Elemental Scientific
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prep*FAST* Quick Guide – Qtegra

By Aaron Musfeldt

Overview

- **The prep*FAST* Quick Guide covers these topics.**

  - **How does the prep*FAST* work?** Understanding how the system works is the first step towards being able to resolve any issues that may arise with it.
  - **What tools are available to you?** There is a section describing how to use the software to help you manage the system.
  - **What common issues can occur?** Knowing the common issues and how to deal with them can help you resolve many issues.
  - **Additional Support.** The final section contains documents and contact information if you continue to have unresolved issues with your prep*FAST*.
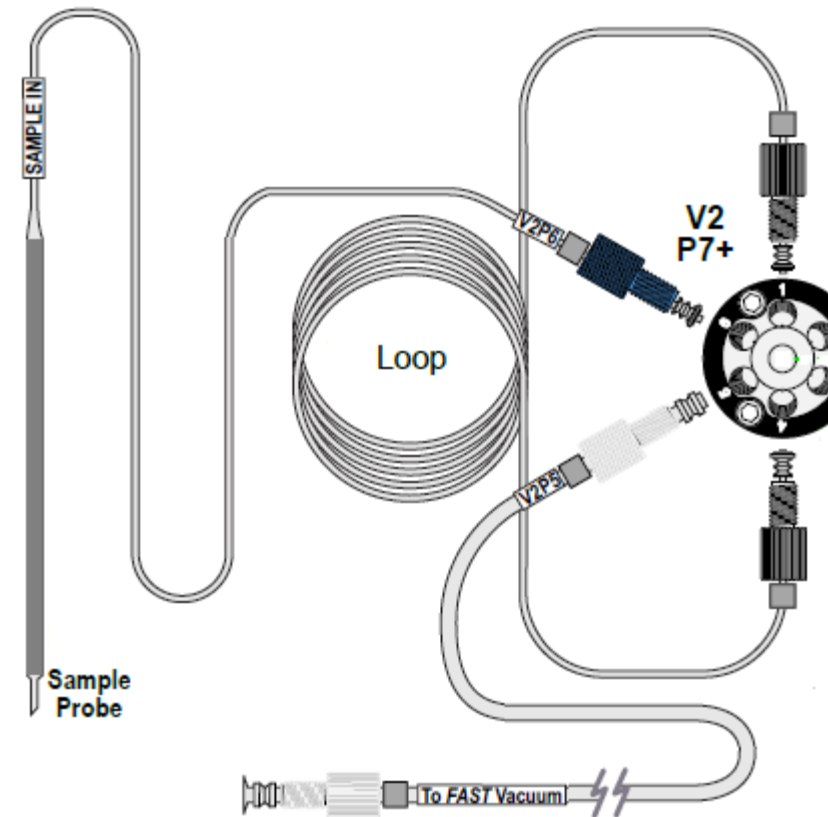
Sample Loading Process

- The first stage involves the autosampler moving to a location and drawing up sample. During this process, the sample loop on the V2 valve will fill. You should observe the following:

  - Sample will enter the probe and flow to the valve.
  - If the valve is in the **Load** position, the sample will enter the valve at port #6 and flow to port #1.
  - From port #1, the sample will fill the loop.
  - The other end of the loop is at port #4. In the **Load** position, port #4 is connected to port #5.
  - Sample should continue into port #5 and head towards the FAST vacuum and waste line.
  - Video Animation example. Sample loading is at the 1:05 mark.
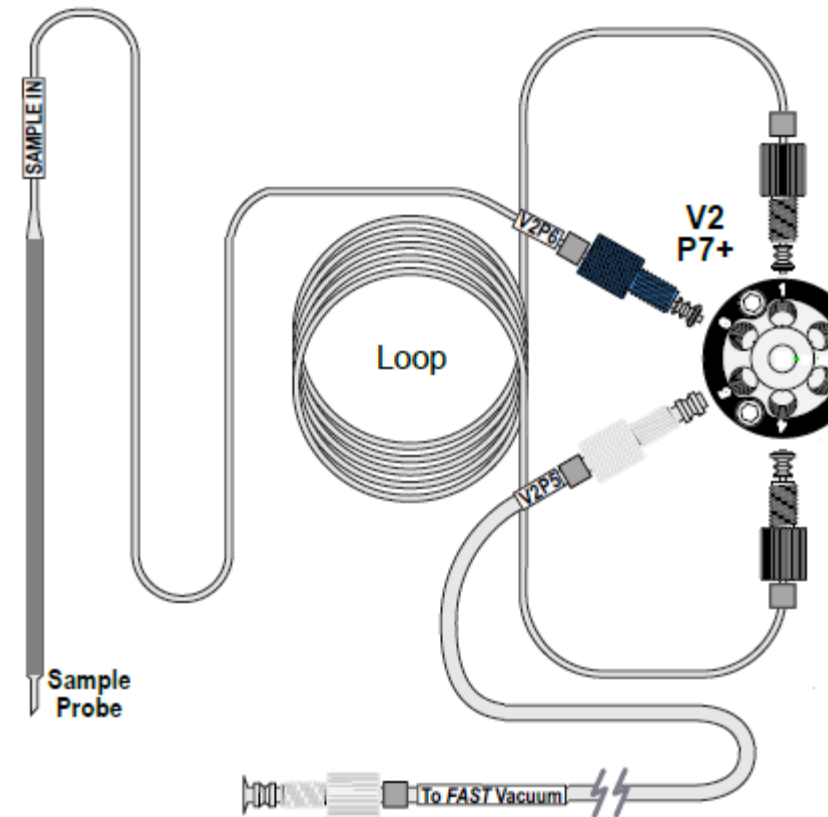
Sample Loading Process

- While the sample loads, here are some things to watch for.

  - You should see continuous flow from the sample vial to the valve through the probe and probe tubing. If you see air pockets, verify that the probe tip is submerged in the sample. If it is submerged, replace the probe and test again.

  - The sample loop should fill. You will know that the sample loop has filled when you see excess sample enter into port #5, the vacuum line before the valve toggles to inject. The addition of food coloring in your test sample may allow you to better see if the loop is filling properly.

  - There should be no air in the sample loop. If you see air in the sample loop as it fills, but no air in the probe line, check the connection points on the valve for the sample probe (Port #6), the loop (Port # 1 & 4) and vacuum line (Port #5). Also verify that the sample loop is loading properly (see previous point).

Sample Preparation

- The second step is a syringe-drive process that takes the sample loaded into the V2 loop and adds internal standard while diluting the sample, if the method calls for it.
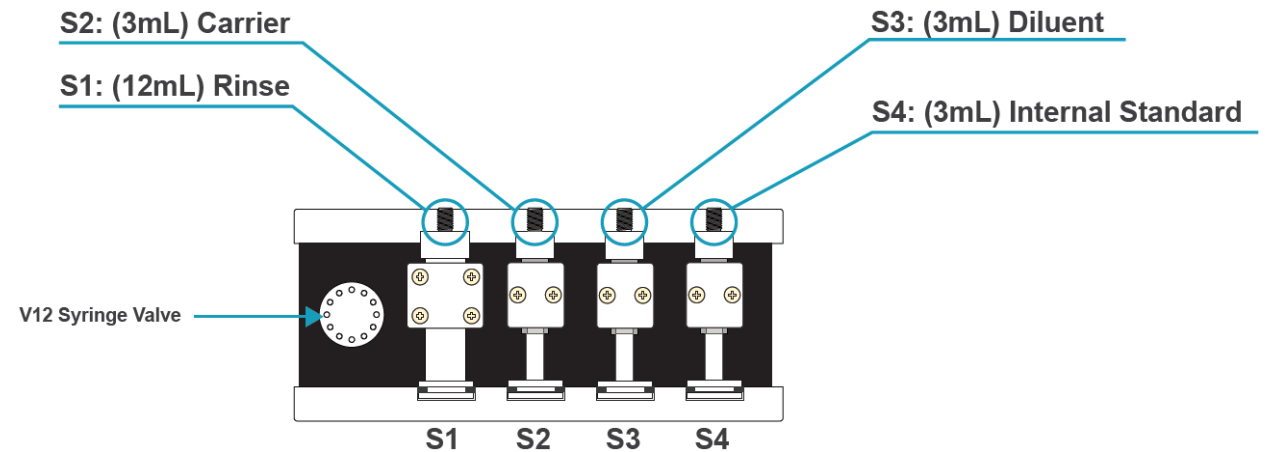
- **S1 (Rinse Syringe)** – Syringe 1 will rinse the lines after each analysis.

- **S2 (Carrier Syringe)** – Syringe 2 will push the sample from the V2 loop into the V1 loop using carrier solution. The rate at which this syringe moves will be dependent on the dilution factor. The higher the DF, the slower this syringe moves.

S2: (3mL) Carrier
S1: (12mL) Rinse
S3: (3mL) Diluent
S4: (3mL) Internal Standard
V12 Syringe Valve
S1 S2 S3 S4

- **S3 (Diluent Syringe)** – Syringe 3 will add diluent if the sample is to be diluted. The rate at which this syringe moves will be dependent on the dilution factor. The higher the DF, the faster this syringe moves.

- **S4 (Internal Standard Syringe)** – Syringe 4 will add internal standard solution. This syringe should always move at the same rate.
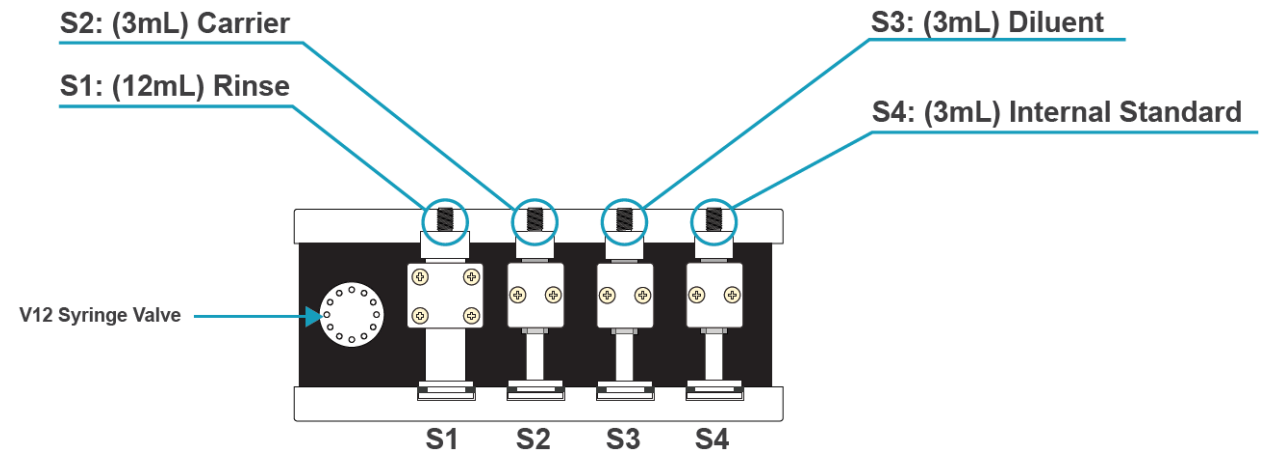
Sample Preparation

- While the sample is being prepared, here are some things to watch for.

  - When the V2 valve toggles to inject, the syringes will start to move. The system "injects" the prepared sample into the loop on V1.

  - If there is no dilution factor for the sample, you should only see S2 and S4 move.

  - If there is a dilution factor, then you should see S2, S3 and S4 move.

S2: (3mL) Carrier

S1: (12mL) Rinse

S3: (3mL) Diluent

S4: (3mL) Internal Standard

V12 Syringe Valve

S1   S2   S3   S4

Sample Injection

- Once prepared, the sample is injected into the nebulizer. Watch for the following.

  - The V1 valve will toggle to inject.

 - The peripump will push carrier solution into the loop and drive the sample into the nebulizer.
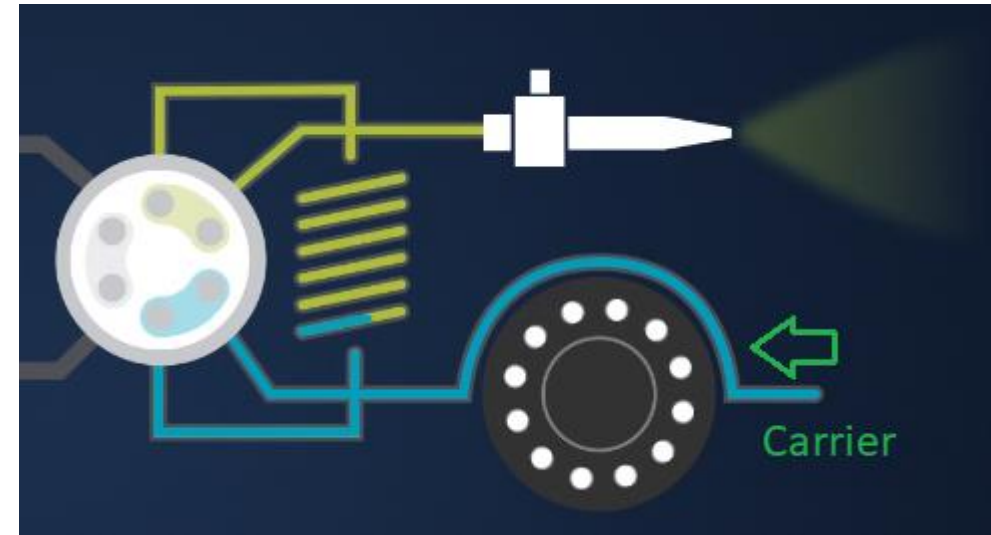
Solution Flow and Considerations

- Solutions need to properly flow throughout the system in order to receive stable results. The prep*FAST* has an autosampler that must move properly, a series of valves that toggle at specific intervals, and syringes that fill and dispense when needed. If any one of these components are not working properly, then flow will be disrupted. The following is a list of the most common issues that can cause prep*FAST* flow issues.

    - Proper FAST method not loaded.
    - Air getting into the lines.
    - Damaged or improperly connected tubing.
    - Leaks.
    - Blockages in the lines.
    - Valves not toggling properly.
    - Syringes not dispensing properly.
    - The vacuum pump not drawing sample from the vial.

- The next few sections of this guide will go over how to use the software and some simple checks that you can do to help pinpoint any issues with your prep*FAST*.
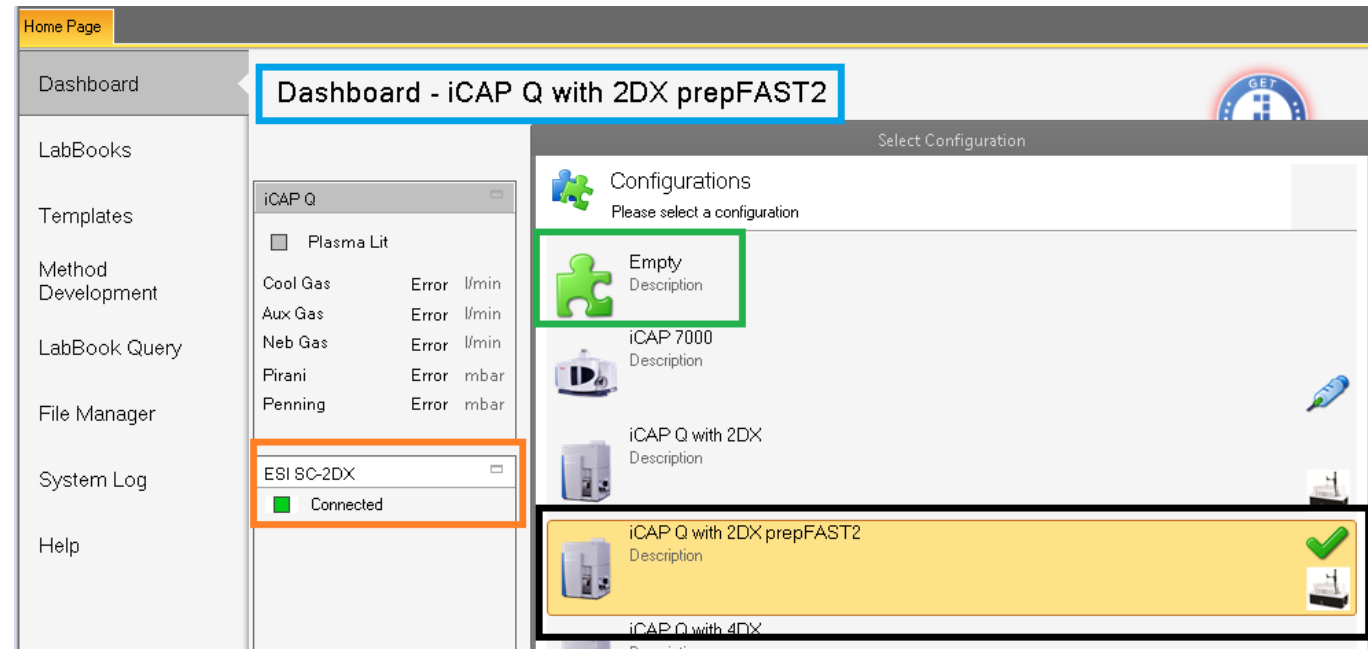
Using the Software – Initialization Process

- The system should initialize when you start the Qtegra software.

- If this is done properly, you will see the **Connected** light turn green in the **Dashboard**.
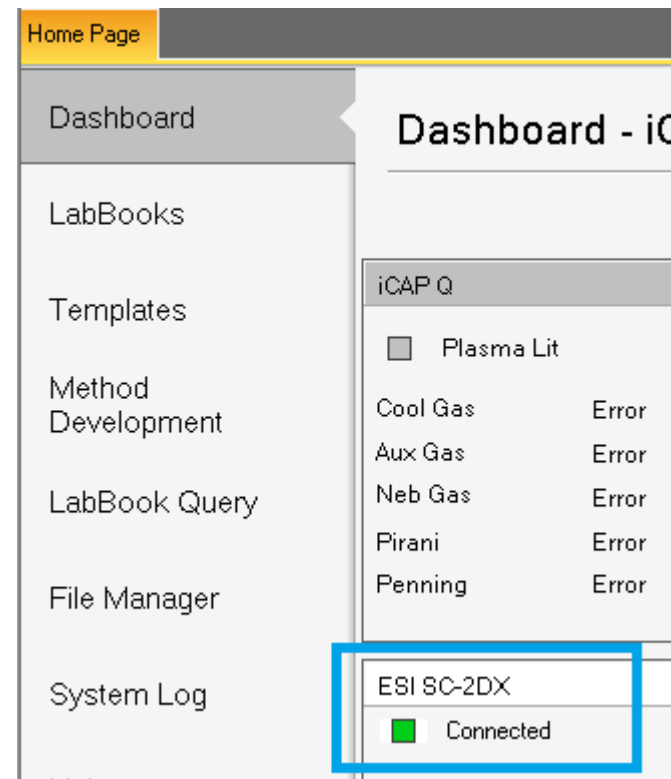
Using the software – Initialization Process

- If the system does not initialize properly, you can follow these instructions to re-initialize it.

- Click on the **Dashboard** selection button at the top and choose an **Empty** configuration.

- If there is no **Empty** configuration, choose a different configuration without the autosampler.

- Once that configuration loads, select the **Dashboard** button again and choose the proper ESI/prepFAST configuration.

- Verify that the **Connected** light turns on.

- Here is a movie that will show you an example of what the system will do during initialization.

- The autosampler will move to its home location. This should be above the rinse station. If the autosampler probe is already here, you may only see slight movements in each of the three directions (horizontal, rotational, and vertical).

- When the autosampler finishes its checks, the syringe module will test the valve and then refill all syringes. If the syringes are already filled, you may only see a slight movement. Syringes are filled when they are in the "up" position.
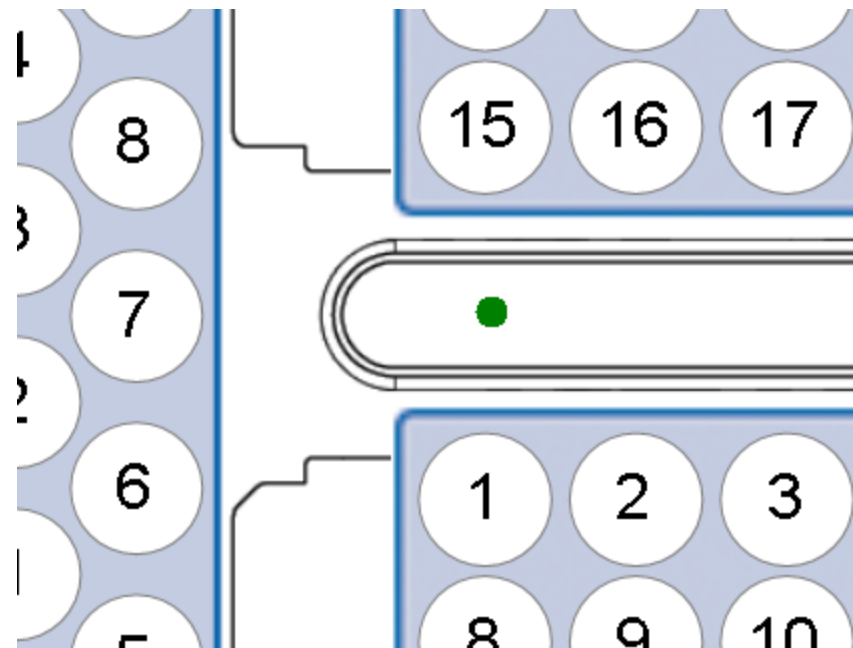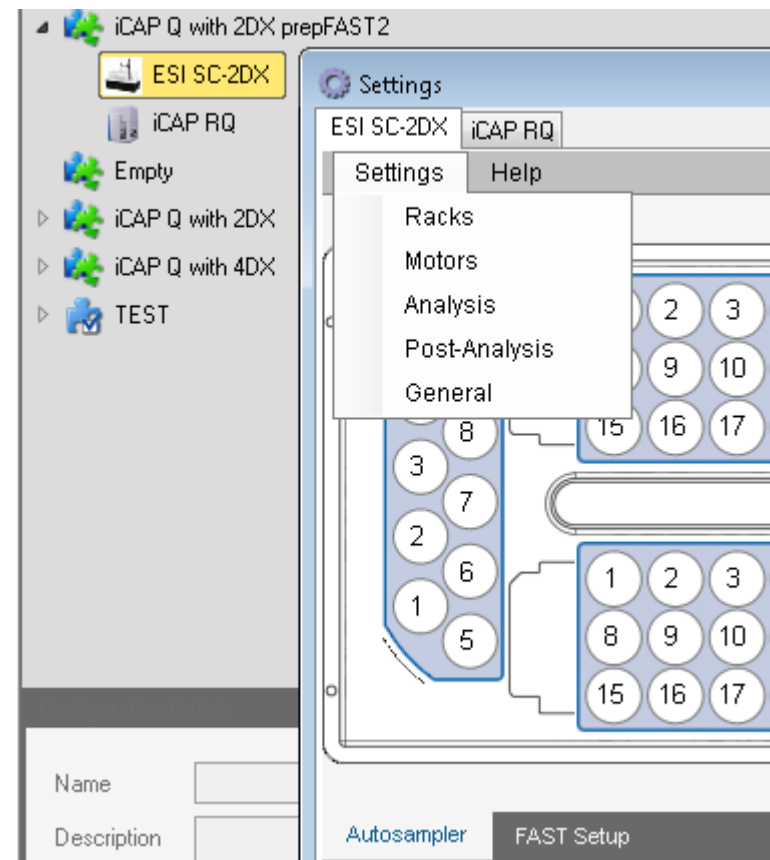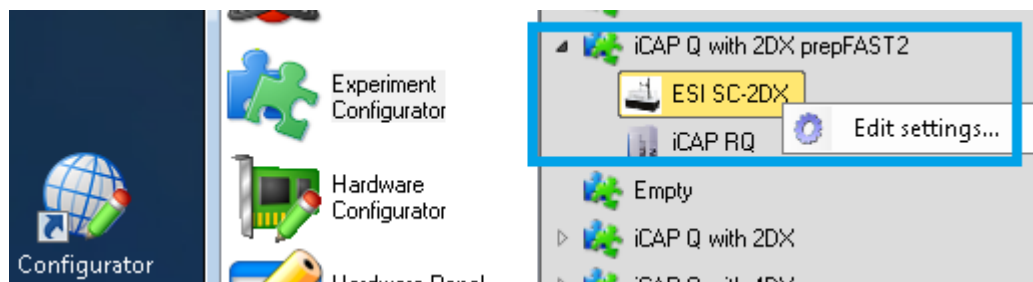
Using the software – ESI Settings button

- Clicking on the **Settings** button will open up the menus for your autosampler, valves and syringes.

- Here you will be able to do things such as:
  - Rack Selections
  - Priming the System
  - Choosing a prep*FAST* method
  - Adjusting Rinse and Motor settings
  - Manually toggling the valves
  - Manually turning the vacuum pumps on/off
 - Manually testing the syringes
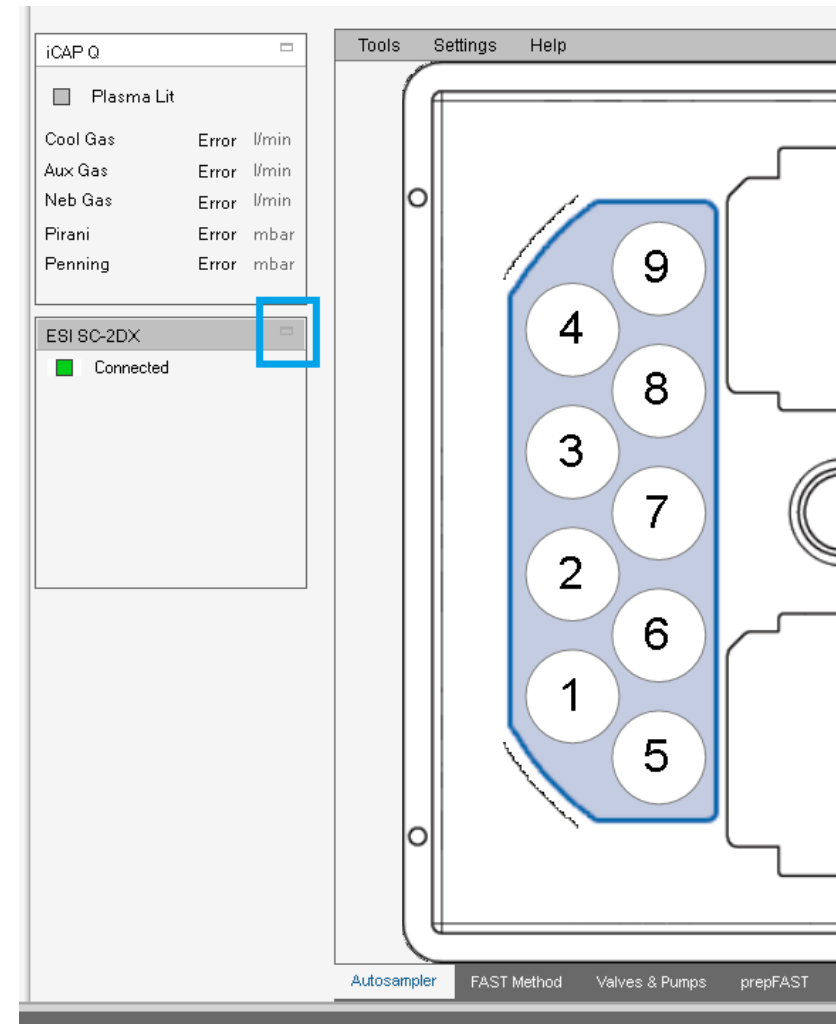
Using the software – ESI Settings button

- The changes you make here are temporary. To make permanent changes, close Qtegra and open the **Configurator** software.

- Find your configuration setting and edit it.

- Make the changes here and save them.

- Restart Qtegra.

Using the Software – Priming the System

- To run a prime sequence, click on the **Settings** button and then the **FAST Method** tab at the bottom. Click on the drop down under **Open a user method** and choose **Prime 3x**.

- Click on the **Play** button to start the prime sequence.
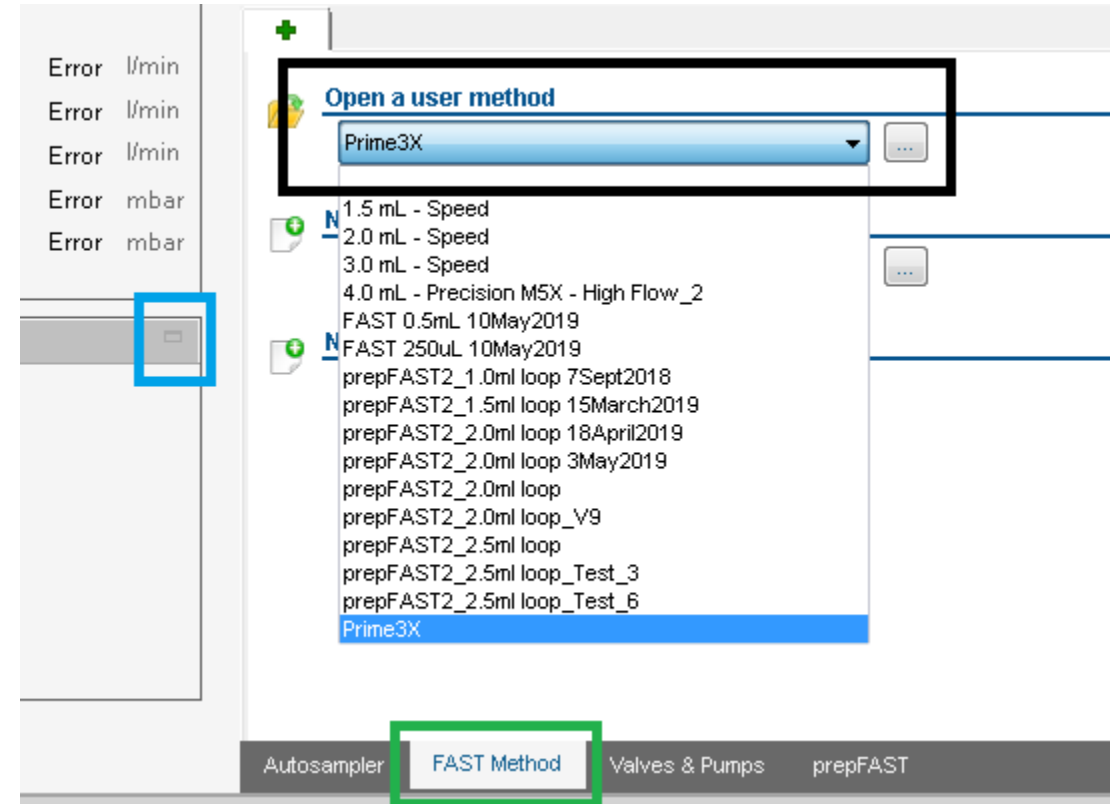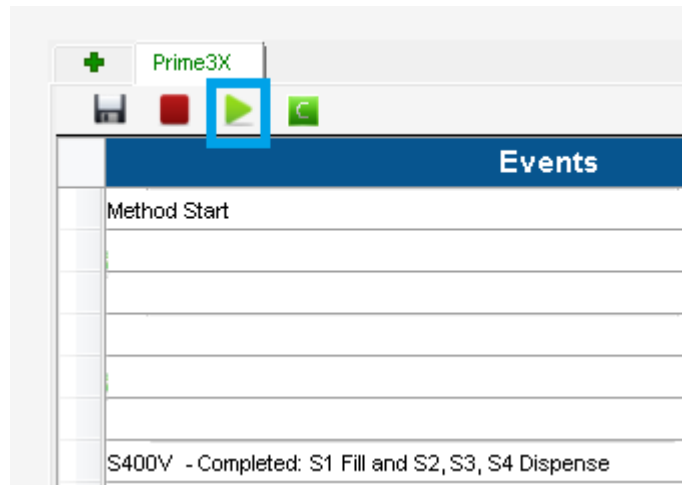
Using the Software – Priming the System

- Syringes 2, 3 and 4 should move together. Syringe 1 will move the opposite direction.

- Here is a movie that will show you an example of what the system will do during a priming sequence. Once the system has been initialized, running a priming sequence will 1) verify that the syringes are moving properly and 2) prime the lines with solutions.

- Once the system has been primed, you can inspect for air in the lines. If you see air, run the prime sequence again.

- If priming does not appear to get the air out of the lines, check the fitting connections on the syringes, the V12 valve and verify that the lines going into the solution containers are fully submerged.
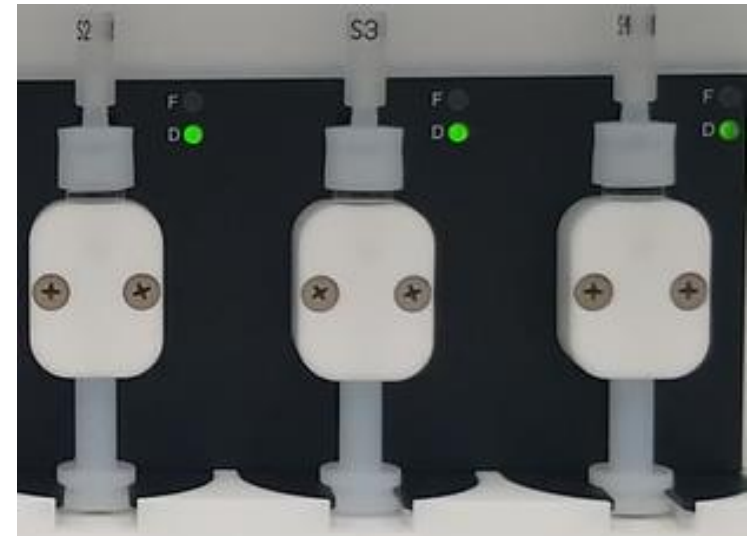
Using the Software – Rack Configurations

- You can modify rack configurations by clicking on **Settings** and then choose the **Racks** option.

- A new menu will open up and you can change the rack layout, the rack types or adjust the **Down Height.**

- Occasionally the **Probe Depth** of the probe will reset to 0. This causes a symptom that the customer may describe as "the autosampler moves fine, but it does not move down into the sample. Correct this by entering a value for **Probe Depth**.
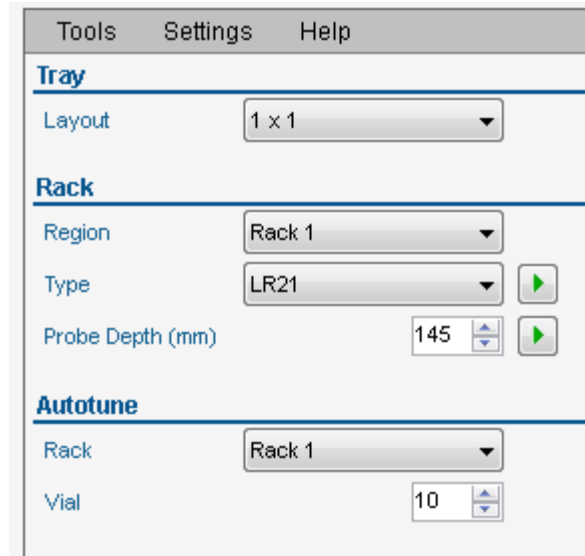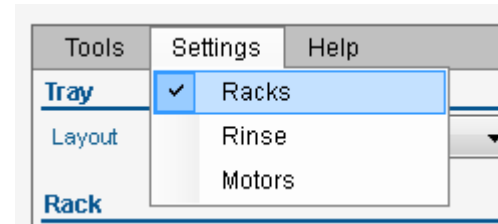
Using the Software – The prep*FAST* Method

- The prep*FAST* method is based on the sample loop size.

- To choose or change your prep*FAST* method, click on the **Settings** button and then the **FAST Method** tab.

- From here, click on the drop down under **Open a user method** and choose the appropriate loop size.

- It's important to make sure that the proper method is chosen. Choosing the wrong method might result in the sample loop not filling properly or using more sample than is desired.
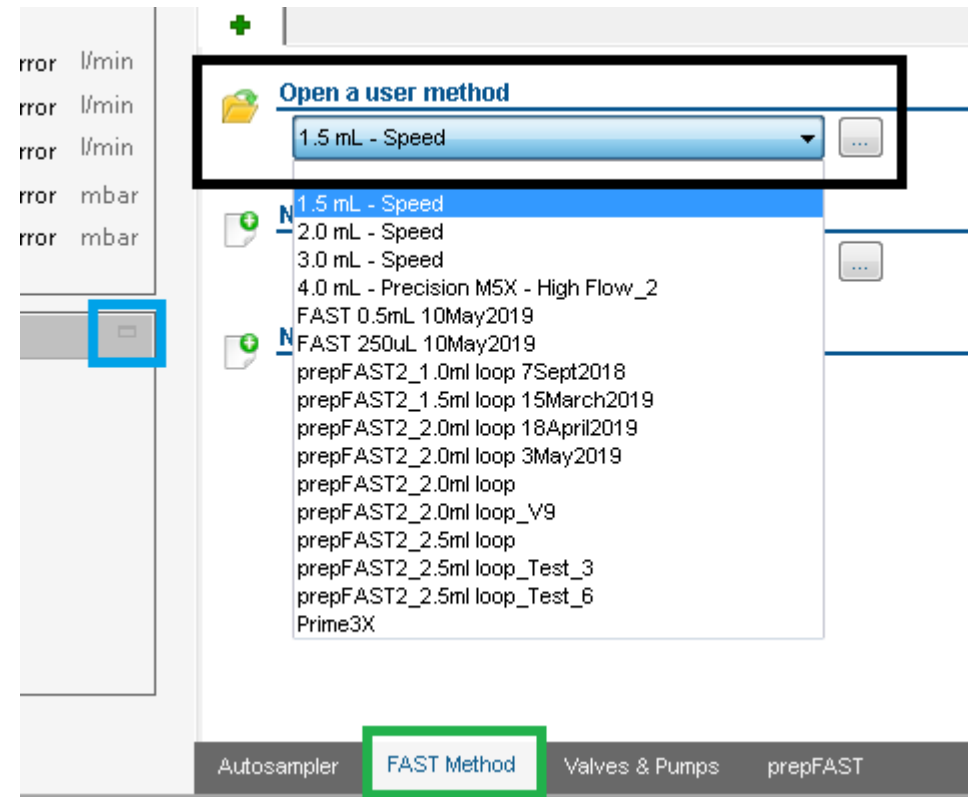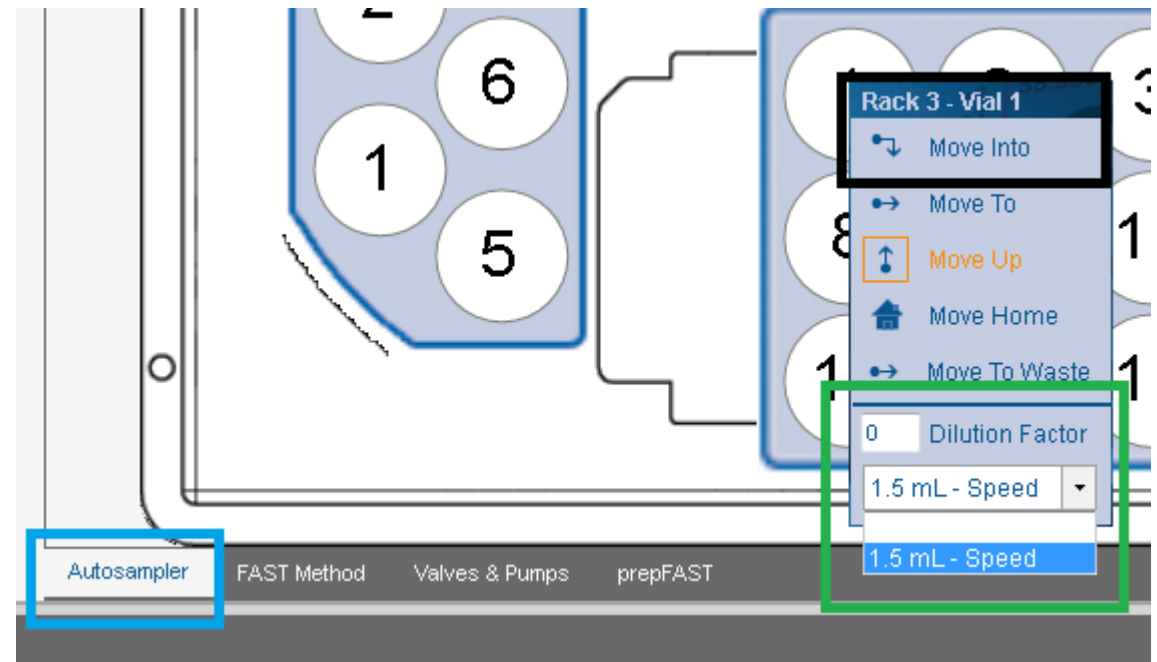
Using the Software – Simulating the prep*FAST*

- You may need to run a simulation of the prepFAST in order to watch for specific hardware movements or sample flow. This can include watching the autosampler move to the proper locations, verifying that the valves toggle properly and that the syringes move as expected.

- If you are testing sample flow, make sure that you have a sample, blank or DI water available in a bottle/vial at a known location on the autosampler. You can also add food coloring or titration dye to this solution to make it easier to watch the flow.

- Remove the nebulizer or disconnect the nebulizer line. Place the end into a bottle or beaker to allow this solution to dispense into that container.

Using the Software – Simulating the prep*FAST*

- Click on the **Settings** button and make sure the **Autosampler** tab has been selected.

- **Right-click** on a vial location where you have test solution. Choose a prep*FAST* method from the drop down.

- (Optional) Enter in a dilution factor.

- Click **Move Into** to start the simulation.

- The system will now run through the prepFAST sample loading and preparation steps.

- When this process has completed, right-click on the rinse station and check **Dual Rinse**. Then click on **Move Into**. This will rinse and reset the system.
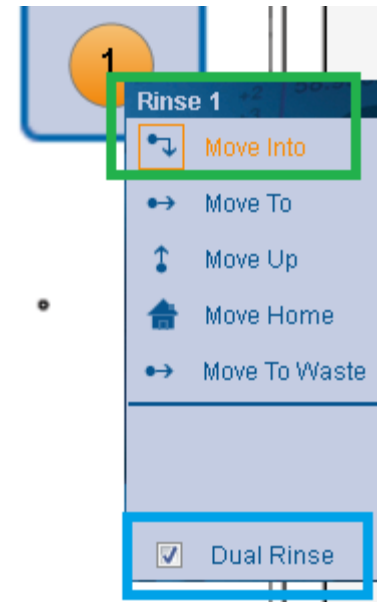
Common Issues with Solution Containers

- All solution containers need to have sufficient solution in them.

- Remove the caps on the Internal Standard, Rinse, and Carrier/Diluent bottles to verify that there is sufficient solution in them and that the tubing that goes into the containers are not coiling back up and are properly submerged.

- Inspect the filters at the top of the solution bottles. If they are clogged or damaged, then air may not be able to return into the solution container as solution is removed via the syringes.

- You can temporarily loosen/remove the cap to ensure proper air return.

Peripump and Carrier Issues

- The peripump will use carrier solution to push the prepared sample from the V1 loop to the nebulizer.

- Verify that connections are made between the carrier probe and port #3 of the V1 valve.

- Verify that the peripump is moving properly and that the carrier probe is in a bottle that contains sufficient carrier solution.

- You should not see air in the lines.
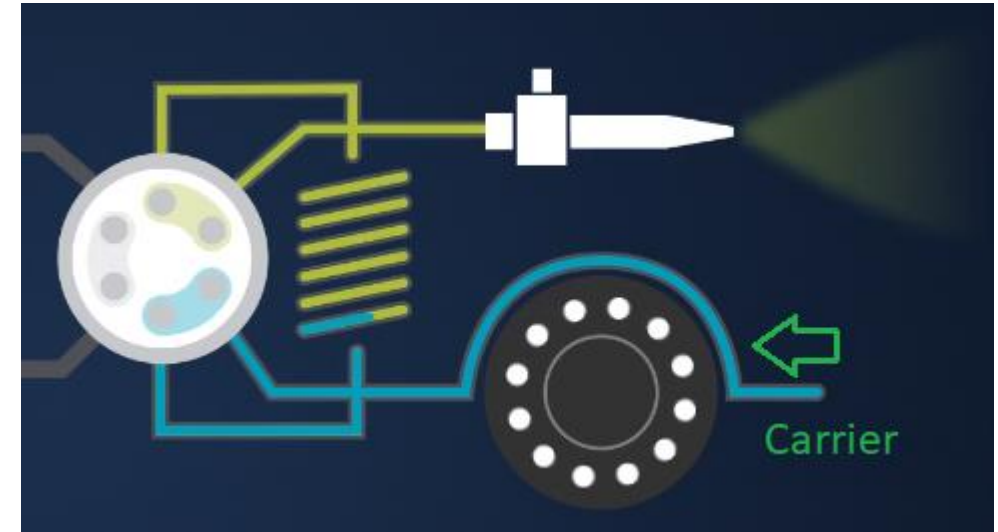
Tubing Inspection

- Damaged Tubing can interrupt sample or solution flow and can also introduce air into the lines. Inspect all tubing for any signs of damage. You may see kinked or bent lines.

- Leaks can indicate a problem as well. Pooling acids around the syringe base can be a sign of a faulty syringe or a blockage in the line(s).

- Sufficient slack is necessary between the carriage and probe tubing holder in order to prevent the carriage from catching or pulling it out of alignment.
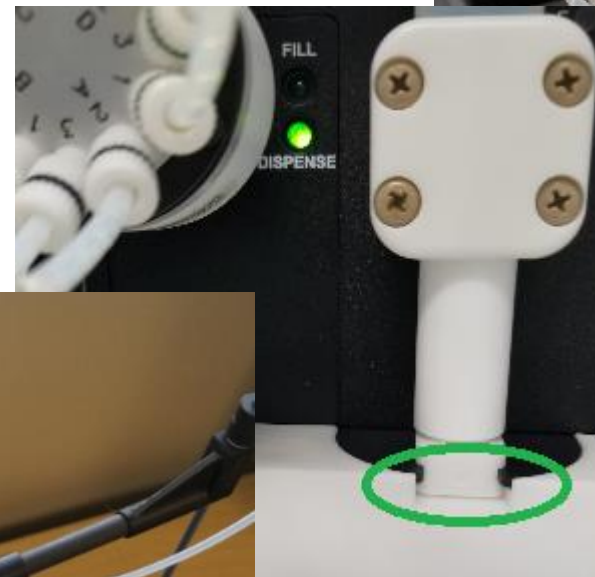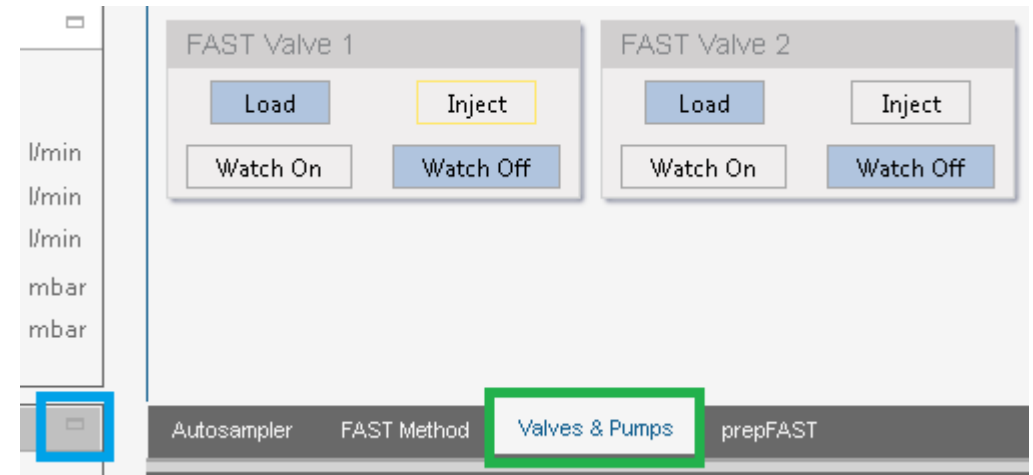
Valve Inspection

- All valves should have one light illuminated at all times. This would either be the Load/Inject light or the Fill/Dispense light. If no light is on, power-cycle the autosampler (for V1 or V2) or the syringe module (for V12).

- Indexing the valve is a process by which the valve is calibrated. This is an automatic process that is done when the valve is power-cycled. This should be done whenever valve maintenance is completed. To index the V1 or V2 valve, shut off the power to the autosampler and then turn it back on. To index the V12 valve, shut off the power to the syringe module and then turn it back on. You should hear the valve click a number of times, see the two lights flicker back-and-forth and finally the valve will finish in the **Load** or **Fill** position.

- If you believe that there is a blockage in the valve, then it can be cleaned. The valve maintenance guide can be found here. It is important to follow the instructions in the guide and properly re-assemble the valve.
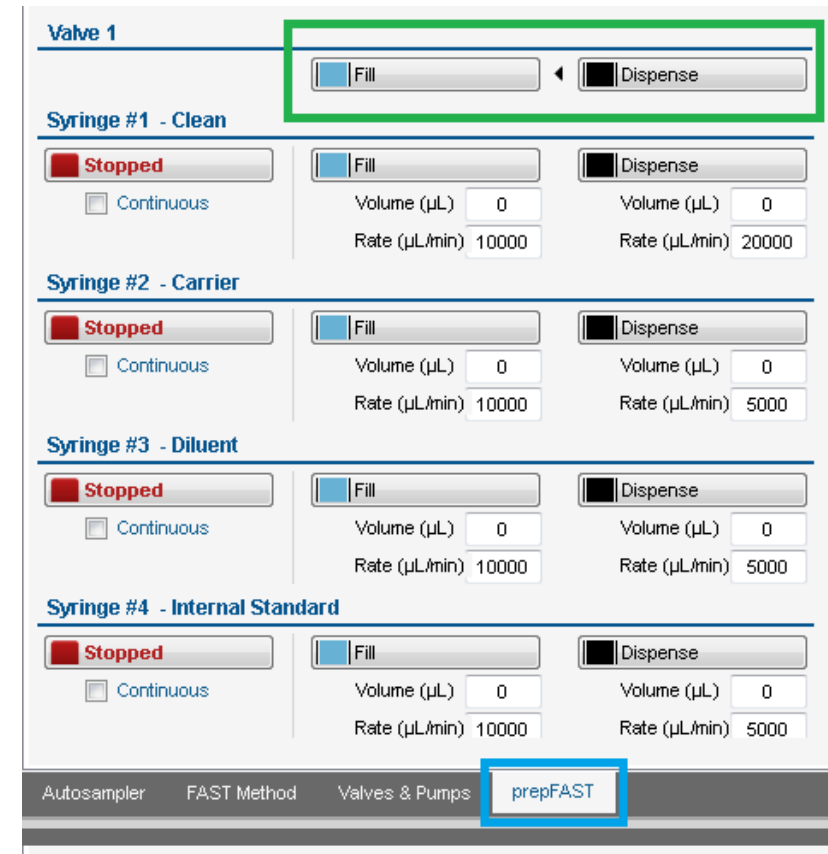
Valve Inspection

- Do all valves toggle properly? You can test them by clicking on the **Valves & Pumps** tab from the **Settings** menu.

- There are buttons here (**Load/Inject**) that will toggle Valve 1(V1) and Valve 2(V2). When you toggle the buttons back and forth, you should hear the valve click and observe the light change.

Valve Inspection

- To test the Syringe valve (V12), click on the **prepFAST** tab. There are buttons here for **Fill** and **Dispense** under the **Valve 1** heading.

- You can toggle the buttons back-and-forth and you should hear the valve click and observe the light change from **Fill** to **Dispense**.
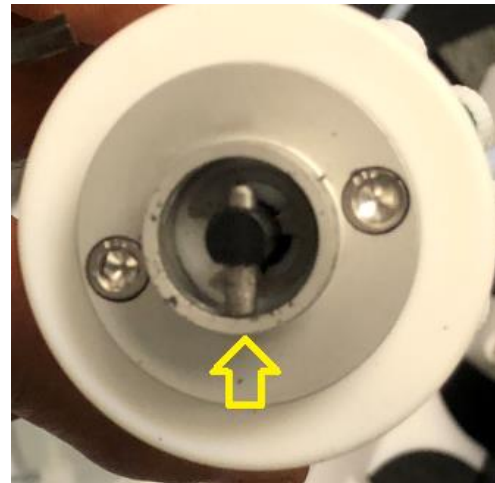
Valve Inspection

- If a faulty valve or actuator is suspected, you can remove the valve head from the base by loosening a screw (yellow in image). Once the screw has been removed, you should be able to pull the valve off.

- Rarely, the pin on the back of the valve that drives it can come out of alignment. The valve will need to be replaced if this happens.

Valve Inspection

- With the valve removed, you can power-cycle the autosampler (for V1 or V2) or the syringe module (for V12) and observe if the drive shaft is properly moving. Here is a movie that shows proper motion for the actuator.

- There is a silver coupler that interfaces between the actuator motor and valve. Verify that this is in place. When the valve is attached to the frame, it should be flush against the black collar and should not move when it is toggled.

Communication Issues

- If you suspect communication issues between Qtegra and the prepFAST (syringe module or autosampler), you can reset things by switching the configuration that Qtegra is using.

- Go to the **Dashboard** under the **Home Page**.

- Click on the configuration (i.e. **Dashboard -**)

- A window will appear. Choose an **Empty** (or a different configuration if Empty is not available).

- After the new configuration loads, click on it again and choose the default configuration.

- The light on the autosampler image should turn green.
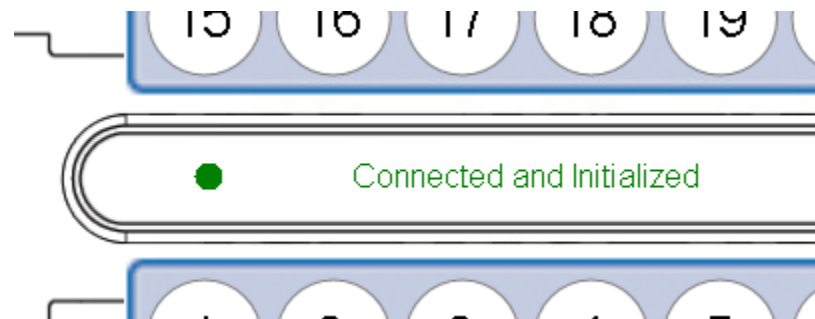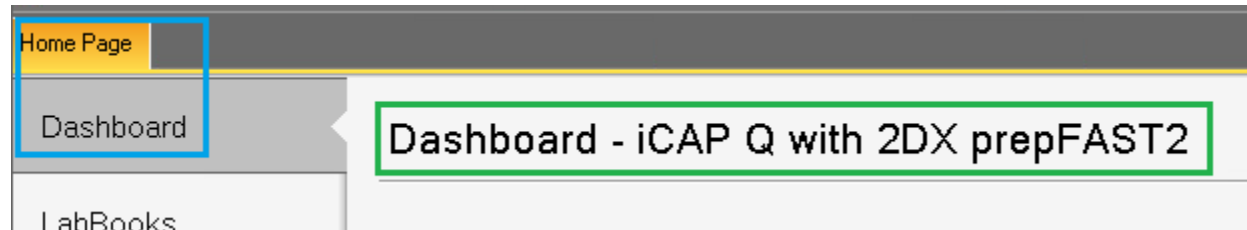
Device Drivers

- Device drivers are required for Windows® to be able to use the prep*FAST*. In Windows 10®, you can access the Device Manager by right-clicking on the start button and choosing the Device Manager option.

- There will be an entry under the **Ports (COM & LPT)** section of Device Manager for the autosampler, and the syringe module. They will be **USB Serial Port** devices.

- If a driver for the autosampler and syringe is not installed properly, you may see a device under the **Other devices** section called **USB Serial Port**. You can obtain a driver for this device [here](#).

- Once downloaded, you will need to extract the folder and run the **CDM21228_Setup** file. After installation, reboot the PC.
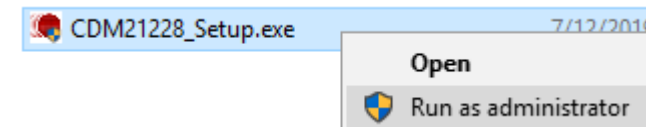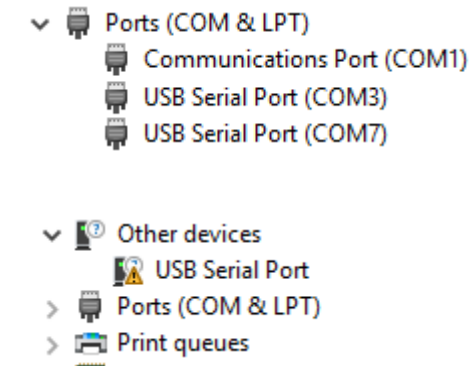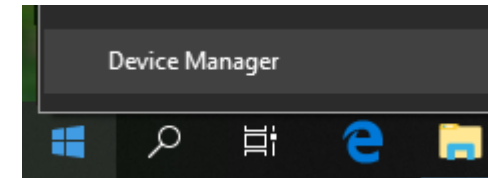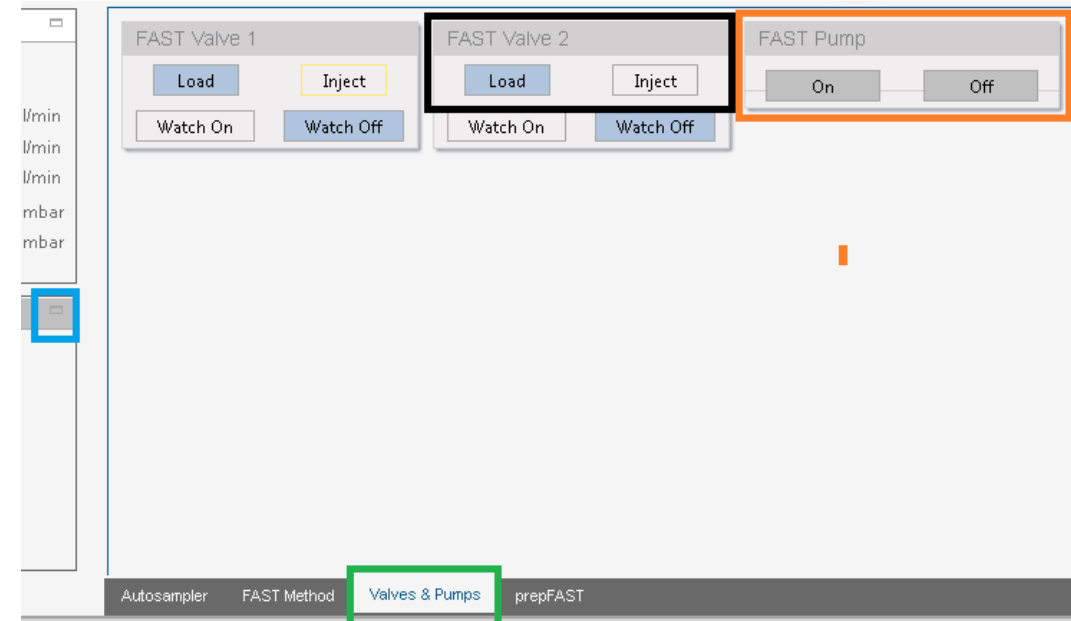
Vacuum Pump Testing

- If sample does not appear to be drawn into the V2 loop from the sample vial, you may need to test your vacuum pump. To do this, follow these steps:

  - Remove the port #5 line from the V2 valve.

  - Place the line removed into a beaker or vial of a known amount of DI water (50 or 100 mL).
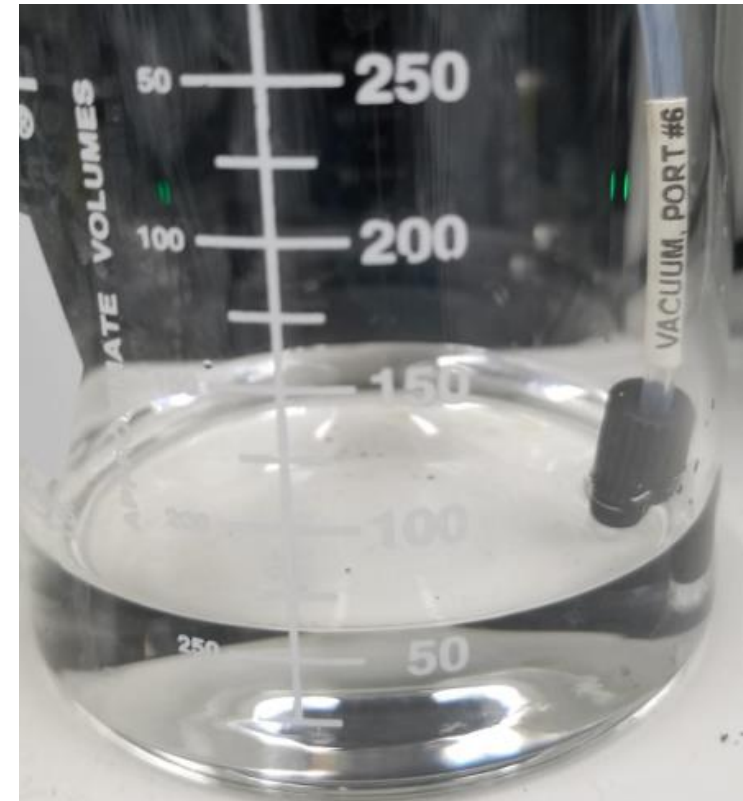
Vacuum Pump Testing

- Click on the **Settings** button and then the **Valves & Pumps** tab.

- Click on the **Load** button under the **FAST Valve 2** section to toggle the valve to the **Load** position. Verify by looking at the V2 valve and making sure that the **Load** light is on.

- Turn the vacuum on/off using the **FAST Pump On/Off** buttons. When you turn on the vacuum, it should draw DI water out of the beaker and then into your waste container via the autosampler *FAST* pump. Use a stopwatch to determine how long it takes to empty the container. You should have rates that are >60mL/min from this line. Repeat the test for consistency.

Vacuum Pump Testing

- The vacuum pump appears fine during this test, but sample uptake is still low. You can isolate specific sections of the tubing pathway and run additional tests to check for consistency.
    - Reconnect the line to V2 Port #5.
    - Disconnect the line at V2 Port #1. Place this end in a sample beaker/vial. This is a bit trickier since this is the sample loop and doesn't have a lot of extra line.

- Run your tests by turning on/off the vacuum pump within the software.

- If there are issues with sample uptake here, replacing the sample loop and/or V2 P7+ value is a possible solution. Cleaning the valve may also resolve the problem.

- A new loop and/or valve may be ordered if they are defective.

Vacuum Pump Testing

- The vacuum pump appears fine during the previous tests, but sample uptake is still low. Add the sample probe back into the equation.

  - Reconnect the line at Port#1.

  - Replace the sample probe with a new one and then place the probe in your beaker/vial.

  - Run your tests by turning on/off the vacuum pump within the software.

- If there are issues with sample uptake here, replacing the sample probe is a possible solution.

- A new sample probe may be ordered if it is defective. Samples probes will have a marker on them to signify the internal diameter of the sample probe. Note this if you need to contact ESI about a new probe.