# emesent

# WORKING WITH COLORIZATION

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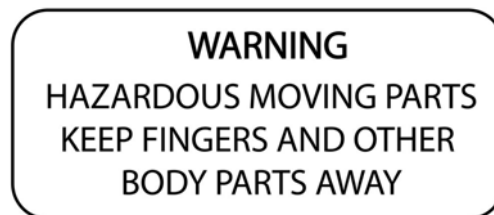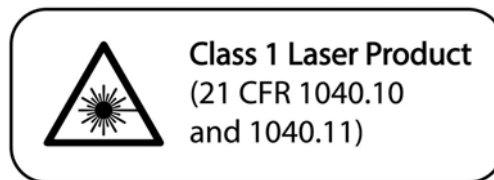
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The use of Remotely Piloted Aircraft Systems (RPAS) may result in serious injury, death, or property damage if operated without proper training and due care. Before using an RPAS, you must ensure that you are suitably qualified, have received all necessary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

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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.

# Contents

# 1.    Introduction

The colorization feature allows point clouds to be colorized by merging LiDAR scan data with video recorded by a calibrated GoPro camera mounted to Hovermap.

# 2.    Concepts

Hovermap colorization is delivered as a complete hardware and software solution.

- **Camera**: A GoPro is supplied with the colorization option, along with a memory card and USB cable for data transfer.

- **Camera mount**: A rigid mount is installed that allows the camera to be installed and removed in a repeatable fashion.

- **Calibration:** Factory calibration is performed on your Hovermap to ensure alignment between LiDAR data and video recording.

- **Software:** An updated version of Emesent Aura, which combines LiDAR and video data.

- **License:** Colorization is an optional extra that requires your USB key to be updated.

# 3.    Requirements

- Factory-installed and calibrated camera hardware

- Emesent Aura or Emesent Processing Software

- Updated license dongle for colorization

- Hovermap scan file

- GoPro video file

# 4.    Setting up the GoPro

Prior to using the colorization software, make sure the GoPro is up to date and video capture settings have been set in the required configuration.

## 4.1    Step 1: Pair the GoPro app

The GoPro app allows you to remotely start and stop recording. This can be useful in some situations where the camera and Hovermap must be started from a distance.

1.  Download the GoPro app from the App Store or Play Store.

2.  Open the GoPro app and press the **+** icon in the top right of the screen.

3.  Follow the instructions to **Add a Camera.** Use the menu screen on the GoPro.

4.  Swipe down and tap **Preferences**.

5.  Tap **Connections and Connect Device**.

6.  Tap **GoPro App** to put your camera in pairing mode.

7.  Press **Continue on the App**.

8.  You will get a pop-up that asks you to join the camera's Wi-Fi. Press **Join**.

9.  Change the GoPro name if required.

## 4.2    Step 2: Update the camera firmware

The colorization software requires version 1.6 or higher of GoPro firmware. Make sure the camera firmware is updated to the latest version. The GoPro App automatically notifies you of firmware upgrades. Follow the on-screen instructions as shown below to upgrade the camera firmware.

> ⓘ  **Note**
> Some other applications may cause the update process to fail due to bluetooth conflicts. Please close other applications whilst configuring the GoPro for the first time.

## 4.3    Step 3: Adjust the camera settings

### 4.3.1   Shooting mode

Before starting a colorization scan, ensure the GoPro is set up correctly. First, it needs to be set to record video. The current capture mode is shown on the top of the screen, as shown in the following image. If it is not set to video mode, press the **Power/Mode** button to cycle capture mode or swipe left/ right on the LCD.
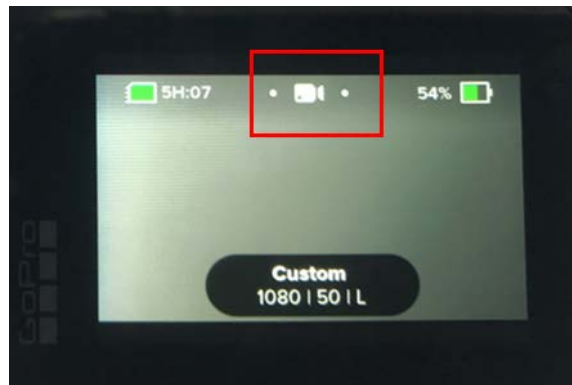


**Figure 1**      **GoPro settings: Shooting mode**

> ⓘ   **Important**
> The GoPro rear viewing screen is very sensitive to touch and can be easily and inadvertently touched to change the shooting mode. Ensure that when capturing data the camera is in the correct mode.

### 4.3.2   Anti-flicker

1.    Swipe down on the screen to reveal the **Settings Menu**.

2.    Press the **Preferences** button to enter the preferences menu.

3.    Select the **General menu**.

4.    Go to the **Anti-Flicker** menu.

> **ⓘ Note**
> Use 50Hz anti-flicker for the maximum quality and use 60Hz anti-flicker in the inevitable conditions. *Do not* use 60Hz anti-flicker for capturing colorization calibration datasets. Choose **50Hz**.

### 4.3.3   Orientation lock

1.   Return to the main screen and swipe down, then select the **Orientation lock** button.
2.   Select orientation mode **Up**.
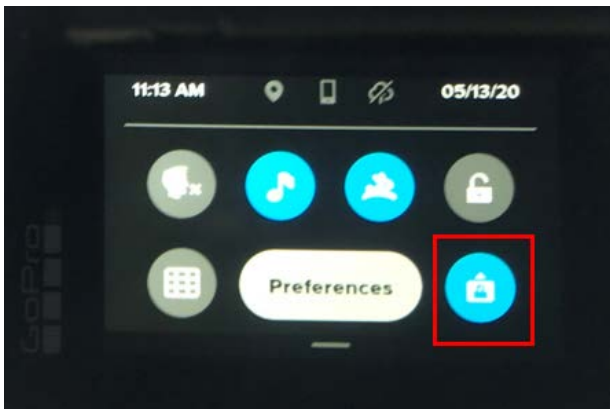


### 4.3.4   Video settings

1.   Return to the home screen and then select the **Video settings**.
2.   Scroll down to the bottom and select the ⊕ button to add a new video shooting profile.

> **ⓘ Important**
> Make sure that all shortcuts are turned off to avoid any unwanted changes in video settings.

### 4.3.5   Other video settings

Set the rest of the video settings as follows.

**Table 1     Other video settings**

| Field | Data |
|---|---|
| Video | • **RES \| FPS:** 1080 \| 50<br>• **Lens:** Linear<br>• **HyperSmooth:** Off<br>• **Low Light:** Off<br>• **Zoom:** 1.0x<br>• **Clips:** Off |
| Protune | • **Bit Rate:** High<br>• **Shutter:** Auto<br>• **EV Comp:** 0<br>• **White Balance:** Auto<br>• **ISO Min:** 100<br>• **ISO Max:** 1600<br>• **Sharpness:** High<br>• **Colour:** GoPro<br>• **RAW Audio:** Off<br>• **Mics:** Auto |
| On-Screen Shortcuts | • **Lower Left:** Off<br>• **Lower Right:** Off<br>• **Upper Left:** Off<br>• **Upper Right:** Off |

**Accept** all changes and **Save** settings into the **Custom** profile.

## 4.4    Step 4: Mount the camera



**Figure 2    Camera mounting**

Emesent or an authorized service agent will supply and install the GoPro mount for your Hovermap. The following instructions are provided in case you need to remove and reinstall the mounting system.

In order to provide the colorization capability the Hovermap and GoPro camera is factory calibrated to become a matched pair. If a different camera or mounting system is employed, the two must be recalibrated. Contact your reseller or Customer Success to have a recalibration done.

> ⊘ **Warning**
> Removal and reinstallation of the GoPro colorzation mount may cause calibration issues and should be avoided unless absolutely necessary. Recalibration may be required. We suggest conducting a test colorization scan after removal and reinstallation of the mount.

Mount the camera bracket to the Hovermap unit using the two supplied screws. The front end of the bracket should be facing toward the LiDAR puck.

Insert the GoPro into the mount such that the record button is facing away from the puck and ensure that it is sitting securely. It should not be able to move laterally when in the mount.

**Figure 3    Mounting to Hovermap**

> ⓘ **Note**
> The GoPro will be recording video upside down when Hovermap is mounted on an drone or handle. This is intentional.

## 4.5    Step 5: Start scanning

In order the capture good data for colorization, there is a number of things that must be considered.

1. Press **Record** on the GoPro and **Start** on Hovermap at the same time.
   **Note:** Start timing does not have to be exact unless doing calibration.
   **Note:** Start GoPro and Hovermap *at the same time* if you are capturing a calibration dataset.

2. Allow Hovermap to remain still for at least 10 seconds (about five slow green pulses).

3. Rotate Hovermap around the Z axis to the sides by approximately 60 degrees, as shown in the following image.

> ⓘ **Note**
> • Rotation must generate substantial angular acceleration. Avoid slow rotations. A proper rotation process takes around 10 seconds. Check the provided video QR link for an example.
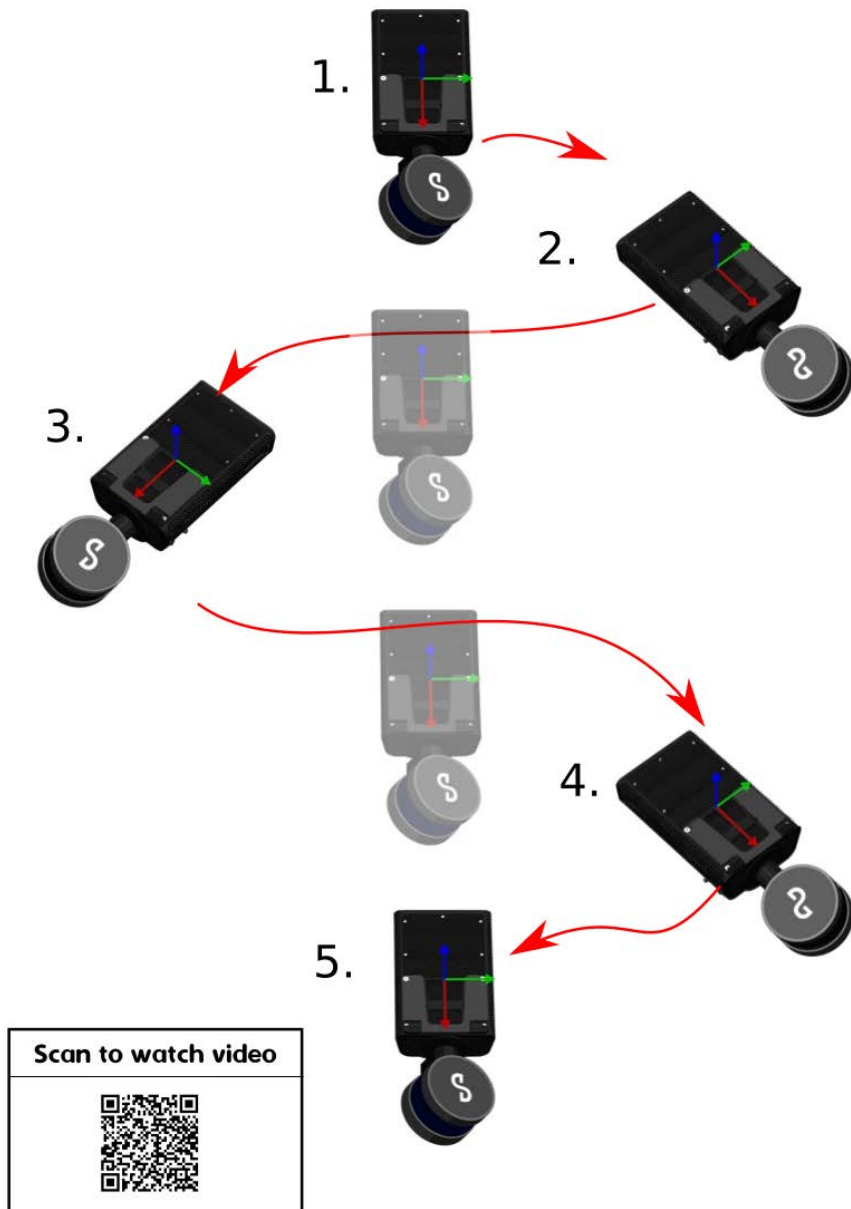
**Figure 4        Hovermap movements when starting a scan**

## 4.6    Step 6: Remotely start the camera (optional)

To remotely start the recording using the GoPro App:

1.    Open the **GoPro App** on your tablet or smartphone.

2.    **Connect** to your GoPro.

3.    Press the middle circle button to **Start** recording.

> ⓘ    **Note**
> Immediately start the Hovermap scan after starting the recording.

To remotely stop the recording:

1.    Re-open the **GoPro App**.

2.    Press the middle circle button to **Stop** recording.

> ⓘ    **Note**
> Immediately stop the Hovermap scan after stopping the recording.

> ⊘    **Scanning tips and techniques**
> There are a number of considerations that will improve the quality of the colorization.
> - Ensure that the GoPro lens is clean and free of dust and other material.
> - Only points that fall into the camera's field of view will be colored.
> - There should be as little vibrational movement in the scene as possible. The camera should be kept as steady as possible to avoid blurry video frames. Avoid sharp turns and jerky movements.
> - Spend time on subjects to be colorized. Additional time spent on a subject will result in improved colorization quality.
> - Each object in the scene should be viewed from as many angles as possible by the GoPro.

- Limit object movement in the scene being captured. For example, a person walking through the frame.

- To help keep your scans and videos in sync, hold your phone in front of the camera after starting the scan and the recording to capture the name of the current scan in the Hovermap web UI.

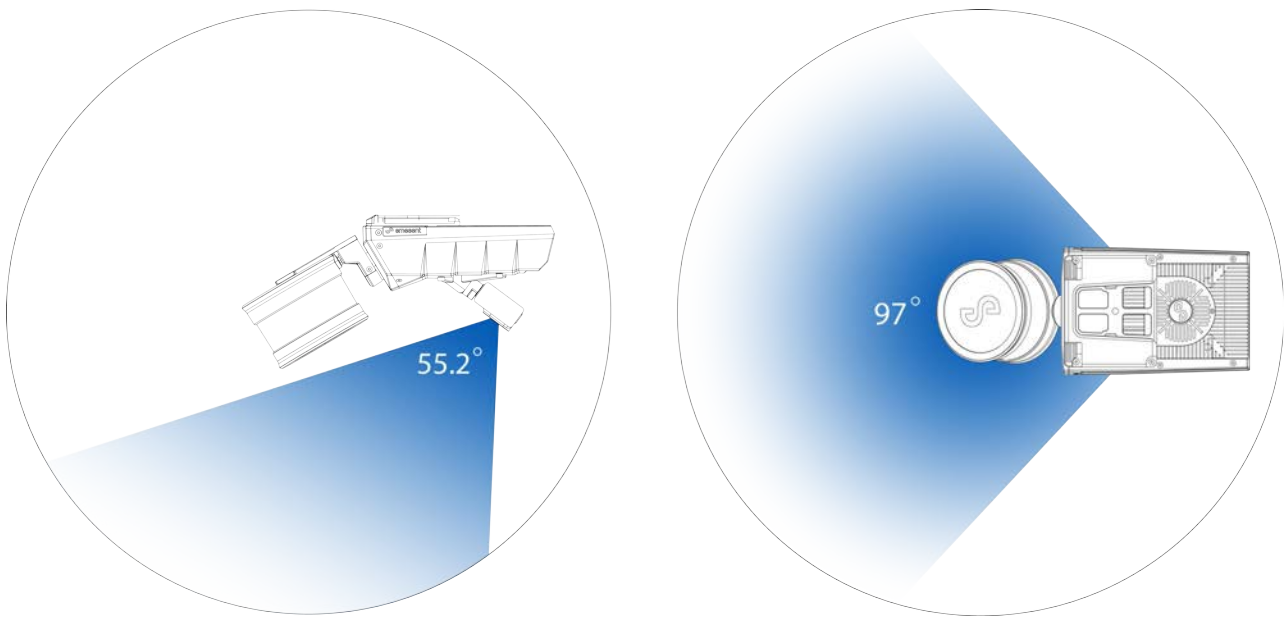- To extend the life of the GoPro battery, minimize the use of the view finder.



**Figure 5      GoPro field of view**

## 4.7    Step 7: Stop your scan

Press **Record** on the GoPro and **Stop** on Hovermap at the same time.

> ⓘ   **Note**
> The timing does not need to be exact.

1.  While the Hovermap dataset is processing to generate the point cloud, begin gathering the corresponding video from the GoPro memory card.

    a.  Insert the supplied USB-C to USB data cable into the GoPro and your computer.

    b.  Navigate to your GoPro. Video files are located in **GoProMTP Client Disk Volume\DCIM\100GOPRO**.

    c.  Copy the video file that corresponds to the scan into the Hovermap scan folder.
        **Note:** Files can also be transferred by removing the memory card from, and inserting into, a Micro SD card reader connected to your computer.
        **Note:** For longer scans, the GoPro may split the recording into multiple video files. Ensure all relevant files are copied to the scan folder.
        **Warning:** If the GoPro has split the video captured into multiple files, ensure that the file sequence (by filename) is not lost if renaming the video files.

2.  Wait for all video files to be transferred and for the initial point cloud processing to complete.

## 4.8    Step 8: Process your Hovermap dataset

Go to the *Colorization* section in the Emesent Aura user manual for more information on how to process your colorized dataset.

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