

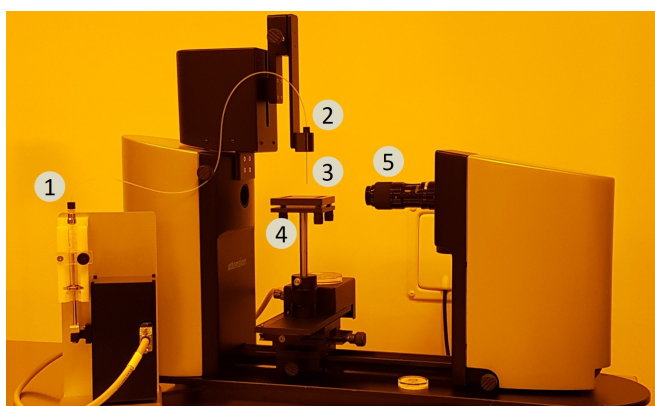
# ThetaLite Optical Tensiometer

Version: May 10, 2023

**ThetaLite** optical tensiometer measures interfacial properties such as contact angle and surface tension. **Contact angle measurement** is commonly used to evaluate surface quality.

In a contact angle measurement, the sample is first placed on the sample stage and brought to image. Before putting a droplet on the sample, inspect the liquid for contaminants. A droplet whose volume is controlled by the analyzing the shape of the pendant drop is then created and deposited smoothly on the surface.

All parameters are present for quick start but can be modified by user. As the droplet is being placed, the OneAttension software automatically starts analyzing the contact angle of the droplet on both sides to show the results immediately. Analysis can be done with multiple analyzing modes such as the Young-Laplace, and either automatic or manual baseline. The results are saved in a library and can be compared and presented with ease.




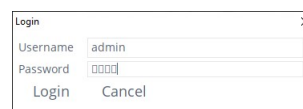
1. Liquid dispenser.
2. Dispense holder.
3. Needle.
4. Sample stage
5. Camera.


## Start up the system

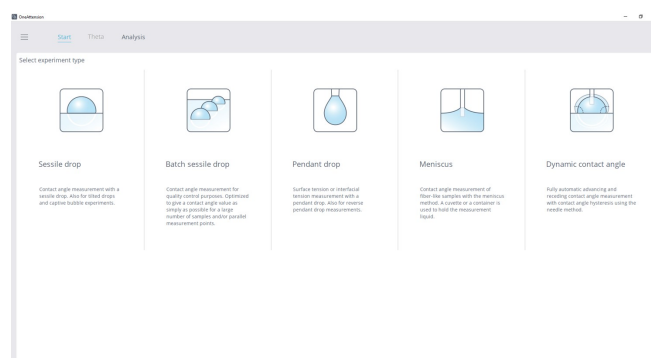
Start exactly in the following sequence:

1. The device is connected to the computer and the computer is always ON, but perhaps in sleep mode (touch the screen).

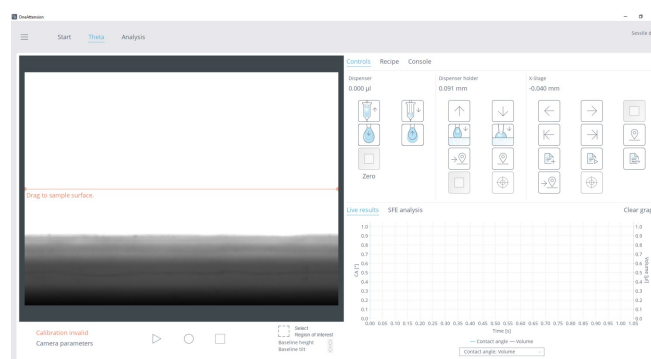
2. Turn ON the optical tensiometer (I/O switch).
3. Start OneAttension  (found on the taskbar).
4. LOG IN, (username: **admin** , password: **0000**).



5. In **Start** tab, click on **Sessile drop** icon 

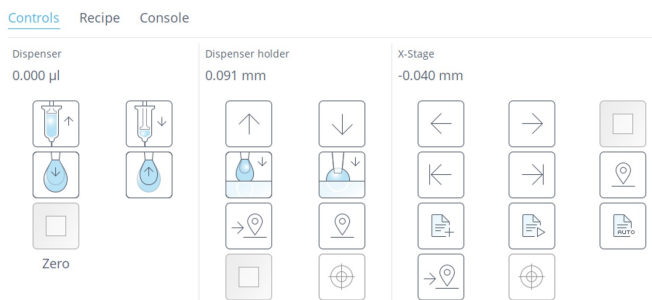



The software will ask to Initialize the device. Press OK on both pop-ups and let it initialize, it can take some 5 seconds before it starts. **DO NOT STOP IT.**



You are now in **Theta** tab, and the device/software are ready to use. Do not touch the camera because you think that the substrate is not in focus. The focus is calibrated for the needle/droplet.


In **Theta** tab, you will find three other sub-tabs: Controls, Recipe and Console. Most what you will need are found in **Controls** sub-tab.




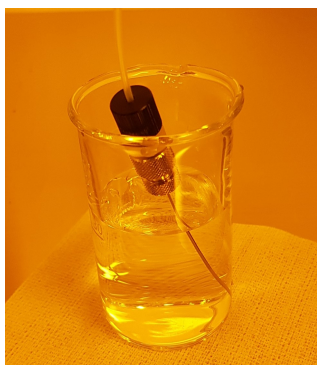
you can start or stop activities by pressing on the same button. First press to start and the second press to stop. Stop can be achieved by pressing on  too.


## Liquid dispenser

6. See if there is liquid in the syringe and the tube, and check for air inside the tube. If satisfied go to step 11.

7. Place the needle in an empty beaker and press , the process will stop automatically when the syringe is empty.

8. Then, place the needle in a beaker of deionized water and press , the process will stop automatically when the syringe is filled.









9. To STOP the movement of the dispenser (if needed), use the STOP button .

10. Place the needle carefully back in the holder.

## Sample stage

11. Go to the X-stage tab.

12. Familiarize yourself with how it moves by pressing the arrow buttons Left, Right , , Step Left, Step Right , , each step is set to 5 mm by default. If you want to use the step function go to Recipe, then X-stage and adjust the Step [mm] parameter to desired length.

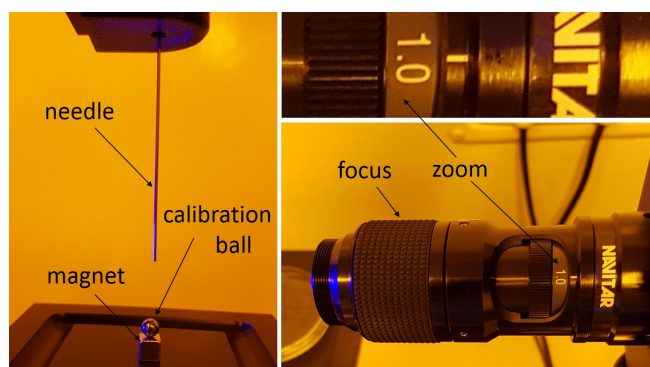
13. When you are done press Go home position  to go back to initial position. If you want to set new home position press Set home .

## Camera Calibration

**WARNING:** After you have calibrated the camera you can not touch the zoom or focus. If this is done, repeat the calibration steps. The camera calibrates using ratio of pixels to the dimensions of calibrating ball. If settings are changed the ratio will be wrong.

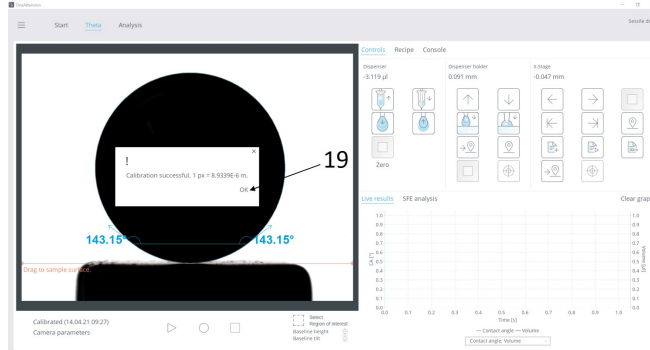
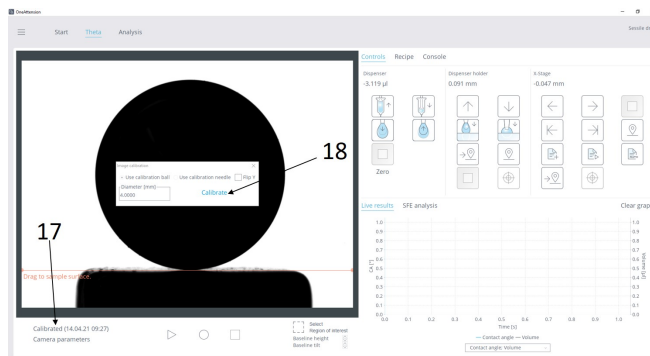
14. Place the magnet with the ball (tungsten carbide calibration ball) on the sample stage, exactly as possible under the needle where you can see a clear picture of the ball on the screen.

**Ball specification:** size  $4.000\text{mm} \pm 1.0\mu\text{m}$  Grade 25 Tungsten Carbide, Batch No. 60517.



15. At zoom fixed to 1.0 the ball will cover most of the live view screen (as seen in the image), do not change zoom.




16. Adjust the focus for a sharp picture of the calibration ball.

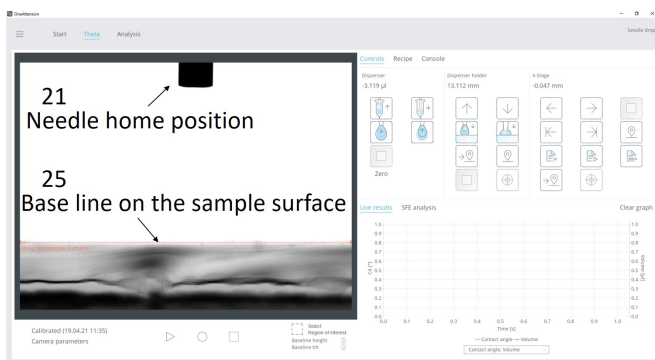




17. Click **Calibrated** ("date") button on the bottom left.
18. In the pop-up window make sure **Use calibration ball** is checked. Press Calibrate.
19. Confirm by pressing OK. The camera is now calibrated and ready for use.

## Dispenser home position setting

**WARNING:** Make sure you know how to stop the dispense holder to avoid running the needle into the sample stage.

20. Locate the Stop button .
21. By use the Up  and Down  arrow buttons adjust the position of the needle in the screen. Move the needle so just the tip is seen in the live view window, as in the picture below.



22. Press the Set Home button . Now the needle has a defined home position which it will return to after applying water droplets. Go home  button can now be used too if needed.

## Placing sample

All type of contact with the sample has a chance of transferring charge and/or particles and altering the results.

23. Use tweezers to place the sample and adjust its position. Does not matter if the sample is not in focus. Remember the droplet is in focus due to the calibration and not the sample.
24. Move the sample to the correct height, by adjusting the sample stage height and checking the live view window.
25. Place the baseline (orange line on the screen) on the sample surface. Keep right clicking on the line and drag this line to sample surface.

**Needle specification:** Stainless steel needle for C205 and C205A/C201, gauge 22, ref. C209-22. Outer diameter approx. 0.72 mm

## Default measurement recipe

26. Click on **Recipe** sub-tab, and check the box "Do live analysis". Then use the default recipe as in below. Experiment name can be added but it is not necessary.

### - Generic

Experiment name  
Comment  
Autosave  
Private to admin

### - Live analysis

Do live analysis  
Analysis mode  
Baseline  
Fil Y

### - SFE

Enable secondary ... etc  
Secondary analysis mode

### - Saving

Image recording setting  
Start saving when  
Stop from trigger

### - Materials

+ Solid  
Light phase  
Heavy phase

### - Dispenser

Enabled  
Drop out Size [ $\mu\text{l}$ ]  
Drop In Size [ $\mu\text{l}$ ]  
Drop Rate [ $\mu\text{l/s}$ ]  
Disp Rate [ $\mu\text{l/s}$ ]  
Fill Rate [ $\mu\text{l/s}$ ]  
Auto Zero Disply  
Volume from image  
Check ST prior to measurement  
ST check tolerance [%]  
ST check volume [ $\mu\text{l}$ ]

### - Dispenser holder

Speed [mm/min]  
Init [mm]  
Stroke length from image  
Stroke length [mm]

### - X-stage

Speed [mm/min]  
Step [mm]  
Center [mm]  
Point mapping


—  
—  
  
  
  
Contact angle (Y-L)  
Automatic  
  
  
Surface tension (Y-L)  
10.0s at 20% (15 FPS)  
Stocke is at bottom  
  
—  
Air  
Water  
  
4.000  
4.000  
1.000  
20.000  
20.000  
  
  
  
5.000  
6.000  
100.000  
20.000  
  
2.000  
100.000  
5.000  
74.960  
No points

## Experiment running

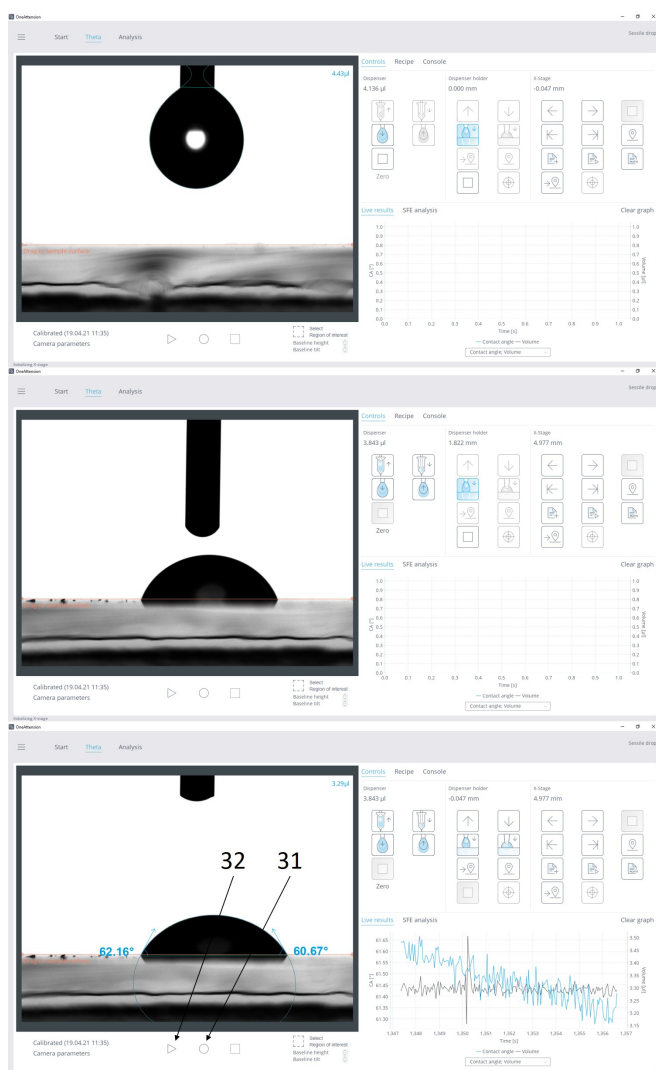
**WARNING:** Check if the baseline is placed correctly. Incorrect baseline placement might result in running the needle into the sample surface. Samples might vary in thickness, so the baseline need to be changed accordingly. If something goes wrong press the STOP button then all actions should cease.



27. Click on **Controls** sub-tab.

28. Make sure the baseline is correctly set.


29. Press Place Drop , the program will now run the default recipe. A droplet of 4  $\mu\text{l}$  will form and the needle will go down close to the sample surface and release the droplet on the surface, then the needle will up to its home position.



Automatic analysis (contact angle) will be shown on the screen.



30. For a second measurement go to X-stage tab, move sample by Step Left or Step Right   and do as described in steps 28 and 29. Or change sample.


31. To generate a data file (if wanted) of the contact angle measurements and images. Press the button

Record only  located at the bottom of the live view screen. 152 or 153 frame images will be recorded within 10 seconds from the time the droplet released on the surface, all will be saved. After 10 seconds recording will stop automatically.

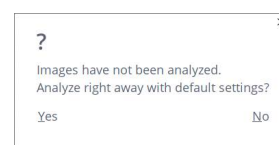
32. For an automatic experiment running (instead of Place Drop ) included data and image recording press Start  located at the bottom of the live view screen. After 10 seconds recording will stop automatically.

## Analyze and save images

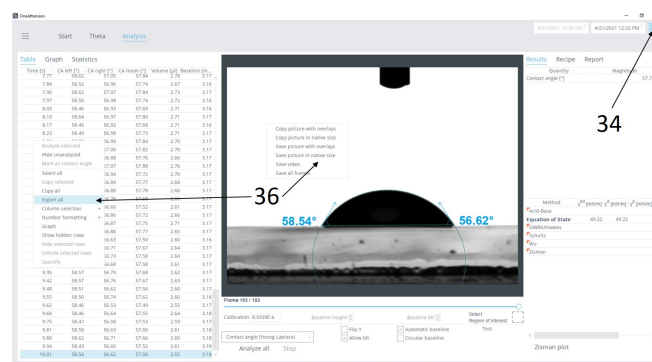
33. Go to **Analysis** tab (top left)

34. Press on the  sign on the upper right corner, find your experiment (sorted by date), and double click on it.

35. On the pop-up window press Yes.



36. Data can be exported: select the experiments you want, right click anywhere on the data, select Export all, then .xls, save in a file. Images or videos can be saved/copied: right click on the image and choose the save alternative you want.



**Done? Shut down software and Switch OFF device.**

**Clean the working station after use.**



## Problems

Often no problems will occur if you will follow the steps given in this manual.

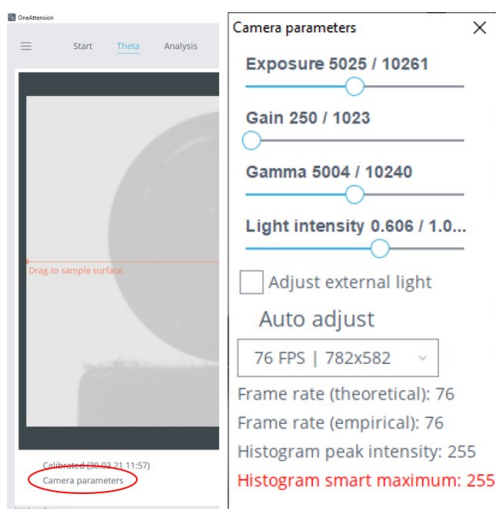
### ■ No Theta tab in the software ?

Your started software too fast after switching ON the device. The device is not detected by the software. Restart software.

If not solved the problem? Switch OFF both device and computer, start device first after 10-15 seconds start software.

### ■ Camera images are blurred ?

Update Camera parameters to as given in the picture below.



### ■ No water droplet forms when pressing Place Drop or Start ?

Check if the tube is attached correctly to the needle and there is enough liquid in the syringe. The most likely reason is the device is not used for a while and water is evaporated in the needle or the tube. Remove needle from the holder and put in an empty beaker, and press Drop Out . Press Stop when liquid started to come out. Or do as given in steps 7-10.

### ■ Water droplet forms, but no stroke ?

The needle home position might be too high up and the software can not calculate stroke distance correctly.

### ■ Water droplets fall from needle ?

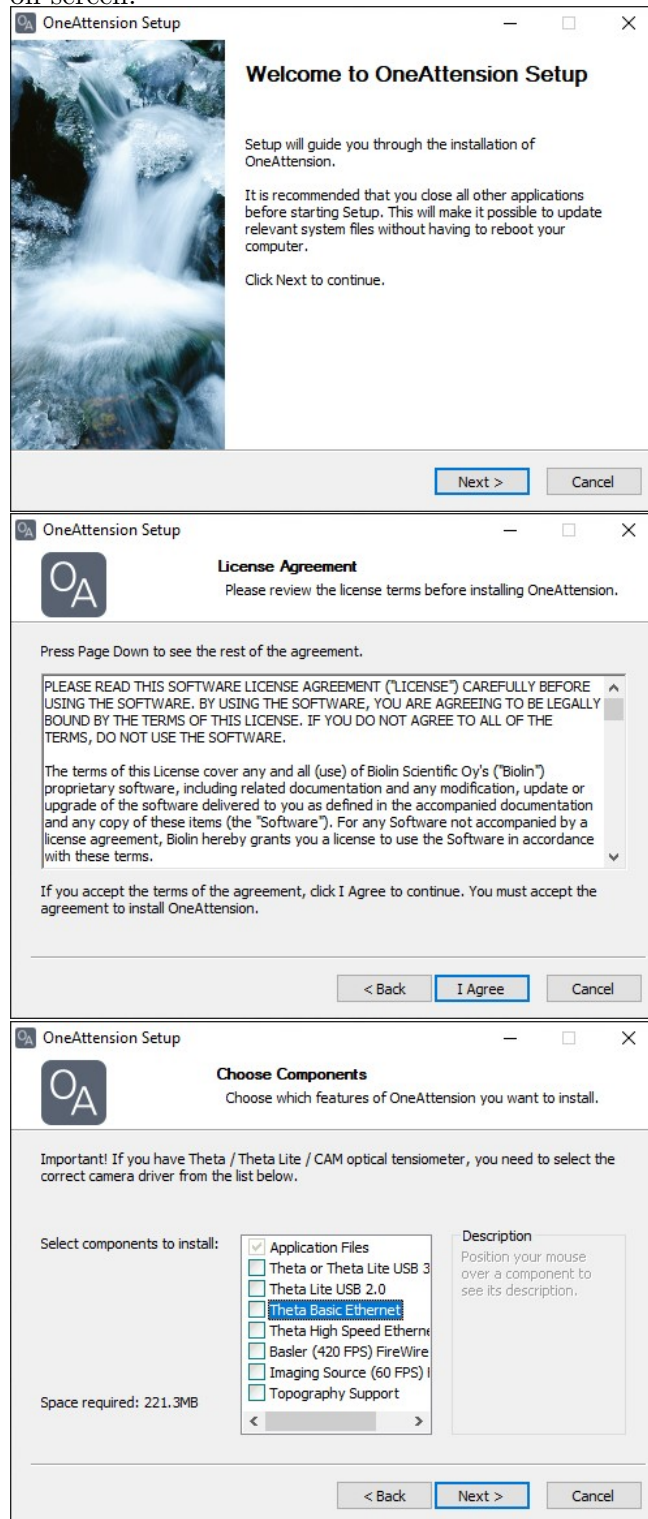
The droplet volume is too large for the sample.

### ■ Sample stage or dispense holder does not move ?

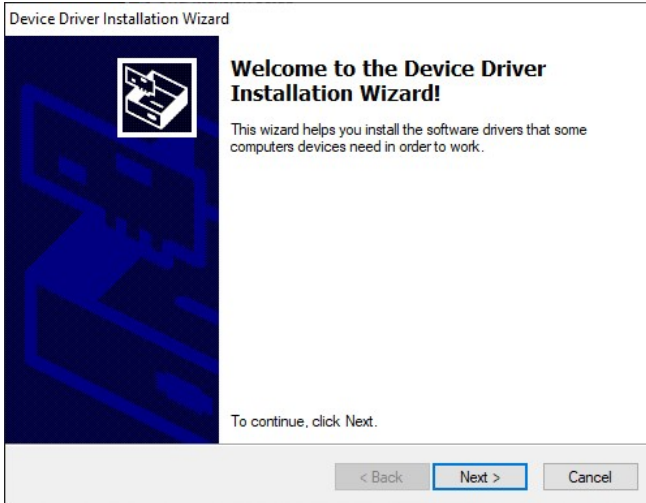
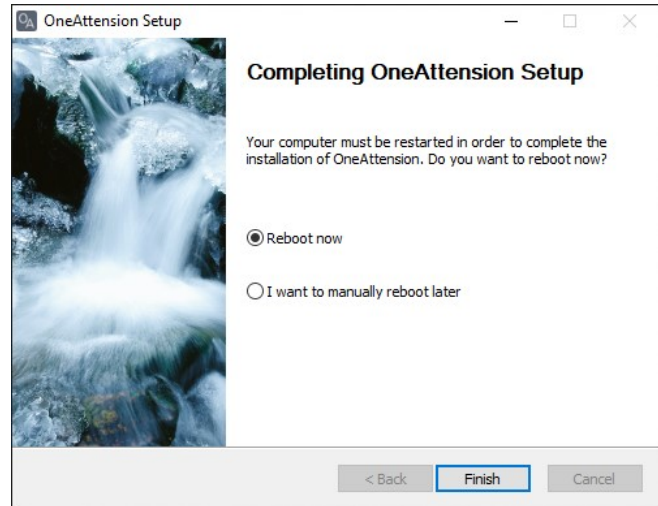
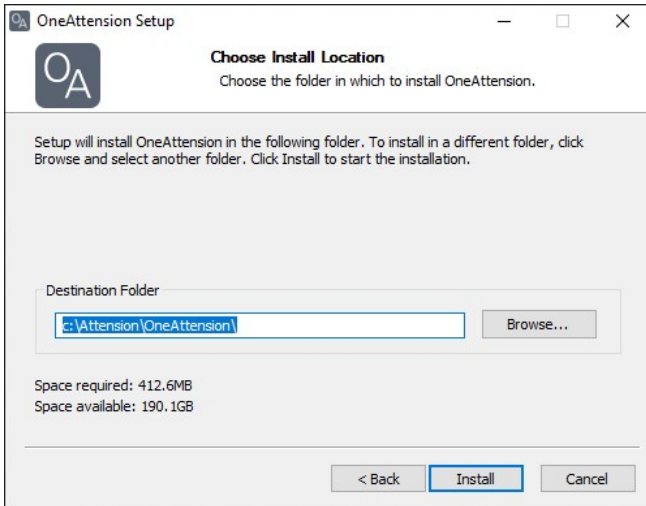
Restart the software and let it initialize.

## Software installation

Turn Theta power OFF. Connect the USB and Ethernet cables. Do not turn Theta power on yet. Run OAssetup.exe version 4.10 for Win10, the installation will now begin. Follow the instructions on screen.



During the installation it is extremely important to choose the correct drivers from the list of drivers: Choose either Theta Basic Ethernet



In some cases, the IP address for the camera has to be set manually. If you installed OneAttention with the "Theta Basic Ethernet" drivers and OneAttention cannot locate the camera (device should be On), please try the following actions:

- Go to Basler folder and open "pylon IP Configurator" program in your computer. The program should locate your camera. Choose your camera and write the following IP addresses to the Static IP cells: IP Address: 169.254.1.0
- Click the Refresh. The IP addresses have now been updated and the camera should be located by OneAttention.

Some of the drivers open a separate driver installation wizard in order to install the drivers. In this case, choose next and wait until the drivers have been installed.

