**Protocol for working with Legolas system (v. 1/27/24)**

Notes:

Connect to local network router: Linksys04582

Prepare 2 (3?) trays and wooden spacer. Trays need to be stacked.

If motors are stuck, turn off power. Then manually adjust.

Assumes config.yaml is fairly close to being right.

1. Power on. Connect wifi. No tray.
2. **Check communication and preliminary setup**.
   1. Anaconda prompt. cd to correct directory.
   2. python manual.py Device calibration window opens.
   3. Reset server. Pi1 IP address: 192.168.1.11 Pi2 IP address: 192.168.1.12
   4. Connect via config. Choose config.yaml. Manual Mode opens. Sometimes you have to wait ~20 seconds.
   5. Home > home Device should hit limit switch and then move away by ~0.5”. If not, something is wrong. Maybe turn off power and turn back on or exit from manual.py. From time to time, you may need to check home.
3. **pH device full-up and full-down can frequently get off**. Remove cap from pH sensor. Try to do everything with commands, not manual motions.
   1. Device calibration window > click pH device. Check full-up and reset according to PPT instructions. This method uses manual xy positioning

Positioning using commands. Place tray. To position pH sensor above a well, use Stage > “Key position” under Cells > 0 1 (as an example) > Goto.

pH device > full down > goto If the sensor is not in the middle, first try shifting the tray a little. If way off, manually adjust x,y motors to be directly over a well. You may need to redo Stage settings according to PPT or revise cell\_map.txt.

It’s OK if the sensor hits the bottom of the well a little bit. Make sure the thread is on pulley and is not too loose. Reset if necessary.

1. File > Export (config.yaml). Save what you have so far. I think cell\_map.txt is updated also.
2. **(If needed) Check Depo\_device height**.

Stage > under General, acid. This moves the pH sensor over acid reservoir. (On 1/24, I don’t see “acid.”)

Check full\_up and full\_down. Refer to PPT to set.

1. **(If needed) Check Stage, i.e. does pH sensor go over the wells**. Follow cell calibration instructions in PPT. The pH sensor does not have to be dead center in the middle of the well. Finer adjustments will be made later in the Jupyter notebook.

File > Export (config.yaml)

1. **(If needed) Work on device offset and depo volume and pH sensor calibration**.
2. **Don’t close Manual Mode**. If you do, there might be a big movement in xy and pH sensor can drop down. When you start Jupyter notebook and establish communication, Manual.py stops running. Then you can X out of Manual mode.
3. **Open Jupyter notebook**. (LegolasDemo.ipynb in This PC\Documents\...\LEGOLAS new4 Scripts)

Ignore Hmm…we couldn’t log you in just now…

1. Set up communication. Reset or stage.home().
2. (If needed) Open cell\_map.txt. Test cell mapping and adjust cell\_map.txt.
3. **Shutdown procedure (to avoid big movements of motors)**
   1. Remove tray.
   2. X out of Manual mode. Exit from Anaconda prompt. There will be no movement of robot.
   3. Within Jupyter nb, pH sensor full\_down. Put cap on. Make sure tip is submerged in 3.3M KCl.
   4. Turn off power to motors.
   5. In Jupyter nb, File > Close and halt. CTRL-C or X out of Jupyter command window. (For CTRL-C, big movement if power to motors is not turned off. Not sure what X does.).

**Causes of abrupt, unexpected motions (turn over)**

If power is on and you X out of Jupyter, CTRL-C out of Jupyter command window will result in a big movement of pH sensor to the left and back but there is no collision. If you X out of Jupyter command window, there is a big dropdown and the pH vertical motor will be stuck.

If you Close and Halt Jupyter, the pH sensor rapidly goes to the back and collides with back rail. Can’t open .ipynb file. Situation is fixed by opening Anaconda prompt and typing “jupyter notebook”.

If Jupyter stops running (async error), quit and restart kernel, there is an abrupt motion.

I have also seen a big movement to left and a collision with acid/base reservoir.

**pH sensor setup**

First measure in a solution close to experiment values. Then calibrate.

1. Calibrate before each run. pH 4, 7 in wells. Assume sensor was in 3.3M KCl initially.
   1. Clean with water and calibrate with pH 7 first.
   2. pH 7: Dip 20 s each time for 120 s total. Dipping mixes. Use final number.
   3. pH 4: Dip 20 s each time for 120 s total. Use final number.
2. Experiment
   1. Clean, dip 20 s, up, dip 20 s, up, dip 20 s. Use this number. Clean.

Cleaning wells: Pipet water into a set of wells.

Cleaning procedure for standards: Well 1, dip 2X. Well 2, dip 2X

Cleaning procedure for experiment: Well, dip 2X.

If ΔpH > .05, repeat measurements until ΔpH ≤ .03.