Using the OpenFlexure microscope

(OpenFlexure Microscope v7 - low cost microscope)
(OpenFlexure operating system image V2 - 2023-04-13)

This user manual is meant to provide instructions on how to navigate the OpenFlexure microscope as well as on how to capture and download images, complementary to official documentation (page 10).
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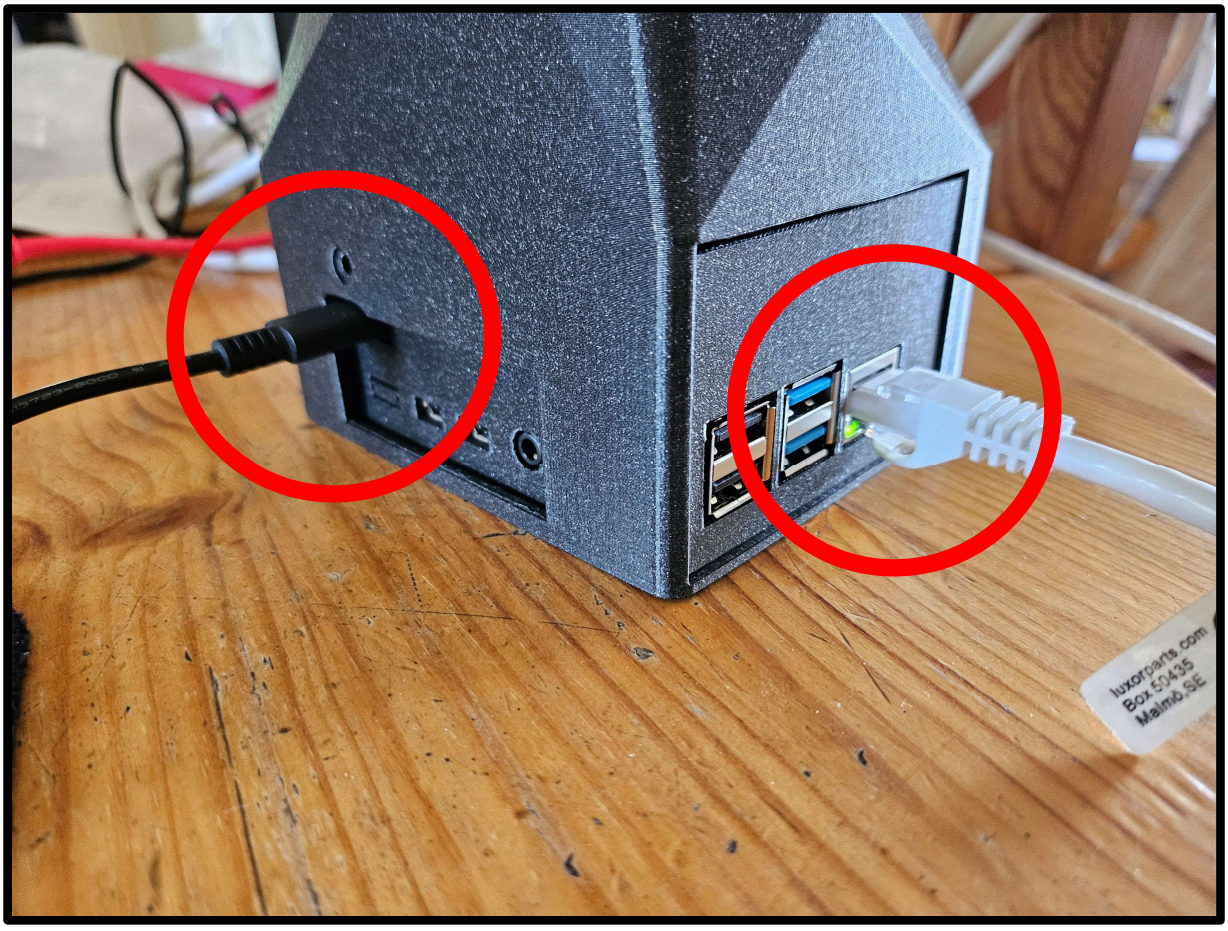
2024-05-23 (updated 2025-10-14)

1. Plug in power and network cable

Plug in the **power cable** between the microscope and electric outlet and the **ethernet cable** between the microscope and your computer.

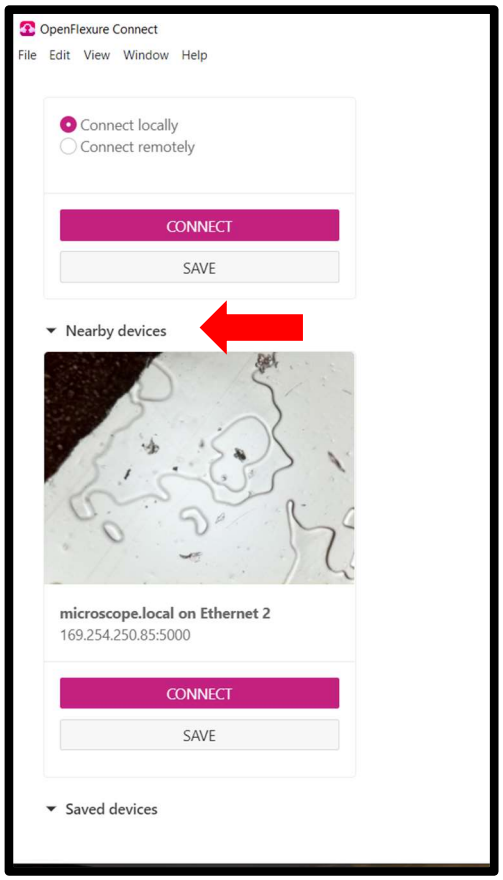


If you don’t have an ethernet socket on your computer you'll need to use a usb-to-ethernet adapter.

2. Connect to the microscope using your computer

While being connected via ethernet cable or being on the same Wi-Fi, it is possible to connect to the microscope using a web browser. To do this you first have to know the name of the microscope (hostname). The hostname of the microscope might be written down on the microscope or given as accompanying information. Using the microscopes **hostname** you write http://**hostname**.local:5000/ in your browser exchanging "**hostname**" with the microscopes actual hostname. E.g if the hostname is "sjolabb“, the browser address would be http://sjolabb.local:5000/

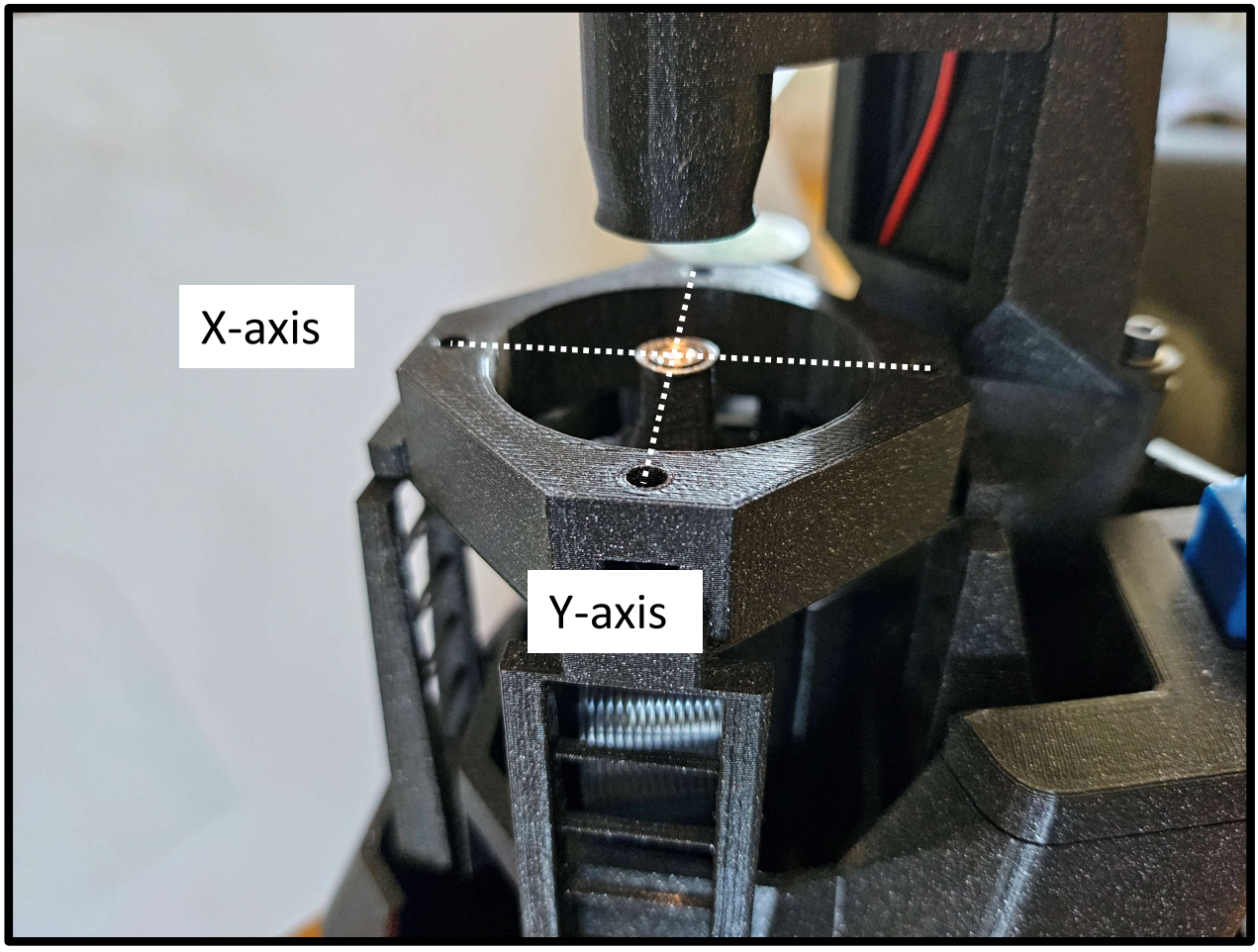
You can also connect to the microscope using the software **OpenFlexure Connect** (download at: **https://openflexure.org/software/openflexure-connect/**).
Both alternatives provide the same interface and functionalities. In **OpenFlexure Connect**, use the “Nearby Devices” section to find your microscope (**red arrow** in image) and press CONNECT to reach the control interface.



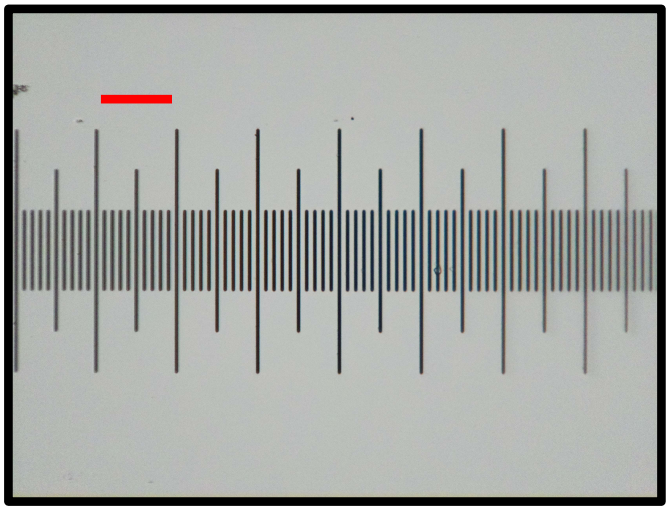
More information with regards to connecting to your microscope can be found at:
https://openflexure.org/projects/microscope/control

! Good to know before navigating the microscope !

It is good practices to try to leave (and start) the microscope in a somewhat centred position, meaning that the stage is somewhat centred above the lens (illustrated by the dotted white lines in the image below). The units of movement (used later in the **Navigate** pane) is based on the steps of the step-motors. From a centred position there are ~70000 steps in each of the four directions (x-axis +/- and y-axis +/-) before reaching the physical stops. It is thus possible to move +70000 steps as well as -70000 steps in both X and Y direction (assuming centred position). Going into the extremes puts a lot of tension on the structure, so staying within the range of ~+50000 and ~-50000 (for x and y) is recommended.



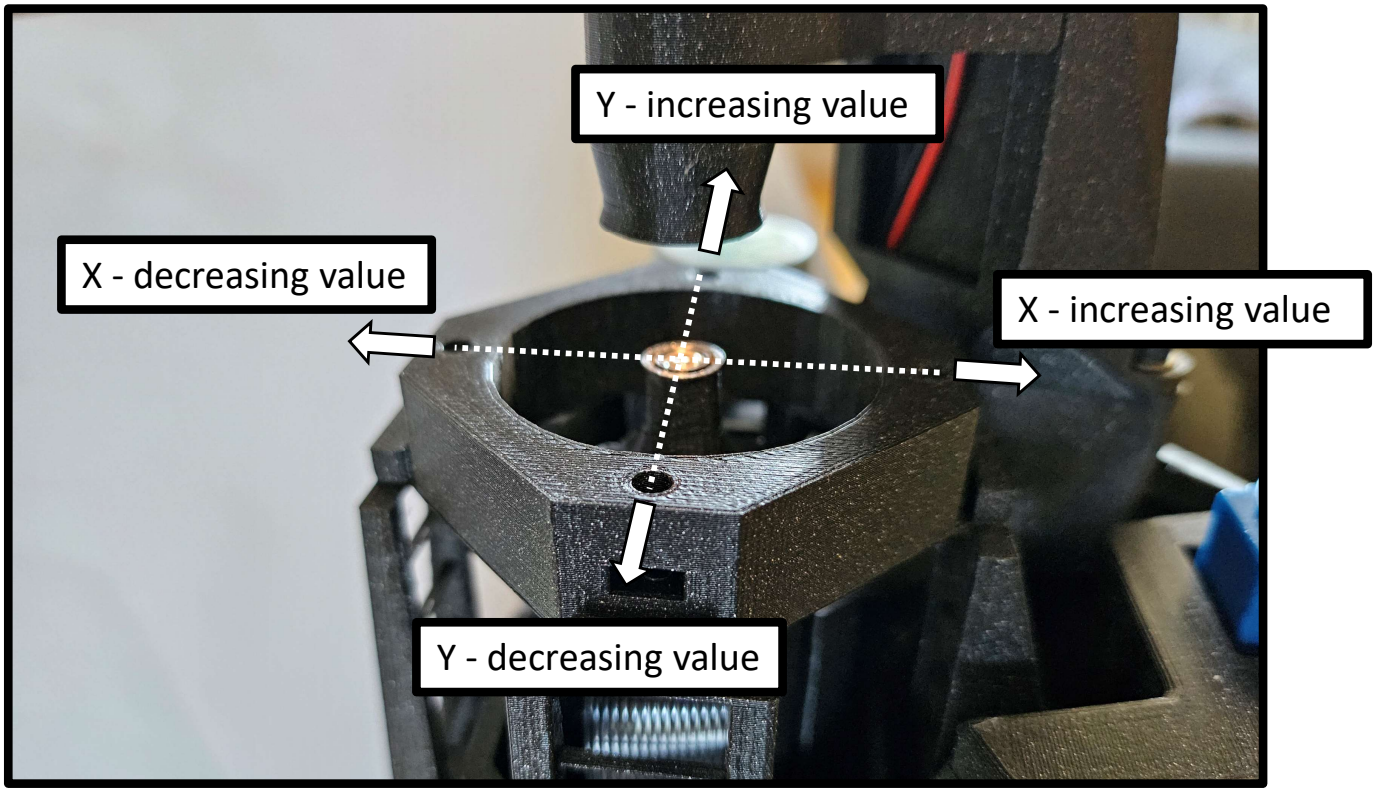
The field-of-view (width of the image shown through the camera) is between 0.7 and 0.8mm. An exact number can be attained by looking at a micrometerslide where each large gap is 0.1mm (**red line**). It is worth to note that it takes ~8000 steps to travel a complete image on x-axis and ~6000 steps to travel a complete image on y-axis (image dimension 4:3). This gives us an approximate working surface area of 1cm^2.



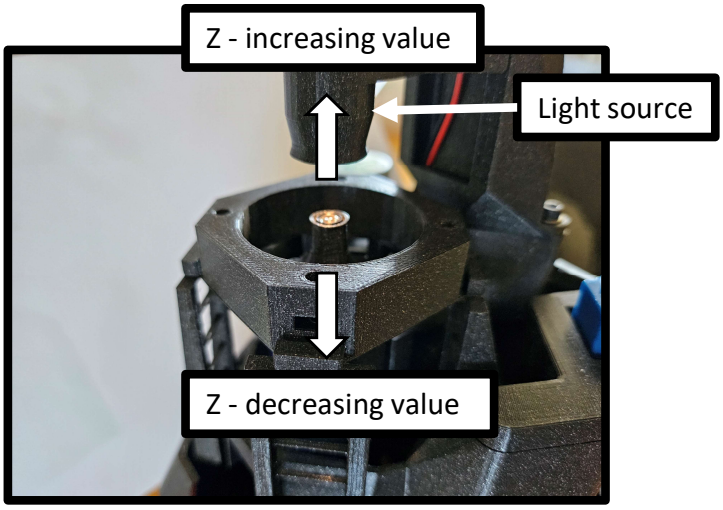
! Cheat-sheet for orientation !

On the **X-axis**: An increased coordinate value (e.g. going from 1000 to 2000) pulls the stage towards the X-motor while a decreased value (e.g. going from 2000 to 1000) pushes the stage away from the X-motor.

This is the same on the **Y-axis**: An increased coordinate value (e.g. going from 1000 to 2000) pulls the stage towards the Y-motor while decreased values (e.g. going from 2000 to 1000) pushes the stage away from the Y-motor.



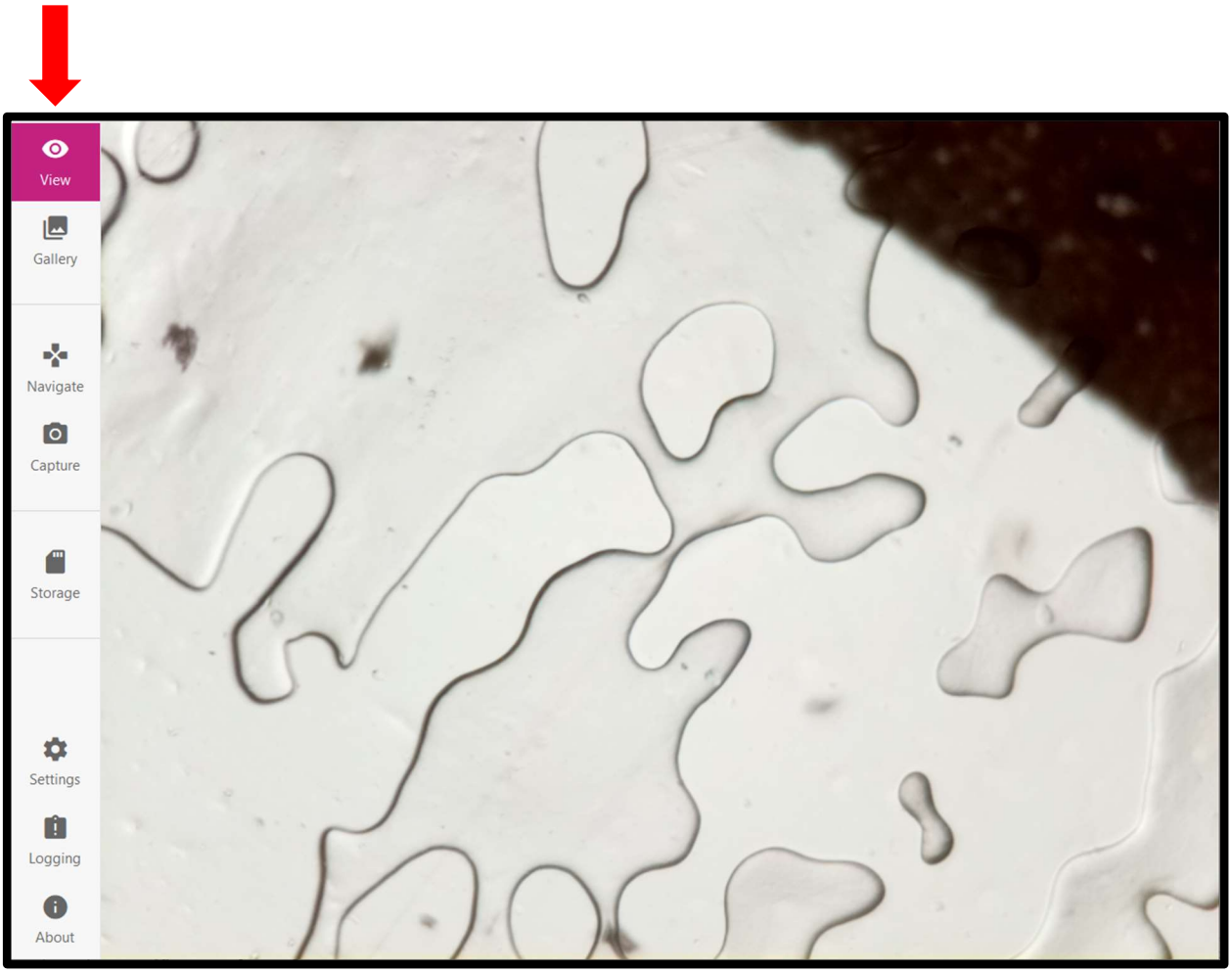
On the **Z-axis** (focus), an increased coordinate value (e.g. going from 1000 to 2000) pushes the lens up through the sample stage towards the light source, while a decreased value (e.g. going from 2000 to 1000) pulls the lens down through the sample stage away from the light source. It is worth to note that it takes ~14500 steps to travel 1mm on z-axis, and the distance from lens to focus plane is ~1.5mm.



This can be useful to keep in mind if you are using different sample containers (petri dishes or flasks) where the container “floors” are on different levels. E.g. a flask containers “floor” is higher up (closes to the light source) compared to petri dish. If your current focus plane is on petri dish you then need to raise the lens (increasing the Z value) to get closer to the light source to find the focus plane of the flask. And then vice versa, decrease the Z value when switching back to petri dish from flask.

3. Microscope interface

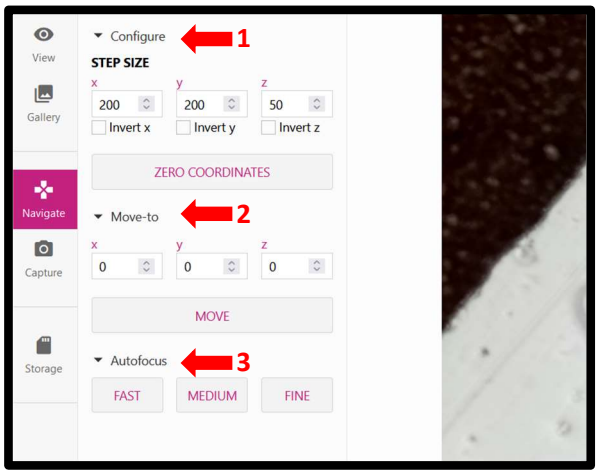
The microscope control interface has a tab bar on the left (**red arrow**) from where different panes can be selected (**View**, **Gallery**, **Navigate**, **Capture**, **Storage**, **Settings**, **Logging** and **About**).



In the **View** pane (image above) a video feed from the camera fills the window. A more detailed explanation of the relevant panes of **Navigate**, **Capture**, **Gallery** and **Settings** will be given in the following pages.

3. Microscope interface – Navigate pane

The Navigate pane has three drop-down menus **>Configure**, **>Move-to** and **>Autofocus** (**red arrow 1-3** in image below). It is possible to navigate the microscope using the **arrow keys** (left and right key controlling x-axis, up and down key controlling y-axis and Pg-Up and Pg-Down for zoom), **mouse** (centre image at double-click and scroll-wheel for zoom) or setting specific coordinates (under **Move-to** drop down menu).



Under **Configure** it is possible to set the travel distance when using the arrow keys (**STEP SIZE**). **STEP SIZEs** should not exceed the amount of steps needed to traverse a full view (~8000 for x and ~6000 for y) and should remain in the low hundred's (or >100) for z-axis. When using the arrow keys or mouse to move around, the coordinates (under **Move-to)** will update, which is useful in keeping track of the absolute position.

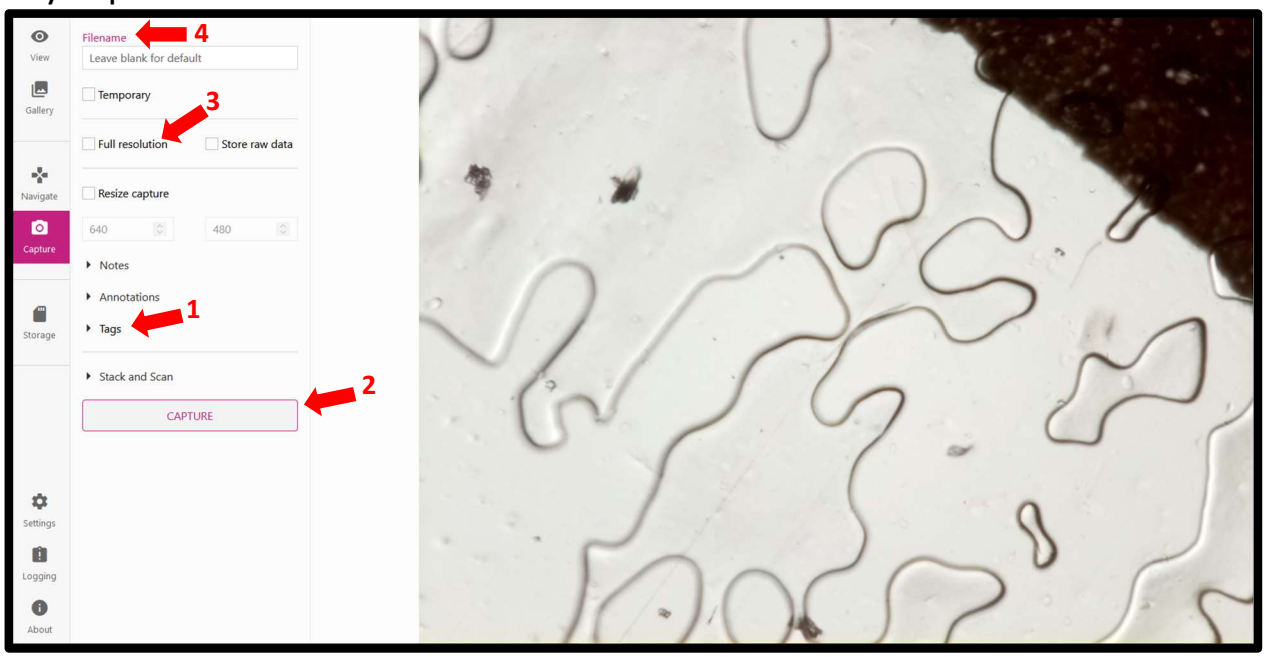
The "**ZERO COORDINATES**" button will zero the coordinates (under **Move-to**), turning all present numbers into 0's. It can be useful to "**ZERO COORDINATES**" when being in a centred position since this will make that position x = 0, y = 0 and z = 0 which are convenient coordinates as "home" position. When ending a microscope session enter 0 in each field of **Move-to** (x,y,z) and click **MOVE**. The stage will return to "home" position. It is still good to double check now and then that your home position has the stage in a somewhat centred position.

Under **Move-to** it is possible to move to specific coordinates. This can be **risky** since (at the moment) there is no option to halt movement. So in case one would mistakenly add an additional zero to the coordinate destination (e.g. 500000 instead of 50000, the motors won't halt until they have spun that many steps. The only way around this is to pull the plug!

Autofocus tries to automatically identify the focal plane. For this microscope configuration (low cost) the **FAST** option will be most useful. **MEDIUM** and **FINE** is useful at higher magnification. Finding focus plane requires one to somewhat know where the sample is relative to the lens. E.g. if you switch sample containers, it is good to know in which direction to re-adjust the z-axis (as explained on page 4). If you don't have a mouse with scroll wheel or Pg-Up and Pg-Down keys you can still use the **Move-to** option to find the focal plane, but be careful so that you don't mistype.

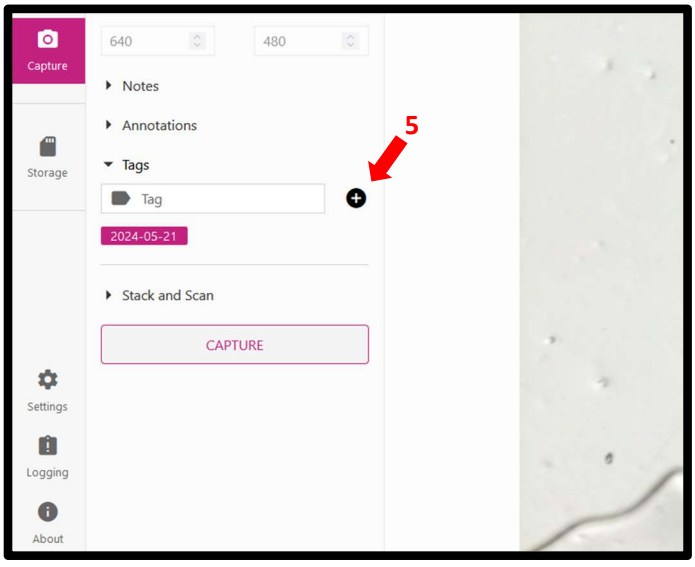
3. Microscope interface – Capture pane (photographing)

The **Capture** pane has 4 drop-down menus **>Notes**, **>Annotations**, **>Tags** and **>Stack and Scan**. Only **>Tags** (**red arrow 1**) will be relevant in this manual. From here it is possible to capture images that will end up in your **Gallery**. You can still navigate your microscope while in this pane by using either mouse or arrow keys option.

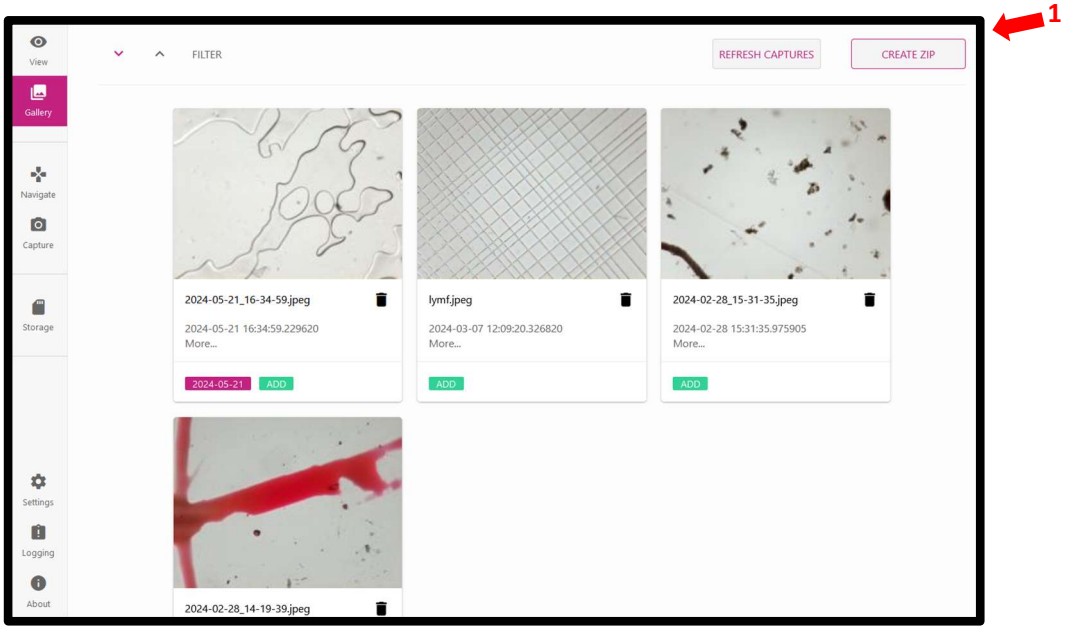


You can capture an image by clicking the **CAPTURE** button (**red arrow 2**). By default the microscope does not take full resolution images so that option has to be checked (**red arrow 3**) in the beginning of a session if full resolution images are desired. If no **Filename** is give (**red arrow 4**), the image will be given a default filename based on date and time (which is convenient).

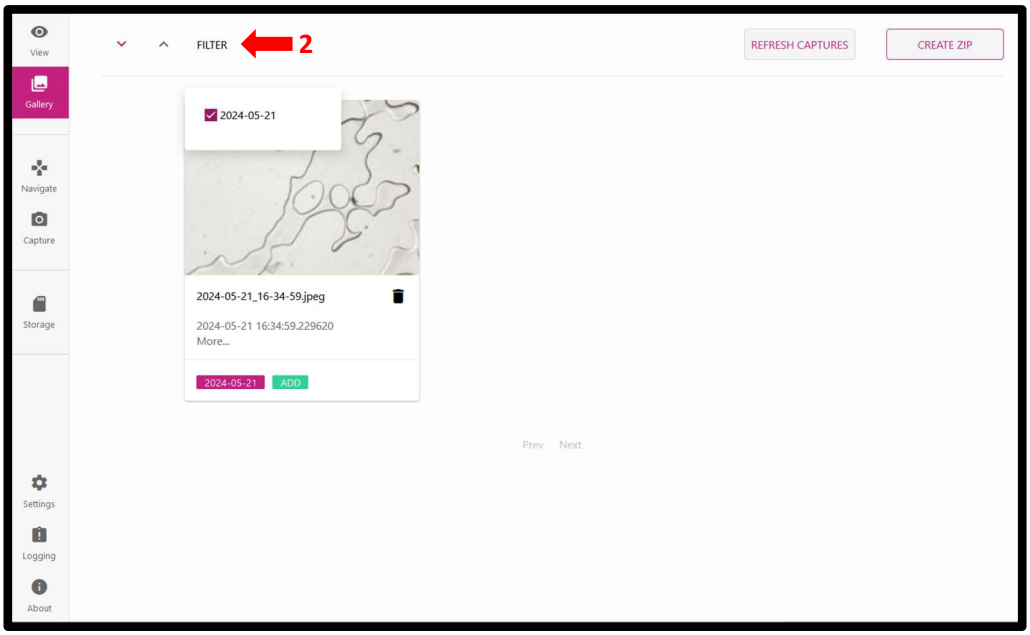
Tags can be very useful for sorting your images when they end up in your **Gallery**. Enter your tag and click the ⊕ sign (**red arrow 5**). That tag will then be added to all images captured and can then be used for sorting in your **Gallery** (e.g. 2024-05-21 in the image here). Other tags, such as location, can also be useful to add. A tag can be removed by clicking it.



3. Microscope interface – Gallery pane

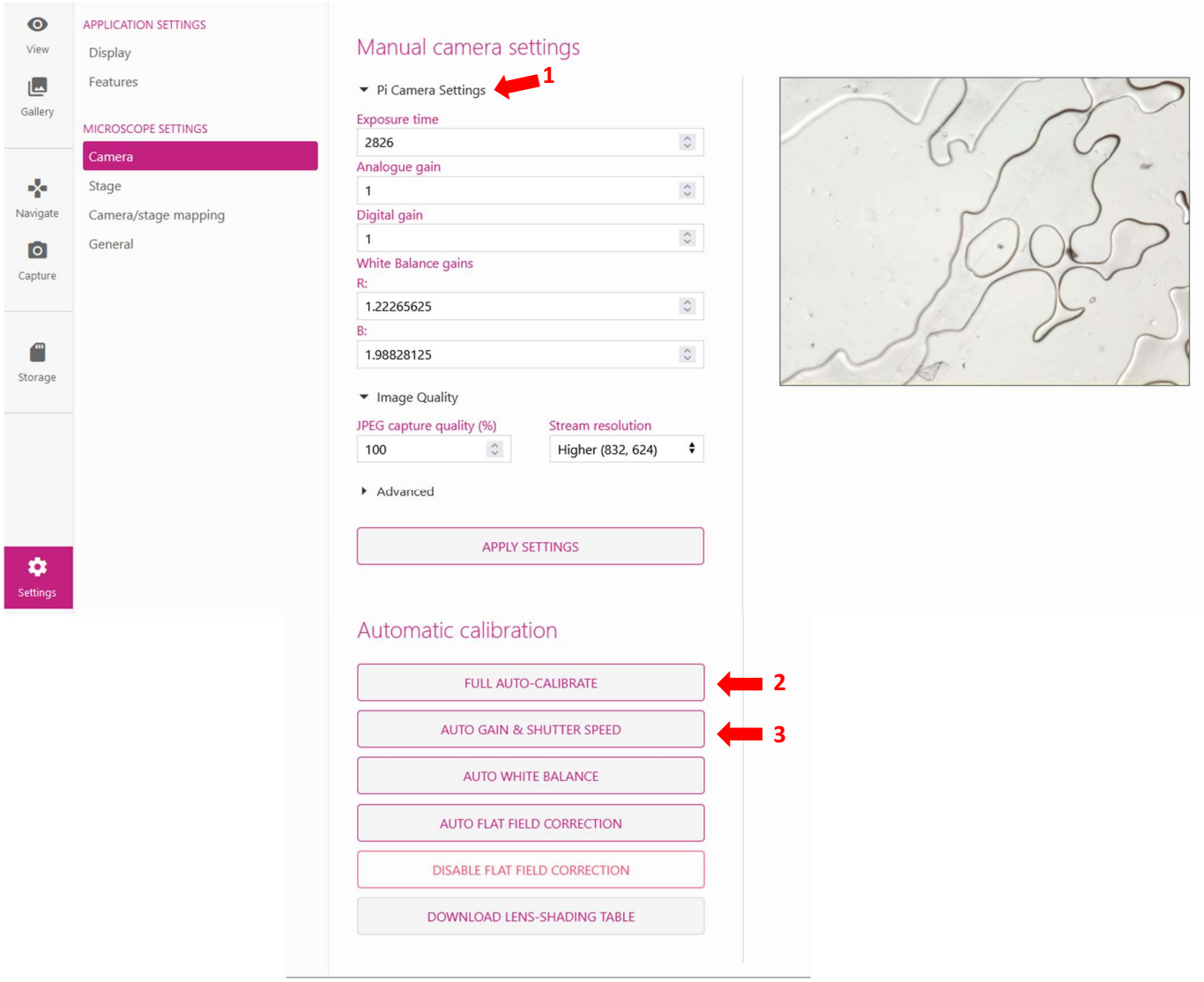


Your captured images will end up in your **Gallery**. You can left click an image in your gallery to display it. When displayed, you can right click the image and use "Save Image As" to download the image to your computer. It is possible to download multiple images by clicking **CREATE ZIP** (**red arrow 1**). This will compress all images. Once this is done the **CREATE ZIP** button will turn into **DOWNLOAD** and your images can be downloaded by clicking it. To avoid downloading all of the images every time we can make us of our **Tags**. Under FILTER (**red arrow 2**) we can sort for tags present in our images. This will then display images with selected tag ("2024-05-21" in image below) and **CREATE ZIP** and **DOWNLOAD** can now be used to only download images with selected tag.



3. Microscope interface – Settings pane

From the Settings pane there are a lot of different drop down menus and options. The most relevant ones can be found under **MICROSCOPE SETTINGS** and **CAMERA**. Here you will find options to change the exposure time (**arrow 1**) (measured in micro seconds) of the camera as well as Analog and Digital gain, which are ways to modify light sensitivity.



There are also options to auto calibrate the WHITE BALANCE and FLAT FIELD CORRECTION (**arrow 2 and 3**). WHITE BALANCE dictates colour temperature and FLAT FIELD CORRECTION corrects for uneven illumination.

4. Other resources

Official documentation regarding how to connecting to your microscope can be found at:
https://openflexure.org/projects/microscope/control

Official documentation regarding the microscope interface can be found at:
https://openflexure-microscope-software.readthedocs.io/en/latest/webapp/index.html

The OpenFlexure forum is also a great resource for information:
https://openflexure.discourse.group/

as well as the OpenFlexure homepage:
https://openflexure.org/