DRONE PILOT GUIDE

DJI Pilot 2 App

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Welcome

Airteam Aerial Intelligence is a company that develops software for surveying and inspecting buildings using drone aerial imagery. In your role as a pilot, you will be responsible for creating the aerial images for your projects. These images form the basis for the inspection and measurement of buildings. We use the images to create accurate 3D models, survey and inspection reports for you with the help of our computer vision algorithms. In order for the algorithms to be able to process the data, a number of points must be taken into account, which we explain below. In addition, all legal regulations that apply to drone flights must be observed.

Requirements

- DJI Pilot App 2
- Registration with DJI
- To use the RTK function, you need a mobile hotspot on site with the help of a mobile device
- Since the DJI Pilot 2 app requires an Internet connection for flight planning, we recommend preparing for the flight (checking for updates and flight planning) in the office or at home. However, you can also do this on site, e.g. via a mobile hotspot on your cell phone.

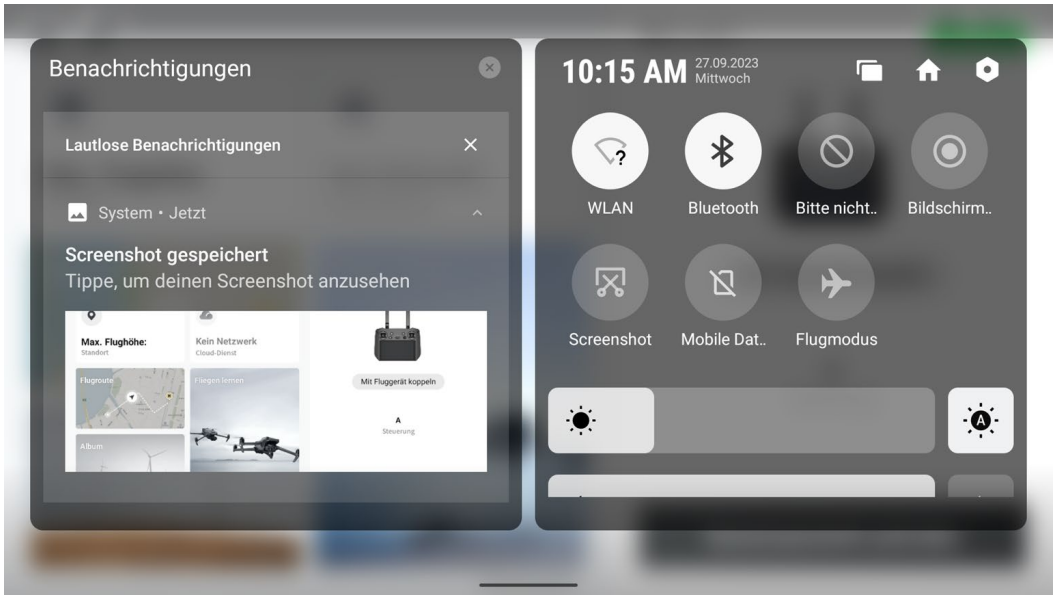
Safety instructions

- Before flying, check the surroundings for obstacles (e.g. chimneys, height jumps, trees, etc.) so that none are within the range of the flight plan and the set altitude. Drones like the DJI Mavic 3 Enterprise series have distance sensors in all directions
- Select a safe take-off and landing site for automated take-off and landing and keep it clear. Please note that the drone may not land exactly where it took off, but within a radius of approx. 1 - 2 m.

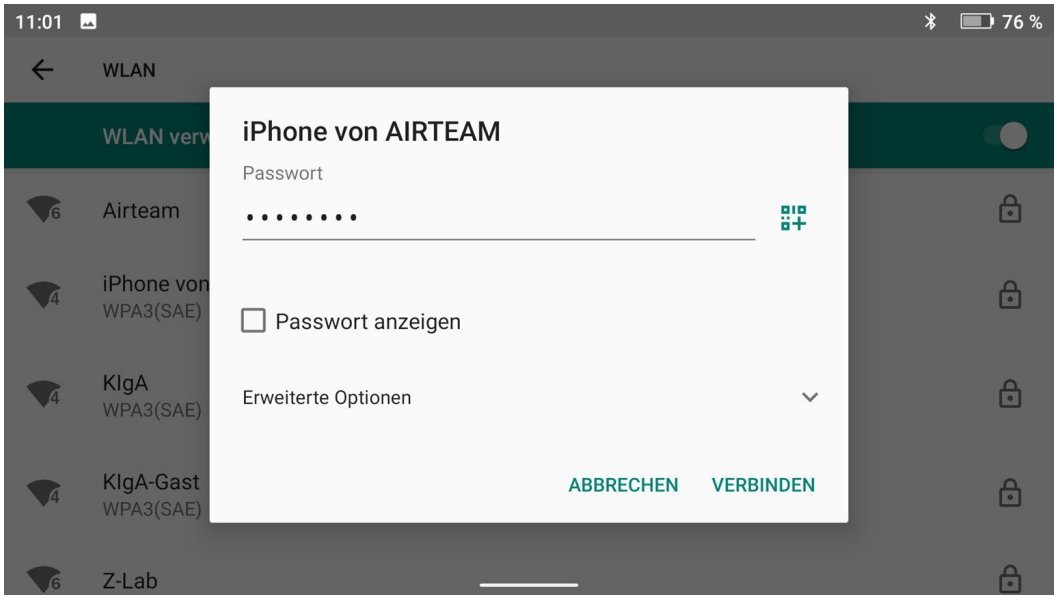
Setting up the controller

Step 1 - Connect the controller to the Internet

Start the controller and switch on your drone. Connect your controller to the internet. You can do this using your home Wi-Fi or a hotspot. To do this, swipe down from the top edge of the display and open the controller menu. Now tap and hold on the Wi-Fi symbol to open the settings.

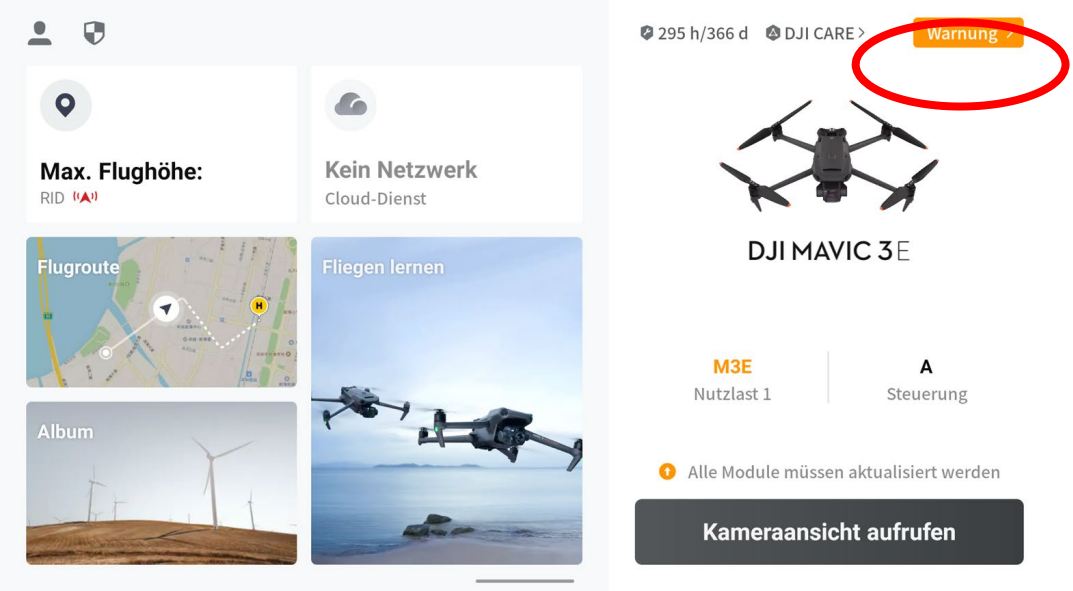


Select your network and then enter your password. Confirm your entry by tapping on "CONNECT". Your network is saved for future use.

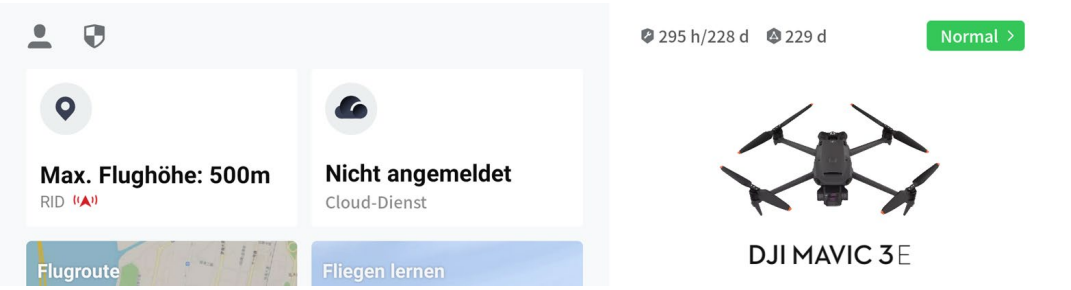


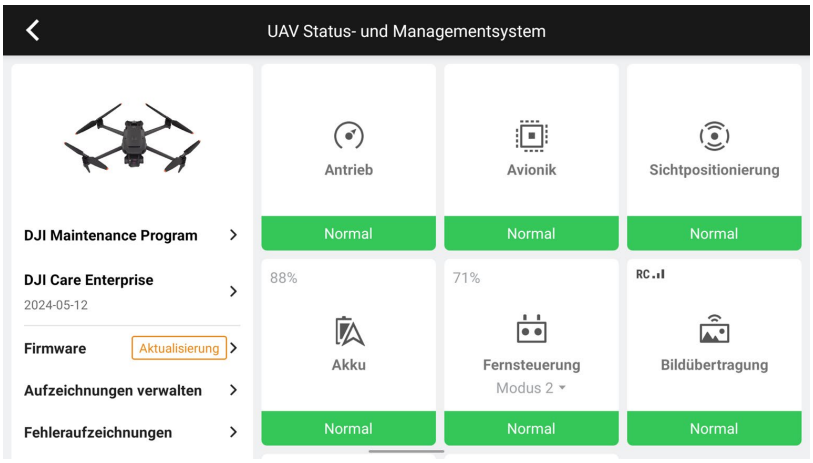
Setting up the controller

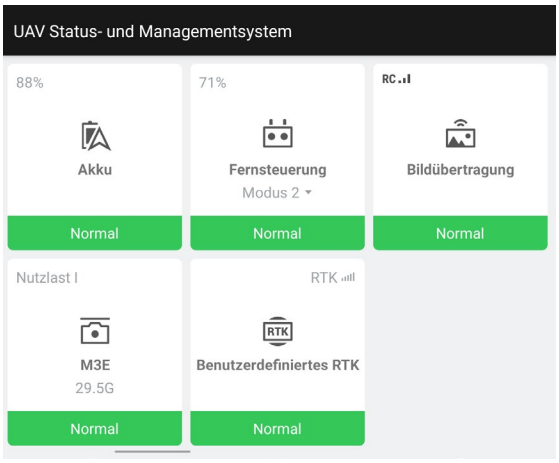
Step 2 - Check system status



If your system is not up to date, the message "Warning" will appear in the top right-hand corner of the display. Tap on the display and carry out the required updates. After the updates, the status is displayed as Normal.



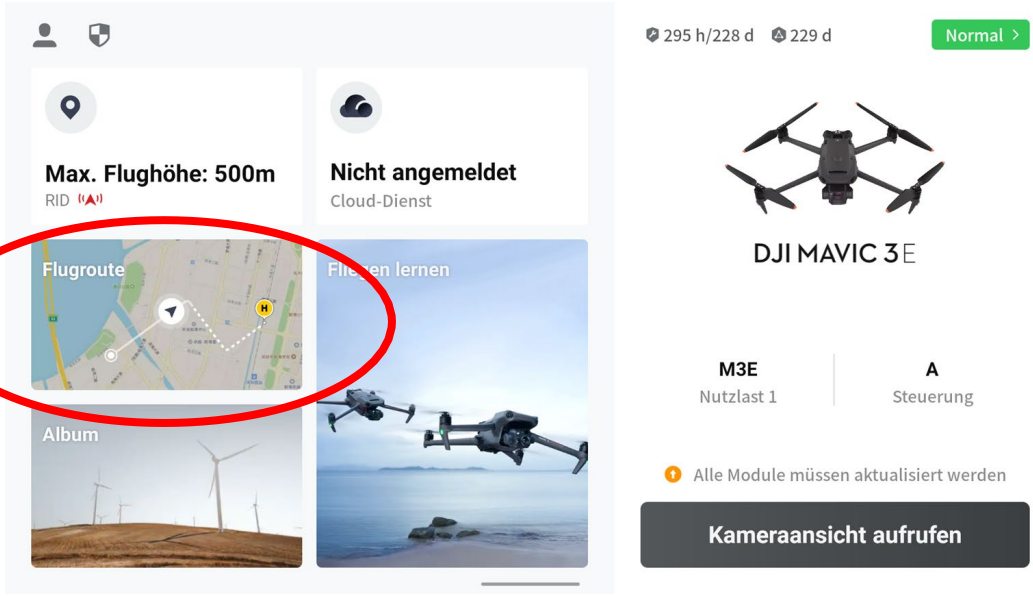




Start route planning

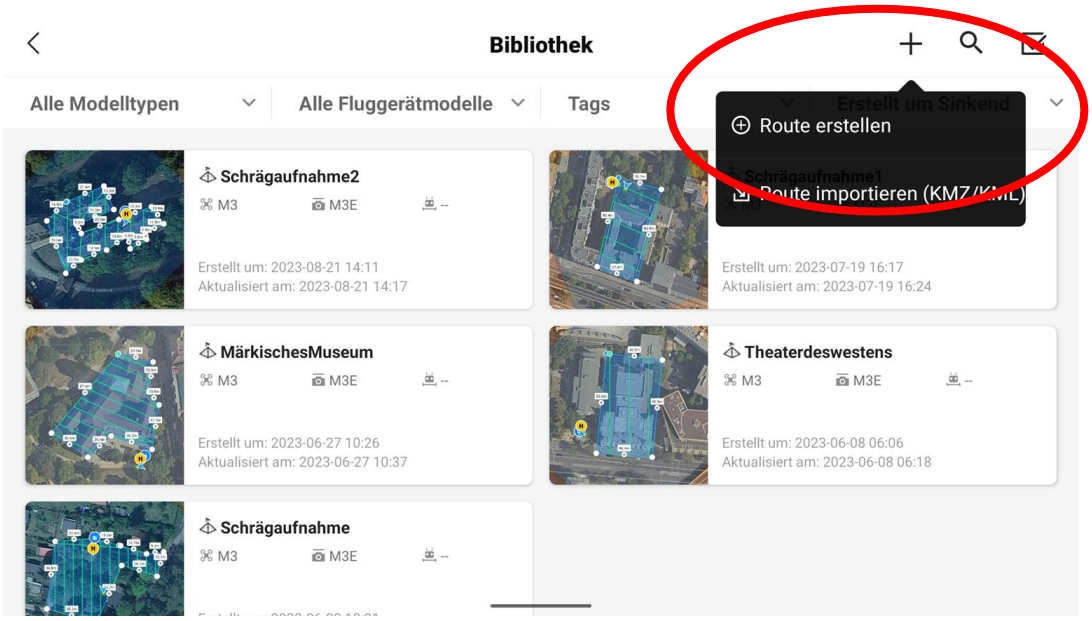
Step 1 - Create route

Your system is now ready, and you can start planning your flight route. To do this, tap on "Flight route"



Different missions for different needs. The DJI Pilot 2 app comes with three different mission types to give you the flexibility you need for your projects. We recommend the "Area Route" for Airteam projects, as this will give you the best results in the shortest time.

Tap on the "+" on this page and then select "Create route".



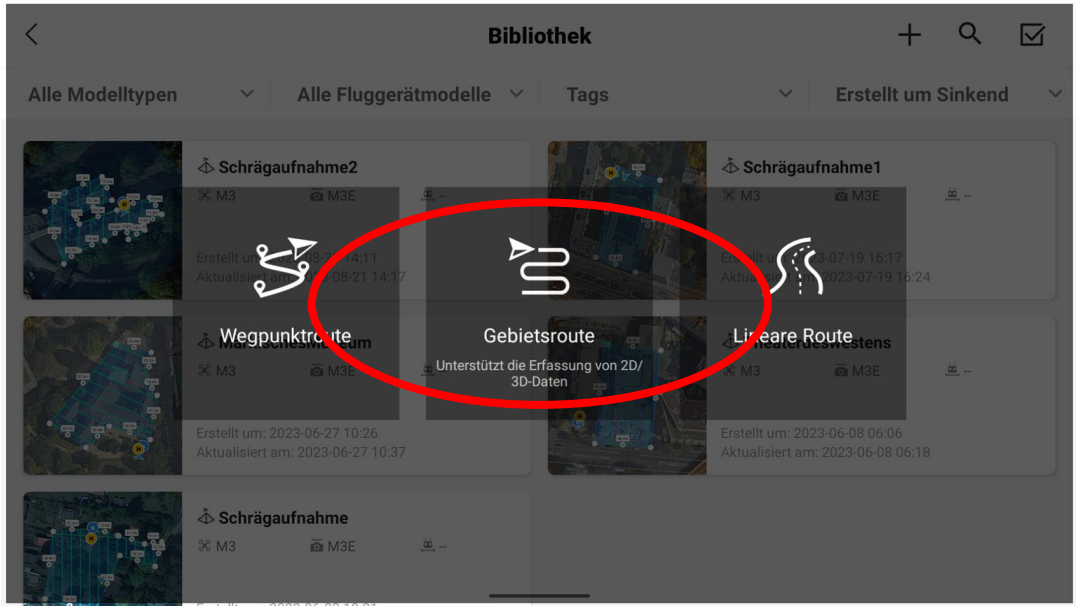
Airteam Tipp

With the DJI Mavic 3 Enterprise series, use the "Area route" item for all projects, whether pitched roof or flat roof.

Start route planning

Step 2 - Select route

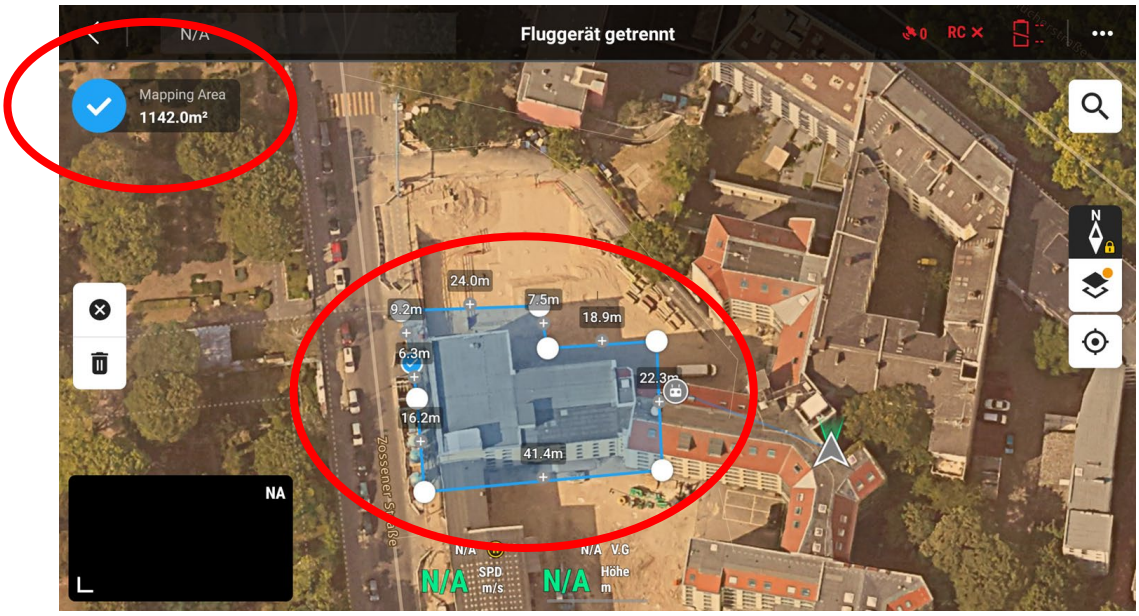
Select the "Area route" type here.



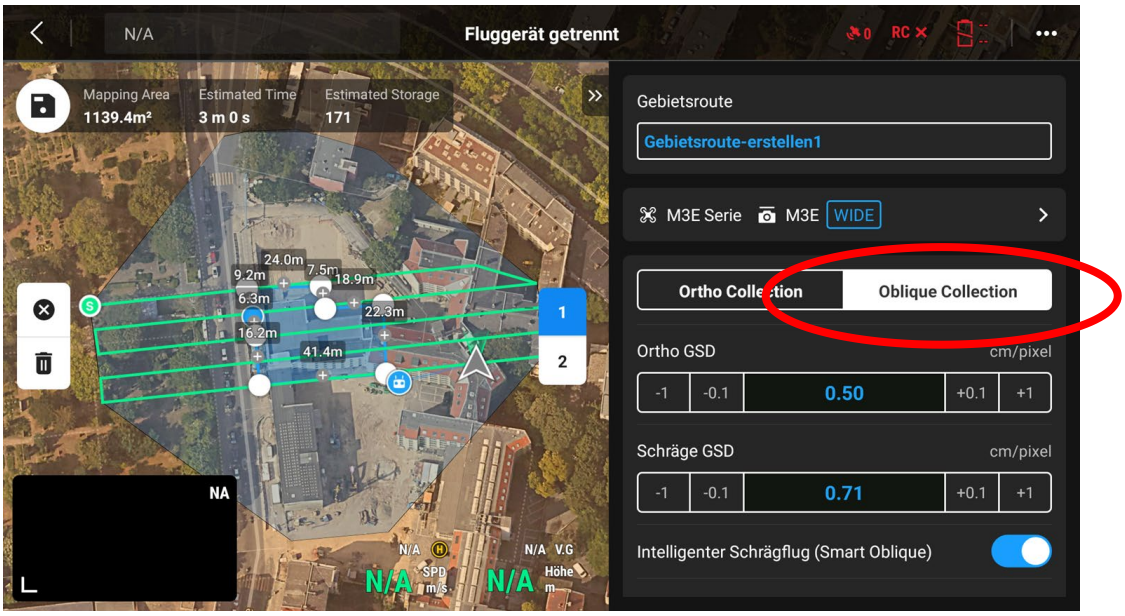
Building procedure - Plenty of space on site

Step 1 - Determine flight plan

Define the extent of your flight plan on the map. To do this, select a larger area than the roof area to be measured. You can move the corner points with your finger until the flight plan corresponds to an area larger than that of the object. When you have finished making your selection, tap the tick in the top left-hand corner to confirm.



Now select the "Oblique Collection" option.

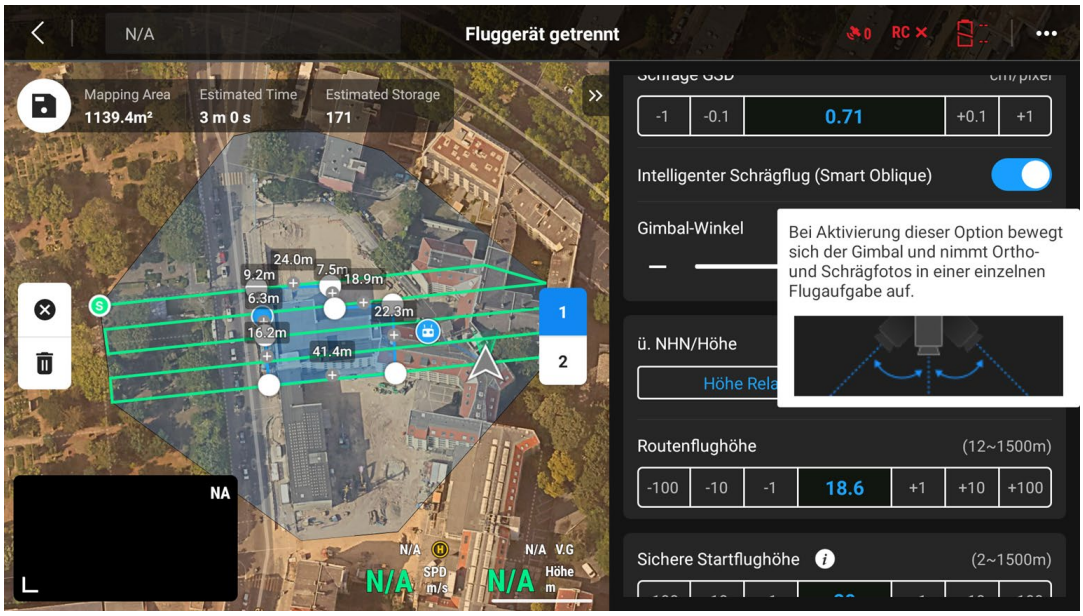


The GSD (Ground Sampling Distance) should ideally be below 1.00 at the end of the mission planning. Since the value depends on the settings made, you can do without setting the value there for the time being.

Building procedure - Plenty of space on site

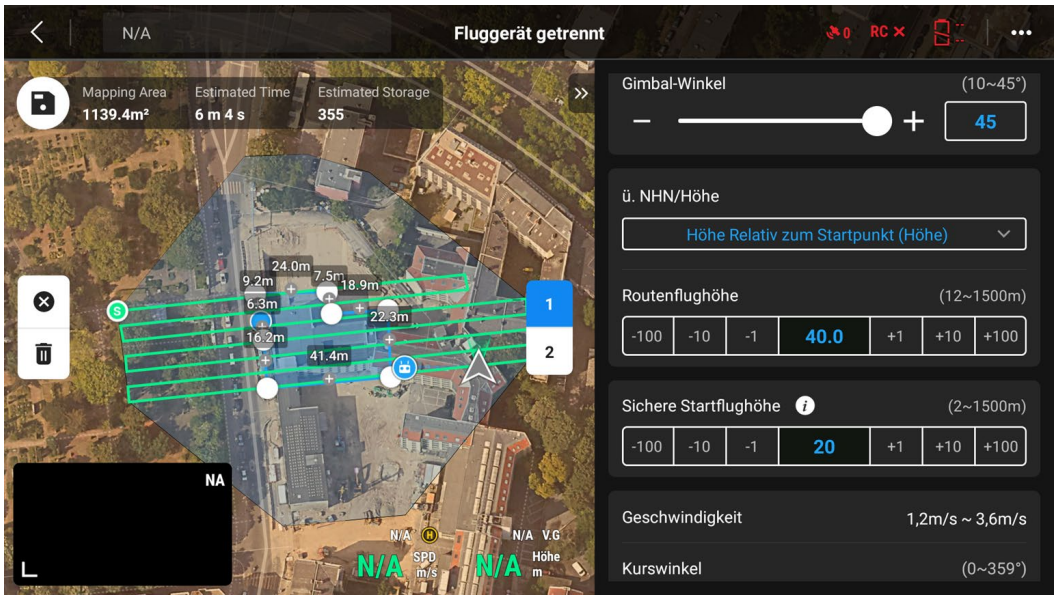
Step 2 - Smart Oblique

With the new Smart Oblique option, all required images are covered by two flight paths instead of the previous 5. This is possible because the drone changes the camera orientation between the individual shots.



Step 3 – Define flight altitude

Als nächstes wählst Du die Flugroutenhöhe. Diese sollte ca. 12 - 15 m über dem Objekt liegen. Hierbei beachtest Du bitte, dass ein sicherer Drohnenflug immer im Fokus steht.



Airteam Tipp

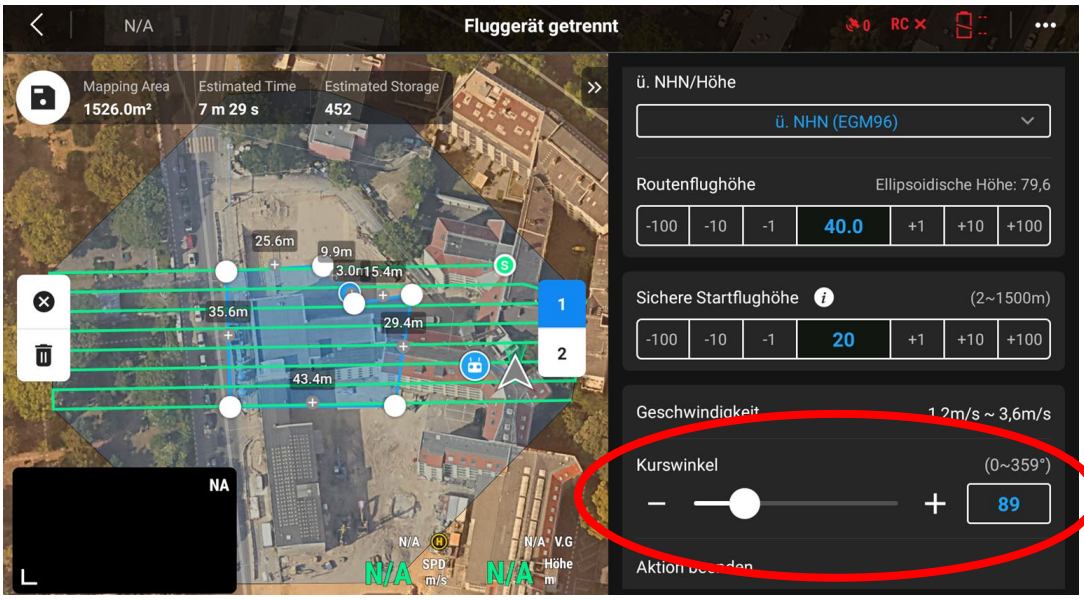
In most cases, you can easily estimate the building height by multiplying the number of floors by 4. In this example, 7 floors times 4 equals 28 m + 12 m distance drone to roof = 40 m flight height.

Building procedure - Plenty of space on site

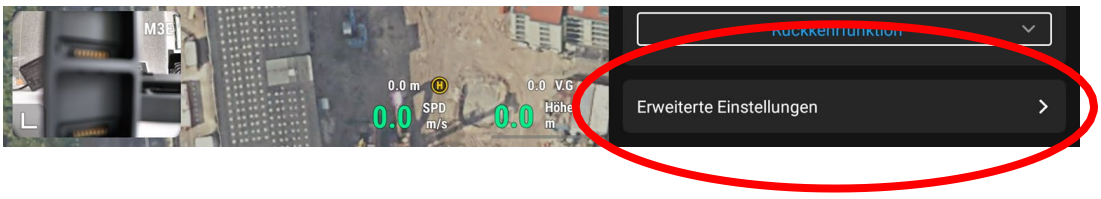
Step 4 - "Course angle" setting

You can use the course angle to influence the flight route. You can see this directly in the map view on the left-hand side of the screen. This can be relevant if there are obstacles near the object.

We recommend selecting the course angle so that the building is flown at a 90° angle to the narrow side or parallel to the long side. In the example below, we have set the short angle to 89° so that the flight path is almost parallel to the long side of the building.



Now go to "Advanced settings" to set the "Height: Start point to target area" and the overlap.



Building procedure - Plenty of space on site

Step 5 - Setting "Height: Starting point to target area“

Set the building height for "Height: Starting point to target area" (e.g. + 28 meters). This is very important so that the overlap of the images is calculated correctly! The setting for the overlap should be 70% to the side and 80% overlap to the front.

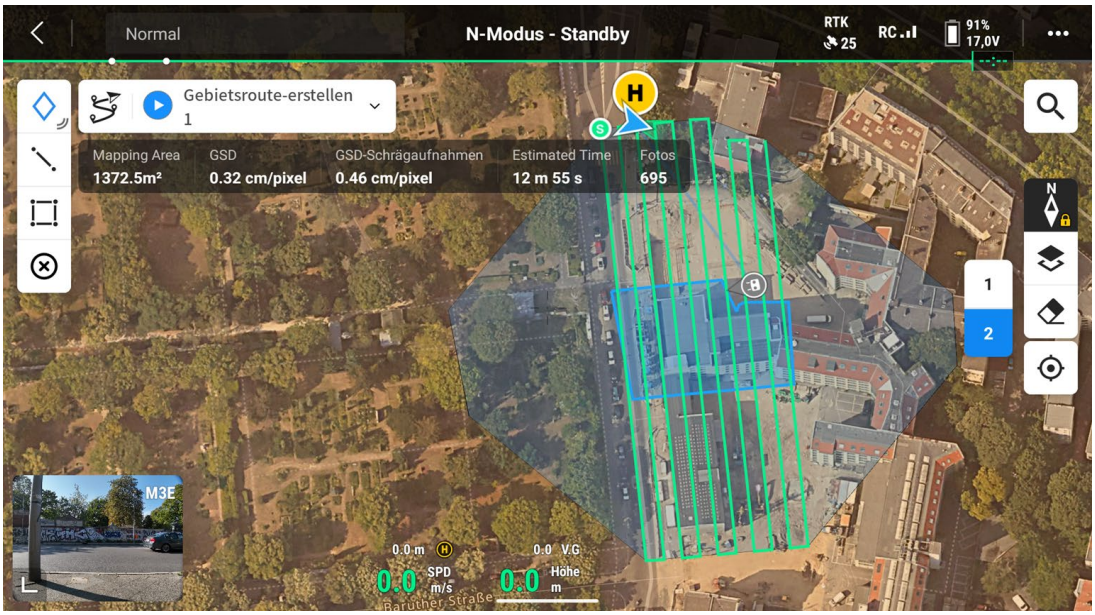
Building procedure - Plenty of space on site

Step 6 - Check flight paths #1 & 2

Before the flight is carried out, you can take another look at the individual routes and check the settings.

Flight path 1

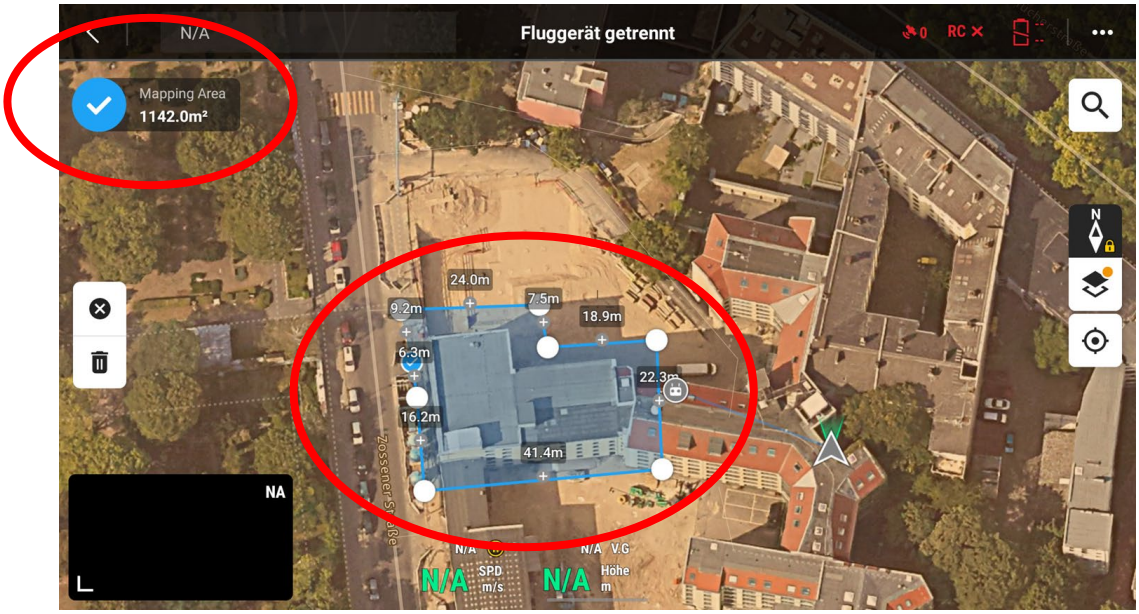
Flight path 2



Building procedure - Little space on site

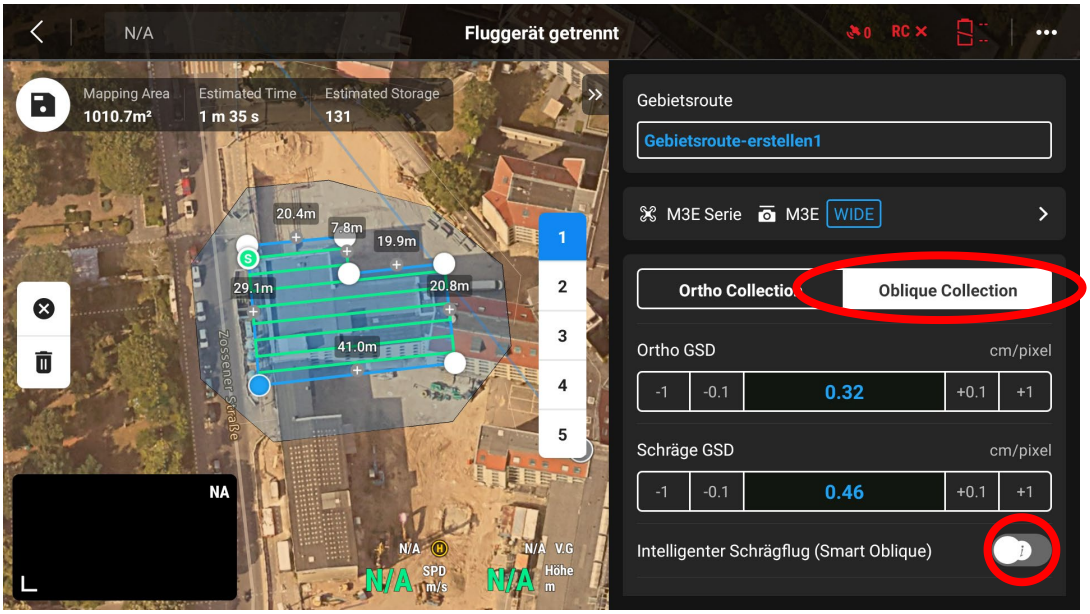
Step 1 - Determine flight plan

Define the extent of your flight plan on the map. To do this, select a larger area than the roof area to be measured. You can move the corner points with your finger until the flight plan corresponds to an area larger than that of the object. When you have finished making your selection, tap the tick in the top left-hand corner to confirm.



Step 2 - Select flight types

Now select the "Oblique Collection" option and deactivate Smart Oblique. This is always a good idea if there is not much space on site or if you do not want to fly over neighboring properties.

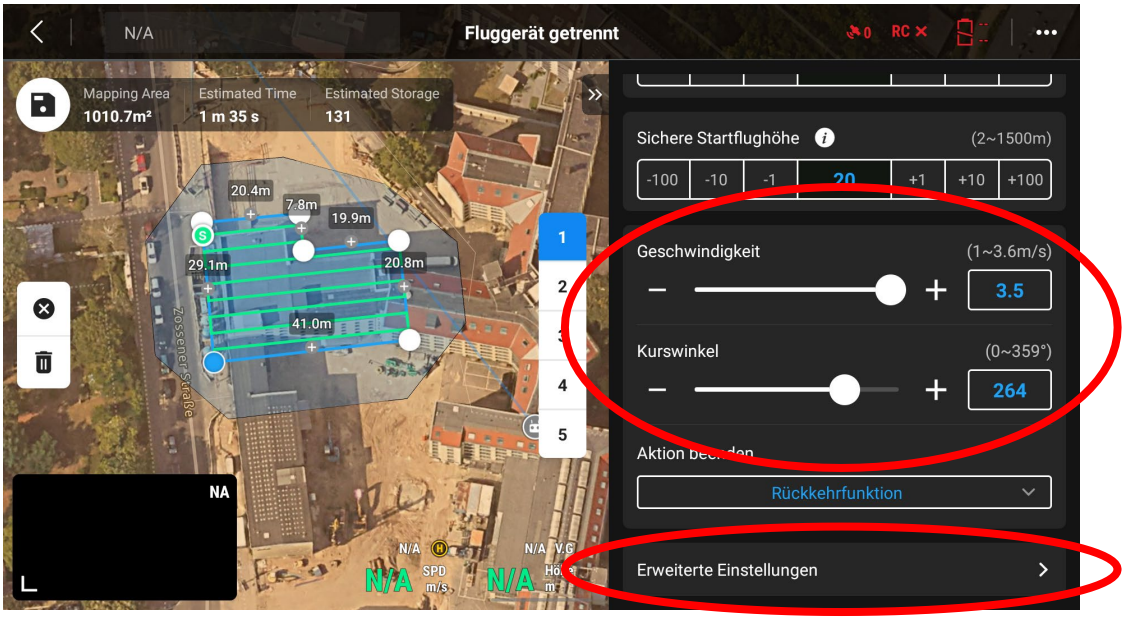


The GSD (Ground Sampling Distance) should ideally be below 1.00 at the end of the mission planning. Since the value depends on the settings made, you can do without setting the value there for the time being.

Building procedure - Little space on site

Step 3 - Set speed and course angle

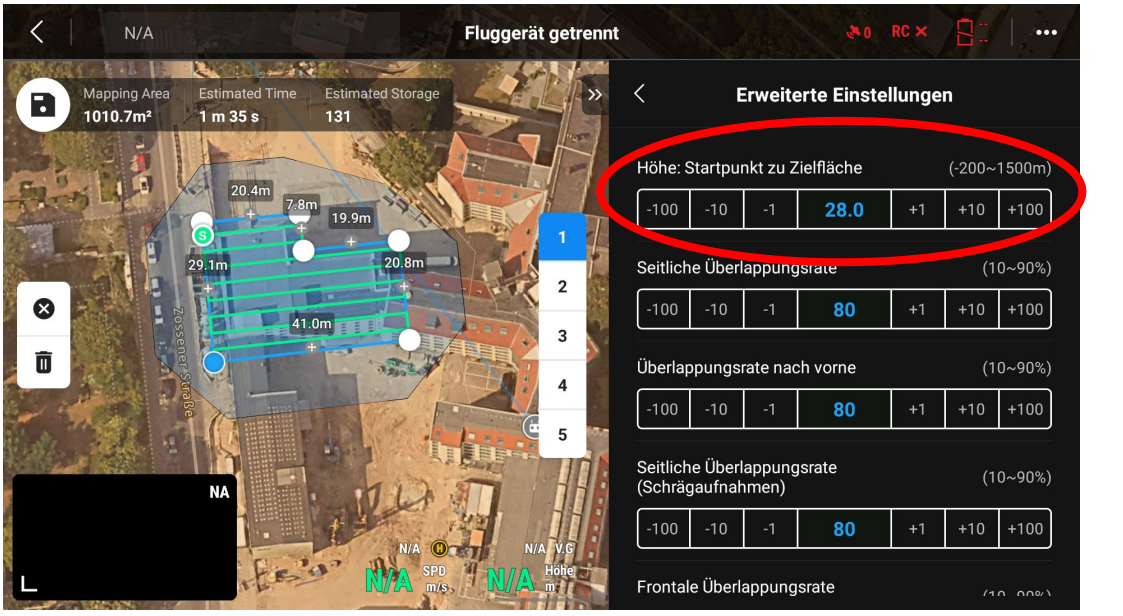
Next, select the speed of the drone. This should be a maximum of 3.5 m/s. The course angle should be selected so that the flight paths run parallel to the long edge of the building.



Then open the advanced settings!

Step 4 - Make advanced settings

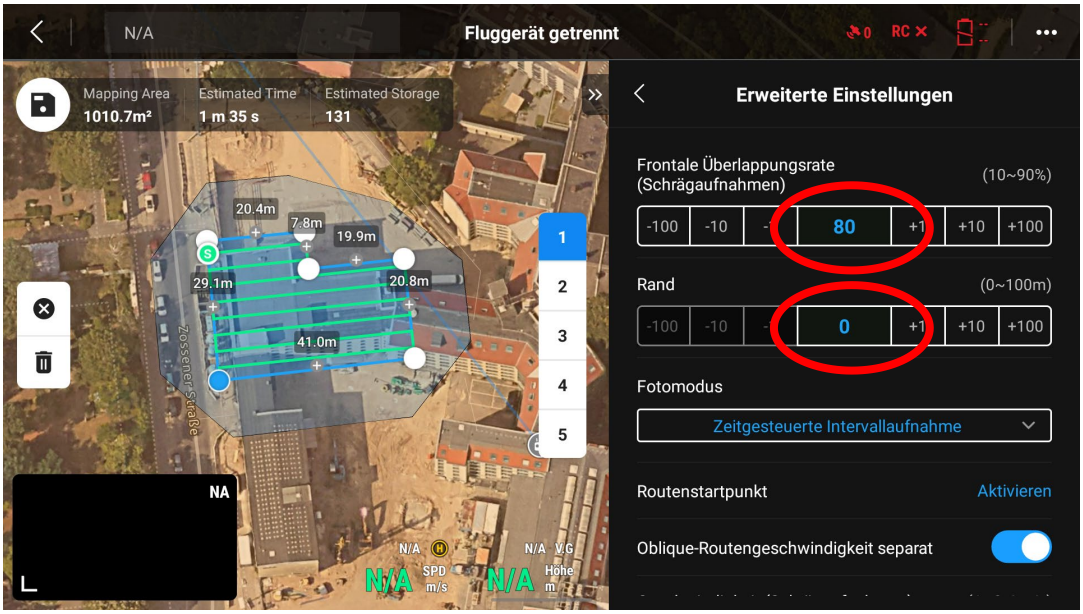
Here you set the building height (e.g. +28 meters) for "Height: Starting point to target area". This is very important so that the overlap of the images is calculated correctly! The target area for the measurement is the height of the roof and not the floor!



Building procedure - Little space on site

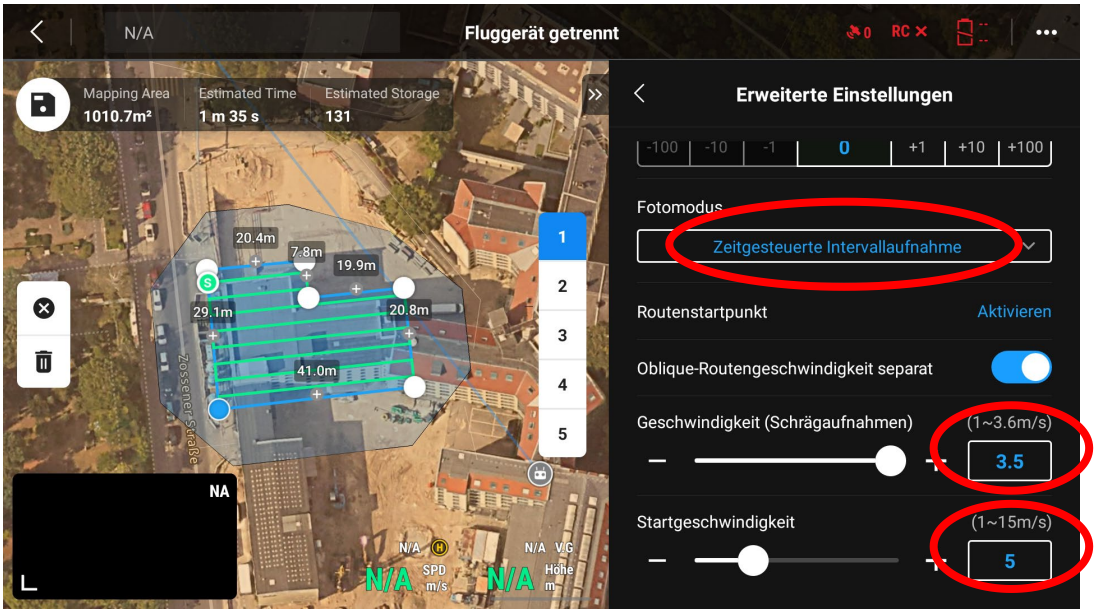
Step 4 - Make advanced settings

Set the image overlap rate to 80 everywhere. This value specifies the percentage by which the captured images should overlap. 80 is the ideal value here.



Set the border setting to 0. You have now made all the settings for the image overlap.

The photo mode must be set to "Timed interval shooting".

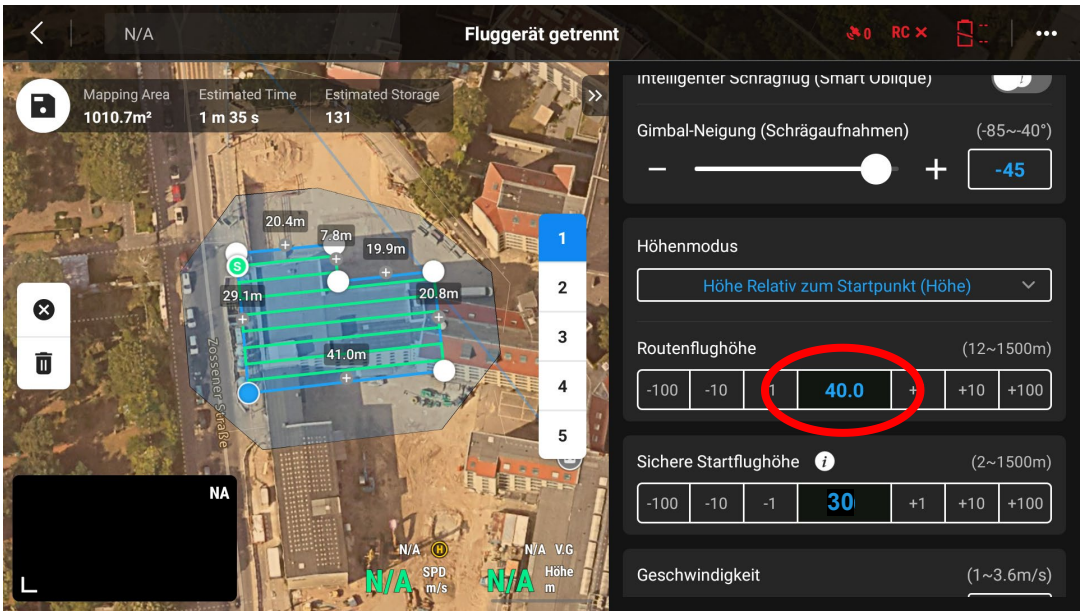


Set the speed to 3.5 m/s in the same way as the previous setting; please do not select a higher speed. Select a take-off speed of 5 m/s. If you are sure that there are no bystanders in your vicinity, you can also select 15 m/s.

Building procedure - Little space on site

Step 5 - Select height settings and gimbal tilt

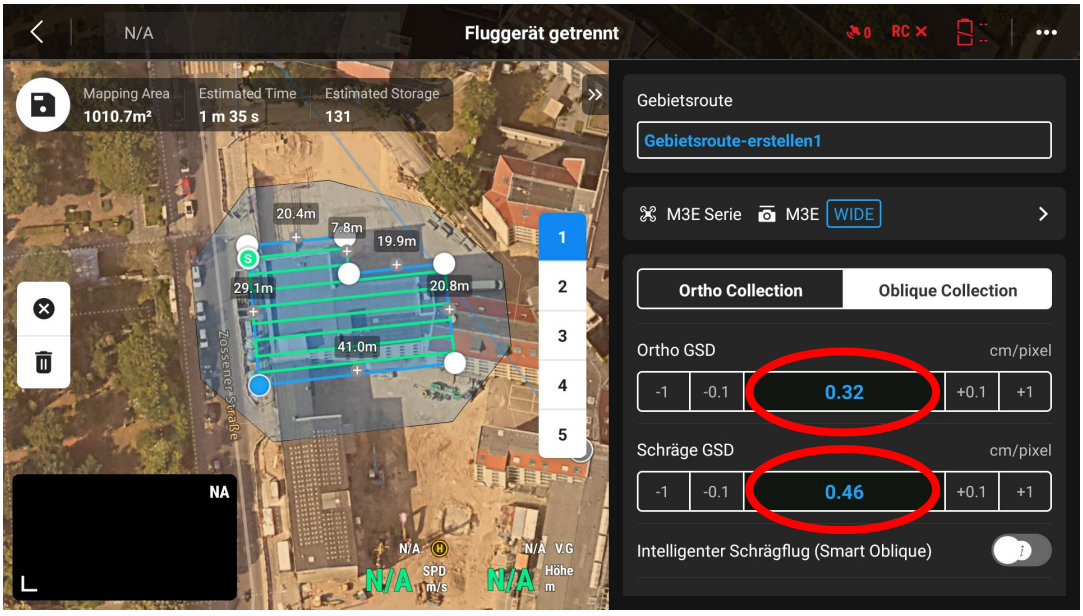
The route flight altitude specifies the altitude at which the drone performs the flight. Ideally, the flight altitude is approx. 12 meters above the roof being surveyed. In the example, the roof is 28 meters high, so the flight altitude is 40 meters.



The altitude mode should be "Altitude relative to starting point". This means that the drone flies 40 meters above the ground where you started. Then set the gimbal tilt to -45°.

Step 6 - Check the GSD settings

Now that you have made all the relevant settings, the value of the GSD should have changed automatically and should be below 1.00! In our example, the value has changed to 0.32 and 0.46, which are two ideal values.



Building procedure - Little space on site

Step 7 - Check the drone's flight paths

As already mentioned, if there is not much space on site, the drone will fly 5 instead of 2 paths. These should be checked again before saving and carrying out the flight. To do this, look at each individual path again by tapping on the respective number on the display.

The first flight path runs directly over the building when set up correctly. The other 4 flight paths are then next to and partly above the building, as can be seen in the following screenshots!

As you can see, the drone flies above and to the right of the building on the 2nd flight path.

Building procedure - Little space on site

Step 7 - Check the drone's flight paths

The 3rd flight path is then again partly above the building and to the south of the building:

As a result, half of the 4th flight path is again above the building and to the west of the building:

Building procedure - Little space on site

Step 7 - Check the drone's flight paths

The 5th flight path, like all the others, is partly above the building and finally also to the north of the building:

If all 5 paths are now viewed together, the drone first flies over the entire roof and then flies over the building once from each direction. In this way, all edges and the roof are captured from different perspectives. This is ideal for obtaining an optimal 3D model and the best quality data.

Comparison: Smart Oblique vs. Oblique Collection

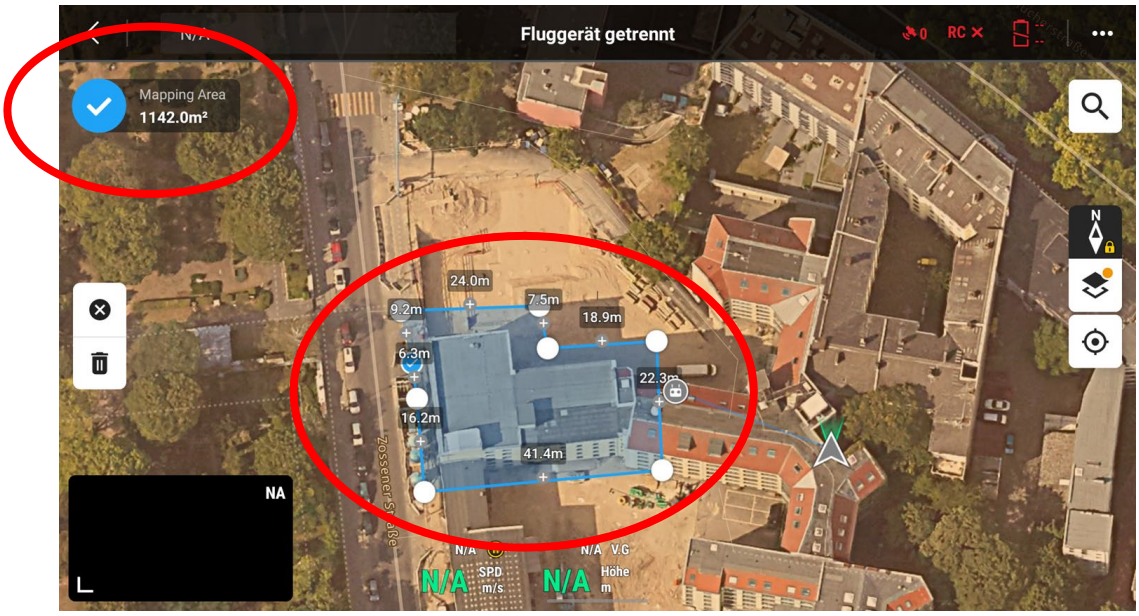
As you can see from the illustrations below, you need significantly less space with the classic Oblique Collection. This is particularly useful if there is little space on site because there are obstacles in the way or there are many neighboring properties. Please note that you also need the consent of the neighbors over whose property the drone flies during the flight! If you have no space rather than little space, take a look at the next flight type.

Smart Oblique (left screenshot) requires approx. 3x more space than the Oblique Collection (right screenshot)

Building procedure - No space on site

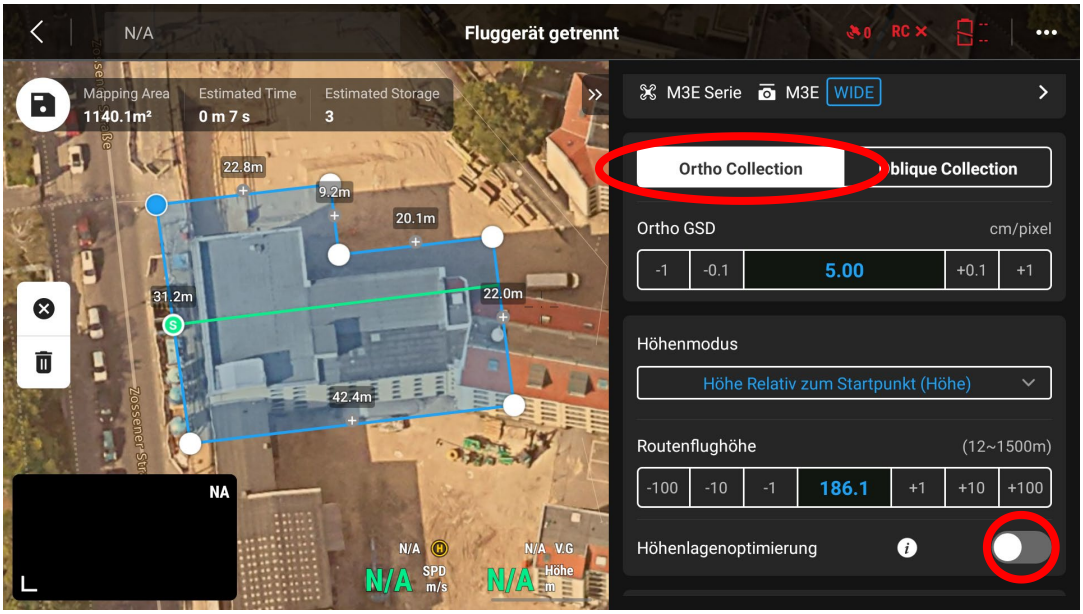
Step 1 - Determine flight plan

Define the extent of your flight plan on the map. To do this, select a larger area than the roof area to be measured. You can move the corner points with your finger until the flight plan corresponds to an area larger than that of the object. When you have finished making your selection, tap the tick in the top left-hand corner to confirm.



Step 2 - Select flight types

Now deactivate the intelligent inclined flight (Smart Oblique) by deactivating the toggle. Then select the "Ortho Collection" as the flight type. This is always useful if there is no space on site or if you do not want to fly over neighboring properties.

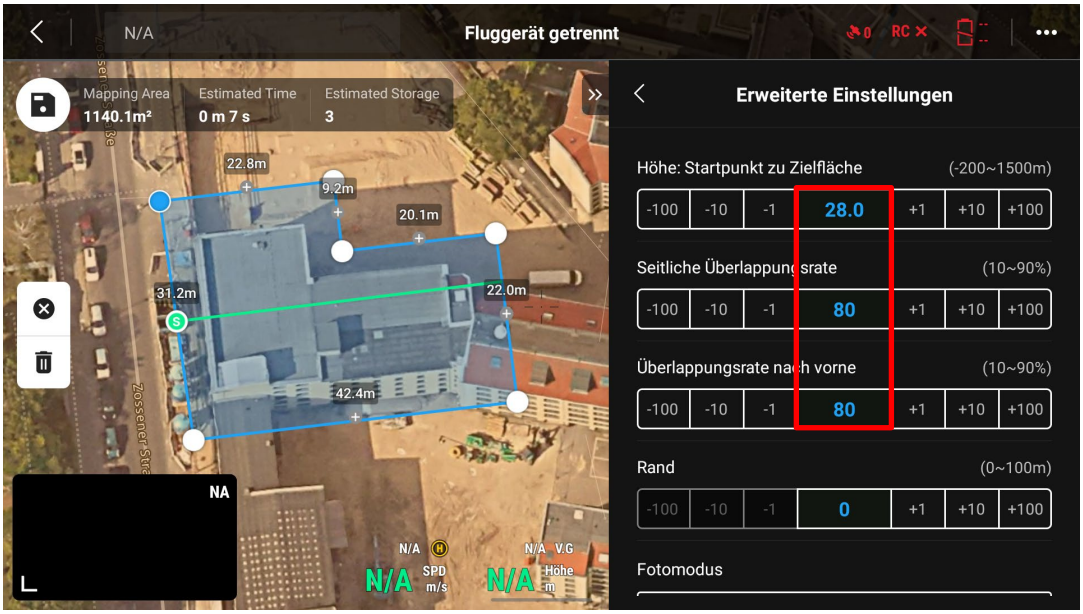


The GSD (Ground Sampling Distance) should ideally be below 1.0 at the end of the mission planning. As this value depends on the settings made, you can dispense with specifying the value there for the time being.

Building procedure - No space on site

Step 3 - Making advanced settings

In the settings on the right-hand side of the display, scroll down to the bottom and click on "Advanced settings"
Here you set the building height (e.g. +28 meters) under "Height: Starting point to target area". This is very important so that the overlap of the images is calculated correctly! The target area for the measurement is the height of the roof and not the floor!



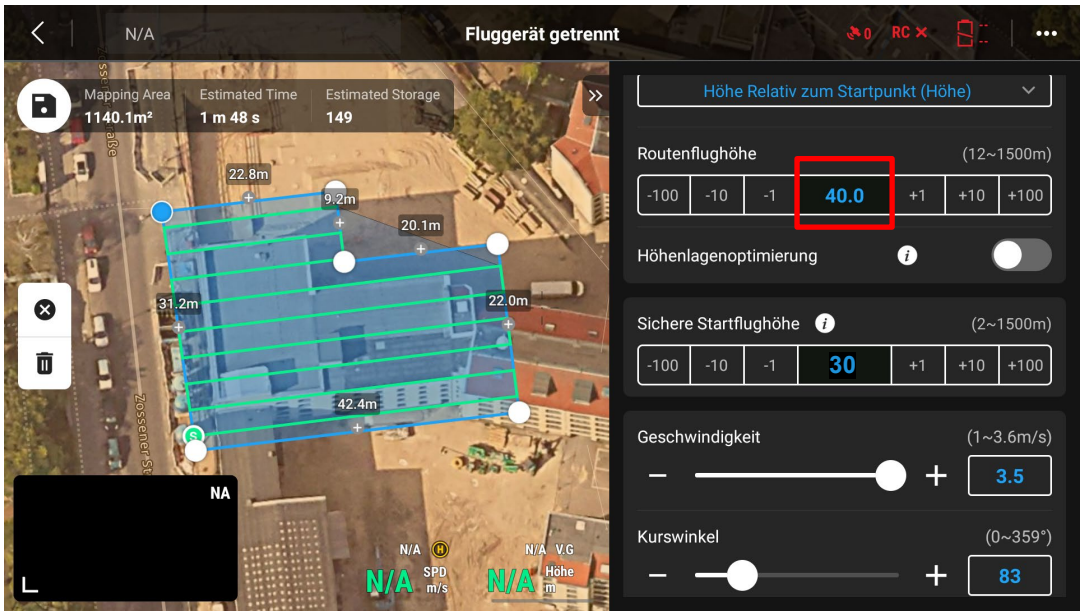
For the lateral and front overlap rate, set 80% in each case, as it is necessary for the measurement that the individual measurement images overlap by 80%.

Enter 5 meters per second as the starting speed if there could be bystanders nearby. If you are sure that no person can be nearby, you can also set this to 15 meters per second.

Building procedure - No space on site

Step 4 - Determine flight altitude

The route flight altitude specifies the altitude at which the drone performs the flight. Ideally, the flight altitude is approx. 12 meters above the roof being surveyed. In the example, the roof is 28 meters high, so the flight altitude is 40 meters.



The safe take-off altitude indicates the height at which the drone can fly unhindered to the starting point of the survey flight. It therefore makes sense to select a higher value than the building height.

Step 5 - Set course angle and speed

The course angle indicates the angle at which the trajectories are flown. The angle should be selected so that the flight paths are parallel to the longest edge of the building. In our example, 83° must therefore be set.

The speed should always be set at 3.5 meters per second. This is the ideal speed for our survey flights.

You have now made all the settings and can check the GSD ground resolution and flight paths in the final step.

Building procedure - No space on site

Step 6 - Check the drone's flight paths and ground resolution

The flight path should now be limited to the area marked at the start of the mission planning. Of all the variants shown, the area required for the survey flight is now minimized.

The "Ortho GSD" (ground resolution) should ultimately be less than 1.00. In our case it is 0.32, which is a great value. Once again, the GSD should not be set manually, as it depends on all the other settings made and therefore results automatically.

Finally, you can now save the mission and are ready for your next survey flight. Have a good flight!

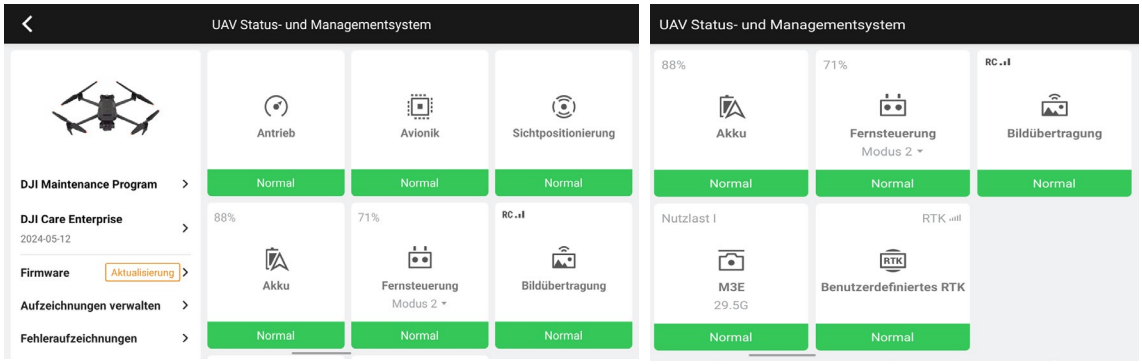
The right start

Step 1 - Select starting point

Choose your take-off point so that you can take off and land safely. Make sure that your take-off point is as open as possible, i.e. that you do not take off too close to buildings or trees. Bystanders should not enter the take-off and landing area.

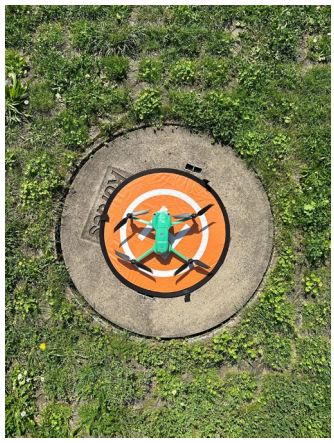
Step 2 - Satellite connections / RTK connection

Check whether you have a stable connection to the Internet, e.g. via a mobile hotspot. Check whether all parameters are normal and wait until the drone has at least 15 satellite connections (without RTK module) or the RTK status is normal.

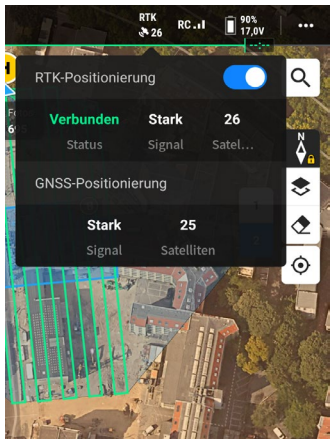


Avoid the following sources of error

Too close to the building - If the drone is too close to the building, the quality of the satellite connections decreases, and the drone takes a very long time to find 12 or more satellites.



Avoid taking off from a surface with metal (e.g. reinforced concrete), as this interferes with the drone's compass.



Do not take off until the drone is >15 satellites or the RTK status is connected, and the signal is Strong.

Small houses – Point-of-Interest (POI)

Step 1 - Launch the drone and climb to a safe altitude

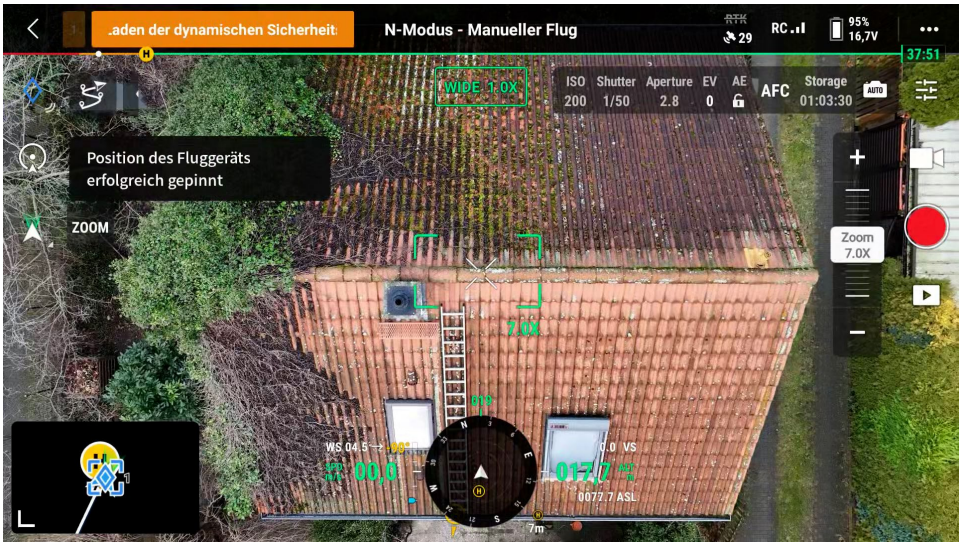
You start the drone manually and fly to an altitude where no people or obstacles are.

Step 2 - Set the center point

The way the Point of Interest (POI) mode works is that the drone circles around a defined center point (the POI). To do this, you must first define the center point around which you want to circle.

To do this, fly the drone to this exact point and then click on the blue diamond symbol on the left-hand side of the screen to pin the drone's location. The flight software then saves the GPS data of the center point. This makes it possible to circle exactly around this point.

After you have tapped the symbol, the flight app will display the message "Position of the aircraft successfully pinned". The center point for the POI is now set and you can continue positioning the drone.

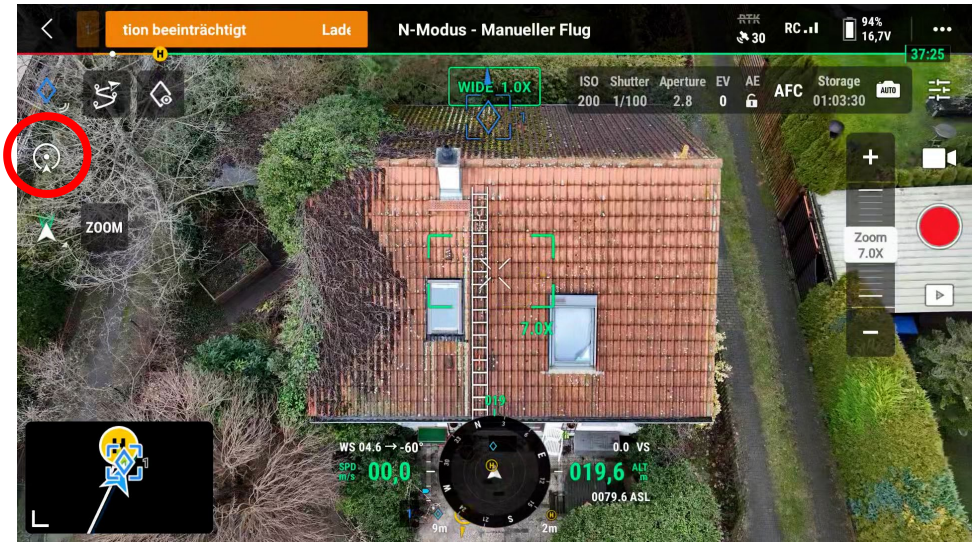


Small houses – Point-of-Interest (POI)

Step 3 - Position the drone and activate POI mode

Once the center point has been determined, you must now position the drone so that the radius of the circle is set so that you can circle around the object with a camera angle of -30° - -60° so that all relevant areas of the roof can be captured. The less space you have on site, the smaller the radius and the larger the camera angle should be.

In our example, we chose a camera angle of -60° and only flew as far back as necessary to keep the radius as small as possible. This is an advantage if obstacles restrict the space or if you do not want to fly over neighboring properties.



The flight altitude should be around 8 - 12 meters above the ridge of the roof. Within this margin, it is ideal if the flying height is approximately twice the ridge height. You should also have a good view of the roof, as shown in the illustration!

Now that you have made all the preparations for positioning, you need to activate POI mode to make the final settings. To do this, click on the symbol for the POI. The symbol is marked in the illustration above!

Small houses – Point-of-Interest (POI)

Step 4 - Freeze the camera angle

If you have activated POI mode, you will again receive a "POI activated" response from the flight app and the flight mode icon will now be yellow.

As you can see from the illustration, you now have two new settings. You can now use the drone's "C buttons" to freeze the speed and the camera angle.

As we have already set the camera angle in advance, you can freeze it by pressing the C2 button.

Small houses – Point-of-Interest (POI)

Step 5 - Activate interval recording

To ensure that the drone takes all the necessary pictures itself, you can set the drone to trigger the camera automatically every 2 seconds after activating the shutter release.

To do this, tap on the symbol above the shutter release. Now you can choose between photo and video, here you select photo. In the submenu, select "Time-controlled" and then set 2 seconds, "2s". The shutter symbol should then show "2s", confirming the setting you have made

Small houses – Point-of-Interest (POI)

Step 6 - Achieve speed and freeze

Remember that the lower the speed, the shorter the distance covered in 2 seconds. The shorter the distance covered, the greater the overlap of 2 images. As the overlap of the individual survey images must be approx. 70-80%, you must not fly too fast. The ideal speed for the flight is approx. 0.5 meters per second.

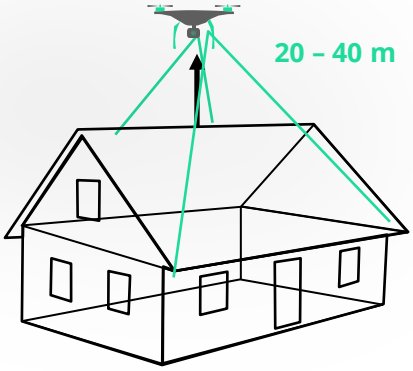
To freeze the speed, you must first accelerate the drone. In POI mode, you can only move the drone in a circular path; all other directions are blocked. So you move the right stick of the controller very slightly to the left or right (depending on the direction in which the circular flight is to be performed). The further you move the right stick in one direction, the faster the drone accelerates. At the moment when the speed reaches 0.5 m/s, you can freeze it by pressing the C1 button.

You can see that the speed is frozen when the lock symbol is yellow!

Aesthetic images for a survey report

Step 1 - Aesthetic images

Fly 20 - 40m above the center of the roof and take the first photo (nadir) directly downwards so that the entire roof is visible. Please note the maximum permitted flight altitude.



AT A GLANCE - Step 1:

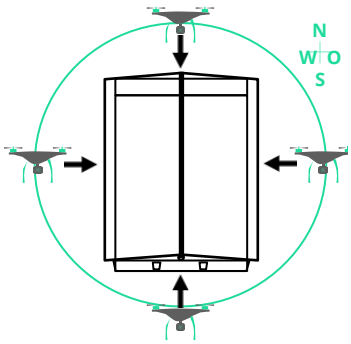
Number of photos: 1
Camera tilt = 90° downwards
Flight altitude = approx. 20 - 40 meters above the roof

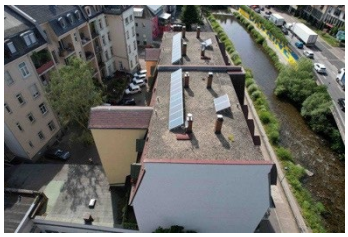
Step 2 - Aesthetic images

Please take pictures of all sides of the building so that the entire roof and facades are clearly visible.

AT A GLANCE - Step 2:

Number of photos = 4
Camera tilt = 45° - 60° downwards Flying height = approx. 10 - 20 meters above the roof



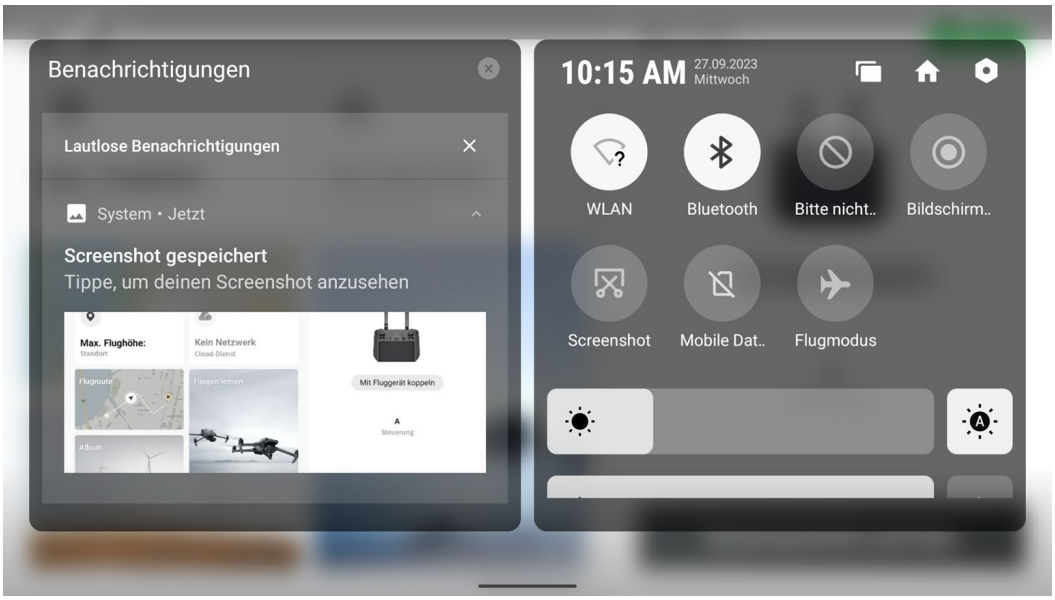


RTK-Settings

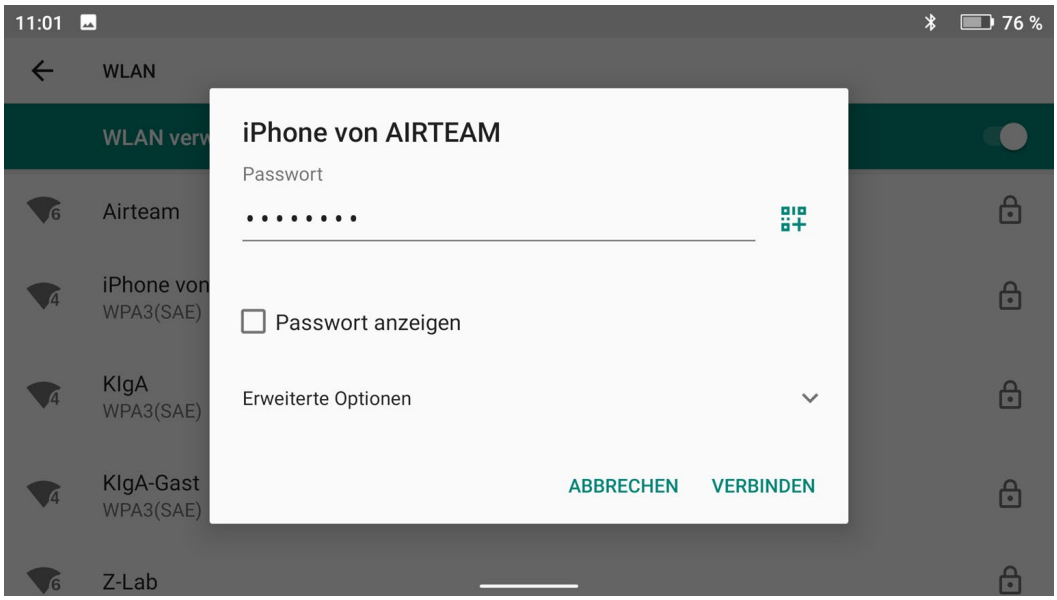
RTK-Settings

In order to use the RTK module to its full extent, the firmware of your DJI Mavic 3 Enterprise RTK must be up to date. In addition, the controller must be connected to the Internet via WLAN or a mobile hotspot for the entire duration of use, proceed as follows so that you can connect your system to SAPOS or another correction data service.

1. Connect your controller to the Internet. To do this, swipe down from the top of the screen and long press on the Wi-Fi icon until these settings open.

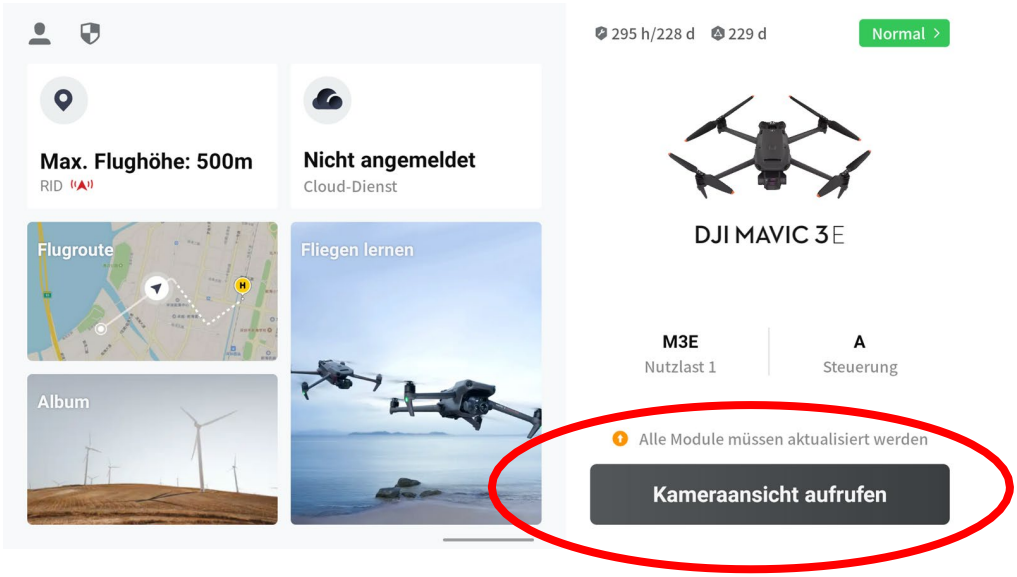


2. Select your hotspot or WLAN and confirm the connection with the corresponding password.

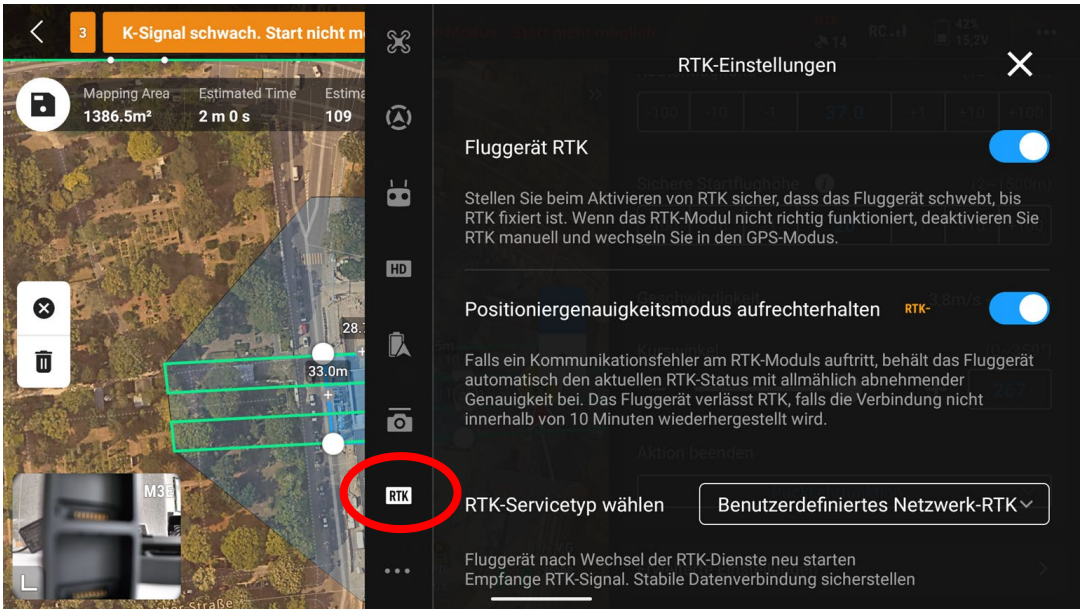


RTK-Settings

3. Open the DJI Pilot 2 app and tap on "Call up camera view"

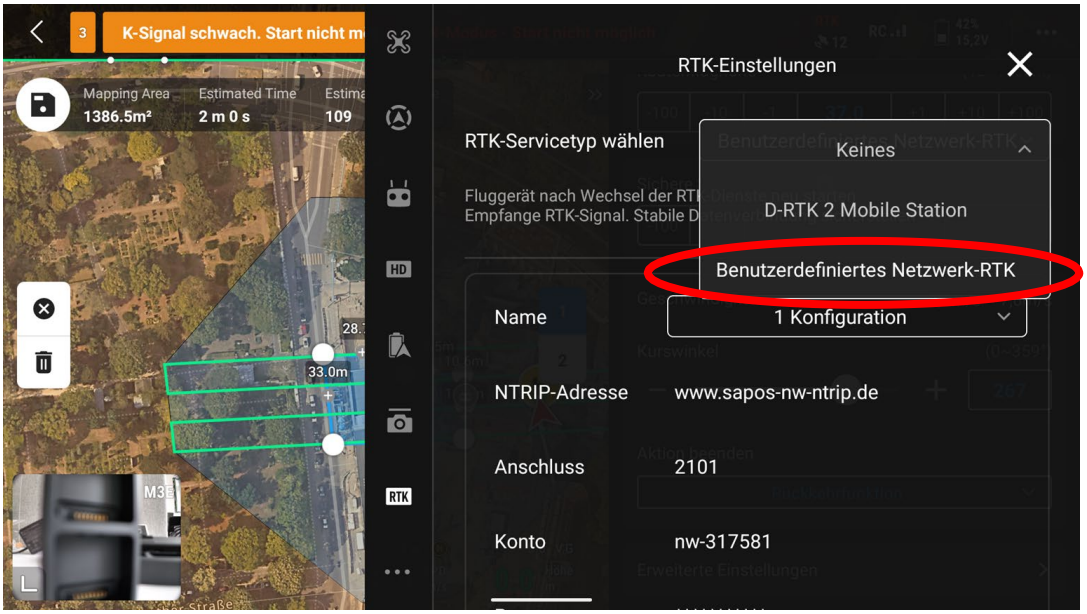


4. Next, tap on the three dots at the top right of the screen and then on "RTK"

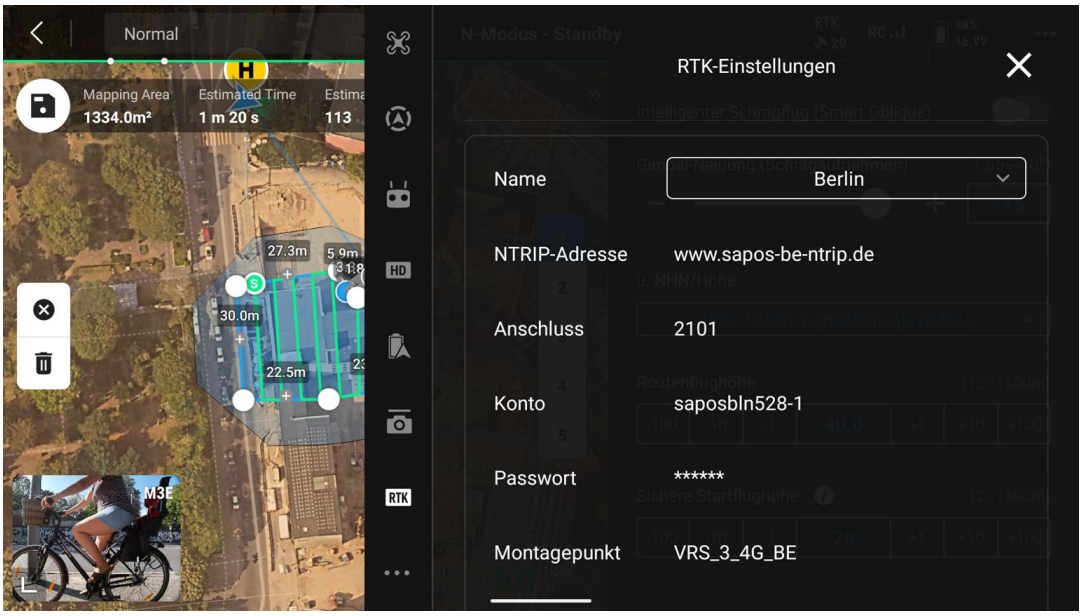


RTK-Settings

5. Select "User-defined network RTK" as the "RTK service type".



6. Next, enter your login details that you received when you registered with SAPOS. The example shows access data for Berlin.



Make sure that you enter everything correctly and do not leave any spaces in the respective lines.

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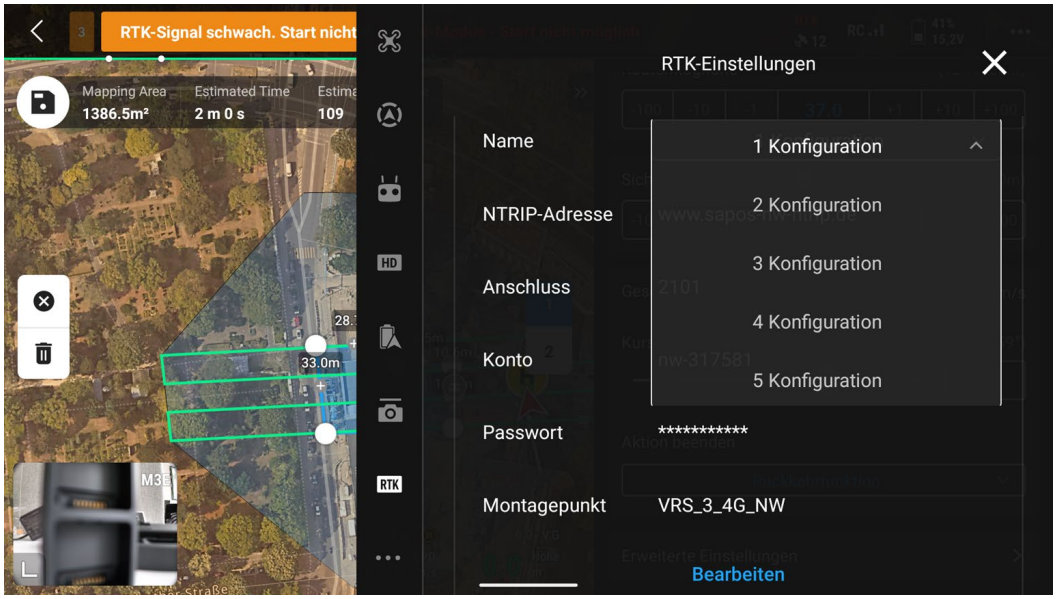
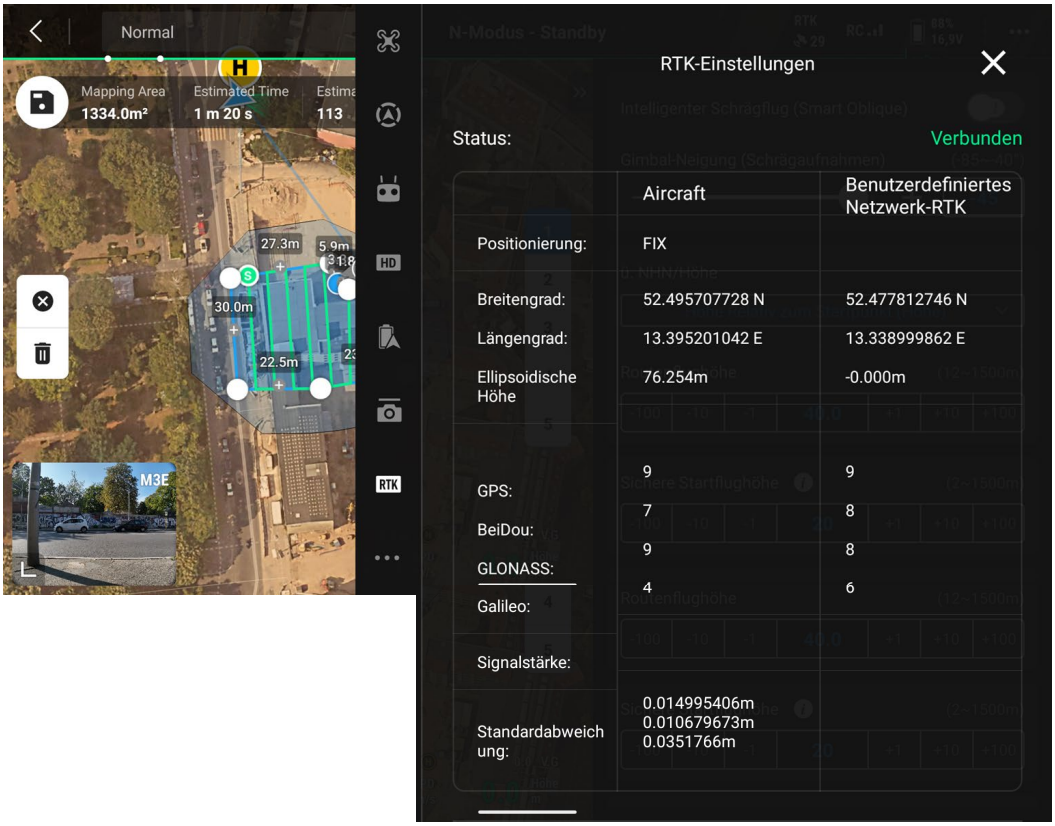
If you have several login details, you can save up to 4 additional login details in configurations 2 - 5.



Before each take-off, check that the connection is stable and that the correction data is being received. Make sure that you have a stable connection during the entire flight.

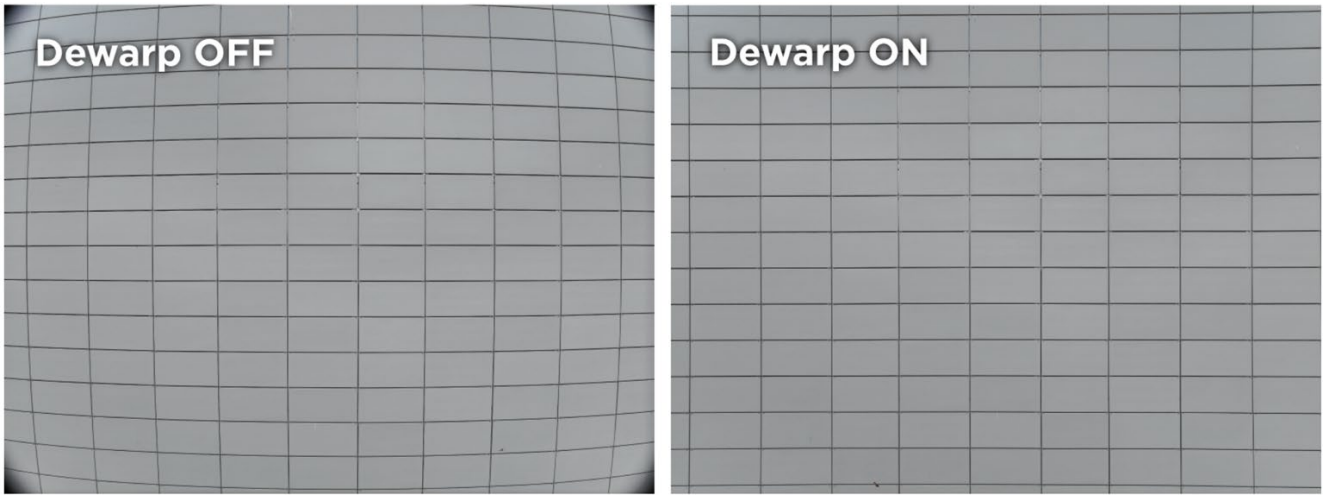


Distortion compensation

Distortioncompensation (dewarping)

If you deactivate the distortion compensation (dewarping) function, the integrated correction of geometric lens distortion is switched off. This means that the drone images may look worse. However, the photogrammetry software can make the corrections based on this setting. As a rule, such a workflow leads to better results in 3D reconstruction.

We therefore recommend deactivating distortion compensation (dewarping) for all survey flights (Off).



Typical Challenges

1. obstacles
During the survey flight, the drone flies automatically. Please make sure that there are no obstacles such as trees, cables or buildings in the way.

2. blurred images
Make sure that the focus of the image is on the roof and not anywhere else. With the DJI Mavic 3 Enterprise, you can set or correct the camera focus by tapping on the display. This is necessary during flight, for example, if you are flying several circles. A common problem is accidental tapping on the screen, which sets the focus incorrectly. It is therefore better to check the focus once too often than too little.

3. camera angle
The current DJI Pilot 2 app offers three flight modes. Ortho shots and two different Oblique shots. For the best resolution in the 3D model, select the Oblique option. Please note that you are flying over the building, i.e. it may be necessary to obtain the consent of the neighbors for the drone flight. For the ortho shots, you always fly above the building. Please also note here that the minimum distance between the drone and uninvolved persons must be maintained.

4. RTK connection
If you are surveying large objects over 1,500m2 and/or require maximum precision, make sure you have a stable RTK connection before every flight. If you are using Network RTK (without a ground station), you will always need an active internet connection on site and must ensure that the controller is connected to it.

5. too few images
Make sure that you set the frontal and lateral overlap to 80% in the DJI Pilot 2 app settings.

6. aesthetic images for the survey report
In addition to the survey flight for the technical images, we ask you to take a picture from above (nadir) showing the entire roof and the property. In addition, you must take one picture each from the north, south, east and west at a 45% angle, showing the entire building.

7. exposure
If the sun is shining very strongly, the images will quickly become too bright. This can lead to problems when creating the 3D models and the algorithms. Activate the overexposure warning in the camera settings. Areas that are too bright will then be displayed in black and white hatching. You can correct the exposure using the EV value. Manual exposure compensation is only necessary in exceptional cases. For example, in strong sunshine, a dark roof and a white façade.

8. Legal requirements
Make sure that you comply with all legal requirements for all flights. These include, among other things
- Obtaining the consent of the landowner (and neighbors if necessary)
- Flying within the pilot's field of vision
- Maintain minimum distances to (uninvolved) persons.

For flights in commercial areas, it may be advisable to fly at the weekend or before the start or end of work. You can find out more about this in the Airteam training courses and from certified bodies.