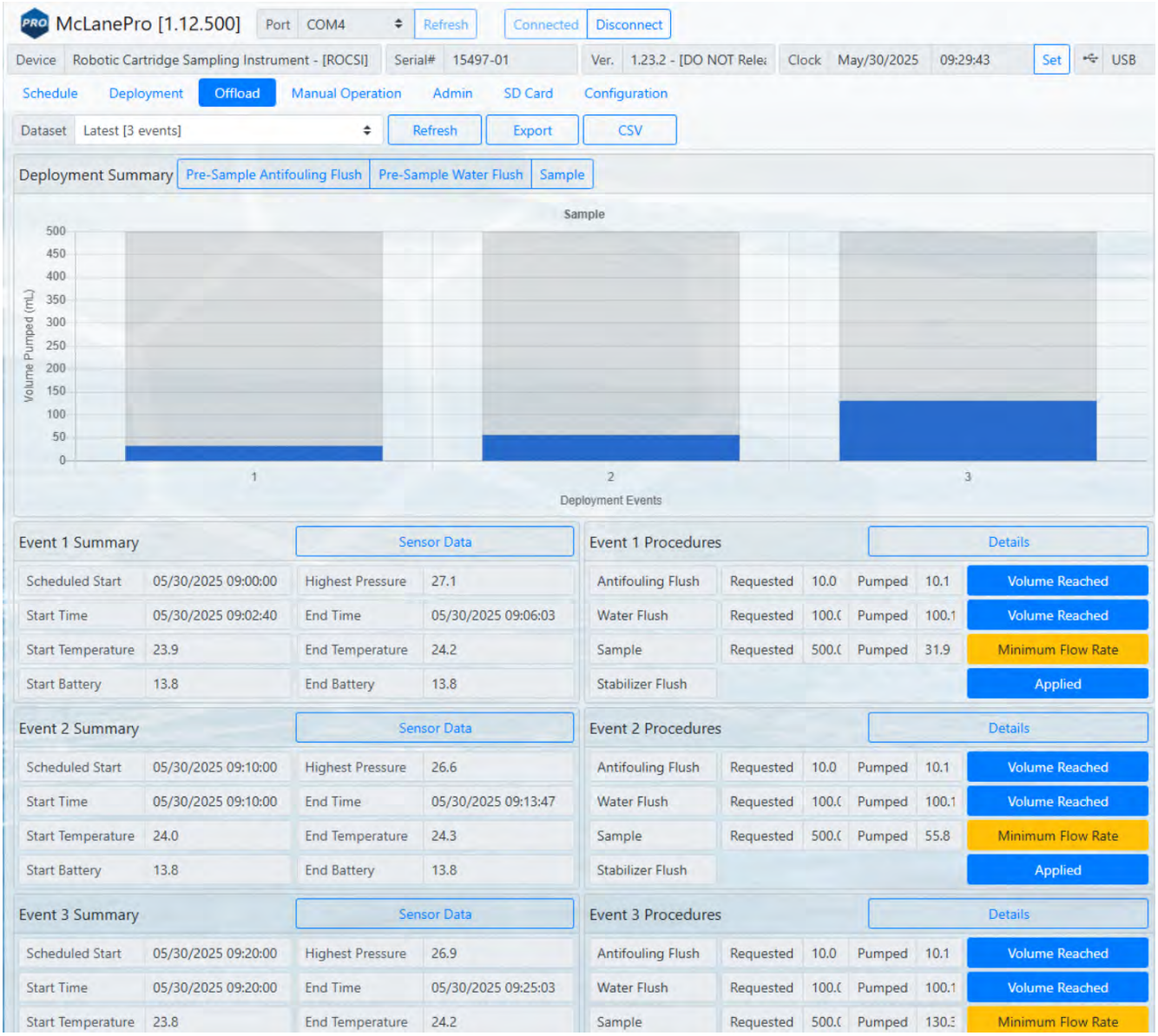
The Offload Tab

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

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

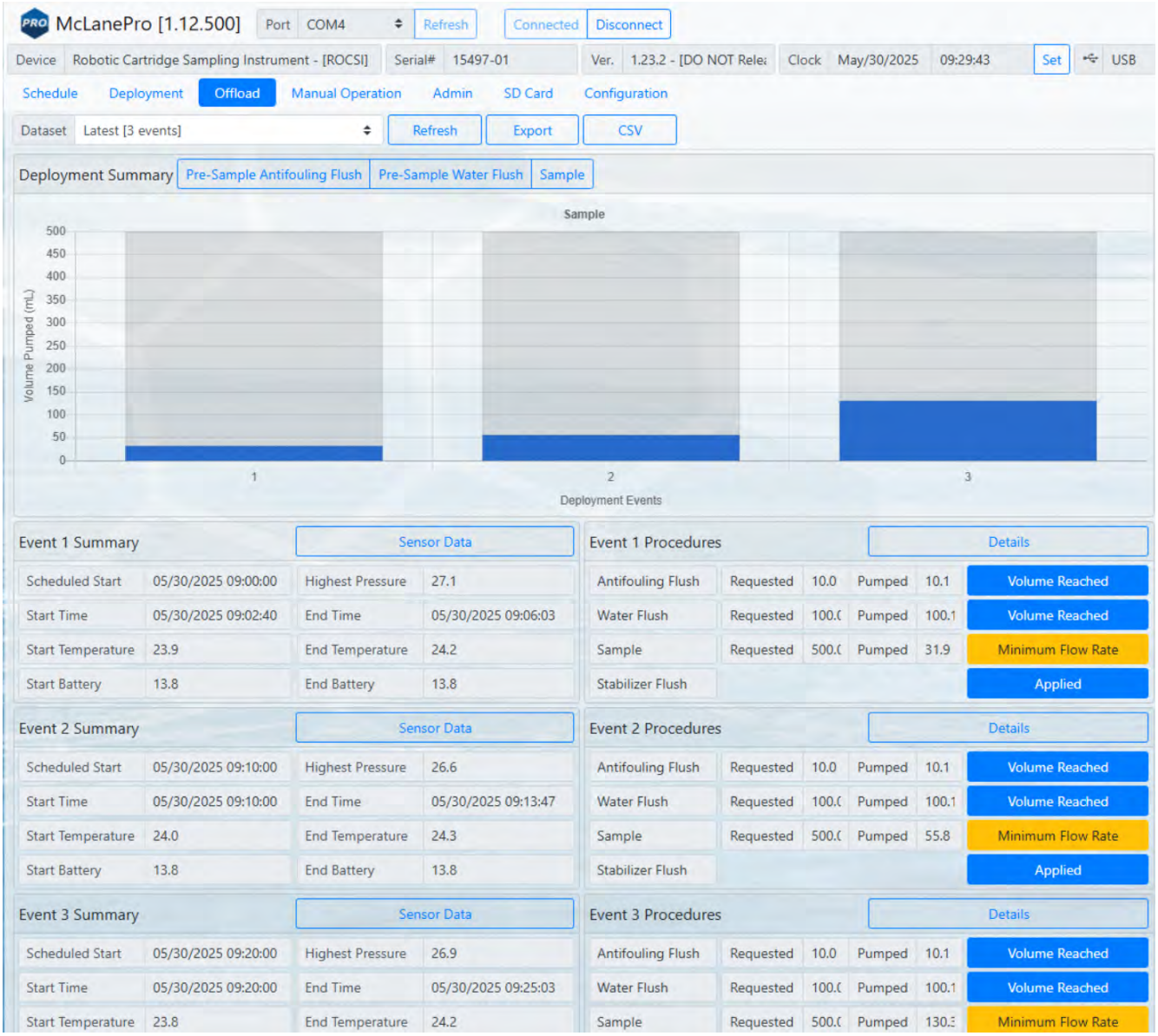


The **Offload tab** displays summary data starting in a bar chart, including pre-sample procedures, flushes, details and sensor data.



Deployment Summary

The Deployment Summary panel offers visualizations of procedures' volume collected during the deployment. Bar charts are selectable for viewing Pre-Sample Antifouling Flush, Pre-Sample Water Flush, and Sample collection data. Each bar is clickable to view detailed summary data for individual events.



Event Data

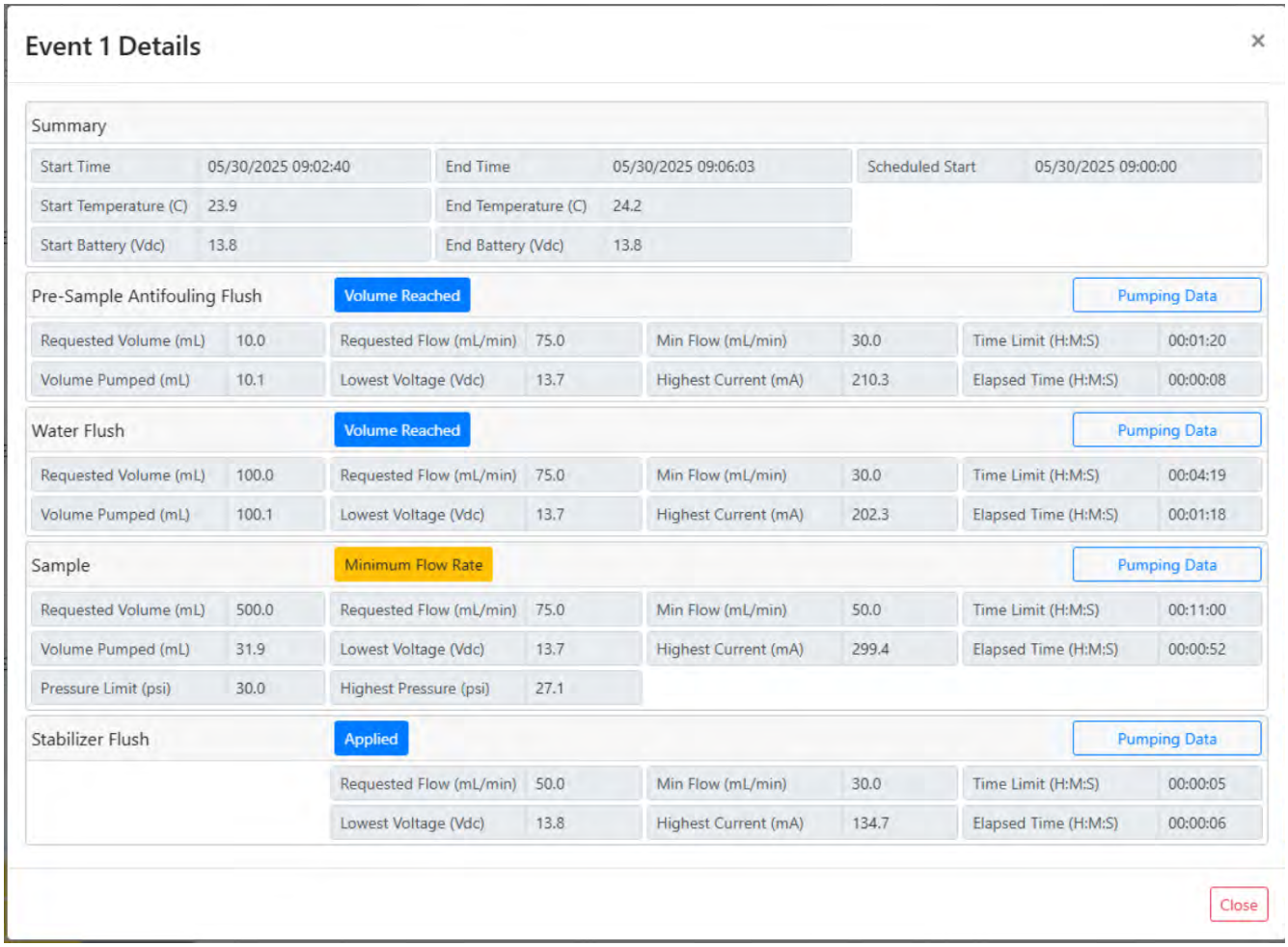
Individual event data are displayed below the bar chart. Each event data panel will display sensor readings taken at the start and end of the event, as well as a listing of procedures performed, and the exit conditions (result) for these procedures.

Event 1 Summary		Sensor Data		Event 1 Procedures					Details
Scheduled Start	05/30/2025 09:00:00	Highest Pressure	27.1	Antifouling Flush	Requested	10.0	Pumped	10.1	Volume Reached
Start Time	05/30/2025 09:02:40	End Time	05/30/2025 09:06:03	Water Flush	Requested	100.(	Pumped	100.1	Volume Reached
Start Temperature	23.9	End Temperature	24.2	Sample	Requested	500.(	Pumped	31.9	Minimum Flow Rate
Start Battery	13.8	End Battery	13.8	Stabilizer Flush					Applied

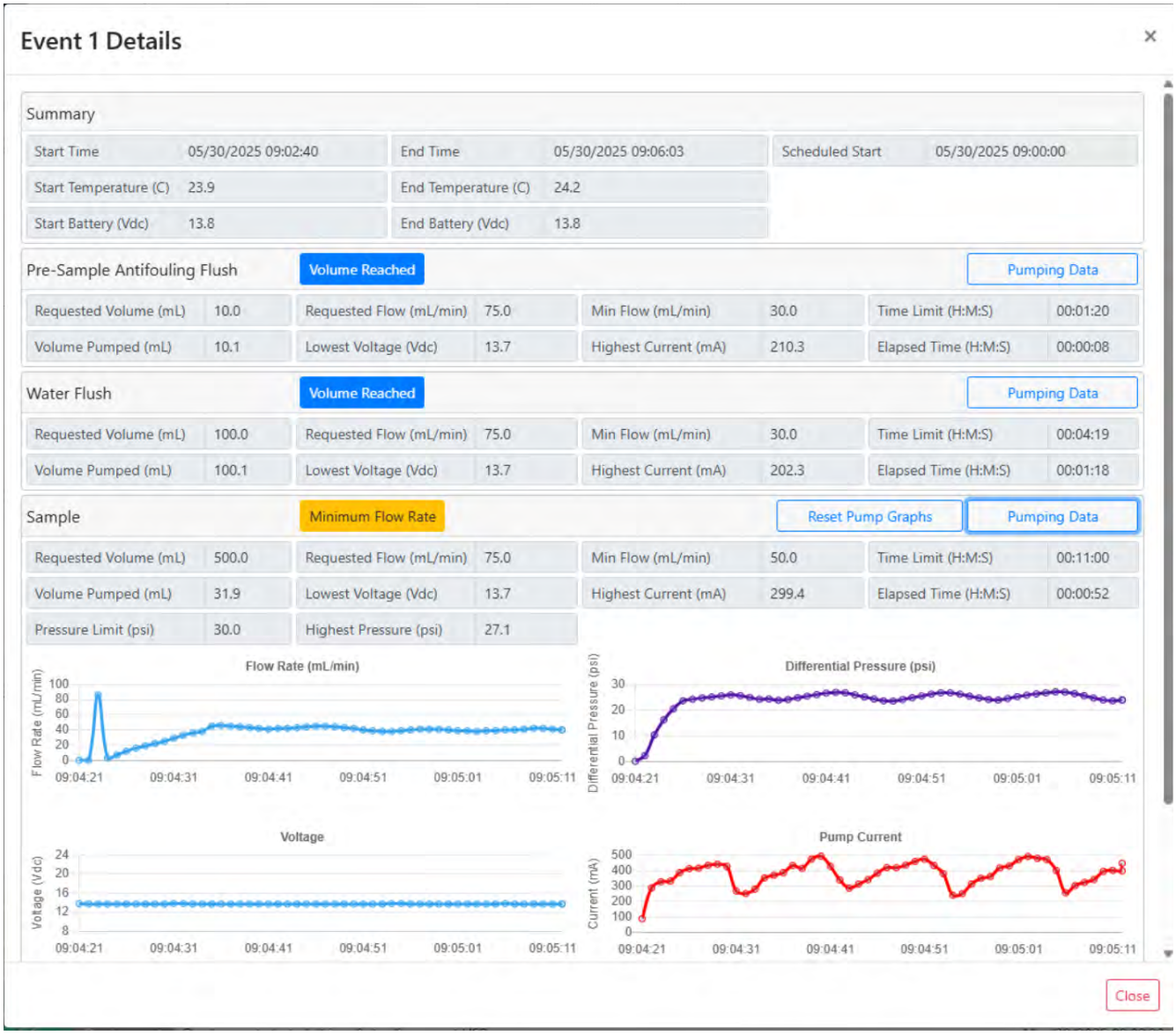
Event 2 Summary		Sensor Data		Event 2 Procedures					Details
Scheduled Start	05/30/2025 09:10:00	Highest Pressure	26.6	Antifouling Flush	Requested	10.0	Pumped	10.1	Volume Reached
Start Time	05/30/2025 09:10:00	End Time	05/30/2025 09:13:47	Water Flush	Requested	100.(	Pumped	100.1	Volume Reached
Start Temperature	24.0	End Temperature	24.3	Sample	Requested	500.(	Pumped	55.8	Minimum Flow Rate
Start Battery	13.8	End Battery	13.8	Stabilizer Flush					Applied

Event 3 Summary		Sensor Data		Event 3 Procedures					Details
Scheduled Start	05/30/2025 09:20:00	Highest Pressure	26.9	Antifouling Flush	Requested	10.0	Pumped	10.1	Volume Reached
Start Time	05/30/2025 09:20:00	End Time	05/30/2025 09:25:03	Water Flush	Requested	100.(	Pumped	100.1	Volume Reached
Start Temperature	23.8	End Temperature	24.2	Sample	Requested	500.(	Pumped	130.3	Minimum Flow Rate
Start Battery	13.8	End Battery	13.8	Stabilizer Flush					Applied

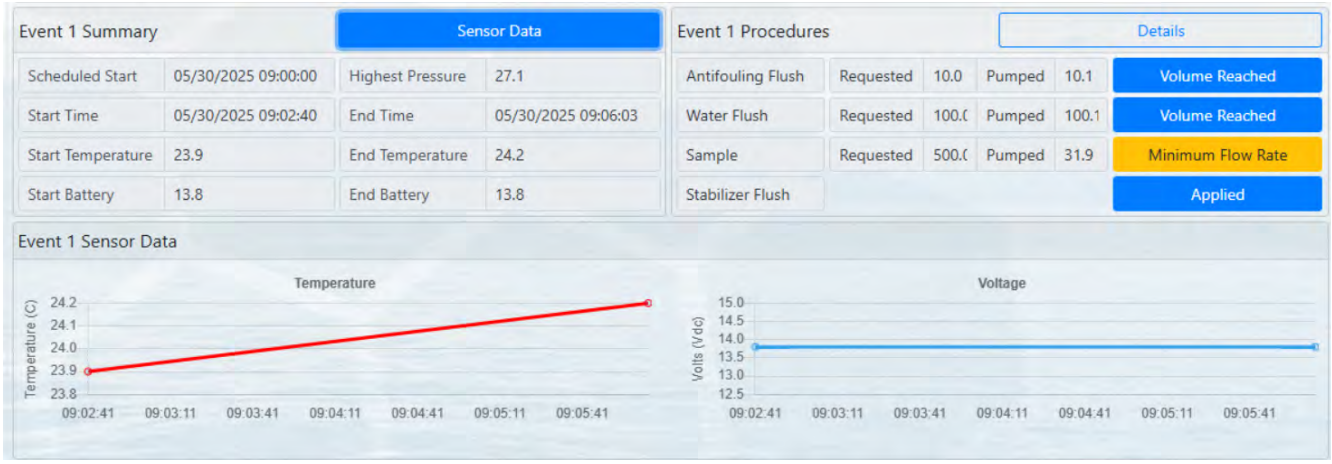
Clicking on the event **Details** button will launch a new window where more detailed information on each procedure is available for viewing.



Clicking the **Pumping Data** button under the Sample heading displays Event 1 pumping data recorded while the RoCSI 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.

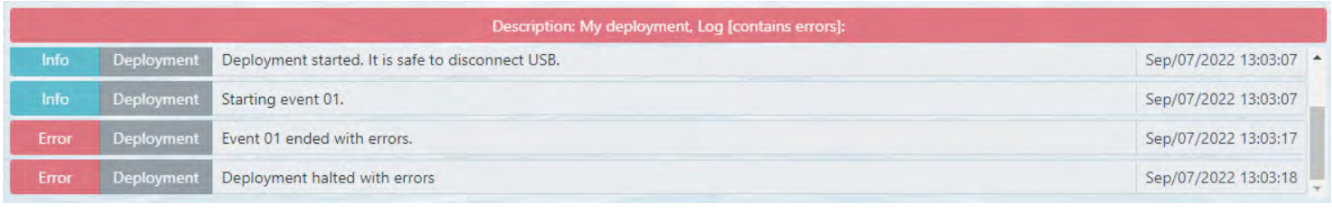


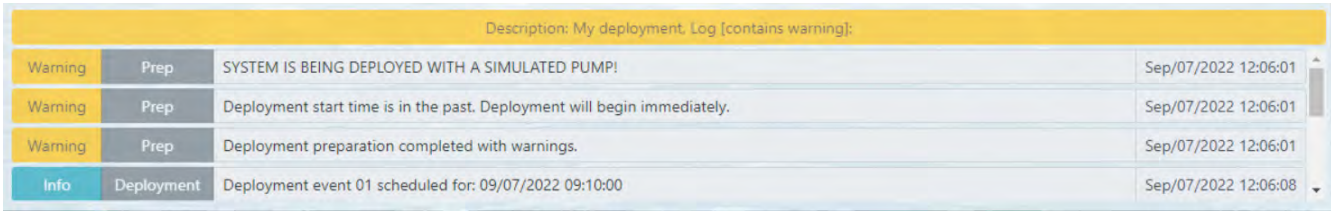
Additionally, from the **Offload tab**, clicking on any event's **Sensor Data** will expand to display charts of sensor data readings taken during the event. These data may include internal temperature and battery voltage.



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. A blue title bar indicates the deployment completed without any errors or warnings.

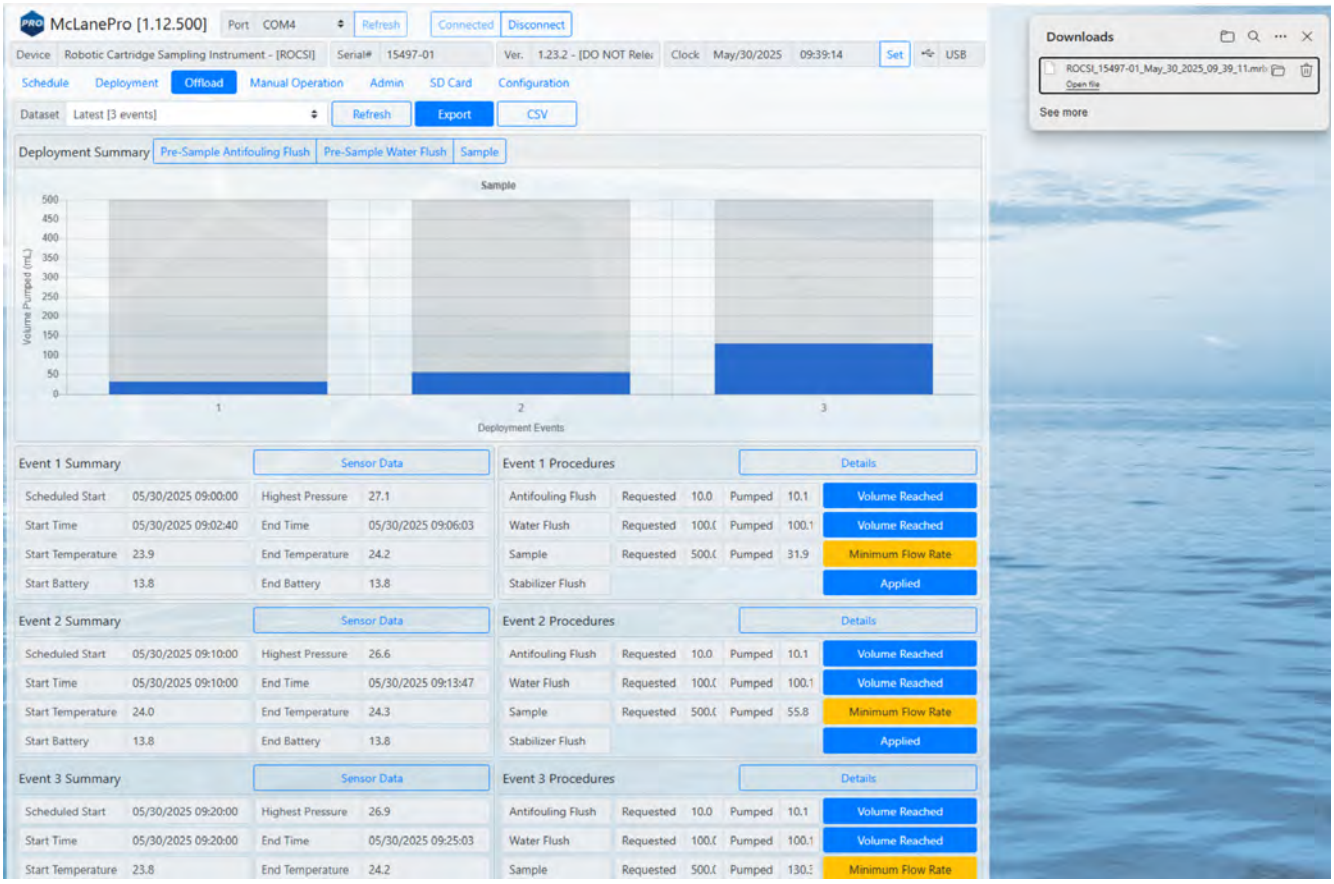




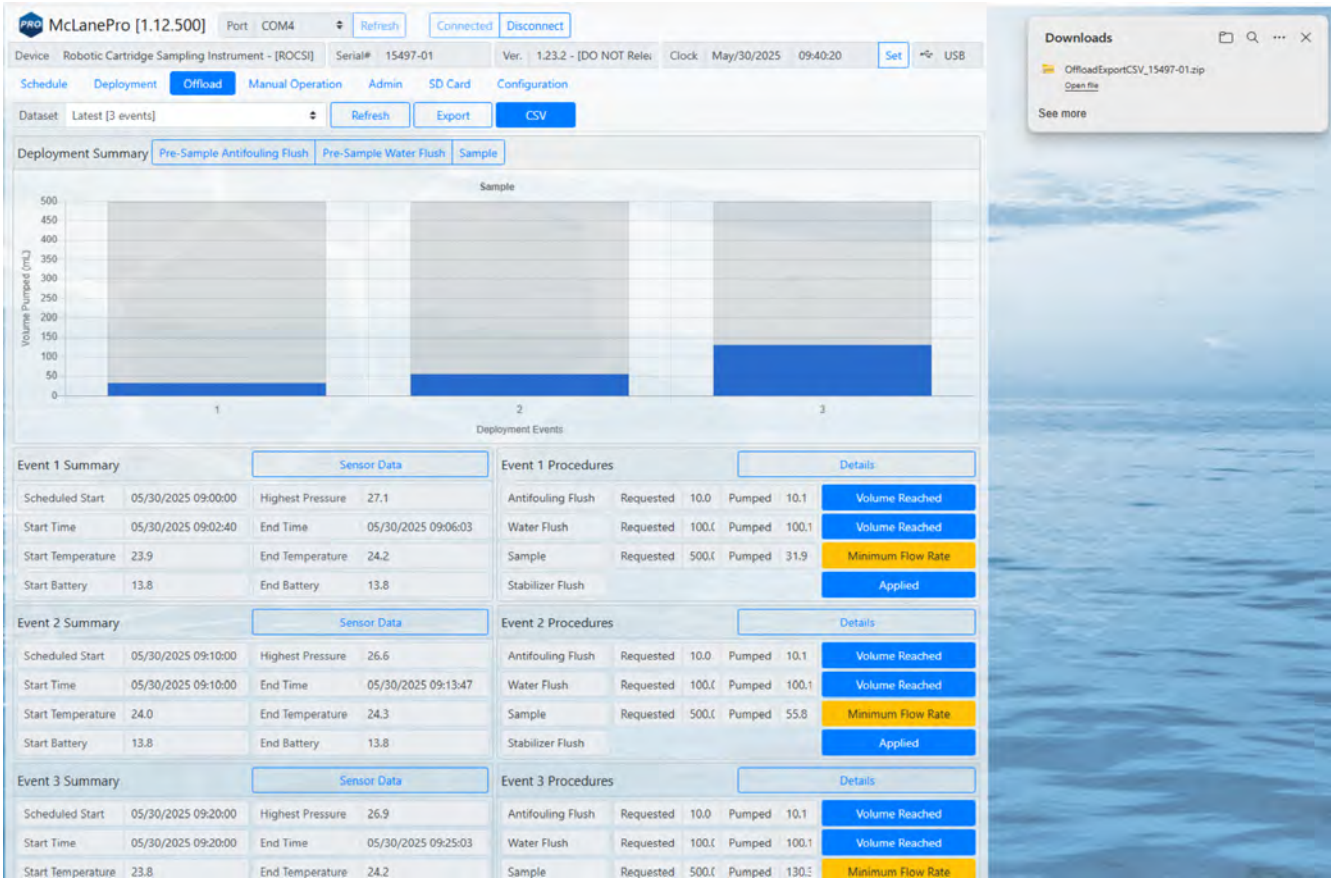
Exporting Deployment Data

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.

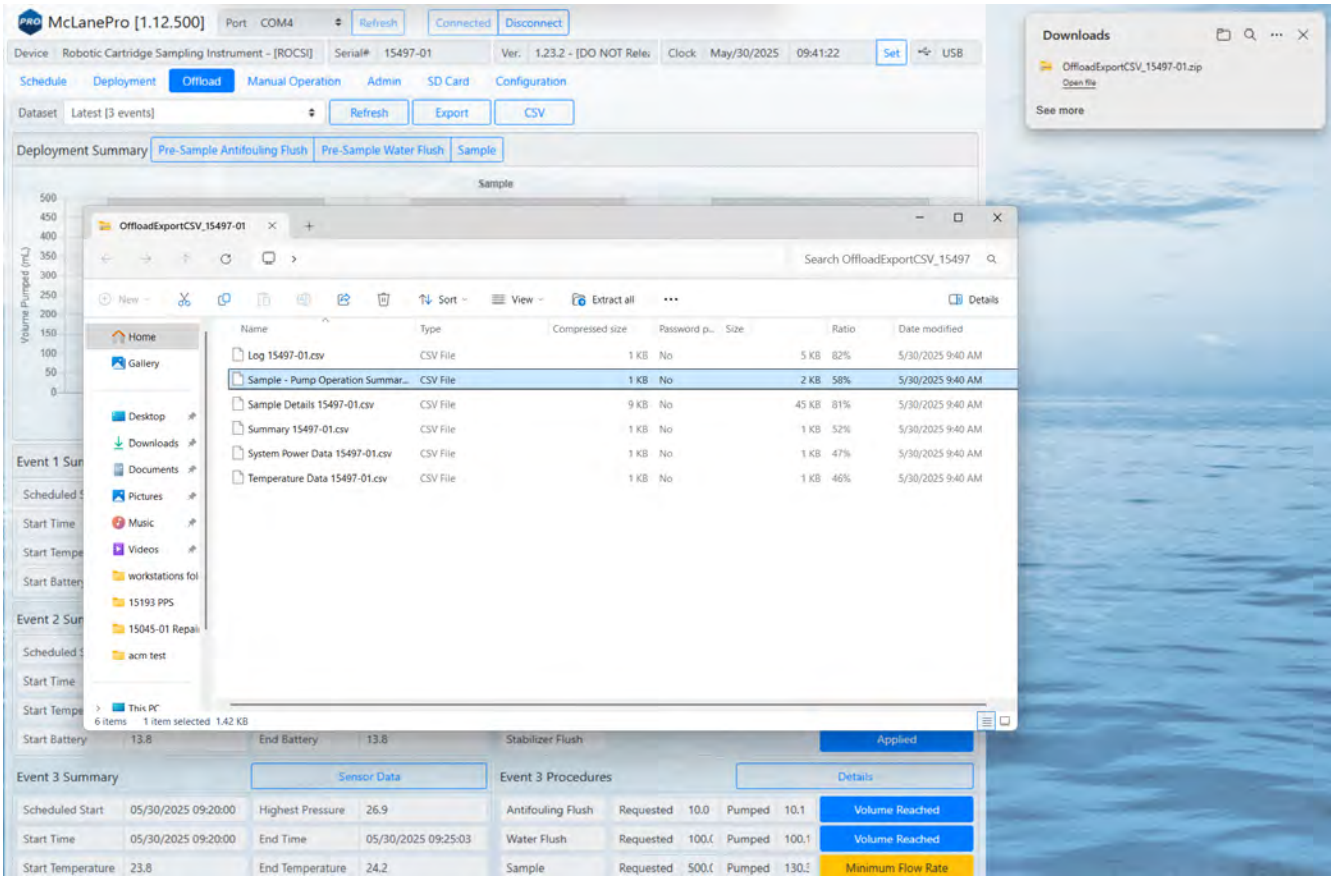
Clicking the **Export** button downloads schedule, configuration and device information in addition to the offload data from the deployment. These data are contained in a *.mrlxprt file that is viewable in McLanePro using Offline Mode.



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

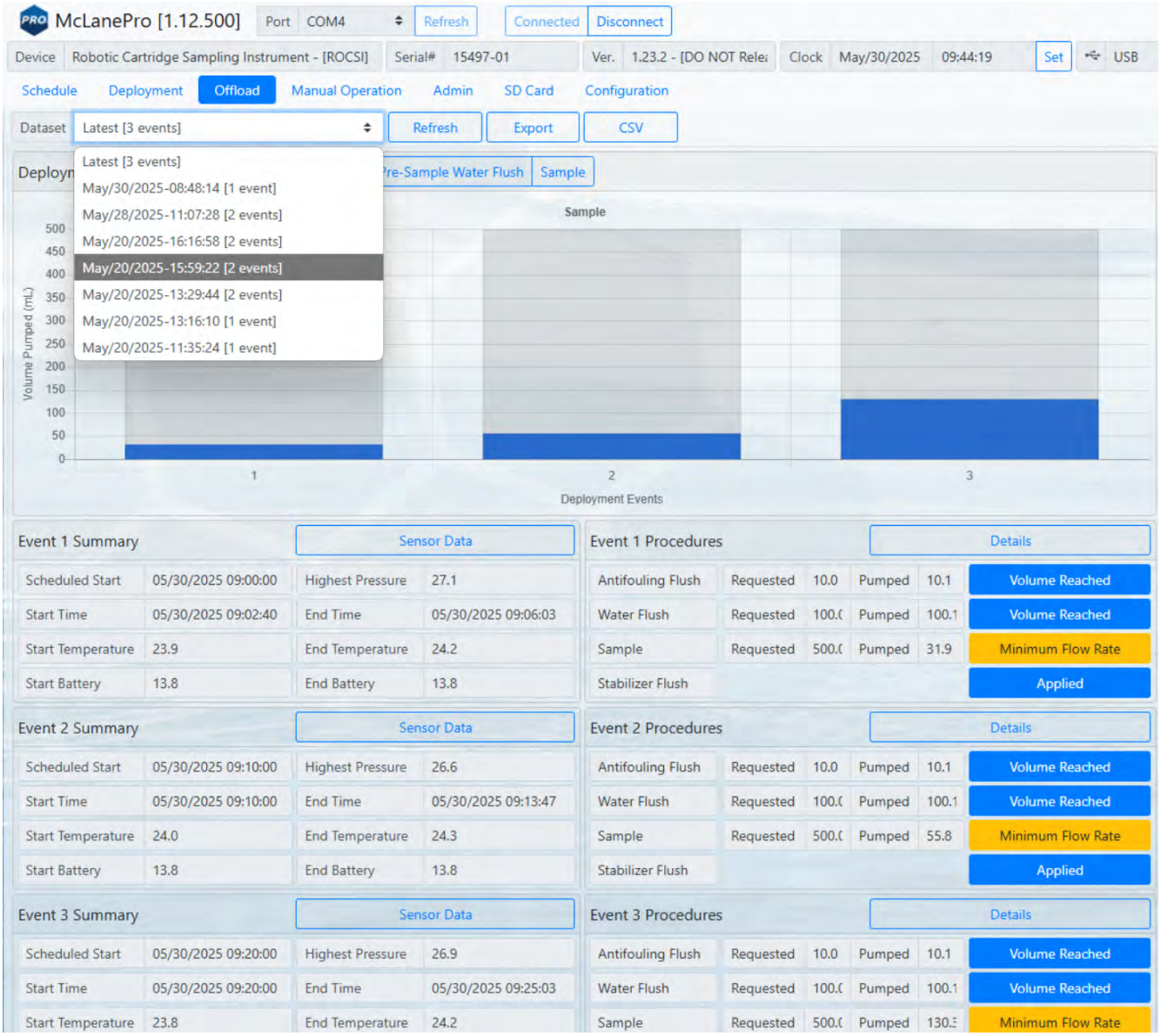


CSV files are compressed into a ZIP file and may be extracted for viewing or evaluation outside of McLanePro.



Viewing and Exporting Data From Previous Deployments

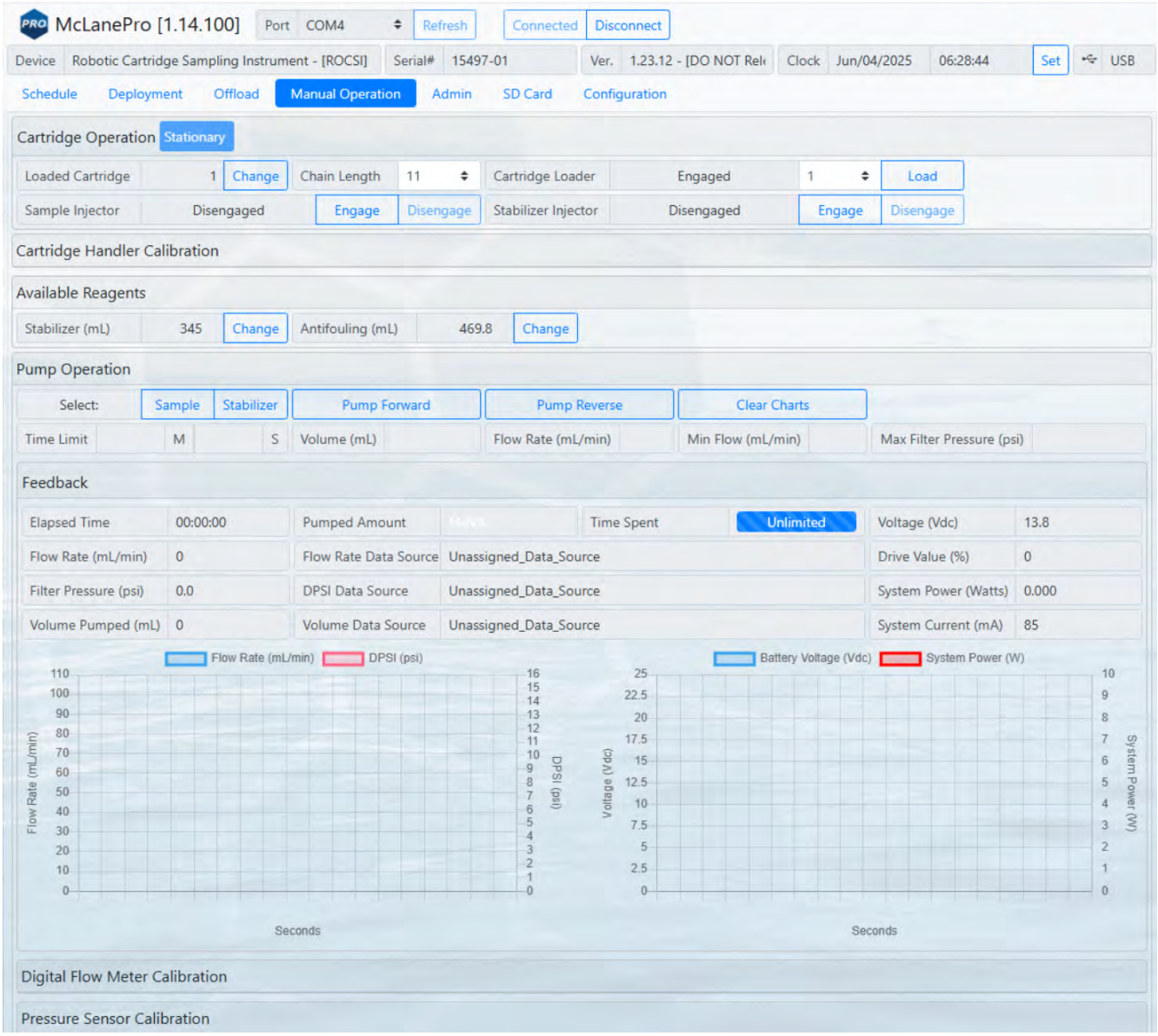
Data from previous deployments may be viewed by selecting a previous data set. To export the data, follow the instructions in Exporting Deployment Data.


McLanePro [1.12.500]
Port COM4
Refresh
Connected
Disconnect
Device Robotic Cartridge Sampling Instrument - [ROCSI]
Serial# 15497-01
Ver. 1.23.2 - [DO NOT Rele
Clock May/30/2025 09:44:19
Set
USB
Schedule
Deployment
Offload
Manual Operation
Admin
SD Card
Configuration
Dataset Latest [3 events]
Refresh
Export
CSV
Latest [3 events]
May/30/2025-08:48:14 [1 event]
May/28/2025-11:07:28 [2 events]
May/20/2025-16:16:58 [2 events]
May/20/2025-15:59:22 [2 events]
May/20/2025-13:29:44 [2 events]
May/20/2025-13:16:10 [1 event]
May/20/2025-11:35:24 [1 event]
Pre-Sample Water Flush
Sample
Sample
Volume Pumped (mL)
Deployment Events
Event 1 Summary
Sensor Data
Scheduled Start 05/30/2025 09:00:00
Highest Pressure 27.1
Start Time 05/30/2025 09:02:40
End Time 05/30/2025 09:06:03
Start Temperature 23.9
End Temperature 24.2
Start Battery 13.8
End Battery 13.8
Event 1 Procedures
Details
Antifouling Flush Requested 10.0 Pumped 10.1 Volume Reached
Water Flush Requested 100.(Pumped 100.1 Volume Reached
Sample Requested 500.(Pumped 31.9 Minimum Flow Rate
Stabilizer Flush Applied
Event 2 Summary
Sensor Data
Scheduled Start 05/30/2025 09:10:00
Highest Pressure 26.6
Start Time 05/30/2025 09:10:00
End Time 05/30/2025 09:13:47
Start Temperature 24.0
End Temperature 24.3
Start Battery 13.8
End Battery 13.8
Event 2 Procedures
Details
Antifouling Flush Requested 10.0 Pumped 10.1 Volume Reached
Water Flush Requested 100.(Pumped 100.1 Volume Reached
Sample Requested 500.(Pumped 55.8 Minimum Flow Rate
Stabilizer Flush Applied
Event 3 Summary
Sensor Data
Scheduled Start 05/30/2025 09:20:00
Highest Pressure 26.9
Start Time 05/30/2025 09:20:00
End Time 05/30/2025 09:25:03
Start Temperature 23.8
End Temperature 24.2
Event 3 Procedures
Details
Antifouling Flush Requested 10.0 Pumped 10.1 Volume Reached
Water Flush Requested 100.(Pumped 100.1 Volume Reached
Sample Requested 500.(Pumped 130.3 Minimum Flow Rate

The Manual Operation Tab

The **Manual Operation tab** allows operation of the cartridge loader, injectors, and pumps. Additionally, stabilizer and antifoulant/cleaner volumes may be set on the **Manual Operation tab**. Pressure and flow rate measurements may also be calibrated from the **Manual Operation** tab.

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



Cartridge Operation

All fluid movement within the RoCSI is routed through individual filter capsules, or cartridges, installed on a continuous sample chain. The **Manual Operation tab** allows access to the cartridge handler in order to place cartridges at the appropriate injectors and to allow for calibration if necessary.

Cartridge Operation:

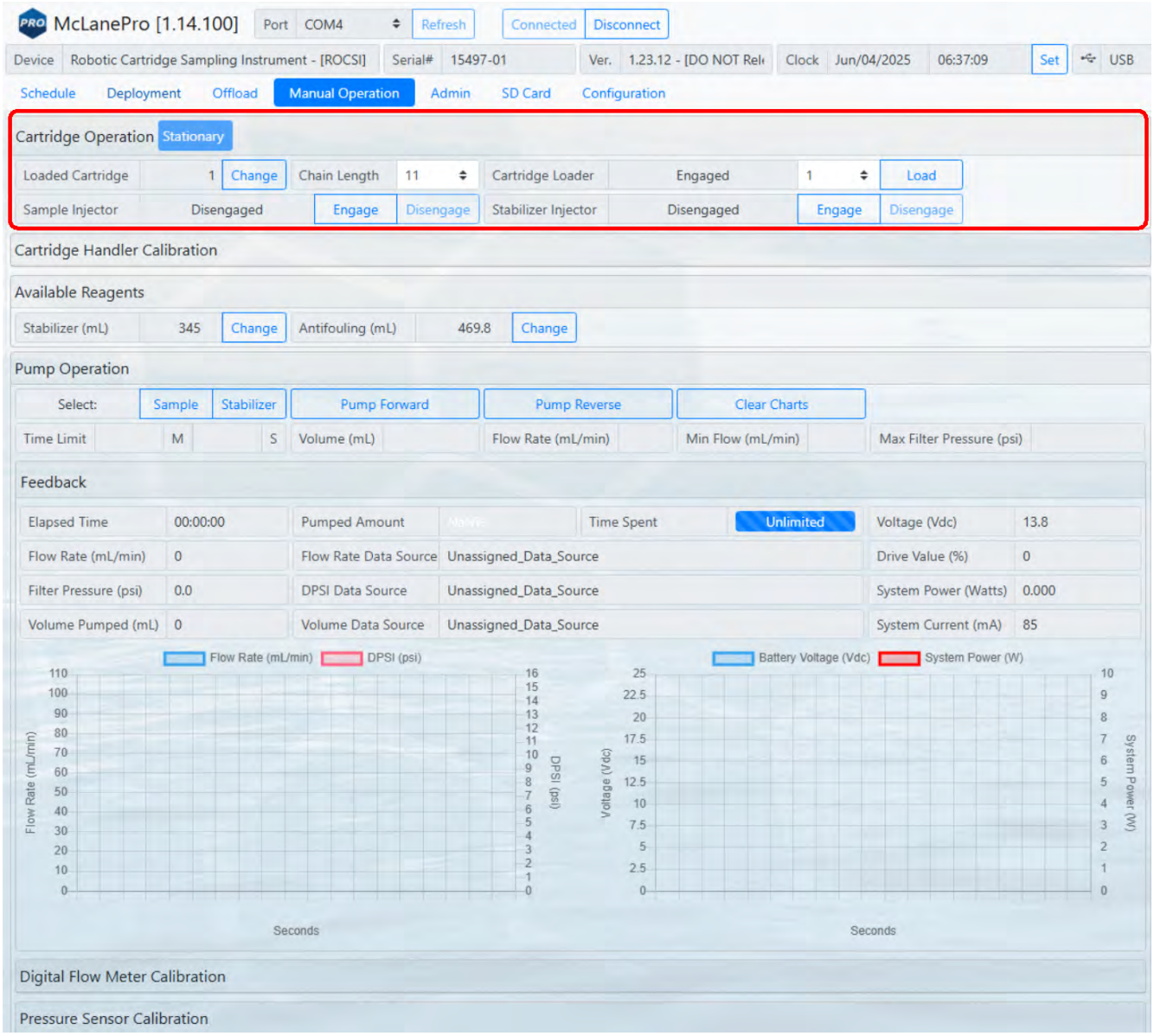
Loaded Cartridge (Change) - indicates the number of the cartridge at the top-most position; aligned with the sample injector. Click **Change** to assign a new value.

Chain Length - sets the number of available cartridges on the currently installed sample chain.

Cartridge Loader (number / load) - used to advance the sample chain. Status window reports alignment status. Drop-down allows moves of multiple cartridges at once.

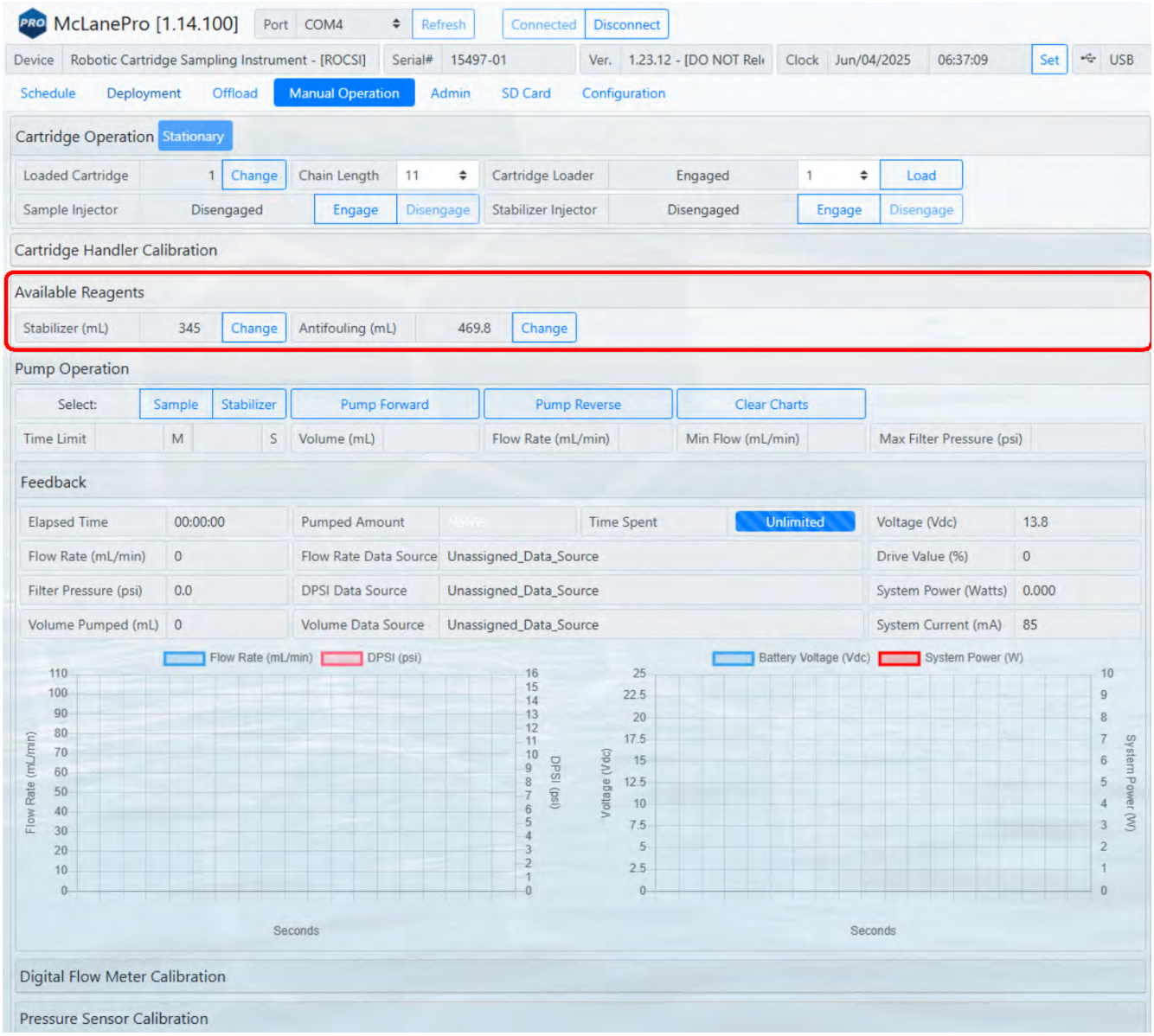
Sample Injector (engage / disengage) - used to engage / disengage a cartridge for sample collection. Status window reports alignment status.

Stabilizer Injector (engage / disengage) - used to engage / disengage a cartridge for sample stabilization. Status window reports alignment status.

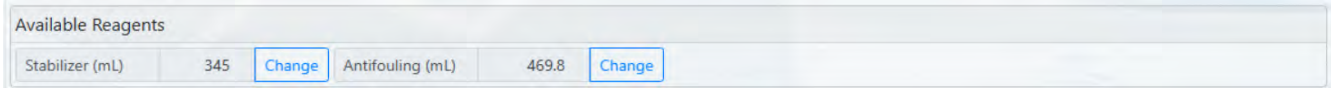


Available Reagents

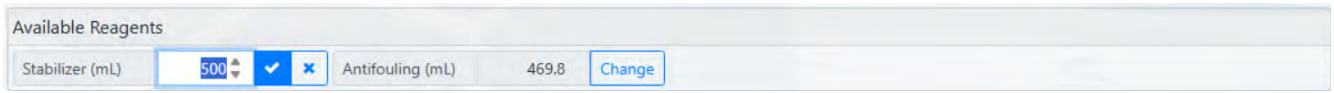
The RoCSI is equipped with reagents for cleaning the intake and preserving samples in situ. The **Manual Operation tab** allows for setting the available volumes stored in the reservoirs or bags.



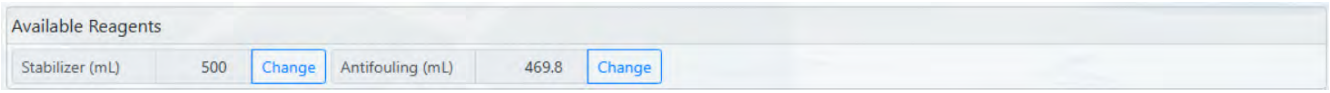
Available reagent volume is tracked and is displayed for reference. When reagent is manually added to the reservoir (bag) this volume needs to be updated by the user. Click the Change button to change the available volume for either the Stabilizer or Antifouling fluid (cleaner).



Enter the volume of stabilizer available in the reservoir and click the check-mark to set the volume.



Available stabilizer will be updated and this value will be used when calculating deployment stabilizer requirement during RoCSI deployment preparation.



Pump Operation

McLanePro provides controls for running the pump and viewing feedback data in the Pump Operation section of the Manual Operation tab.

Select (sample/stabilizer) - allows for selection of the sample or stabilizer pump for manual pumping operations.

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 filter pressure, and a second chart that displays battery voltage and the average system power.

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

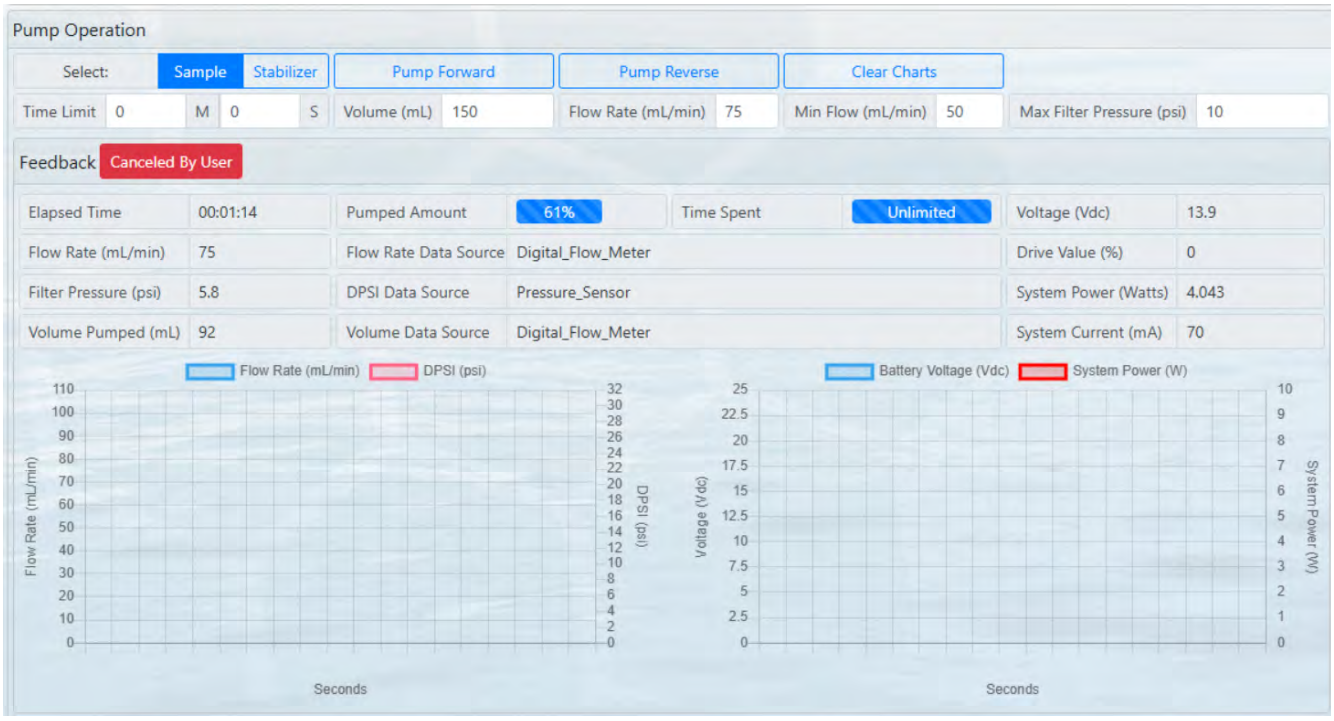
Time Limit - defines a time limit for the manual pumping operation. A value of zero disables the time limit.

Volume - sets the requested volume for a manual pumping operation.

Flow Rate - sets the requested target flow rate for a manual pumping operation.

Minimum Flow Rate - defines the minimum acceptable flow rate for the manual pumping operation. This setting defines when the event will terminate due to a decreasing flow rate.

Maximum Filter Pressure - defines the maximum acceptable differential pressure at the filter. This setting defines when the event will terminate due to a decreasing flow rate.



Pumping Parameters and Feedback

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

Feedback:

Elapsed Time - 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.

Voltage - the measured battery or external power voltage while pumping.

Flow Rate* - the target flow rate of the pump, based on flow meter feedback.

- Achievable flow rate is variable due to filter selection, differential pressure and environmental conditions.

Flow Rate Data Source - the RoCSI may meter flow directly using the digital flow meter, or, if not using flow meter feedback, flow is an estimate calculated in firmware.

Drive Value - the percentage of available power applied to the pump motor.

Filter Pressure - the differential pressure generated at the filter as measured or estimated.

DPSI Data Source - the RoCSI measures pressure at the filter directly using the differential pressure sensor, or, alternatively, filter pressure is an estimate calculated in firmware.

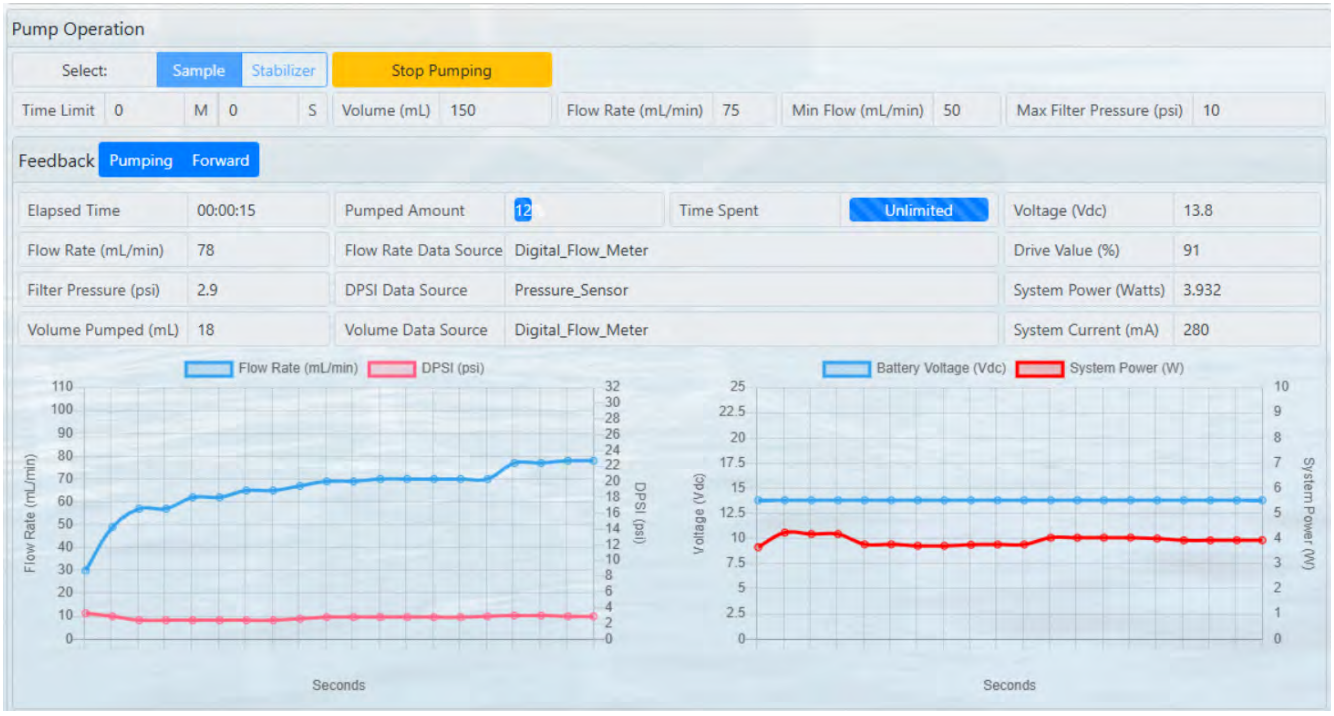
System Power - power currently being consumed by the system.

Volume Pumped - the total volume pumped for the current pumping event.

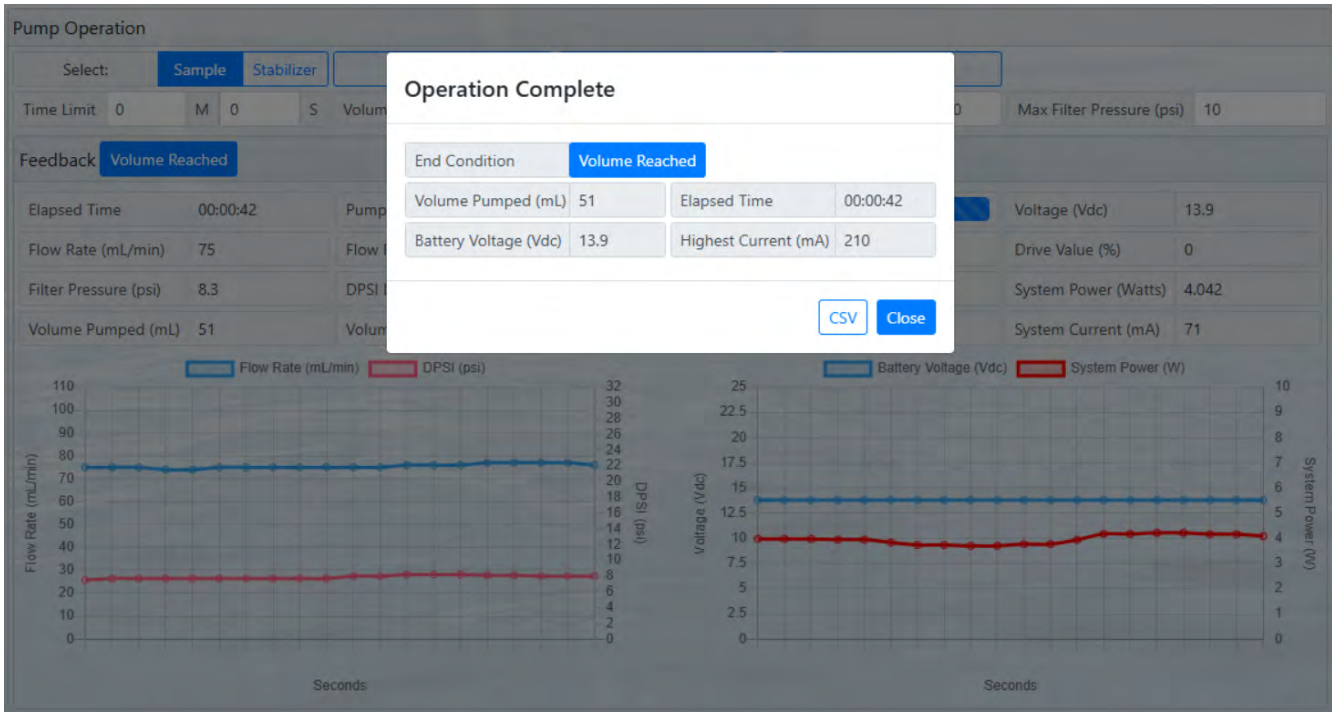
Volume Data Source - the RoCSI may meter volume directly using the digital flow meter, or, if not using flow meter feedback, volume is an estimate calculated in firmware.

System Current - total current draw of the system.

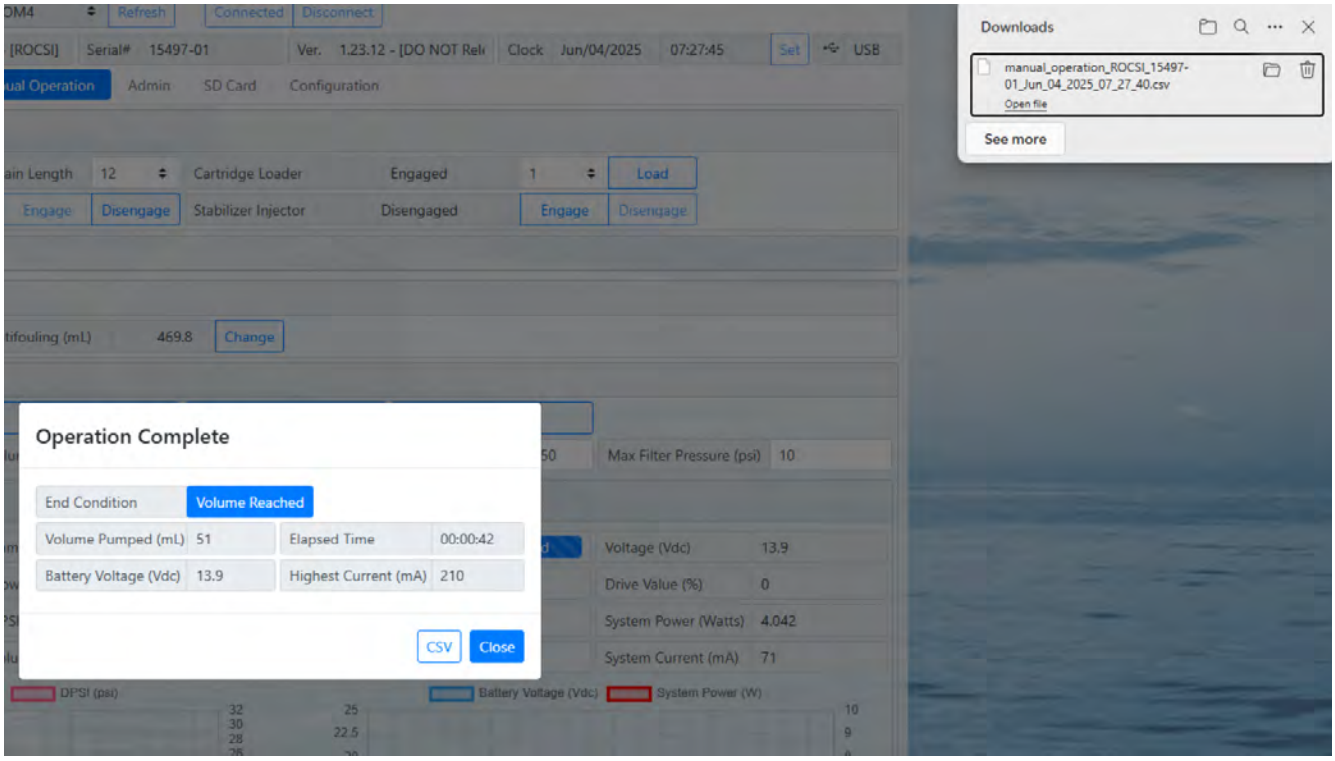
Flow rate, filter pressure, voltage and system power data are plotted during manually operated pumping. Clicking **Clear Charts** will erase the existing data from the charts.



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



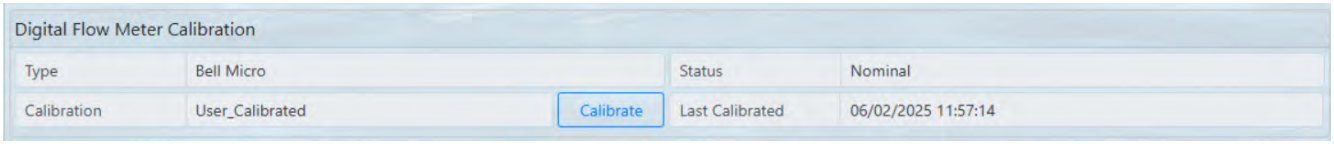
Clicking the CSV button downloads the file to a local computer for review and evaluation.



Digital Flow Meter

The RoCSI is equipped with a micro-gear flow meter that is used to accurately measure the flow rate during sample collection. The flow meter may be user-calibrated and should be checked prior

to and after each mission. Controls for calibration are provided on the **Manual Operation** tab. The Digital Flow Meter section indicates the type of flow meter, status, the calibration type and date.

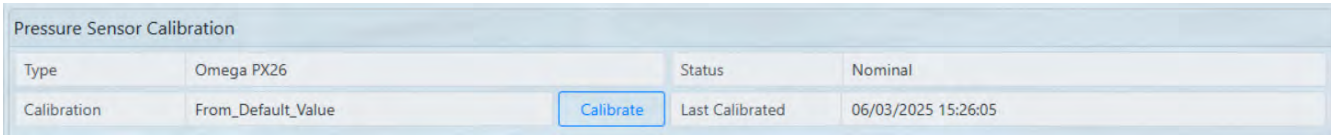


For calibration instructions see the section, Calibrating the Flow Meter.

The flow meter (and pressure is used during forward pumping of the sample pump only, specifically designed for accurate volume measurements during sample collection. Other pump operations use estimated flow rates and software estimated volumes.

Filter Pressure Sensor

Filter pressure is monitored continuously during sample collection as a proxy for the level of filter clogging. Controls are provided to calibrate the on-board pressure sensor on the **Manual Operation** tab. For most applications, the factory or default calibration should be sufficient. However, accuracy should be checked and the sensor re-calibrated if necessary.

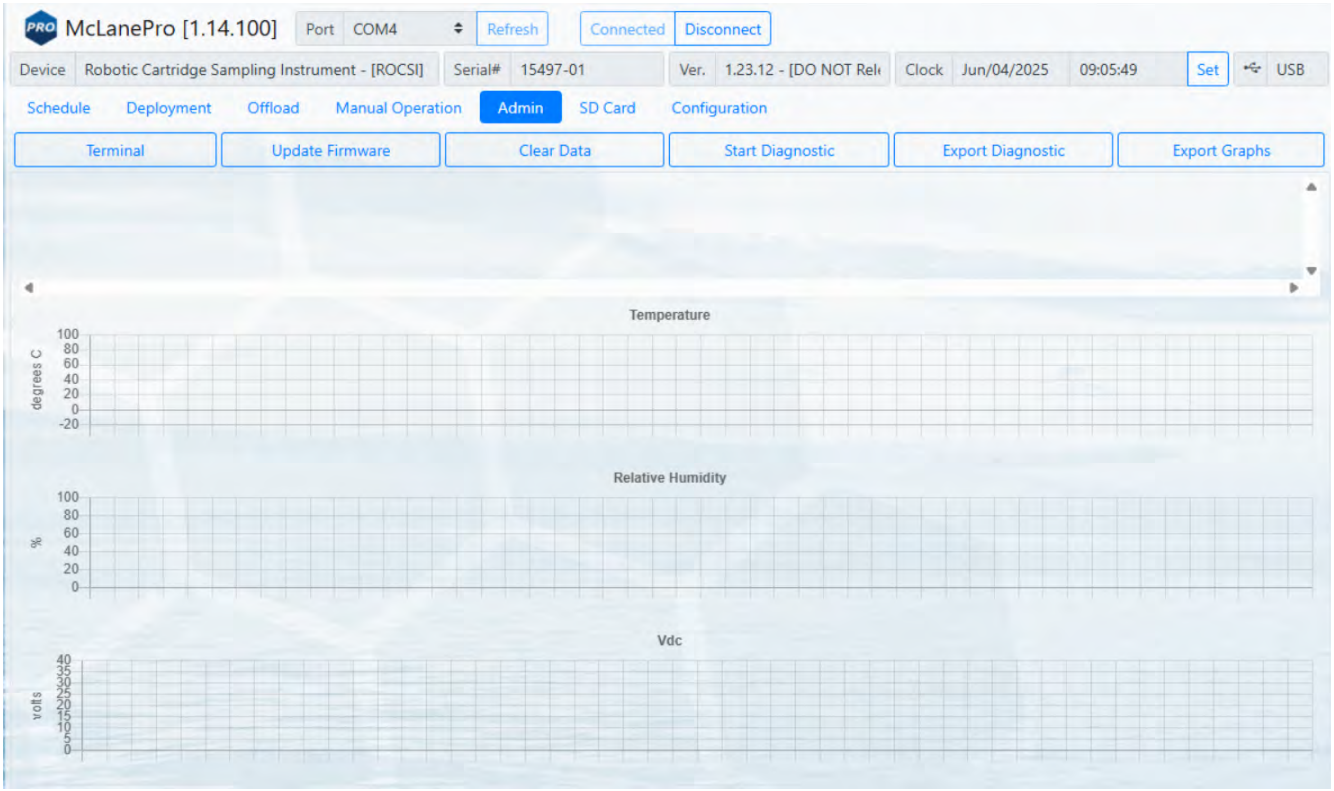


For calibration instructions see the section, Calibrating the Pressure Sensor.

The Admin Tab

The **Admin tab** is used to:

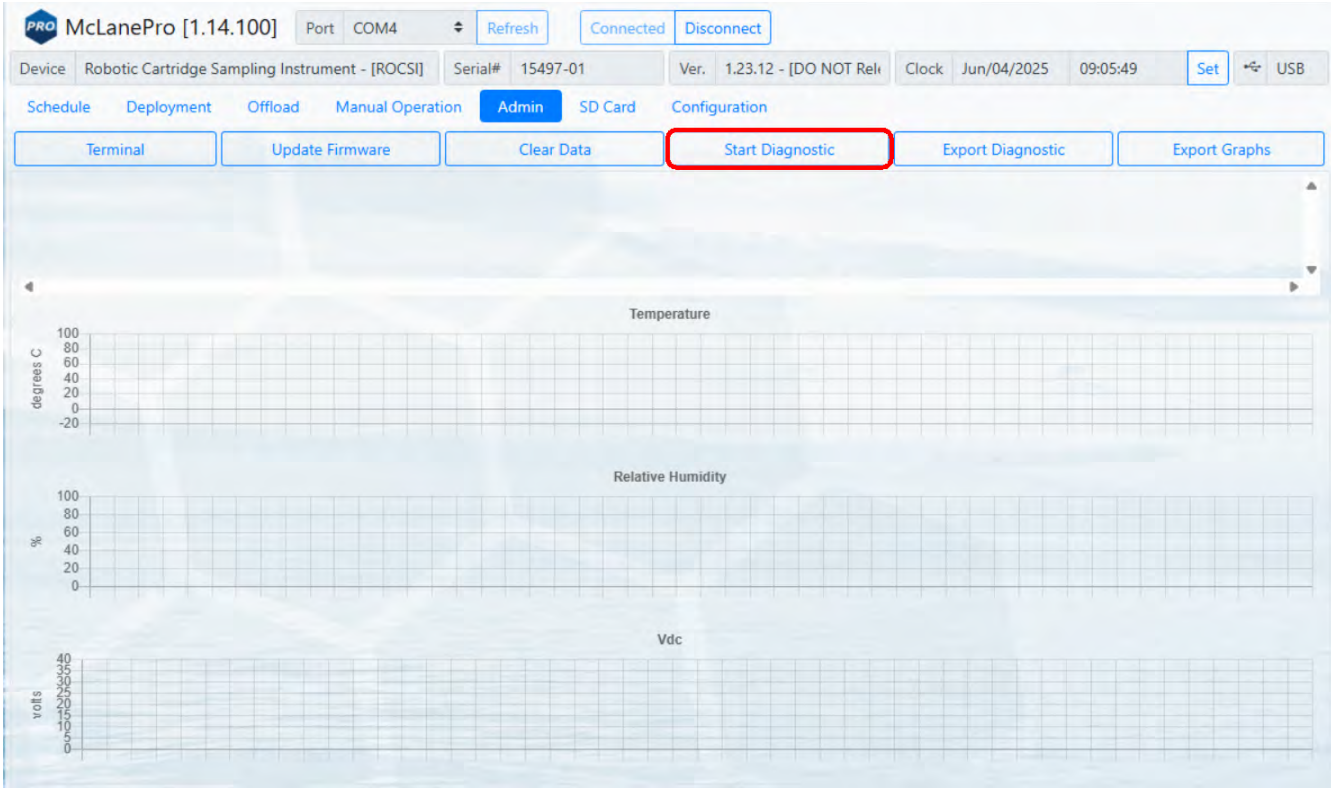
- Run Diagnostics
- Update Firmware
- Communicate to the RoCSI Using the Terminal



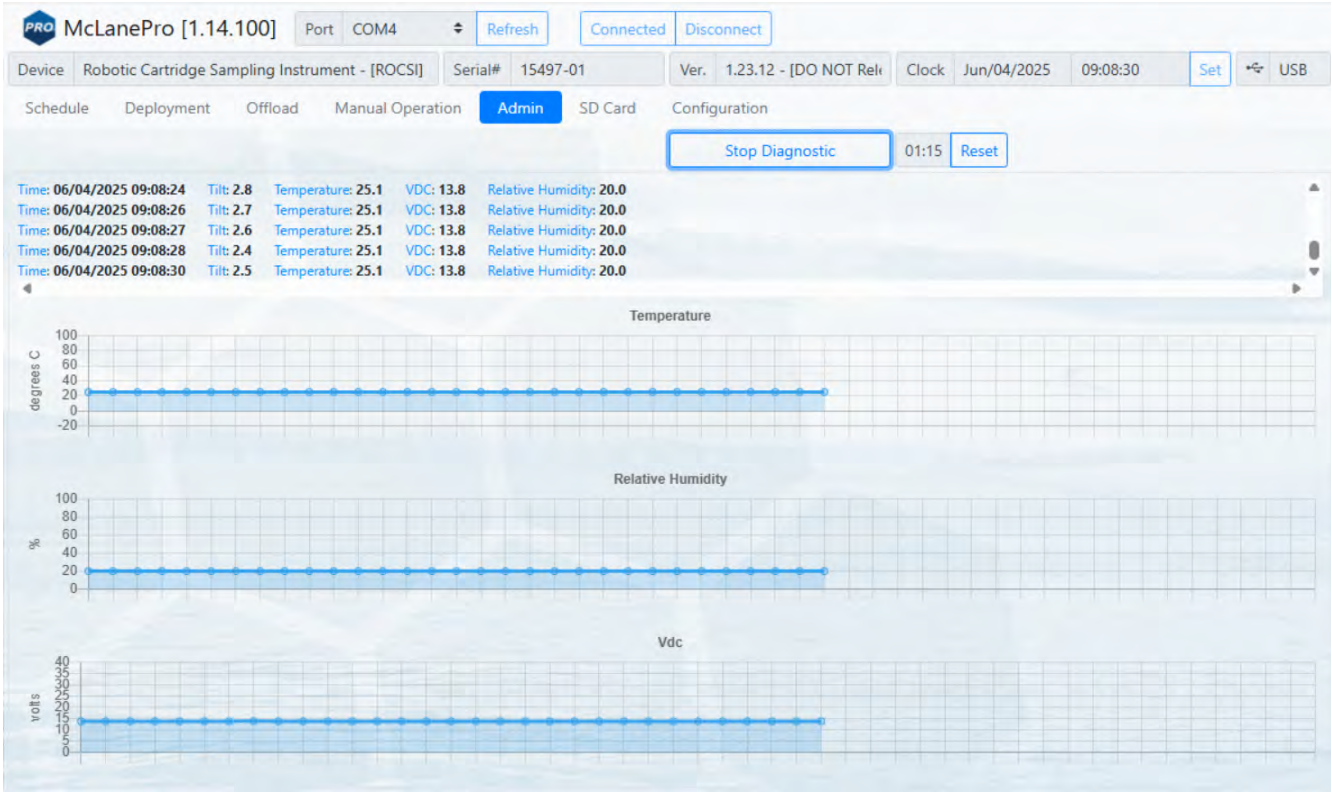
Running Diagnostics

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.



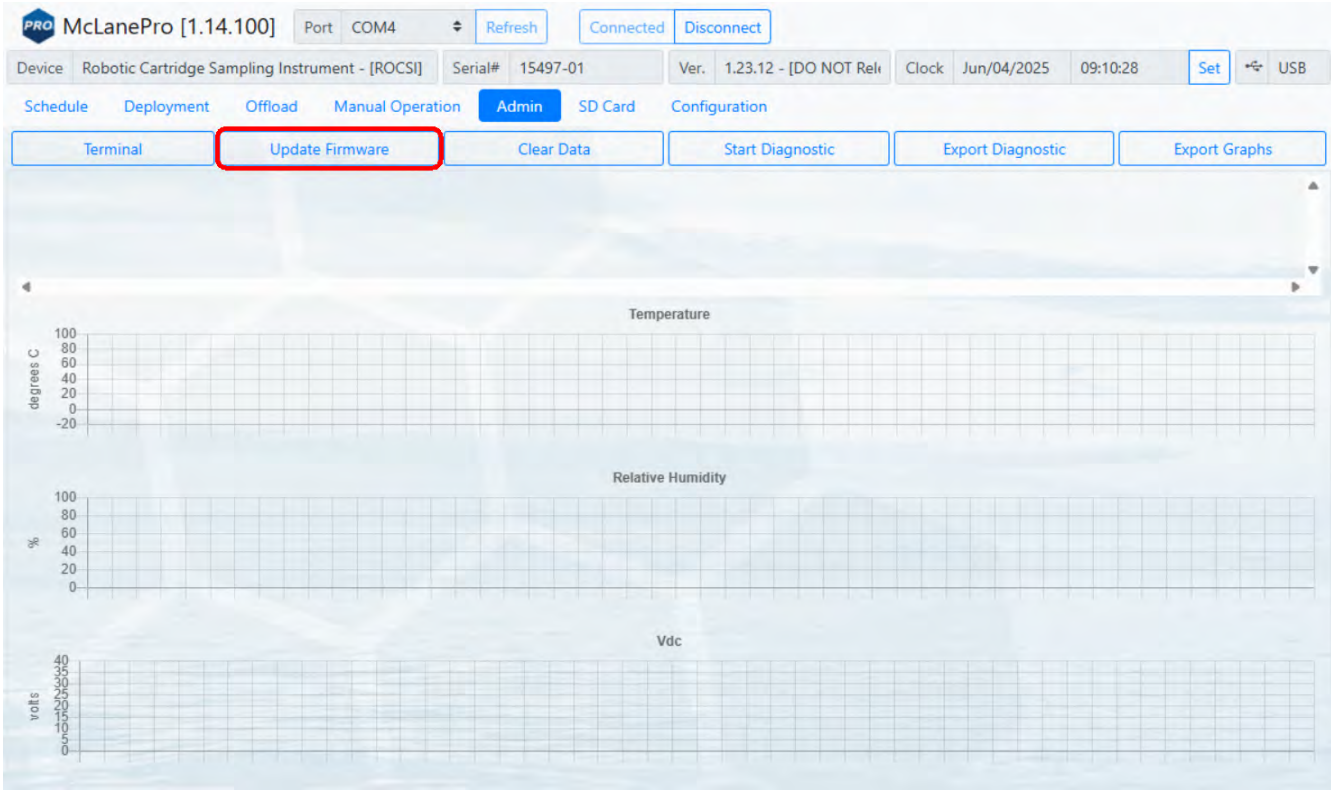
Diagnostics will run for two minutes, otherwise, click **Stop Diagnostic**.



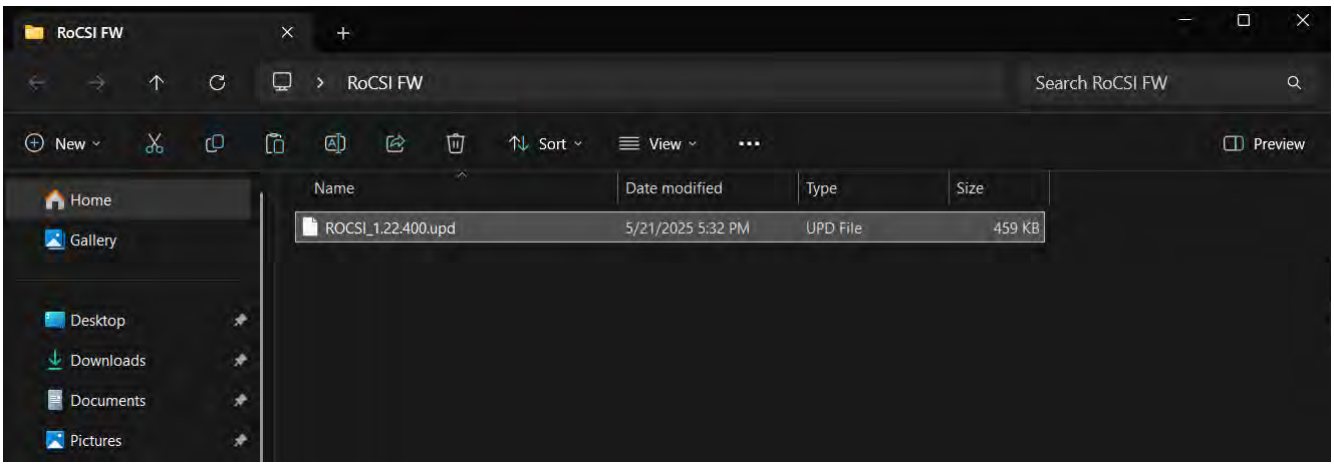
After running diagnostics, clear the data on the **Admin** tab by clicking the **Clear Data** button. Alternatively, diagnostic data and graphs may be exported using the buttons provided.

Update Firmware

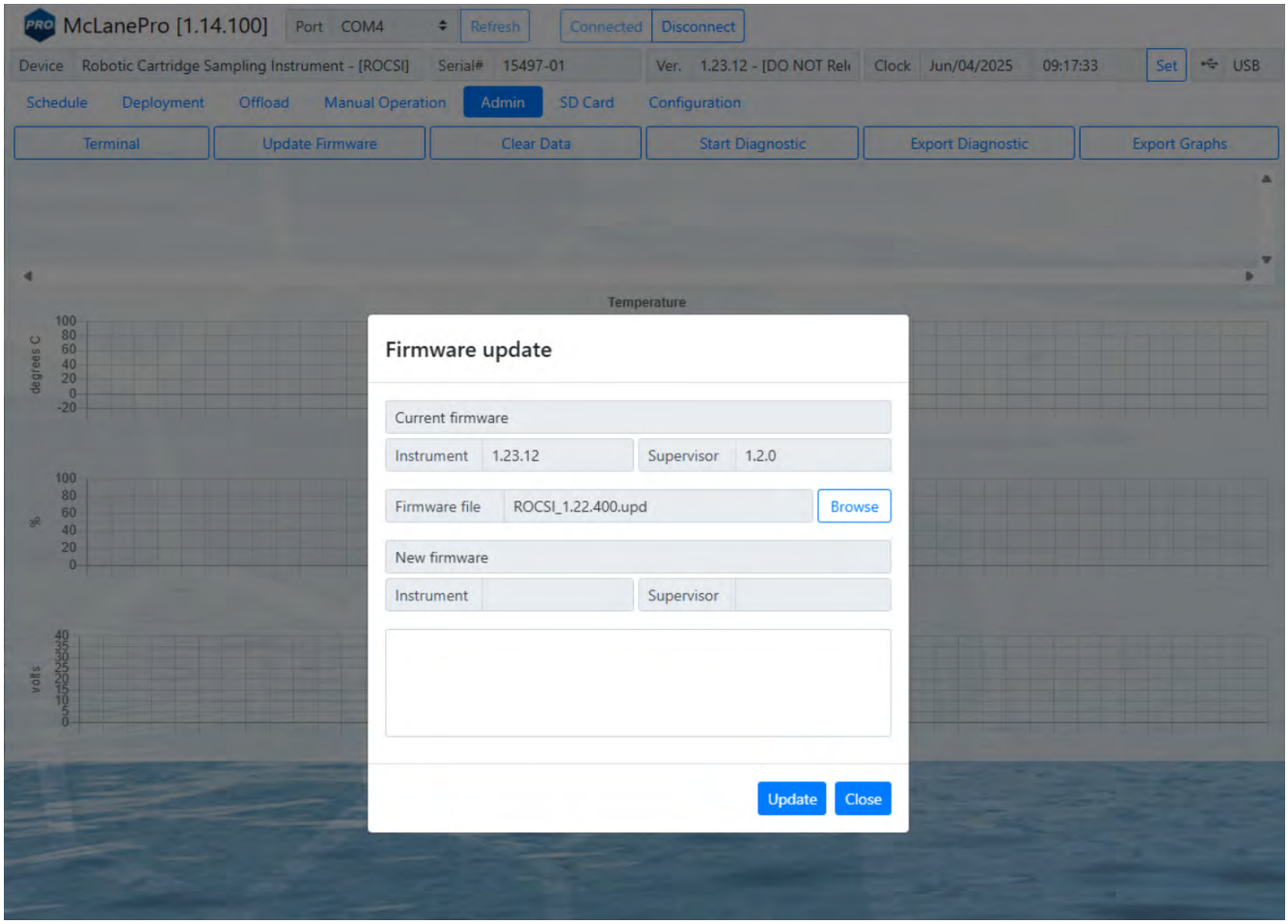
1. To update firmware click the **Update Firmware** button on the **Admin tab**.



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



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

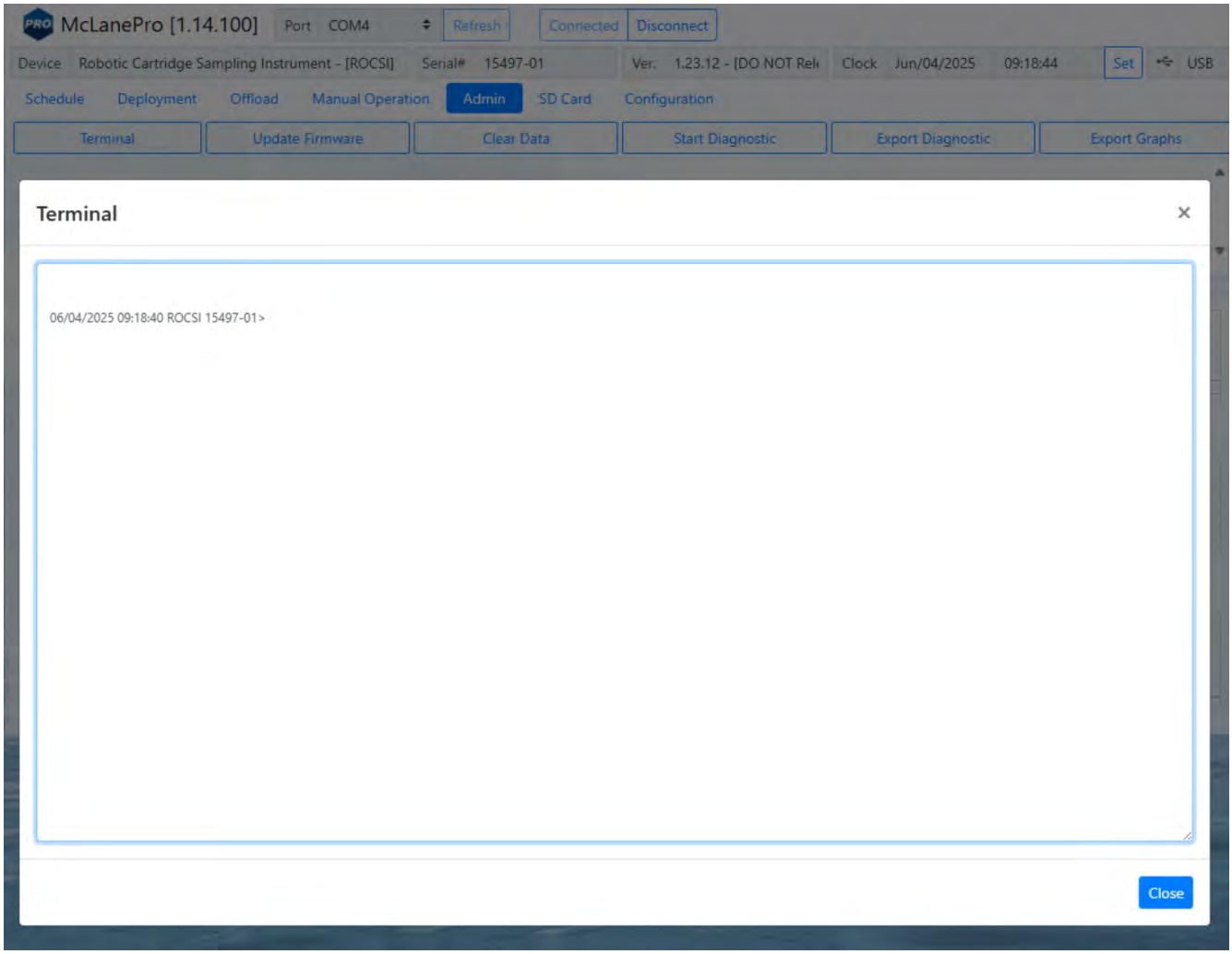


In some cases, a firmware update may revert the RoCSI configuration to default values. McLanePro detects when this happens, and loads the **Configuration tab** to allow reconfiguration of the instrument after the firmware update is complete. Otherwise, the update will complete and report that the configuration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

The Terminal

A command-line interface provides an option for command-driven control over the RoCSI.

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.

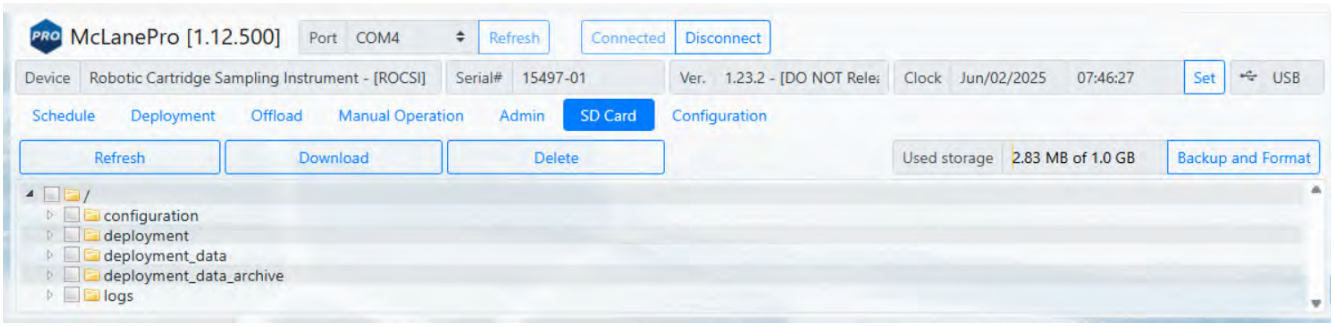
Contact mclane@mclanelabs.com for a list of available terminal commands.

The SD Card Tab

The **SD Card tab** allows for file operations on the RoCSI 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

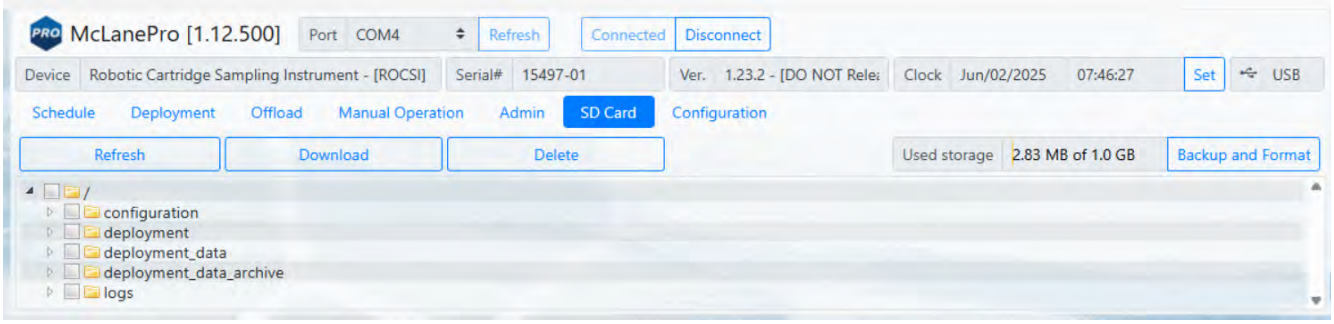
The **SD Card** tab provides buttons to execute commands relating to the data files on the installed SD card. Data files may be viewed, downloaded, or deleted.

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.

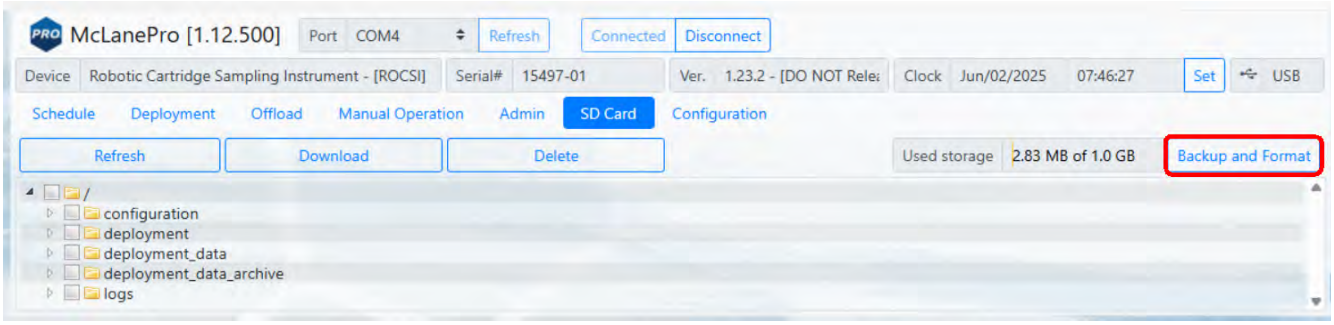
Download - clicking **Download** will compress selected files into a ZIP file that is then downloaded to the connected computer.

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

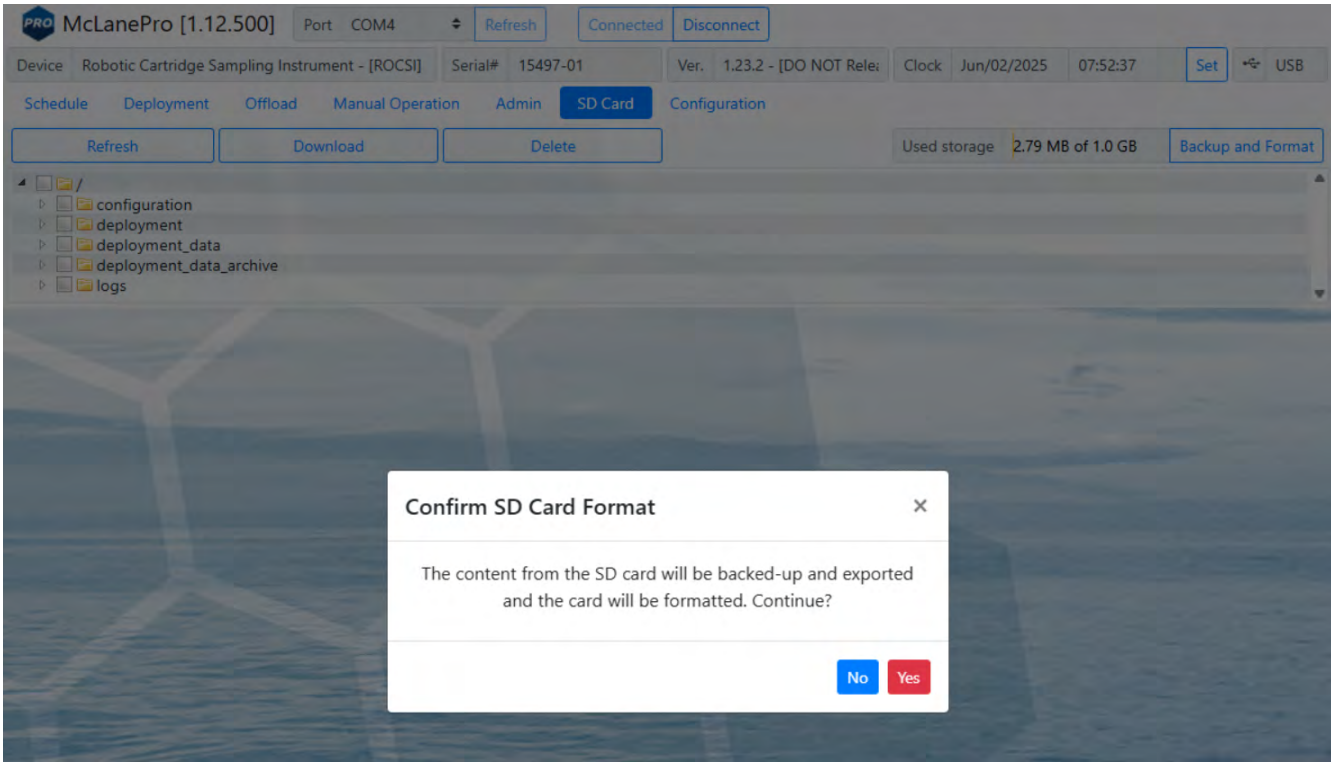


Status of the SD card is provided via the **Used storage** display. Additionally, a **Backup and Format**

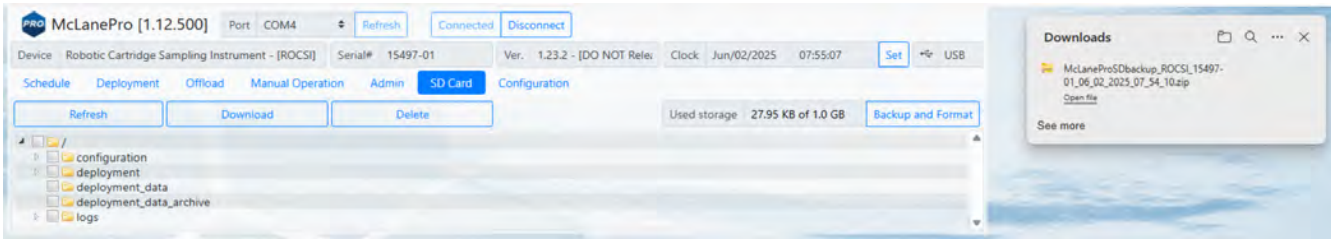
button is provided that allows for the user to download all the data from the SD card and then format the card.



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

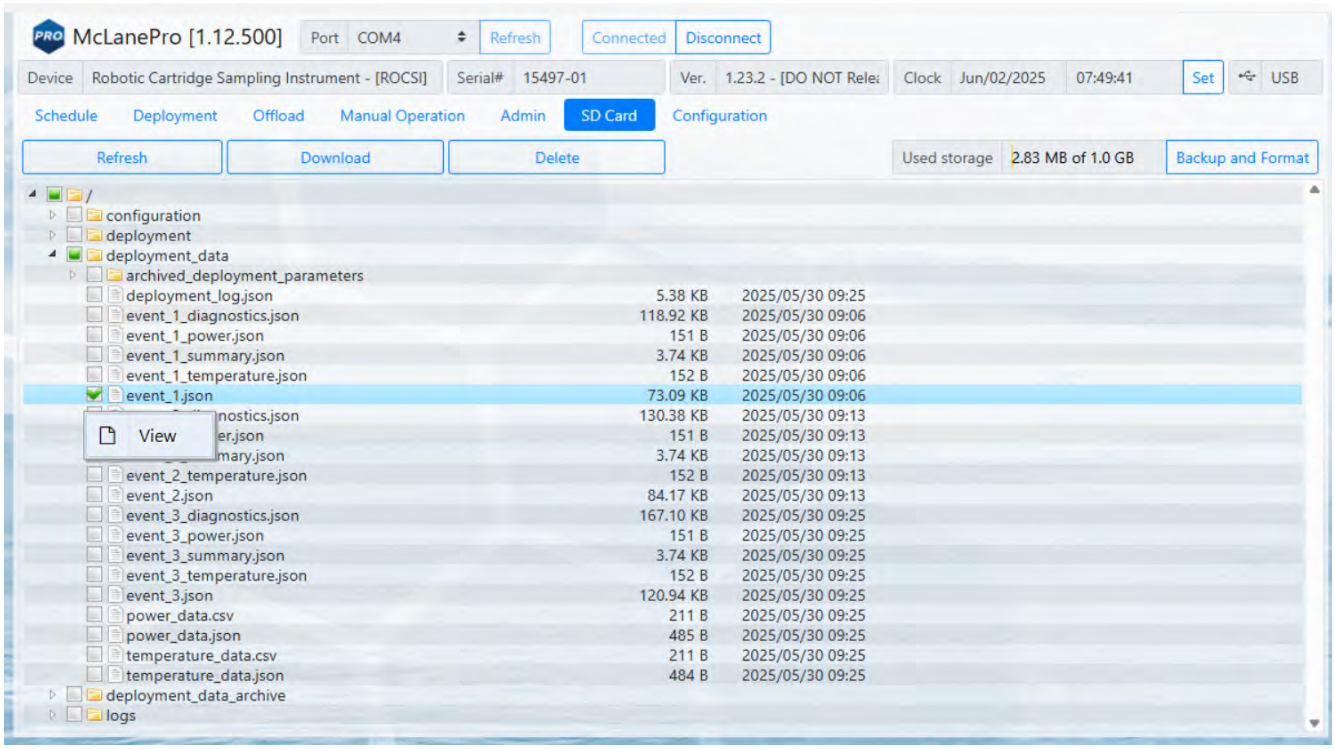


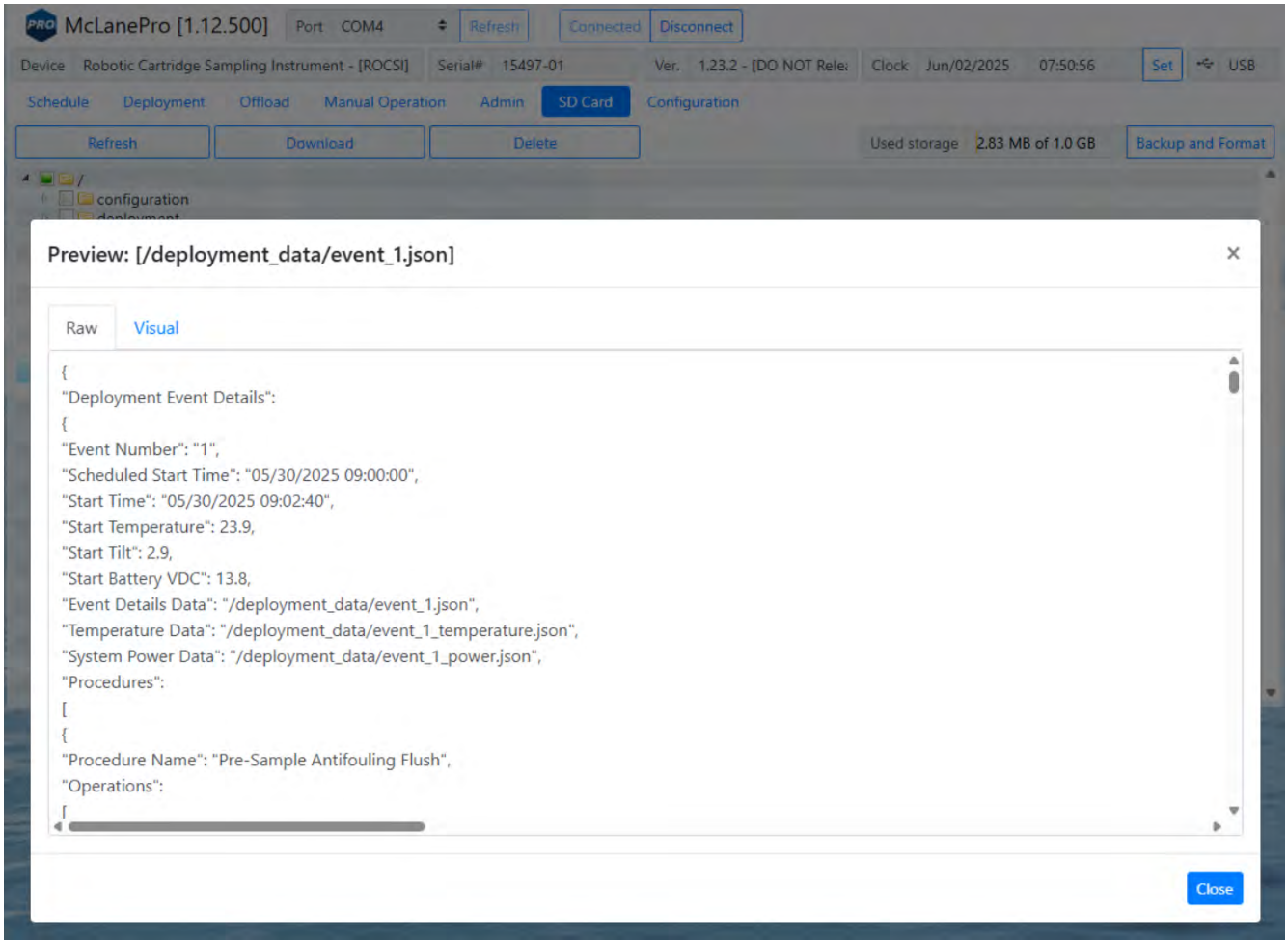
All data from the SD card are compressed into a ZIP file and downloaded before the SD card is formatted.



File preview

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

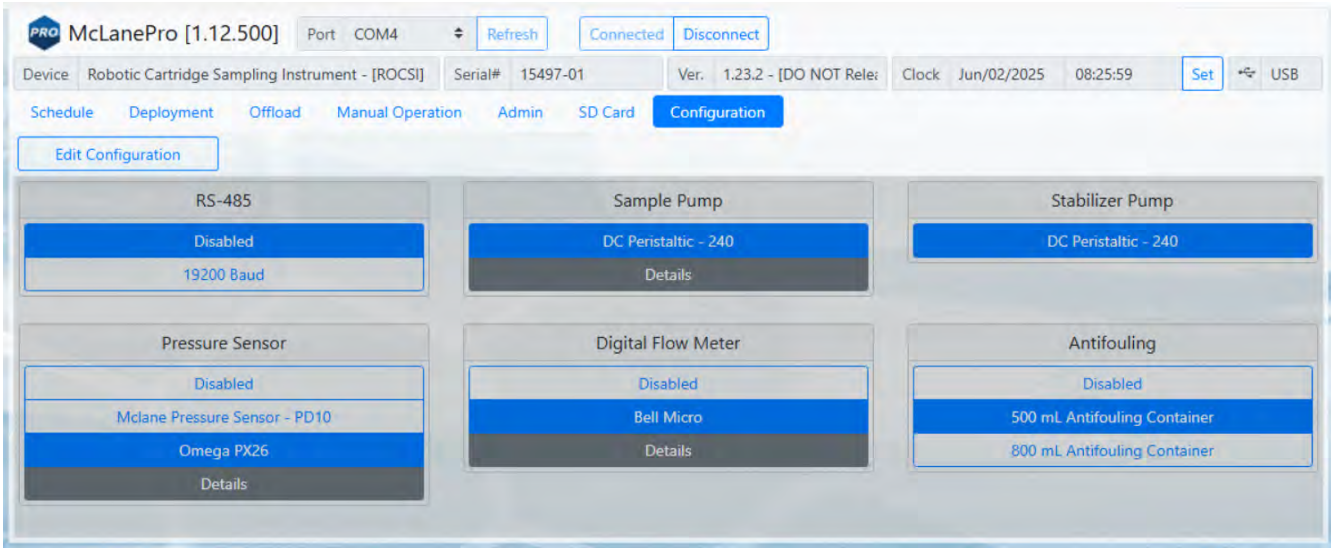



McLanePro [1.12.500]
Port COM4
Refresh
Connected
Disconnect
Device Robotic Cartridge Sampling Instrument - [ROCSI]
Serial# 15497-01
Ver. 1.23.2 - [DO NOT Rele
Clock Jun/02/2025 07:50:56
Set
USB
Schedule
Deployment
Offload
Manual Operation
Admin
SD Card
Configuration
Refresh
Download
Delete
Used storage 2.83 MB of 1.0 GB
Backup and Format
/
configuration
Preview: [/deployment_data/event_1.json]
Raw
Visual
{
"Deployment Event Details":
{
"Event Number": "1",
"Scheduled Start Time": "05/30/2025 09:00:00",
"Start Time": "05/30/2025 09:02:40",
"Start Temperature": 23.9,
"Start Tilt": 2.9,
"Start Battery VDC": 13.8,
"Event Details Data": "/deployment_data/event_1.json",
"Temperature Data": "/deployment_data/event_1_temperature.json",
"System Power Data": "/deployment_data/event_1_power.json",
"Procedures":
[
{
"Procedure Name": "Pre-Sample Antifouling Flush",
"Operations":
[
Close

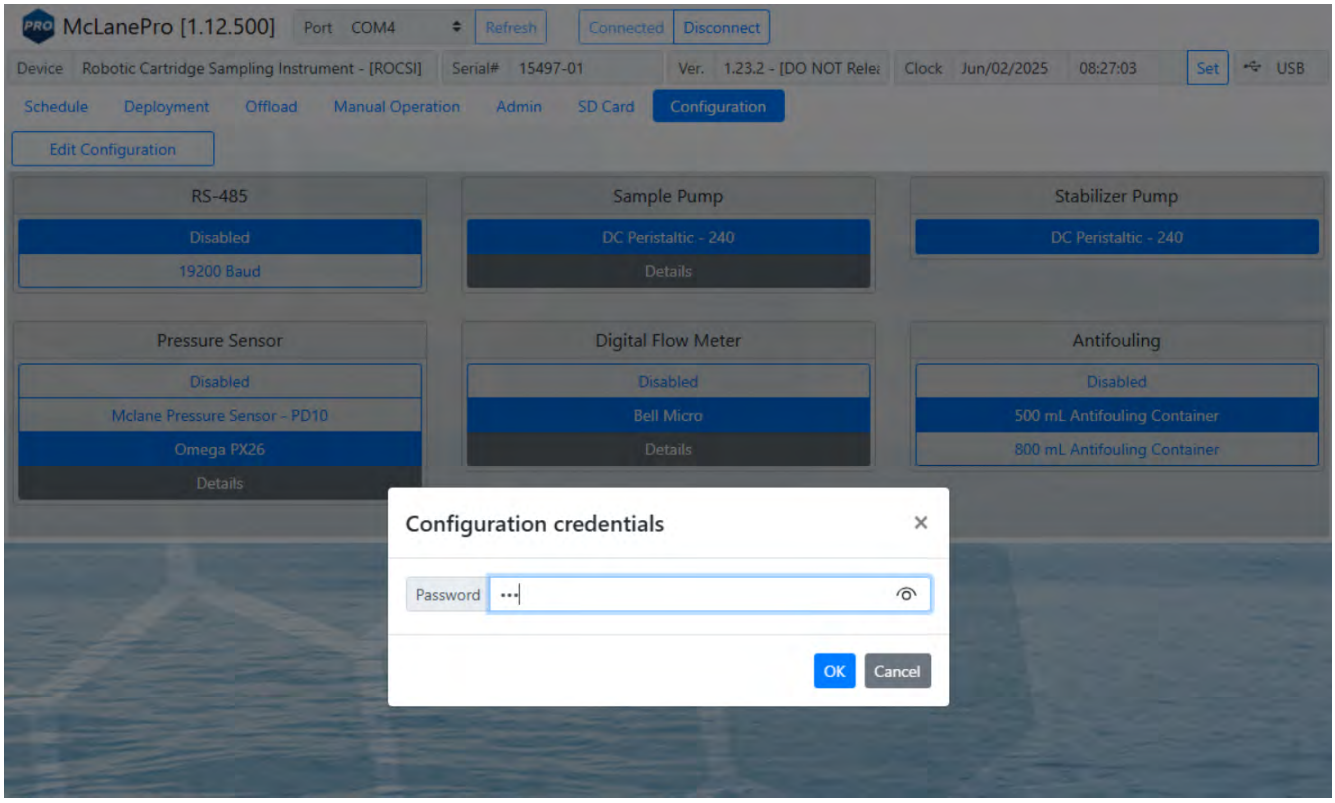
The Configuration Tab

RoCSI firmware is configured and tested to match the standard hardware before shipping. The **Configuration tab** is not used often. If a firmware update reverts the RoCSI to default values, the **Configuration tab** is used to change the values.

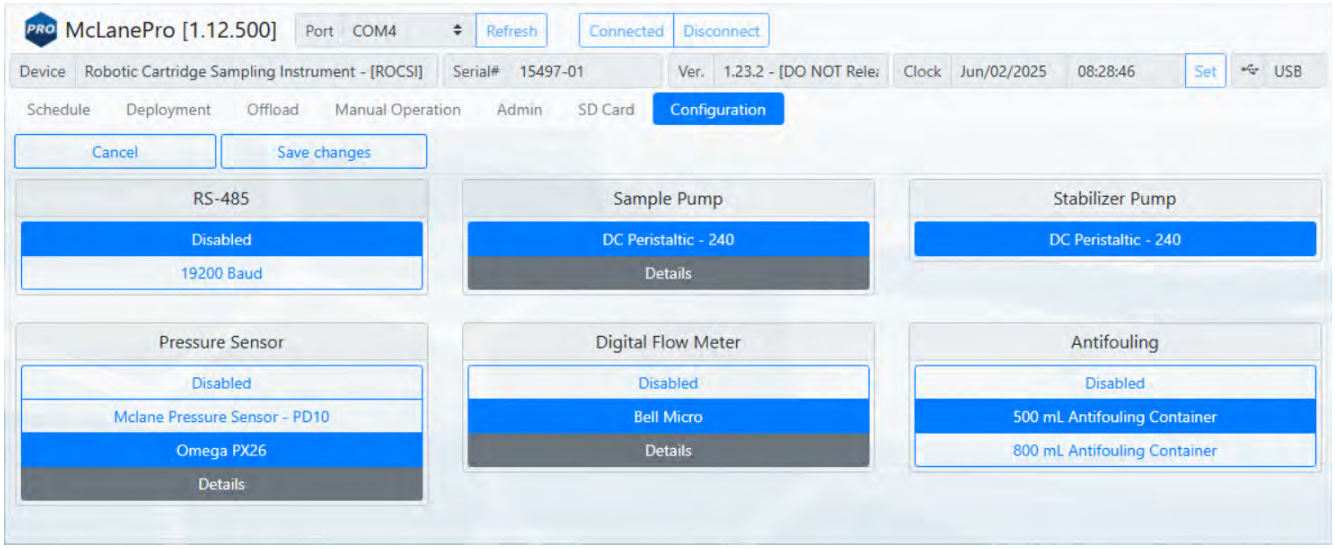
1. To change the RoCSI configuration, navigate to the **Configuration tab** and select **Edit Configuration**.



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

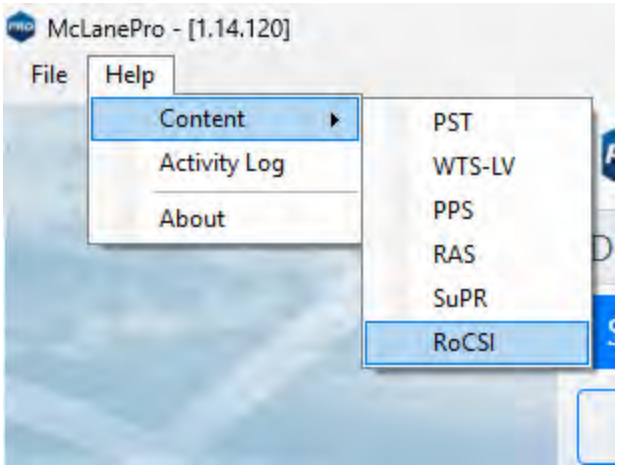


3. Confirm or change the RoCSI pump configuration, or other available options, and click **Save changes**.

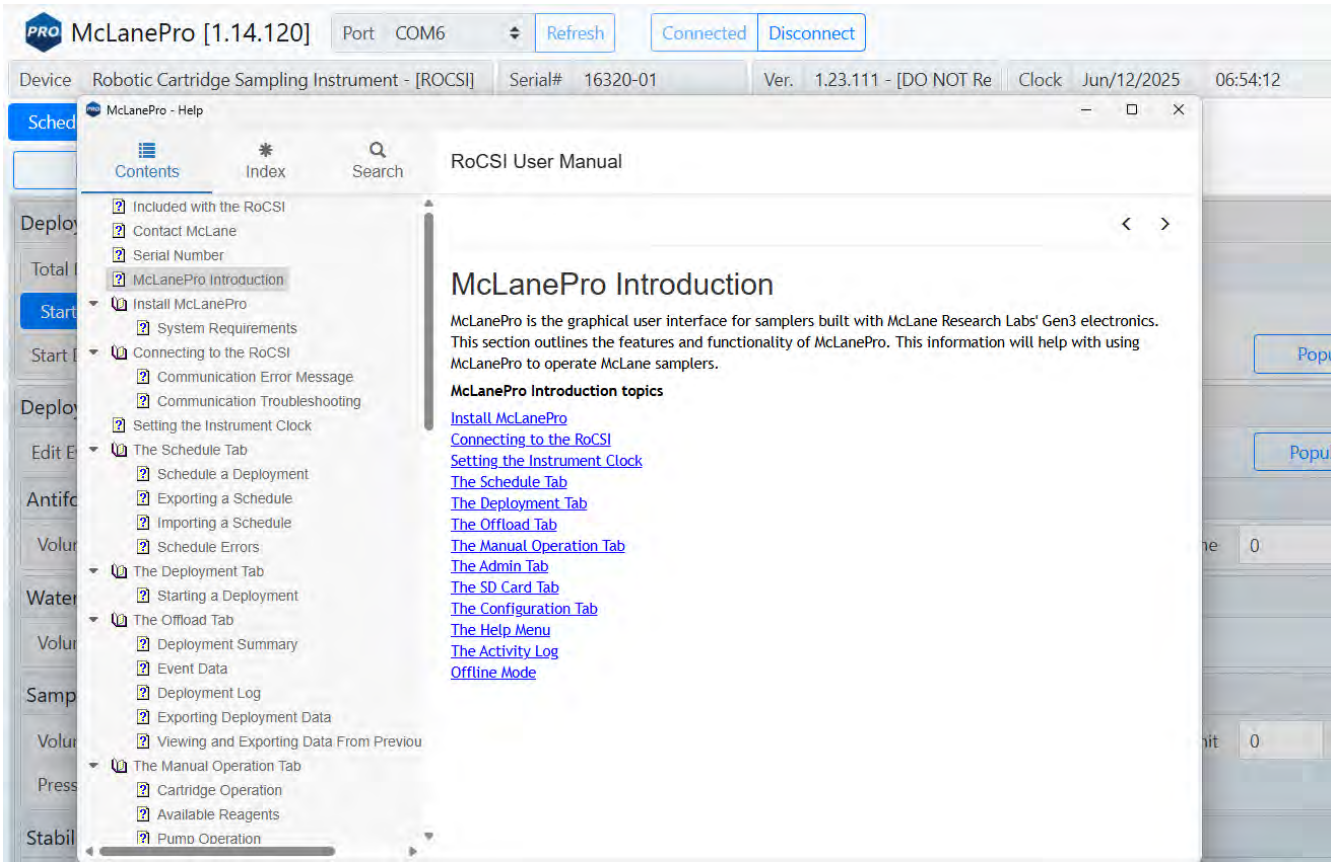


The Help Menu

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

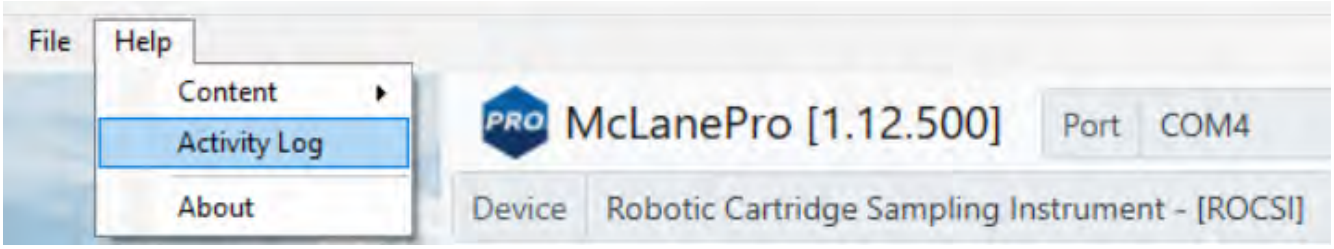


Select the appropriate help file for the device connected to McLanePro. In this example, the device is a Robotic Cartridge Sampling Instrument with device code RoCSI. The help file contains user instruction and information on RoCSI.

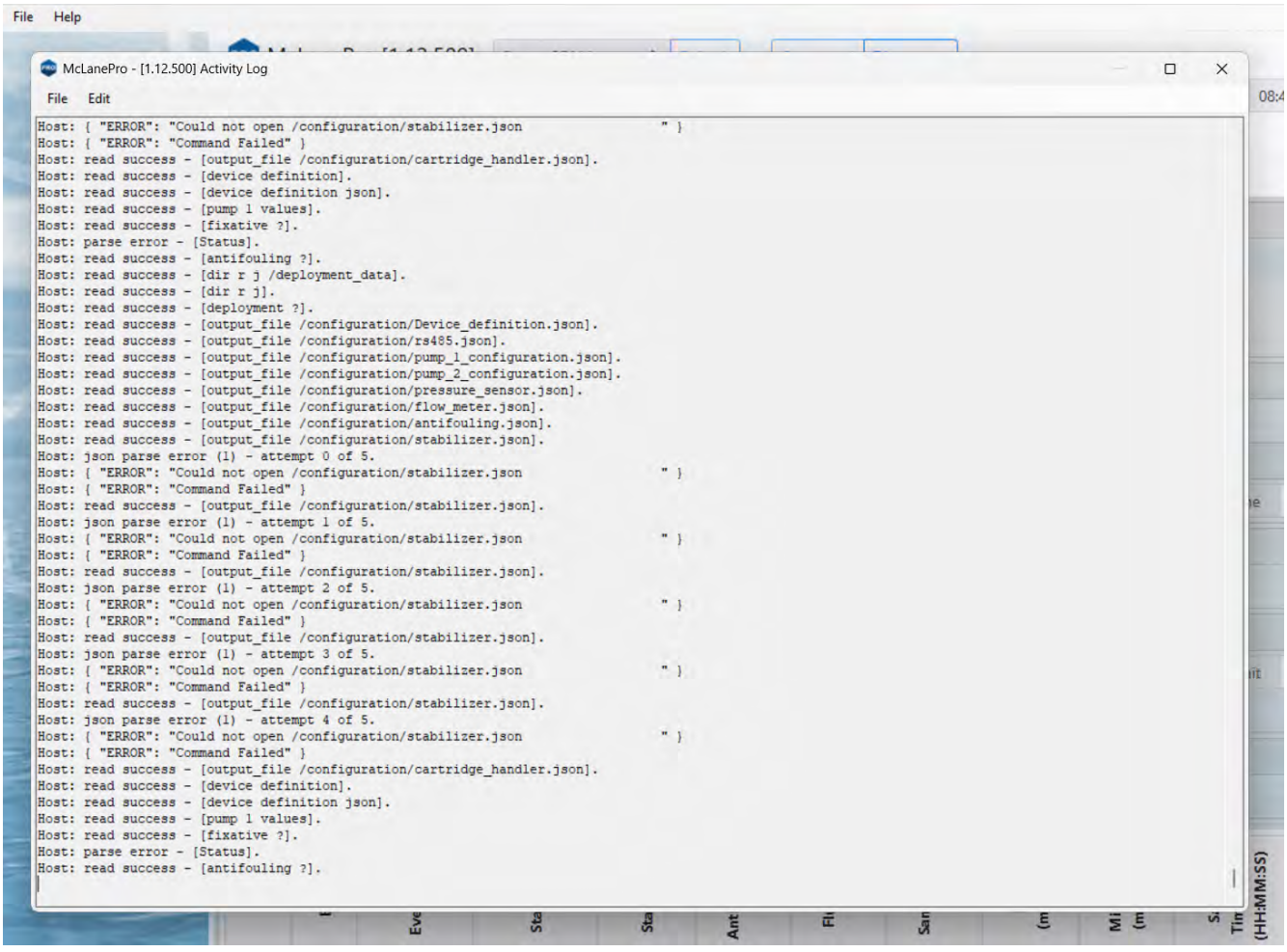


The Activity Log

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

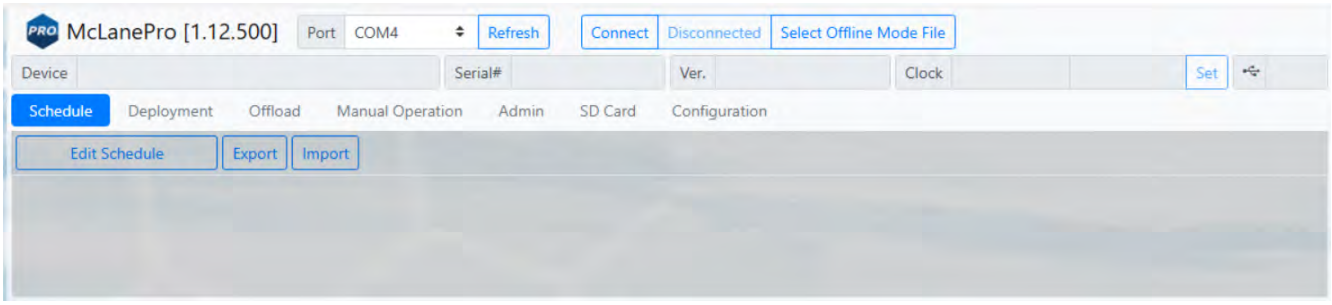


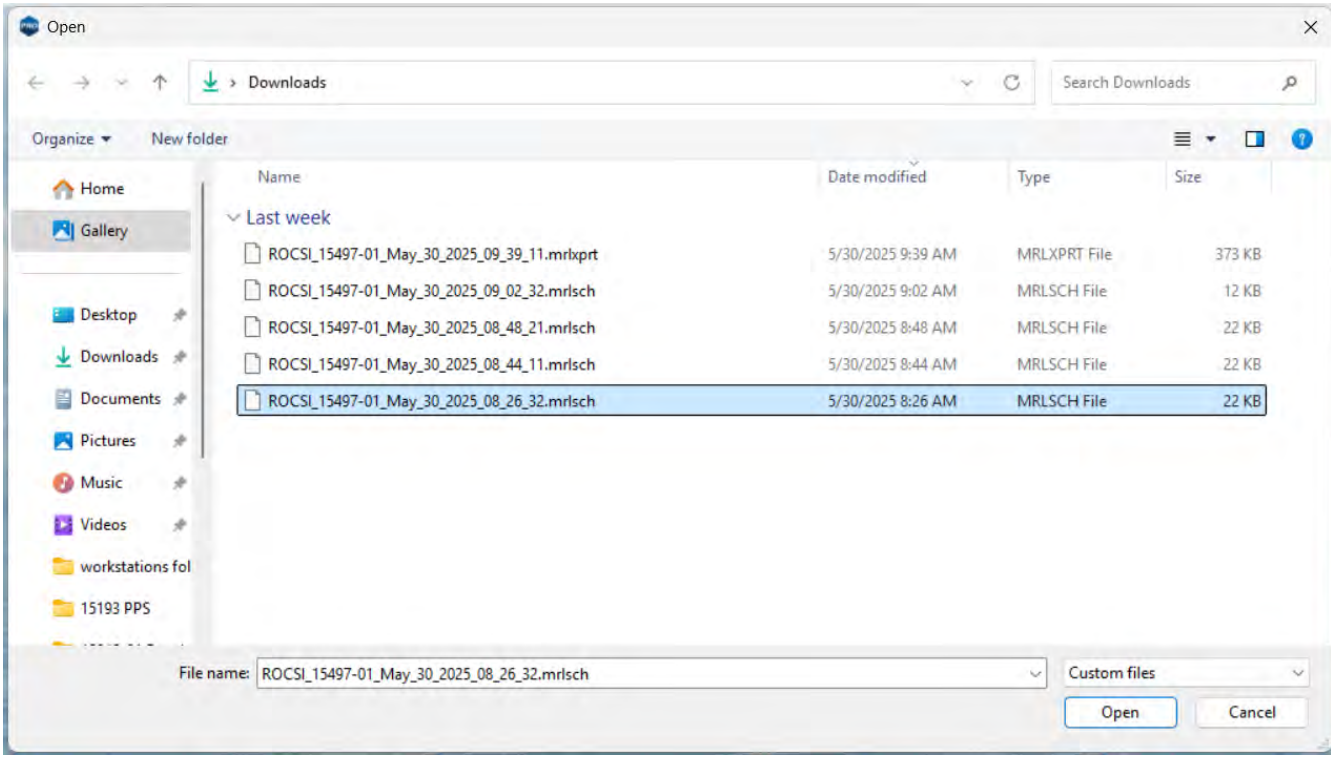
Within the **Activity Log**, there are options to **Save** the log to a text file (using the **File Menu**), or to **Copy** a selection of the **Activity Log** to the clipboard (using the **Edit Menu**).



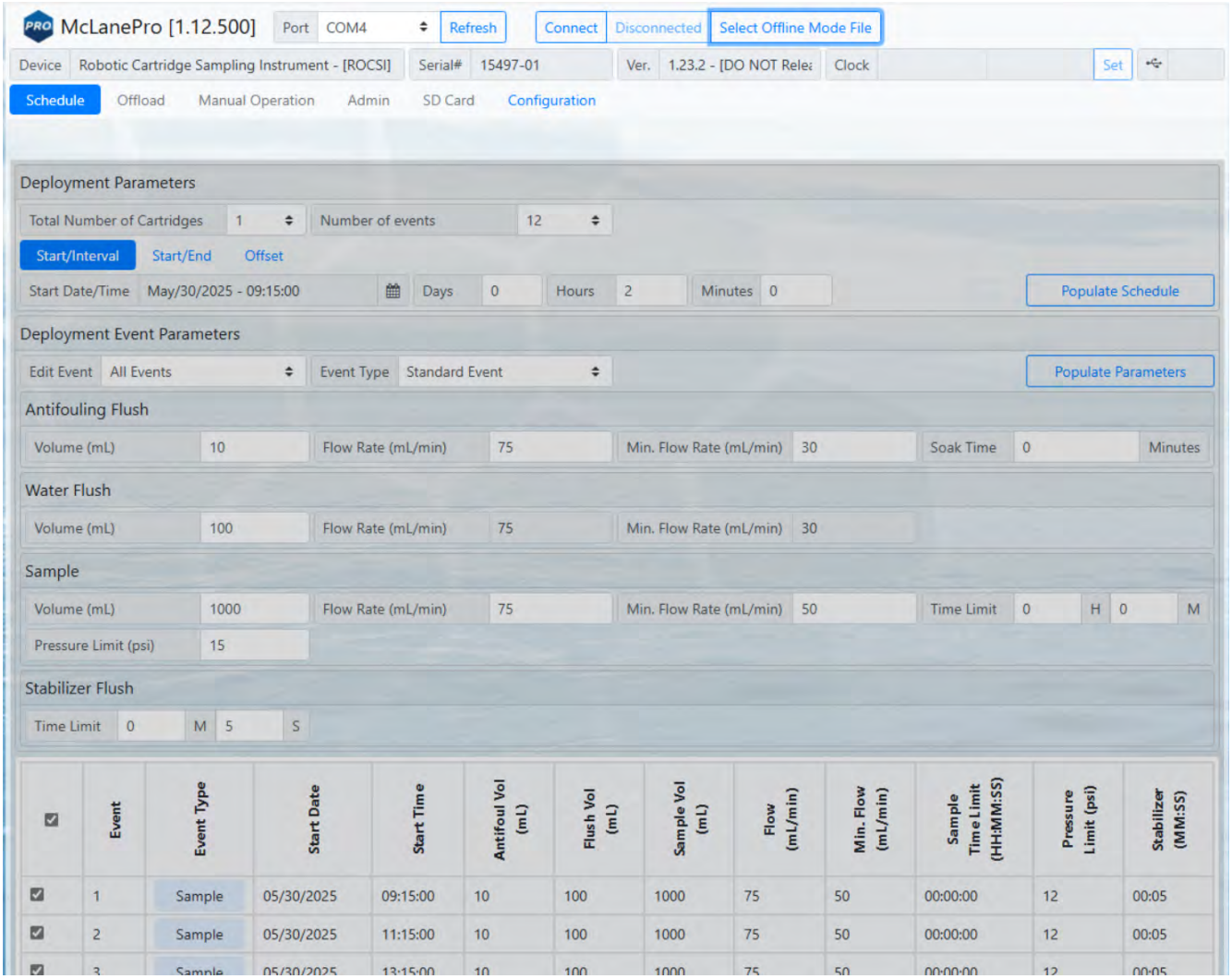
Offline Mode

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.

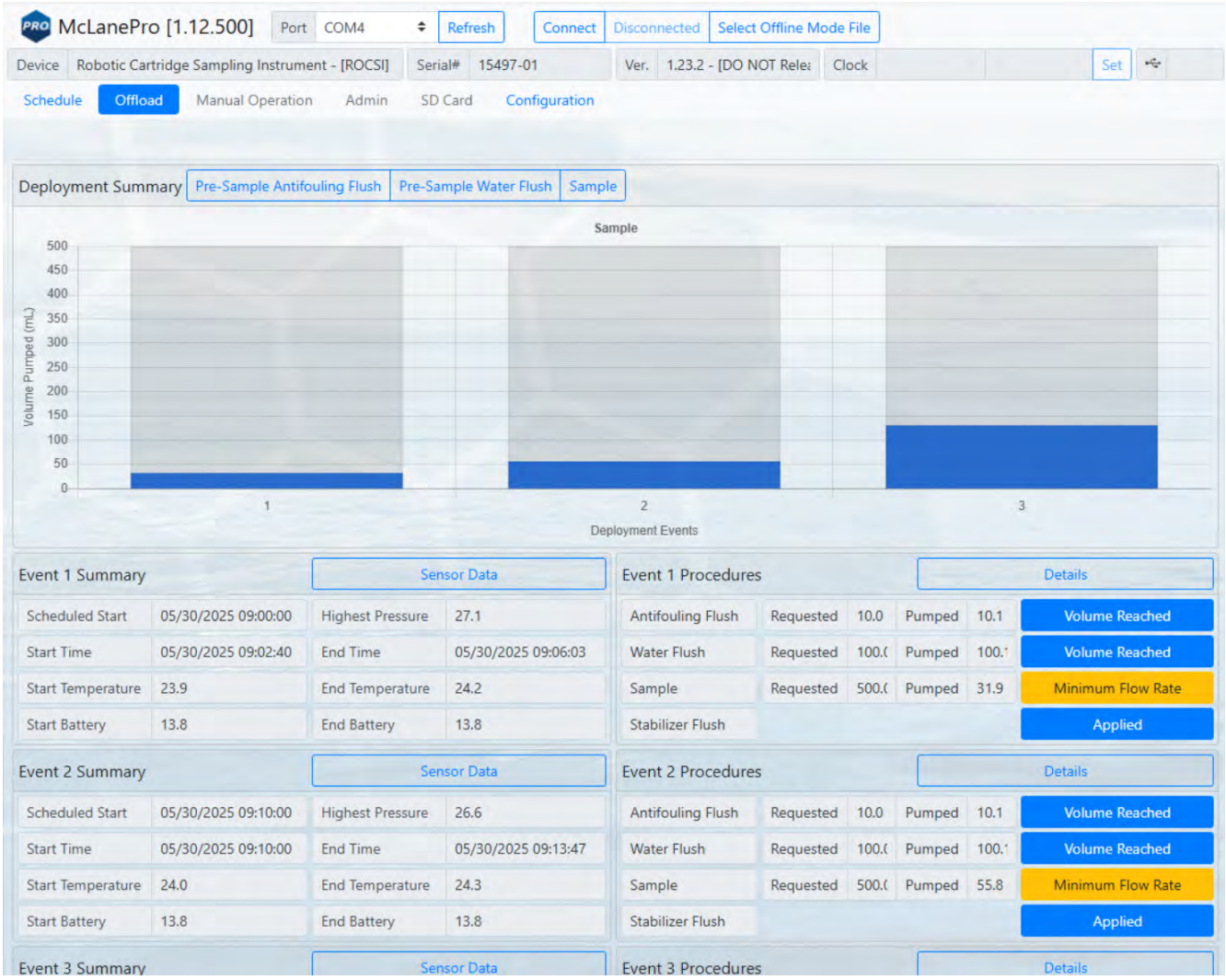




A ***.mrlsch** file will contain the schedule and device configuration along with the device, serial number and firmware information.



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


McLanePro [1.12.500]
Port COM4
Refresh
Connect
Disconnected
Select Offline Mode File
Device Robotic Cartridge Sampling Instrument - [ROCSI]
Serial# 15497-01
Ver. 1.23.2 - [DO NOT Rele
Clock
Set
Schedule
Offload
Manual Operation
Admin
SD Card
Configuration
Deployment Summary
Pre-Sample Antifouling Flush
Pre-Sample Water Flush
Sample
Sample
Volume Pumped (mL)
500
450
400
350
300
250
200
150
100
50
0
1
2
3
Deployment Events
Event 1 Summary
Sensor Data
Scheduled Start 05/30/2025 09:00:00
Highest Pressure 27.1
Start Time 05/30/2025 09:02:40
End Time 05/30/2025 09:06:03
Start Temperature 23.9
End Temperature 24.2
Start Battery 13.8
End Battery 13.8
Event 1 Procedures
Details
Antifouling Flush Requested 10.0 Pumped 10.1 Volume Reached
Water Flush Requested 100.(Pumped 100.1 Volume Reached
Sample Requested 500.(Pumped 31.9 Minimum Flow Rate
Stabilizer Flush Applied
Event 2 Summary
Sensor Data
Scheduled Start 05/30/2025 09:10:00
Highest Pressure 26.6
Start Time 05/30/2025 09:10:00
End Time 05/30/2025 09:13:47
Start Temperature 24.0
End Temperature 24.3
Start Battery 13.8
End Battery 13.8
Event 2 Procedures
Details
Antifouling Flush Requested 10.0 Pumped 10.1 Volume Reached
Water Flush Requested 100.(Pumped 100.1 Volume Reached
Sample Requested 500.(Pumped 55.8 Minimum Flow Rate
Stabilizer Flush Applied
Event 3 Summary
Sensor Data
Event 3 Procedures
Details

RoCSI General Information

General information includes short descriptions of RoCSI models and available options. More detailed specification sheets are available on the McLane website, RoCSI product page.

RoCSI General Information topics

Description & Models
Optional Moored System

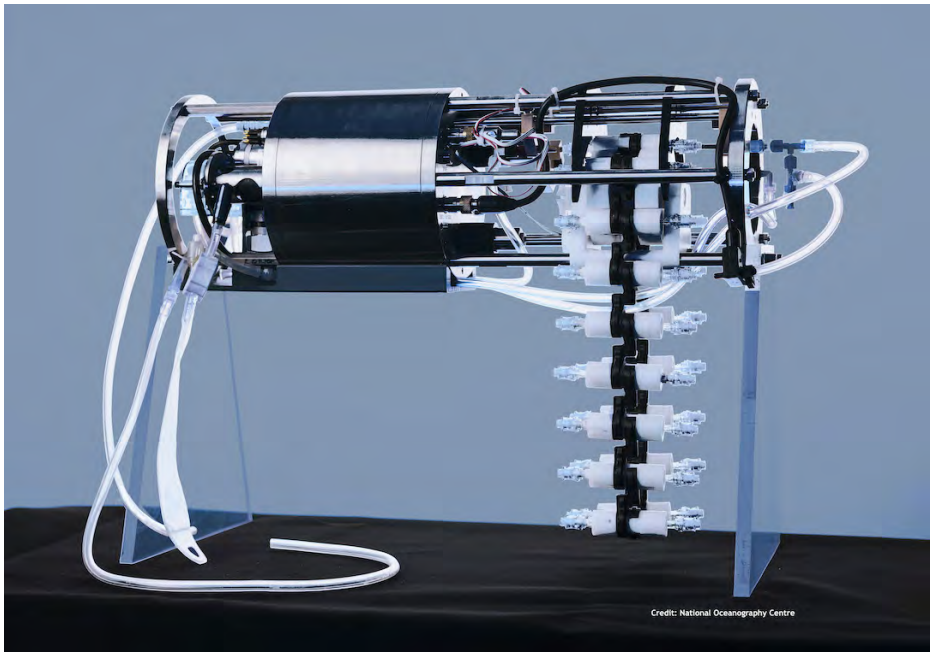
Description & Models

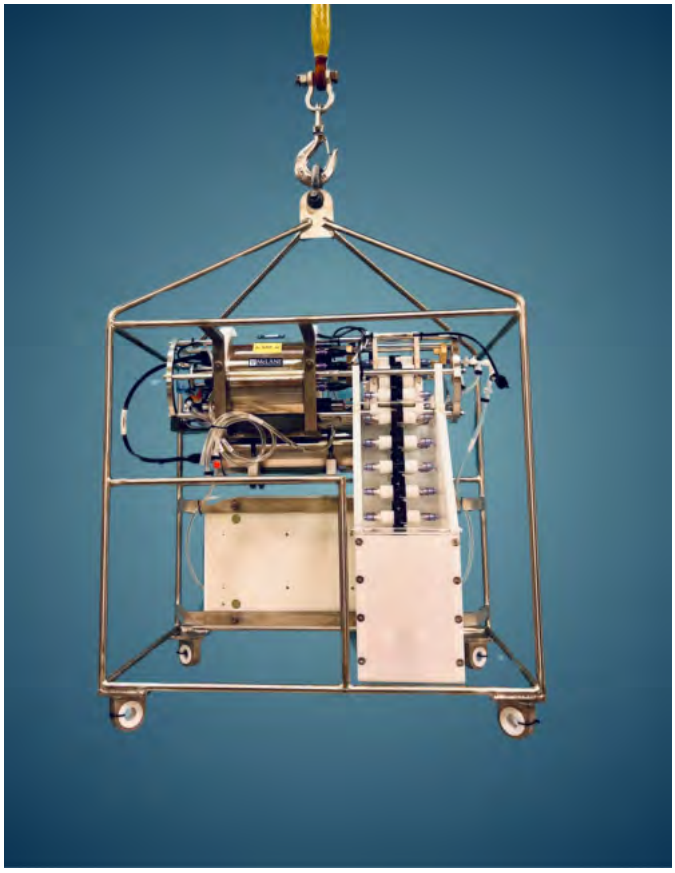
The Robotic Cartridge Sampling Instrument (RoCSI) is a field-proven, in situ, autonomous oceanographic sampler that collects and preserves water samples into industry standard 0.22 and 0.45 micron Sterivex™ filter cartridges for later eDNA analysis. RoCSI has high sample count capabilities in a compact instrument that is depth rated to 6,000 meters.

- RoCSI Sterivex™ filter cartridge chains are available in 12, 24, or 48 samples.
- RoCSI uses common industry liquid preservatives such as RNAlater™.

RoCSI is also available as a fully self-contained, moored system including reagent bag storage, external battery housing and cartridge containment (hopper), mounted on a frame.

Please note that deployment duration is typically limited by the efficiency of preservative over time. Typical deployments may not exceed one month depending on environmental temperature, if using RNAlater™, as longer deployments may not return viable samples due to longevity/effectiveness of the preservative. Other preservatives may offer longer term sample viability, but should be tested and confirmed by the user.



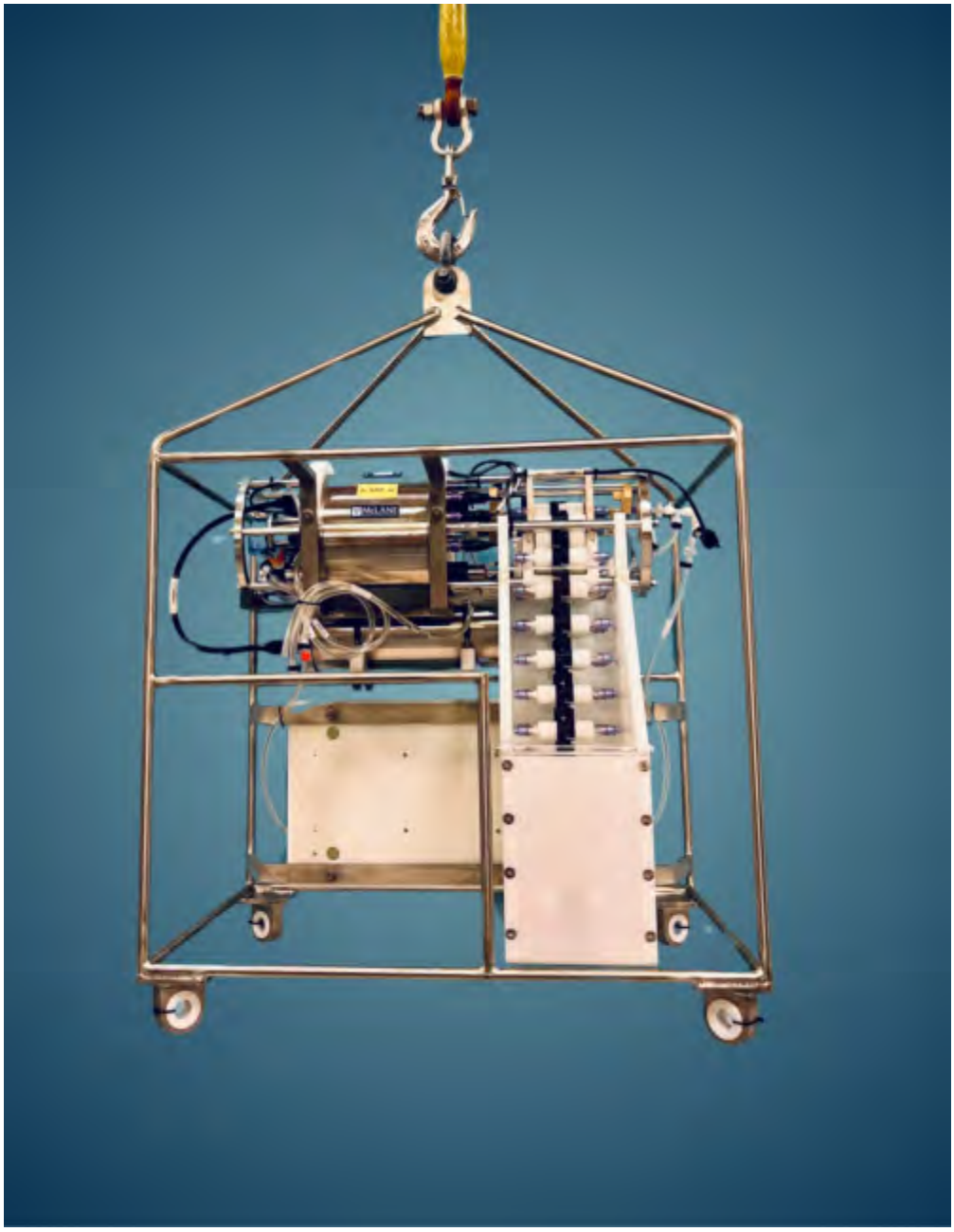


Options

- Lithium primary battery
- Moored frame
- Cartridge containment hopper

Optional Moored System

The moored configuration provides power and protection for the RoCSI when attached to a mooring. Components includes a 316SS frame (titanium frame optional), reagent storage box and deep-rated titanium battery pack that contains four non-rechargeable lithium primary batteries. A cartridge hopper is typically also installed to contain large sample chains.



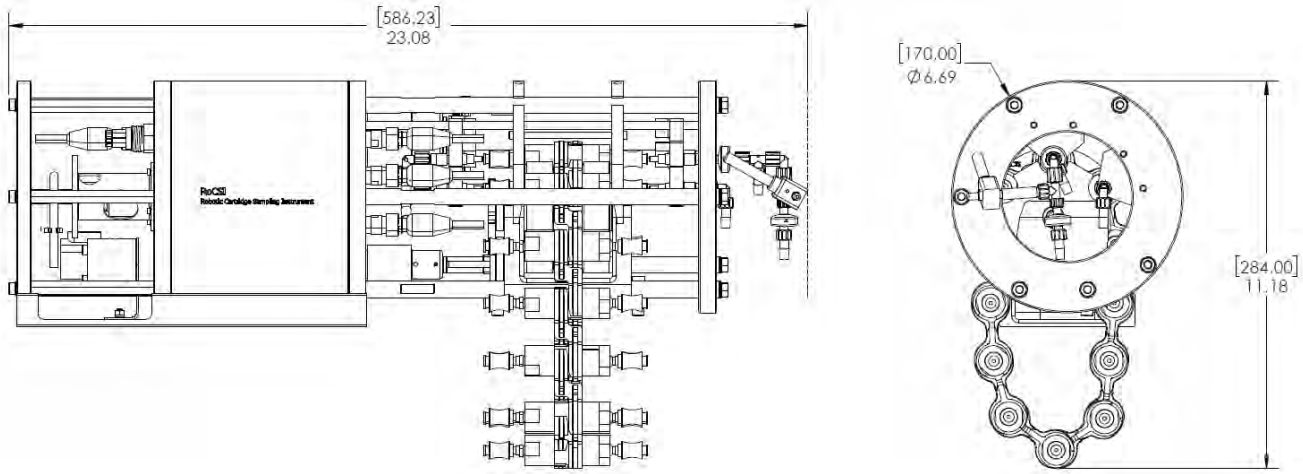
RoCSI Specifications

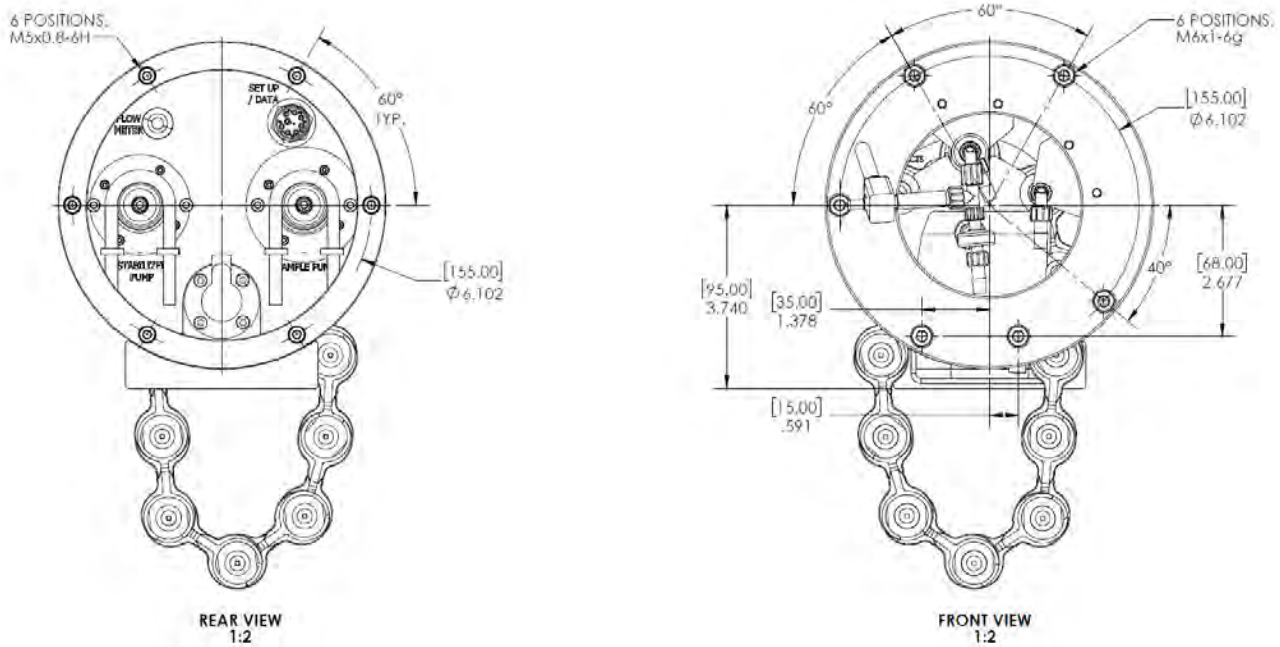
This section provides mechanical and electrical specifications for RoCSI.

Physical Specifications

Physical

For physical specifications, see the RoCSI data sheet here.





Electrical Specifications

Electrical

- Nominal: +12 Vdc (10-25 Vdc) / 2 A
- Absolute Max: 25 Vdc
- Typical Pumping Current (at 12 Vdc): 0.4-0.7 A

Communication Cable Specifications

Communication Cable

If you want to make your own lead, you will need a cable terminated with a Subconn MCIL8F plug (to mate with the Subconn MCBH8M bulkhead connector on the sampler's end-cap).

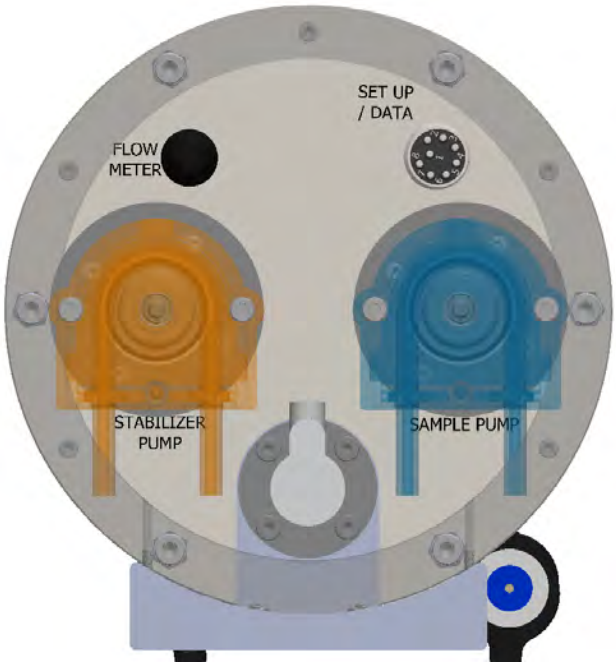
The pin-out of the connector is as follows:

- PIN 1 (black) 12 Vdc
- PIN 2 (white) GND
- PIN 3 (red) USB VBUS
- PIN 4 (green) USB GND
- PIN 5 (orange) USB DP
- PIN 6 (blue) USB DM
- PIN 7 (white & black) RS232 SAMPLER RX
- PIN 8 (red & black) RS232 SAMPLER TX

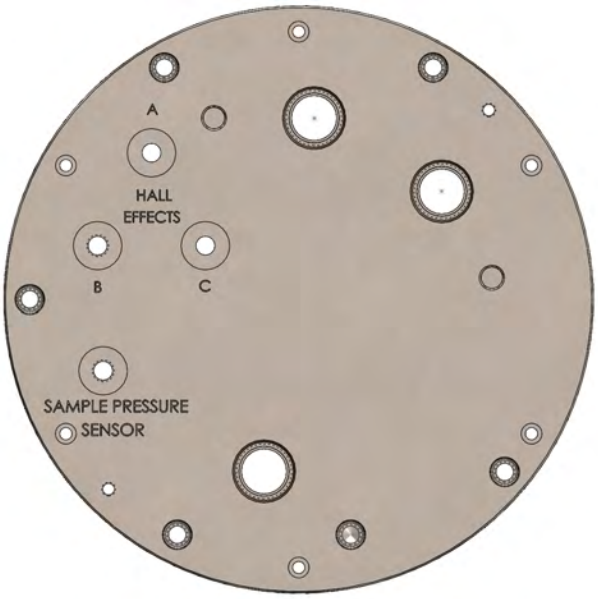
The deck lead provided with the unit has power, USB, and RS232 connections. A USB deck lead should not exceed 2m. An RS232 graphical user interface (GUI) is available with the same functionality as the USB GUI but you will need an RS232 port (or RS232-USB adapter) on your PC to use it. There is also an RS232 vehicle interface available to allow a vehicle to start/stop the sampler autonomously. An RS232 deck lead should work up to at least 7 meters.

Controller Housing End Cap Diagrams

Front End Cap:



Rear End Cap:



Bulkhead Connectors

Front End Cap:

Set Up / Data - Communication and Power Port (+12 Vdc / USB / RS232)

Flow Meter - Flow Meter Sensor

Rear End Cap:

Hall Effects A - Sample Injector Position Sensor

Hall Effects B - Stabilizer Injector Position Sensor

Hall Effects C - Cartridge Loader Position Sensor

Sample Pressure Sensor - Differential Pressure Sensor

Sterivex™ Filter Cartridge Specifications

RoCSI Sterivex™ filter cartridge chains are available in 12, 24, or 48 samples. Each new sample belt includes one set of the specified number of cartridge filters (for example, the 12 sample chain includes 12 Sterivex™ filter cartridges), the 24 sample belt includes 24 cartridges, and so on.

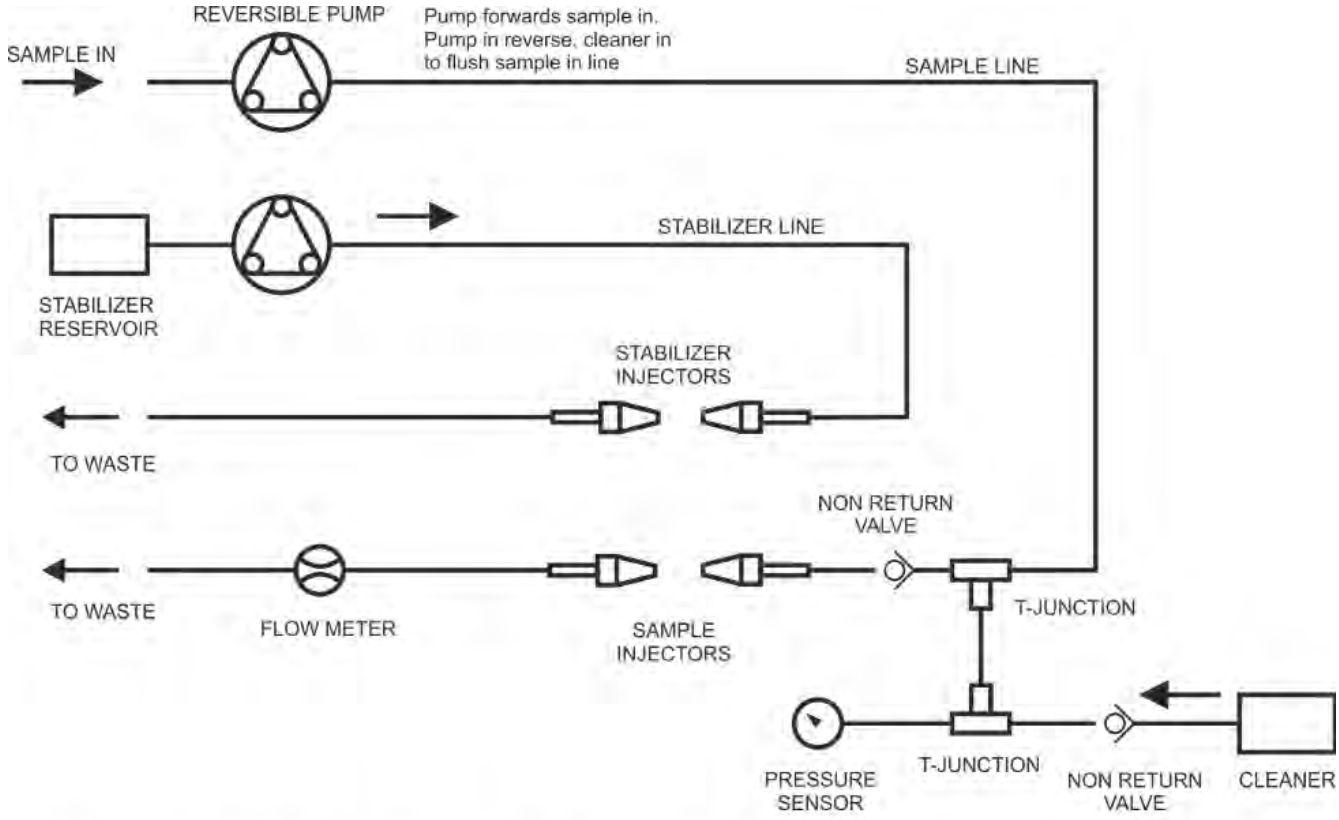
Filter cartridges are Merk Millipore Sterivex™. Additional filter cartridges can be purchased from Merk or Sigma.

Sterivex GP – 0.22um PES membrane, p/n SVGP010 (pictured below)

Sterivex HV – 0.45um PVDF membrane, p/n SVHV010

Millipore.
OPEN
Sterivex™
Filter Unit without Filling Bell
For sterilizing aqueous solutions
• Sterile
• Non-pyrogenic
• Single use only
• For laboratory use only
STERIVEX™
GP 0.22 um FILTER UNIT
For Sterilizing Aqueous Solutions
Cat. No.: SVGP01050
Lot. No.: 2323/04981
Contents.: 1 Filter Unit
Exp. Date: NOV 2026
EMD Millipore Corporation, Burlington MA 01803
20298649
The initial M and Millipore are trademarks of Merck KGaA, Darmstadt, Germany or its affiliates.
© 2018 Merck KGaA, Darmstadt, Germany and/or its affiliates. All rights reserved.
103674DR
Art No.: 2018-09351 Rev.01/18

Fluidic System Schematic



SCHEMATIC OF RoCSI FLUIDIC SYSTEM

RoCSI Electronics Information

The RoCSI operates on McLane Research Labs' Gen3 electronics 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

RoCSI Operations

This section provides guidance for operating the RoCSI.

A typical deployment or mission will require the following steps.
Use these as a guide for designing a RoCSI mission.

Prepare

Pre-Deployment Checklist
Mounting the Sampler
Setting the Instrument Clock
Loading the Cartridge Chain
Schedule a Deployment

Prime

Filling Reagent Bags
Priming the Pumps
Priming Sample, Stabilization and Cleaner Lines
Priming Cartridges

Deploy

Start a Deployment

Recover

Recovery
Unloading the Cartridge Chain
Data Offload

Pre-Deployment Checklist

Prior to the RoCSI being deployed or operated, a few pre-flight checks should be made:

- Ensure all plumbing connections are secure.

- Check that any electrical connections are secure and replace the dummy plug on the COM bulkhead connector.
- Ensure that the chain length is configured correctly and that the current loaded cartridge is correct.
- Run through 2 complete cycles of the cartridge chain before taking any samples.
- Make sure the sample inlet is submerged in ‘sample’, and that the stabilizer and cleaner containers are filled.
- Ensure that the stabilizer and cleaner lines have been primed.
- For deployments at depth, ensure that the Sterivex™ filters are all primed with Milli-Q before taking samples.
- If using a long sample inlet line, be sure to prime the sample line prior to sample collection.

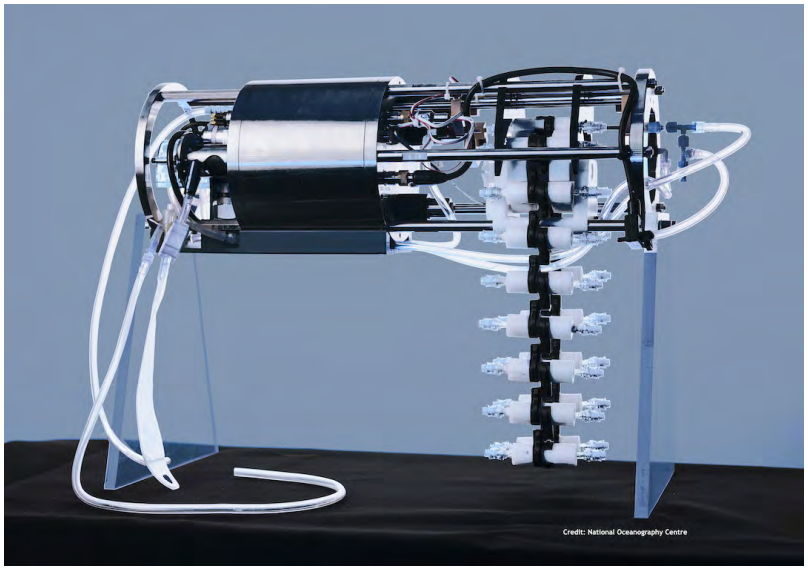
Mounting the Sampler

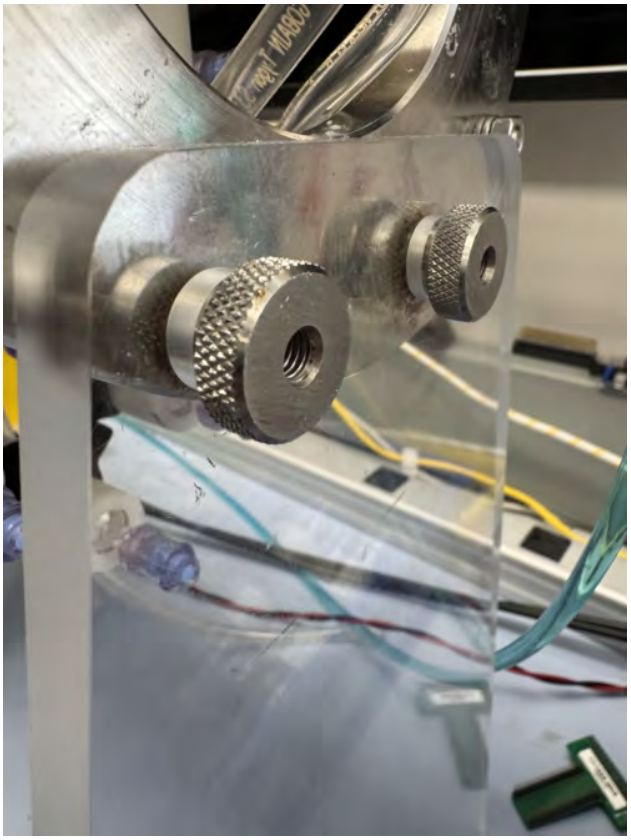
When operating the RoCSI on the bench-top, allow the cartridge chain to hang freely over the end of the bench, with gravity aiding the loading of the instrument. The main housing will need to be secured to the bench or other mounting apparatus prior to installing the sample chain.

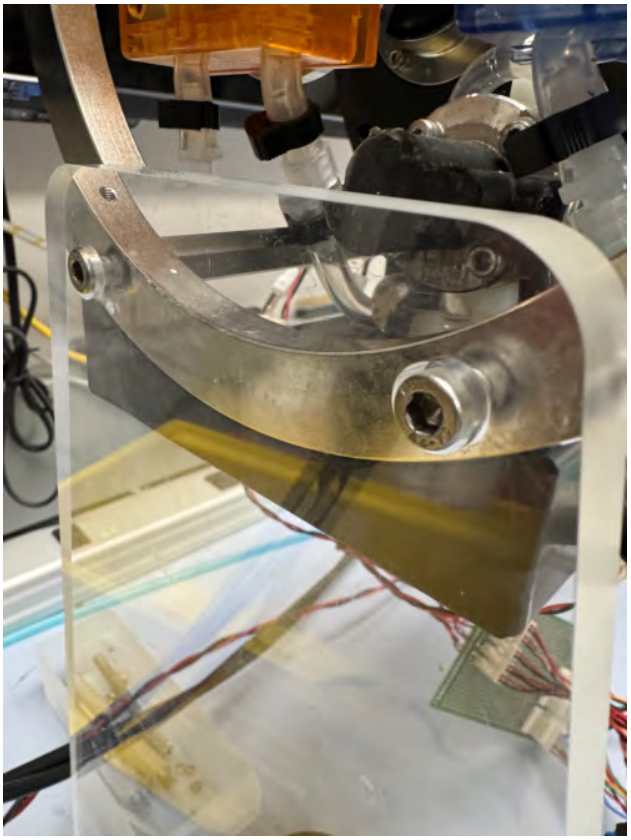
A bench stand is also supplied for bench top operation. See thenext section for instruction on mounting the stand.

Installing the Bench Stand

An acrylic bench stand is included with the RoCSI. Extra hardware is provided in the toolkit to mount the RoCSI to the stand. Two thumb screws are used to attach the stand closest to the cartridge mechanics and two long M5 screws are used to mount the stand on the pump end. Installation is straightforward, but is easiest achieved by laying the RoCSI on its side and attaching each stand before standing the RoCSI up.





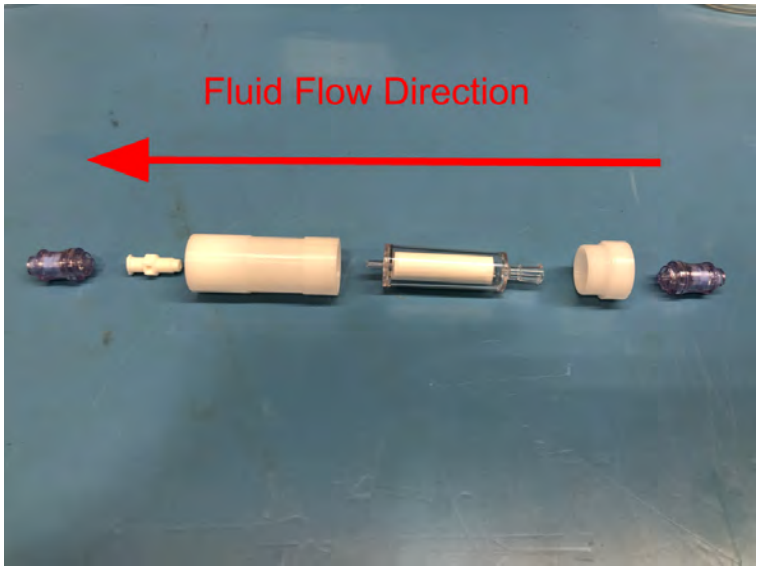


Assembling New Filter Cartridges

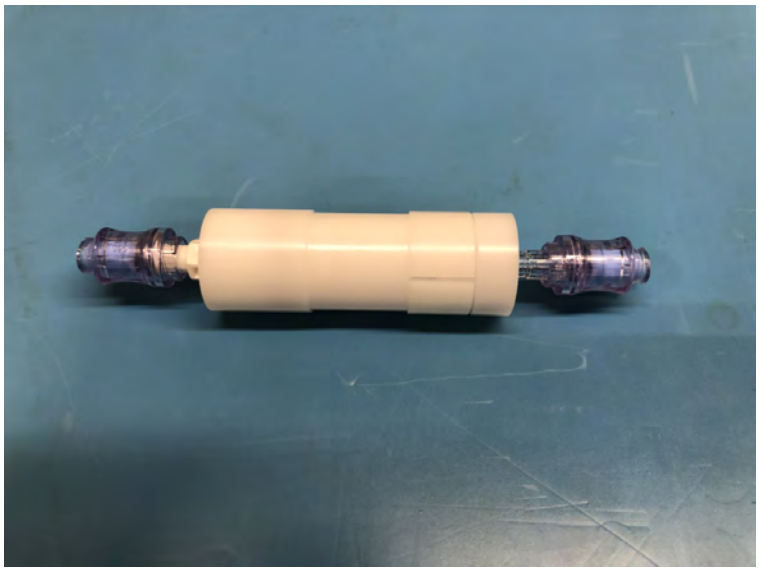
Follow the steps in this section to assemble the filter cartridges and sample chain. If cartridges are to be reused, follow the instructions for cleaning prior to filter assembly.

Be sure to follow best practices with regard to wearing gloves, cleanliness of the work area, and general clean handling protocols in order to reduce contamination of the filter components during assembly.

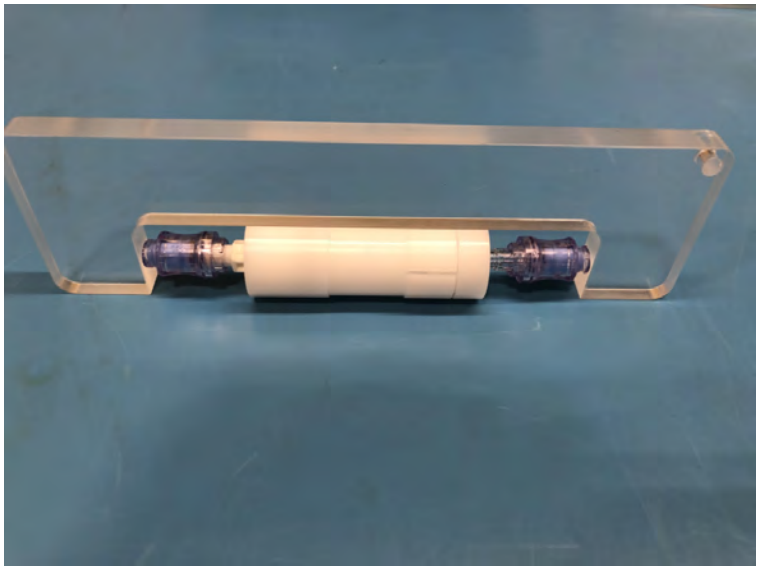
Please note that the direction of fluid flow will be from right to left as shown below. When mounting cartridges onto the chain and loading into the RoCSI, pay careful attention to direction of flow.

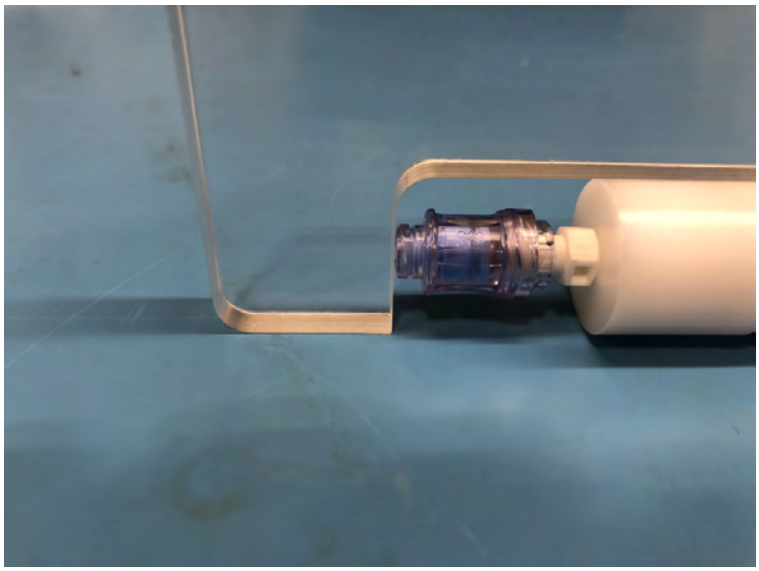


1. Noting the orientation of the parts shown above, start by screwing the Luer lock male to female connector into the sample holder using an 8 mm wrench.
2. Using (gloved) fingers, screw the needle free valve onto the Luer Lock female connection at the outlet of the sample cartridge holder.
3. Push a Sterivex™ filter cartridge firmly into the sample holder (it will self-center), then screw on the sample holder cap.
4. Screw the remaining needle free valve onto the cartridge inlet.

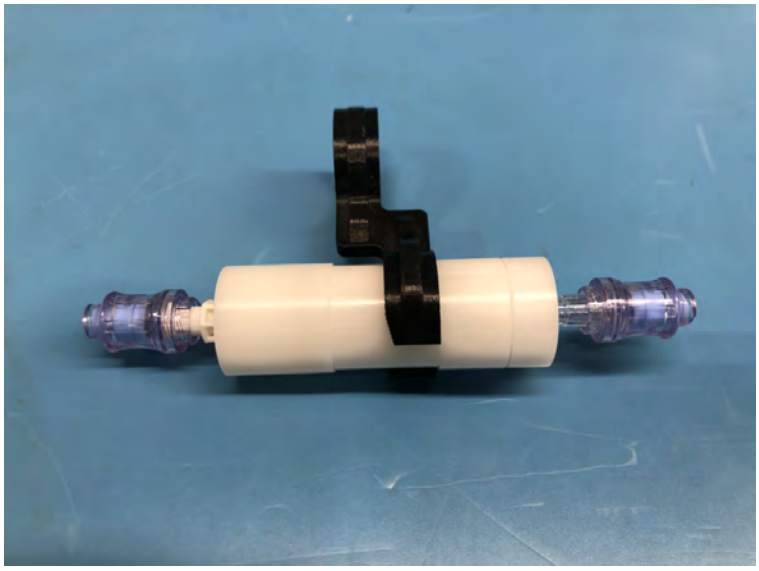


5. Use the gauge provided in the toolkit to ensure the cartridge is the correct length. The cartridge should gently slide into the gap and remain in position without falling out.

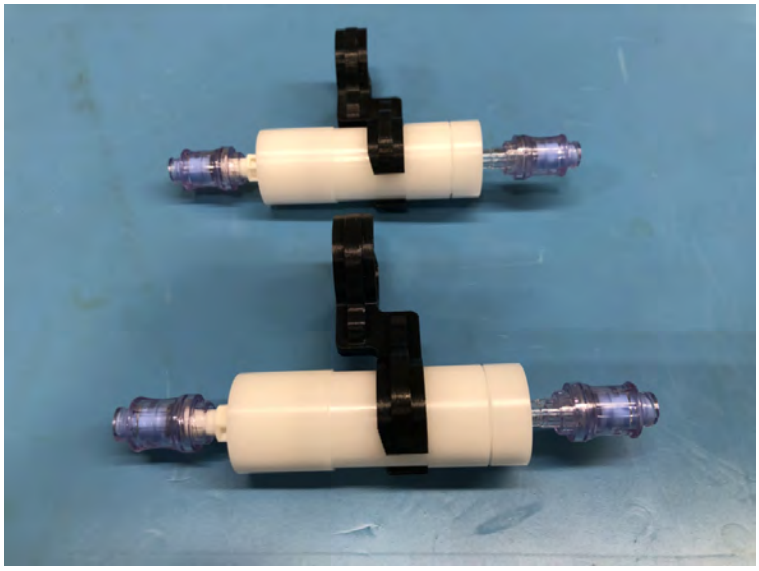


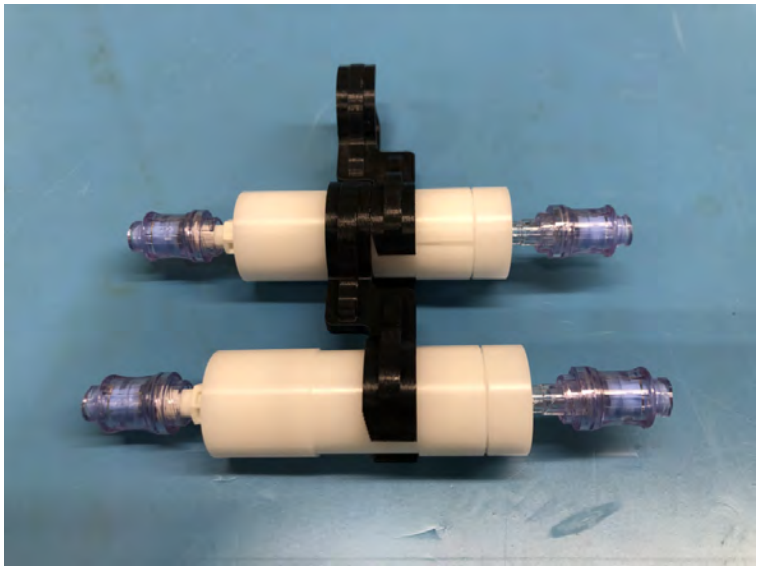


6. To begin creating a sample chain, install a chain link onto the cartridge as shown. Please note that in the orientation shown, water flow will be right to left.



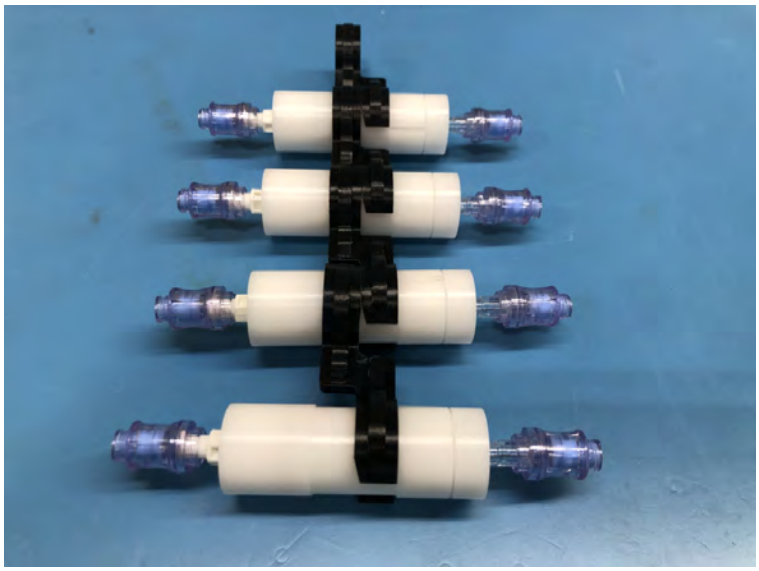
7. To begin creating a sample chain, install a chain link onto the cartridge as shown. The link is installed by firmly pushing it onto the reduced diameter section of the cartridge holder.
8. Prepare another sample cartridge as shown above and install another clip. Then clip the two assemblies together as shown.





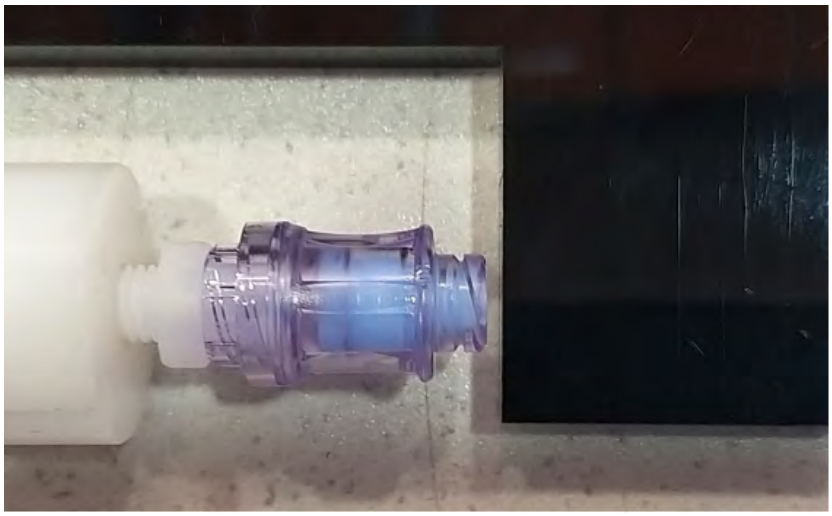
9. Continue adding cartridges until the desired sample chain length is achieved.

Note that RoCSI requires a minimum of 10 cartridges to load correctly.



Incorrect Filter Cartridge Assembly

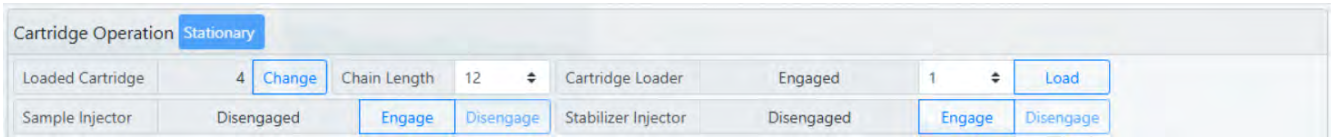
The image shown next illustrates a cartridge that is incorrectly assembled (there is a small gap between the needle free valve and the end of the gauge). If gaps are present when measuring the assembled length, the cartridge assembly will need to be rebuilt, or a different sample holder will need to be assembled. Cartridge assemblies that are too long or too short will not be loaded correctly by RoCSI.



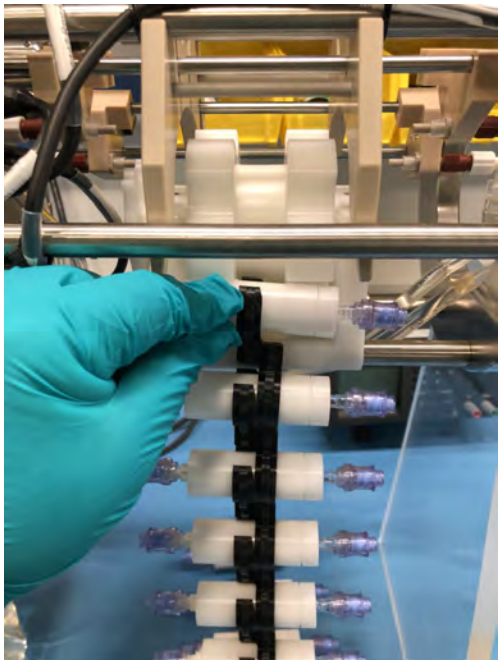
Loading the Cartridge Chain

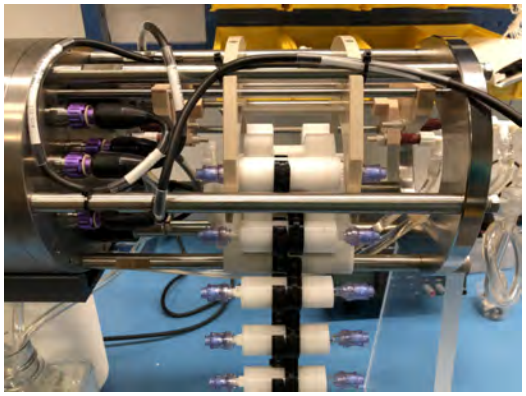
The Sterivex™ filter units are loaded into the sampler on a **cartridge chain** as shown next.

1. Ensure the 12 Vdc supply is turned on and McLanePro is running.
2. Connect to the RoCSI and navigate to the **Manual Operation tab**.
3. Set the **Chain Length** value to the number of cartridges installed in the sample chain that is being loaded.
4. Set the **Cartridge Loader** drop down to '1'.

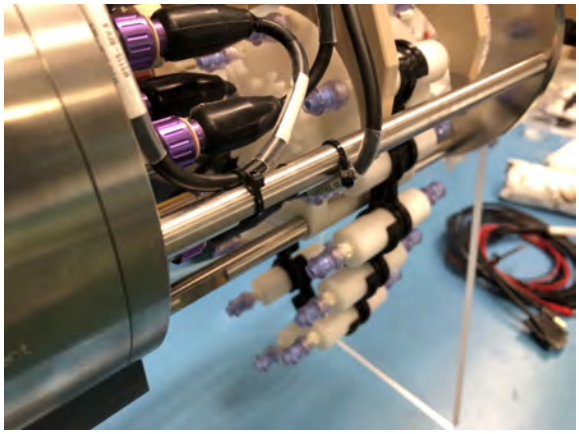


5. Gently hold the *first* cartridge (with no leading clip) against the loader wheel in the lowest accessible cartridge slot and click the **Load** button in the software. The cartridge should be pulled into position automatically. Note that water flow will be from right to left in the images below; ensure the cartridge is oriented correctly for flow.





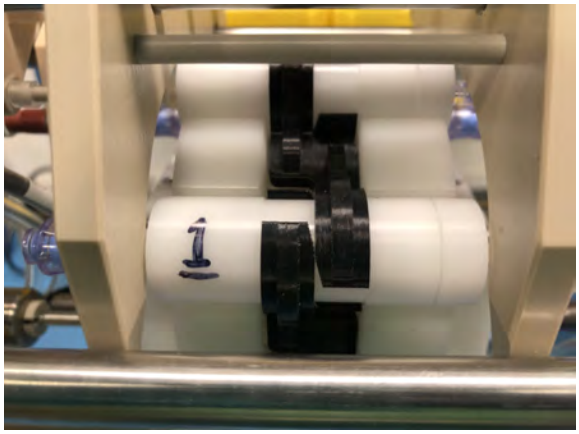
5. Continue to advance the cartridge chain (using **Load button**) until there are an even amount of cartridges hanging below the RoCSI. This allows the chain to be completed by linking the first and last cartridges together.

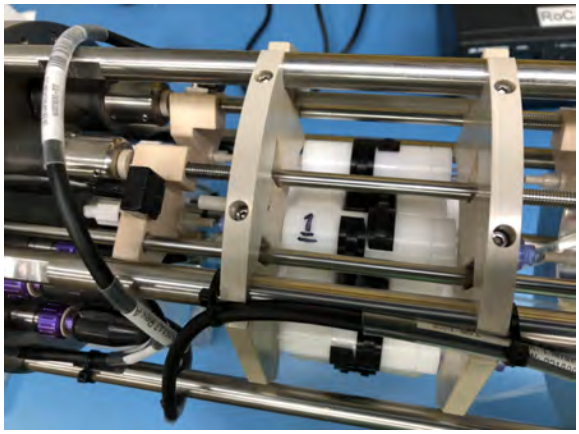


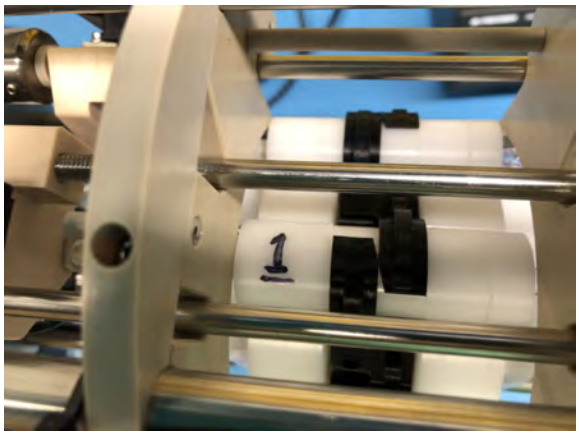
6. If not done so already, mark the first cartridge to be sampled with the number 1. Then

advance the chain until this cartridge is in the top position (in-line with the sample injectors).

1. It is good practice to apply a number label to each cartridge in the chain in order to make keeping track of the sample number easier.

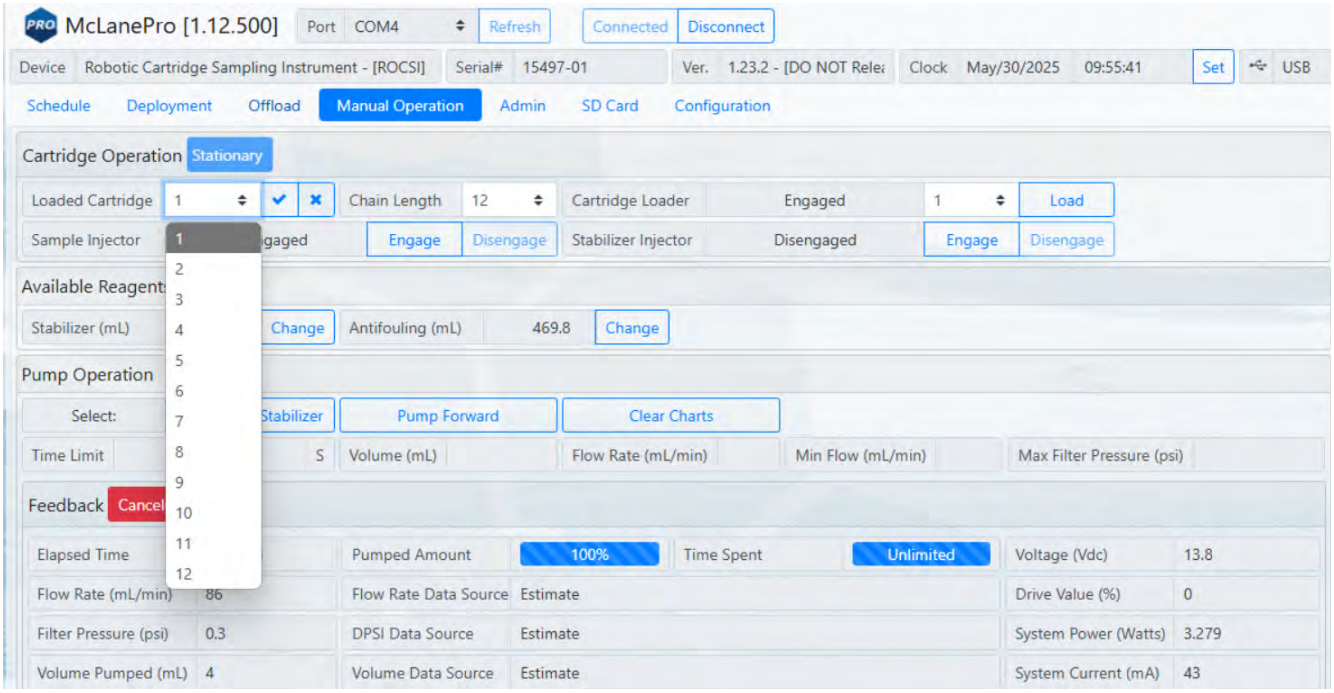






7. To change the **Loaded Cartridge** to match what is written on the cartridge that was just loaded, click **Change.**

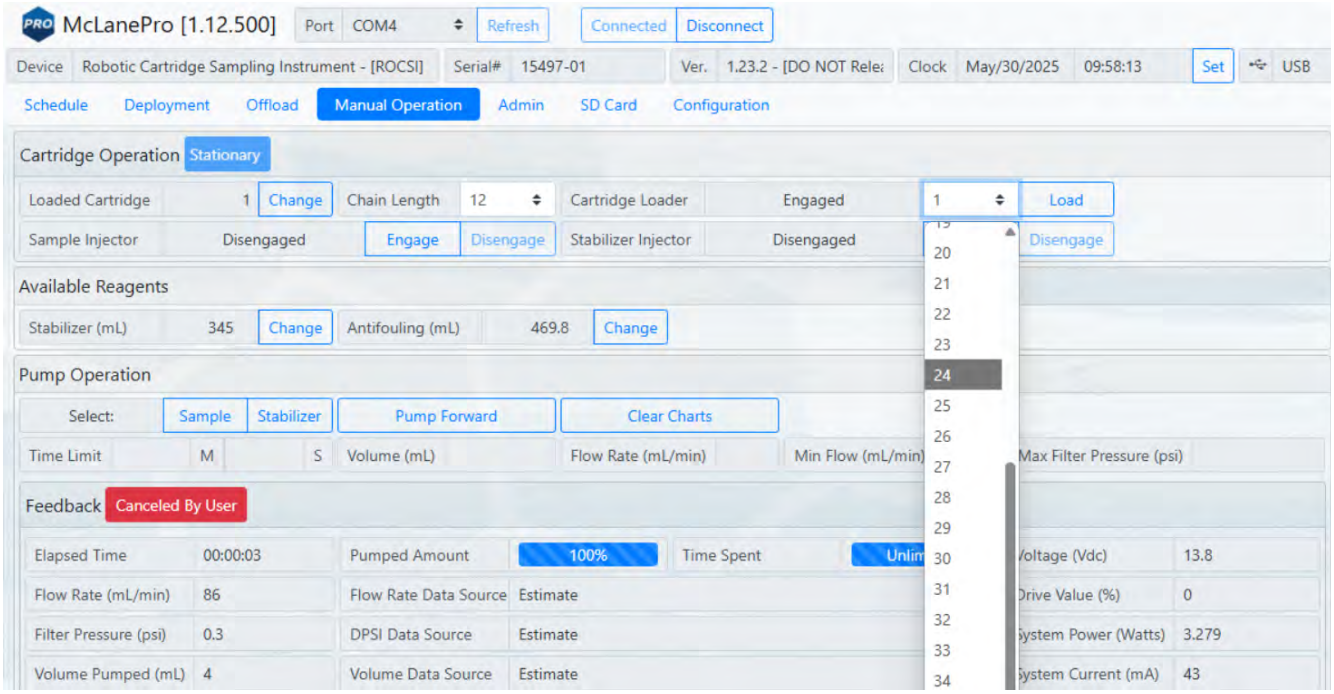
8. Choose your cartridge number (# 1, in this case) in the drop-down box and click the **checkmark.**



9. After the cartridge number is entered, RoCSI will keep track of cartridge numbers as long as they are consecutively numbered.

10. Before a deployment, cycle the entire cartridge chain twice through the sampler (without sampling) to check the cartridges are all aligned properly and do not cause any loading problems. You can do this by using the **Load** function in the **Manual Operation tab.**

11. In this example, the sample chain is 12 cartridges long, so 12 will be entered in the Chain Length box. Set the number of cartridges to load to '24' and click **Load** to cycle through the entire sample chain twice.



Run **two** complete cycles of the cartridge chain using the **Load function** to ensure trouble free loading of the sampler.

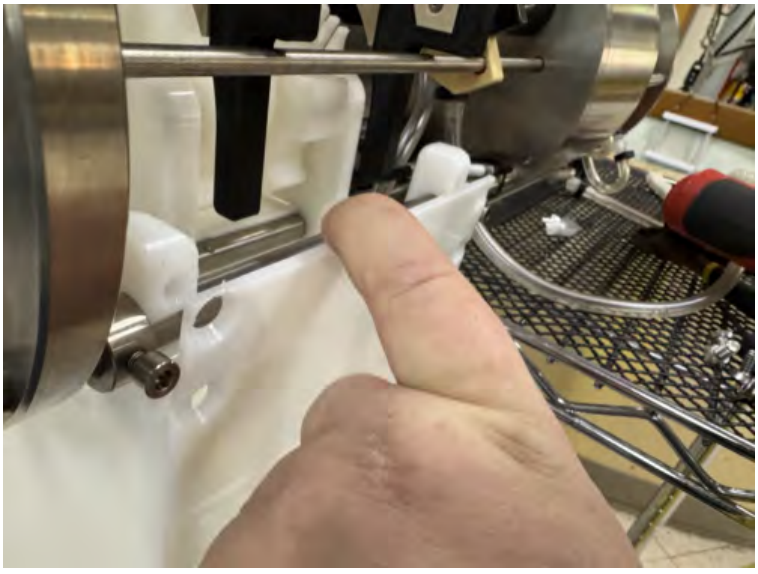
Hopper

If a hopper is provided, it can optionally be fitted to house the cartridge chain. The cartridges do not need to be specially arranged in the hopper.

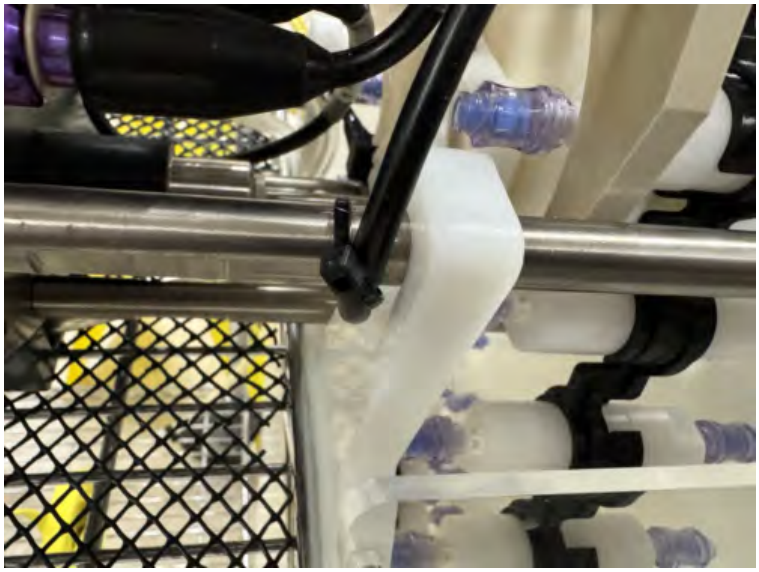
Please note that the maximum number of cartridges that can be used in the large hopper is 40 if operating in air, and 48 if operating submerged.

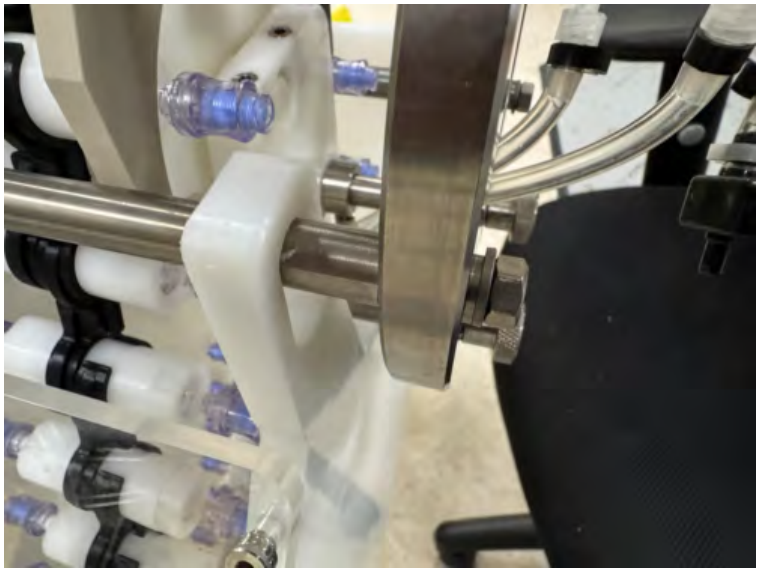
Installing the Hopper

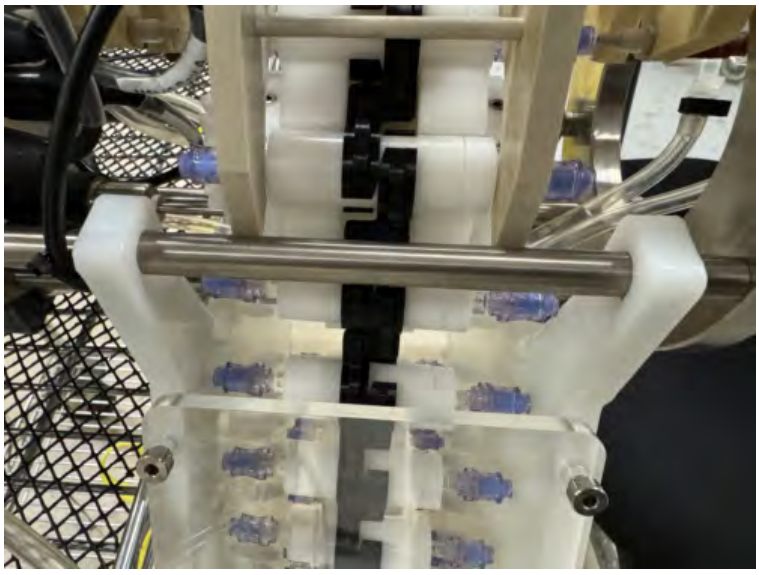
1. First, remove the 4 screws on the top of the back side of the hopper.
2. Gently push back the plastic panel and slide the hopper up onto the cross bar as shown.



3. In this position, it is then possible to rotate the hopper up and to hook the front hangers onto the opposite cross bar.



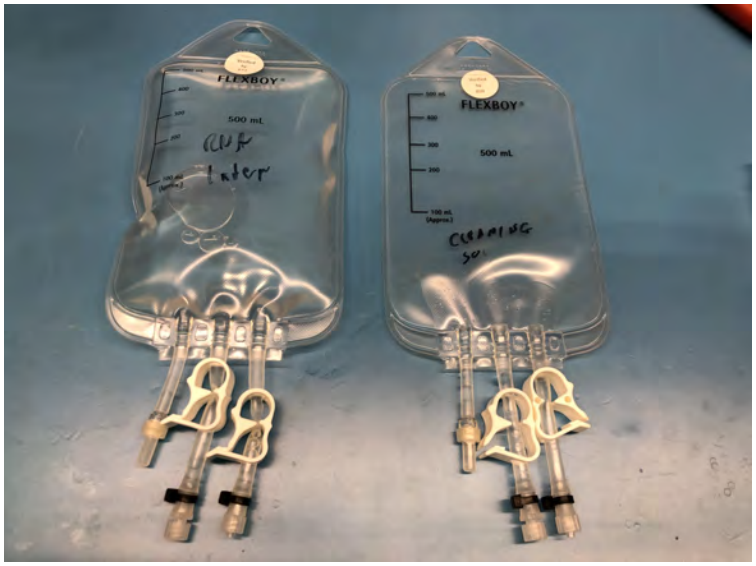




4. When the hopper is properly hung, reinstall the 4 screws on the back side to secure the hopper in place.

Filling Reagent Bags

RoCSI requires reagents stored in plastic IV bags. Depending on the number of samples, required stabilizer and expected number of cleaning cycles, these bags may contain varying volumes of stabilizer or cleaning agent. RoCSI ships with .5 L bags as default in order to cover most deployment needs. Also supplied is a syringe with Luer Lock fittings used to fill the bags with fluid and also to remove air after filling.


FLEXBOY
500 mL
FLEXBOY
500 mL

FLEXBOY
500 mL

Fill each bag according to expected reagent use, and connect to the marked inlet tubes at each end of the instrument.

- The stabilizer bag connects to the inlet of the stabilizer pump on the left hand side of the RoCSI.
- The cleaner bag connects to the inlet of the sample injector, attached to a one-way valve on the right hand side of the RoCSI, near the pressure sensor.

Be careful to work in a clean area with gloves to reduce contamination risk during filling of reagent bags. For most applications, RNAlater will be an appropriate stabilizer and 2.5% bleach is an acceptable cleaning agent.

Priming the Pumps

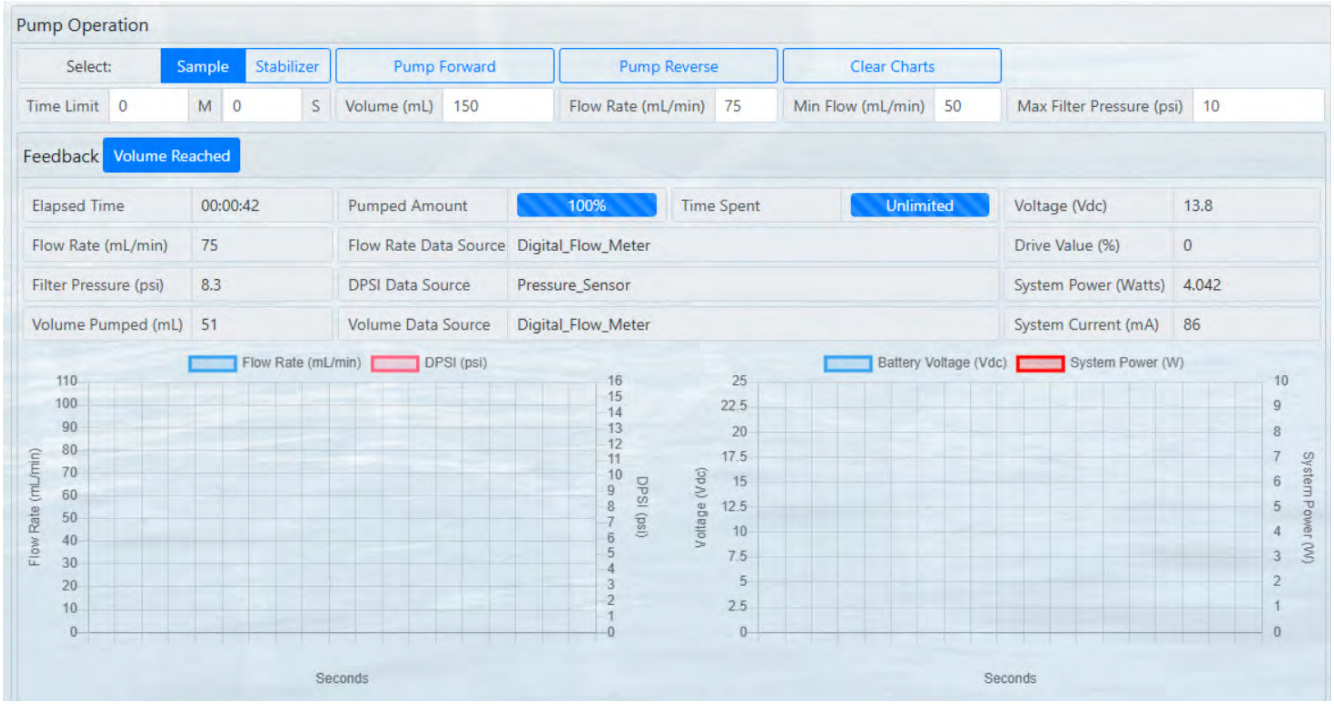
Inherent to the design of peristaltic pumps is an issue whereas the pump tubing becomes sticky and the pinched section of tubing may not initially separate to allow pumping. When the tubing is stuck together, the pumps will produce a "popping" sound while running and will not effectively move water. To remedy this issue, the pumps must be primed with clean water to allow the peristaltic tubing to separate. In extreme cases where the instrument has been sitting for a long time, the pump head may need to be removed in order to restore the tubing section.

If priming steps are not successful in restoring the pump function, the pump head may need to be removed as detailed in Changing Peristaltic Tubing.

Priming the sample pump:

1. Navigate to the **Manual Operation tab**.
2. Select the **Sample** pump in the pump selection menu. This allows direct control of the sample

pump.



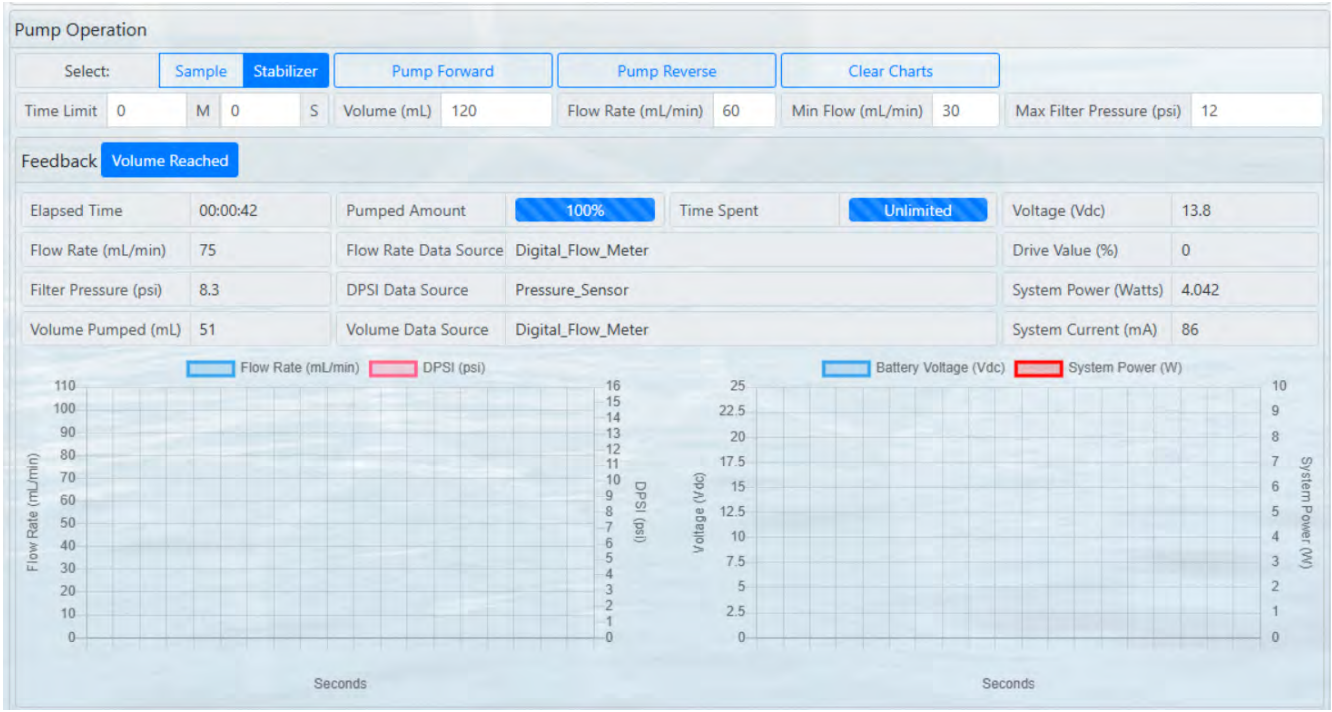
3. Prepare a syringe with clean water that will be used to prime the sample pump.
4. Disconnect the exhaust line from the sample pump and connect the syringe directly to the exhaust of the pump.

5. In the Pump Parameters section, set the Flow Rate to 75 mL/min. and click **Pump Reverse**.
6. Apply some light pressure to the syringe and inject water into the pump until it is moving water successfully. Be aware that, with no cartridge installed and engaged, water will flow from the injector onto the bench.
7. Click Stop, once the pump is primed.

8. Remove the syringe from the pump exhaust and reconnect the exhaust tube.

Priming the stabilizer pump:

1. Navigate to the **Manual Operation tab**.
2. Select Stabilizer pump in the pump selection menu. This allows direct control of the stabilizer pump.



3. Prepare a syringe with clean water that will be used to prime the sample pump.
4. Disconnect the intake line from the stabilizer pump and connect the syringe directly to the intake of the pump.

5. In the Pump Parameters section, set the Flow Rate to 60 mL/min. and click **Forward**.
6. Apply some light pressure to the syringe and inject water into the pump until it is moving water successfully. Be aware that, with no cartridge installed and engaged, water will flow from the injector onto the bench.
7. Click **Stop Pumping**, once the pump is primed.
8. Remove the syringe and reconnect the stabilizer bag line to the pump.

Priming Sample, Stabilization and Cleaner Lines

Prior to deployment or running samples, the sample inlet, cleaner inlet and stabilization lines should be primed to remove air bubbles. These procedures will use commands located in the **Manual Operation tab**. Please note that priming is a wet process and should be performed in an appropriate area.

Priming the Stabilizer line:

1. First, connect a full bag of stabilizer to the stabilizer bag line. Ensure that clips are

disengaged and the connection is secure.

2. Navigate to the **Manual Operation tab**.
3. Select **Stabilizer** in the pump selection selection menu.
4. Set the Flow Rate to 60 mL/min.
5. Click the **Pump Forward** button to start pumping stabilizer into the system.
6. Click the **Stop Pumping** button when stabilizer begins to drip from the stabilizer injector. The line is now primed and ready for deployment.

Priming the Cleaner line:

1. First, connect a full bag of cleaner to the cleaner bag line. Ensure that clips are disengaged and the connection is secure.
2. Navigate to the **Manual Operation tab**.
3. Select **Sample** in the pump selection menu.
4. Set the Flow Rate to 75 mL/min.
5. Click the **Pump Reverse** button to start pumping cleaner into the system.
6. Click the **Stop Pumping** button when cleaner fills the cleaner line and enters the main plumbing. The line is now primed and ready for deployment.

Priming the Sample line:

1. After priming the cleaner bag, it is recommended to flush the system and prime the sample inlet.
2. Prepare a container of clean water and submerge the sample inlet in the priming water. Another container may be used to collect the exhaust.
3. Navigate to the **Manual Operation tab**.
4. Select **Sample** in the pump selection menu.
5. Set the Flow Rate to 75 mL/min.
6. Click the **Pump Forward** button to start pumping sample into the system.
7. Click the **Stop Pumping** button when sample fills the inlet line and begins to drip from the sample injector. The line is now primed and ready for deployment.

Priming Cartridges

1. **For deployments underwater, the cartridges must be pre-filled with Milli-Q water before deployment**. This can be done in the lab with a syringe, but it is also possible to use the sampler itself by connecting the sample inlet tube temporarily to a container filled with Milli-Q water and running a mock deployment without stabilization, cleaning or flushing enabled.

Sampling

RoCSI sampling times are variable – based on a nominal flow rate of 75 mL/minute. Depending on the filter type (Sterivex™ 0.22 or 0.45 µm) as little as few hundred mL or as much as a couple of liters (if using the larger pore size in oligotrophic waters) can be achieved before clogging.

The following sections are provided to clarify RoCSI operational control and to understand limitations.

Setting the Flow Volume & Maximum Pressure

The RoCSI is designed to maximize collection of sample material while observing careful control of filter pressure generated while the filter begins to clog. As the filter clogs and generates back-pressure, the RoCSI will modulate the flow rate in order to operate at or below the specified maximum filter pressure. The RoCSI will continue to slow the flow rate as the filter clogs until the user-defined minimum flow rate is reached, at which point sample collection is terminated and the stabilization step is performed.

If maximum collection of sample material is the goal, then set a lower flow rate as the minimum flow rate. This will allow the system to throttle the sample pump to it's slowest rate while maintaining a constant pressure at the filter.

Setting a lower flow rate may significantly extend collection time. Careful attention should be made to event time limits of if scheduling and accurate timing are important to the mission.

Alternatively, if rapid collection and termination of events is the goal, then a higher minimum flow rate should be set. 50 to 60 mL/min is usually sufficient to allow satisfactory sample collection without extending collection times significantly.

Pressure at the filter is one of the most important factors for successful sample collection without damaging cells or biology. Typically, an upper threshold of 10 to 15 psi is appropriate to protect the filter and sample material from damage.

Sample volume will be dictated by filter clogging and is highly variable depending on the sample environment. Additionally, finer pore 0.22 um filters will be able to process less water than the 0.45 um variant, so careful attention should be paid to filter selection based on mission objectives. Typical sample volumes may range from a few hundred mL to multiple liters.

Configuring Stabilization & Cleaning

RoCSI may be configured to pump a cleaning fluid, such as 2.5% bleach, through the sample intake in order to prevent cross contamination and biofouling of the inlet. The waste cleaning fluid can either be released to the environment via the sample injector, or pumped through a cartridge into the waste outlet, consuming a sample cartridge. Cleaning and flushing behavior is set on an individual event basis using the scheduler.

The scheduler uses a concept of "**event types**" for defining RoCSI sample collection events. The scheduler offers three event types.

- If programming a standard event, cleaning fluid (and sample flush) is ejected to the environment via the sample injector, and sample water is used to flush the intake line prior to collecting a sample.
- If programming a sacrificial flush event, then cleaning fluid and flushing water are recovered to the exhaust via a cartridge. This expels a cartridge and it will not be able to be used for sample collection.
- If programming a negative control event, no intake cleaning, flushing, or sample collection takes place. Only stabilizer is applied to the cartridge.

Stabilization application is performed using a dedicated stabilizer pump running at a fixed flow rate. Depending on the loading condition of the filter, the effective flow rate may be reduced. For this reason, it is recommended that the user confirm the application time is sufficient to fully saturate the filter and fill the cartridge with stabilizer. For most applications, a stabilization time of 4 to 6 seconds will be appropriate.

Configuring the Sample Schedule

The scheduler is used to define deployments and contains controls for individual event types and parameters.

The RoCSI eDNA sampler has scalable sample capacity based on a modular, expandable sample chain. Each “link” in the chain comprises a sample cartridge and clip, with each cartridge representing a single discrete sample, flushing event or negative control. The current maximum sample capacity is limited to 48 cartridges. It is critical that the number of programmed events is equal to the number of available cartridges in the chain.

There are a few rules that the sample scheduler follows that the user should be aware of.

- Event timing: if a sample event is still running when the next event is scheduled to occur, the RoCSI will allow the current event to finish before immediately starting the next event. If this is of concern, a schedule should be designed with event timeouts that limit collection so as to not interfere with the next event.
- Warnings are generated if the schedule contains events in the past, but this does not prevent deployment. Upon deployment, these events will run immediately.
- Setting a time limit of zero disables the time limit for an individual event. In this case, the event will only terminate on low flow rate, or volume reached.

Deployment Exit Conditions

Deployment exit conditions (pressure, time and flow) are critical to understand for maintaining sample viability, and designing successful missions.

Setting the over-pressure threshold to 10 to 15 psi is recommended, as higher thresholds can damage biology in the the sample.

Sample Viability

Deployment duration is limited by the efficiency of sample preservative over time. For example, typical deployments with RNAlater™ may be limited to a couple months or shorter depending on environmental temperature. Longer deployments may not return viable samples due to preservative longevity/effectiveness. Preservatives that offer longer term sample viability should be tested and confirmed by the user.

The RoCSI system is highly configurable to accommodate diverse sampling regimes and strategies. Achievable sample volume will be dictated by the porosity of the filter, the environmental conditions of the deployment and the maximum allowable filter pressure. RoCSI is capable of sampling and filter loading up to 30 psi, though 10 to 15 psi is recommended for most applications in order to protect the filter material or biology.

RoCSI may terminate a sample based on the filter pressure (via a low flow rate condition), a sample timeout, or target volume reached. It is important for the user to understand the balance between filter pressure, target volume and flow rate when designing a sampling regime. Additionally, careful attention should be paid to filter loading and expected downstream processing requirements.

Sample Time Outs

A sample timeout allows for an "emergency stop" of the sample if it has not terminated under normal conditions and is running longer than expected. Even if a sample times out, stabilization will still be attempted on that sample. It may be desirable to design a sampling schedule with timeouts that ensure events do not overlap and/or delay subsequent events if timing is critical.

Advanced Software Settings

RoCSI is shipped with sensors calibrated and configured at the factory and do not typically require changes.

This section is provided to help make repairs or alterations during a deployment if necessary.

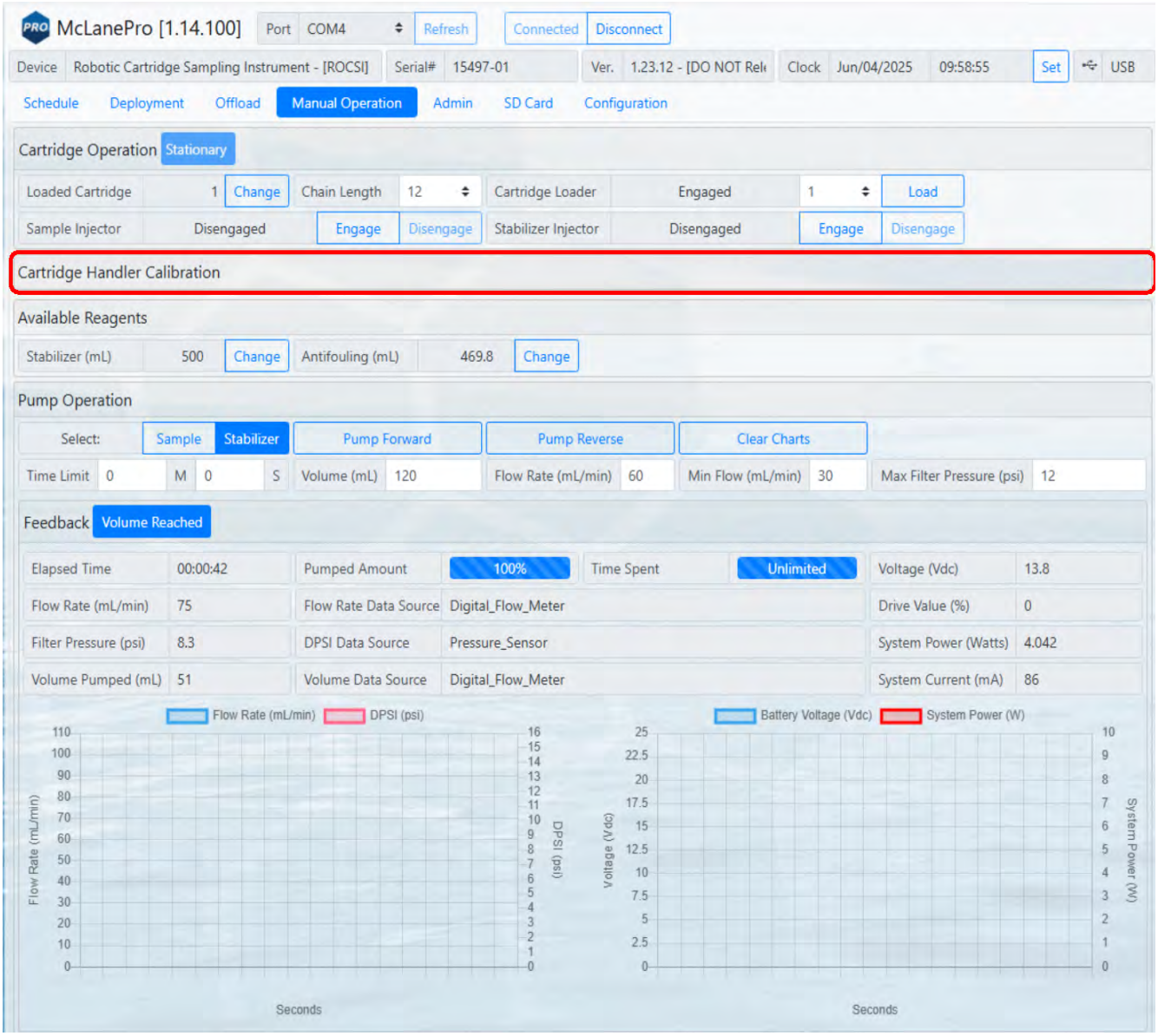
The **controls provided on the calibration panel** simply start and stop the requested motor. The motor will not stop automatically and there are no interlocks. It is the user's responsibility to ensure that the requested motor can be operated safely (for example making sure the injector nozzles are disengaged from the cartridge before attempting to rotate the cartridge loader).

These settings should only be adjusted if the RoCSI is not performing optimally, or during troubleshooting. Factory settings are generally appropriate and long lasting.

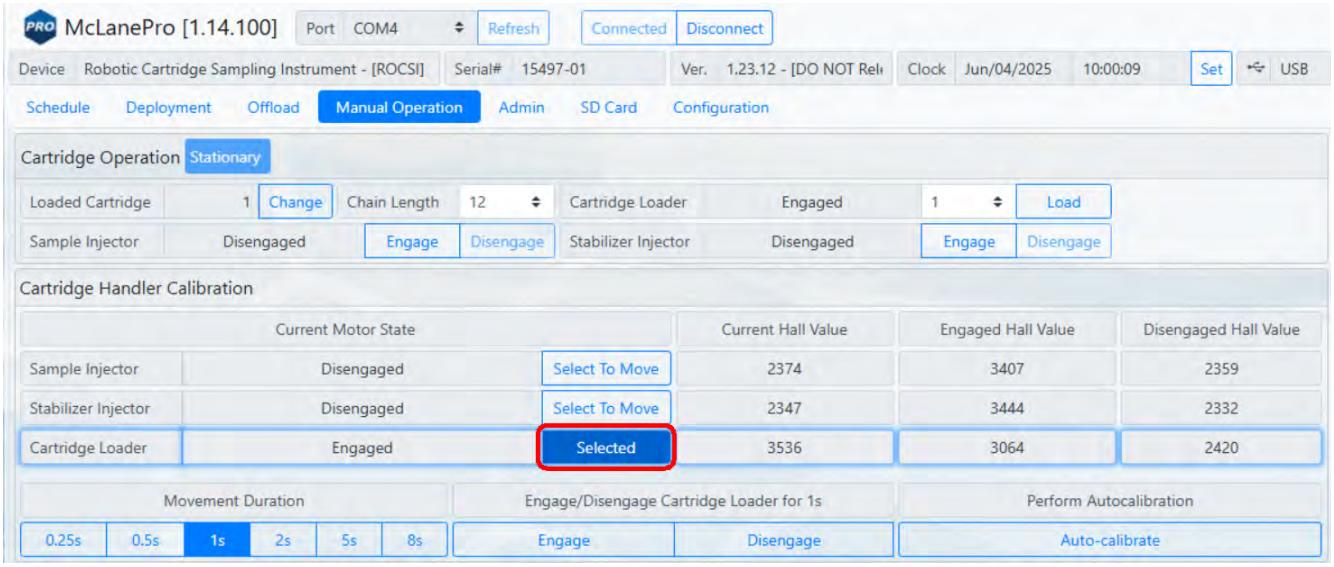
Calibrating the Cartridge Loader

Cartridge loader positioning is performed using a magnet and hall sensor combination. For every complete turn of the index wheel, the cartridge loader will advance one position. If the loader is generating errors or losing track of the current position, then calibration may be necessary.

To calibrate the cartridge loader, click on the Cartridge Handler Calibration panel to expand it.

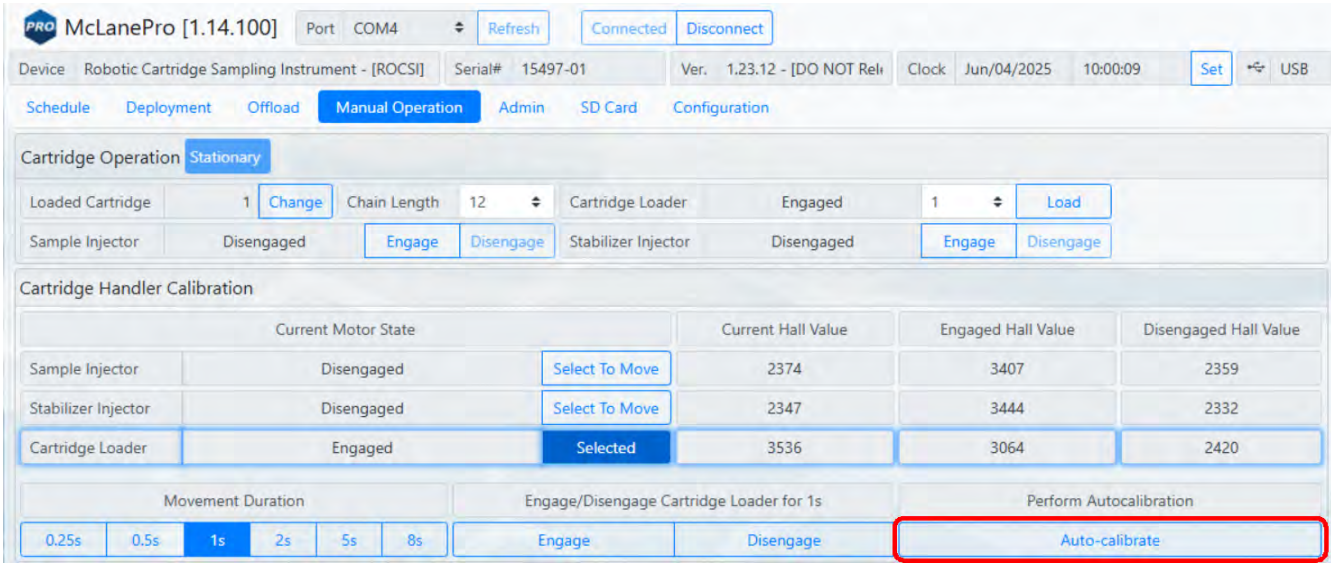


Select the Cartridge Loader by clicking on the **Select to Move** button.



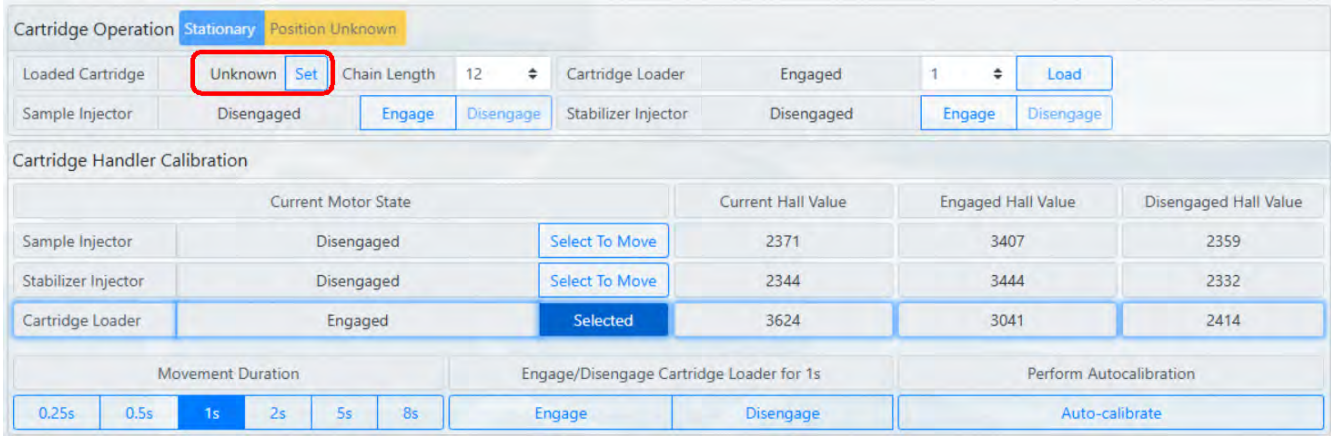
Ensure that the injectors are open and clear of any cartridges that could collide if the cartridge loaded is rotated. Auto-calibration may be performed with or without a cartridge chain installed.

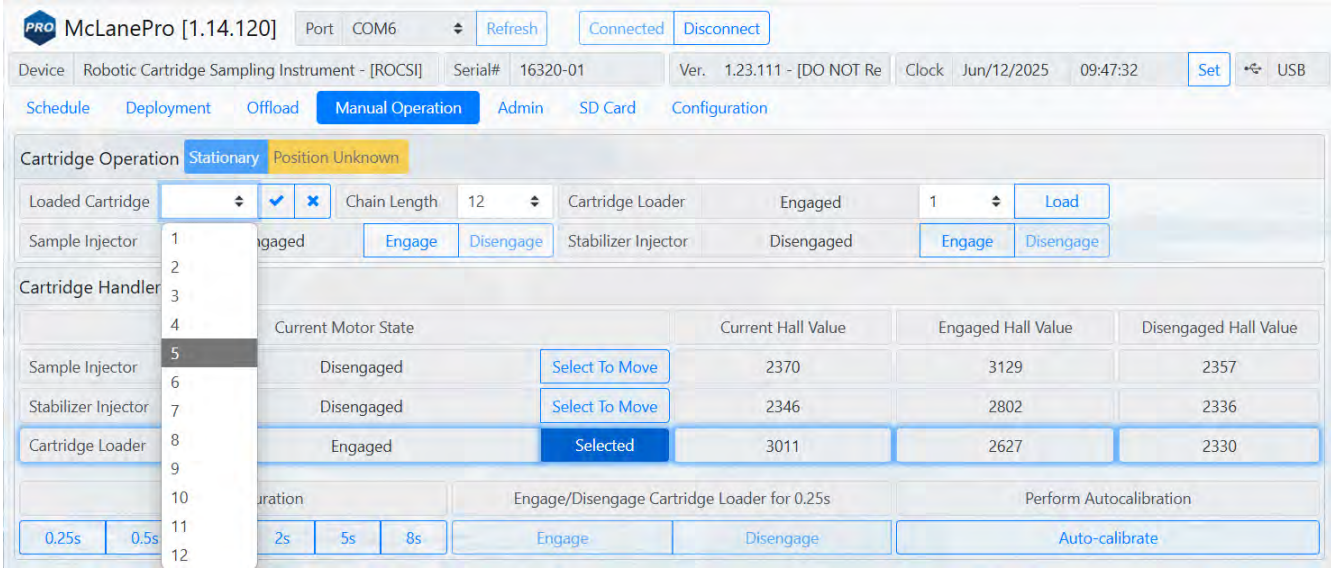
Click **Auto-calibrate** to begin the calibration sequence for the cartridge loader. The loader will advance 4 to 5 positions while calibrating.

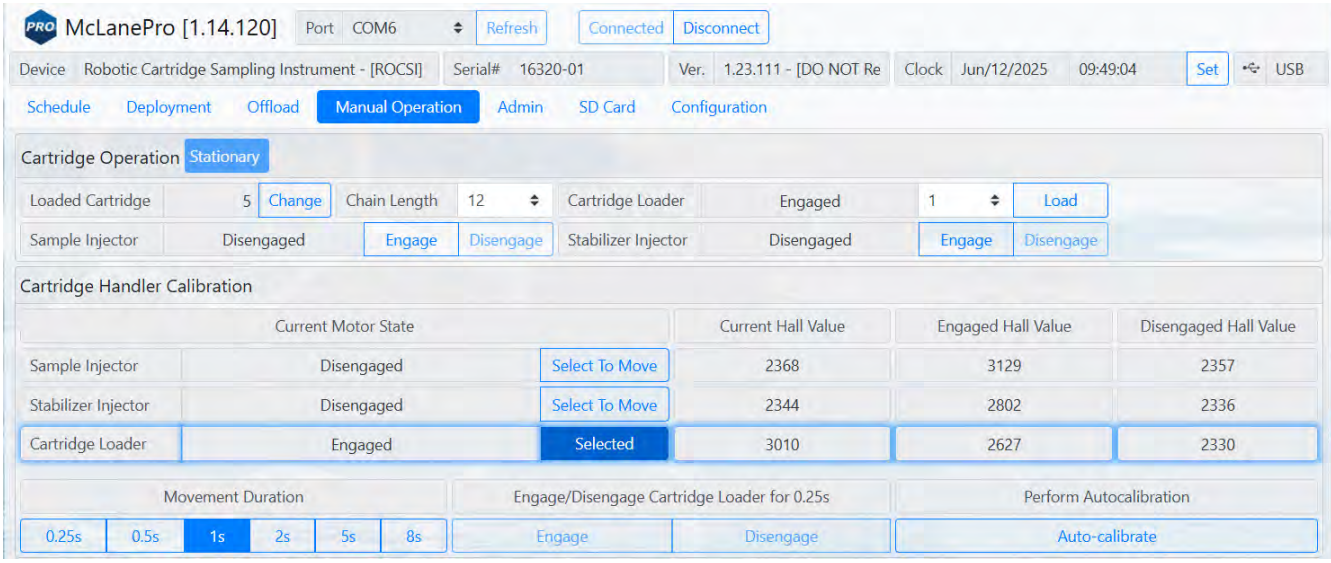


When the calibration routine is complete, the position of the cartridges will be unknown and must be reset.

Click **Set** to specify the currently loaded cartridge.





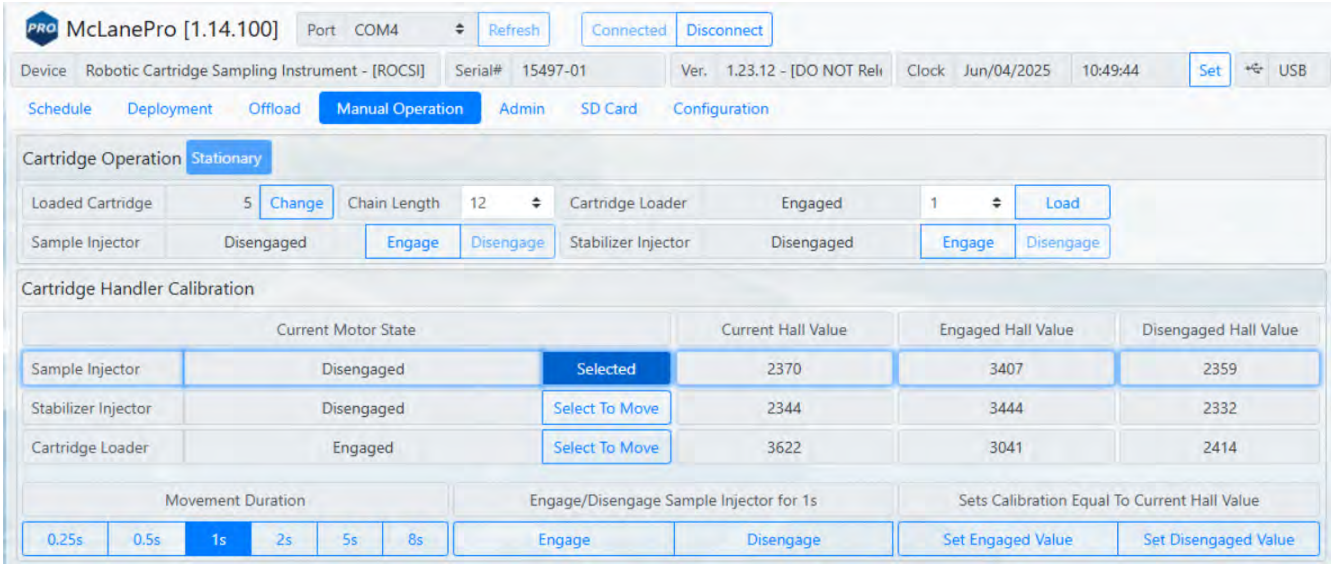


Calibrating the Injectors

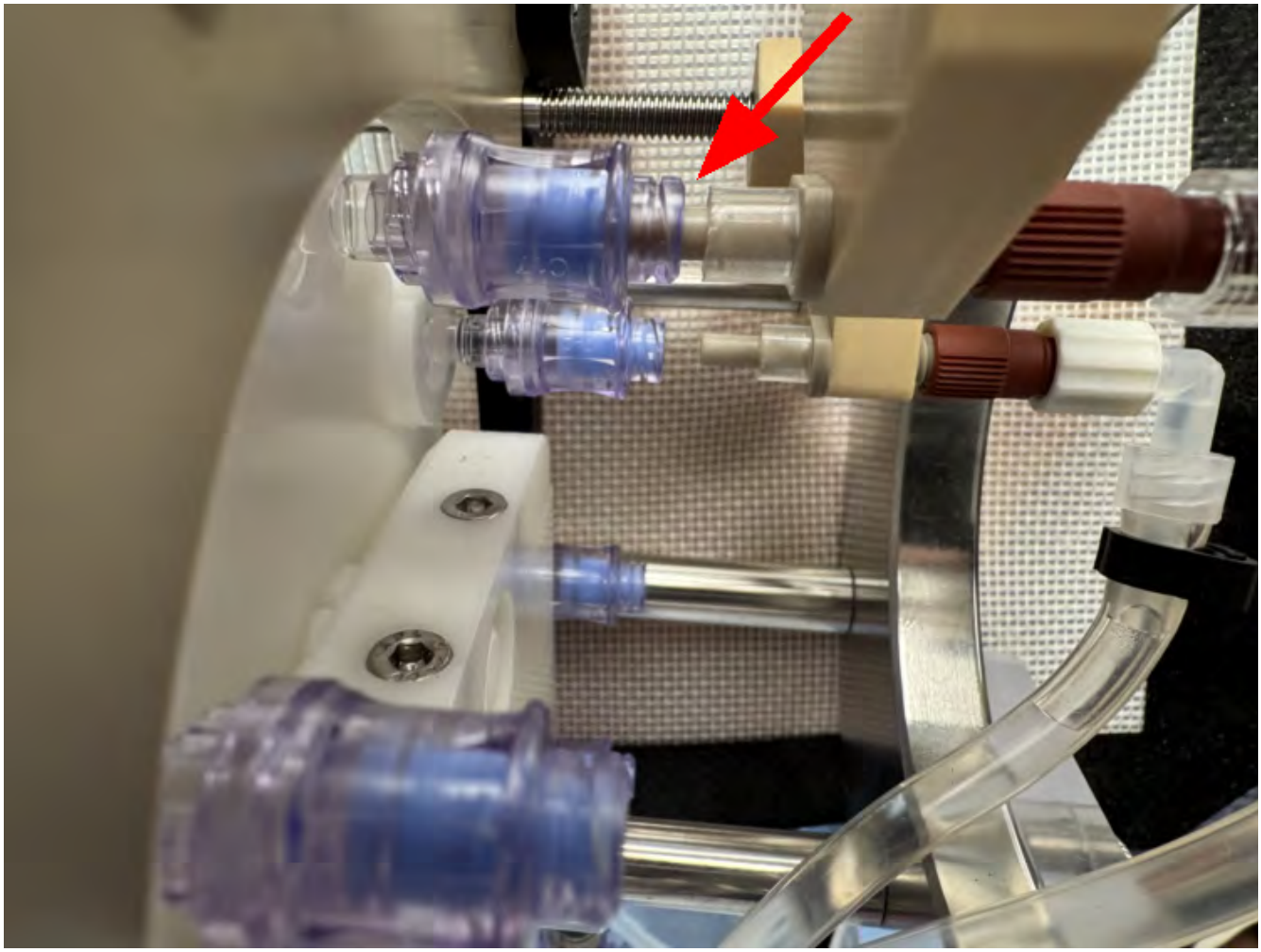
The motors that control the sample and stabilizer injectors use magnet and Hall effect sensor pairs to determine when they have reached their engaged or disengaged position. To calibrate these positions, manual controls are provided to move in small, timed increments in order to engage the injectors and record the position. Once the cartridge loader has been calibrated, the injectors may be calibrated next.

Sample Injector

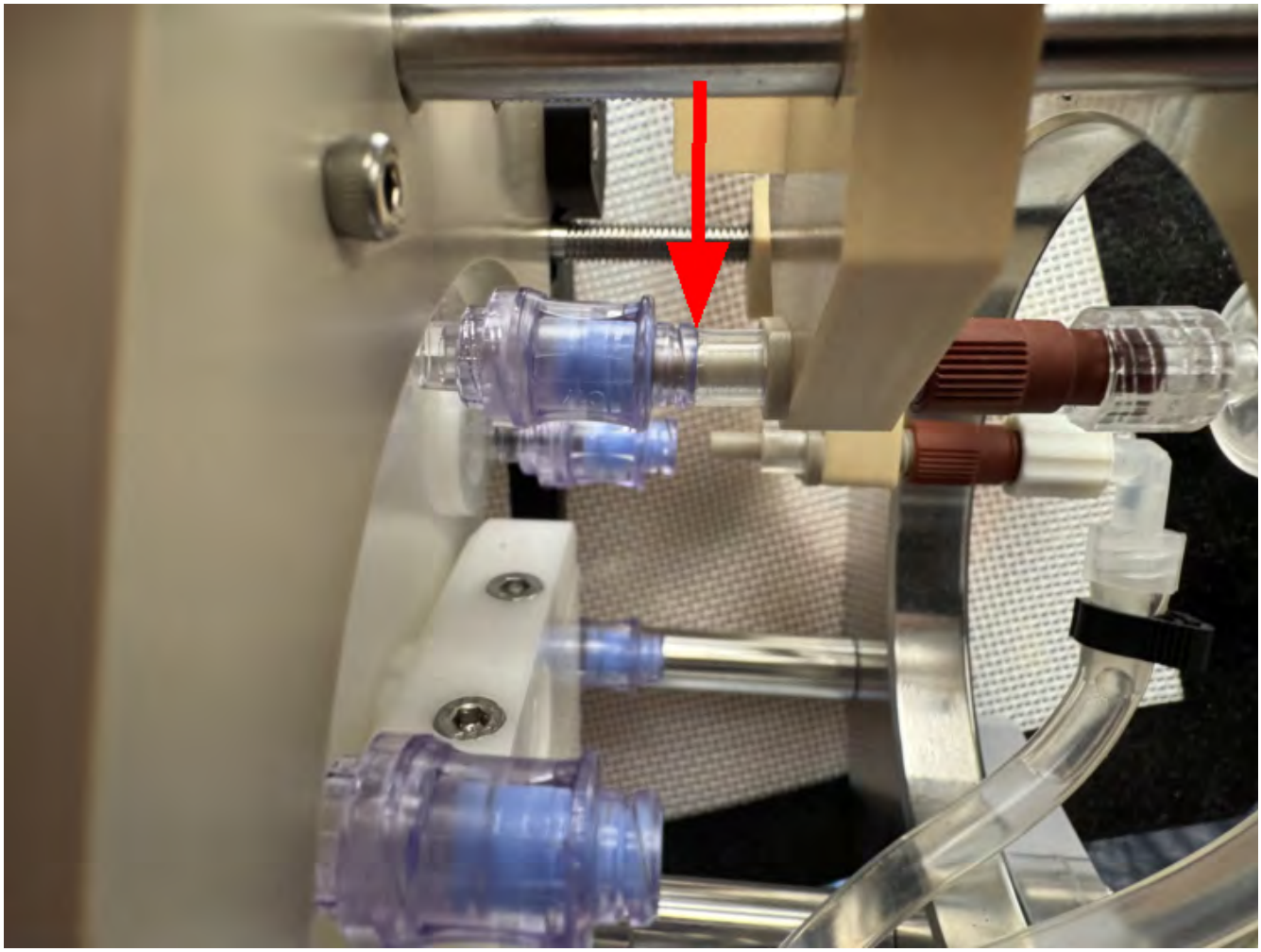
1. To calibrate the sample injector, first, find a safe disengaged position. This should be a position that places each injector nozzle far away from the cartridges to avoid collisions.
2. First, select the Sample Injector in the Cartridge Handler Calibration panel.
3. Set the movement duration to 1 second.



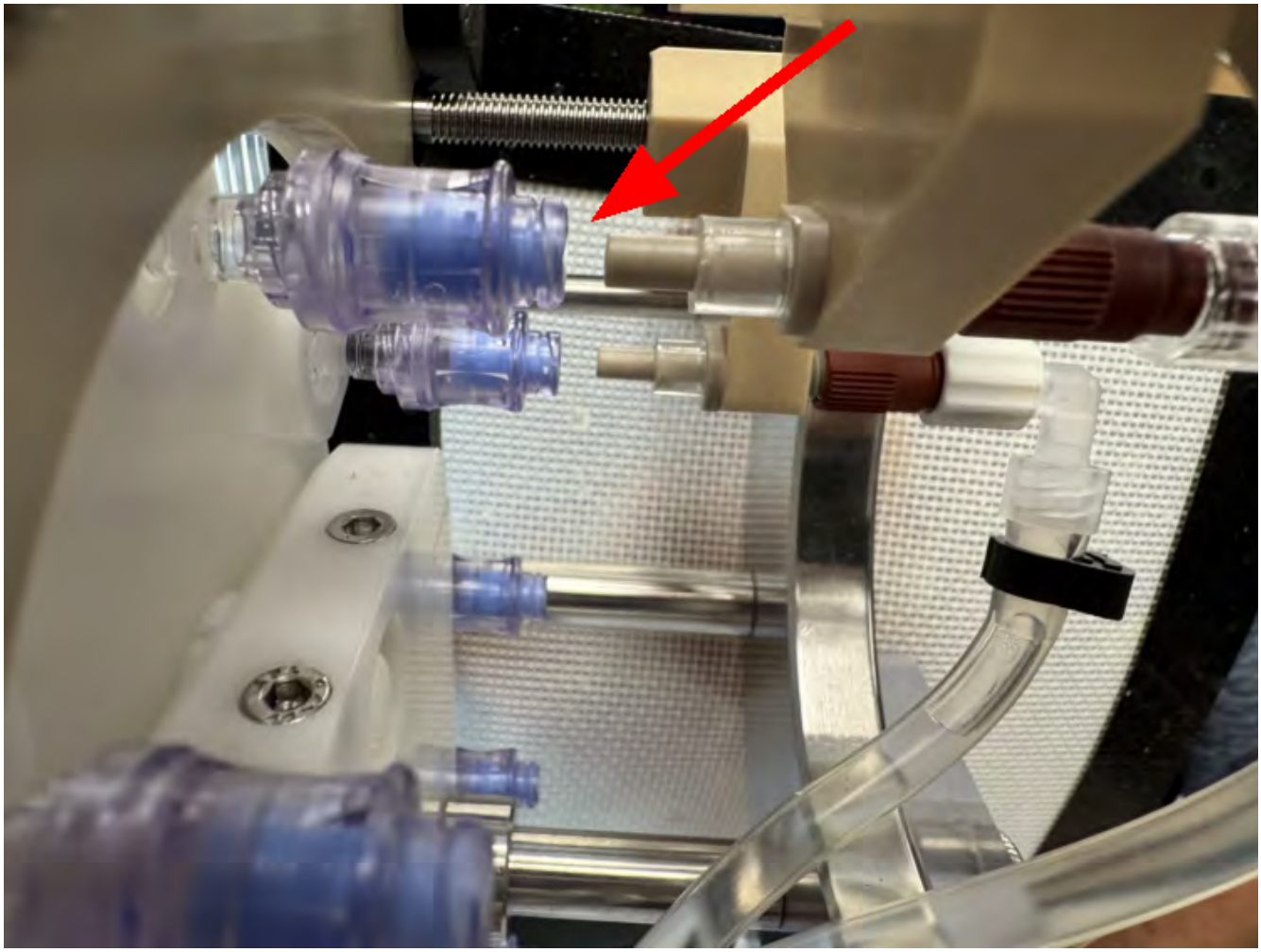
4. Click **Disengage** to move the injectors away from the center (for one second). Keep pressing **disengage** until one of the injector blocks is approximately 2 mm away from the driven hub or 2 mm from the end plate.
5. Click **Set Disengaged Value**. This will assign this position as disengaged.
6. Load a cartridge into the RoCSI and advance it to the sample injector position.
    1. Confirm that the cartridge is of the correct length using the cartridge measurement gauge.
7. Select the Sample Injector in the Cartridge Handler Calibration panel.
8. Set the movement duration to 1 second.
9. Click **Engage** to move the injectors toward the cartridge. Keep clicking **engage** until the nozzles begin to enter the needle-free valves on the end of the sample cartridge.



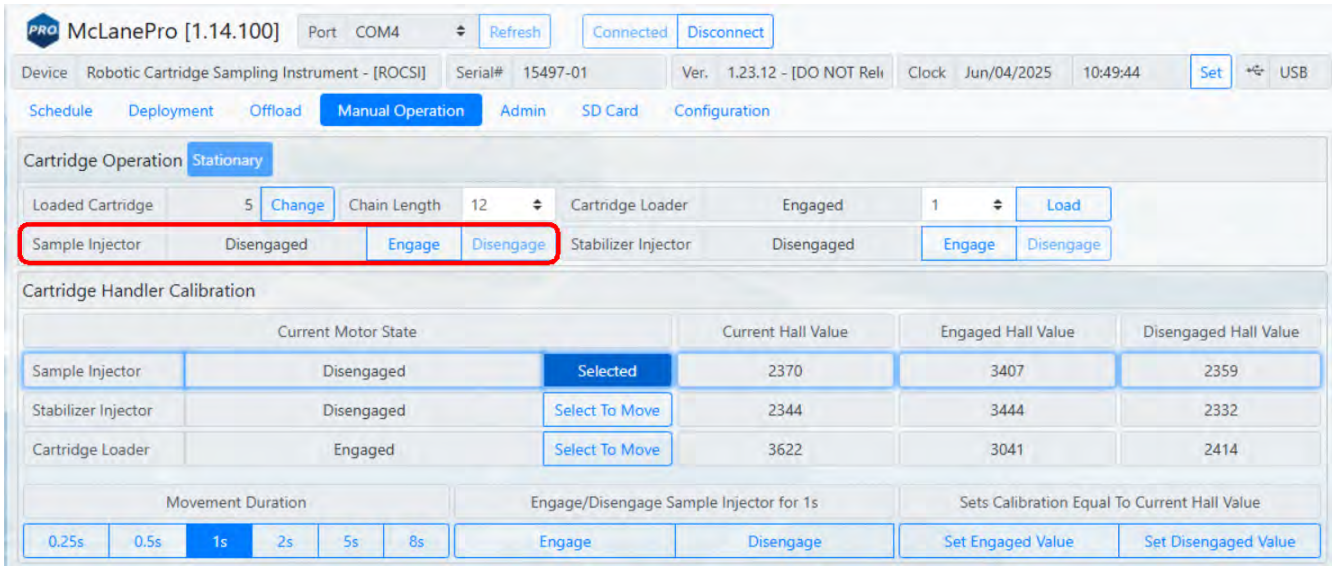
10. Now set the movement duration to 0.25 seconds.
11. Click **Engage** to move the injectors toward the cartridge. Keep clicking **engage** until the nozzles fully engage the needle-free valves on the end of the sample cartridge. There should be no remaining gap between the cartridge and the rubber stopper collar on the injector nozzle.



12. Click **Set Engaged Value**. This will assign this position as engaged.
13. Set the movement duration to 1 second.
14. Click **Disengage** to move the injectors away from the center. Keep pressing **disengage** until the injectors begin to exit the needle-free valves.
15. Now set the movement duration to 0.25 seconds.
16. Click **Disengage** to move the injectors away from the center. Keep pressing **disengage** until each injector nozzle is approximately 3 mm away from the cartridge needle-free valve.



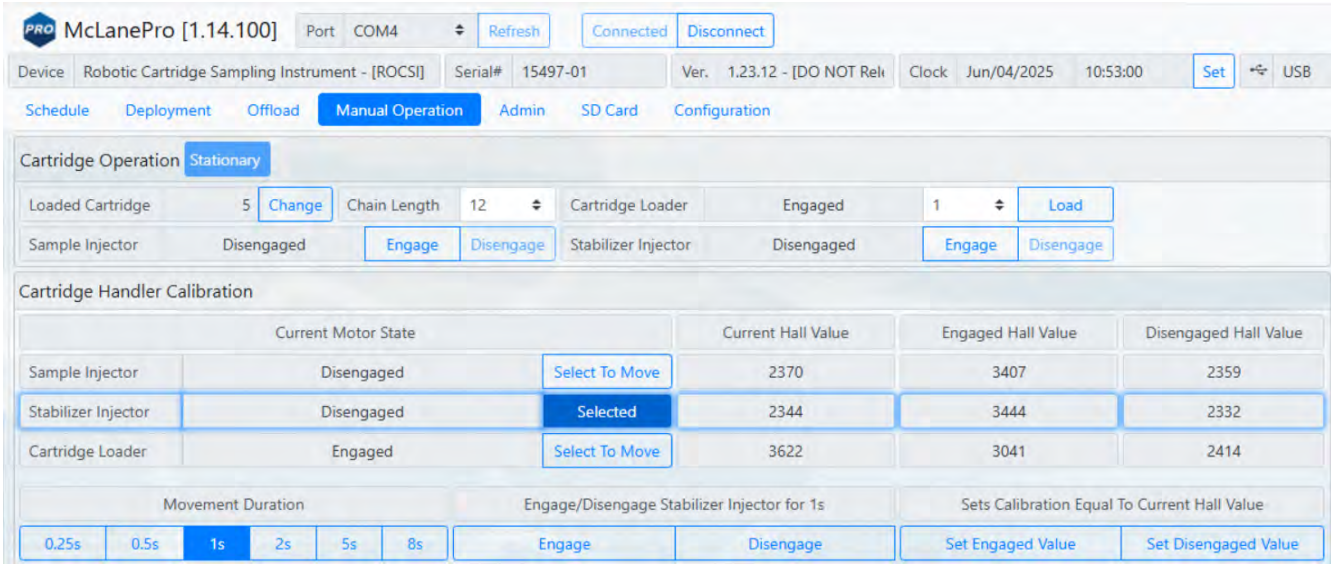
17. Click **Set Disengaged Value**. This will assign this position as disengaged.
18. To check the positions, click **Engage** in the Cartridge Operation panel. The sample injector should fully engage the cartridge without straining the motor and without leaving any gaps between the needle-free valve and the rubber collar.



19. Check the disengaged position by clicking **Disengage** on the Cartridge Operation panel. The nozzles should stop approximately 3 mm from the cartridge.

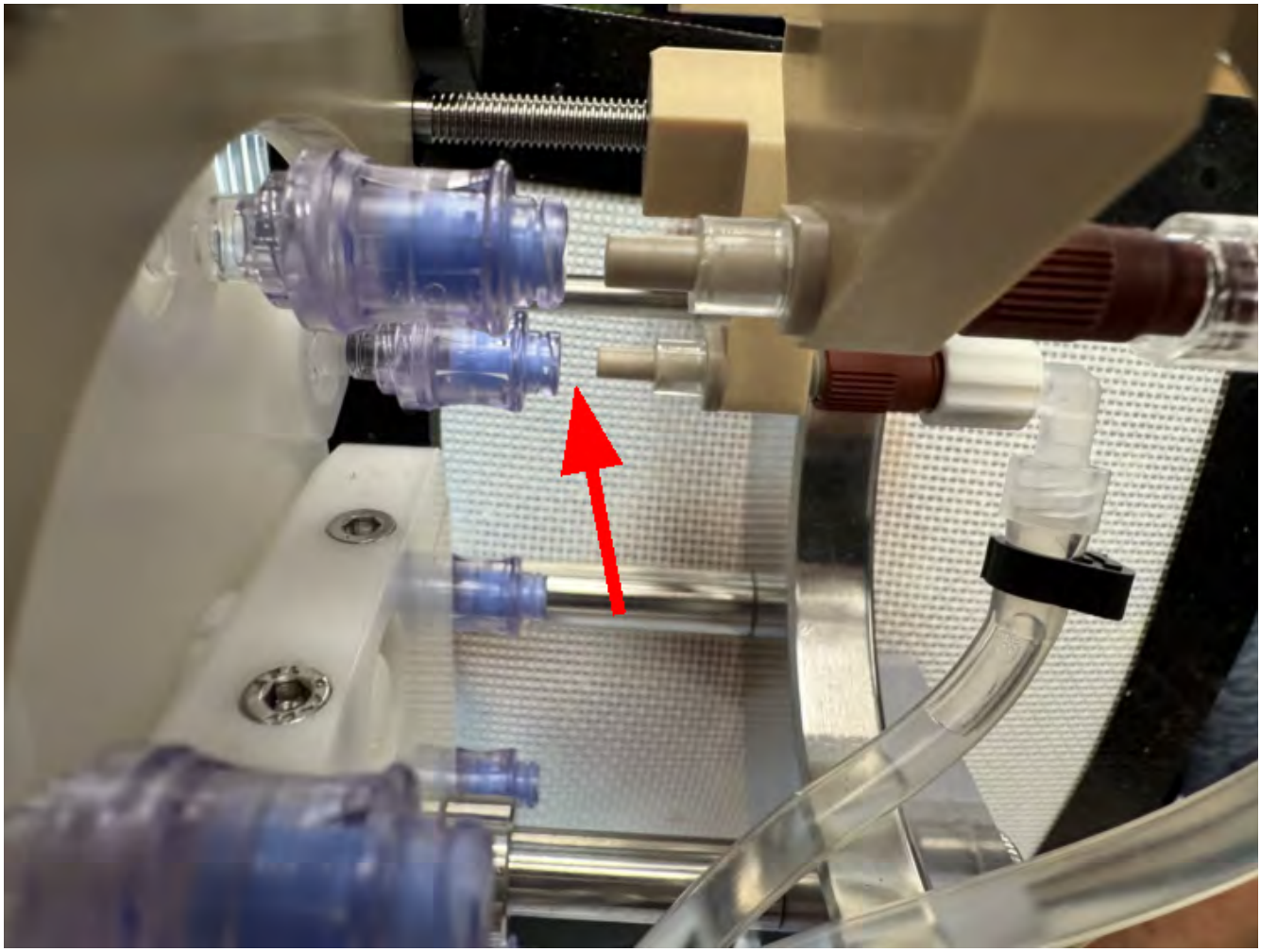
Stabilizer Injector

1. To calibrate the stabilizer injector, first find a safe disengaged position. This should be a position that places each injector nozzle far away from the cartridges to avoid collisions.
2. First, select the Stabilizer Injector in the Cartridge Handler Calibration panel.
3. Set the movement duration to 1 second.

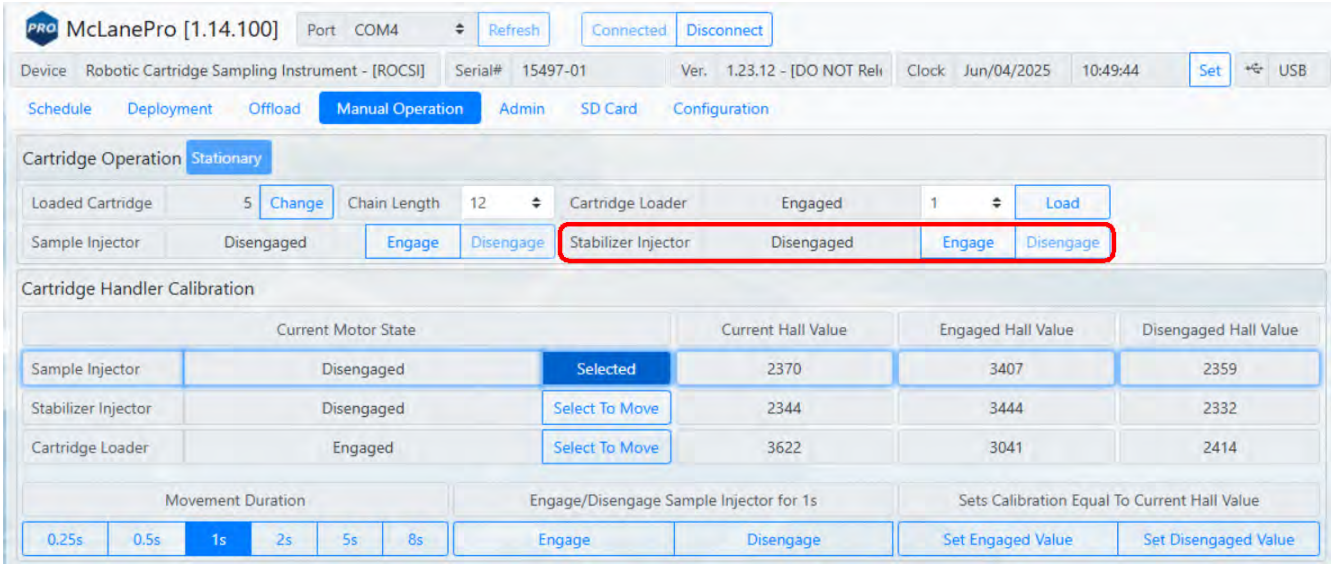


4. Click **Disengage** to move the injectors away from the center (for one second). Keep pressing **disengage** until one of the injector blocks is approximately 2 mm away from the driven hub or 2 mm from the end plate.
5. Click **Set Disengaged Value**. This will assign this position as disengaged.
6. Load a cartridge into the RoCSI and advance it to the stabilizer injector position.
    1. Confirm that the cartridge is of the correct length using the cartridge measurement gauge.
7. Select the Stabilizer Injector in the Cartridge Handler Calibration panel.
8. Set the movement duration to 1 second.
9. Click **Engage** to move the injectors toward the cartridge. Keep clicking **engage** until the nozzles begin to enter the needle-free valves on the end of the sample cartridge.
10. Now set the movement duration to 0.25 seconds.
11. Click **Engage** to move the injectors toward the cartridge. Keep clicking **engage** until the nozzles fully engage the needle-free valves on the end of the sample cartridge. There should be no remaining gap between the cartridge and the rubber stopper collar on the injector nozzle.

12. Click **Set Engaged Value**. This will assign this position as engaged.
13. Set the movement duration to 1 second.
14. Click **disengage** to move the injectors away from the center. Keep pressing **disengage** until the injectors begin to exit the needle-free valves.
15. Now set the movement duration to 0.25 seconds.
16. Click **disengage** to move the injectors away from the center. Keep pressing **disengage** until each injector nozzle is approximately 3 mm away from the cartridge needle-free valve.



17. Click **Set Disengaged Value**. This will assign this position as disengaged.
18. To check the positions, click **Engage** in the Cartridge Operation panel. The stabilizer injector should fully engage the cartridge without straining the motor and without leaving any gaps between the needle-free valve and the rubber collar.



19. Check the disengaged position by clicking **Disengage** on the Cartridge Operation panel. The nozzles should stop approximately 3 mm from the cartridge.

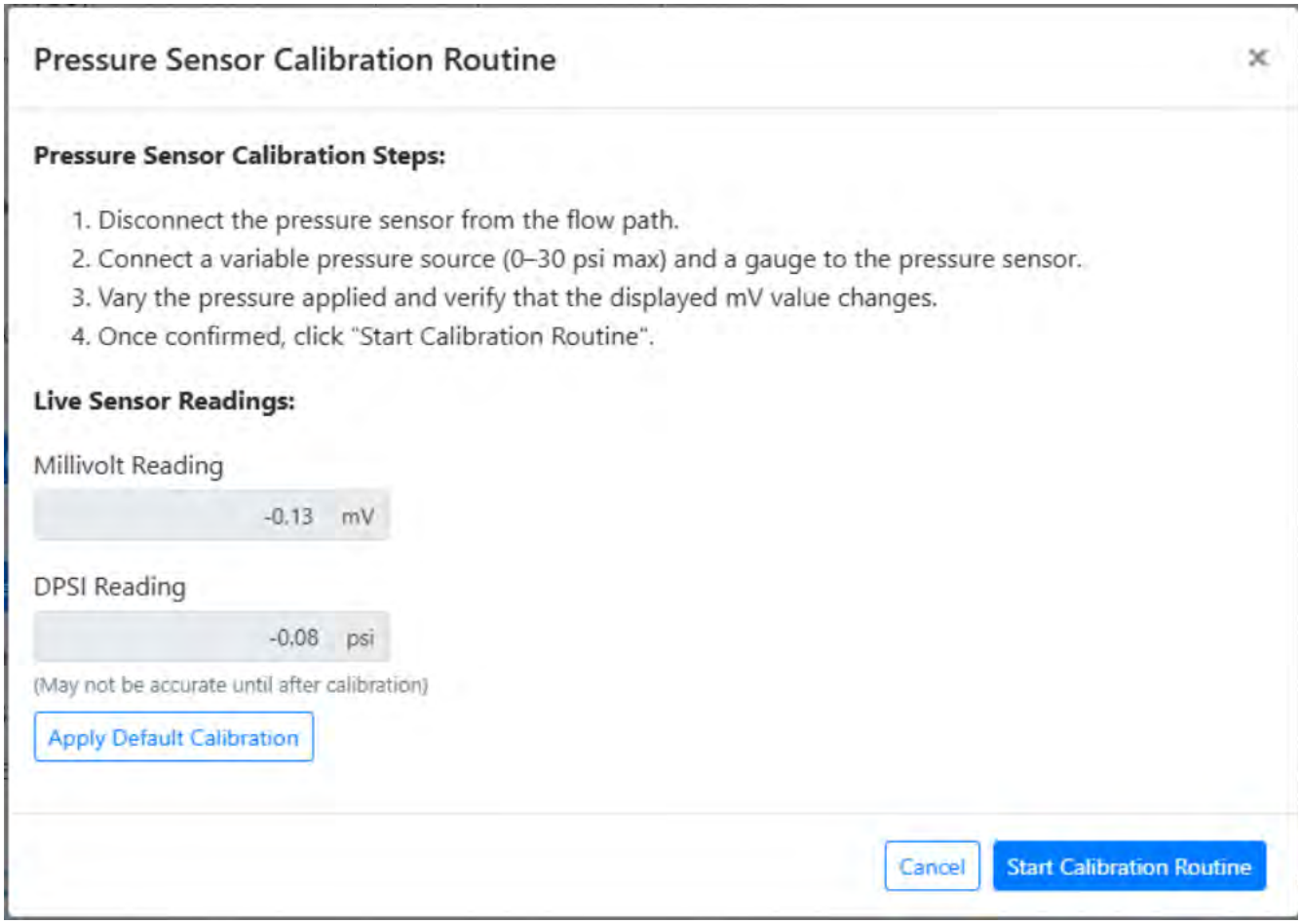
Calibrating the Pressure Sensor

Click **Calibrate** to launch the calibration window.

The Pressure Sensor Calibration Routine window allows for a live reading of the sensor's millivolt output as well as it's calibrated pressure reading (DPSI).

Applying pressure to the sensor inlet should increase both mV and psi.

The pressure sensor is rated for 30 psi. The sensor will become damaged and unusable if exposed to pressure greater than 60 psi.



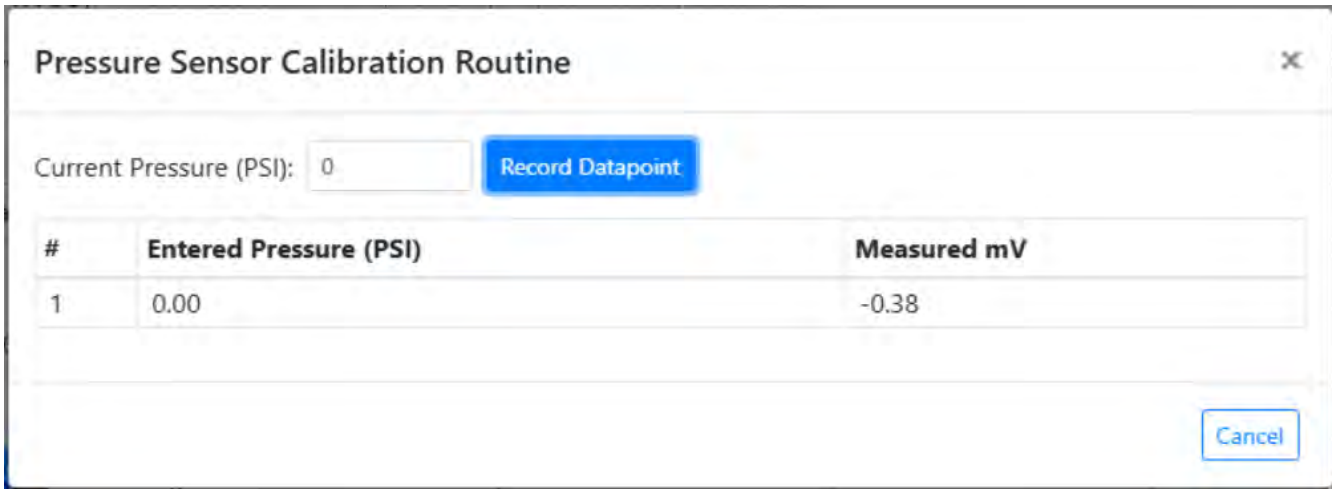
Connect a water-filled syringe (or other reliable pressure source) and a reference pressure sensor to the positive side of the pressure sensor only. A handheld pressure calibration device is used at the factory. If a retort stand is available this is a more convenient way to maintain steady pressures with the syringe than by hand. Do not apply pressure with a syringe without the reference pressure sensor attached because one can easily exceed 30 psi even by hand **(the pressure sensor will be damaged beyond 60 psi)**.

To capture the calibration points follow these steps:

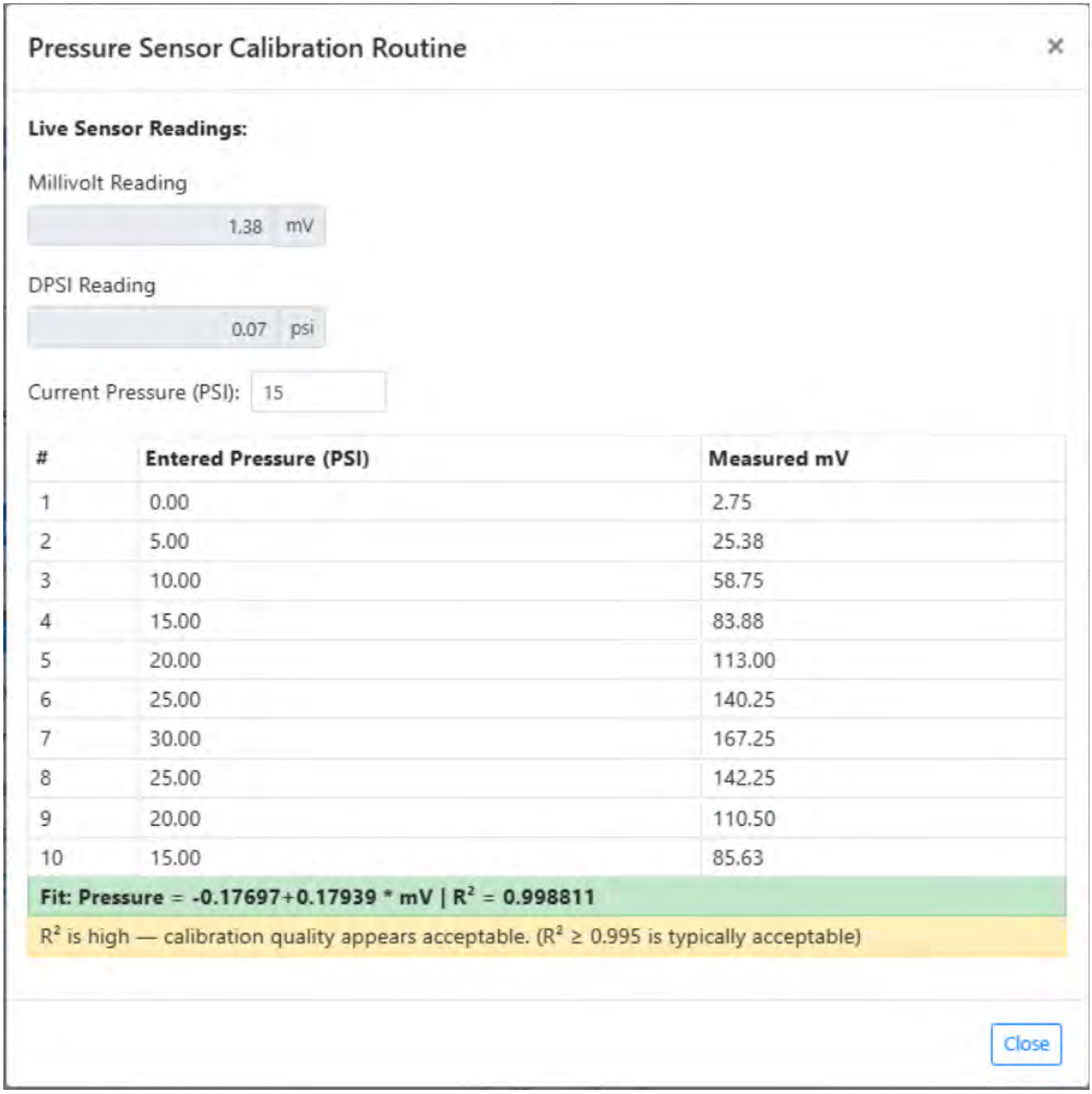
1. Navigate to the Manual Operation tab. Click calibrate on the Pressure Sensor Calibration panel.
2. A new window is opened with the live readout of the pressure sensor mV and calibrated output indicated.
3. Apply the pressure at roughly equal intervals from 0 to 30 psi. It is recommended to capture at least 4 to 5 points in ascending and then descending order. The routine is limited to 10 calibration points.
    a. For example, calibrate at 0, 7, 15 , 22 , 30 , 22, 15, 7, 0 psi for an accurate calibration.
4. Enter the corresponding reference pressure manually and press **Record Datapoint** to

capture each point in turn from the sampler's pressure sensor.

5. Click **Process Calibration** when you are done.



6. The RoCSI will apply the calibration and provide a live sensor reading.



6. Test the calibration by applying a pressure and observing the Live Sensor Readings. Compare these readings with the reference sensor. Typically an accuracy of +/- 1 psi is acceptable.

Calibrating the Flow Meter

To perform calibration of the flow meter; first prepare a cartridge with a new Sterivex filter installed. A graduated cylinder or micro-gram scale is necessary to measure the volume pumped for calibration purposes.

1. Load the cartridge into the RoCSI and advance it to the sample position.

2. Using controls on the **Manual Operation** tab, **Engage** the sample injector.

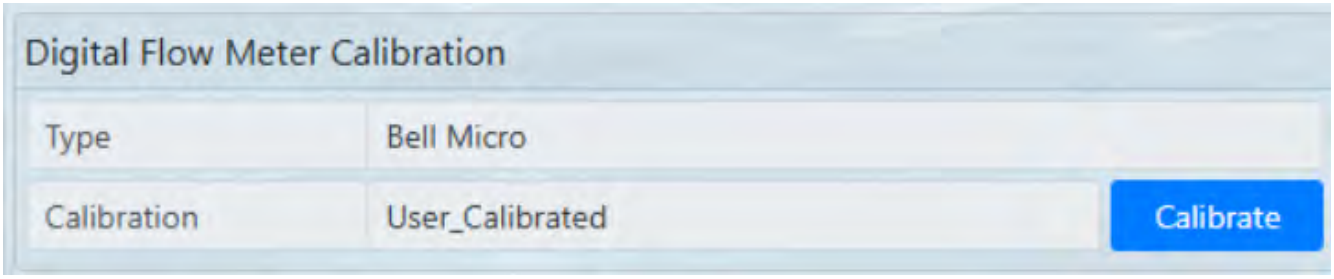
3. Put the RoCSI's intake line into a container of clean water. 500 mL or more of water is recommended.

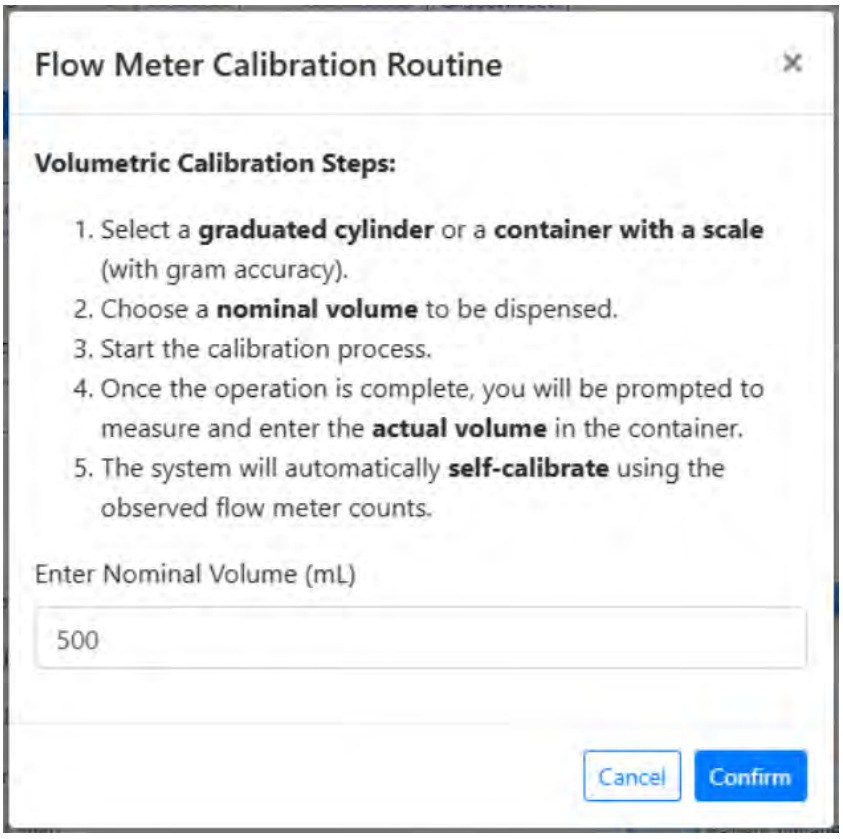
4. Put the RoCSI's exhaust line into the graduated cylinder (or into a container on a scale).

5. Briefly pump forward to prime the lines up to the graduated cylinder. Stop pumping when the line is primed.

6. Empty any water collected in the graduated cylinder and replace the exhaust tube into the cylinder.

7. Click the **Calibrate** button on the Digital Flow Meter Calibration panel. This will launch a window with instructions for calibration.

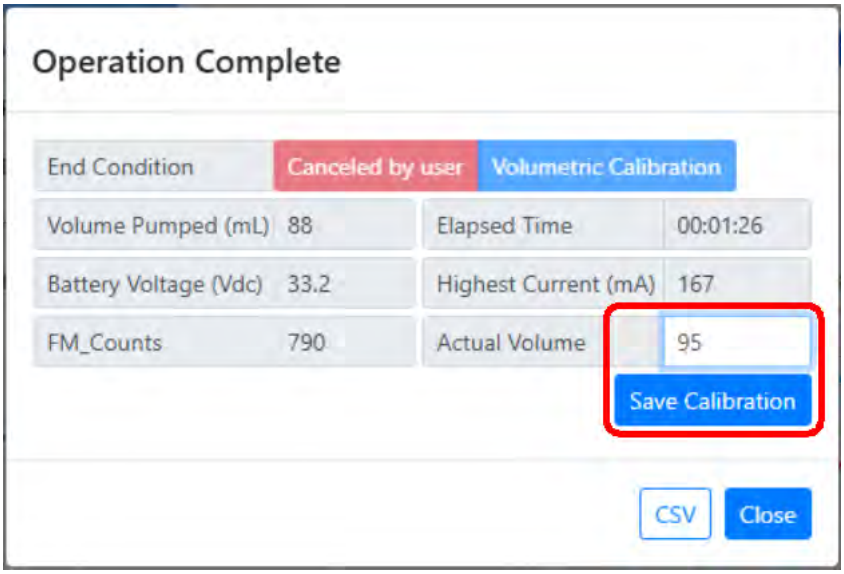




7. Define a volume to collect during calibration. At least 500 mL is recommended.

8. Proceed with the calibration test and record the volume pumped; enter it when prompted at the end of the test.

9. Click **Save Calibration** to calculate the calibration value and apply it to the RoCSI.



Recovery and Data Offload

Following a completed deployment, the RoCSI must be recovered and samples removed as soon as is practically possible. Care should be taken to avoid leaving the RoCSI in direct sunlight or exposed to extremely high temperatures.

Recovery

Whether installed in a vehicle, on an installation, or mooring; the RoCSI samples should be retrieved as soon as possible to prevent any unnecessary degradation of genetic material. In most scenarios, the entire chain is removed from the RoCSI and brought to a separate clean area for processing of the filter capsules.

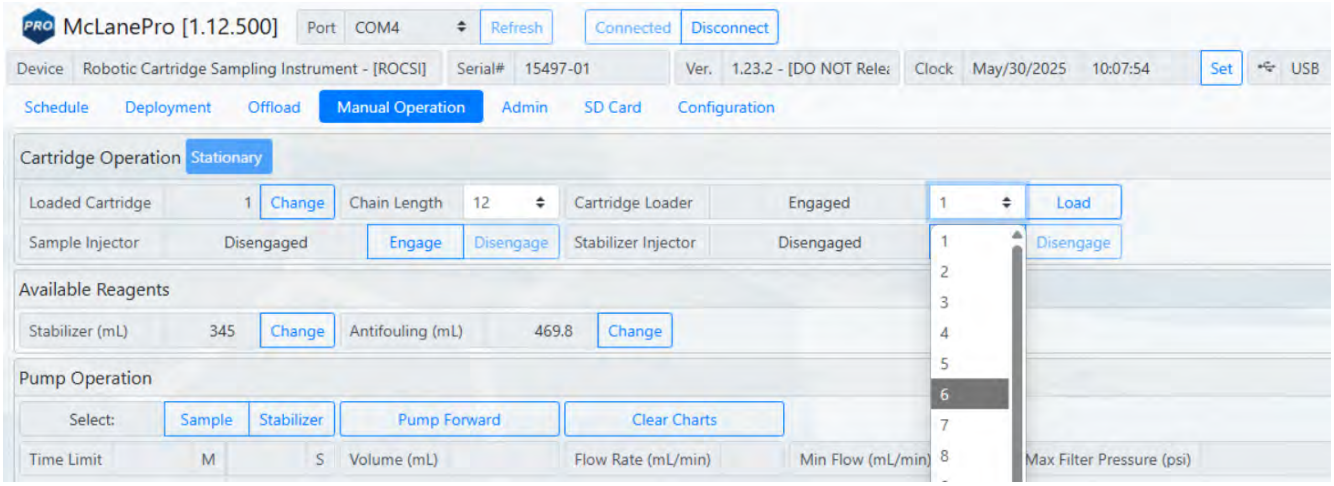
Unloading the Cartridge Chain

Cartridges containing sample filters should be recovered and stored as soon as possible to avoid any sample degradation.

Unloading the Sterivex™ filter units from the **cartridge chain** uses the same functions as loading the chain.

The cartridge chain must be supported by hand when unloading.

1. Ensure the 12 Vdc supply is turned on and McLanePro is running.
2. Navigate to the **Manual Operation** tab.
3. Set the **Cartridge Loader** drop down to '6'.



4. Disconnect the link from between the two lowest cartridges in the chain.

6. The magazine loader will be advanced (by clicking Load) until the sample chain is free of the mechanism. Please note that the weight of the chain must be supported while advancing the loading magazine. If not supported, there is a chance the drive mechanism may become jammed.
7. While supporting the weight of the chain as it is unloaded, advance the loader until the chain is removed from the loader mechanism.

Data Offload

Data should be offloaded from the RoCSI as soon as possible after recovery. RoCSI will retain previous deployment records as a backup, but care should be taken to offload, catalog, and archive the deployment data in a safe location. Deployment data will provide important context for any subsequent genetic analyses performed on physical samples recovered.

See the section on the Offload tab for details on downloading and archiving deployment data.

RoCSI 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:

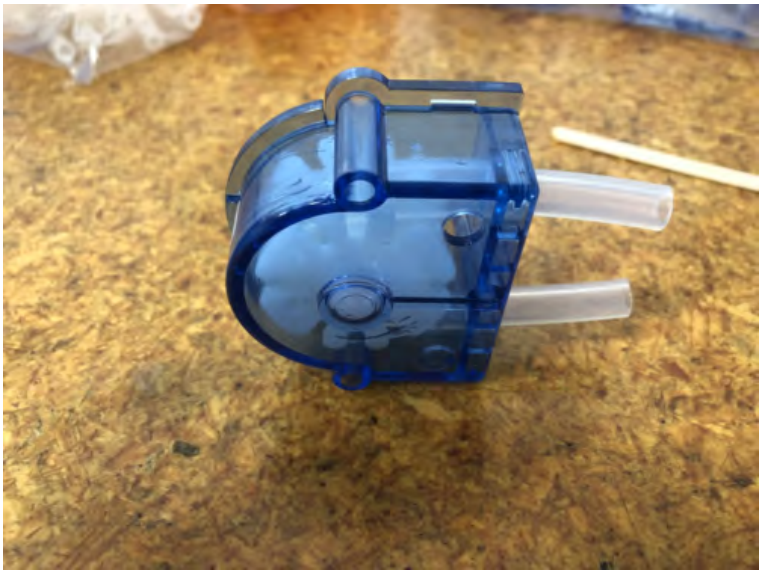
- Thoroughly rinse the instrument.
- Flush and purge all fluid lines of water.
- Reuse the shipping crate for storage and transport.

RoCSI Maintenance & Storage topics
Storage and Transport

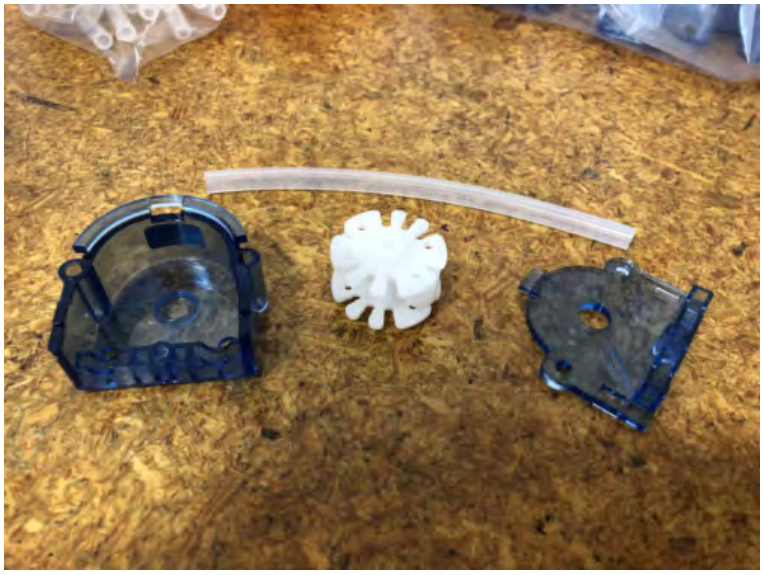
Changing Peristaltic Tubing

Spare peristaltic tubing is included in the toolkit. Follow these steps to remove/disassemble the pumps for tubing replacement.

1. First, disconnect the tubing from the intake and exhaust of the pump that requires service.
2. Remove the two screws that secure the pump head to the pump mount. Set the screws aside for reuse.
3. Gently pull the pump head straight off of the mount and drive shaft.



4. Separate the two halves of the pump housing. They are clipped together.



5. Remove the used tubing from the pump and disconnect any fittings that will be reused.
6. Fold the new peristaltic tubing piece and wrap it around the rotor.
7. Place the rotor and tubing back into the front half of the pump housing making sure the rotor clicks into place.
8. Please note that the 'D' cutout for the drive shaft is different sizes on each side of the rotor. The larger cutout must be facing the rear of the pump head assembly.

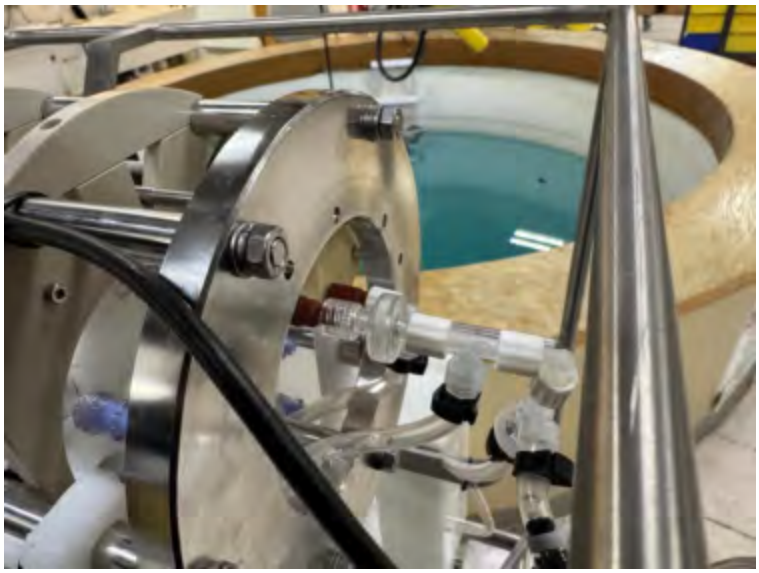
9. Replace the rear pump housing to secure the rotor and tubing in place.

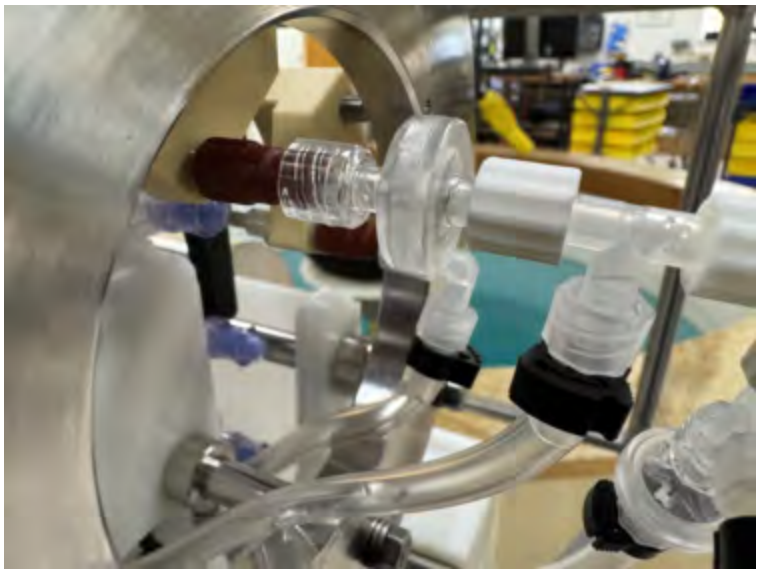
10. Replace the tubing fittings and tube clamps if not already installed. Note the orientation and type of fitting according to the image below.
11. The pump head must now be reattached to the pump mount while engaging the D-shaft that drives the rotor. It may be necessary to rotate either the pump or the drive shaft to engage correctly.
12. Secure the pump head to the pump mount using the two M4 screws and lock-washers.

Changing Out Check Valves

Replacing check valves is recommended prior to each deployment. Spare check valves are included with the toolkit. Additional check valves are commercially available, or available from McLane.

The main intake check valve will periodically need replacement. It is attached directly to the inlet side of the sample injector.





A second check valve is attached to the cleaner inlet, and will only need replacement occasionally.

Storage and Transport

The shipping case is a reusable international container. Always use the original shipping case for transporting the RoCSI or when storing long term.

It is advisable to clear out any water from the RoCSI 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.

Post-Deployment Cartridge Processing

The level of cleanliness of the RoCSI, its plumbing and sample cartridges can affect downstream processing steps. A clean and flushed system will generally provide better collection and preservation, avoiding contamination or sample corruption. It is the responsibility of the user to maintain a clean system and to properly clean components between deployments. The following is an example of one method that is appropriate for cleaning the sample cartridge housings and fittings.

1. First, wash all components in a mild detergent solution to remove residue or bio-fouling.
2. Place all washed components in a tray of 2.5% bleach solution and soak for 30 minutes.
3. Fully rinse all parts using clean water (such as Milli-Q) using at least 3 water exchanges.
4. Leave parts in clean water to soak for at least 12 hours.
5. After soaking in water, allow parts to dry in a clean location (such as a laminar flow hood) on paper towels.

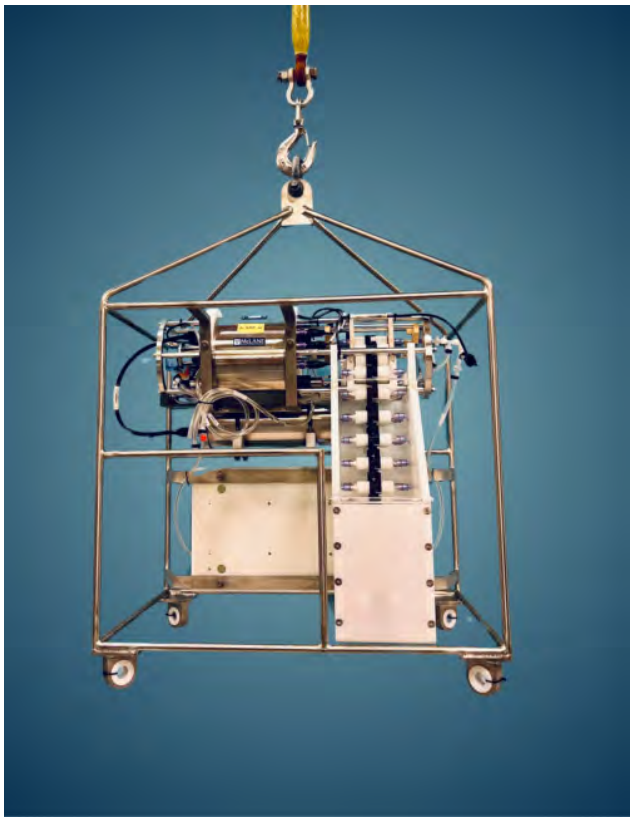
6. Parts must be fully dried before reuse.

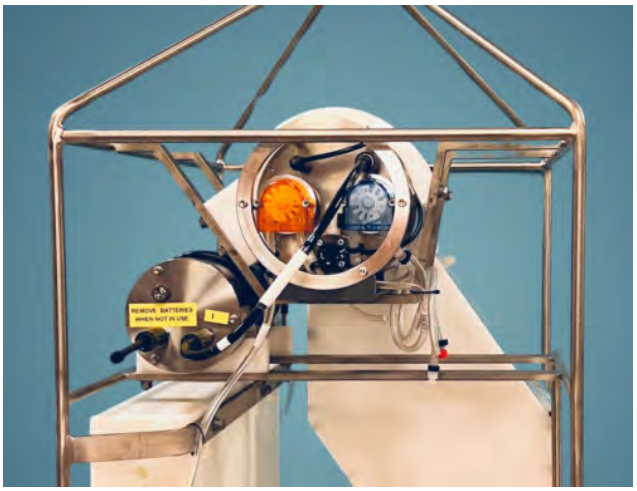
Appendix

This Appendix provides additional details including information about the RoCSI moored configuration and use with the external battery.

Moored Configuration

RoCSI is available as a fully self-contained, moored system including reagent bag storage, external titanium battery housing that holds four non-rechargeable lithium packs, and cartridge containment (hopper), all mounted on a 316 stainless steel or titanium frame.





The cable that connects the RoCSI to the battery housing allows for communications pass-thru when using batteries. If not using battery power, the communication cable should be directly connected to the RoCSI. The pass-thru cable does not allow external power when connected to the battery housing communication bulkhead.

External Battery

The external battery option includes a pressure housing and battery holder designed to accept 4 custom lithium primary battery packs. The bulkhead connections on the battery case allow for communications pass-thru while the RoCSI is powered by the batteries. If using external power (such as a power supply), plug directly into the RoCSI device; the communications bulkhead on the

battery housing will not pass external power by design.

NEVER power the RoCSI with less than 4 battery packs or with mixed new and used battery packs and NEVER use dropped or damaged batteries.

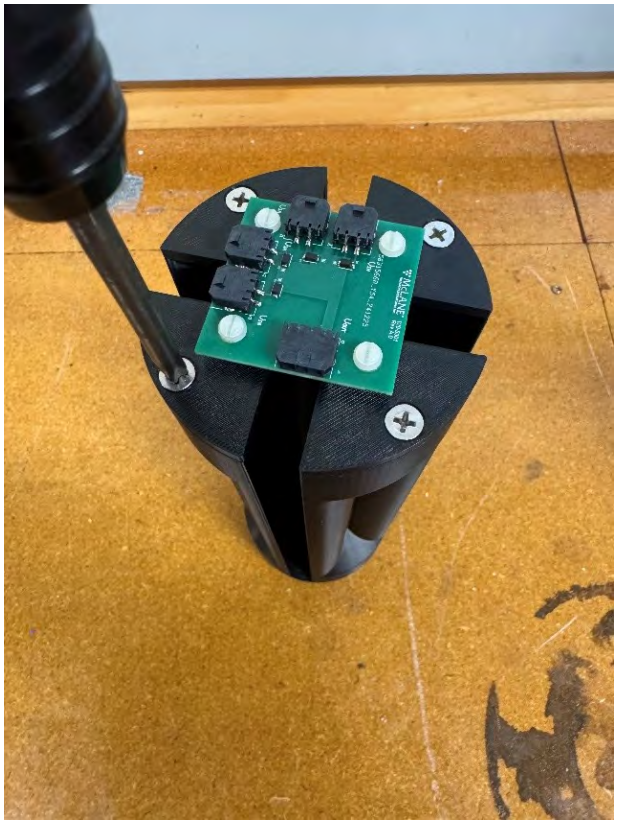
ALWAYS remove batteries from the pressure housing when not in use and store in a cool, dry storage area, protected from excess moisture or humidity.

NEVER store batteries in direct sunlight or high heat.

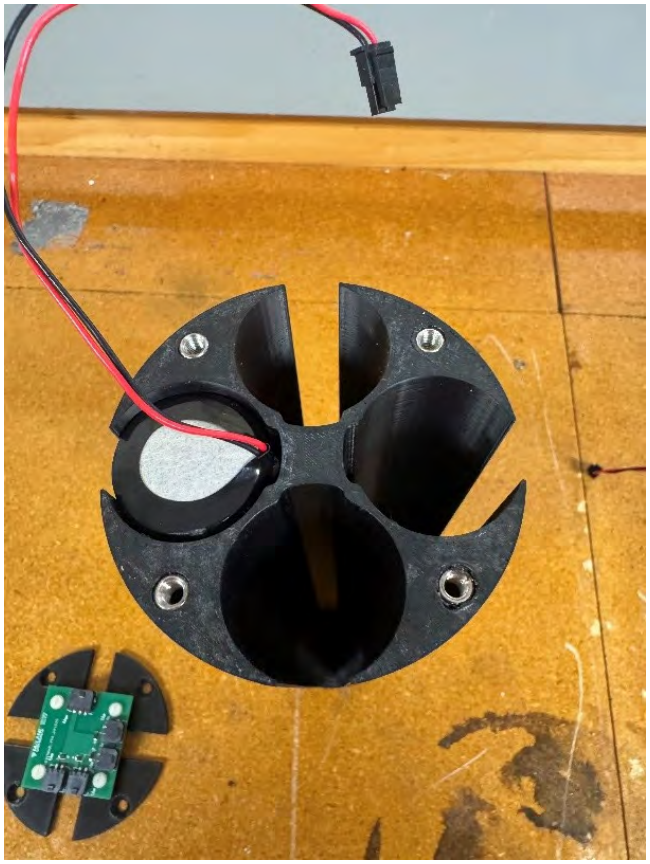
Installing the Battery Pack

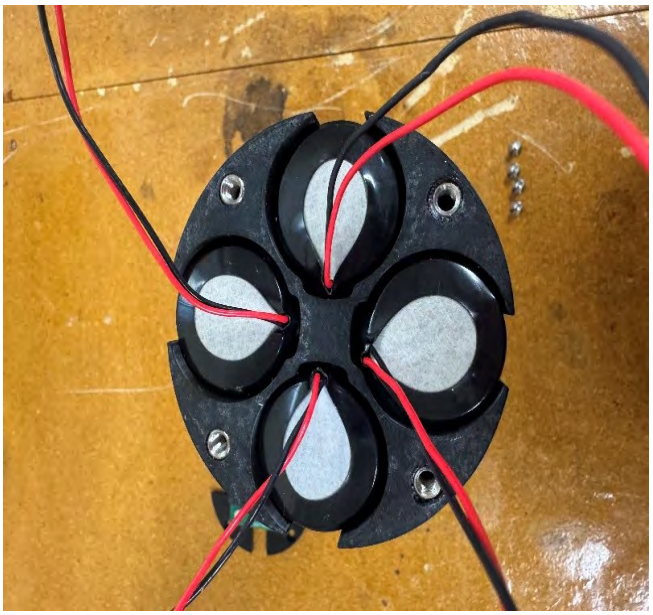
1. Remove the 3 screws on the battery housing end cap.

2. Remove the end cap from the housing.
3. Remove the battery pack holder from the battery housing. Unscrew the four Phillips head screws that secure the top plate to the battery pack holder.

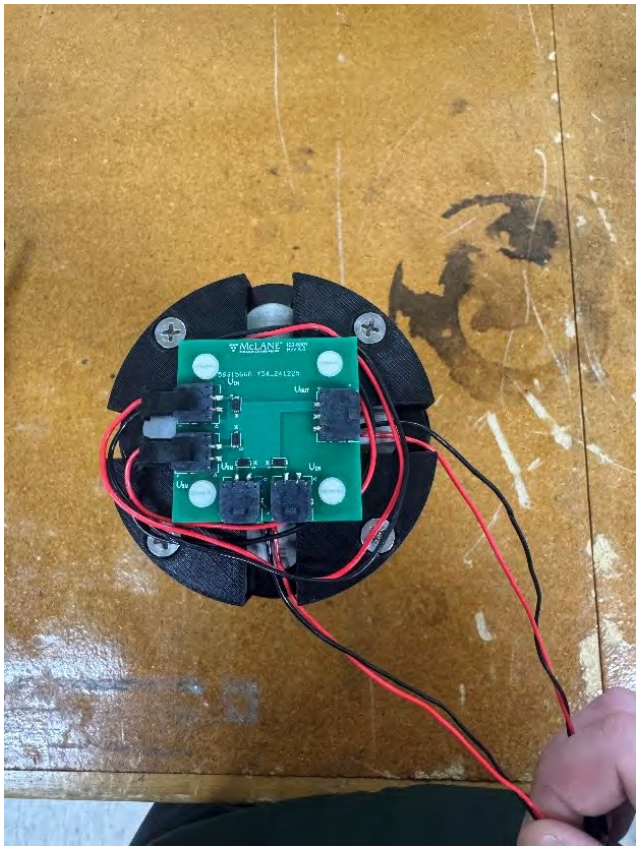


4. With the top plate removed, add the M4501 batteries to the battery pack. Ensure the wires of the battery are facing the center of the battery pack holder. This is to prevent the filled battery pack holder from getting stuck in the battery housing. Place the top plate back on the battery holder and screw the plate back onto the holder.

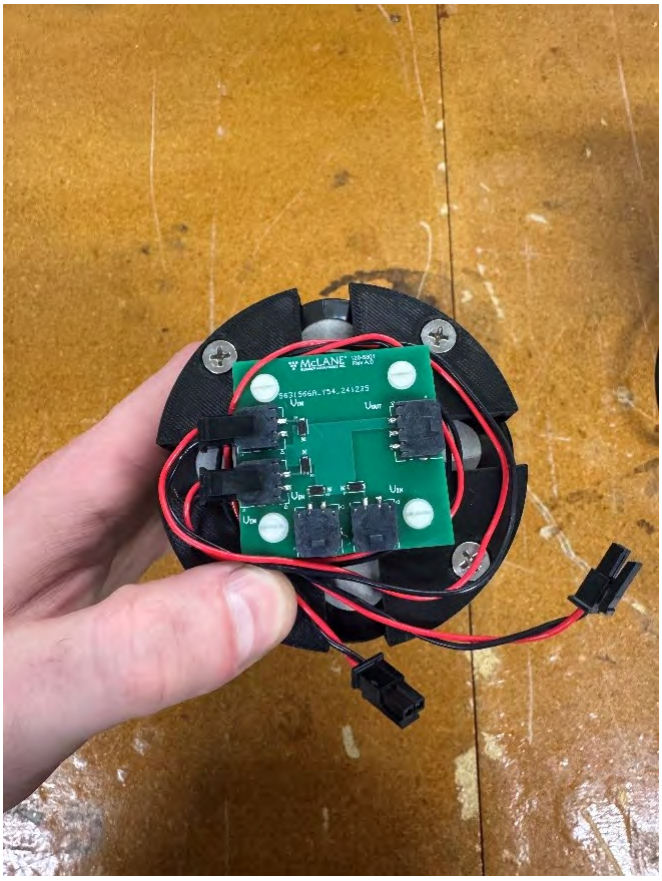




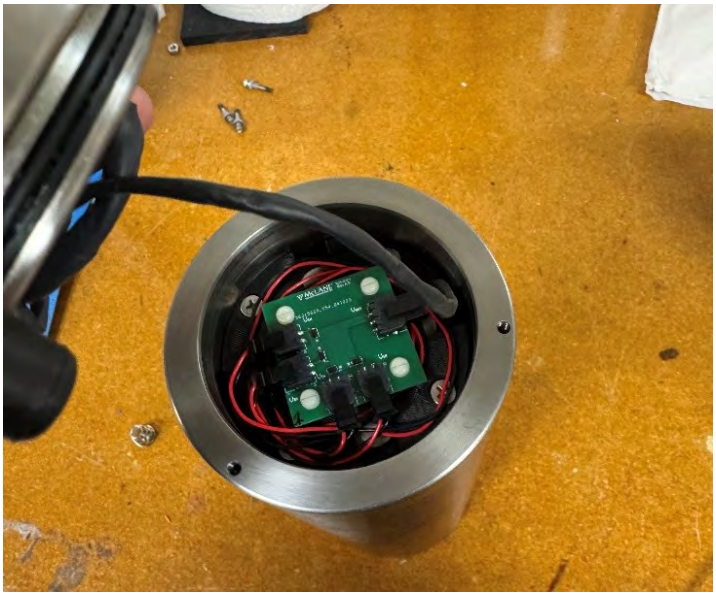
5. Take the 4 headers from the batteries and wrap them under the control board wrapping them clockwise. Two of the headers should line up with the J3 & J4 connectors of the control board.

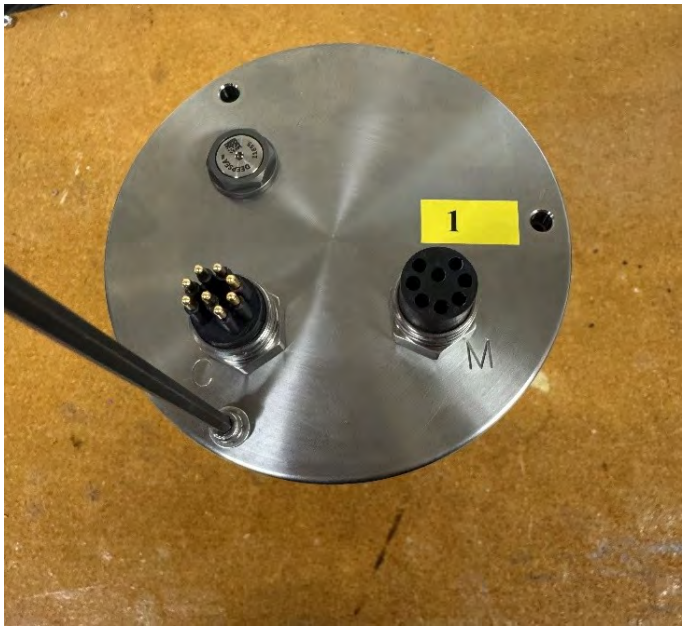


6. Wrap the remaining two headers counter clockwise and the two headers should line up with the J1 & J2 connectors on the control board.



7. Insert the fully loaded battery pack into the housing. Ensure that the corner between J2 & J3 lines up with the sticker on the housing and end cap. This is to ensure the rubber bumpers on the end cap do not land directly on the connectors. Plug in the 3-pin header on the bulkhead to J5 on the control board. Align the end cap sticker ("1") with the housing sticker.





It is important to ensure that the controller housing is sealed correctly before performing operations with the RoCSI.

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. Spare O-rings are provided in the toolkit 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 end cap:

8. 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.
9. 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.

10. Slide the end cap into the controller housing, ensuring that the O-rings evenly enter the housing. Also, be careful to line up the index mark ("1") and confirm that the rubber bumpers will press against the battery holder and not the diode PCB or battery connectors.
11. 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.
12. Rotate the end cap to align the end cap bolt holes with the controller housing tube.
13. Install the end cap hardware. Ensure that the screw holes have plastic insulators installed before adding hardware. These screws should also be lubricated with non-metal anti-seize compound.
14. Secure the end cap screws and tighten enough that the split lock washers compress under the bolt heads. Be careful not to over-tighten.

Removing the Battery Pack

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.
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. Be aware that the battery pack is connected to the end cap. Do not pull on the wires or connector when removing the end cap.
5. Disconnect the 3-pin connector from the battery control board and set the end cap aside.
6. Gently pull out the battery holder from the pressure housing.
7. Disconnect the 4 battery packs from the battery control board.
8. Remove the 4 screws from the top battery holder cap and remove the cap.
9. Remove the battery packs.
10. Recycle or dispose of used batteries according to local laws and regulations.