Profilers Samplers Flotation

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WTS-LV & McLanePro
User Manual

2025 McLane Research Laboratories, Inc., Rev.25.F.06

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Included with the WTS-LV

A new WTS-LV includes a USB drive that contains the User Manual and McLanePro, the graphical user interface for samplers built with McLane Research Labs' Gen3 electronics. Each WTS-LV also includes a toolkit. The toolkit and contents are referred to throughout this User Guide, and should remain with the instrument at all times.

The toolkit pictured is only an example.

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

Contact McLane

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

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

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

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

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

The WTS-LV pages on the McLane website contain links to documentation including Technical Bulletins, and papers that describe the development and use of the WTS-LV.

Printable User Manual

Check the WTS-LV User Manual page on the McLane website for updates and a downloadable WTS-LV & McLanePro User Manual.

Training Videos

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

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

Video	Content
Battery Replacement with Drop-in Battery Holder	Shows user replaceable 'D' cell alkaline batteries installation in the WTS-LV standard model (also applies to the Bore Hole model).
Replacing the WTS-LV Battery Holder	Explains the correct battery orientation when using a WTS-LV drop in battery holder.
Replacing O-rings	Provides the steps to clean and install O-rings.
WTS-LV Deployment Preparation	Shows A72-1000 battery pack replacement in the WTS-LVUP Upright model (also applies to the WTS-LVDF dual filter model).

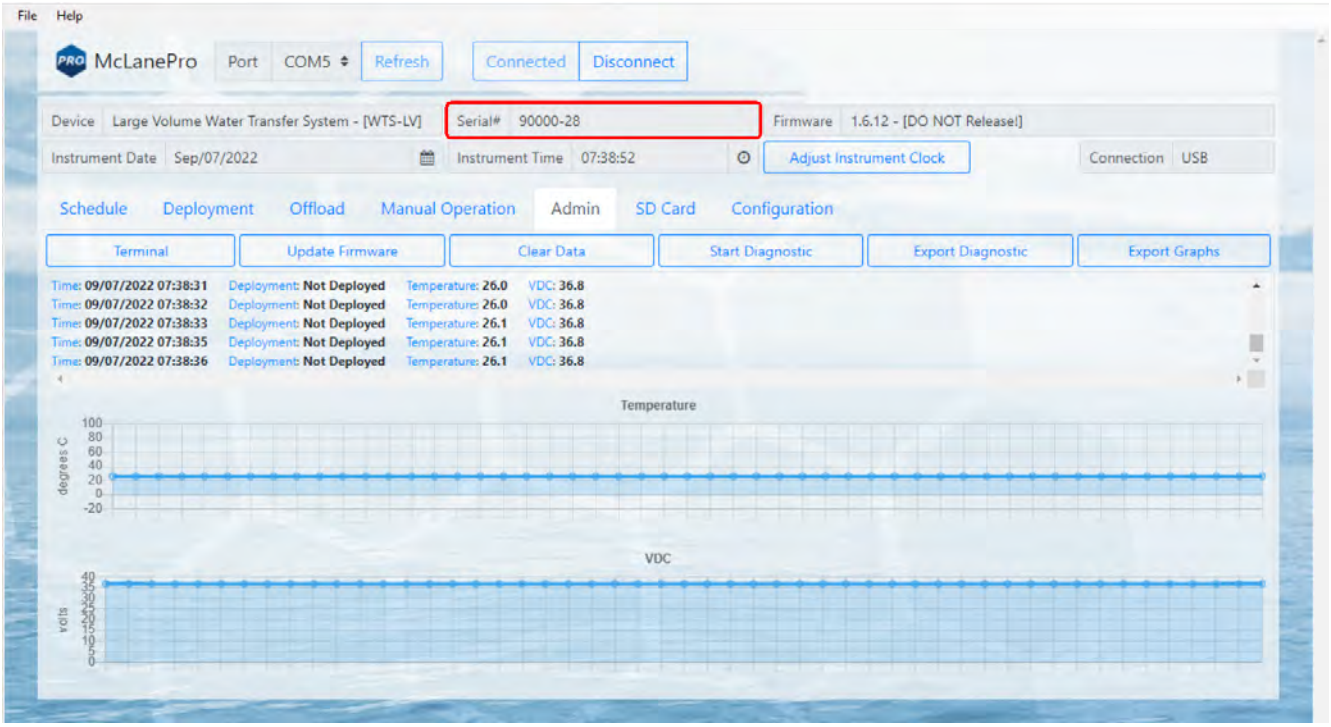
Serial Number

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

Example: ML12345-01

This information is located in multiple places:

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



McLanePro Introduction

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

McLanePro Introduction topics

Install McLanePro
Connecting Battery Power
Closing the Controller Housing
Connecting to the WTS-LV
Setting the Instrument Clock
The Schedule Tab
The Deployment Tab
The Offload Tab
The Manual Operation Tab
The Admin Tab
The SD Card Tab
The Configuration Tab
The Help Menu
The Activity Log
Offline Mode

Install McLanePro

Installation

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

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

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

Follow the installation wizard instructions to install the program.

McLanePro Updates

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

System Requirements

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

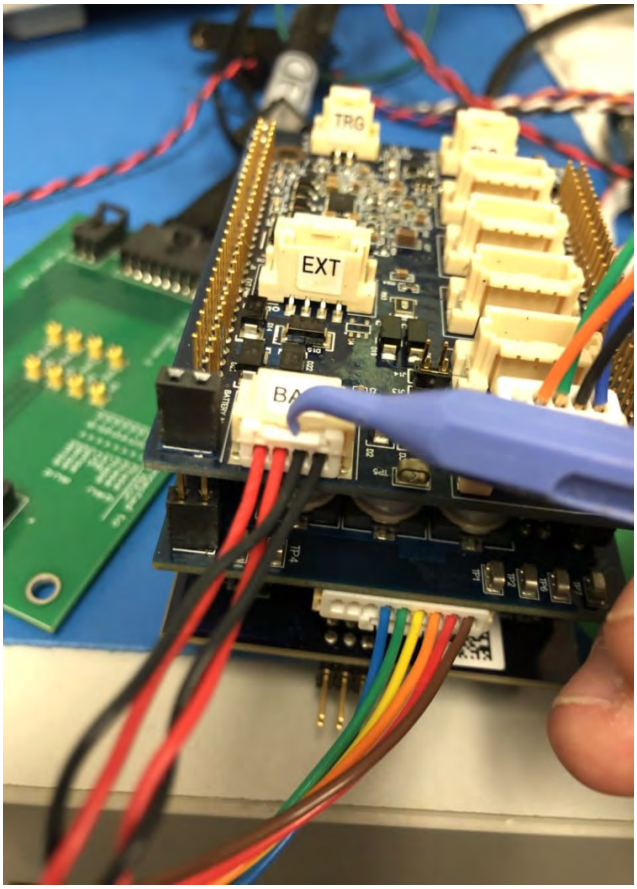
Connecting the Batteries (models with Drop-in Batteries)

Follow these steps to load the drop-in battery holder and connect to the electronics. Always use caution when opening and closing the controller electronics housing. If your WTS-LV model uses the high capacity battery pack, see Connecting the A72-1000 battery pack

Related topics
Opening the controller housing
Connecting the A72-1000 battery pack

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

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



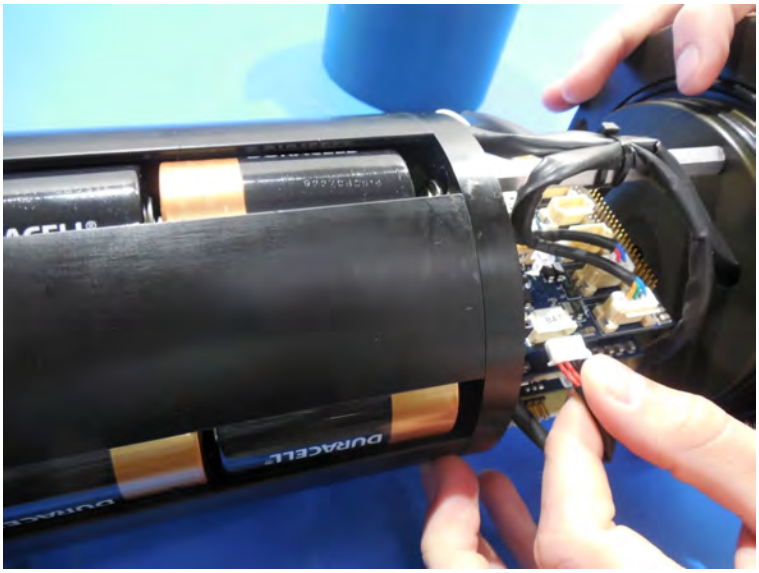
3. Remove the battery enclosure cap.

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

A video that explains correct battery placement can be downloaded from the WTS-LV Videos page on McLane's website.

5. Secure the battery enclosure cap.

6. Reconnect the batteries to the electronics.



Close the Controller Housing

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

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

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

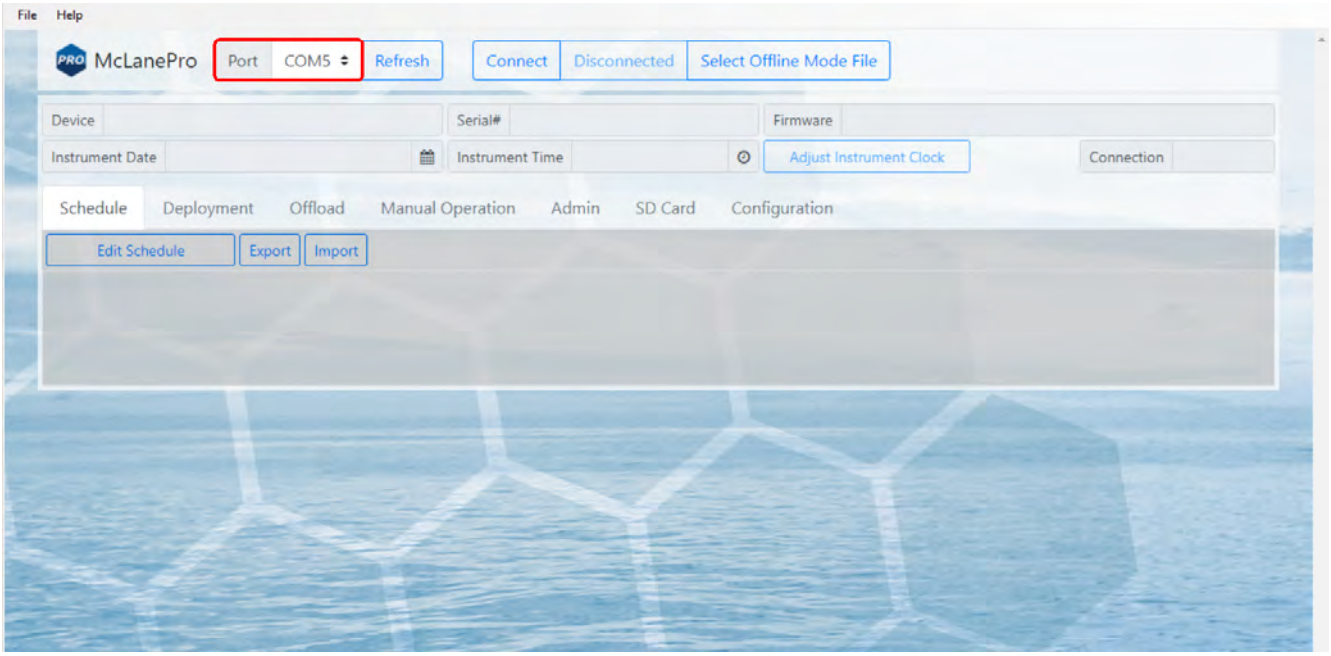
Once the battery holder (or battery pack) has been installed and connected to the WTS-LV electronics:

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

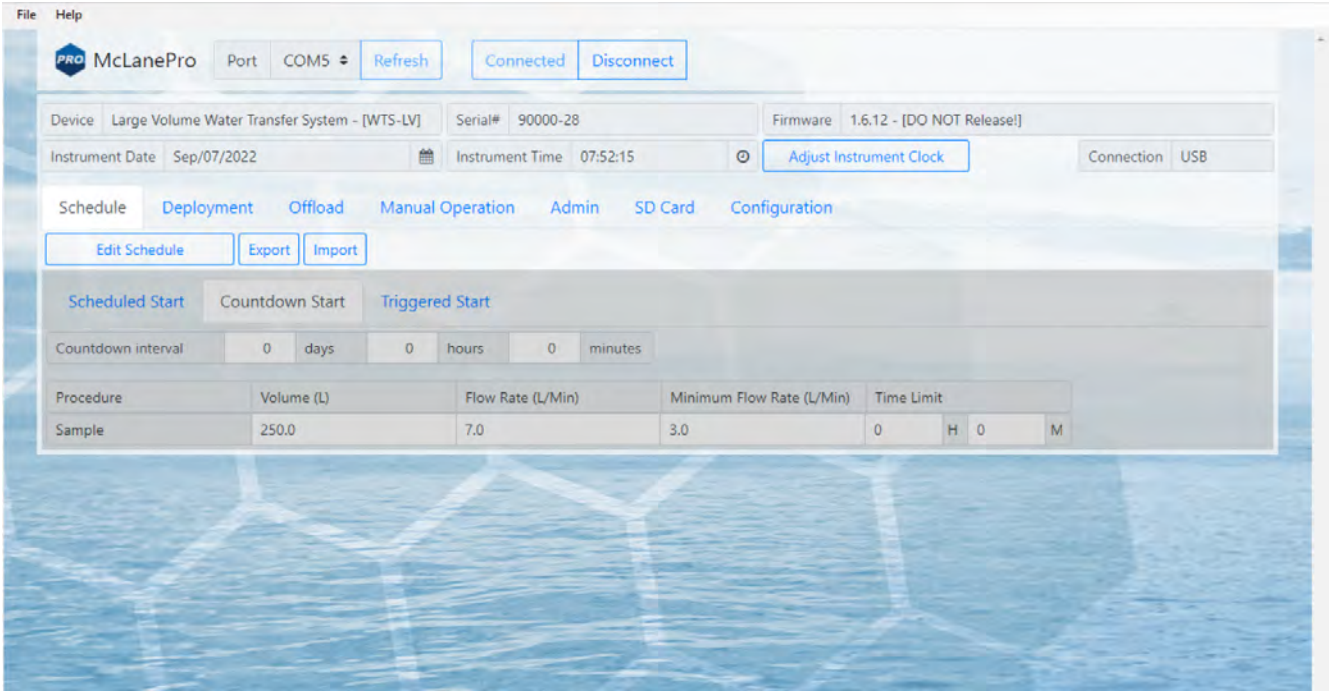
Connecting to the WTS-LV

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

1. Plug the USB COM cable into a USB port on the host computer.
2. Remove the dummy plug from the communication port on the WTS-LV.
3. Plug the USB COM cable onto the COM bulkhead of the WTS-LV.
4. After plugging the USB cable into the WTS-LV controller, the host computer should recognize the USB connection as a virtual serial port.
5. Open McLanePro.
6. Find and select the communication (COM) port associated with the McLane WTS-LV in the **Port** window.
7. Click **Connect**.

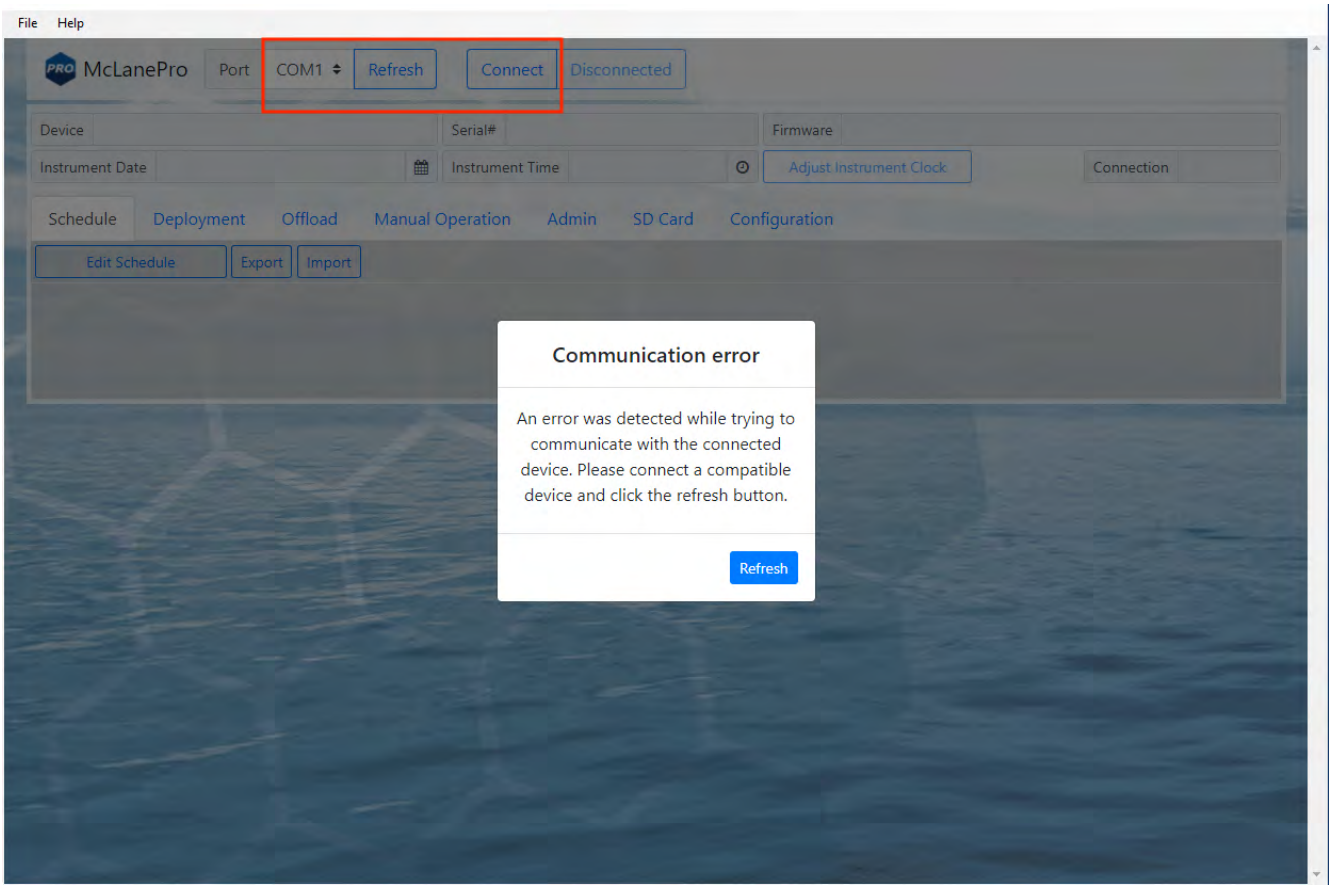


In the above example, the communication port associated with the WTS-LV is COM 5.
After successfully connecting to the WTS-LV, McLanePro tabs will display data stored on the instrument such as the schedule (in this example).



Communication Error Message

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

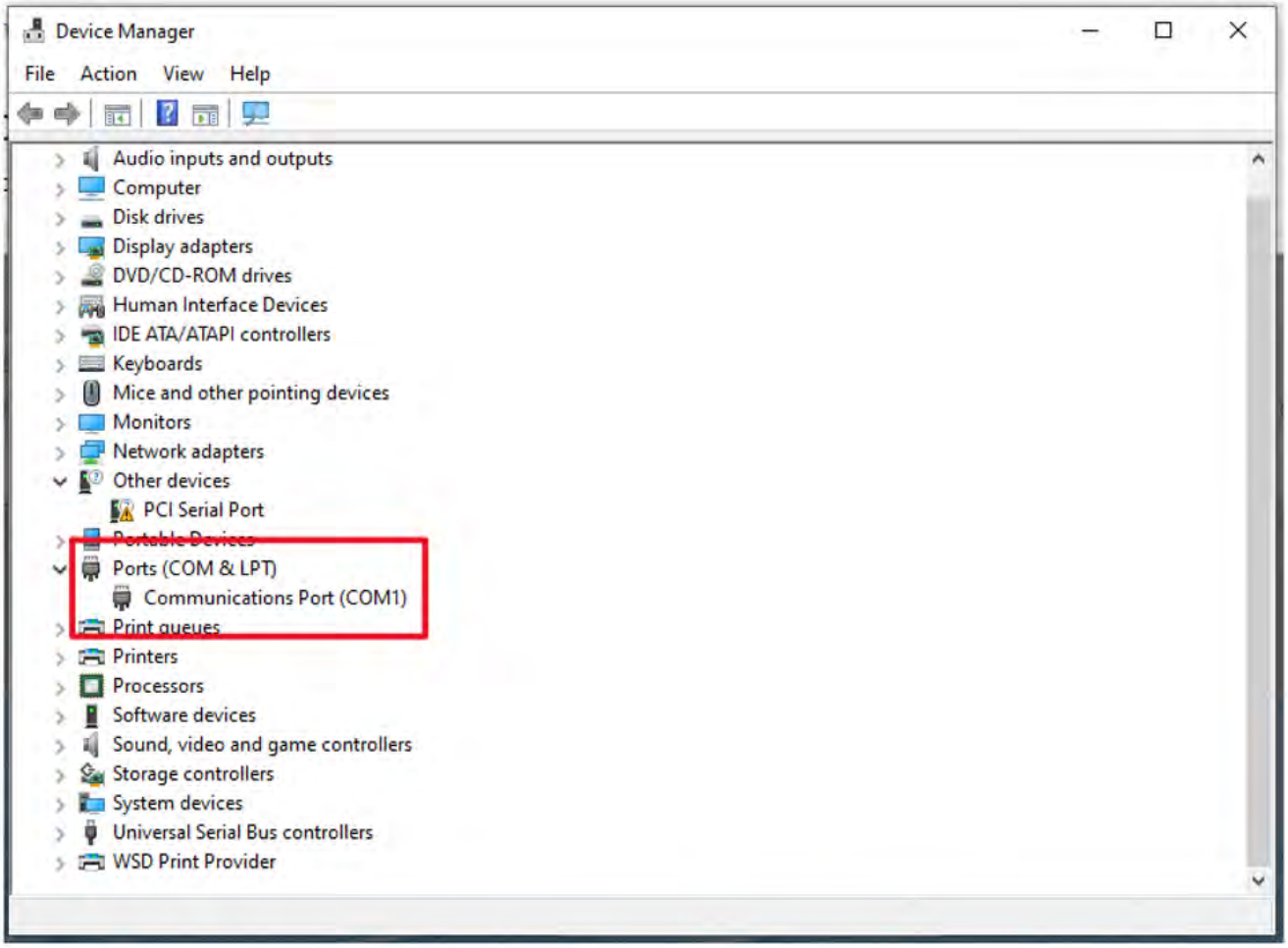


Communication Troubleshooting

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

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

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



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

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

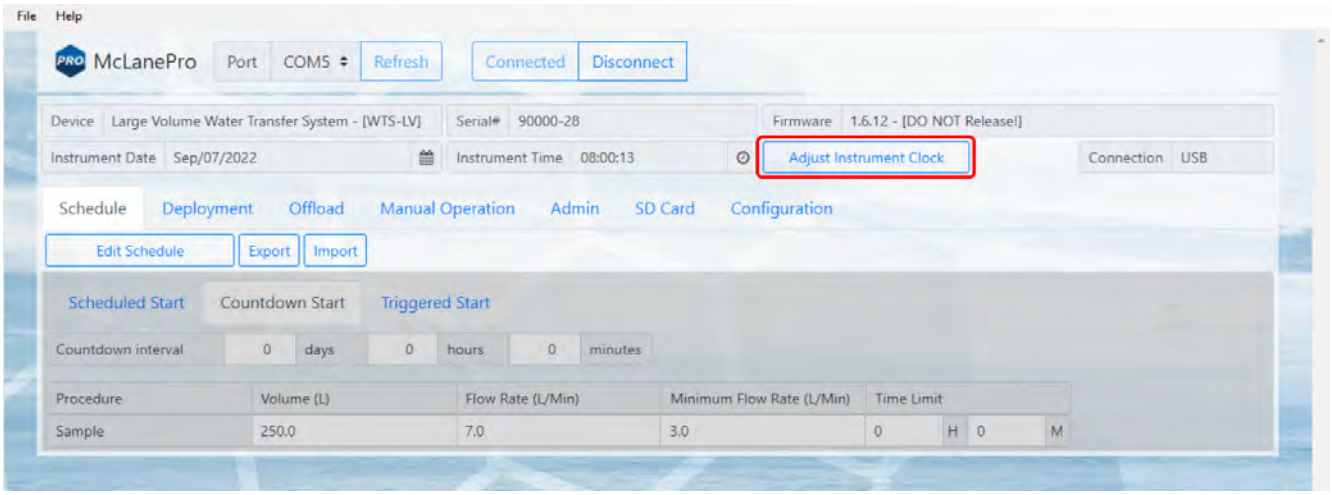
If the device remains unresponsive, try disconnecting the device, restarting the computer, and reconnecting.

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

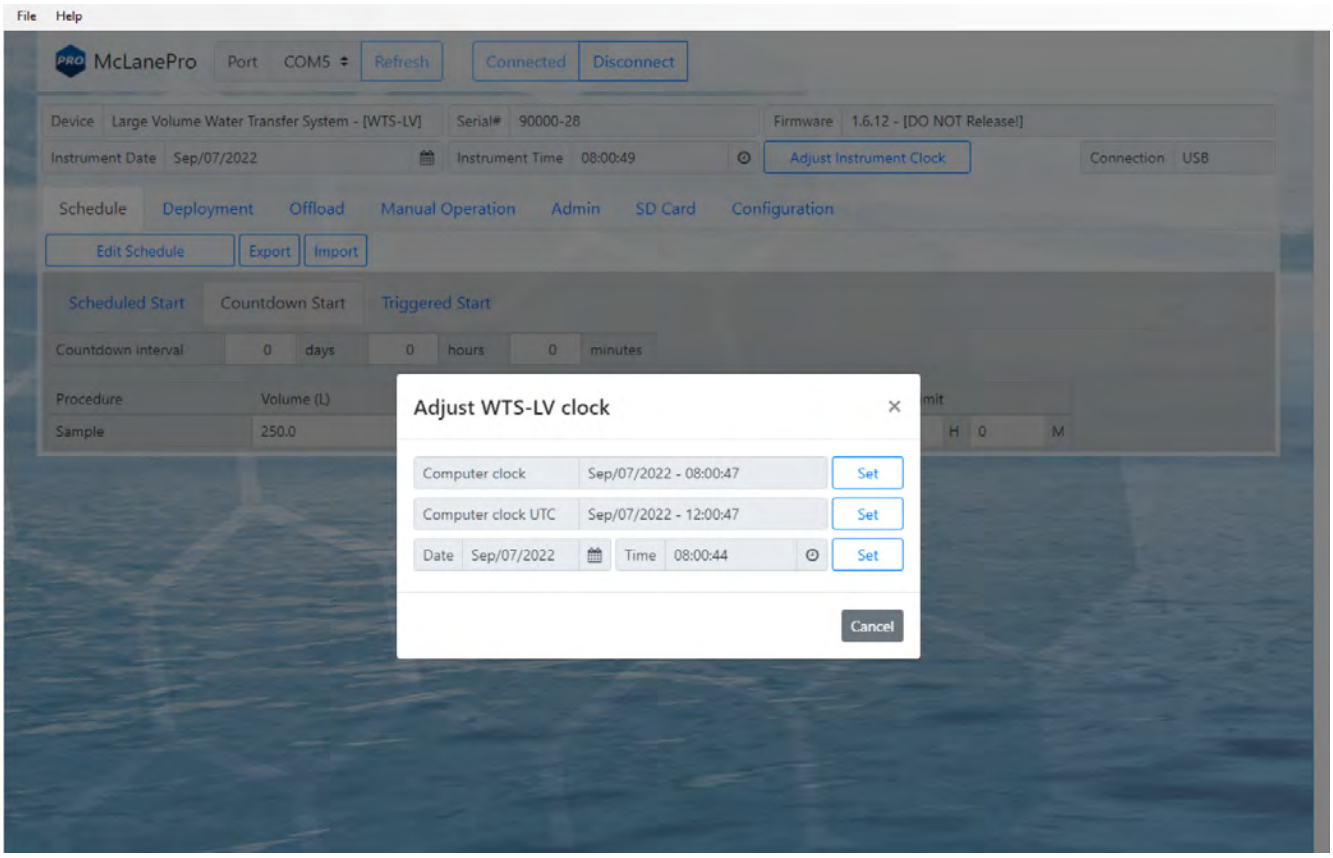
Setting the Instrument Clock

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

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



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

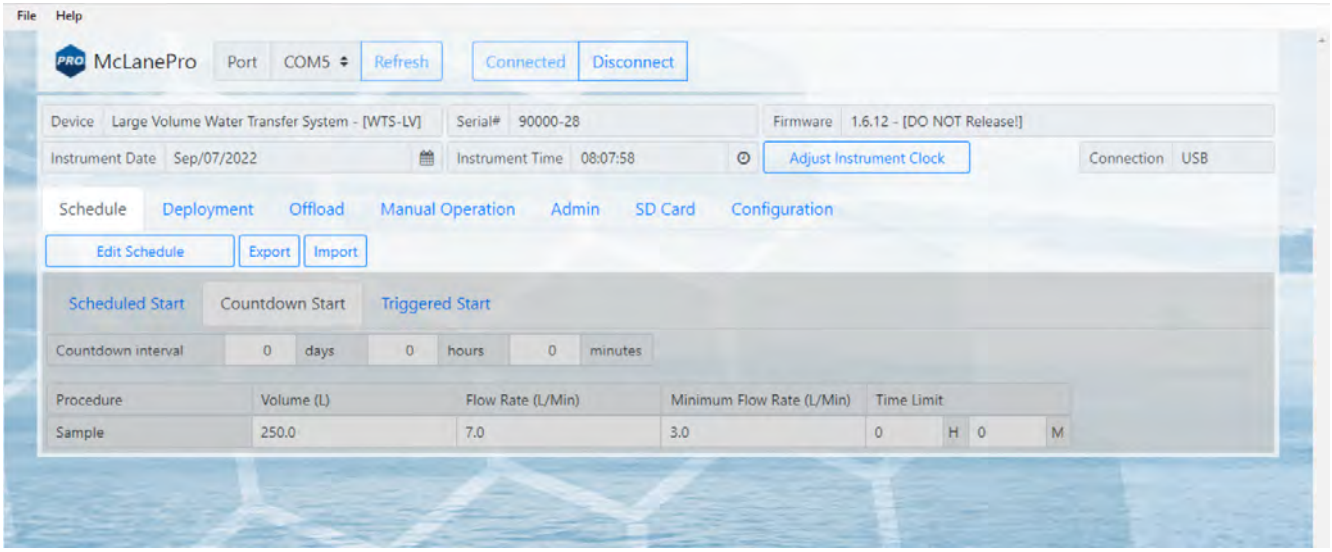


The Schedule Tab

The **Schedule tab** is used to define a deployment schedule before deploying the WTS-LV.

There are three ways to define a WTS-LV deployment in the **Schedule tab**:
Scheduled Start - Uses a start time and date for the deployment to begin.
Countdown Start - Uses a deployment delay time. After deploying the instrument from McLanePro, a countdown timer will delay the sampling event by the defined interval.

Triggered Start - Uses a deployment trigger delay time. The WTS-LV will wait to receive a signal from the electronic trigger. After the trigger is activated, a user defined countdown delays the sampling event by the defined interval. May be used to synchronize multiple WTS-LV instruments.

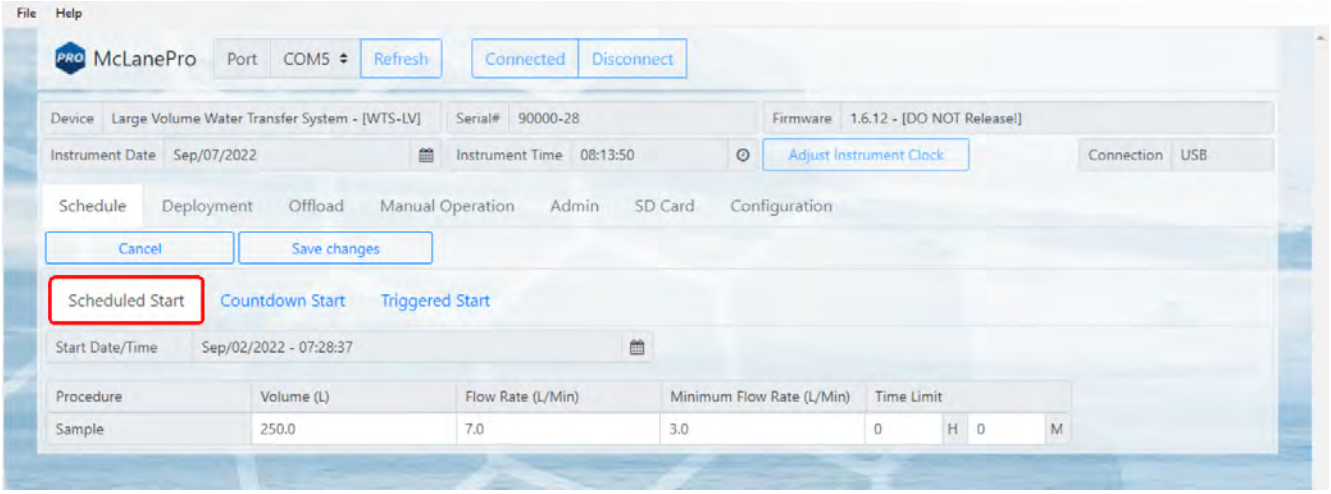


Schedule a Deployment Using a Scheduled Start

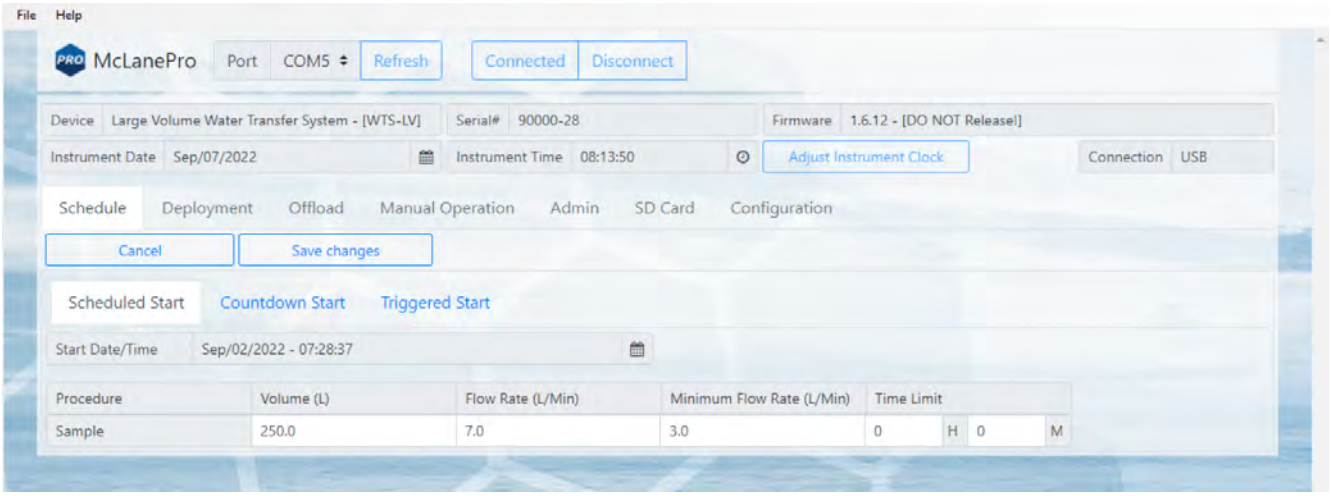
Follow these steps to define a deployment using a scheduled start date and time.

Before scheduling and deploying the WTS-LV, make sure the instrument time is set!

1. Click the **Schedule tab**.
2. Click the **Edit Schedule** button.
3. Click the **Scheduled Start** tab.



4. Click the calendar next to the **Start Date/Time** field to select a start time for the deployment.
5. Fill in the deployment parameters:
    - **Sample volume** - set the target volume of water that will be processed in the deployment. Actual volume will depend on filter type, filter porosity and loading characteristics.
    - **Sample flow rate** - define the target flow rate. Flow rate may be automatically adjusted lower if limited by filter loading or battery voltage at any time during the deployment.
    - **Sample minimum flow rate** - define the minimum acceptable flow rate. The WTS-LV will adjust the flow rate to preserve material on the filter and to prevent damage to the filter or the system. This setting defines when the event will terminate due to a decreasing flow rate.
    - **Sample event time limit** - define a maximum deployment time. If the desired volume has not been reached within this time limit, the event will terminate. Setting this value to zero disables the timeout function.



6. Click **Save changes**. The new settings are immediately applied to the WTS-LV.

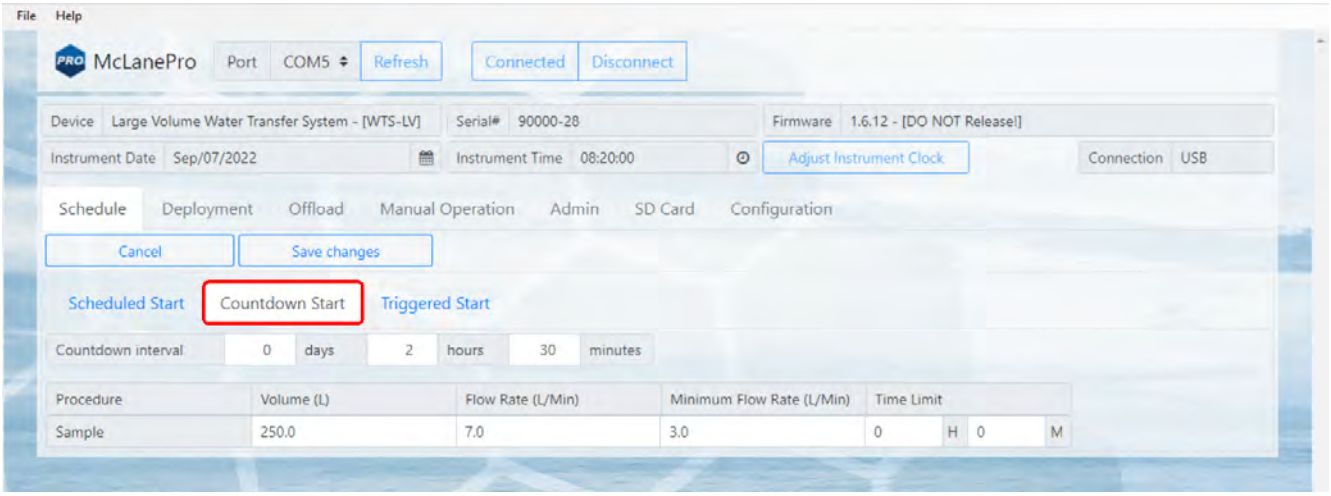
Schedule a Deployment Using a Countdown Start

Follow these steps to create a schedule that begins the sampling event after a specified countdown

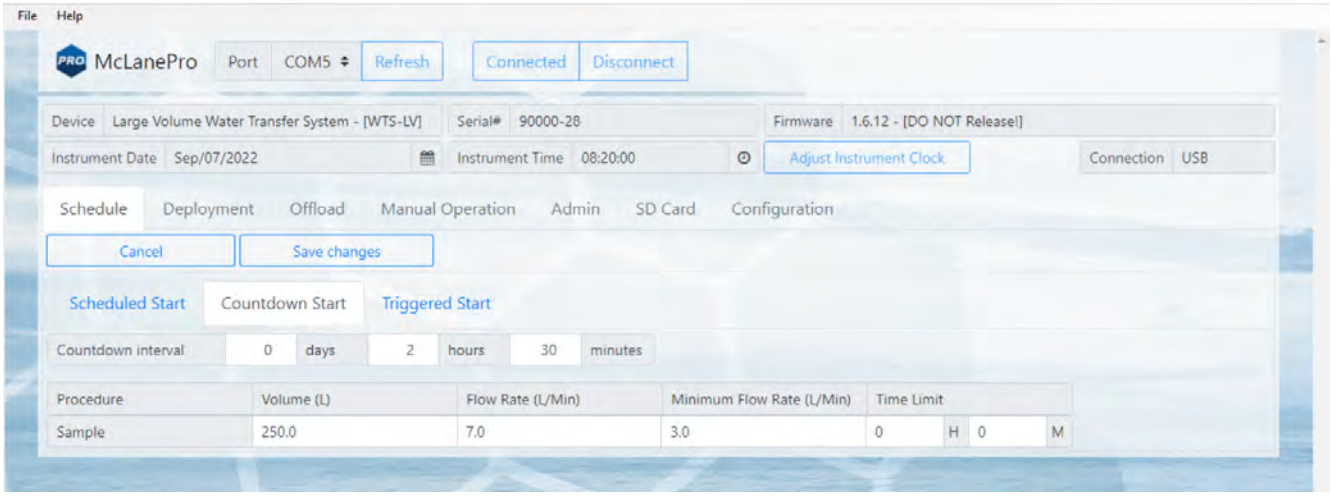
interval. The countdown is started as soon as the instrument is deployed from McLanePro.

Before scheduling and deploying the WTS-LV, make sure the instrument time is set!

1. Click the **Schedule tab**.
2. Click the **Edit Schedule** button.
3. Click the **Countdown Start** tab.



4. Define a countdown delay (Countdown interval) using the **Days**, **Hours** and **Minutes** boxes.
5. Fill in the deployment parameters:
    - **Sample volume** - set the target volume of water that will be processed in the deployment. Actual volume will depend on filter type, filter porosity and loading characteristics.
    - **Sample flow rate** - define the target flow rate. Flow rate may be automatically adjusted lower if limited by filter loading or battery voltage at any time during the deployment.
    - **Sample minimum flow rate** - define the minimum acceptable flow rate. The WTS-LV will adjust the flow rate to preserve material on the filter and to prevent damage to the filter or the system. This setting defines when the event will terminate due to a decreasing flow rate.
    - **Sample event time limit** - define a maximum deployment time. If the desired volume has not been reached within this time limit, the event will terminate. Setting this value to zero disables the timeout function.



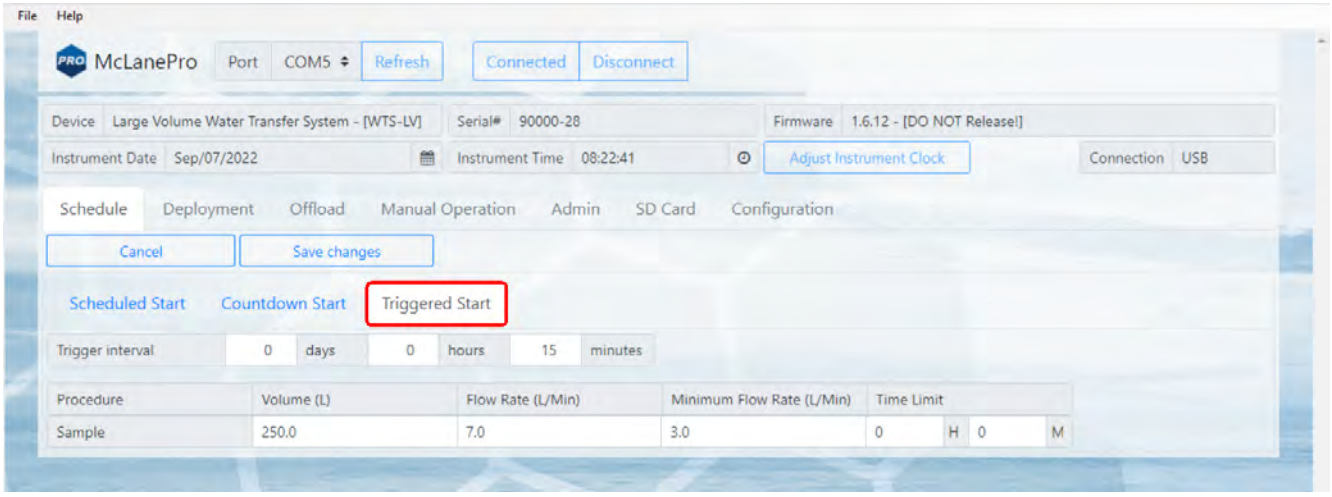
6. Click **Save changes**. The new settings are immediately applied to the WTS-LV.

Schedule a Deployment Using a Triggered Start

Follow these steps to create a schedule that starts the sampling event only after receiving a trigger signal and waiting for a specified trigger interval. *Setting the trigger interval to zero will program the WTS-LV to start immediately upon receiving the trigger*. This feature can be useful for synchronizing multiple WTS-LV instruments performing parallel deployments.

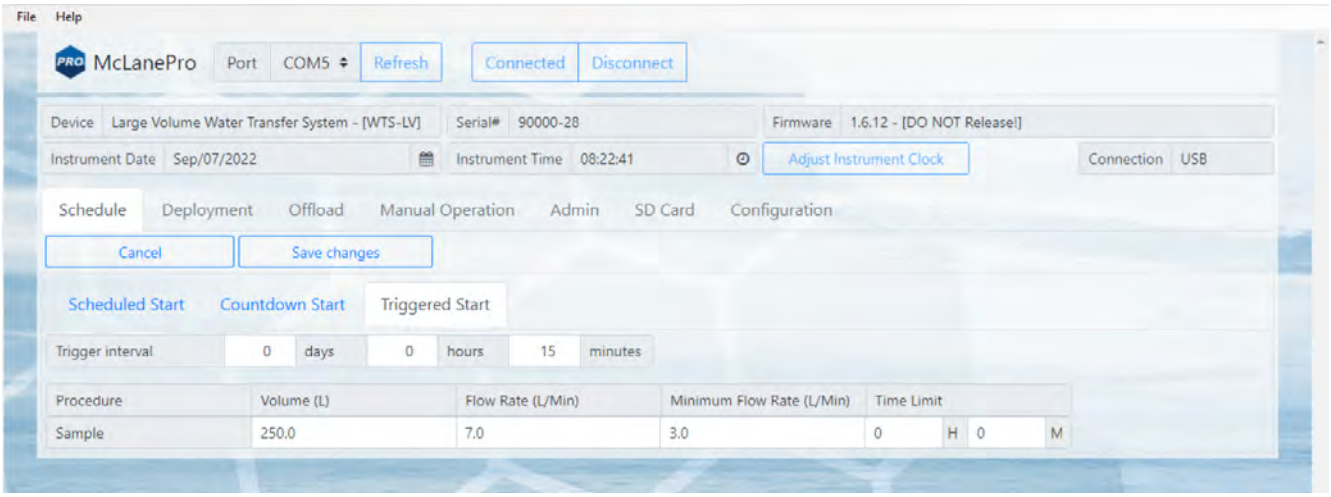
Before scheduling and deploying the WTS-LV, make sure the instrument time is set!

1. Click the **Schedule tab**.
2. Click the **Edit Schedule** button.
3. Click the **Triggered Start** tab.



4. Define a triggered countdown delay (Trigger interval) using the**Days**, **Hours** and **Minutes** boxes. Or, set to zero to activate the sampling event immediately after receiving the trigger signal.
5. Fill in the deployment parameters:
    - **Sample volume** - set the target volume of water that will be processed in the deployment. Actual volume will depend on filter type, filter porosity and loading characteristics.

- **Sample flow rate** - define the target flow rate. Flow rate may be automatically adjusted lower if limited by filter loading or battery voltage at any time during the deployment.
- **Sample minimum flow rate** - define the minimum acceptable flow rate. The WTS-LV will adjust the flow rate to preserve material on the filter and to prevent damage to the filter or the system. This setting defines when the event will terminate due to a decreasing flow rate.
- **Sample event time limit** - define a maximum deployment time. If the desired volume has not been reached within this time limit, the event will terminate. Setting this value to zero disables the timeout function.

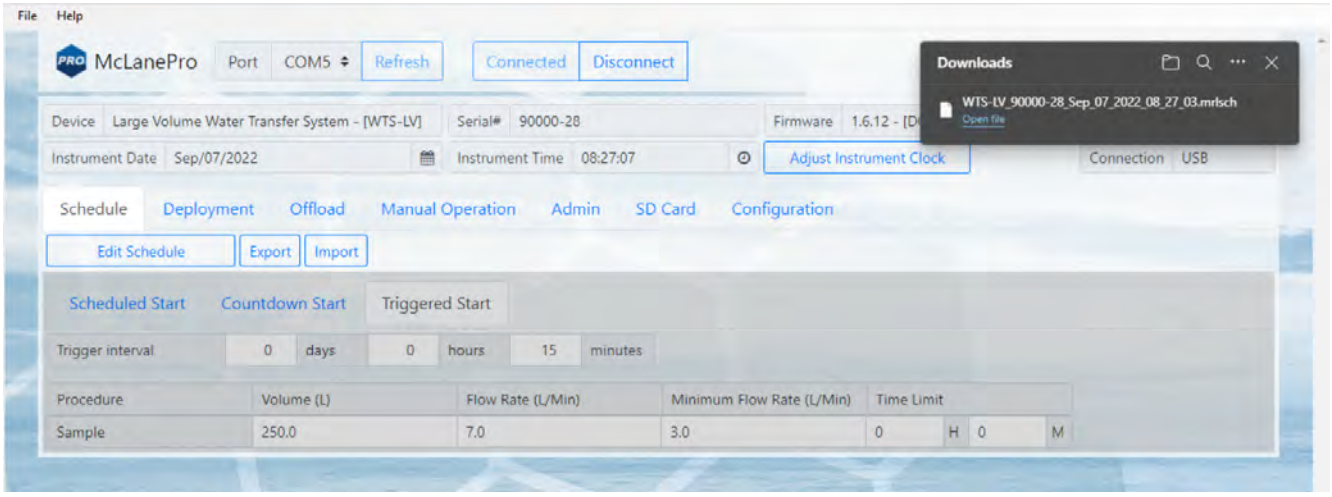


6. Click **Save changes**. The new settings are immediately applied to the WTS-LV.

Exporting a Schedule

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

1. Create a new schedule, countdown, and/or change the start condition, using **Edit Schedule**.
2. Set the deployment parameters.
3. Click **Save changes** to load that schedule onto the WTS-LV.
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 WTS-LV. This file is useful for reviewing the deployment parameters and schedule after disconnecting from the WTS-LV.

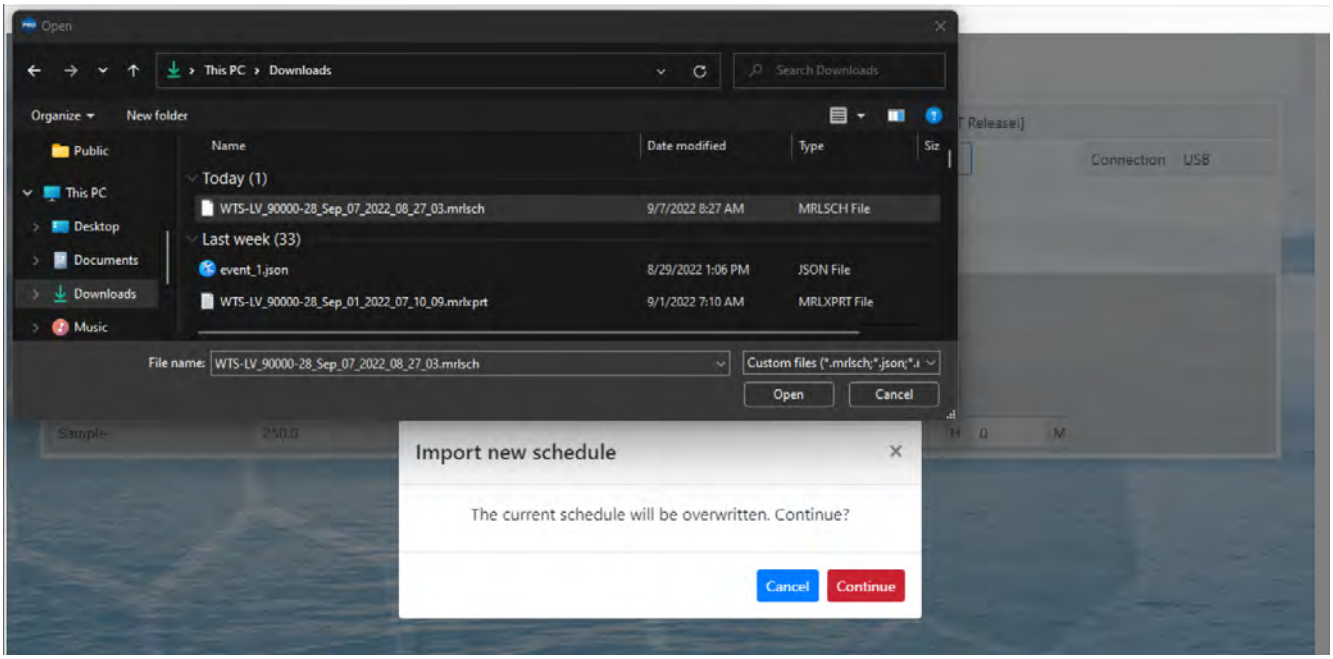
Importing a Schedule

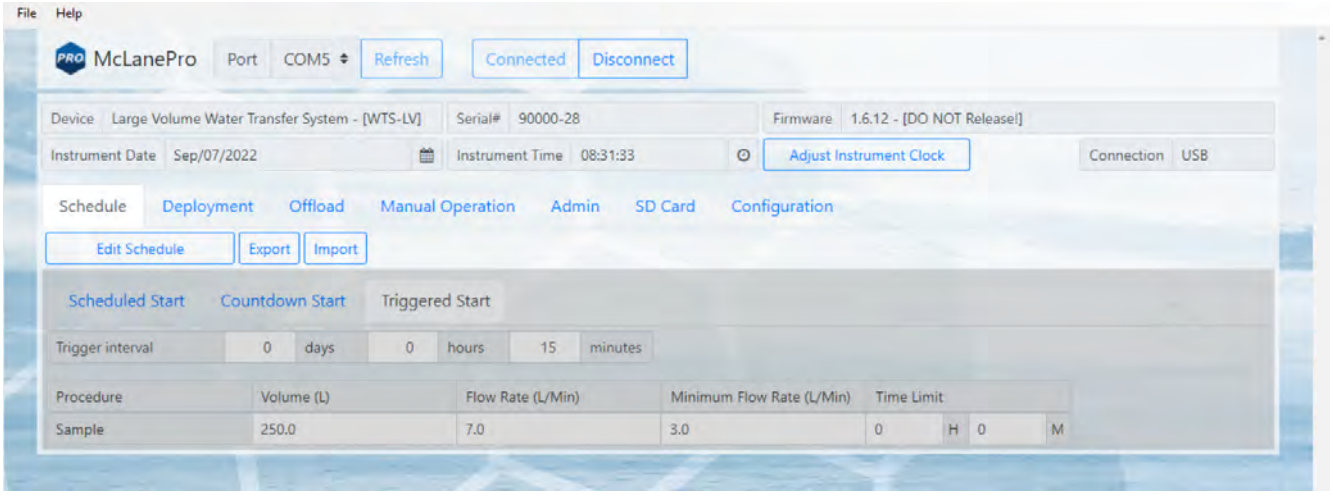
Schedules may be imported for deployment of multiple instruments or for modification and reuse.

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 WTS-LV 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.

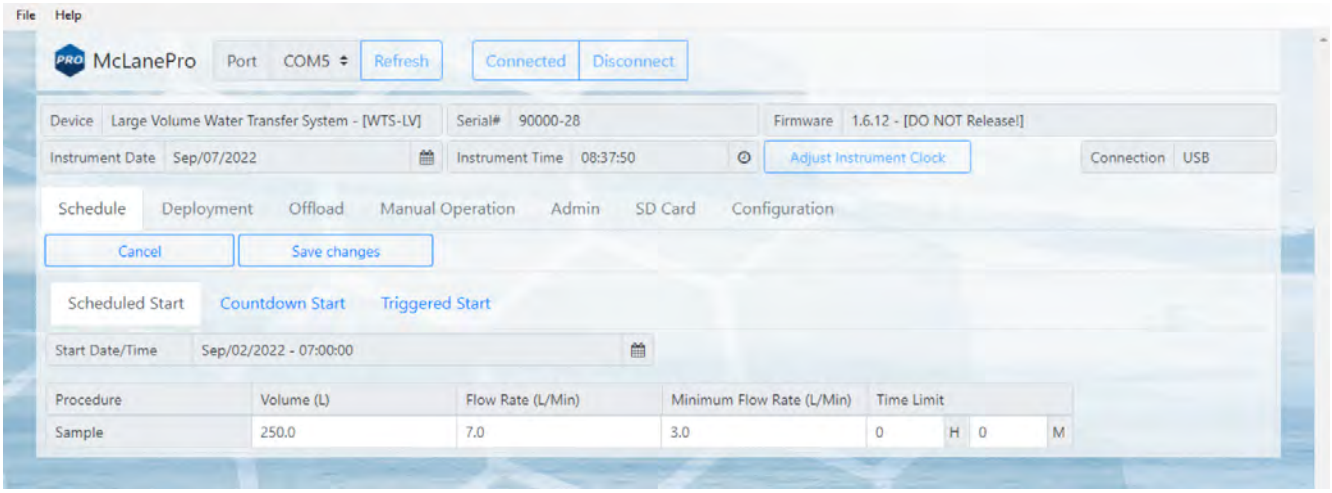
Importing a schedule immediately loads that schedule into memory on the WTS-LV. This is the schedule that will be used when deploying the instrument. Always double check event times before proceeding to deployment preparation.



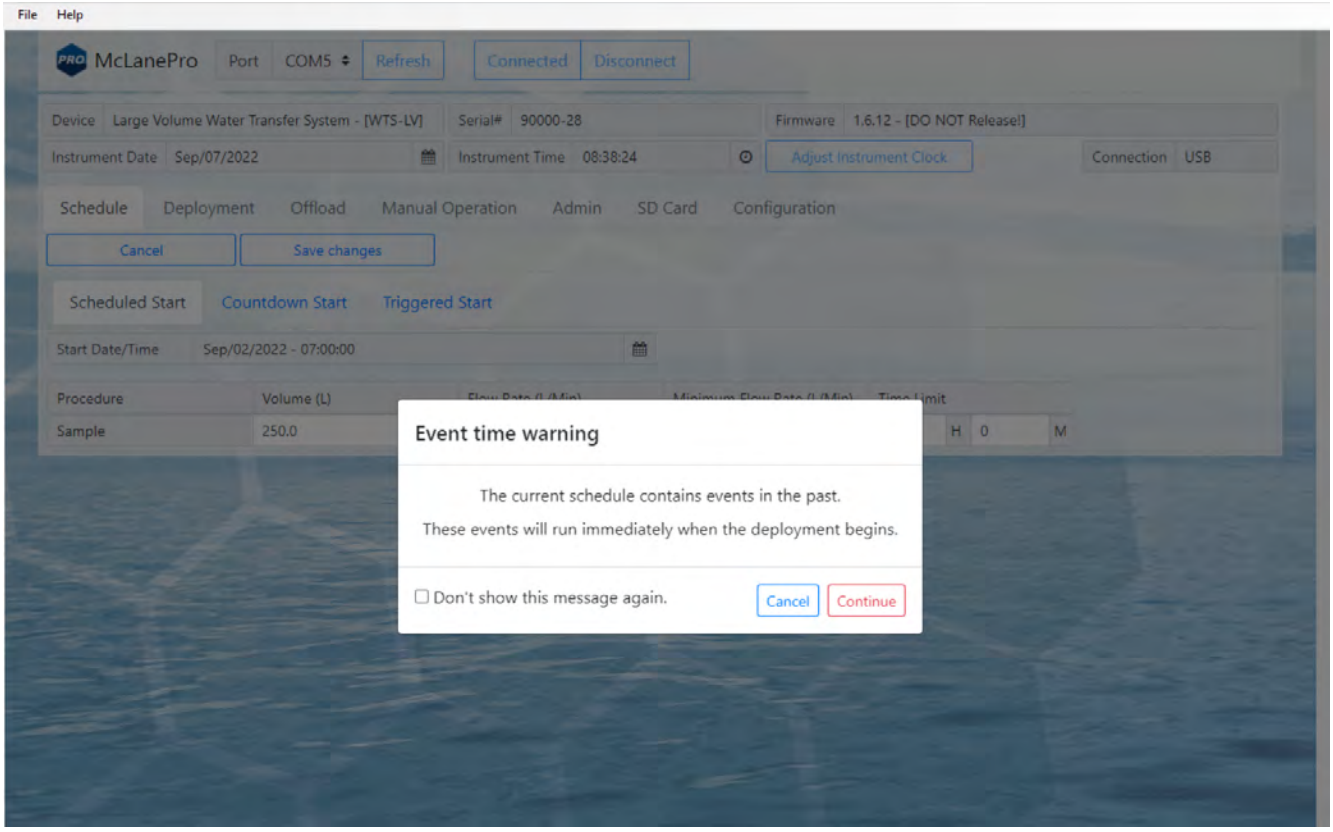


Schedule Errors

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



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

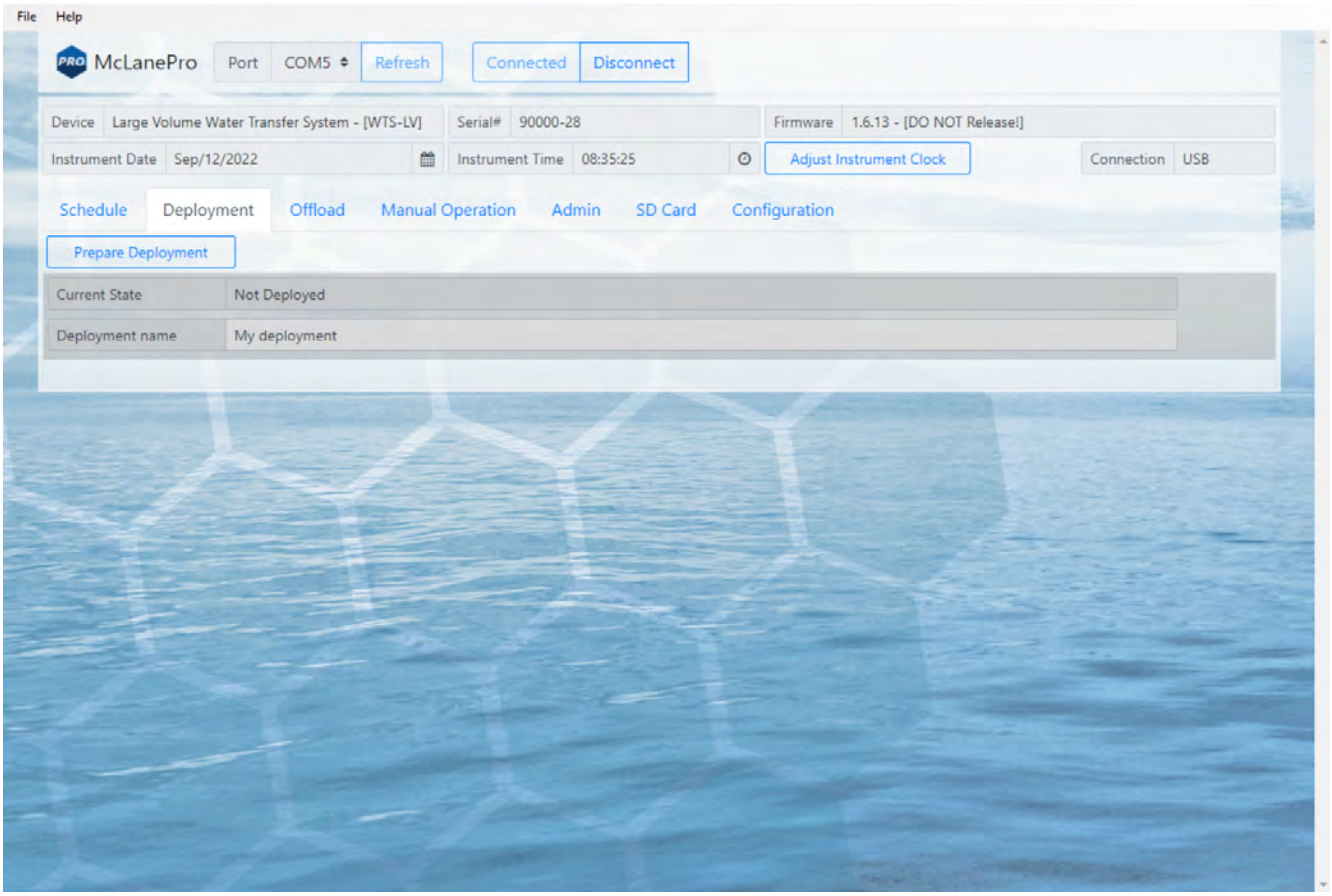


The Deployment Tab

The **Deployment tab** is used to:

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

Related topic
Starting a Deployment



Starting a Deployment

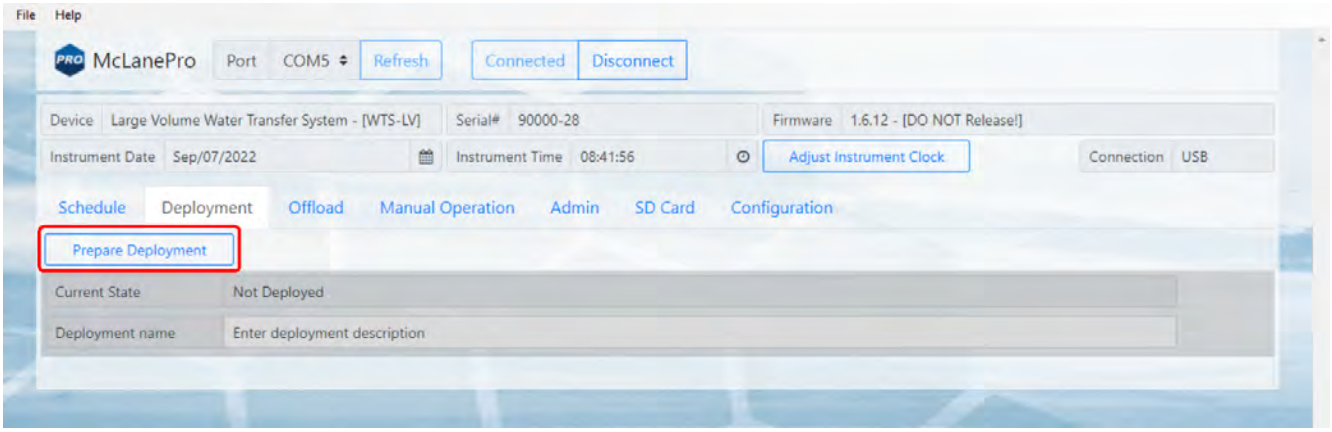
Follow these steps to start a deployment using the current schedule.

Before scheduling and deploying the WTS-LV, make sure the instrument time is set!

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

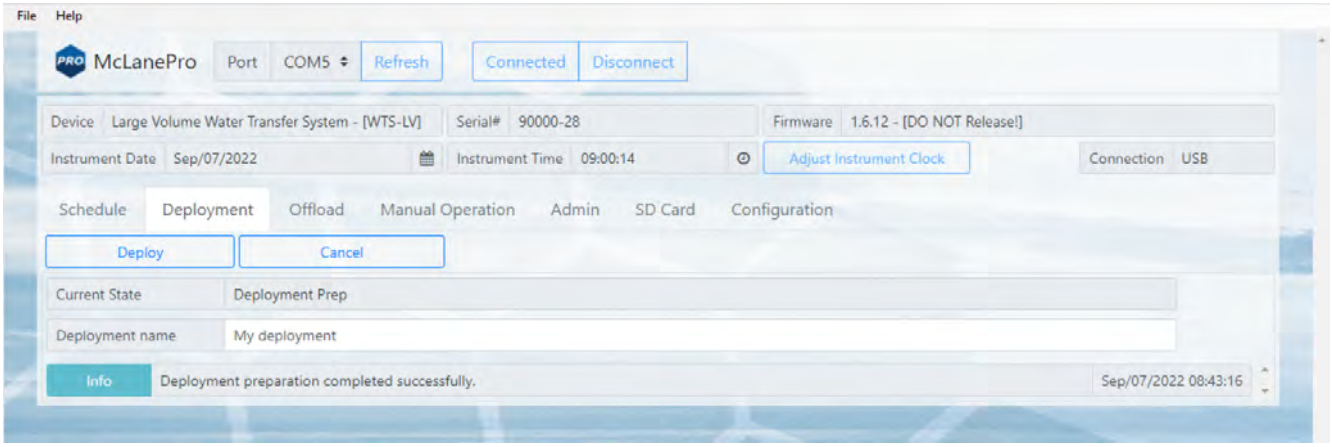
1. On the **Deployment** tab, click **Prepare Deployment.**

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

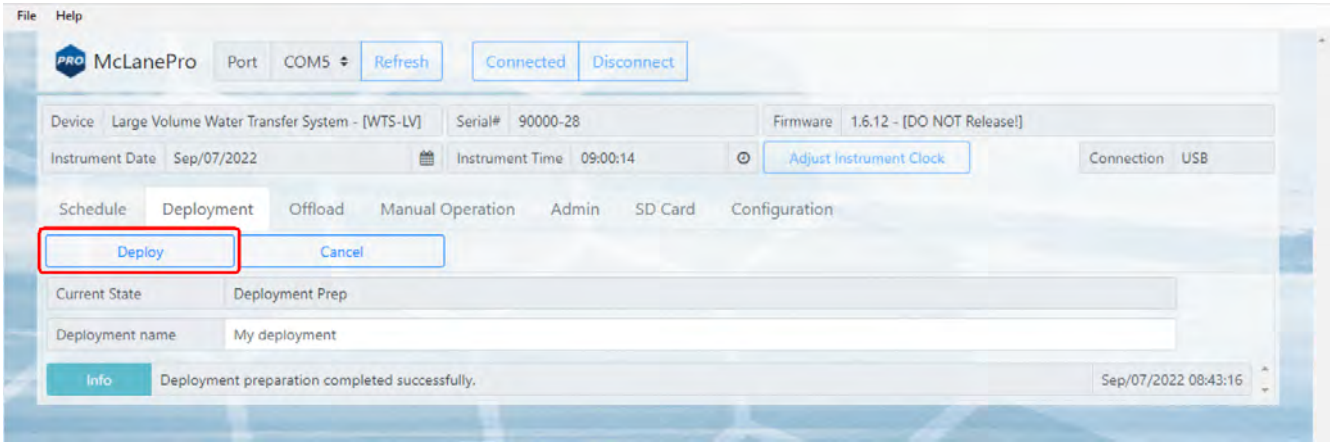


After passing checks, the WTS-LV allows setting of the deployment name before deploying.

2. Enter a deployment name or description.

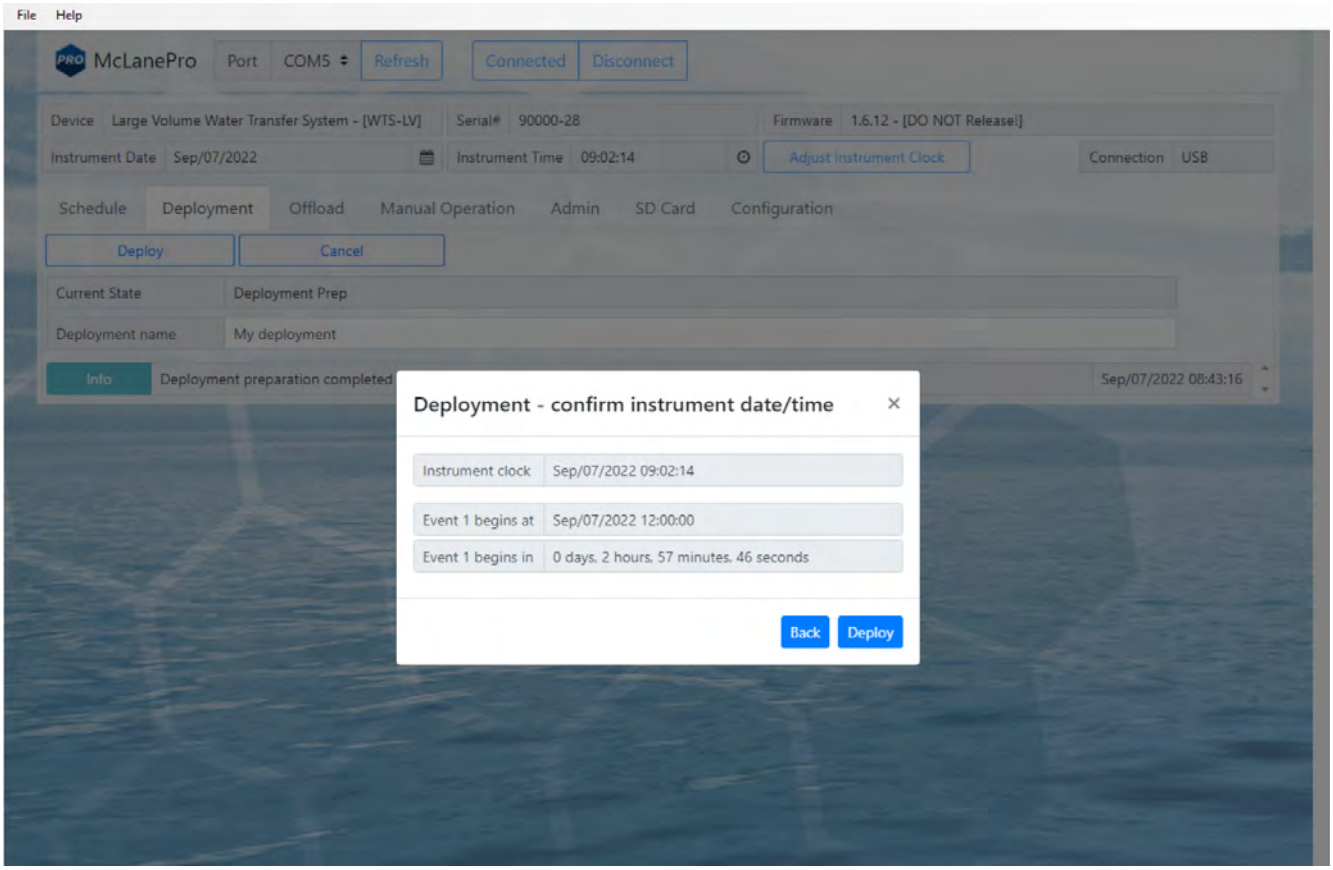


After setting the deployment name, the WTS-LV may be deployed.



3. Click the **Deploy** button.

After clicking the **Deploy** button, McLanePro displays the scheduled time for the first event, the current time according to the instrument clock, and a countdown timer indicating the amount of time before the first event will start. If a countdown or trigger is to be used, this interval is displayed instead of a scheduled date and time.



The WTS-LV offers a final check of the current time and conditions for starting the deployment.

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

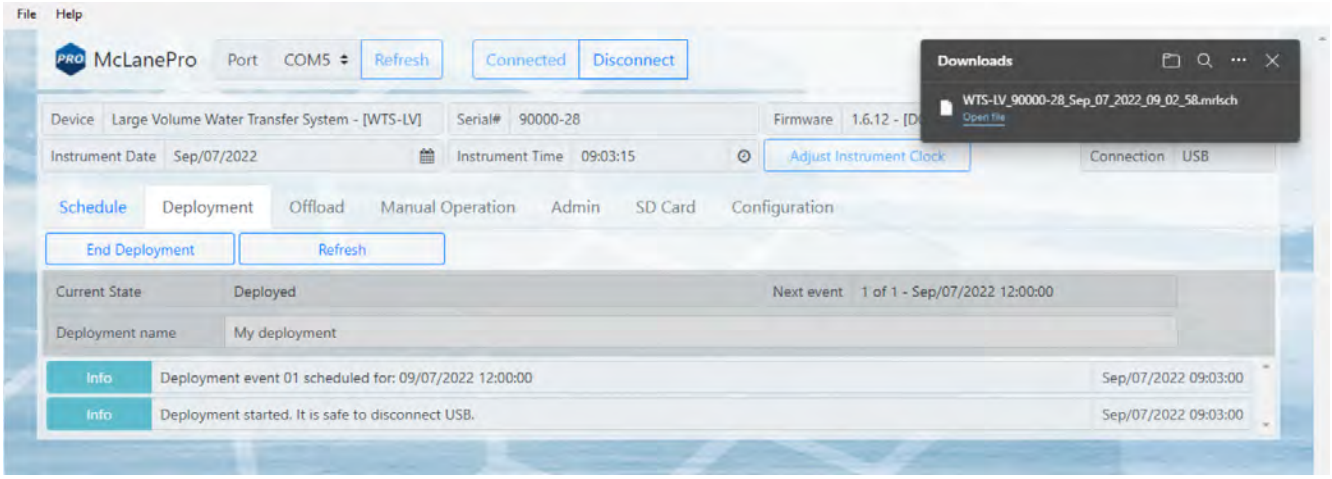
*After clicking the **Deploy** button;*

For a scheduled start - the WTS-LV displays the scheduled time for the first event, and a message that confirms it is safe to disconnect the USB connection.

For a countdown start - the WTS-LV displays the scheduled time for the first event based on the current time and the countdown interval. A message confirms it is safe to disconnect the USB connection.

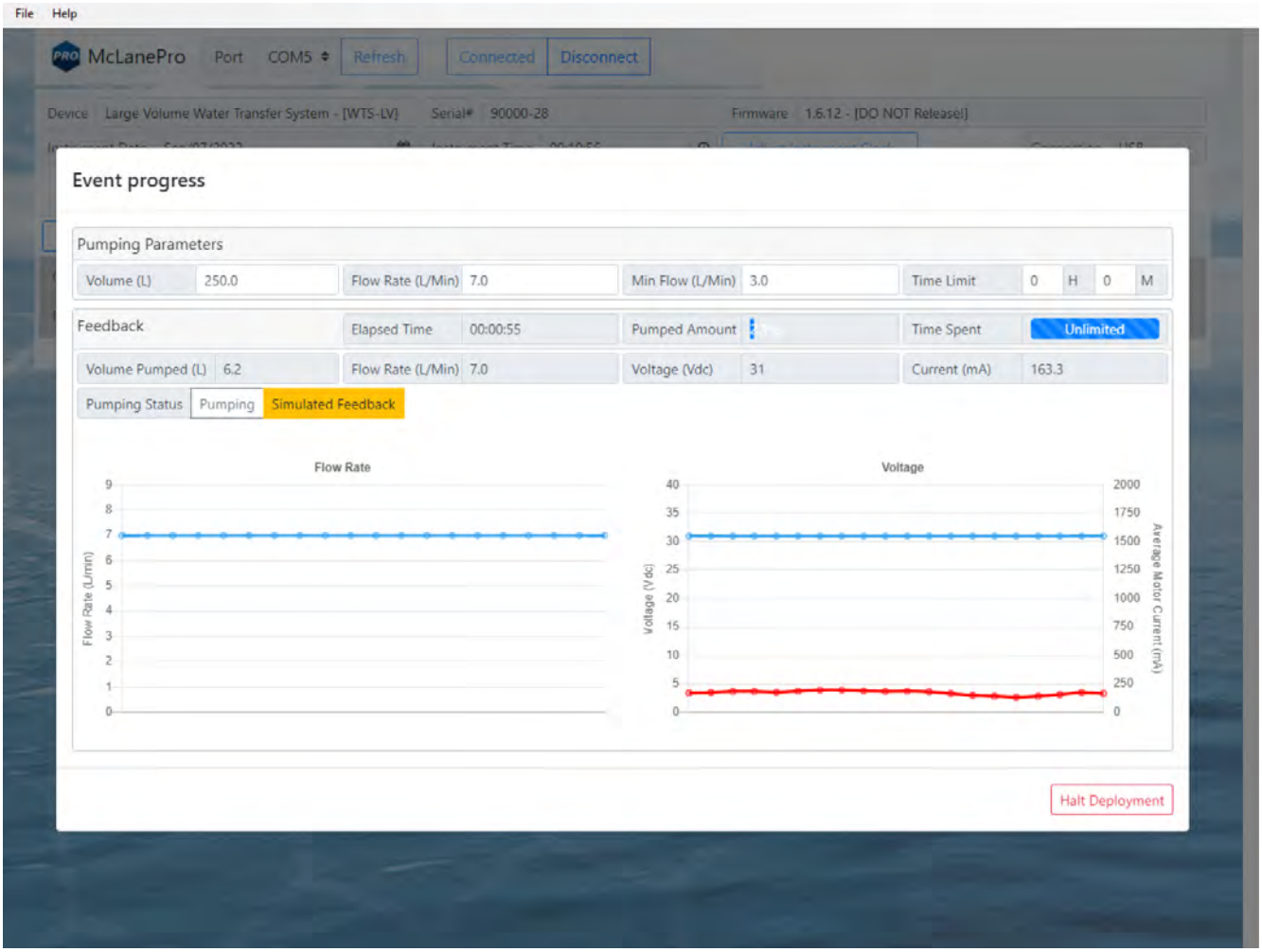
For a triggered start - the WTS-LV will proceed to the trigger test before allowing deployment. Once trigger function is verified, the deployment is allowed to proceed. The WTS-LV will display the current status as "waiting for trigger," once deployed. A message confirms it is safe to disconnect the USB connection. Once the trigger is activated, the WTS-LV will wait for the specified trigger delay interval before starting the sampling event.

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



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

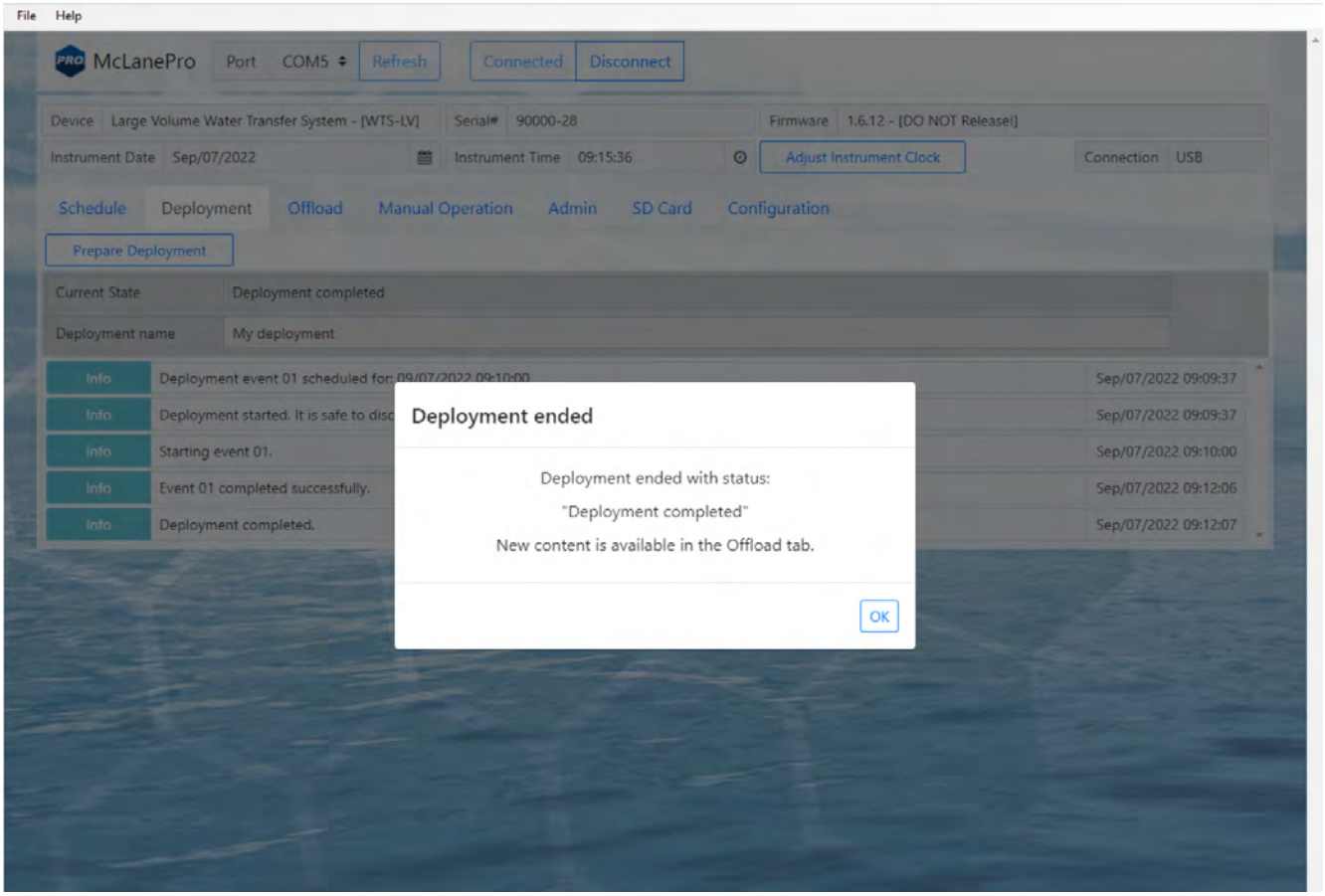
For testing or monitoring deployments, if USB is connected while running a test deployment, an event progress pop-up window reports the progress of the event that is being executed, and the deployment log will be updated as events are executed or completed.


File
Help
McLanePro
Port
COM5
Refresh
Connected
Disconnect
Device
Large Volume Water Transfer System - [WTS-LV]
Serial#
90000-28
Firmware
1.6.12 - [DO NOT Release!]
Event progress
Pumping Parameters
Volume (L)
250.0
Flow Rate (L/Min)
7.0
Min Flow (L/Min)
3.0
Time Limit
0
H
0
M
Feedback
Elapsed Time
00:00:55
Pumped Amount
Time Spent
Unlimited
Volume Pumped (L)
6.2
Flow Rate (L/Min)
7.0
Voltage (Vdc)
31
Current (mA)
163.3
Pumping Status
Pumping
Simulated Feedback
Flow Rate
Flow Rate (L/min)
Voltage
Voltage (Vdc)
Average Motor Current (mA)
Halt Deployment

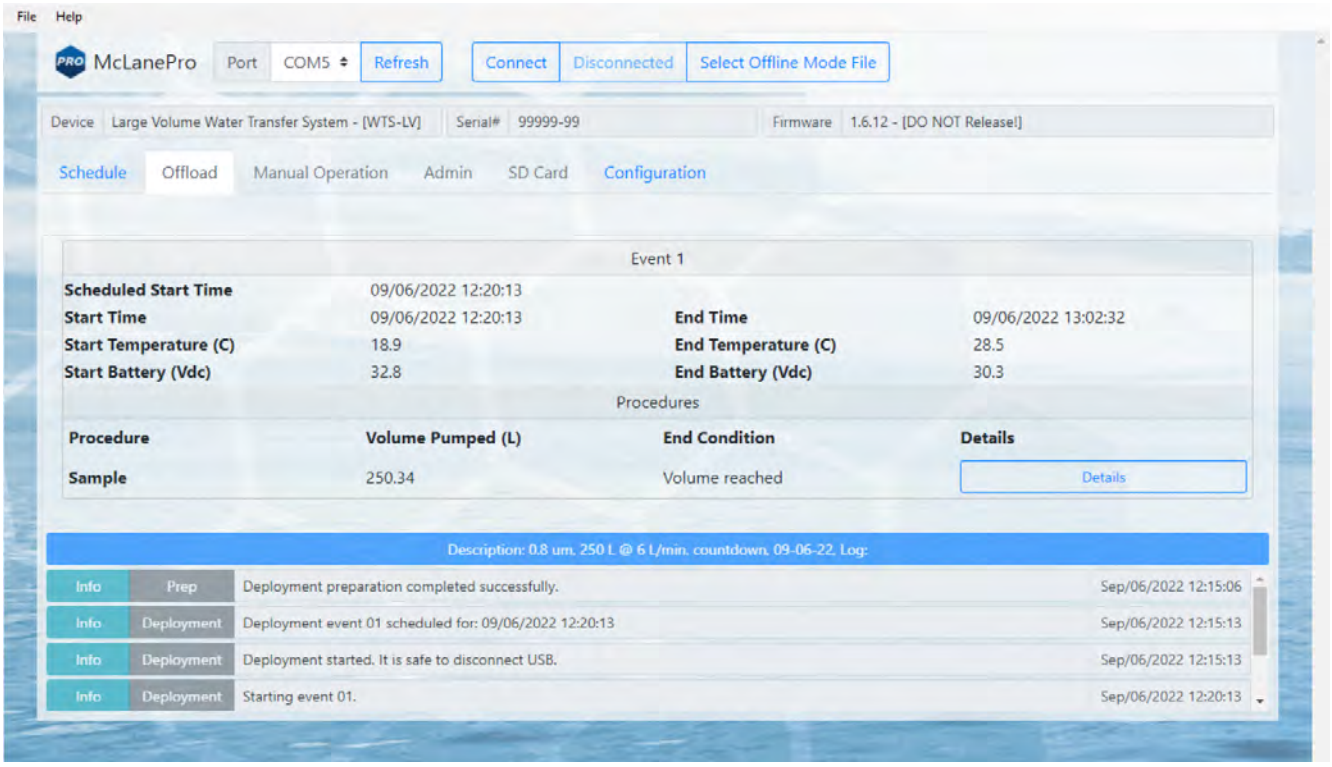
The Offload Tab

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

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

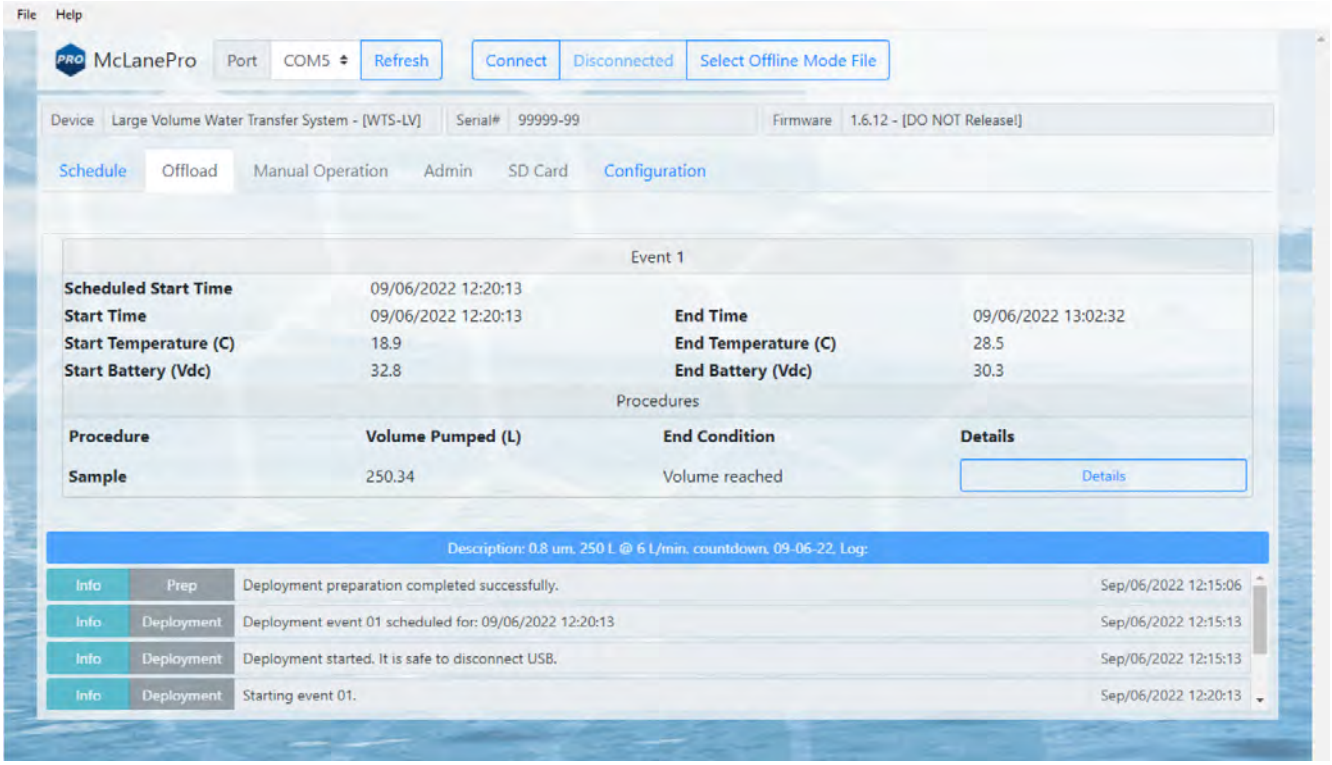


The **Offload tab** displays data for Event 1 (WTS-LV is a single event sampler), including procedure data, details and the deployment log.

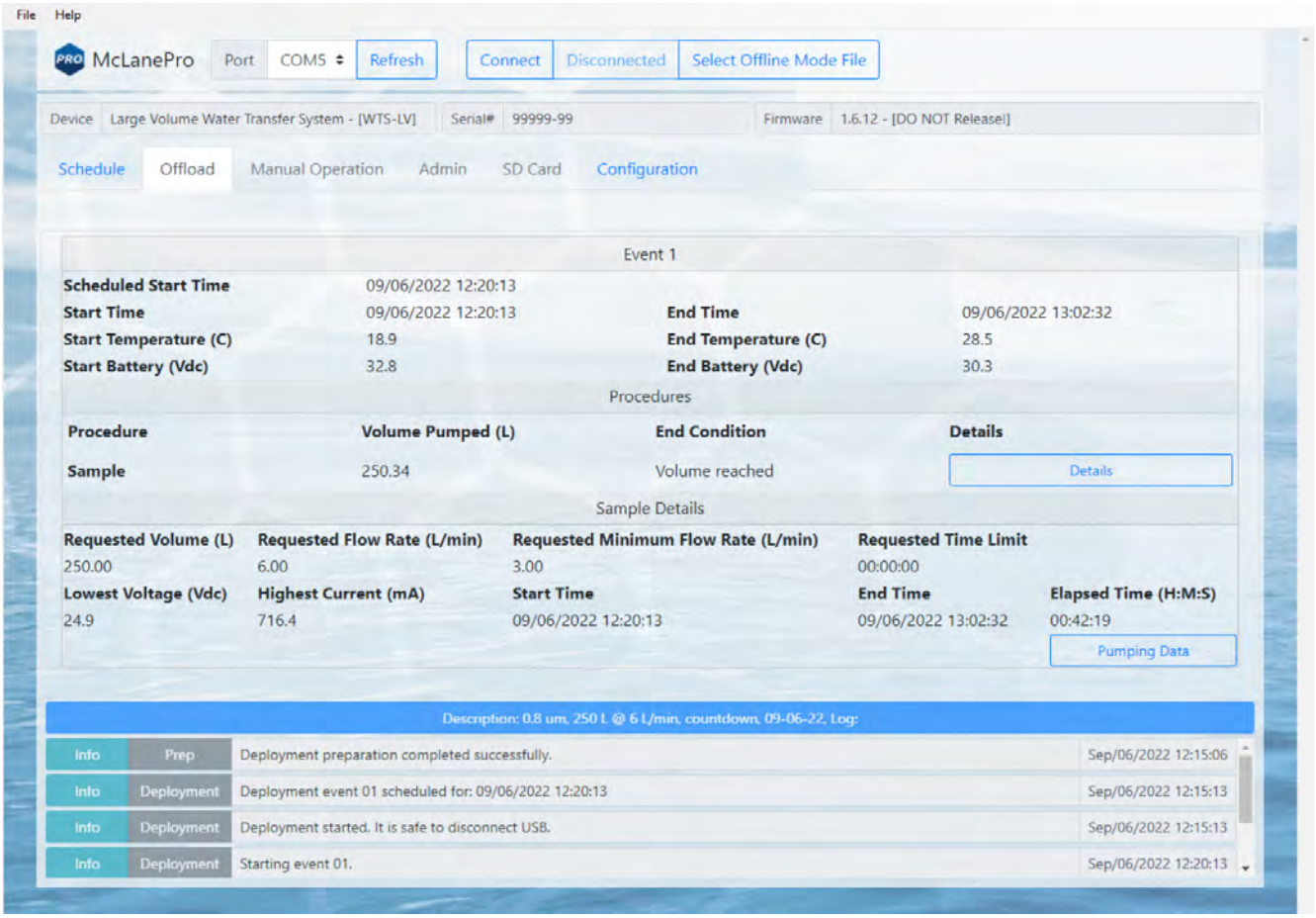


Event Data

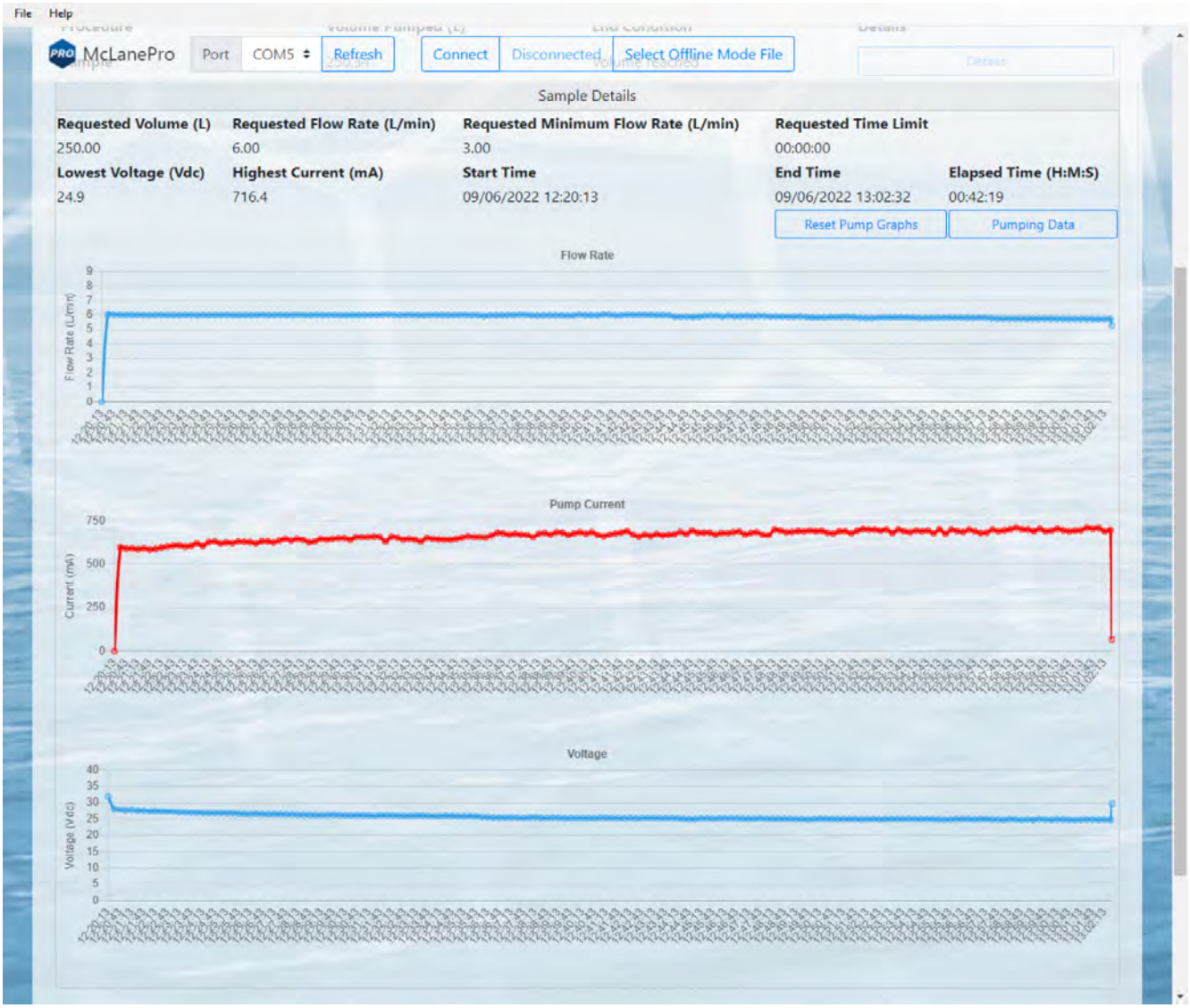
Data are presented in a card view for the single event WTS-LV sample.



Clicking the **Details** button will provide access to the pumping data, as well as voltage and current measurements taken during the event.

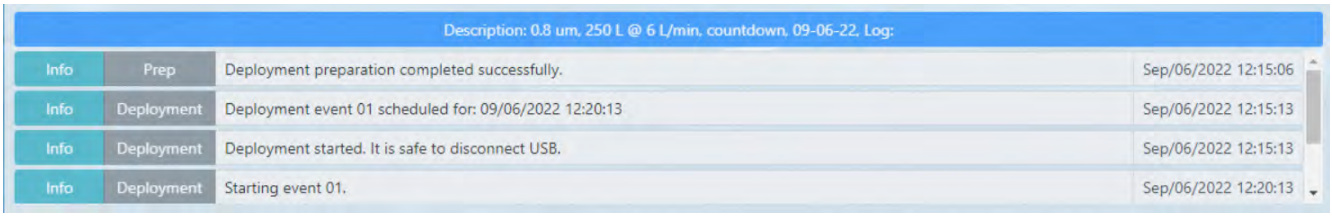


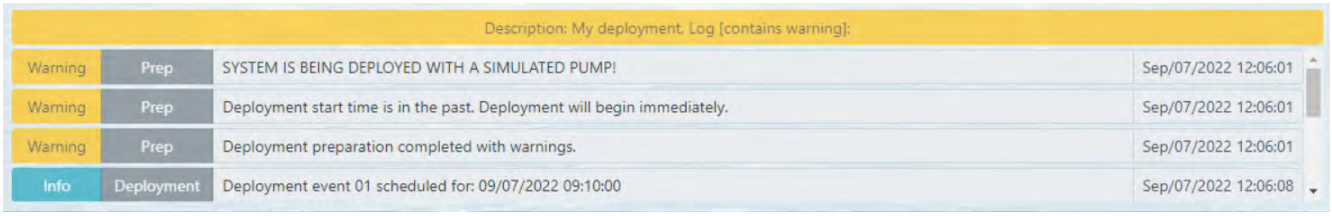
Clicking the **Pumping Data** button displays Event 1 pumping data recorded while the WTS-LV was collecting the sample. Clicking and dragging on a section of the pumping data will zoom in for a more detailed display of the data. Clicking **Reset Pump Graphs** returns the plots to the default view.

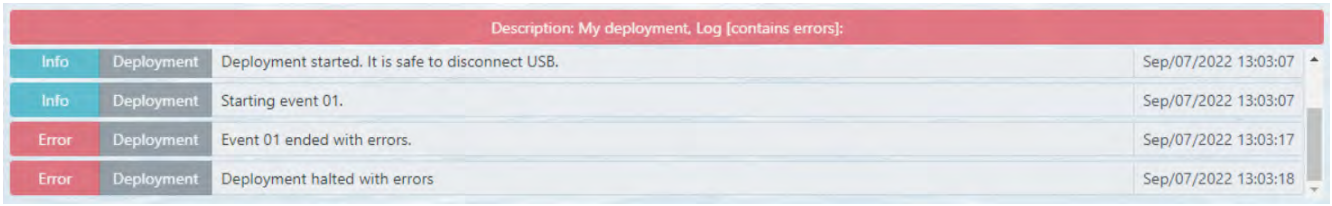


Deployment Log

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.



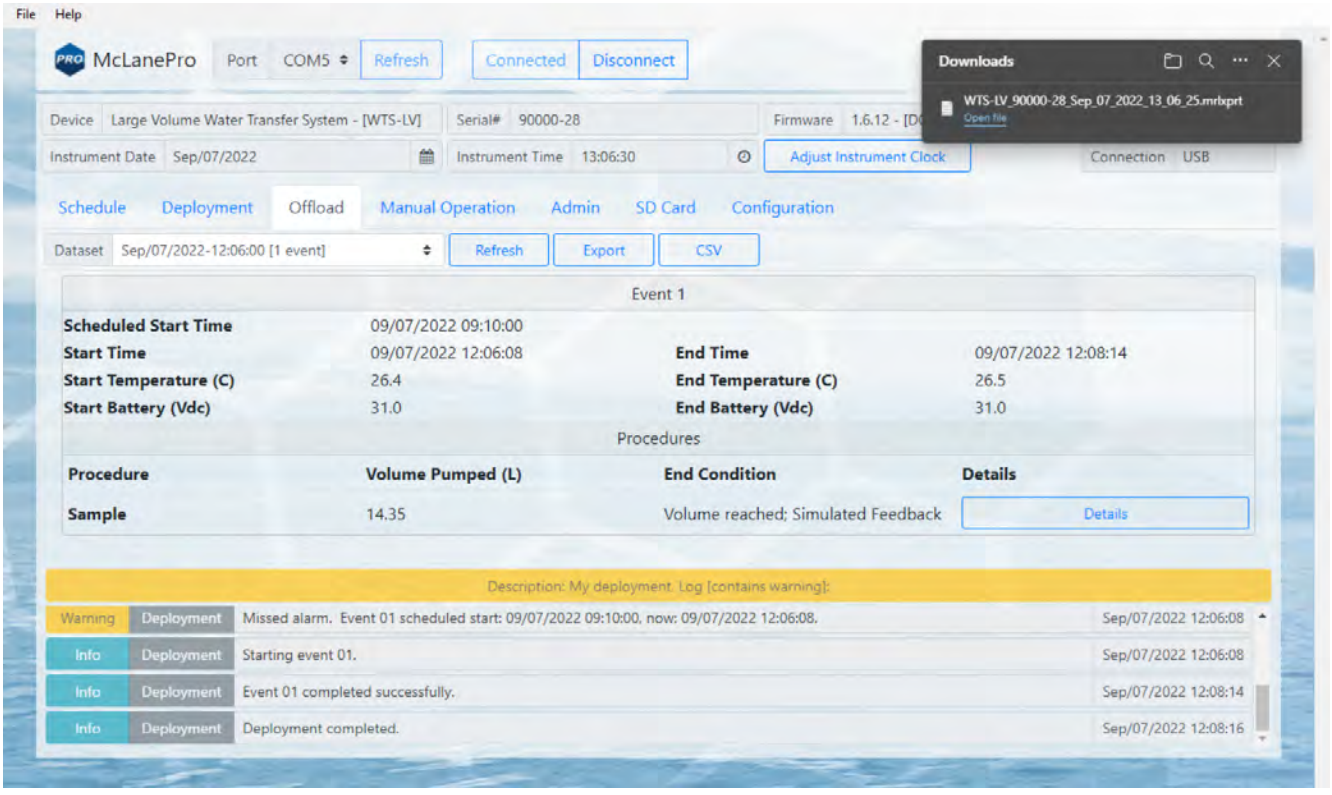




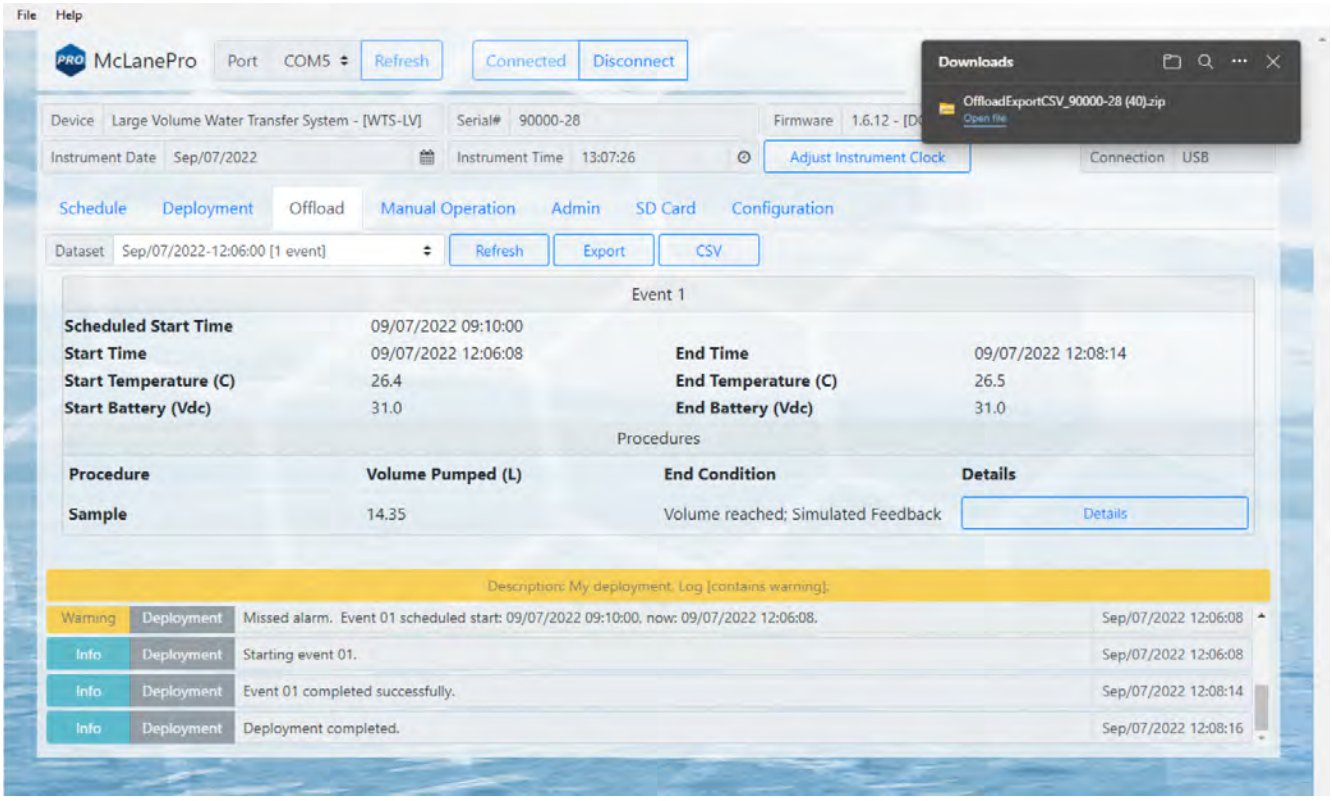
Exporting Deployment Data

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

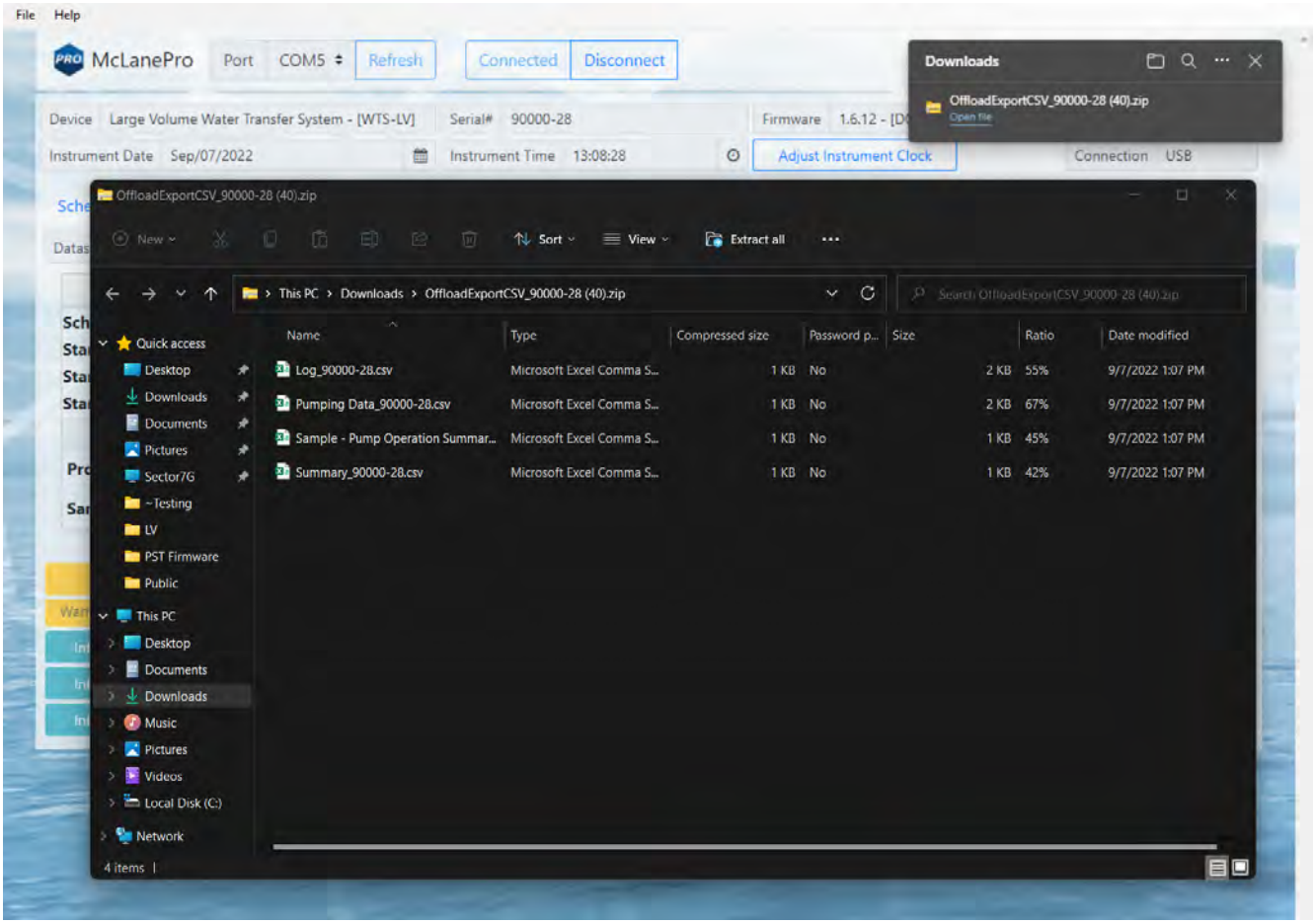
Clicking the **Export** button downloads schedule, configuration and device information in addition to the offload data from the deployment. These data are contained in a *.mrlxprt file that is viewable in McLanePro using Offline Mode.

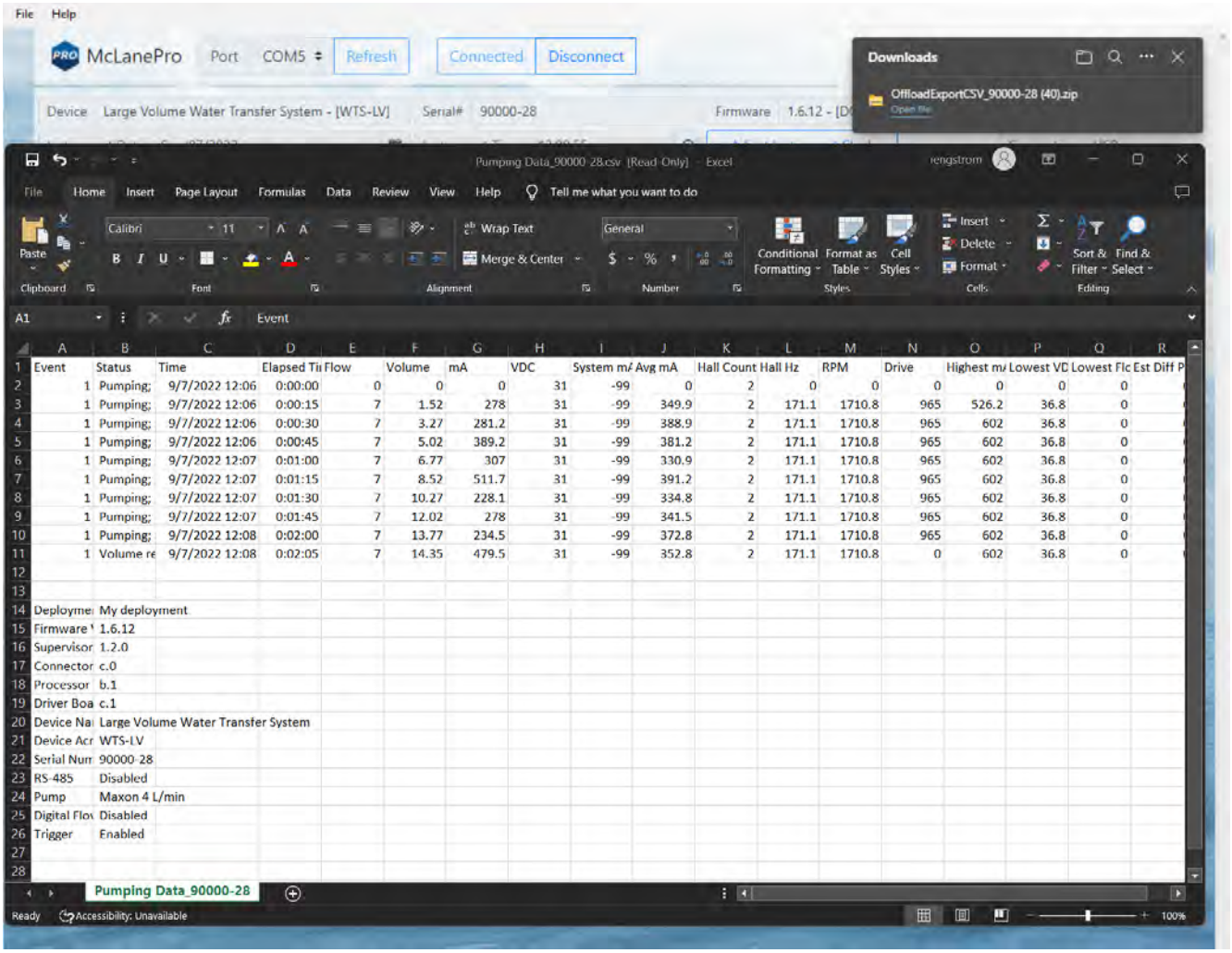


Deployment data may also be exported in CSV format by clicking the **CSV** button, and automatically downloading the compressed files to the host computer.



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

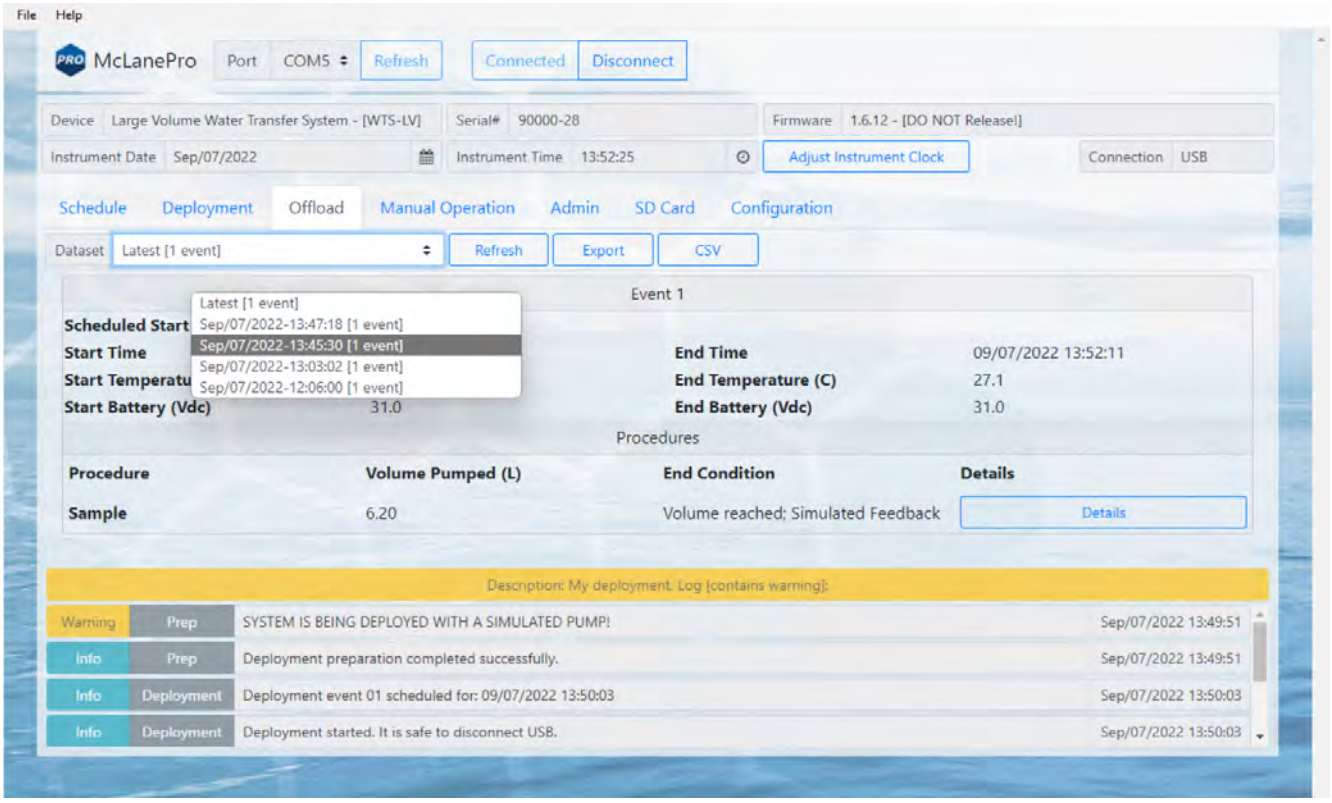

File
Help
McLanePro
Port
COM5
Refresh
Connected
Disconnect
Downloads
OffloadExportCSV_90000-28 (40).zip
Open file
Device
Large Volume Water Transfer System - [WTS-LV]
Serial#
90000-28
Firmware
1.6.12 - [D
Instrument Date
Sep/07/2022
Instrument Time
13:08:28
Adjust Instrument Clock
Connection
USB
OffloadExportCSV_90000-28 (40).zip
New
Sort
View
Extract all
This PC
Downloads
OffloadExportCSV_90000-28 (40).zip
Search OffloadExportCSV_90000-28 (40).zip
Quick access
Desktop
Downloads
Documents
Pictures
Sector7G
~Testing
LV
PST Firmware
Public
This PC
Desktop
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Network
Name
Type
Compressed size
Password p...
Size
Ratio
Date modified
Log_90000-28.csv
Microsoft Excel Comma S...
1 KB
No
2 KB
55%
9/7/2022 1:07 PM
Pumping Data_90000-28.csv
Microsoft Excel Comma S...
1 KB
No
2 KB
67%
9/7/2022 1:07 PM
Sample - Pump Operation Summar...
Microsoft Excel Comma S...
1 KB
No
1 KB
45%
9/7/2022 1:07 PM
Summary_90000-28.csv
Microsoft Excel Comma S...
1 KB
No
1 KB
42%
9/7/2022 1:07 PM
4 items



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Event	Status	Time	Elapsed Ti	Flow	Volume	mA	VDC	System mA	Avg mA	Hall Count	Hall Hz	RPM	Drive	Highest mA	Lowest VD	Lowest Flc	Est Diff P
2	1	Pumping;	9/7/2022 12:06	0:00:00	0	0	0	31	-99	0	2	0	0	0	0	0	0	
3	1	Pumping;	9/7/2022 12:06	0:00:15	7	1.52	278	31	-99	349.9	2	171.1	1710.8	965	526.2	36.8	0	
4	1	Pumping;	9/7/2022 12:06	0:00:30	7	3.27	281.2	31	-99	388.9	2	171.1	1710.8	965	602	36.8	0	
5	1	Pumping;	9/7/2022 12:06	0:00:45	7	5.02	389.2	31	-99	381.2	2	171.1	1710.8	965	602	36.8	0	
6	1	Pumping;	9/7/2022 12:07	0:01:00	7	6.77	307	31	-99	330.9	2	171.1	1710.8	965	602	36.8	0	
7	1	Pumping;	9/7/2022 12:07	0:01:15	7	8.52	511.7	31	-99	391.2	2	171.1	1710.8	965	602	36.8	0	
8	1	Pumping;	9/7/2022 12:07	0:01:30	7	10.27	228.1	31	-99	334.8	2	171.1	1710.8	965	602	36.8	0	
9	1	Pumping;	9/7/2022 12:07	0:01:45	7	12.02	278	31	-99	341.5	2	171.1	1710.8	965	602	36.8	0	
10	1	Pumping;	9/7/2022 12:08	0:02:00	7	13.77	234.5	31	-99	372.8	2	171.1	1710.8	965	602	36.8	0	
11	1	Volume re	9/7/2022 12:08	0:02:05	7	14.35	479.5	31	-99	352.8	2	171.1	1710.8	0	602	36.8	0	
12																		
13																		
14	Deployme	My deployment																
15	Firmware	1.6.12																
16	Supervisor	1.2.0																
17	Connector	c.0																
18	Processor	b.1																
19	Driver Boa	c.1																
20	Device Na	Large Volume Water Transfer System																
21	Device Acr	WTS-LV																
22	Serial Num	90000-28																
23	RS-485	Disabled																
24	Pump	Maxon 4 L/min																
25	Digital Flo	Disabled																
26	Trigger	Enabled																
27																		
28																		

Viewing and Exporting Data From Previous Deployments

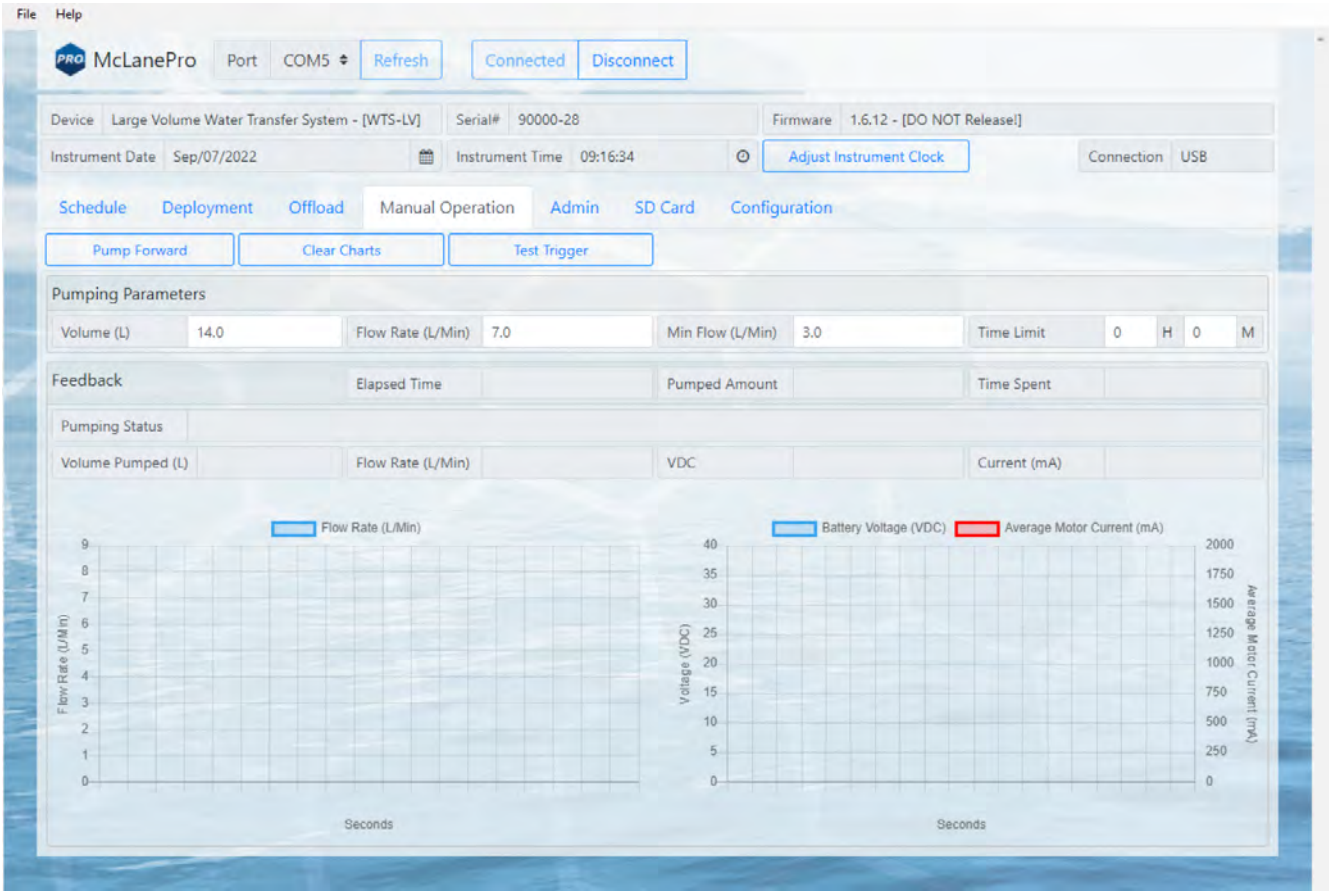
Data from previous deployments may be viewed by selecting a previous data set. To export the data, follow the instructions in Exporting Deployment Data.


File
Help
McLanePro
Port
COM5
Refresh
Connected
Disconnect
Device
Large Volume Water Transfer System - [WTS-LV]
Serial#
90000-28
Firmware
1.6.12 - [DO NOT Release!]
Instrument Date
Sep/07/2022
Instrument Time
13:52:25
Adjust Instrument Clock
Connection
USB
Schedule
Deployment
Offload
Manual Operation
Admin
SD Card
Configuration
Dataset
Latest [1 event]
Refresh
Export
CSV
Event 1
Latest [1 event]
Sep/07/2022-13:47:18 [1 event]
Sep/07/2022-13:45:30 [1 event]
Sep/07/2022-13:03:02 [1 event]
Sep/07/2022-12:06:00 [1 event]
Scheduled Start
Start Time
Start Temperatu
Start Battery (Vdc)
31.0
End Time
09/07/2022 13:52:11
End Temperature (C)
27.1
End Battery (Vdc)
31.0
Procedures
Procedure
Volume Pumped (L)
End Condition
Details
Sample
6.20
Volume reached; Simulated Feedback
Details
Description: My deployment. Log [contains warning]:
Warning
Prep
SYSTEM IS BEING DEPLOYED WITH A SIMULATED PUMP!
Sep/07/2022 13:49:51
Info
Prep
Deployment preparation completed successfully.
Sep/07/2022 13:49:51
Info
Deployment
Deployment event 01 scheduled for: 09/07/2022 13:50:03
Sep/07/2022 13:50:03
Info
Deployment
Deployment started. It is safe to disconnect USB.
Sep/07/2022 13:50:03

The Manual Operation Tab

The **Manual Operation tab** allows operation of the pump and functional testing of the trigger.

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



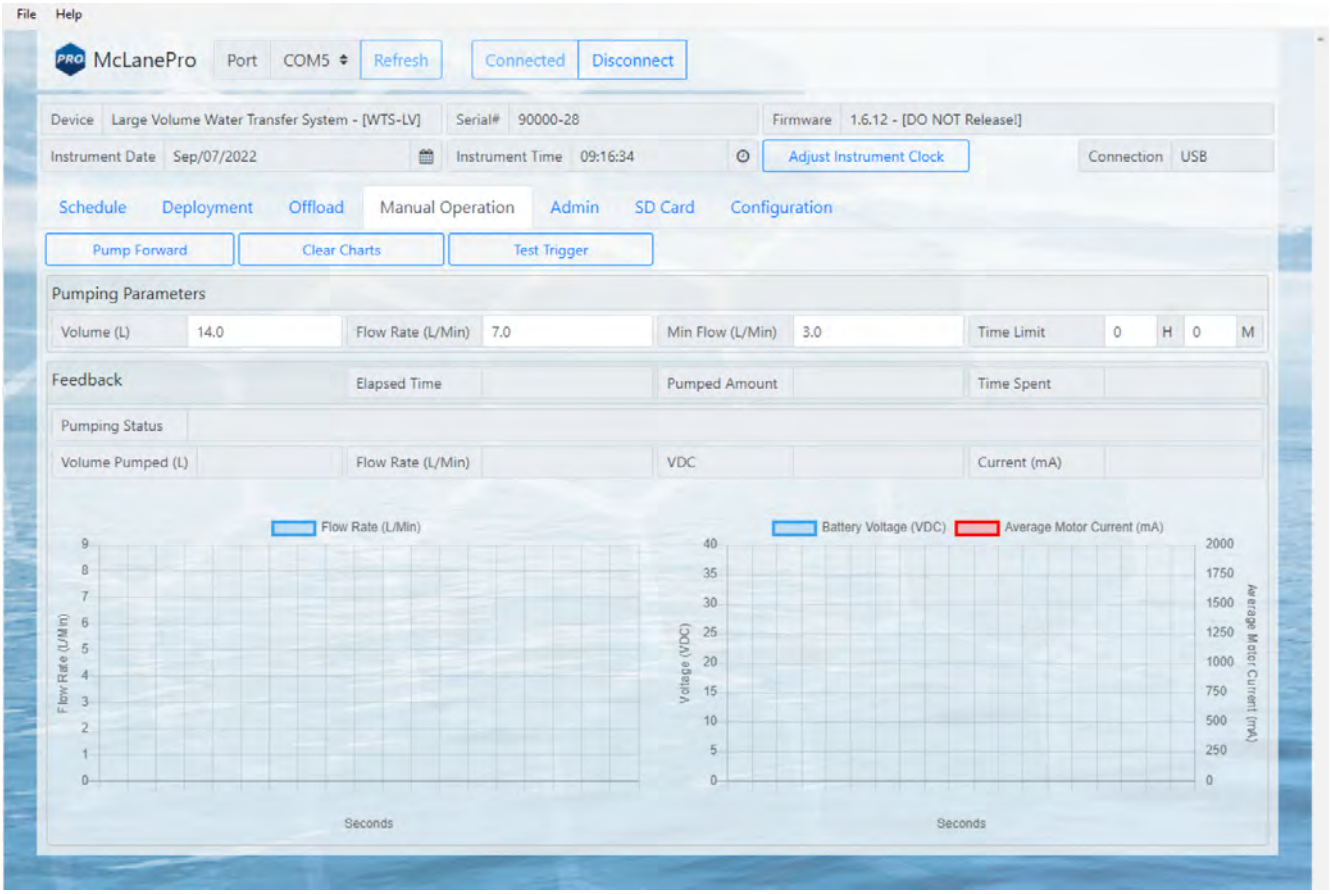
Forward Pumping

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

Pump Forward - starts a forward pumping routine according to parameters set in the Pumping Parameters.

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

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



Pumping Parameters and Feedback

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

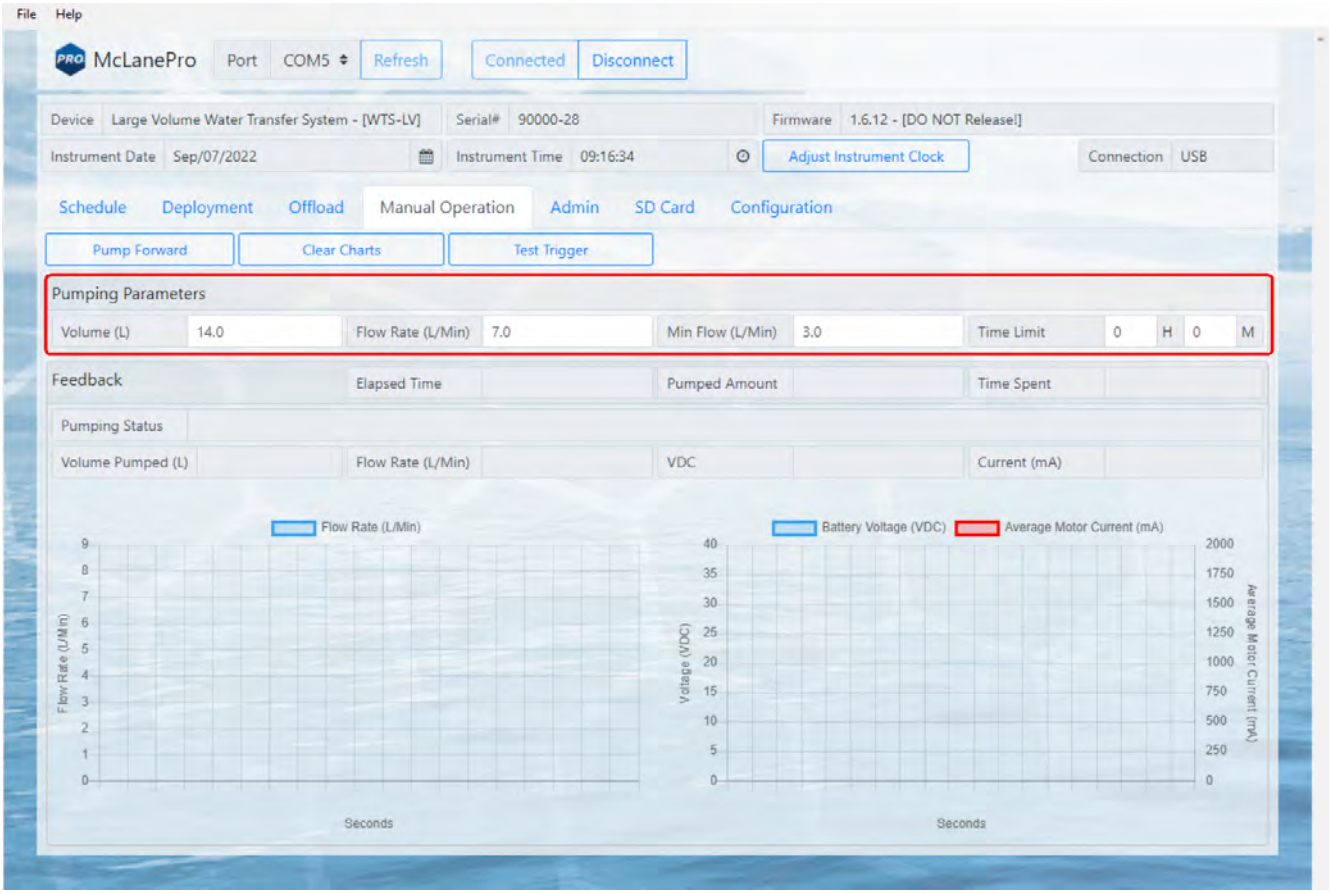
Pumping parameters:

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

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

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

Time Limit - sets a maximum event time limit for the pumping event.



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

Feedback:

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

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

Time Spent (%) - the elapsed time percentage for the current pumping event.

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

Volume Pumped - the total volume pumped.

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

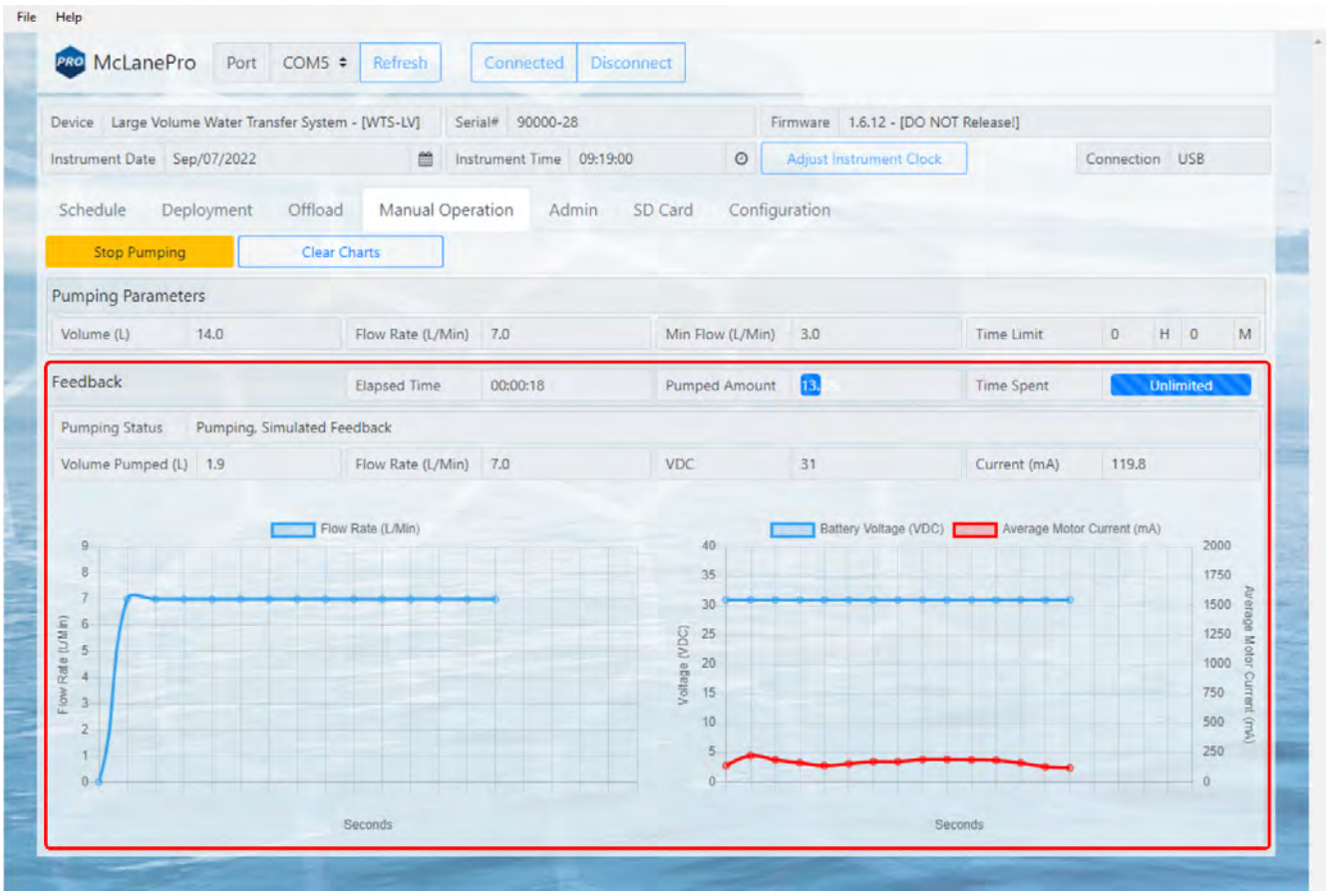
- Actual flow rate varies due to filter selection, differential pressure and environmental conditions. When deploying the WTS-LV, it is important to always log the mechanical flow meter reading before and after the deployment for an accurate record of the total volume pumped.

Vdc - the measured battery voltage while pumping.

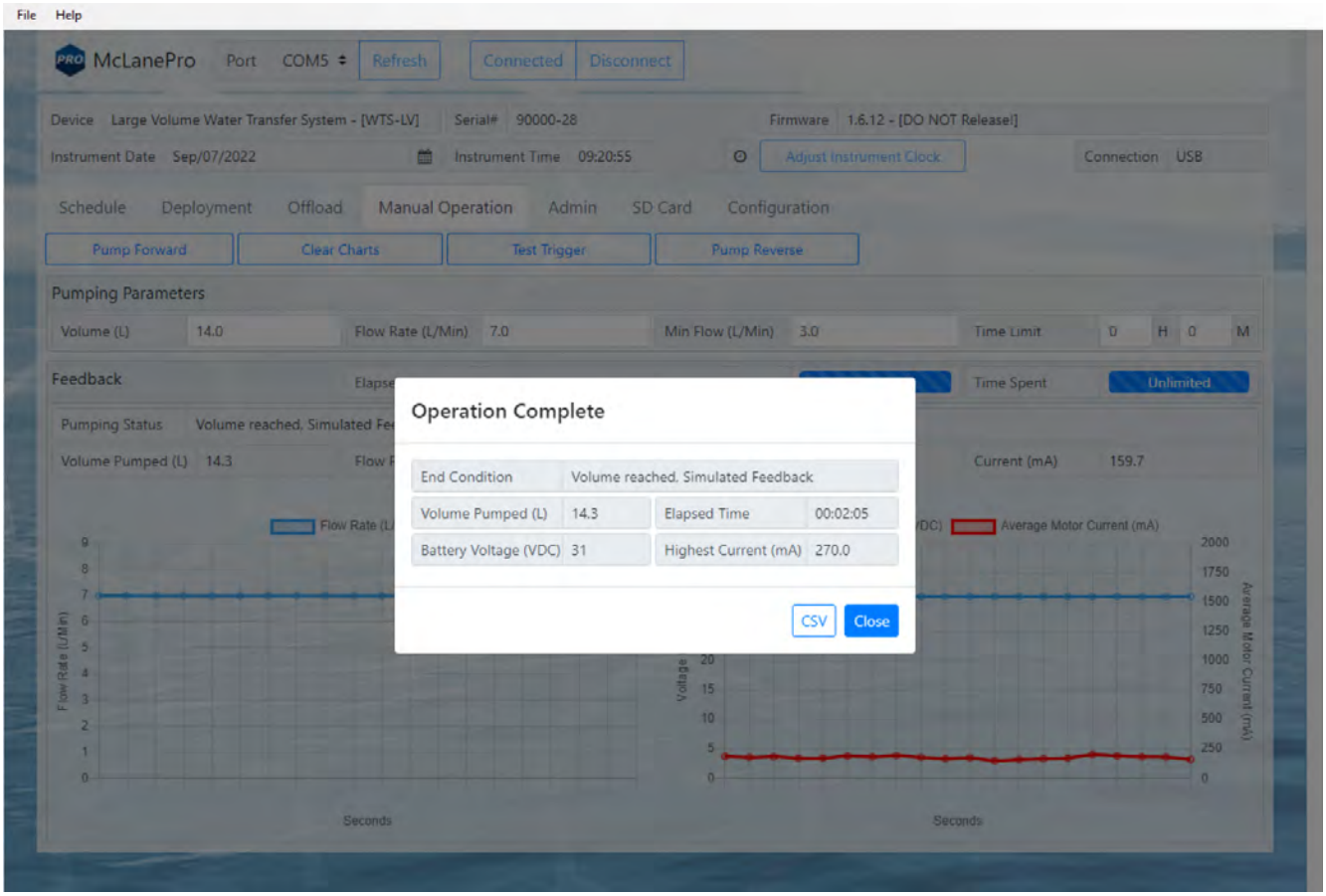
Current (mA) - The measured current while pumping.

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

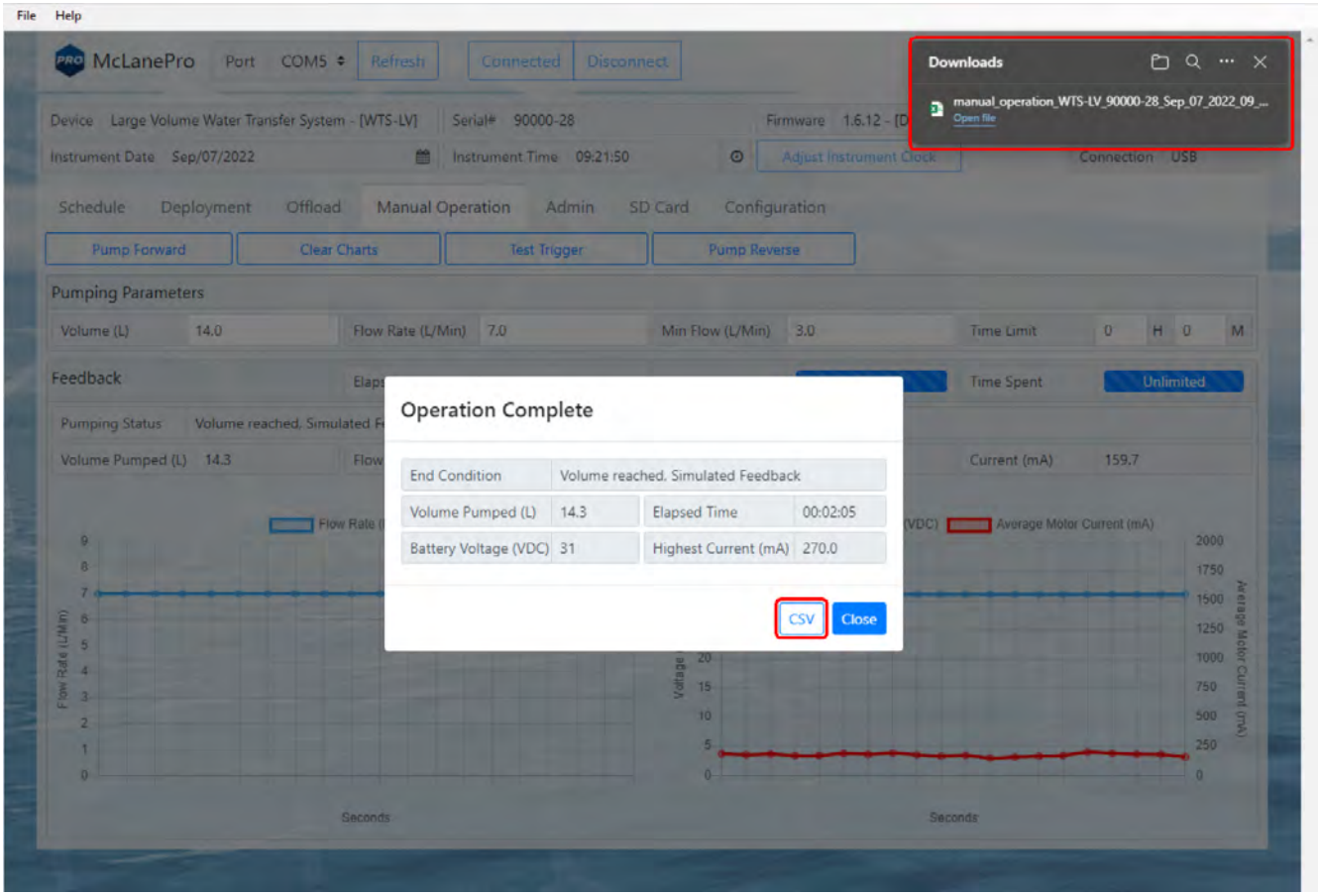
Clear Charts will erase the existing data from the charts.



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



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

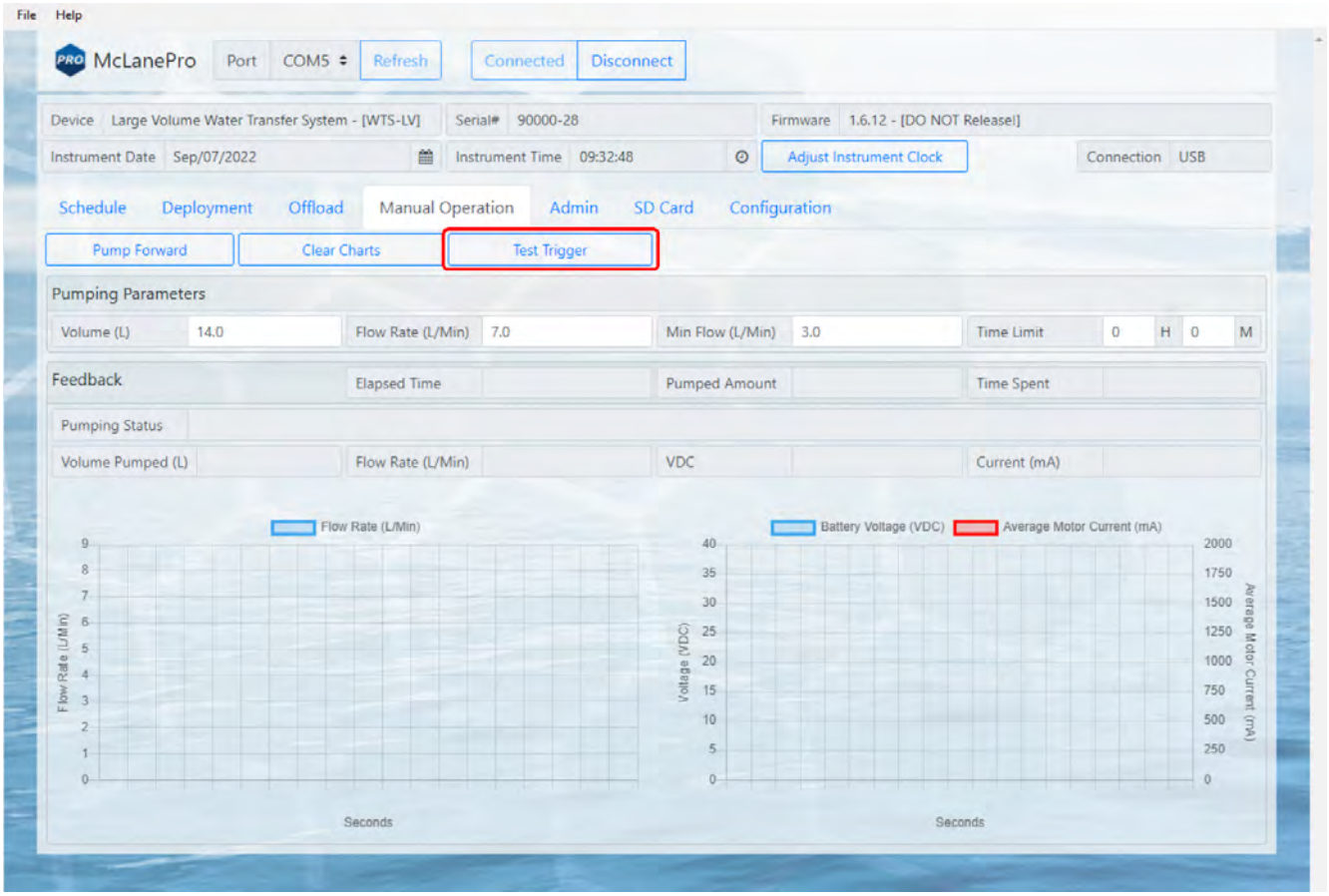


Test Trigger

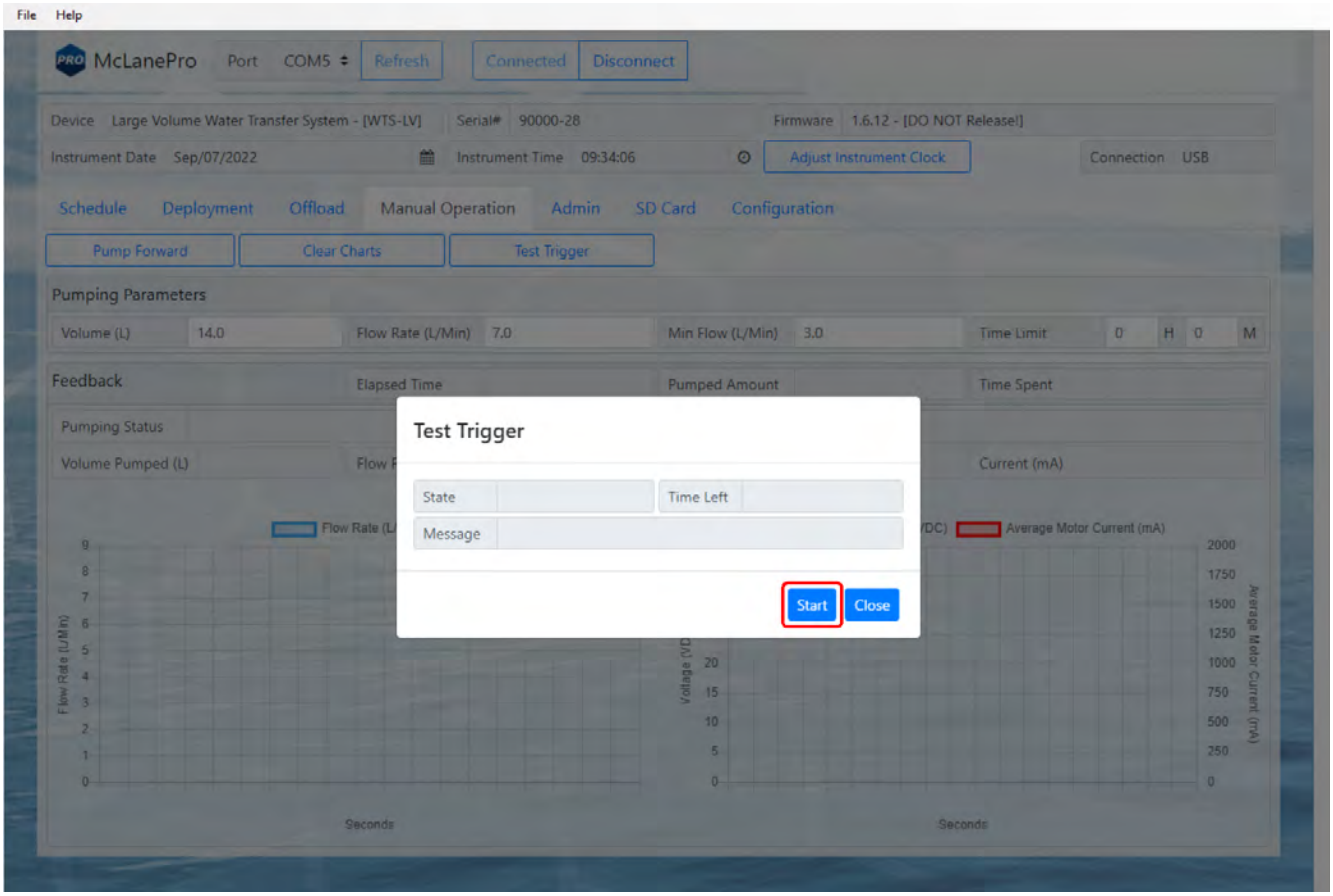
The WTS-LV is equipped with an electronic trigger. This trigger is activated by removing, and then replacing the trigger plug on the controller end cap. A trigger test will be required at the time of deployment if scheduled as a triggered start. The trigger may be checked manually using the **Test Trigger** procedure.

To test the trigger on the WTS-LV:

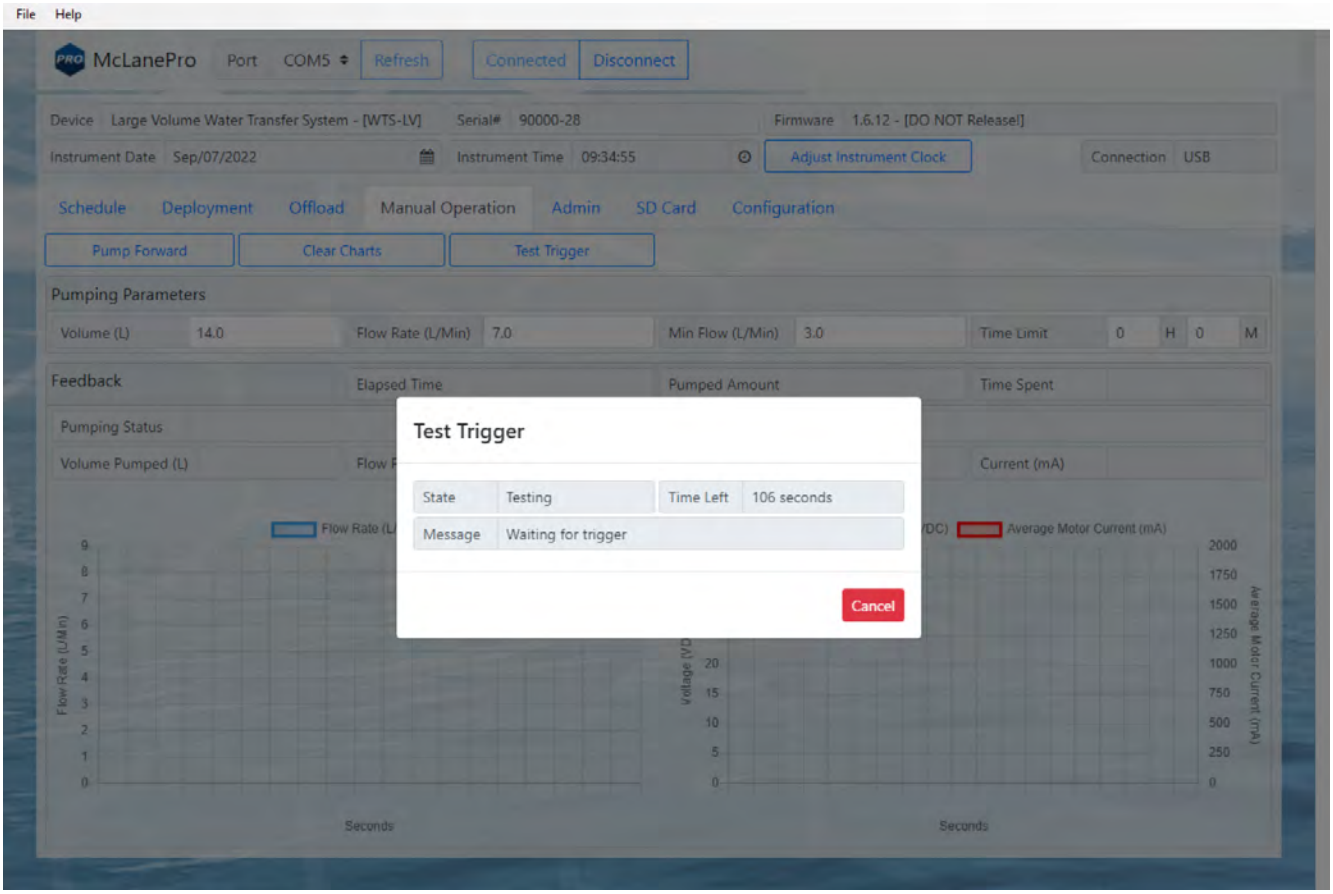
1. Click **Test Trigger** on the **Manual Operation** tab.



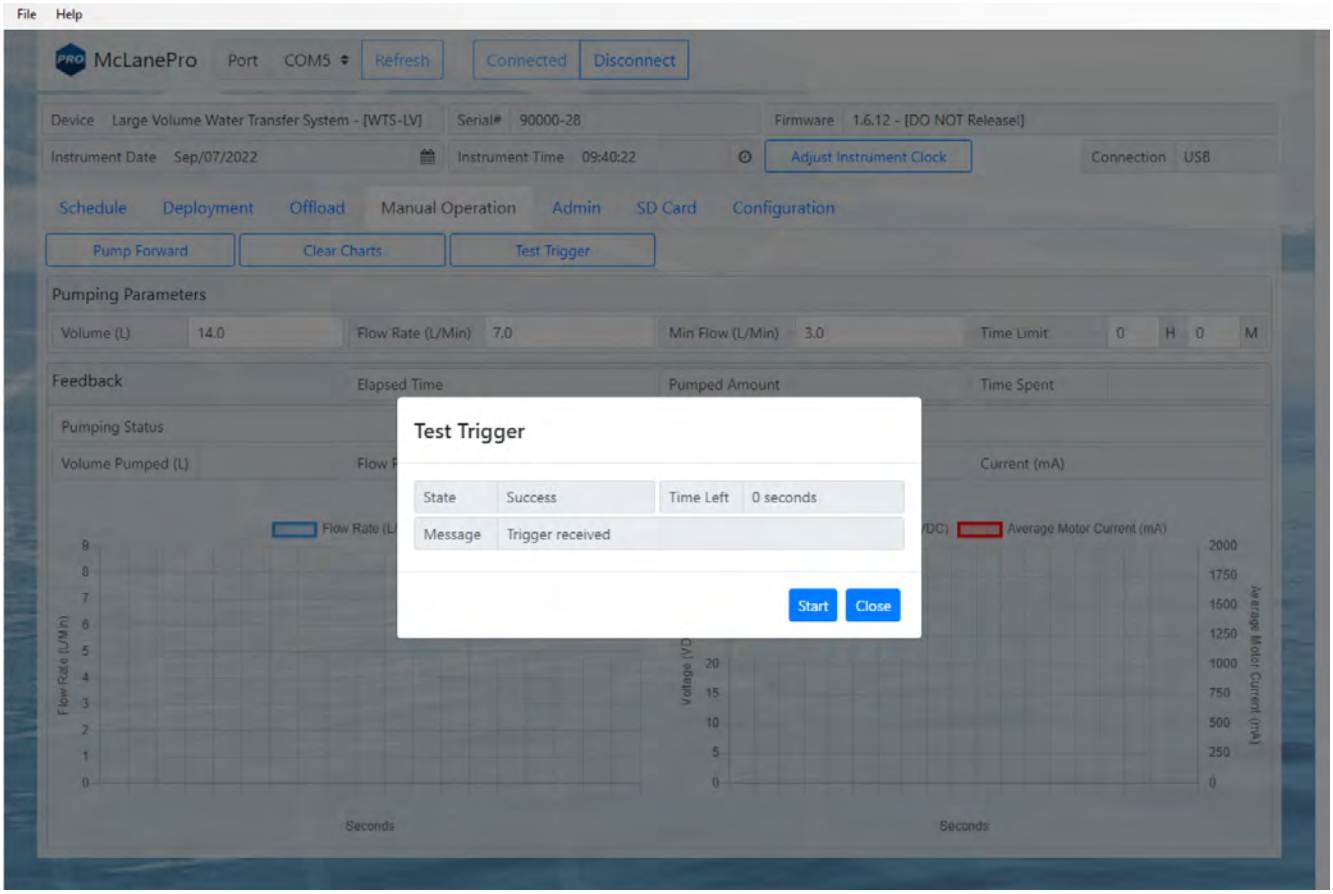
2. The test trigger window will appear indicating the WTS-LV is prepared to perform the test.



3. Click **Start**. The WTS-LV will indicate that it is "waiting for trigger." There is a two minute timeout for this test.



4. Remove the trigger plug from the controller end cap.
5. The WTS-LV is programmed to provide feedback for a received trigger via pump motor vibration. Place a hand on the pump motor when replacing the trigger onto the end cap.
6. Replace the trigger plug onto the controller end cap. Verify that the pump motor provides vibration feedback, this indicates the system has received the trigger.
7. The WTS-LV should report that a trigger was received and that the test was successful.

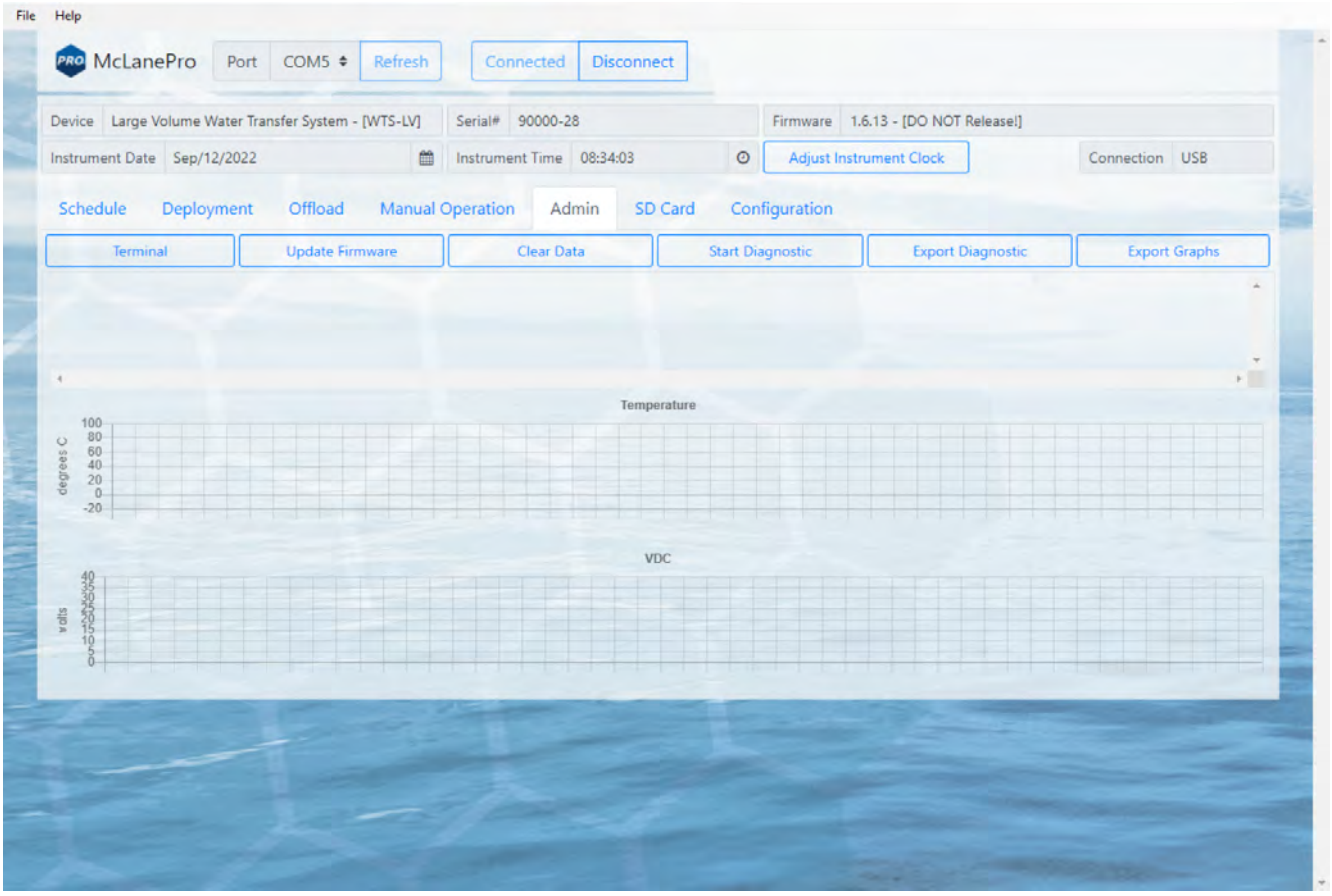


8. Click **Close** to return to the **Manual Operation tab.**

The Admin Tab

The **Admin tab** is used to:

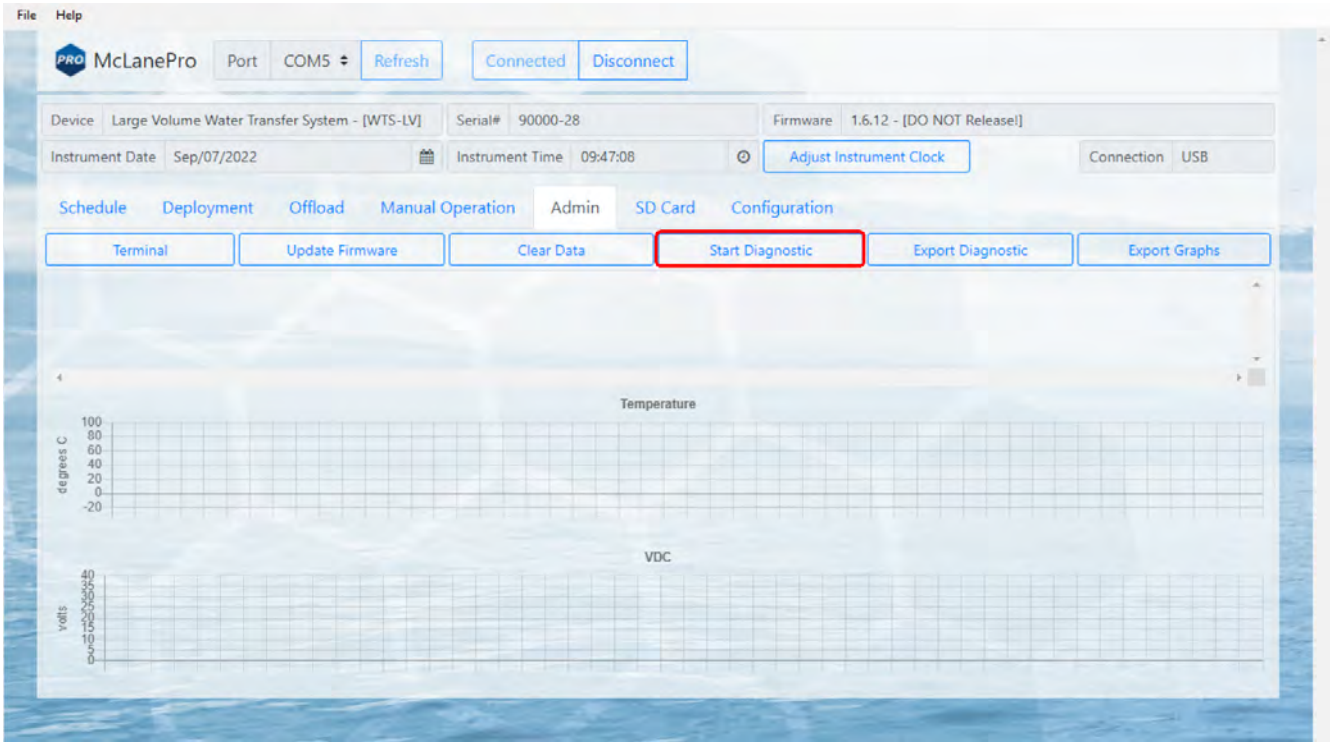
- Run Diagnostics
- Update Firmware
- Communicate to the WTS-LV Using the Terminal



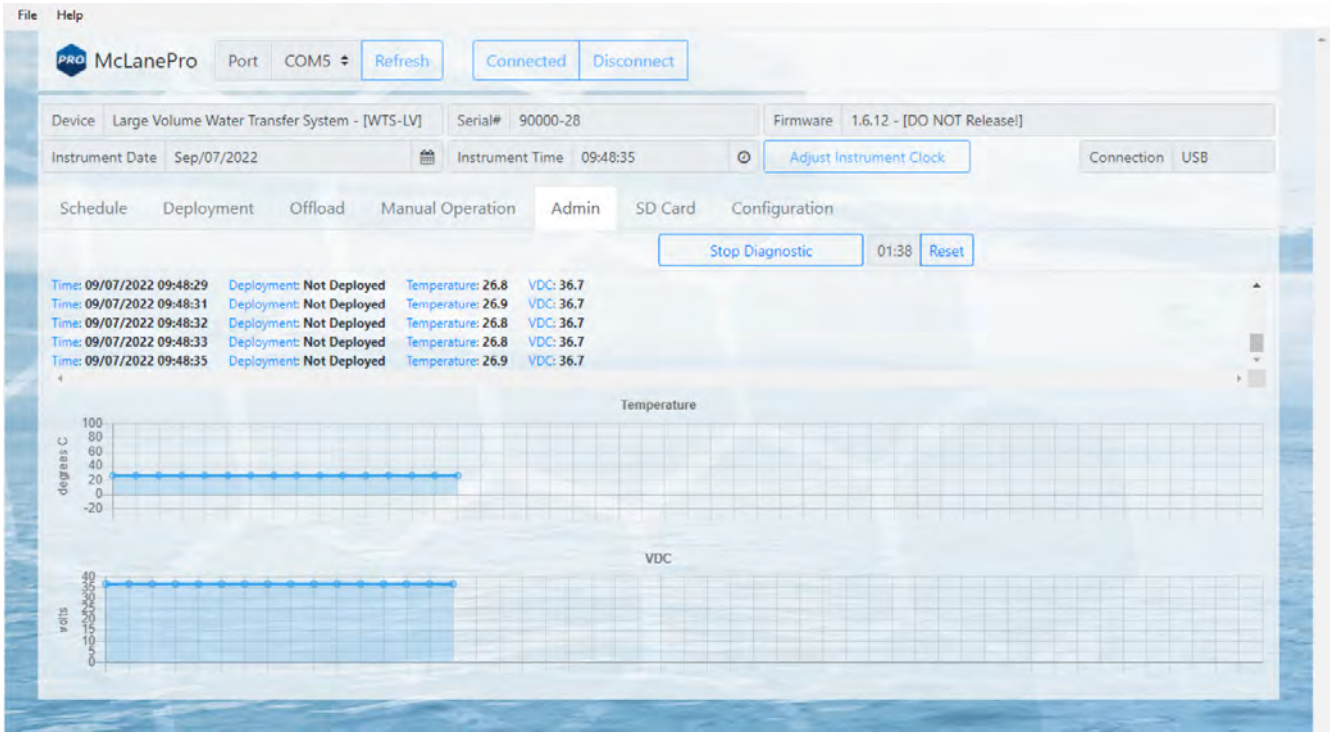
Running Diagnostics

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.



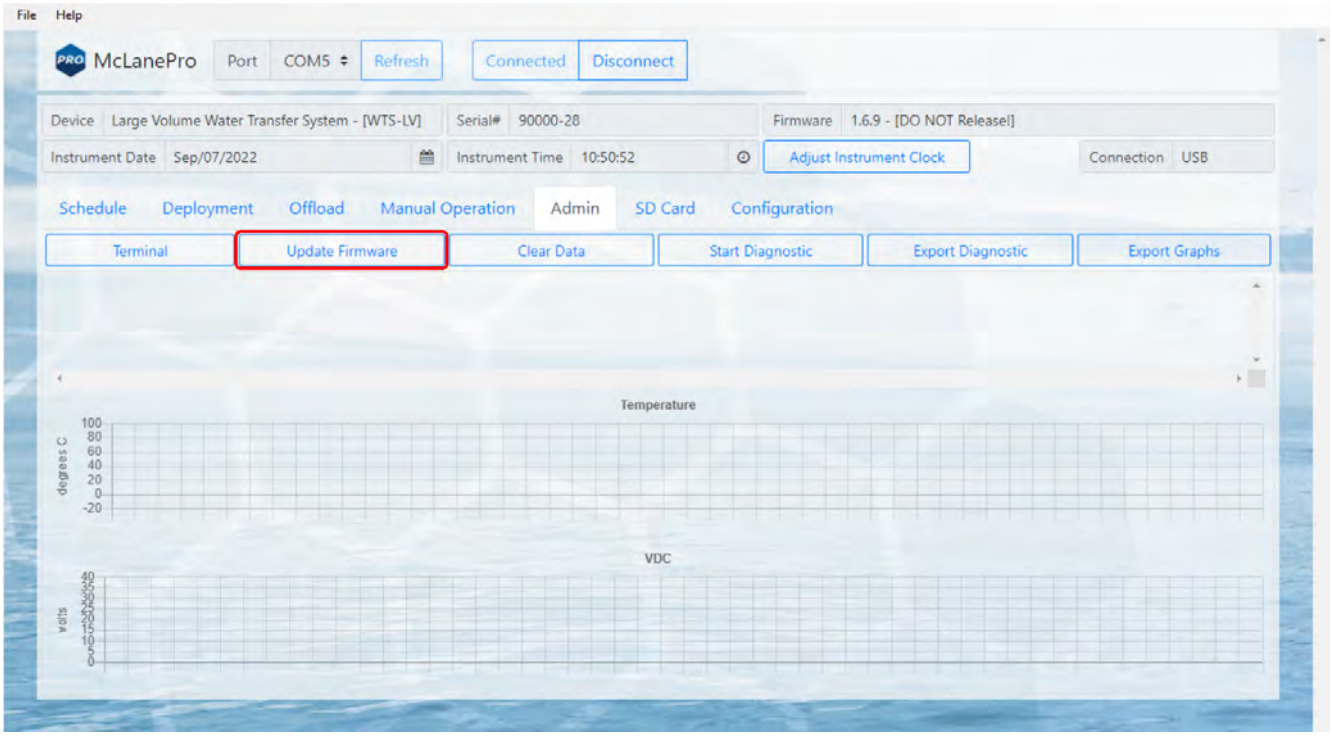
Diagnostics will run for two minutes, otherwise, click **Stop diagnostic**.



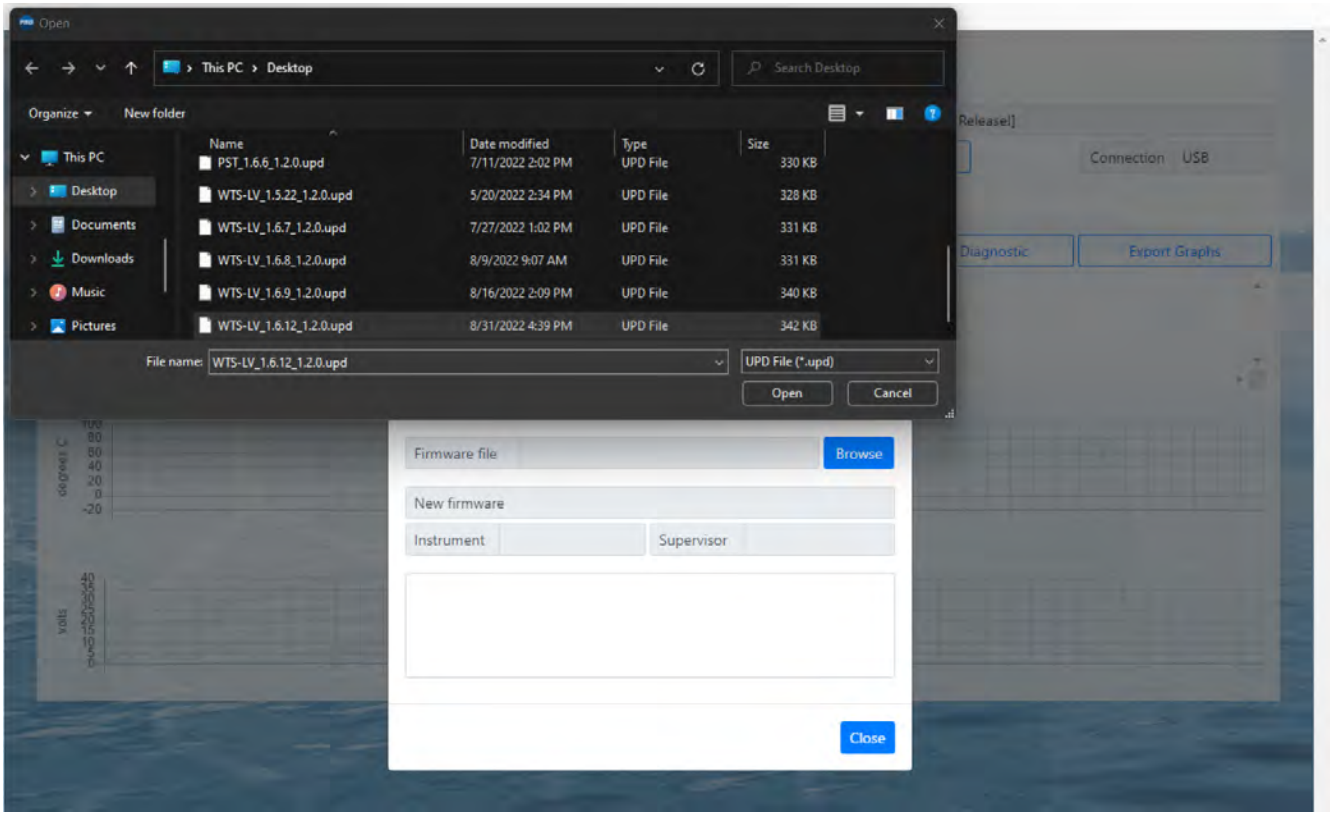
After running diagnostics, clear the data on the **Admin** tab by clicking the **Clear Data** button. Alternatively, diagnostic data and graphs may be exported using the buttons provided.

Update Firmware

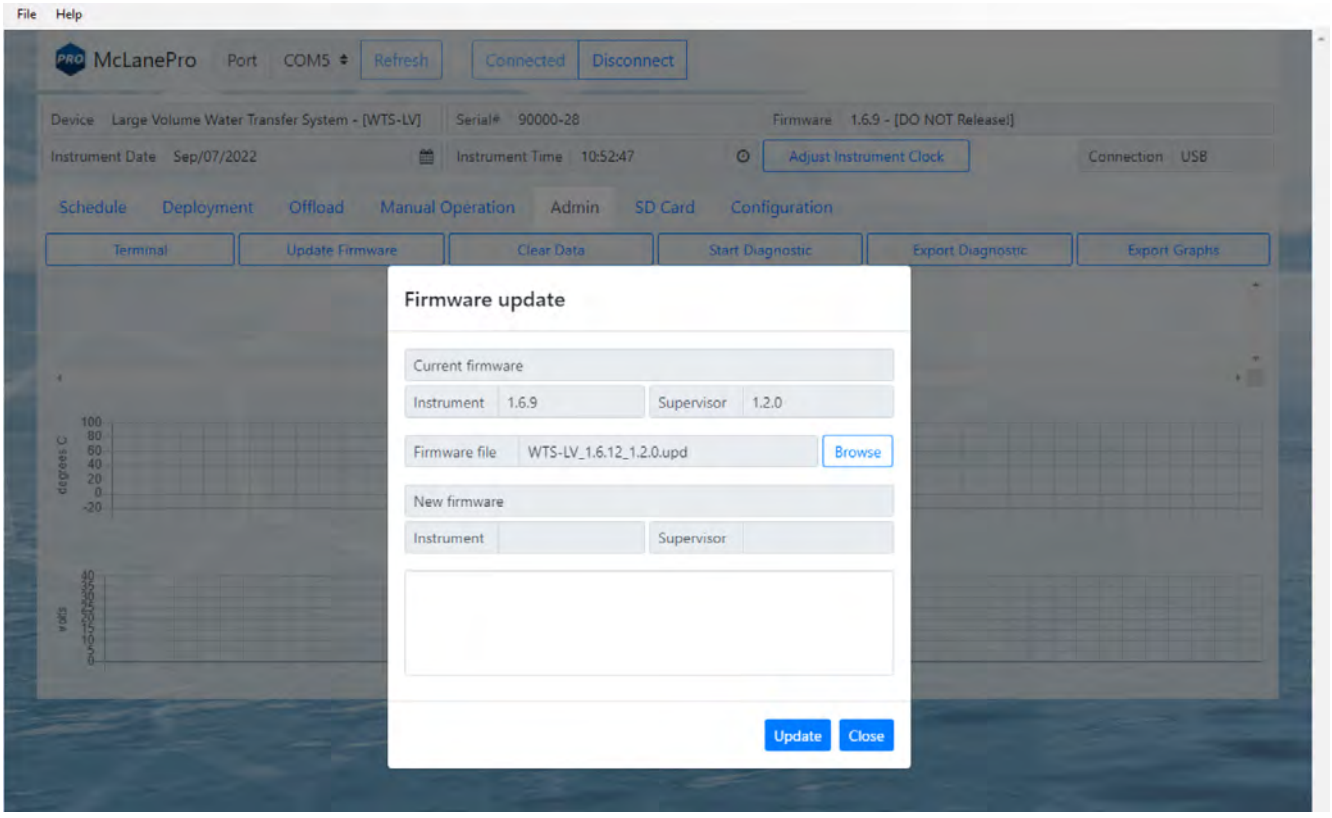
1. To update firmware click the **Update firmware** button on the **Admin tab.**



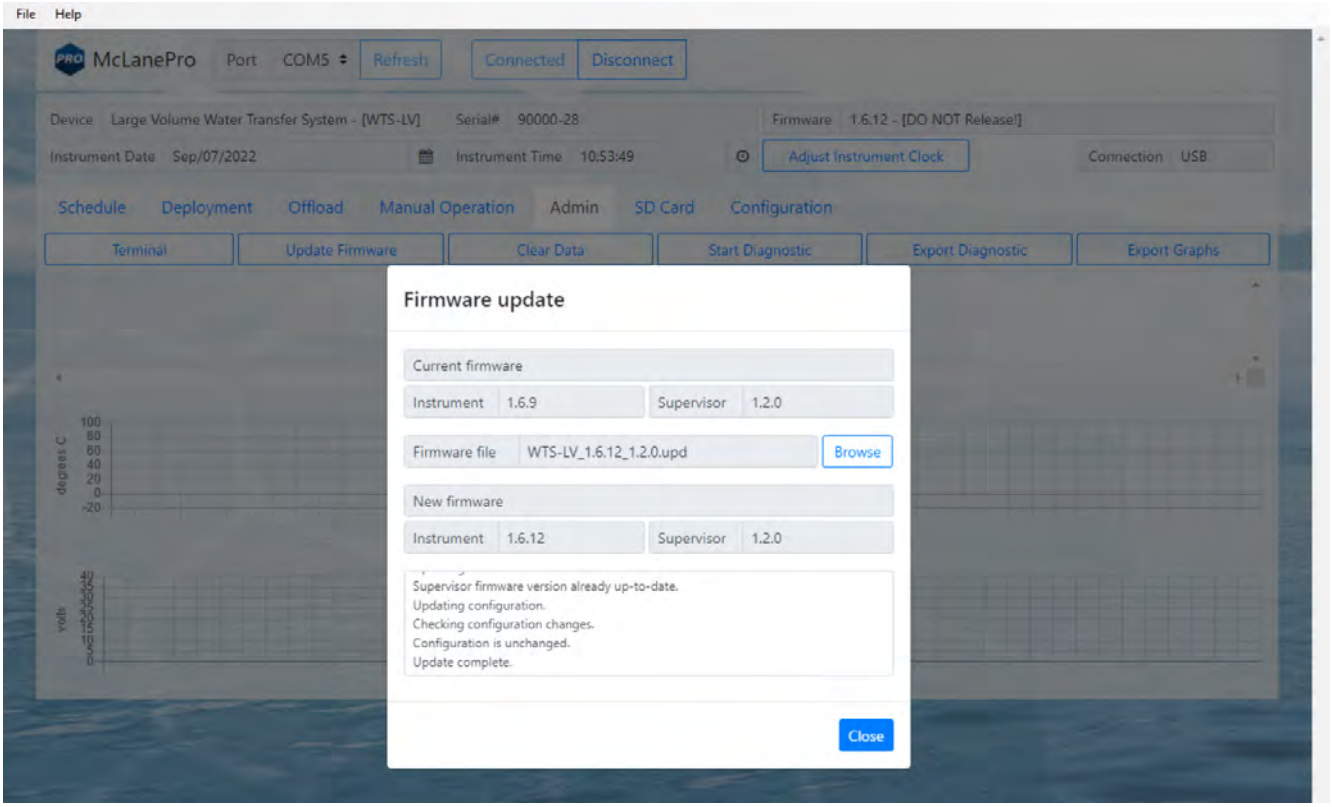
2. Click **Browse**, and select a McLane *.UPD file to upload.



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



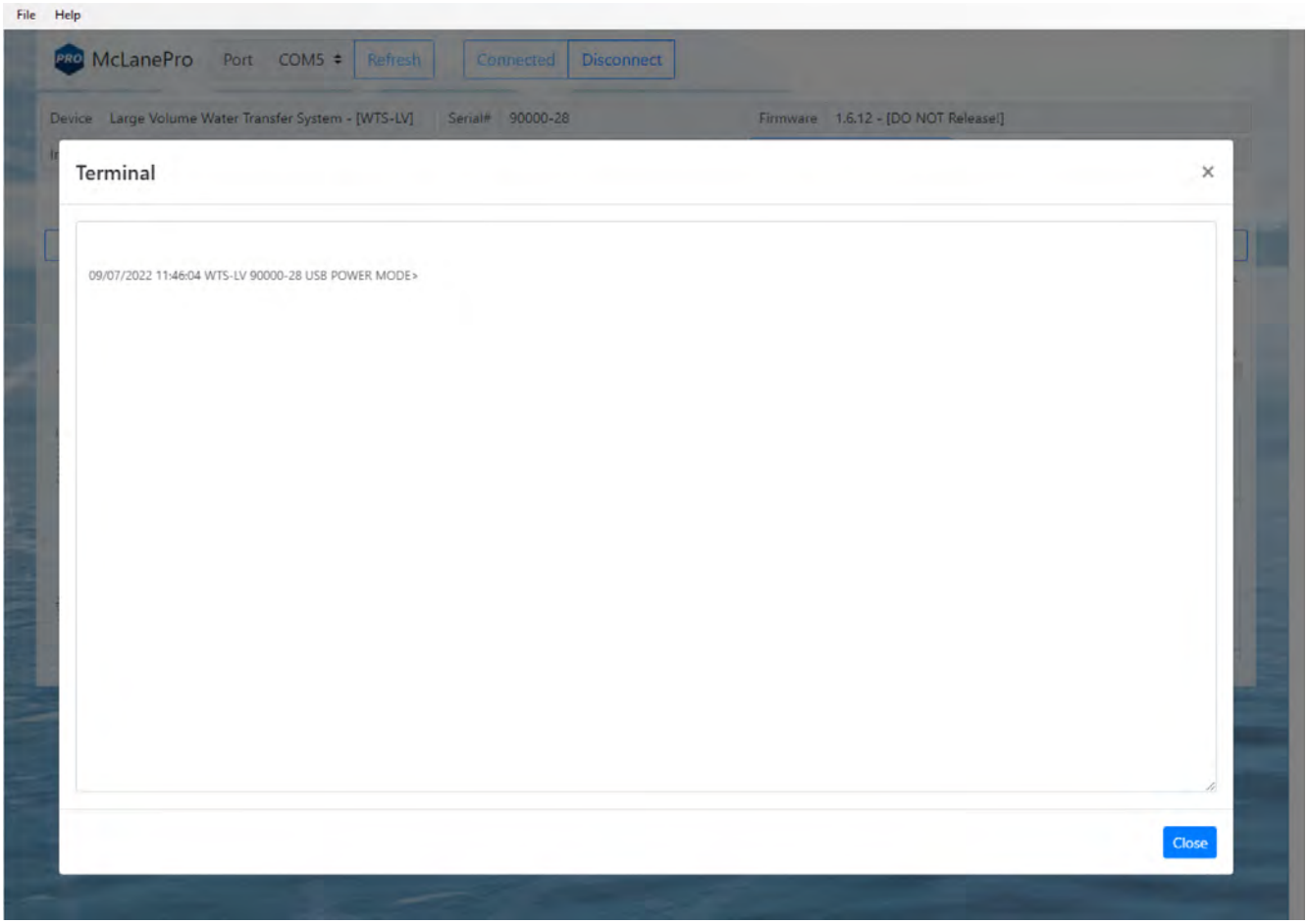
In some cases, a firmware update may revert the WTS-LV configuration to default values. McLanePro detects when this happens, and loads the **Configuration tab** to allow reconfiguration of the instrument after the firmware update is complete. Otherwise, the update will complete and report that the configuration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



The Terminal

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

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.

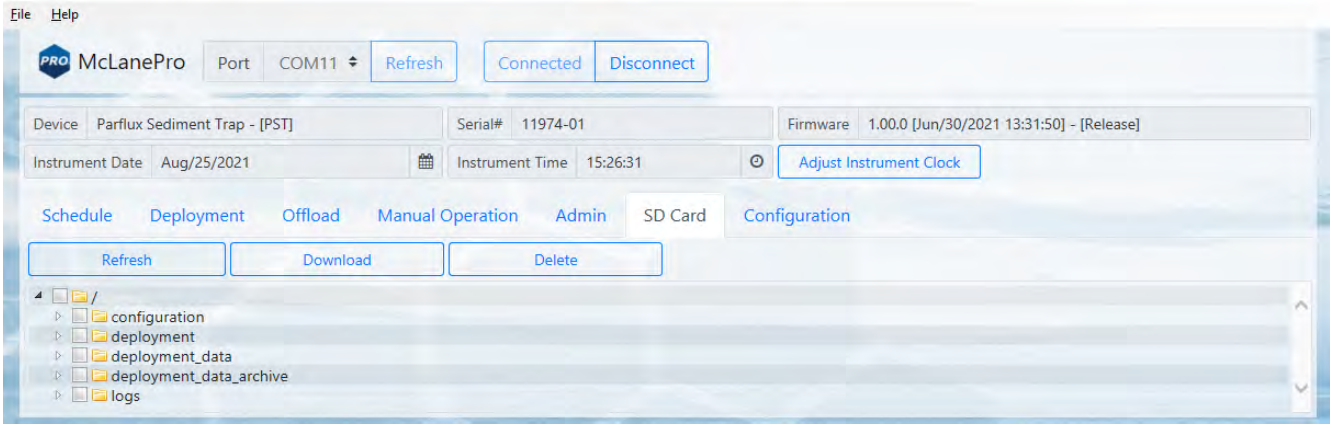
Contact mclane@mclanelabs.com for a list of available terminal commands.

The SD Card Tab

The **SD Card tab** allows for file operations on the WTS-LV MicroSD© Card.

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

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



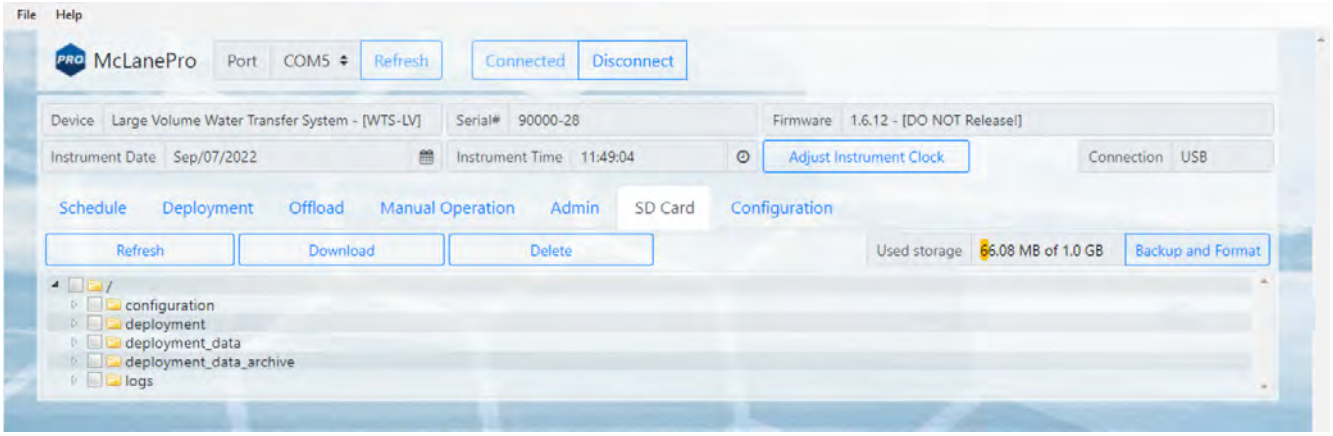
File Operations

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

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

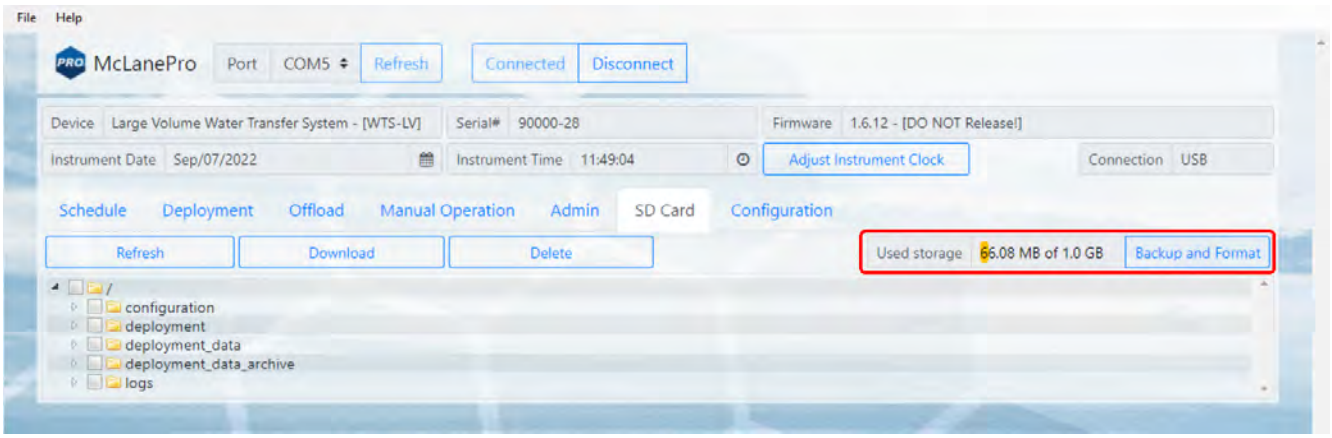
Download - clicking **Download** will compress selected files into a ZIP file that is then downloaded to the connected computer.

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

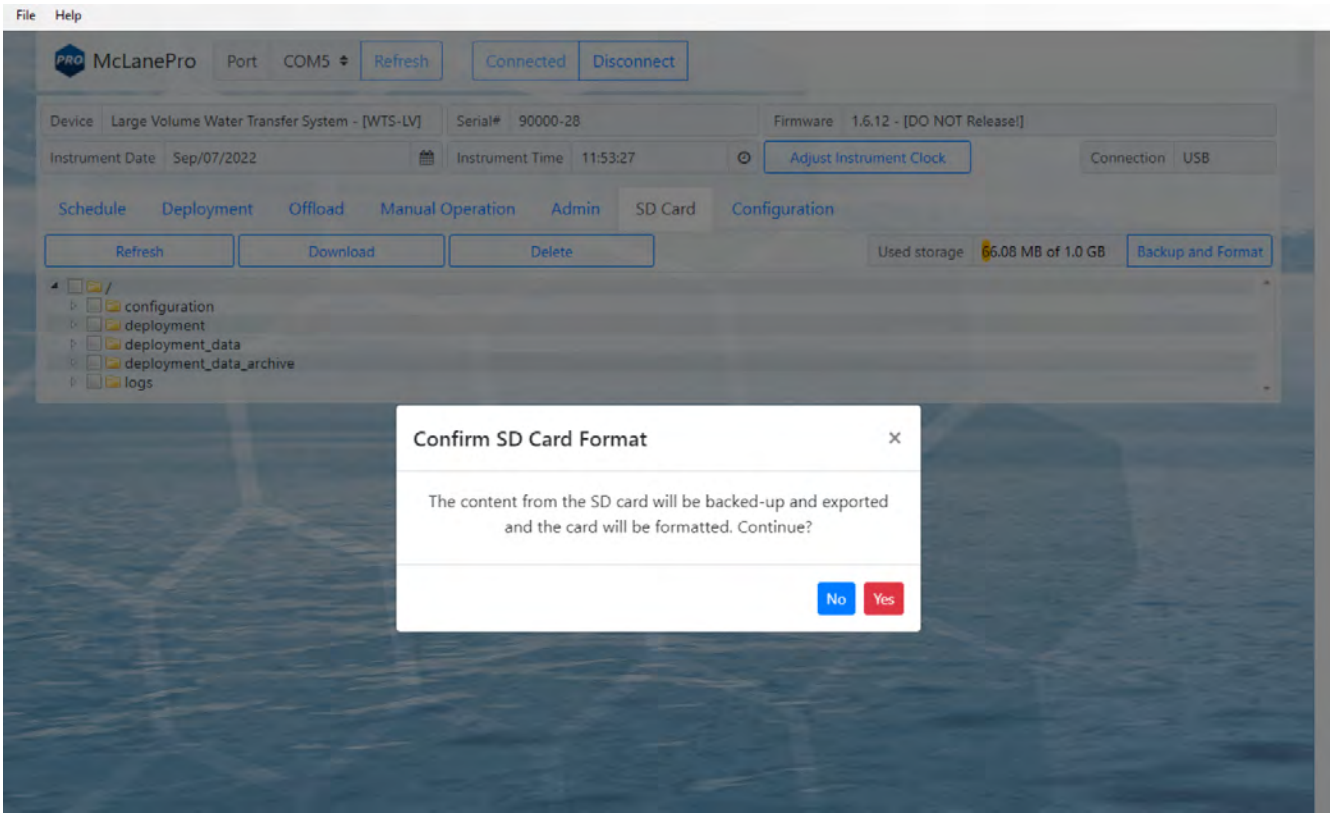


Status of the SD card is provided via the **Used storage** display. Additionally, a **Backup and Format** button is provided that allows for the user to download all the data from the SD card and then format

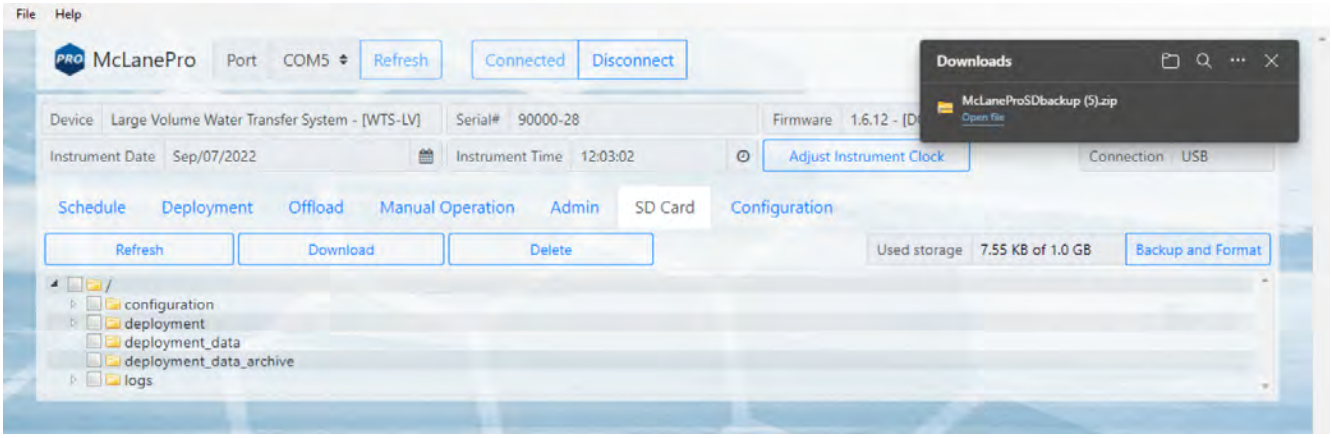
the card.



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

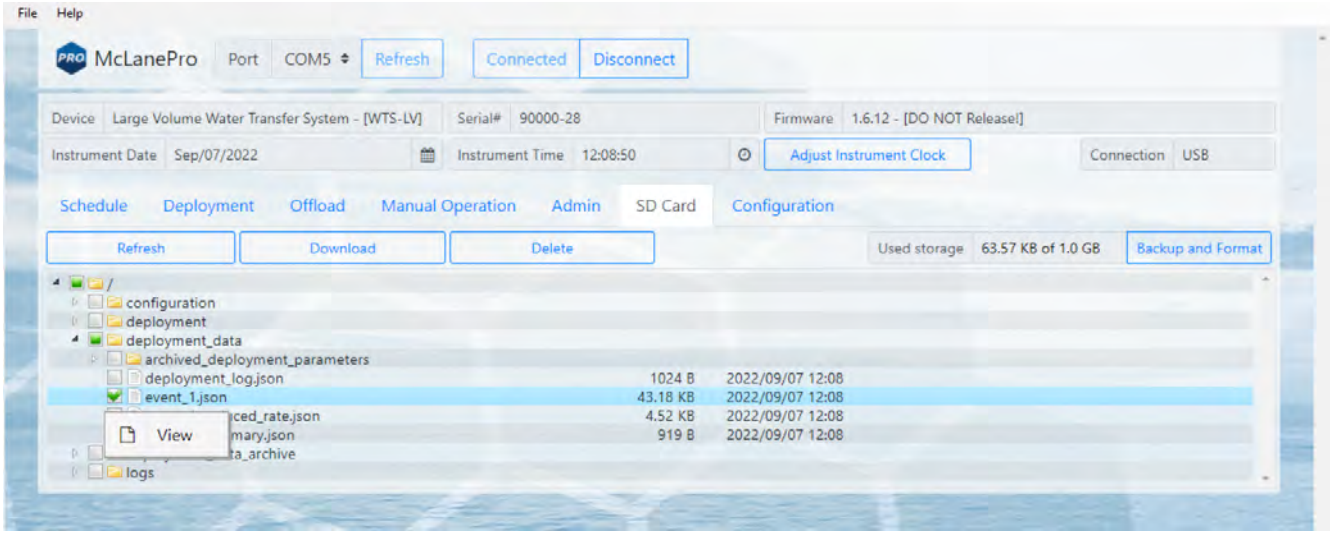


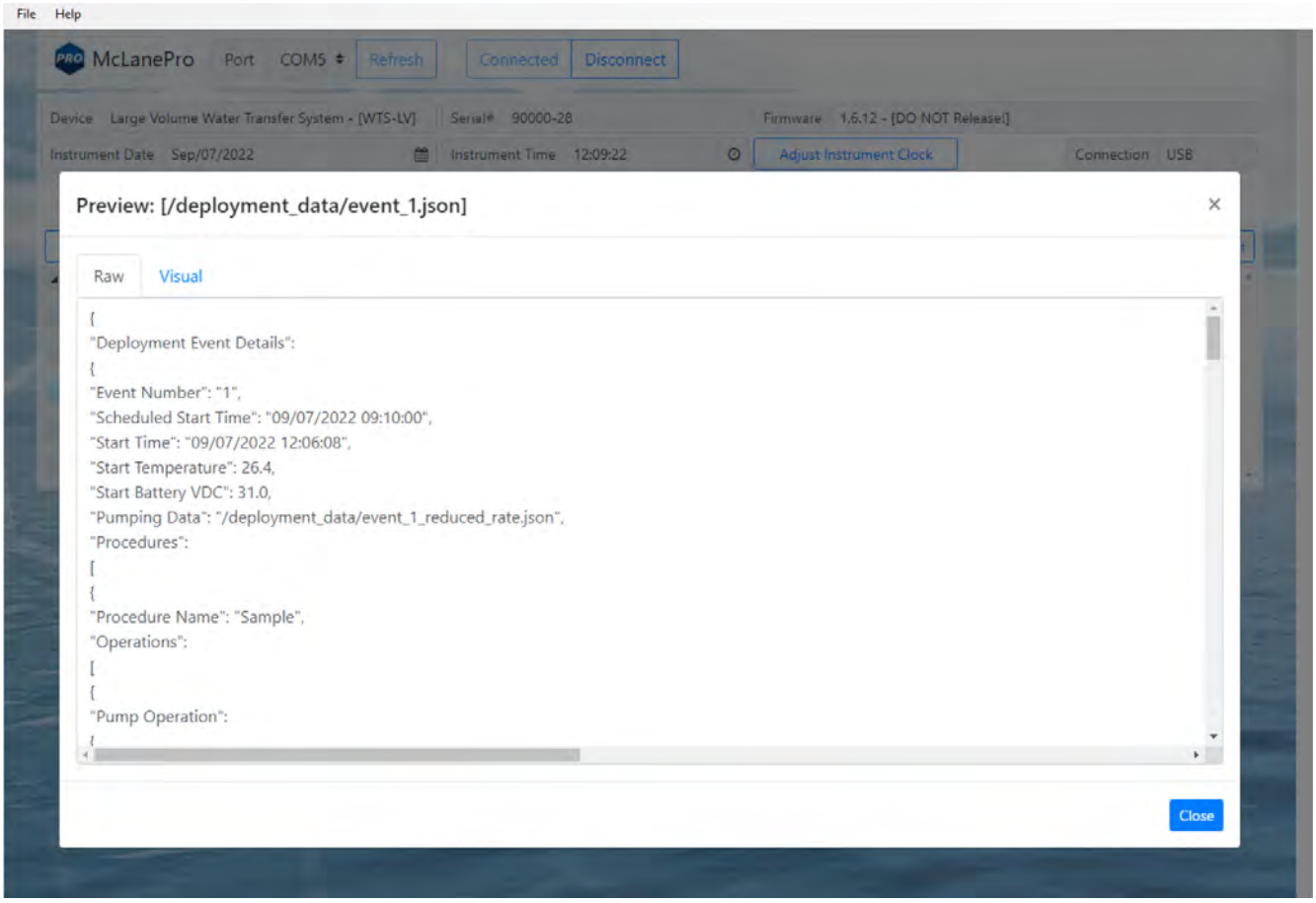
All data from the SD card are compressed into a ZIP file and downloaded before the SD card is formatted.



File preview

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

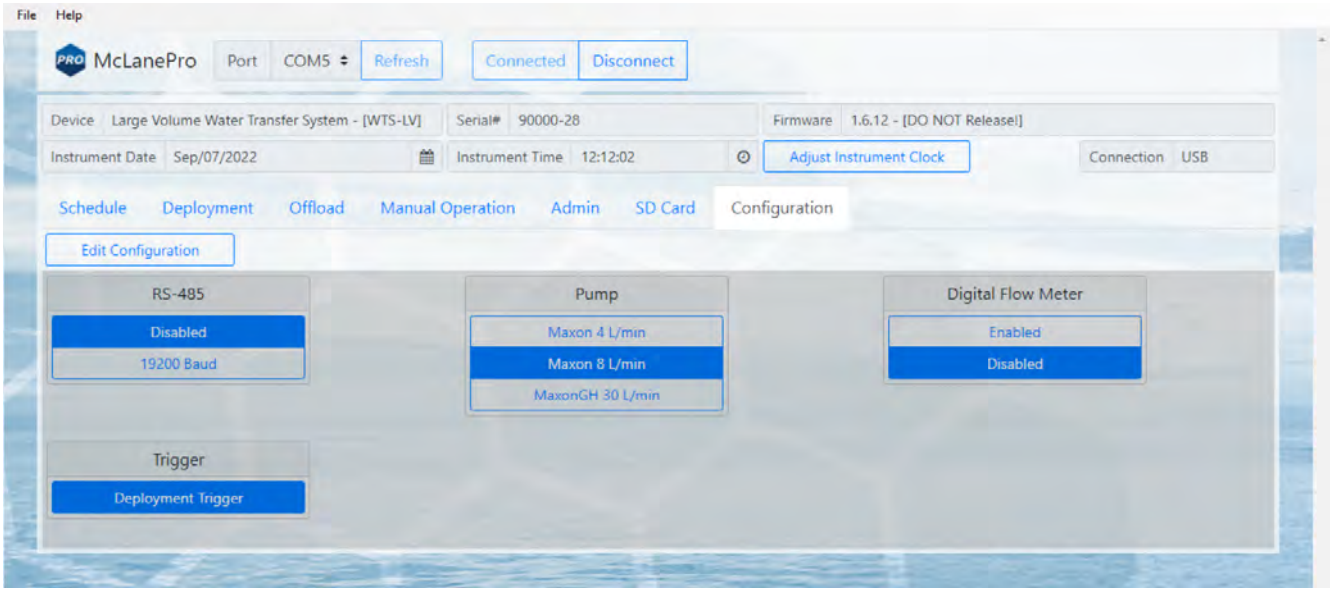



File Help
McLanePro Port COM5 Refresh Connected Disconnect
Device Large Volume Water Transfer System - [WTS-LV] Serial# 90000-28 Firmware 1.6.12 - [DO NOT Release!]
Instrument Date Sep/07/2022 Instrument Time 12:09:22 Adjust Instrument Clock Connection USB
Preview: [/deployment_data/event_1.json]
Raw Visual
{
"Deployment Event Details":
{
"Event Number": "1",
"Scheduled Start Time": "09/07/2022 09:10:00",
"Start Time": "09/07/2022 12:06:08",
"Start Temperature": 26.4,
"Start Battery VDC": 31.0,
"Pumping Data": "/deployment_data/event_1_reduced_rate.json",
"Procedures":
[
{
"Procedure Name": "Sample",
"Operations":
[
{
"Pump Operation":
Close

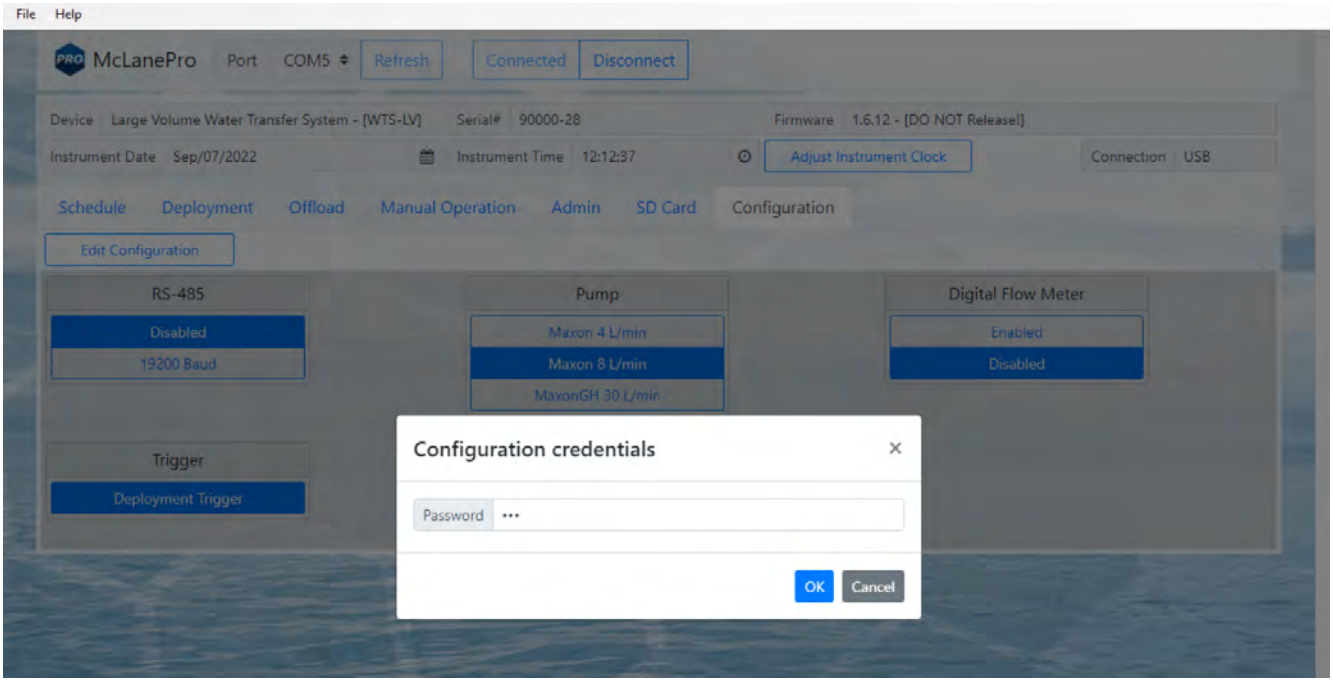
The Configuration Tab

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

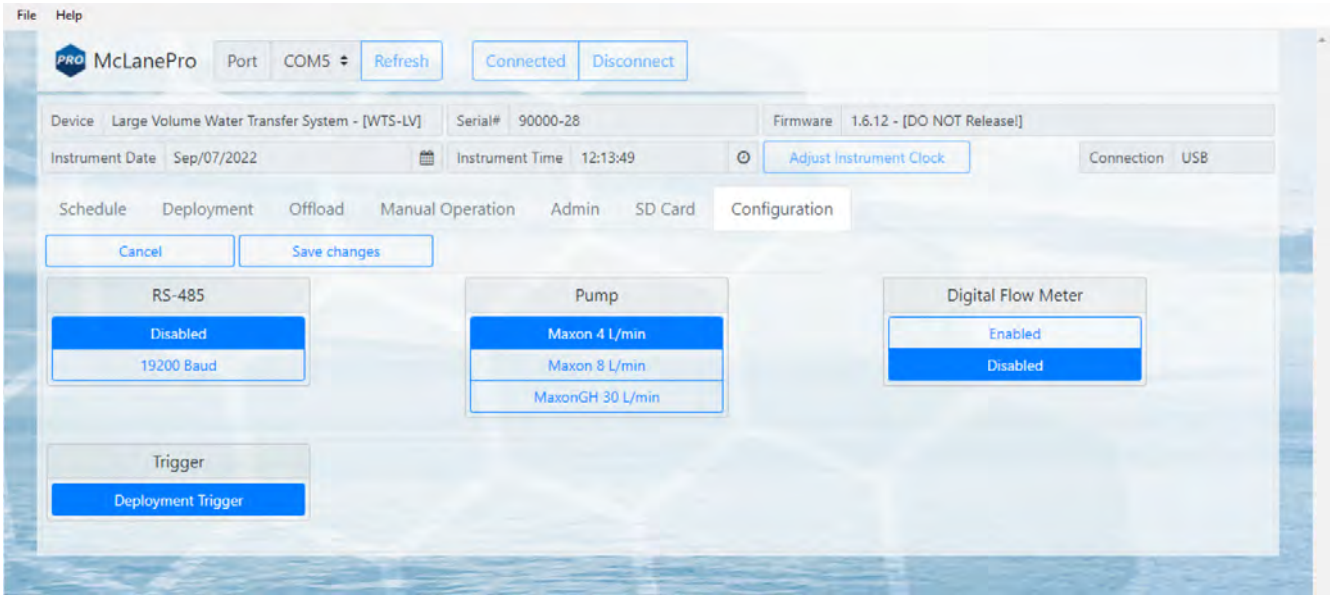
1. To change the WTS-LV configuration, navigate to the **Configuration tab** and select **Edit Configuration**.



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

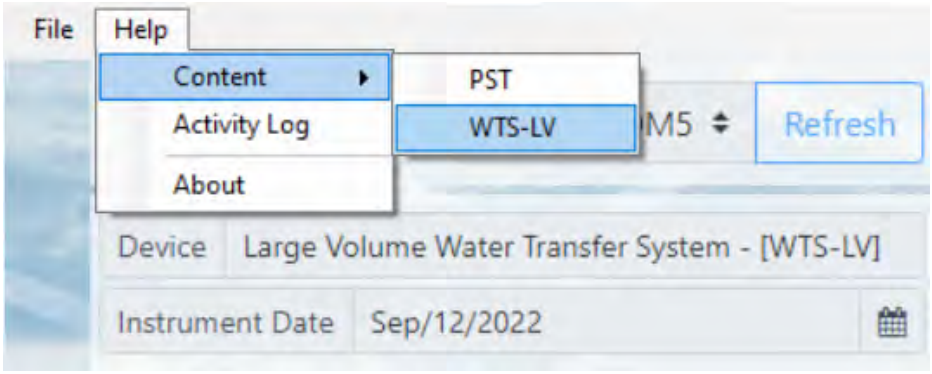


3. Confirm or change the WTS-LV pump configuration, or other available options, and click **Save changes**.

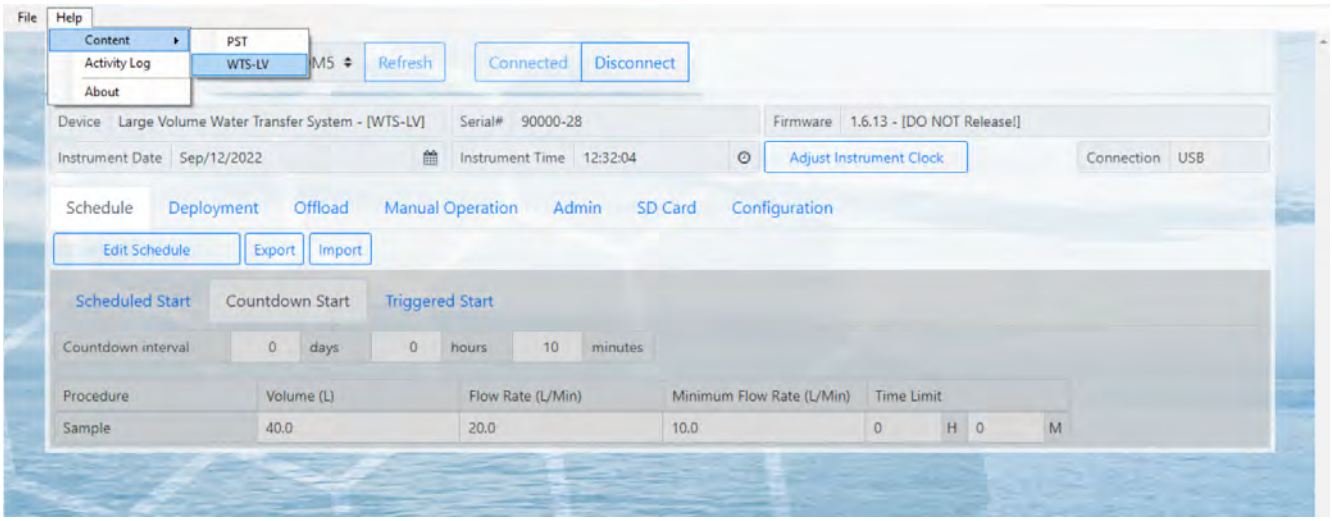


The Help Menu

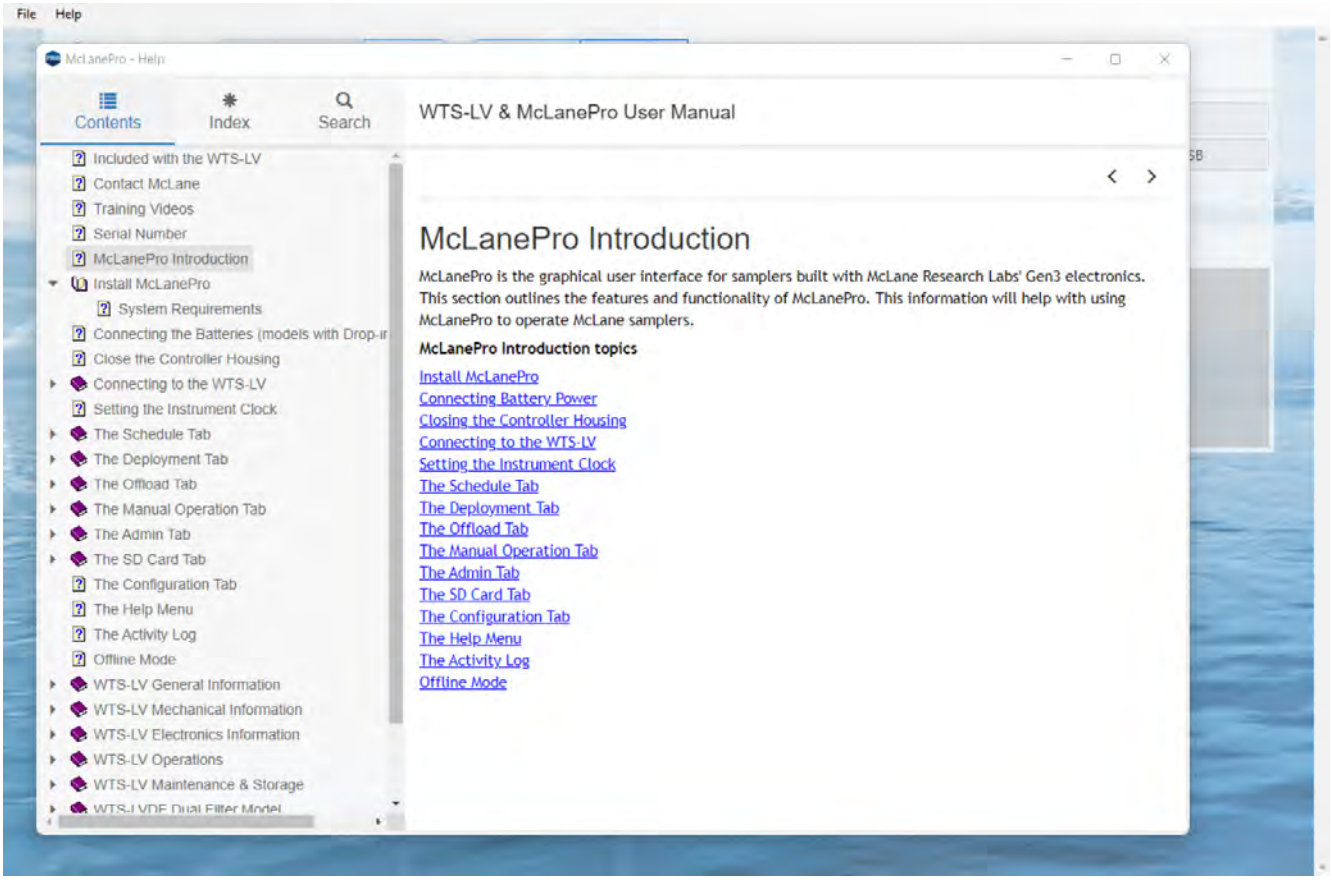
The McLanePro **Help Menu** contains links to device-specific user manuals, as well as McLanePro general information.



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

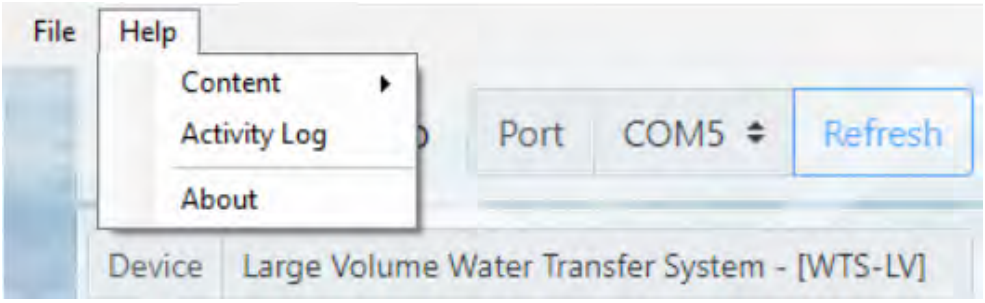


In this example, the device is a Large Volume Water Transfer System with device code WTS-LV. The help file contains user instruction and information on WTS-LV.

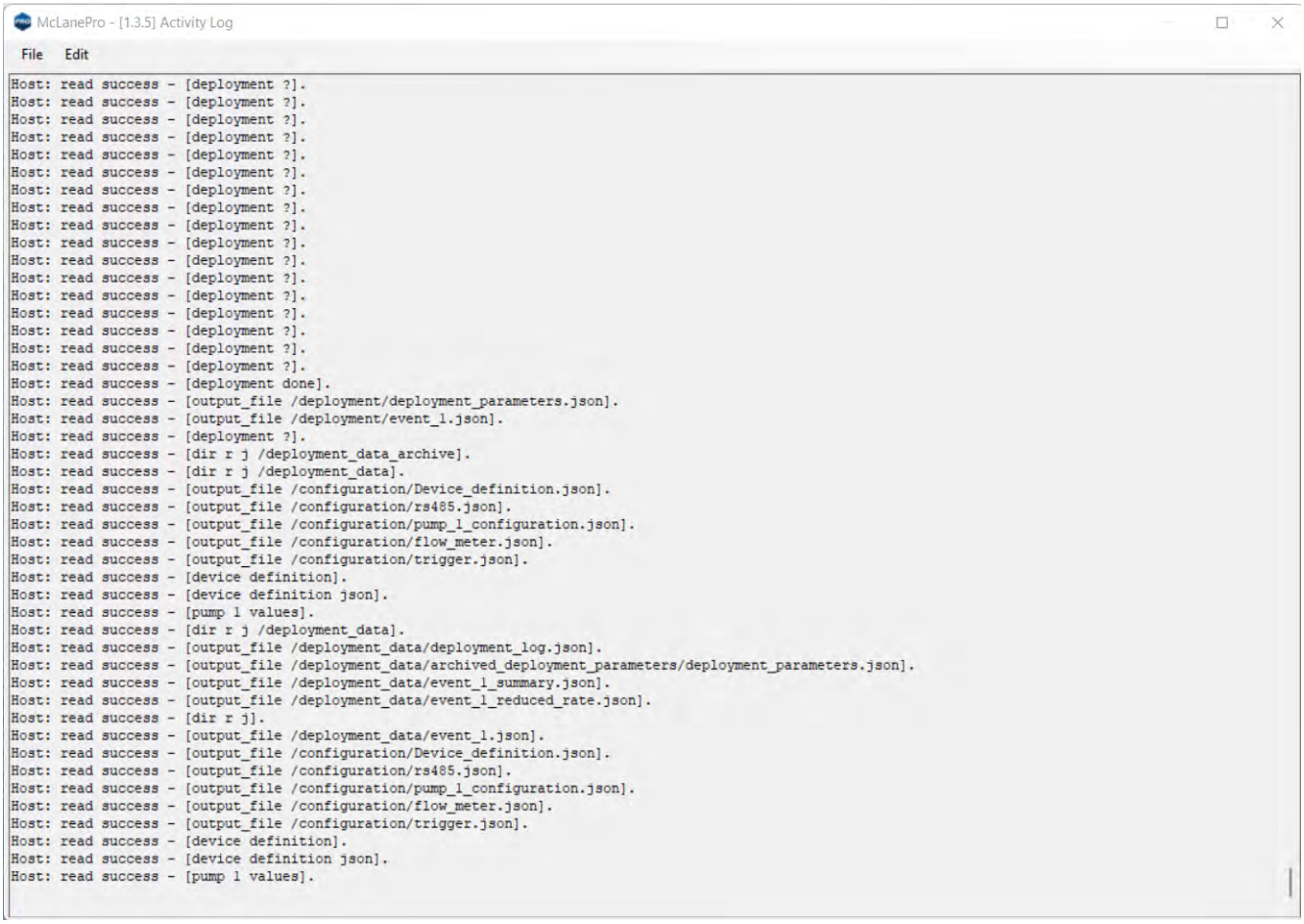

File Help
McLanePro - Help
Contents
Index
Search
WTS-LV & McLanePro User Manual
Included with the WTS-LV
Contact McLane
Training Videos
Serial Number
McLanePro Introduction
Install McLanePro
System Requirements
Connecting the Batteries (models with Drop-in
Close the Controller Housing
Connecting to the WTS-LV
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
WTS-LV General Information
WTS-LV Mechanical Information
WTS-LV Electronics Information
WTS-LV Operations
WTS-LV Maintenance & Storage
McLanePro Introduction
McLanePro is the graphical user interface for samplers built with McLane Research Labs' Gen3 electronics. This section outlines the features and functionality of McLanePro. This information will help with using McLanePro to operate McLane samplers.
McLanePro Introduction topics
Install McLanePro
Connecting Battery Power
Closing the Controller Housing
Connecting to the WTS-LV
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

The Activity Log

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

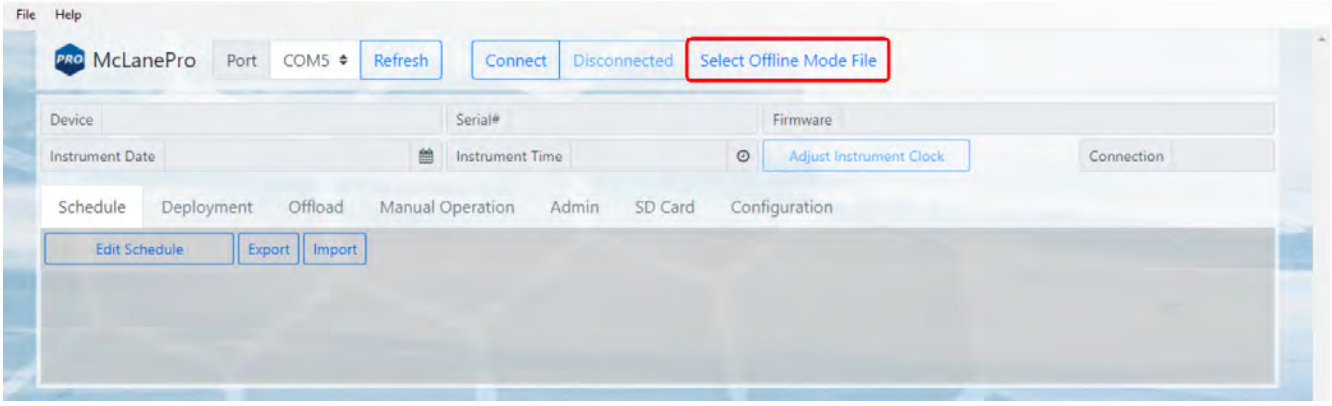


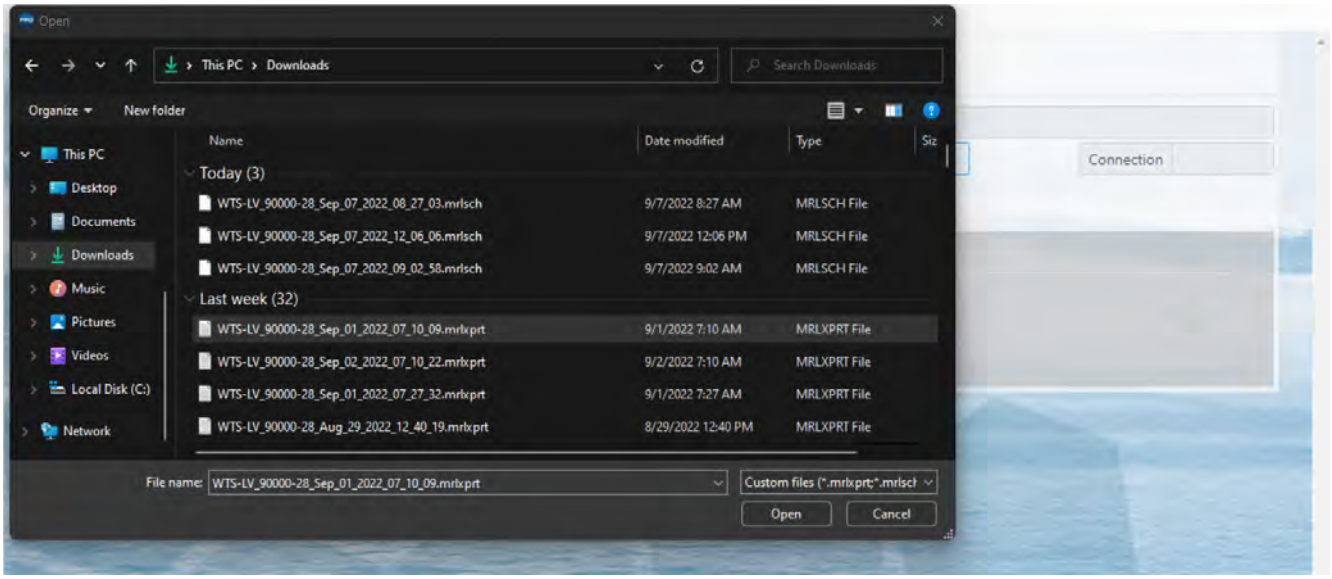
Within the **Activity Log**, there are options to **Save** the log to a text file (using the **File Menu**), or to **Copy** a selection of the **Activity Log** to the clipboard (using the **Edit Menu**).



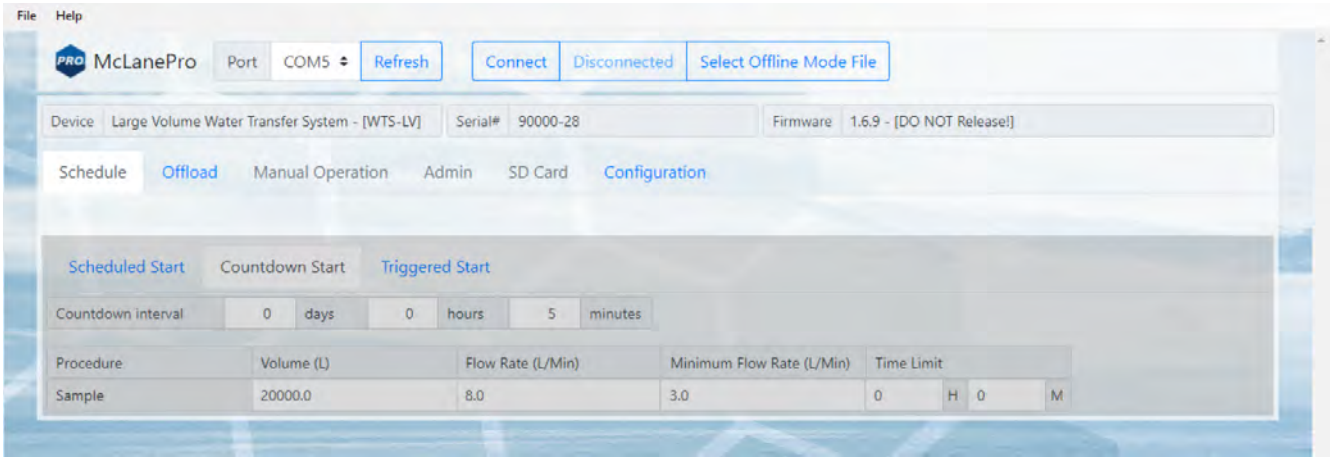
Offline Mode

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.

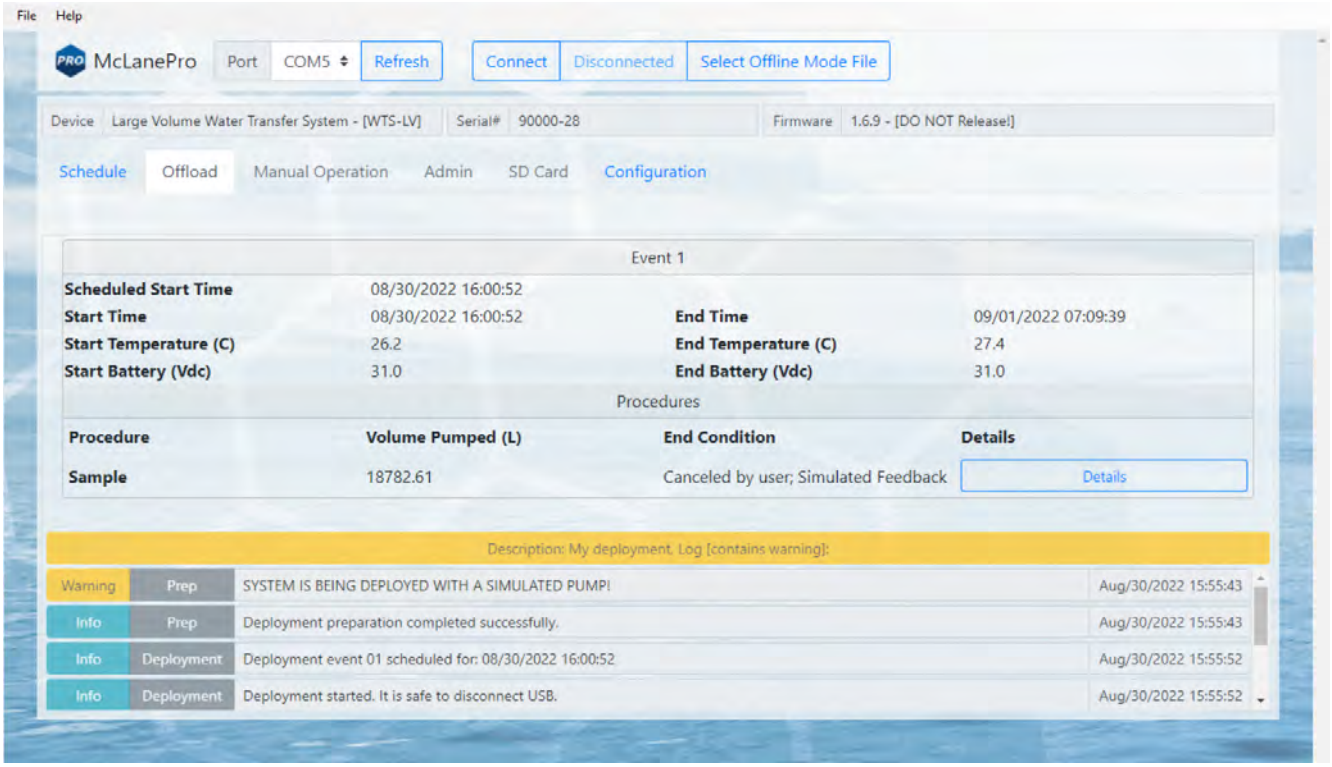




A ***.mrlsch** file will contain the schedule and device configuration along with the device, serial number and firmware information.



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



WTS-LV General Information

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

WTS-LV General Information topics

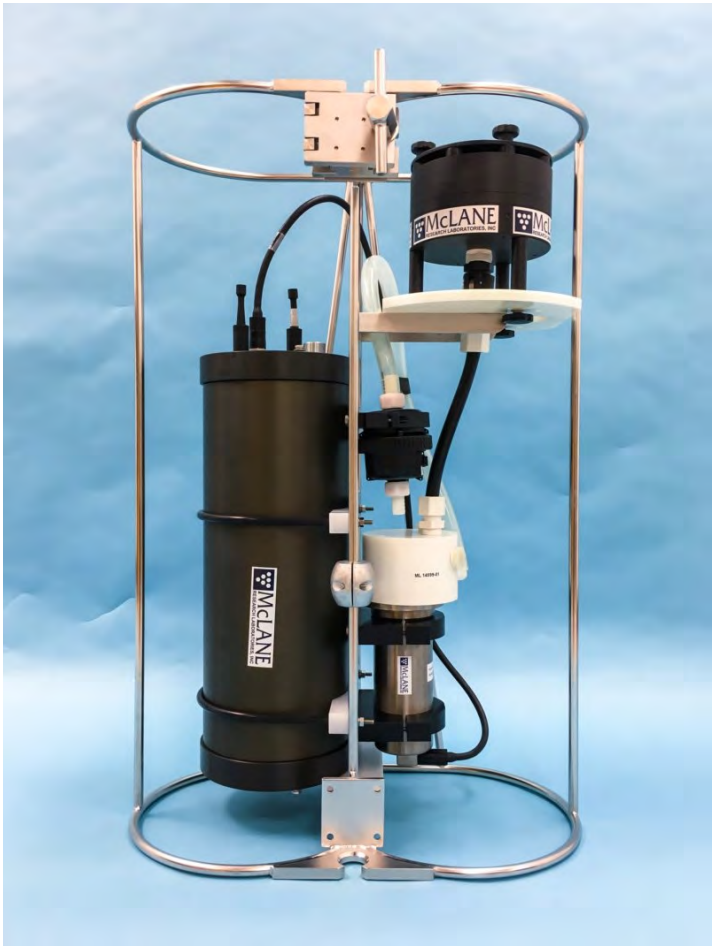
Description & Models
Pump Heads & Flow Rates
Optional Deep Controller Housing

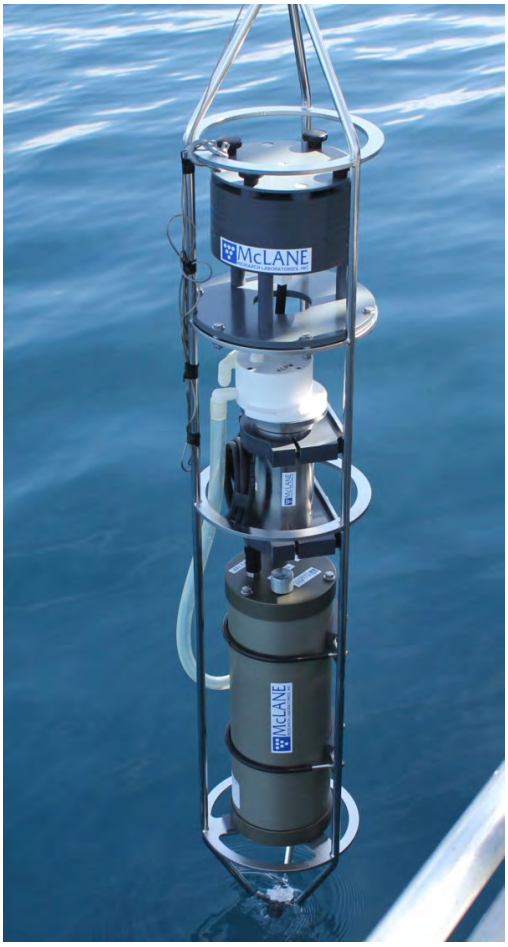
Description & Models

The McLane Large Volume Water Transfer System (WTS-LV) is a single-event sampler that collects large volumes of water, concentrating in situ particles onto a mesh, GFF or membrane filter. Sampling flow rate is determined by pump head size, filter porosity and filter load. Data recorded during a deployment include sample volume, initial and minimum flow rates, instrument current data, and pump data collected during the sample event.

- Standard: WTS-LV - Collects sample onto a 142 mm membrane, mesh, or glass fiber filter. Powered by 24 user replaceable “D” cell batteries. Additional filter holder options available.
- Dual Filter: WTS-LVDF - Collects sample onto dual, 142 mm filters that perform separately metered parallel filtration. Powered by a 30 Ah battery pack with approximately 3 times the capacity of 24 “D” cells.
- High Capacity: WTS-LVUP - Collects sample onto a 142 mm filter, powered by a 30Ah battery pack with 3 times the capacity of 24 “D” cells. Arranged in an "upright" frame. May be configured with a 30 L/min pump.
- Bore Hole: WTS-LVBH - Collects sample onto a 142 mm filter, and fits through a 30 cm hole. Powered by 24 user replaceable “D” cell batteries.

McLANE





Pump Heads & Flow Rates

Available pump heads and resulting flow rates are:

- 8 L/min pump head – 1 to 8 liters per minute.
- 30 L/min pump head (WTS-LVUP only) – 5 to 30 liters per minute.

Optional Deep Controller Housing

A WTS-LV may be configured with a deep, 7000 meter pressure rated controller housing. This option allows for deployment depths deeper than the standard WTS-LV models.

WTS-LV Mechanical Information

Mechanical components of the WTS-LV are described in the following sections.

WTS-LV Mechanical Information topics

Frame
Cable Clamps
Clamp Inserts
Controller Housing
End Caps & O-rings
End Cap Bulkhead Connectors
Trigger Feature
Pump
Filter Holders
Filter Material
Flow Meter

Frame

The WTS-LV frame is an electro-polished 316 stainless steel welded frame designed to protect the pump and provide easy access to the filter holder. The frame can be an inline part of a high-tension (up to 2,200 kg) ocean mooring and has built-in attachment points for cable clamps.

Cable Clamps

Top and bottom 316 stainless steel wire clamps attach the WTS-LV to a hydro wire without interrupting the cable (an inline frame option is also available).

The clamps fasten to the wire with a threaded bolt and a T-handle nut that compresses the stainless steel clamp around the wire. The bottom clamp attaches to the wire first (supporting the full system weight). The top clamp is secured second.

Related topics

Clamp insert sizes
Attaching clamps to the wire

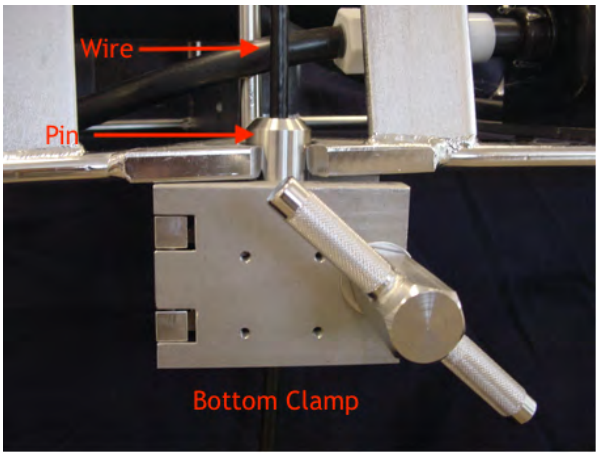
Clamp Inserts

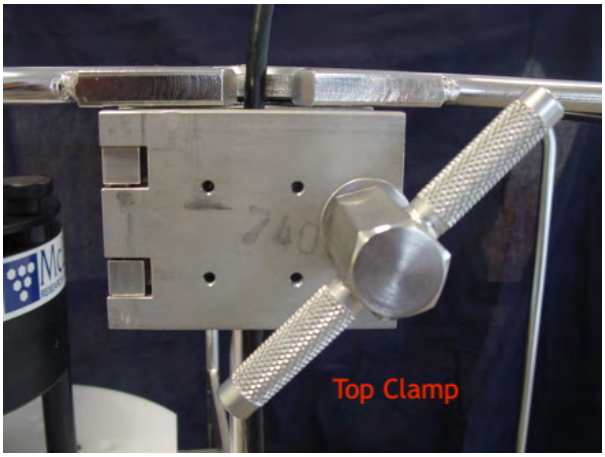
Clamp inserts fit various wire sizes. Wire clamp inserts are designed for the actual outside diameter (OD) of the mooring wire (whether the wire is jacketed or not). For example, 5/16” jacketed wire has a 3/8” OD, and fits a 3/8” clamp insert.

A new WTS-LV includes two sets of wire clamp inserts. Each insert set has one set for the bottom clamp and one set for the top clamp (see next photo). Unless specific sizes are requested, 5/16” and 1/2” inserts are provided with a new WTS-LV. The sizes listed below are readily available. Additional sizes are available upon request.

Available Clamp Insert Sizes

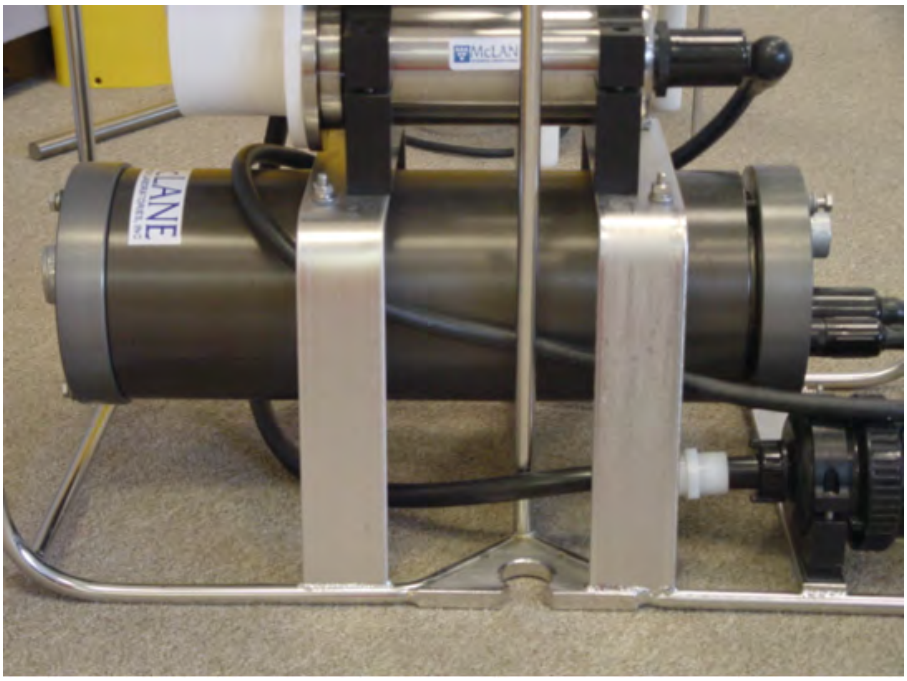
1/4”	5/8”
1/2”	5/16”
3/8”	7/16”





Controller Housing

The WTS-LV controller housing is a heat-treated aluminum alloy cylinder. The standard WTS-LV controller housing is rated to a depth of 5,500 meters. The housing holds the battery and electronics. This User Manual contains detailed instructions for[opening the controller housing](). Follow these instructions and the recommended safety precautions when opening the controller housing.



O-Rings

The top end cap seals the controller housing from water intrusion with a face O-ring seal and a radial O-ring seal (with a backup ring). O-ring maintenance and correct placement is critical to prevent water intrusion.

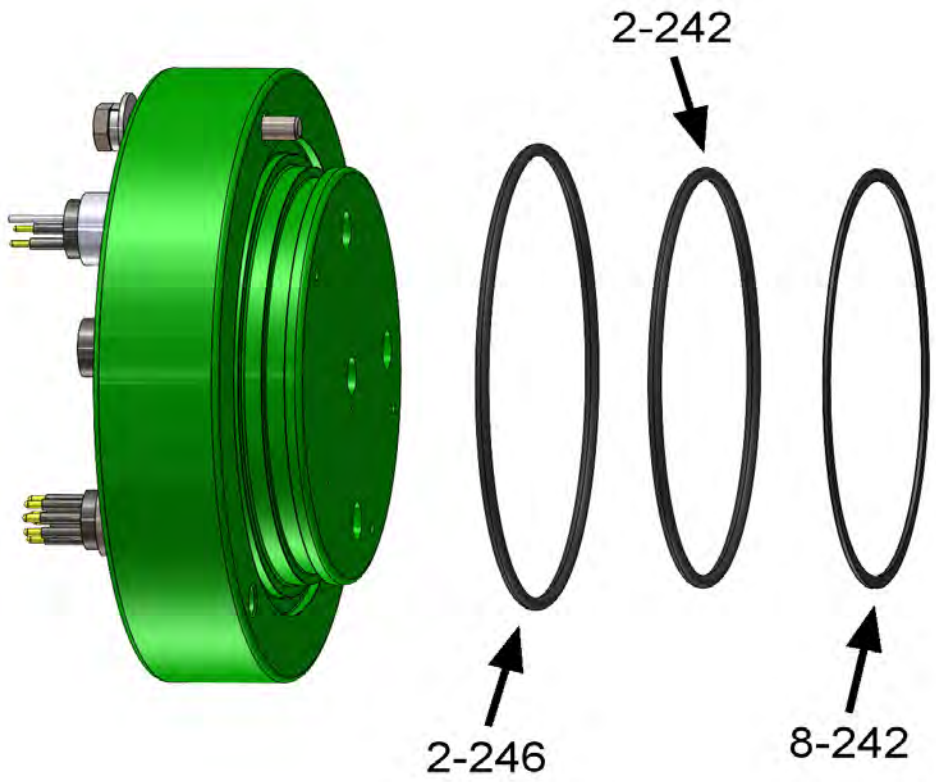
Each O-ring set includes three O-rings (2-246, 2-242, 8-242)

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

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

O-RING	SPECIFICATION
2-246	2-246, Buna-N, 70 A Durometer
2-242	2-242, Buna-N, 70 A Durometer
8-242	8-242, Buna-N, 90 A Durometer

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



End Cap Bulkhead Connectors

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

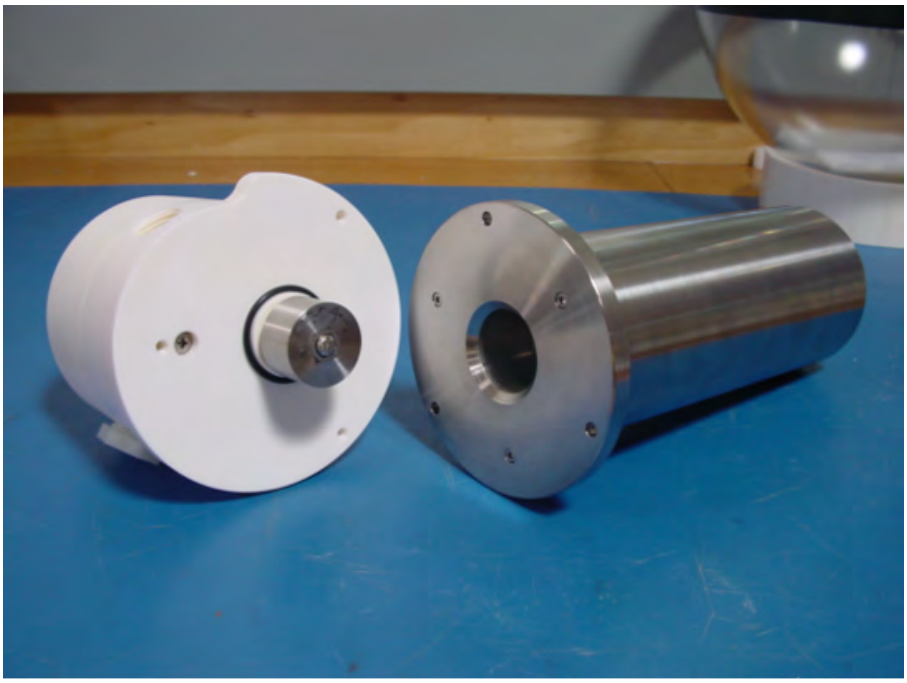
Do not over-tighten the end cap bolts and do not replace the stainless steel hardware with any other hardware. The toolkit includes spare hardware, otherwise contactmclane@mclanelabs.com.

Trigger Feature

The WTS-LV is equipped with an electronic trigger that allows the user to time synchronize and simultaneously deploy multiple WTS-LV samplers. This type of deployment may be performed to obtain a profile of the water column. For example, three WTS-LVs can be deployed to trigger sample collection at three different depths such as 500 m, 1,000 m and 1,500 m.

Pump

The WTS-LV pump assembly is located downstream from the filter holder to prevent sample contamination. A brushless DC 3-phase motor is magnetically coupled to the pump head. McLane's large volume, positive displacement pump heads (8 L/min and 30 L/min), may be used with the WTS-LV.



A pump speed algorithm in the firmware adjusts flow rate to prevent sample or filter damage and to manage battery endurance. The algorithm adjusts in response to differential pressure as material collects on the filter.

Properly sizing the pump head and target flow rate for the filter type is critical for accurate pump volume calculations. See Pump Head Sizing in this User Manual for a chart of pump head and filter porosity compatibility. Contact McLane with any questions.

Filter Holders

The WTS-LV may be configured with one of McLane's 142 mm filter holder models:

- Radial intake filter holder (included with the WTS-LV, WTS-LVUP, and WTS-LVBH models)
- Vertical intake filter holder (included with the WTS-LVDF model)

A 142 mm vertical intake filter holder may be installed on any WTS-LV model in place of the standard radial intake filter holder.

Additional filter holder styles are available, depending on the WTS-LV model. See Optional Filter Holders in this User Manual for reference.

Radial Intake Filter Holder

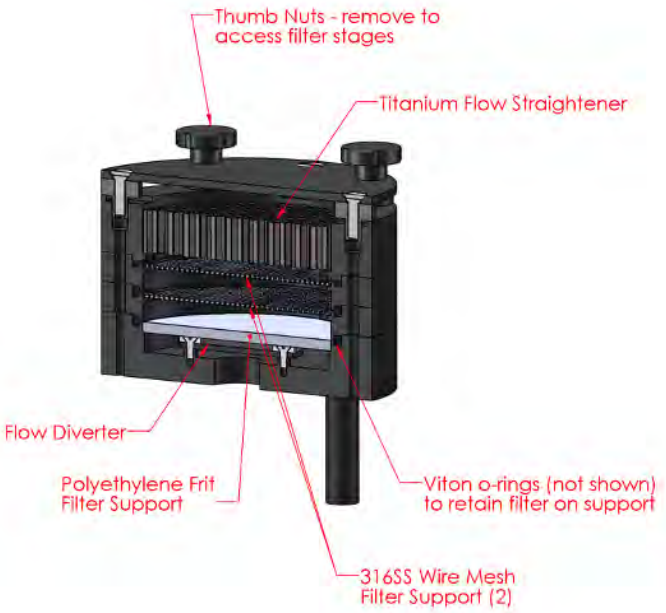
The WTS-LV Standard, Upright, and Bore Hole models include a single 142 mm radial intake filter holder. The radial intake filter holder is machined from black acetal, with large horizontal intake openings at the top for a low-resistance path to the filter.

- Water flow moves through the horizontal intakes and down through a titanium honeycomb

baffle that straightens the flow and suppresses turbulence.

- Water then passes through a 316 stainless steel wire prefilter support.
- The filter holder evenly distributes the sample flow over the entire filter surface. The filter is placed on a support frit approximately 5 mm below the base of the baffle.
- Filtered water passes through the filter and frit, down a short length of tubing, and through the pump to the exhaust port.
- The cross section and image shown next illustrate the standard 142 mm radial intake filter holder.

The radial intake filter holder can be configured with additional prefilter tiers.



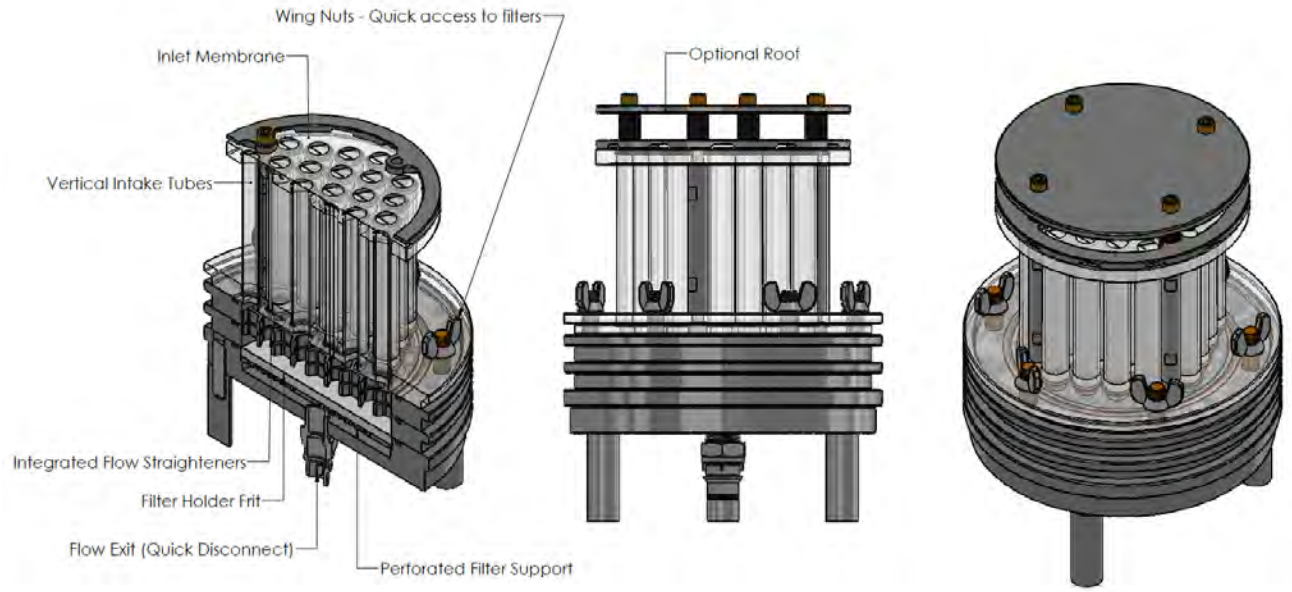
Flow enters the top of the filter holder around the circumference, passes thru the flow straightener and each filter, exiting thru the bottom

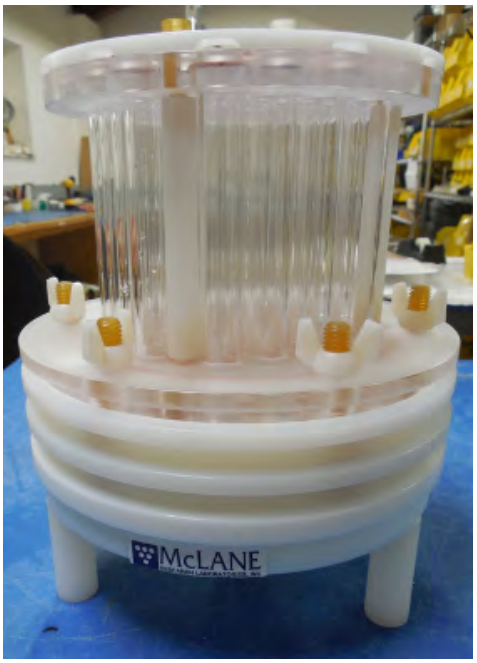
Vertical Intake Filter Holder

The WTS-LVDF, Dual Filter model, includes two 142 mm vertical intake filter holders. The vertical intake filter holder has increased internal baffling to mitigate losses of large particles during handling and recovery.

- The 142 mm vertical intake filter holder may be installed on any WTS-LV model in place of the radial intake filter holder
- The cross section and image shown next illustrate the standard 142 mm vertical intake filter holder.

The vertical intake filter holder can be configured with additional prefilter tiers.





Filter Material

Filters are supplied by the user. Filter porosity and pump head size must be compatible for accurate pump volume calculations and pump operation.

Pump Head Sizing in this User Manual lists pump head and filter porosity compatibility. This chart is included on the next page for reference. Contact McLane with any questions about filter and pump head recommendations.

Pump Head Sizing

Pump heads must be compatible with the filter type and flow rate. See the McLane WTS-LV Pump Head Sizing reference shown next. Check the WTS-LV data sheet page to download the most up-to-date reference.

McLANE® RESEARCH LABORATORIES, INC. Profilers Samplers Flotation

WTS-LV Filter Types and Recommended Pump Heads (Gen3)

The tables shown below provide a list of available pump heads and recommendations based on compatible filter type and flow rate.

Note – Flow rate can vary widely based on filter porosity and sample load.

Pump Size	*LV08	LV30
Flow Rate Range (L/min)	1–8	5–30

** LV08 is standard on the WTS-LV*

			Recommended Pump Heads	
Filter Type	**Pore Size in µm**	**Max Flow Rate (L/min)**	**LV08**	**LV30**
Polycarbonate and Polyester Membrane (Nuclepore®, Millipore®)	0.2	2	●	
Polycarbonate and Polyester Membrane (Nuclepore®, Millipore®)	0.4	3	●	
Polycarbonate and Polyester Membrane (Nuclepore®, Millipore®)	0.8	6	●	
Polycarbonate and Polyester Membrane (Nuclepore®, Millipore®)	1.0	8	●	
Glass Fiber (GF/F®, QMA®)	0.8	7	●	
	1.7	8	●	
	5.0	8 (LV08 pump) 20 (LV30 pump)	●	●
Mesh (Nytex®)	60.0 (+)	8 (LV08 pump) 30 (LV30 pump)	●	●

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Flow Meter

A calibrated mechanical flow meter measures the WTS-LV pump exhaust for total volume pumped. The cumulative meter reading cannot be reset. To compare to the data recorded by the firmware, record the flow meter reading before deploying the WTS-LV and once again after recovery.

Recording the mechanical flow meter before and after deployment is a critical step that provides an accurate reading of volume pumped.

This reading is a true measurement compared to the firmware estimated pumped volume, which can vary greatly based on deployment conditions and filter types.

Flow meter units are listed on the flow meter above the readout window. Units may be liters or gallons.

WTS-LV Electronics Information

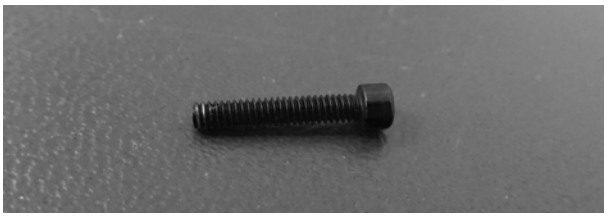
The WTS-LV operates on McLane Research Labs' Gen3 hardware consisting of a low-power micro-controller, motor controller, and connector interface board. Gen3 electronics interface with a McLane built graphical user interface (GUI), called McLanePro. Data are stored to a MicroSD© memory card, and are accessed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

Related topic
McLanePro Introduction

WTS-LV Electronics Information topics
Opening the Controller Housing
Main Battery
Deployment Duration Estimate

Opening the Controller Housing

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



WARNING - Turning the release valve adjusts release pressure.

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

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

1. Slowly pull on the pressure relief valve using the supplied pressure release valve tool to release any vacuum or built-up pressure in the housing.
2. Loosen each end cap bolt a few turns at a time in a star pattern.
3. When pressure is equalized, remove and place the end cap hardware somewhere safe. Typically

plastic inserts have a snug fit and will remain in the end cap.

4. Grasp the end cap lip with fingertips and pull the end cap out of the housing. The end cap to housing seal is tight and sometimes difficult to open. Do not use a tool to pull open the housing. The end cap O-rings can be damaged if objects are used to separate the end cap from the housing.

Main Battery

The standard WTS-LV and Bore Hole models have a battery holder that accepts 24 user replaceable drop-in alkaline "D" cell batteries providing 10,000 mAh of battery capacity. The Upright and Dual Filter WTS-LV models' main battery is a high capacity A72-1000 battery pack (30,000 mAh capacity). The batteries do not come installed in a new WTS-LV. New batteries are included either in the toolkit or in the shipping crate. Additional packs are available from McLane.

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

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

Connecting the Batteries

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

Related topics

WTS-LVUP Upright Model
WTS-LVDF Dual Filter Model

Deployment Duration Estimate

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

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

Battery life for a planned Standard WTS-LV deployment can be estimated using the instrument current consumption values provided here. These values apply to electronics using the Gen3 microcontroller. An 8 L/min pump operated at 7 L/min is used for the example. The 24 alkaline "D" cells in the drop-in battery holder deliver approximately 10,000 mAh. In addition to pumping time, many other deployment conditions can affect the battery duration. Use this example for estimation only.

- Pre-deployment battery estimate assumes initial setup steps and does not include

bench testing or running diagnostics.

- Pumping assumes unrestricted flow.

Pre-deployment	
Controller (1 hour)	1 h x 25 mA = 25 mAh
Pumping (0.2 hour)	0.2 h x 850 mA = 170 mAh
	Subtotal = 195 mAh
Deployment	
Controller (6 hours)	6 h x 25 mA = 150 mAh
Pumping (6 hours)	6 h x 850 mA = 5,100 mAh
	Subtotal = 5,250 mAh
Recovery	
Controller (1 hour)	1 h x 25 mA = 25 mAh
	Subtotal = 25 mAh
Total Current Consumption	**Total = 5,470 mAh**

This example shows that the total energy consumed is 5,470 mAh, which will not exceed the 10,000 mAh battery life.

The WTS-LV Upright and Dual Filter models' A72-1000 battery has a 30,000 mAh capacity. Use 30,000 mAh as the capacity rather than 10,000 mAh when estimating battery endurance for these WTS-LV models.

WTS-LV Operations

This section provides guidance for operating the WTS-LV.

WTS-LV Operations topics

Prepare
Deployment Preparation

Prime
Priming the WTS-LV
Attaching the Flow Meter Exhaust Tube
Priming with the Priming Intake Tube
Installing & Priming - Radial Intake FH
Installing & Priming - Vertical Intake FH

Deploy
Programming a Deployment
Deploying the WTS-LV
Attaching Clamps to the Wire

Recover
Recovery and Data Offload
Recover the WTS-LV
Record the Flow Meter Reading
Connect to the WTS-LV
Download Deployment Data
Removing the Filter

Deployment Preparation

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

1. Install the "D" cell alkaline batteries (for WTS-LV Standard or WTS-LVBH models). Or, install the battery pack (for WTS-LVUP and WTS-LVDF models).
2. Connect battery power.
3. Close the controller housing.
4. Remove the dummy plug from the communications bulkhead.
5. Connect the USB COM cable.
6. Confirm that McLanePro and the instrument are communicating.

Related topics
Download McLanePro
Priming the WTS-LV

Priming the WTS-LV

Priming is an important deployment preparation step. Steps vary according to the WTS-LV model, choice of filter holders, and filter characteristics.

There are several steps required for priming a standard WTS-LV. The ultimate priming goal is to clear trapped air from the tubing between the pump and filter holder by flooding the tubing with water. Always prime when new filters are added. Replacing a filter can introduce air into the system. This step is especially important when using filters with smaller porosity. Use of an exhaust tube is recommended to retain a full system prime.

When selecting your customer-supplied filters, the pump head size and filter porosity must be compatible. Refer to Pump Head Sizing in this User Manual for a detailed chart.

Priming is a wet process. Required tools for priming are included in the tool kit:

- 500 ml squirt bottle (to wet the frit and filter).
- Intake priming tube.
- Exhaust tube.
- Clean water container.

Related topics

Attaching the Flow Meter Exhaust Tube

Priming with the Priming Intake Tube

Installing & Priming - Radial Intake Filter Holder

Installing & Priming - Vertical Intake Filter Holder

Attaching the Flow Meter Exhaust Tube

The WTS-LV toolkit includes a length of large diameter tubing that can be connected to the flow meter exhaust. When the system is primed, the tubing fills with water. This prevents trapped air which can form bubbles on the underside of the filter holder prior to deployment. If these air bubbles 'push up' under the filter, the filter could be damaged, affecting sample collection.

Precisely installing and positioning this tubing is critical to minimizing flow resistance and preventing obstruction of the filter flow path. Do not add elbows, tees, check valves or other plumbing.

1. Attach the tubing to the barbed fitting on the flow meter exhaust.

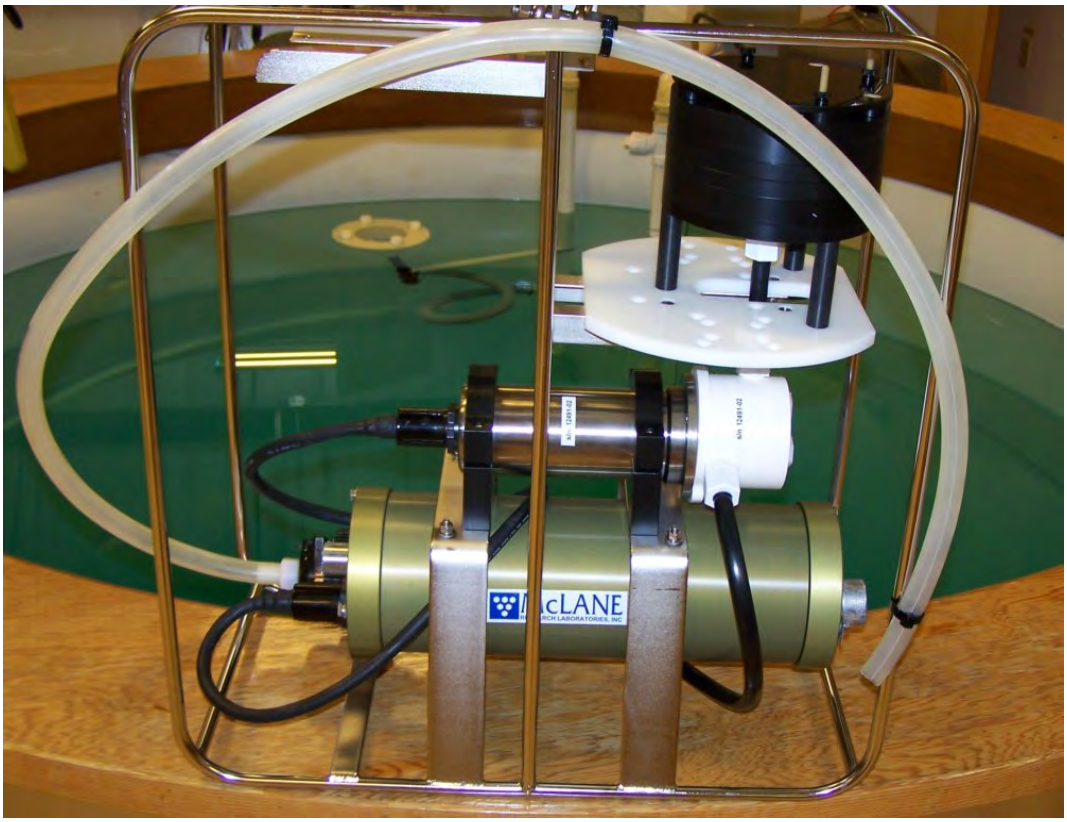
2. Using a zip tie (provided in the toolkit) attach the top of the tubing to the frame, matching the height of the filter holder.

3. Attach the open end of the tubing to the WTS-LV frame below the filter holder. The pump

exhaust should be directed away from the filter holder.

4. Follow instructions for Priming with the Priming Intake Tube to fill the system with clean water prior to priming the filter holder(s).

    - Water stays in the system plumbing until the pump turns on for the deployment. The first few seconds of pumping will clear out the neutral water.



Priming with the Priming Intake Tube

The WTS-LV toolkit includes a length of large diameter tubing that can be connected to the pump inlet connector (in place of the filter holder). This priming intake tube is used to fill the system plumbing with clean water prior to preparing and priming the filter holder for deployment.

1. Remove the filter holder from the WTS-LV intake.
    a. Unscrew and remove the three thumb screws below the filter holder mount plate.
    b. Remove the filter holder from the pump intake tube by unscrewing the compression fitting or releasing the quick disconnect below the filter holder.
2. Attach the priming tube to the pump intake tube.
3. Place the open end of the priming tube into a bucket of neutral water (such as distilled water or filtered sea water).
4. Using the **Manual Operation** tab, click **Pump Forward** and allow the pump to run until water fills the system plumbing and flows out of the exhaust tube.
5. Click **Stop pumping** to stop the pump manually.

6. Remove the priming tube from the pump intake.
7. Install the filter holder back onto the pump intake and secure with the three thumb screws.
8. Follow Priming the Radial Filter Intake Holder, or Priming the Vertical Intake Filter Holder, to install filters into the filter holder.
    - Water stays in the system plumbing until the pump turns on for the deployment. The first few seconds of pumping will clear out the neutral water.

Installing & Priming - Radial Intake FH

To prime and install filters, complete the following steps with the radial intake filter holder installed in the WTS-LV system. For best results, utilize the priming intake tube to prime the system before priming the filter holders.

Related topics

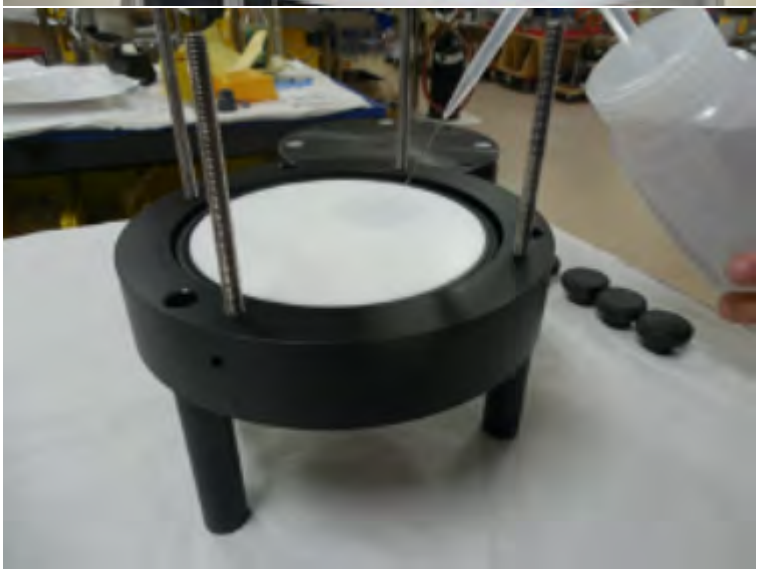
Installing the Filter
Assembling the Filter Holder Plate
Correct Filter Plate Assembly

Installing the Filter & Priming the Filter Holder

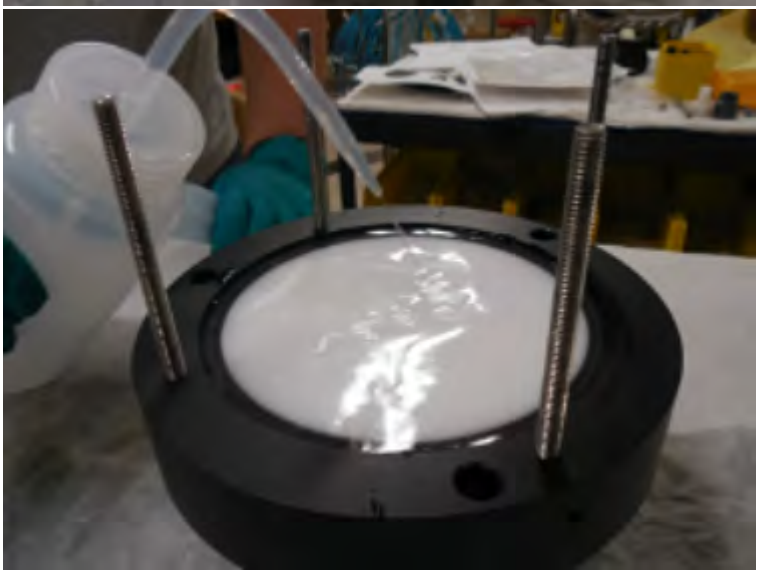
For demonstration purposes, the photos here show the radial intake filter holder uninstalled from the frame. The filter holder should be installed on the WTS-LV when performing this procedure.

Radial intake filter holder priming:

1. If not already connected, attach the pump intake tube to the underside of the radial intake filter holder, which should be installed on the WTS-LV frame.
2. Unscrew the four thrumb nuts that secure the top of the filter assembly. Remove the filter holder top and any prefilter plates until the filter holder bottom plate remains.
3. Fill the 500 ml squirt bottle with neutral water and flood the filter holder bottom plate. As the space below the frit is filled with water, puddles will form on the porous frit service. This puddling indicates the exhaust tubing is filling with water and pushing out any air bubbles.



4. Place a 142 mm filter (customer supplied) onto the filter holder bottom.
5. Wet the filter with water from the squirt bottle. Confirm that the filter is flat and centered on the filter holder plate by gently moving the filter and pressing down lightly to displace trapped air.
6. Allow water to saturate the membrane from below.



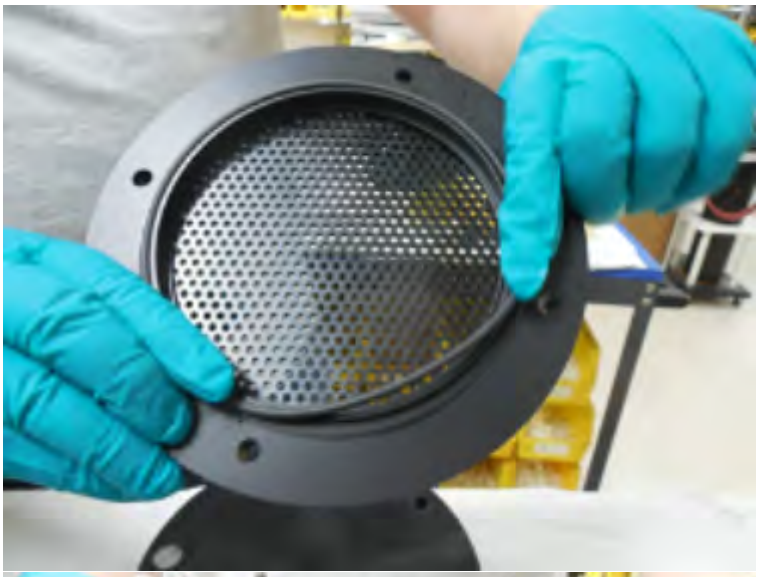
7. Repeat this process for each additional filter holder tier.

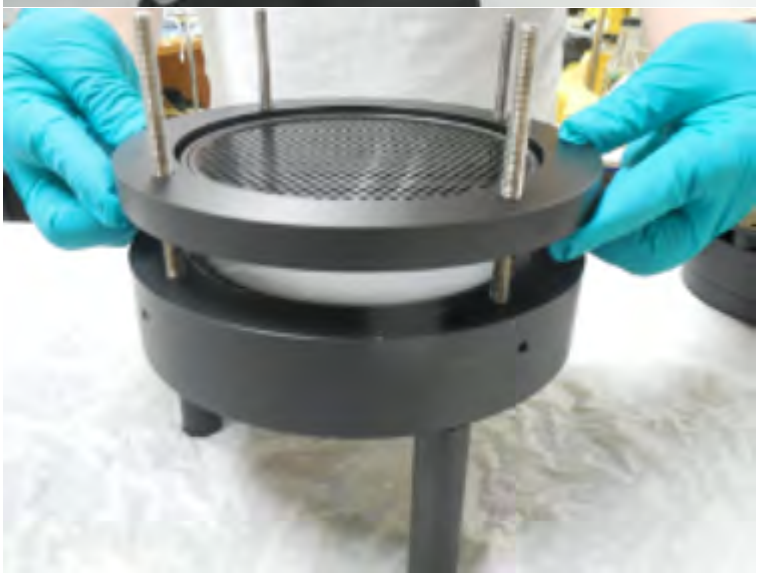
Related topic

Assembling the Filter Holder Plate

Assembling the Filter Holder Plate

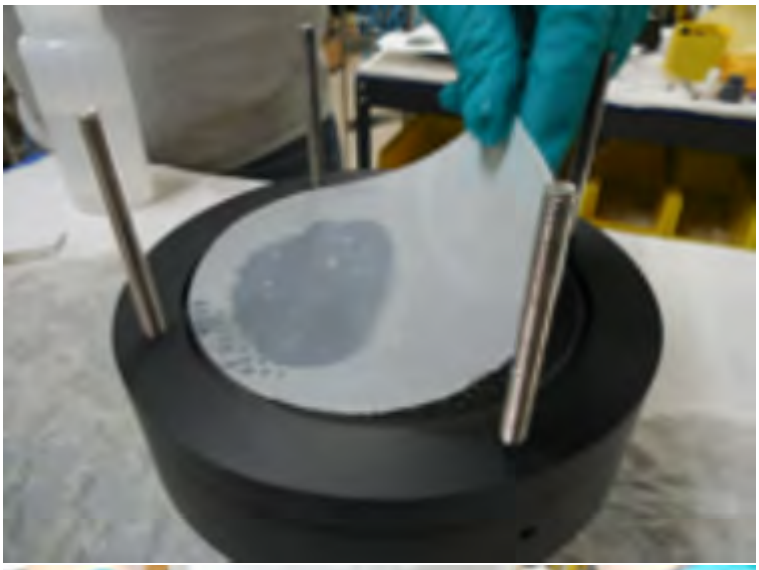
1. Install the prefilter plate(s). Ensure that both the upper and lower O-rings are seated correctly.
2. Place the prefilter plate onto the filter holder.

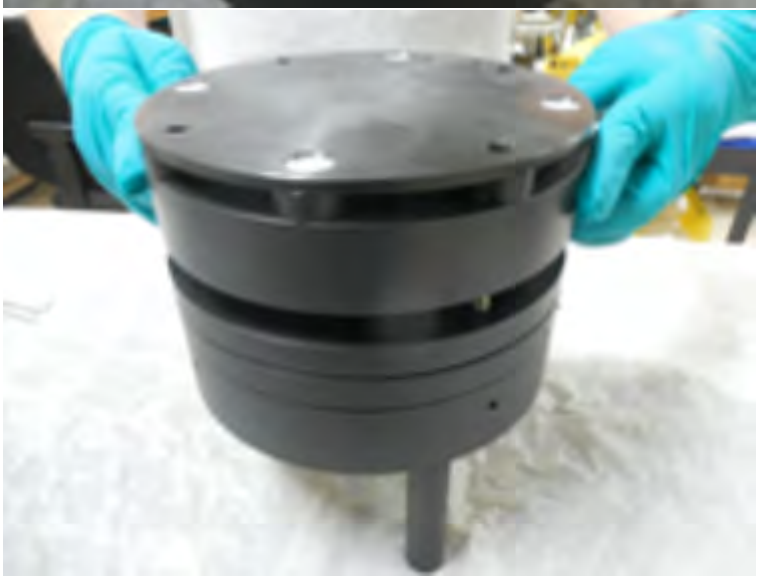




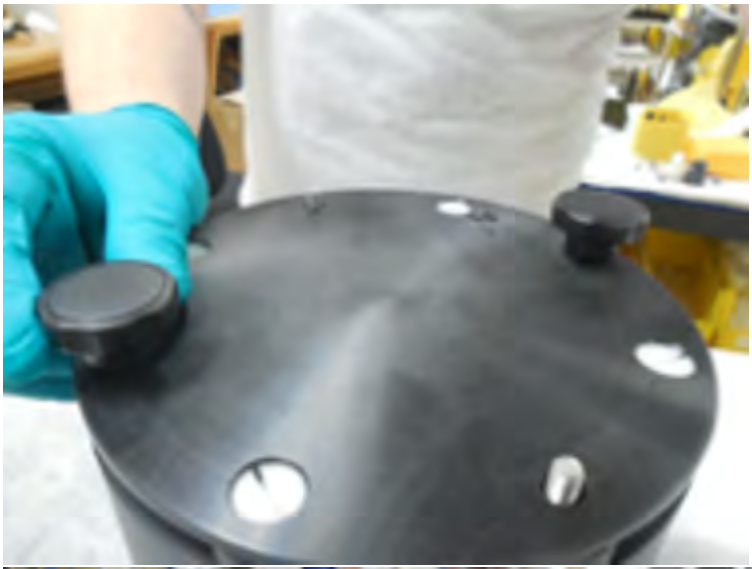
3. Fill the prefilter plate with neutral water until a pool forms on the plate surface.

4. Install a 142 mm mesh prefilter (customer supplied) and flood the top of the prefilter with water.
5. Repeat as needed for additional prefilter tiers.
6. Place the top section on the filter holder assembly.





7. Install and tighten the four thumb nuts.
8. Fill top of the filter holder assembly with neutral water prior to deployment.



9. WTS-LV is now fully primed and ready for deployment.

Related topic

Correct Filter Plate Assembly

Correct Filter Plate Assembly

A correctly secured filter holder assembly will not have gaps between the plates.

- Use the thumb nuts to tighten the plates until they are closed without gaps.
- An example of the 3-tier filter holder is shown here. The standard assembly for the radial intake filter holder has one less prefilter stage.

Installing & Priming - Vertical Intake FH

To prime and install filters, complete the following steps with the vertical intake filter holder installed in the WTS-LV system. For best results, utilize the priming intake tube to prime the system before priming the filter holders.

Related topics

Installing the Filter
Assembling the Filter Holder Plate
Correct Filter Plate Assembly

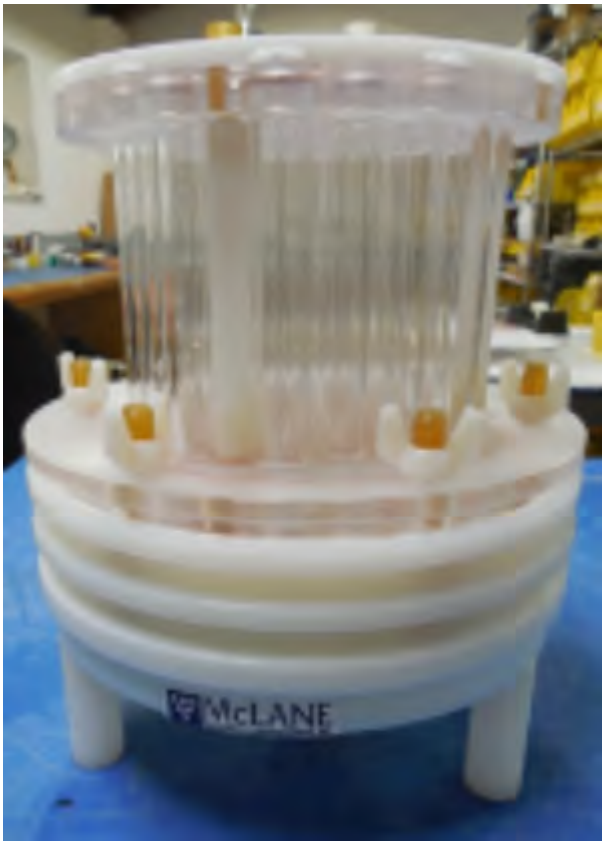
Installing the Filter & Priming the Filter Holder

For demonstration purposes, the photos here show the vertical intake filter holder uninstalled from

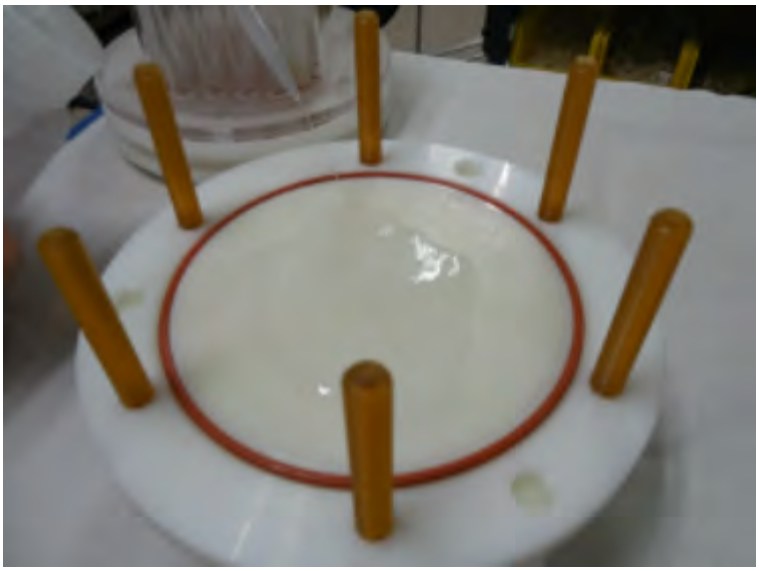
the frame. The filter holder should be installed on the WTS-LV when performing this procedure.

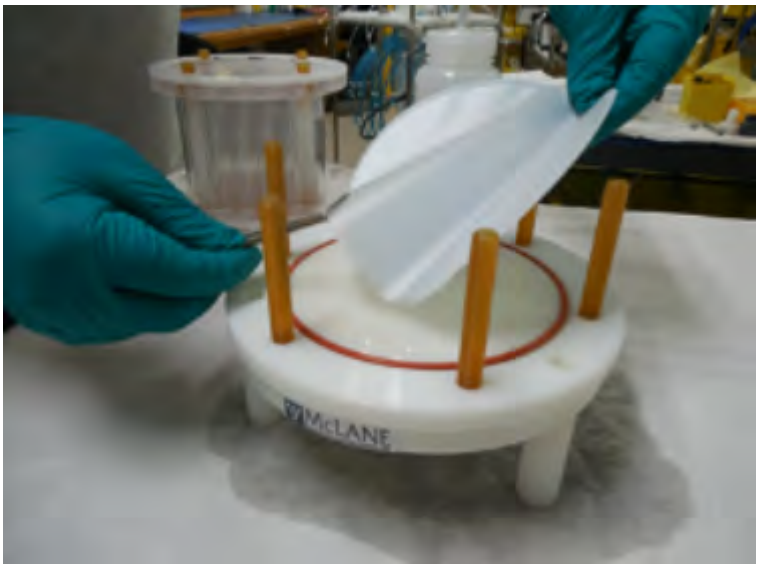
Vertical intake filter holder priming:

1. If not already connected, attach the pump intake tube to the underside of the vertical intake filter holder, which should be installed on the WTS-LV frame.
2. Unscrew the six wing nuts located at the top of the filter assembly. Remove the filter holder top and any prefilter plates until the filter holder bottom plate remains.



3. Fill the 500 ml squirt bottle included in the tool kit with neutral water. Flood the filter holder bottom plate. Water will eventually pool on the porous surface when the space below the frit has filled completely.
4. Place a 142 mm filter onto the filter holder bottom plate.
5. Confirm that the filter is flat and centered on the filter holder plate by gently moving the filter and pressing down lightly to remove trapped air.





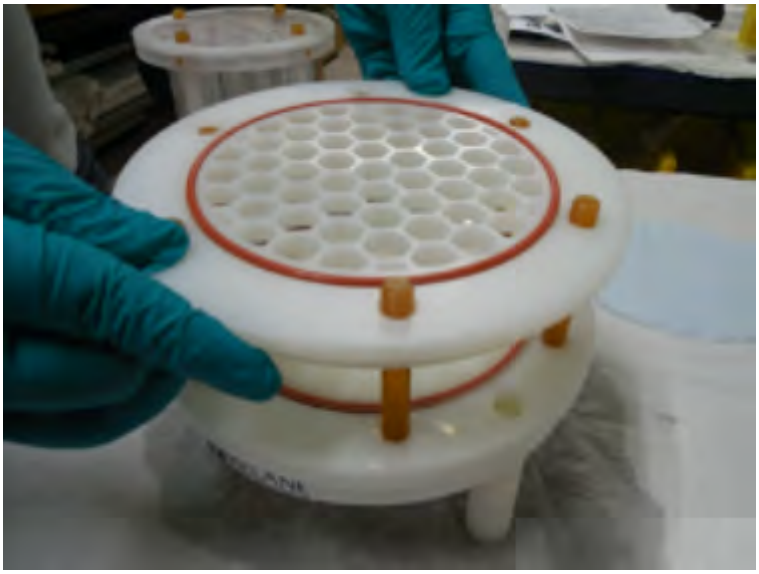
6. Allow water to saturate the membrane from below and then flood top of the filter with water.
7. Repeat this process for each additional filter holder tier.

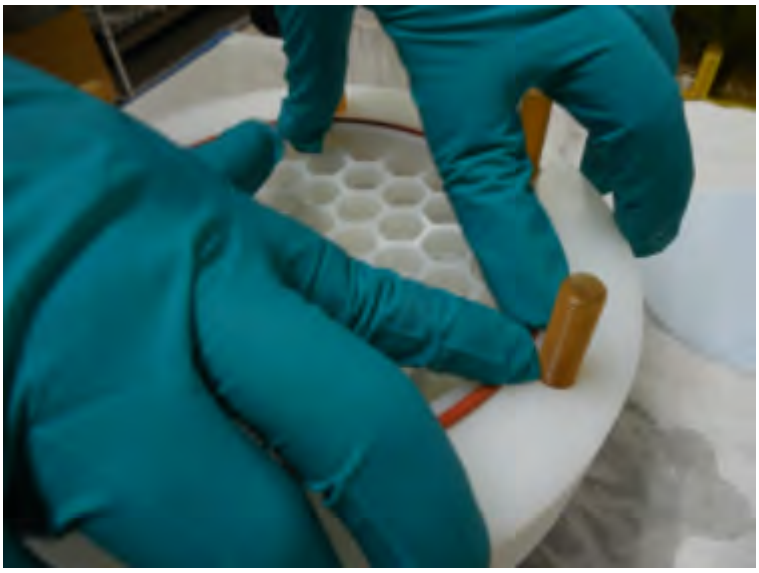
Related topic

Assembling the Filter Holder Plate

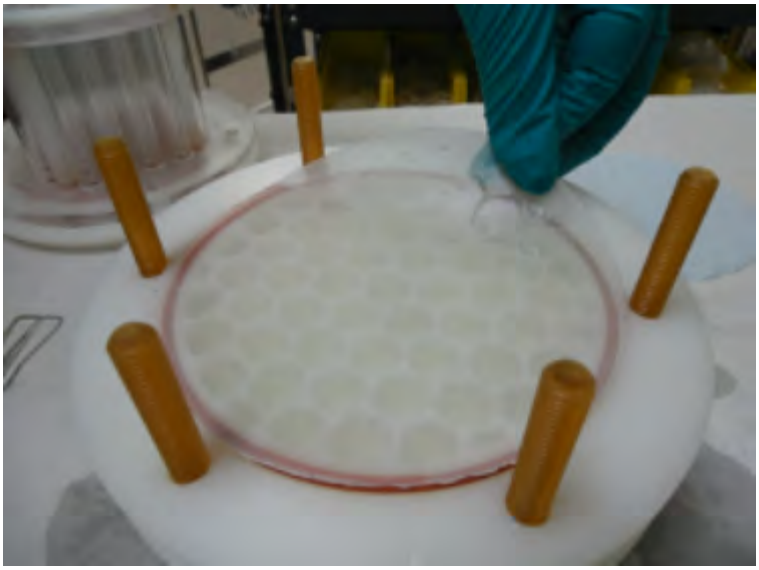
Assembling the Filter Holder Plate

1. Install prefilter plate(s). Ensure that the O-ring seal is seated in the groove.

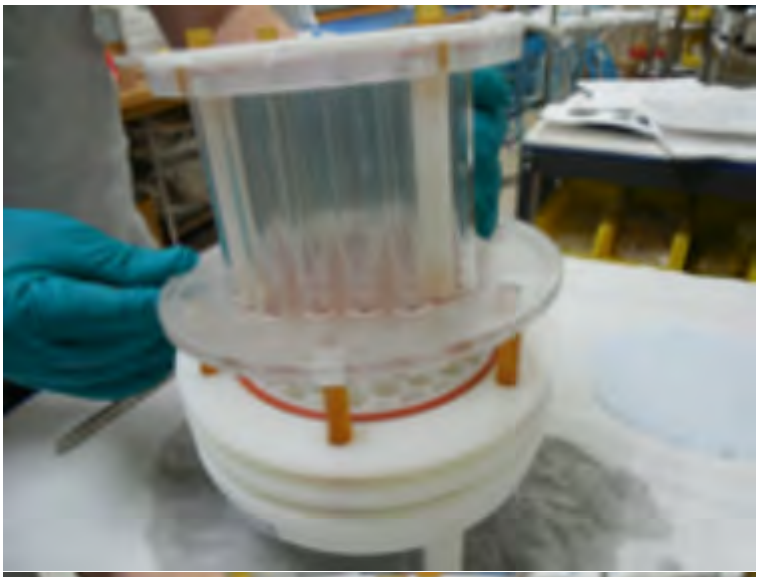




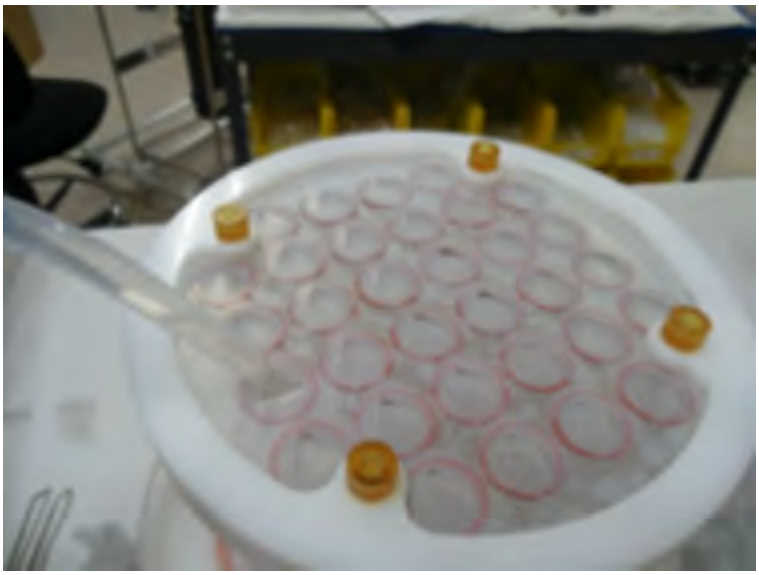
2. Install a 142 mm mesh prefilter and flood the top of the prefilter with water. If the prefilter is made from coarse material, it may also be necessary to install the optional gasket seal on the prefilter plate.



3. Place the top section on the filter holder.
4. Evenly tighten the six wing nuts to secure the filter holder stack.



5. Verify that the inlet membrane is in place and secure.
6. Fill the top of the filter holder assembly with neutral water prior to deployment.



7. WTS-LV is now fully primed and ready for deployment.

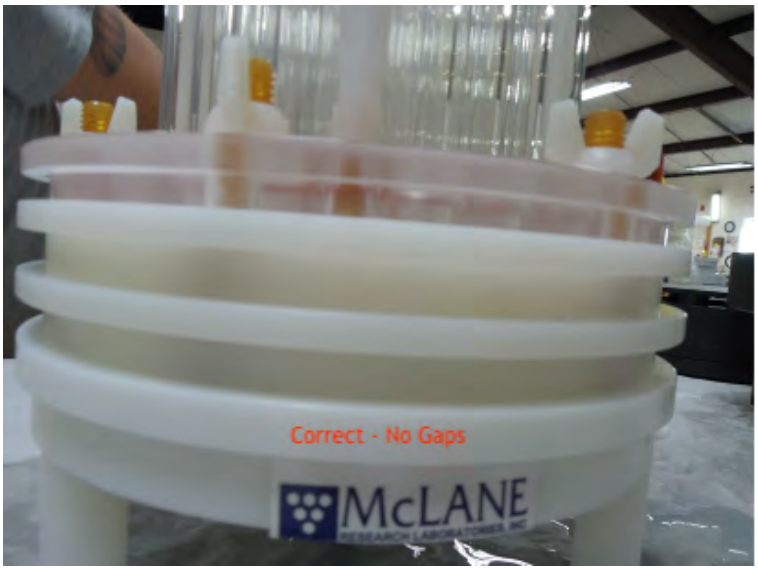
Related topic

Correct Filter Plate Assembly

Correct Filter Plate Assembly

A correctly secured filter holder assembly will not have gaps between the plates.

- Use the wing nuts to tighten the plates until they are closed without gaps.



Programming a Deployment

Using McLanePro, follow the steps outlined in the Schedule tab descriptions to program the deployment parameters.

Related topics
Deploying the WTS-LV

Deploying the WTS-LV

1. Follow the steps in Starting a Deployment to start the deployment.
2. Record the value of the mechanical flow meter before deploying the WTS-LV. The flow meter will provide an actual measurement of the sample volume that may differ from the estimated sample volume presented in the firmware.

Flow meter units are listed on the flow meter above the readout window. Units may be liters or gallons.

Related topics
Attaching Clamps to the Wire

Attaching Clamps to the Wire

The WTS-LV has two cable clamps that are designed for fast and easy attachment to and from oceanographic wires (WTS-LVBH does not utilize cable clamps). The bottom clamp attaches to the wire first (supporting the full system weight) and the top clamp (which is permanently attached to the frame) is secured second.

Follow these steps to attach the WTS-LV to the wire:

1. Secure the pin clamp, pin facing up, around the wire and tighten the T-nut until the clamp is fastened.
2. Slide the WTS-LV frame down onto the pin clamp placing the hole at the bottom of the frame onto the pin clamp.
3. Secure the top clamp to the wire confirming that the wire is taught between the top and bottom

clamps.

4. Confirm that both clamps are well tightened (a shackle can be placed around the deployment cable and connected to the WTS-LV with a short cable bridle as a safety wire).

Related topics

Cable clamps
Clamp insert sizes
Recovery and Data Offload

Recovery and Data Offload

After the deployment is completed, the required steps are:

- Recover the WTS-LV and prepare to communicate with the instrument.
- Record the flow meter after the deployment.
- Connect to the WTS-LV using McLanePro and download deployment data. See the instructions in the **Offload** tab section.
- Retrieve the filter for sample analysis.

Related topics

Recover the WTS-LV

Record the Flow Meter Reading

Connect to the WTS-LV

Download Deployment Data

Removing the Filter

Recover the WTS-LV

The WTS-LV is a single event sampler. Once the sampling event has completed, or as time dictates, the WTS-LV must be recovered in order to retrieve the filter(s) and to download the deployment data.

1. Recover the WTS-LV and uninstall from the oceanographic wire.
2. Release the top cable clamp first, then remove WTS-LV from the wire.
3. Uninstall the pin clamp from the wire.

If the WTS-LV is recovered while pumping, do not disconnect any cabling to the pump or flow meter. Disconnecting the pump while operating will damage the pump motor and require replacement. If still pumping when recovered, connect to the WTS-LV as usual using McLanePro. Use the **Cancel** button to terminate the deployment.

Related topic

Record the Flow Meter Reading

Record the Flow Meter Reading

1. Follow the steps to recover the WTS-LV.
2. Record the value of the mechanical flow meter after recovering the WTS-LV. The flow meter will provide an actual measurement of the sample volume that may differ from the estimated sample volume presented in the firmware.

Flow meter units are listed on the flow meter above the readout window. Units may be liters or gallons.

Related topic

Connect to the WTS-LV

Connect to the WTS-LV

1. Remove the dummy plug from the WTS-LV communication bulkhead connector.
2. Connect to the WTS-LV using McLanePro and prepare to download deployment data.

Related topic

Download Deployment Data

Download Deployment Data

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

1. Follow steps listed in Connecting to the WTS-LV to initiate communication with the instrument.
2. Download the recent deployment data using tools available on the Offload tab.
    1. It is recommended to export data using both the **Export** and **CSV** buttons provided on the **Offload tab**.
3. Check downloaded data to ensure that the correct data set has been offloaded and that there are no problems reported.
4. Continue to Removing the Filter in order to retrieve the filter and prepare for another deployment or to prepare for storage.

Related topic

Removing the Filter

Removing the Filter

After a deployment is complete and the system has been recovered, the filter holder can be removed to retrieve the filter for sample analysis. The filter holder may be removed with or without first purging sample water. Protocols for filter removal will vary according to customer requirements. In the following example, water is removed from the filter holder using the WTS-LV pump, before removing the filter holder from the system in order to retrieve the filter.

To remove the WTS-LV filter, complete the following steps:

1. Power on the computer, plug the USB COM cable into one of the computer's USB ports, and then connect the communications cable to the controller housing.
2. Start McLanePro and connect to the WTS-LV.
3. Navigate to the **Manual Operation** tab. The pump will be manually operated in order to draw excess water from the filter holder..
4. To remove standing water from the filter holder, run the pump forward at the minimum flow rate for 3-5 seconds and click **Stop Pumping** when the standing water is gone.
    1. Set the **Pumping Parameters** to a low sample volume and flow rate. For example, if using an 8 L/min pump, set the parameters to 8 L volume, 4 L/min flow rate and no timeout. For a 4 L/min pump, pump at 2 L/min flow rate with no timeout .
    2. Be prepared to click **Stop Pumping** when there is no more water in the filter holder and/or system plumbing.
5. Disconnect the tubing from the filter holder and unscrew the three large thumb screws under the

filter holder plate that secure the filter holder.

6. Move the entire filter holder to a protected location for removal of the filter.
7. Unscrew the four thumb nuts (for radial intake holders) or remove the six wing nuts (for vertical intake holders) and remove the filter holder top.
8. Remove any prefilter(s) and prefilter tier(s). Prefilters may be stored for analysis or discarded.
9. Carefully remove the 142 mm filter and store/secure as necessary for analysis.
10. Wash or rinse the filter holder plates.
11. Replace the top sections of the filter holder and secure with the thumb nuts/wing nuts.
12. Place the filter holder back onto its mounting plate and install the three large thumb screws to secure it to the plate.
13. Reconnect the pump tubing to the filter holder.
14. If the WTS-LV is not being immediately redeployed, perform any necessary maintenance before storage.

Related topic

WTS-LV Maintenance & Storage

WTS-LV Maintenance & Storage

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

Steps may include:

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

WTS-LV Maintenance & Storage topics
Immediately Following Recovery
Back from Sea
Storage and Transport

Immediately Following Recovery

After the deployment is completed, the required steps are:

- Connect to the WTS-LV using McLanePro and download deployment data. See the instructions in the **Offload tab** section.
- Retrieve the filter for sample analysis.
- Rinse the WTS-LV.
- Clean WTS-LV fluid paths and plumbing.
- Remove and dispose of expired batteries.

Rinse the WTS-LV

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

Related topics

Clear the fluid paths & plumbing
Flushing the pump head

Flushing the Pump Head

The **Manual Operation** tab provides a way to flush the pump head interior with fresh water. Flushing the pump head after every deployment can prevent salt crystal formation. To flush the pump head, complete the following steps:

1. Ensure that the controller housing is sealed.

2. Establish communication with the WTS-LV.
3. After removing the filters from the filter holder, wash, and reassemble the filter holder sections.
4. Set the clean filter holder aside.
5. Attach the priming intake tube to the pump inlet.
6. Place the free end of the tube in a reservoir of fresh, clean water. Optionally, a mild detergent solution can be used for a first flush, followed by a clean water flush.
7. Forward pump five liters of fresh water to clear the pump head of salt water.
    1. Change the pumping parameters in the **Manual Operation** tab to 5 L volume.
    2. Click **Pump Forward** in the **Manual Operation** tab.
8. Watch the water container, and make sure it does not run dry.

If a cleaning solution is used to flush the system, make sure to perform another flush with water to rinse the cleaning solution from the system.

Clear the Fluid Paths & Plumbing

After removing filters and flushing the pump head, the WTS-LV should be purged of water.

1. Power on the computer, plug the USB COM cable into one of the computer's USB ports, and then connect the communications cable to the controller housing.
2. Start McLanePro and connect to the WTS-LV.
3. Navigate to the **Manual Operation** tab. The pump will be manually operated in order to draw excess water from the filter holder.
4. To remove standing water from the filter holder run the pump at the minimum flow rate for 3-5 seconds and click **Stop Pumping** when the standing water is gone.
    1. Set the **Pumping Parameters** to a low sample volume and flow rate. For example, if using an 8 L/min pump, set the parameters to 8 L volume, 4 L/min flow rate and no timeout.
    2. Be prepared to click **Stop Pumping** when there is no more water in the filter holder and/or system plumbing.

Dispose of Used Batteries

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

1. Dry the controller housing. Ensure that there is no water remaining on or above the controller housing that could enter the housing when opened.
2. Open the controller housing according to steps listed in Opening the Controller Housing.
3. Disconnect the batteries from the electronics.
4. Open battery holder and remove "D" cells, or, remove the A72-1000 battery pack.
5. Recycle or dispose of used batteries according to local laws and regulations.

6. Replace batteries if redeploying.

Back from Sea

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

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

Cleaning & Inspecting the Controller Housing

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

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

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

Related topic

Controller Housing

Cleaning & Inspecting the O-Rings

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

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

Related topic

O-rings

Cleaning & Inspecting Cables & Connectors

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

Related topic

End Cap Bulkhead Connectors

Cleaning & Inspecting Hardware

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

Related topic

Frame

Backup Deployment Data

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

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

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

Storage and Transport

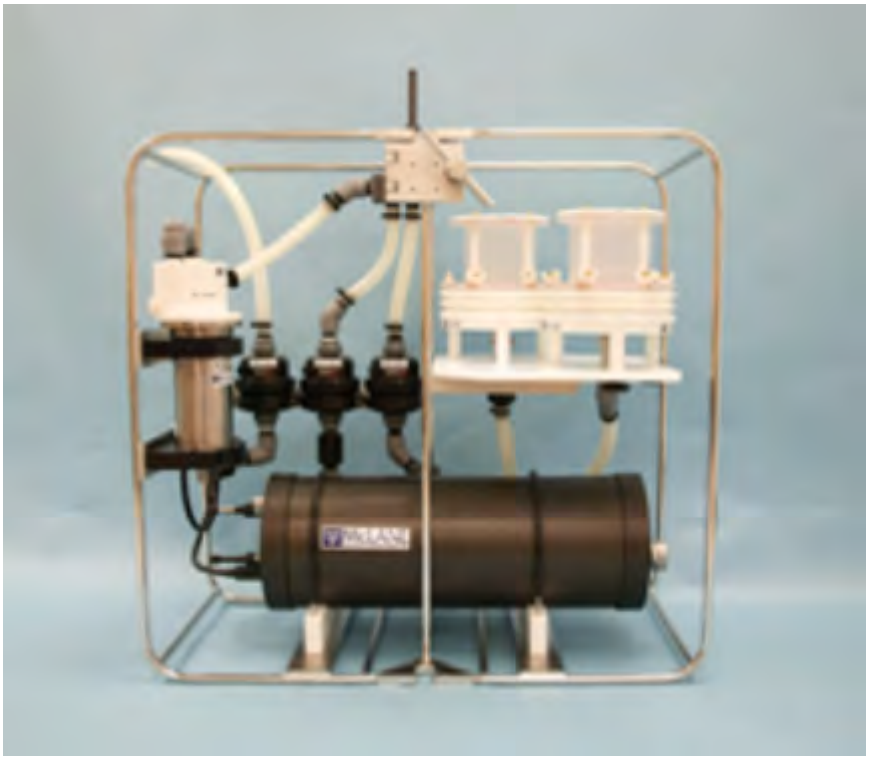
The shipping crate is a reusable international freight container that is ISPM-15 compliant for international transport. Always use the original shipping crate for transporting the WTS-LV or when storing long term.

Always disconnect and remove batteries before long term storage or transport.

WTS-LVDF Dual Filter Model

The dual filter WTS-LV model (WTS-LVDF) features two vertical intake, 142 mm filter holders that allow for simultaneous, independent sampling within the same water mass.

- The WTS-LVDF model is designed for applications that require sampling of very large water volumes in order to capture sufficient amounts of trace elements, suspended metals, or other particulate matter.
- The vertical intake filter holder follows a modular design and has increased internal baffling to mitigate losses of large particles during handling and recovery.
- The WTS-LVDF uses the A72-1000 battery pack (30,000 mAh) which provides three times the battery capacity of the standard WTS-LV using 24 replaceable alkaline "D" cells.



Introduction

The vertical intake filter holder follows a modular design with increased internal baffling in order to mitigate losses of large particles during handling and recovery of the instrument. Utilizing two different filter porosities during a single deployment allows for greater sampling flexibility and may increase overall volume capacity when compared to single filter designs.

Other features include:

- A72-1000 battery pack (30,000 mAh), which provides three times the battery capacity of the standard WTS-LV.
- Independently metered flow circuits, plus metered "Total output" at exhaust.

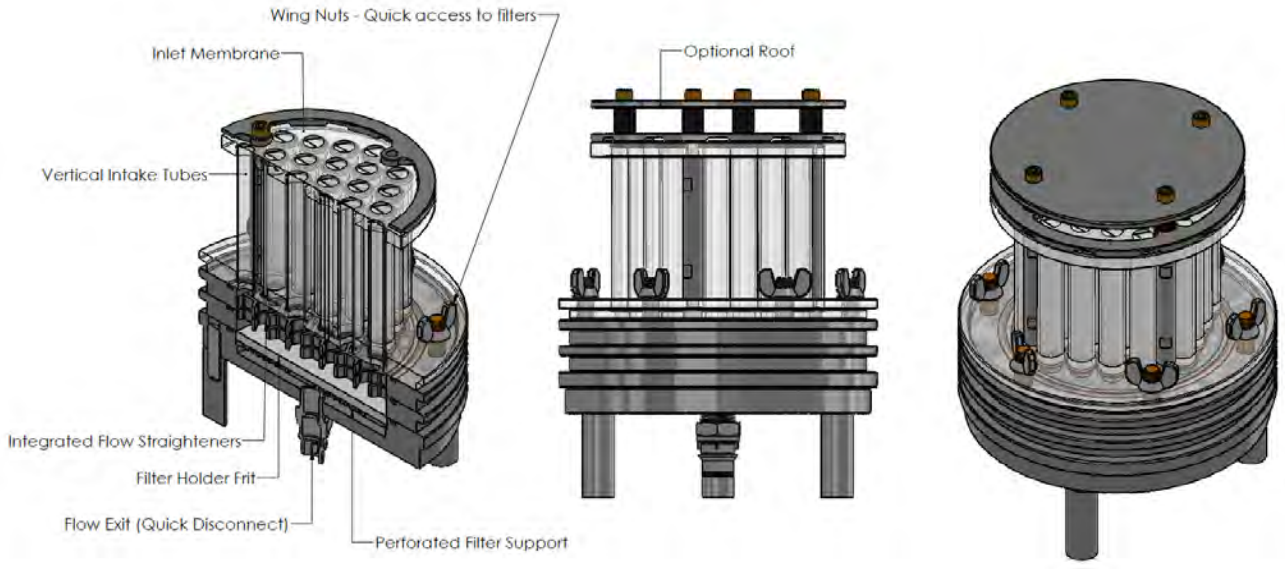
The WTS-LVDF model may only be configured with the 8 L/min pump head.

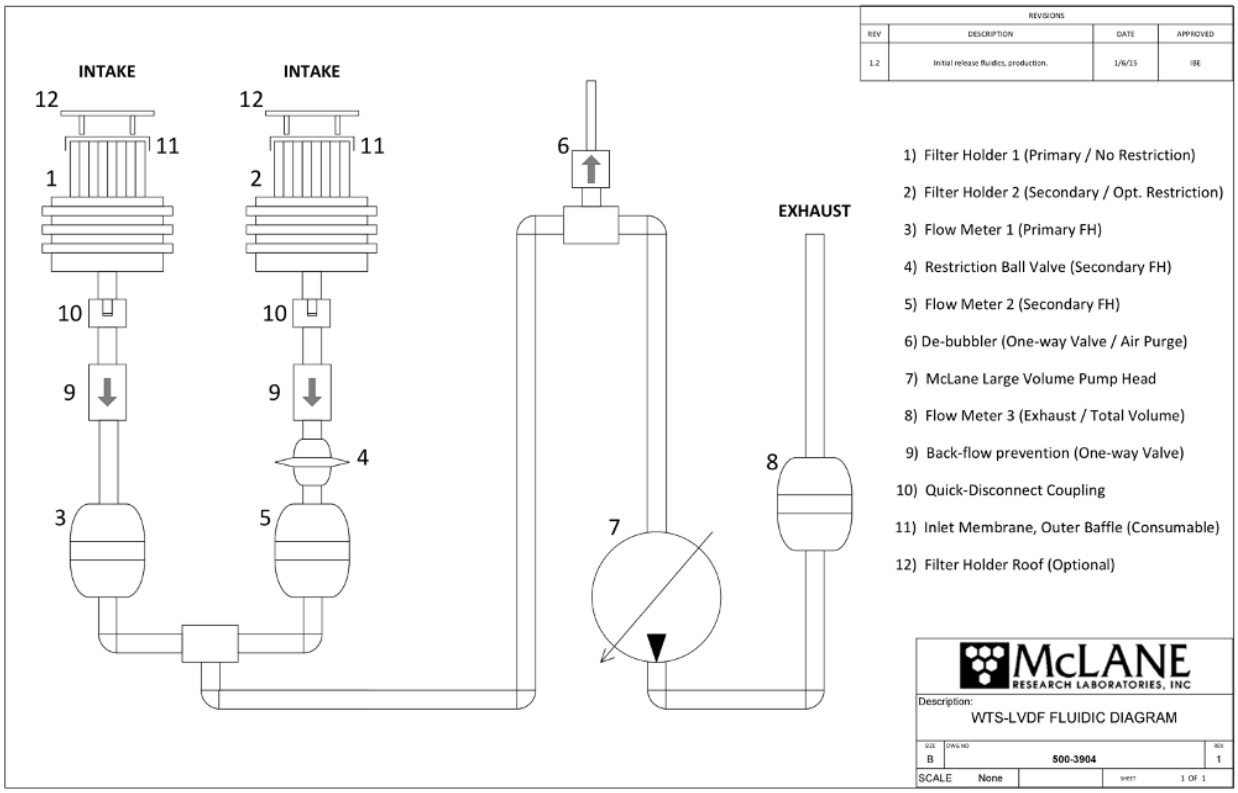
WTS-LVDF topics

[Vertical intake filter holders](#)
[Removing filter holders](#)
[Installing filter holders](#)
[Installing the optional debubbler](#)
[Connecting the battery pack](#)
[Priming](#)
[Reading and recording flow meters](#)

Vertical intake filter holders

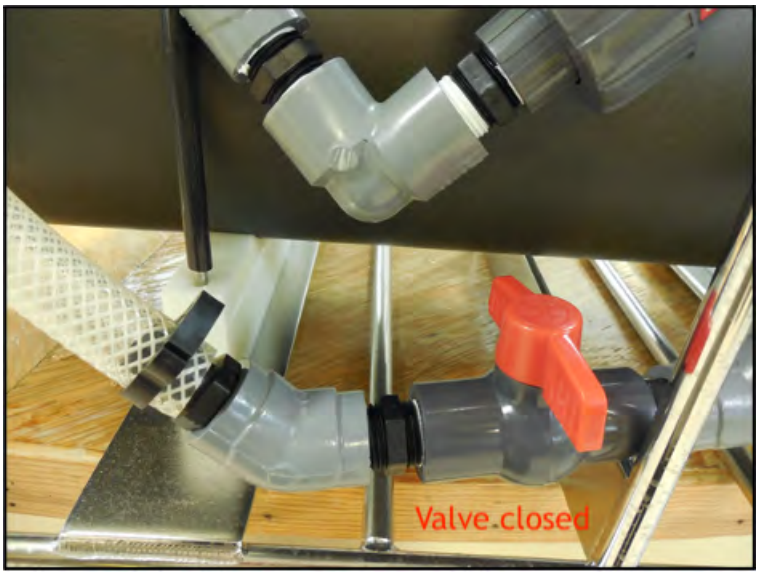
The WTS-LVDF is calibrated to perform optimally with membrane filters ranging from 0.22 μm to 3.00 μm or greater porosity. Vertical intake filter holders are the standard option for a WTS-LVDF. A cross section of the filter holder and flow path diagram are shown below.

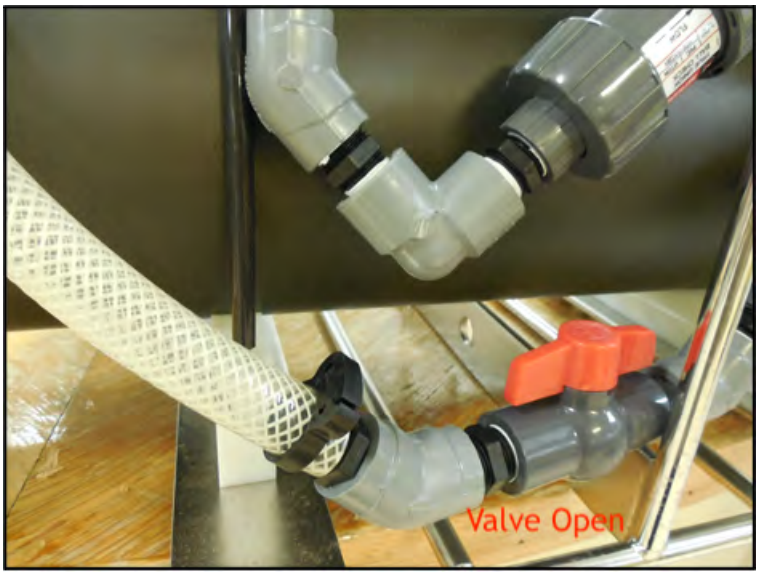




Operate WTS-LVDF as Single Filter Sampler

To operate the WTS-LVDF as a single filter sampler, turn the red flow valve counterclockwise (closed). This closes the flow path to the connected filter holder. Sample will be pumped only through a single filter holder connected to the non-valved plumbing.

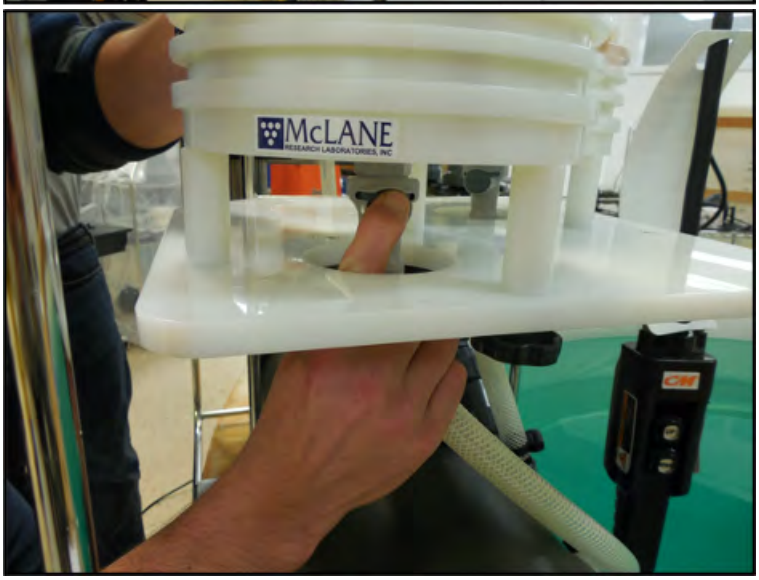




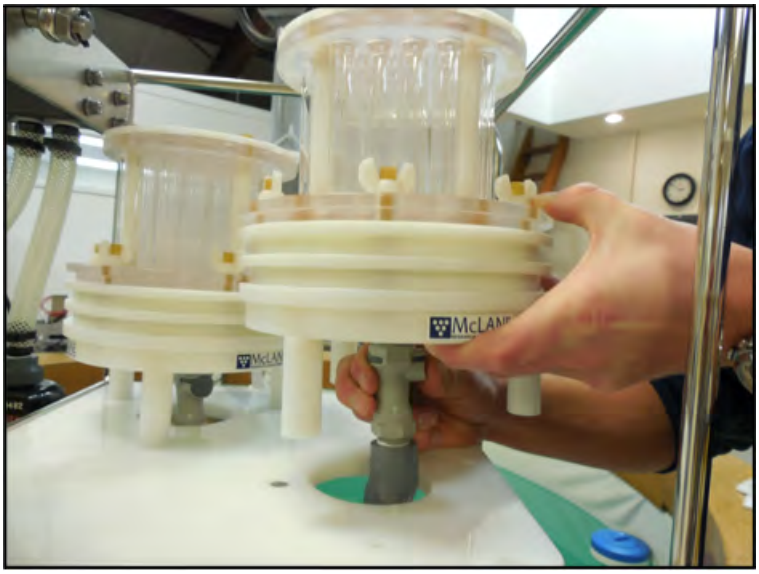
Removing Filter Holders

The WTS-LVDF ships with filter holders installed. To remove either filter holder, complete the following steps:

1. Remove each of the three thumb screws at the bottom of the filter holder plate.
2. Press to release the latch on the quick disconnect fitting from below the filter holder.



3. Gently lift the filter holder from the filter holder plate and remove filter holder unit from connector.

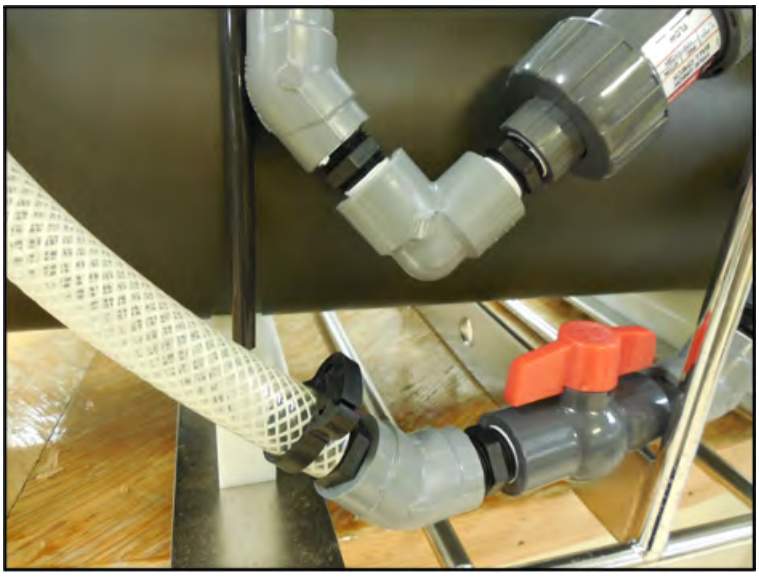


Installing Filter Holders

To install either filter holder, complete the following steps:

1. Place the filter holder over the filter holder plate and push the male outlet connecter onto the female quick disconnect. The latch should engage when fully mated.

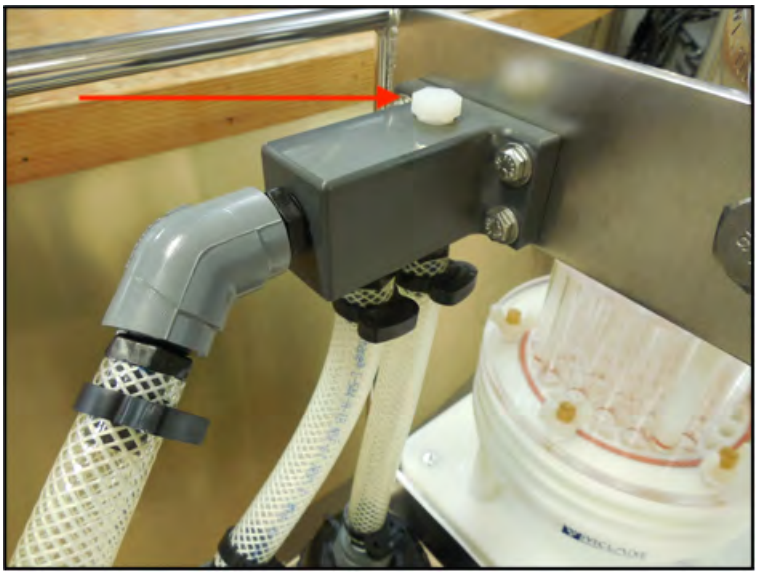
2. Secure the three thumb screws through the filter holder plate up into the filter holder legs.
3. Confirm that the red flow valve is correctly set for either single (closed), or dual (open) filtering.



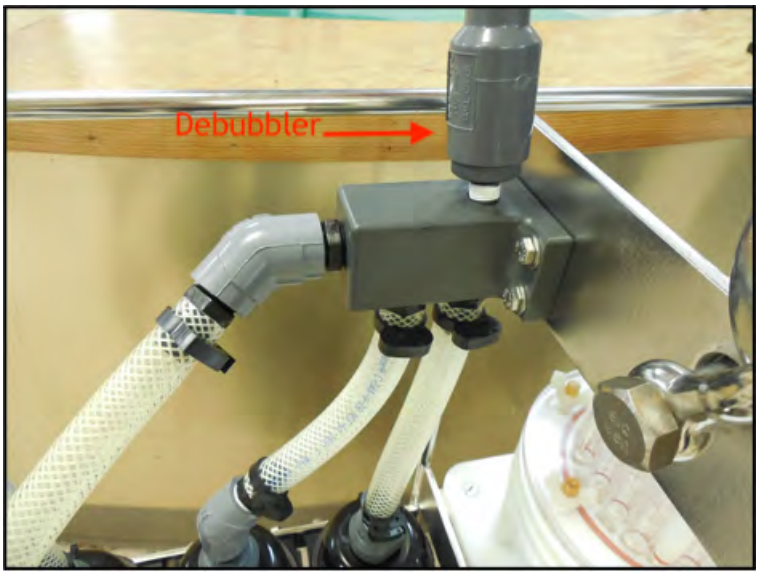
Installing the Optional Debubbler

The WTS-LVDF ships with an optional debubbler. The debubbler must be installed prior to use. The debubbler will allow escape of any air bubbles during deployment in the case of insufficient priming. The WTS-LVDF must be deployed with a plug at the top of the manifold if the debubber is not installed. Spare plugs are included in the toolkit.

1. Remove the plug from the top of the manifold.



2. Screw the threaded end of the debubbler into the manifold until tight.



Connecting the A72-1000 Battery Pack

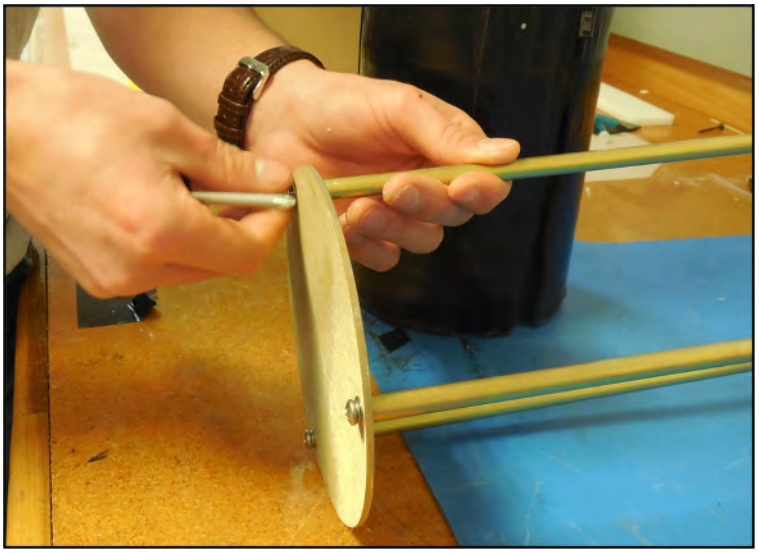
Connecting and disconnecting the A72-1000 battery to the electronics powers the WTS-LV on and off. The firmware starts automatically when the main battery is connected.

To power on the sampler and connect to a computer, complete the following steps:

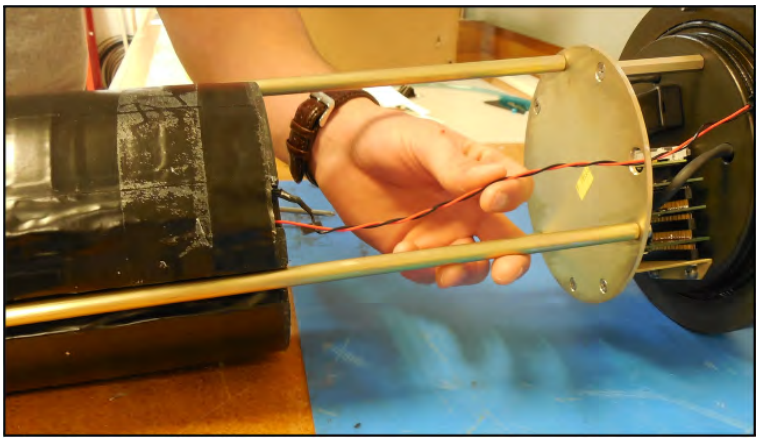
1. Place the sampler in a dry area.
2. Boot the operator PC and start the communications software (McLanePro).
3. Open the controller housing.

Follow standard electrostatic discharge (ESD) precautions when handling the electronics and work in a dry area.

4. Using a screwdriver, loosen the screws and remove the bottom plate.

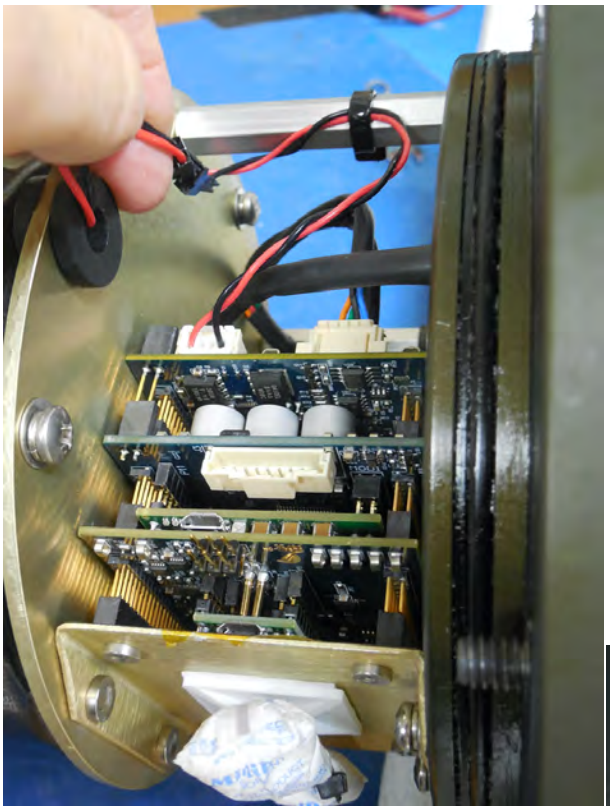


5. Align the battery so the output leads will pass through the hole cutout in the top plate. Begin sliding the battery up toward the upper battery plate.



6. Feed the connector wires through the battery feed through hole in the battery holder frame plate.

7. Reinstall the bottom battery plate, and secure with three screws.
8. Connect the main battery to the A72-1000 Gen3 Battery Adapter, which plugs into the connector on the the electronics stack.



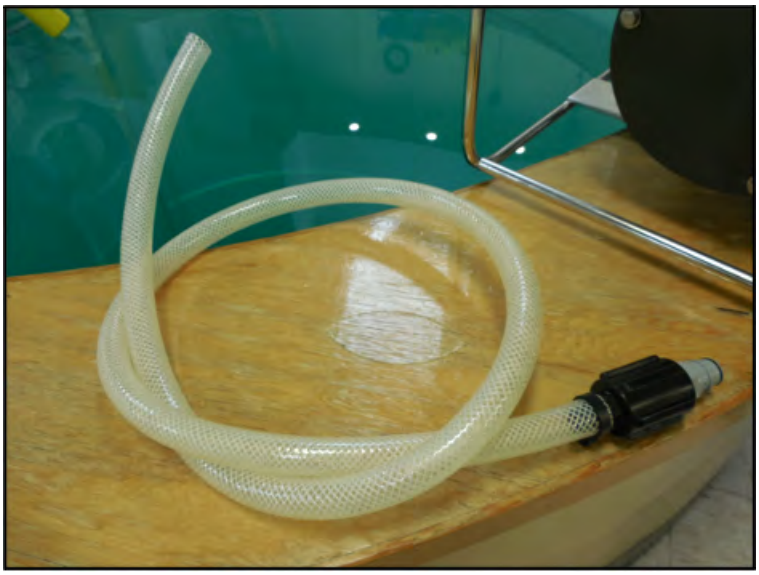
9. Slide the controller into the housing and then close the controller housing.
10. Remove the dummy plug from the communications connector.
11. Attach the communication cable assembly (supplied in the Toolkit) first to the PC USB port and then to the COM bulkhead connector on the controller housing.

Priming the WTS-LVDF

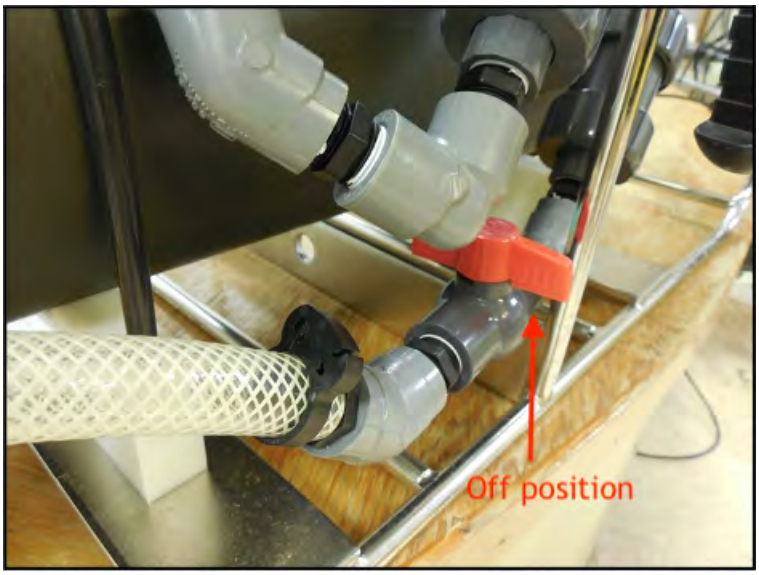
Priming is an important deployment preparation step. Steps vary according to WTS-LV model and filter holders. See Priming the WTS-LV for general priming information. The steps in this section are specific to the WTS-LVDF model.

To prime the WTS-LVDF sampler, complete the following steps:

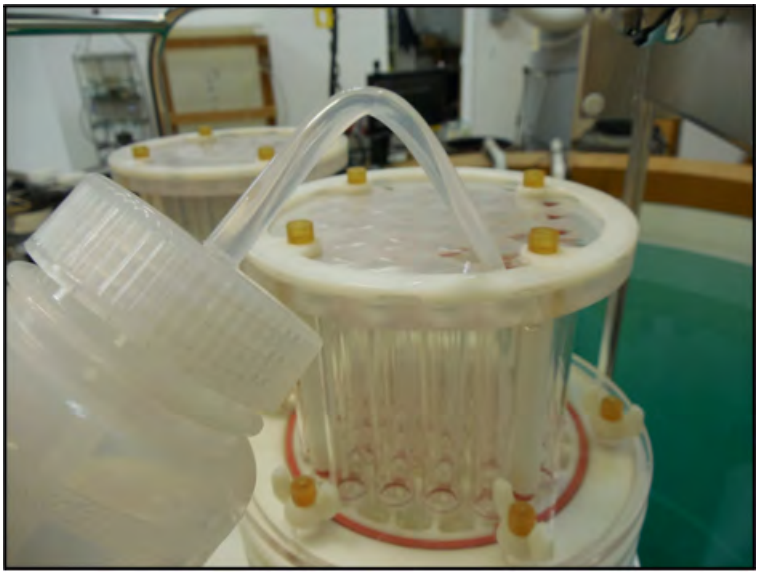
1. Remove both filter holders from the mounting plate.
2. Locate the priming fixture from the toolkit. Connect the fixture to Inlet 2 (on the valved inlet tubing).
3. Connect the WTS-LV to a computer, and click **Pump Forward** to fill lines with water. When lines are filled, click **Stop Pumping**.



4. Turn the red flow valve for the side being primed to the ‘off/closed’ position, then attach priming tube to Inlet 1.



5. Click **Pump Forward** to fill the second set of lines. Click **Stop Pumping** when lines are full.
6. Attach each filter holder. Using a squirt bottle, fill the top of each filter holder with clean deionized water.
    1. Alternately, prime each stage after installing a filter and/or prefilter. See instructions in Priming the Vertical Intake Filter Holder.



Reading and Recording Flow Meters

The WTS-LVDF utilizes three flow meters. Each filter holder has an associated flow meter and the third flow meter measures the exhaust (total system volume).

Recording the mechanical flow meters before and after deployment is required in order to provide an accurate reading of volume pumped.

This reading is a true measurement compared to the firmware estimated pumped volume, which can vary greatly based on deployment conditions and filter types.

The WTS-LVDF firmware estimates total volume only. It is critical to record each flow meter before and after deployment to determine volumes filtered through each individual filter holder.

Flow meter units are listed on the flow meter above the readout window. Units may be liters or gallons.

WTS-LVUP Upright Model

The high capacity WTS-LVUP, "upright" model includes the same features and user interface as the standard WTS-LV. This section explains the options on the upright model that may differ from the standard WTS-LV.

- The WTS-LVUP uses the A72-1000 battery pack (30,000 mAh) which provides three times the battery capacity of the standard WTS-LV.
- The WTS-LVUP may be configured with a 30 L/min pump head.

Connecting the A72-1000 Battery Pack

Connecting and disconnecting the A72-1000 battery pack to the electronics powers the sampler on and off. The firmware starts automatically when the battery is connected.

Related topic

Connecting the A72-1000 battery pack

Optional 30 L/min Pump

The 30 L/min pump head is an optional feature of the Upright WTS-LV model (WTS-LVUP). The maximum flow rate of 30 L/min can be reached with a 100 µm mesh filter, no frit, no cartridge housing and no flow meter installed. Installing a frit, cartridge housing and/or flow meter produces lower maximum flow rates.

The WTS-LVUP with 30 L/min pump option may be shipped with no flow meter installed (the flow meter is included in the crate).

Related topic

Installing the Optional Flowmeter

Installing the Optional Flow Meter

Installing the flow meter creates back pressure on the pump exhaust which slows the maximum flow rate (estimated flow rate of 25 L/min).

A filter with a pore size of 3 µm or greater must be used with the 30 L/min pump head.

- When configured with the 30 L/min pump head, the WTS-LVUP initial pumping flow rate can be set from 5 to 30 L/min in the firmware.
- Adding a cartridge filter holder or flow meter further reduces the maximum flow rate.

Pump testing results shown below illustrate how maximum flow rate is affected by the flow meter, cartridge housing, and frit. Pumping was performed using a 3 µm filter, with no cartridge housing and no flow meter installed. This configuration produces a maximum flow rate of 25 L/min. Adding a cartridge housing and/or flow meter reduces the maximum flow rate as shown.

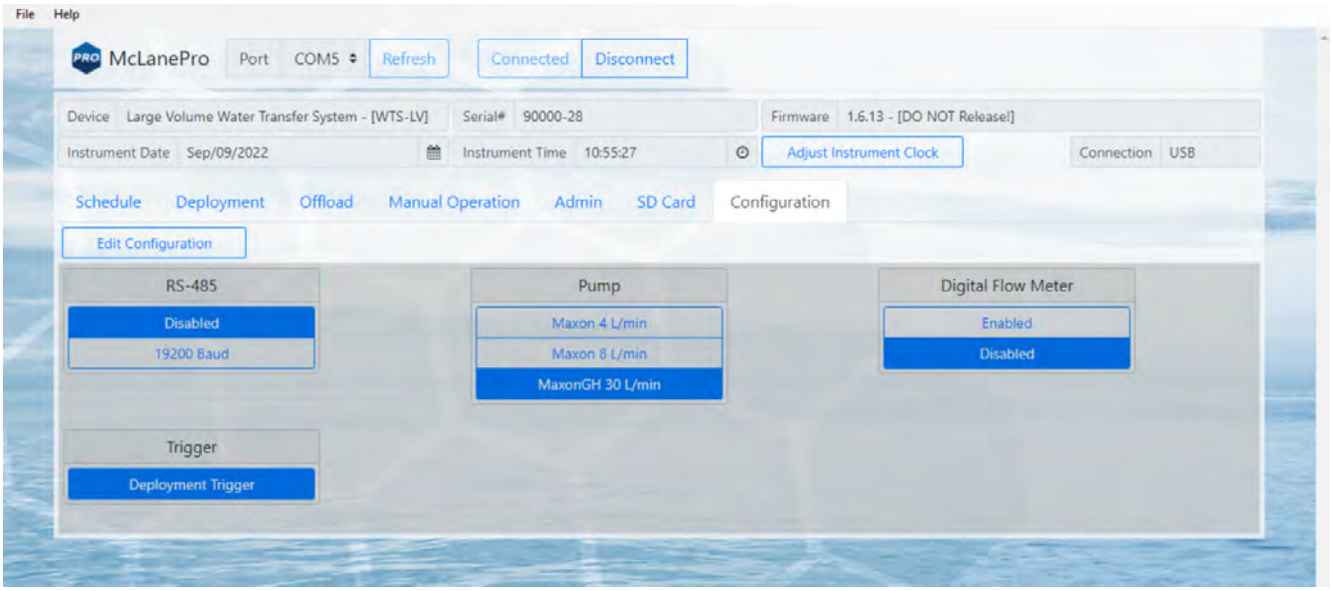
Filter	Frit	Cartridge Housing	Flow Meter	Maximum Flow Rate (L/min)
100 µm Mesh	None	None	None	30
3 µm	Standard	None	None	25
3 µm	Standard	10” DOE (double open ended plumbing only - no filter installed)	None	23
3 µm	Standard	10” DOE (double open ended plumbing only - no filter installed)	V100	16

* These estimates were performed on the CF2 hardware but will be similar for Gen3 WTS-LVs.

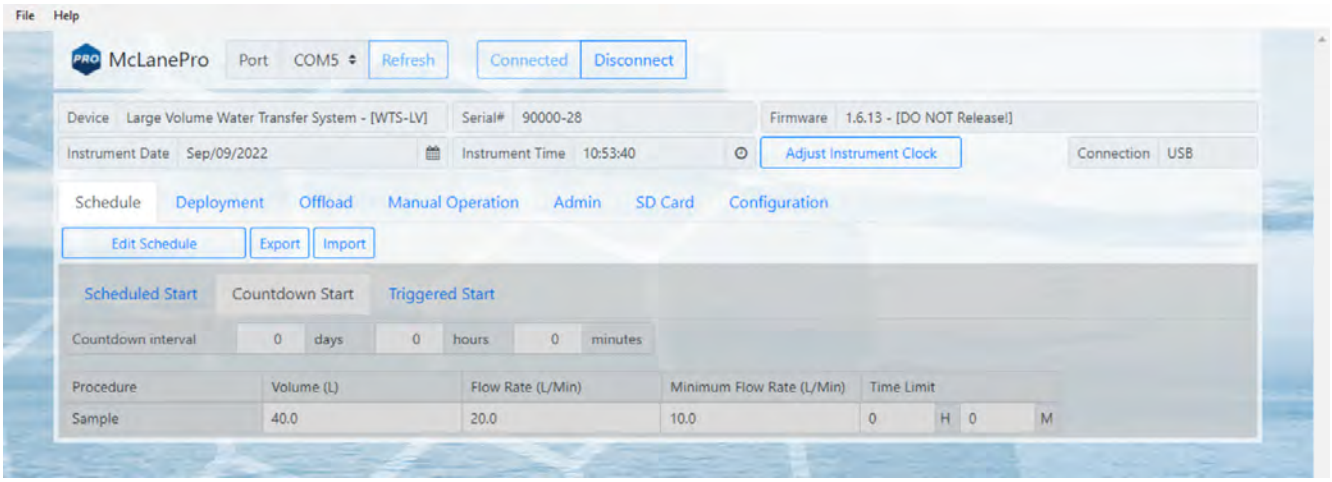
However, the V100 flow meter is no longer supplied with the 30 L/min pump. A less restrictive 3/4" flow meter is shipped with Gen3 30 L/min WTS-LVs and allows for flow rates up to 25 L/min.

Deployment Settings for Using 30 L/min pump

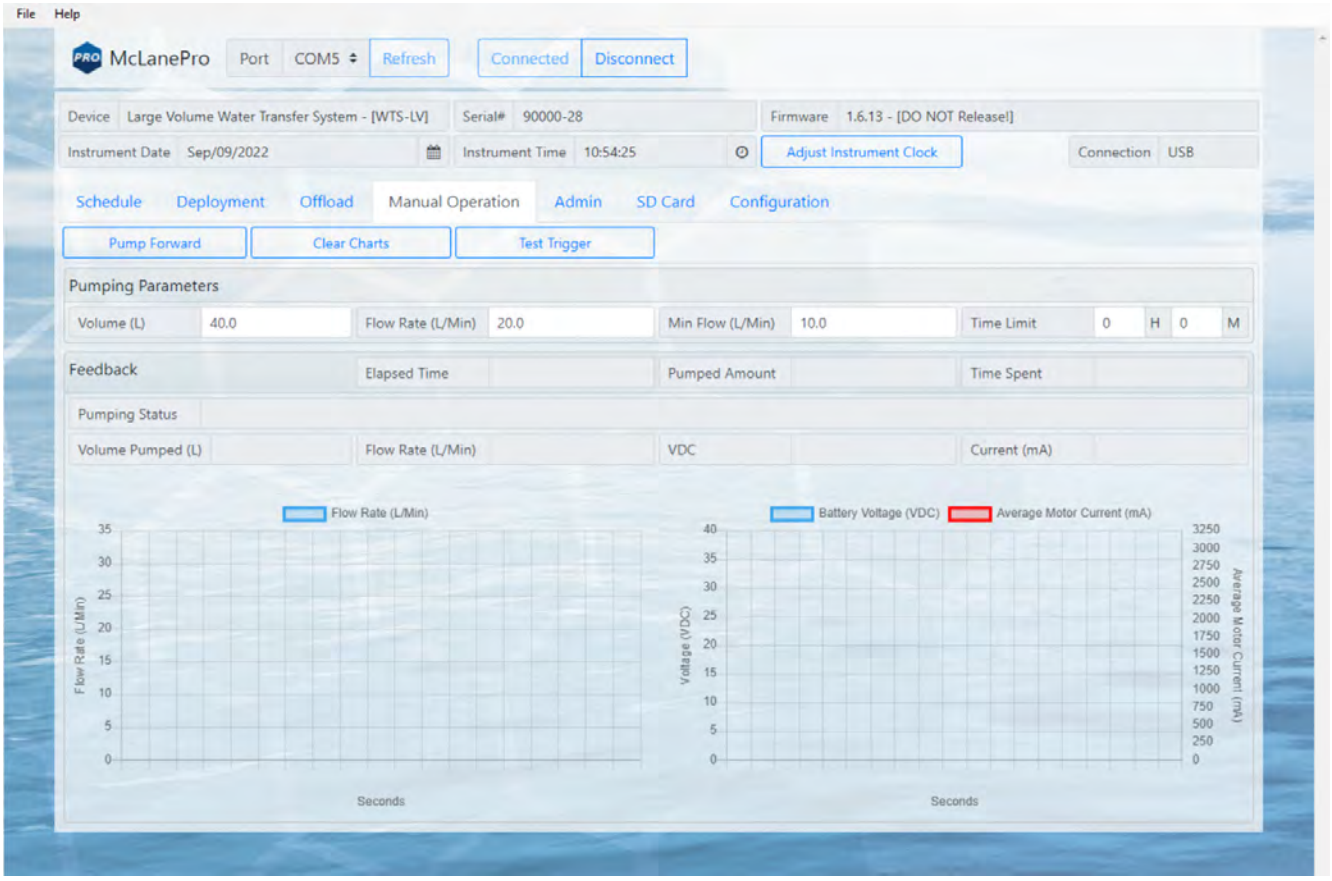
If equipped with a 30 L/min pump, the firmware should be configured to use this pump head. This can be checked by clicking the **Configuration tab**.



On the **Schedule tab**, default options for volume, flow rate and minimum flow rate will be set automatically to accommodate the 30 L/min pump.



On the **Manual Operation tab**, default options for volume, flow rate and minimum flow rate will be set automatically to accommodate the 30 L/min pump.



Battery Endurance Example Calculation

This deployment endurance estimate for the WTS-LVUP A72-1000 battery pack assumes:

- New, unused battery pack.
- A de-rated battery capacity of 30,000 mAh.
- Per-year self-discharge rate of 6%.

Battery life for a planned WTS-LV Upright deployment can be estimated using the instrument current consumption values provided here. These values apply to electronics using the Gen3 micro-controller. An 30 L/min pump operated at 25 L/min is used for the example. In addition to pumping time, many other deployment conditions can affect the battery duration. Use this example for estimation only.

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

Pre-deployment	
Controller (1 hour)	1 h x 25 mA = 25 mAh
Pumping (0.2 hour)	0.2 h x 2,000 mA = 400 mAh
	Subtotal = 425 mAh
Deployment	

Controller (6 hours)	6 h x 25 mA = 150 mAh
Pumping (6 hours)	6 h x 2,000 mA = 12,000 mAh
	Subtotal = 12,150 mAh
Recovery	
Controller (1 hour)	1 h x 25 mA = 25 mAh
	Subtotal = 25 mAh
Total Current Consumption	**Total = 12,600 mAh**

This example shows that the total energy consumed is 12,600 mAh, which will not exceed the 30,000 mAh battery life.

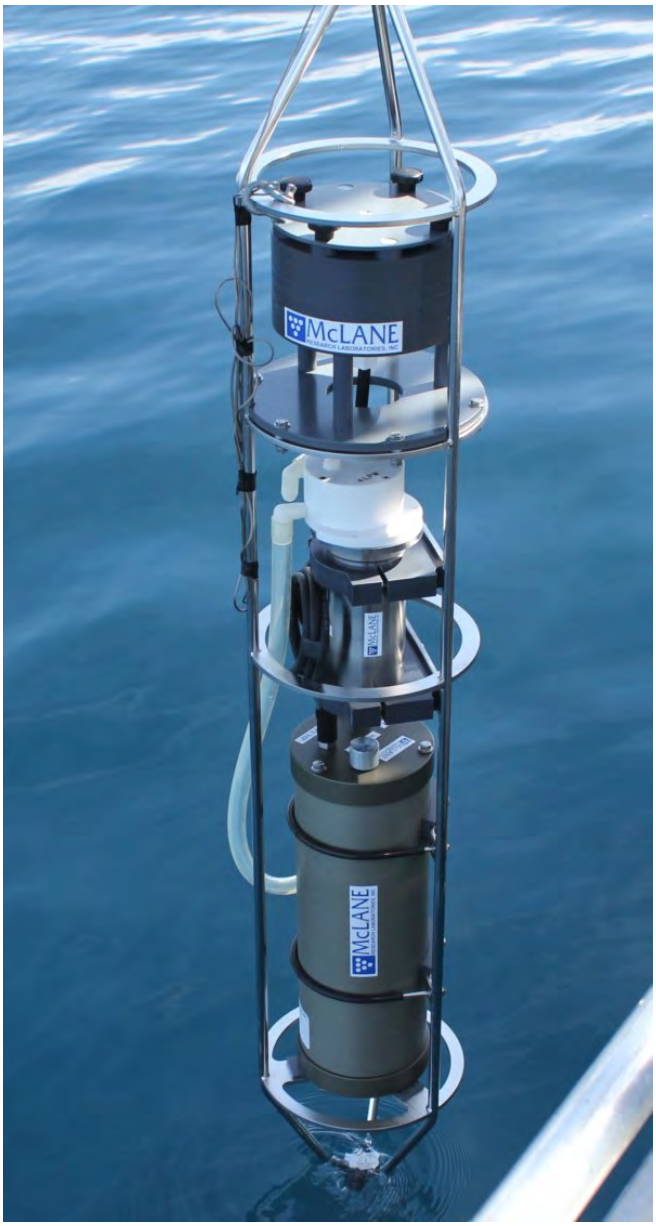
WTS-LVBH Bore Hole Model

The Bore-Hole WTS-LVBH is designed to fit through a narrow opening such as a 30 cm bore-hole and collects a single suspended particulate sample *in situ* onto a 142 mm membrane or glass fiber filter.

The Bore-Hole WTS-LVBH is identical to the standard WTS-LV, with a compact re-arrangement of the components.

Related topic

Installing batteries

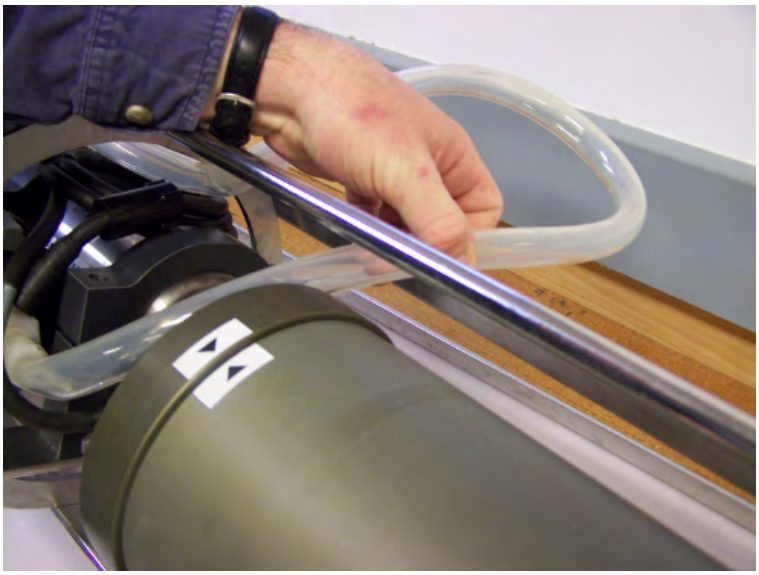


Installing the Alkaline Batteries

Like the standard WTS-LV model, the Bore Hole model has a battery holder that accepts 24 user replaceable drop-in alkaline "D" cell batteries for a total of 10,000 mAh of battery capacity. The batteries are not installed in a new WTS-LVBH. However, new batteries are included either in the toolkit or in the shipping crate.

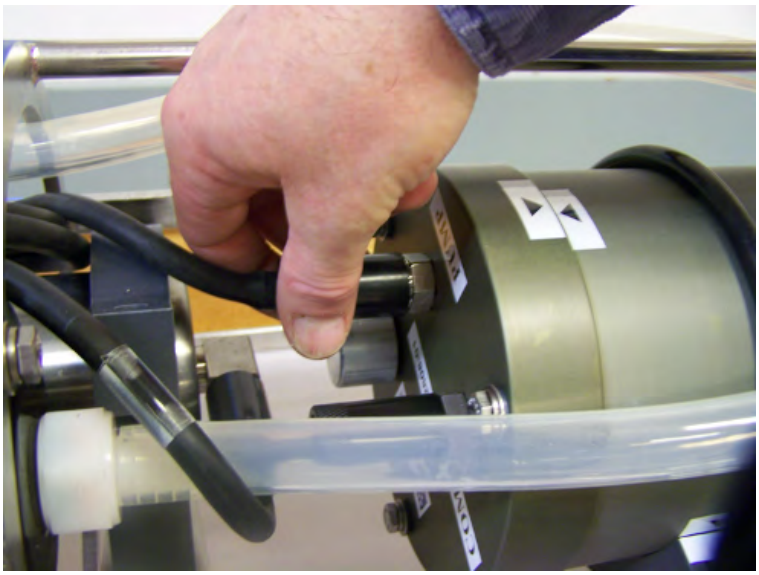
To install batteries into the controller housing, complete the following steps:

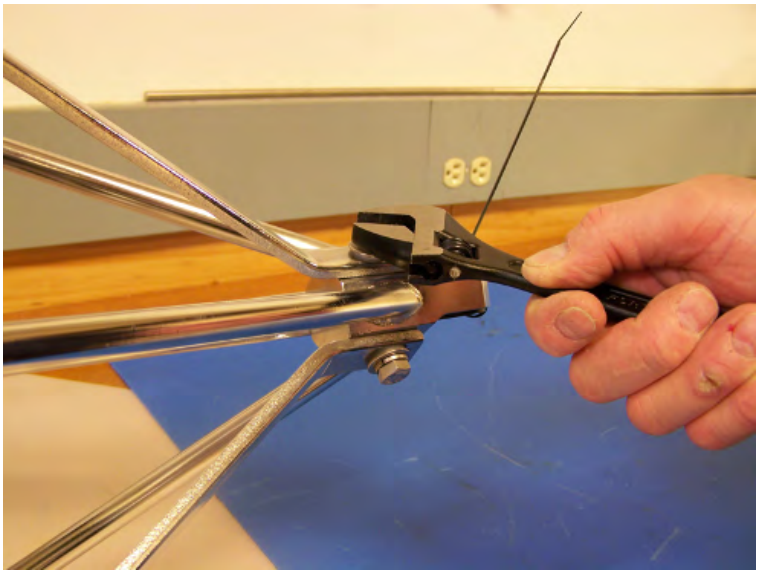
1. Use a box wrench and adjustable wrench included in the toolkit to remove and reinstall the frame guard and u-bolts
2. When removing the controller housing, the white exhaust tubing can be moved out of the way or disconnected at the inlet to the flow meter.



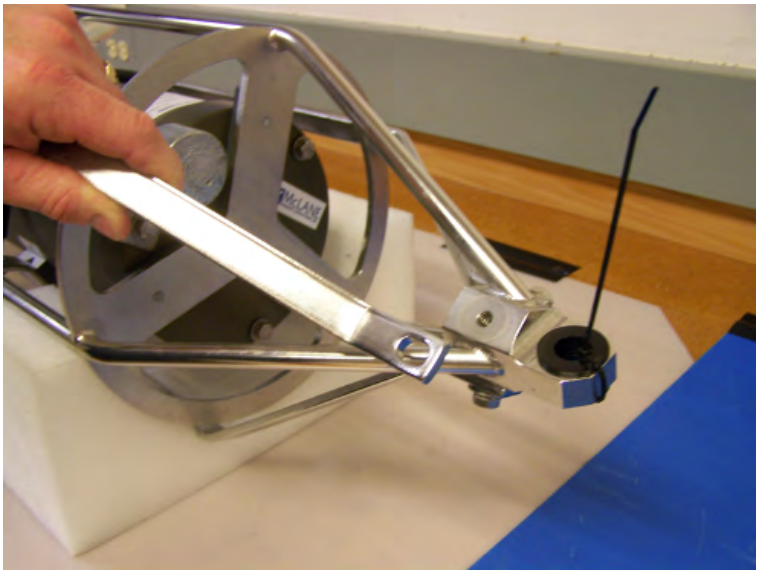
3. Position the WTS-LV on a flat surface and stable support so that it does not roll. Foam cradles from the shipping crate work well for this purpose.

4. Remove the pump connector from the controller housing.
5. Using the adjustable wrench, loosen the connecting bolt on one of the frame guards.

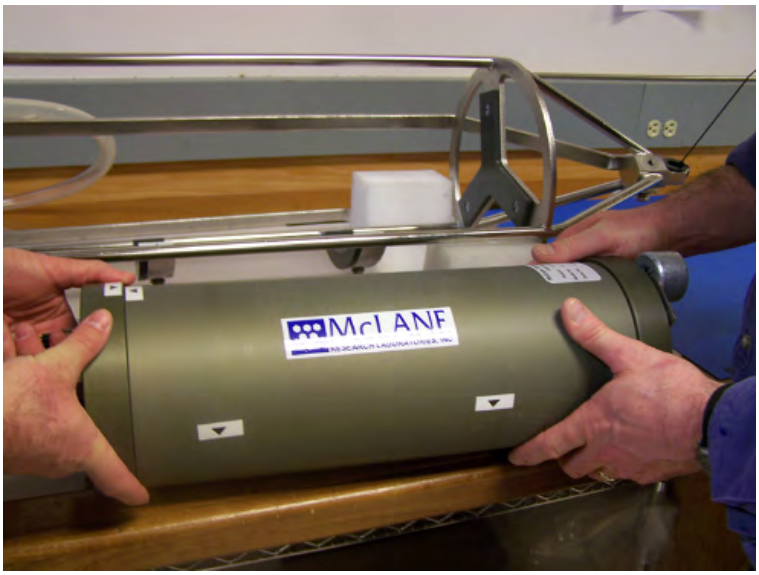




6. Slide the frame guard away from the controller housing.
7. Using the box wrench, loosen the bolts at the bottom of the u-bolts and remove the u-bolts completely.



8. Gently lift the controller housing away from the frame.



10. Open the controller housing. See Opening the Controller Housing.
11. Install the drop-in alkaline batteries. See Connecting the Batteries.
12. Plug in the battery connector to power the electronics before closing the controller housing.
13. Install the controller into the housing. Close the controller housing.
14. Return the controller housing to the frame and reattach the bulkhead connector.
15. Position the controller housing with the alignment arrows as shown.

Correctly aligning the end cap with the orientation arrows is important to ensure proper alignment of the top end cap bulkhead connectors.

16. Reinstall the u-bolts to secure the controller housing.
17. Reattach the frame guard to the frame.

Optional Filter Holders

Filters for the WTS-LV are supplied by the user. Available filter holder styles:

- Standard Radial Intake
- Vertical Intake
- 3-tier (radial or vertical)
- Cartridge Holder
- Zooplankton
- 293mm

Filter holder options are compatible with specific WTS-LV models. The WTS-LV Filter Holder Specifications reference shows filter and WTS-LV model compatibility. Check the[WTS-LV data sheet page] to download the most up-to-date reference.

McLANE RESEARCH LABORATORIES, INC.

WTS-LV Filter Holder Specifications

Profilers Samplers Flotation

	Standard Radial	Vertical Intake	3-Tier	Cartridge	Zooplankton	293mm
Sampler Fit	WTS-LV, WTS-LVDF, WTS-LVUP, WTS-LVBH	WTS-LV, WTS-LVDF, WTS-LVUP, WTS-LVBH	WTS-LV, WTS-LVDF, WTS-LVUP, WTS-LVBH	WTS-LV	WTS-LV, WTS-LVUP	WTS-LV
Description	Radial intake has large horizontal intake openings at the top to provide low resistance path to the filter	Vertical intake minimizes particle wash out	Large horizontal intake with additional pre-filter (mesh or glass)	Cartridge housing for standard 2.5 x 10 inch double open ended (DOE) cartridges	Valved intake	Same as standard radial filter holder with larger diameter for more filter surface area
Filter Size & Specs	142mm mesh, GFF or membrane	142mm mesh, GFF or membrane	142mm mesh, GFF or membrane	10in DOE Cartridge filter	203mm mesh 60µm or greater	293mm mesh or GFF
Flow Rates (Dependent on filter load and pore size)	2-8 liters/min (based on pump head size)	2-8 liters/min (based on pump head size)	2-8 liters/min (based on pump head size)	Variable with choice of cartridge	Up to 30 liters/min depends on mesh size	2-8 liters per minute
Material	Black Acetal	HDPE/Acrylic	Black Acetal	Styrene Acrylonitrite (SAN) & Polypropylene CAP	HDPE	Black Acetal

WTS-LV and WTS-LVBH are powered by 24 drop-in "D" cell alkaline batteries (10,000 mAh). WTS-LVUP and WTS-LVDF powered by A72-1000 battery pack (30,000 mAh) (3x the battery capacity of the drop-in "D" batteries). Trigger is standard on all WTS-LV models.

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24.K.06

3-Tier Filter Holder

The WTS-LV modular filter design permits several filters to be stacked in series and used

simultaneously (in series). Each filter tier has a filter support frit and supports an independent filter with intermediate spacing for sample accumulation.

Multiple filter layers can be used for size fractionation or other specialized programs where *in situ* sample separation is appropriate.

Related topic
Priming with the Priming Intake Tube

Cartridge Filter Holder

If optional cartridge filter holders are used, priming is completed using forward pumping with a priming intake tube (priming is filling the tubing between the filter holder and the pump with water before installing the filter, to displace any air pockets).

Install cartridge filters into the cartridge holder after priming is completed. When installing filters after priming, completely refill the cartridge holders before reinstalling on the system.

To prime the pump when the cartridge filter holder is in use, complete the following steps (this process assumes communication is already established with the WTS-LV):

1. Remove the radial (or vertical intake) filter holder from the frame by unscrewing the three thumb nuts below the mounting plate and unscrewing the compression fitting or releasing the quick disconnect fitting below the filter holder. Set the filter holder safely aside.
2. Attach the priming intake tube (included in the toolkit) to the inlet, in place of the filter holder.
3. Attach the exhaust tube (also included in the toolkit) to the exit of the mechanical flow meter. See Attaching the Flow Meter Exhaust Tube.
4. Place the free end of the priming tubing into a (minimum) 5 gallon bucket or large reservoir containing several liters of clean fresh water. Keep the hose submerged during priming so that air bubbles are not introduced into the system.
5. To assist the water flow, set the reservoir with the intake tube at or above the level of the filter housings.
6. Unscrew the cartridge holder(s) and manually fill with clean water. Replace the full cartridge holder(s) onto its mount/cap.
7. From the **Manual Operation tab**, click **Pump Forward** after setting a flow rate of 4 L/min and a time limit of several minutes.
8. The pump will begin drawing water into the system from the bucket (if multiples are installed, each of the cartridge holders will purge remaining air consecutively). Once the cartridge holders are all full, water will fill the pump head and remaining plumbing of the system.
8. Once the water fills the system and starts flowing from the exhaust tube, click **Stop Pumping**.
9. Remove the priming intake tube and continue on to priming the filter holder. See Priming the Radial Intake Filter Holder or Priming the Vertical Intake Filter Holder.

Related topic

Priming with the Priming Intake Tube

Optional Temperature and Pressure Sensor

WTS-LVs may be optionally equipped with the Sea-Bird model 39plus Temperature (Depth) Recorder. Information on the SBE 39plus can be found at:

https://www.seabird.com/moored/sbe-39plus-temperature-depth-recorder/family?productCategoryId=54627473774

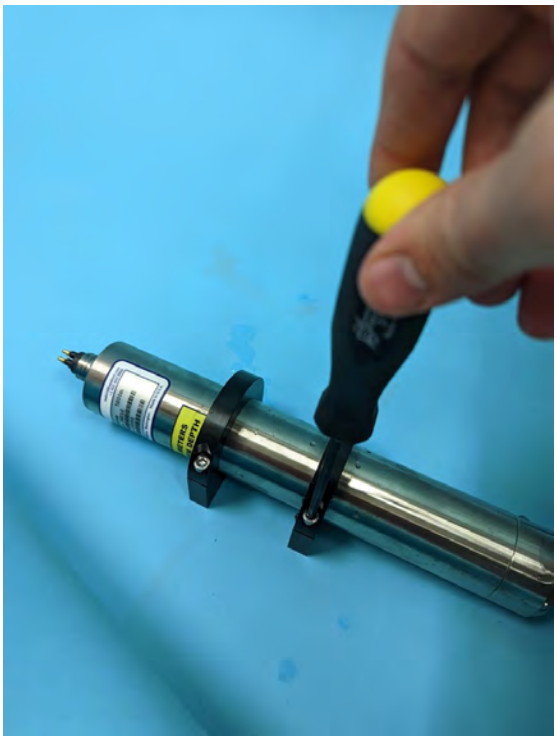
When integrated with the WTS-LV, power is provided by the WTS-LV controller. Lithium batteries are removed from the SBE 39plus. Data are stored on the WTS-LV controller and are available upon recovery from the deployment.

If operating with the batteries installed and connected to external power, be advised that the battery pack is diode-OR'd with the external source, so power is drawn from whichever voltage source is higher.

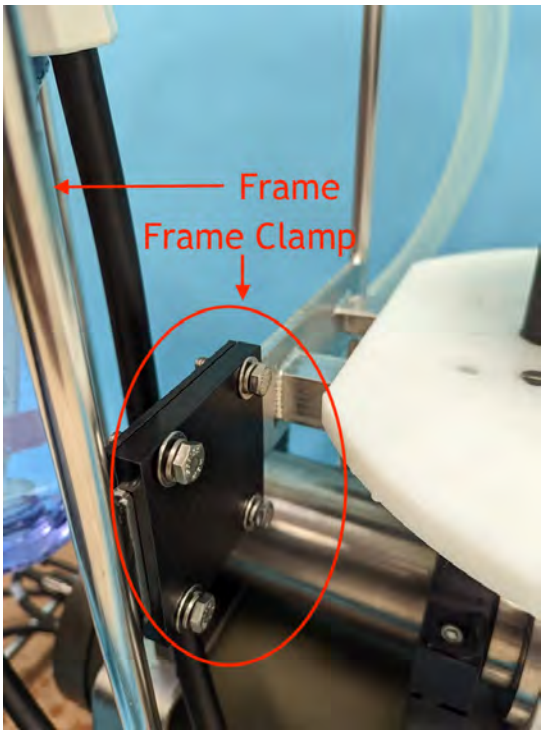
Sensor Mounting

The SBE 39plus is mounted centrally on the WTS-LV frame.

1. Install the mounting clamps on the Sea-Bird 39plus sensor.



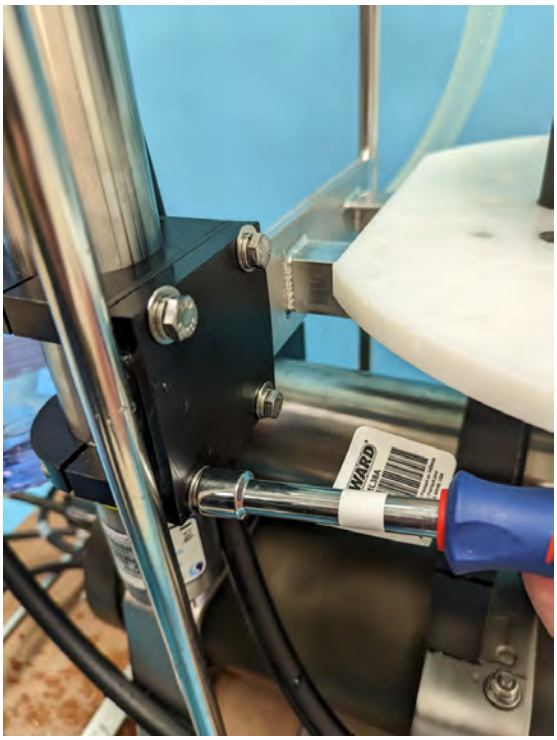
2. Install the frame clamp front and back on the frame with ¼-20 screws.



3. Secure the top Sea-Bird39plus clamp to frame with ¼-20 screws.

4. Adjust height of the Sea-bird 39plus sensor so at least 3cm of clearance is between the frame and the bottom of the connector pins.

5. Secure the bottom Sea-Bird39plus clamp to the frame with ¼-20 screws and a nut driver.

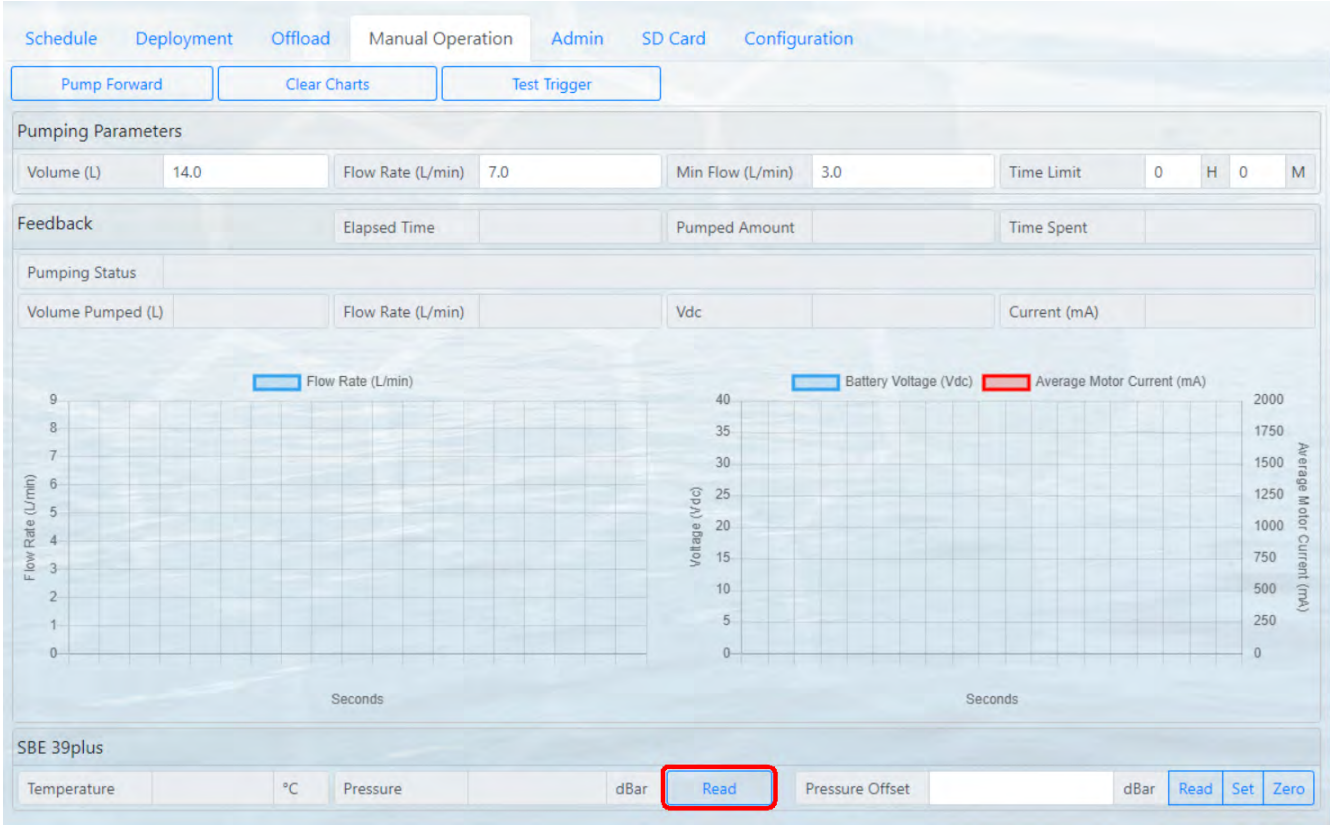


6. Tighten the bottom Sea-Bird39plus clamp with a 3/16” hex driver.

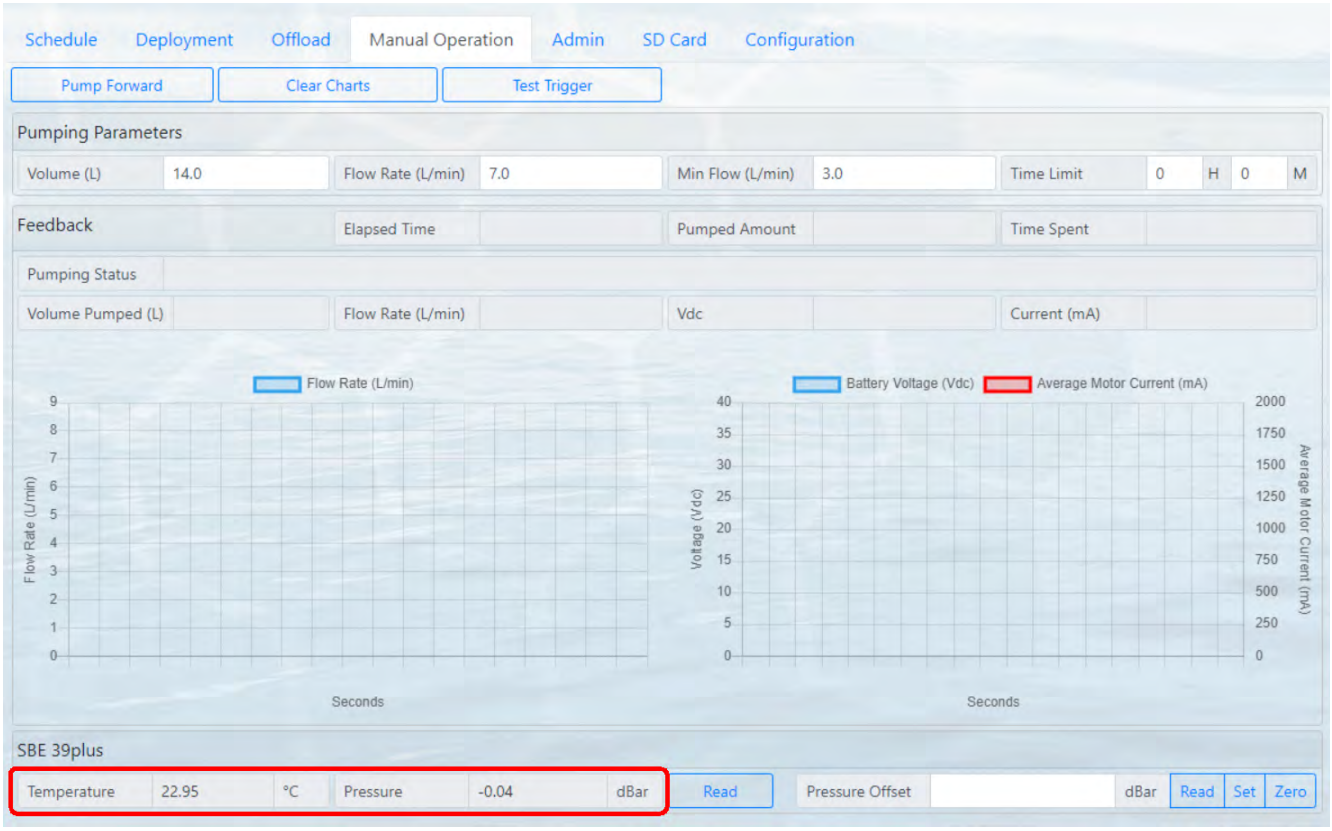
7. Install the M3558 cable onto the Sea-Bird39plus sensor.

Manual Operation

Control for the SBE 39plus is provided on the **Manual Operation** tab. Click the **Read** button to query the sensor for a measurement.

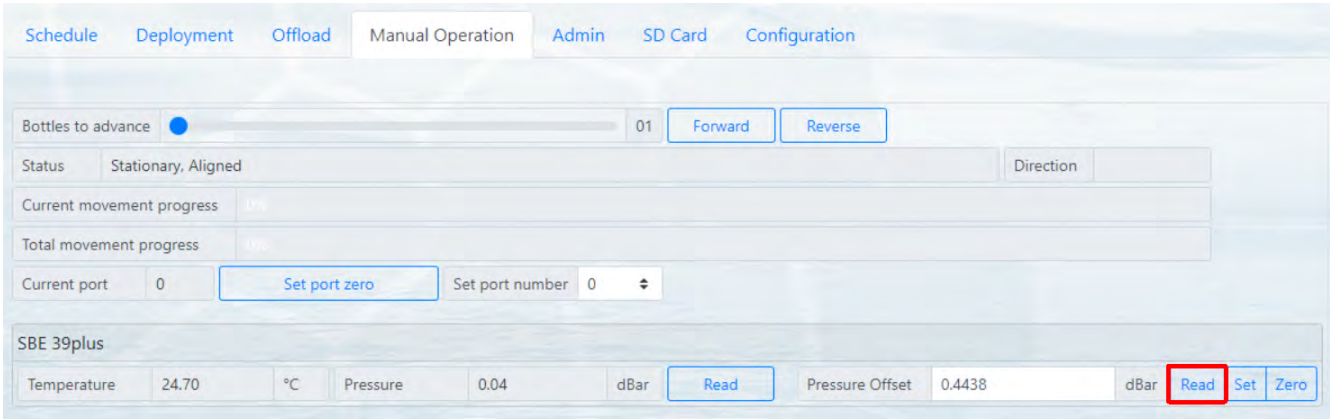


The WTS-LV will communicate with the SBE 39plus to obtain a temperature and pressure reading.

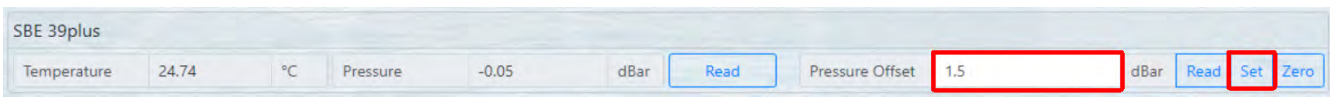


Setting the Pressure Offset

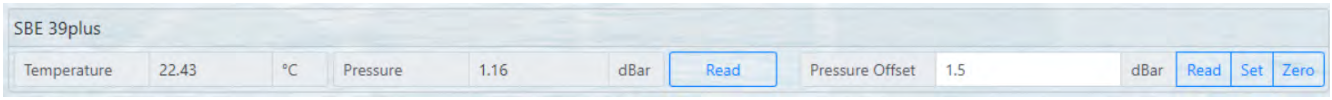
Controls are provided on the **Manual Operation tab** to read and set the pressure offset value. Click **Read** to display the current value for the pressure offset.



A new value may be set by using the **Set** button. Enter a value in the **Pressure Offset** window and click **Set**.

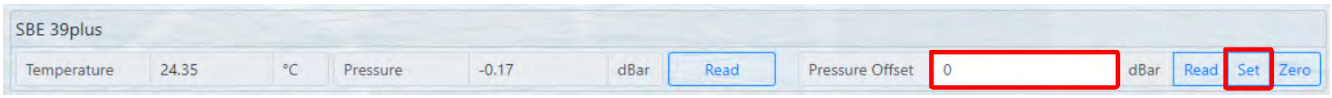


The new adjusted pressure reading will now be displayed.

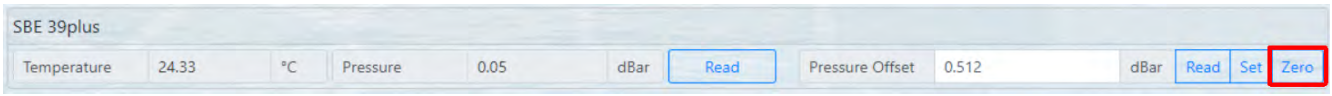


Clicking the **Zero** button will command the sensor to take an average of 5 readings and applies the corresponding pressure offset. Please note that the pressure offset should first be set to '0' before running this routine.

First set the pressure offset to zero.



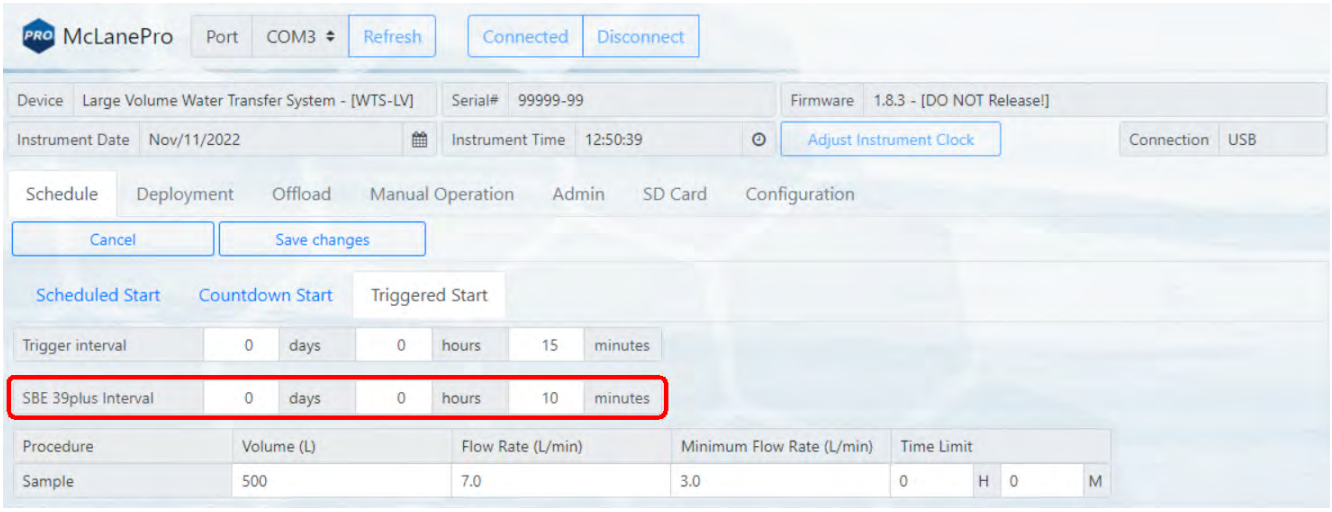
Next, click **Zero** to take the average of 5 readings and apply the corresponding pressure offset.



Deployment Settings

Temperature and pressure measurements are made when an event is started or finished, and also according to the preset sensor interval (SBE 39plus Interval). Measurements are made interactively while in an adaptive deployment.

Select an appropriate data interval when defining the deployment schedule. The default value is 10 minutes.

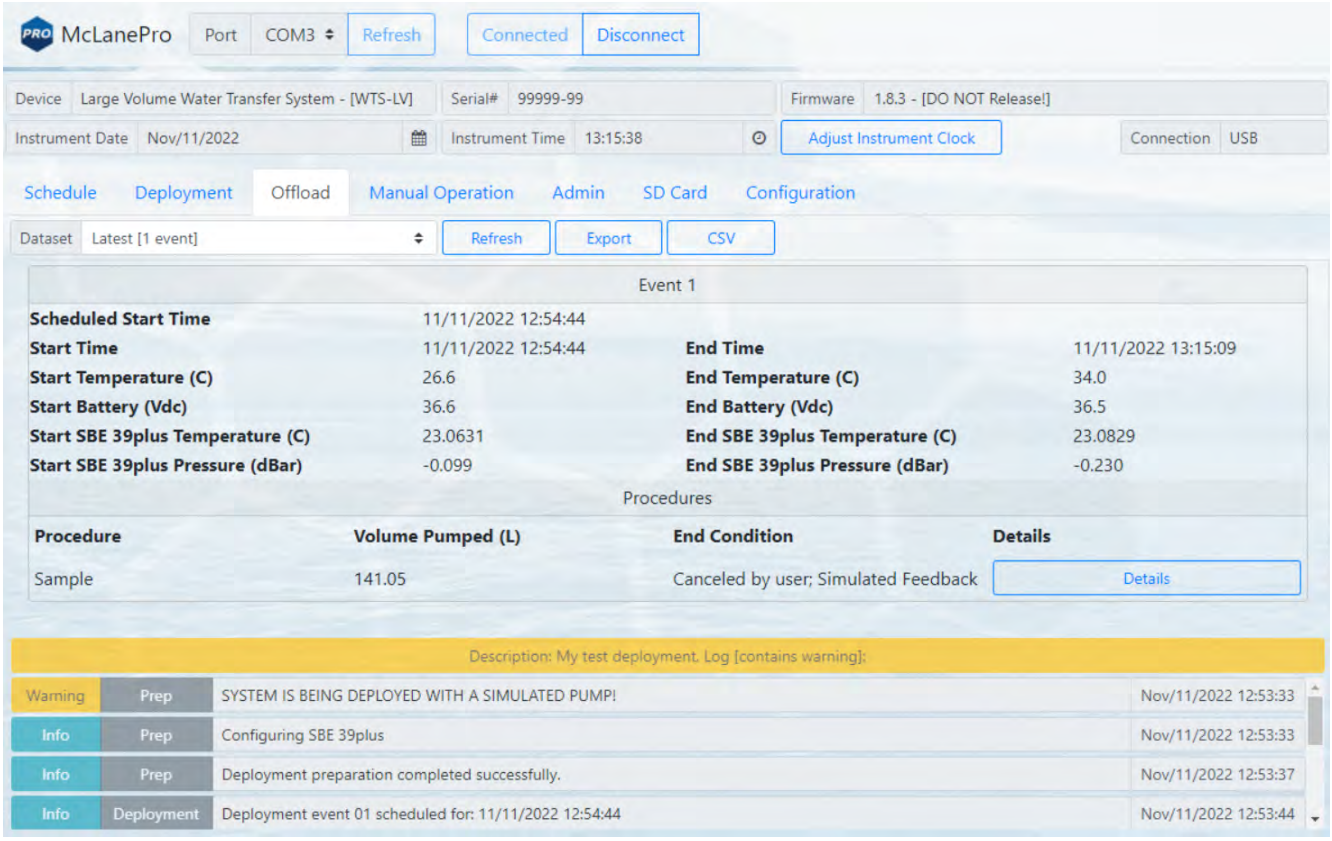


Deployment duration may be impacted when using a sensor data interval below the default.

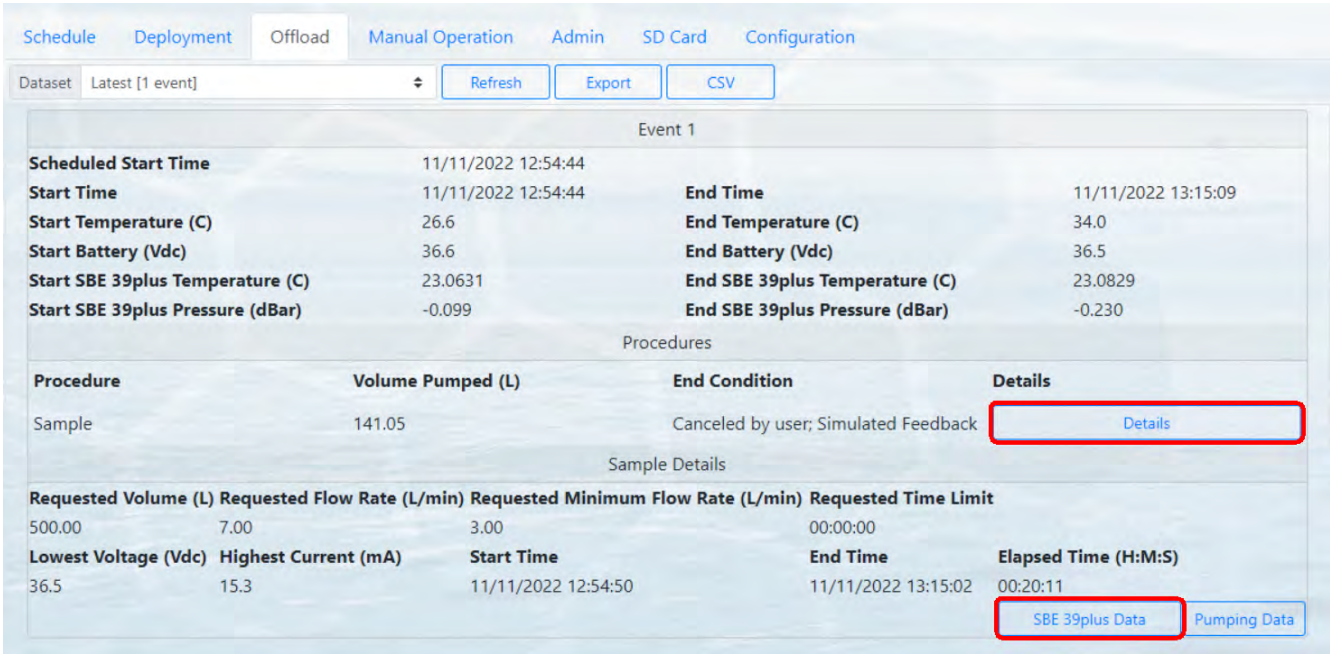
Offload Tab

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

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

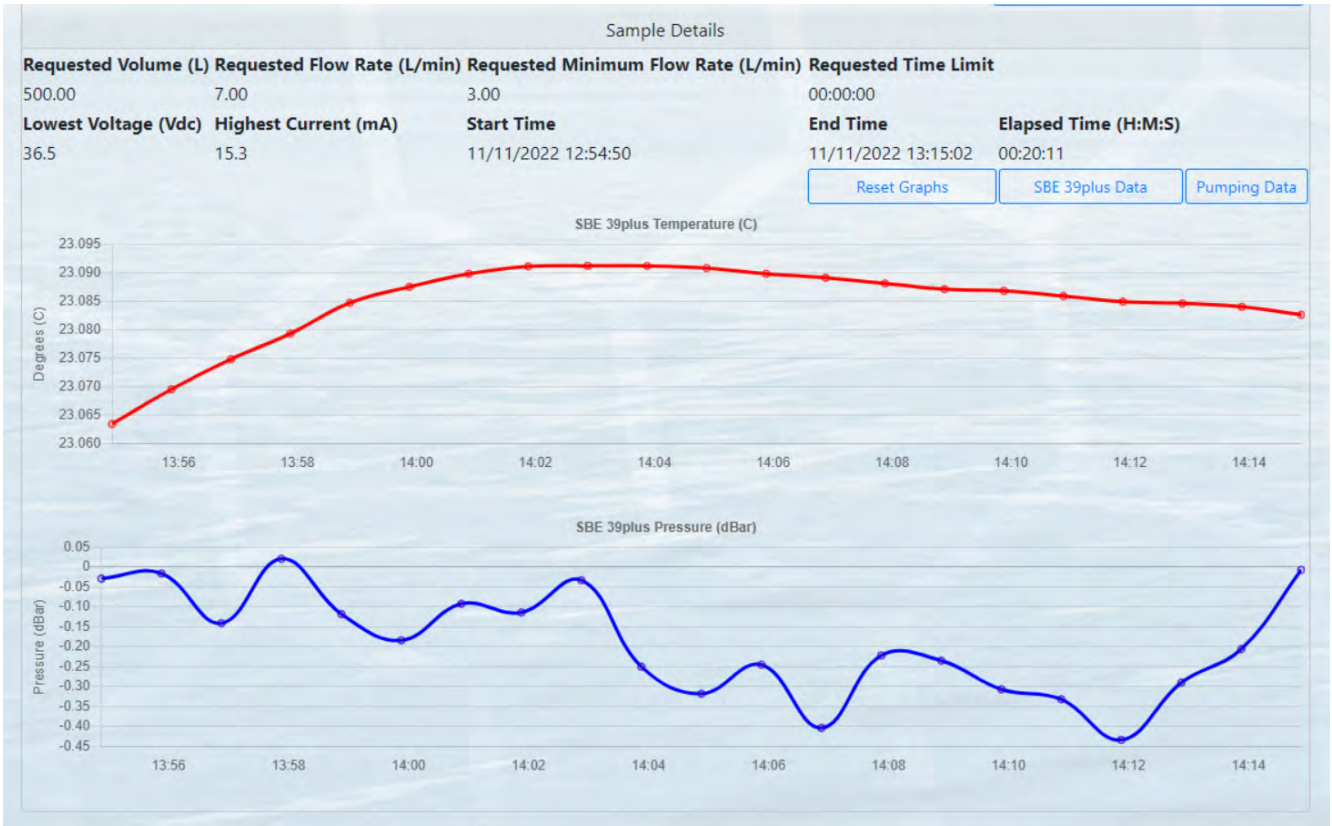


Click the **Details** button, and then the **SBE 39plus Data** button to expand the event data and display the sensor data collected during the event.



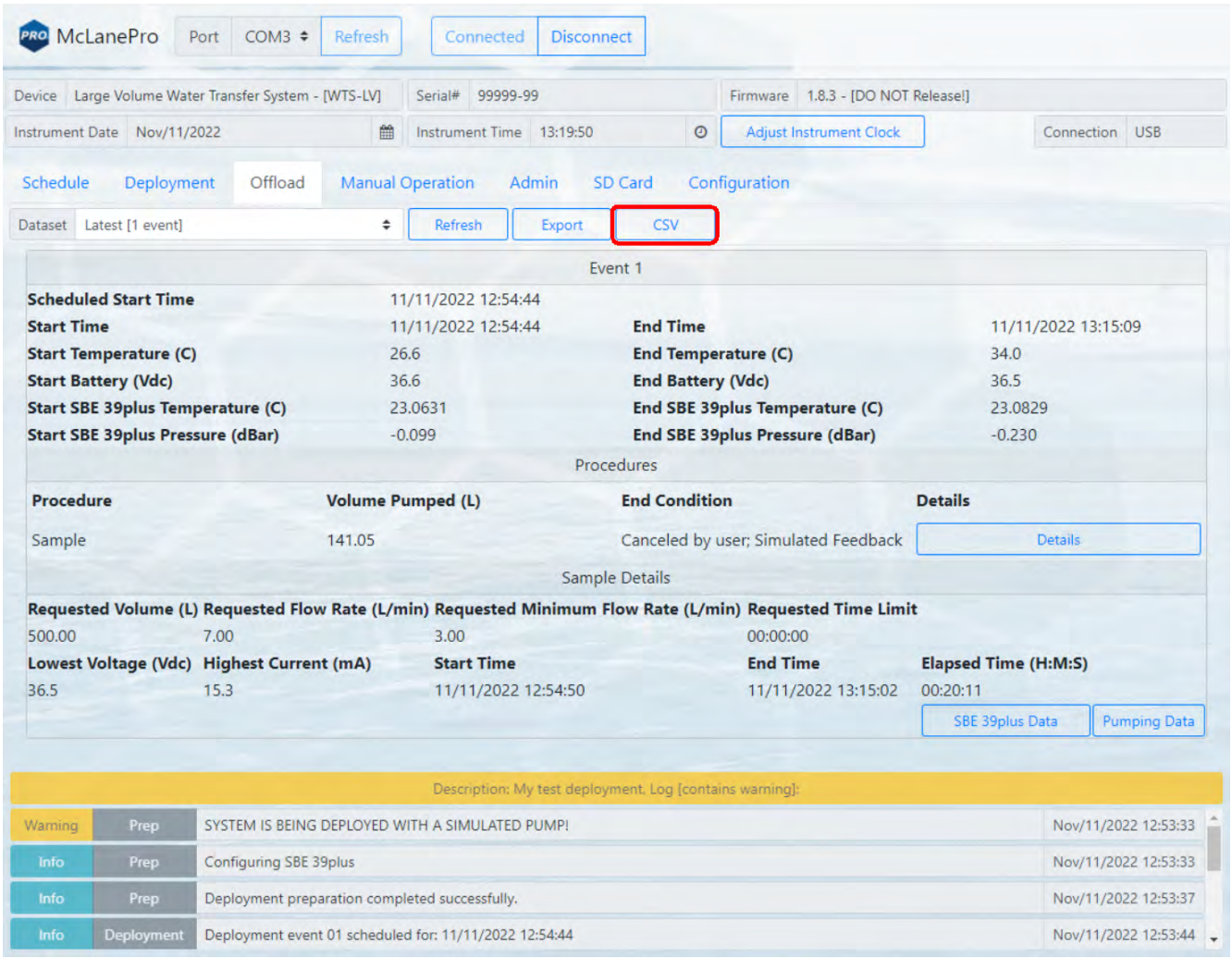
Sensor data collected for Event 1 are data collected at the defined sensor data interval while executing event 1. WTS-LV is a single event sampler.

Sensor data readings are always measured at the start and end of an event, except that no sensor data are collected before the first event, or after the last event.

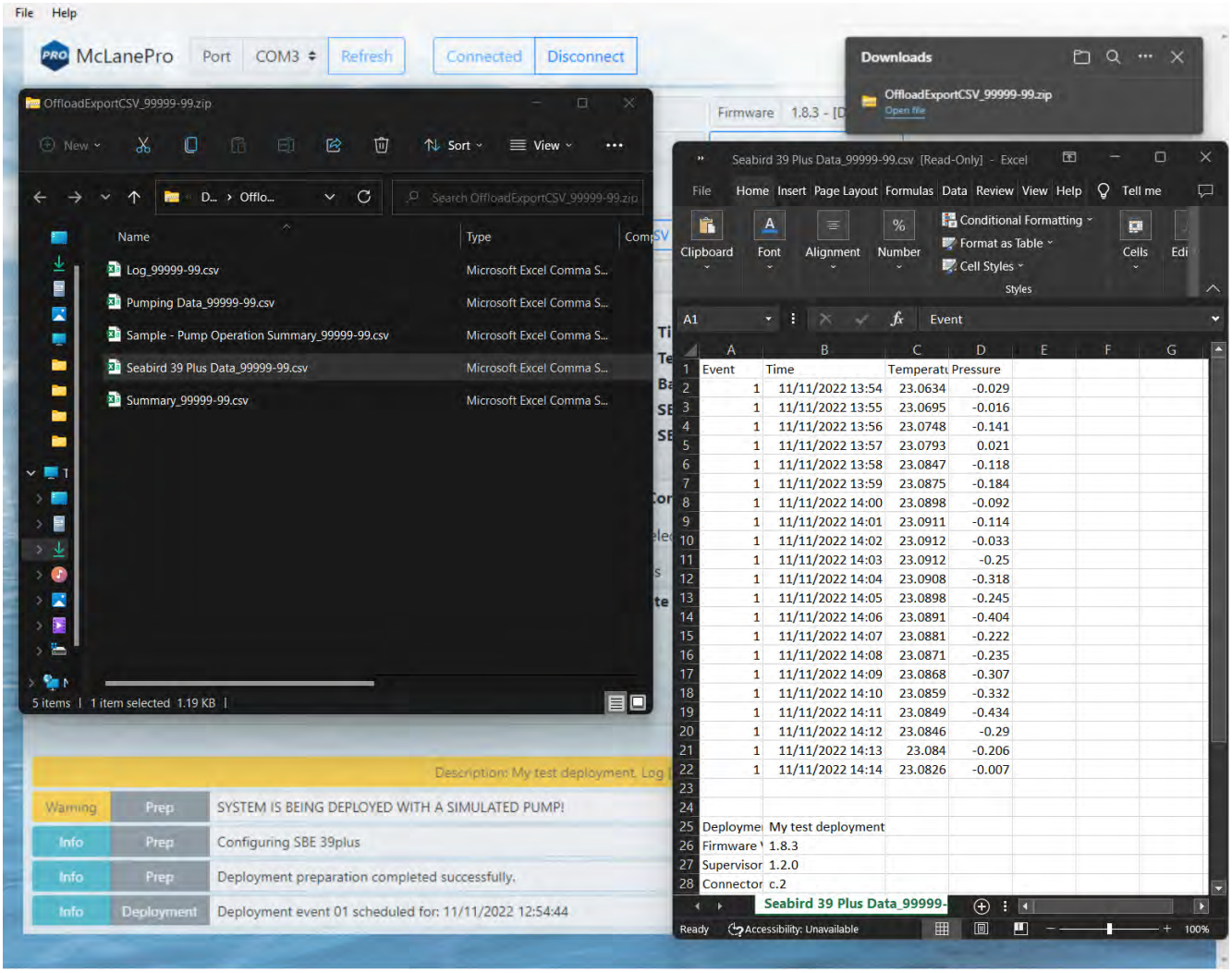


Offload Files

SBE 39plus data are recorded to file and available as part of the data offload. Click **CSV** to offload the compressed data.

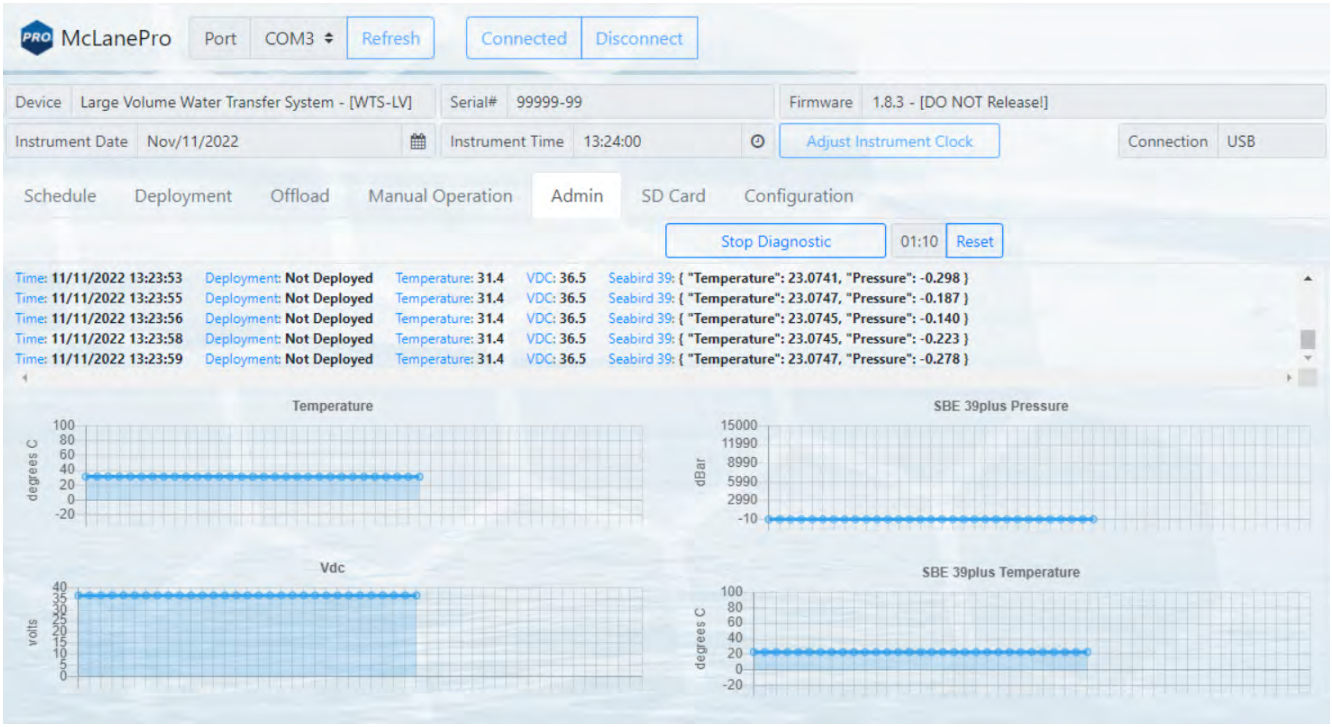


Once extracted, these data are viewable by opening the *Seabird 39 Plus Data_(serial number).csv* file.



Admin Tab

SBE 39plus measurements are also made when using the diagnostic tool on the **Admin tab**. SBE 39plus data are plotted along with the WTS-LV's internal sensor data.


McLanePro
Port
COM3
Refresh
Connected
Disconnect
Device
Large Volume Water Transfer System - [WTS-LV]
Serial#
99999-99
Firmware
1.8.3 - [DO NOT Release!]
Instrument Date
Nov/11/2022
Instrument Time
13:24:00
Adjust Instrument Clock
Connection
USB
Schedule
Deployment
Offload
Manual Operation
Admin
SD Card
Configuration
Stop Diagnostic
01:10
Reset
Time: 11/11/2022 13:23:53 Deployment: Not Deployed Temperature: 31.4 VDC: 36.5 Seabird 39: { "Temperature": 23.0741, "Pressure": -0.298 }
Time: 11/11/2022 13:23:55 Deployment: Not Deployed Temperature: 31.4 VDC: 36.5 Seabird 39: { "Temperature": 23.0747, "Pressure": -0.187 }
Time: 11/11/2022 13:23:56 Deployment: Not Deployed Temperature: 31.4 VDC: 36.5 Seabird 39: { "Temperature": 23.0745, "Pressure": -0.140 }
Time: 11/11/2022 13:23:58 Deployment: Not Deployed Temperature: 31.4 VDC: 36.5 Seabird 39: { "Temperature": 23.0745, "Pressure": -0.223 }
Time: 11/11/2022 13:23:59 Deployment: Not Deployed Temperature: 31.4 VDC: 36.5 Seabird 39: { "Temperature": 23.0747, "Pressure": -0.278 }
Temperature
degrees C
SBE 39plus Pressure
dBar
Vdc
volts
SBE 39plus Temperature
degrees C