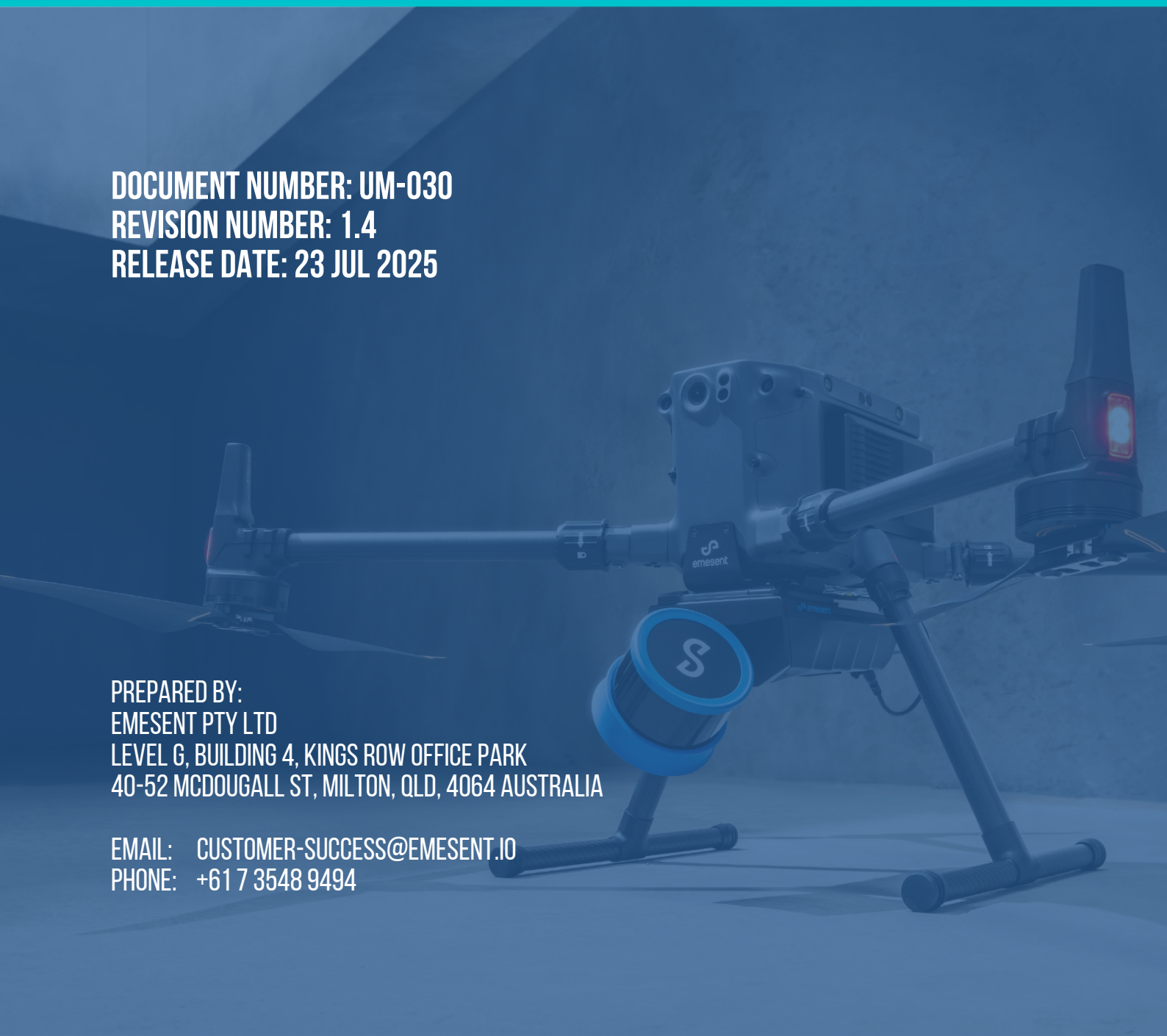
emesent

EMESENT COMMANDER USER MANUAL



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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 and other platforms. We therefore recommended that you 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

- This document is legally privileged, confidential under applicable law and is intended only for the use of the individual or entity to whom it is addressed. If you have received this transmission in error, you are hereby notified that any use, dissemination, distribution or reproduction is strictly prohibited. If you are not the intended recipient, please notify the sender and delete the message from your system.

- Do not attempt to disassemble, repair, tamper with, or modify the this product. This product contains no user-serviceable parts inside. Any disassembly of the product enclosure will invalidate the IP65 rating and disrupt the factory calibration of LiDAR. Contact Emesent for any repairs or modifications.

- 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. Getting Started with Emesent Commander

Emesent Commander is a cutting-edge application for mission planning and execution that is designed to interact seamlessly with your Hovermap. Whether you are an experienced user or new to the field, Commander simplifies mapping, pilot assistance, and autonomous mission planning and control. With its user-friendly workflow prompts and built-in failsafes, Emesent Commander offers unmatched ease of navigation and live point cloud visualization through its intuitive touchscreen interface, allowing you to perform your mission with confidence.

1.1 Available Versions

Emesent Commander is offered in two versions, each providing the same robust support for Hovermap, ensuring a seamless and highly compatible performance across multiple platforms.

Platform	Commander App
Freefly Astro	Commander
Freefly Astro Max	Commander
DJI M350	Commander
DJI M300 DJI Firmware v5 and above	Commander
DJI M300 DJI Firmware v4 and below	Commander 210
DJI M210	Commander 210

To help identify the application version, the main title bar will display "Emesent Commander (210)" if the app supports DJI M210 drones or uses DJI SDK v4.

If you are using a DJI M300 with DJI firmware v4 and below, or a DJI M210, **DO NOT** update past **Commander 1.5.2** and **Cortex 3.3.3** this is the latest supported version for DJI firmware v4.

1.2 Supported Devices

Emesent Commander can be installed on and supported by the following Android devices that meet the minimum and recommended specifications required to run the application.

Device	Minimum Version
Freefly Pilot Pro Controller	Android 13
DJI RC Plus Remote Controller	Android 10
Samsung Galaxy Tab S9 5G (recommended tablet specifications)	Android 13
Samsung Galaxy Tab Active3	Android 13
Samsung Galaxy Tab Active4 Pro 5G (minimum tablet specifications)	Android 13
Samsung Galaxy Tab Active5	Android 14
Samsung Galaxy S23 (minimum smartphone specifications)	Android 13

You can install and operate the Commander application on an Android smartphone or tablet with similar or higher capabilities. However, it is advised to use the device with the recommended specifications listed above as it has been thoroughly tested for installing and operating the app to ensure you have smooth and reliable experience.

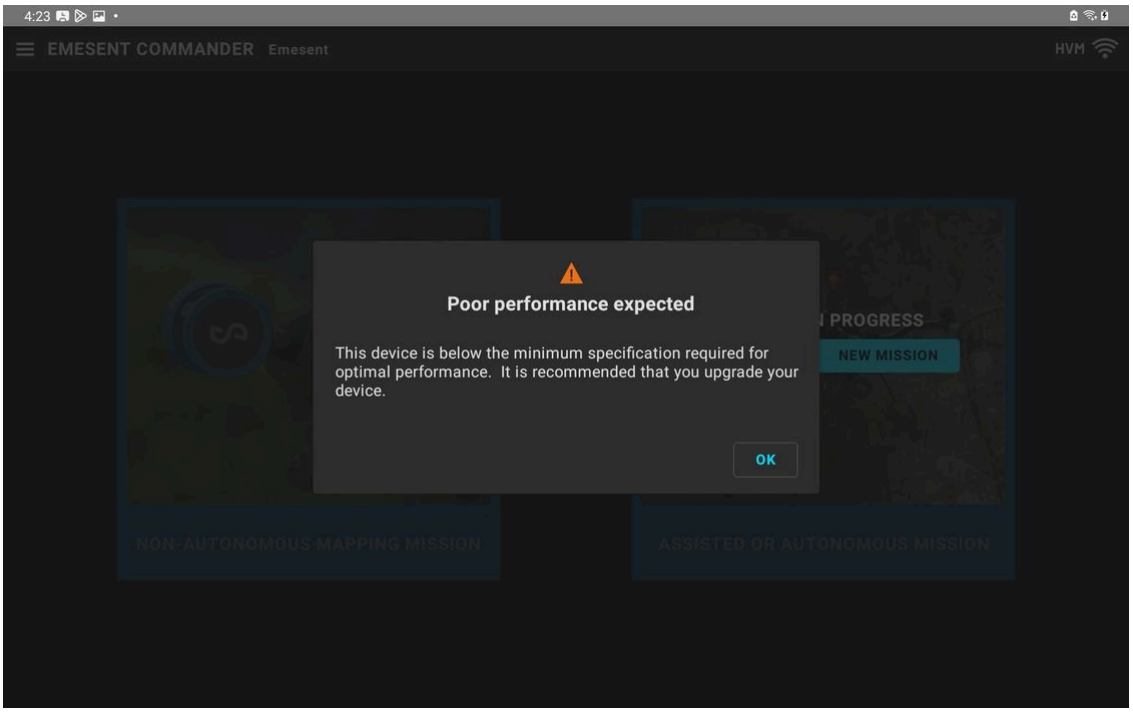
1.3 Installing the application

Refer to the *Emesent Commander App Installation guide* for instructions.

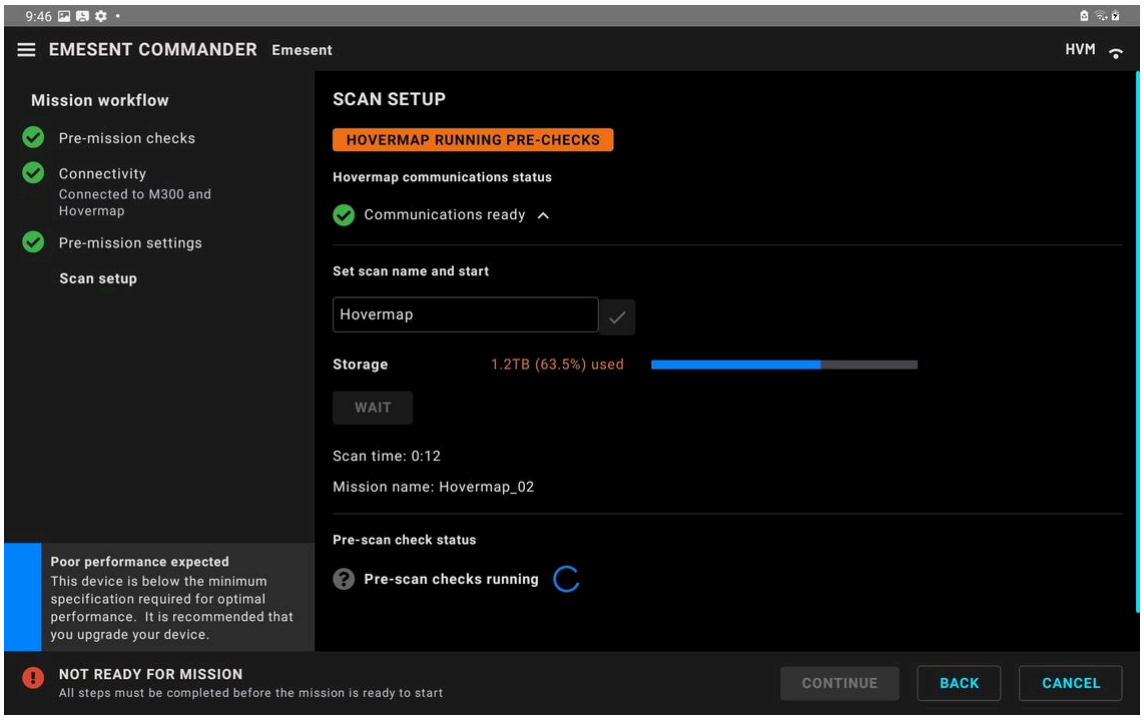
1.4 Device Benchmarking

If the Commander app is installed or updated on a Samsung Galaxy Tab Active Pro tablet that's below the minimum specification required for optimal performance, it has several ways to notify you.

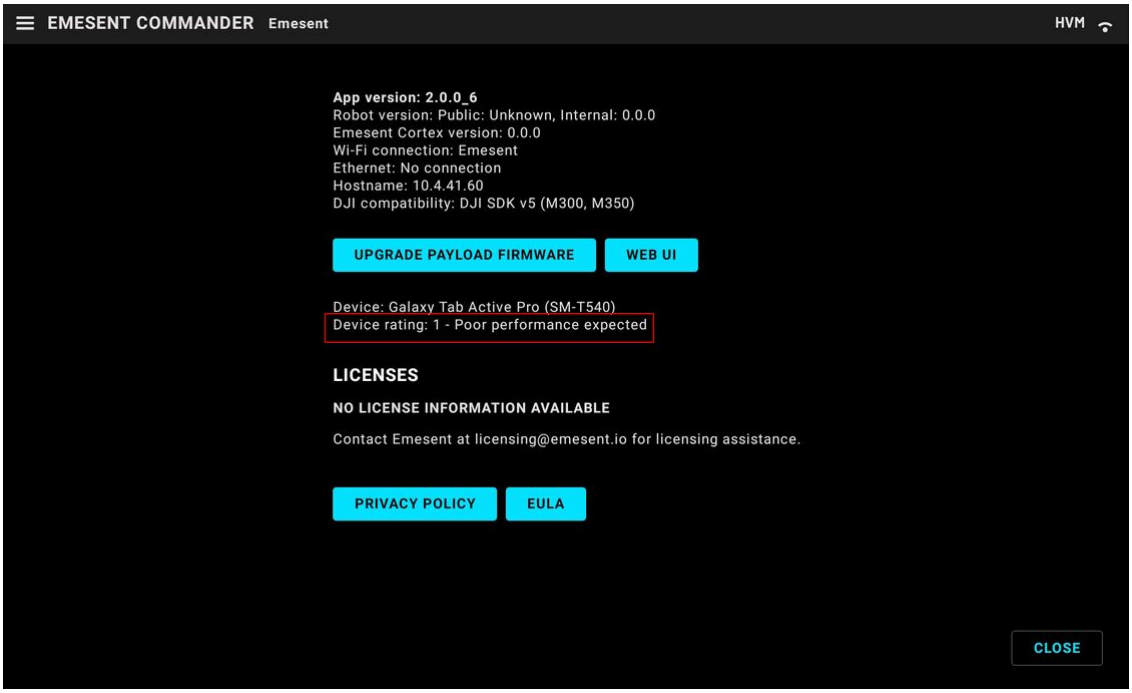
When Commander first opens, a message will display to indicate that poor performance is expected on the device. The message will not appear again on the same installation.



If you begin a Hovermap scan with Commander installed on a Samsung Galaxy Tab Active Pro tablet that's below the minimum specification, the notification that poor performance is expected will display on the sidebar.



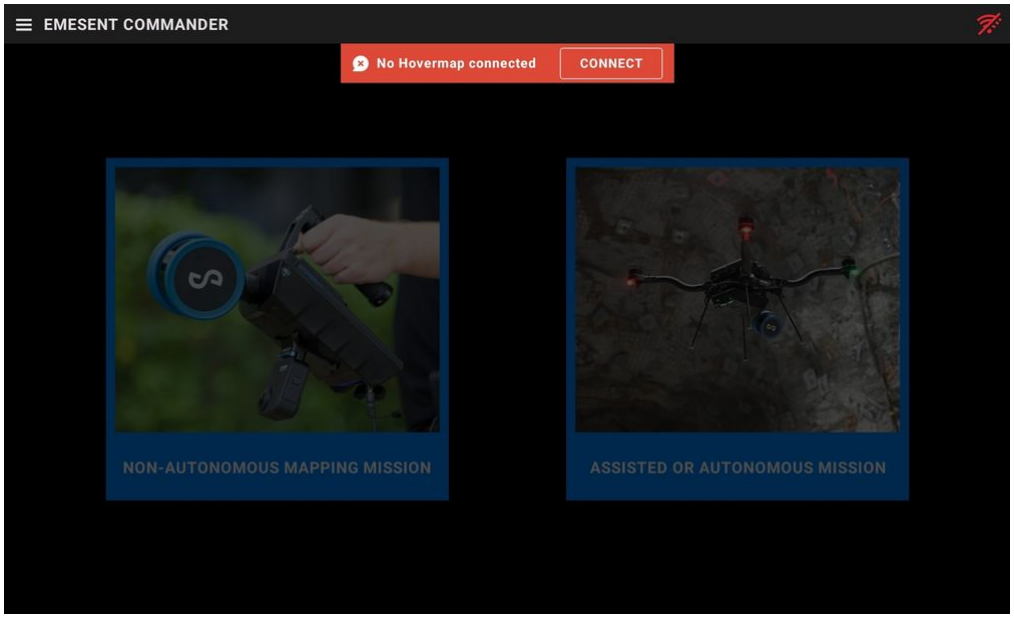
In the About section of the Option menu, you will also see the message about the Samsung Galaxy Tab Active Pro tablet : 'Device rating: 1 - poor performance expected'.



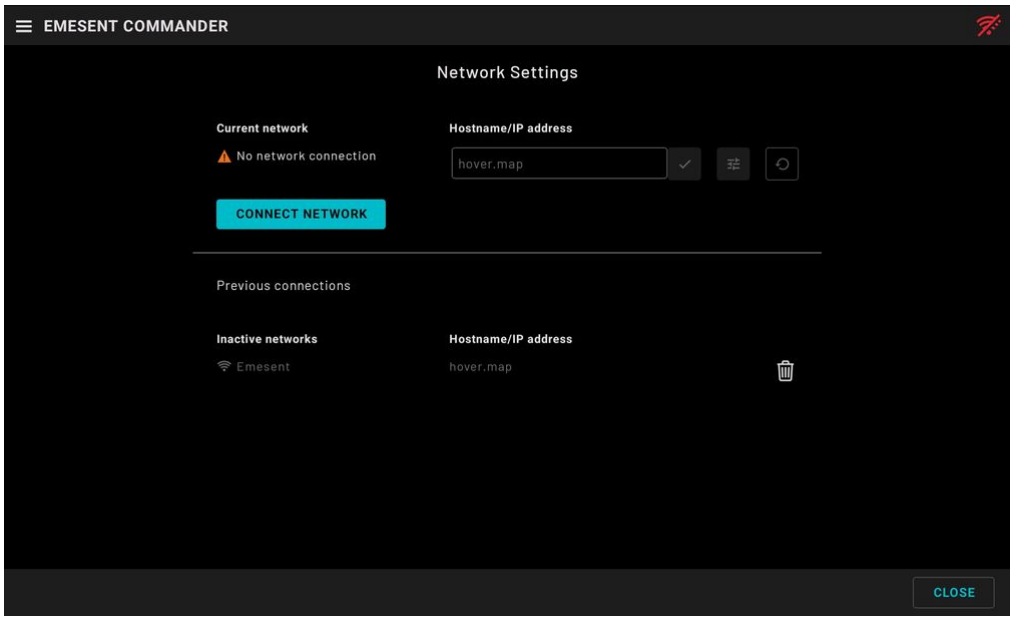
If you have Commander in 3D View and poor performance on a Samsung Galaxy Tab Active Pro tablet is expected, a small turtle icon will appear on the bottom right of the screen.

1.5 Connecting to Hovermap

1. Power on the Hovermap by connecting it to a battery or power source, then pressing the power button.
2. Wait until the status LEDs turn from blinking red to a blue pulsing light. This indicates that the Hovermap is ready to scan.
3. Launch Emesent Commander then tap **Connect** to display the **Network Settings** page.



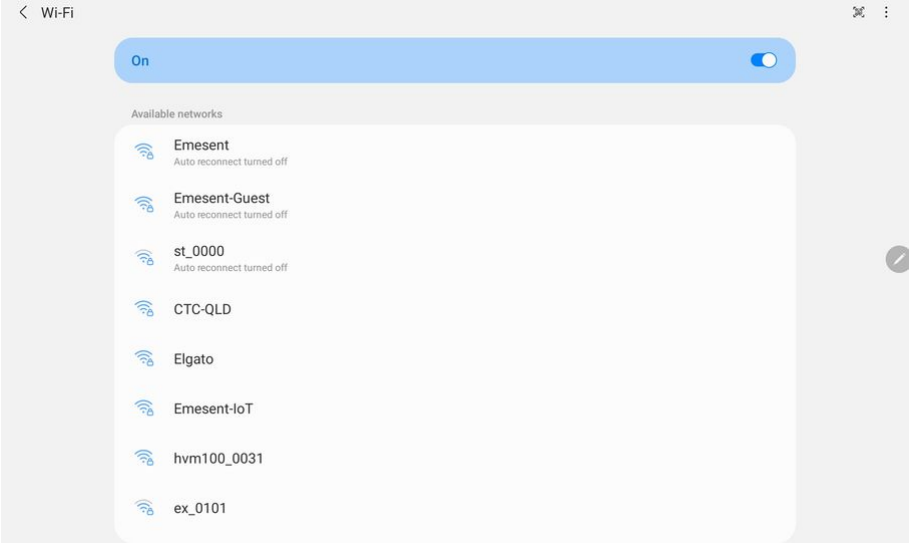
Your current connection status as well as previous and inactive connections are displayed.



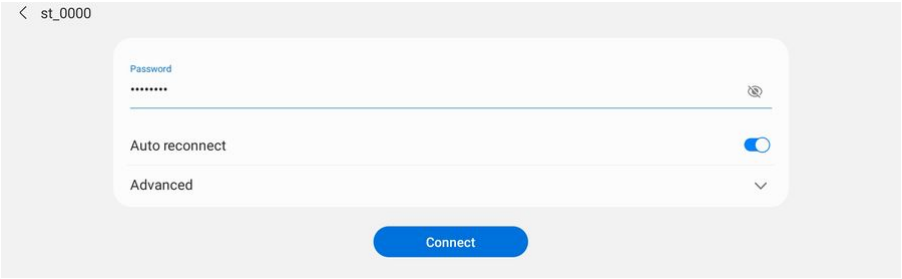
4. Tap **Connect Network** or **Change Network** depending on whether or not there is an existing connection. This takes you to your device's native network manager. You can also specify the **Hostname** assigned to the Hovermap to connect to or enter its **IP address**.

> A custom IP address is only required when using an Emesent LHD, Freefly Astro, or Astro Max. For most users, it is recommended to retain the default hostname: `hover.map`.

5. Look for **ST_xxxx**, **HVM_xxxx**, or **LRR_xxxx** (where **xxxx** = Hovermap device to connect to) in the list of networks.

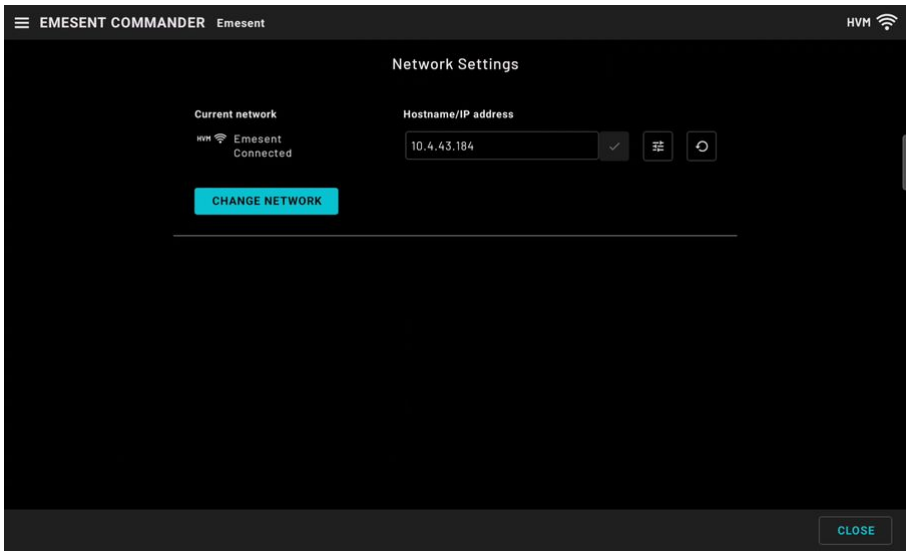


6. Select the desired network. Enter the Wi-Fi password (**hovermap**) then click **Connect**. If prompted to keep the connection or disconnect, select **Keep WiFi connection**.

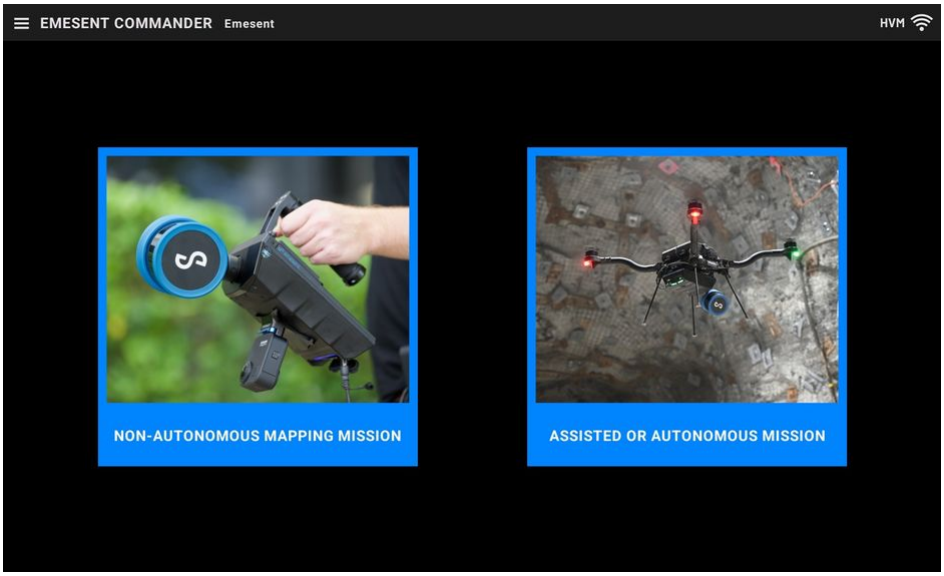


Make sure that the **Auto reconnect** option is enabled for the Hovermap network you are connecting to. This allows your device to automatically re-establish a connection to your Hovermap network if it gets disconnected and re-enters its coverage area.
However, keep in mind that your Android device typically maintains its connection to the current network until it either loses signal or you manually switch to a different network. Therefore, it is advisable to **disable the Auto reconnect option for other networks** that may be available within range during your flights. This prevents your Android device from automatically reconnecting to non-Hovermap Wi-Fi networks. If such a connection occurs, you will need to manually reselect the desired Hovermap network when it becomes available again.

7. Once the connection is established, the connected network is shown on the page and you will hear an audio message indicating you are “connected”.



8. Click **Close** to navigate back to the main landing page.



To connect to another Hovermap, tap the **Hamburger** button on the top left of the screen to access the **Options Menu**. Tap **Network settings** then repeat steps 4 to 6.

1.6 Connecting to Hovermap via the Freefly PilotPro controller

Emesent Commander communicates directly with the Hovermap ST-X via the Freefly PilotPro controller. Connection to the Hovermap's Wi-Fi network is not required.

1. Hold the power button on the Pilot Pro tablet for 4 seconds. This will power on both the tablet and the controller. Press again when prompted on the controller to complete powering on.
2. Turn off the Wi-Fi on the Pilot Pro tablet.

> ⚠ Emesent Commander communicates directly with the Hovermap ST-X via the Freefly PilotPro controller. Connection to the Hovermap's Wi-Fi network is not required. The Wi-Fi on the Pilot Pro tablet **MUST BE DISABLED**.

3. Power on your Hovermap.

> ℹ As stated in the next step, perform this step before launching the Emesent Commander app.

4. Launch Emesent Commander then tap **Connect** to display the **Network Settings** page.

> ℹ If the app has been opened before powering on your Hovermap, you need to restart the app.

5. Set **Hostname** to **192.168.144.101** then tap the tick button to connect.
6. Once the connection is established, you will hear an audio message indicating that you are "Connected" and the mission tiles are enabled.

2. Emesent Commander User Interface

The Emesent Commander user interface has three main sections:

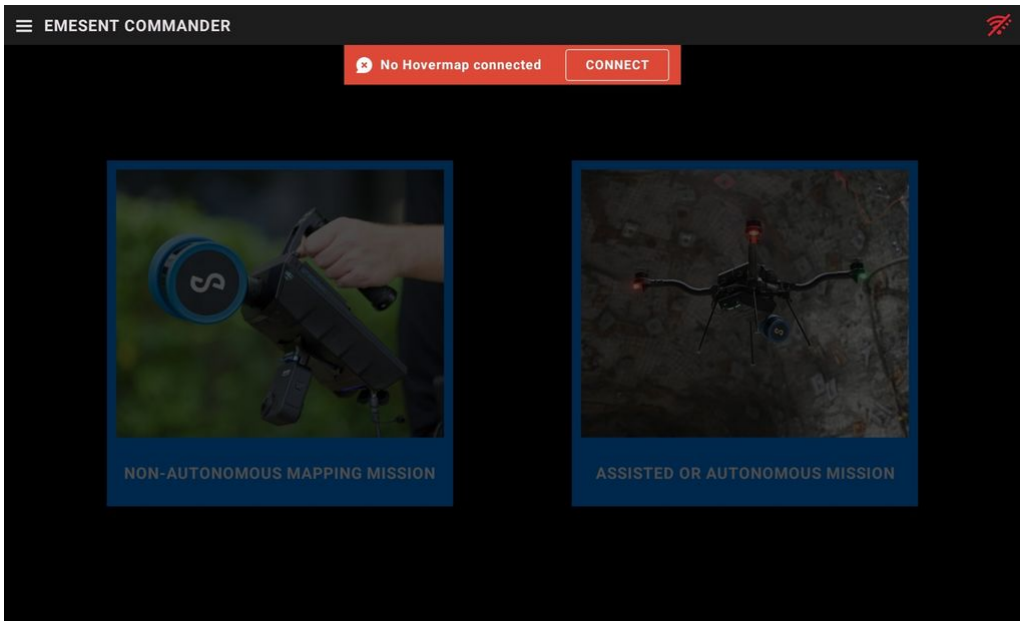
- Landing Page
- Mission Workflow
- Main View

For instructions on how to set up a scan, refer to the Emesent Commander Operations section of this manual.

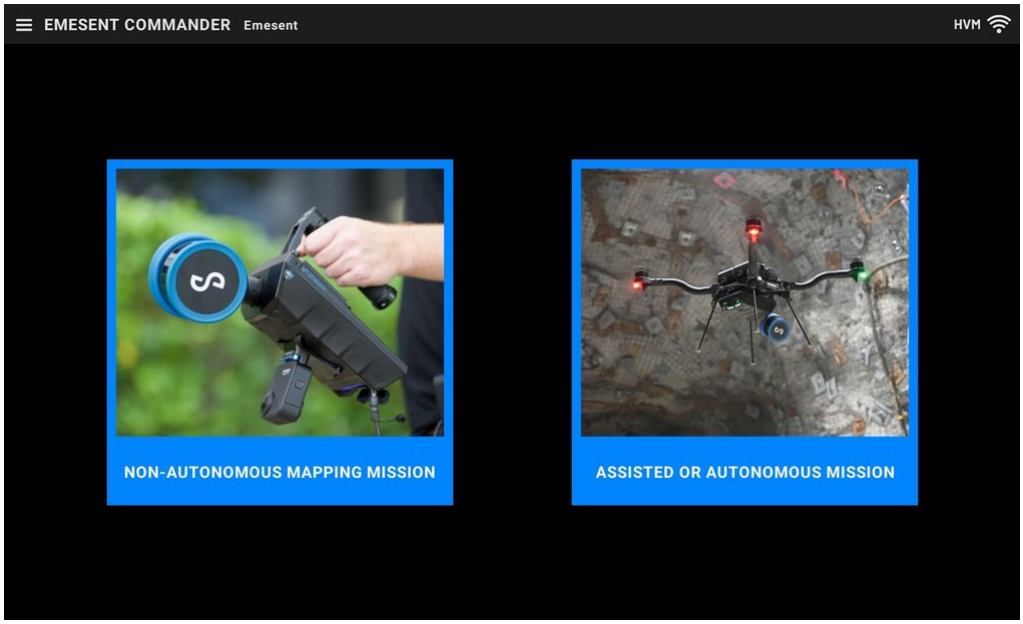
2.1 Landing Page

The Landing Page displays when the Emesent Commander application is first loaded. A connection with Hovermap must be established before license information can be detected and the mission tiles enabled.

For more information, refer to the Getting Started with Emesent Commander section of this manual.



Once connected, the network name is displayed on the application's title bar, and the mission tiles are enabled. In addition, expired licenses or grace periods (if any), are shown at the bottom of the screen. If all licenses are active, no licensing information is displayed.



2.2 Mission Workflow

When you tap on a mission tile, you are directed to its **Mission workflow**. This guides you through the prerequisites of the mission. The workflow steps vary (including the required pre-mission checks) depending on the selected mission mode.

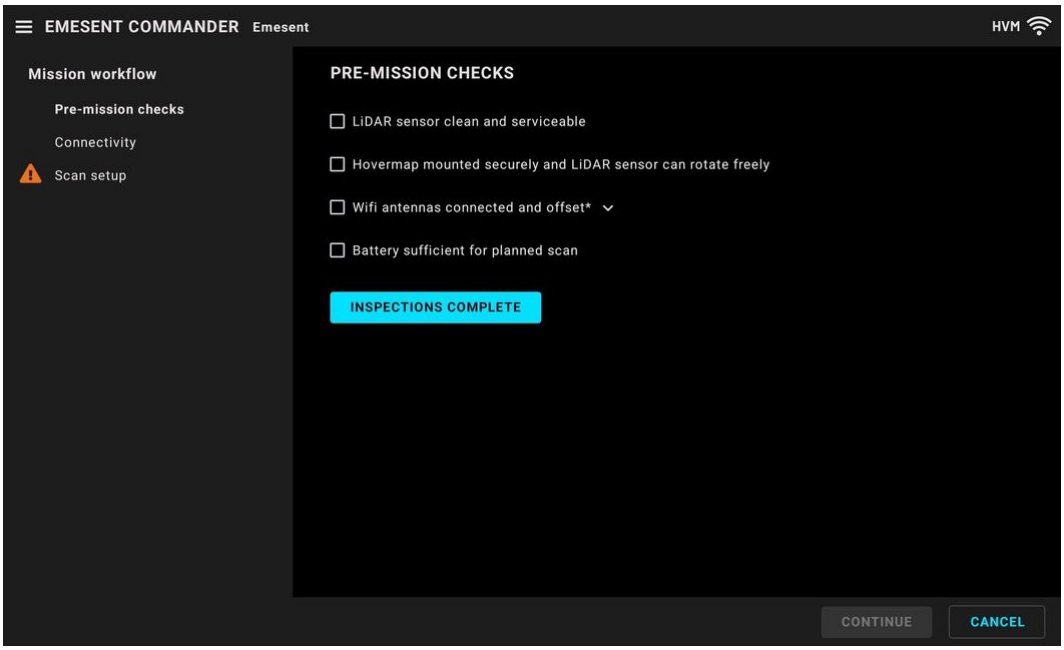


Figure 1 Mission Workflow - Mapping mode

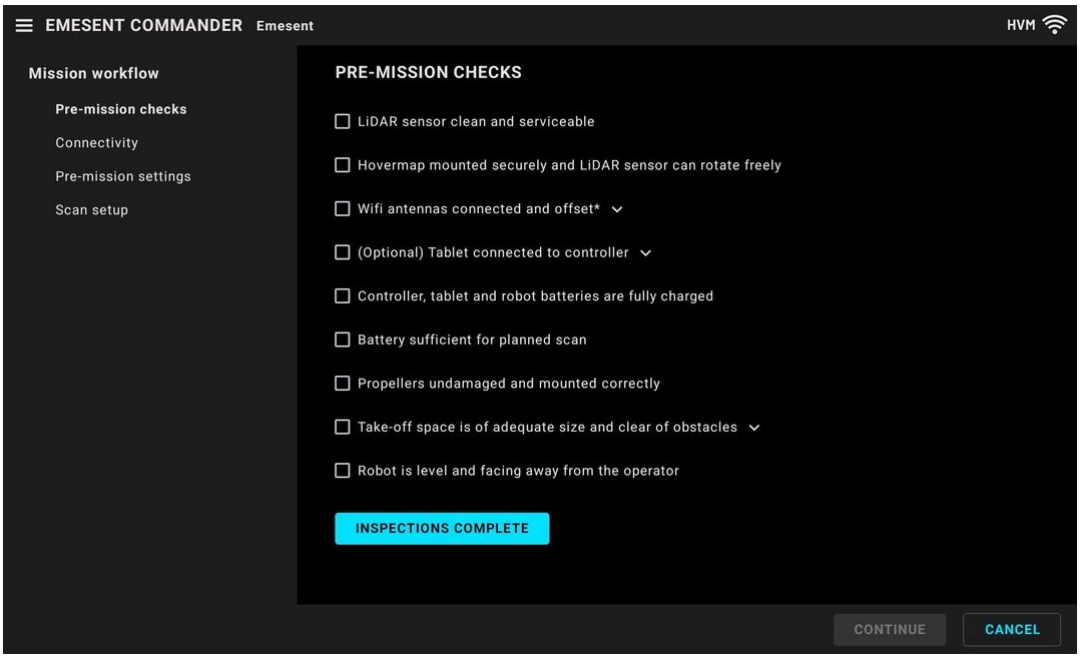


Figure 2 Mission Workflow - Pilot Assist / Autonomous mode

2.3 Main View

The Main View provides an interface to view the 3D environment in real time while the system is in operation. It contains features to help you complete your mission such as checking device status, viewing notifications, changing shield settings, adding/editing waypoints, accessing mission buttons, switching camera views, changing display settings, and stopping/starting a scan.

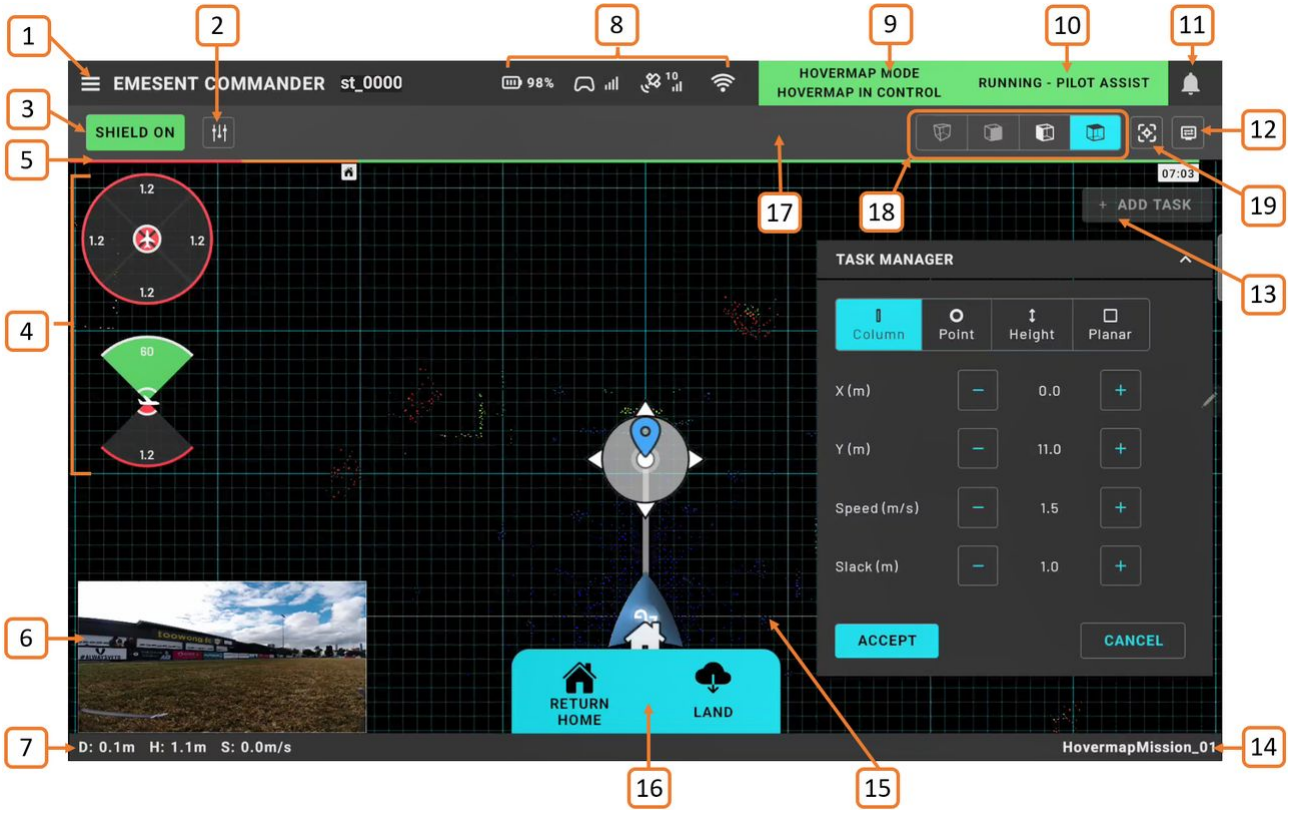
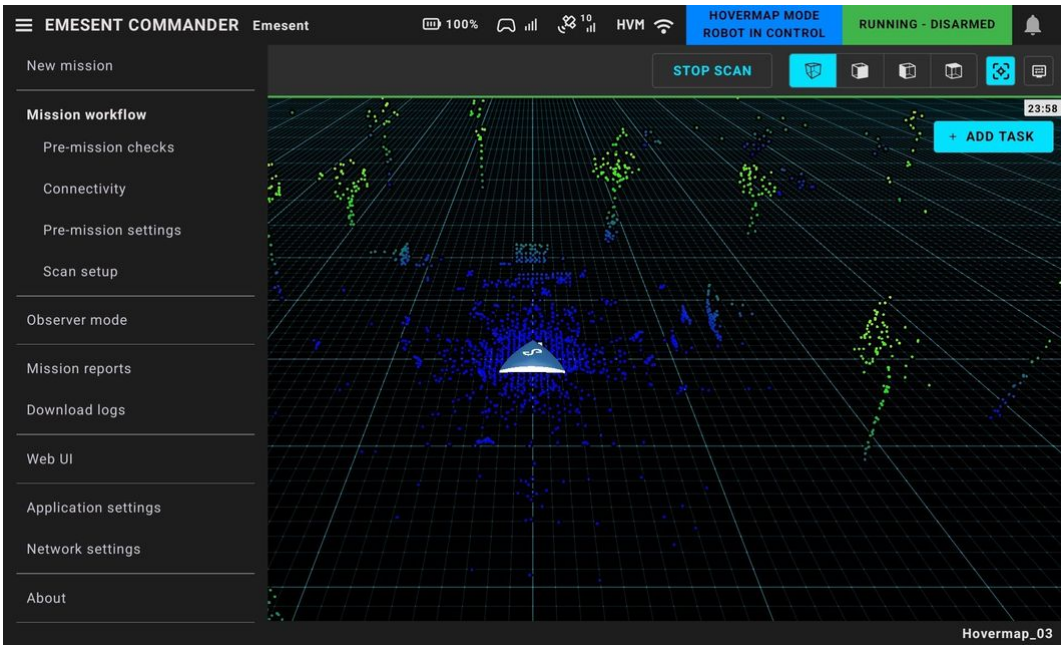


Figure 3 Commander User Interface

1. **Options Menu** button
2. **Mission Settings** button
3. **Shield Settings** button
4. Shield Indicator
5. Battery Indicator
6. FPV Camera
7. Telemetry
8. System Indicators
9. RC Switch Status
10. Mission Status
11. **Notification** button
12. **Display Settings** button
13. **Add Task** button
14. Mission Name
15. 3D View
16. **Mission** action buttons
17. **Start Scan / Stop Scan** buttons (NOT SHOWN)
18. **Camera Control** buttons
19. **Follow Robot** button

2.3.1 Options Menu

Tap the **Hamburger** button on the top left of the screen to access the Options Menu. These options provide a way back to the Landing page, switch between the various Mission workflow steps, access the Web UI, download logs, configure application settings, upgrade the firmware, and view licensing information. The menu can be accessed from the Landing Page, Mission Workflow, and the Main View.



Option	Description
New mission	Takes you back to the Landing Page where you can start a new mission or resume the existing one.
Mission workflow	Allows you to switch between the Mission workflow steps.

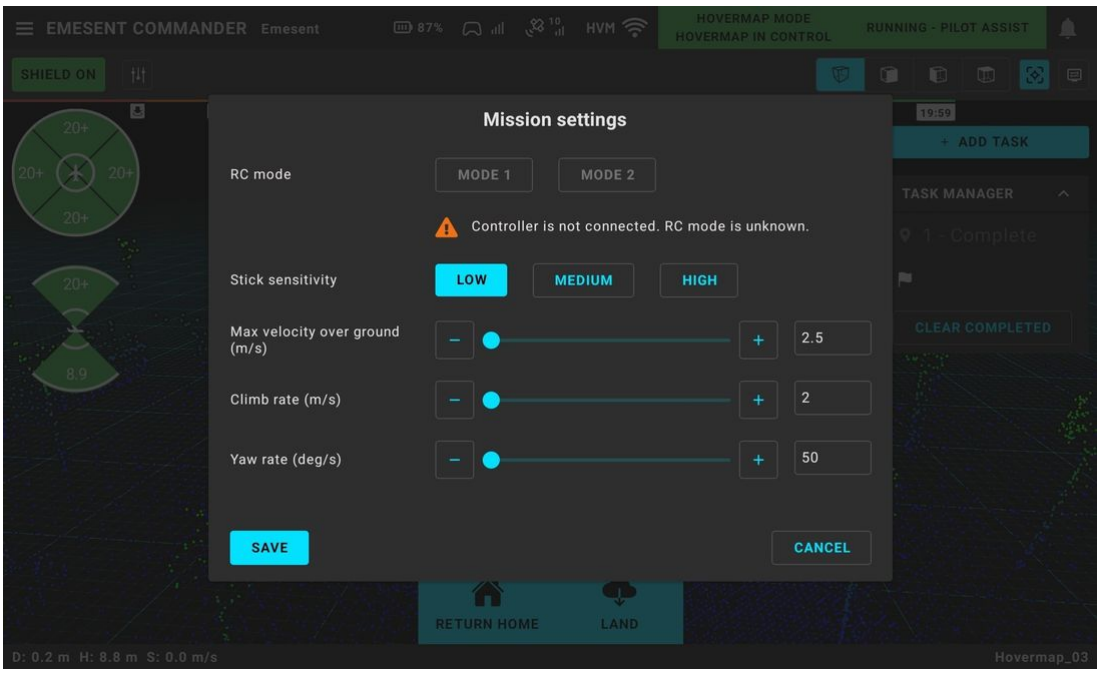
Option	Description
Observer mode	Enables real-time viewing of the ongoing mission on multiple devices simultaneously, ensuring that stakeholders, supervisors, or team members can monitor the progress from different locations or using other devices. While observers can view the mission progress, control over mission settings and robot operation are disabled to ensure that those monitoring cannot inadvertently interfere with the ongoing operation. Observer Mode on the Freefly Pilot Pro is available via ethernet connection only. Connect another tablet to the ethernet port on the Freefly Pilot Pro to use this mode. This will require an ethernet cable and a USB-C to ethernet adapter.
Mission reports	Contains a complete list of all available scans for download, including the scan currently in progress (if any). It provides details about the chosen scan and features a graph displaying the scan height and time. Additionally, it includes specific event logs for each scan. Refer to the Mission Review and Reports section for more information.
Download logs	Allows you to download logs from Commander to your device. You can download all logs or only those generated in the last 24 hours. Refer to the Download Commander Log Files section for instructions.
Web UI	Allows you to access the Web UI from the app. Connection to the Hovermap is required. Refer to the Hovermap Web UI section for more information.

Option	Description
Application settings	**Enable light mode:** Changes the color profile of the app to use lighter colors for backgrounds, text, and other interface elements. This helps you see the display better in well-lit environments. **Language:** Allows you to set the language in which the Emesent Commander interface and content are presented. **Measurement units:** Allows you to set the measurement units to use in the application. ℹ When using the **Imperial** system, **feet** will be represented by a whole number and **inches** by a decimal, separated by a comma. **Overlay:** Allows you to set the information presented in the Overlay view, at the bottom left of the screen. Refer to the section Using the Map Widget (DJI only) and Overlay View for more information. **Allow registration with DJI to use DJI drones**: Select to allow automatic detection of DJI drones when connected to the Hovermap device. This enables the configuration of remote controls, geofence information, and flight control settings required for autonomous control of DJI drones. A connection to the internet is required. This option is not required if you are not using a DJI drone. **Override default DJI controller frequencies:** If you unselect this option, the DJI controller settings will allow auto switching between 2.4GHz and 5GHz, which may cause the connection between Commander and Hovermap to be unstable or lost.
Network settings	Allows you to manage and configure network connections. The list of available or inactive networks displays any previous connections based on the availability of the Wi-Fi network. Refer to the Getting Started with Emesent Commander section for instructions on how to connect to Hovermap.

Option	Description
About	Allows you to view the information about the app, connected robot, the Emesent Cortex version, and the DJI SDK version (which determines the supported robot). In addition, you can also upgrade Emesent Cortex, access the Web UI, and view licensing information from this page.

2.3.2 Mission Settings

These settings allow you to configure flight characteristics when performing a mission in Pilot Assist mode.



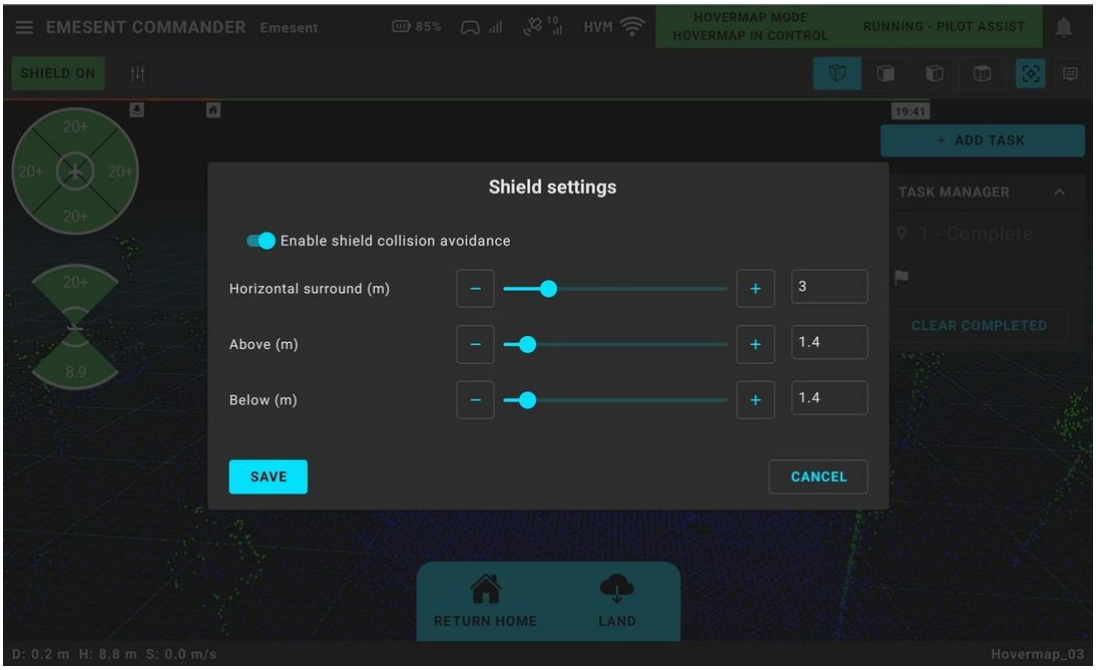
Setting	Description
RC mode (DJI only)	Sets the remote control mapping mode to determine which hand is used for maneuvering the drone's roll (left or right banking) and pitch (forward or backward movement), as well as controlling the yaw (direction or orientation changes) and throttle (vertical movement and altitude adjustments). The buttons are only enabled if a DJI controller is connected to the tablet. • **Mode 1:** Allows you to control the roll and pitch with your right hand, while the yaw and throttle are controlled by your left hand.

Setting	Description
	• **Mode 2:** Allows you to control the roll and pitch with your left hand, while the yaw and throttle are controlled by your right hand. RC mode selection is only available if you have selected the **Allow registration with DJI to use DJI drones** option on the EULA signup page (when the application is first run) or in the **Application settings** page.
Stick sensitivity	Sets the level of responsiveness of the control sticks on the remote controller. It determines how quickly and precisely the drone responds to your input when you operate the control sticks.
Max velocity over ground	Controls the maximum speed at which the drone can fly horizontally across the ground. Regulating how fast the drone can travel allows you to maintain control and stability.
Climb rate	Controls how quickly or slowly the drone climbs to higher altitudes. A higher climb rate allows for a quicker altitude gain. A lower climb rate results in a more gradual change in altitude.
Yaw rate	Controls how quickly the drone rotates or turns horizontally while maintaining its current altitude. A higher yaw rate allows the drone to rotate more quickly, resulting in rapid changes in direction. A lower yaw rate provides smoother and more precise control because of the slower rotation.

2.3.3 Shield Settings

Shield settings are used when operating in Pilot Assist mode. Shield settings are used when operating in Pilot Assist mode. In Autonomous mode, Shield settings are predetermined and cannot be changed.

> When the **Shield settings** panel is open in the **Main View** and Emesent Commander loses connection with the Hovermap, a message at the top of the panel shows that the Hovermap is disconnected and you need to re-establish the connection to continue.



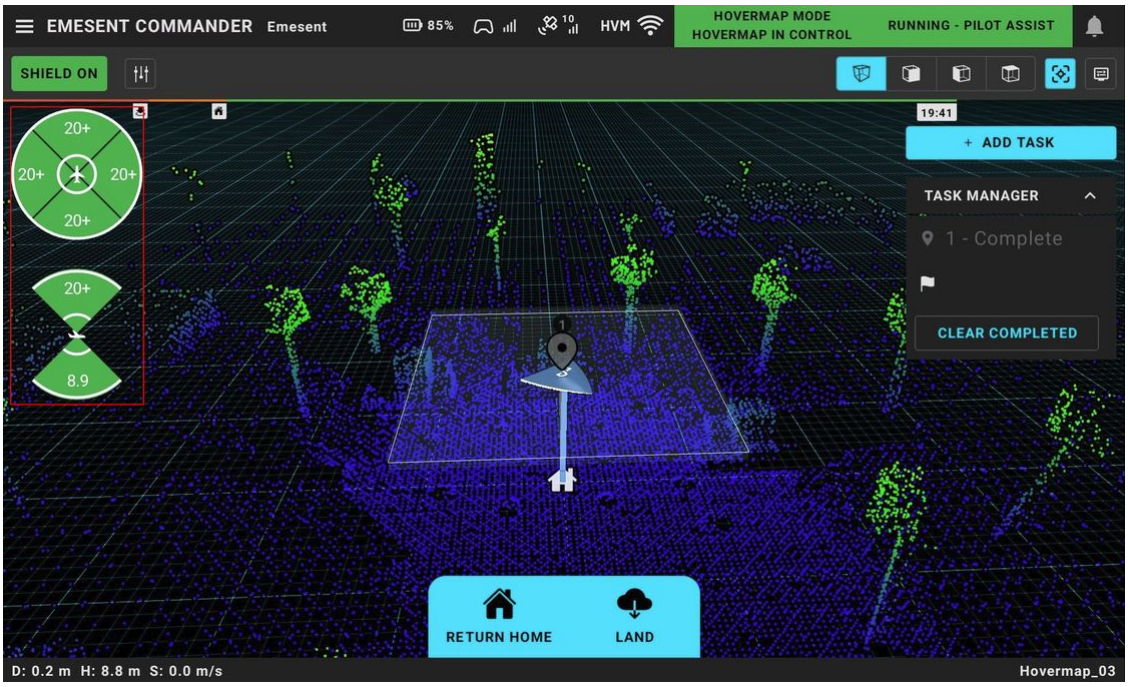
Setting	Description
Enable shield collision avoidance	Enables/disables Shield from being used during AL1 operation (Pilot Assist mode). The button in the Main View indicates whether Shield is enabled (Shield On). For example, Shield can be turned during take-off/landing when AL2 (Autonomy mode) uses its own internal Shield limits.
Horizontal surround	Sets the closest horizontal distance (in meters) the drone can fly to an obstacle.

Setting	Description
Above	The size of the bubble above an obstacle that the drone cannot enter.
Below	The size of the bubble below an obstacle that the drone cannot enter.

2.3.4 Shield Indicator

When performing an assisted mission or switching from Autonomous mode to Pilot Assist mode, the Shield Indicator is displayed on the left side of the screen. The displayed values indicate an obstacle's proximity to the drone using the configured limits. A beep will be played when an obstacle is within very close proximity, with the direction highlighted in red.

In Autonomous mode, once the scan has started and the robot is armed, the Shield automatically displays while taking off to ensure any obstacles can be seen. During arming and take-off, audio is not played if obstacles are reported below the robot.



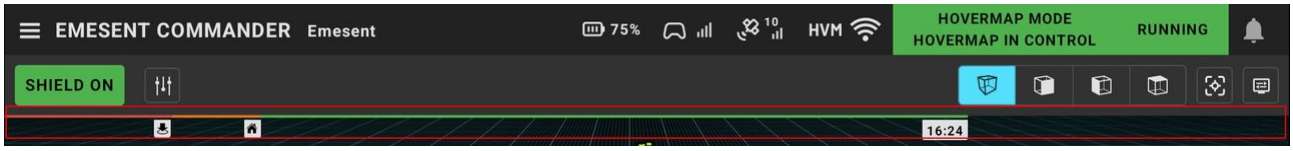
The Shield button colors provide the following information.

Color	Description
White	Shield is not available. This usually happens when Hovermap is not connected.
Green	Shield is operational and enabled.
Red	Indicates an error. The system needs to be restarted.

Shield works by adjusting and overriding pilot commands to prevent the drone from flying into obstacles. However, if the drone is passively drifting toward an obstacle, or dynamic obstacles are moving toward the drone, Shield will not stop or move the drone to prevent a collision.

2.3.5 Battery Indicator

The Battery Indicator will appear for autonomous missions (non-mapping missions) to show an estimation of the time left before the battery reaches critical level. This allows you to plan your flight effectively, ensuring a safe return to home, or initiate a landing before the battery is completely drained.



The following color indications are used in the battery bar.

Color	Description
Green	The battery capacity is sufficient to perform the mission.
Orange	The remaining battery capacity has dropped to a level where the robot needs to return home.

Color	Description
Red	The remaining battery capacity has dropped to a level where the robot needs to land (if it is a UAV) and disarm. The robot will begin an emergency descent.

2.3.6 FPV Camera (DJI only)

The lower-left portion of the Main View shows the FPV feed if a remote controller is connected to the tablet. Otherwise, the box is empty and will show as "Disconnected".

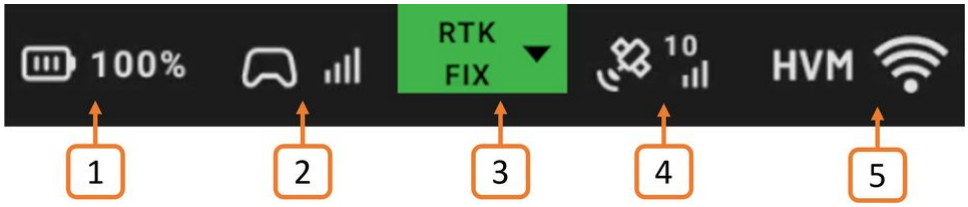
> The FPV Camera feed can be disabled via the **Options Menu**. Go to the **Overlay** setting under **Application Settings** then select **None**.

2.3.7 Telemetry

Provides real-time information about the robot's flight parameters, such as distance from the home location, altitude, and speed.

2.3.8 System Indicators

System indicators provide important information and feedback about Hovermap's current state. In the case of a lost or weak signal, this may affect Hovermap operation or trigger a failsafe.



Refer to the Hovermap Emergency Procedures section for more information.

1	Battery Percentage	Indicates the remaining battery level to help keep track of the available runtime or estimate how much time is left before the Hovermap's battery needs to be recharged or replaced.

2	RC Status	Indicates the strength and quality of the signal between the robot and the remote controller. This indicator changes dynamically as the drone moves or encounters obstacles that could affect the signal. Tap on this indicator to display the name of the connected robot (if connected to a DJI drone) or the robot model (if connected to an Astro or Astro Max).
3	RTK Status	Displays the RTK Status in real-time from GNSS receivers connected to Vehicle RTK and Backpack RTK devices. The RTK Status descriptions are shown in the table below. Refer also to the Monitoring RTK Status section for more information.
4	Satellites in use	Represents the number of GPS satellites the Hovermap is currently communicating with. A strong GPS signal indicates a reliable connection with satellites, which is essential for features like autonomous flight, Return to Home functionality, and waypoint navigation.
5	Network Status	Indicates the strength and quality of the network connection to Hovermap. A weak signal suggests potential issues such as distance limitations or signal interference. Tap on this indicator to show the current network connection. An option to change the connection/ hostname is also provided.

2.3.8.1 RTK Status descriptions

RTK Status	Description
RTK Fix	This is the best status you can achieve with RTK. It means the receiver has successfully locked onto enough satellites and received corrections that allow it to determine a very precise position. An RTK fix is highly accurate, often within a few centimeters.
RTK Float	This means the GNSS receiver is using RTK corrections to improve GPS accuracy, but it has not yet achieved a fully stable and accurate fix. It is still refining the position, so there might be slight inaccuracies.

RTK Status	Description
RTK Single	This status is less precise and is typically used when RTK corrections are not available or when lower accuracy is acceptable. RTK Single can also display when the GNSS receiver is not receiving corrections from the base station. If you are in an environment where RTK Fix or RTK Float is expected, and are only receiving RTK Single, check your GNSS Receiver settings to ensure corrections are configured correctly.
RTK Offline	The GNSS receiver is not sending all required GPS information to the Hovermap. This can occur when there is a loss in communication with the base station or correction source, such as during signal dropout or when the receiver is not connected to a correction service. You can try the following troubleshooting steps: • Disconnect the GNSS receiver's cable and then reconnect it. • Ensure the GNSS receiver settings are configured correctly. • Reboot the GNSS receiver.
No GPS	The GNSS receiver is online but it has no RTK or GPS signal.

2.3.9 Hovermap Control Indicator

The Hovermap control indicator provides information on how the robot is controlled during a mission.

2.3.9.1 DJI Drones

Switch Position (M210)	Switch Position (M300)	Switch Position (M350)	Hovermap Authority	Commander Text	Background Color
P (Hovermap) mode	P (Hovermap) mode	N (Hovermap) mode	Hovermap in control	Hovermap mode Hovermap in control	Green
			Robot in control	Hovermap mode Robot in control	Blue
S (Sports) mode	S (Sports) mode	S (Sports) mode	Hovermap in control	N/A	N/A
			Robot in control	GPS assist mode Robot in control	Blue
A (Atti) mode	T (Tripod) mode	T (Tripod) mode	Hovermap in control	N/A	N/A
			Robot in control	Attitude mode Robot in control	Orange

Figure 4 RC Plus Controller (M350)

Figure 5 Smart Controller (M300)

Figure 6 Cendence Controller (M210)

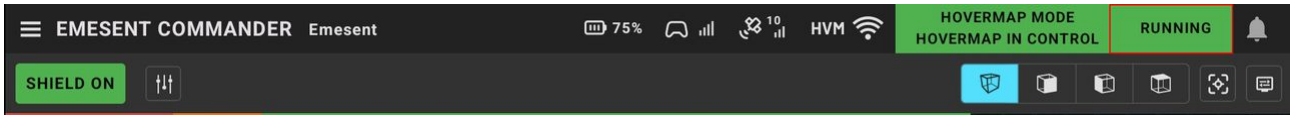
2.3.9.2 Freefly Astro (ST-X only) and Astro Max (ST and ST-X)

To set to Hovermap mode, **Switch 2 (S2)** on the Pilot Pro controller must be in the highest position (away from the pilot). The Pilot Pro will indicate that Hovermap has control of the Astro by showing **Offboard** on the status screen.

Hovermap ST-X will automatically revert to **Altitude** mode if no adequate GPS signal is available.

2.3.10 Mission Status Indicator

The Mission Status provides real-time updates and crucial information related to the Hovermap operation.



> The indicator changes to an Active Failsafe area to notify you when a failsafe is triggered. Clicking the notification shows more detailed information about the failsafe. For more information, refer to the *Hovermap Operational Failsafes* section.

Status	Description	Background Color
Standby	System is idle.	Blue
Transferring Data	Hovermap data is being transferred to an external storage device.	Blue
Upgrading Hovermap	Hovermap firmware is being upgraded.	Blue
Starting	Scan is in the process of starting.	Blue
Shutting down	Scan is in the process of stopping.	Blue
Running pre-checks	Hovermap is executing the required mission pre-checks.	Yellow
Pre-checks failed	At least one pre-check requirement has failed.	Red
Running	All pre-checks have passed and the scan has started. Hovermap is ready for use.	Green
Running - Disarmed	All pre-checks have passed and the scan has started. This status is shown if the robot is identified as a drone and has not been armed yet.	Green

Status	Description	Background Color
Running - Taking Off	This status is shown if the robot is identified as a drone, armed, and in the process of taking off (i.e. the **Take Off** button has been tapped).	Green
Running degraded	The system is running in a degraded state after a failure has been triggered.	Yellow
Running failsafe	A failsafe is active, which affects the ability to execute the mission.	Red
Failsafe - Going home	A Return to Home is initiated as a result of the failsafe.	Red

The background color indicates the severity:

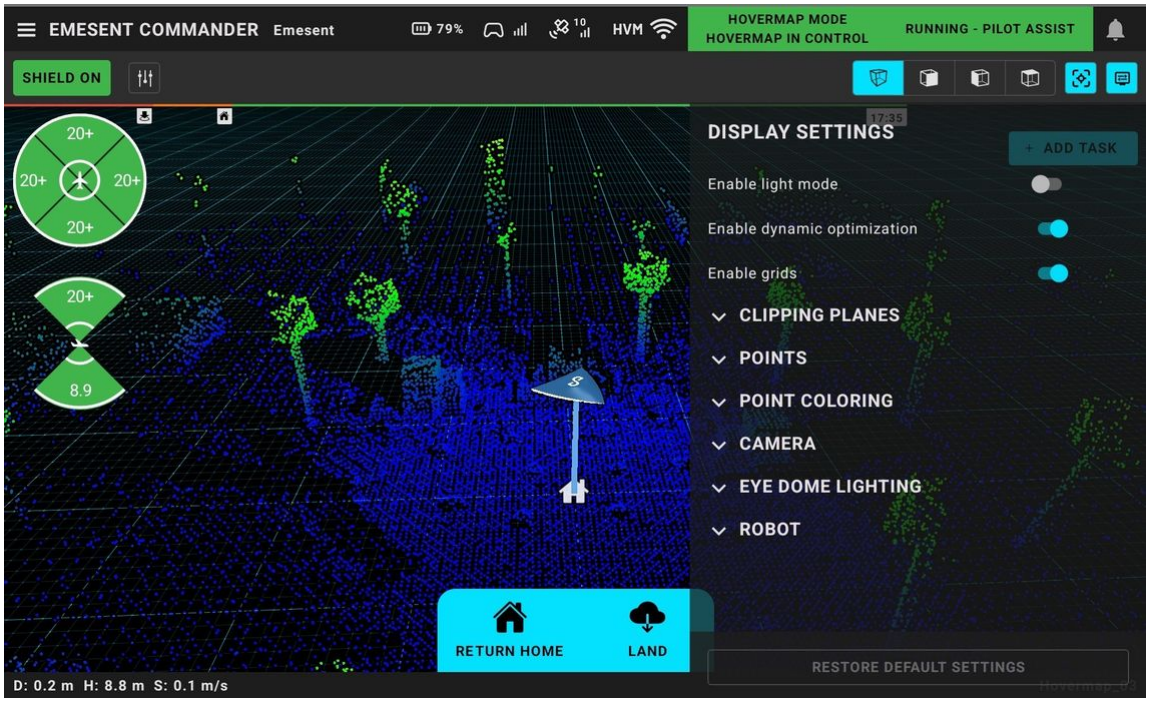
Background Color	Meaning	Description
Blue	Neutral	Data is being downloaded or the firmware is being upgraded. Also, when Hovermap is in the process of starting/stopping.
Yellow	Warning	The system is running in a degraded state.
Red	Danger	A failsafe has been initiated.
Green	Good	The system is running in good condition.

2.3.11 Notifications

Notifications provide a way to alert you to any errors, malfunctions, or warnings that may affect how Hovermap operates. Refer to the Failsafes and Notifications section below for a detailed list.

2.3.12 Display Settings

These settings enable you to fine-tune and customize the 3D display and navigation. You can tailor the display parameters according to your preferences to get a better visualization of the live point cloud.



Setting	Description
Enable light mode	Changes the color profile of the app to use lighter colors for backgrounds, text, and other interface elements. This helps you see the display better in well-lit environments.
Enable dynamic optimization	Temporarily turns off animations and similar features when rendering the point cloud image when the tablet is under high load.

Setting	Description
Enable grids	Overlays a grid pattern on the 3D View. This grid helps in several ways during the mapping process: • provides a visual reference for defining the flight path and coverage area • used as a reference point for placing ground control points • used to reference specific areas of interest on the map
Clipping Planes	
Camera clip plane position	Sets the distance or position from the robot or viewer's perspective at which the point cloud data is rendered. Adjusting this setting determines how far or near the point cloud data is visible in the 3D Display.
Enable height clip plane	Enables you to remove points from the point cloud above the configured height clip plane. This is particularly useful for visualizing and understanding floor plans, by hiding the excess clutter of ceilings or multiple stories. To remove the points that fall within the configured height clip plane, select the corresponding **Invert** option.
Position	Sets the distance (in meters) of the height clip plane.
Enable front clip plane	Enables you to remove points from the point cloud that are beyond the configured front clip plane. This is useful if you want to look through a wall. To remove the points that fall within the configured front clip plane, select the corresponding **Invert** option.
Position	Sets the distance (in meters) of the front clip plane.

Setting	Description
Enable side clip plane	Enables you to remove points from the point cloud beyond the configured side clip plane. This is useful if you want to look at a cross-section of your point cloud. To remove the points that fall within the configured side clip plane, select the corresponding **Invert** option.
Position	Sets the distance (in meters) of the side clip plane.
Points	
Point size	Controls the size of each point in your point cloud. Increasing the point size can make the points more visible and help highlight the structure and details in the point cloud. Decreasing the point size can reduce visual clutter, especially in dense point clouds, and provide a smoother overall display. The maximum point size is 15.
Enable point opacity	Allows you to set the opacity of the individual points in a point cloud. When the toggle button is enabled, the configured opacity level is applied to the point cloud. When the toggle button is disabled, the points are displayed with their default opacity.
Opacity level	Controls the transparency or visibility of the individual points in the point cloud. This determines how much of the underlying image or terrain is visible through the points.
Enable point size attenuation	Allows you to set the point cloud attenuation. When the toggle button is enabled, the configured attenuation level is applied to the point cloud. When the toggle button is disabled, the points are displayed with their default attenuation.
Attenuation level	Controls how the size of the individual points in a point cloud changes based on their distance from the viewer or the camera perspective. This can help draw attention to objects or areas of interest that are closer to the viewer and require more detailed examination.
Point Coloring	

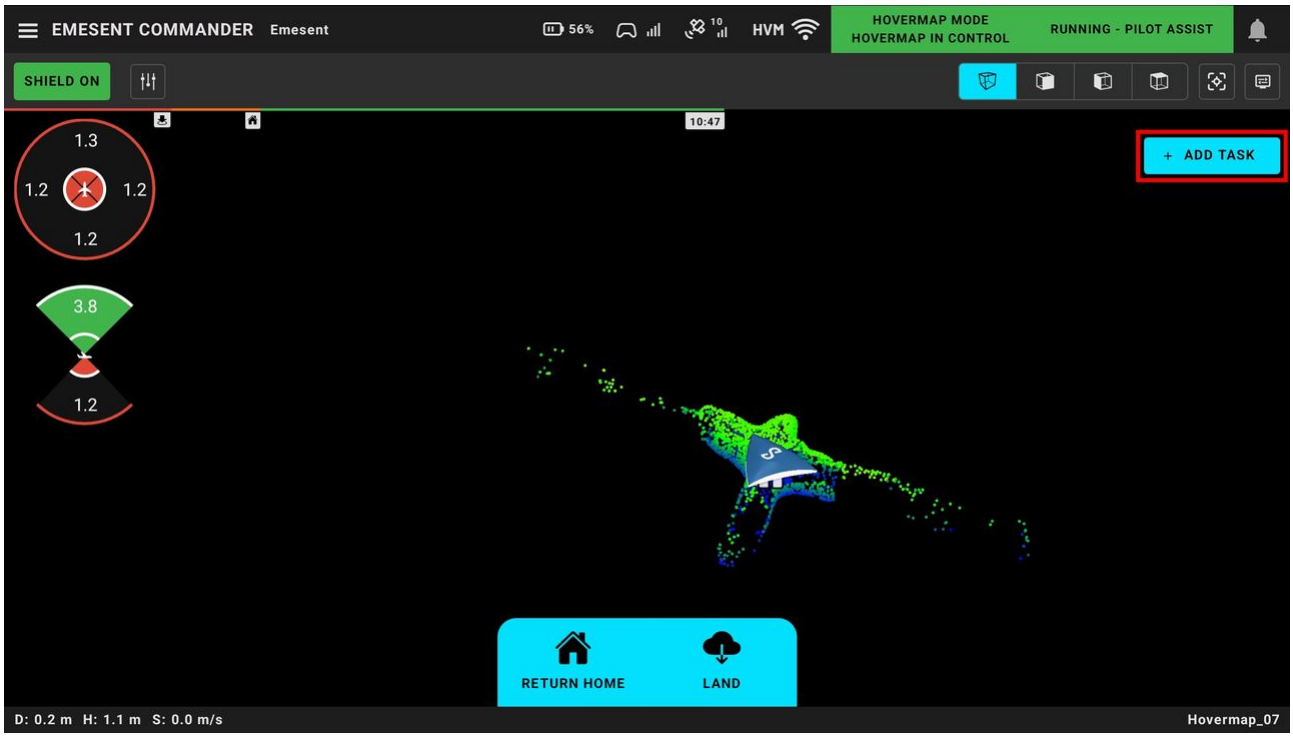
Setting	Description
Gradient selector	Use the left and right arrows to select from several predefined color gradients.
Calculated height range	Automatically applies/spreads the selected color gradient across the entire vertical range of the point cloud.
Custom height range	Manually override/narrow the vertical range over which the selected color gradient is applied.
Camera	
Field of view	Defines the range of visibility from your perspective. A wider field of view allows a larger portion of the point cloud to be displayed, providing a broader context of the surrounding area. A narrower field of view focuses on a smaller region on the point cloud, emphasizing more detailed information.
Rotation sensitivity	Controls how fast the camera rotates when the perspective camera is rotated. Specify a higher setting if you are comfortable and proficient in rotating the camera quickly, or use a lower setting to have more control.
Pan Sensitivity	Controls the responsiveness of the camera to panning movements. A higher setting enables quick and broad pans across the point cloud, while a lower setting gives you finer control and allows you to make more precise adjustments when moving the camera horizontally or vertically.
Zoom Sensitivity	Determines the rate at which you can zoom in and out of the point cloud. Increasing this setting makes zooming faster, decreasing the setting makes zooming more gradual.
Eye Dome lighting	
Enable eye dome lighting	Allows you to accentuate the shape of objects in the point cloud by applying shading to their contours, which enhances depth perception.
Strength	Controls the intensity of the effect. A large value will give you a stronger depth perception.

Setting	Description
Radius	Controls the width of the lighting effect.
Robot	
Enable history path	Displays a visual trace of the robot's past trajectory (previous paths) within the 3D view.

2.3.13 Add Task / Task Manager

To configure a mission, tap the **Add Task** button to open the Task Manager panel. From this panel, you can add individual tasks to the mission. There are two available task types: **Explore** and **Waypoint**. These can be combined to meet specific mission objectives, as described below.

Refer to the workflow detailed in the Autonomous Missions section for more information.

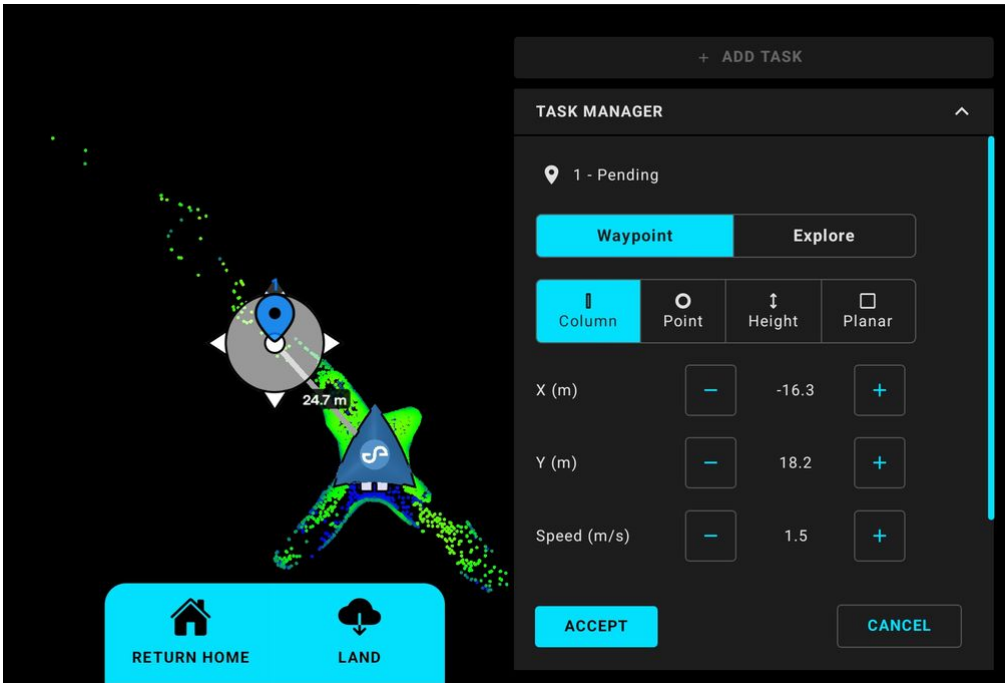


2.3.14 Waypoints

Waypoint Navigation enables operators to define specific locations for Hovermap to autonomously navigate to during a mission. Waypoints can be placed directly on the live 3D point cloud, or beyond the currently mapped area including locations outside Hovermap's field of view, or beyond visual line of sight and communications range.

Hovermap plans and follows a safe, efficient path between waypoints using its onboard autonomy. It dynamically avoids obstacles and recalculates its route in real time based on environmental conditions.

This navigation mode is ideal for missions that require focused coverage of specific areas or strict adherence to a defined flight path.



All waypoints can be adjusted using the touchscreen. Users can drag and drop the waypoint or manually enter X, Y, Z coordinates and rotation values, where applicable, via the Task Manager interface.

Each waypoint includes configurable parameters:

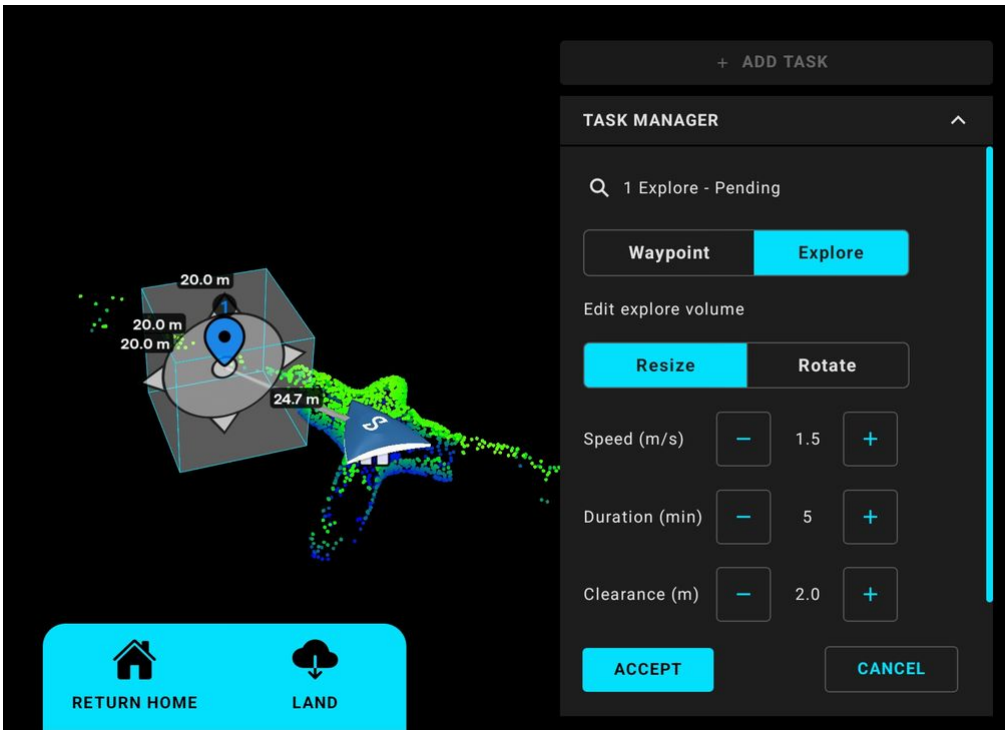
- **X, Y, Z:** Defines the waypoint position. X is longitude, Y is latitude, and Z is altitude. These coordinates are relative to the home location and vary by waypoint type.
- **Speed:** Specifies the velocity at which Hovermap travels toward the waypoint. The configurable range is 0.5 to 2.0 meters per second.
- **Slack:** Defines the distance within which Hovermap considers a waypoint reached. Once within this radius of the waypoint coordinates, it will proceed to the next waypoint.

There are four waypoint types, each suited to different operational scenarios.

Option	Description
Column	A vertical line Hovermap will attempt to intersect • **Placement:** Select a location on the map using the horizontal (XY) plane. • **Behavior:** Hovermap navigates to intersect a vertical line at the specified XY location. It maintains its current altitude when possible but adjusts vertically as required. • **Use Case:** Commonly used for general navigation. This waypoint type is versatile and supports a wide range of mission requirements.
Point	A singular point Hovermap will attempt to reach • **Placement:** Specify an exact location on the map using both the horizontal (XY) and vertical (Z) planes. • **Behavior:** Hovermap attempts to reach the defined XYZ coordinate. Accuracy depends on slack and shield settings. • **Use Case:** Used when Hovermap must navigate to a precise location.
Height	A target height Hovermap will attempt to navigate to • **Placement:** Specify a vertical height on the map using the vertical (Z) coordinate only. • **Behavior:** Hovermap ascends or descends to the specified altitude, independent of horizontal position. • **Use Case:** Ideal when a specific ceiling or floor height must be reached.
Planar	A vertical surface Hovermap will attempt to navigate to • **Placement:** Specify a vertical plane on the map using horizontal (XY) coordinates, with optional angle rotation. • **Behaviour:** Hovermap navigates to any location along the defined vertical plane. The plane extends infinitely along the X and Y axes. • **Use Case:** Recommended when orientation or surface alignment is more important than reaching a fixed point.

2.3.15 Exploration

Exploration is an alternative to waypoint navigation. In Explore mode, Hovermap autonomously navigates a defined area to achieve full coverage, exploring in a logical pattern until the environment is completely captured. When a bounding box is set, Hovermap explores the area autonomously, prioritizing larger unexplored regions before smaller ones.



You can influence Hovermap's logic using two key settings:

- **Clearance**: Controls the minimum size of spaces the drone is willing to enter. Lower values let it explore tighter or more complex environments; higher values focus it on larger open areas.
- **Duration**: Sets how long the drone will spend exploring. Longer durations enable more thorough scans, while shorter ones provide quicker, broad overviews.

2.3.16 Mission Name

Displays the name assigned to the current mission. A number is also added to the mission name to help maintain a clear and sequential record of missions. For example, once a mission is completed and another

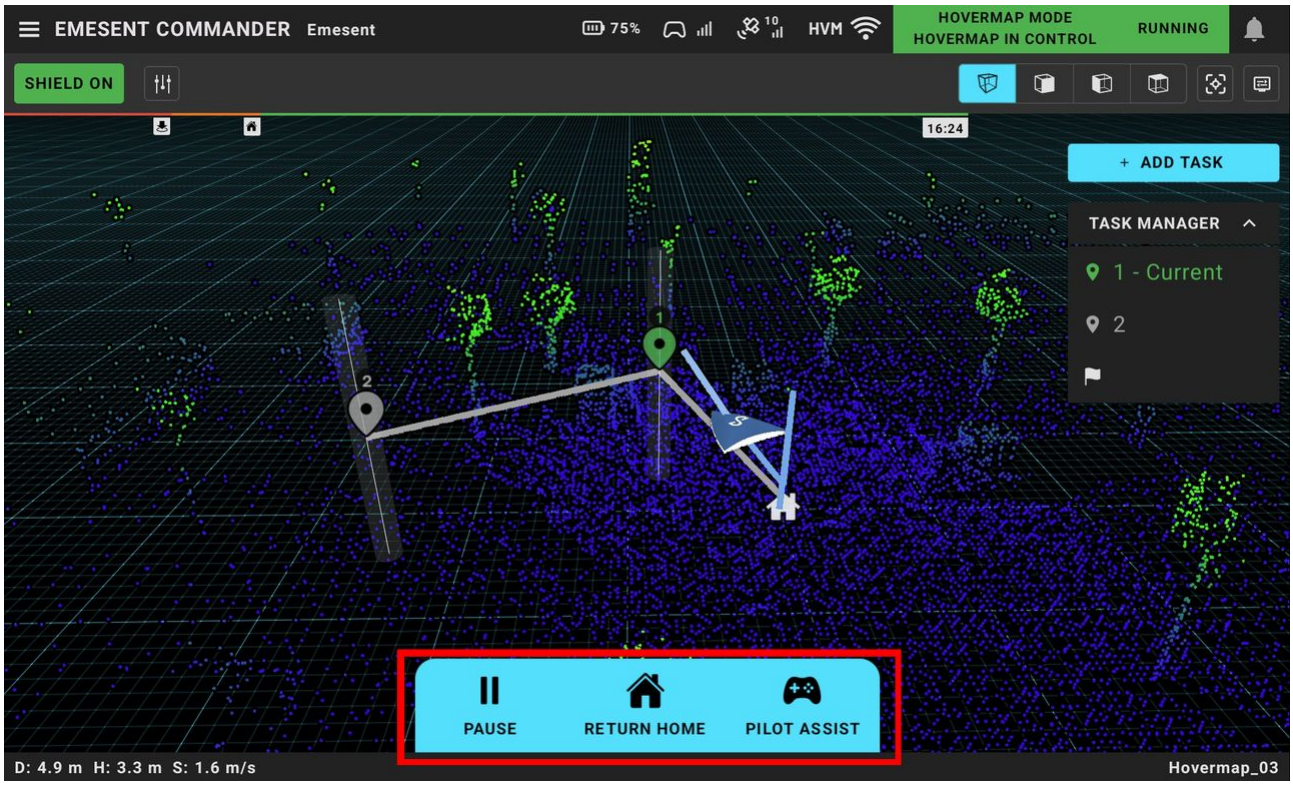
scan starts immediately or you are starting a new mission with the same name, the mission number is appended to indicate that it is a continuation or subsequent scan of the same project.

2.3.17 3D View

Provides a three-dimensional visualization of the mapped area or terrain. It allows you to view the point cloud and interact with the display using the various Camera Control buttons or multi-touch gestures (e.g., to zoom, use two fingers to pinch the view).

2.3.18 Mission Action Buttons

Context-specific buttons are available to simplify the steps required to complete a mission, including take-off, landing, returning home, and switching to Pilot Assist mode. The available mission buttons vary depending on the mission mode and your current progress.



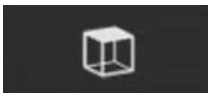
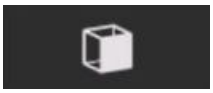
Button	Description
Take Off	Initiates the lift-off sequence, initially launching the drone to a height of 1 meter.
Land	Initiates the landing sequence, ensuring a controlled and gradual decrease in altitude.
Pause	Stops the current mission causing the robot to remain in its current location waiting for further commands.
Pilot Assist	Enables manual control of the system while retaining Shield. You can use the control sticks to fly to the desired location. Once repositioned, you have the option to re-engage Autonomous Mode.
Return Home	An advanced autonomy function that allows a safe return to home in complex environments. When Return to Home is activated, the drone will pause momentarily and then return to the home location. Once it reaches this point, it will rotate to face the direction where the scan originated.
Abort	Serves as a failsafe mechanism, allowing you to stop the take-off or landing process.

2.3.19 Start / Stop Buttons

- **Stop Scan:** This button is displayed on the toolbar once a scan has started for autonomous or assisted missions, but it is only available when the robot is on the ground and disarmed (i.e., a mission is not active). This is to ensure that the Hovermap is not turned off mid-flight.
- **Start Scan:** Once a Mission Workflow has been completed for a mission, a subsequent scan can be started without needing to complete the mission workflow steps again.

2.3.20 Camera Controls

These button controls enable you to explore and analyze the point cloud from different viewpoints. The top, left, and front controls provide specific viewing angles, while the perspective mode provides a 3D view.

Button	Description
	Provides a 3D view of the point cloud.
	Provides a top view of the point cloud.
	Provides a view of the point cloud from a left-hand side perspective.
	Provides a frontal view of the point cloud, as if you were facing it directly.

In addition to the camera controls, you can use the following multi-touch gestures to interact with your point cloud:

Action	Gesture
Zoom	Use two fingers to pinch the view.
Pan	Use two fingers to drag the view.
Rotate	Use one finger then drag the view (Perspective Camera view only).
Teleport	Double-tap the view.

2.3.21 Follow Robot Button

This button, located beside the View Controls, is enabled by default.

Button	Description
	Follows the Hovermap as you move through the view.

3. Emesent Commander Operations

This section guides you through the essential processes and procedures for efficiently performing a mission. Whether it is a new mission or resuming an existing one, the step-by-step instructions will guide you to complete your mission from start to finish.

3.1 Mapping, Pilot Assist, or Autonomous Mission

This section takes you through the step-by-step process of successfully executing a mapping, pilot assist, or autonomous mission.

> ⚠ Emesent Commander remains active without user interaction to ensure that the point cloud is populated in the Main View. When a mission has started, it is important to keep your phone or tablet screen unlocked. If the device is locked, the app may enter sleep mode, resulting in incomplete data and gaps in the point cloud visualization. While the Hovermap will continue to capture data, it may not be rendered in the app. To ensure you can visualize all captured data, do not lock your device while the mission is in progress.

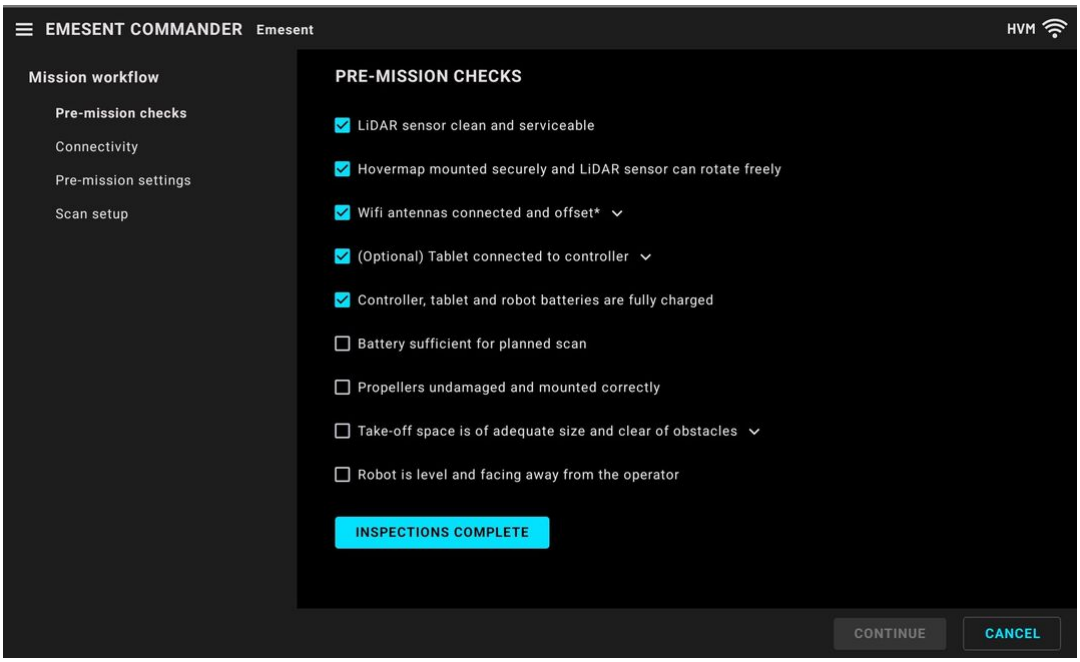
3.1.1 Step 1: Landing Page

Choose your mission by tapping either the **Non-Autonomous Mapping Mission** or the **Assisted or Autonomous Mission** tile.

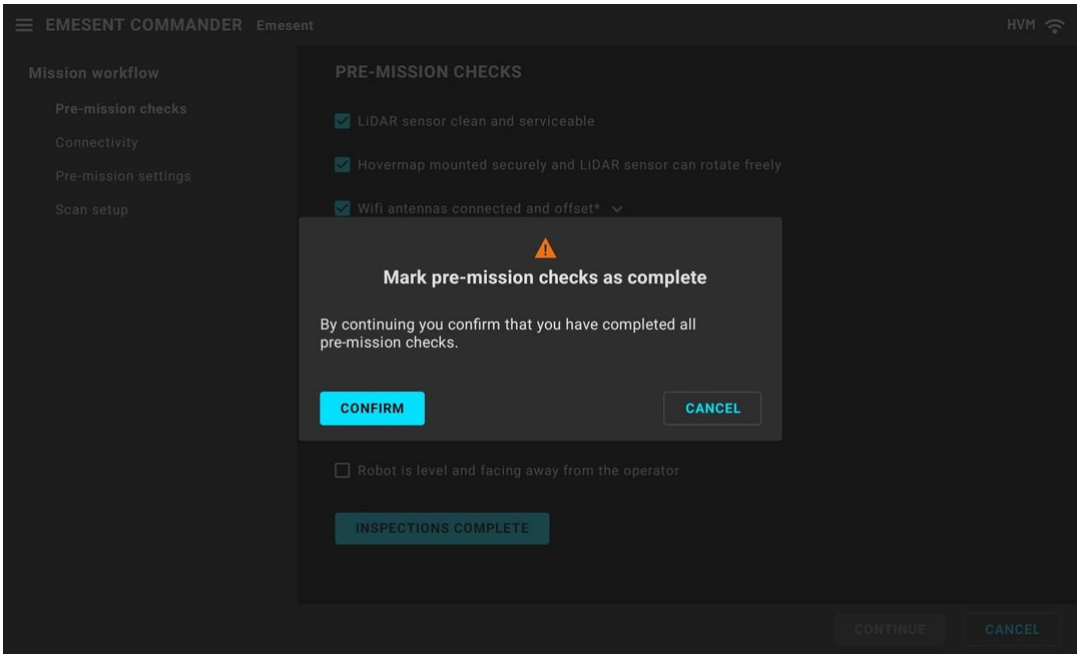
3.1.2 Step 2: Pre-mission checks

Emesent Commander is designed to walk you through the pre-mission phase to ensure all the necessary checks are completed and the system is correctly configured to conduct a safe and successful data collection. The first phase in the Mission workflow is the **Pre-mission checks** page. Read, check, and confirm each inspection item as you finish.

> ℹ You can expand the item related to checking Wi-Fi antennas, remote controller, and take off space to reveal more information.



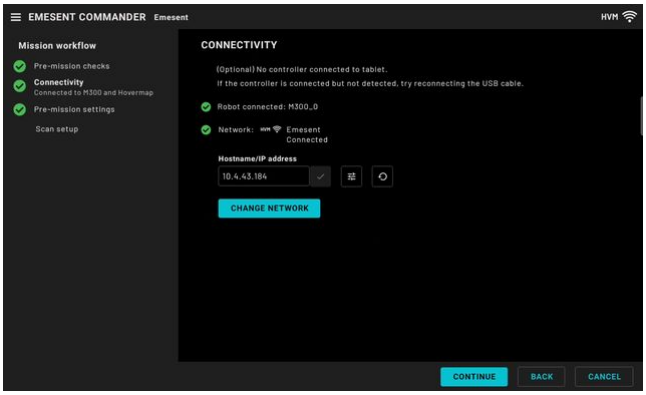
If you are confident that all the necessary checks have been completed, simply tap the **Inspections Complete** button instead of manually checking each item. A message prompt is displayed to confirm your intention before proceeding.



> By tapping the **Inspections Complete** button, you acknowledge and assume full responsibility for ensuring all necessary checks are completed. The log reflects that you have skipped this step of the **Mission workflow**.

Once all checks are complete, tap **Continue**.

3.1.3 Step 3: Connectivity



This page shows the robot and the Hovermap you are connected to. Make sure they are correct. Also, observe the following:

- A green tick that indicates a remote controller is connected to the tablet. This is optional and you can still proceed if not connected.

> If connected to a DJI drone, it is highly recommended to connect your controller to the tablet to enable real-time access to crucial DJI data, including RC signal strength, GPS signal accuracy, and, most importantly, accurate battery level readings.
> When connecting the tablet to the remote controller via USB, you will be prompted to grant USB permission to a program. Tap the **Commander** icon and select **Just once**.

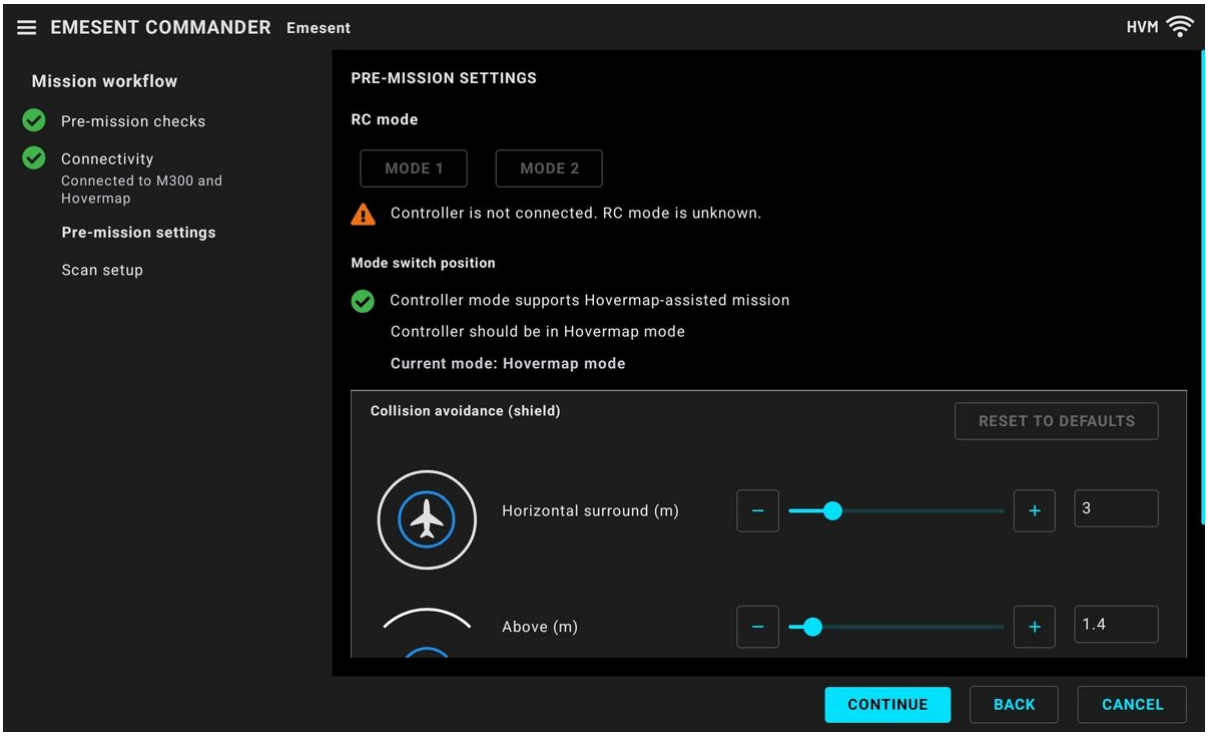
- A green tick that indicates you are connected to a robot. The robot's name is also shown.

- A green tick that indicates you are connected to a Hovermap network. Check if you have the correct connection. If not, tap **Change Network** to connect to another Hovermap. For more information, refer to the Getting Started with Emesent Commander section.

Once all connections are confirmed, tap **Continue**.

> ⚠ If using a Hovermap mounted to a Vehicle RTK or Backpack RTK and Emesent Commander detects a GNSS receiver is connected but is offline, you cannot continue to the next page.

3.1.4 Step 4: Pre-mission settings



There are several things to check/configure on this page.

- **RC mode (DJI only):** Select the remote control mapping mode. The buttons are only enabled if a controller is connected to the tablet. You will still be able to proceed if none is connected. Refer to *"Mission Settings"* in the Emesent Commander User Interface section for more information.
  Note: RC mode selection is only available if you have selected the **Allow registration with DJI to**

use DJI drones option on the Eula signup page (when the application is first run) or in the **Application settings** page.

- **Mode switch position:** The mode switch position confirms whether the remote controller mode switch is placed in a position that allows Hovermap to obtain control. Check the following:
  - Observe that there is a green tick beside **Controller mode supports Hovermap-assisted mission**.
  - Make sure the controller is in Hovermap mode. Refer to "*Hovermap Control Indicators*" in the Emesent Commander User Interface section for more information.
- **Collision avoidance (shield):** Shield settings are used for assisted missions. The configured distances will not be used when Hovermap is performing an autonomous mission.

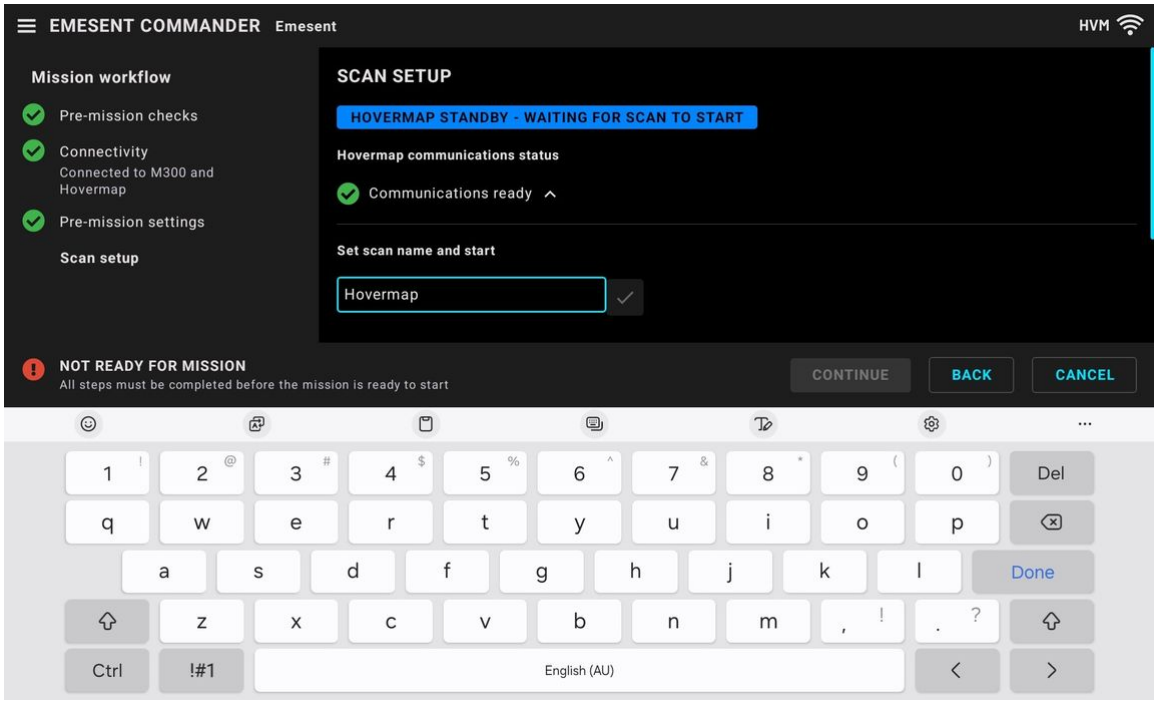
> Tap **Reset to defaults** to revert to the original shield settings.

Once all pre-mission settings are configured, tap **Continue**.

3.1.5 Step 5: Scan setup

Enter a name for the current mission. The name entered will be orange until it has been applied.
Tap **Done** on the keyboard to apply the new name, or close the keyboard then tap the tick button beside the name field.

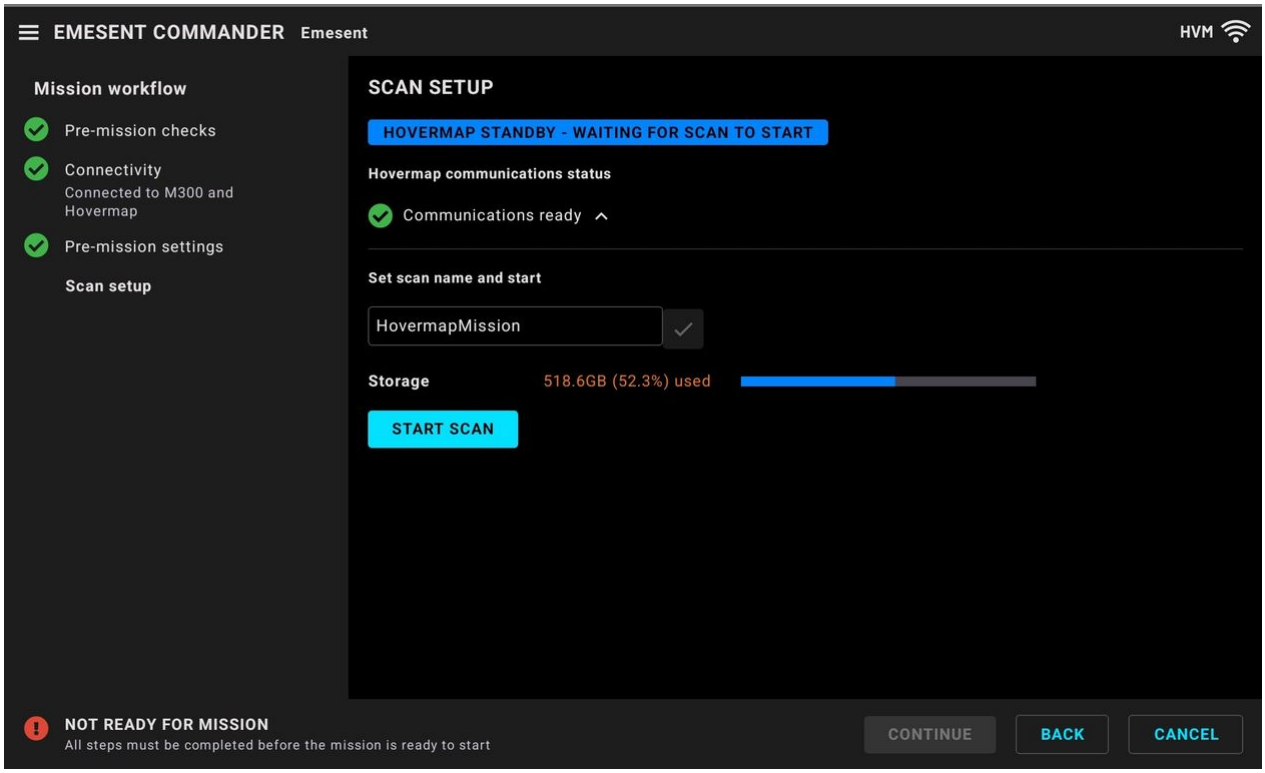
> If the tick button remains teal (instead of turning grey) after closing the keyboard, it means the new name has not been applied. If this happens, simply tap the teal tick button to apply the new name.



Once the new scan name is applied, tap the **Start Scan** button to begin the scan startup process. The startup duration varies, typically ranging from one to two minutes.

> If you attempt to start the scan and there are unsaved changes to the scan name, you will be prompted to confirm whether you want to save it before continuing.

> ⚠ If using a Hovermap mounted to a Vehicle RTK or Backpack RTK and Emesent Commander detects a GNSS receiver is connected but is offline, you cannot start the scan.

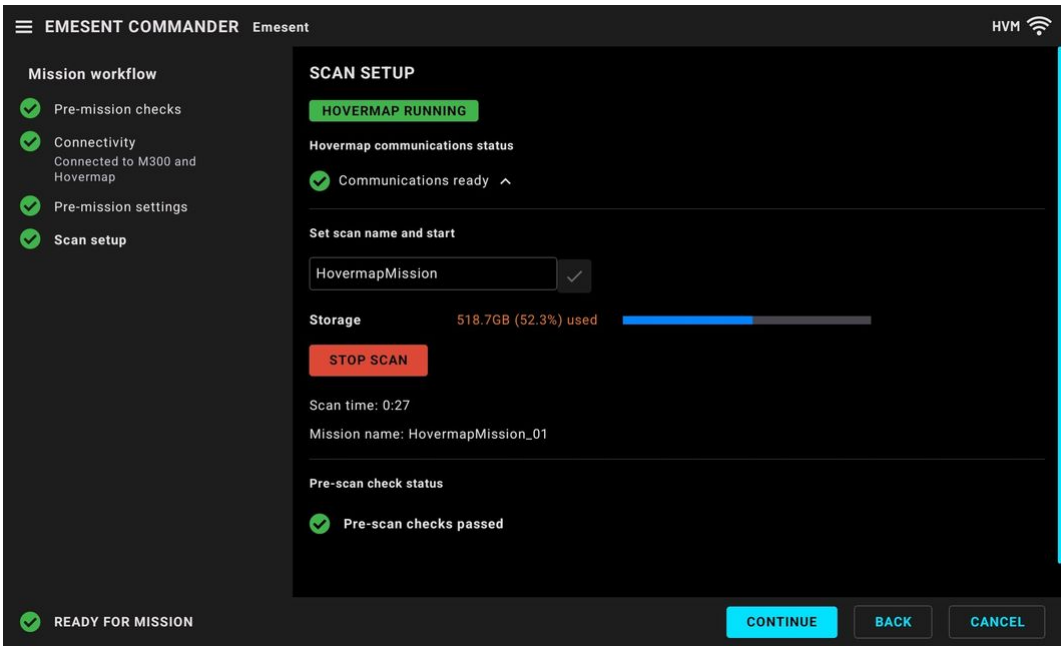


> ⚠ During this initialization phase, the LiDAR sensor will start rotating. This is not an indication that the scan has started. Do not proceed until you get a notification that the mission is ready.

Once the pre-scan checks are complete and the scan has started, the following indications are displayed under **Pre-scan check status**:

- A green tick and “Pre-scan checks passed” message
- A green tick and “Ready for Mission” message

Tap the **Continue** button to navigate to the Main View.



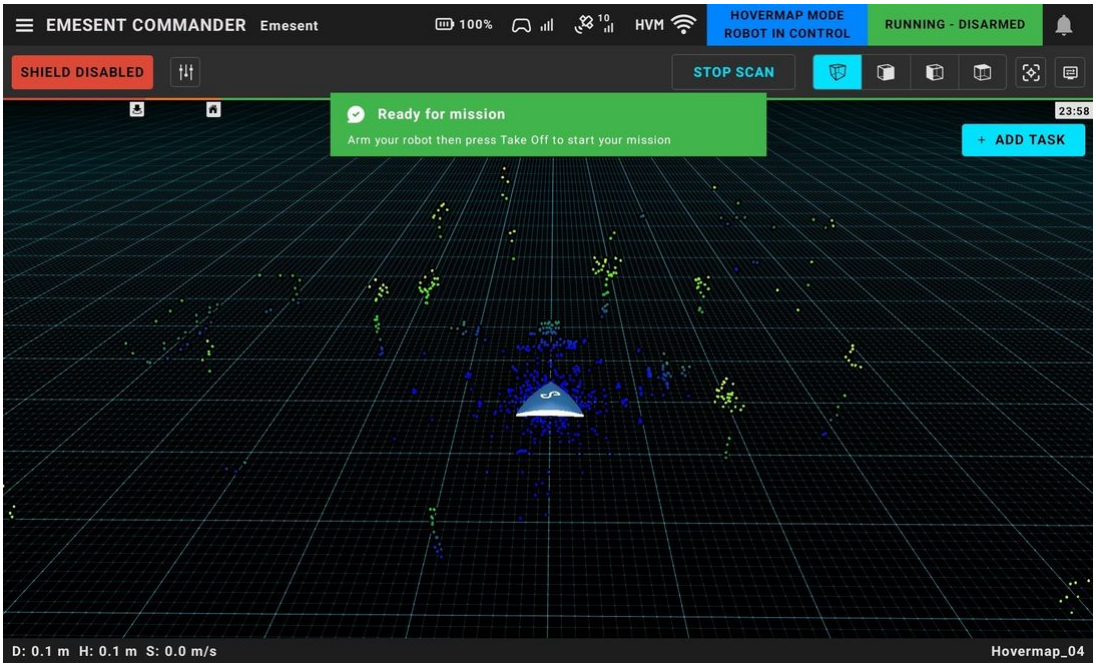
At this point, if you have selected to do a mapping mission, go ahead and start scanning. Remember to take it nice and slow. Concentrate on the area you want to map out. To get the most accurate results, it's a good idea to finish the scan in the same spot where you began.
To enhance user safety during Mapping mode missions on compatible robots, you will receive a confirmation message that you will not have the assistance of **Shield** protection, which could expose the drone to risks in GPS-denied environments. You can proceed without **Shield** or cancel and plan an Autonomous mode mission to provide additional protection against obstacles.

For pilot-assisted or autonomous missions, refer to the succeeding steps.
For details on how to stop a scan, refer to step 13.

3.1.6 Step 6: Arm your Robot (For Pilot Assist and Autonomous Mission)

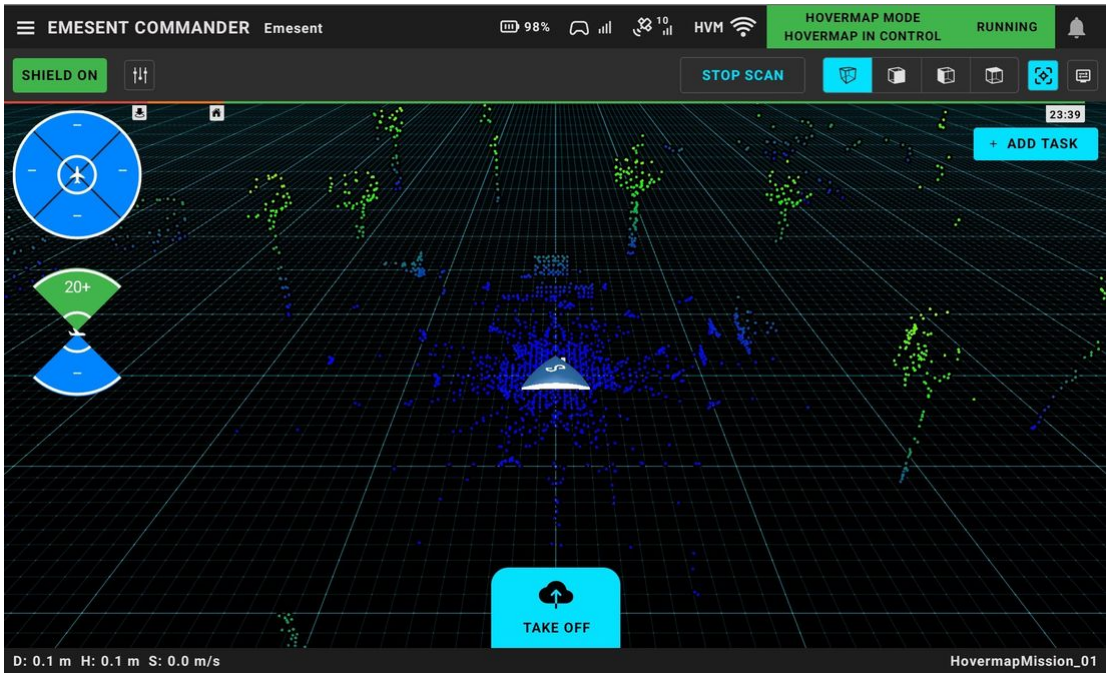
The status bar on the upper-right initially shows that your robot is **Running - Disarmed**.

Arm your robot using the remote controller, ensuring that the area above the robot is clear, then confirm the action when prompted. Arming can only be done via the controller (not from the app) to ensure the robot does not start an autonomous mission unless you have control.

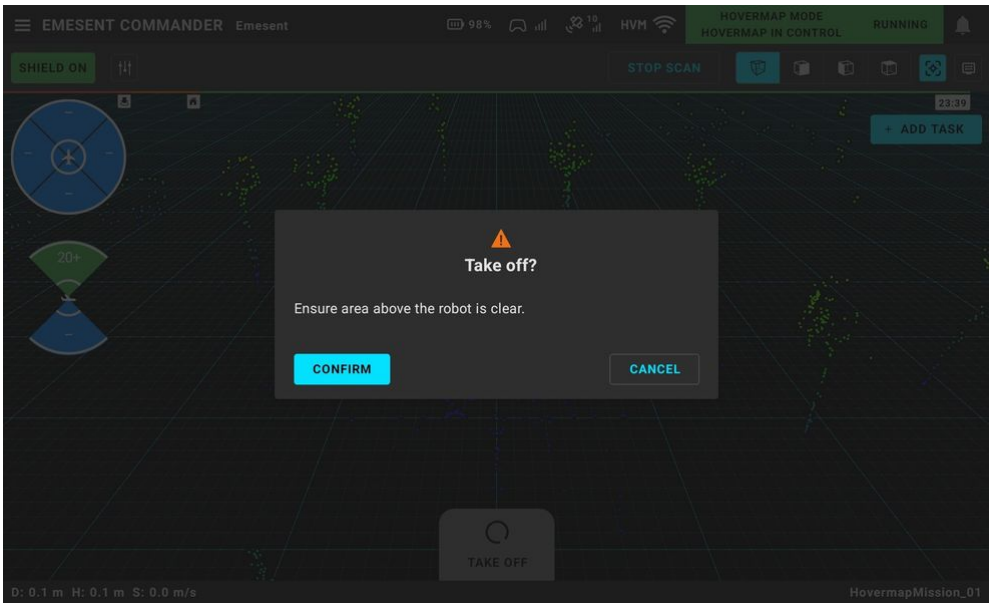


3.1.7 Step 7: Take Off (For Pilot Assist and Autonomous Mission)

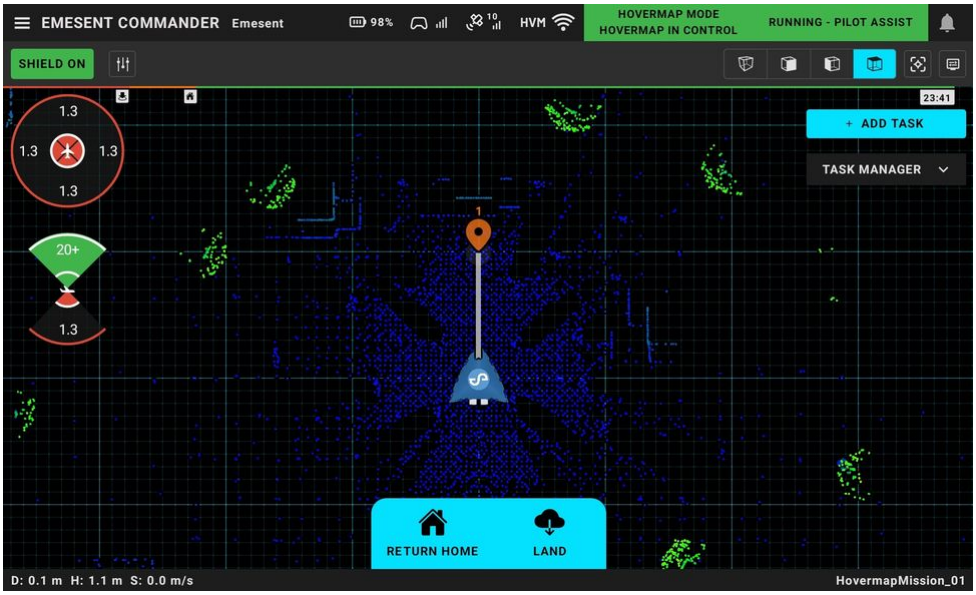
Once your robot is armed, the status will show as **Running** and the **Take Off** button becomes available.



Tap the **Take Off** button, ensuring that the area above the robot is clear, then confirm the action when prompted to start the mission.



An arrow cursor with the Emesent logo represents the current location of your robot while the Home icon indicates your starting position.



At this point, you are ready to proceed on an assisted mission using your robot's remote controller. Alternatively, you can also conduct an autonomous mission by adding waypoints in the **Task Manager** and sending these waypoint locations to Hovermap.

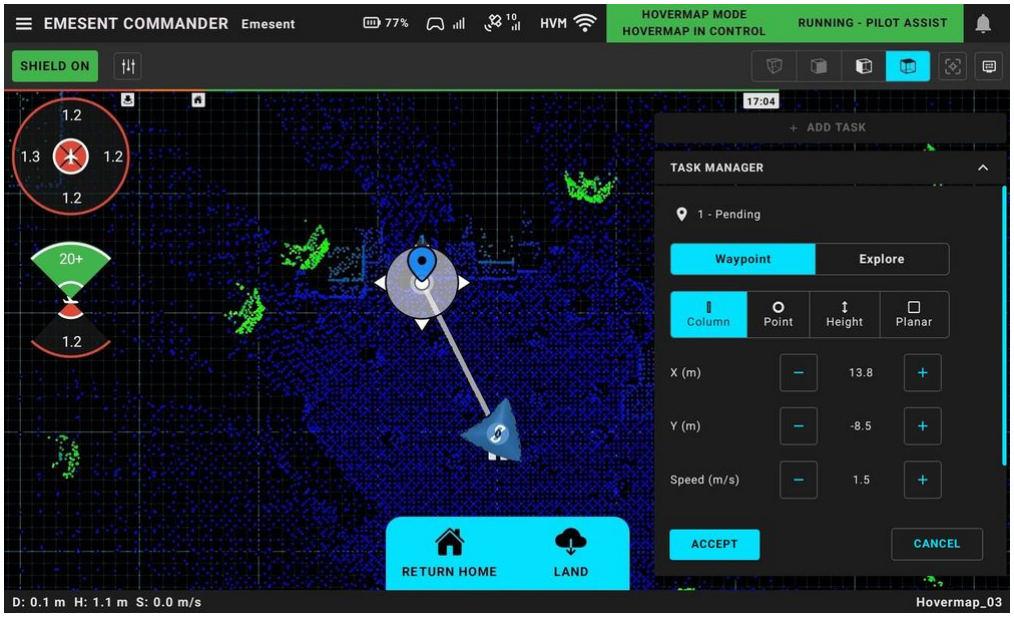
3.1.8 Step 8: Add / Edit Tasks (Only for Autonomous Mission)

To create a mission, add individual tasks to the **Task Manager**, then start the mission. Hovermap will execute each task in sequence. There are two available task types: **Explore** and **Waypoint**. These task types can be combined to meet specific mission objectives.

In the Task Manager, select *Explore* or *Waypoint* as the task type. For additional information on the types of tasks see Emesent Commander User Interface.

After configuring a Waypoint or Explore task, tap **Accept** to add it to the mission. You can then add additional tasks or view, edit, delete, and monitor the status of existing tasks.

> A task can be created before take off but you can only send it once you take off.

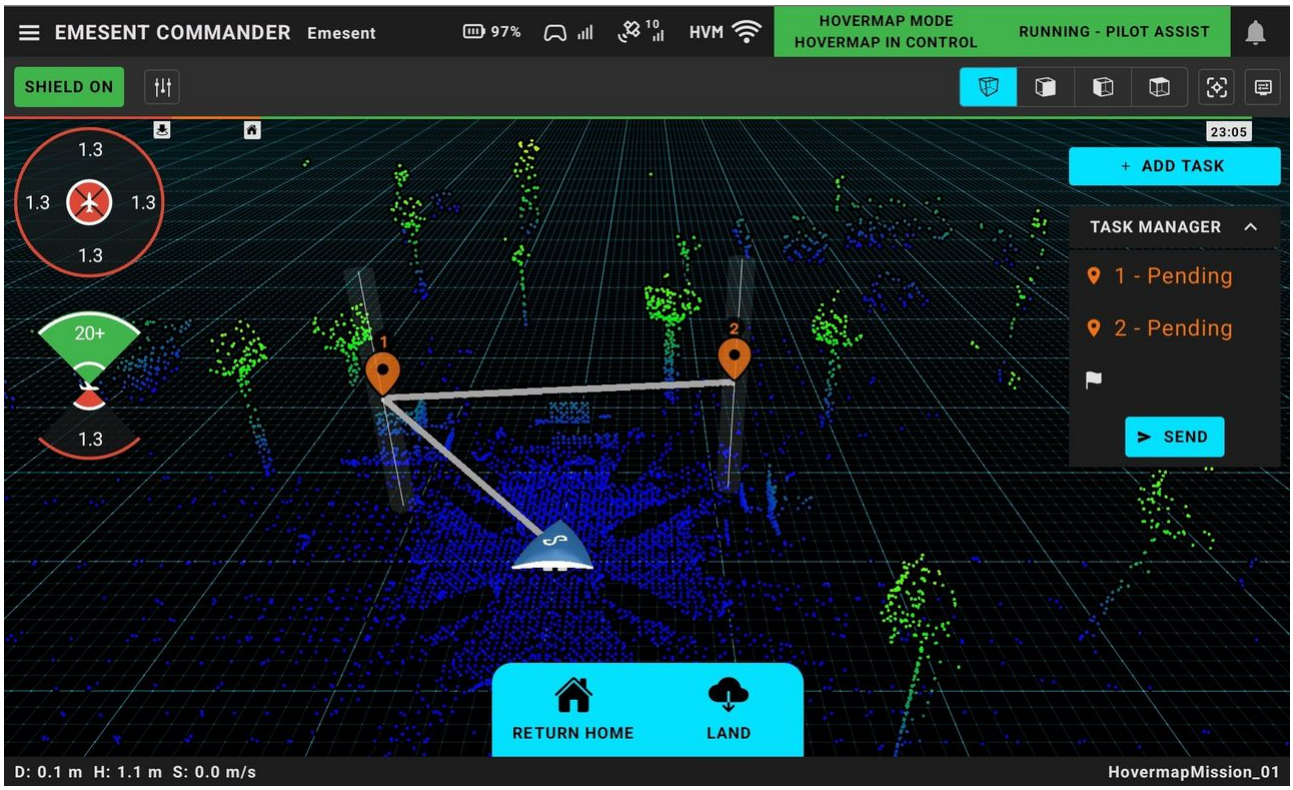


> Certain tasks have set default camera views when chosen.

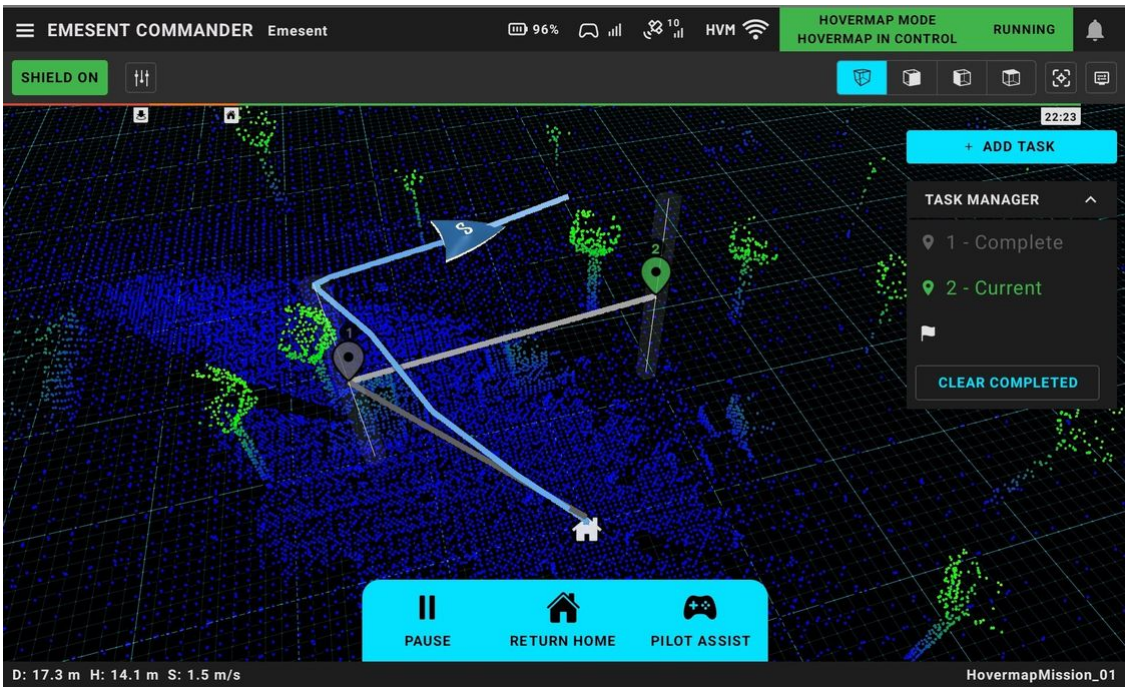
> Editing the currently active task pauses the current mission until the tasks are re-sent.
> To edit a task, select the task in either the 3D view or in the Task Manager. Tap **Accept** to apply the new settings then tap **Send**. If you do not send the update, the robot will continue to go to the previously set location.

3.1.9 Step 9: Send Tasks to Hovermap (Only for Autonomous Mission)

The newly created task is initially shown as “Pending“, which means the coordinates are not yet sent to Hovermap. You can send a task as soon as it is created or create a list and send them all at once.



Once you click **Send**, you will hear an audio message indicating that the robot has started to move and the task list is updated to remove the “Pending” text. The task being actively executed by Hovermap is marked as “Current”. When you reach the end of the current task, the task turns grey and the app moves on to the next queued task.

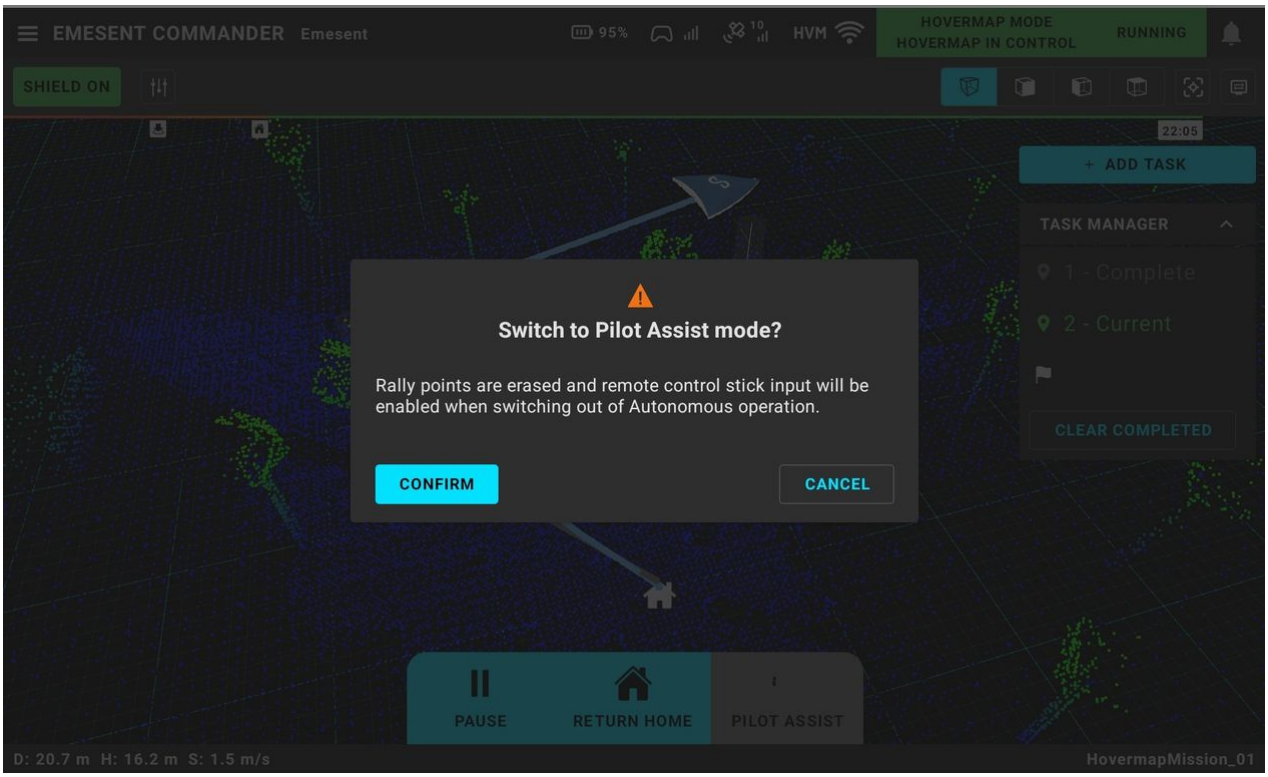


The following color indications are used:

Task Color	Description
Orange	The task is pending and has not been sent to the robot.
White	The task has been sent to the robot.
Green	Indicates the current task.
Gray	The task has been completed or aborted.
Red	The task has failed or is not achievable.

3.1.10 Step 10: Switch to Pilot Assist Mode (Only for Autonomous Mission)

If pilot intervention is required at any point during an autonomous mission, tap the **Pilot Assist** button then confirm the action when prompted.

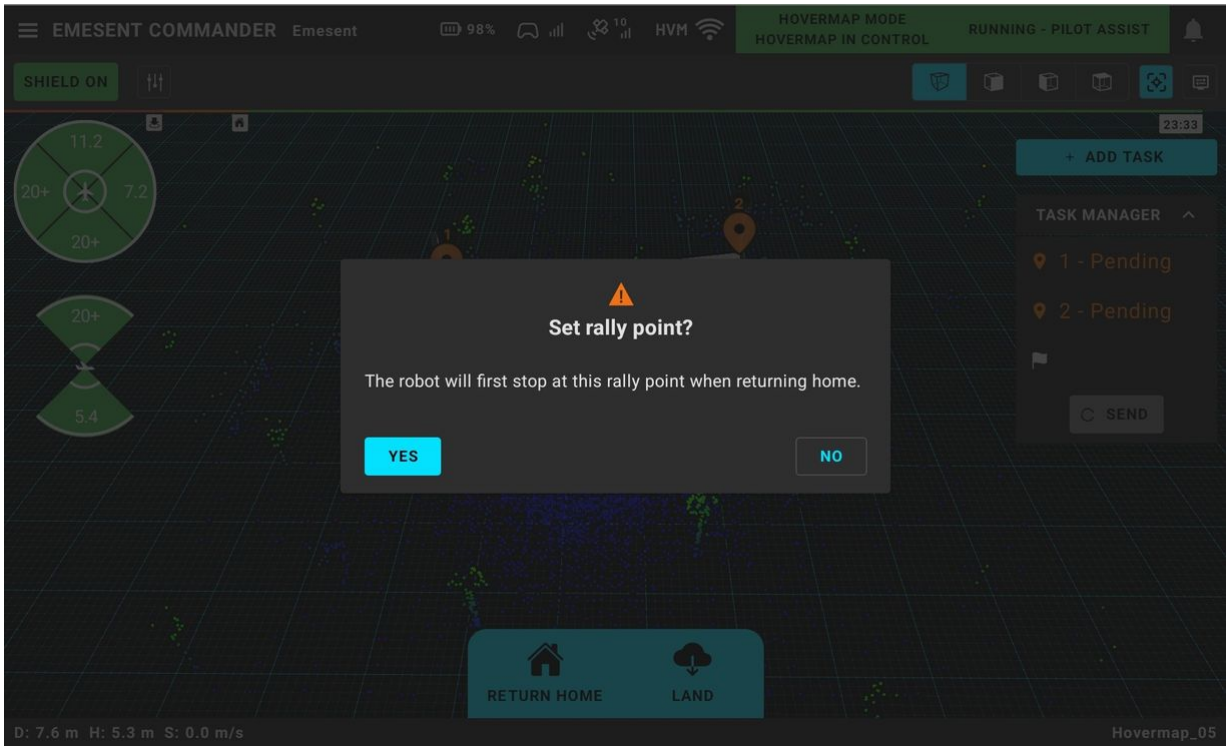


You need to be connected to the Hovermap's Wi-Fi network to switch from Autonomous to Pilot Assist mode via the app.
If you have lost Wi-Fi connection to your Hovermap, switch out of Hovermap mode and back again twice. When Hovermap detects that the flight mode switch is toggled out of Hovermap mode and back twice, it will take the system out of Autonomous mode so you can manually control your drone using the remote controller.
Refer to "*Hovermap Control Indicators*" in the Emesent Commander User Interface section for more information.

Rally Point

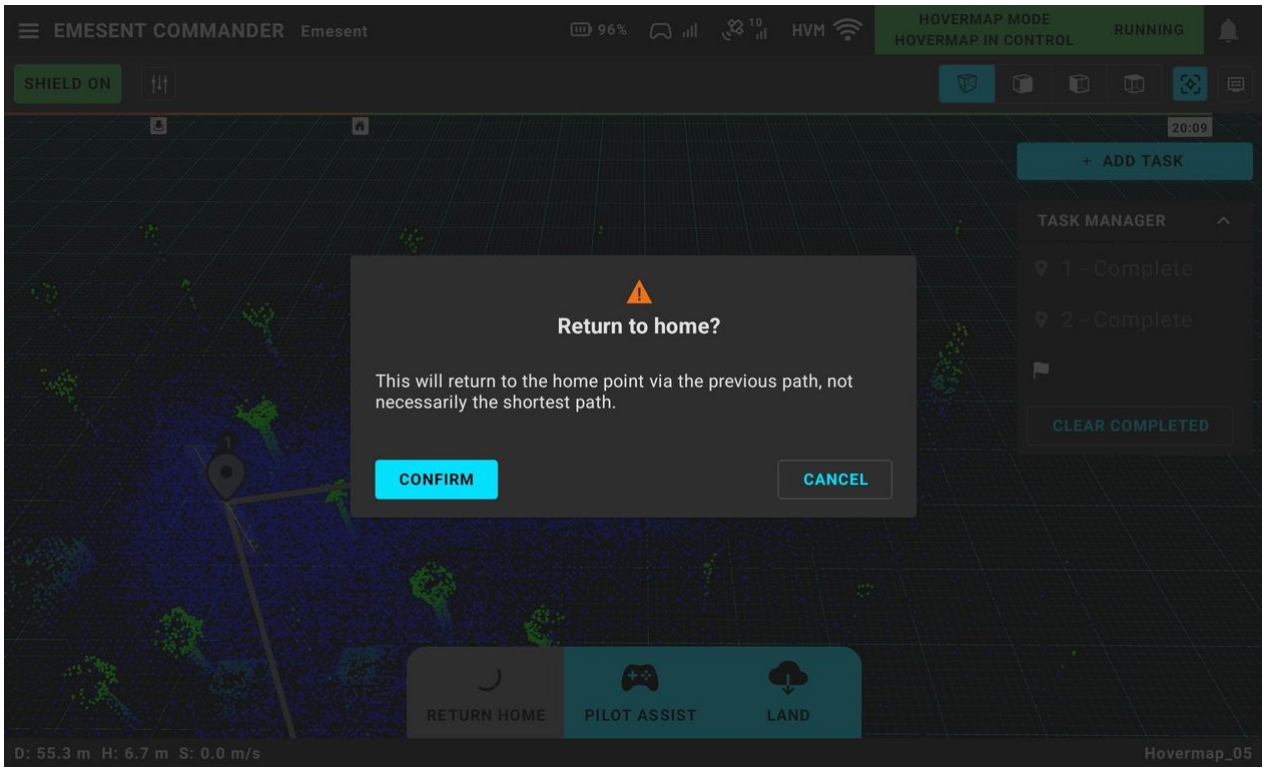
Once you switch to Pilot Assist mode, the rally point (if set) is erased. A rally point is a temporary point where the robot returns in case of an error or loss of connection. This allows you to re-establish Wi-Fi communications, take control of your robot, and make the necessary corrections so you can proceed with your mission, or return home. Also, any incomplete tasks are shown as Aborted but will remain in the Task Manager. To switch back to Autonomous mode, send new waypoint(s) or resend incomplete tasks to continue the mission.

When you send waypoints in Pilot Assist mode and are away from home, you will be asked if you want to set a new rally point.



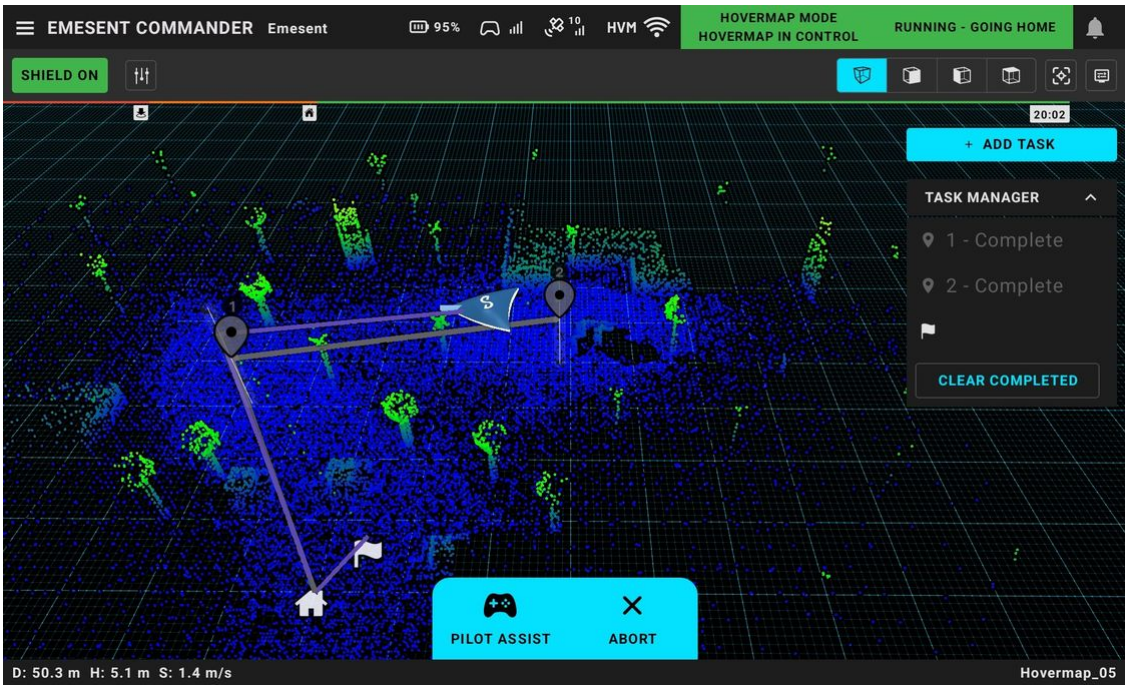
3.1.11 Step 11: Return to Home (For Pilot Assist and Autonomous Mission)

Tap the **Return Home** button then confirm the action when prompted. Do this when you have completed your mission or during various scenarios such as low battery levels or loss of connection.



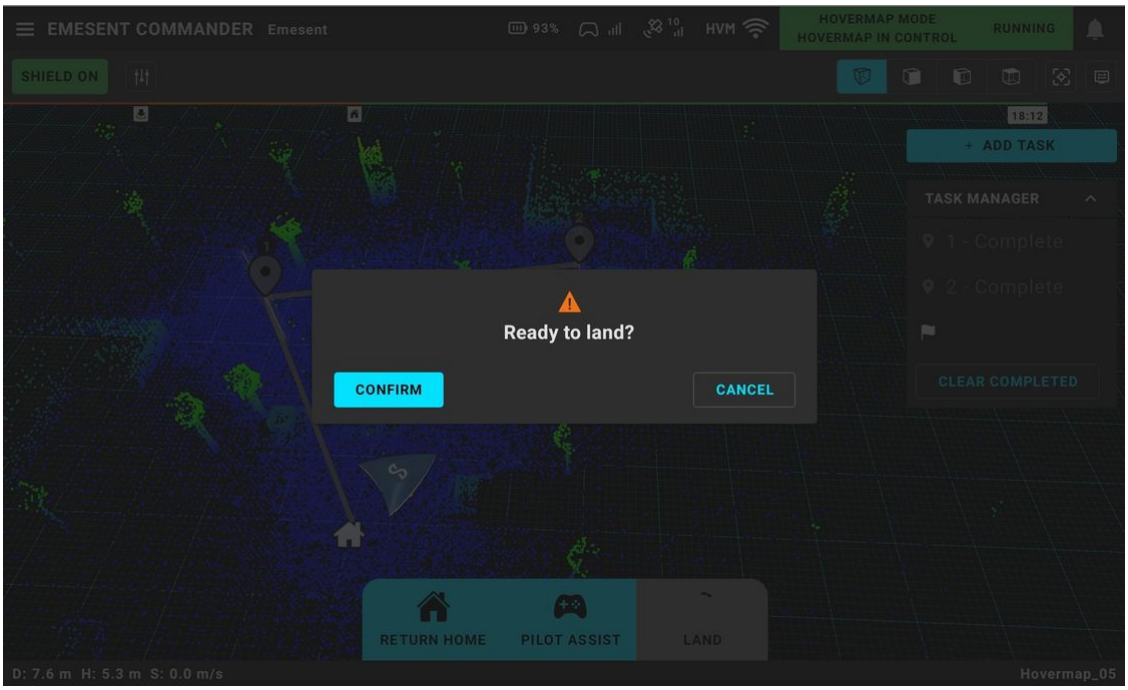
You will hear an audio message and the Status Bar shows **Running - Going Home** to indicate that the process has started. In the 3D view, a purple line appears which corresponds to the path the robot will take to go back. At this point, you can abort or switch to Pilot Assist mode.

> The return to home path may not be the shortest path to the starting point. Instead, it retraces the previously navigated path considered safe and achieved by the robot. It might appear that the robot is taking an indirect route home, especially when an apparently obstacle-free straight path exists. This intentional behavior ensures that the robot returns via a path that has already been explored and deemed safe rather than potentially encountering unknown obstacles on a new route.



Once you have reached home, you will hear an audio message. Ensure the area around the robot is clear then tap the **Land** button. Tap **Confirm** when prompted. The Status Bar then shows **Running - Landing**.

> It is **strongly recommended** to use this method of landing as it also automatically disarms the drone once it has landed.



3.1.12 Step 12: Disarm the Drone (For Pilot Assist and Autonomous Mission)

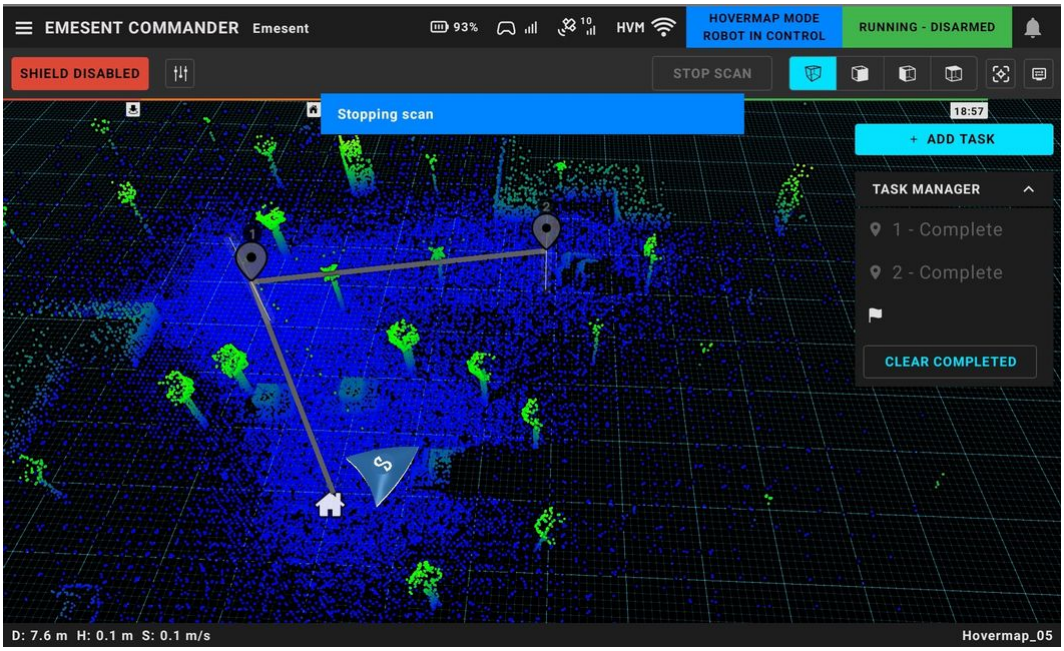
As with the previous step, the drone automatically disarms once it lands if using the app's **Land** button.

Another option is to disable the **Shield** and immediately throttle down (with no other stick input) to land the drone. Then, continue to hold the throttle down until the drone disarms.

> ⚠ **The Hovermap does not support disarming the drone in this way.** If absolutely necessary, landing the drone using the remote control should only be done by experienced pilots. It is important to remember that, with the drone still armed and **Shield** disabled, any stick inputs will be obeyed. Therefore, the only necessary action is to hold the throttle down until the drone disarms.

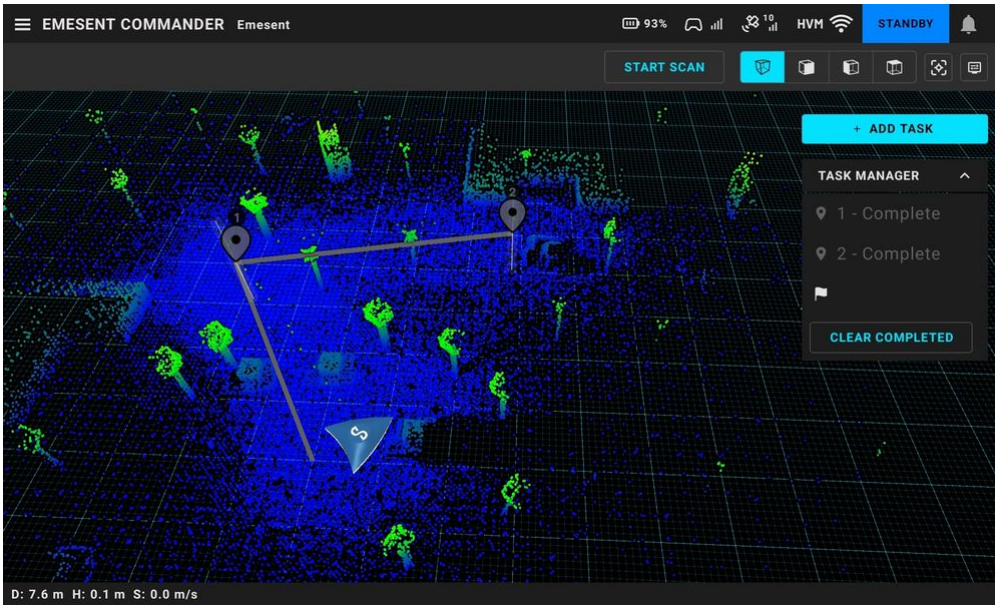
3.1.13 Step 13: Stop the Scan

Once you have safely landed and disarmed your robot, tap the **Stop Scan** button to end the mission. The Status Bar shows **Shutting Down** then changes to **Standby** once the scan has stopped.

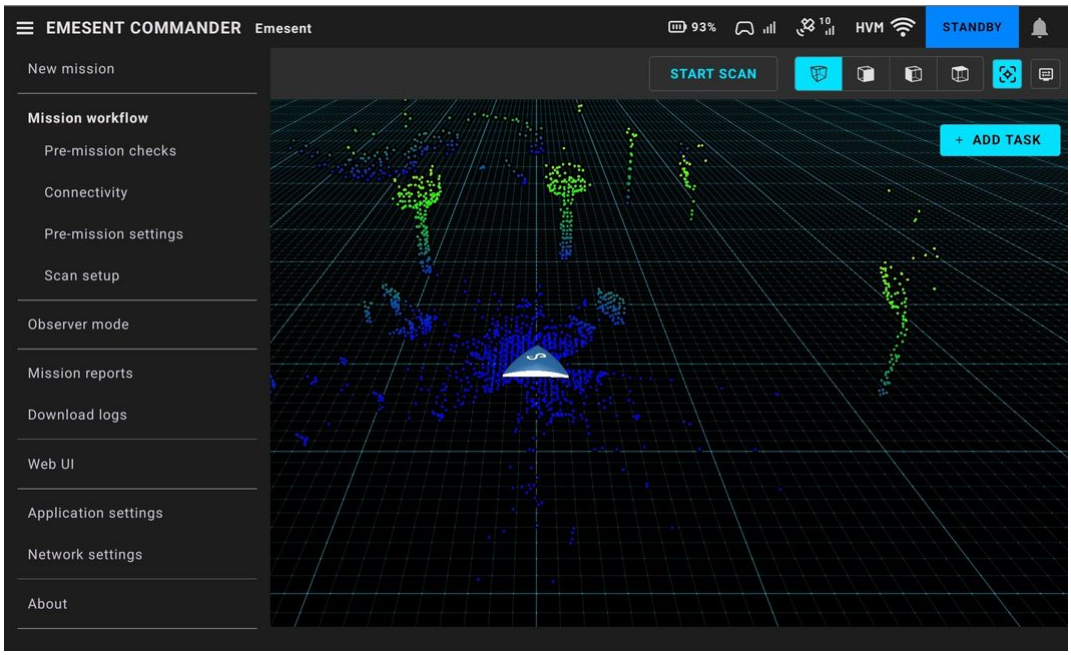


3.1.14 Step 14: Start a New Scan (Optional)

Optionally, tap **Start Scan** to begin another scan using the same name and configuration while skipping the Mission workflow.



To go back to the main landing page, tap the **Hamburger** button on the upper-left then select **New Mission**.



3.1.15 Step 15: Transferring Scan Data from Hovermap

There are two main methods to transfer scan data from Hovermap:

1. **Automatic USB Offload:**
   Insert a USB drive into Hovermap. The most recent scans will automatically begin transferring, no user action required. The status LED will flash blue while the transfer is in progress and stop once complete.
2. **Web UI Transfer (USB or Wi-Fi):**
   Connect to Hovermap via the Web UI for more control over scan transfers. From the interface, you can:
   - Choose to transfer scans to a connected USB drive or via Wi-Fi
   - Select specific scans to transfer
   - Re-transfer scans that have already been offloaded

3.1.16 Step 16: Processing your Data

Once your scan data has been transferred, you can process it using Emesent Aura.

Alternatively, you can process scans **directly onboard Hovermap** without exporting to Aura. For detailed instructions on **onboard processing**, refer to the *Mission Review and Reports* section of the Commander User Manual.

Scans processed onboard Hovermap will have different accuracy than scans processed in Aura. To understand the difference, please refer to our *Aura vs Hovermap Onboard Processing Accuracy Comparison*.

3.2 Operating on a Smartphone

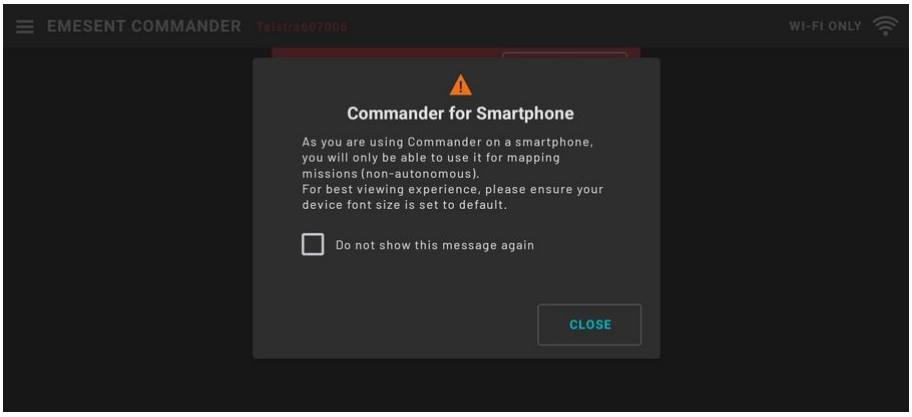
The Emesent Commander interface has been designed to be user-friendly, especially on smaller screens. With this interface, you can easily execute scanning missions in Mapping mode. Autonomous missions are currently not supported on smartphones but can be monitored using Observer Mode.

While using this streamlined version, you can still access useful features such as starting and stopping scans, enabling Observer Mode, accessing the Web UI, downloading logs, and configuring application settings

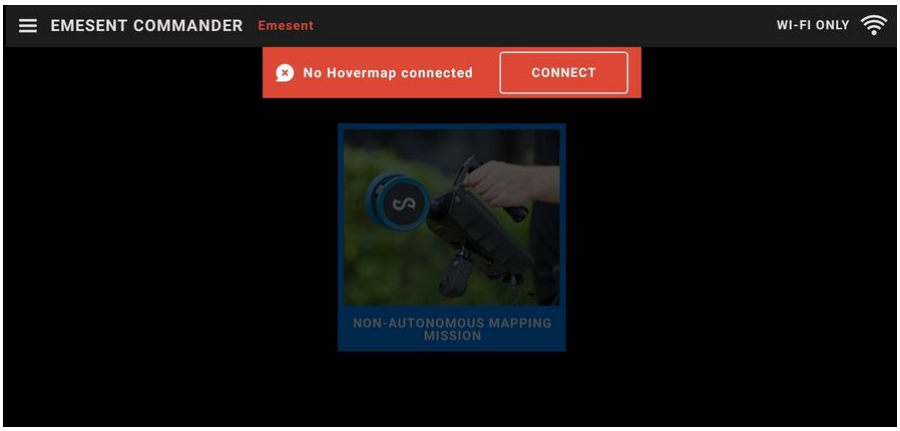
> The Emesent Commander works using the split screen mode on Android devices. However, **it is strongly not recommended** as some features may not be available.

Although the steps for conducting a mapping mission are similar regardless of the device, the following information will help you get familiarized with the smartphone interface. Refer to the Mapping, Pilot Assist, or Autonomous Mission section for more detailed information on the mission workflow.

1. When you run Emesent Commander, a pop-up dialog displays indicating that Commander is being used on your smartphone. Tap **Close** to go to the main landing page.

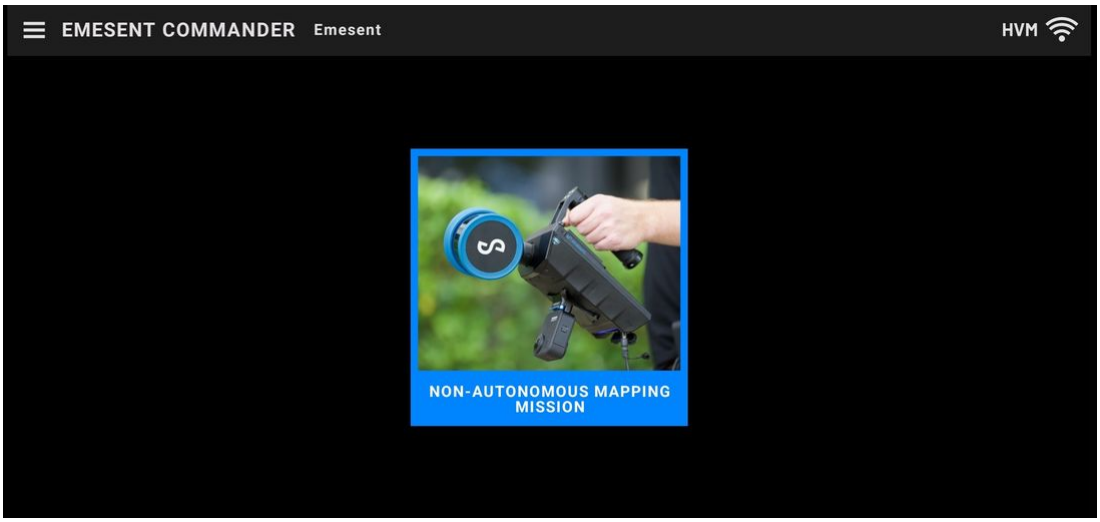


2. Tap **Connect** to display the **Network Settings** window where you can manage your connections. Refer to the Getting Started with Emesent Commander section for detailed instructions on connecting to Hovermap.

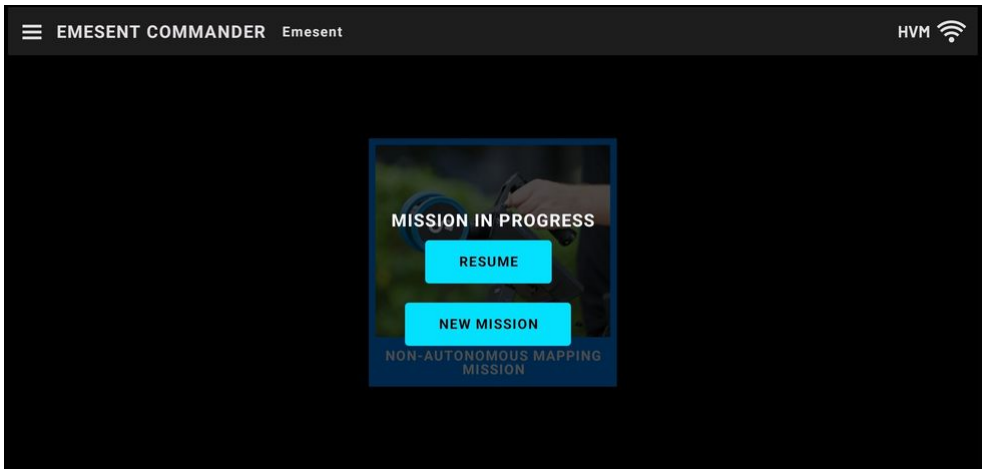


3. To begin, tap the **Non-Autonomous Mapping Mission** tile.

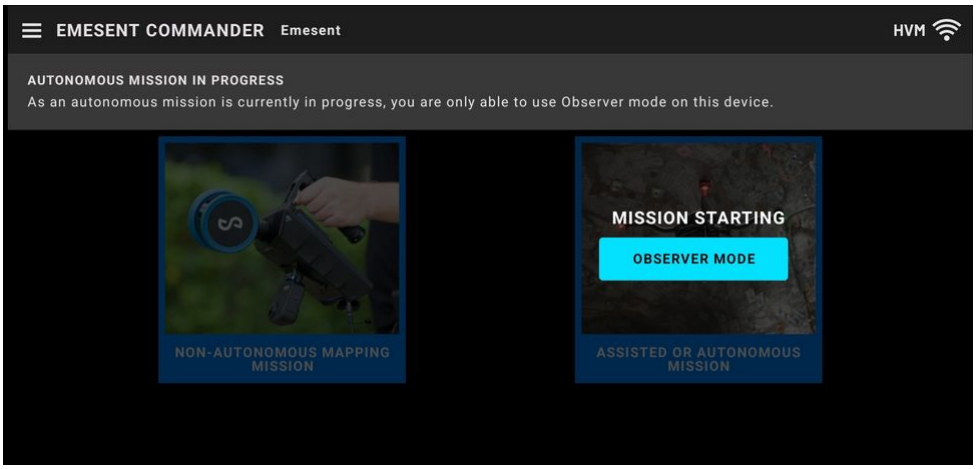
> Smartphone operation only supports a scanning mission in Mapping mode.

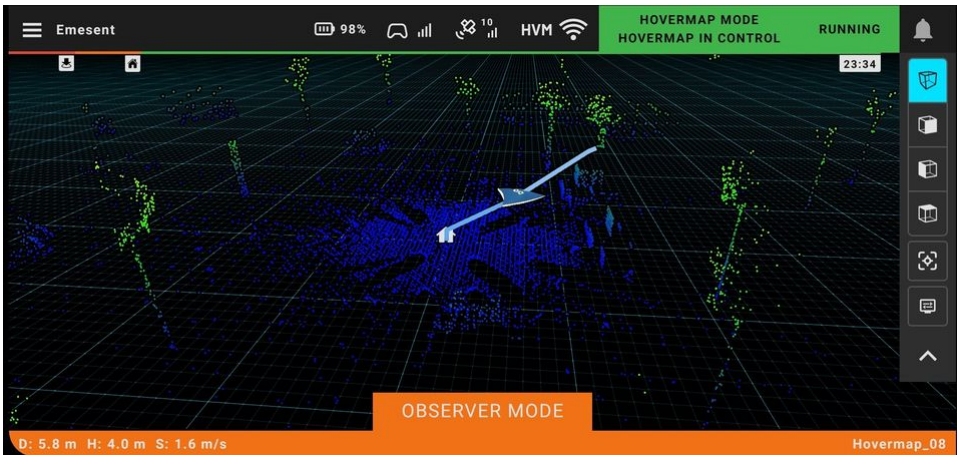


If a Mapping mode mission is in progress, you can resume that mission or start a new one.

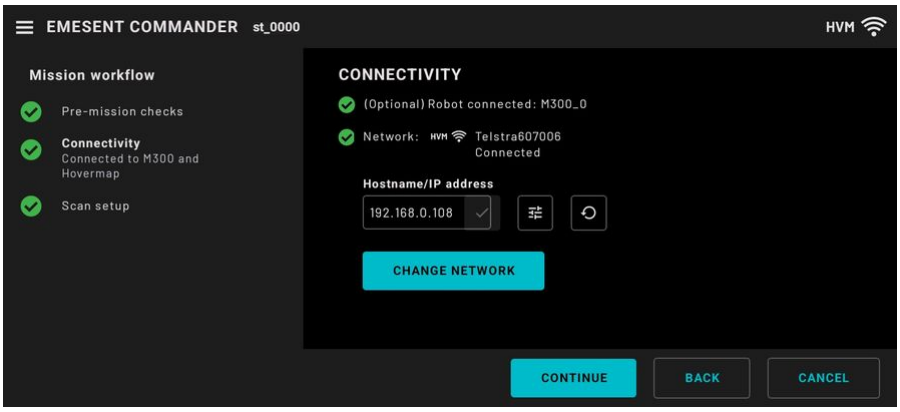


If an Autonomous mode mission is in progress, you can only monitor the mission in **Observer Mode**.

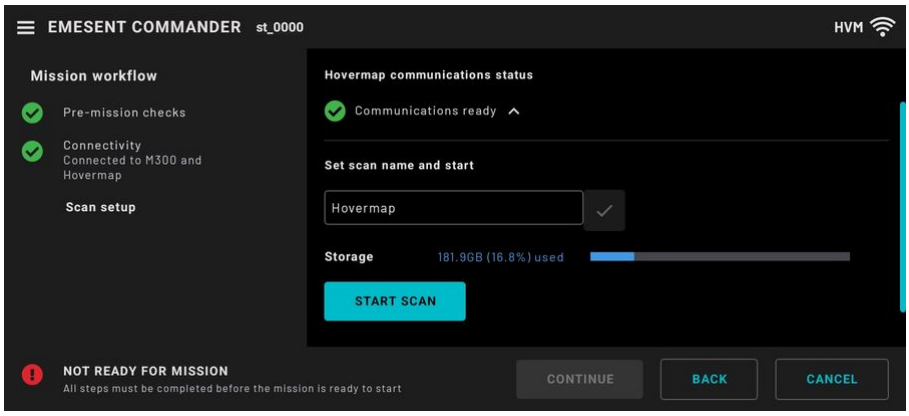




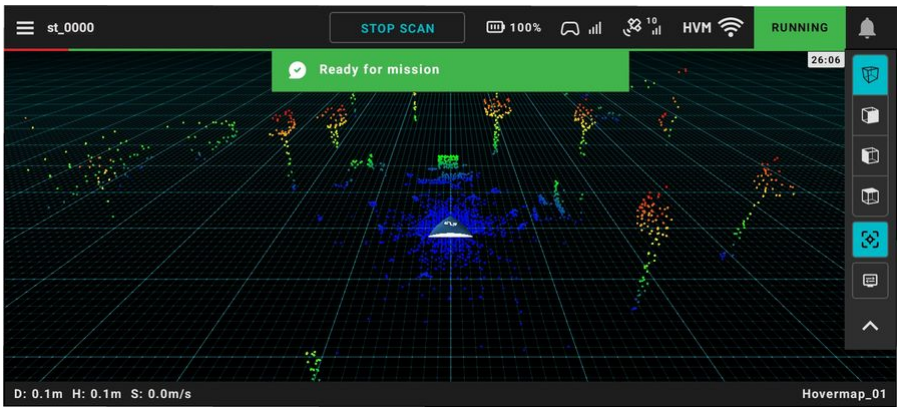
4. In the **Pre-mission checks page**, read, check, and confirm each inspection item as you finish.
5. In the **Connectivity** page, check that you are connected to the correct Hovermap and robot (if any) then tap **Continue**. To change the connection, tap **Change Network** or specify the **Host** or IP **address**.



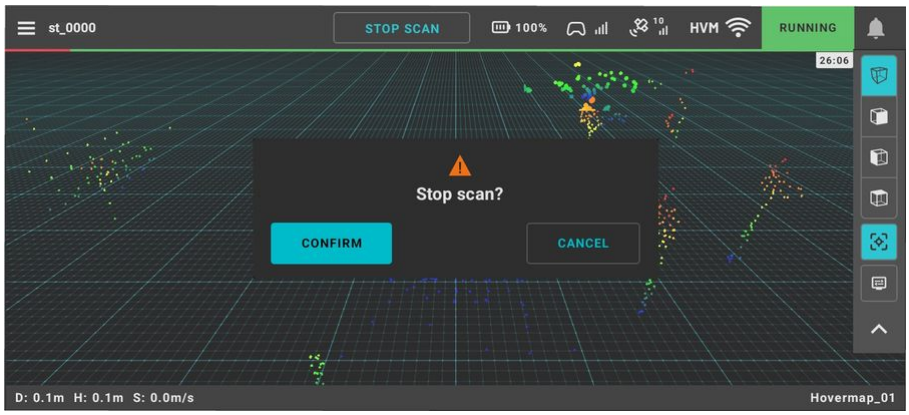
6. In the **Scan setup** page, enter a name for the mission then tap **Start Scan**.



7. Once the pre-scan checks are complete and the scan has started, tap **Continue**. Refer to the Emesent Commander User Interface section for more information on the Main View components.



8. Tap **Stop Scan** to end the mission. Once you have captured everything you need, you can download your scan data off Hovermap and then process your data using Emesent Aura.



3.3 Using the Map Widget (DJI only) and Overlay View

The **Map Widget** provides real-time mapping capabilities, for DJI users when the remote controller is connected. This enables users to monitor drone telemetry data overlaid on a map, ensuring situational awareness even without a reliable connection. This capability is essential, particularly in Pilot Assist and Autonomous missions, where precision and operational insight are critical.

In addition, the **Overlay** feature facilitates seamless transitions between the map, first-person view (FPV), and point cloud view, ensuring a comprehensive understanding of the operational environment.

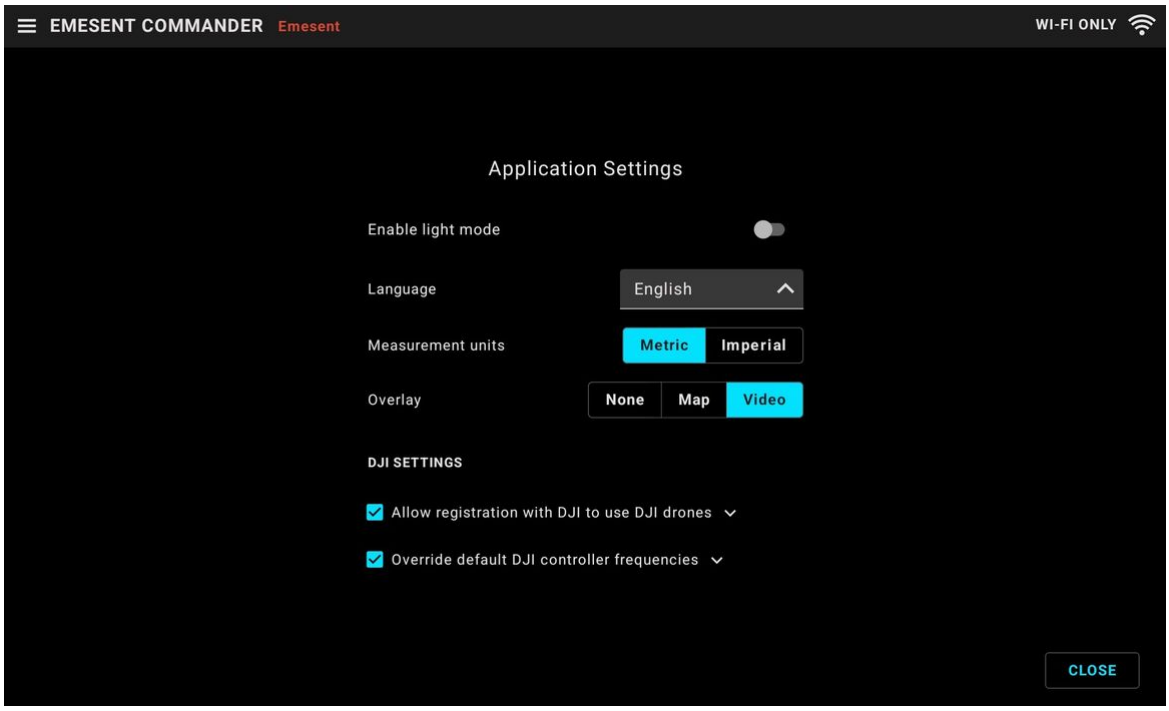
3.3.1 Downloading the Map

When initiating a mission for the first time, you may notice that the map overlay appears empty. This is due to the initial download process required for the map data. Once the download is complete, the map will populate with the relevant geographic information and become fully interactive.

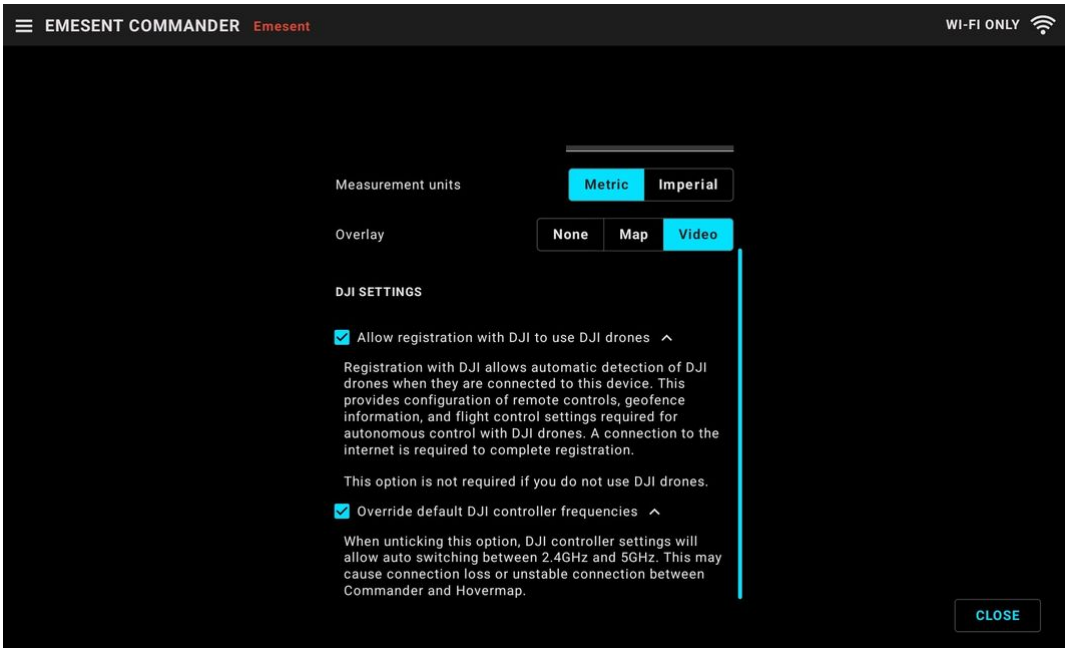
1. Connect your tablet to a Wi-Fi network with internet access.
2. Launch the Emesent Commander application.

On the **Application settings** page:

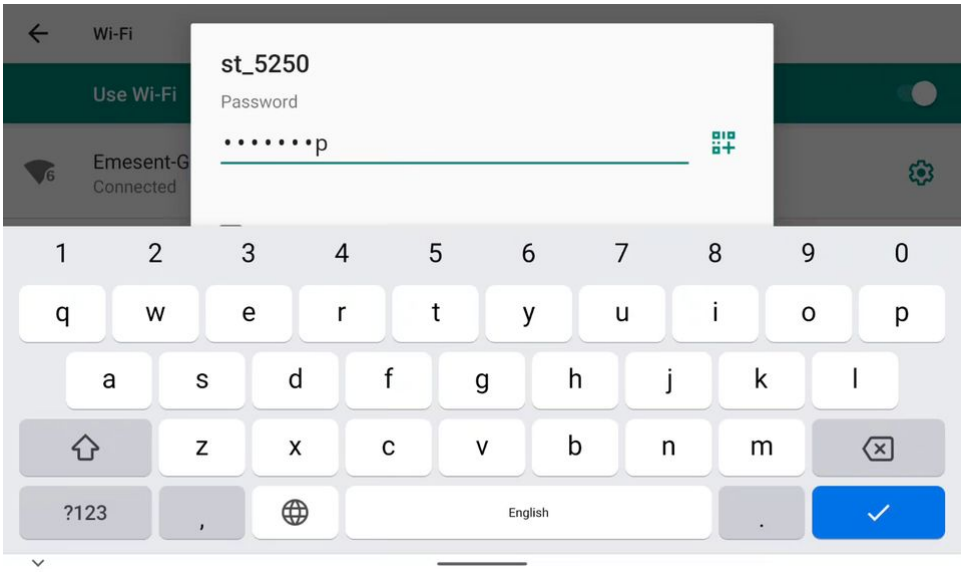
1. Enable the option to **Allow registration with DJI to use DJI drones**.
2. Enable the option to **Override default DJI controller frequencies**.



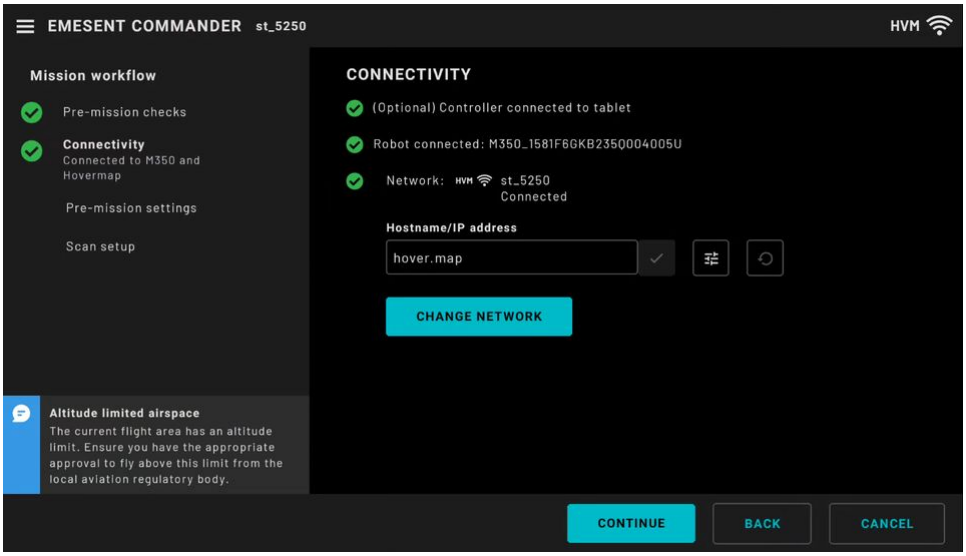
Or the user information page when running the app for the first time.



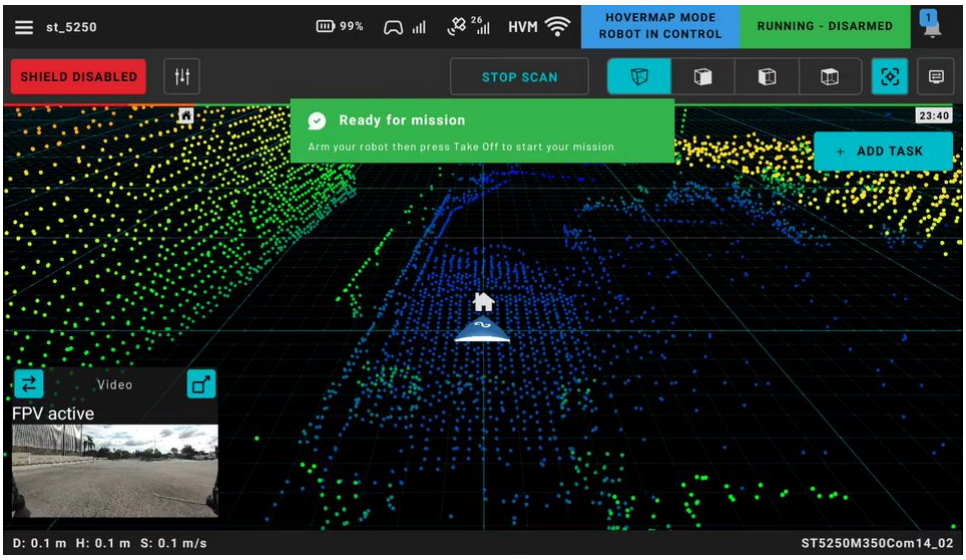
4. Connect to your Hovermap's Wi-Fi network. Refer to the Getting Started with Emesent Commander section for detailed instructions.



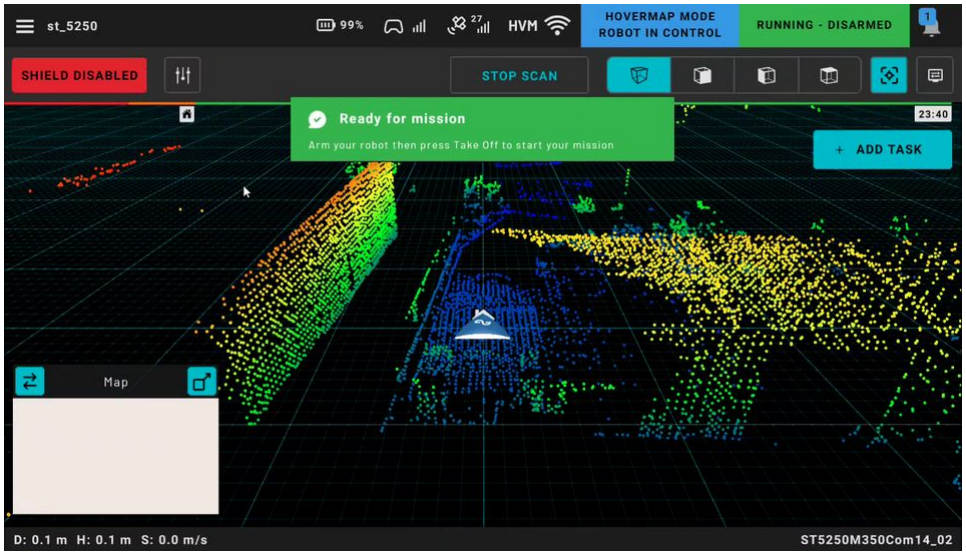
5. Connect the remote controller. You should see the controller connected on the **Connectivity** page.



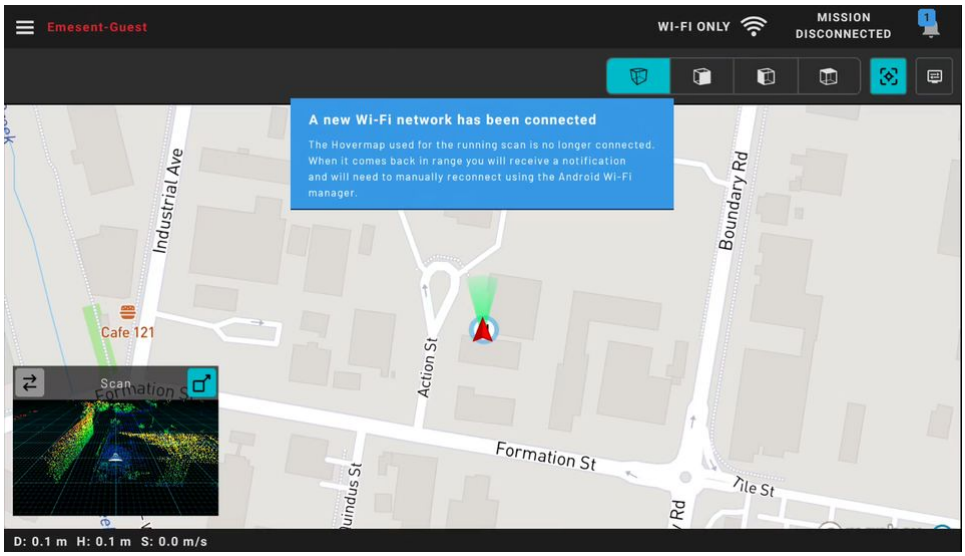
6. Start a Pilot Assist or Autonomous mission. The FPV feed is displayed as the overlay by default.



7. Tap the **Switch** button (or go to **Application Settings**) to change to map overlay. You will notice that the map appears empty.



8. Connect to a Wi-Fi network with access to the Internet. Once connected, a map of your area is automatically downloaded.

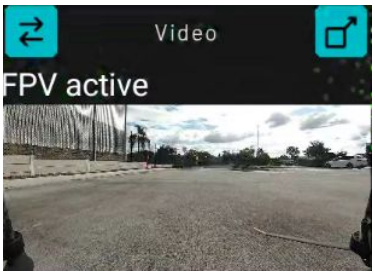


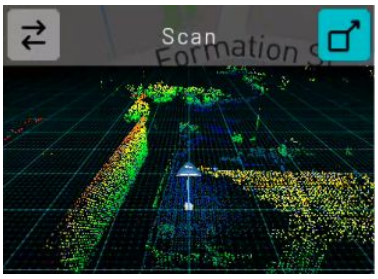
> You can download maps for alternate locations by navigating to those areas on the map. However, it is important to note that the cache will be cleared when the application is restarted.

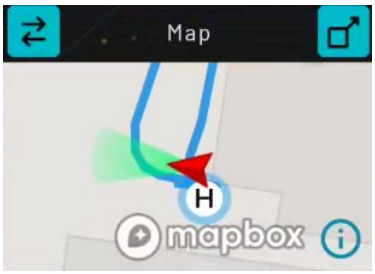
9. Change the connection back to your Hovermap's Wi-Fi network.

3.3.2 Switching/Expanding Views

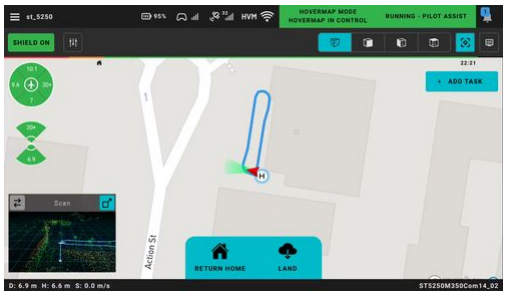
The overlay can be easily changed between the point cloud, map, and FPV feed by tapping ⇄ on the top left.

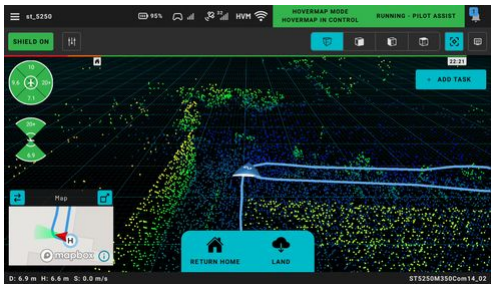






To expand the current overlay into the Main View, tap ⧉.





> ⚠ The point cloud is always visible in the system. If the point cloud is in the **Overlay**, it cannot be switched out to view FPV and the map simultaneously.

3.3.3 Adding Tasks

When the Main View displays either the map or the FPV feed, adding a task automatically replaces the view with the point cloud, and the map is displayed on the Overlay. Refer to the Mapping, Pilot Assist, or Autonomous Mission for detailed instructions on adding and editing tasks.

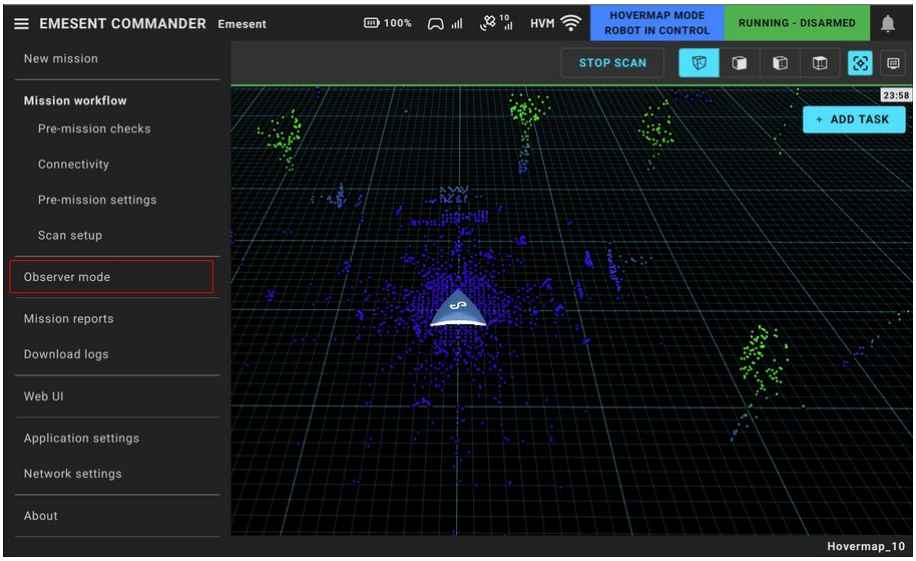
3.4 Observer Mode

Observer Mode enables viewing of the ongoing mission in real-time on multiple Android devices, ensuring that stakeholders, supervisors, or team members can monitor the progress from different locations or using different devices.

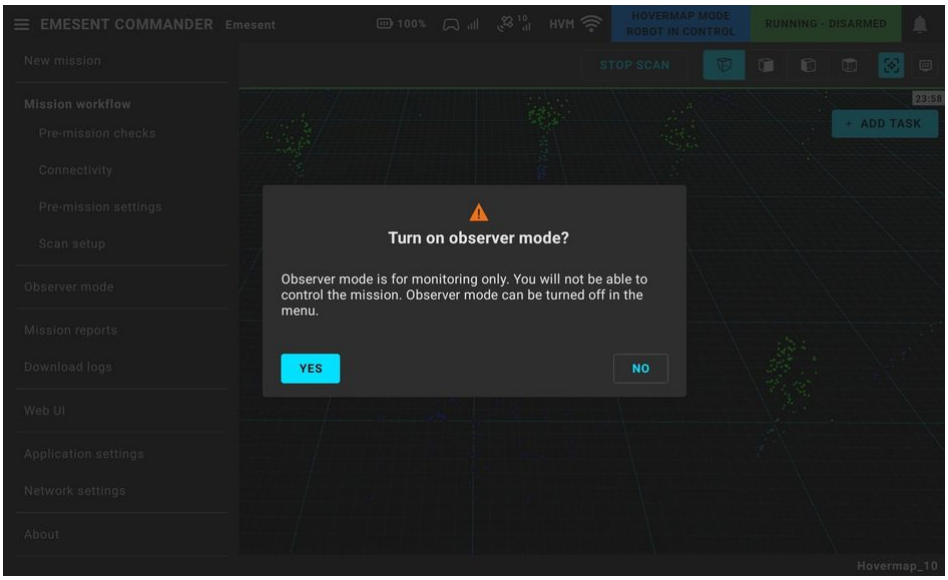
> ⚠ While observers can view the mission progress, control over mission settings and robot operation are disabled to ensure that those monitoring cannot inadvertently interfere with the ongoing operation.

> ℹ Observer Mode on the Freefly Pilot Pro is available via an ethernet connection. To use this mode, connect another tablet to the ethernet port on the Freefly Pilot Pro. This will require the use of an ethernet cable and a USB-C to ethernet adapter.

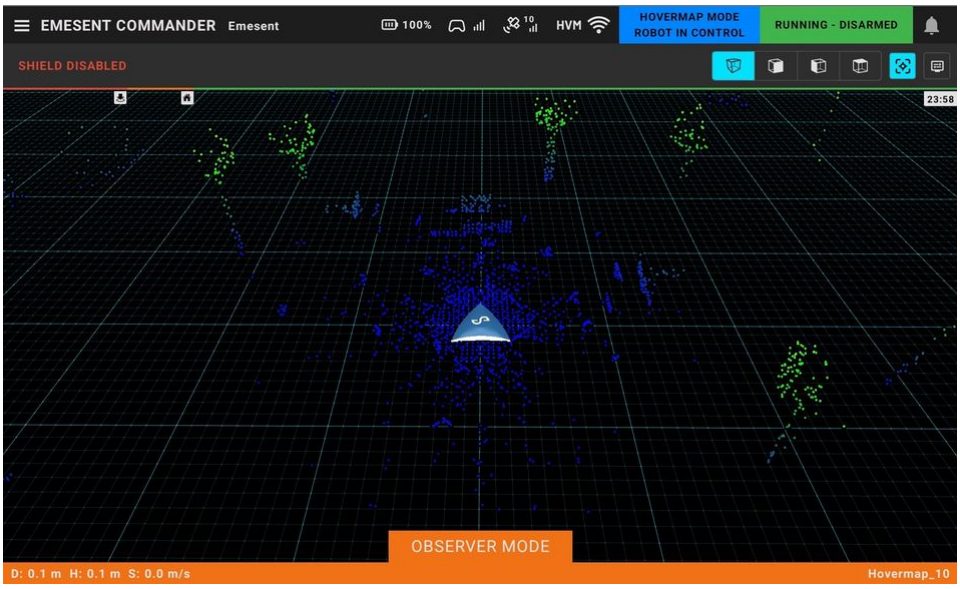
1. Connect to the Wi-Fi network of the Hovermap you want to observe.
2. Tap the **Hamburger** button on the top left of the screen to access the **Options Menu**.
3. Tap **Observer Mode**.



4. Confirm the action when prompted.



5. Interact with the point cloud via the camera control buttons or use multi-touch gestures. Refer to the Emesent Commander User Interface for more information.



6. To exit Observer Mode, return to the **Options Menu** then tap **Observer Mode** again.

3.5 Mission Review and Reports

Commander provides two tools for reviewing mission data after a scan is completed:

- **Review Missions**: Enables onboard processing of scans to validate capture quality and generate outputs without requiring post-processing in Aura. This supports rapid verification and faster workflows in the field.
- **Mission Reports**: Displays detailed scan information, including available scans for download, scan metadata, height-over-time graphs, and event logs. It also supports note-taking for in-progress scans.

3.5.1 Review Missions

The **Review Missions** screen is the primary interface for **onboard scan processing** using Hovermap. It enables users to **validate mission results** and generate outputs **without requiring post-processing** in Aura. Onboard processing supports:

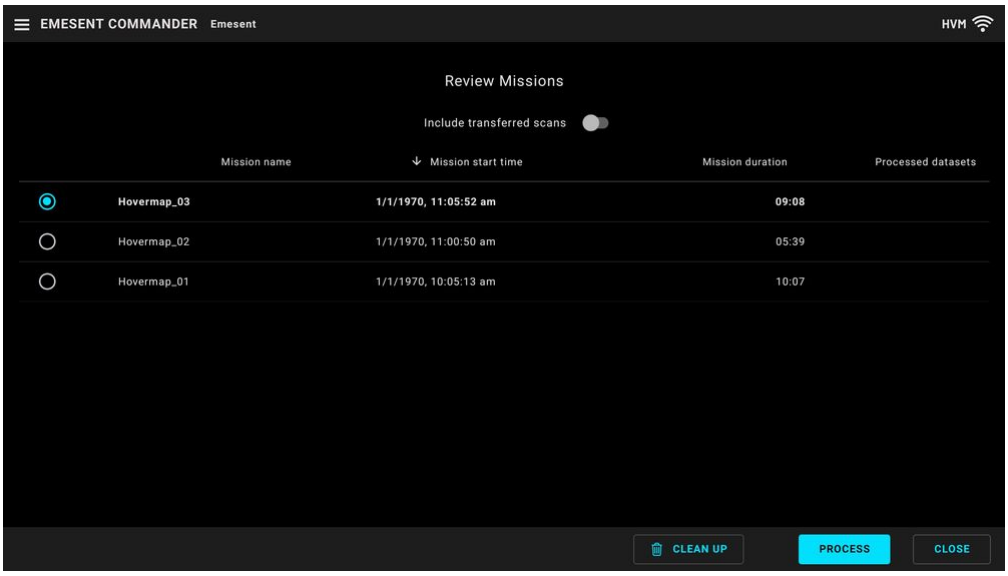
- Immediate **validation of captured data**
- Generation of **quick outputs**
- **Rapid, in-field decision-making** when full Aura processing is not required

3.5.1.1 Overview

After a scan is completed, it appears in the **Review Missions** list. Each mission displays the following information:

- **Mission name**: The name of the mission, set at the time of capture.
- **Mission start time**: The time the scan began for that mission.
- **Mission duration**: The total duration of the scan.
- **Processed datasets**: The number of times the dataset has been processed onboard.

Use the **Include transferred scans** toggle to display missions that have already been **transferred off Hovermap** to an external device or application.



Missions are only visible when connected to the **same Hovermap** that captured and processed them. For example:

- When connected to **Hovermap 1**, only scans from Hovermap 1 are shown.
- When connected to **Hovermap 2**, only scans from Hovermap 2 are shown.

The **Review Missions** screen also includes the following additional actions:

- **Clean Up** – Removes all scans no longer on the HVM or scans previously processed from another HVM
- **Close** – Exits the **Review Missions** screen and returns to the **New Mission** menu.

3.5.1.2 Processing a Scan

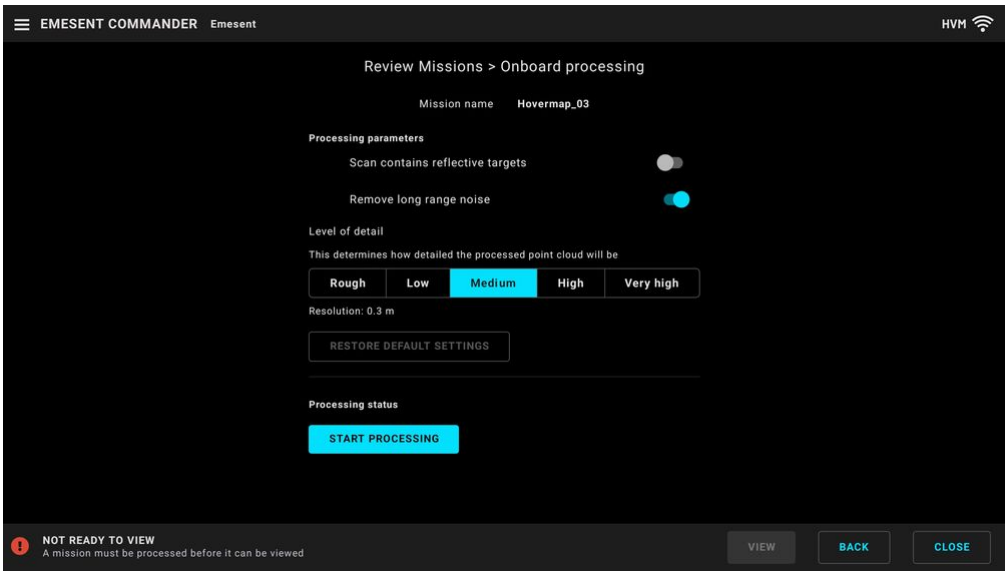
To process a scan onboard Hovermap:

1. **Select** the mission by checking the box next to the **mission name**.
2. Click **Process** in the **bottom-right corner** of the screen.
3. Choose a **Level of Detail** (This configures the distance between points)
4. (Optional) Configure additional processing options:
    - **Scan contains reflective targets** (This will remove high reflectivity points)

- **Remove long-range noise**

5. Click **View** to load the **mission review**.

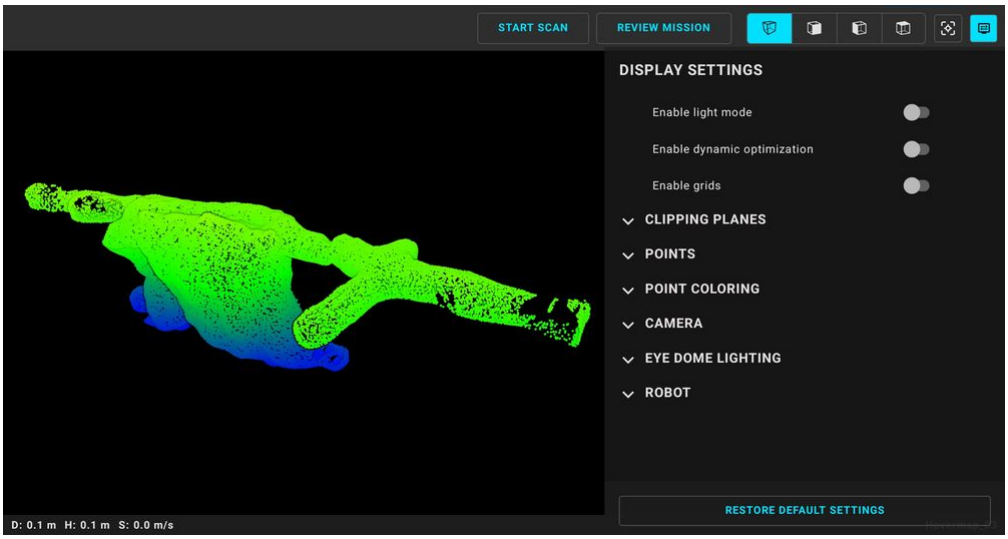
> Higher detail levels generate more precise outputs but may increase processing time and resource usage.



3.5.1.3 Interacting with the Scan

To change how a point cloud looks, use the display settings which are available by pressing the icon to the right of the camera buttons at the top of the application. Clipping planes are available in these display settings tools.

- To zoom, use two fingers to pinch the view.
- To pan, use two fingers to drag the view.
- To rotate (in perspective camera view only), use one finger and drag the view.
- To teleport, double-tap the view.



3.5.1.4 Review Processed Missions

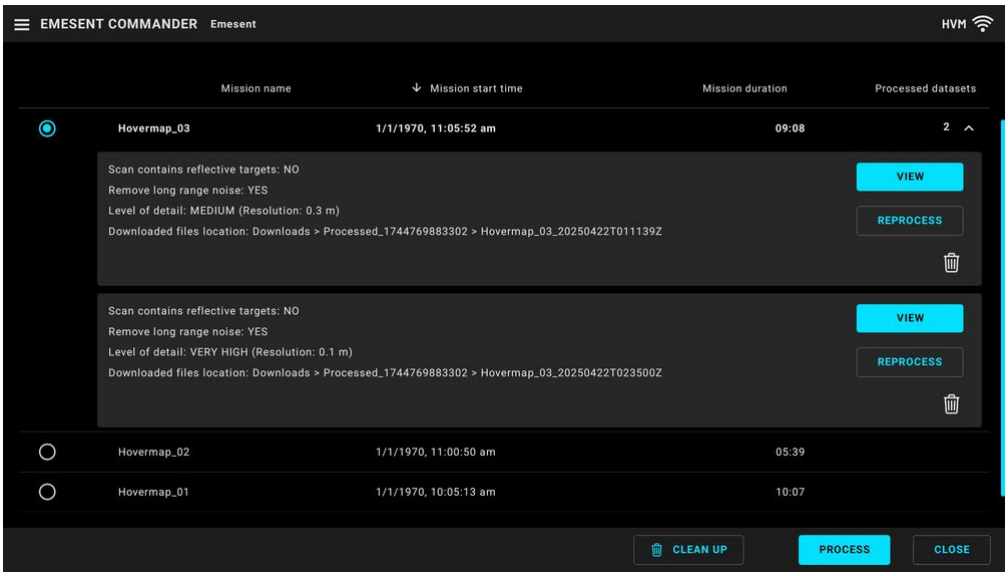
Once processed each mission can be **expanded** to show details of individual scans.

To expand a mission:

- Click the **dropdown arrow** on the right side of the mission entry.

The expanded view allows you to:

- **View** each processed scan including:
  - The **processing settings** used
  - The **file location** if the scan has been transferred to the device running Commander
- **Reprocess** a scan with different settings
- **Delete** scans that are no longer needed



3.5.1.5 Processed Scan Location and File Transfer

Scans processed in Commander are processed **on the connected Hovermap unit**, not on the device running Commander.

> ⚠ Processing a scan does not automatically transfer the output to your local device.

To transfer a processed scan to your device:

1. **View** the scan in Commander.
2. This action **triggers the file transfer** from Hovermap to your local machine.

Once transferred, scan files are available on Hovermap at the following path:
`Downloads/OnboardProcessingResults/"ScanName_ProcessedDate"/`

You can **export** scan data from this location as needed.

> ℹ The **exact download location** on your local device is shown in the **Review Missions** UI.

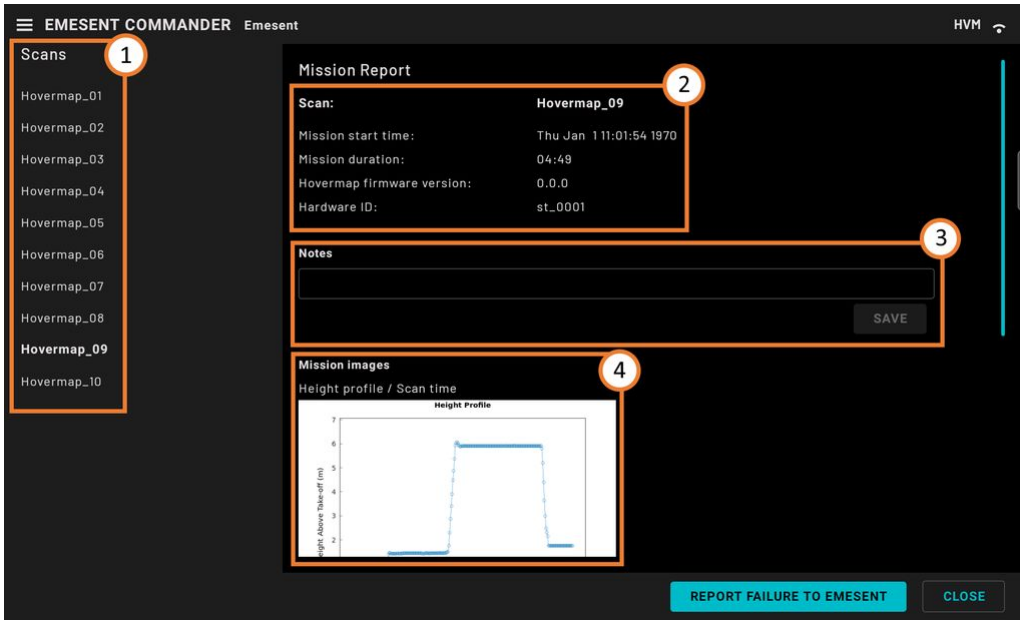
For stope mapping applications, surveyors can **reduce time to insight** by using **onboard processing** to generate `.laz` **files** directly on the **Hovermap**. These files can be quickly exported to **Deswik** or other **mine planning software**, enabling **faster turnaround** and more **streamlined workflows**.

3.5.2 Mission Reports

The Mission Report contains a complete list of all available scans for download, including the scan currently in progress (if any). It provides details about the chosen scan and features a graph displaying the scan height and time. Additionally, it includes specific event logs for each scan.

> The scans are arranged chronologically, with the latest appearing at the top. Scans that have been transferred are not included.

> You can add notes to a scan that is in progress, but some information may not be available until the scan is finished. Most of the information will be shown only after the scan has been stopped.



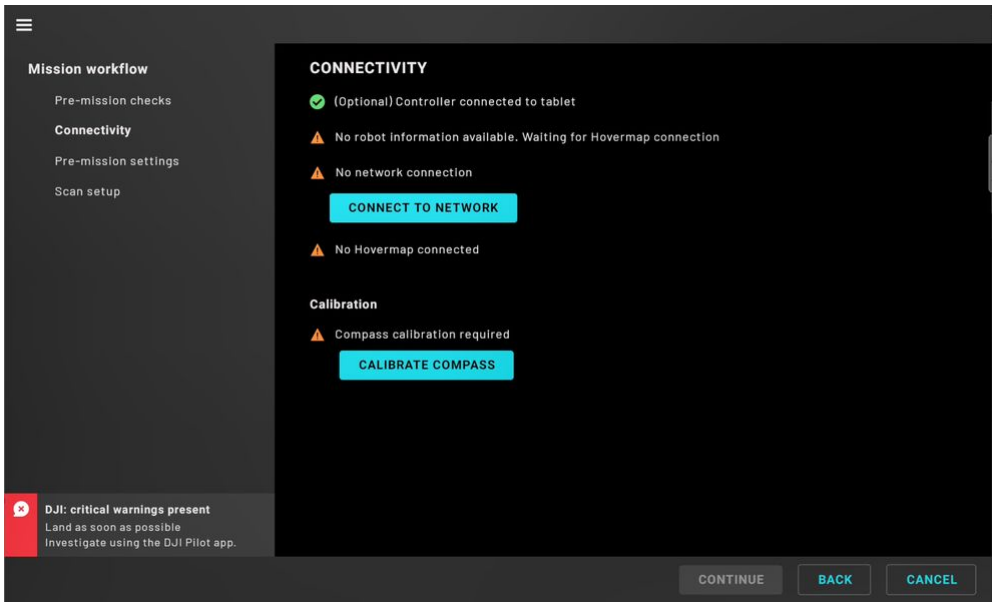
1	Scans	A list of all scans, which are available for download from the connected Hovermap,
2	Scan Properties	• **Scan:** Name assigned to the selected scan. Usually, scan names convey the purpose or location of the scan. • **Mission type:** Indicates whether the scan is a **Non-autonomous Mapping Mission** or an **Assisted or Autonomous Mission**. • **Mission start time:** Indicates the exact time when the mission was started. This timestamp is crucial for tracking and logging purposes. • **Mission duration:** The total elapsed time of the entire mission, from when the scan was started until it was stopped. • **Emesent Cortex version:** Specifies the firmware version in use during the mission. • **Hardware ID:** Identifies the specific Hovermap used in the mission.

3	Notes	Allows you to add annotations, comments, important details, and observations related to the selected scan. Tap **Save** when done. This information is saved in a **mission notes.txt** file that is stored in the scan file after the data has been transferred to your computer.
4	Mission Images	Displays a graph representing the Hovermap's altitude (scan height) throughout the mission, plotted against time. The x-axis represents the time (in seconds), progressing from the start to the end of the mission, while the y-axis denotes the altitude in meters above ground level.
5	Mission task overview	Provides a detailed timeline of significant mission activities.
6	Report Failure to Emesent	Displays the steps required when reporting a failure.

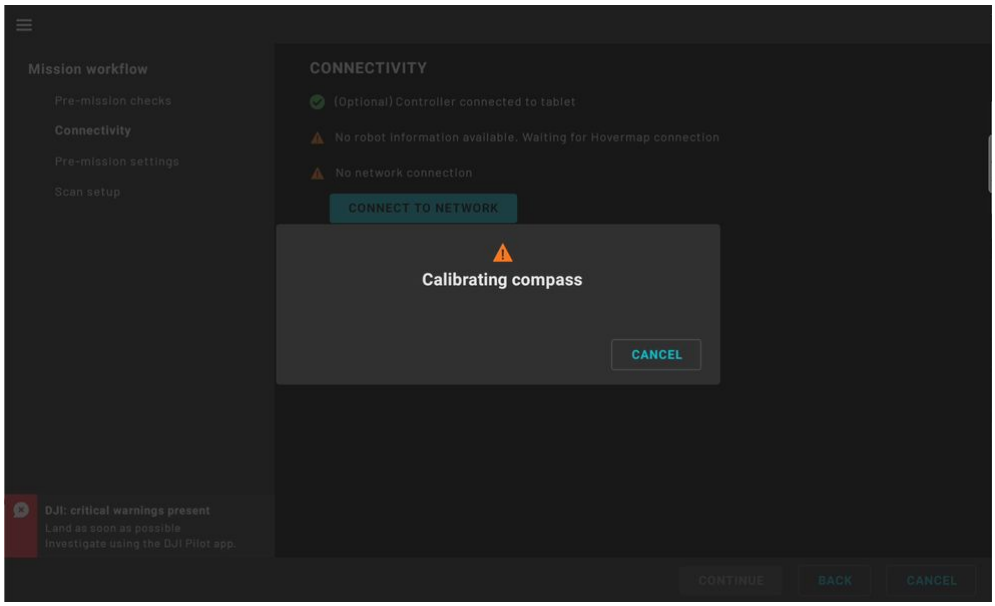
3.6 Calibrating the Drone Compass (DJI only)

Compass calibration can be done directly through Emesent Commander's Mission Workflow, ensuring the drone compass is accurately calibrated before takeoff, without the need to navigate through complex remote controller menus. Emesent Commander provides a user-friendly, step-by-step guide of the calibration process with clear instructions and visual cues.

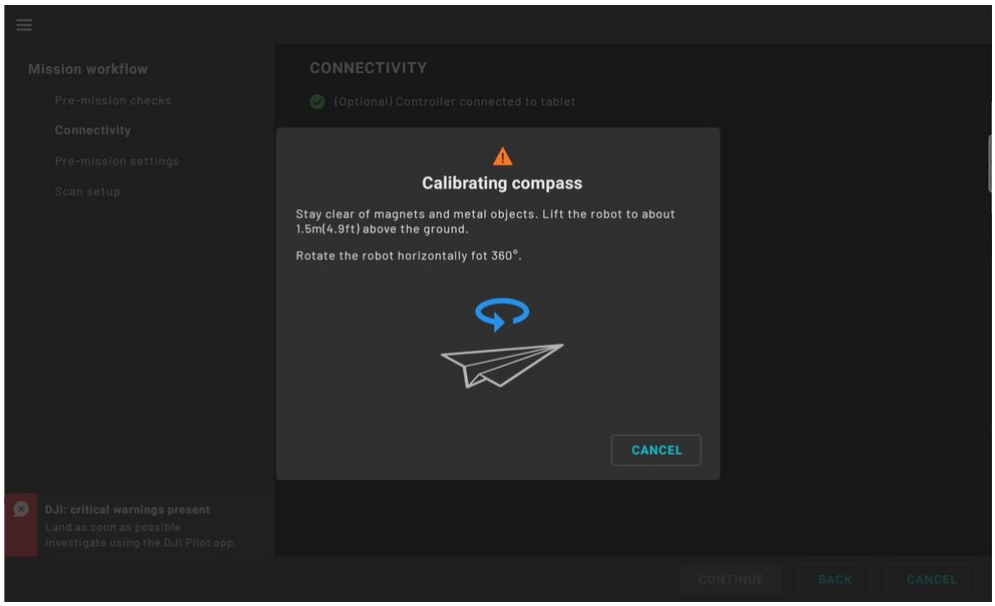
1. Start a mission by tapping on the **Assisted or Autonomous Mission** tile from the app's landing page.
2. Complete the required pre-mission checks then tap **Continue**.
3. On the **Connectivity** page, you will see a notification if compass calibration is required.

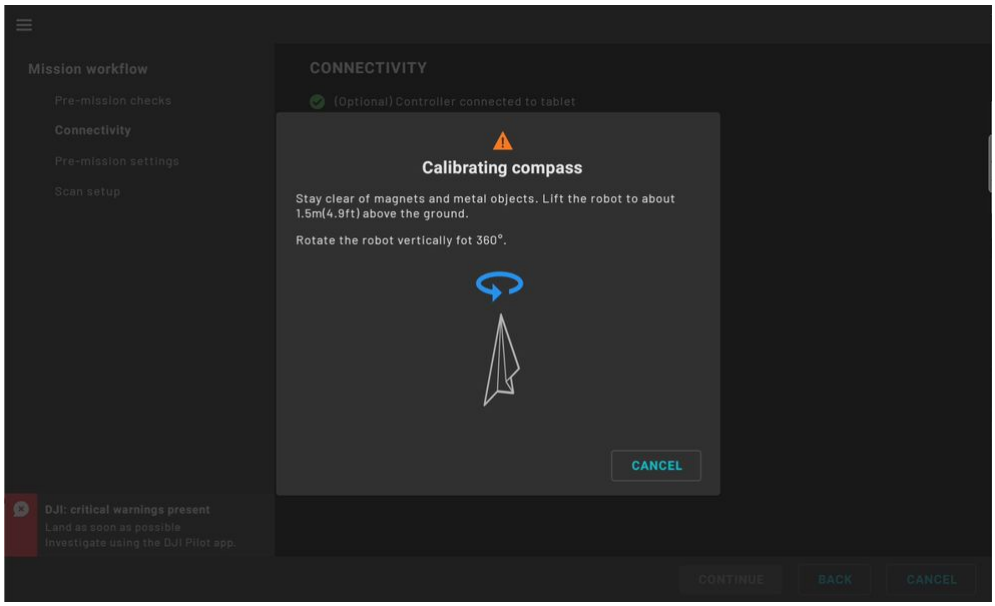

Mission workflow
Pre-mission checks
Connectivity
Pre-mission settings
Scan setup
CONNECTIVITY
(Optional) Controller connected to tablet
No robot information available. Waiting for Hovermap connection
No network connection
CONNECT TO NETWORK
No Hovermap connected
Calibration
Compass calibration required
CALIBRATE COMPASS
DJI: critical warnings present
Land as soon as possible
Investigate using the DJI Pilot app.
CONTINUE
BACK
CANCEL

4. Tap on the **Calibrate Compass** button to start the process.

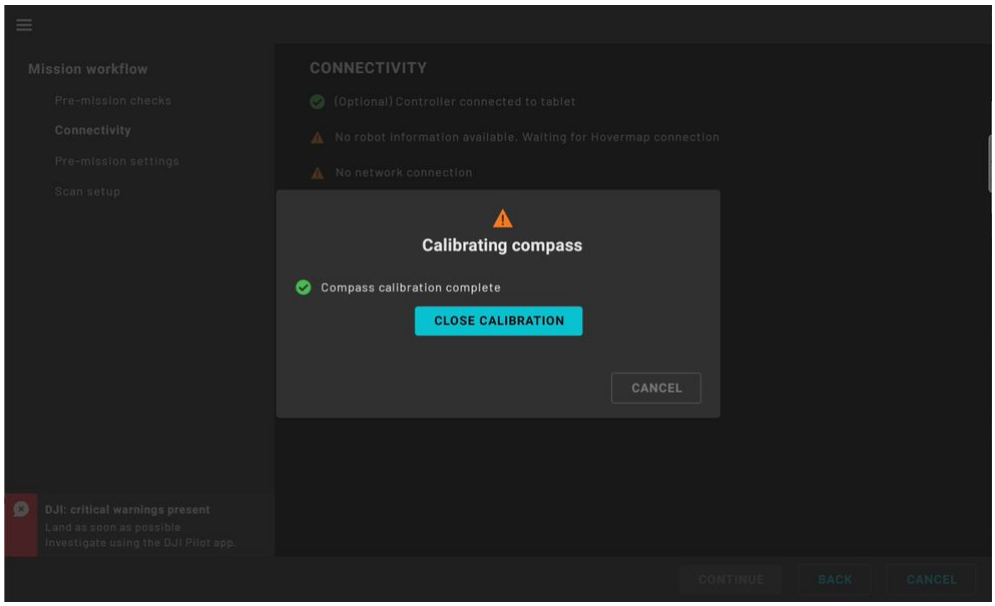


5. Follow the on-screen instructions. These instructions involve rotating your robot vertically and horizontally.

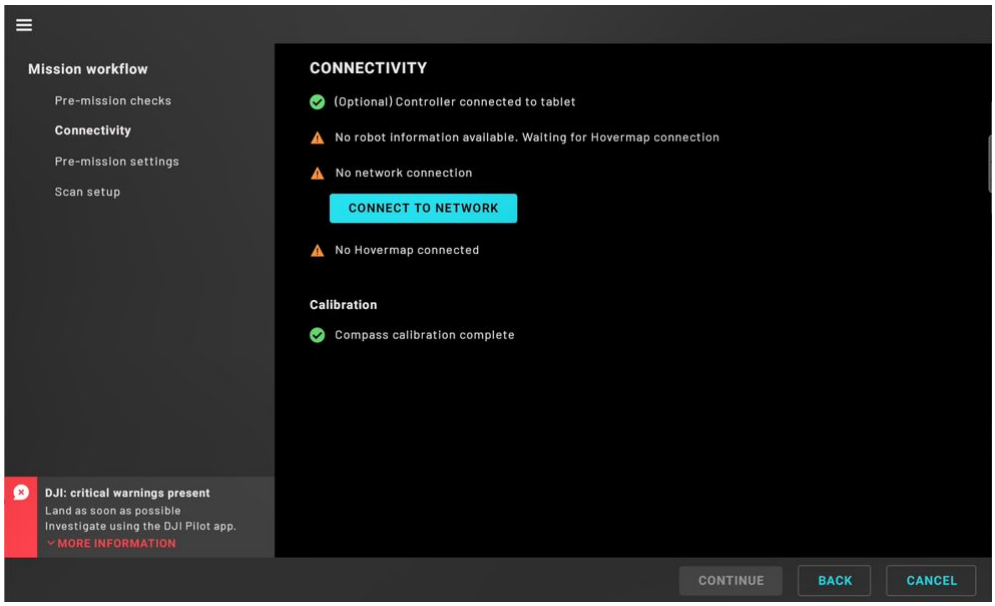




6. Once you have completed the calibration, a message is displayed indicating that the calibration was successful.



7. Tap **Close Calibration** to return to the main **Connectivity** page.



8. Proceed to perform the rest of the Mission Workflow steps. Refer to the Mapping, Pilot Assist, or Autonomous Mission section for more information.

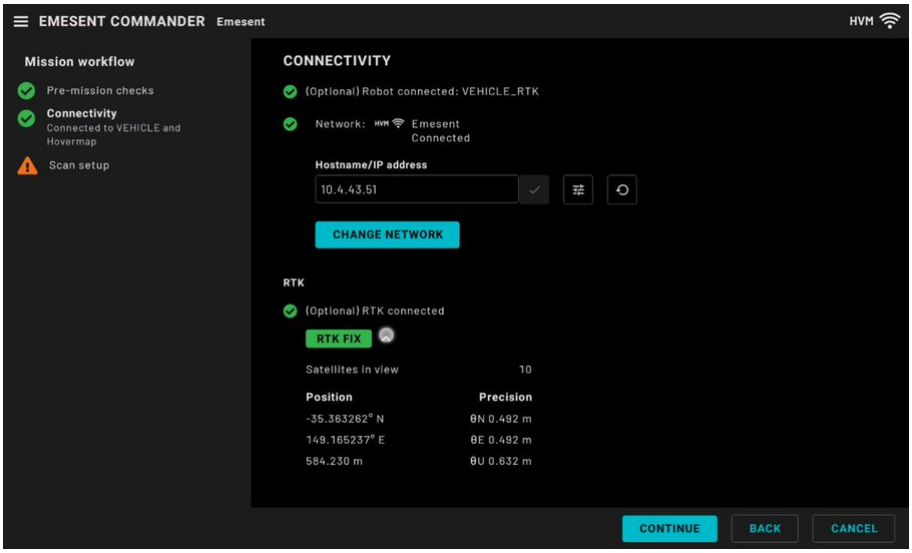
3.7 Monitoring RTK Status

Emesent Commander provides clear visibility of the RTK status before and during the mission, updated in real-time. This enables you to monitor RTK quality without leaving the app to check for information via the GNSS receiver's native application.

> Emesent Commander only provides RTK information from GNSS receivers connected to Vehicle RTK and Backpack RTK devices. RTK data from drones such as the M350 cannot be accessed through the application.

3.7.1 Mission Workflow

Before a scan is started, RTK information is provided in the **Mission Workflow**. The **Connectivity** page shows in real-time if a GNSS receiver is connected to a Vehicle RTK or Backpack RTK. The **RTK** section at the bottom of the dashboard displays, in a dropdown list, the RTK quality, number of satellites, position, and precision.

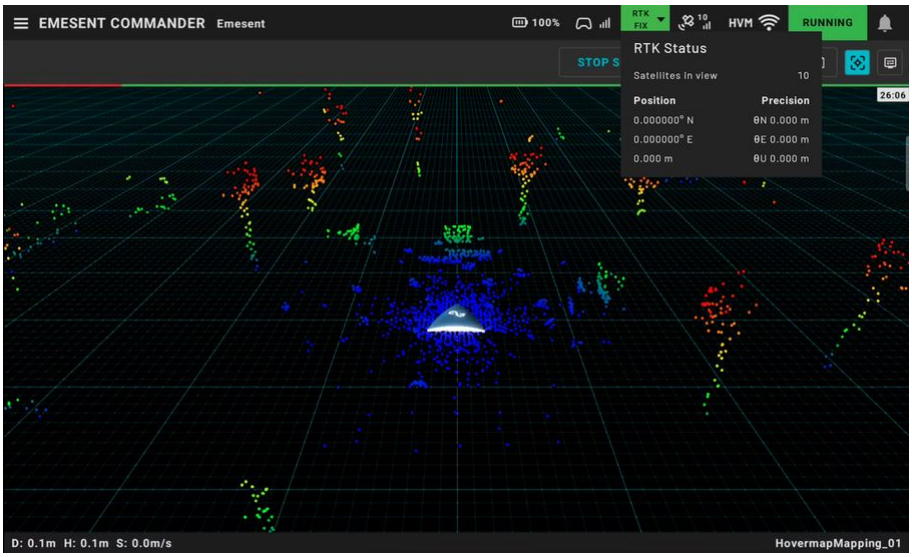


> If Emesent Commander detects that a GNSS receiver is connected but is offline, you cannot continue to the next page or start the scan.

3.7.2 Main View

During the scan, the RTK Status and the number of satellites which the GNSS receiver receives signals from, are displayed on the main header.

Tap the drop-down arrow beside the RTK Status to display the RTK quality, number of satellites, position, and precision; see the table below for RTK Status descriptions.



RTK Status	Description
RTK Fix	This is the best status you can achieve with RTK. It means the receiver has successfully locked onto enough satellites and received corrections that allow it to determine a very precise position. An RTK fix is highly accurate, often within a few centimeters.
RTK Float	This means the GNSS receiver is using RTK corrections to improve GPS accuracy, but it has not yet achieved a fully stable and accurate fix. It is still refining the position, so there might be slight inaccuracies.

RTK Status	Description
RTK Single	This status is less precise and is typically used when RTK corrections are not available or when lower accuracy is acceptable. RTK Single can also display when the GNSS receiver is not receiving corrections from the base station. If you are in an environment where RTK Fix or RTK Float is expected, and are only receiving RTK Single, check your GNSS Receiver settings to ensure corrections are configured correctly.
RTK Offline	The GNSS receiver is not sending all required GPS information to the Hovermap. This can occur when there is a loss in communication with the base station or correction source, such as during signal dropout or when the receiver is not connected to a correction service. You can try the following troubleshooting steps: • Disconnect the GNSS receiver's cable and then reconnect it. • Ensure the GNSS receiver settings are configured correctly. • Reboot the GNSS receiver.
No GPS	The GNSS receiver is online but it has no RTK or GPS signal.

3.7.2.1 Expected RTK accuracy

The table below displays the approximate accuracy for each RTK status. However, it is important to note that the actual accuracy can vary due to multiple factors and the stated accuracy is not guaranteed.

GPS Status	Approx. Horizontal Georeferencing Accuracy
RTK Fixed	3cm
RTK Float Fix	30cm
GPS	1.5m - 3m
No GPS Fix	N/A

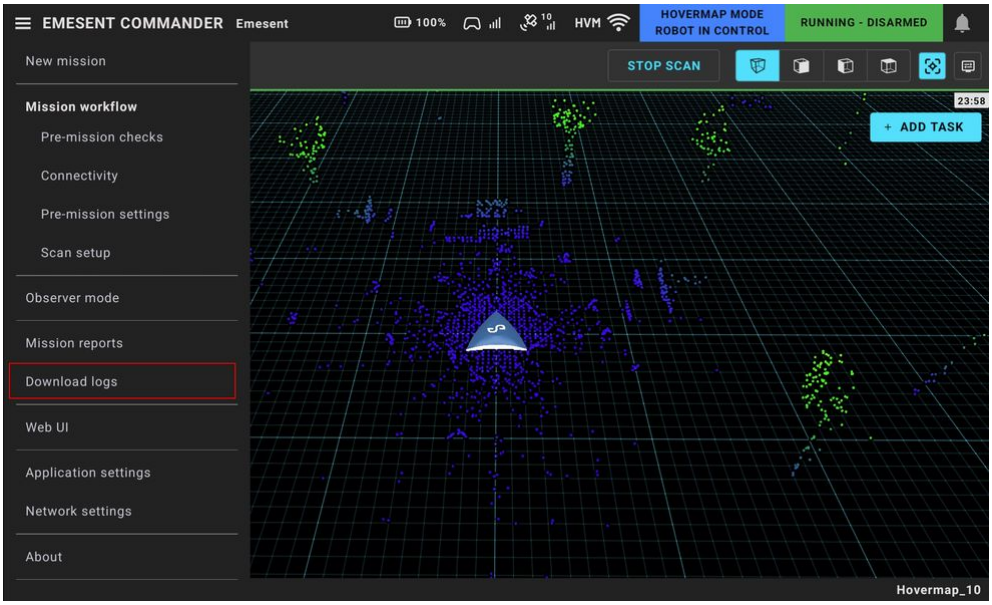
It is important to understand that the global (georeferencing) accuracy is different than that of local point cloud accuracy. Poor RTK quality might only slightly affect point cloud accuracy. This means that when you scan with poor RTK, the scan might be less accurate compared to the ground truth, but measurements between objects within the point cloud will still be accurate.

3.8 Download Commander Log Files

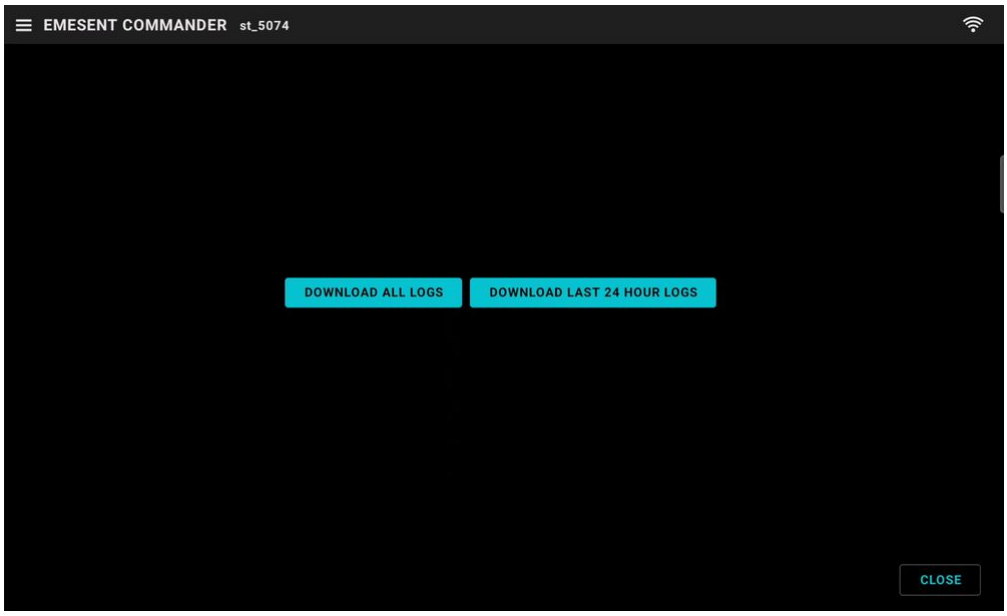
Follow these steps to download a zip file containing the Emesent Commander application log files.

> Access to **DJI** or **Freefly Astro** aircraft flight logs requires a USB connection between the tablet and the remote control. Please refer to these articles for instructions:
>
> - Recover DJI flight logs
> - Recover Freefly Astro & Astro Max flight logs

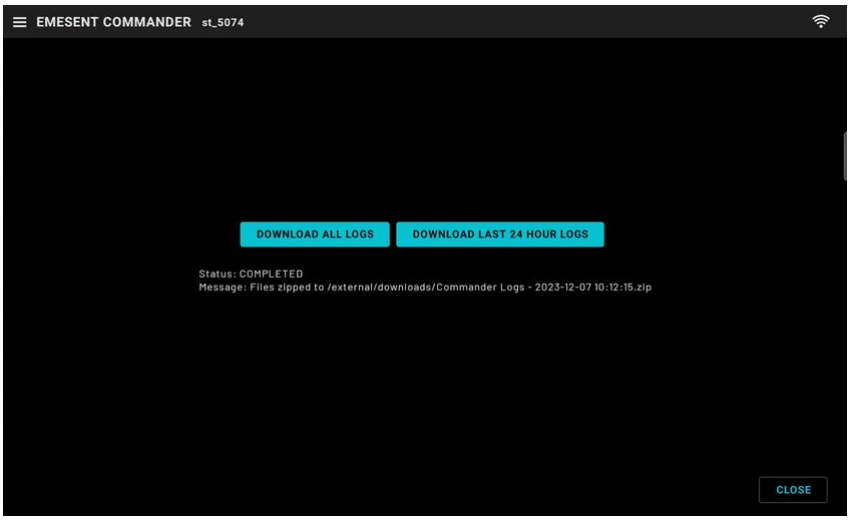
1. Launch the Emesent Commander app.
2. Tap the **Hamburger** button on the top left of the screen to access the **Options Menu**.
3. Tap **Download logs**.



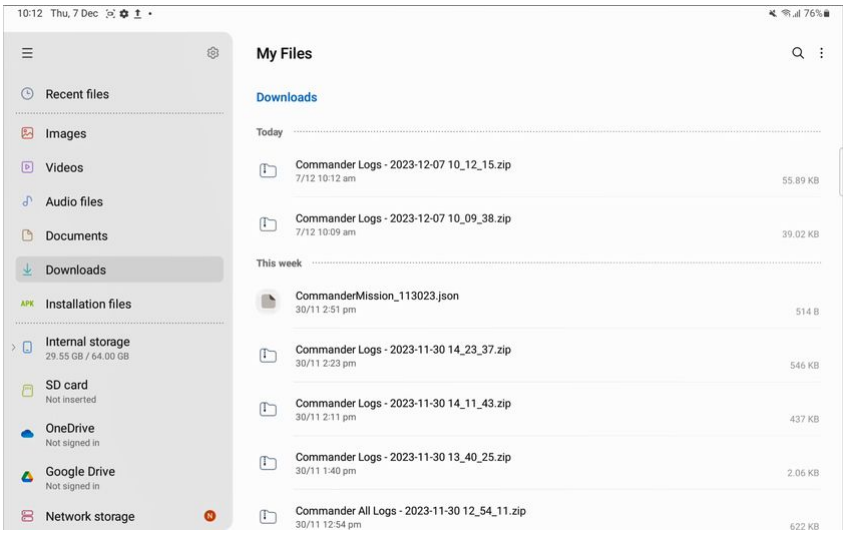
4. Select if you want to download all logs or only those captured within the last 24 hours.



5. Tap **Close** once you get the notification that the download is completed.



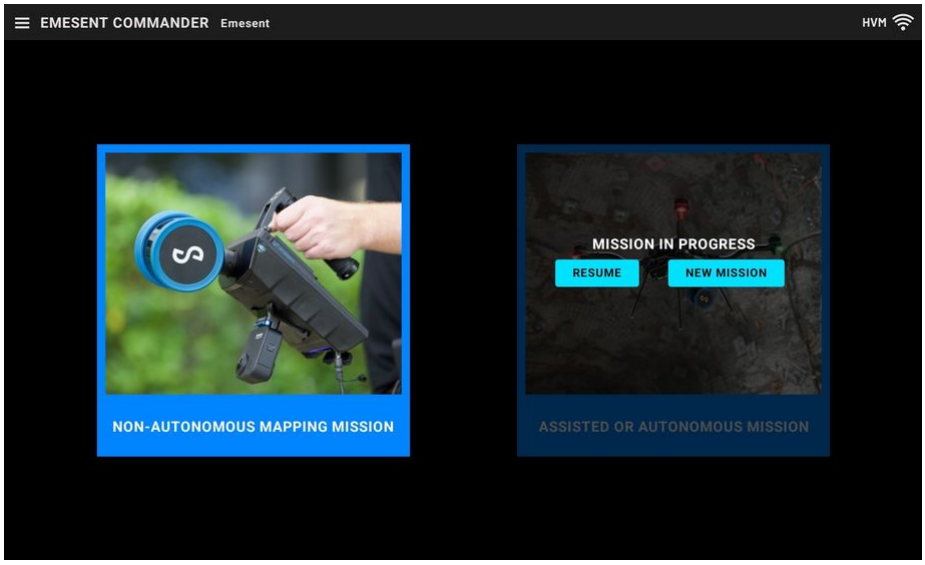
6. Open the **My Files** app on your tablet (or the equivalent app for your Android version).
7. Go to the **Downloads** section to access the downloaded logs.



8. Connect SSD/ USB to tablet, or Astro Max controller. Store Commander log file on USB/SSD

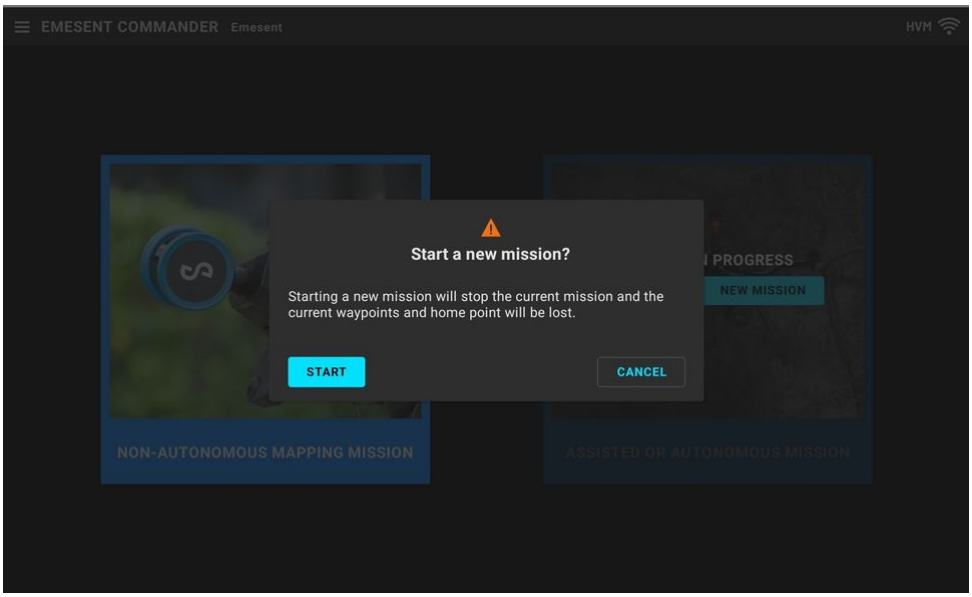
3.9 Resume a Mission in Progress

If the app is restarted while a mission is in progress, you have the option to resume that mission or start a new one when the app is reloaded.



Select **Resume** to skip the **Mission workflow**. You are immediately directed to the main screen.

If you choose to start a new mission, a confirmation dialog reminds you that starting a new mission ends the current one. Tap **Start** to access the **Mission workflow**. For more information on starting a new mission, refer to the Emesent Commander Operations section.



Starting a new mission while an existing autonomous mission is in progress will cause loss of control of the robot (if it is still executing a mission). A new mission should only be started if the robot is in a safe position.

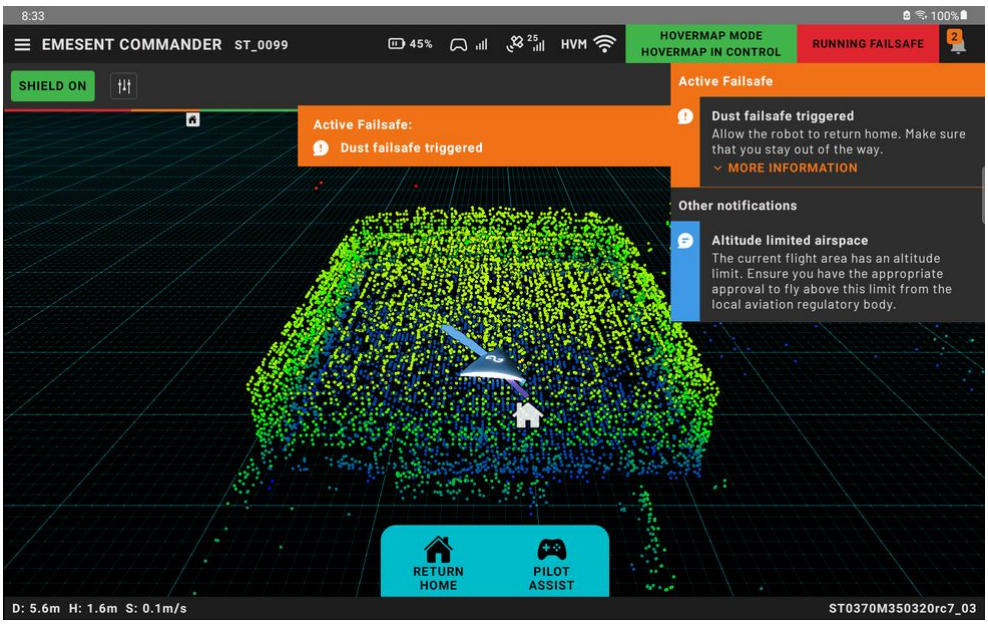
4. Failsafes and Notifications

4.1 Operational Failsafes

Hovermap has been engineered to operate autonomously when attached to a compatible robot or vehicle. It can take these platforms into unsafe places, or where it is simply impossible to go with other systems. In response to a failure during Autonomy-assisted missions, Hovermap has a range of operational smart failsafes to ensure safe and reliable operation.

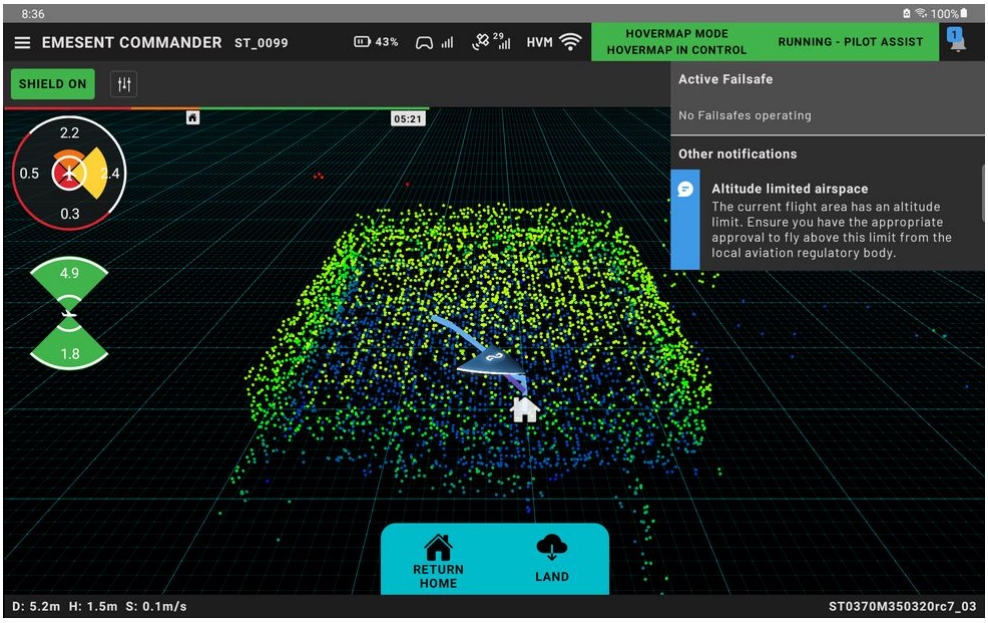
> Only one failsafe can be active at any given time. Therefore, failsafes are ordered in a prioritized list as indicated by the priority number in the table below. In case multiple failsafes are triggered, the one with the lowest priority number will be prioritized.

When a failsafe is triggered, it will be displayed as a notification in the **Active Failsafe** area beside the **Notification** button. Click that notification to see more detailed information about the failsafe. All other notifications (if any) are shown below the failsafe in order of severity.



> When a failsafe is active, no other notifications will appear in the **Main View**. They can still be shown by clicking the **Notification** button.

Once the failsafe has been completed, it will be removed from the **Active Failsafe** area and notifications are displayed as per normal operation.



Priority	Description	Operator Action	Pre-requisite	Abort-able
Robot Link Loss				
1	The link between the robot and Hovermap has been lost. Hovermap will try to re-establish a connection with the robot and take control of the robot.	Take manual control of the robot and land immediately. Do not take off if the robot is on the ground.	N/A	This failsafe will self-abort when the connection to the robot has been re-established.
Control Authority Denied				
2	The robot is not allowing Hovermap to take control. Hovermap will keep requesting control of the robot.	Land the robot immediately. Do not take off if the robot is on the ground.	N/A	The failsafe will self-abort when the robot allows Hovermap to take control.

Control Authority Loss				
3	Hovermap has lost control and authority over the robot. Hovermap will attempt to re-acquire control of the robot	Take manual control of the robot and land immediately. Do not take off if the robot is on the ground.	N/A	The failsafe will self-abort when Hovermap re-acquires control of the robot.
Robot Control Not Take-able				
4	Hovermap indicates that it can't take control of the Robot. Hovermap will monitor the state of the robot to check when it can take control.	Land the robot immediately. Do not take off if the robot is on the ground.	N/A	The failsafe will self-abort when Hovermap assesses that it is safe to do so.
Hardware Integrity				
5	Hovermap has detected that the robot has sustained physical damage. Hovermap will attempt to put the robot into a safe state.	If safe to do so, take manual control of the robot, land, and disarm the motors immediately.	N/A	Not abort-able

Launch Error				
6	Hovermap has aborted a take-off.	Monitor the drone as it disarms or lands. Ensure that the shield settings are set appropriately, there are no objects in the vicinity of the robot, and attempt to re-launch.	N/A	Not abort-able
State Estimation Critical				
7	Hovermap has lost all of its navigation sources (SLAM and GPS). Hovermap will Land the robot.	Take manual control of the robot and land immediately. Do not take off if the robot is on the ground.	N/A	Not abort-able
Battery Critical				
8	Hovermap has detected that the robot's battery source has reached a critical level. Hovermap will land the robot.	Monitor	N/A	Not abort-able

Path Planner Stuck (Heavy Dust)				
9	Hovermap has detected that it is not able to navigate through the environment. The robot will retrace its path back through the environment for 30 meters or until it gets to home. During this period, Hovermap is unable to register any new obstacles that have moved into its path. After Hovermap has retraced its path for 30 meters, it will initiate a Return to Home sequence.	Monitor	N/A	The user can abort the failsafe at any time via the Commander app. The user can abort the failsafe at any time by toggling the flight mode switch out and back into Hovermap mode twice (double toggle).

Lidar Data Integrity				
10	Hovermap has detected that its lidar points are starting to not be able to reach the objects around it due to atmospheric conditions. Hovermap will start to Return to Home immediately to remove itself from the atmospheric conditions.	Monitor	N/A	The user can abort the failsafe at any time via the Commander app. The user can abort the failsafe at any time by toggling the flight mode switch out and back into Hovermap mode twice (double toggle). **Note:** Once the Lidar Data Integrity failsafe triggers there will be a constant notification advising to return home immediately. This notification will persist for the remainder of the mission, even after the Lidar Data Integrity failsafe has been aborted by the user.

State Estimation Degraded				
11	Hovermap has lost its primary source of navigation. Hovermap will wait for up to 10 seconds to regain a navigation source (SLAM or GPS) If a navigation source is acquired, Hovermap will initiate a Return to Home. If after 10 seconds a navigation source is not acquired, the 'State Estimation Critical' failsafe will be triggered.	Monitor Take control in Pilot-Assist mode and land as soon as possible.	N/A	The user can abort the failsafe at any time via the Commander app. The user can abort the failsafe at any time by toggling the flight mode switch out and back into Hovermap mode twice (double toggle). **Note:** Once the State Estimation Degraded failsafe has been aborted, it will not trigger again until the robot has landed and disarmed.
Battery Low				
12	Hovermap has detected that the robot's battery source has reached a low level. Hovermap will initiate a Return to Home sequence	Monitor	N/A	The user can abort the failsafe at any time via the Commander app. The user can abort the failsafe at any time by toggling the flight mode switch out and back into Hovermap mode twice (double toggle). **Note:** Once the low battery failsafe has been aborted, it will not trigger again until the robot has landed and disarmed.

GCS Link Loss				
13	Hovermap has detected that it has lost its connection to the Commander App and has reached its final waypoint with no further instruction. Hovermap will initiate a Return to Home sequence	Monitor	The GCS Link Loss failsafe will only trigger if the robot arrives at the last user-defined waypoint and the GCS link has been lost	The failsafe will self-abort when Hovermap regains connection to the GCS and arrives at either the Home point or the Rally point. The user can abort the failsafe at any time via the Commander app after the GCS link has been restored. The user can abort the failsafe at any time by toggling the flight mode switch out and back into Hovermap mode.
RC Link Loss				
14	Hovermap has detected that the robot no longer has a link to its remote control unit and is being operated in Teleoperate mode. Hovermap will initiate a Return to Home Sequence	Monitor	The RC Link Loss failafe will only trigger if the robot is being operated in Pilot Assist mode and the RC link is lost.	The failsafe will self-abort when Hovermap regains an RC connection and arrives at either the Home point or the Rally point. The user can abort the failsafe at any time via the Commander app. The user can abort the failsafe at any time by toggling the flight mode switch out and back into Hovermap mode.
Data Recording Stopped				
15	The remaining data storage is below 2GB.	Land	N/A	Not abort-able

Data Storage Critical				
16	The remaining data storage is below 5GB. Hovermap will initiate a Return to Home Sequence	Monitor	N/A	The user can abort the failsafe at any time via the Commander app.
Not Ready to Arm				
17	Hovermap has detected that it is not yet in a state for the robot to be armed. Hovermap will send a notification to the user.	Do not attempt to take off.	N/A	Not abort-able
18	Hovermap has detected that its CPU temperature is reaching a high limit. Hovermap will send a notification to the user.	Take care when handling the Hovermap payload. The heatsink on the payload may be hot.	N/A	Not abort-able
Data Storage Low				
19	The remaining data storage is below 20GB. Hovermap will send a notification to the user.	Monitor Consider returning to home before data storage is exhausted	N/A	Not abort-able

4.2 Warnings and Notifications

Notifications provide situational information regarding the status of your mission, including the Hovermap and your robot. In addition, a notification may also include the recommended operator action.

4.2.1 Notification Types

There are two different types of notifications.

- Pre-mission Notifications: Shown in the mission workflow only when starting a scan, during pre-checks. They will not occur once pre-checks have been passed.
- Notifications During Mission: These can occur at any point after a scan has started. If failures are associated with an active failsafe, the system will report it is running degraded.

Additional notifications are also available from the following sources:

- Platform Notifications
- DJI Notifications (only when connected to a remote control)
- Tablet Notifications
- Commander Status Notifications

4.2.2 Notification Severities

4.2.2.1 Error Notifications

When a problem is encountered, notifications appear as a popup at the top of the application. In addition, you can tap the **Notification** button on the main view to see the list of all active critical errors, warnings, and status notifications. The list is ordered by severity and reported time (the highest severity with the most recently reported time is displayed at the top).

Notification	Description
Critical	Indicated by a red icon and accompanied by three successive “beep” sounds. This notification indicates that the problem requires immediate attention. Swipe on the notification to close it.
Warning	Indicated by an orange icon. This notification indicates that the problem may impact operation so continued observation is required. Swipe on the notification to close it.
Caution	Indicated by a blue icon. This notification indicates that the problem requires monitoring but presents no hazard. This notification is only displayed when you tap the **Notification** button.

4.2.2.2 Operational Status Notifications

Operational Status notifications provide information on ongoing actions and let you know when these actions are successful. They look similar to and appear in the same place as error notifications in the Main View, but have different icons. Also, there is no option to tap (for further action) or close these types of notifications.

Notification	Description
Status	Indicated by a blue background. This notification provides information on system actions currently in progress. This notification automatically clears after 10 seconds.
Success	Indicated by a green background. This notification shows when an action has been completed successfully (e.g. “Ready for mission”). This notification automatically clears after 10 seconds.

4.2.3 Pre-mission Notifications

Notification	Description	Recommended Action
Critical		
Hovermap battery critical	The remaining battery capacity is insufficient to start a mission.	Replace or charge the battery.
Hovermap hardware link not connected	The hardware connection between the Hovermap and the robot is not working. The connecting cable may be faulty or unplugged.	Check the cable connection. If the failure persists, try using a different cable.
Please wait until Hovermap is ready before starting a mission	Hovermap's state estimation is not ready. A possible cause is a payload hardware error, but there are other possibilities.	

Notification	Description	Recommended Action
Robot baud rate incompatible	The data rate on the robot connection is set to an unsupported value. Consult the Hovermap user manual and reconfigure the robot.	Use DJI assistant to change the baud rate on the robot.
Robot firmware incompatible	The version of firmware on the robot is unsupported.	Change your firmware version to continue.
Robot platform type not supported	The robot is not supported for autonomous operations.	Change the type of robot connected to continue.
Robot hardware failure	There is a critical hardware error. For example, the system has crashed.	Refer to the user manual provided by the manufacturer or reach out to their customer support team.
Autonomous flight unavailable	Autonomous missions cannot be performed as planning the path between waypoints or detecting potential collisions is currently not possible.	Restart Hovermap and contact Technical Support Services via https://emesent.com/customer-support/
Robot requires restart	The robot requires a restart before pre-mission checks can be completed.	Restart the robot.
Warning		
License Expired	The mission cannot be started as the license for the current mission type has expired.	Update your software license. Contact licensing@emesent.io
Hovermap storage full	The remaining storage capacity is insufficient to start a mission.	Transfer scans off of Hovermap before starting a new mission. Once transferred, delete the scans from Hovermap to free up storage space.
Remote control not detected	The robot's remote control unit is not connected.	Power on the remote control unit, and ensure it can be used to control the robot.

Notification	Description	Recommended Action
Cannot arm - not ready	All pre-conditions required to allow arming have not been met. Other pre-mission checks failures may or may not indicate why this is.	Ensure all required pre-mission checks are completed.
Robot's onboard health checks failed	The robot's own onboard health checks have failed	Refer to the user manual provided by the manufacturer or reach out to their customer support team.
Robot's position not stable	The initial state estimation reports that the robot is not stationary.	If the robot is stationary, the robot will need to be restarted.
Caution		
Waiting for robot's position to stabilize	The robot or our own state estimation indicates that the robot is moving. This is likely because of errors induced by a previous landing, or the environment.	If the robot is stationary, the robot will need to be restarted.
Robot communication is not activated	The robot SDK has not been activated, which results in Hovermap being unable to communicate with the robot.	Refer to SDK activation with the DJI M300 and Hovermap for more information on how to activate the SDK.
Connection between Hovermap and user device not detected	There is no link to the Hovermap ground control station.	Ensure ground control station hardware is connected to the Hovermap Wi-Fi or Long Range Radio network.
Robot sensor error	The robot's sensors are providing the data required by Hovermap.	Refer to the user manual provided by the manufacturer or reach out to their customer support team.
Robot internal error	The robot is not ready for some unspecified reason.	Refer to the user manual provided by the manufacturer or reach out to their customer support team.

4.2.4 Notifications During Mission

Notification	Description	Recommended Action
Critical		
Hovermap battery critical	The remaining battery capacity has dropped to a level where the robot needs to land (if it's a UAV) and disarm.	
Lost Hovermap control	The robot has unexpectedly taken back control of the robot from Hovermap.	Switch to robot control mode.
Hovermap control refused	The robot has unexpectedly denied control to Hovermap.	Switch to robot control mode.
Robot hardware failure	There has been a failure in the robot or Hovermap hardware integrity. Generally, this means the robot has crashed.	Switch to robot control mode to return home. Check the robot's condition and restart the robot.
Lost robot link	The control and telemetry link to the robot has been lost. This may be caused by a failure in the interface cable, or it becoming unplugged.	Switch to robot control mode and land as soon as possible.
Navigation solution failure - lost navigation	No usable state estimate is available. The robot will return home via the rally point set.	Switch to robot control mode and manually return to home safely.
SLAM solution failed	The local SLAM solution has failed. This indicates that the data captured in this mission will not result in a good map.	Stop then restart your mission to continue.
Warning		
High Hovermap temperature	The CPU has undergone throttling events recently, and the heatsink may be hot to the touch.	Avoid touching the Hovermap body while hot.

Notification	Description	Recommended Action
Hovermap battery low	The remaining battery capacity has dropped to a level where the robot needs to return home. The robot will return home via the rally point if set.	Allow the failsafe to complete.
Connection between Hovermap and user device was lost	The link to the ground control station has been lost, at a time in the mission where it is required. The robot will return home.	Monitor for safe flight.
Take off aborted	The robot encountered difficulty in executing the takeoff procedure. This can occur when there are obstacles near the robot.	Check for obstacles near the robot.
LiDAR point loss	The LiDAR has encountered an environment in which it cannot operate effectively. The robot will return home via the rally point if set.	Allow the failsafe to complete.
Dust failsafe triggered	The path planner is unable to make a plan, and is 'stuck'. This is most likely to happen because of excessive dust. The robot will return home via the rally point if set.	Allow the failsafe to complete.
Navigation solution degraded	Hovermap's state estimate accuracy is decreasing due to environmental conditions causing the SLAM system to be degraded. The robot will return home via the rally point if set.	Monitor for safe flight and switch to robot control mode if required.
Hovermap cannot take control	The preconditions required to allow Hovermap to take control of the robot are not satisfied.	Switch to robot control mode.
Robot’s position not stable	The requirements for arming the robot have not been met. Hovermap is not ready.	The robot will need to be restarted if it is reporting this while the robot is actually stationary.

Notification	Description	Recommended Action
Robot outside geofence	The robot indicates it is outside a geofence.	Return the robot to a safe distance inside the geofence to ensure a mission can be started and control maintained during a mission.
LiDAR point data unstable	This will appear if a **LiDAR point loss** notification has already appeared during a mission.	Return to home using Pilot Assist and avoid the area where the LiDAR point loss occurred.
Caution		
Remote control has been disconnected	The link to the remote control unit has been lost, at a time in the mission where it is required. The robot will return home.	To intervene when connection to the remote control has been recovered, change to Pilot Assist mode first then to robot control mode if required.

4.2.5 Platform Notifications

Notification	Description	Recommended Action
Robot Module		
The robot reported an error	Autonomy has reported a problem with the robot which is not captured by any other notifications.	Review the information provided by the robot and refer to manufacturer's instructions.
Hovermap Module		
The Hovermap reported an error	Autonomy has reported a problem with the Hovermap which is not captured by any other notifications.	Review the information provided by the Hovermap and contact Emesent support for further details.
Camera Module		

Notification	Description	Recommended Action
The camera reported an error	Autonomy has reported a problem with the Camera which is not captured by any other notifications.	Review the information provided by the camera and refer to manufacturer's instructions.

4.2.6 DJI Notifications

Notification	Description	Recommended Action
Critical		
Hovermap is using a different robot than the connected remote control	The RC and the Hovermap are connected to different, incompatible models.	Ensure the correct Hovermap is connected. If the problem persists, land and restart the mission.
Take off failed	DJI reported that take off has failed for an unknown reason.	Investigate using the DJI Pilot app.
DJI: Critical warnings present	DJI is reporting a critical issue which needs investigation.	Land as soon as possible. Investigate using the DJI Pilot app.
DJI configuration changes: Multiple flight modes disabled	The Multiple Flight Modes setting could not be enabled, or it is currently trying to update to being enabled but the changes have not been applied yet.	The **Multiple Flight Modes** setting needs to be enabled for safe flight control with Hovermap.
DJI configuration changes: Enabling Multiple flight modes failed	Attempting to enable the **Multiple Flight Modes** setting with DJI failed.	
DJI configuration changes: Novice mode enabled	The **Novice mode** setting is reported as enabled.	The **Novice mode** setting needs to be disabled for safe flight control with Hovermap.

Notification	Description	Recommended Action
DJI configuration changes: Downward vision positioning enabled	The **Downward vision positioning** setting is reported as enabled.	The **Downward vision positioning** setting needs to be disabled for safe flight control with Hovermap.
DJI configuration changes: Precision landing enabled	The **Precision landing** setting is reported as enabled.	The **Precision landing** setting needs to be disabled for safe flight control with Hovermap.
DJI configuration changes: Changing collision avoidance state failed	Attempting to change the state of the **Collision avoidance** setting through DJI failed.	
DJI configuration changes: Changing RTH obstacle avoidance state failed	Attempting to change the state of the **RTH obstacle avoidance** setting through DJI failed.	
DJI configuration changes: Landing protection enabled	The **Landing protection** setting is reported as enabled.	The **Landing protection** setting needs to be disabled for safe flight control with Hovermap.
DJI configuration changes: Changing landing protection state failed	Attempting to change the state of the Precision Landing setting through DJI failed.	
DJI configuration changes: Enabling Landing protection failed	Attempting to enable the **Landing protection** setting with DJI failed.	
Battery overheating	DJI has reported that the batteries in the drone are too hot. Robot may shut down mid-air.	Land immediately.
Warning		
DJI: App is not registered	The DJI SDK registration could not be completed, which means you are unable to connect to the DJI RC.	Connect to the internet and restart the application to continue.

Notification	Description	Recommended Action
DJI: Low GPS signal	GPS signal is poor, or satellite search produced an error.	Move the robot to an open area to use GPS.
DJI: Warnings present	DJI reported a warning which needs investigation.	Investigate using the DJI Pilot app.
DJI: Flight Status unkown	The DJI flight assistant could not be contacted on the DJI remote control.	Reconnect the robot or restart the app if this persists.
DJI configuration changes: Battery critical threshold different	The critical battery threshold reported by DJI is different to the expected values.	
DJI configuration changes: Setting battery critical threshold failed	Attempting to set the new critical battery threshold with DJI failed.	
DJI configuration changes: Battery critical warning different	The warning battery threshold reported by DJI is different to the expected values.	
DJI configuration changes: Setting battery warning threshold failed	Attempting to set the new warning battery threshold with DJI failed.	
DJI configuration changes: Smart RTH enabled	The **Smart RTH** setting is reported as being enabled by DJI.	The **Smart RTH** setting needs to be disabled for safe flight control with Hovermap.
DJI configuration changes: Disabling Smart RTH failed	Attempting to disable the **Smart RTH** setting through DJI failed.	
Geofence could not be disabled	DJI has detected low GPS signal, reported after the drone has been armed or while airborne.	Connect the RC to the tablet.
Caution		
DJI: Low GPS signal	GPS signal is poor, or satellite search produced an error.	Move the robot to an open area to use GPS.

Notification	Description	Recommended Action
Drone downward sensors need to be covered with stickers to resolve the current DJI error	DJI reported that its sensors have detected a problem. This is likely caused by the downward sensors being uncovered during takeoff.	
Altitude limited airspace	DJI reported that there is a maximum altitude limit which must be observed in the current flight area. Pilots must not exceed the altitude limit without authorisation (e.g. from CASA).	Ensure you have the appropriate approval to fly above this limit from the local aviation regulatory body.
DJI Visual Positioning is active	DJI reported that the in-flight vision positioning system has been activated due to low GPS for navigation.	Use DJI Pilot app to switch off if required.
DJI configuration changes: Multiple flight mode settings unknown	The current **Multiple Flight Modes** setting could not be determined from DJI.	
DJI configuration changes: Battery critical threshold unknown	The current critical battery threshold could not be provided by DJI.	
DJI configuration changes: Battery warning threshold unknown	The current warning battery threshold could not be provided by DJI.	
DJI configuration changes: Smart RTH status unknown	The current **Smart RTH** setting could not be provided by DJI.	
DJI configuration changes: Novice mode setting unknown	The current **Novice mode** setting could not be provided by DJI.	
DJI configuration changes: Disabling novice mode failed	Attempting to disable the **Novice mode** setting through DJI failed.	

Notification	Description	Recommended Action
DJI configuration changes: Downward vision positioning status unknown	The current **Downward vision positioning** setting could not be provided by DJI.	
DJI configuration changes: Changing downward vision positioning failed	Attempting to change the state of the **Downward vision positioning** setting through DJI failed.	
DJI configuration changes: Changing vision assisted positioning state failed	Attempting to change the state of the **Vision assisted positioning** setting through DJI failed.	
DJI configuration changes: Precision landing status unknown	The current **Precision Landing** setting could not be provided by DJI.	
DJI configuration changes: Changing active obstacle avoidance state failed	Attempting to change the state of the **Active obstacle avoidance** setting through DJI failed.	
DJI configuration changes: Changing upward collision avoidance state failed	Attempting to change the state of the **Upwards collision avoidance** setting through DJI failed.	
DJI configuration changes: Changing RTH obstacle avoidance state failed	Attempting to change the state of the **RTH obstacle avoidance** setting through DJI failed.	
DJI configuration changes: Changing horizontal vision obstacle avoidance failed	Attempting to change the state of the **Horizontal vision obstacle avoidance** setting through DJI failed.	
DJI configuration changes: Landing protection status unknown	The current **Precision Landing** setting could not be provided by DJI.	
DJI configuration changes: Changing advanced pilot assistance state failed	Attempting to change the state of the **Advanced pilot assistance** setting through DJI failed.	

Notification	Description	Recommended Action
Battery high age or wear	DJI has reported that the drone's batteries have a high level of age or wear.	
Battery too cold	DJI has reported that the drone's batteries are too cold.	
Battery cell broken	DJI has reported that one of drone's batteries has a broken cell.	
Geofence enabled	The Geofence applied by DJI is active.	Use DJI Pilot to disable geofence.
Geofence disabled	The Geofence applied by DJI is not active.	Use DJI Pilot to enable geofence.

4.2.7 Tablet Notifications

Notification	Description	Recommended Action
Warning		
Tablet battery critical and may shut down. Hovermap control can be lost. Bring the robot home as soon as possible.	The tablet battery is critical and the tablet is about to shut down.	Bring the robot home as soon as possible.
Caution		
Tablet battery very low	The tablet battery is very low.	
Tablet storage is low. It is recommended to free up space before starting your mission	The storage space on the tablet is low.	Free up storage space
Tablet storage very low. Free up storage space.	The storage space on the tablet is very low.	Free up storage space
Wi-Fi lost - attempting to connect	The tablet Wi-Fi was not available.	

4.2.8 Commander Status Notifications

Notification	Description	Recommended Action
Critical		
No Hovermap connected. Please check and turn off any unsupported networks (e.g. Mobile data)	A Hovermap is currently not connected to Commander, but an unsupported network has been detected which may be preventing connection.	You need to approve connection to a Wi-Fi that does not have internet access, or turn off mobile data.
Commander - Hovermap version mismatch	The Emesent Cortex version is not compatible with Emesent Commander. A mission cannot be started unless both versions are compatible.	Download the latest versions of Emesent Cortex and Emesent Commander from the Emesent Customer Portal (https://emesent.com/software-downloads), then reconnect.
Failed to change Shield Settings. Please try again.	Attempting to change the Shield settings failed for an unknown reason.	Try changing the settings again.
Failed to change Mission Settings. Please try again.	Attempting to change the Mission Settings failed for an unknown reason.	Try changing the settings again.
Location services MUST be turned on	The tablet's location services are turned off, resulting in the Wi-Fi information not being published. It needs to be turned back on for reliable payload reconnection.	Enable the Location Services on your device.
Warning		
Commander - Hovermap version mismatch	The Emesent Cortex version is not compatible with Emesent Commander. A mission cannot be started unless both versions are compatible.	Download the latest versions of Emesent Cortex and Emesent Commander from the Emesent Customer Portal (https://emesent.com/software-downloads), then reconnect.

Notification	Description	Recommended Action
Status		
Starting Scan	A scan has been started by the user.	
Stopping scan	A scan has been stopped by the user.	
Establishing onboard communications	The connection from the tablet to the payload is not receiving data and the tablet is waiting for a response from the server.	
The preferred Hovermap Wi-Fi is available	When a Hovermap drops out of Wi-Fi range and a new non-Hovermap network is connected, the last Hovermap network will be saved. When the Hovermap comes back in Wi-Fi range, you will receive this notification.	If the Wi-Fi does not automatically reconnect, re-select the preferred Hovermap from the Android Wi-Fi Manager. Disable the auto reconnect option for all other networks.
A new Hovermap has been connected	When a scan is running and the Wi-Fi connection is changed to a new Hovermap network.	
A new Wi-Fi network has been connected	The Hovermap being used to run the scan is no longer connected. The Wi-Fi connection is changed to a new non-Hovermap network.	You will need to manually reconnect using the Android Wi-Fi Manager.
Success		
Ready for mission	An autonomous scan has been started, all pre-checks have been completed, and the mission is ready to commence.	Arm your robot then press Take Off to start your mission.
Ready for mission	A mapping scan has been started, all pre-checks have been completed, and the mission is ready to commence.	Start your mission.

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