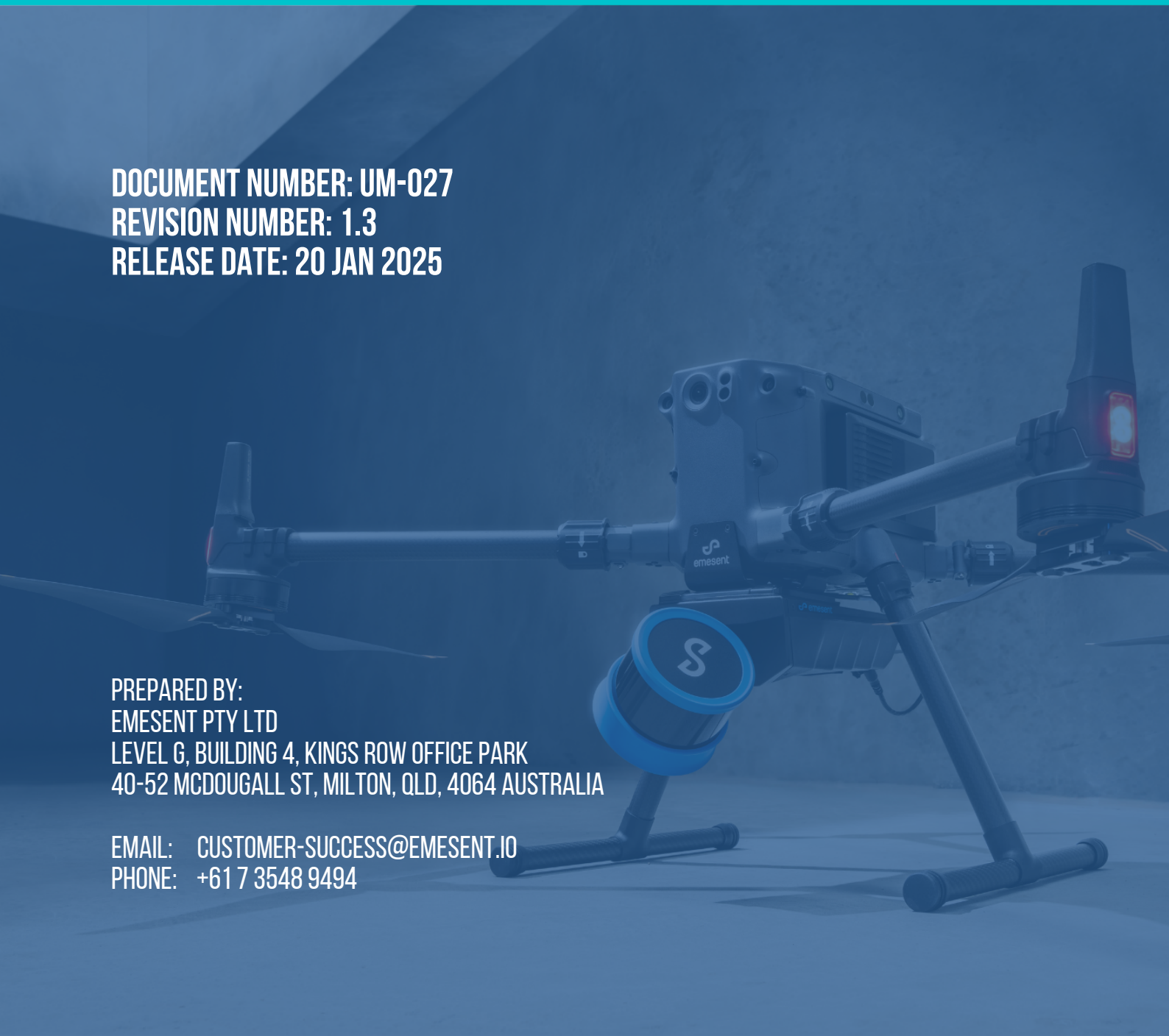
emesent

EMESENT HOVERMAP LHD 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. Overview

Emesent's Hovermap LHD improves mine productivity and safety by enabling near real-time stope evaluation and hazard identification. Advanced 3D analysis tools are provided directly to remote operators, enabling faster and more informed decision-making.

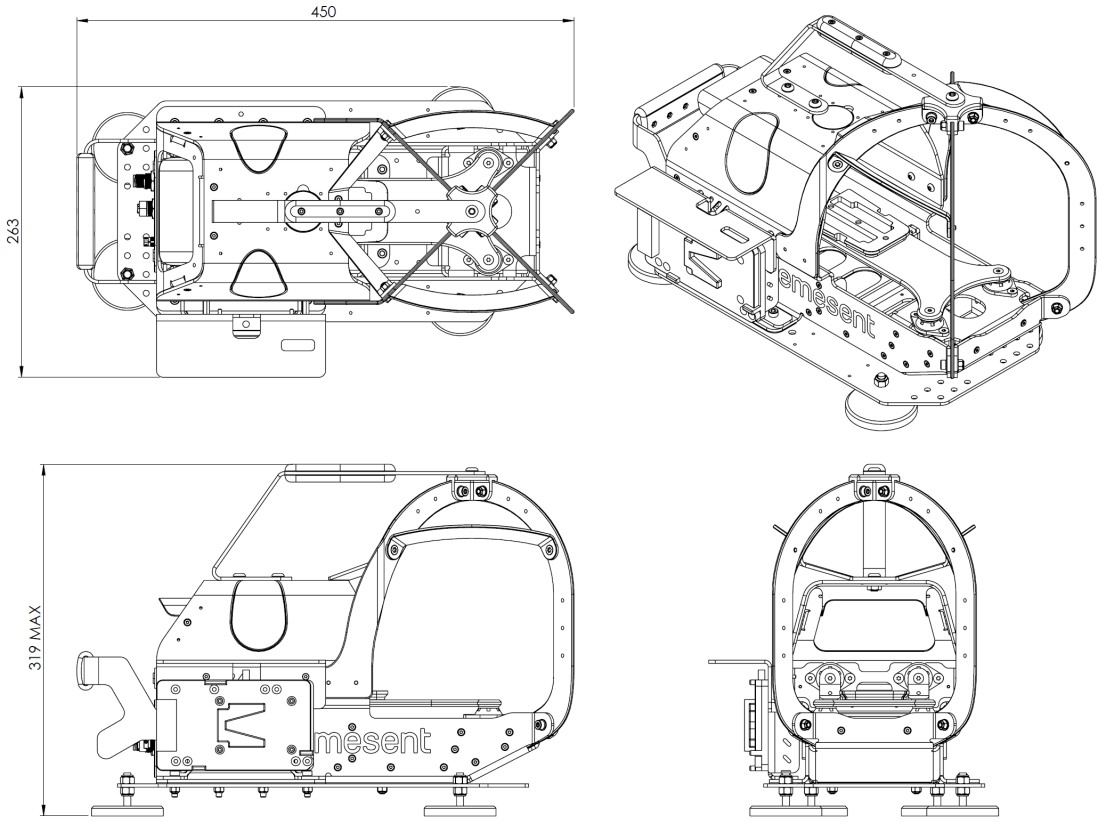
Featuring robust magnetic mounting feet, the LHD mount provides impact protection and vibration isolation for the Hovermap ST or Hovermap ST-X. It includes M12 connectors for external power and integration with the mine network, as well as an onboard V-mount battery bay for redundant power supply.

> ⚠ Using your Emesent Hovermap LHD outside the standard operating procedures described in this user manual is done at your own risk. Non-permitted use may degrade performance.
> The LHD Mount is designed to resist shocks and knocks during handling and transportation, but there is no guarantee that it can withstand direct impacts from rocks, rock bolts, wire mesh, or other physical obstacles when mounted to the LHD.
> Prolonged exposure to saline water and spray will gradually degrade the LHD Mount and Hovermap over time. To mitigate this, it is recommended to rinse both items thoroughly with low-pressure water after they have been exposed to saline environments.

2. Technical Specifications

2.1 Dimensions

Length	450mm
Width	263mm
Height	319mm @ maximum magnet extension



2.2 Emesent Product Compatibility

2.2.1 Commander-Cortex compatibility

For the best LHD experience, use the table below to ensure you use an LHD-compatible version of Commander with a complementary Cortex version.

> Use this link to download the latest LHD-compatible Commander version: Commander 1.5.1 for LHD. The standard Commander app is not currently compatible with LHD.
> Use this link to download the latest LHD-compatible version of Cortex from the Software Downloads page: Cortex 3.3.3

LHD-compatible Commander version	Cortex version
Commander 1.0	Cortex 3.0.0
Commander 1.1	Cortex 3.1.0
Commander 1.2	Cortex 3.2.0
Commander 1.3	Cortex 3.2.1
Commander 1.4	Cortex 3.2.2
Commander 1.5	Cortex 3.3.2
Commander 1.5.1	Cortex 3.3.2
Commander 1.5.1	Cortex 3.3.3

2.2.2 Hovermap-LHD compatibility

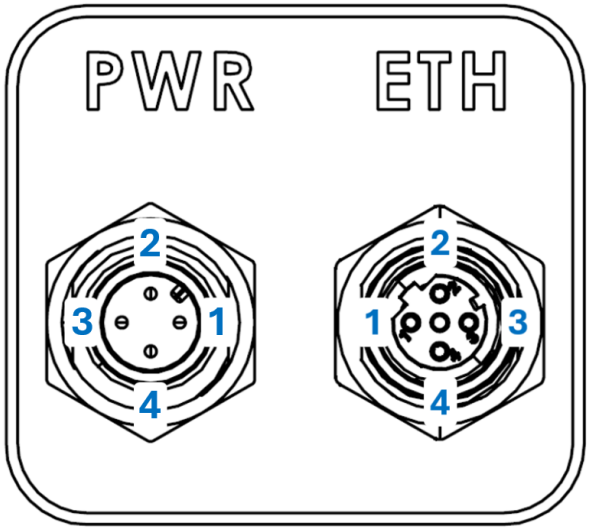
Product	Compatible
Hovermap ST	Yes

Product	Compatible
Hovermap ST-X[1]	Yes[1]
Hovermap ST/ST-X w/ LRR[2]	No[2]
Hovermap ST/ST-X w/ colorization[3]	No[3]
Hovermap ST/ST-X w/ LRR colorization	No
Commander Prototype	Yes

1. The LRR must be removed. LRR thermal performance cannot be guaranteed in LHD Mount.
2. A Hovermap ST or ST-X with a calibrated LRR colorization system cannot fit into the LHD Mount.
3. The Colorization mounting bracket can remain attached to the Hovermap ST or ST-X, but the camera cannot be fitted.

2.3 M12 Connector Pinouts

The following section displays the pinout for the LHD Mount back panel connectors.



Power (PWR) (14V-48V)		Ethernet (ETH)	
Pin	**Designation**	**Pin**	**Designation**
1	Power +	1	ETH_TX_P
2	NC	2	ETH_RX_P
3	GND	3	ETH_TX_N
4	NC	4	ETH_RX_N
M12 connector (M12A-04PMMP-SF8001) A-coded male pins 		M12 connector (M12D-04PFFP-SF8001) D-coded female pins 	

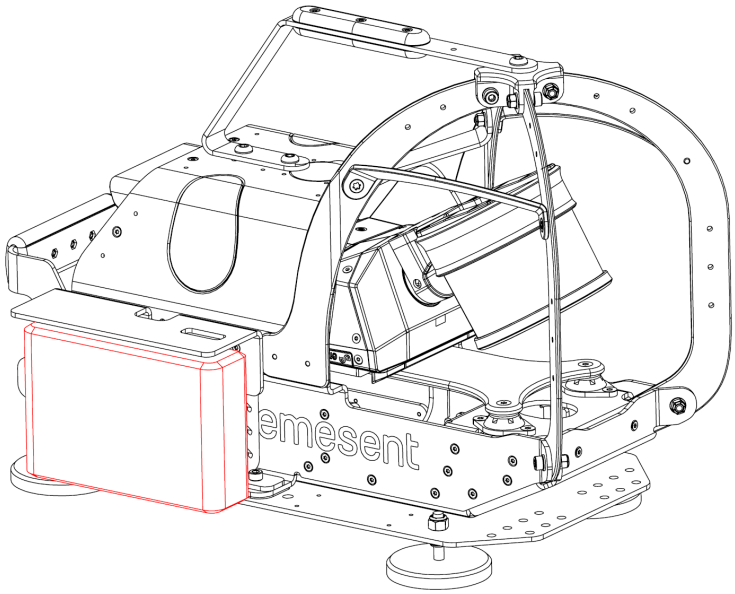
3. Installation and Setup

3.1 Power Supply Configuration

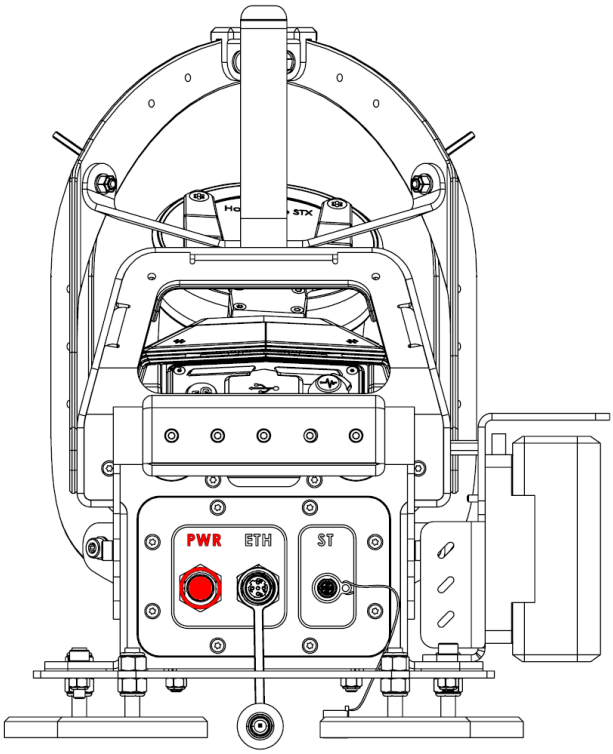
The Emesent LHD Mount for Hovermap supports two power supply configurations that can be connected simultaneously:

- The Hovermap is powered by a portable V-mount battery.

> The battery bay fits the Core SWX Nano Slim Battery or equivalent-sized V-lock batteries.



- The Hovermap is powered externally through an M12 connector.



3.2 Network Configuration

The LHD mount incorporates two network configuration options:

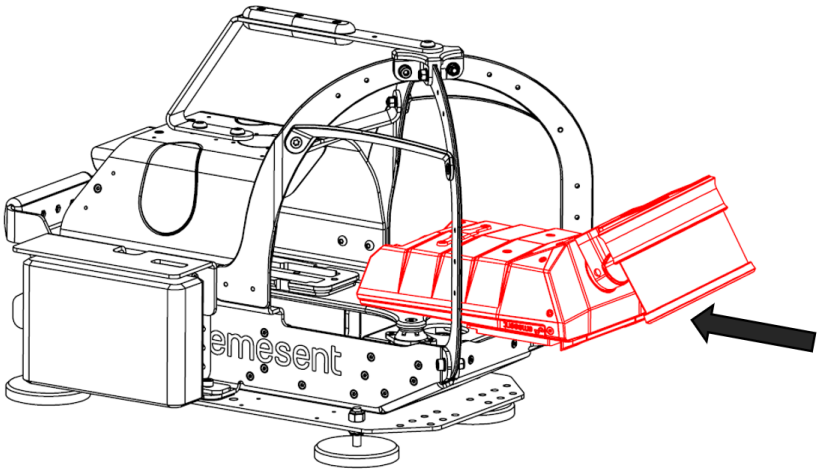
- Connection over the Hovermap Wi-Fi Access Point (AP).
- Connection over an existing network infrastructure (using the **ETH** port).

Network requirements:

- Hovermap rarely requires more than 20Mbps bandwidth, but as a minimum you will need an M-12 (A) connector – ETH 100Mbps (BASE100-TX) – as described in section 2.3 'M12 Connector Pinouts' of this manual.
- At the IP layer the configured network on the **Web UI** (user interface) page must be unblocked on the network (default is 192.168.2.115/24).

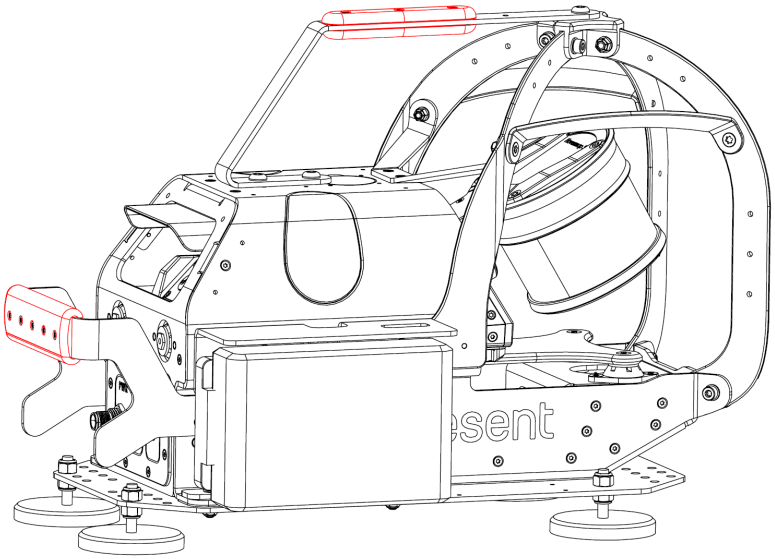
3.3 User Installation

1. Ensure the mounting location is clear of dirt and debris that could interfere with the magnetic connection.
2. Place the Hovermap ST/ST-X in the LHD Mount from the front until seated on the dovetail.



> ⚠ Ensure that the two dovetail locks are secured.

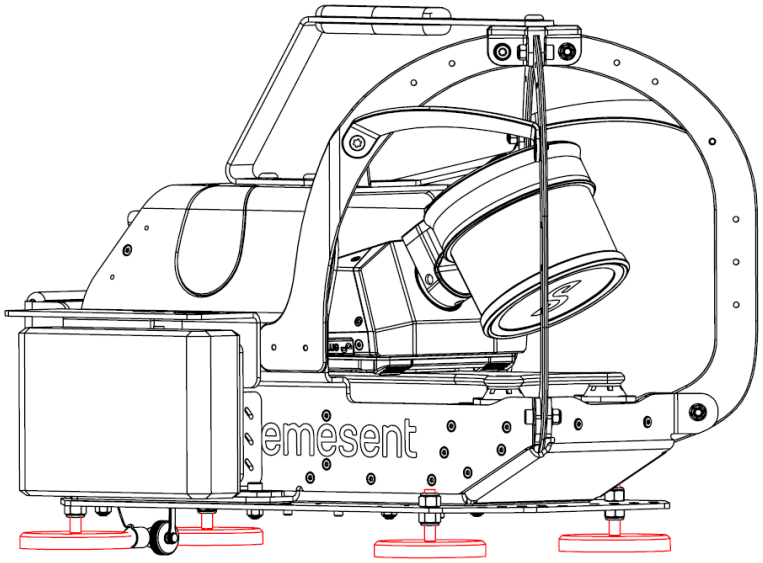
3. Pick up the LHD Mount using the provided grab handles.



4. Carefully place the LHD Mount onto a steel surface on the vehicle by slowly lowering the rear feet and then the front feet (or vice versa).

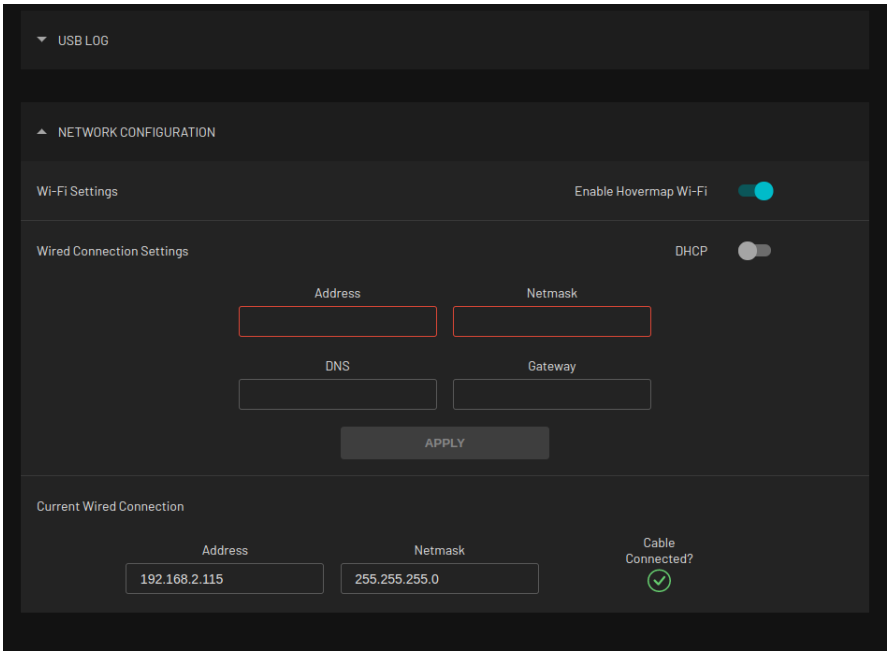
> **DO NOT** allow the magnets to forcefully slam down, as this could damage either the magnets or the Hovermap.

5. Check that all magnets are positively secured to the mounting surface by performing a light pull test and checking for gaps.
    - If the mounting location is not flat and gaps are present, reposition the mount until all feet make contact.
    - The height of each magnet can be adjusted using 2x 7/16” wrenches, although this is recommended only if the mounting surface is severely uneven.



6. Connect one end of the the Hovermap Power Cable to the **ST** port on the LHD Mount, and the other to the Hovermap.
7. Connect a fully charged battery into the battery bay of the LHD Mount, or power the mount through the **PWR** connector. Ensure that the battery latch is secured.
8. If using the system over existing network infrastructure, connect the LHD Mount to the network via an M12-RJ45 cable to the “ETH” port.
9. Power on the Hovermap and wait for the status lights to switch to a slow pulsing Emesent blue.

10. Set up the Hovermap network connection.
    a. Connect the tablet to the Hovermap via Wi-Fi (look for STxxxx in the list of Android WiFi networks)
    b. In the tablet's web browser, navigate to `hover.map` and open **Network Configuration**.
    c. Under **Wired Connection Settings**, enter the desired IPv4 **Address** and **Netmask**.
    d. Click **Apply**.
    e. Confirm the connection is successful under **Current Wired Connection**.
        i. The **Address** and **Netmask** should match the values entered in the previous step
        ii. **Cable Connected?** should have a green tick underneath



3.4 Recommended Android Tablet Specifications

The following tablet contains the recommended specifications for running Commander.

Samsung Galaxy Tab S9 5G

- Chipset: Qualcomm Snapdragon® 8 Gen 2 5G (4 nm)
- OS: Android 13
- Released: August 2023

3.5 Installing Emesent Commander to Tablet from a File

1. Copy the APK file to the tablet.
2. On the tablet, select the APK file via the Files application
3. Select **Install** on the confirmation message.
4. You will get an "*App installed*" notification once the installation has been completed,

3.6 Tablet Wi-Fi Configuration

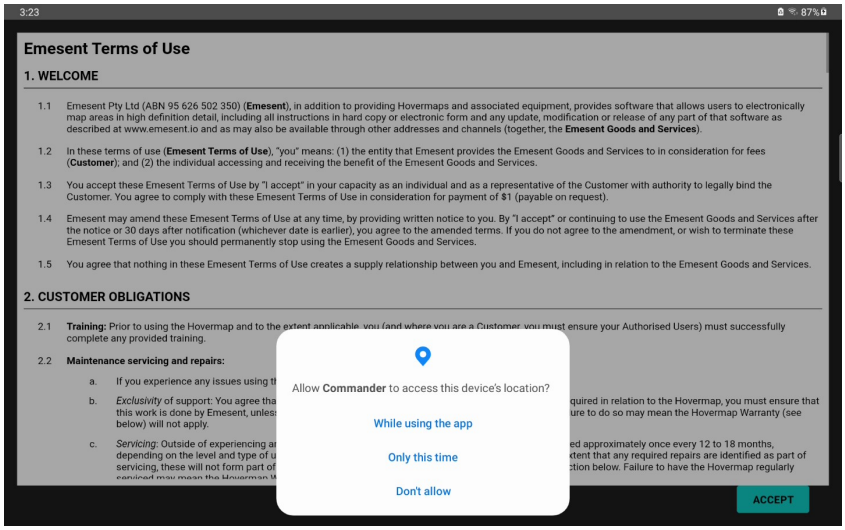
If there are issues connecting to the mine Wi-Fi network from the tablet, the advanced Android Ethernet settings on the tablet may need to be modified. In this case, contact your onsite IT for help connecting to the mine network.

4. Commander Application Usage

4.1 Starting Commander the First Time

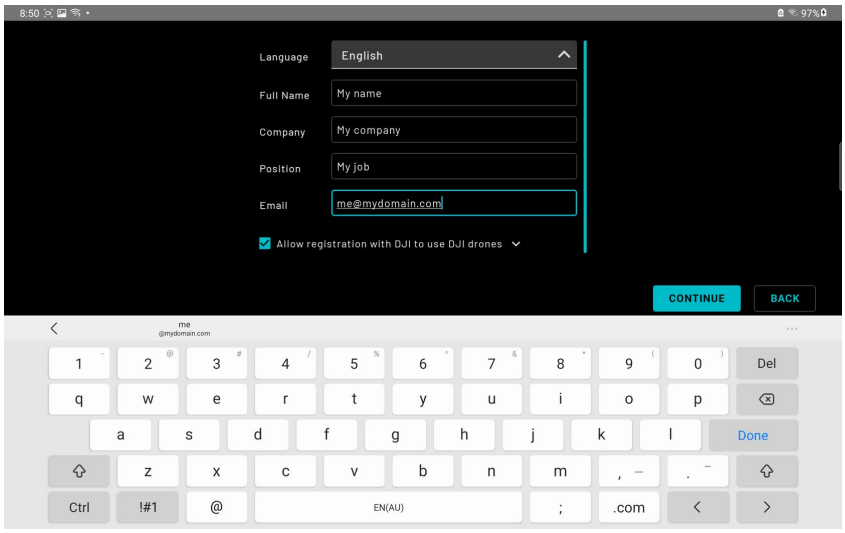
1. Tap the Commander application on the tablet to begin.
2. Accept the permissions via the popups.

> These permissions, only requested once after installation, are required for Commander to operate. Disallowing them will result in Commander not being functional.



3. Read the **Emesent Terms of Use**, then accept the terms by tapping the **Accept** button.
4. Enter user information then tap **Continue**.

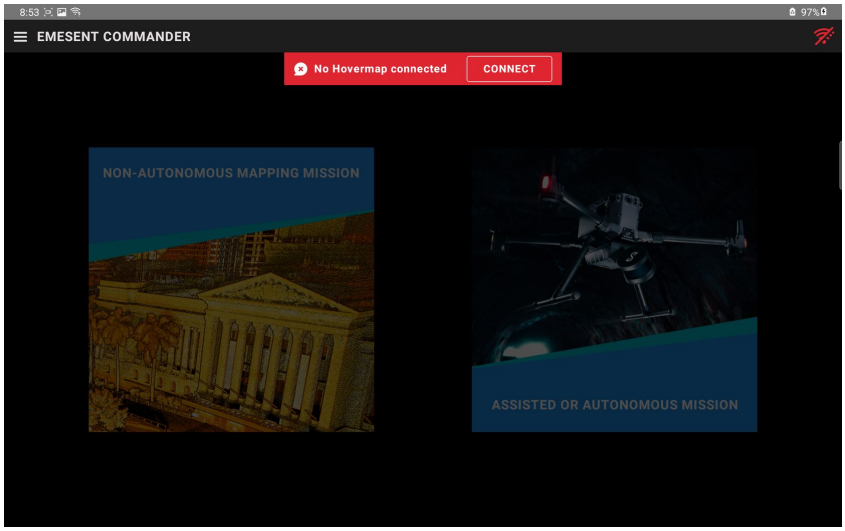
> The terms of use and user information will only be requested once after installation.



5. The application will open a landing page, ready for connection to a Hovermap.

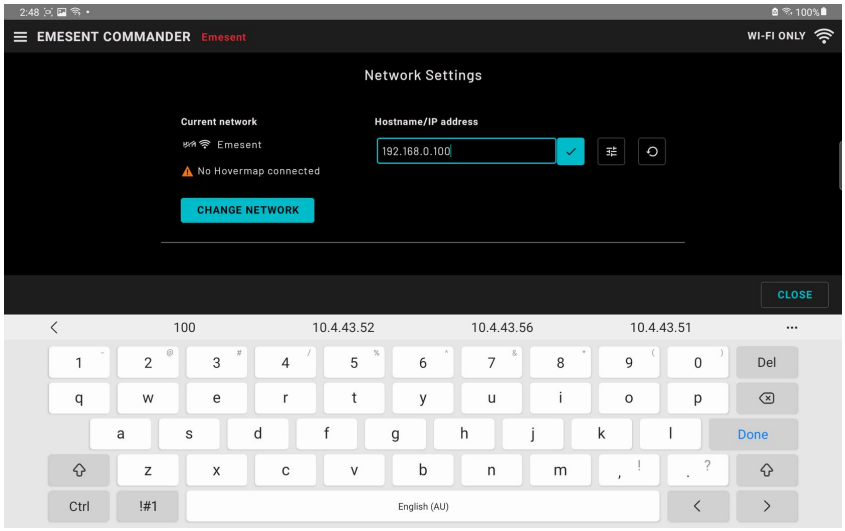
4.2 Connecting to Hovermap

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



2. Use the Android Wi-Fi Manager to ensure Wi-Fi is turned on.
3. Login to the Wi-Fi network where the Hovermap payloads are connected, then return to Commander.
4. In Commander, tap the red **Connect** button.

5. Alternatively, tap the Hamburger button on the top left then select **Network Settings** from the menu.
6. Enter the **Hostname** or **IP address** corresponding to the Hovermap payload hosted on the network, then tap the blue tick button beside the field or tap **Done** on the keyboard.

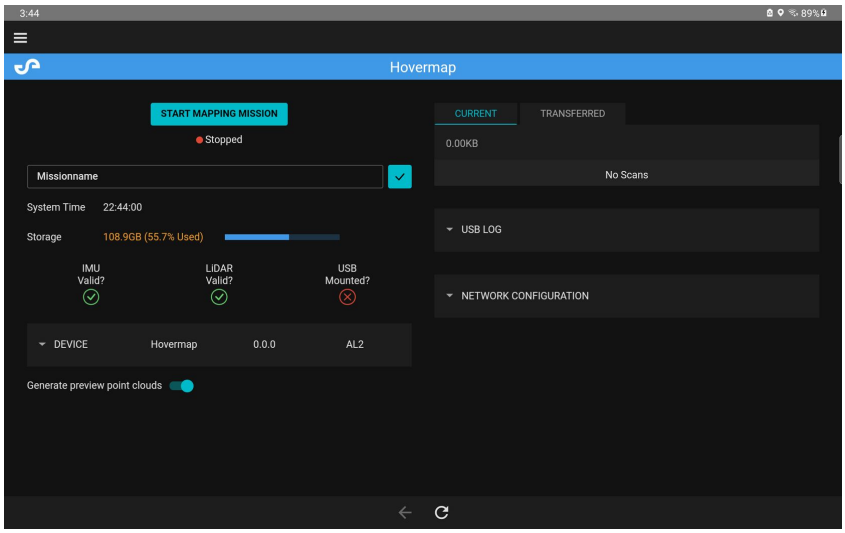


7. Once Commander detects the Hovermap and establishes a connection:
   a. The "*No Hovermap connected*" message is replaced with "*Connected*" on the **Network Settings** page.
   b. The red banner is removed from the landing page and the **Non-Autonomous Mapping Mission** tile becomes enabled.

4.3 Turn on Point Cloud Previews

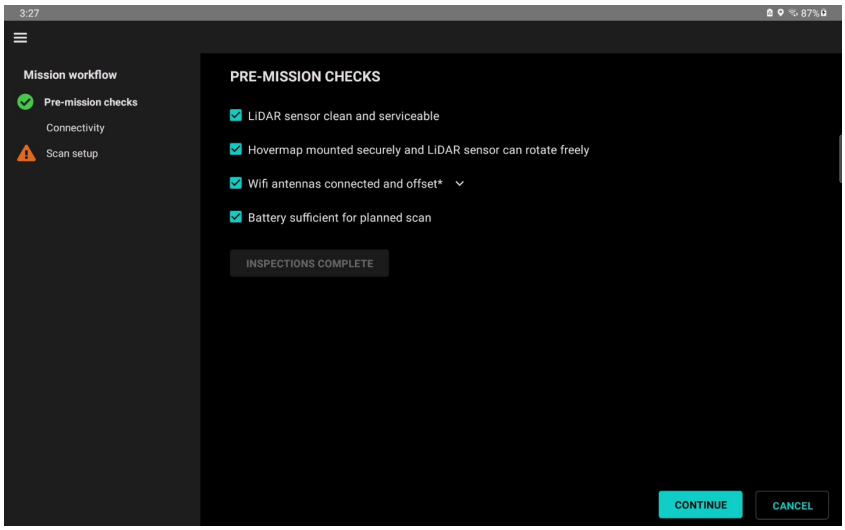
1. Tap the Hamburger button on the top left then select **Web UI** from the menu.
2. If the **Generate preview point clouds** toggle button is displayed, ensure it is turned on. Otherwise, point cloud previews are automatically generated by default.

3. Tap the **Back** button on the tablet to return to Commander.

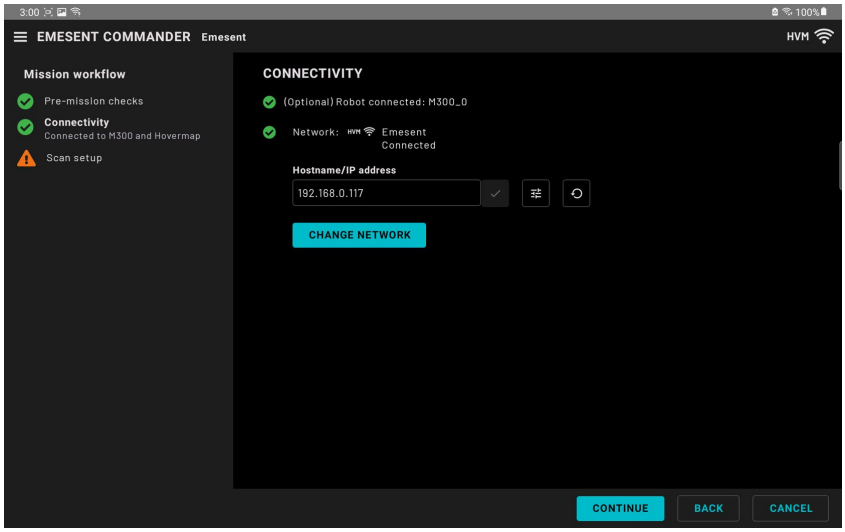


4.4 Starting a Scan

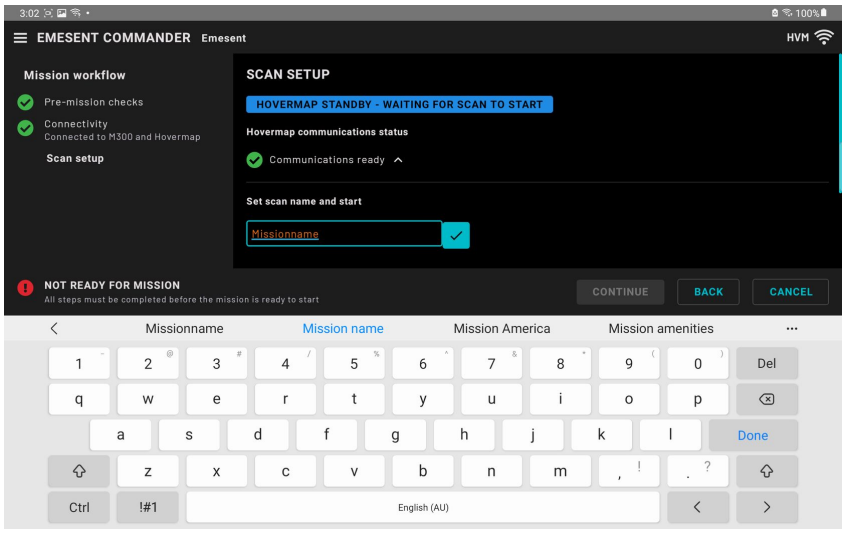
1. On the landing page, tap the **Non-Autonomous Mapping Mission** tile.
2. Complete the **Pre-Mission checks**, then press **Continue**.



3. On the **Connectivity** page, observe that there is a green tick and the word "*Connected*" displayed beside the **Network** option, then press **Continue**.



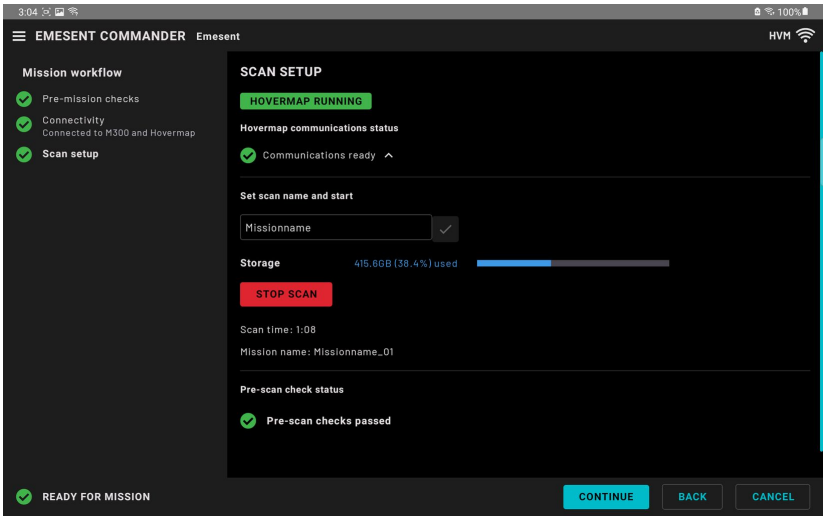
4. On the **Scan Setup** page, enter the name of the scan then tap the tick button beside the field. All scan logs will be created with this name.



5. Tap the **Start Scan** button to begin the scan.

6. After the scan has completed pre-scan checks and started, tap the **Continue** button to navigate to the Main View.

> The scan startup process varies but may take up to 2 minutes to complete. Once the scan has successfully started a green tick and “Ready for Mission” message will be displayed at the bottom of the page.



7. In the Main View, the low-definition point cloud will be displayed.
8. Once the scan has been completed, tap **Stop Scan** at the top of the main view.

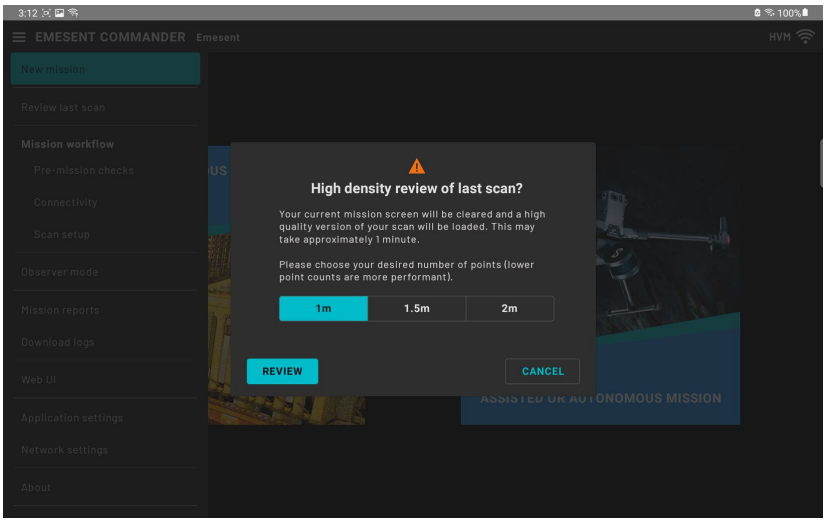
> For best results with the high-density previews of a scan, limit the scan time to short durations (e.g. 1-3 minutes).

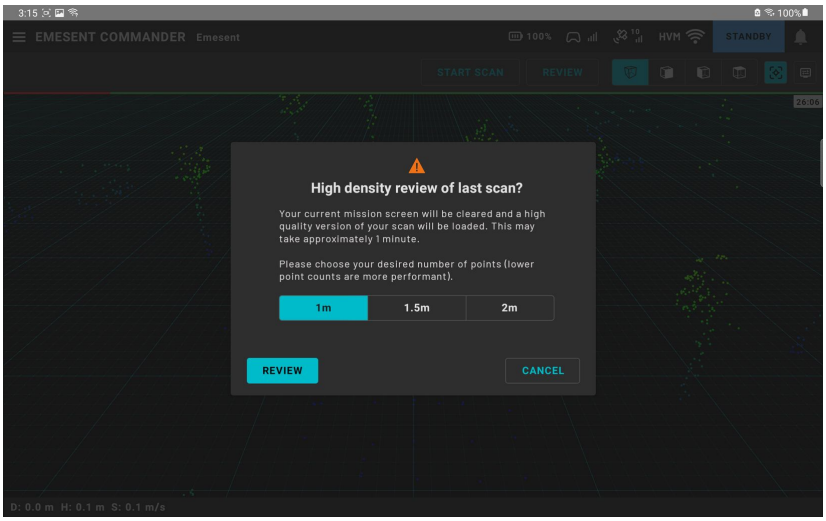
4.5 Perform a Review

1. Ensure that the scan has been stopped.
2. In the Main View, tap the **Review** button.

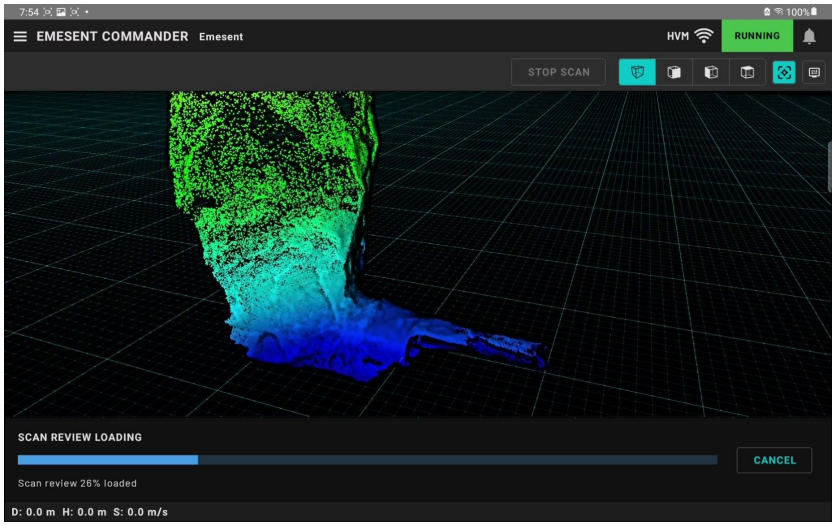
> A **Review last scan** option is also available in the main application menu.

3. On the confirmation message, choose the desired number of points then tap **Review** to begin.





4. A progress bar is displayed while the data is processed on the Hovermap payload. As high-density point cloud data becomes available, it will be presented in the Main View.



4.6 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.

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