flow robotics

USER MANUAL

Get familiar with the flowbot® ONE software

User Manual for flowbot® ONE

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Issued by:
Flow Robotics A/S
Glentevej 70A
2400 Copenhagen NV
Denmark

flow-robotics.com

linkedin.com/company/flowrobotics/

Contact:

Sales:
info@flow-robotics.com

Support:
support@flow-robotics.com

Online user community:
flowbot ONE community on LinkedIn

INTRODUCTION

Congratulations on owning your new flowbot® ONE – we hope that you will enjoy working with it in your laboratory.

Precautions using flowbot® ONE

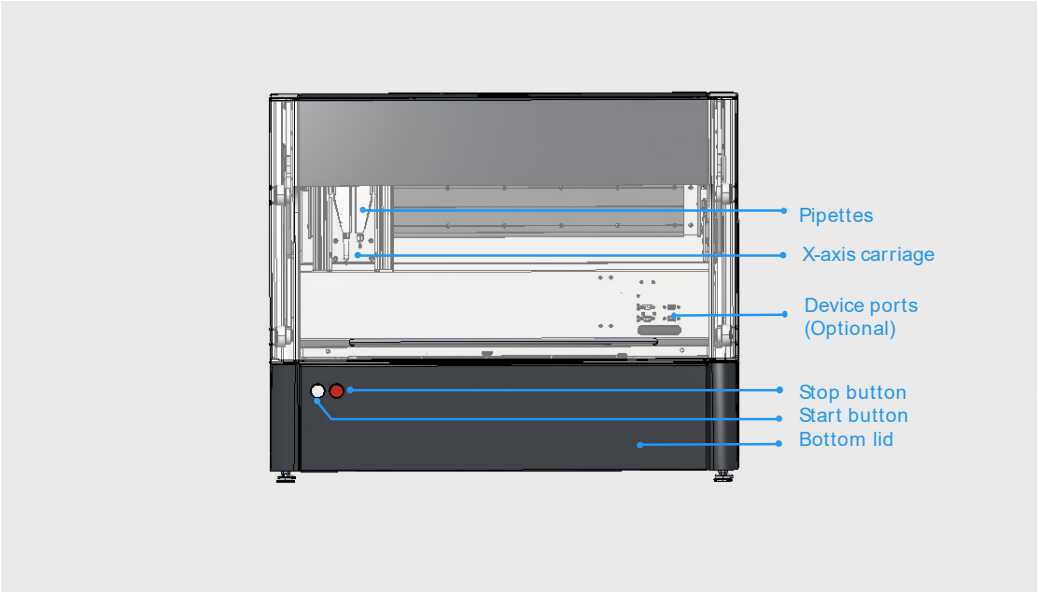
Before first use, please make sure the robot has been qualified and installed in accordance with the chapter **Unpacking and installing the robot**.
Always operate the robot with the front door closed. Operating it with the door switch override activated can cause bodily harm.
Use personal protection equipment when working with materials which require this.

flowbot® ONE comes with the option of mounting a ventilation duct at the top of the robot. It is up to the user to make sure any dangerous fumes are sufficiently removed, not causing harm to the user.

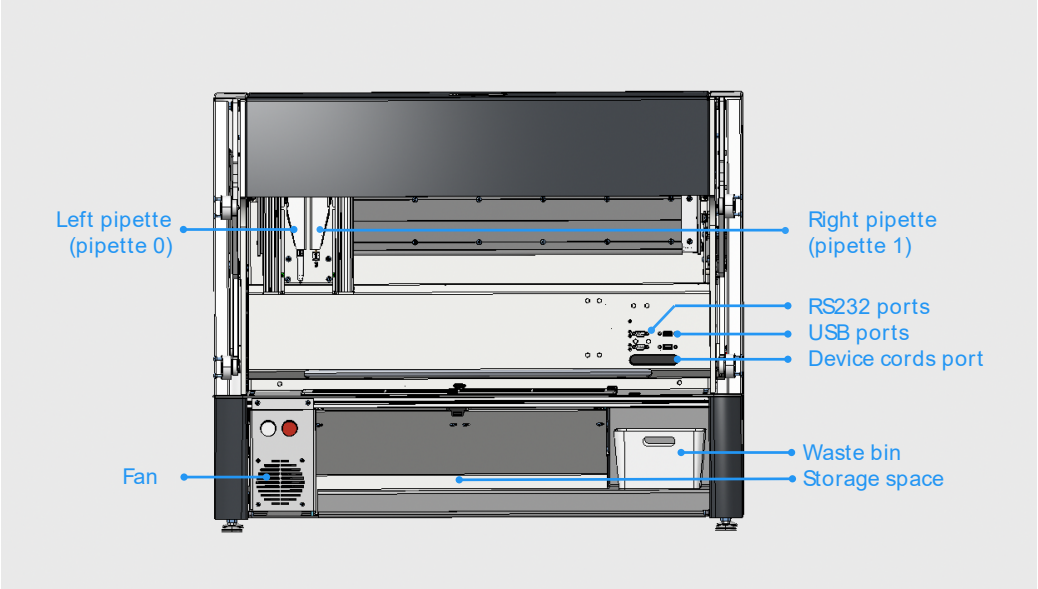
TABLE OF CONTENTS

ROBOT OVERVIEW

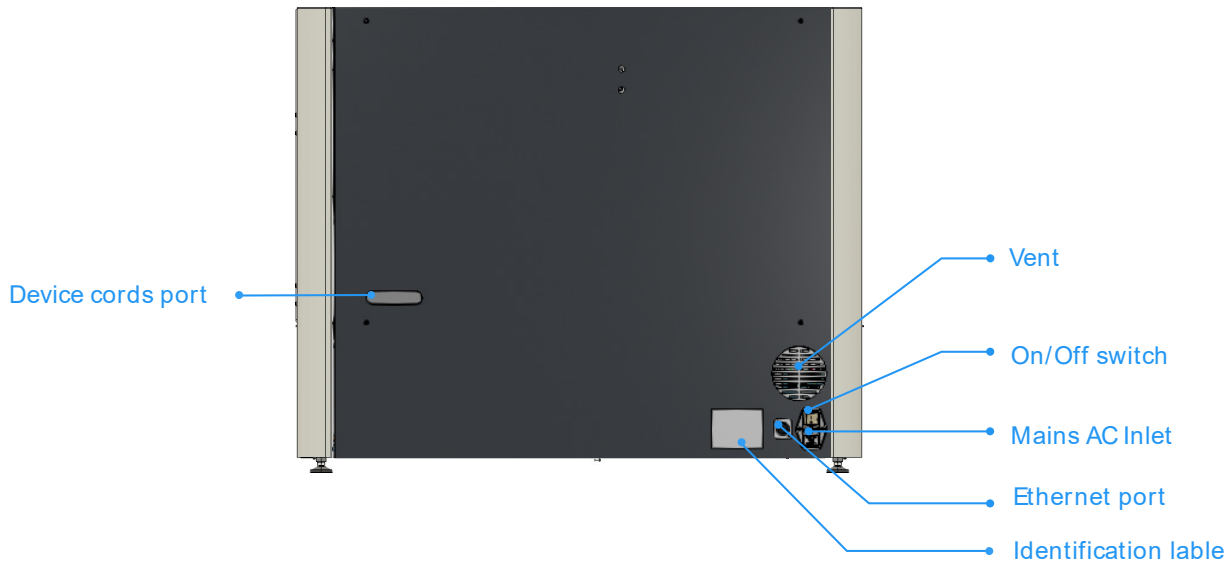
The flowbot® ONE is an easy-to-use XYZ-pipetting robot suitable for most routine pipetting tasks in a life science laboratory setting. It uses negative pressure pipetting modules with disposable tips for all tasks. A waste container for used tips is fitted under the workspace area.



Front view of robot

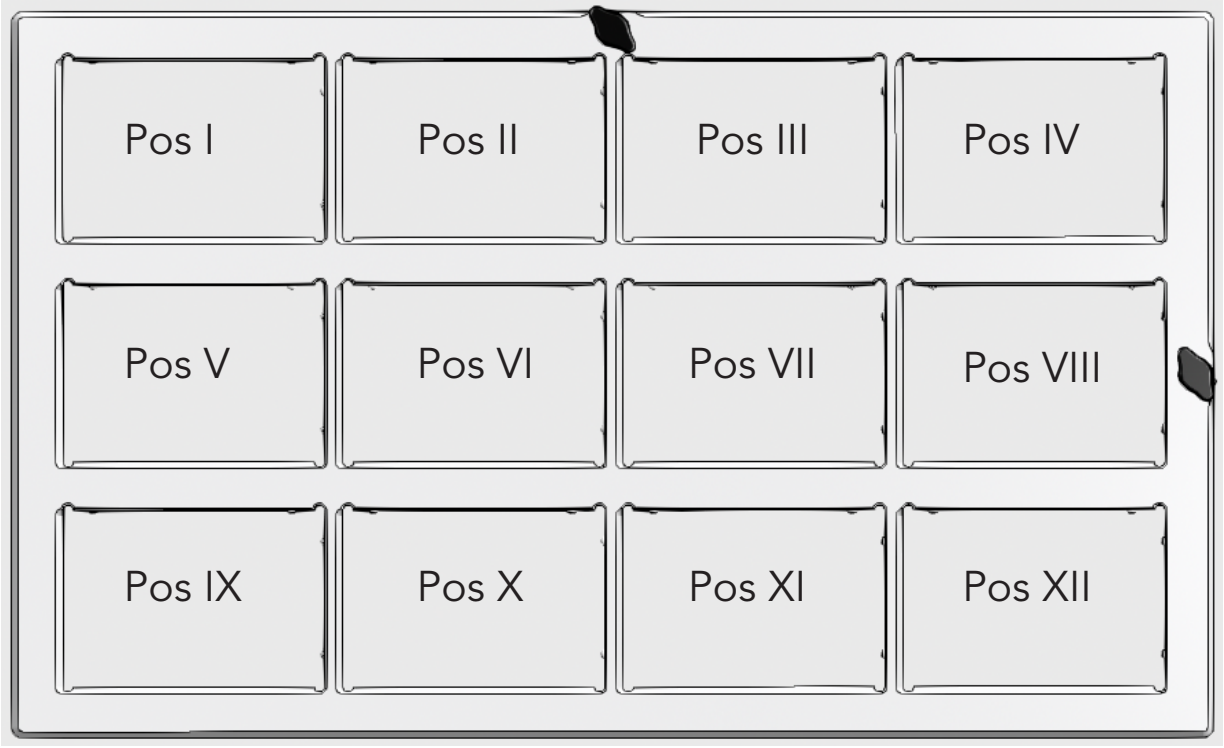


Front view of robot, with open covers



Back view of robot

The robot work area is designed with 12 fixed positions for plates, pipette holders and reservoirs in the 96-well plate footprint, numbered from the top right when facing the robot platform.

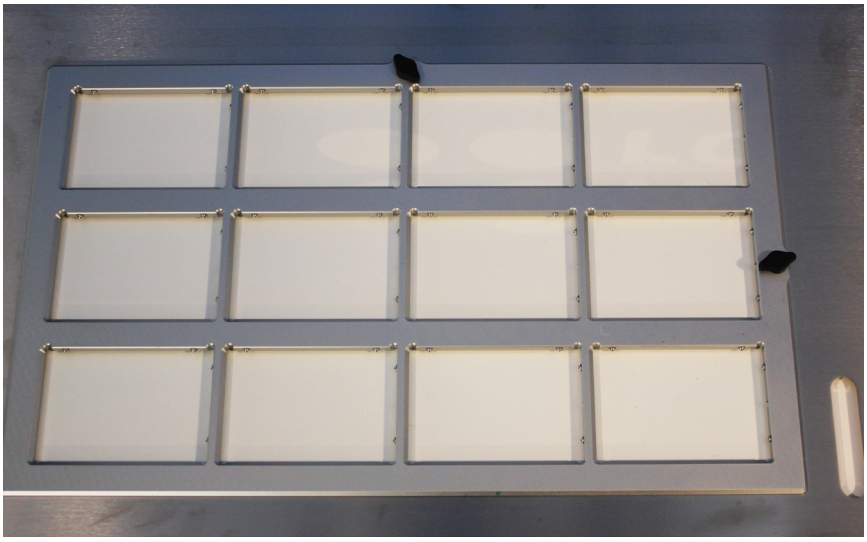


Robot work area grid layout (software graphic)

BEFORE RUNNING A PROGRAM

Secure grid

Before running programs, make sure that the grid on the deck is positioned correctly and that the securing knobs are fastened. See picture below for how the grid frame on the deck should be positioned.



Deck workarea grid

Check door and Stop button

The front door of the robot has to be closed before the robot can be started. If the door is opened during the run, the program will stop immediately.

There is also a Stop button on the front of the robot, it is the red button next to the white Start button. Pressing the Stop button will also stop the program immediately, halting all movement.

If you use the Stop button, it has to be released before robot can operate again.

Daily O-ring maintenance

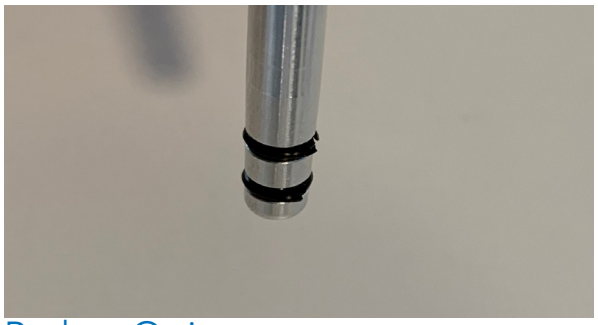
The tip cone O-rings of the pipette have to be cleaned and greased on a daily basis - it is recommended this is done before operating the robot

For your personal safety and to prevent long term effects of daily exposure to the grease, wear gloves for this task.

- Use a paper tissue or a piece of cloth to wipe off the lower part of the tip cones. to remove dirt and old grease.
- Check that the O-rings look whole and are not cracked or broken.
- Use the silicon grease supplied by Flow Robotics, or a similar product.
- Add small amount of grease to your fingertip and distribute it to the O-rings as illustrated in the picture below.
- There should be not visible grease residue on the tips, if so, you have used too much.


Perfect amount of grease


Too much grease


Broken O-ring


Cracked O-ring

QUICK GUIDE

Getting started

This is your quick introduction on how to operate an installed and prepared robot. If the robot is not yet installed and prepped, please see chapters on **Installation** and **Setting up programs**.

1. Connect the power supply and turn the robot on. The on/off switch is on the the back of the robot. When powered up, the robot is by default in standby mode and needs to be switched on to run.

2. Switch on the robot by pushing the white Start button at the front of the robot. The Start button will start flashing, to indicate the robot is starting up.

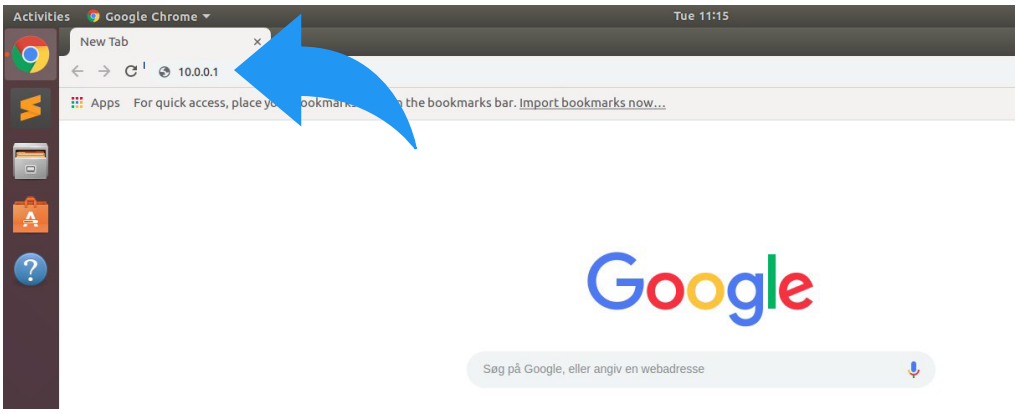
3. Wait 2-3 minutes for the the robot to fully initiate – during startup the Start button will be blinking. When the robot is ready for operation, the platform lighting will turn on and the Start button will be constantly lit.

   Find the WiFi for your flowbot® ONE on your computer or tablet. Type in the WiFi password and connect to the WiFi. (Use security key instead of pin, if optional). Alternatively, you can connect to the robot directly via an ethernet cable.

   WiFi SSID and PSK are supplied with the robot at delivery.

4

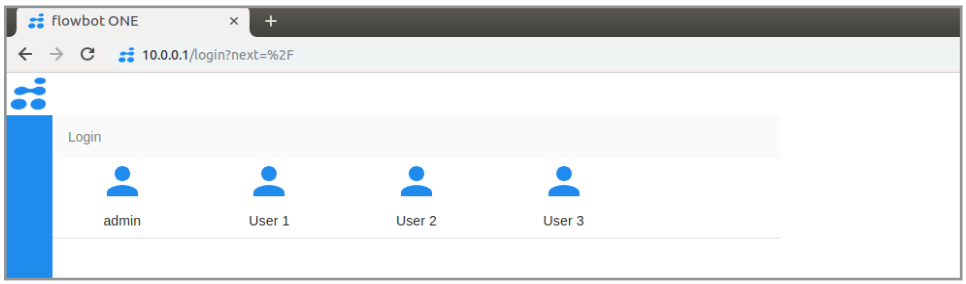
Open your browser.
Type 10.0.0.1 in the address bar as shown below.



5

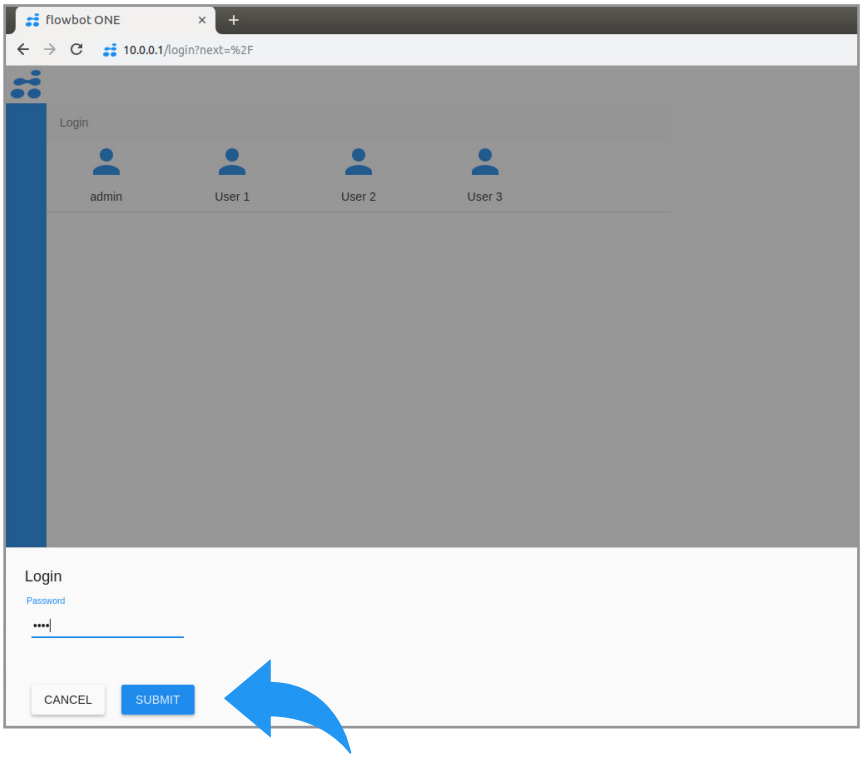
When connected, you will see the login screen with an overview of the available users.

Point and click on your user icon.

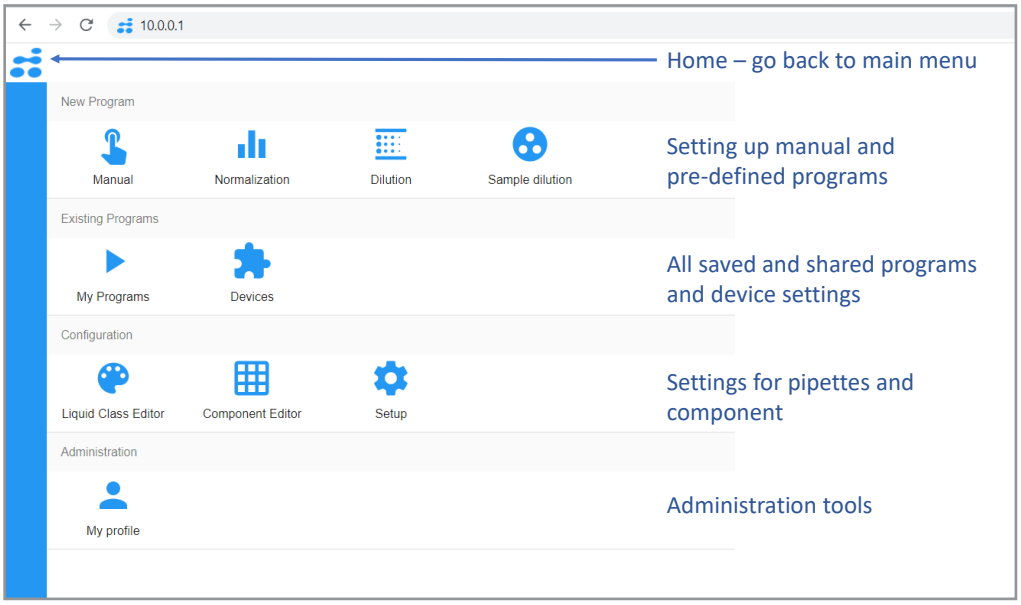


6

Type in your password and press SUBMIT.



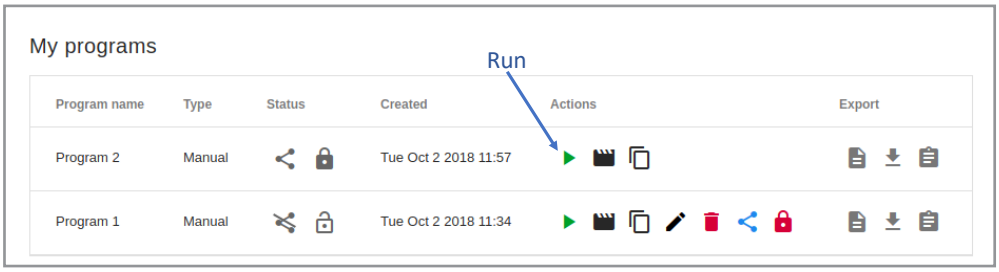
The Main Dashboard is now displayed, and you are ready to use the robot. Click the icons to choose functions from the menu (explaination in picture)



Running a pre-existing program from the My Programs menu

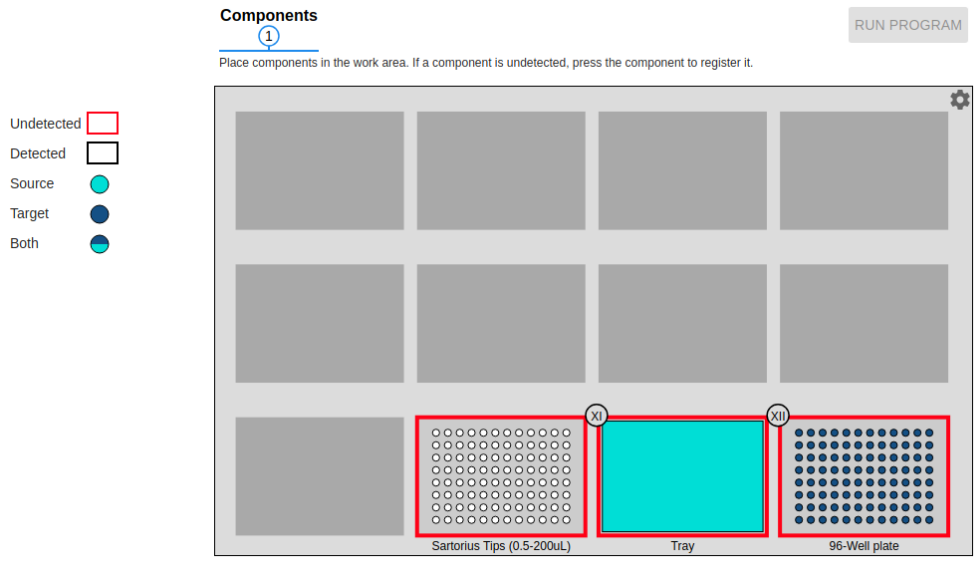
1

To run a pre-existing program from the My Programs menu, open My Programs from the Main Dashboard, and press the green Play symbol of the program you want to run. The software will display the program setup graphically.



2

Confirm any components that are not recognized by their QR code by clicking on them. If not recognized, the software will mark them with a red frame.
Before confirming a component, make sure it is actually present on the robot work area grid.



3

Press Run program
On the next screen, press Connect.

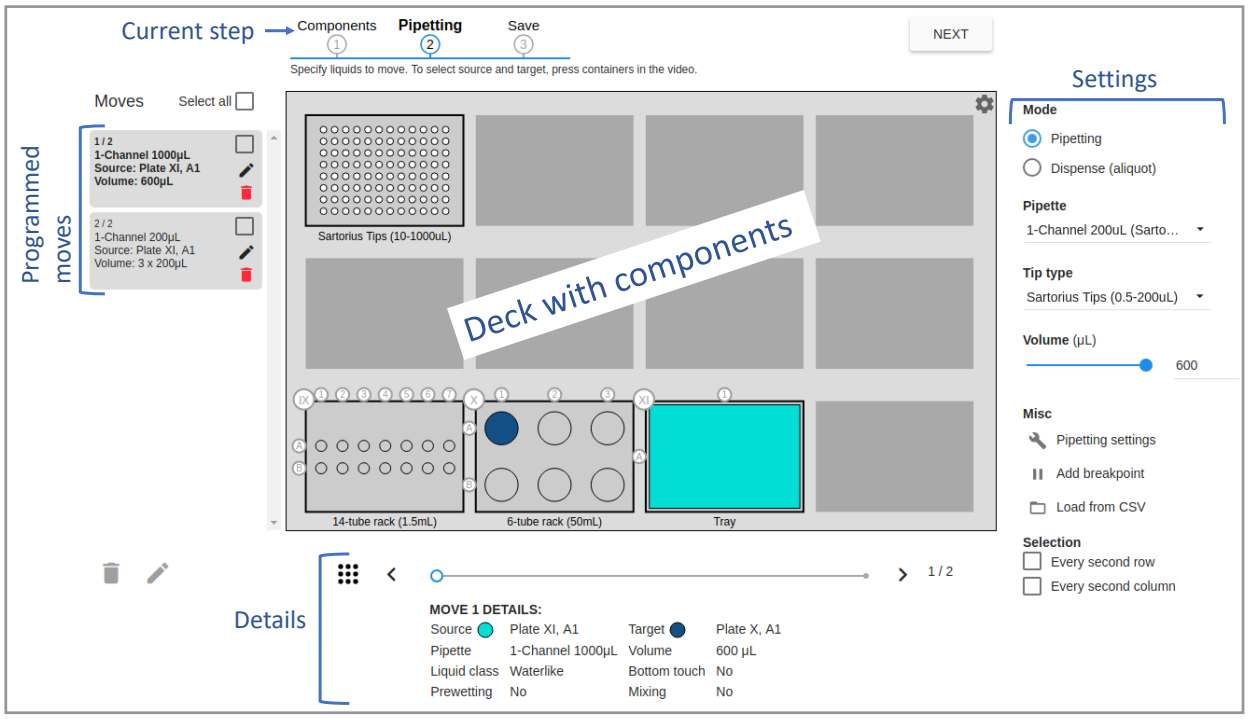
The robot is now ready to execute the program. Make sure front door is closed and press EXECUTE.
Please refer to the chapters **Setting up programs** and **Program execution** for a more detailed introduction.

SETTING UP PROGRAMS

A manual program setup consists of consists of three steps – Adding Components, Defining Pipetting, and Saving.

To create a new program, press the Manual icon on the Main Dashboard.

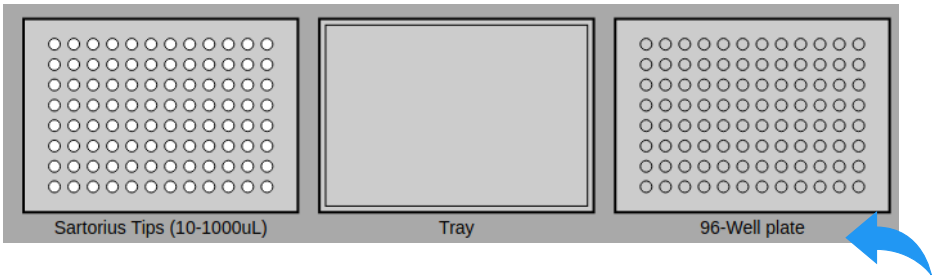
During setup of a manual program the following manual setup window is shown:



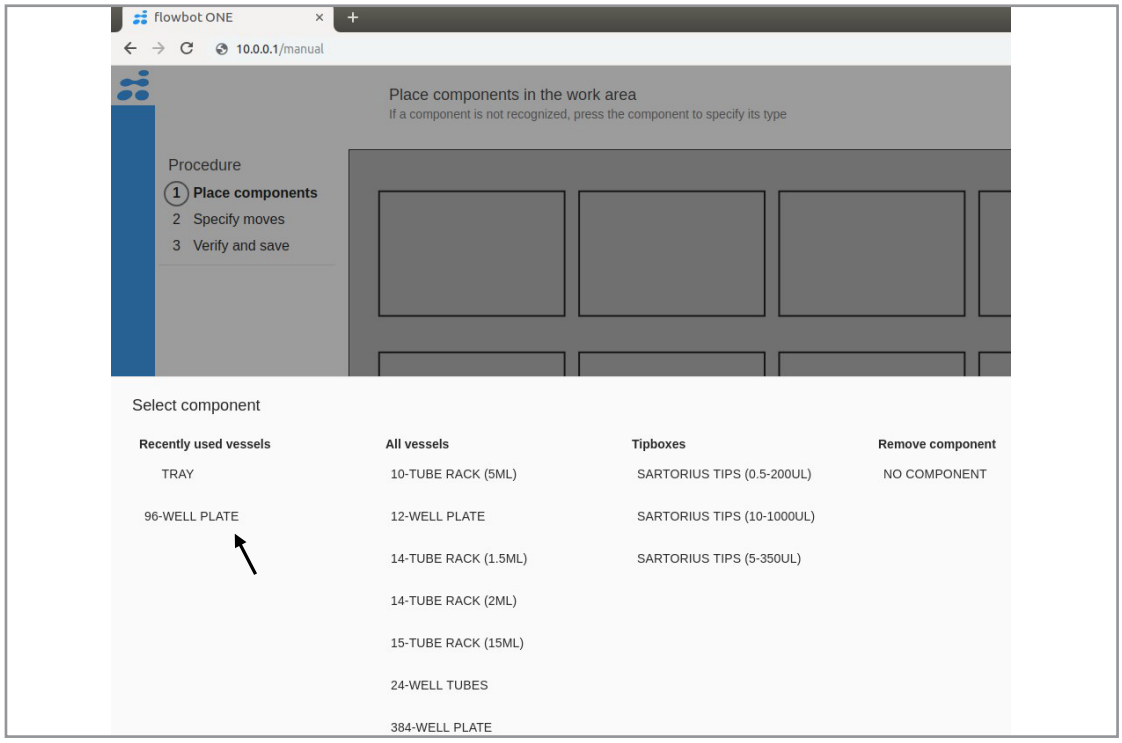
In the predefined programs, more steps are available for dilution, normalization and sample dilution. However, in the following, an introduction is given to the three steps of the basic program setup.

Components step

The robot needs to know what is on the deck for it to work with, so the software graphics have to reflect the physical layout of the robot work area. To "show" the robot what is on the deck, place pipette tip racks, well-plates and racks for tubes and vials on the work area grid. The robot will recognize any QR codes on the bottom of the components using the built in cameras under the deck. When a component is recognized, the software will write the name of the component below the component.

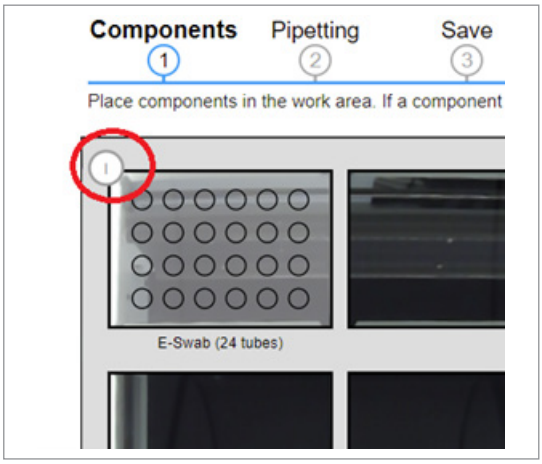


If a component is not recognized by the camera automatically, the component type can be selected by clicking in the position on the deck where the component in question is placed, and the selecting the correct component type from the list.



When selected, components can be moved around by drag and drop on the working area.

You can rename an entire component by clicking on the round icon that indicates the deck position in roman numerals at the top left corner of the component. This is useful for describing what the component is used for in the program, e.g., sample dilution



If you want to name the individual wells, tubes, or reservoirs of a component, click directly on the well, tube, or reservoir you want to name and edit it. Later, when you hover over the well, tube, or reservoir in the program, this new name will appear.

Individual wells will be grouped according to the default pipette on the flowbot® ONE. For an 8 channel pipette, you can only choose whole columns. For 4 channel pipettes, you can choose every 2nd row in a column and for a 1 channel pipette, you can choose and name individual positions.

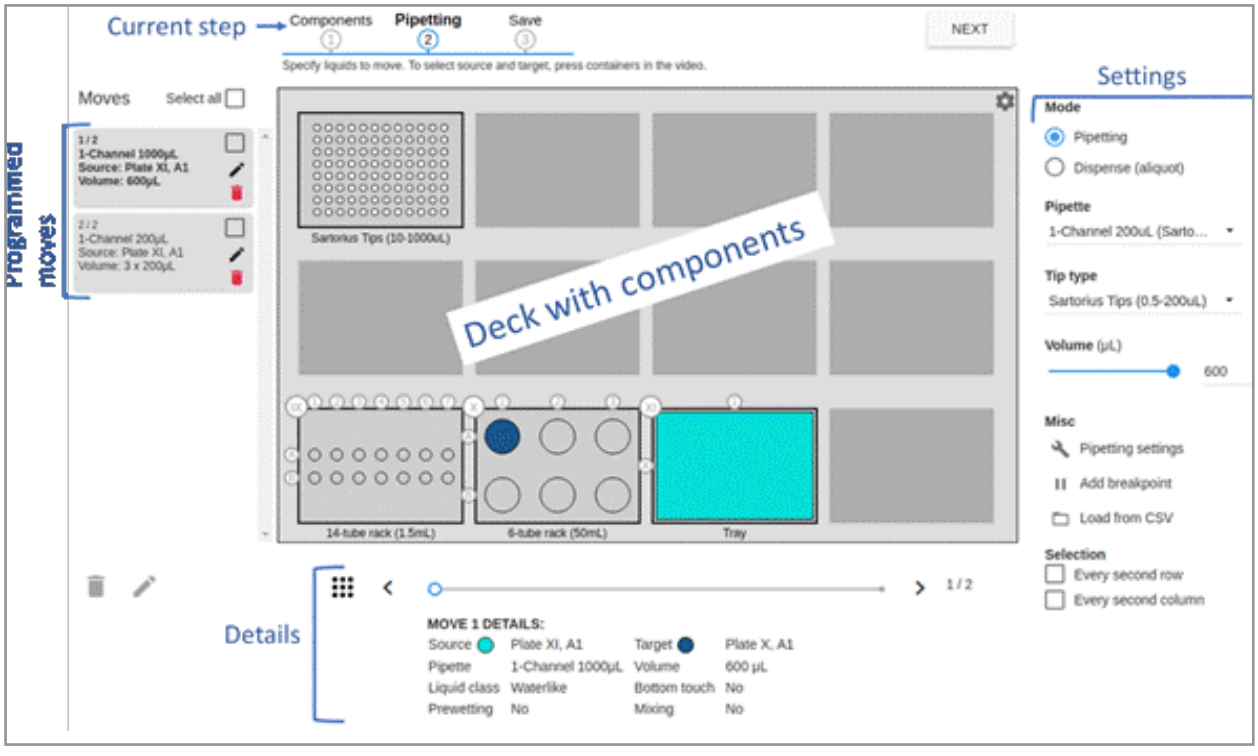
Pipetting step

Once the robot knows what is on the deck, you have to tell it what to do with the contents of the components. It needs to know:

- How much volume to move
- Where to get the volume (source)
- Where to deliver the volume (target)

The pipetting requirements are informed by defining the volumes and movements for the robot to perform in the software. This is done by placing simple block commands in the correct sequence to fullfill your application requirements. It is all done by click, drag and point in the pipetting step of the Manual setup window.

You can easily follow your progress, as everything is depicted graphically in the Manual setup window. The pipetting moves with volumes are shown as blocks to the left of the deck, details of each move are shown below the deck, and the pipetting settings are shown to the right of the deck.

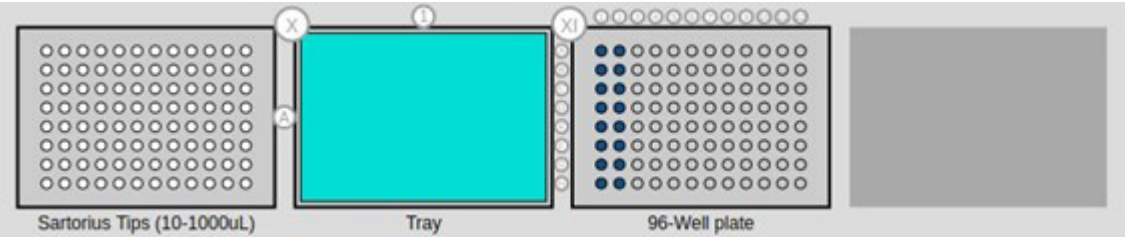


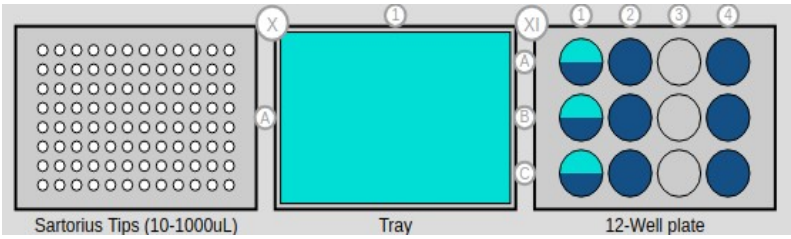
Manual setup window, pipetting step

Creating moves

To create a move, you choose pipette, tip, and volume. Then you choose the source and target for your move.

The source is where you pipette from. When a source is selected, its graphic is colored light blue. The target is where you pipette to, and when it is selected, its graphic is colored dark blue.
If you select a source, that is also a target for at previous step, the source graphic will be colored both light blue and dark blue.

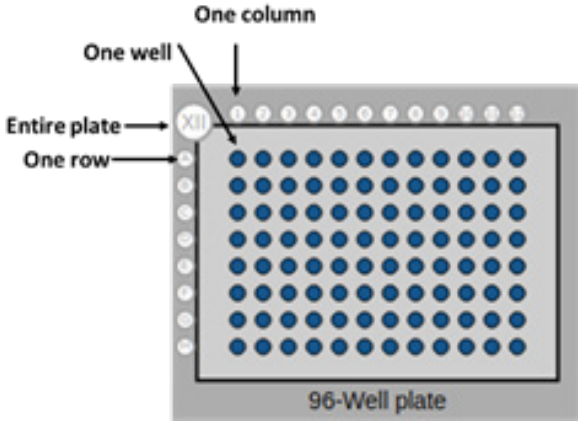




Select an entire plate by clicking the Roman numeral for that plate.
Select one or more columns by clicking the number of the columns.
Rows are selected by clicking the letter of that row.

A single well/tube/vial is selected by clicking directly on the single well/ tube/vial. This is only applicable when using a single channel pipette module.

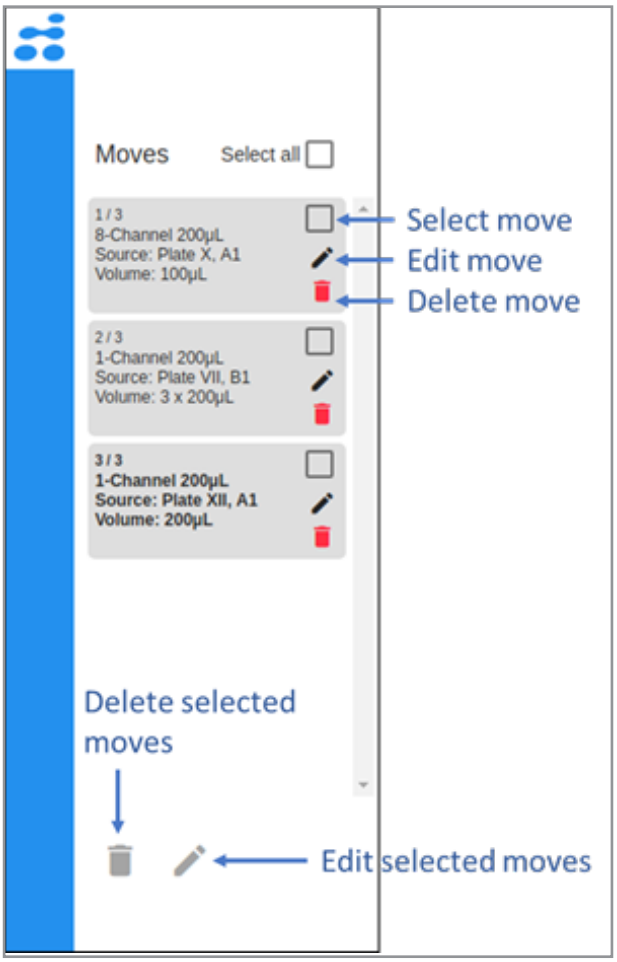
Select more than one well/tube/vial at a time by click-drag-release.



If you are using a multichannel pipette, the software will automatically choose/light up the same amount of wells that will be targeted with that pipette module. It is possible to change pipetting modules, if the demands in your laboratory change.

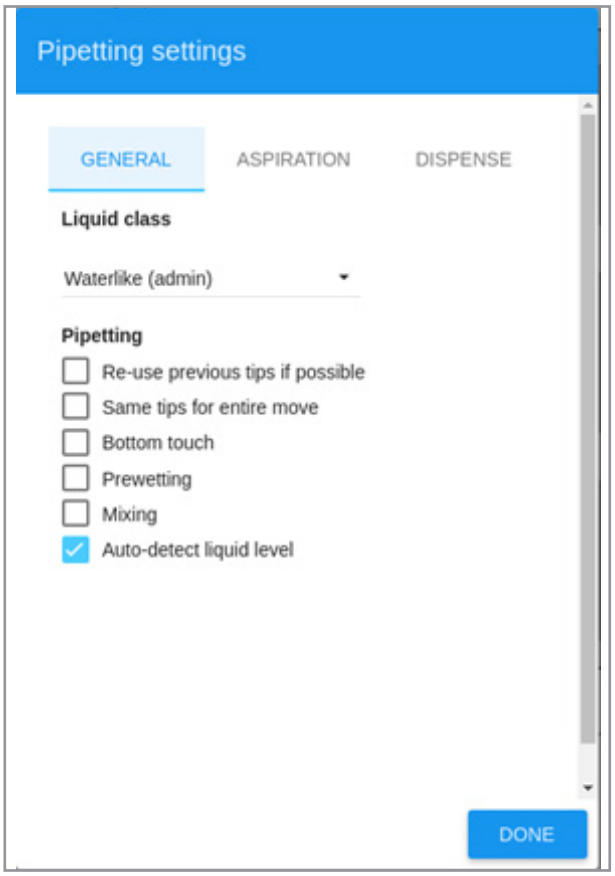
Each defined move can be edited or deleted, as shown on the screenshot, and reeordering the moves is done by drag and drop.

You can select all moves by clicking the Select all box at the top of this section. If you want to select many moves but not all of them, you can click Select all, and then deselect any individual moves you do not want.



Pipette settings

When defining programs it is possible to choose between various settings for pipetting techniques. Different techniques can be used for different moves in the same program.



In manual programs, the pipetting settings for a move can be defined by pressing Pipetting settings in the right side of the screen during the pipetting step. This will display the pop-up box. Each mode and setting option is described below.

Once chosen, these will be the settings for all the moves generated afterwards in this program, if they are not changed. It is also possible to edit each individual move on the left side by clicking on the Edit icon.

Please see chapters on **Pipetting settings** for a discussion on the different choices.

Pipetting settings GENERAL tab

Liquid Class

For each move, you can choose a liquid class that reflects the properties of the liquid you will be transferring. The liquid class determines parameters like the pipetting speed of different parts of the process, use of air gaps, etc. depending on the liquids in question. There is only one standard class. You can choose Waterlike class or create a new, custom class in the **Liquid Class Editor**.

Re-use previous tips if possible

If this box is checked for a move, the robot will re-use the tips already picked up in the previous move, provided that the following conditions are true:

1. The new move uses the same pipette as the previous move.
2. The new move uses the same tip type as the previous move.
3. There is no need for liquid level detection in the new move.

If any one of the above conditions are false, the robot will eject any tips mounted on the pipette before performing the move.

Note: The reason for 3. is that fresh tips are needed for liquid level detection.

Same tips for entire move

If this box is checked then the same tips will be used for the complete transfer.

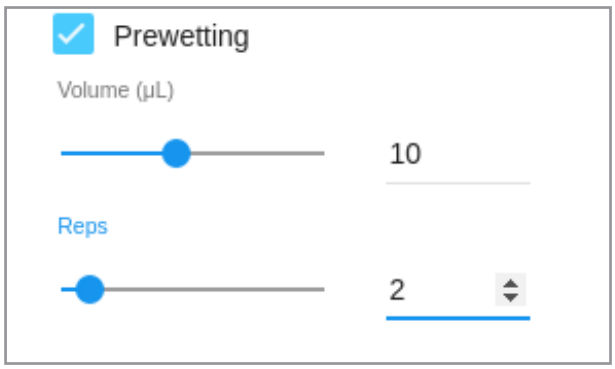
Bottom touch

The robot will touch the bottom of the target vessel after it has dispensed liquid to make sure no drops are hanging from the tip. This especially useful when pipetting small volumes into dry vessels.

Prewetting

Checking the prewetting option will display a pop-up for programming the robot to perform this at the start of each move. Prewetting tips reduces liquid adhesion to the plastic of the tips and increases dispension precision.

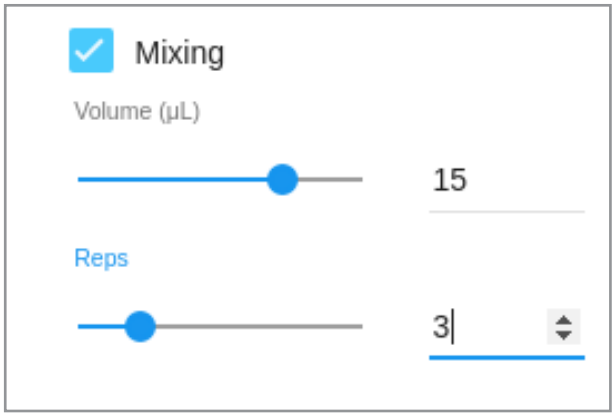
The setting displayed in the screenshot to the right would make the robot aspirate and dispense 10µL 2 times in the source vessel before actually aspirating the volume to be moved.



Mixing

Checking the mixing box will display a pop-up for programming mixing at the end of a dipsense, to comply with any application needs.

The setting displayed in the screenshot shown to the right would make the robot aspirate and dispense 15µL from the target vessel 3 times after having moved and dispensed the desired volume, thus mixing the target liquids in the target vessel.
For more thorough mixing, volumes and reps. can be increased.



Auto-detect liquid level

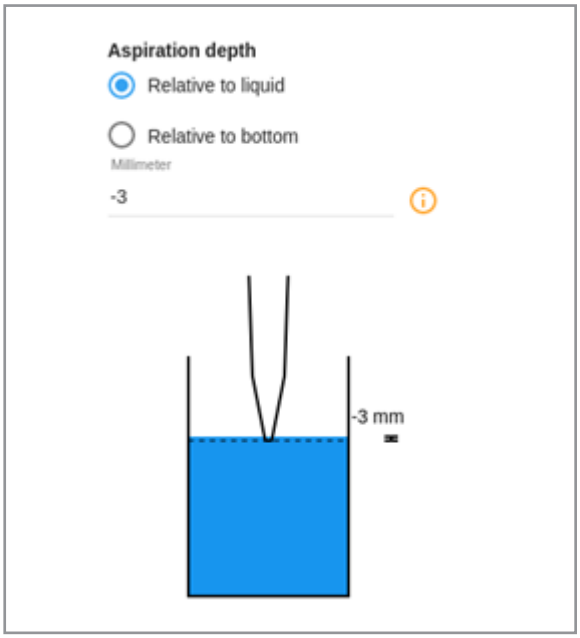
The robot will perform pressure-based liquid level detection from the source in this move provided that the source liquid level has not been detected earlier during the program. Small volume tips and liquids with low viscosity can't be used for liquid level detection. See section on **Liquid level detection.**

Pipetting settings ASPIRATION tab

Aspiration depth

In the ASPIRATION tab, the position of the tip at aspiration time can be adjusted. The standard is to use liquid level detection to position the end of the tip such that after finishing aspiration, it will be 3mm below the liquid level. This reduces the risk of dispensing air with the source liquid, and for adhering source liquid to the outside of the tip when aspirationg. It is recommended for most pipetting needs.

However, the aspiration depth can also be specified relative to the bottom of the vessel. This is useful for aspirating larger volumes and speeding up the execution process.



Pipetting settings DISPENSE tab

Dispense depth

In the DISPENSE tab, the position of the tip at dispense time can be adjusted. The standard is to place the end of the tip such that after finishing dispense, it will be 3mm below the liquid level in the target vessel. This reduces risk of formation of foam when dispensing, as well as keeping the tips relatively dry for further use. It is recommended for most pipetting needs.

Pipetting modes

In the settings window to the right of the deck, you can choose between two pipetting modes for each individual move:

Pipetting mode and Dispense (aliquot) mode.

Pipetting mode covers traditional pipetting, where the pipette more or less aspirates the excact volume it means to dispense. This is the pipetting mode to use when precision is important.

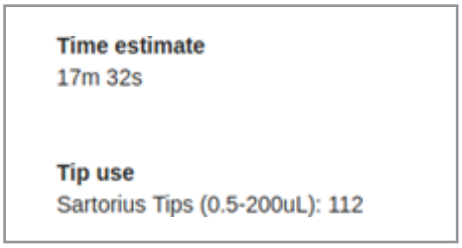
When using dispense(aliquot) mode, the robot can aspirate larger volumes of liquid and dispense it out into several target portions. This method can speed up the execution of the program, but will be less precise.

When creating a dispense move, set the mode on the right to Dispense (aliquot). Then you press Start dispense move. Here you specify the move like in the pipetting move. The only difference here is that you can add excess volume. If excess volume is chosen it will per default be dispensed back into the source but it can also be set to be dispensed into the waste container.

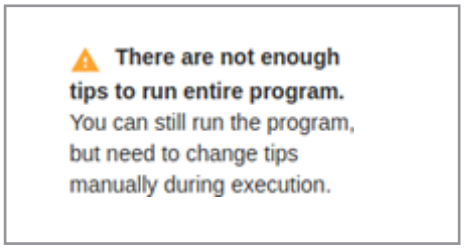
Save step

Once you have finished setting up an new program, you must check and save your program in the final Save step.

In this step a time estimate of the program is given based on the programming steps you have added.



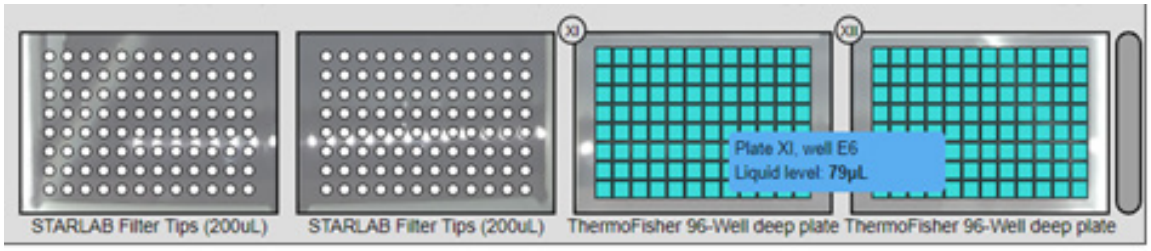
The number of tips required is also calculated, and a warning is given if the program needs more pipette tips than are reportedly placed on the deck.



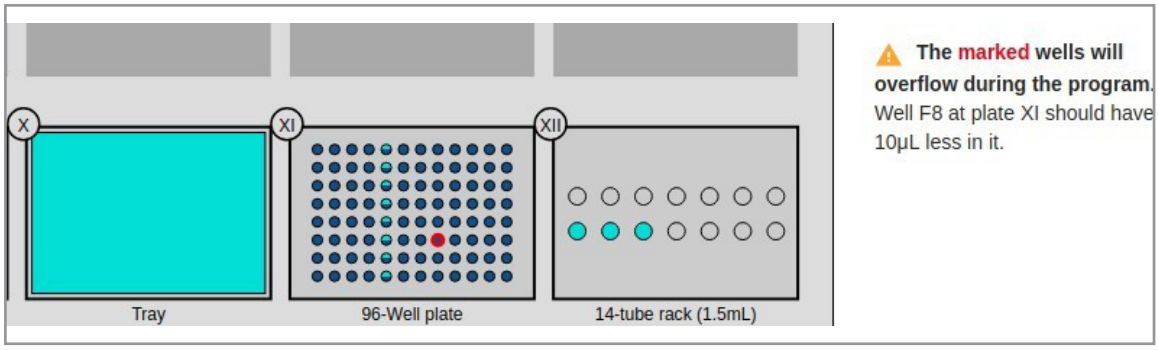
You can still run the program even though there are not enough tips or tipboxes on the platform. The program will be paused when it runs out of tips, and it will prompt you to replace the tipbox on the robot with a new, full tipbox.

Default liquid volumes

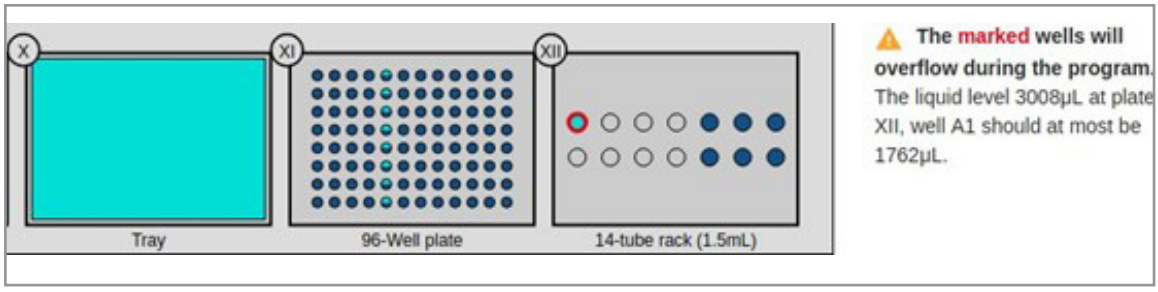
At the save step you are also guided to the minimum required liquid in the tubes/wells/vials to be able to run the program. Simply hover the mouse over a well/tube/vial, and the required minimum liquid will be displayed. See example below.



A warning is given if you have created a program, where you dispense more liquid in wells/tubes/vials than is actually possible calculated from the volume dimensions. A red circle will show the position and you are also guided to how much the dispensing of liquid should be decreased.



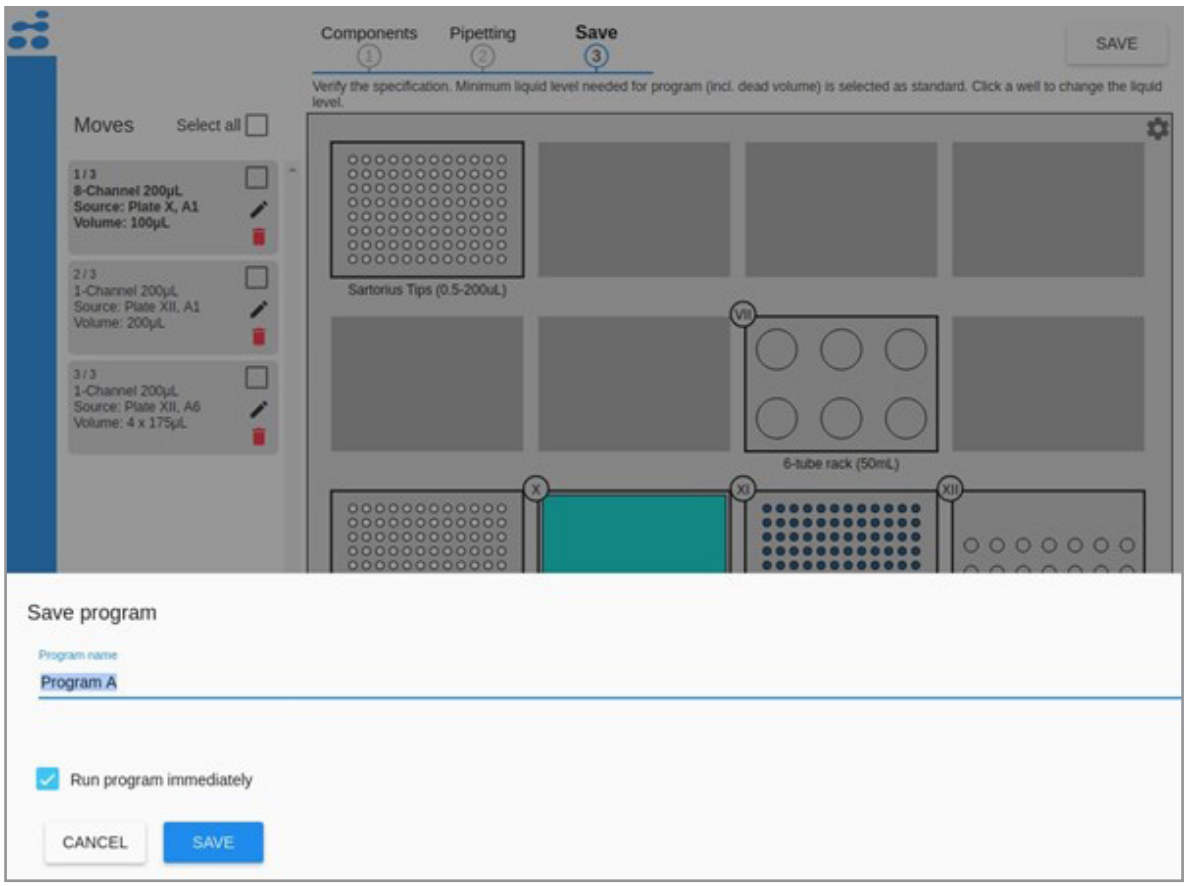
A similar warning is given if you aspirate too much liquid out of a well/ tube/vial. A red circle will show the position and you are also guided to how much the aspiration of liquid should be decreased.



Name program

When all checks are performed and your new program is returning no warnings or errors, you can give the program a name and save it.

The program can be run immediately or saved for later use.



LIQUID CLASS EDITOR

Because of the different properties of liquids used in laboratory applications it is useful to chance pipetting conditions as you change liquids to ensure optimal precision and speed for every step. This is done by adding the appropriate liquid class to every pipetting step, so parameters like aspiration speed and use of air gaps can follow the choice of liquid.

Any user can setup new liquid classes that control some of the pipetting-parameters, and we will use this chapter to describe the different parameters and provide advice for customization.

Aspiration

Under aspiration it is possible to control the aspiration speed used when pipetting for each of the pipettes. As a rule of thumb, slower aspiration gives better precision. It can be especially important for slowly flowing liquids to not move the piston of the pipette too fast.

The aspiration delay is the time the robot keeps the pipette in the source after moving the piston up. For slowly flowing liquids a higher value may be needed. Otherwise, equilibrium will not be obtained before moving the pipette out of the liquid leading to worse precision.

The retraction speed option is for both aspiration and dispense. It determines how fast the pipette tip is moved out of the liquid.
Note: Too high retraction speed can cause drops to hang from the pipette tip. So, if you have problems with drops hanging, consider decreasing the retraction speed.

Dispense

Under dispense, it is possible to adjust speed like for aspiration. As a general rule, the same advice can be used as for aspiration.

Air gaps

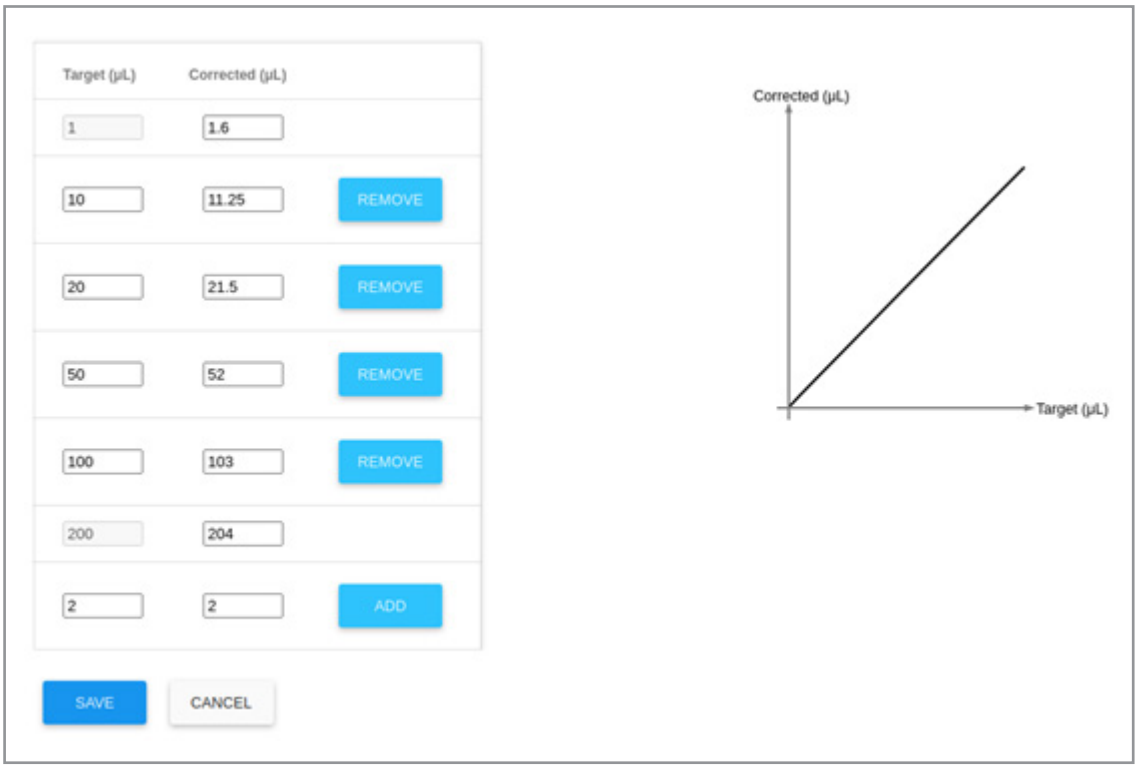
Air gaps that are sucked into the pipetting tips before or after liquids are often useful for pipetting precision and for avoiding droplets and dripping.

A leading air gap can be aspirated before aspirating liquid. The volume of the air gap as well as speed for dispensing the air gap can be manipulated to help pipetting tasks. A leading air gap will help ensure that all of the aspirated liquid is dispensed.
Note: Using a leading air gap can lead to air bubbles in the target vessel. In some applications it is more important to get all the liquid out, but in others it is more important to avoid bubbles. Depending on your application you can choose the leading air gap the fits your situation.

A trailing air gap can be aspirated after aspirating liquid. This can be very useful for containing liquids inside the tip that otherwise tend to drip out of the pipette quickly. It is usually not necessary with water solutions, but is recommended for more volatile fluids, e.g. ethanol.
Note: A trailing air gap may also lead to air bubbles in the target well, but not to a large extent if the target well is empty before dispensing there.

Calibration curve

A calibration curve is used to optimize accuracy and precision of the pipettes. Each pipette module is calibrated with water before shipment of the robots. To obtain high accuracy with other liquids it may be necessary to perform experiments and create a calibration curve for your particular liquid class. However, for most applications, this is overkill.



The main reasons a calibration curve is needed are the following:

1. Small differences in production of pipettes
2. Expansion of air during aspiration

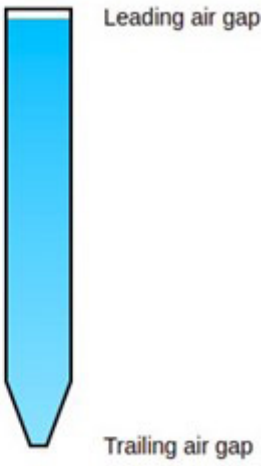
Regarding 2., if the piston of a pipette is moved up to free up 100µL of space, the air above the liquid will expand slightly, resulting in a bit less than 100µL liquid being aspirated. To compensate for this phenomenon, a corrected volume is used. In the example above, when aspirating 100µL of liquid, the piston will be moved up to free 103µL of space. A linear interpolation will be used between any two calibration points on the curve. E.g. in the example above, if aspirating 150µL of liquid, the piston will be moved up by (204µL + 103µL) / 2 = 153.5µL

Standard liquid class for water

The standard parameters for the liquid class for pipetting water can be seen below for the 20µL, 200µL and 1000µL pipettes respectively.

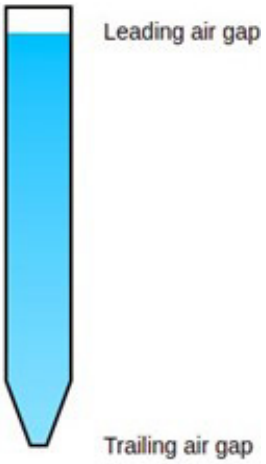
20 µL pipette

Leading air gap		**Trailing air gap**	
Leading air gap	5 µL	Trailing air gap	0 µL
Leading air gap speed	20 µL/s	Trailing air gap speed	20 µL/s
Leading air gap min speed	3 µL/s	Trailing air gap min speed	3 µL/s
Leading air gap acceleration	20 µL/s²	Trailing air gap acceleration	20 µL/s²
Leading air gap deceleration	20 µL/s²	Trailing air gap deceleration	20 µL/s²
Aspiration		**Dispense**	
Aspiration speed	70 µL/s	Dispense speed	70 µL/s
Aspiration min speed	3 µL/s	Dispense min speed	5 µL/s
Aspiration acceleration	20 µL/s²	Dispense acceleration	50 µL/s²
Aspiration deceleration	20 µL/s²	Dispense deceleration	300 µL/s²
Aspiration delay	500 ms	Dispense delay	500 ms
Retract speed	25 mm/s		



200 µL pipette

Leading air gap		**Trailing air gap**	
Leading air gap	15 µL	Trailing air gap	0 µL
Leading air gap speed	20 µL/s	Trailing air gap speed	20 µL/s
Leading air gap min speed	3 µL/s	Trailing air gap min speed	3 µL/s
Leading air gap acceleration	20 µL/s²	Trailing air gap acceleration	20 µL/s²
Leading air gap deceleration	20 µL/s²	Trailing air gap deceleration	20 µL/s²
Aspiration		**Dispense**	
Aspiration speed	78 µL/s	Dispense speed	78 µL/s
Aspiration min speed	3 µL/s	Dispense min speed	5 µL/s
Aspiration acceleration	78 µL/s²	Dispense acceleration	78 µL/s²
Aspiration deceleration	78 µL/s²	Dispense deceleration	300 µL/s²
Aspiration delay	500 ms	Dispense delay	500 ms
Retract speed	25 mm/s		



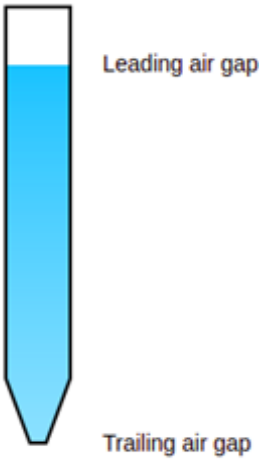
1000 µL pipette

Leading air gap	
Leading air gap	35 µL
Leading air gap speed	20 µL/s
Leading air gap min speed	3 µL/s
Leading air gap acceleration	20 µL/s²
Leading air gap deceleration	20 µL/s²

Trailing air gap	
Trailing air gap	0 µL
Trailing air gap speed	20 µL/s
Trailing air gap min speed	3 µL/s
Trailing air gap acceleration	20 µL/s²
Trailing air gap deceleration	20 µL/s²

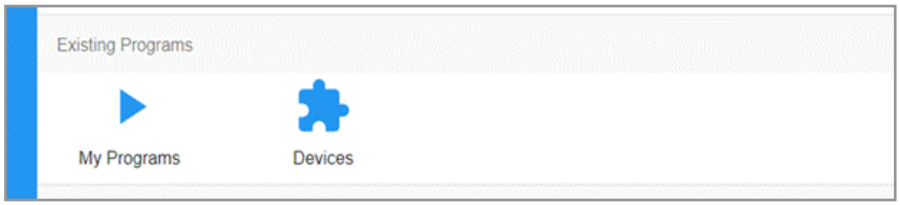
Aspiration	
Aspiration speed	313 µL/s
Aspiration min speed	5 µL/s
Aspiration acceleration	313 µL/s²
Aspiration deceleration	313 µL/s²
Aspiration delay	500 ms
Retract speed	25 mm/s

Dispense	
Dispense speed	313 µL/s
Dispense min speed	5 µL/s
Dispense acceleration	313 µL/s²
Dispense deceleration	313 µL/s²
Dispense delay	500 ms

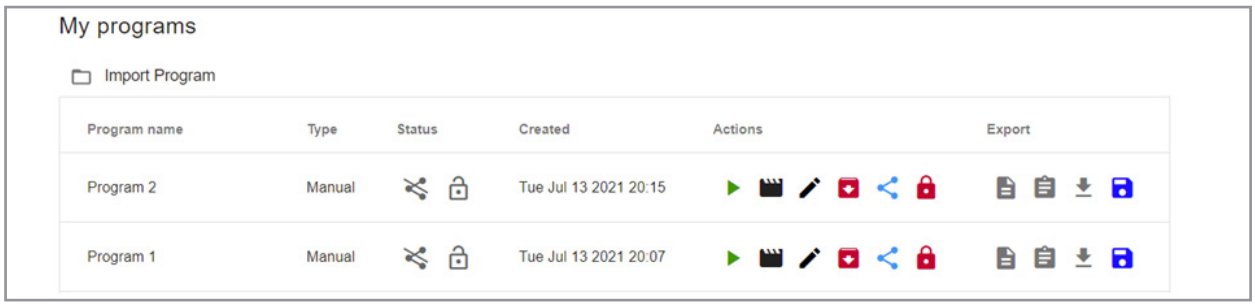


PROGRAM EXECUTION

To find a program to run, click the My Programs icon in the Main Dashboard.



In the My programs overview there is access to all programs available to you.



My programs: Your saved programs, accessable only to you.

Shared programs: Programs shared by you or other users of the flowbot® ONE. You can also choose different actions for each program, as seen below.

Archived programs: Programs removed from program lists. Can be restored or deleted completely. Archived programs give access to execution logs for otherwise obsolete programs.

Actions

From the My Programs menu you can choose different actions to perform for each program, as you can see in the list of action icon descriptions below.

Run program: Start the run of a program.

Preview program: Visually review the program.

Edit program: Add/delete components, pipetting moves, change volumes, set up, or pipetting sequence. A locked program cannot be edited.

Archive program: Archive program to remove it from your list of programs and move it down into the archived folder. From the archived folder you can delete it permanently.

Share program: Share a program with all users of the flowbot® ONE. When a program is shared it is locked and cannot be changed or deleted.

Lock program: When a program is locked it cannot be changed or deleted.

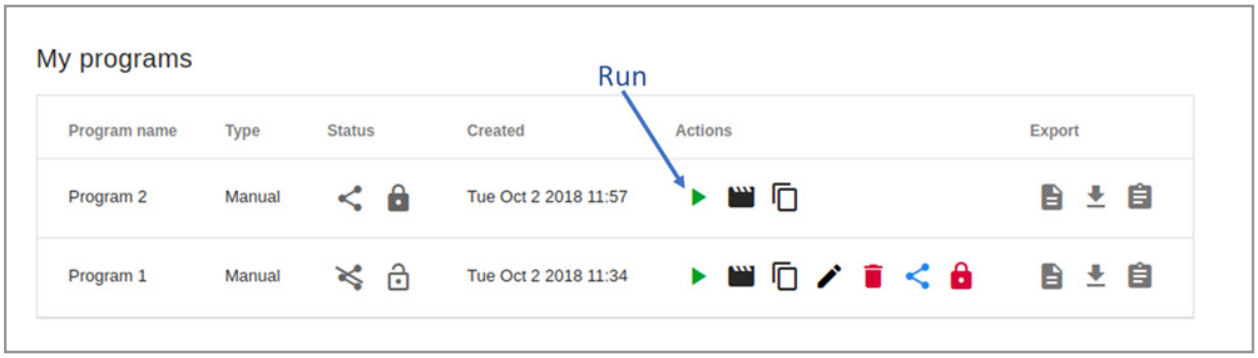
Download PDF: A PDF file is immediately available with detailed information of the program

Download CSV: A CSV file is immediately available. This file can be used to load programs onto other flowbot® ONE's or for editing and uploading onto the flowbot® ONE.

Download execution file: Execution files for all runs of the program can be found immediately and downloaded as a PDF file. The execution log will include sample IDs, user name and logs of every step in the execution.

Download program: Download the entire program, including components and liquid classes in a json format. This format is not for editing, but only for exporting and importing programs between robots.

Execute

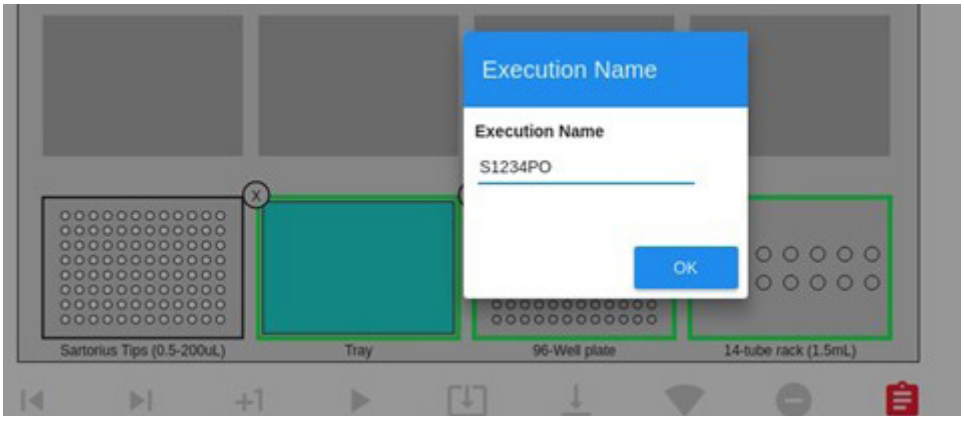


To execute a program you select Run Program under Actions.

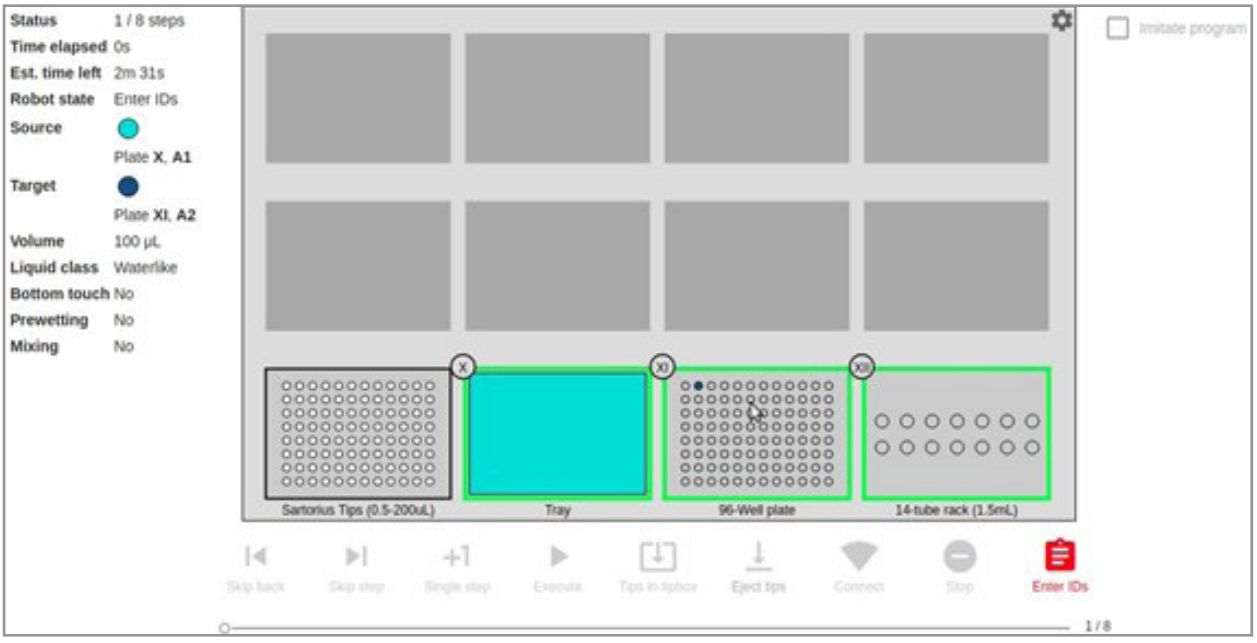
An overview of the deck with the required components is shown. Fill up your deck as pictured on the program overview. Any components marked with a QR code on the bottom should be automatically recognised. In case the auto-recognition fails, or when registerring other components, the component can be manually selected by clicking on the red square. Click on the component to confirm that the component is placed correctly on the robot deck, and remove the red square.
When no more red squares are present, you can run the program by clicking Run Program in the top right corner.

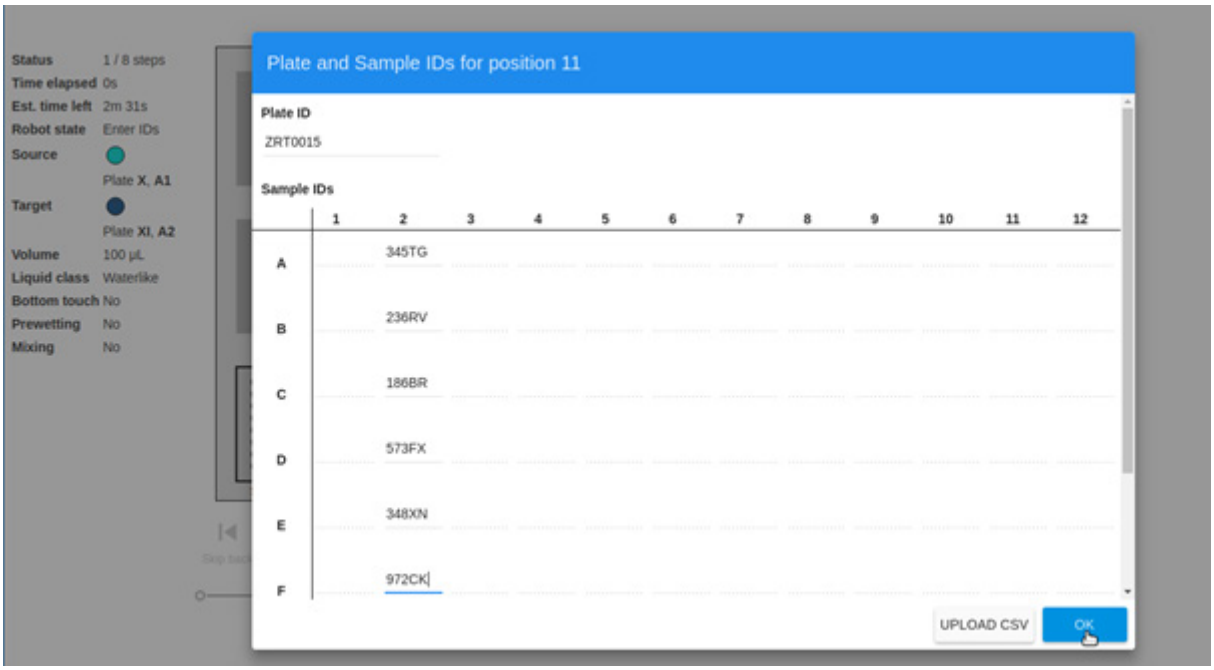
Enter IDs

Before connecting to the robot, you can type in an ID for the execution and/or samples – entering an ID is optional and not a requirement. To enter the IDs simply click Enter IDs and type in the Execution Name or click OK if you want to skip that step.



The plates available for adding IDs will have a green square around them. Click on the component, for which you want to type/scan in sample IDs and type/scan in the information.



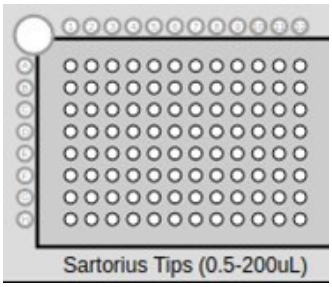


You can either type/scan in the sample ID or upload it from a CSV file.

When you have typed in all relevant IDs and names, then close this function by clicking the Enter IDs icon.

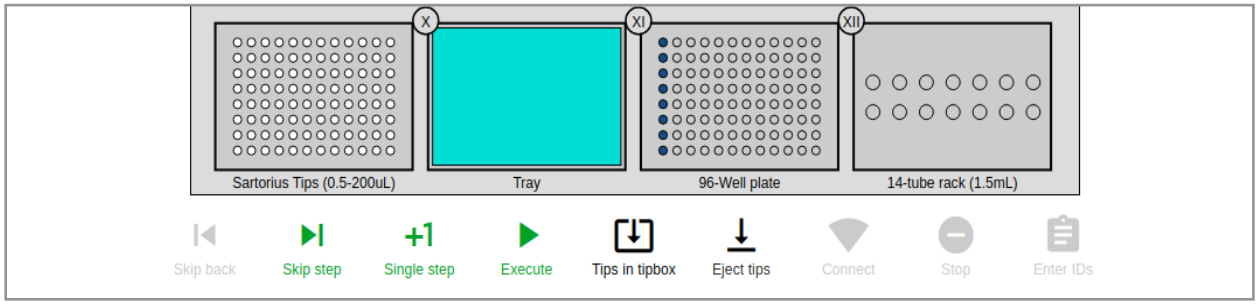
To execute, click Connect to connect to the robot.

Load tips



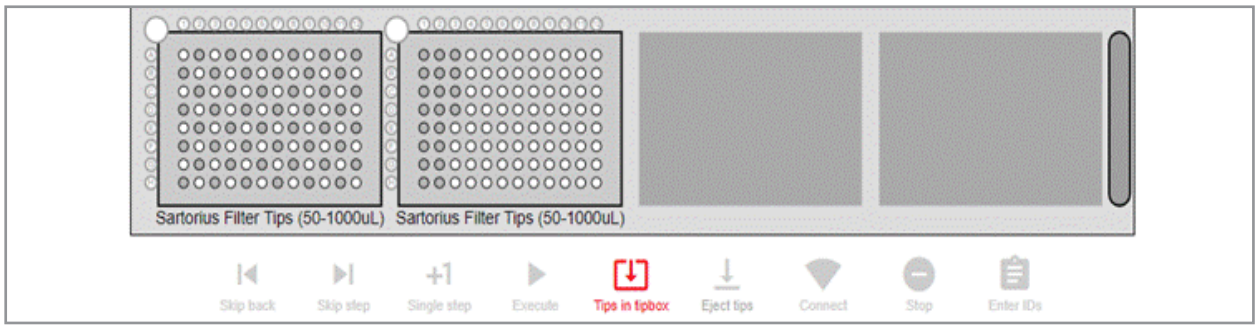
Per default it is expected that every tip box is fully loaded with pipette tips and the tips are shown as white circles in the tip box.

If you are using a partially filled tip box, it is possible to inform the robot in advance. Before starting the program, click the icon Tips in tipbox.



Now you can deselect any rows/columns/single positions where there are no tips. Positions without tips will be greyed out. Select by either clicking individual tips or columns. Tips can also be selected with drag and drop.

For some 4-channel pipettes, a diagonal grid is used to hold back tips at pickup. You can select this diagonal pattern in the tip box by pressing the white circle in the top left corner of the tip box. Multiple clicks will rotate the options.



Click the icon Tips in tipbox to return to the execution mode.

Changing liquid levels

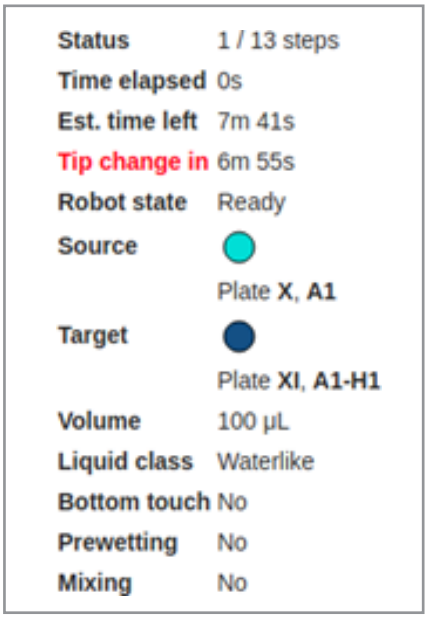
Liquid levels for whole plates or individual wells can be edited before executing the program by clicking on the plate. A pop-up allows you to edit values for the whole plate, rows, columns, or individual wells. Programs come with either calculated minimum levels need from source wells, or customized level when the program was created. If the liquid level detection function isn't used, adjusting the liquid level to the actual level can improve the aspiration and dispense performance.

Now the program can be started by clicking the icon Execute and the program will start executing.

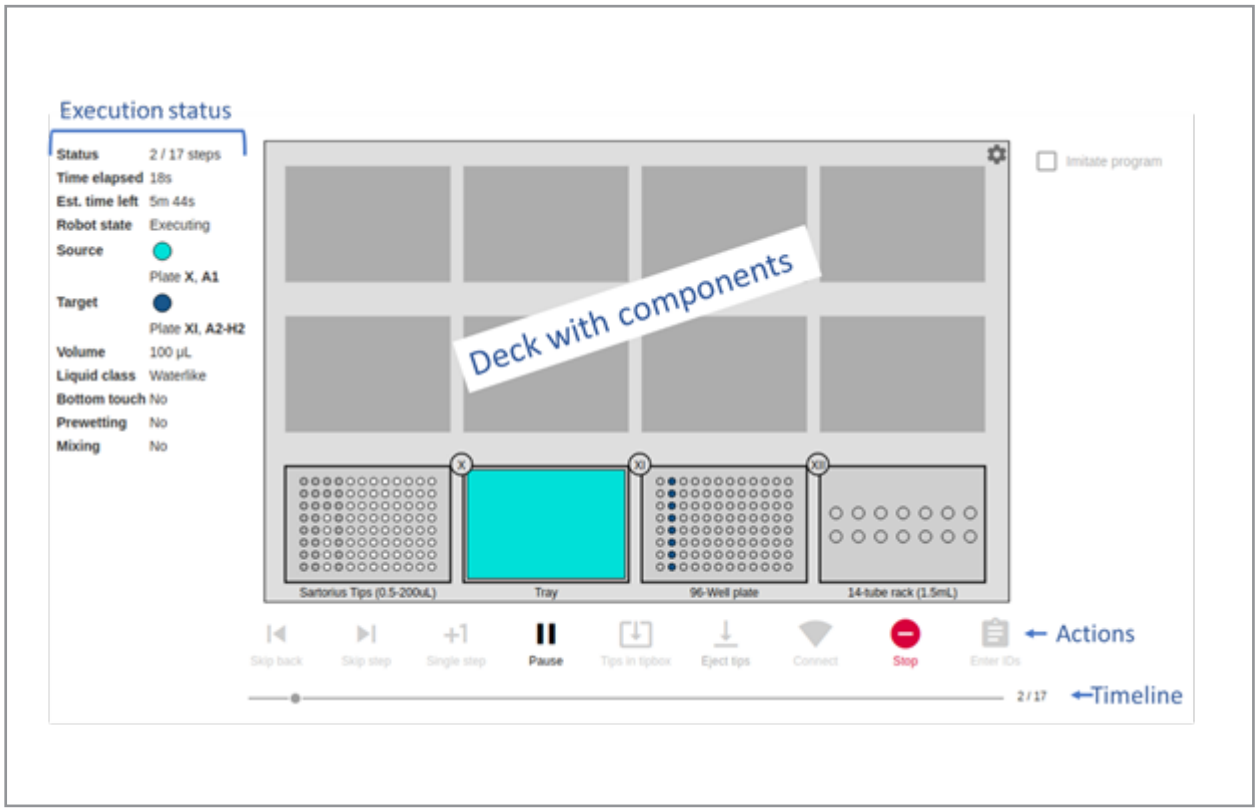
You can choose to run only a single step by clicking the Single step icon. The robot will perform 1 step and automatically stop.

You can also choose to only run part of the program, this is done by starting at a different step than step number 1. Here, the function Skip step can be used to navigate in the program.

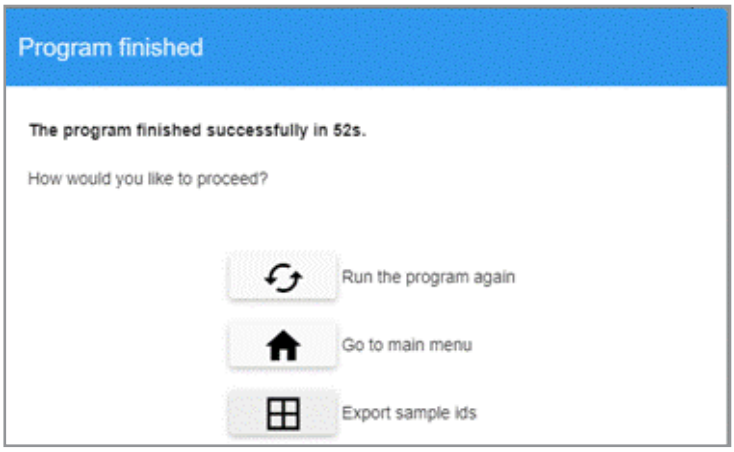
If you have started the program with too few pipette tips, then you will be guided to when to change the pipette tips. flowbot® ONE will stop and wait for pipette tip change when it calculates, there are no tips left.



During execution the following window is shown, with time progress and the estimated remaining time. From here, the program can be paused or stopped completely by clikng the appropriate icons.



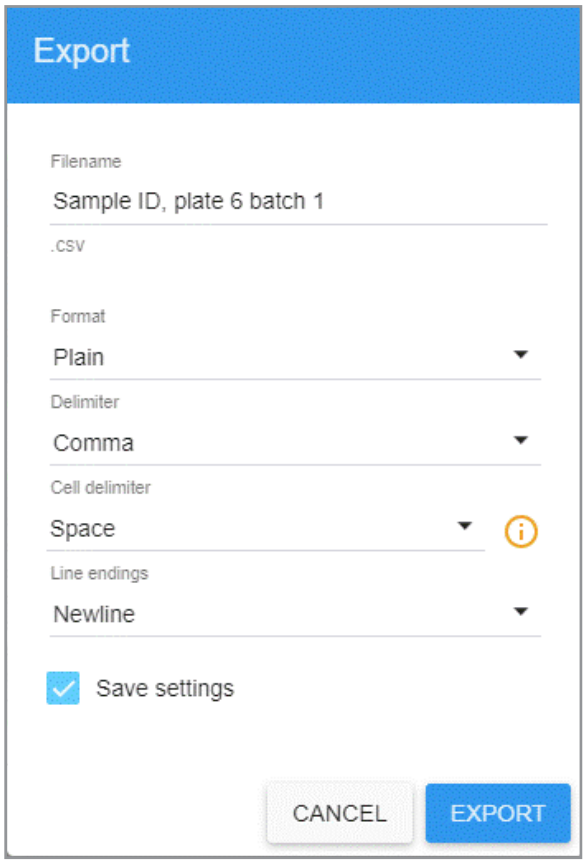
At the end of a program, you will get a pop-up with 3 options
- Run the program again
- Go to main menu (Main Dashboard)
- Export sample IDs



The last option lets you export sample IDs from any position on the work area. The available plates will be marked with a green frame. Click on a plate position to export.

Sample IDs are also available from the execution log under My Programs if you want to get the sample IDs later.

Name the sample and set export options. If you check Save Settings, the same export options are saved for all exports. Click Export. A csv-file will be downloaded to the default download folder on your computer.

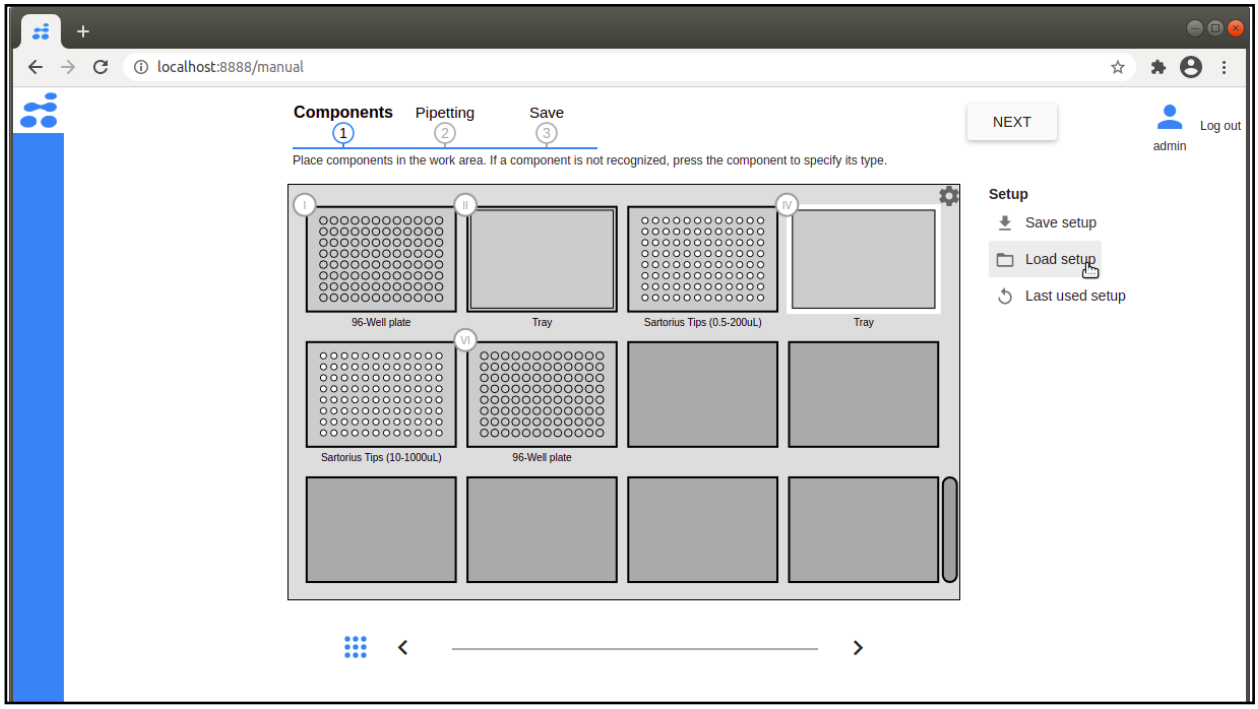


CREATE AND EDIT PROGRAMS USING CSV FILES

Instead of defining programs manually in the user interface, you have the option to specify them in a spreadsheet using the CSV format. The details of the format is described in the **Appendix**. Note that breaks and device actions are not supported in the CSV format.

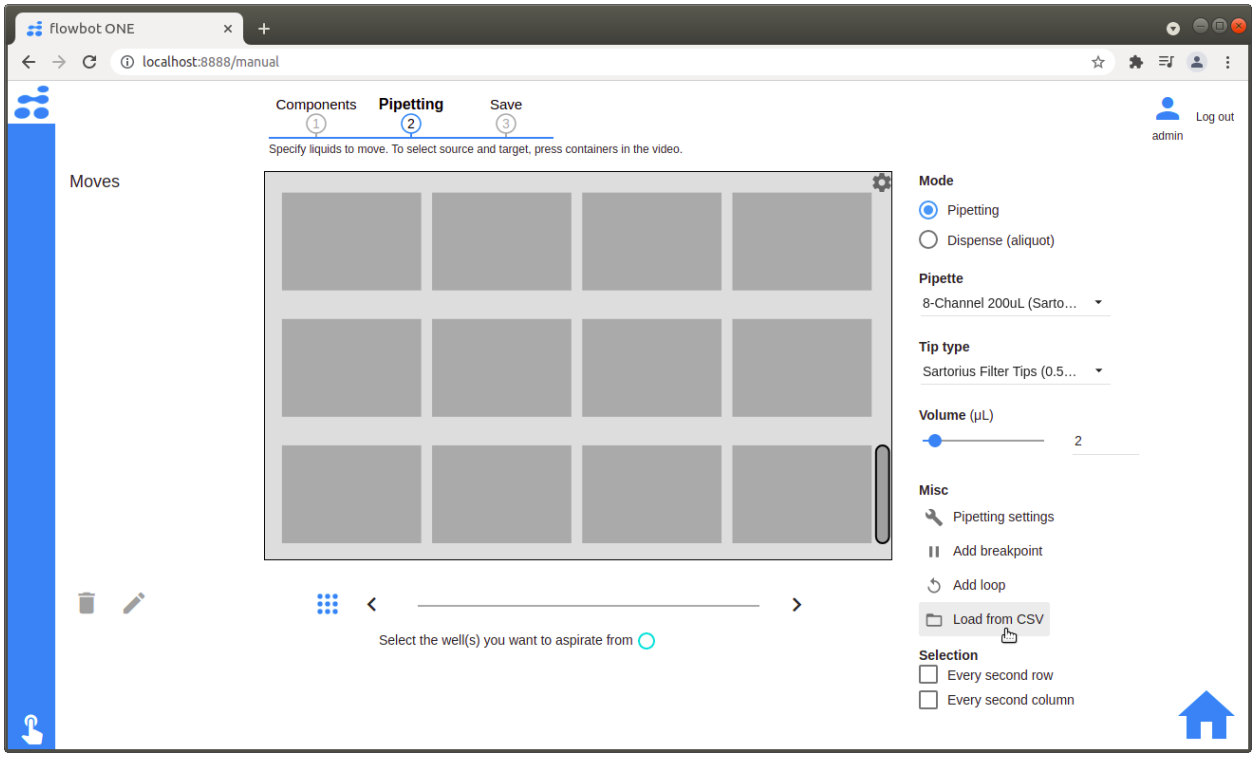
Importing CSV files

To import a CSV program, two files are used. One with setup data, the other with the program commands. Click the Manual icon from the Main Dashboard. Click Load setup and browse to your setup CSV file. Your setup should now be visible in the user interface as shown below.



Click the NEXT button in the upper right corner to go to step 2, Pipetting.

Click Load from CSV and browse to your program CSV file. Your program should now be visible in the user interface as shown below, and you can edit it like you would with any other program.



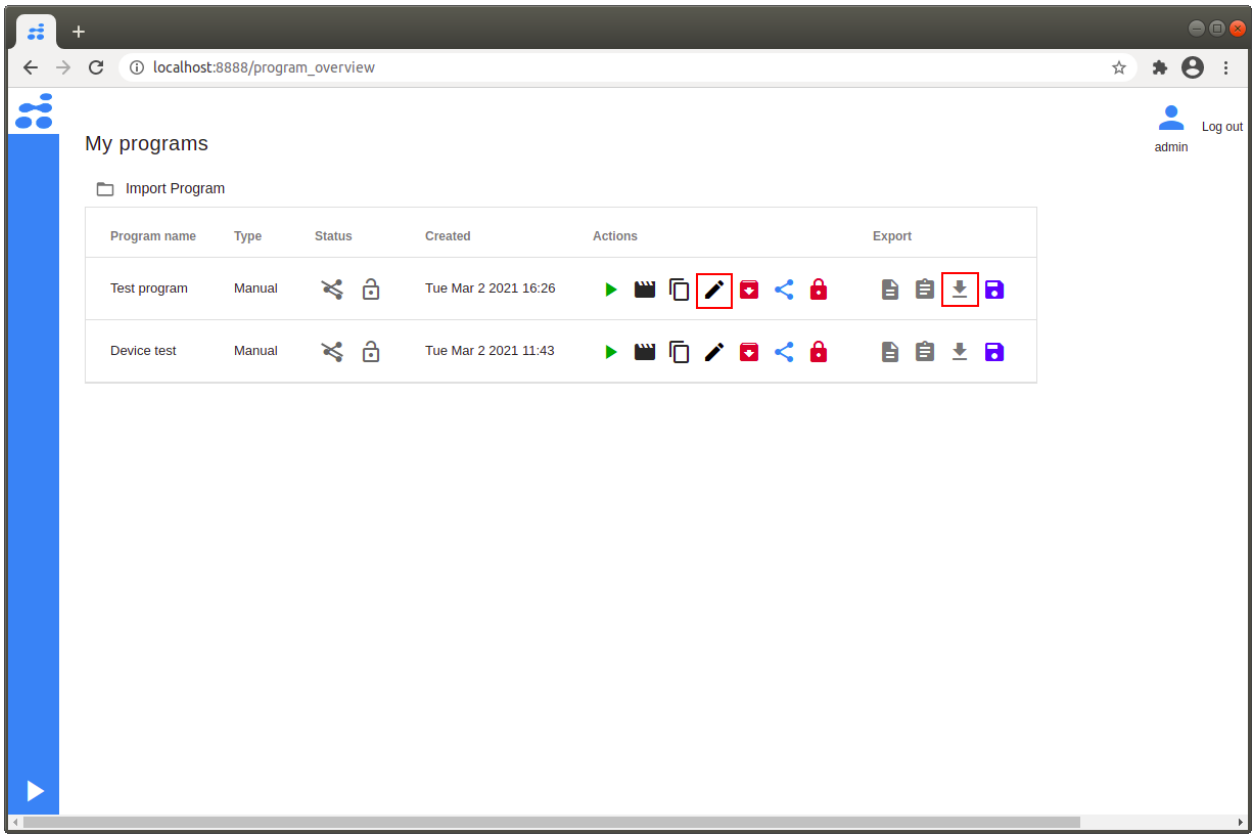
If you are inserting the program CSV file into an already started program, you can choose where to insert them in the program.

Exporting CSV files

You can also export existing programs as CSV files and view/modify those.

To prepare a program for export to CSV file, go to My Programs from the main menu and click the pencil icon (marked in red on the picture below) to edit the program. From here you can click Save setup to download the setup CSV file - it's just above the Load setup button.

To export a program CSV file directly, go to My Programs from the Main Dashboard and click the download icon (also marked in red on the picture below) to download the program CSV file.



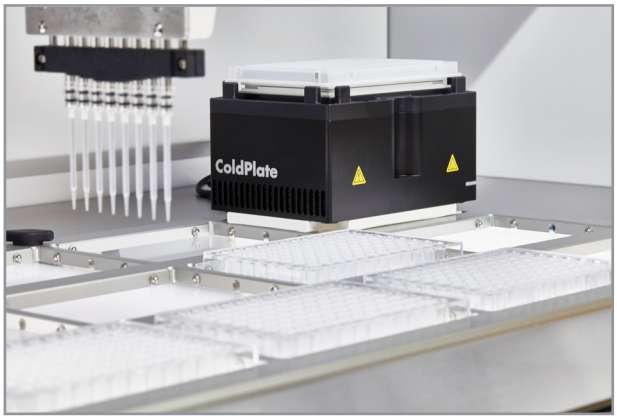
DEVICES, SETUP AND USE

With the flowbot® ONE you have the option of adding different devices to optimize your setup. Each device, except the handheld barcode scanner, will take up one position on the deck and use an outlet position on the backplate.

Device overview

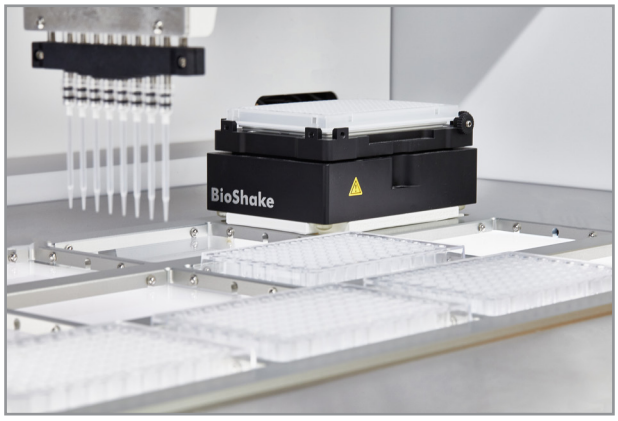
ColdPlate

The ColdPlate provides quick and precise temperature control. The Heater-cooler thermoblock is fully adjustable between -10°C and 99°C. The ColdPlate is plugged into the RS232 port on the back panel. Different exchangeable adapter plates for tubes, plates etc. can be purchased with the device.



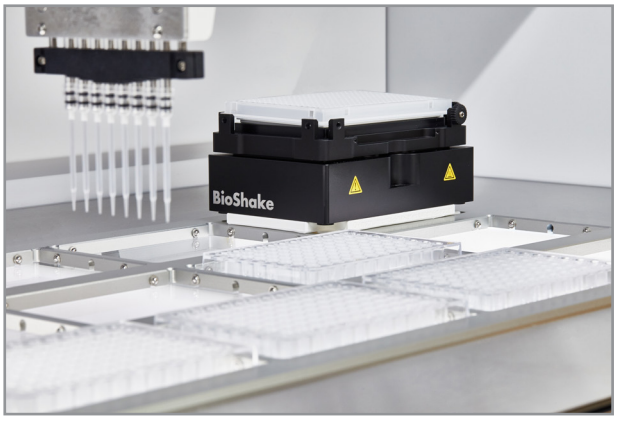
Bioshake 3000

The BioShake 3000 provides reliable mixing of your samples. The BioShake can be adjusted between 200 to 3000 rpm. Different exchangeable adapter plates for tubes and vials etc. can be purchased with the device. The BioShake is plugged into the RS232 port on the back panel.



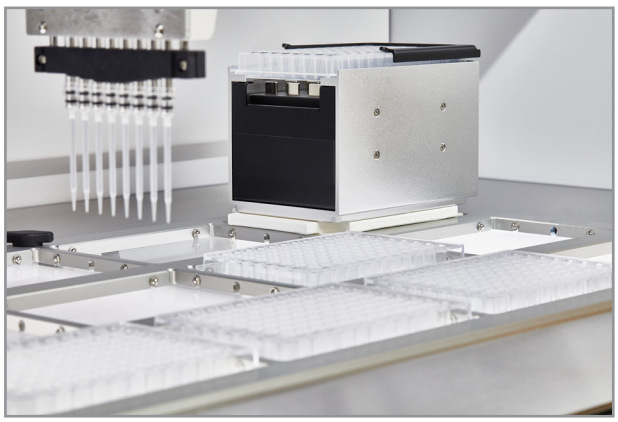
BioShake 3000-T

Just like the BioShake 3000 the BioShake 3000-T provides reliable mixing of your samples but with an addition of the possibility to add temperature control to it. With the BioShake 3000-T you have high-precision heating from ambient to 99°C. The BioShake can be adjusted between 200 to 3000 rpm. Different exchangeable adapter plates for tubes and vials etc. can be purchased with the device. The BioShake 3000-T is plugged into the RS232 port on the back panel.



MagDeck

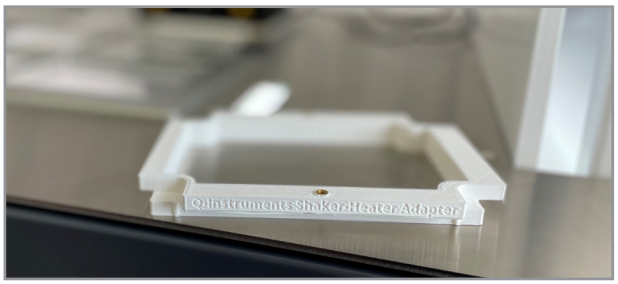
With the magnetic module you have the option of running magnetic bead-based purification protocols. The magnetic module has high strength magnetic bars that can be engaged and disengage by raising and lowering them. It is ready to be used with your own plate labware from 22mm to 44mm. The MagDeck is plugged into the USB port on the back panel.



Handheld Barcode Scanner

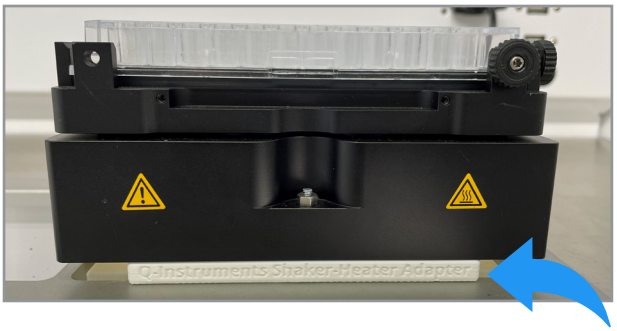
By using the handheld barcode scanning function with your flowbot® ONE you can ensure full traceability of your processed samples. The Handheld Scanner is plugged into the user computer USB port. After the program has run you can get the output in CSV format for downstream processing.

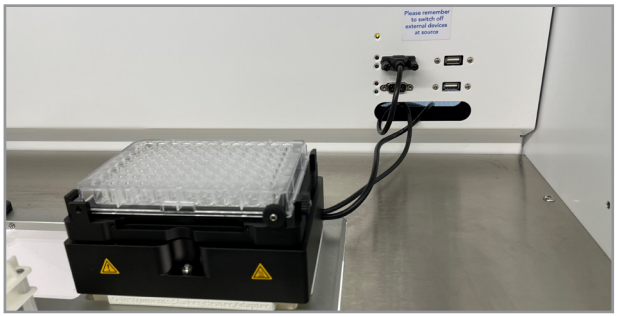
Device Installation



Connecting a device

To connect a device, you need to attach an adapter (above) to the device, so it fits into one of the positions of the robot. Use a 2 or 2.5mm hex key to fasten the screws.
The adapter is a little wider on one side. This side should be placed to the right when positioned on the work area positions, so the cables extend from the far right corner. This is in order to offset components on the device correctly.
With the robot turned off, insert the RS-232/USB connector and draw the power cable through the hole in the corner. You can also direct excess wire from the data cable through this hole to tidy up the work area. Once positioned, you can turn on the device and the robot. Note that devices have an external power source. Please remember to switch off external devices at the source after use.



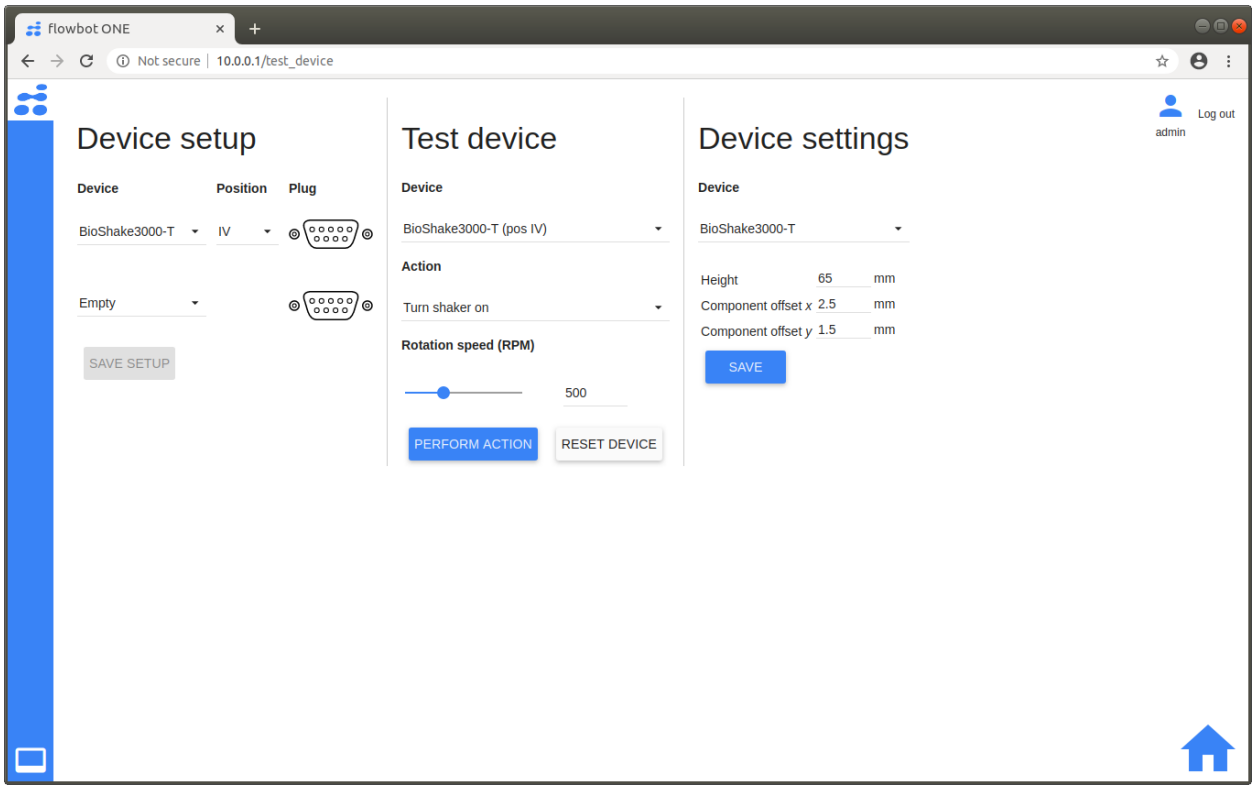


Device setup in the user interface

From the Main Dashboard go to Devices. From the dropdown menu, select the device you just attached in the corresponding RS-232/ USB plug and select the slot position you put it in. Always use the top USB port first. Click SAVE SETUP when you are done. The page will now refresh, and the robot will check the connection to the device.

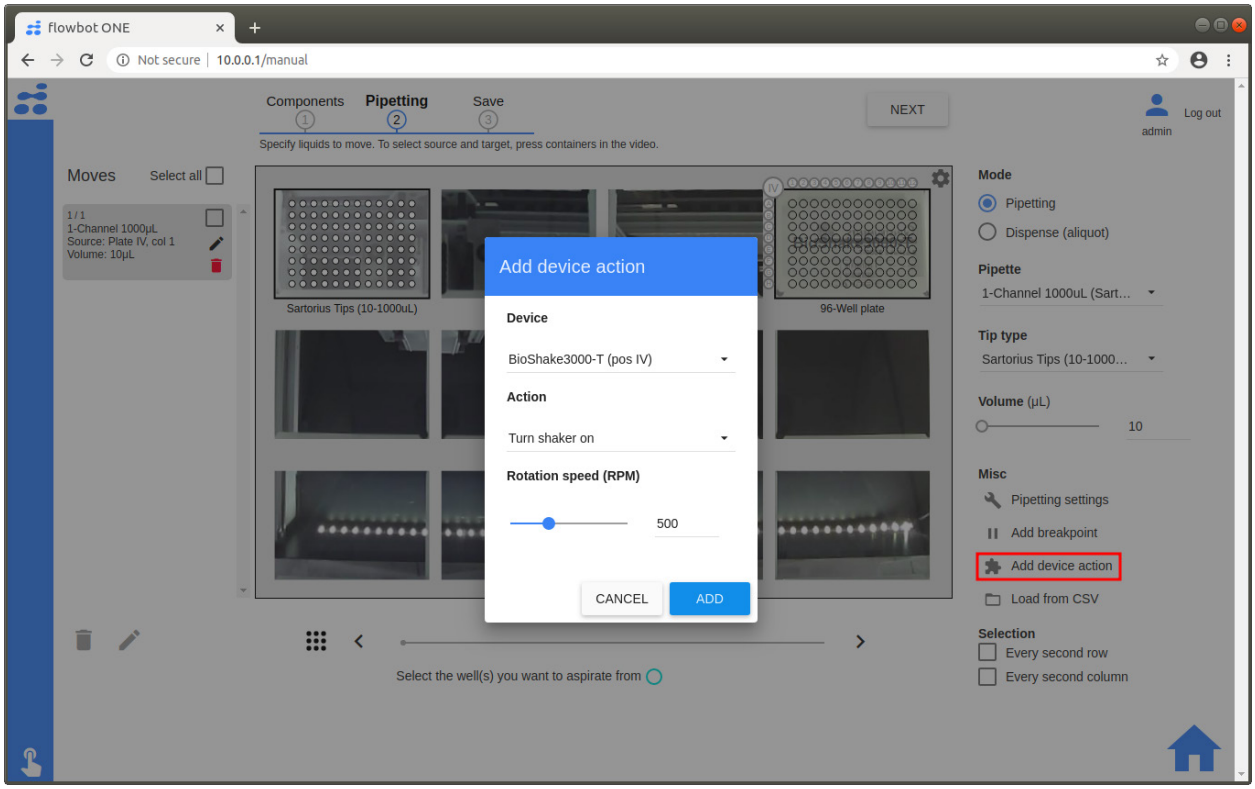
Now, you can test the device via the controls below. Simply select the device and the desired action and parameters, then click PERFORM ACTION.

Depending on the component you place on top of the device and how it is fastened, it can be necessary to adjust the offsets of components placed on the device. Adjust it up/down (Height), left/right (Component offset (x)), and back/forth (Component offset (y)).



Creating programs with device actions

You can use device actions in manual programs. In the Components step, you add components on the device slot, as you would in any other slot. In the Pipetting step, you can add device actions at any point in the program. Simply click Add device action and select the desired action and parameters, then click ADD.

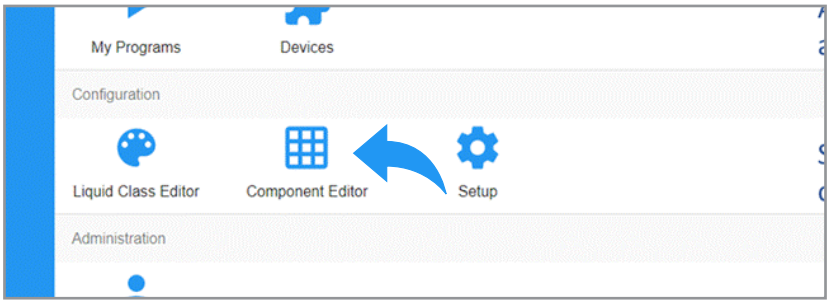


COMPONENT EDITOR

With the component editor you can download, edit, share or create a new component. From here you can also print QR codes for your components.

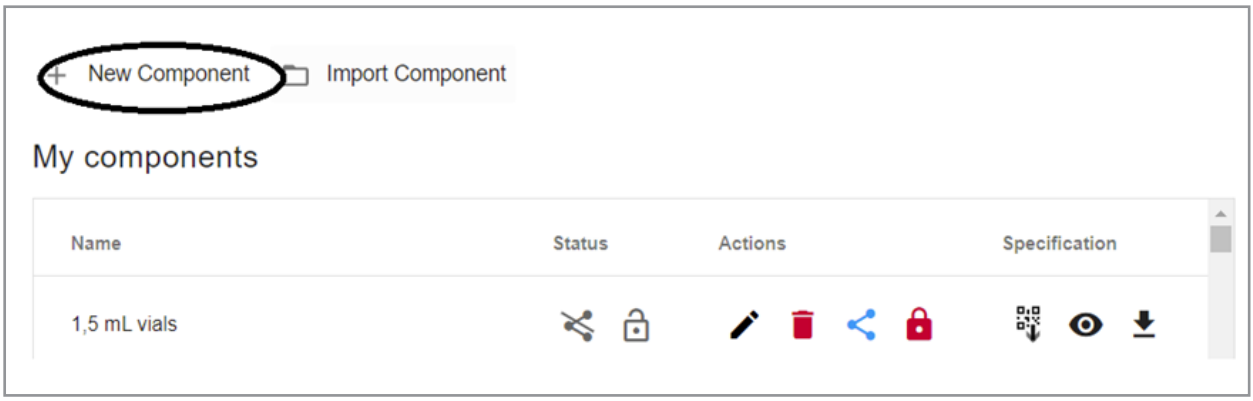
Creating new components

In the following, we have described how to create a new component in the flowbot® ONE software. For the displayed example, a rack for DIN vials was created.



Choose Component Editor from the Main Dashboard.

Select New Component



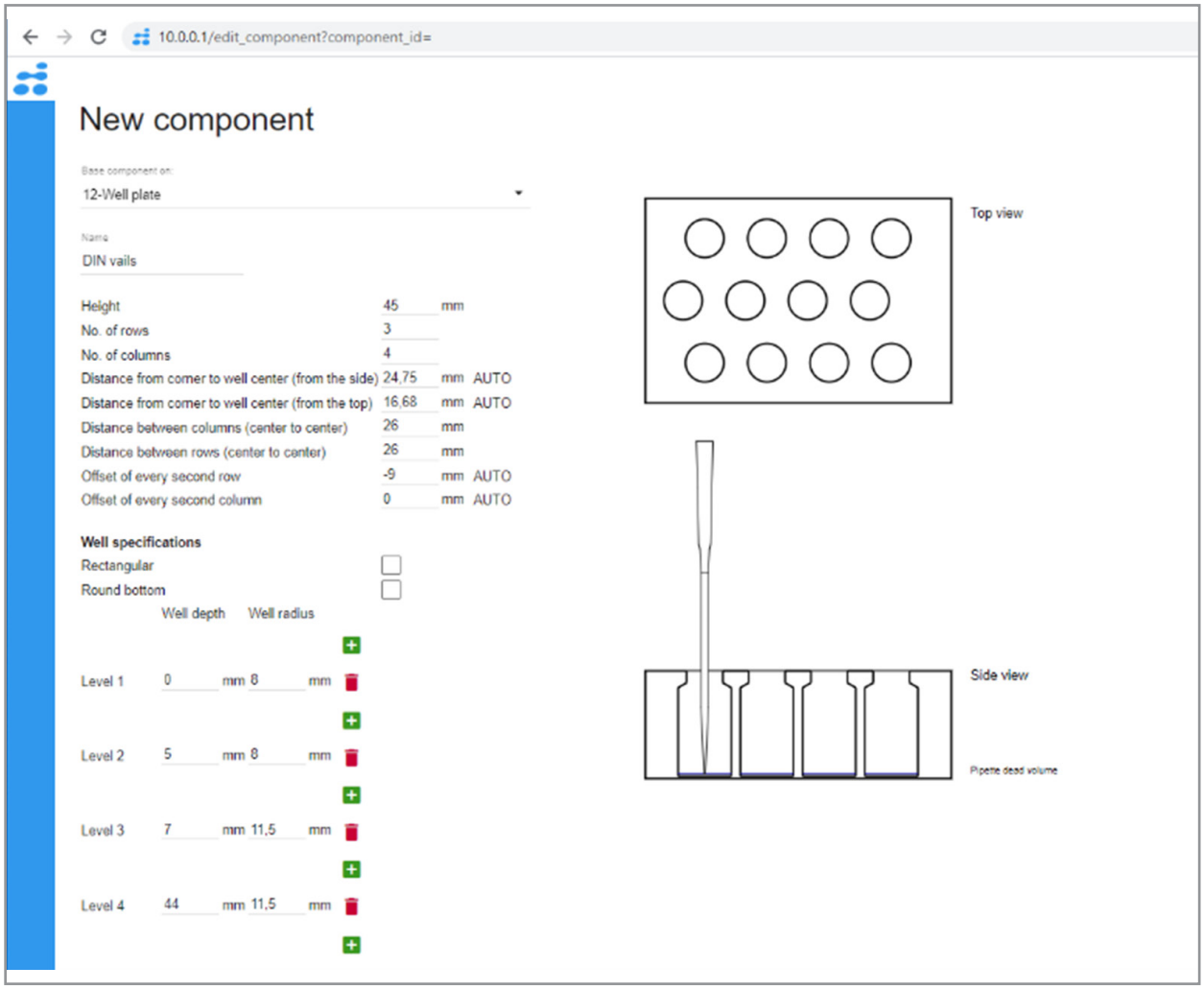
Select Base component on: 12-well plate.

When making a new component you should choose to base the component on an already defined type, which is close to the new component to be defined.

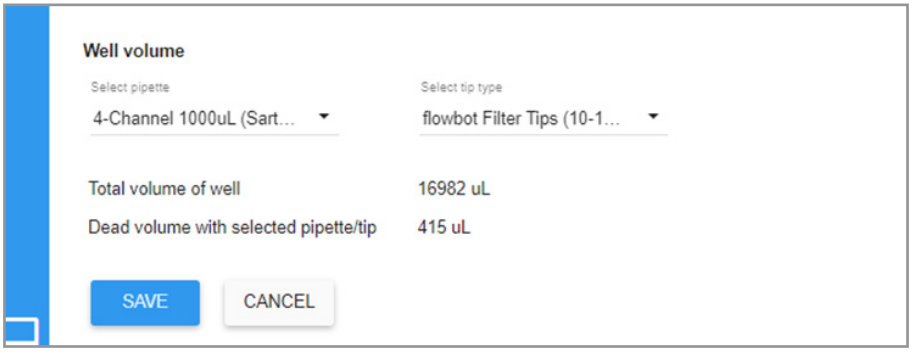
Name the new component: DIN vials. Adjust settings according to the measured physical dimensions of the component.

You can add or remove level lines to describe the well. These dimensions are both used to calculate liquid height and to check how far down tips can access.

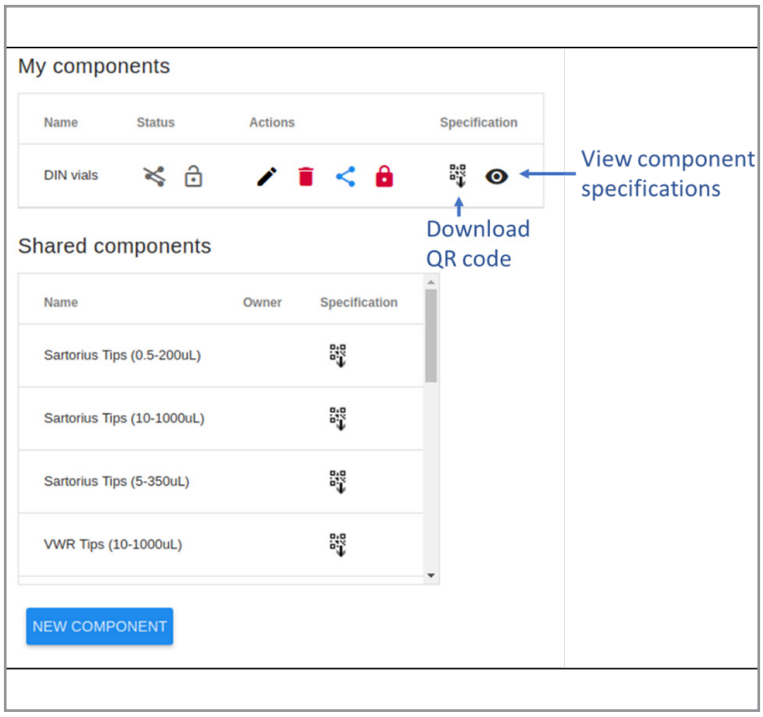
AUTO will center rows and columns, if the component is symmetric.



Notice that the well volume and dead volume both are calculated when making changes. Select pipette module and tips to calculate the correct dead volume. Using the correct tips will also tell you if the tip is able to access the bottom of the well. 1 mm from the bottom is calculated as dead volume, not accessible for the tip. Using narrow geometrics may increase the dead volume.
Save the new component.



The component is now visible in the My components overview.



Notes on the importance of correct measurements when setting up components

Measurement of components such as tubes and well-plates is a critical part of successfully setting up protocols on flowbot® ONE.

These are important for several reasons
1. When the robot moves the pipettes around, it will use the dimensions (e.g. height) of components to make sure it does not hit anything unintendedly.
2. When the robot knows the volume in a vessel, it will use the specification of the component to compute where the liquid level is and use this computation to place the pipette tip correctly when aspirating and dispensing from the tube.
3. When the liquid level changes in a vessel, for instance when aspirating 0.5mL from a 2mL tube, the robot will know that there is 0.5mL less liquid in the vessel next time it aspirates from it. To calculate the position to aspirate from, it will use the specification of the component.
4. The robot uses the specification of a vessel to decide how far it can go with the pipette tip without the tip getting stuck due to the vessel being too narrow. Thus, if a tube is specified narrower than it actually is, the robot might not want to move to the bottom of it. On the other hand, if a tube is specified wider than it is, then the pipette tip might get stuck inside the tube because the robot moves too far down.

Each of the issues above can lead to unintended consequences. Therefore, when measuring new components and entering specifications, it is a good idea to test that the robot works well with the components before using them in real protocols.

1. To ensure that placement of tubes/wells/vials are correct, test that the pipette tip position is in the middle of the tube/well/vial in each of the corners of the component.
2. To ensure the well dimensions are correct, test that you can empty the tube/well/vial without aspiration of air.

Editing and sharing components

The component editor also lets you edit and share the components. Each component listed gives you its status, available actions, and an overview of specifications, as shown on the following page.

There are 2 lists of components. My components holds the ones you have created yourself, or if you are logged in as Admin, the default components from Flow Robotics. Shared components show components shared by other users, and tip boxes, for access to printing QR codes. Tip boxes cannot be edited from here.

See the list on the next page, for an explanation of the component lists.

Import component

Components can also be imported from a json text file. Press the Import button in top of the screen. Two components cannot share a name. If you are importing a component with the same name of an existing one, you will be prompted to change it.

Status:	
	**Shared:** Shows if the component is shared to other profiles on the same robot.
	**Locked:** Shows if the component is locked. And therefore, can't be edited by other users.
Actions:	
	**Edit component:** Change dimensions for component. Keep in mind changes can affect other users if the component is shared.
	**Delete:** Removes component. If the component is share to other profiles the delete option is removed. If it is in use in a program, or have been used, you will be prompt to delete the program before the component can be deleted.
	**Share program:** Share a component with all users of the flowbot® ONE. When sharing you get the option to also lock it (see below). If shared and unlocked, other users can also edit it. Sharing can't be undone.
	**Lock component:** When a component is locked it cannot be edited or deleted.
Specifications:	
	**Download QR code:** A PDF file with 8 QR images is immediately downloaded to your default download folder. For printing and placing under the components.
	**View specifications:** Access to see component details. Not available for tip boxes.
	**Download:** A .json text file with component specifications, allowing sharing of components between flowbot® ONEs.

ADJUSTING LIQUID LEVEL DETECTION PARAMETERS

The Liquid Level Detection (LLD) function primary depends on tip hole size and the porosity of the tip filter. Liquid viscosity and surface tension can also have an influence. If tips have inconsistent filters, it might not be possible to do LLD. I.e., sometimes there will be false positives, when the robot thinks it has found liquid in mid air. Other times, there will be false negatives, when the robot does not detect liquid even though the tip is emmersed in the liquid. In such cases, the robot would simply move the tip all the way down to the bottom through the liquid. If you have a component where you know the liquid level, then it is usually safest not to use LLD. LLD also takes more time.

LLD does not work with small tips like 20µL.
The detection works individually for each channel in multi-channel pipettes. The lowest of the detected levels is used for setting aspiration depth. If level differences are found to be too large for the tips to handle, an error message will appear. Both tip length and volume can restrict this.

LLD works by monitoring the cylinder pressure delta while sucking in air through the tips and syringe is moving down. Change in pressure indicates liquid detection. The pipette will retract again before aspiration. You can adjust the liquid level pressure delta in Setup and Tip Boxes, making individual settings for each tip type. All pressure deltas are listed negative, in hPa. Press Save after changing setting for a tip type.

- If the robot finds the liquid level in the air before hitting the liquid, make the delta larger (more negative).
- If the robot doesn't find the liquid, but have the tips submerged in the liquid, make the delta smaller (less negative)

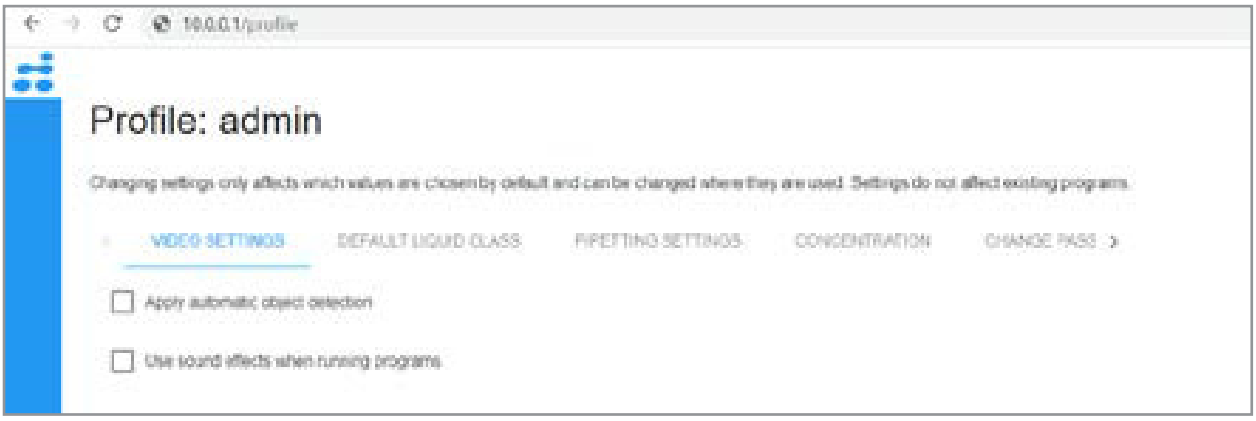
Pressure delta values are usually found between -0.3 to -3.0 hPa. Test with several tips after changing delta values, to make sure detection works consistently.

ADMINISTRATION TOOLS

On the Main Dashboard there is a row called Administration. This is where you can edit your profile settings. If you are logged into an account with Admin rights, you will also be able to create new users, backup your robot data, or retrieve logfiles. As default, the robot has one Admin account, from where the installation will be performed. However, it is recommended to create at least one separate User or Admin account for running the robot.

My Profile

In My Profile you can change default values for several features. These default values can often be overridden directly when editing programs, moves, etc. This page is also where you will be led to if clicking on the User icon in the top right-hand corner.



Video settings

In Video settings you can change whether you want to apply the automatic object detection. This feature has cameras under the work area deck of the robot recognize QR codes on the bottom of placed components automatically.
You can also turn sound effects on and off. Sound effects are programmed to occur when a program finishes, if a program runs out of tips, if liquid level is not found during a program, if there is a break, or if a problem occurs.

Automatic QR code detection is enabled by default, whereas sound effects will need to be turned on, if desired.

Default Liquid Class
The only liquid class available on the robot at installation is ´Waterlike´. This will be the liquid class used when creating programs, unless the default is specified otherwise after installation. If you want a different liquid class to be selected by default when defining new protocols, this is where to change the default.

Pipetting settings
Here, you can change the default prewetting settings for the different pipette modules. Select the pipette module for which you want to specify the prewetting settings, and specify if prewetting should be selected by default, which volume to use and how many repetitions to perform. When setting up a new program and choosing prewetting, the software will preselect the values you have specified.

Concentration
In Concentration you can change the default unit of concentration, which is mg/mL at installation. This is preselected e.g. when creating a normalization program and/or single source dilution.

You can also choose the following concentration units:
g/mL – grams per milliliter
µg/mL – micrograms per milliliter
ng/µL – nanograms per microliter
g/L – grams per liter

Change Password
Here, you can change the password of the account you are logged in to. You must know and enter the current password in order to make the change to a new password. If you have forgotten your current password, please refer to the section under Users. It is important not to change the password for the Admin account.

Aspiration/dispense depth

When creating and editing programs, you can set the dispense and aspiration depth to fit your application. By default, the robot will position the tip after finishing aspiration to be 3 mm below the liquid level. When dispensing, the default is also to position the tip 3mm below the liquid level after dispensing. The aspiration and dispense depth can be specified either relative to liquid level or relative to the bottom of the component. The values set as default here, will be preselected when creating new moves.

Scan settings

This feature is only available if you have a handheld barcode scanner system with your flowbot® ONE.
When scanning your samples before running a program, you can specify the default settings for the scan direction. This can be changed in the program when scanning the samples. The scanning direction will per default be set to column-wise, meaning that it will take the first column and scan downwards in the rows. If you want it to scan from left to right you should change it to row-wise. Here, you can also change the settings if you have more than one sample-ID (scans) per well by default.

Users

This is a feature that is available on accounts with Admin rights. Here, you can create new users, reset passwords, delete, or give Admin rights to the different accounts.

New User

Here, you can create a new user, which also creates a separate account in the robot software that is able to create, edit and run its own programs. You must specify a username and password, and determine if the account should contain Admin rights or not. (Admin rights allow access to more options in the software. It is recommendet to limit Admin rights to one account, the original Admin account.) Then you press SUBMIT and the new user is created. You are now ready to log out of the Admin account and into the newly created account.

Reset password

From the Admin account or any other accounts with Admin rights you can reset the password for any of the created users. There is a drop-down menu where you can select the User you wish to reset the password for. This does not require knowing the existing password, as Admin you can simply create a new password that will overwrite the existing one.

User administration

In User administration you can see a full list of all users and delete individual users. It is also possible to give other accounts Admin rights.

Backup

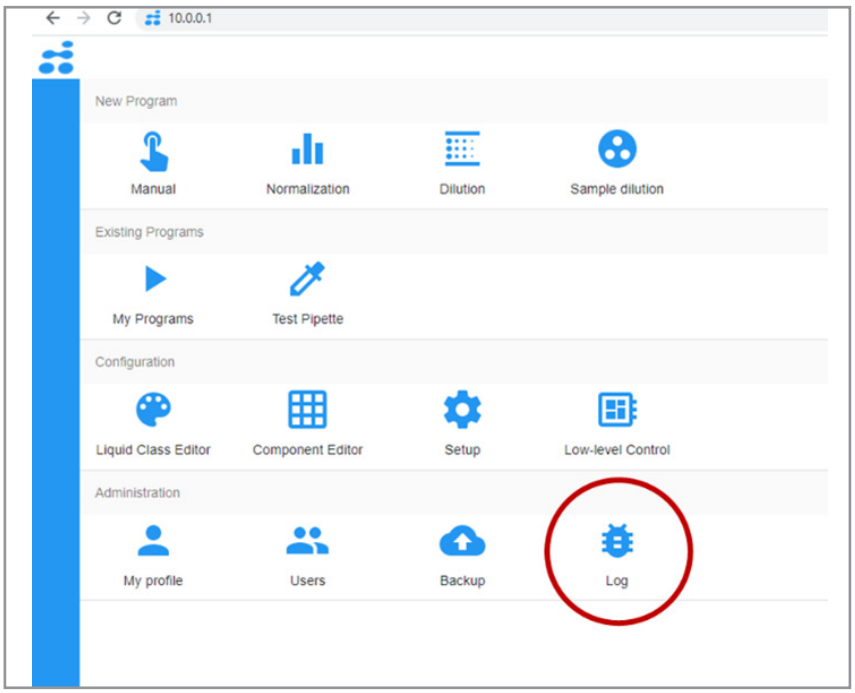
Backup to file and Automatic backup

On this page, you can create a backup archive and download it. You can also configure automatic backups, where you can instruct the flowbot® to perform a backup in the following intervals: daily, weekly, monthly, or never. By default, all robots will be set to automatically backup on a monthly basis. Automatic backups are placed on an external SD card placed in the robot CPU.

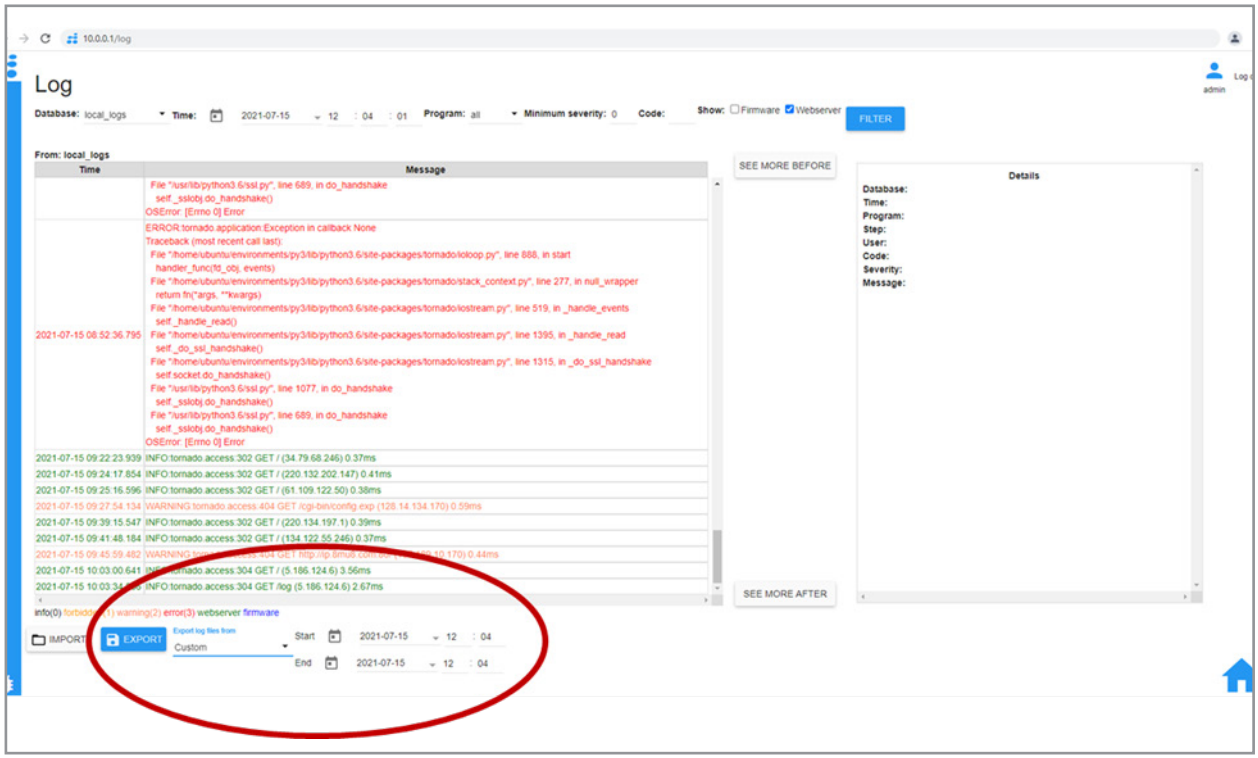
Log

The robot logs information related to almost all processes, both while executing procedures or changing settings, programs, etc. On this page you can view the log and export logs for a certain time-period. If you experience issues with your flowbot® ONE, and the troubleshooting section does not cover your issue, we suggest you export the logs here and forward them to your local representative. The log menu is available for the Admin profile and users with Admin rights. The downloaded file is a zip file. Send the entire zip file to your support team.

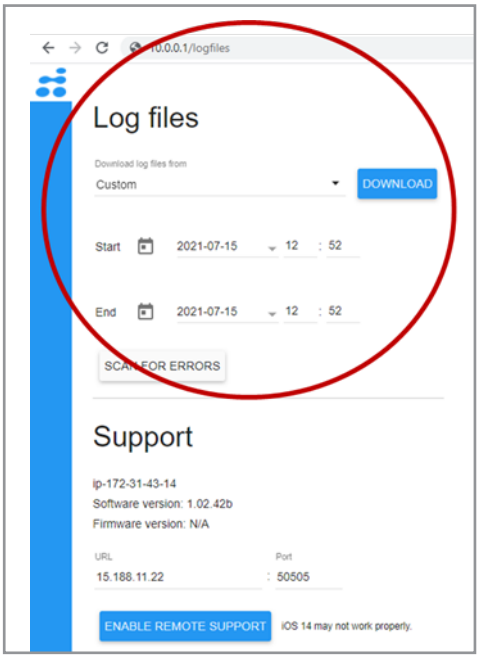
Finding the log from the Main Dashboard:



Log menu from SW version 1.03.xx:
Choose time range for log file down. From Last hour to As long as possible. The later can generate very large files. For more precise data, choose Custom and select start and end for log file.



Log menu for old SW version 1.02.xx:



TROUBLESHOOTING

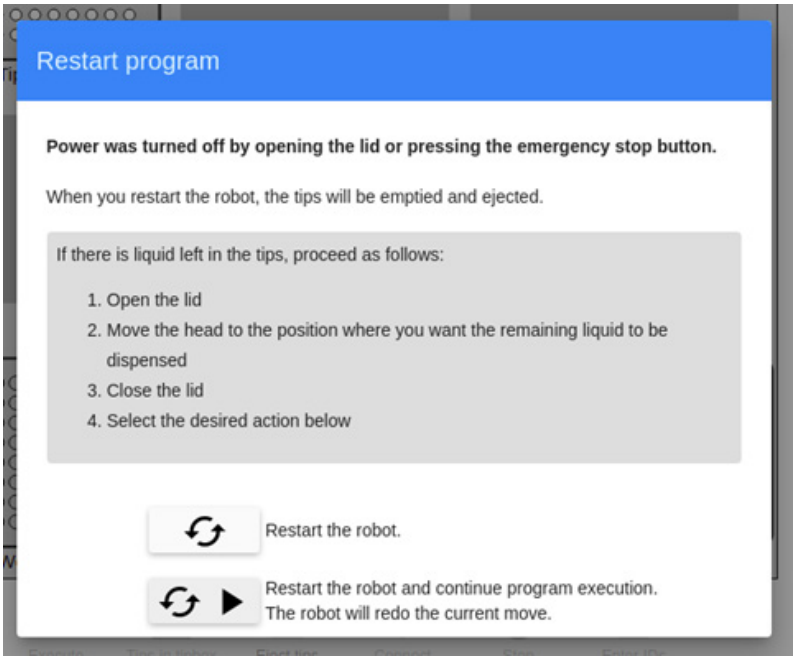
This is a list of the most common and reported incidences from the field. Please do not hesitate to contact Flow Robotics if something occurs that is not on this list.

Common info pop-ups

Power off

Log error code: 072
Occurs if you open the lid or press the red stop button on the robot. After closing the lid and/or un-pressing the stop button, you can:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.
- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.
- Click next to the popup and go to the main menu to abort execution.



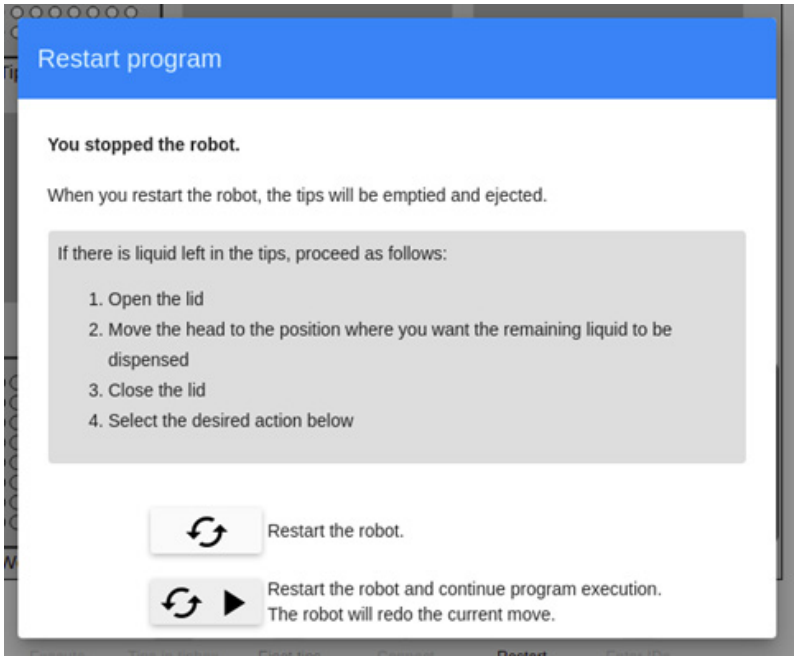
Full stop

Log error code: 023
Occurs if you click the red stop button in the user interface. When you're ready to resume, make sure the lid is closed. You can proceed as follows:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.

- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.

- Click next to the popup and go to the main menu to abort execution.



Out of tips

Occurs if the robot runs out of tips. You may proceed as follows:

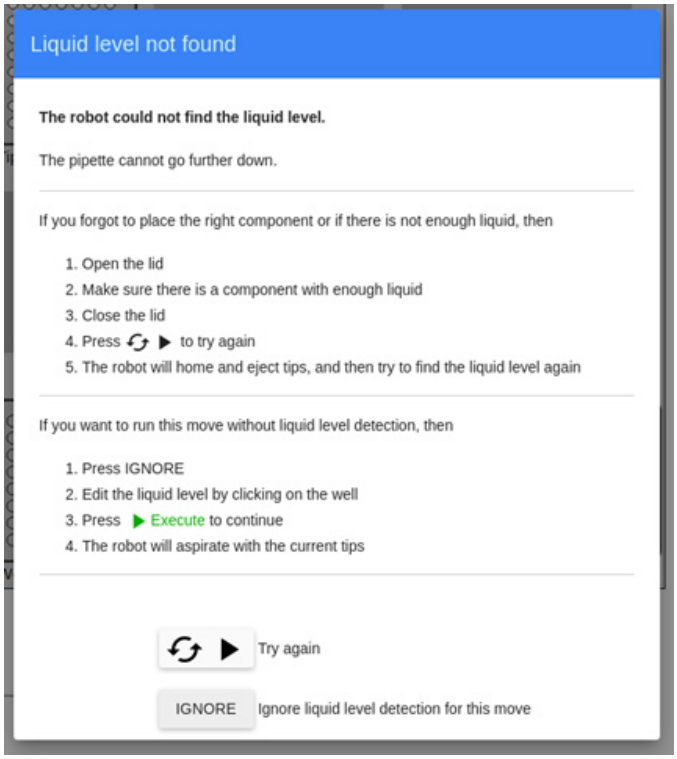
- If there are tips left in the box, and it was simply not specified correctly when program execution began, click CLOSE and then Tips in tipbox. Now you can specify where there are tips. Click Tips in tipbox when you're done. The robot will not continue until you press Execute.
- If there are no tips left, follow the steps described in the popup.
- Click next to the popup and go to the Main Dashboard to abort execution.

Liquid level not found

Log error code: 037
This error can occur for different reasons:

- The pipette cannot go further down (See screen shot below). Occurs if there is not enough liquid in the component, so the pipette cannot reach it. This can also occur if the liquid level detections isn't working. The tips are submerged in the liquid but haven't detected it. See section on adjusting liquid level parameter.
- Liquid level difference is larger than tip size. Occurs with multi-channel pipettes if the difference in liquid level is larger than the tip size. Then the robot cannot aspirate without getting submerged in liquid. This can also occur if the liquid level detections isn't working. See section on adjusting liquid level parameter.
- Liquid level difference is larger than pipette/tip volume. Occurs with multi-channel pipettes if the difference in liquid level is larger than the volume the pipette/tip can handle, since then the liquid would be aspirated into the pipette channel itself (and not just the tip). Liquid/air is aspirated during liquid level detection. See section **Adjusting liquid level parameters**.

You can proceed in two ways, as described in the popup, or click next to the popup and go to the Main Dashboard to abort execution.



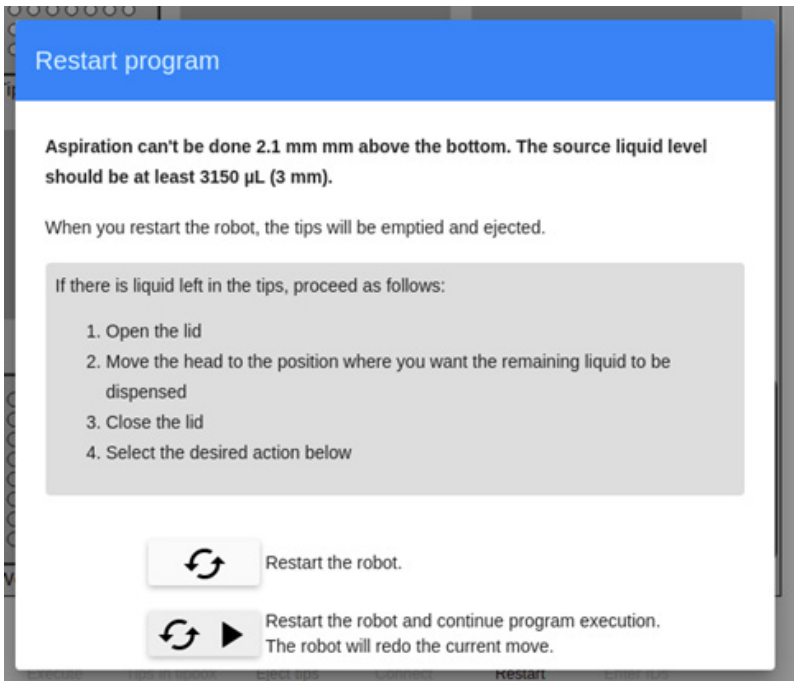
Aspiration/dispense cannot be done

This occurs if the pipette cannot reach the specified position in a well. This can occur if there's too little liquid and the robot cannot reach the bottom of the component, e.g., if there was less liquid than expected after liquid level detection, or the liquid level was changed manually before/during execution.
It can also happen if component specifications have been changed since the program was last saved, so the liquid level calculations are no longer valid. You should edit the program and save it again, so the liquid levels are re-calculated.
You can proceed as follows:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.

- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.

- Click next to the popup and go to the Main Dashboard to abort execution.



Error pop-ups

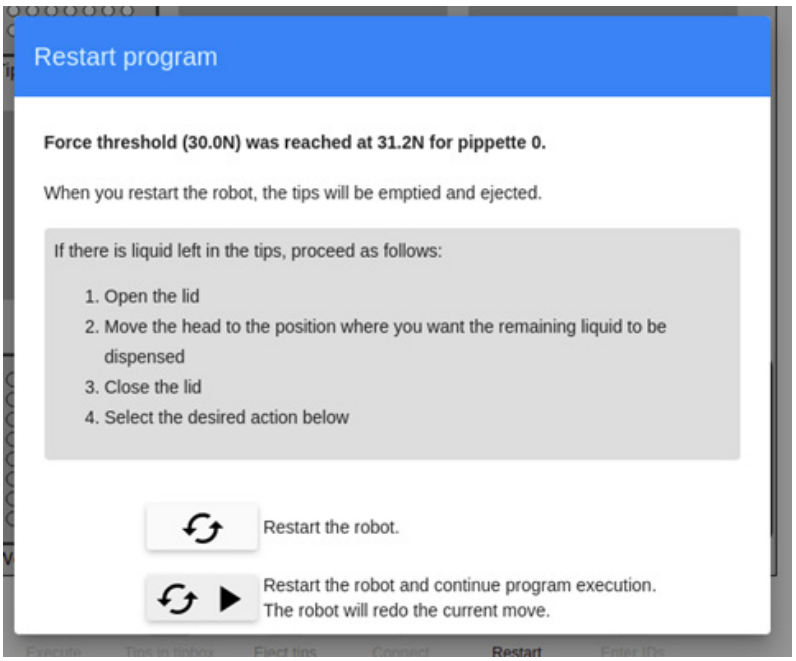
Force threshold was reached

Log error code: 029
Occurs if the robot detected more resistance than anticipated. This happens if one of the pipettes hit something unexpectedly, e.g., a component that is not specified correctly, or if tips are not mounted straight on tip cones. You can proceed as follows:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.

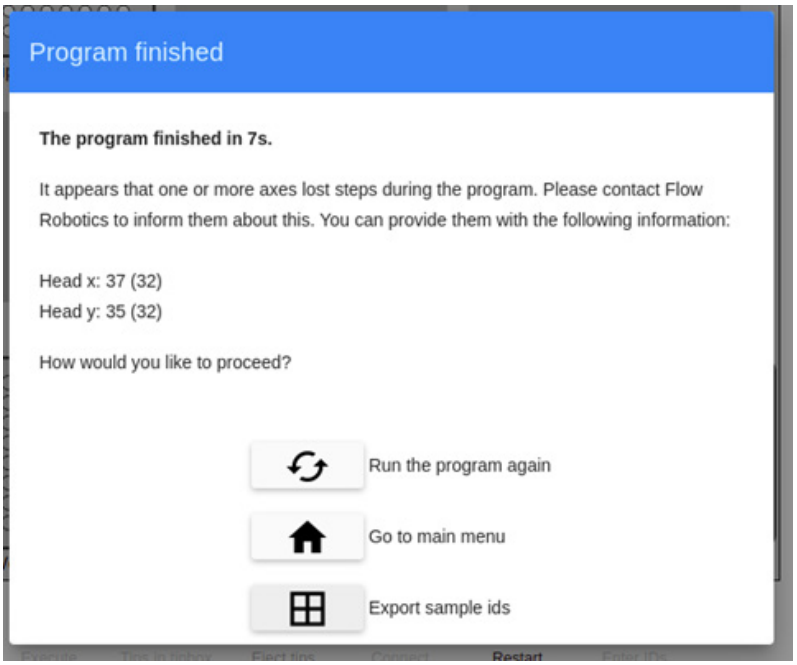
- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.

- Click next to the popup and go to the Main Dashboard to abort execution.



Lost steps

Log error code: 068
At the end of every program execution, the robot checks whether it has lost positional precision during execution. This is an early warning that a mechanical component needs to be examined by a technician, who can do further investigation.



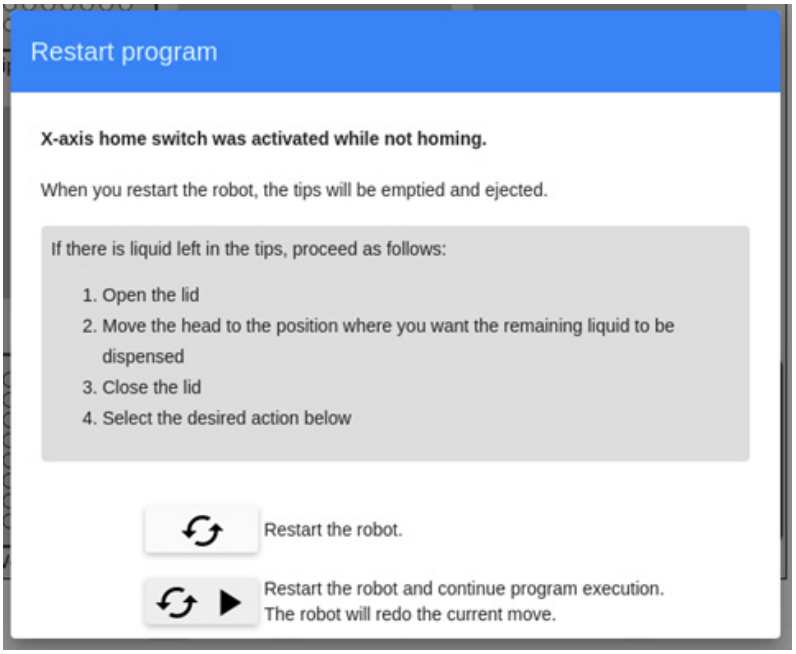
Switch hit

Log error code: 104
Occurs if the robot loses positional precision during execution. This indicates that a mechanical component needs to be examined by a technician, who can do further investigation. You can still choose to proceed:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.

- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.

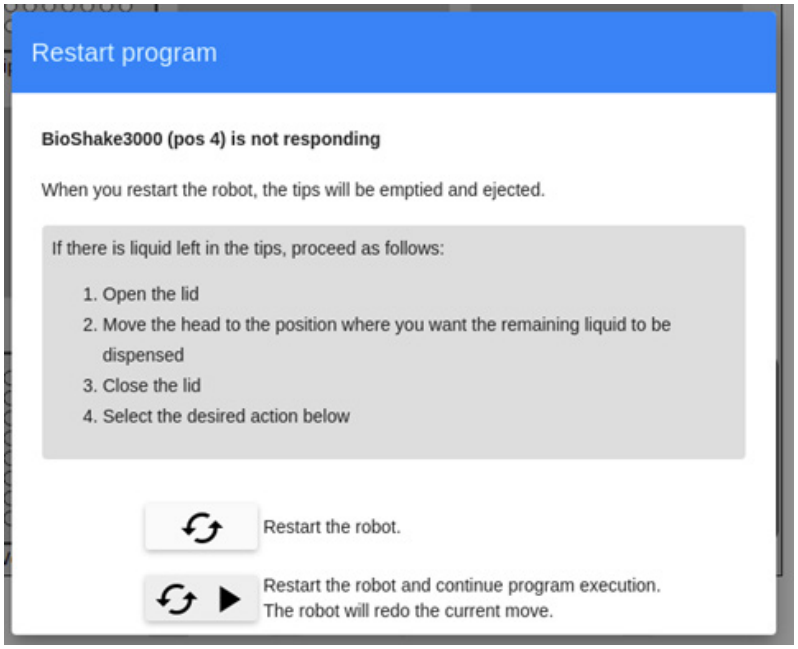
- Click next to the popup and go to the Main Dashboard to abort execution.



Devices

This occurs if a device is not plugged in or plugged into the wrong port. You can check the port in Devices from the main menu. Always use top USB port first of the two ports. If it is not plugged in, simply plug it in, wait a few seconds for it to startup and register itself. You can proceed as follows:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.
- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.
- Click next to the popup and go to the Main Dashboard to abort execution.



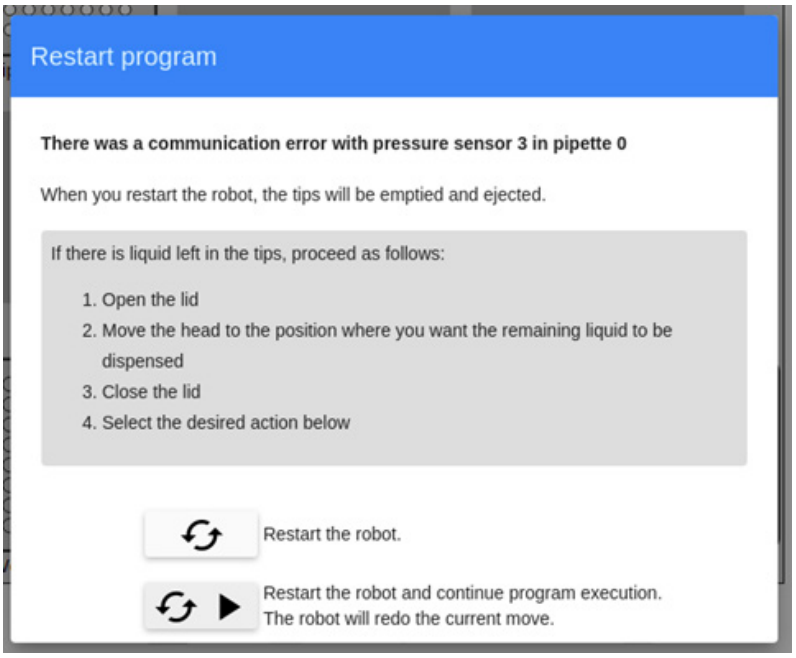
Communication error

Log error codes (non-exhaustive): 026, 040, 073, 099
Execution can fail for other reasons, which usually indicates problems communicating with an electronic component. You can proceed as follows:

- Restart the robot. After homing and ejecting tips, the robot will not continue until you press Execute.

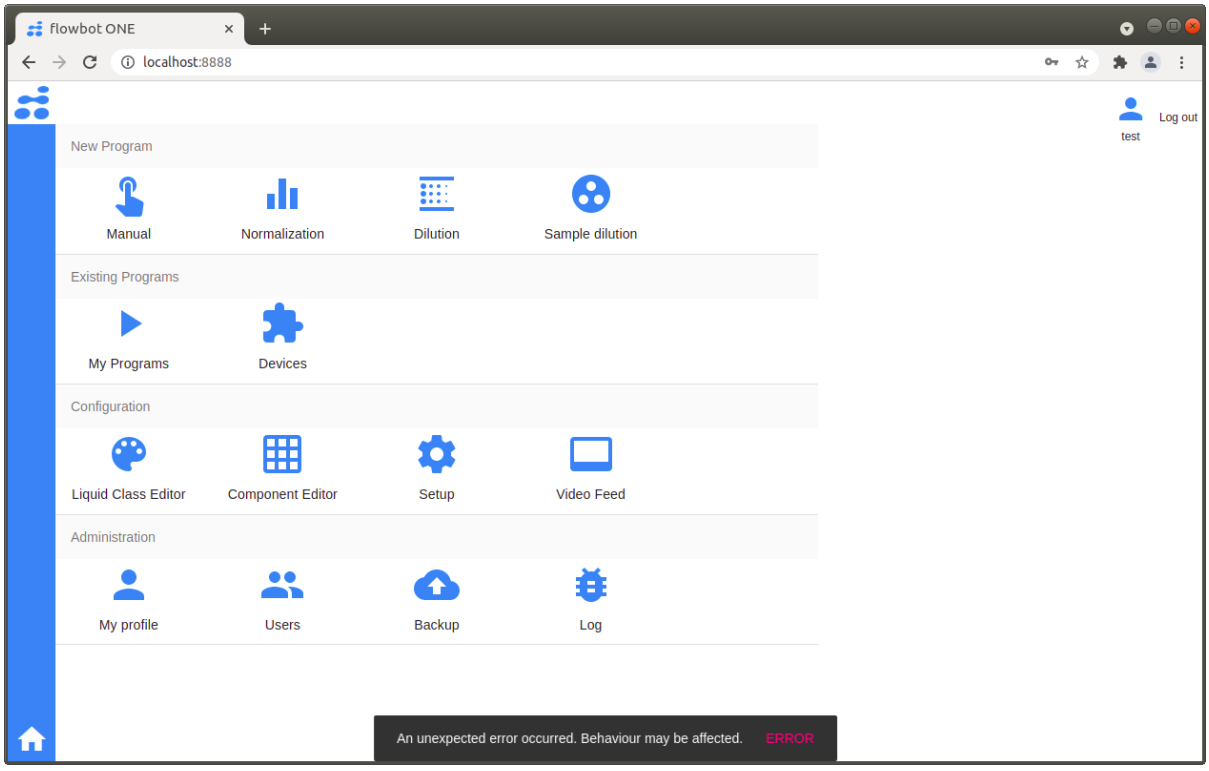
- Restart the robot and continue program execution. The robot will redo the current move, i.e., the one that was in progress when the error occurred.

- Click next to the popup and go to the Main Dashboard to abort execution.



Unexpected errors

Even though we do our best to prevent it, unforeseen errors can occur. Sometimes these errors impact behaviour. They look as follows:



If you want to report an error, please attach the relevant logs.

Operational problems

Drops hanging from pipette tip after dispense

This could be a symptom of the following issues

- First thing to test is if the pipette tip is below liquid level after dispense. When doing dry dispense (i.e. above liquid level), drops will often be hanging from the tip. If dry dispense was unintended, then it might be because the component definition is not precise enough. Another reason could be that the robot thinks there is more liquid in the vessel than there is. For more information on how to adjust these parameters, please refer to the sections on **Components** and **Liquid Levels** above.

- If you are dispensing a small volume into an empty well, you can try to use bottom touch to set off the droplet on the bottom of the well.

- Try decreasing the Retract speed option in the liquid class. If the pipette tip is moved too fast out of the liquid after dispense, drops might stick to the end of the pipette tip.

Drops hanging from pipette after aspiration

This could be a symptom of the following issues

- Try decreasing the Retract speed option in the liquid class. If the pipette tip is moved too fast out of the liquid after aspiration, drops might stick to the end of the pipette tip.

- If you have a liquid that can easily flow out of the tip, you may need to add a trailing air gap in the liquid class. Usually 10-20µL will be an appropriate trailing volume.

Liquid left in tip after dispensing

This could happen if one or more of the tips touches the bottom of the vessel when dispensing. This usually means one of the following:

- That the component specification should be adjusted a bit so the robot thinks the bottom of the vessel is higher above the working area.
- That different pipette tips were used than those specified.

When aspirating, initially no liquid enters the tip, but suddenly liquid enters the tip very quickly.

This happens if the pipette tip touches the bottom while aspirating. This usually means one of the following:

- That the component specification should be adjusted a bit so the robot thinks the bottom of the vessel is higher above the working area.
- That different pipette tips were used than those specified.

The robot misses the pipette tip openings when trying to pick them up

When this happens, try the following:

- Make sure that the tipbox is placed properly in the grid.
- If the pipette is consistently off by 1-2 mm to one side, the calibration is off. To fix this, log in as an admin user, choose Setup and Tune Calibration. Then choose the pipette that is off, choose Without tip, adjust it 1-2 mm in the direction needed. If the robot is consistently too far to the left, the pipette should be moved to the right. Finally, press Update Calibration. Ater that, the robot will aim more in that direction when picking up tips.

The tip(s) do(es) not hit the vessel it aims for

When this happens, try the following:

- Make sure that the component is placed properly in the grid
- Check tips are picked up correctly and are positioned straight on the tip cones. If not, make sure the tip cone O-rings are greased and not broken or cracked.
- If the pipette is consistently off by 1-2 mm to one side, the calibration may be a bit off. To fix this, log in as Admin, and choose Setup →Tune Calibration. Then choose the pipette that is off, choose With tip, adjust it 1-2 mm in the direction needed. Finally, press Update Calibration. After that, the robot will aim more in that direction when going into vessels.
- If it is only in a particular component, it is probably the component that is not specified accurately enough. This can be changed in the **Component Editor**.

Pipetting is not accurate enough when using small volumes

When working with very small volumes it is usually important to:

- Use fresh/new tips.
- Make sure to perform wet-dispense. That is, the dispense should be performed below liquid level and not into a dry well.
- Use a low aspiration speed. See **Liquid Class Editor.**
- Use a leading airgap to blow out the volume aspirated. See **Liquid Class Editor**.

The pipette will not go all the way to the bottom of the tube

The following could be the cause of the issue:

- If the tube is too narrow (or specified too narrowly), the robot will not move all the way down into the tube. In the **Component Editor**, you can select pipette and tip type and visually see how deep the tip can go into the tube.

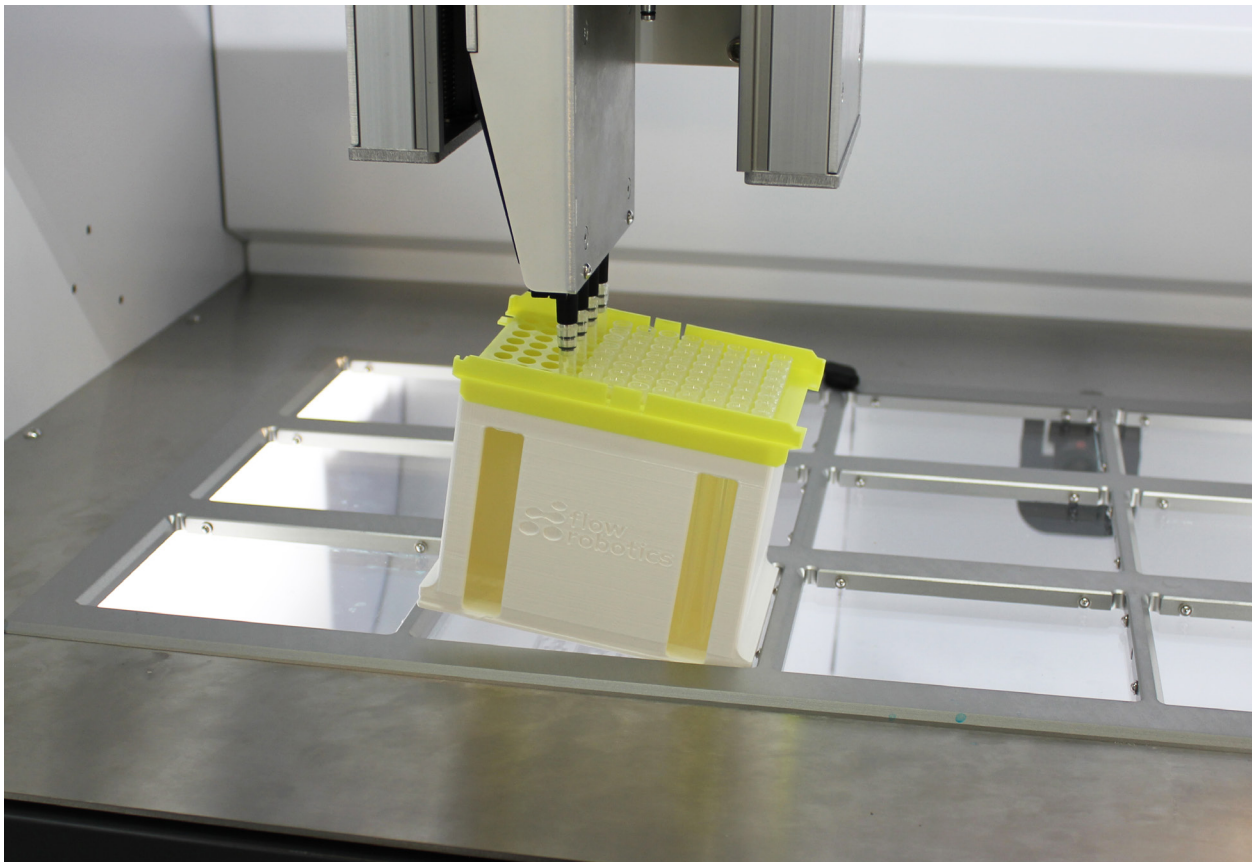
- If you are not using liquid level detection, check that the liquid level specified in your program is correct. If the robot expected a large volume of liquid, it will not go far down into the tube. See the section above on liquid levels on details.

The pipette tip gets stuck in narrow tubes

In this case, the problem is the specification of the component. If the tube is specified as being wider than it is, the robot will think it can go deeper than is possible. Another possibility is that it is specified that the tube is positioned lower than it is. In this case, the robot will try to move further down than what is possible.

Robot tilts tip box at tip pickup

Tip box gets pulled sidewards after pipette has attempted pickup.



Missed tip thresholds are wrong. The robot thinks it has hit the edge of the tip and not picked it up, even though it has hit correctly. Therefore, it tries to adjust its position 0.5 mm in multiple directions or moves to next position in tip box.

When this happens, try the following:

Run Detect missed tips threshold under Low-level Control. Refer to the Service Manual for instructions.

Robot detects liquid level in the air

- The pressure delta specified for the tip could be off
- Perhaps dirt or other objects are blocking the tip cone

When this happenes, try the following:

- Increase the delta pressure (more negative). See **Adjust Liquid level parameters**.
- Clean tip cones with a brush. If necessary, dismantle tip cones for thorough cleaning.

Robot cannot detect liquid level, moves to bottom of the container/ tube

- The delta pressure specified for the tip is off

When this happens, try the following:

- Decrease the delta pressure (less negative). See **Adjust Liquid level parameter.**

Tip hits bottom when aspirating/dispensing

Probably, the calibration of Z-axis or component specifications are off. When this happens, try the following:

- Adjust Z-axis calibration under Setup and Tune calibration.
- Go to **Component Editor** and check that the specifications for the component are correct, particularly the well depth and component height

Tips/pipette crashes into device (cold plate, shaker, or mag deck)

There are several possible causes for this problem:

- Device is not enabled in software
- Device is placed in wrong grid position
- Device specifications are incorrect

When this happens, try the following:

- Check that the device is enabled in Devices
- Check that the device is enabled for the correct position.
- In Devices, adjust the device settings: Height, Component offset x, Component offset y.

Tips are not ejected

It is possible, that the tip dispense/eject position is not set deep enough in mm.

When this happens, try the following:

- Reset tip dispense/eject position. Described in Service Manual

Disconnection errors during program execution

This is often caused by PC entering sleep mode.

- Ensure that the PC or tablet is always connected to a power source and that Sleep Mode is disabled.

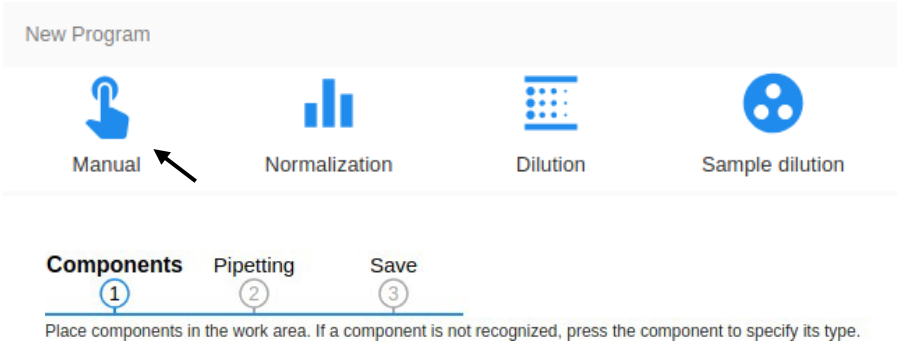
PROGRAM SETUP EXERCISES

We have prepared six exercises for practice that will help you gain experience in setting up programs.

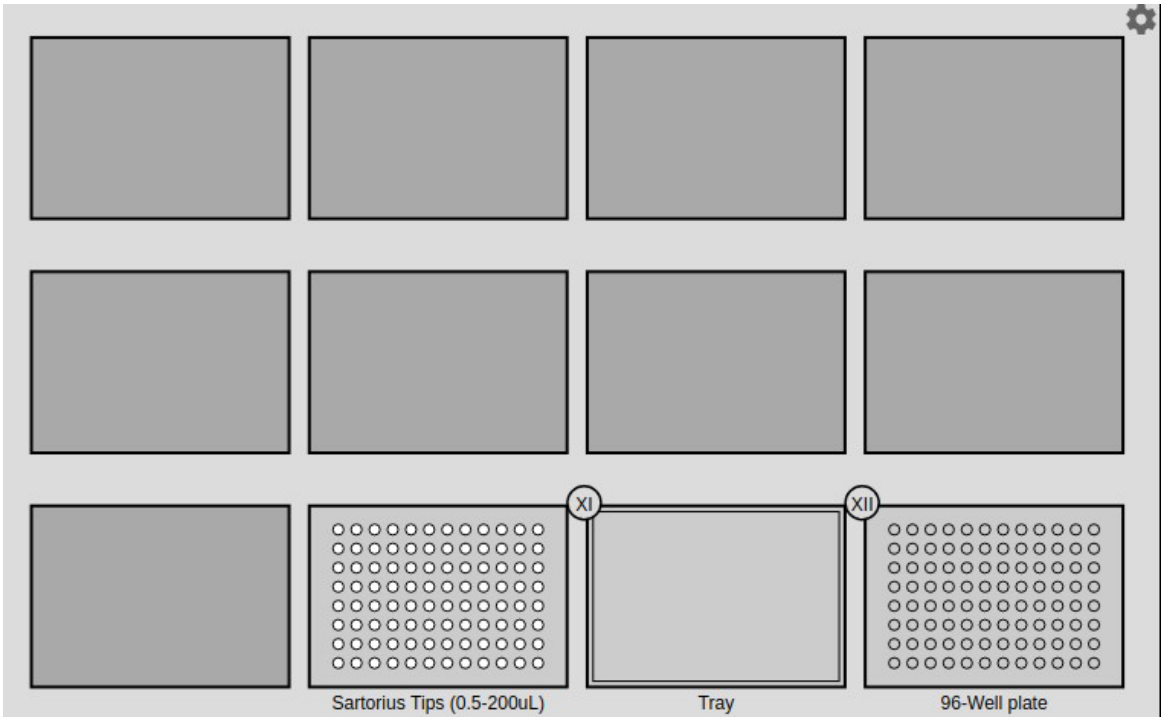
Manual pipetting program

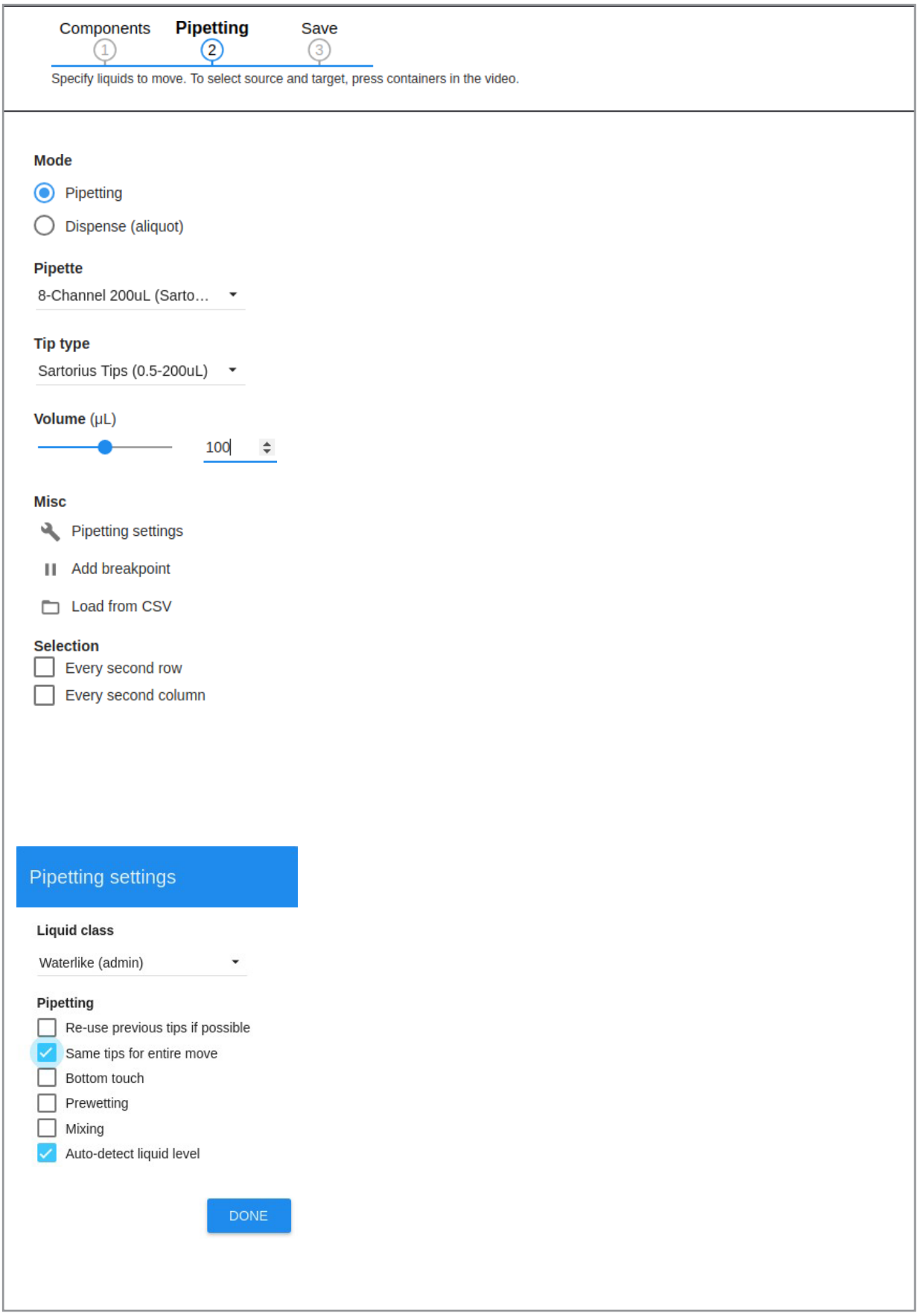
Task: Move 100µL liquid from a tray to all wells of a 96-Well plate. Use the 8-channel pipette for the entire pipetting task.

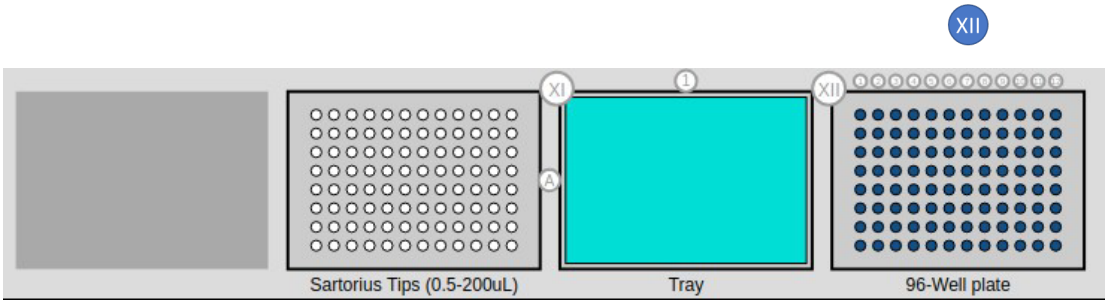
Click **Manual**.



Select placement of pipette tips and components according to the drawing below. Click the position and select component from the list if a component is not recognized automatically.




Components
Pipetting
Save
1
2
3
Specify liquids to move. To select source and target, press containers in the video.
Mode
Pipetting
Dispense (aliquot)
Pipette
8-Channel 200uL (Sarto…
Tip type
Sartorius Tips (0.5-200uL)
Volume (µL)
100
Misc
Pipetting settings
Add breakpoint
Load from CSV
Selection
Every second row
Every second column
Pipetting settings
Liquid class
Waterlike (admin)
Pipetting
Re-use previous tips if possible
Same tips for entire move
Bottom touch
Prewetting
Mixing
Auto-detect liquid level
DONE



Components 1 — Pipetting 2 — **Save** 3 SAVE

Verify the specification. Minimum liquid level needed for program (incl. dead volume) is selected as standard. Click a well to change the liquid level.

Time estimate
3m 24s

Tip use
Sartorius Tips (0.5-200uL): 8

Components 1 — Pipetting 2 — **Save** 3 SAVE

Verify the specification. Minimum liquid level needed for program (incl. dead volume) is selected as standard. Click a well to change the liquid level.

Save program

Program name
Fill one 96-Well plate

Run program immediately

CANCEL SAVE

Click SAVE

Execution

Task: Execute your newly programmed program.

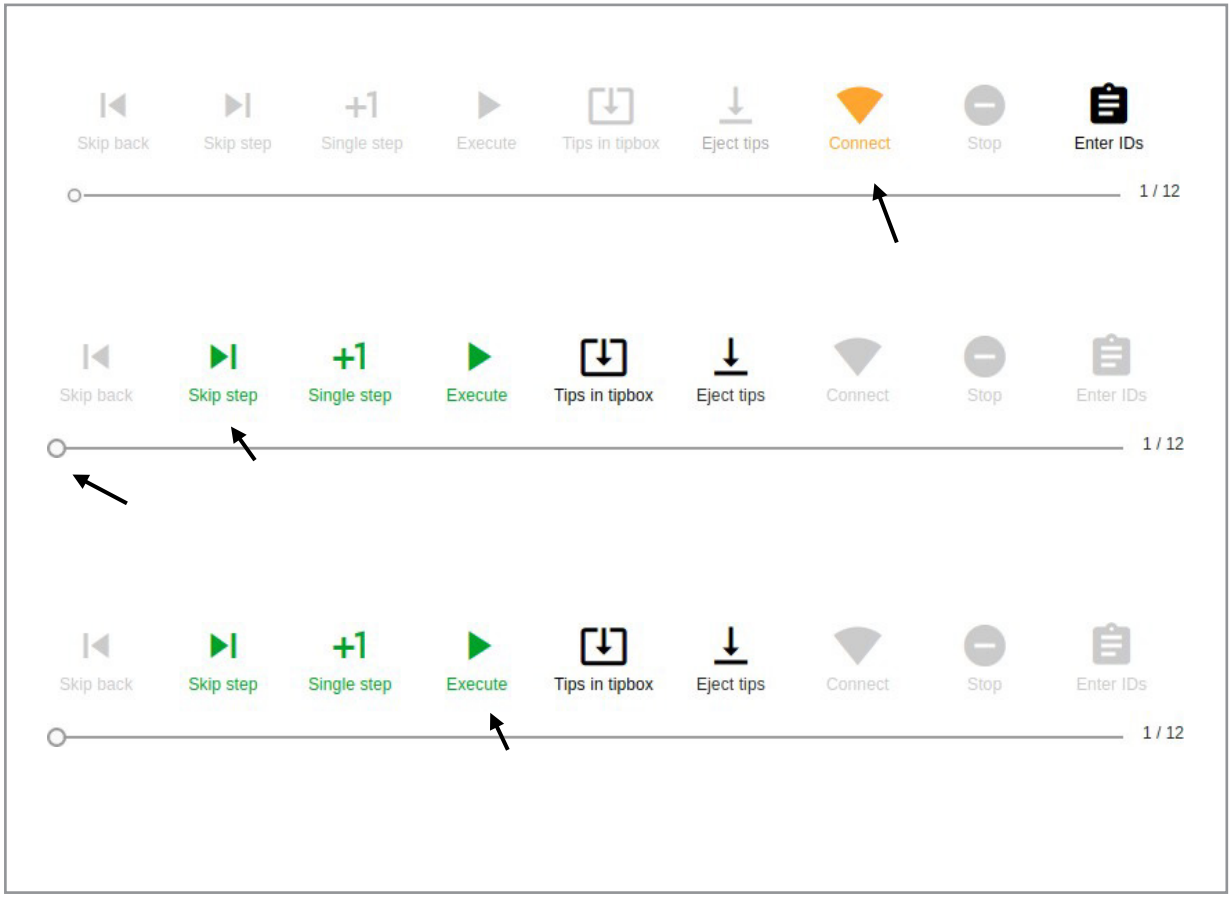
Click Connect and wait for the robot to home. The light will turn green when the robot has homed.

Check the program before start:
Click on Skip step or move the cursor on the timeline

Move the cursor back to start.

Click Execute (the program starts).

After a few steps, click Pause. The robot will stop after it has finished the move it is currently performing.
Click the Home icon to return to the Main Dashboard.



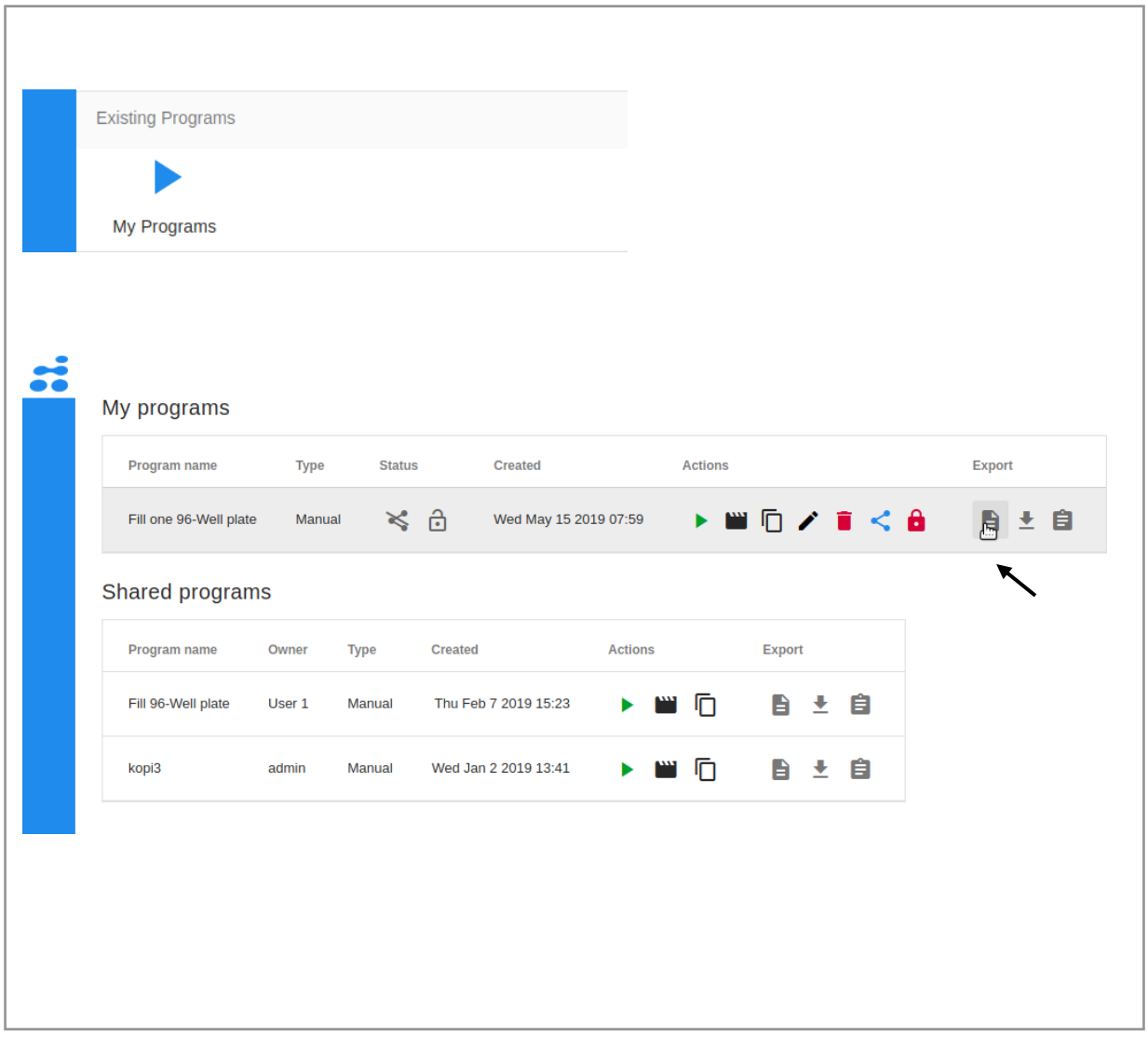
Download a program as a PDF file

Task: Run a Click My Programs.

Find your program. Click the document icon (Download PDF).

The PDF file can now be either saved or printed.

Click the Home icon to return to the Main Dashboard.



Preview a program

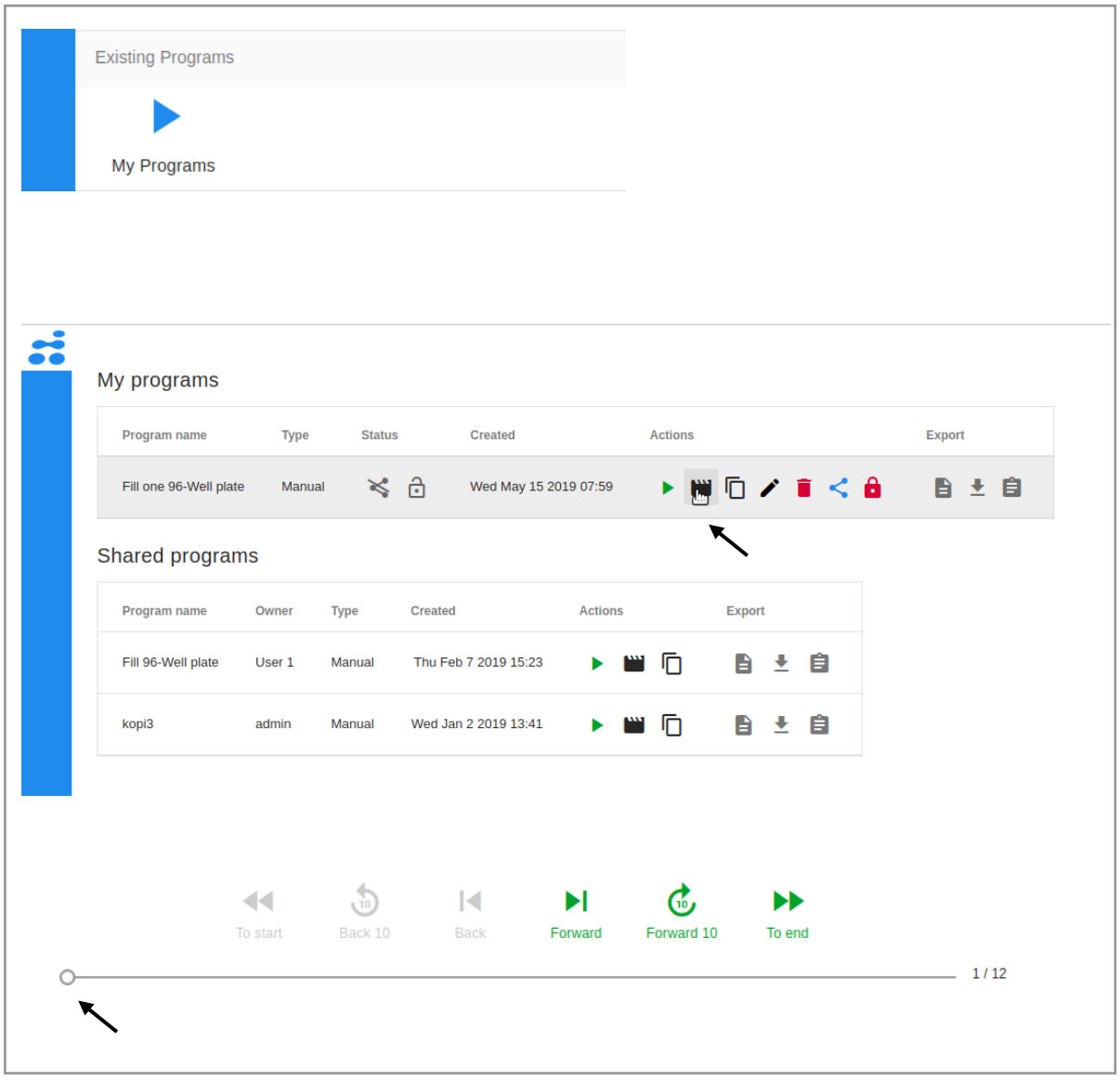
Click My Programs.

Find your program.

Click the film icon (Preview program).

Check the program: Click Forward or move cursor on the timeline.

Click the Home icon to return to the Main Dashboard.



Re-run a program

Click My Programs.

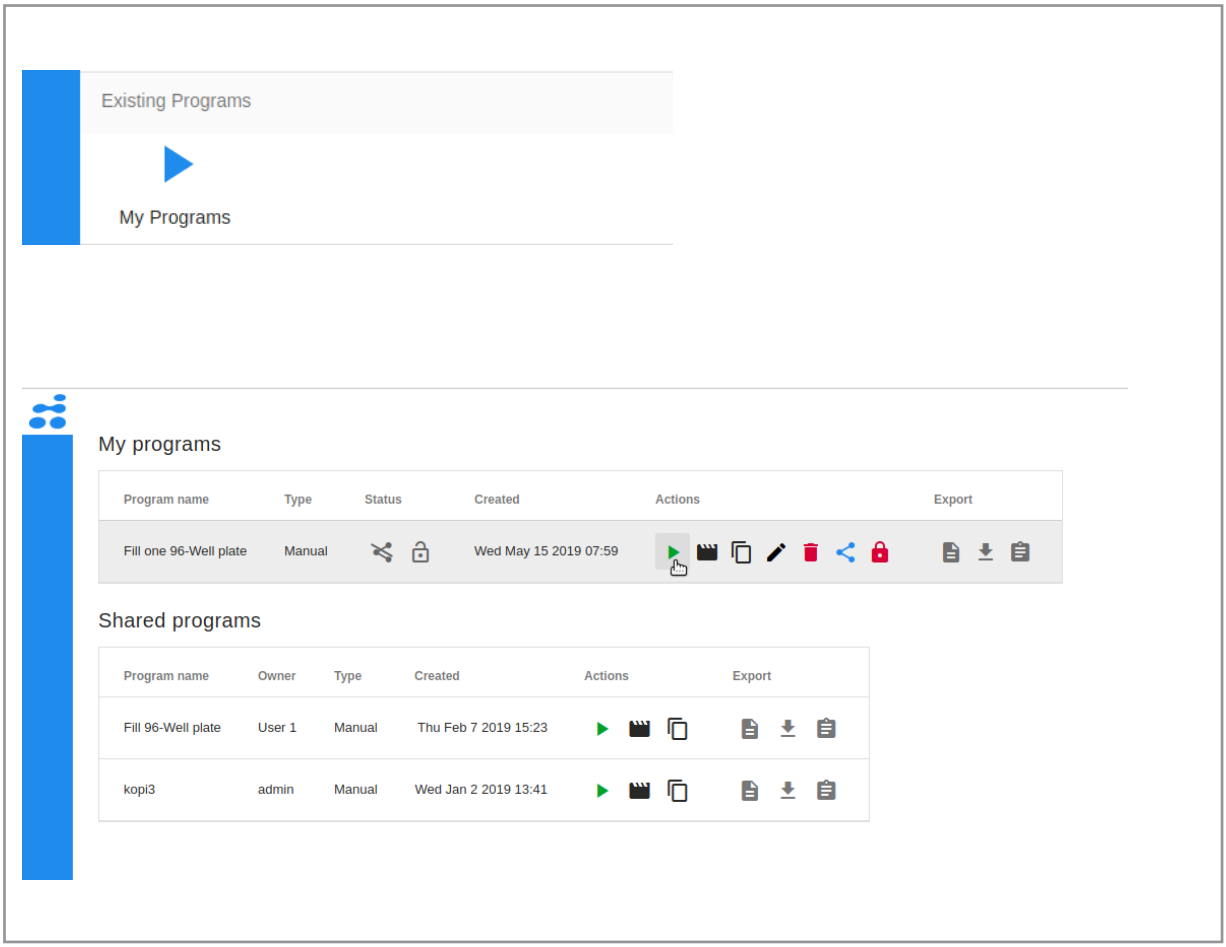
Find your new program.

Click the green play icon (Run program).

Check placement of tip boxes and components.
Click and select any components that are not automatically recognized.
Click Run Program.

For execution of the program, see the previous description in **Manuel pipetting program**.

Click the Home icon to return to the Main Dashboard.



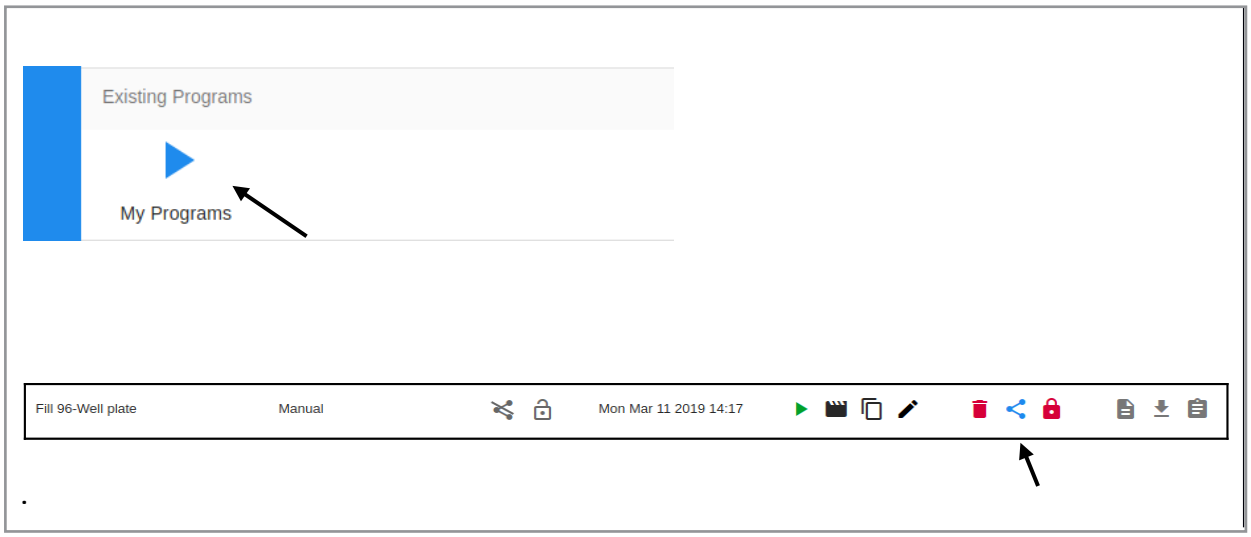
Share a program with other users

Task: Share a specific program with other users of the robot.

Click My Programs and find one of your programs.

Click the blue connect icon (Share program).

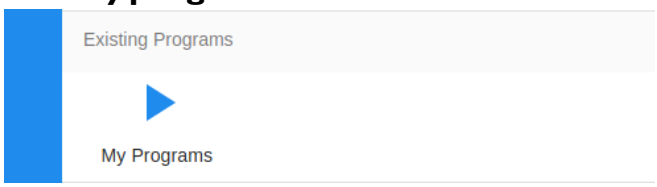
The program is now locked for editing and can be used (not edited) by all users without restrictions.



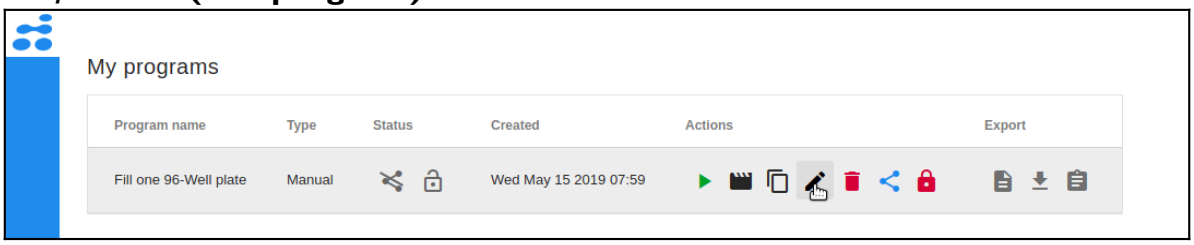
Editing a program

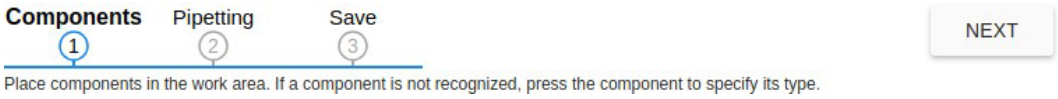
Task: Fill each well of two 12-Well plates with 100µL og 300µL respectively and subsequently fill each well of a 96-Well plate with 50µL.

Click **My programs**.

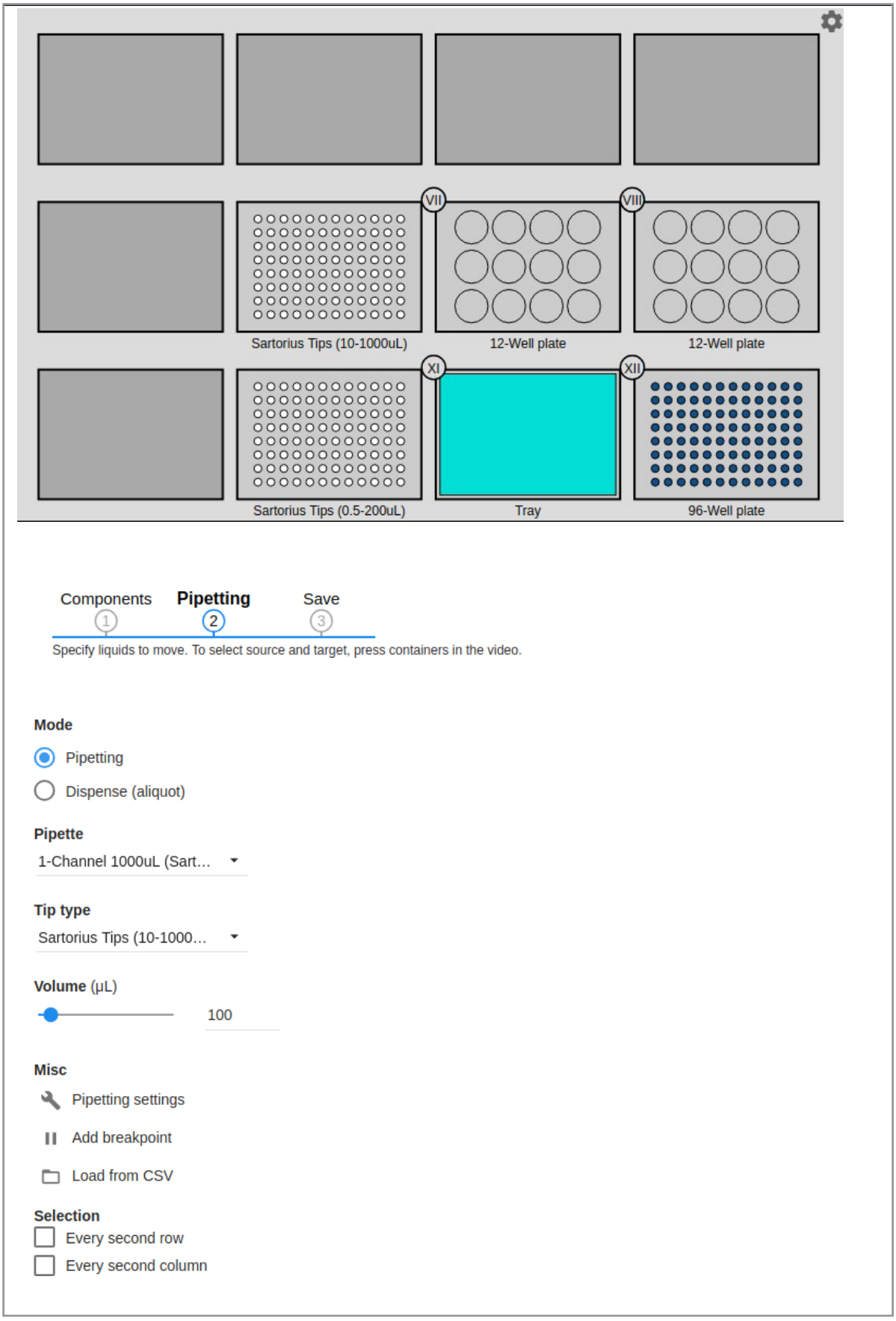


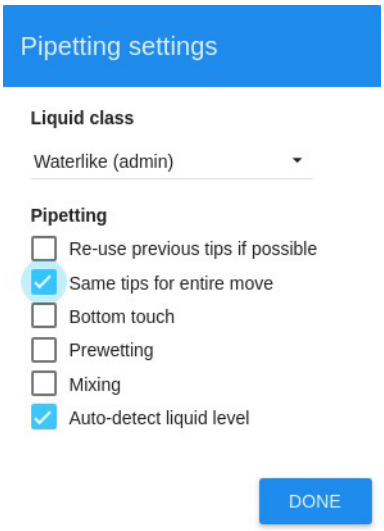
Find your program “Fill one 96-Well plate” from the manual program exercise. Click the *pen* icon **(Edit program).**

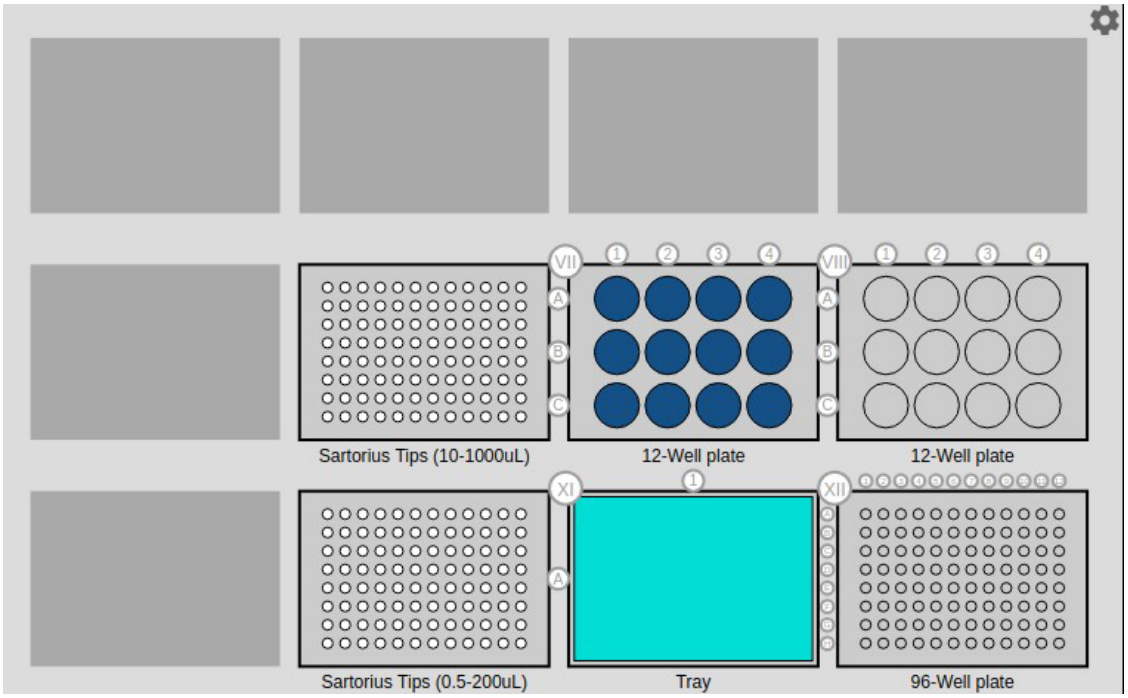


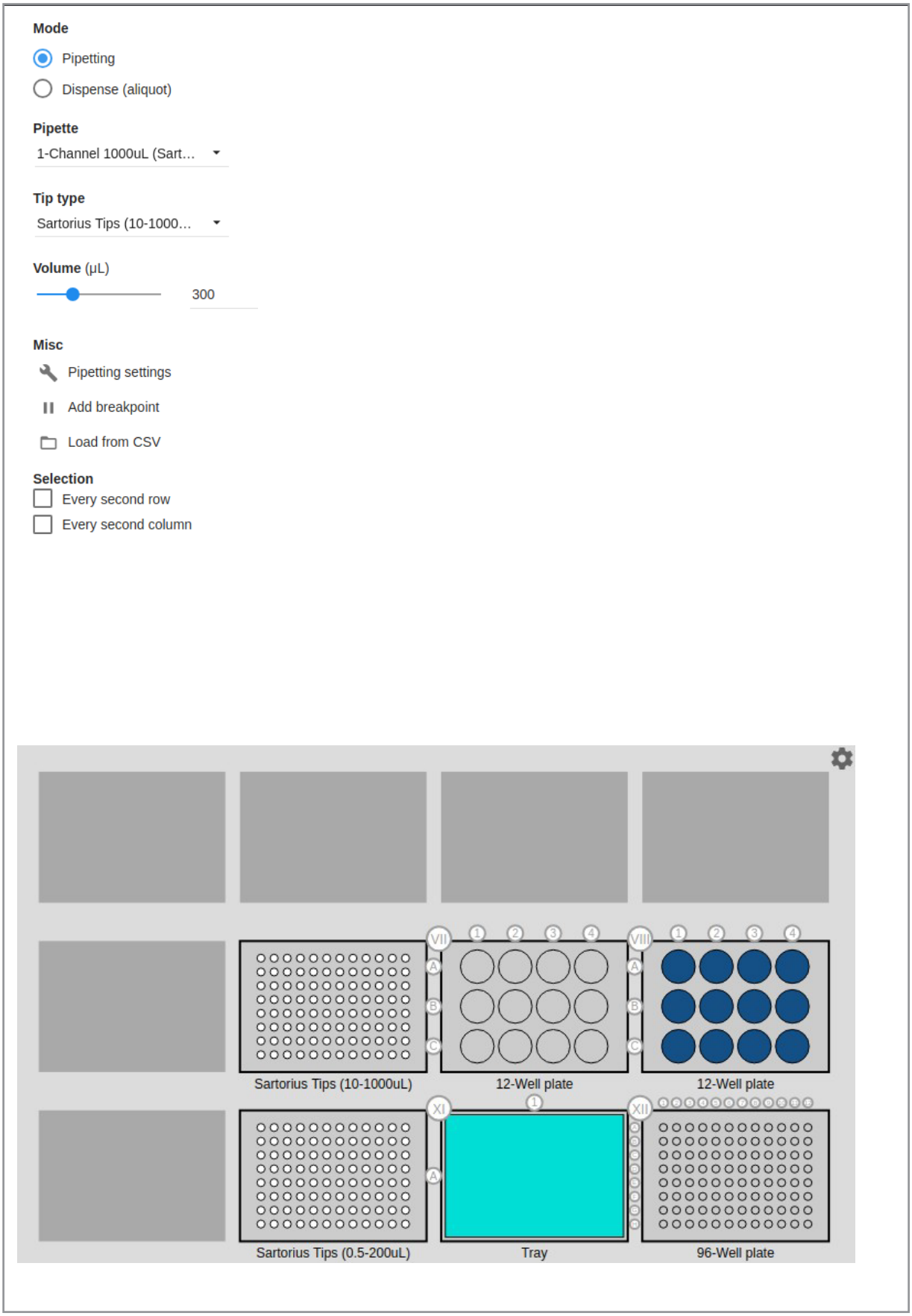


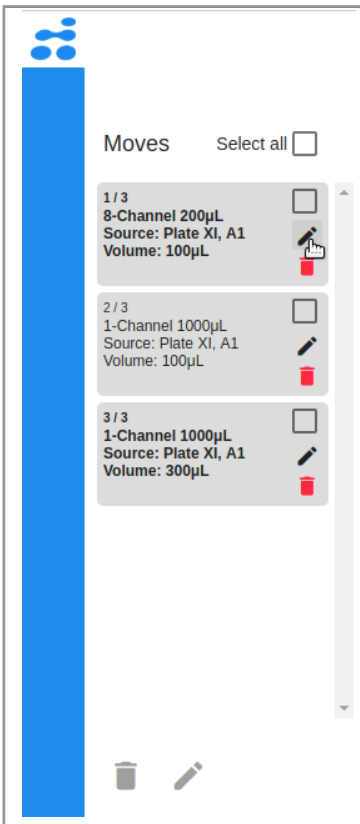
Select placement of pipette tips and components according to the drawing below. Click the position and select component from the list if a component is not recognized automatically.


VII
VIII
Sartorius Tips (10-1000uL)
12-Well plate
12-Well plate
XI
XII
Sartorius Tips (0.5-200uL)
Tray
96-Well plate
Components
1
Pipetting
2
Save
3
Specify liquids to move. To select source and target, press containers in the video.
Mode
Pipetting
Dispense (aliquot)
Pipette
1-Channel 1000uL (Sart…
Tip type
Sartorius Tips (10-1000…
Volume (µL)
100
Misc
Pipetting settings
Add breakpoint
Load from CSV
Selection
Every second row
Every second column

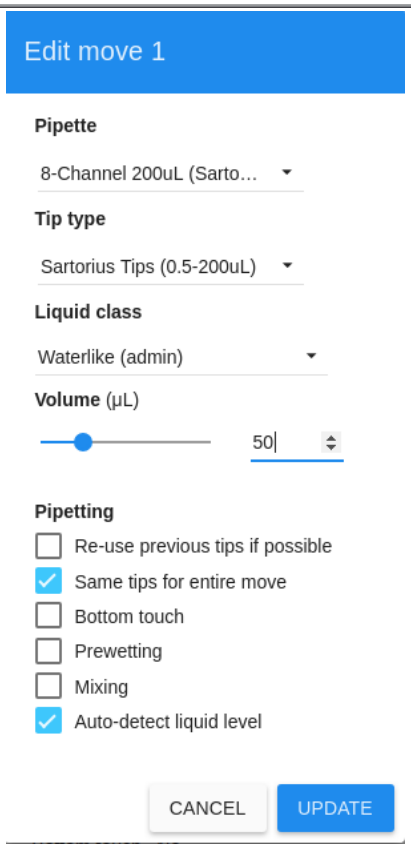

Pipetting settings
Liquid class
Waterlike (admin)
Pipetting
Re-use previous tips if possible
Same tips for entire move
Bottom touch
Prewetting
Mixing
Auto-detect liquid level
DONE

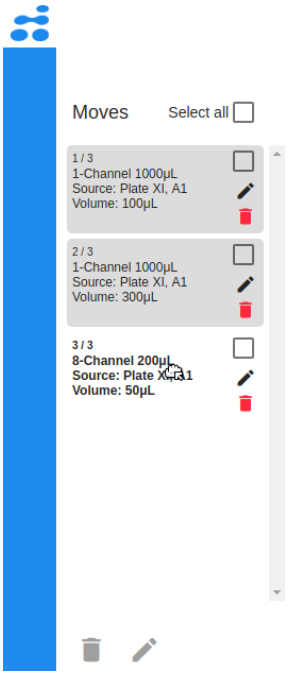

Sartorius Tips (10-1000uL)
12-Well plate
12-Well plate
Sartorius Tips (0.5-200uL)
Tray
96-Well plate


Mode
Pipetting
Dispense (aliquot)
Pipette
1-Channel 1000uL (Sart…
Tip type
Sartorius Tips (10-1000…
Volume (µL)
300
Misc
Pipetting settings
Add breakpoint
Load from CSV
Selection
Every second row
Every second column
Sartorius Tips (10-1000uL)
12-Well plate
12-Well plate
Sartorius Tips (0.5-200uL)
Tray
96-Well plate



Select Volume (µL): 50 and click UPDATE.





Place move 1 at the end of the program by dragging move 1 to the end.

Click Save

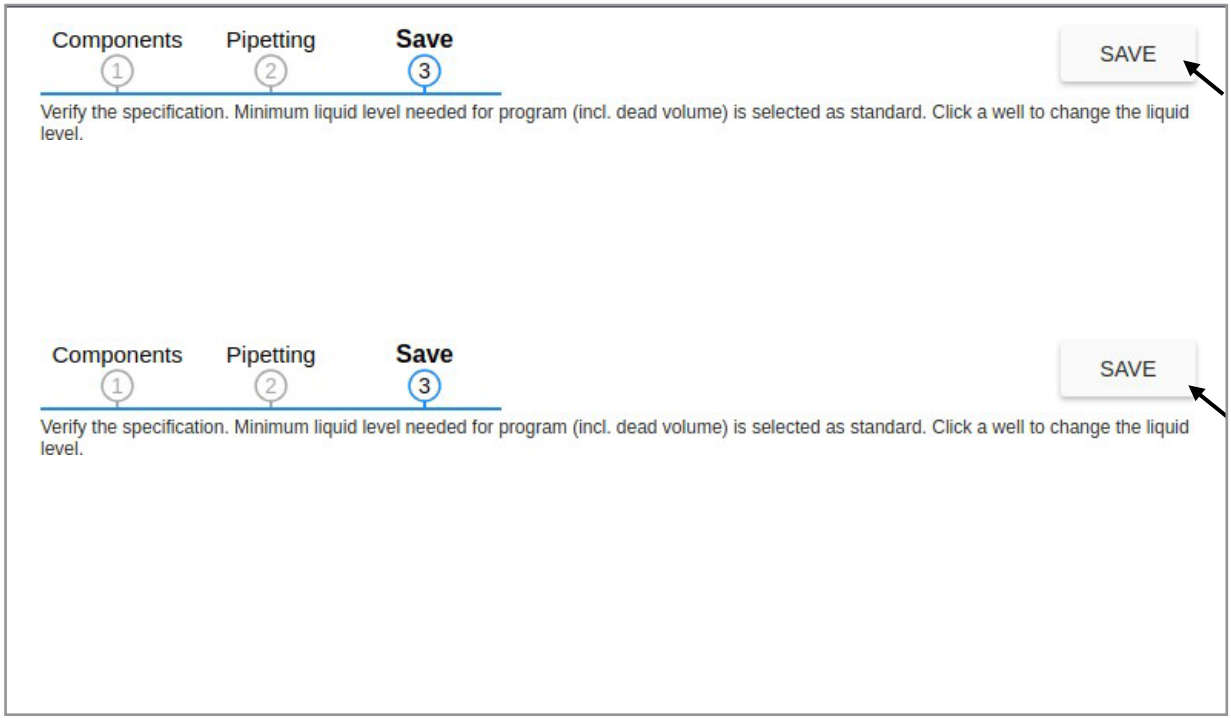
Check time estimate and use of pipette tips to the right. Check the minimum required liquid volume by placing your mouse over the wells.

Click SAVE.

Name the program.

Click SAVE.

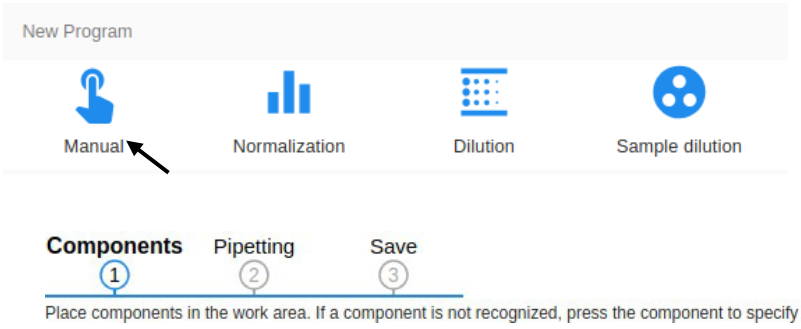
For execution, see the previous description in **Manuel pipetting program**



Distributing samples in smaller portions

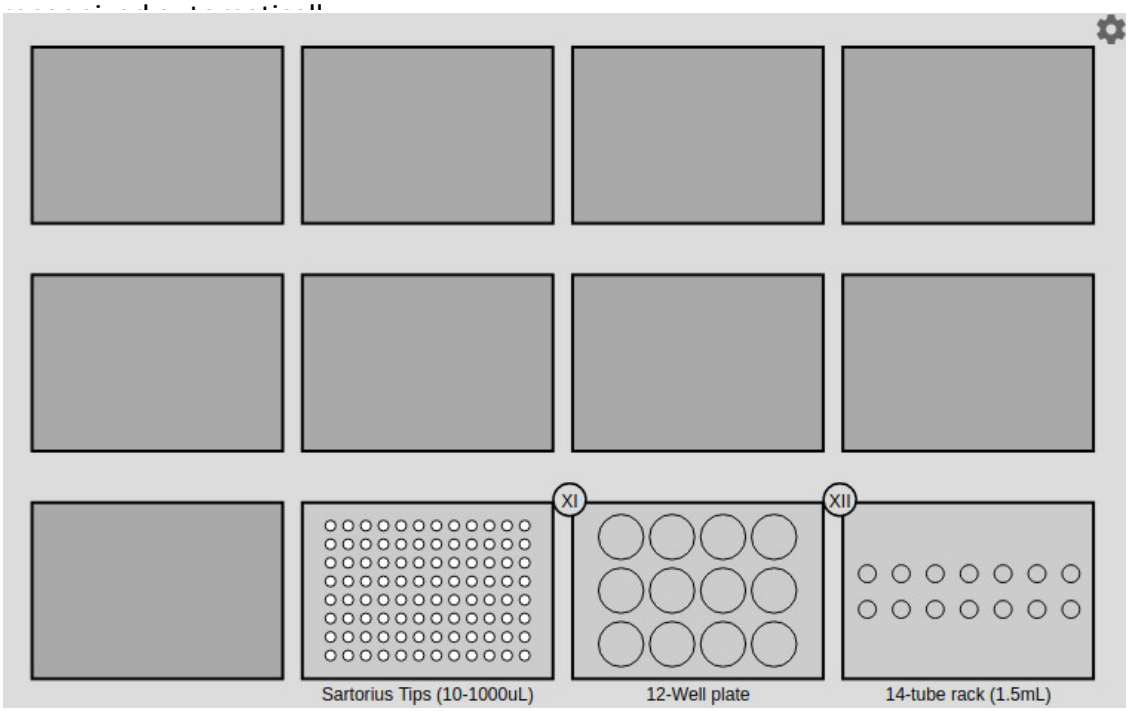
Two samples in a 12-Well plate are each distributed in four tubes (200µL in each) by aliquoting (dispense mode).

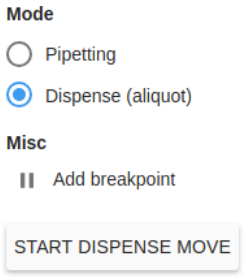
Click **Manual**.



Select placement of pipette tips and components according to the drawing below.

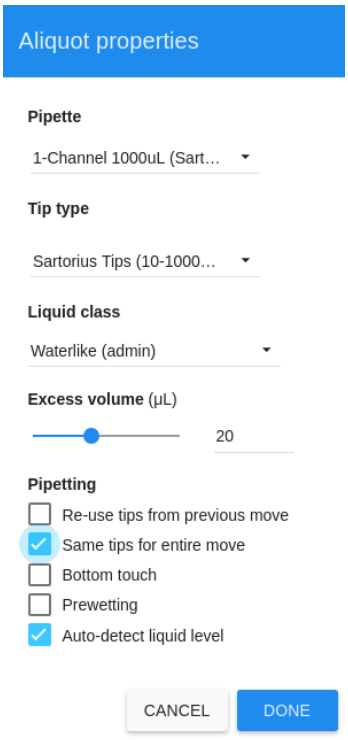
Click the position and select component from the list if a component is not





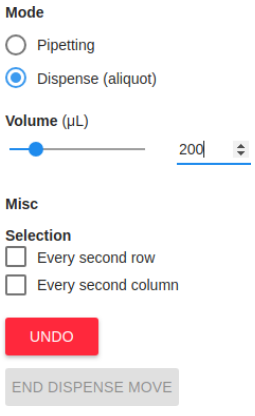
Select Dispense (aliquot) mode.

Click START DISPENSE MOVE



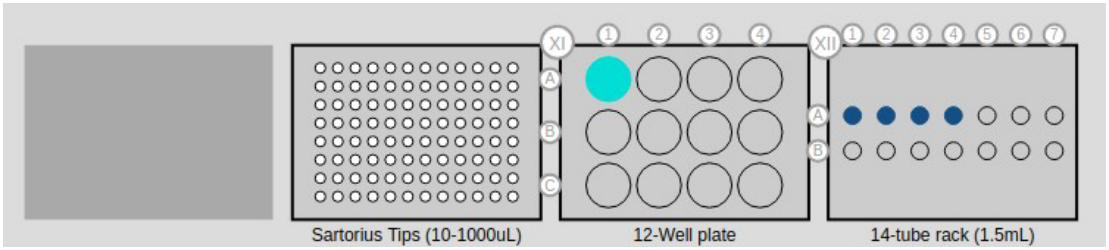
Select settings, see below.

Click DONE

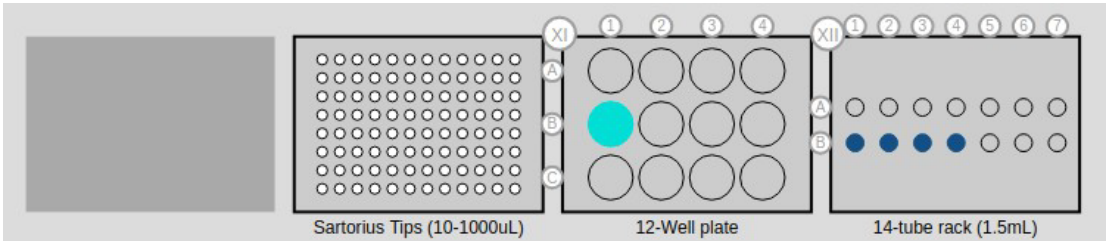


Select Volume (µL): 200
(200µL in each tube from each sample).

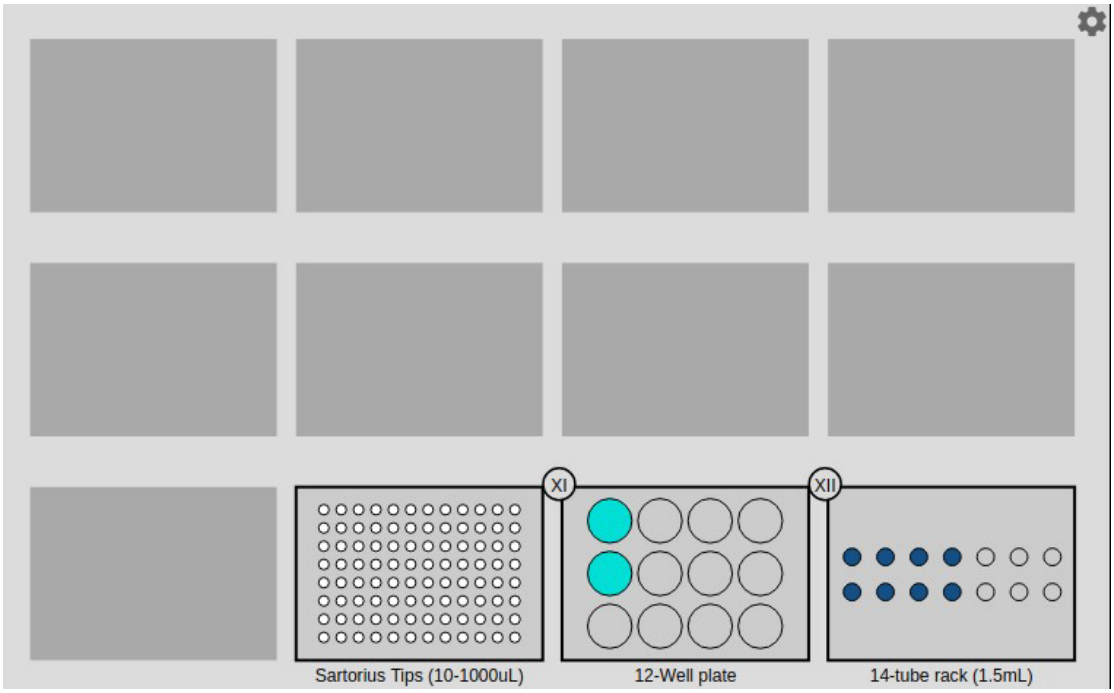
Click the first sample in the 12-Well plate to be distributed, source.
Click and drag over the first four wells in row A in the 14-tube rack (1.5mL), in which the sample is distributed, target.



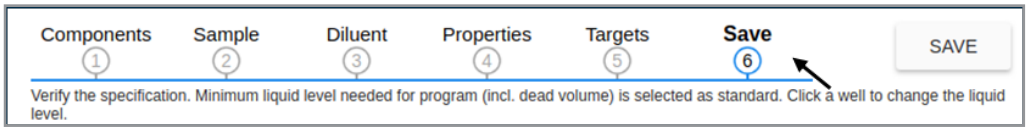
Click END DISPENSE MOVE
Repeat for the second sample in the 12-Well plate, see below:



Click END DISPENSE MOVE
Click ⁞⁞ to see the entire program.

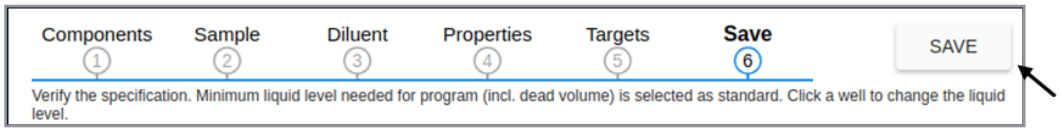


Click Save.



Check time estimate and use of pipette tips to the right. Check the minimum required liquid volume by placing your mouse over the wells.

Click SAVE.



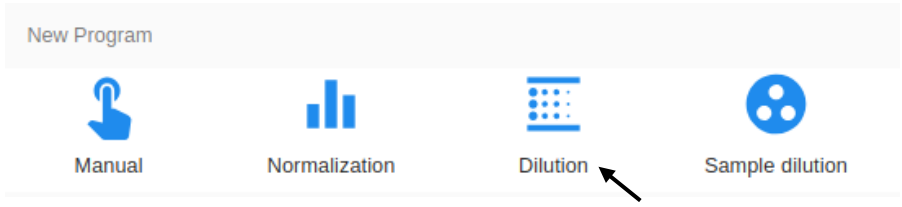
Name the program and click Save.

For execution, see **Manual pipetting program**.

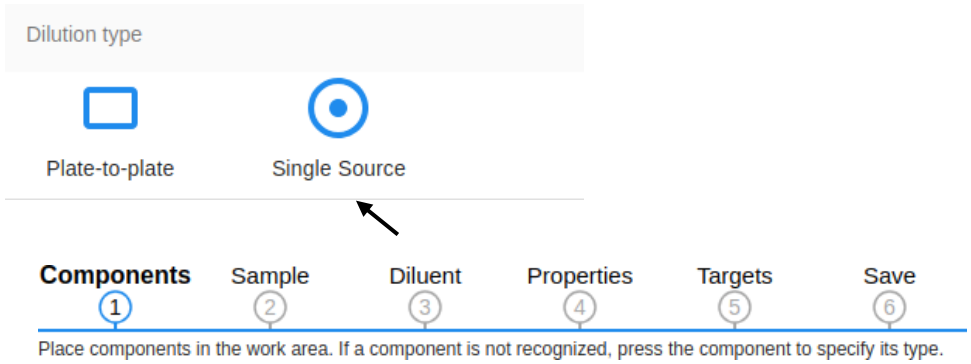
Several dilutions of one sample

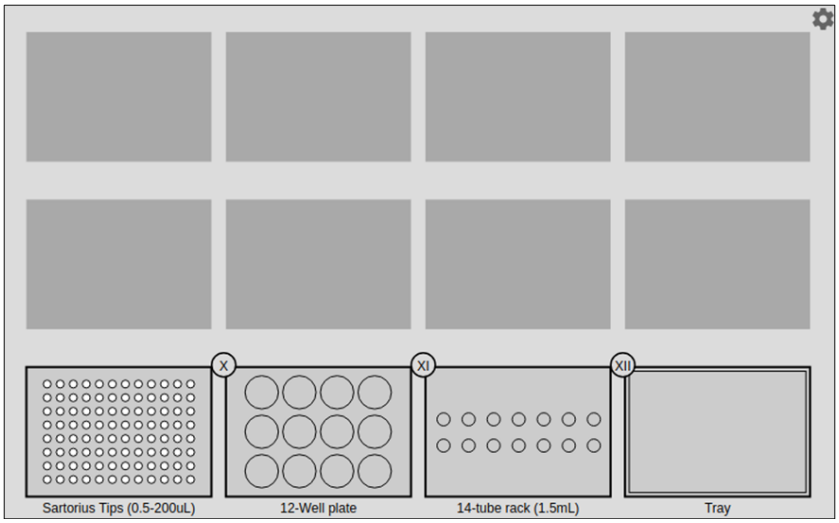
Dilute a sample down to four different concentrations.
Select placement of pipette tips and components according to the graphic.

Click **Dilution** to go to the Dilutionboard.



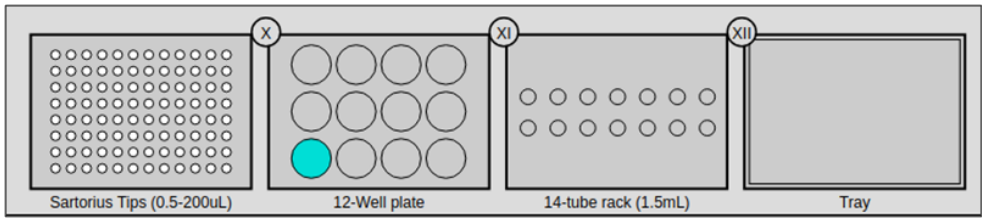
Click **Single Source**.



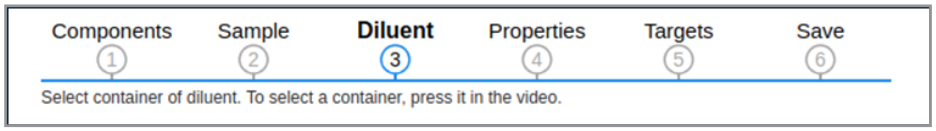


Click Sample.

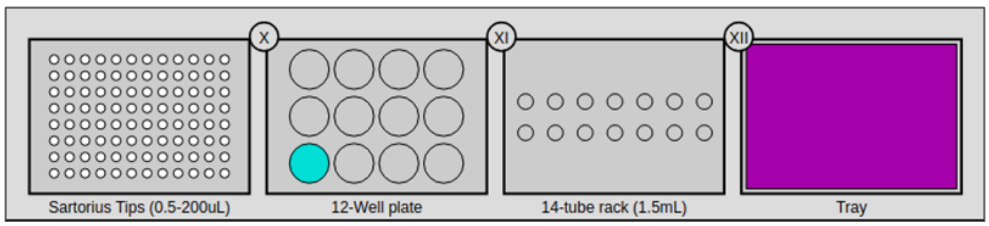
Select sample - the well with the sample, see below.



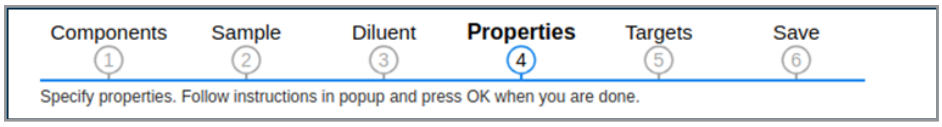
Click Diluent.



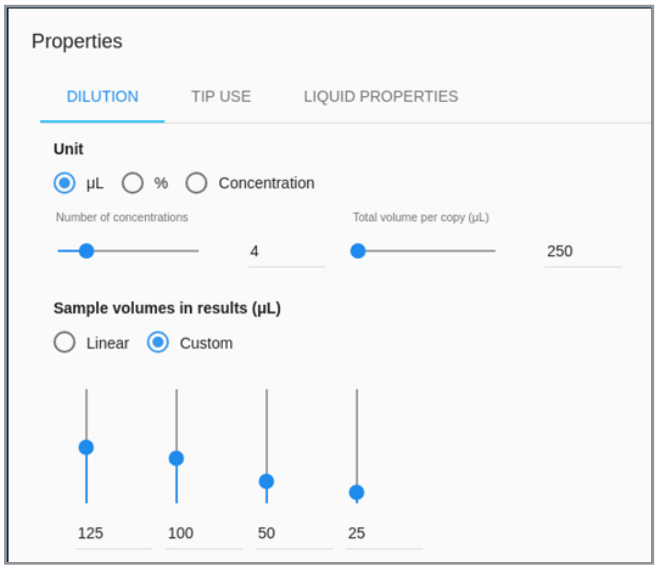
Select diluent - the container with diluent, see below.

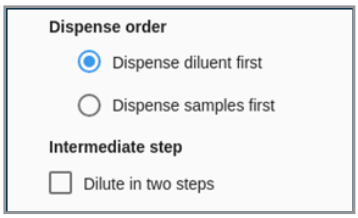


Click Properties.

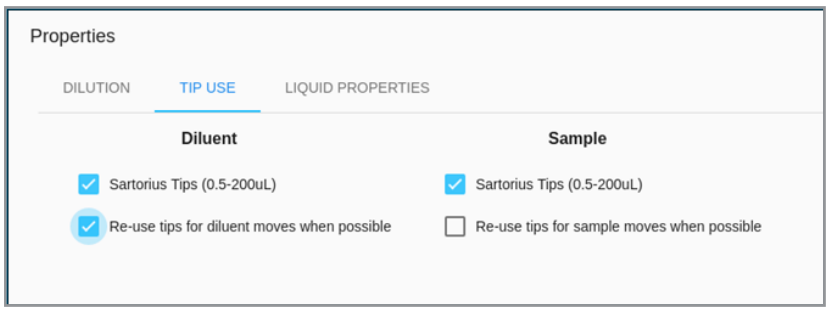


Specify properties for DILUTION.

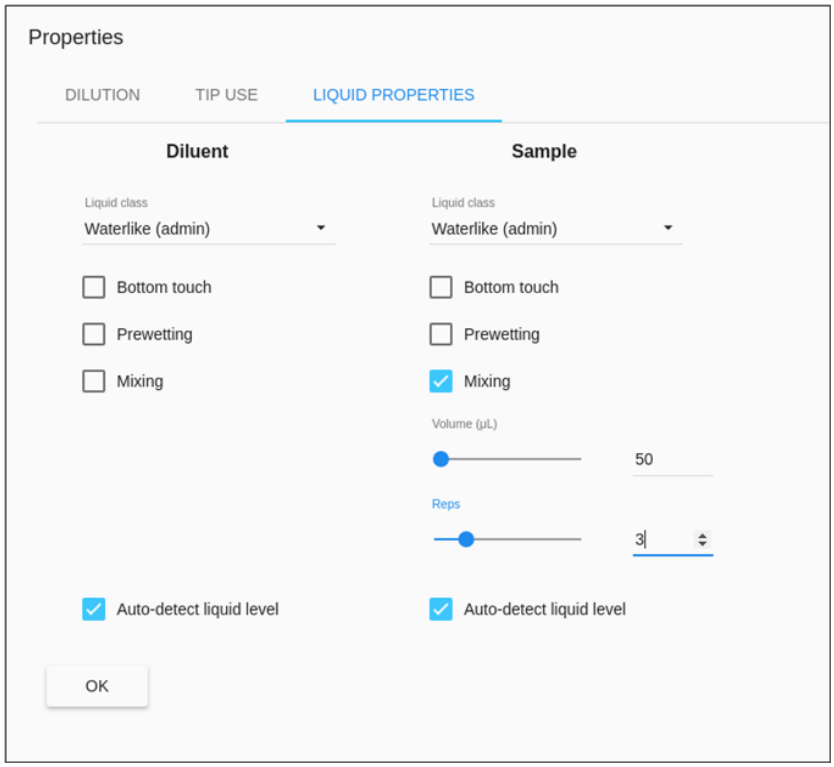




Specify properties for TIP USE.

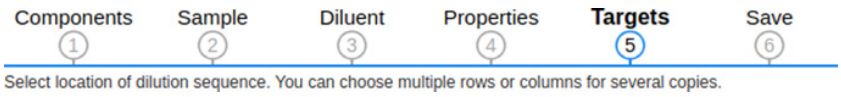


Specify properties for LIQUID PROPERTIES.

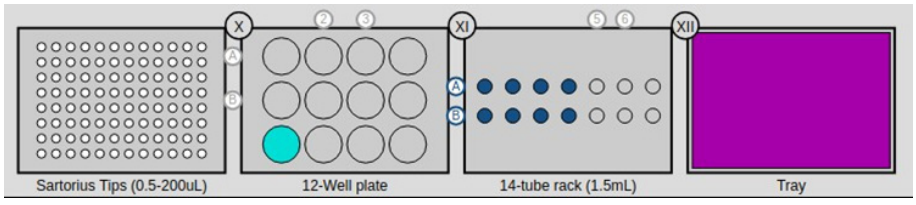


Click OK.

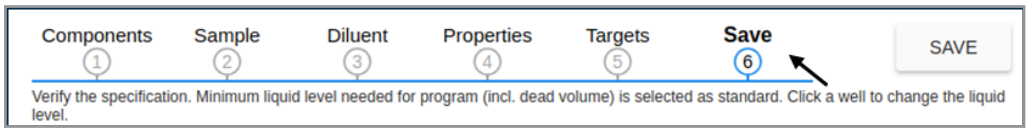
Click Targets.



Select targets: Row A and B in the 14-tube rack (1.5mL).

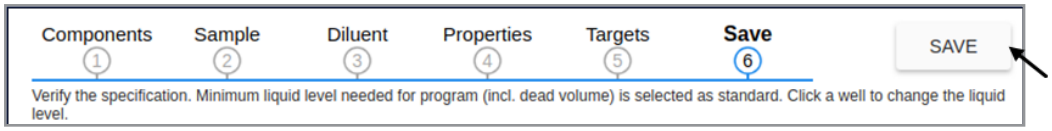


Click Save.



Check time estimate and use of pipette tips to the right. Check the minimum required liquid volume by placing your mouse over the wells.

Click SAVE.



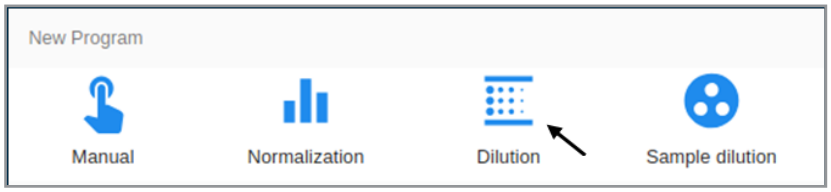
Name the program and click Save.

For execution, see **Manual pipetting program**.

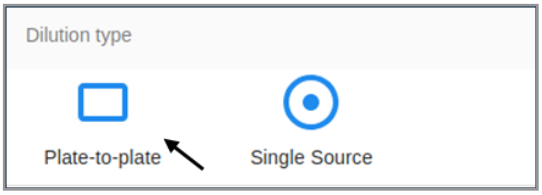
Plate to plate dilution

Dilute 96 samples in a 96-Well plate to half concentration in a new 96-Well plate (100µL in total in each well).

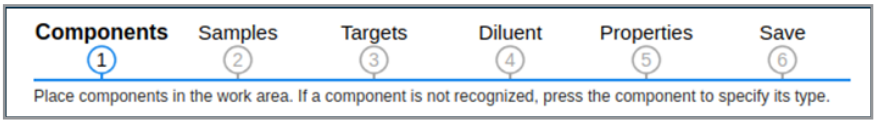
Click Dilution and go to the Dilution dashboard.

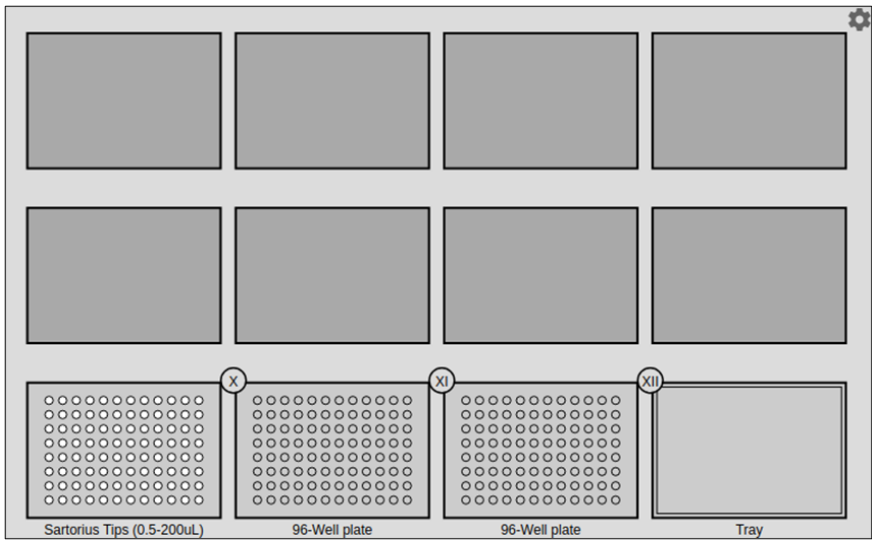


Click Plate-to-plate.

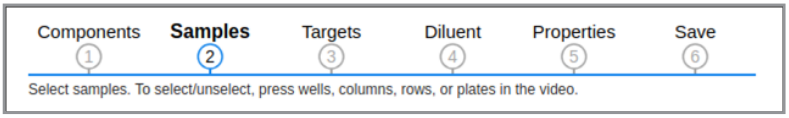


Select placement of pipette tips and components according to the graphic below. Click the position and select component from the list if a component is not recognized automatically.

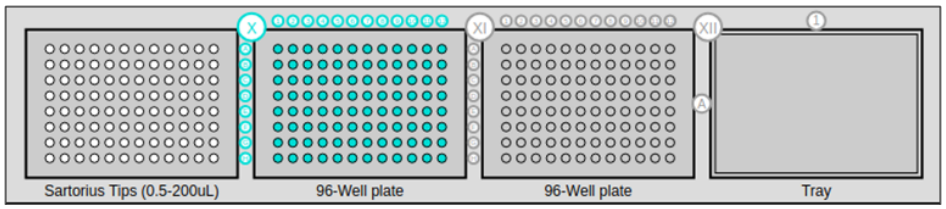




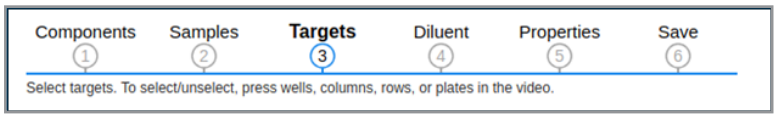
Click Samples.



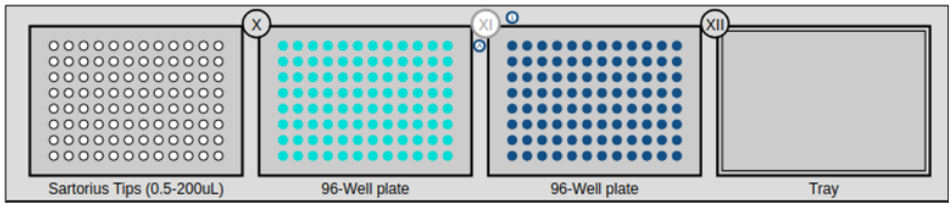
Select samples - the 96-Well plate (pos X).



Click Targets.

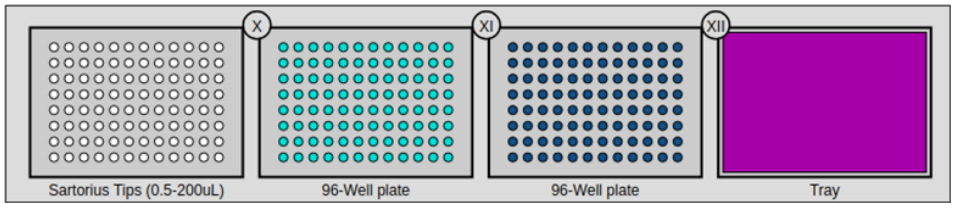


Select targets - the 96-Well plate (pos XI).



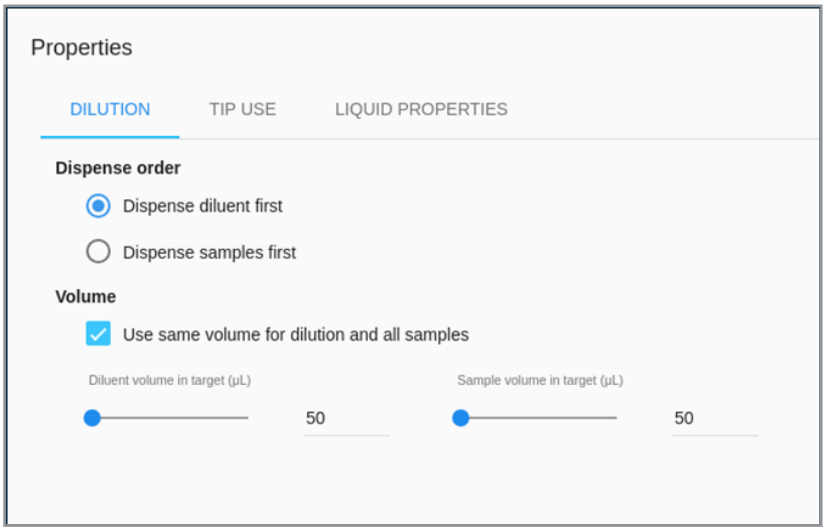
Click Diluent.

Select diluent - the container with diluent (Tray).

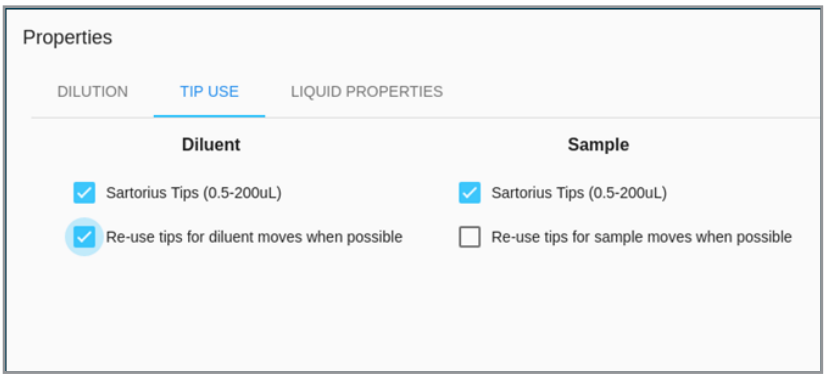


Click Properties.

Specify properties for DILUTION.

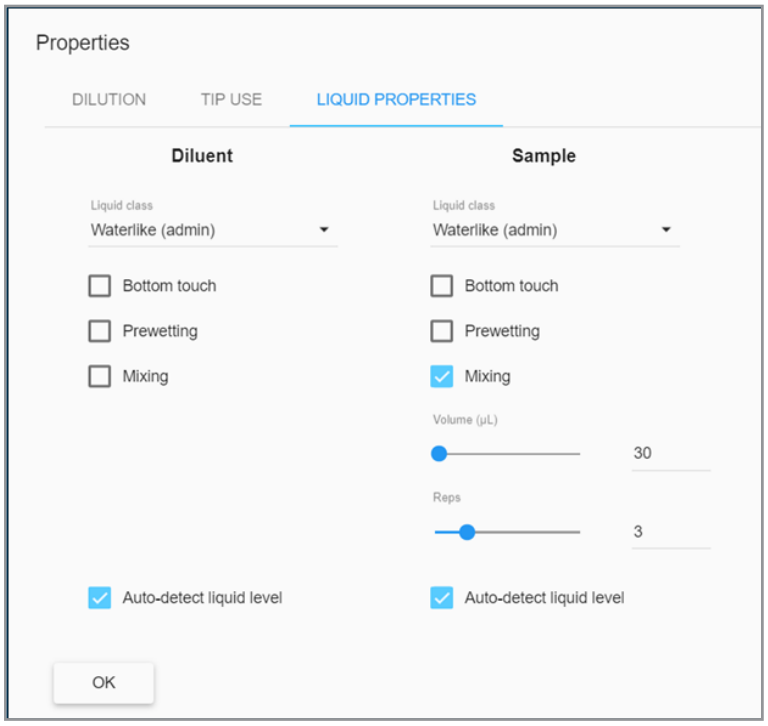


Specify properties for TIP USE.

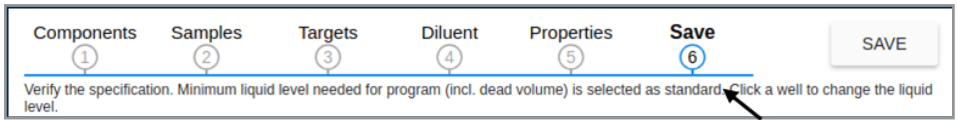


For execution, see **Manual pipetting program**.

Specify properties for LIQUID PROPERTIES.

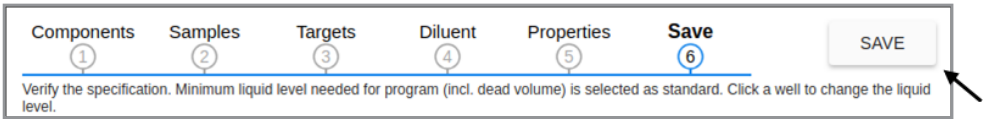


Click OK.



Check time estimate and use of pipette tips to the right. Check the minimum required liquid volume by placing your mouse over the wells.

Name the program.
Click SAVE.

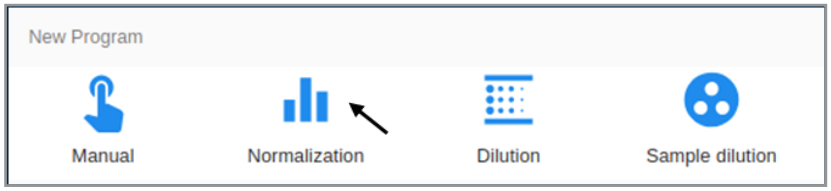


For execution, see **Manual pipetting program**.

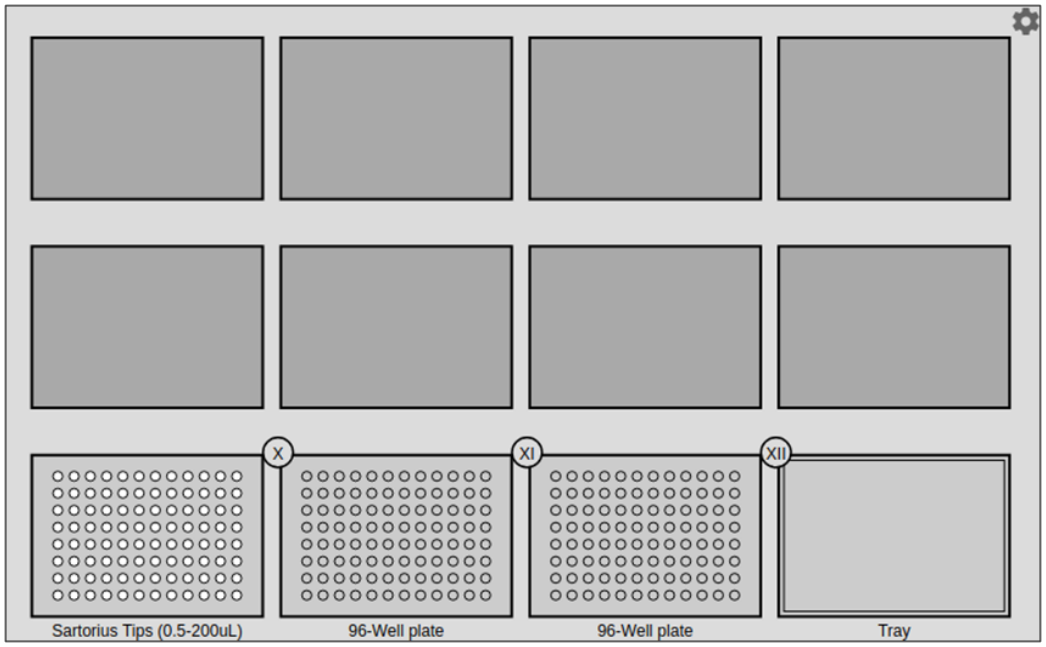
Normalization of 96 samples on a 96-Well plate

A 96-Well plate with 96 different concentrations should all be normalized to the same concentration and volume on a new 96-Well plate.

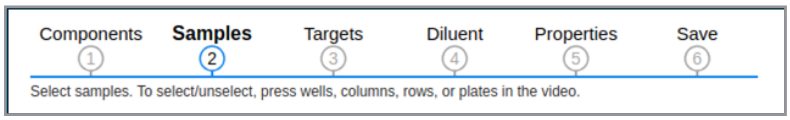
Click Normalization.



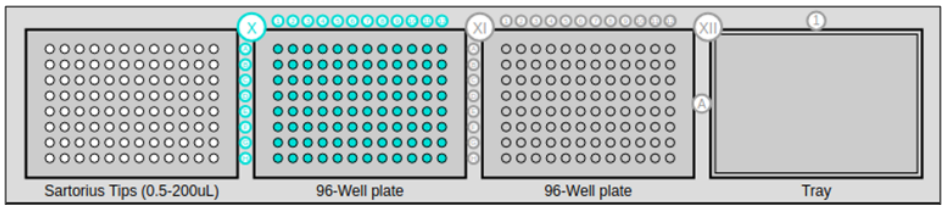
Select placement of pipette tips and components according to the graphic below. Click the position and select the component from the list, if the components are not recognized automatically.



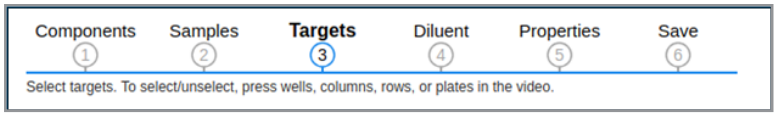
Click Samples.



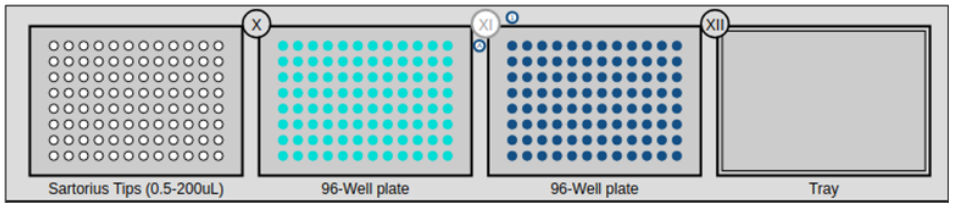
Select samples - the 96-Well plate (pos X)



Click Targets.

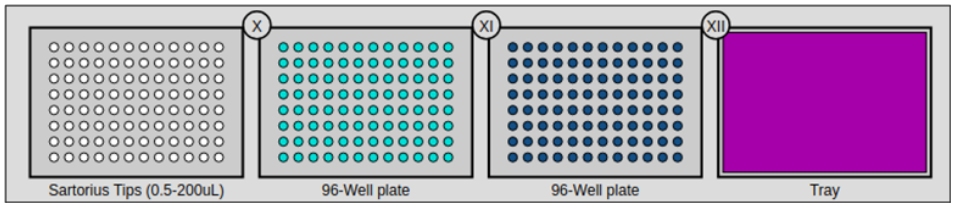


Select targets - the 96-Well plate (pos XI).



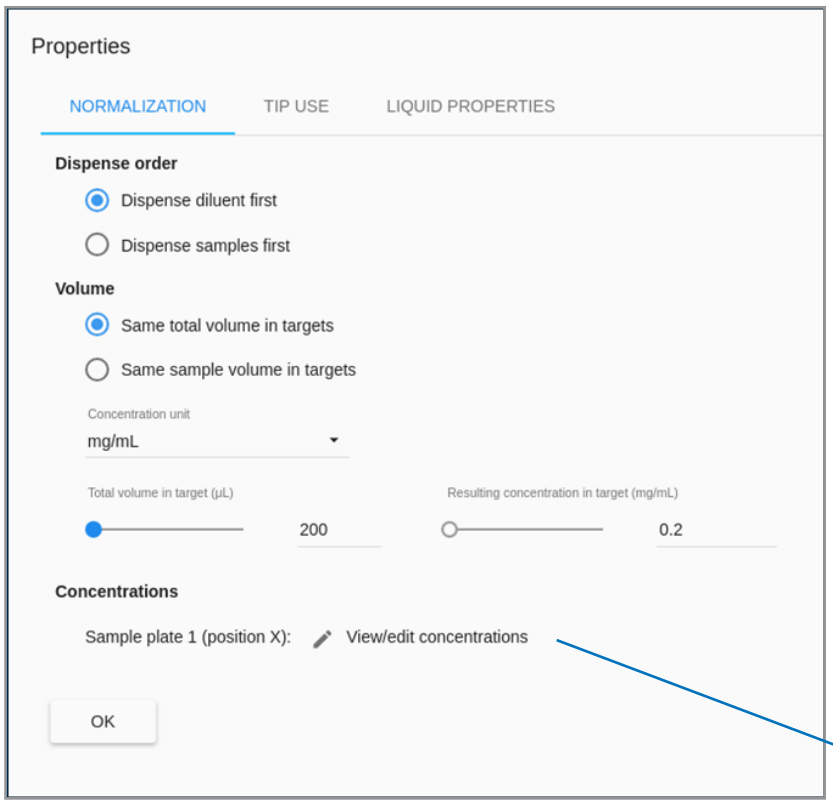
Click Diluent.

Select diluent - the container with diluent (Tray).

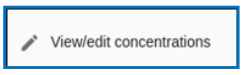


Click Properties.

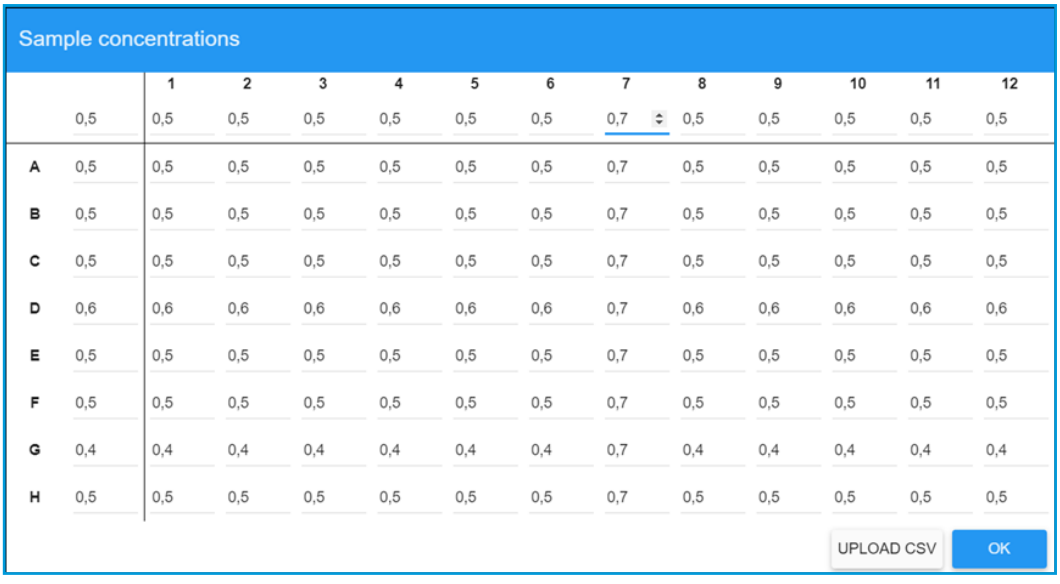
Specify properties for NORMALIZATION.



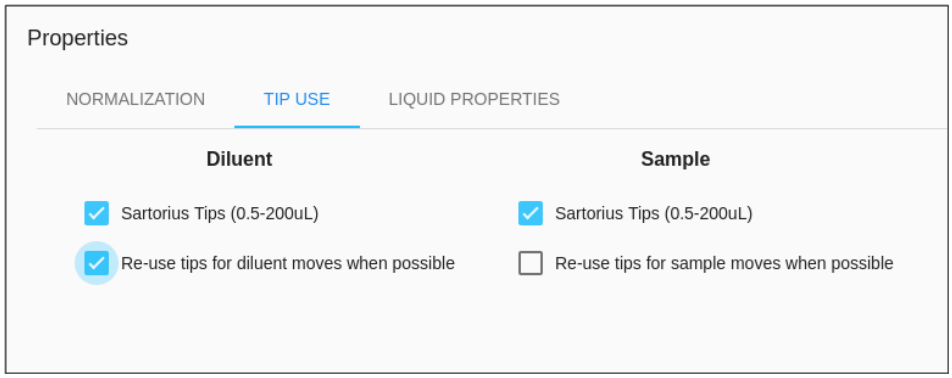
Click



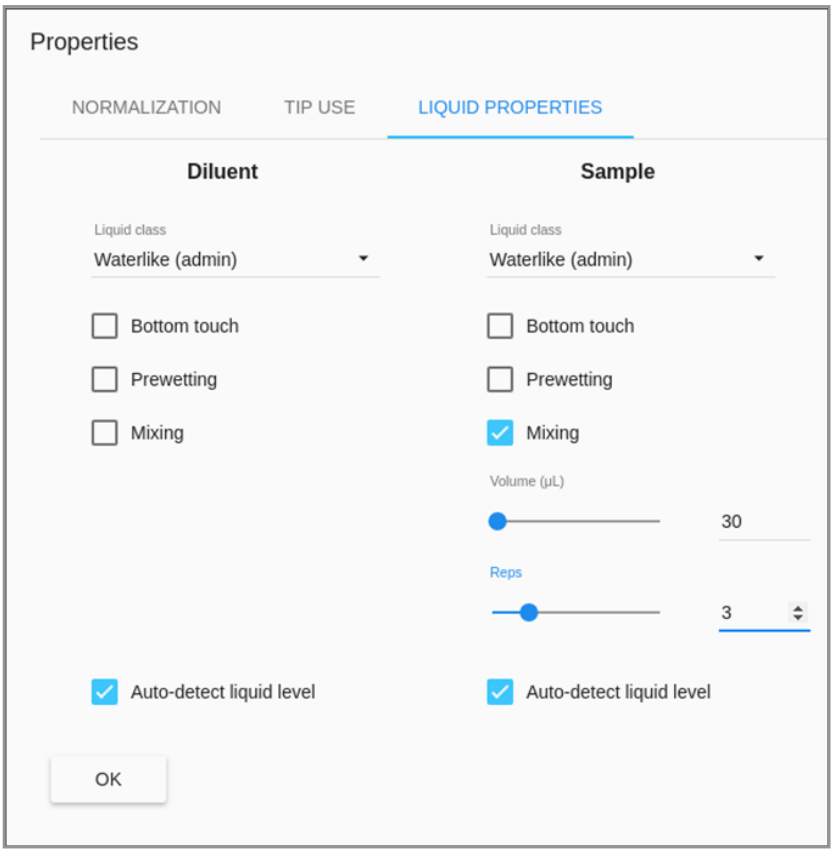
Edit Sample concentrations according to table below and finalize with a click on OK.



Specify properties for TIP USE.



Specify properties for LIQUID PROPERTIES.



Click OK.

Check time estimate and use of pipette tips to the right. Check the minimum required liquid volume by placing your mouse over the wells

Name the program. Click SAVE.

For execution, see **Manual pipetting program**.

UNPACKING AND INSTALLING THE ROBOT

The flowbot® ONE is delivered in a wooden crate.

You will need a TX20 bit to unscrew the screws. Once all the screws are unscrewed the lid can be lifted off. After the lid is removed, we recommend moving the top foam before lifting the sides from the crate. From here the robot can be lifted from the bottom and placed on a table. The robot weighs approximately 105 kg without packing and accessories.

Installation Qualification (IQ)

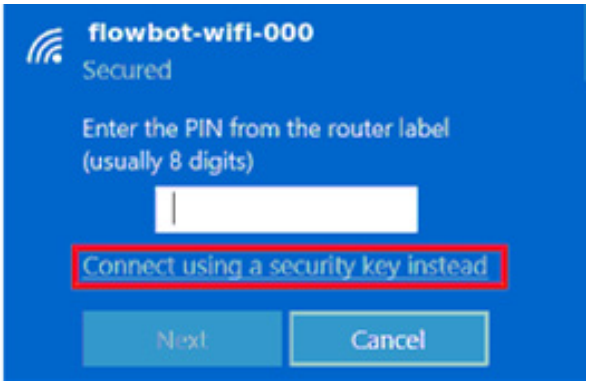
Place flowbot® ONE

Place the robot on a levelled, stable table, suitable for the weight of the robot. Check all four feet are fastened and at even height. Avoid re-positioning feet, if you do not have to. It can affect the factory xyz calibration.

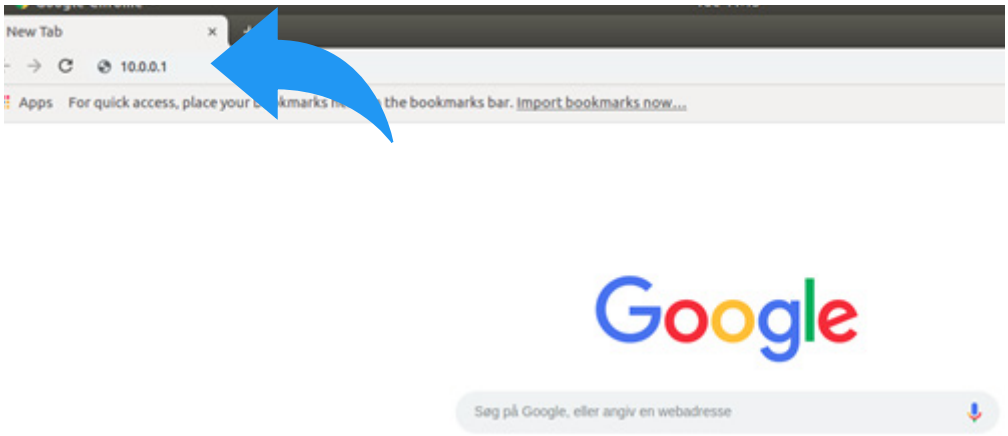
Connecting to the robot

Choose the WiFi network that belongs to the robot. The network SSID is given with the installation documents and has the form flowbot-WiFi-XXX. When asked for the PIN, do not enter the WiFi password here, but click Connect using security key instead and then enter the password:

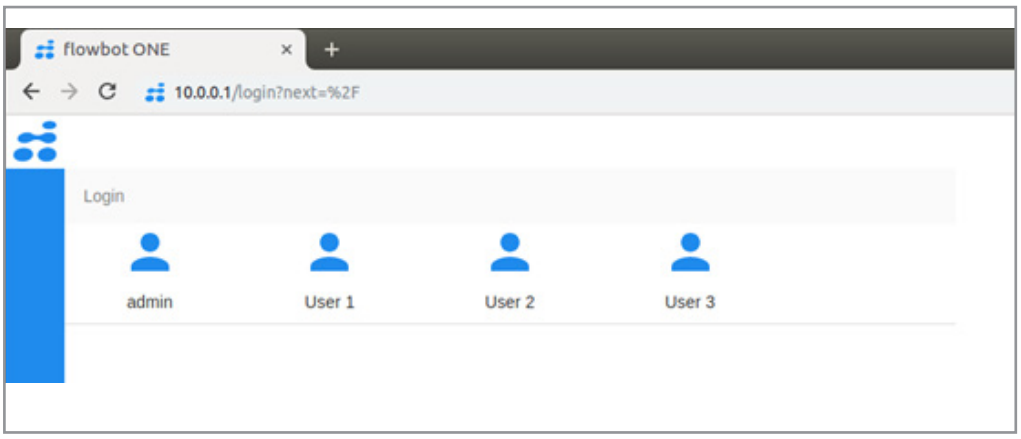
Note: The robot is not connected to the internet, so it works even though Windows says No internet connection.



Open your browser and type in the address 10.0.0.1



Then click on Admin in the Main Dashboard and login as admin. The admin password is given with the installation documents.

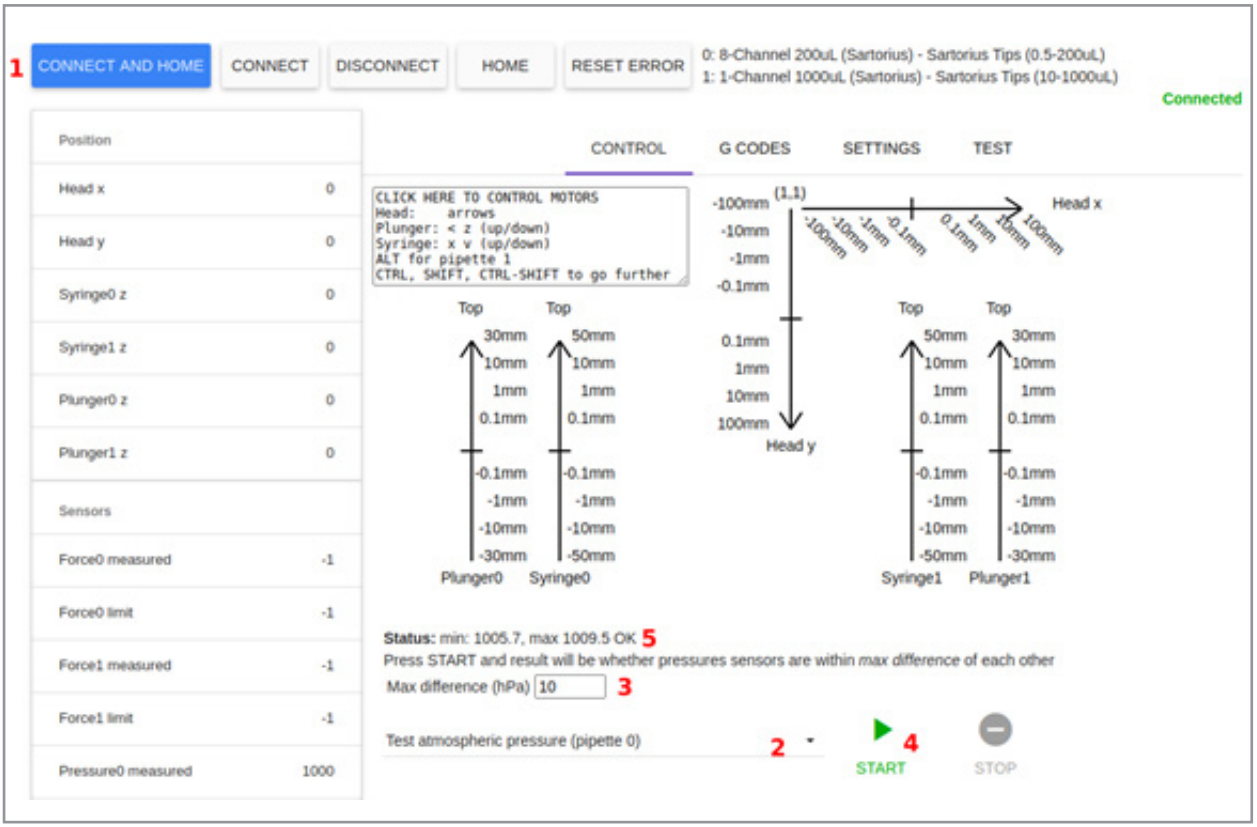


Check pressure sensors

Go to Low Level Control

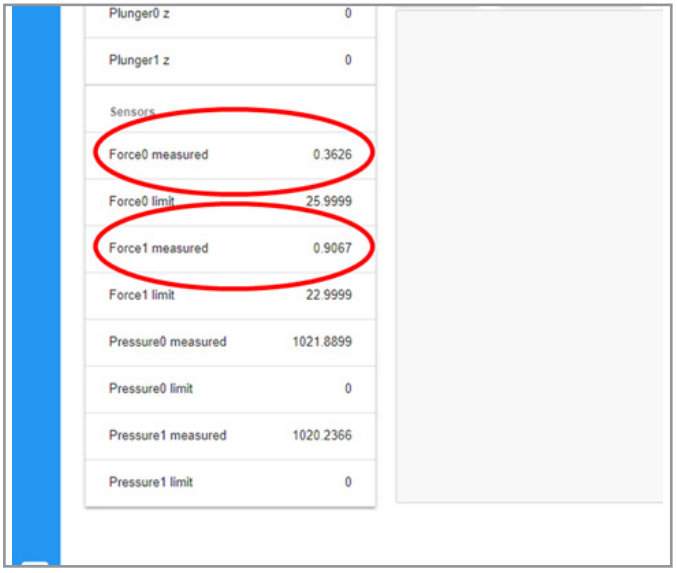
1. Press CONNECT AND HOME.
2. From the dropdown menu select Test atmospheric pressure ((pipette 0).
3. Set Max difference (hPa) to 10
4. Press START.
5. The Status will show the minimum and maximum pressure in the eight sensors and OK if they are within 10 hPa of each other.

Do it for both pipette 0 and pipette 1.



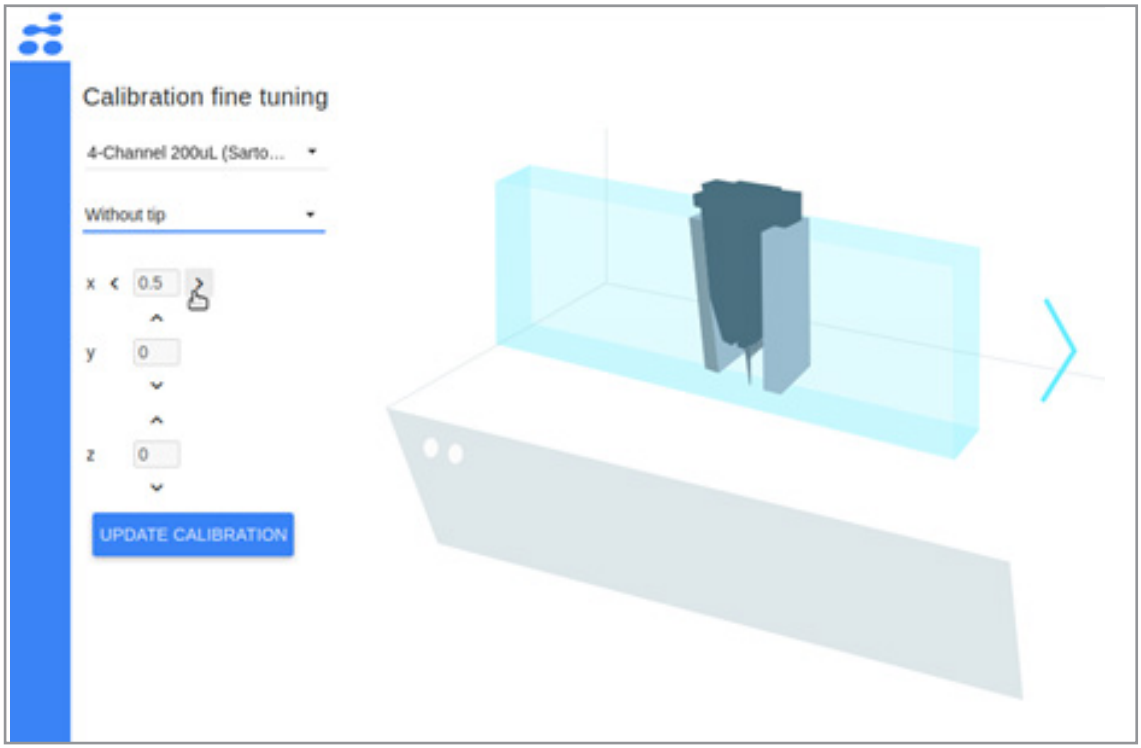
Check force sensors

Continue in Low Level Control
When pushing on the pipettes from underneath (on the metal plate towards the center of the two pipettes with the logo carved out), note that the force increases the more you push. When you stop pushing, note that the force decreases again. It might not go all the way back to 0, but 1-3 N is fine.



Adjusting the geometric calibration

If the pipettes are not centered over the tips when picking them up, or if it does not hit the center of the wells/tubes, you can adjust the geometric calibration of the robot in Setup => Tune Calibration. For example, if the pipette hits the left side of the tips when picking them up, you can tune the calibration to the right, like below.

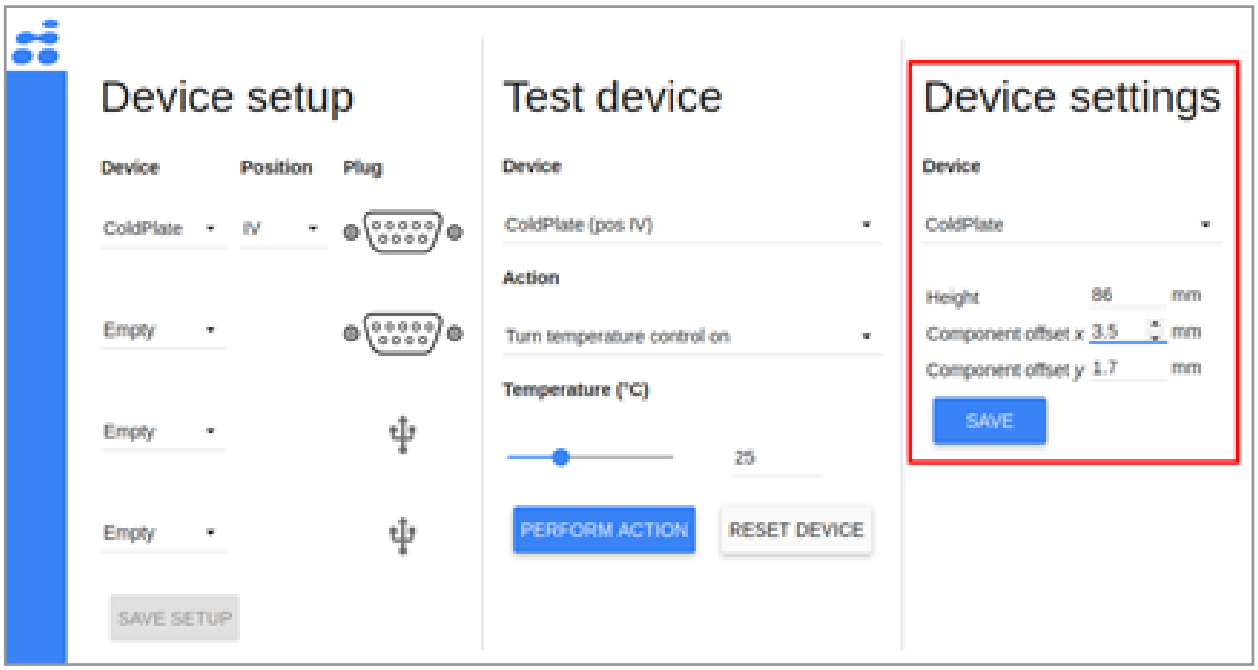


Here we have tuned the calibration 0.5 mm to the right. Once the calibration is updated, press UPDATE CALIBRATION to save.

Note that we selected Without tip, because we want to adjust the calibration when the robot is picking up tips, i.e., when it does not have tips on. To adjust the position of the pipette with tips, i.e., when aspirating or dispensing from a component, select With tip.

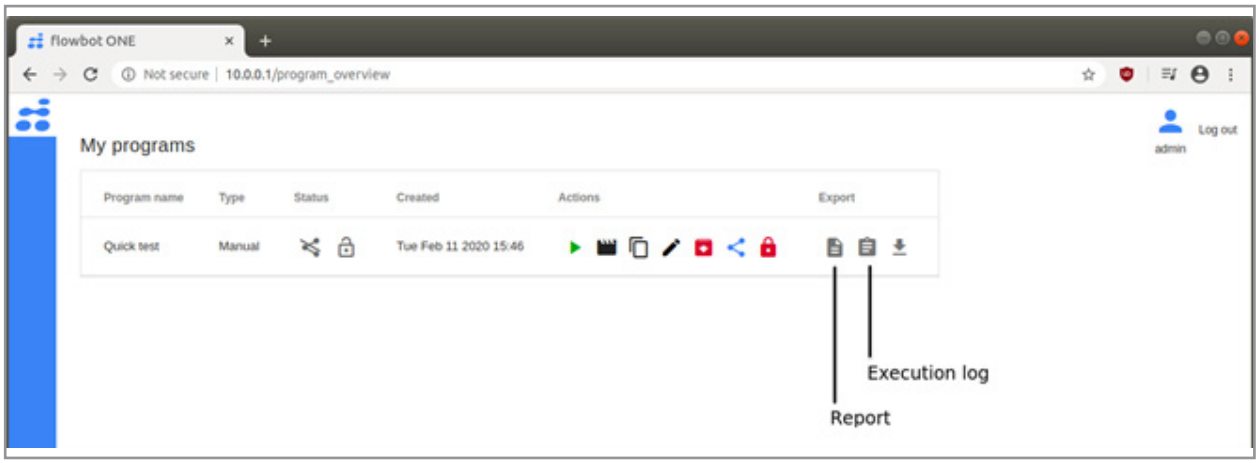
Adjusting the geometric calibration on a device

If you find that the robot does not hit the wells when they are placed on a device, such as a ColdPlate or a BioShake-3000, you can similarly adjust the offset of components sitting on a device. From the Main Dashboard, go to Devices. In the column called Device settings, select the device you want to make the adjustment for, adjust Height and Component offset x/y as needed, then press SAVE.
For example, if the robot hits a little too far to the left side of the wells when placed on a ColdPlate. Decrease Component offset x as shown below. If the tips hit the bottom of the wells, increase Height.



Operational Qualification (OQ)

Go to My Programs and press the green play button →for the program called Quick test. Place the components as shown in the overview. Click on the components that are not recognized by the camera and then click the RUN PROGRAM button in the top right corner.
Click the yellow Connect button and wait for the robot to home, then press Execute. Observe the requirements from the IQ and OQ Check List. On customer request, you can print the Report for the OQ specification (sometimes called the protocol) of the program and the Execution log for



the program from My Programs. Add these under Appendices in the IQ and OQ Check List.

OQ troubleshooting guide

Should you notice anything going wrong during OQ, the most common problems and their solutions are listed in the table on the following page.

Problem	Solution
The tips are pushed on too hard or too soft.	Go to Setup and Local Pipette Specs. For each pipette you can adjust the force it uses when picking up tips with pickup_force and adjust the number of times it pushes with pickup_reps. See the document Local Pipette Specs for more details.
The pipette/tip is not centered over the tip-box/well.	If tuning the calibration does not solve the problem, you might have to do a full calibration. Proceed as explained in the document XYZ Calibration manual.
Tips are not ejected properly.	Go to Low Level Control and press CONNECT AND HOME. From the dropdown menu select Set dispense tip position. After pressing START, the pipette will move to the waste position. Use the Syringe controls to move the pipette down until it dispenses the tips, then press STOP.
The robot does not find the liquid level.	If the robot finds the liquid level in the air, the delta should be increased (more negative). If it doesn't find the liquid level, the delta should be decreased (less negative). To adjust the delta for a tipbox, go to Setup and Tip Boxes.
The robot does not detect when it picks up tips.	Go to Low Level Control and press CONNECT AND HOME. From the dropdown menu select Detect missed tip threshold. Set a tip box in position XII (Tipbox pos 11) and press START. The robot will pick up tips four times and adjust the missed tip threshold.

TECHNICAL SPECIFICATIONS

Physical dimensions

- Height x width x depth: 110 x 100 x 82 cm (opened)
- Height x width x depth: 80 x 100 x 60 cm (closed)
- Weight: 105 kg

Electricity

- Nominal supply voltage: 90-264 V AC plug Nominal supply frequency: 50/60 Hz
- Power consumption: 2A/115VAC, 1A/230VAC. Power consumption: 160W. (Excl. additional devices used with own power supply)
- The power is consumed at Cos (Φ): 0.40

Noise

- Airborne noise emitted by the machine:
- Measured sound pressure level is less than 70 dB(A).

Work area and table dimensions

The space inside the robot consists of a stainless-steel plate with a glass plate in the middle. An grid is mounted in on the glass plate, and is called the work area. It consists of 12 SLAS (SBS) standard positions (127.8 x 85.5) in 3 rows and 4 columns. Two pipette modules with either 1, 4, or 8 channels operated above the work area.

- Column center distance: 137.8 mm
- Row center distance: 110.5 mm
- Work height from glass plate to tip cones (without tips):
  - 200/1000µL flowbot® tips: 232 mm
  - 200µL Sartorius: 232 mm
  - 1000µL Sartorius: 196 mm
- Work height under pipette module 185 mm

- Table dimensions inside door. Width x depth: 868 x 567 mm

Targeting accuracy
The robot targeting accuracy is depended on several factors: tip quality, how they fit the pipette tips cones, maintenance of tip O-rings and settings for tip pickup. It is therefore important to follow Flow Robotics recommendations for tip use and maintenance.

- Expected target accuracy: x, y, and z (syringe) axis: ± 0.3 mm

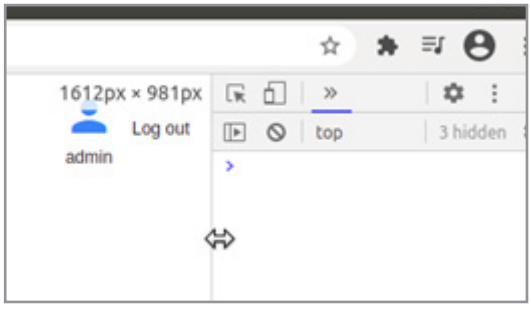
Dispense accuracy
Pipette modules are calibrated according to ISO 8655. In three points: Minimum, maximum and middle volume.

Operating limits, Environment

• Allowed temperature range	0 °C to 40 °C
• Permissible relative humidity (none condensing)	Min. 20 % Max. 80 %

Requirements for PC/tablet user interface
Browser
We recommend that you use the Google Chrome™ browser for using the web application with flowbot® ONE.

Display
The best user experience is obtained when the window has a resolution of minimum 1560 x 840 pixels. Note that Windows uses zoom by default on some computers which reduces the effective number of pixels. This setting can be changed in the Windows Display settings.
You can check the effective number of pixels that the web application has by pressing Ctrl + Shift + i in Google Chrome and dragging on the side bar as shown in the picture below.



Power
If a laptop is used with flowbot® ONE, it is recommended that you ensure that the computer will not sleep or hibernate while a program is running. Otherwise, the computer might shut down network connection which can result in the robot stopping during program execution, and the program will have to be restarted before execution can continue.

Networking
The robot has the IP address 10.0.0.1 on its own network. It will assign computers that connect to it, an IP in the range 10.0.0.2 - 10.0.0.14. The WiFi network uses WPA/WPA2 (personal) encryption. We recommend that the computer you use for the web application cannot switch to other networks automatically.
If the computer loses connection to the robot's network, the robot will stop after 10-60 minutes. Due to the way the web socket protocol works, we cannot set this stop time explicitly.
The web application uses port 80 (HTTP). Remote support is done by connecting to a server with SSH via port 22 and creating a tunnel back that by default uses port 50505, but this can be configured by the user for a particular remote support session. This tunnel will be closed by the technician when the remote session is over, but the user can also abort it by turning off the robot.

Anti-virus and firewall
We recommend that you check your anti-virus and/or firewall configuration to see if they're compatible with the network settings if you experience long load times in the web application. In particular, ensure that the IP 10.0.0.1 is whitelisted.

APPENDIX 1: CSV FORMAT FOR SETUP AND PROGRAMS

Note on CSV files and Excel

CSV formats can be edited in spreadsheet software like Microsoft Excel, but depending on the regional settings of Excel, there can be issues, if the regional setting uses comma (,) as the decimal separator, since the robot expects period (.) as decimal separator.
Furthermore, comma is the default cell delimiter in CSV files, hence, the software cannot parse the files correctly if commas are present. If your regional setting uses comma as decimal separator it cannot use comma as the cell delimiter, so most spreadsheet software will then use semi-colon (;) as cell delimiter. The flowbot® software can handle semi-colon as the cell delimiter, again, only if there are no commas.

Setup

A setup is specified as a csv-file with the two headers pos and component.

- pos is the slot position of a component. The slots are numbered starting with 1 in the top-left corner and consecutively numbered left-to-right and top-to-bottom.
- component is the name of the component specified

Each line in the file corresponds to one component.
An example of the contents of a setup file is shown below

```
pos,component
1,96-Well plate
3,Sartorius Tips (0.5-200uL)
4,Tray
2,Tray
5,Sartorius Tips (10-1000uL)
6,96-Well plate
```

As can be seen above, the components do not have to specified in the same order as the positions. It is important that names of components exactly match those of the components of the robot. This includes capitalized letters, parentheses, etc.
It is also necessary to have the one-line header in every setup file.

Programs

Manual programs can be specified using CSV files in the format described in this section.

Each line of a CSV program file (except for the header line) will contain one action such as

- "Move 20µL from well A3 to A6 in the component in position 4"
- "Move 50.7µL liquid from well A1 in the component in position 3 to every well in the component in position 7"
- "Move 100µL liquid from every well in row A in the component in position 2 to every well in row B, C, D, E and F in the component in position 2"

The CSV program file should start with a header line. This specifies the columns present in the subsequent rows of the file. The order of the columns is not important.

We specify the name of the column headers below along with their type.

Mandatory column headers are:
- source: <<rectangle>>
- target: <<rectangle>>
- volume: real
- pipette: string
- tipType: string

The rectangle format is discussed in more detail below. A simple example, only using the mandatory column headers, specifying the three actions specified above is given below.

source, target, volume, pipette, tipType
4:A3, 4:A6, 20, 1-Channel 100uL (Sartorius), Sartorius Tips (10-1000uL)
3:A1, 7, 50.7, 1-Channel 100uL (Sartorius), Sartorius Tips (10-1000uL)
2:A, 2:B-F, 100, 1-Channel 100uL (Sartorius), Sartorius Tips (10-1000uL)

Optional column headers are:

- bottomTouch: boolean
- pipette: string
- tipType: string
- liquidClass: string
- liquidLevelDetection: boolean
- liquidMixingAspirationReps: int
- liquidMixingAspirationVolume: real
- liquidMixingAspirationEnabled: boolean
- liquidMixingDispenseReps: int
- liquidMixingDispenseVolume: real
- liquidMixingDispenseEnabled: boolean
- sameTips: boolean
- reuseTips: boolean
- stepRowSource: int
- stepColSource: int
- stepRowTarget: int
- stepColTarget: int
- offsetRowSource: int
- offsetColSource: int
- offsetRowTarget: int
- offsetColTarget: int
- type: pipetting or dispense
- excessDispense: source or waste
- excessVol: real
- aspirationDepthRelative: liquid or bottom
- aspirationDepthValue: int

- dispenseDepthRelative: liquid or bottom
- dispenseDepthValue: int

If column headers are left out, they will be given standard values when loaded by the robot. The robot will then also choose appropriate pipettes and tips for the different actions specified.

Constraints

source/target
Specifies the source and target of the action respectively. There must be a component at the specified position.

volume
Specifies the volume to be moved. The volume must be positive. Moreover, it must be within the range of one of the pipettes.

bottomTouch
Specifies whether the pipette should touch the bottom of the vessel after dispensing liquid. Can be either True or False. However, cannot be used if target is too deep for the pipette.

pipette
Specifies the name of the pipette to be used for the action. Must match the tipType (if defined) and the volume of the move.

tipType
Specifies the name of the type of tip used for the action. Must match the pipette (if defined) and the volume of the move.

liquidClass
Specifies the name of the liquid class to be used for the action. Must match the name of an existing liquid class in the database of the robot.

liquidLevelDetection
Specifies whether the robot keeps track of the liquid level of the wells. If

liquidLevelDetection is enabled, liquidLevelSource and liquidLevelTarget are ignored, and the liquid level is instead determined from the last known liquid level (or the liquid level is detected via pressure sensor, if that is enabled for the pipette).

liquidMixingAspirationReps / liquidMixingDispenseReps
Specifies the number of times mixing is performed (if mixing is enabled) for aspiration and dispense respectively. Must be non-negative.

liquidMixingAspirationVolume / liquidMixingDispenseVolume
Specifies the volume used for mixing (if mixing is enabled) for aspiration and dispense respectively. Must be non-negative.

liquidMixingAspirationEnabled / liquidMixingDispenseEnabled
Specifies whether mixing is enabled for aspiration and dispense respectively. Can be either True or False.

sameTips / reuseTips
sameTips specifies whether the same tips can be used for the entire action (e.g. moving liquid from a tray to every well in a well-plate).

reuseTips specifies if the tips used in the previous action can be reused for this action.
Both can be either True or False.

stepRowSource / stepColSource / stepRowTarget / stepColTarget
Can be used to specify every second row/column for a move for source and target respectively. Must be positive. Standard value is 1. Every second row/col is 2, every third is 3 and so on.

offsetRowSource / offsetColSource / offsetRowTarget / offsetColTarget
Standard value is 0. Can be used to specify if the first n rows or columns should not be used. For instance, consider the action defined in the program below:

source, target, volume, offsetColTarget
1:A1, 2:A, 50.0, 3

Here, the robot will move 50µL from well A1 in the component in position 1 to every well in row A in the component in position 2, except for the first 3 wells of row A.
type
Specifies whether the move is a normal pipetting move, pipetting, or a multi-dispense (aliquot) move, dispense.

excessDispense
Specifies whether the excess liquid in a dispense move should go back to the source well (if so, select source) or to the waste bin (if so, select waste).

excessVol
Specifies how much excess liquid the robot should aspirate with a dispense move (in µL).

aspirationDepthRelative / dispenseDepthRelative
Specifies whether aspiration/dispense should be done relative to the liquid (if so, select liquid) or relative to the bottom of the component well (if so, select bottom)

aspirationDepthValue / dispenseDepthValue
Specifies how many millimeters from liquid or the component well bottom the liquid should be aspirated dispensed. For example, if you want to aspirate 2 mm below the surface of the liquid, you should set aspirationDepthValue to -2 (negative because it's below). Or, if you want to dispense 5 mm above the component well bottom, you should set dispenseDepthValue to 5 (positive because it's above) along with dispenseDepthRelative set to bottom.
Rectangle format

The rectangle format is a string meant to describe either a source or target. This could be a single well, a row, a column, a rectangular area or an entire plate.

Single well
A single well is specified by a string of the form
<<pos>>:<<row>><<col>>
Here, <<pos>> is an integer specifying the position of the slot where the component containing the well is positioned. The positions are counted starting with 1 in the top-left corner, counted first in the right direction, then in the down direction. A tip ejection slot is not counted. Thus, in FlowBot 1, the positions are numbered 1-11.
<<row>> is a capital letter specifying the row of the well. The top-most row is called A, the second top-most row B and so forth.
<<col>> is an integer specifying the col of the well. The left-most column is called 1, the second left-most column 2 and so forth.

Row
A row is a string of the form
<<pos>>:<<row>>
where <<pos>> and <<row>> are of the formats described above.
Column
A column is a string of the form
<<pos>>:<<col>>
where <<pos>> and <<col>> are of the formats described above.
Rectangular area
A rectangular area is a string of one of the forms:
<<pos>>:<<well>>-<<well>>
<<pos>>:<<row>>-<<row>>
<<pos>>:<<col>>-<<col>>

For instance,

- 4:A3-C7 specifies the wells A3, A4, A5, A6, A7, B3, B4, B5, B6, B7, C3, C4, C5, C6 and C7 in the component at position 4.
- 3:A-D specifies all wells in row A, B, C and D in the component in position 3.
- 2:3-7 specifies all wells in column 3, 4, 5, 6 and 7 in the component in position 2.

Plate
A plate is a string of the form
<<pos>>
Thus, it is just an integer corresponding to the position of a plate.
Standard values for optional columns
Standard values for optional column headers are as follows. These will be used if column is not present in csv file or for rows where the content is the empty string.

- bottomTouch: False
- pipette: 'All pipettes are possible'
- tipType: 'All tips are possible'
- liquidClass: Waterlike
- liquidLevelDetection: False
- liquidLevelSource: 0
- liquidLevelTarget: 0
- liquidMixingAspirationCount: 0
- liquidMixingAspirationVolume: 0
- liquidMixingDispenseCount: 0
- liquidMixingDispenseVolume: 0
- sameTips: False
- reuseTips: False
- stepRowSource: 1
- stepColSource: 1
- stepRowTarget: 1
- stepColTarget: 1
- offsetRowSource: 0
- offsetColSource: 0
- offsetRowTarget: 0

- offsetColTarget: 0
- type: pipetting
- excessDispense: source
- excessVol: 0
- aspirationDepthRelative: liquid
- aspirationDepthValue: -3
- dispenseDepthRelative: liquid
- dispenseDepthValue: -3

Note that it is not possible to write 'All pipettes are possible' and 'All tips are possible' for pipettes and tip types. In this case, the fields should just be left blank.

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NEED HELP?

Contact Flow Robotics at

Support@flow-robotics.com