



HOVERMAP 360 PANORAMIC IMAGE GUIDE

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Using this manual

Hovermap is a powerful system that can be used as a Lidar mapping payload but also as an advanced autopilot for drones. It is therefore recommended to read the user manual thoroughly to make use of all its capabilities in a safe and productive way.

Disclaimer and safety guidelines

This product is not a toy and must not be used by any person under the age of 18. It must be operated with caution, common sense, and in accordance with the instructions in the user manual. Failure to operate it in a safe and responsible manner could result in product loss or injury.

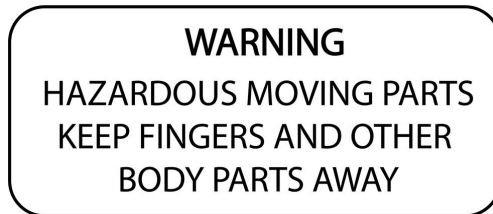
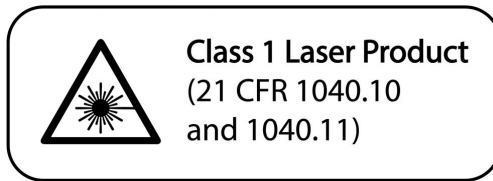
By using this product, you hereby agree that you are solely responsible for your own conduct while using it, and for any consequences thereof. You also agree to use this product only for purposes that are in accordance with all applicable laws, rules and regulations.

The use of Remotely Piloted Aircraft Systems (RPAS) may result in serious injury, death, or property damage if operated without proper training and due care. Before using an RPAS, you must ensure that you are suitably qualified, have received all necessary training, and read all relevant instructions, including the user manual. When using an RPAS, you must adopt safe practices and procedures at all times.



Warnings

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- Always be aware of moving objects that may cause serious injury, such as spinning propellers or other components. *Never* approach a drone while the propellers are spinning or attempt to catch an airborne drone.





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1. Introduction

Provide additional context to your point cloud by adding 360 contextual reality to your Hovermap point cloud scans. The plug-and-play 360-degree camera accessory for Hovermap combined with seamless processing in Aura, enables the easy capture, registration, and export of 360 panoramic images to highlight areas of interest and enhance understanding for remote stakeholders or data users. Images are automatically registered and exported in Aura, ready for visualization.

Integration with third-party applications – such as Emesent partner Pointerra3D – allows the effortless display and sharing of visualizations via a simple streamlined workflow.

**Note**

Point cloud colorization using the 360-degree camera is not supported in Emesent Aura 1.4.

This will be available in an upcoming software release.

2. Prerequisites

2.1 Hardware

- Emesent Hovermap (ST-X/ST/HVM100 are all supported)
- Telescopic handheld mount or Hovermap GoPro mount
- GoPro MAX (including SD Storage Card preconfigured) and quick mount swap adaptor
- Hovermap Handle
- Hovermap Battery
- USB stick (for scan and 360 video transfer)
- Fischer cable



2.2 Software

- Emesent Aura version 1.4 or higher with a valid Colorization license
- Third-party software for exporting point cloud 360 image data. The following tools have been officially tested with Emesent Aura 1.4:
 - Pointerra3D: <https://www.pointerra.com/>
 - Cintoo Cloud: <https://cintoo.com/>
 - Bentley iTwin Capture Import & Upload Tool: <https://www.bentley.com/software/itwin-platform/>

3. GoPro Max settings to support Image Extraction

The Go Pro MAX camera comes preconfigured straight from the box. However, it is advisable to double-check the settings before initial use. Any adjustments will be saved for subsequent usage.

For more guidance on navigating the GoPro MAX menu and understanding its settings, refer to the official GoPro MAX documentation:

https://gopro.com/content/dam/help/max/manuals/MAX_UM_ENG_REVB.pdf

To check the GoPro MAX settings:

1. Power on the GoPro Max.
2. Swipe down from the top to access the dashboard then select **Preferences**. Ensure the following settings are correct:
 - **Preferences > General**
 - Default Mode = Last 360 video
 - Anti-Flicker = 50 Hz
 - **Preferences > Touch Screen**
 - Orientation = Landscape
3. Press the **Mode** button on the side of the camera until **360 Video** is highlighted. Doing this will set the camera to **Hero** mode (indicated by the GoPro icon on the bottom left) by default. Click the icon to change the mode to **360 Video** (indicated by a Sphere icon).
4. Swipe down to access the dashboard then select the bottom right icon to set orientation lock to **UP**.



5. From the home screen, access the 360 Video capture settings by selecting the bottom middle icon and then the **Pencil** icon. Ensure the following settings are correct:
 - Mode: 360 Video
 - RES | FPS = **5.6k | 25**
 - On-Screen Shortcuts:
 - Upper Left = **Off**
 - Upper Right = **Off**
6. From the home screen, access the HERO Mode capture settings by selecting the bottom left icon and then the **Pencil** icon. Ensure the following settings are correct:
 - Mode: Video
 - RES | FPS | Lens = **1080 | 50 | L**
 - Bitrate = **High**
 - Shutter = **Auto**
 - MaxHypersmooth = **Off**
 - Lens = **Linear 19mm**

The GoPro MAX configuration settings are complete, and the camera is ready to be attached to the Hovermap.



4. Attach the GoPro MAX to the Hovermap

This section describes the method for connecting the GoPro MAX to the telescopic mount provided with the 360 camera kit for handheld scanning purposes. It is also possible to connect the 360 camera to an existing fixed camera mount. However, the orientation settings will need to be customized (refer to later section).

To attach the GoPro MAX to Hovermap:

1. Attach the provided telescopic 360 camera mount to the Hovermap handle using the supplied thumb screw and plate.





2. Attach the GoPro Max to the top mounting location using the blue locking lever.



3. Ensure that the telescopic mount is fully extended.



Note

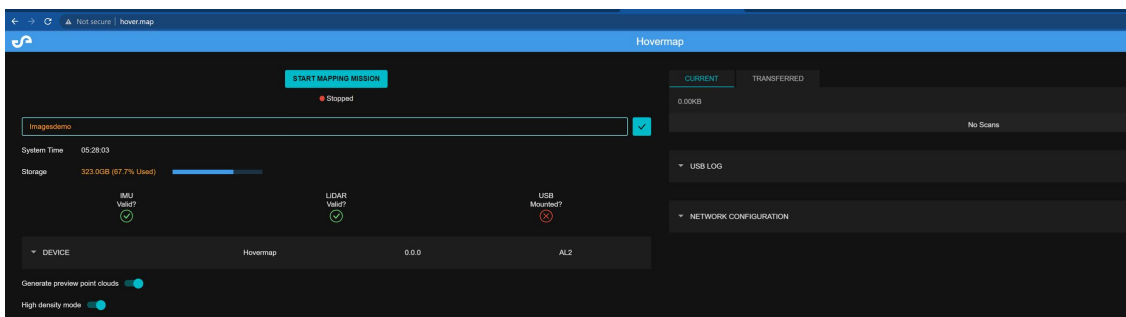
During the 360 image extraction process in Emesent Aura, a mask file blurs the operator from the images. However, it is important to note that the mask files provided are designed to work only when the mount is fully extended

4. Attach the Hovermap handle to the Hovermap.
5. Power on the Hovermap by connecting it to the battery using the Fischer cable provided, then pressing the power button. The belt clip can be used to carry the battery. You are now ready to perform a scan mission.

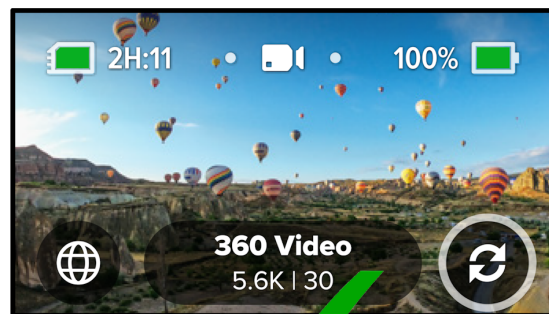
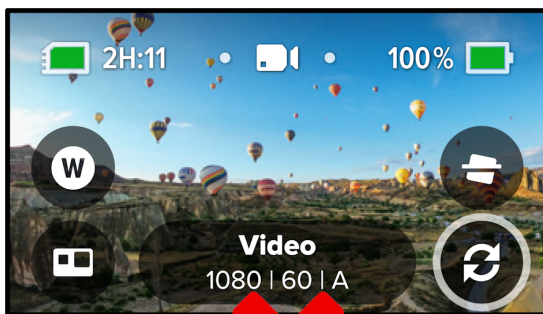


5. Capture your scan

1. Open the Web UI:
 - a. Connect to the Hovermap via Wi-Fi.
 - b. Look for the HVM ID (e.g., if your payload’s serial number is HST5009, the Wi-Fi name will be ST5009).
 - c. Select that payload then enter the Wi-Fi password (**hovermap**) to log in.
 - d. From the Web UI, enter a name for the scan then click **Start Mapping Mission**.



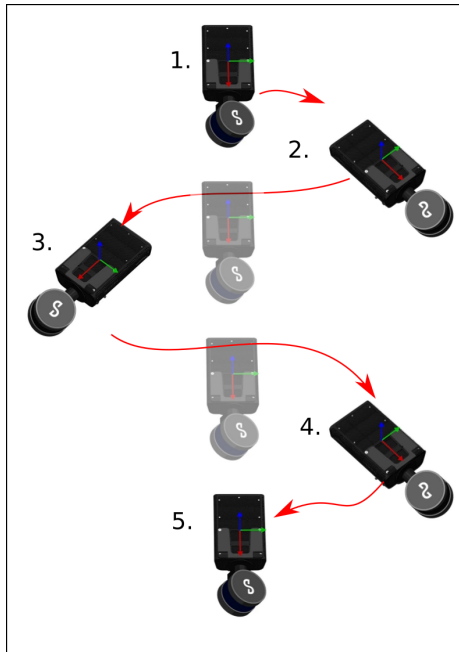
2. Turn on the GoPro MAX. This can be done as the Hovermap is starting to rotate.
 - a. Remove both the front and back lens caps.
 - b. Ensure the GoPro MAX is set to **360 Video** by pressing the camera screen and then checking for the **Sphere** icon located at the bottom left corner, as depicted in the image below on the right. If not, tap it to switch to the correct mode.



3. Once the GoPro Max has been set to the correct mode and the Hovermap scan has started, press the red **Record** button on the top face of the GoPro MAX.
4. Allow the Hovermap to remain still for at least 10 seconds (about five slow green pulses).



5. Rotate the Hovermap around the Z-axis to the sides by approximately 60 degrees, as shown in the following image. The rotation must generate a substantial angular motion (avoid slow rotations). A proper rotation process takes around 10 seconds. Check the provided video QR link for an example.



⚠ Important

The applied image mask blurs for either right-handed or left-handed operations. Switching hands during the scan might result in the operator not being blurred out in all extracted images. To avoid this, any accompanying individuals should walk on the opposite side of the operator while capturing. This will reduce the number of people appearing in the final image.

6. Once the capture is completed, download the raw data for processing in Emesent Aura.
 - a. Connect the GoPro HERO Max to your Windows device using the USB-C connector. Locate the data within the DCIM folder to offload the content.
-or-
 - b. Insert a USB flash drive into the USB port at the back of the Hovermap unit to automatically transfer the data. The USB flash drive must be formatted in an exFAT file format.



6. Process your scan

To prepare for image extraction, begin by processing the raw point cloud data. Once processed, the 360 images can then be automatically registered and aligned to the point cloud, ready for export and visualization.



Note

Emesent Aura does not use the color calibration file for image extraction. Instead, it relies on the user specifying an orientation in the **Processing Settings**.

6.1 Process raw point cloud

1. Download the raw scan data from Hovermap to your hard drive.
2. Copy the .360 video file(s) from your GoPro MAX into the same folder as the raw scan data (where the .bag and calibration files are located).
3. Launch Emesent Aura.
4. Go to the **Process** tab then click **Process Scan**.
5. Select the **Process** workflow then click **Add Dataset**.
6. In the **Location** field, enter the preferred name for the output folder. Emesent Aura will create this folder, which stores all the processed results and data, as a child directory within the raw scan folder.
7. Browse for the folder that contains the raw point cloud dataset to be processed. Select that folder.



8. Select the processing profile to use.

**Note**

You can use the **built-in** profile that is automatically detected for the Hovermap hardware. Follow standard support escalation procedures for any issues.

**Note**

If you are exporting to Cintoo, go to the **Output** tab in the **Processing Settings** panel then in **Point Cloud - output file types**, select the **E57** format.

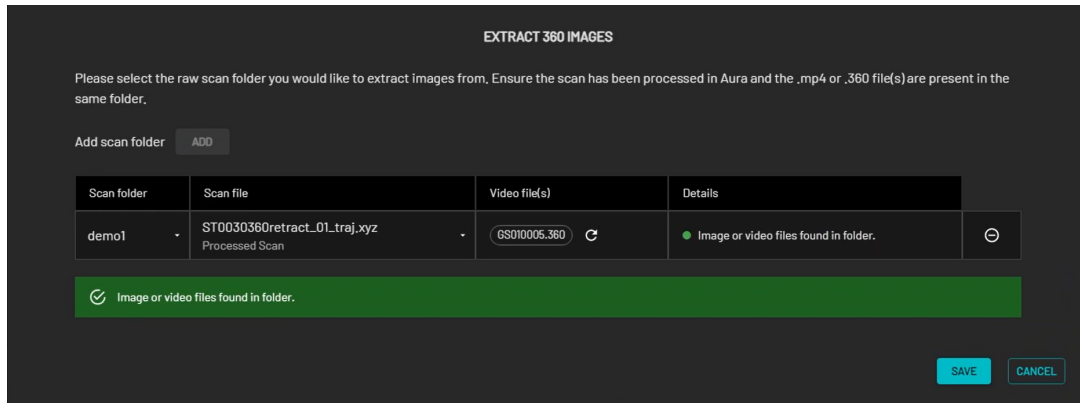
9. Click **Start** to begin processing. Once the raw data has been processed and the point cloud has been generated, proceed with the image extraction.

6.2 Extract 360 images

1. Go to the **Process Tab** and select **Process Scan**.
2. In the **Configure New Scan Job** panel, select the **Extract 360 images** workflow.
3. Click **Add Dataset**.
4. In the panel that displays, navigate to the same folder used in processing the raw point cloud data.

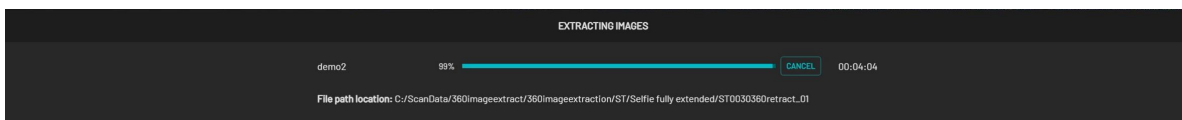
**Note**

To reiterate, the **.360** video file(s) should also be contained in the scan folder. If not, copy the video then click the **Refresh Video** button.



- Click **Save** to return to the main panel.
- Click **Processing Settings**. Configure the start and end time of when the frames are to be extracted from the video, the camera orientation, and image masking settings as needed. Then, click **Save**. Refer to the *Processing Settings* section for more information.
- Click **Start** to begin processing. The **Configure New Scan Job** panel is replaced with the **Starting Processing Job** panel and shows a progress bar showing how far along you are in your processing job. In addition to the progress bar, the elapsed time of the processing job is shown to the right.

The directory file path below the progress bar provides a way to identify the dataset source. This is useful if multiple jobs are simultaneously processed with the same output folder name. Copying the file path and pasting it on your computer’s file explorer allows you to access the completed files without waiting for the processing job to be completed.



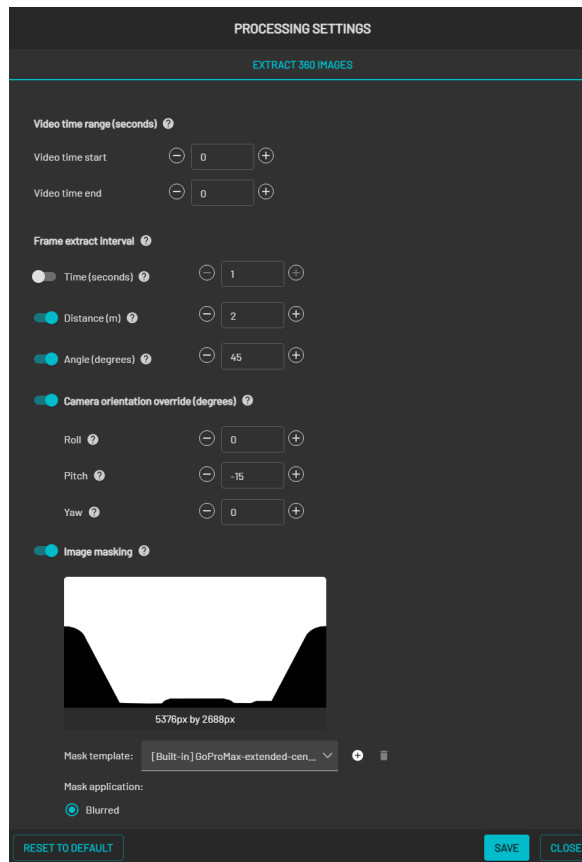
- You will get an indication once the extraction has been completed. Also, a button becomes available allowing you to navigate to the output folder, which contains the extracted images and 3 CSV reference files that can be uploaded to supported third-party applications.

Note

It is recommended to review the images in Windows File Explorer before uploading and delete any that show recognizable people outside the masked areas. There is no need to alter CSV files.



6.3 Processing Settings



6.3.1 Video Time Range

- **Video time start:** The number of seconds from the beginning of the video and serves as the actual start time for frame extraction.
- **Video time end:** The number of seconds from the start of the video at which the frame extraction ends. Setting the value to **0** means the frame extraction will end at the end of the video.
- **Frame step:** A frame will be extracted whenever either the time, distance or angle relative to the last extracted frame exceeds the set threshold. Lowering the thresholds will generate more images that are spaced closer together. However, this will also increase in the amount of data to be processed and managed. It is recommended to use a combination of distance and angle only, to avoid extraction of repetitive, redundant frames when the camera is not moving.



6.3.2 Camera orientation override (degrees)

⚠ Important
 If you are extracting 360 images from a video captured using a color-calibrated 360 Color Mount, the **Camera orientation override** setting is not required and should be disabled in Processing Settings.

To capture panoramic images from a 360 video, the camera orientation needs to be set to align the camera virtually with the Hovermap to ensure the camera is facing forward along the x-axis. To do this, enable the **Camera orientation override** setting then input the angles (in degrees) for yaw, pitch, and roll.

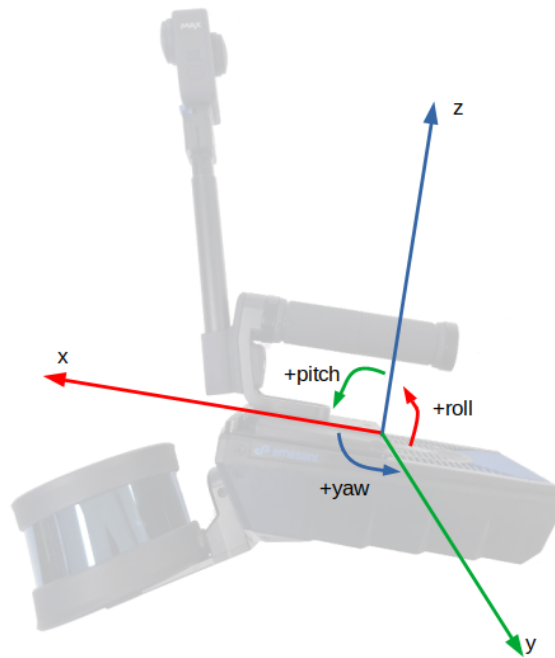


Figure 1 Hovermap Orientation



6.3.2.1 The camera is attached to the Hovermap ST-X via the telescopic handheld mount

The camera already faces roughly in the same direction as the Hovermap but is slightly tilted down by 15 degrees. To align with the Hovermap, the camera should be virtually pitched upwards by 15 degrees.

- Roll : 0
- Pitch : -15
- Yaw : 0

6.3.2.2 The camera is directly attached to the Hovermap 100 via a standard camera mount

The camera is attached to the bottom side of the Hovermap facing forward.

- Roll : 180
- Pitch : 0
- Yaw : 0

6.3.2.3 The camera is attached upside down to the Hovermap ST/ST-X via an angled bracket (GoPro Hero colorization bracket)

The camera is attached to the bottom side of the Hovermap, facing forward and downward.

- Roll : 180
- Pitch : -20
- Yaw : 0

**Note:**

The angles provided above are precise for extracting images intended for export to third-party software. However, for colorization, greater precision is required beyond these specified angles. This feature is currently not supported in Emesent Aura.



6.3.3 Image Masking

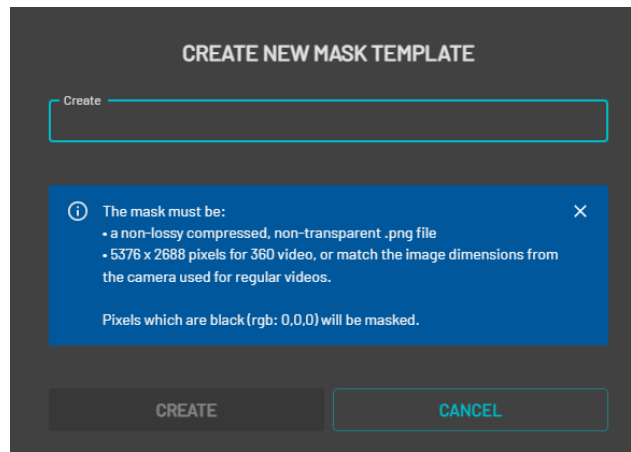
This feature is essential for blurring or blacking out the operator from 360 images when they are imported into third-party tools. Three pre-built templates are available specifically designed for use with the fully extended handheld telescopic mount.

Operator Use	Masking Result	Profile
Scanning using the right hand	The left portion of the image is masked.	[Built-in] GoProMax-extended-righthanded
Scanning using the left hand	The right portion of the image is masked.	[Built-in] GoProMax-extended-lefthanded
Scanning while holding the device close to, or in front of the operator	The left and right edges of the image are masked. Note: If you are swapping hands, use a custom mask that covers both the left and right side of the image.	[Built-in] GoProMax-extended-centre
Custom mask is supplied	Custom	Custom profile created



6.3.3.1 Mask Template

You can apply a black or blurred (default selection) portion to the mask. For a customized mask, click the “+” button to define a mask using any third-party software (e.g., Photoshop). Assign a name to the custom template and load the PNG file generated externally. The following image lists the requirements for the mask file.



Warning

Failure to adhere to mask file requirements will result in the mask not being applied correctly.

6.3.3.2 Creating a customized mask

To create a custom mask, the following process is recommended:

1. Run image extraction once on a small subset of data. You can achieve this by setting a high **Frame Extract Interval** (e.g. **Distance: 20** and **Angle: 90**) or specifying a low **Video time end** setting (e.g. **10 seconds**). For Aura 1.5 and earlier versions, you can also use a **Frame Interval** of **250**.
2. Open the folder that contains the extracted images, select a representative image, and open it using a third-party image editing software.



3. In the editing software select the areas you want to mask out, and fill them with black (RGB: 0,0,0).



Note

It is recommended to check for any black pixels in the unmasked parts of your image or to ensure that your image is properly masked, select all areas that are not meant to be masked and fill them with white.

4. If layers were used during editing, flatten the image.
5. Save the image as a PNG file with non-lossy compression, typically the default option. Ideally, use the 8-bit RGB format.



Note

If using Emesent Aura version 1.6 or earlier, ensure transparency is disabled and avoid using software that saves the image with transparency (e.g. MS Paint).



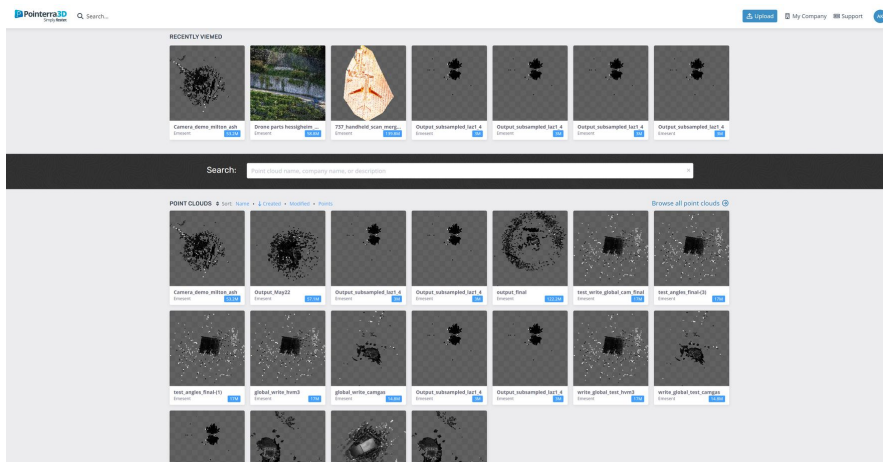
7. Upload the images and point clouds (Optional)

This section contains instructions for uploading images with associated point clouds using the various third-party tools supported in Emesent Aura version 1.4 or higher.

7.1 Pointerra3D CORE

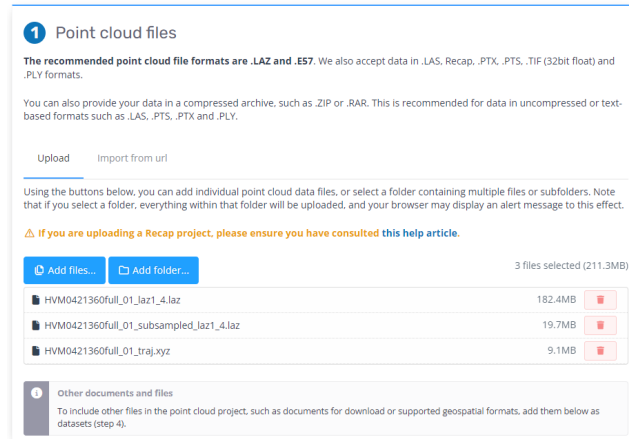
File format requirements	Support for various file formats and sources (e.g. LAS/LAZ, PTS, E57, Geotiff, XYZ, PLY, SHP, DXF, KML, Geojson, ESRI GDB, OBJ, IFC, FBX, Cesium 3D Tiles, ECW, JPGs)
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1. Go to <https://www.pointerra.com/product/core/> and log in to your Pointerra3D account.
2. Click the **Upload** button on the top right of the page to display the **Upload data** wizard.





- Click Add files then browse for the point cloud files that were processed in Emesent Aura (before the image extraction). The point cloud file(s) in the `write_global` folder must be used for this, not the ones in any of the georeferenced `write_global_XXX` folders.



- Specify the **Source coordinate system**. If there is no GPS/RTK data in the scan, select **My data is not georeferenced**.

- OR -

Select **Let me select from a list of coordinate systems** if the data is georeferenced. The Coordinate System should match the coordinate system described by the `.prj` file(s) in the `write_global` folder. Usually, this is a **WGS84 UTM** zone, with the **Vertical Datum** set to **Ellipsoid**.

Note

Before importing into Pointerra, ensure the data is projected using an external tool. You can use third-party GIS software like QGIS or Global Mapper to re-project your data to a different coordinate system. Note that both the point cloud files and the `frames_pointerra.csv` (see below) must be re-projected the same way. Re-projection of the point cloud and images will come in a future version of Aura.



2 Source coordinate system

To locate your dataset on the globe, you'll need to provide the Spatial Reference System (SRS) information for it.

You can search for an existing SRS by name or EPSG code, or manually enter a proj4 string if you have one.

If your SRS is not listed here, you may be able to find it at spatialreference.org. If you find it there, copy the proj4 string and paste it into the custom proj4 field. For local grids, contact Pointerra, and we will assist you with creating a custom SRS definition.

If you don't know which SRS to use, you can also choose to not georeference your data set. This will disable some features, such as map tile generation and base map layers.

How would you like to define the source coordinate system for your data?

- Let me select from a list of coordinate systems
- My data is not georeferenced**
- Let me pick from a list of recent uploads
- I want to enter a proj4 string manually (advanced users only)

SOURCE HORIZONTAL UNITS: Meters, Feet (US), Feet (Intl), Custom

SOURCE VERTICAL UNITS: Meters, Feet (US), Feet (Intl), Custom

APPROXIMATE LOCATION: lat: -27.602643, lon: 152.930599 Select location Clear

Note
Source vertical units are in meters.

- 5. Enter any metadata information to help identify the scan (optional).
- 6. Click the **360 Photos** button.

3 Metadata

PROJECT NAME: Output_subsampled_laz1_4

POINT CLOUD TYPE: Not specified

CLASSIFICATION SCHEME: default (ASPRS LAS)

DATE ACQUIRED: Select acquisition date

DESCRIPTION: Dataset description.

ATTRIBUTION / COPYRIGHT: Attribution or copyright statement.

ADDITIONAL METADATA: Additional freeform metadata. This will only be visible to members of your company.

4 Other files or datasets

ADD TO FOLDER: Home/Pointcloud Datasets/Output_subsampled_laz1_4/

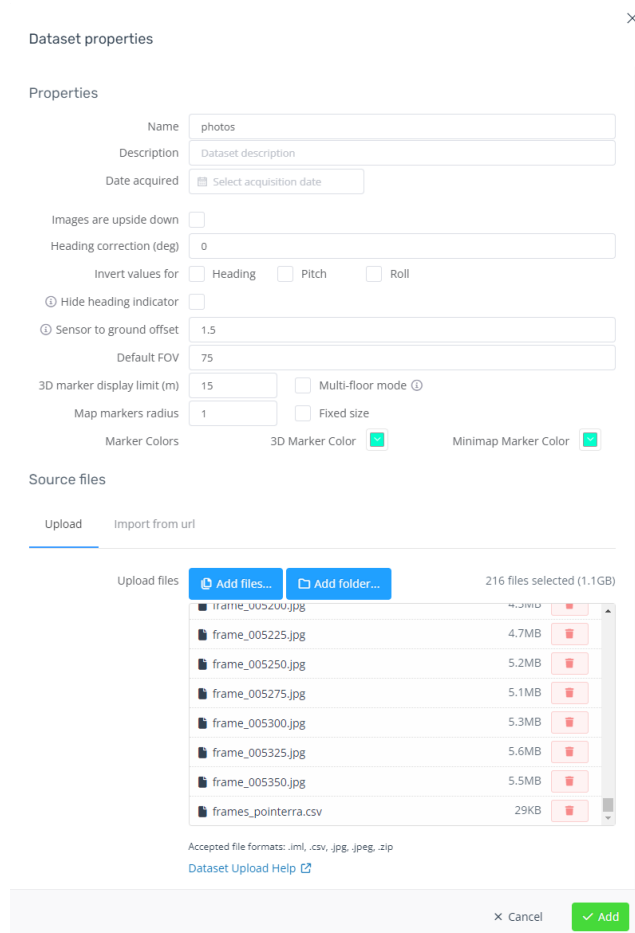
ATTACH DATASETS: [DOCUMENTS](#) [360 PHOTOS](#) [VECTOR DATA](#) [POLES AND WIRES ANALYTICS**](#) [MORE TYPES](#)

To add files that are just for download, attach them as a Documents dataset. Other dataset types are for spatial data that you wish to display in the viewer. More information is available at [Supported Spatial Dataset formats](#).



7. Enter a dataset name then under **Source Files**, click on the **Upload** tab.
8. Click **Add files** to attach the images and the **frames_pointerra.csv** file, which contains the spatial reference and file association.

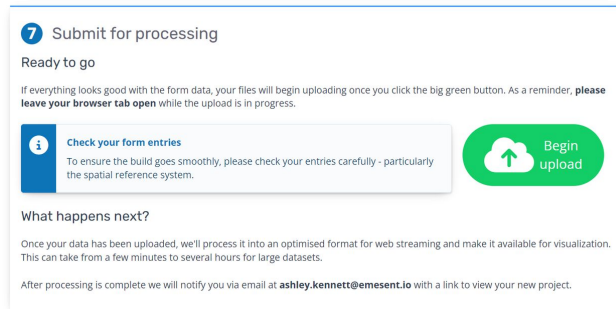
Note
It is recommended to manually select the files instead of adding a folder as there may be additional files in a folder that may confuse the system.



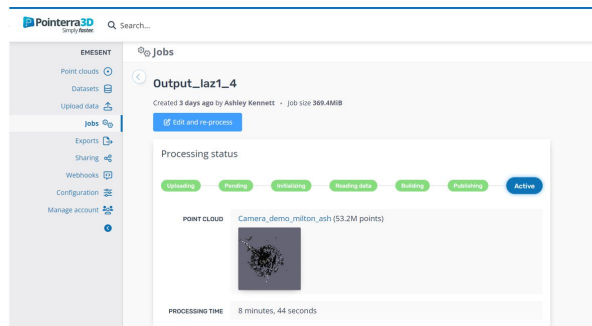
9. If your data is georeferenced, ensure the **Same as point cloud** option under **Source coordinate system** is selected.
10. Click **Add**.
11. Specify the destination of the point cloud and images in the Pointerra cloud folder structure.
12. Configure the email notifications (optional).



- 13. After completing the wizard, click the **Begin Upload** button.



- 14. Wait for the upload to be completed before closing the web browser.
- 15. You will be taken to a **Jobs** screen where you can track the progress of the processing job, when it is completed you receive a notification that it is available to view.



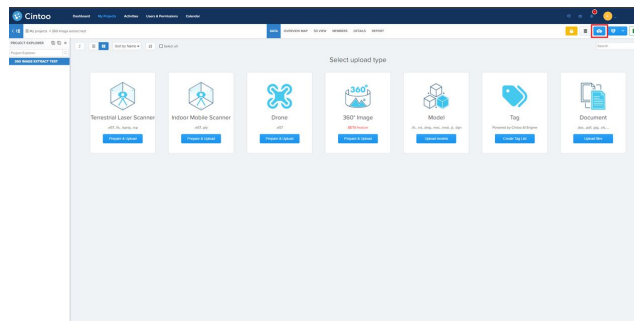


7.2 Cintoo Cloud

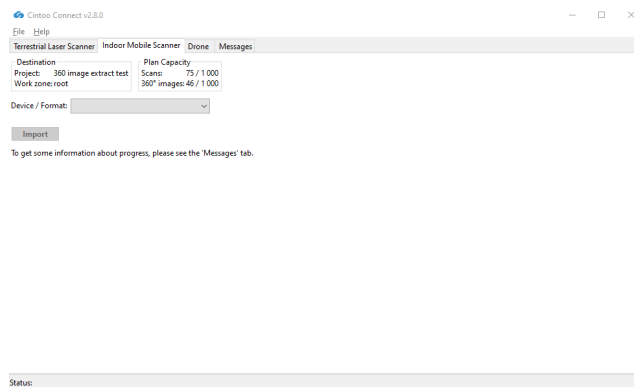
7.2.1 Import Scans

File format requirements	E57, traj (.xyz), .jpeg
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1. Click the cloud icon in the top right to install the application locally. Once installed (using admin privileges), upload the 360 images within the selected project. This will launch **Cintoo Connect**.



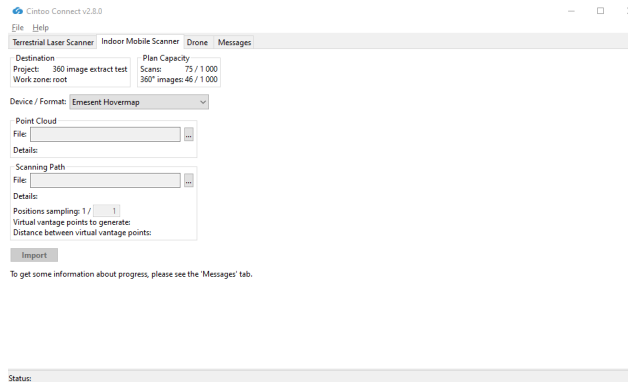
2. Click the **Indoor Mobile Scanner** tab.



3. Select **Emesent Hovermap** as the source **Device / Format**.



- Select the point cloud (E57) and the scanning path (.xyz) files generated from Emesent Aura.



- You may modify the **Positions sampling** value as required. For example, a value of **1/4** creates 1 scan location for every 4 panoramic images included in the scanning path. The number of 3D scans and the average distance between each one is indicated in Cintoo Connect and will be added to your scan count.
- Click **Import**.
- Check the **Messages** tab from time to time to see if the process is running smoothly.
- Your new 3D scans will appear in your Cintoo Cloud project.

7.2.2 Import 360 images

Importing the 360° images to Cintoo requires an additional step. The images are geolocated within the cloud and are presented as the same coordinate system that is available to the 360 scans.

Note

- The 360° images do not count as scans in your scan count.
- The maximum number of 360 images that you can upload to Cintoo Cloud is limited to the number of scans that you subscribed to. For example, if you have a subscription for 5,000 scans, you can upload up to 5,000 additional 360° images.
- 360° images are 2D only, so you cannot use them to add annotations (which are linked to a 3D point) or to make measurements. They are used for display only.



7.3 iTwin (Bentley)

- Download and install iTwin Capture Import and Upload Tool (available from Bentley)
- Download and add Emesent template for uploading the point cloud (available from Bentley)
- Download and add Generic Mobile Mapping template for uploading the 360 images (or Panoramas as Bentley calls them) https://kb.orbitgt.com/_media/237/desktop_ext/mapping/manage_import/mobile_mapping_generic.zip

7.3.1 Import Emesent Point Cloud

1. Click the **Resources** button then select **Create Mapping Resource**.

Create Mapping Resource

Type : Mobile

Directory : j office scan 12-Oct\Output\write_global

Name : Demo 30-Oct-23

Template : Emesent-Hovermap

Source CRS : 20047 CRS

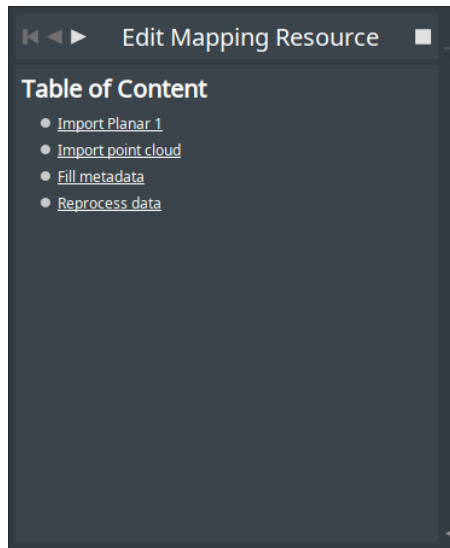
[Download additional templates](#)

Create

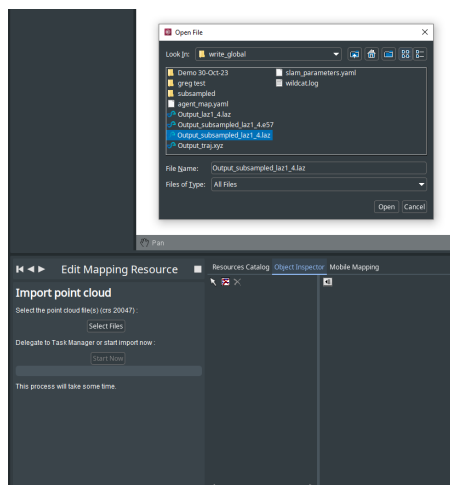
2. Specify the following settings:
 - Directory:** Choose the write global output for your point cloud
 - Name:** Enter a name for your resource
 - Template:** Select **Emesent-Hovermap**
 - CRS:** Select the appropriate CRS for your dataset
3. Click **Create**.



- In the Edit Mapping Resource panel, click **Import point cloud**.

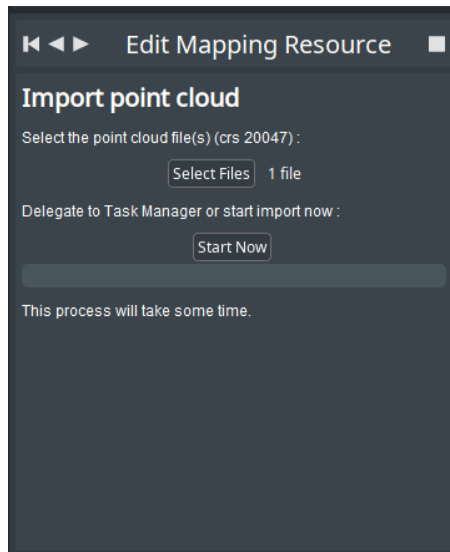


- Click **Select Files** then browse for the point cloud generated using Emesent Aura.

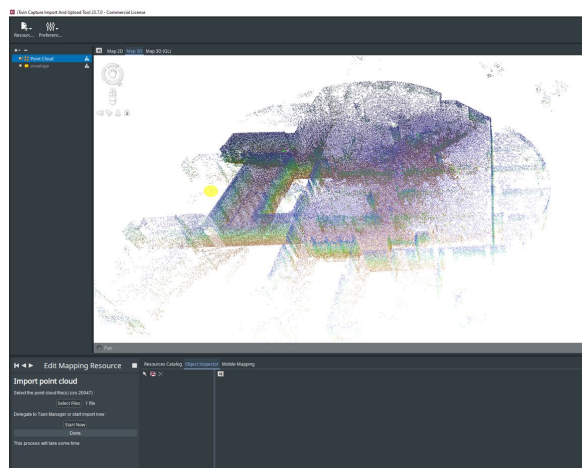




6. Click **Start Now**.



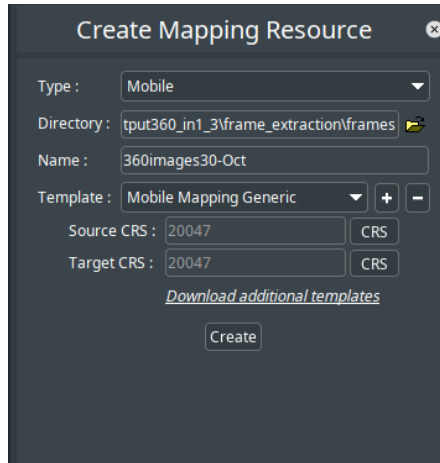
7. Wait for the dataset to load.



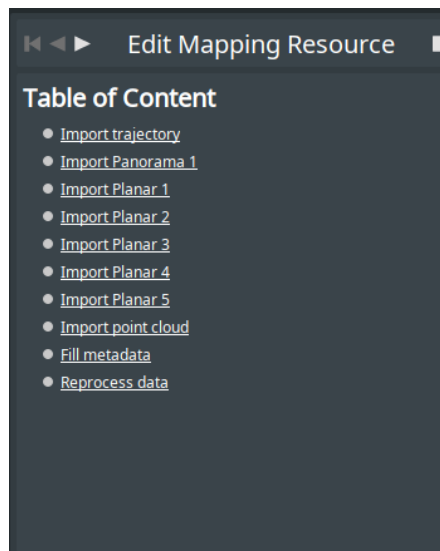


7.3.2 Import 360 images

1. Click the **Resources** button then select **Create Mapping Resource**.

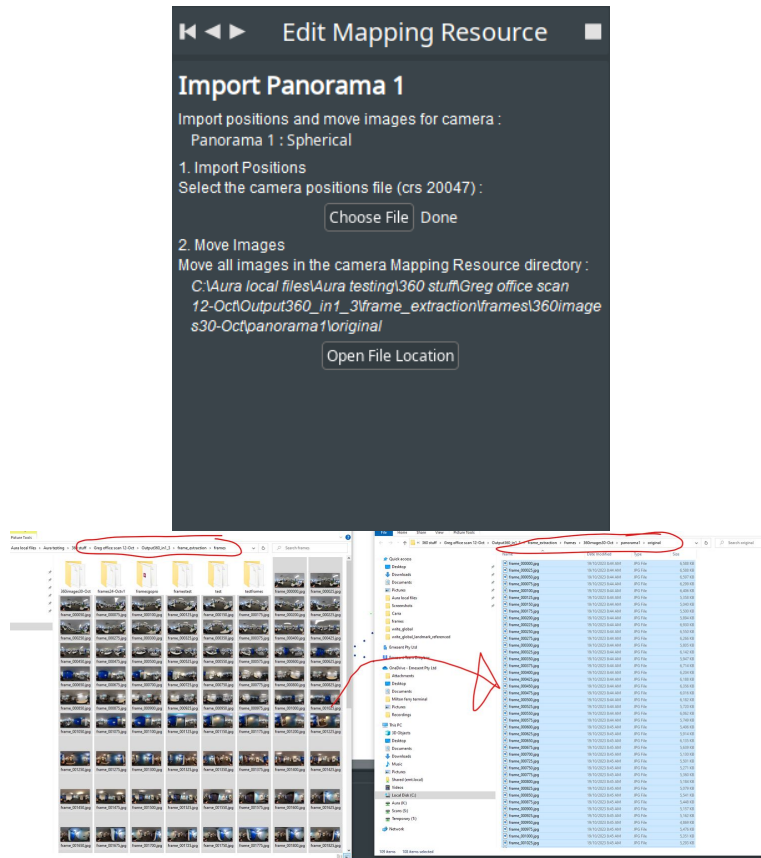


2. Specify the following settings:
 - Type:** Mobile
 - Directory:** Enter the frames directory from your 360 image output (that includes all the images)
 - Name:** Enter a name for your resource
 - Template:** Select **Mobile Mapping Generic**
 - Source / Target CRS:** Select the appropriate CRS for your dataset
3. Click **Create**.
4. In the Edit Mapping Resource panel, click **Import Panorama 1**.

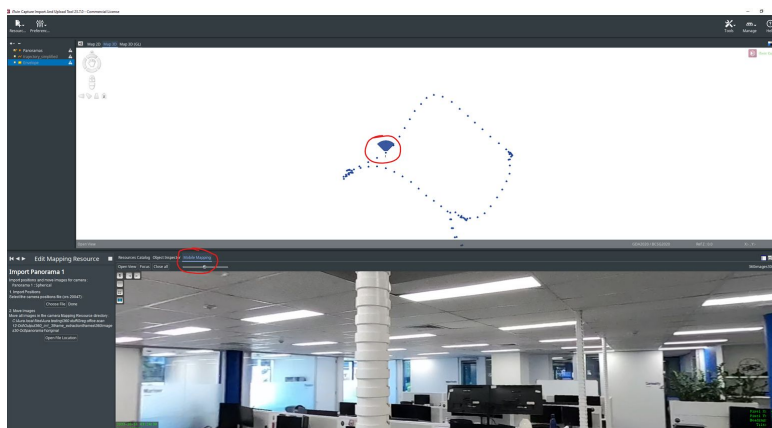




5. Click **Choose File** then browse for **frames_bentley.csv** file located in the **frame_extraction** folder generated during the image extract process in Emesent Aura.
6. Click **Open File Location** then copy all the images from the **frame_extraction** folder into this folder.



7. Click on the **Mobile Mapping** tab at the bottom window then click on one of the capture points to view the corresponding 360 images.





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