User/Safety Manual

Interface Overview

The Robosquirt GUI is divided into three main tabs:

Plate Setup: Import and create well plates of different sizes and specifications and place them accordingly in the dispensing window (Fig. 1)

Device Control: Create experimental stages, control what stage of the experiment is running, manually dispense specific volumes to particular locations, or clear experiments (Fig. 3)
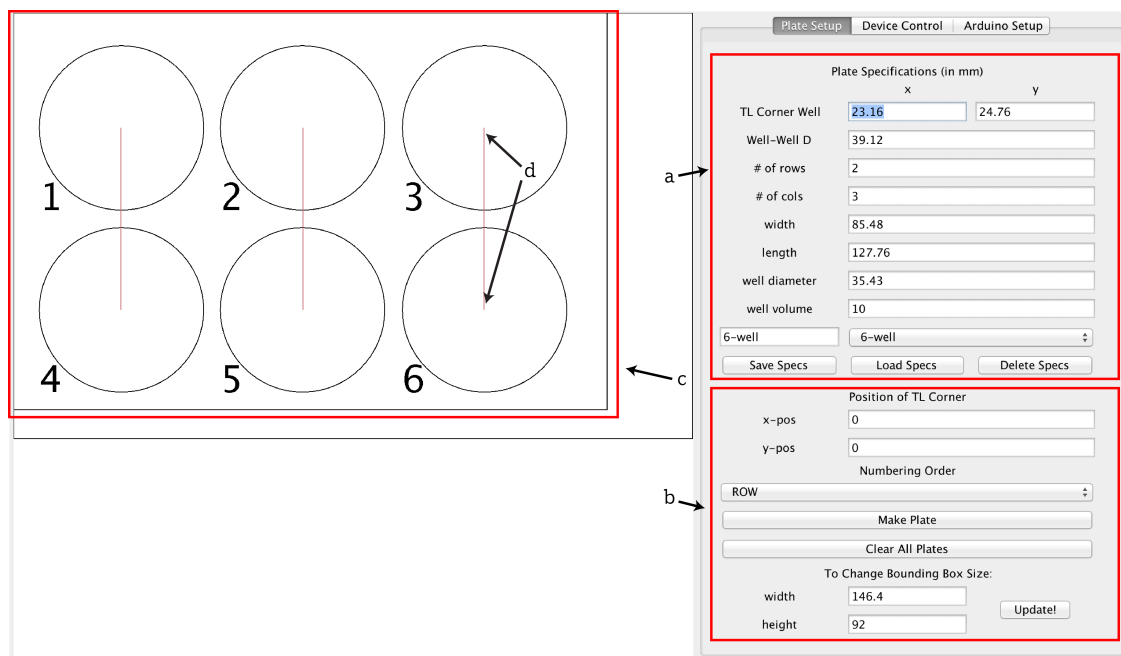
Arduino Setup: Configure connection to the Arduino

Figure 1: Plate Setup: (a.) Plate specifications can be inserted, saved, and loaded. (b.) Plates, once loaded, can be placed on the workspace. (c.) A plate loaded on the workspace. (d.) An example well-to-well fluid movement task

Figure 2: Device Control: (a.) Select the stage of the experiement to modify or add more. (b.) The details of the task including volume, color coding, source, and destination. (c.) Execcute or clear all stages.

Plate Setup | Device Control | Arduino Setup
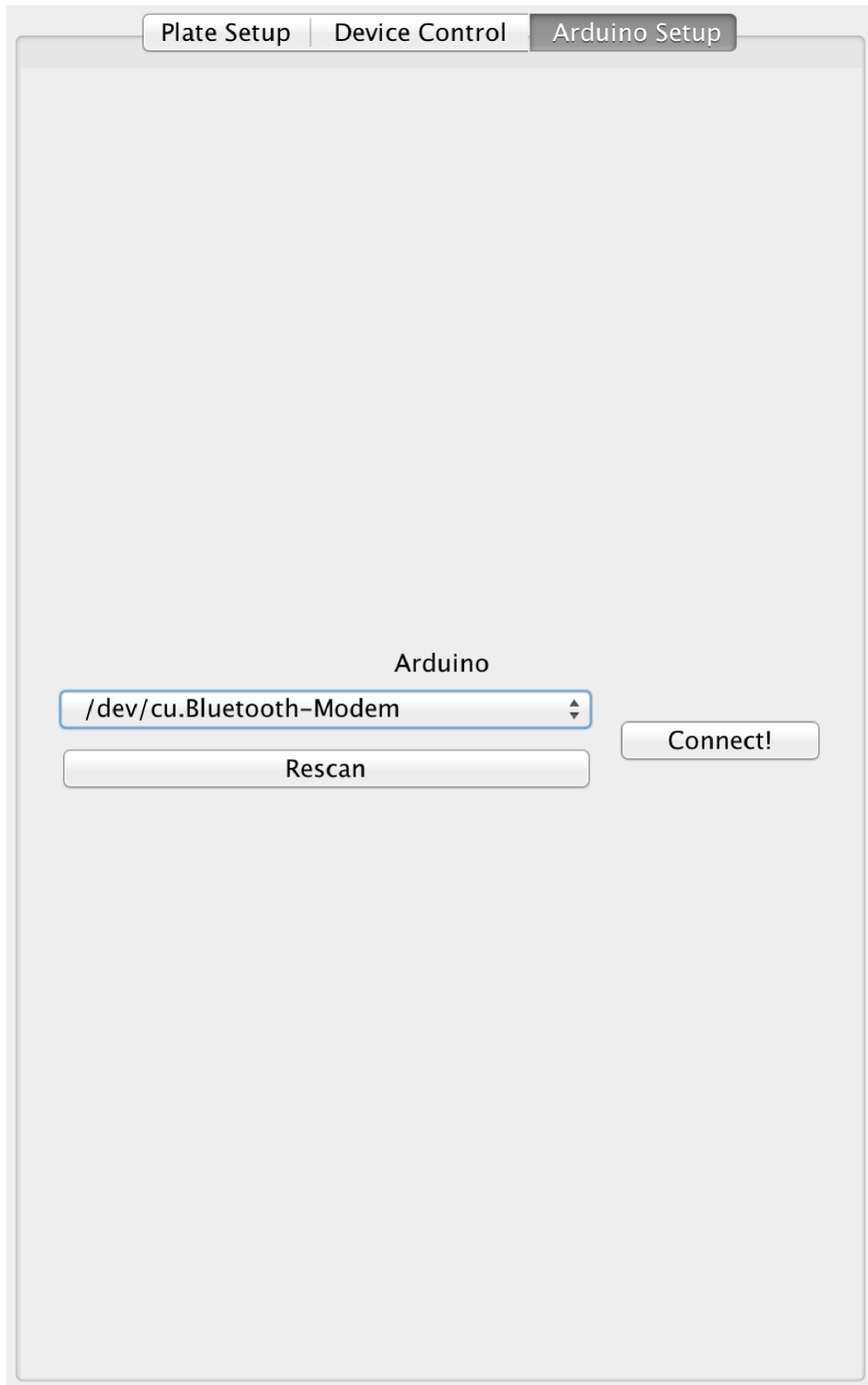
Arduino

/dev/cu.Bluetooth-Modem

Rescan

Connect!

Figure 3: Arduino Setup: Select the port to which the Arduino is connected and then connect.

Plate Creation

1. Load information from existing well-plate examples by clicking "Load Specs".

2. Click "Make Plate" to generate one on the RoboSquirt screen.

3. Using the "x-pos" and "y-pos," input the measurement (in mm) of the X and Y position of the top left corner of the well.

4. If your well plate is not among the examples included with the RoboSquirt software, use this tab ("Plate Setup") to create and save plates for future experiments

5. Search for the datasheet for the desired well plate and input the corresponding information into the text boxes. It is important that the information is carefully inserted and accurate to prevent incorrect operation and well overflow.

6. Click "Save Plate" and input a model name to save the plate for future use.

7. Click "Make Plate" to generate one on the screen.

Designing Experiments

1. As you can divide your experiment into discrete stages, pick the stage you would like to add your task to (or create a new one).

2. Select the type of task you would like to add. There are basic tasks like Move, Dispense, NozzleHeight, and more abstract tasks like moving from a well to another well, moving from an external source to a well, etc.

3. Fill out the appropriate parameters for this task.

4. Add the task to the current stages queue. This will add it to the tree visualization of tasks at the top of the screen. It will also add a line between wells in the main screen, visually showing you where fluid is being moved in your experiment.

5. Repeat steps 2-4 until all tasks have been assigned, for all stages.

6. Optionally, save either your entire workflow (all stages) or an individual stage with a nickname so that you can easily repeat the current experiment through closing / opening the application.

Running Experiments

1. Make sure Arduino is connected to a computer and powered with external power.

2. Place necessary well-plates or other fluid receptacles in the dispensing area of RoboSquirt.

3. Attach fluid sources to the normally closed port of the 3-way valve.

4. Use the "Arduino Setup" tab to ensure the Arduino is connected. Click rescan if the port to which the Arduino is connected is unavailable.

5. Click on the "Device Control" tab to run the experiment.

6. Load experimental stages using "Load Workflow."

7. Select the desired stage using the drop-down menu at the top of the window.

8. Click "Run Stage" or "Run Workflow," and the application will handle running from there.

Precautions

Device Operation

Before giving power to the Arduino control board, ensure that no objects capable of hindering the movement of the dispensing head in the X- and Y-directions are within the confines of the X-Y frame. If the GUI suddenly stops working, close and reopen the program.

Electronics

If everything is working correctly, the maximum voltage found in the system will be 15 V. However, it is important to be vigilant. Watch out for components that may be faulty. If a component appears to be flawed, turn off all power to the system. Additionally, keep water within the confines of the X-Y frame, away from all circuits. Not only is this for the safety of the user, but it will also prevent damage to the device.

Troubleshooting

Hardware

Arduino flashes and resets:

1. Unplug power.
2. Check wiring to ensure power is not directly connected to ground in the circuit.

X-axis motors vibrate but don't move

1. Unplug power.
2. Check motor cables to ensure the 4 pins are connected correctly.

Servo head doesn't move:

1. Unplug power and move servo head to check for obstruction.

2. Unscrew servo horn.

3. Plug in Arduino to USB to reset servo head position.

4. Screw in the servo horn at the desire home height.

Software

Inability to connect:

1. Check Arduino connection.

2. Unplug the Arduino and reset it.

3. Reconnect Arduino.