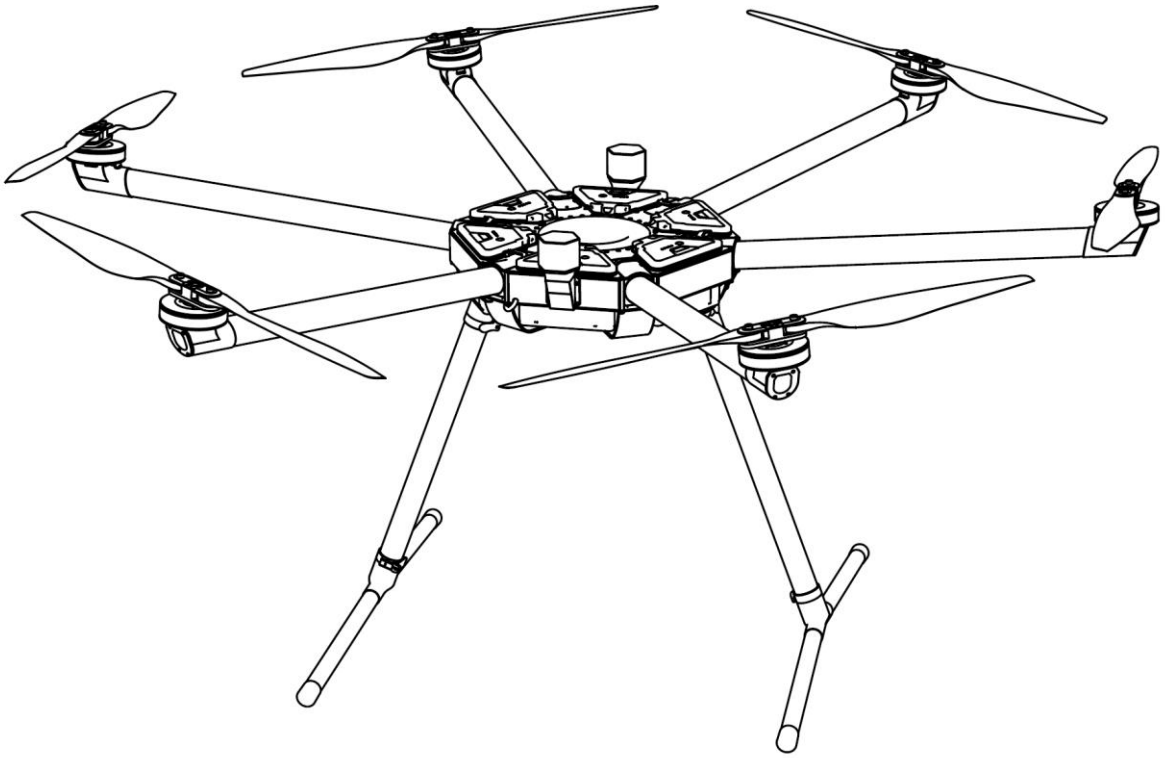
starcopter

Operating Manual

starcopter HIGHDRA



Revision Log

Version	Date	Revisions
v1.0	2024-11-29	Initial Release
v1.1	2025-03-25	See separate changelog for details

Table of Contents

1 Using this Manual

Welcome to the starcopter HIGHDRA Operating Manual. This guide is designed to ensure efficient and safe flight operations. This manual is organized into the following chapters:

1. **Using this Manual**
   This chapter explains how to navigate and use the manual effectively. It outlines the structure and provides an overview of the information included in each section.
2. **System Overview**
   Here you'll find an introduction to the drone's components, specifications, and what is included in the package. This section will help you familiarize yourself with the system before getting started.
3. **Auterion Mission Control**
   Auterion Mission Control is your ground control station application and will be covered in this chapter. It guides you through the tools and features needed to operate the drone safely, confidently, and in compliance with regulations.
4. **Flight Modes**
   In this section, you'll learn about the various flight modes, including pilot-controlled modes, automatic modes, and emergency procedures. This will prepare you for different flight scenarios.
5. **Operational Limitation**
   Understanding the operational limitations will help ensure safe and compliant flying. This chapter outlines the types of approved operations, performance limitations, and environmental conditions that may affect your drone's operation.
6. **Operational Instructions**
   This section provides detailed instructions on charging batteries, preparing the UAV for flight, performing pre-flight checks, and following post-flight procedures. These step-by-step guidelines are essential for proper drone maintenance and operation.
7. **Maintenance Instructions**
   This section provides instructions on how to handle maintenance tasks.
8. **Appendix**
   The appendix includes troubleshooting tips, risk categories, and additional helpful information for ongoing support and maintenance.

1.1 Legend

You will find different symbols used throughout the manual. Understanding these will help you interpret instructions, safety notices, and key information quickly and accurately.

Symbols

Symbol	Meaning
⚠ **Warning**	Indicates potential hazards or important safety information.
📖 **Reference**	Indicates where additional information can be found.
🛑 **Caution**	Indicates potential risks to the equipment or flight performance. Use caution when following these instructions.
ℹ **Information**	Provides important details that will help you understand a procedure or a feature more effectively.

2 System Overview

The system overview provides a high-level understanding of the key components and functionality of the UAV, ensuring a clear grasp of its design and capabilities.

2.1 Delivery Scope

Items	Quantity
Aircraft Body	1
Arm, incl. Propeller	6
Propeller Transport Safeguards	6
Landing Leg Vertical Part	2
Landing Leg Horizontal Part	2
Remote Control (RC)	1
Remote Control Charging Cable (Mircro USB)	1
Powerbank (for the Remote Control)	1
Battery Set (6 individual batteries)	1
Battery Charging Station	1
EASA Information Notice	1

2.2 Specifications

Items	Unit (g)	Quantity	Subtotal (g)
Body	3,700	1	3,700
Arm, incl. Propeller	750	6	4,500
Landing Leg	300	2	600
Battery	1,450	6	8,700
Total			**17,500**

HIGHDRA	
UAS Class	C3
Operating Area in the Open Category	A3
Max. Takeoff Mass	24.99 kg
Dimensions	223.0 (W) x 202.6 (D) x 77.0 (H) cm
Max. Flight Time	60 min without payload 30 min, with max. Takeoff Mass
Max. Tilt Angle	36°
GNSS	GPS, GLONASS, Galileo and BDS
Hovering Accuracy Range	Vertical: ±20 cm (with GPS position) Horizontal: ±30 cm (with GPS position)
Guaranteed Sound Power Level	104 dBA
Max. Altitude (AMSL)	3500m with up to 2.5 kg Payload 1500 m with MTOM
Altitude Line of Sight	749 m

Remote Control	
Operating Frequency	2.400-2.4835 GHz
Display Size	5.46-inch, touch screen LCD
Display Brightness	1000 nits
Max. Transmission Distance	700 m
Battery Capacity	4950 mAh
Charging Current/Voltage	5VDC, 2A
Dimension	21.7 (W) × 10.6 (D) × 3.1 (H) cm (excluded external antenna and joystick rocker)
Supported USB Port Types	Micro USB

Supported SD Card Types	Micro-SD
Supported Operating System	Android 7
Power Output (selecting by region)	USA: 23 dBm (200 mW) Europe: 20 dBm (100 mW) - default

Battery	
Battery Capacity	272 Wh
Voltage	24.0 VDC
Charging Voltage Limit	25.2 VDC
Battery Type	Li-Ion 6S
Weight	1,450 g
Charging Environment Temperature	Max. 40 °C

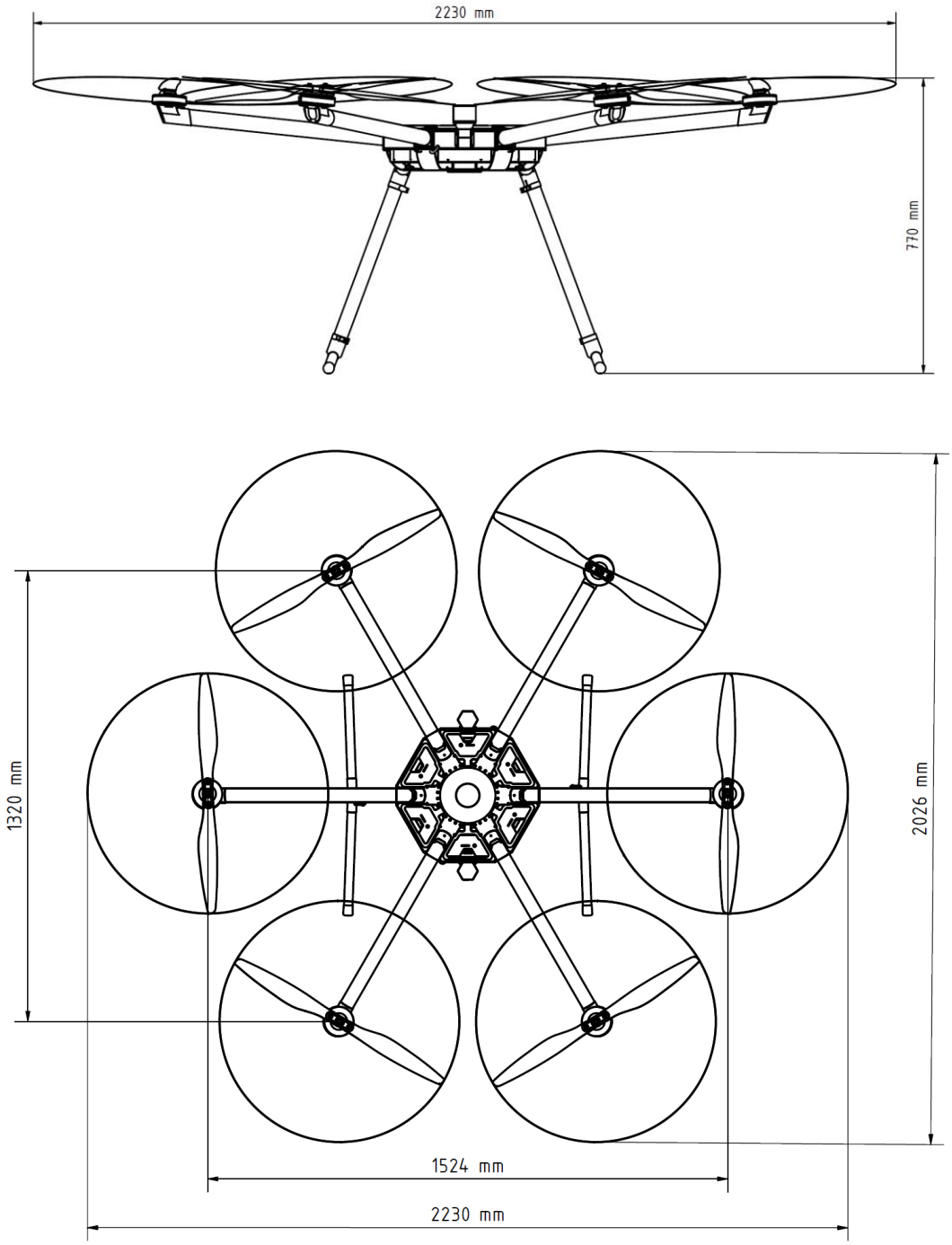
Battery Charger	
Input voltage	110~240 VAC
Output voltage	20~58 VDC
Max. input current	AC 16 A
Max. charging power	3000 W (@220 VAC)
Max. discharging power	200 W
Charging current	1.0~52.0 A (Max)
Discharging current	0.5~5.0 A (Max)
Working temperature	0°C to 40 °C
Storage temperature	-20°C to 60 °C
Size	35.6 × 13.68 × 16.41 cm
Weight	about 3973 g
Charging Duration	Six (6) batteries @ 55 A – 1 hours

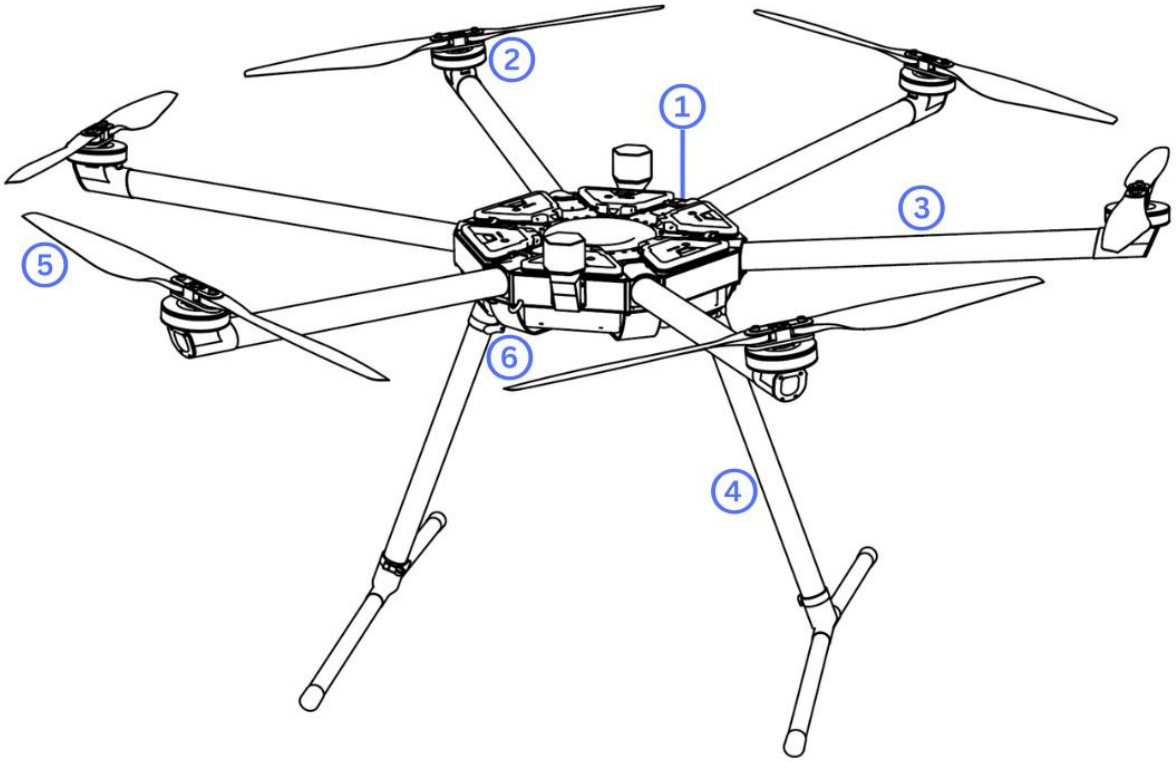
Payload	
Max. Payload Mass (including accessories, mount mechanism and cables)	7.49 kg

2.3 COMPONENTS

In this section, we will explore the key components of your drone, each designed to work together to ensure optimal performance and reliability. Understanding these parts—such as the body, motors, batteries and any additional features—will enhance your ability to operate and maintain your drone effectively.

> 🕮 Information on how to unbox and assemble these components can be found in 6.4.4.1 Unboxing and Assembling of the UAV.

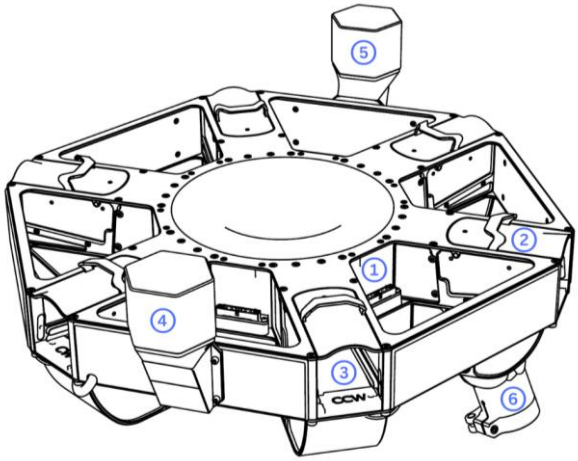




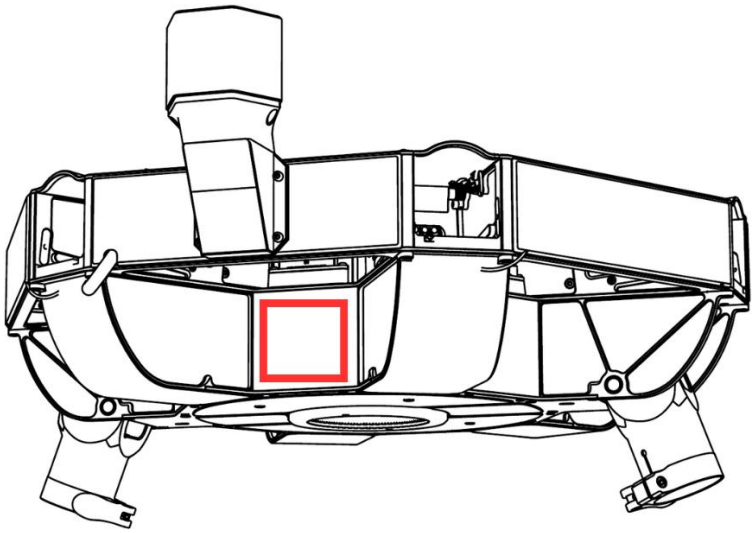
① Battery
② Motor
③ Arm
④ Landing leg
⑤ Propeller
⑥ Body

2.3.1 Body

The UAV body houses key electronic components, including the Flight Management Unit (FMU), RC receiver, telemetry receiver, and GPS sensors. The arms, landing legs and batteries are designed to be detachable, enabling easy transport and straightforward replacement when necessary.



① Battery slot
② Arm locking mechanism
③ Arm slot
④⑤ GPS antenna
⑥ Landing leg lock mechanism

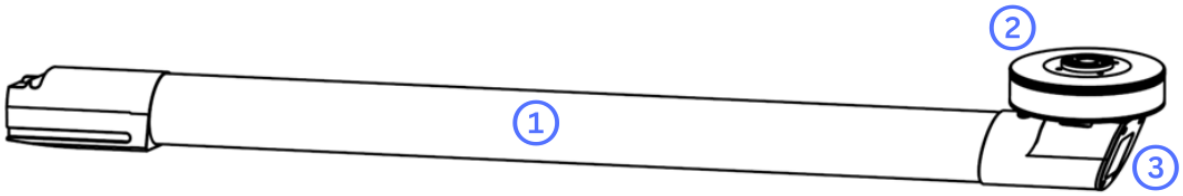


ⓘ The C3 marking, CE marking and the serial number are located on the area at the 6 o'clock position of the UAV body.

2.3.2 Arm

The arm is constructed from a combination of aluminum and carbon-fiber tubing. It incorporates an integrated brushless AC motor and a navigation light system. The color of the navigation light corresponds to the arm's position on the UAV body and changes sequentially.

📖 The navigation and conspicuity light patterns are outlined in 2.3.2.1 Navigation and Conspicuity Lights.

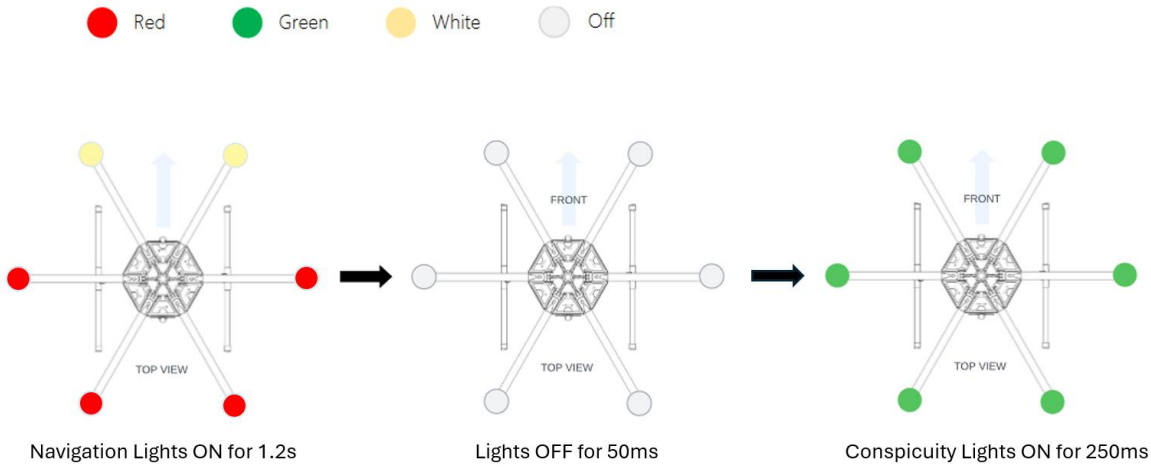


① Arm ② Motor ③ Navigation and conspicuity light

2.3.2.1 Navigation and Conspicuity Lights

The navigation lights provide information about the UAV's heading direction, while the conspicuity lights help people on the ground recognize your UAV and distinguish it from manned aircraft.

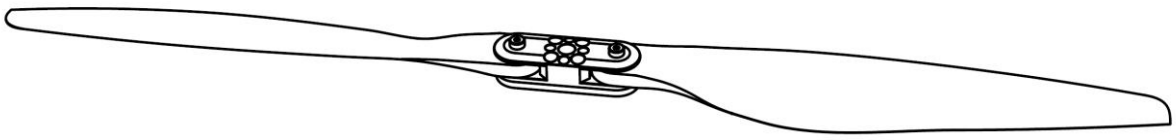
The navigation and conspicuity light patterns alternate with 1.5-second intervals and are automatically powered when the UAV batteries are activated. Below is a visualization of the light pattern transitions and their timing during operation.



Navigation Lights ON for 1.2s | Lights OFF for 50ms | Conspicuity Lights ON for 250ms

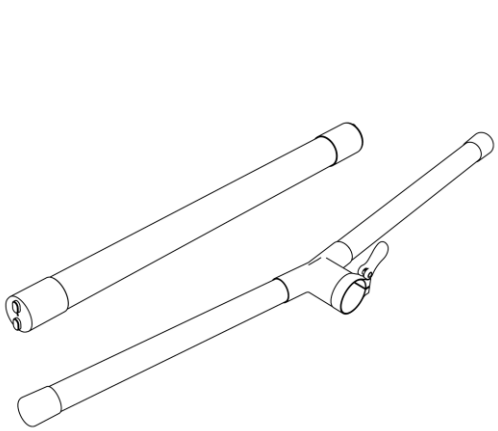
2.3.3 Propeller

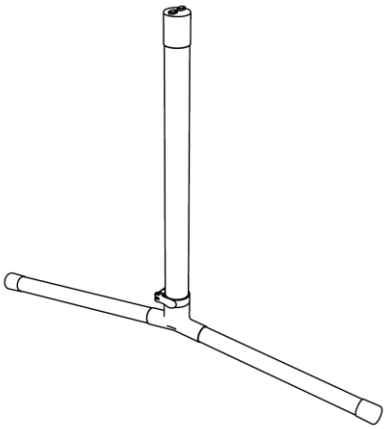
The UAV uses 28-inch Mejzlik propellers made of carbon fiber, which have been factory balanced for optimal performance. The drone is equipped with six foldable propellers in total: three rotate clockwise (CW) and three rotate counterclockwise (CCW)



2.3.4 Landing Leg horizontal and vertical part

The starcopter HIGHDRA is equipped with two landing legs, each of which can be detached using a quick-release mechanism for easy removal and replacement.



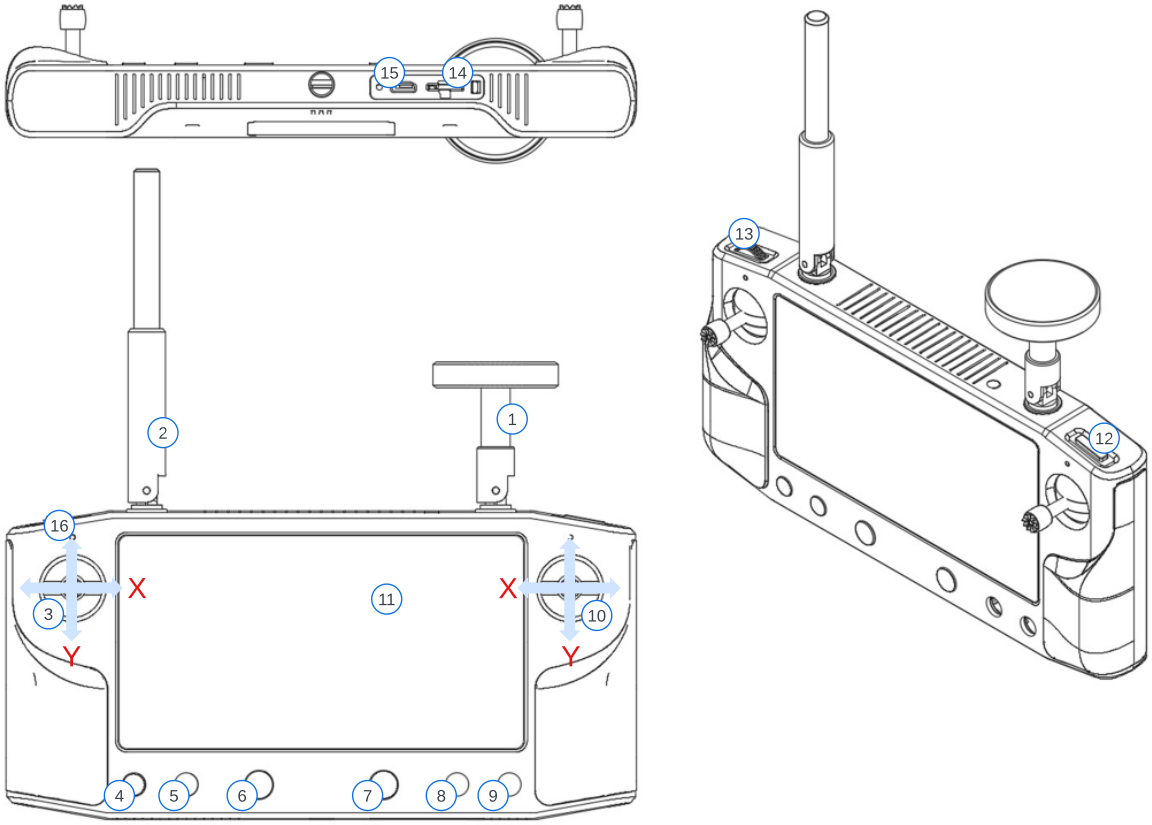


2.3.5 Remote Control (RC) & Ground Control Station (GCS)

The CubePilot Remote Control serves a dual purpose as both a Remote Control and a Ground Control Station. The Herelink offers a seamless interface for UAV control, reducing the risk of interference and enhancing the user experience. To minimize the risks of control interference and misuse, the design features a clear, intuitive information layout that ensures readability under various lighting conditions. This thoughtful design enables you to effectively operate your starcopter HIGHDRA, even in challenging environments. The Remote Control is pre-installed with

Auterion Mission Control software, providing a reliable and efficient platform for mission planning and control.

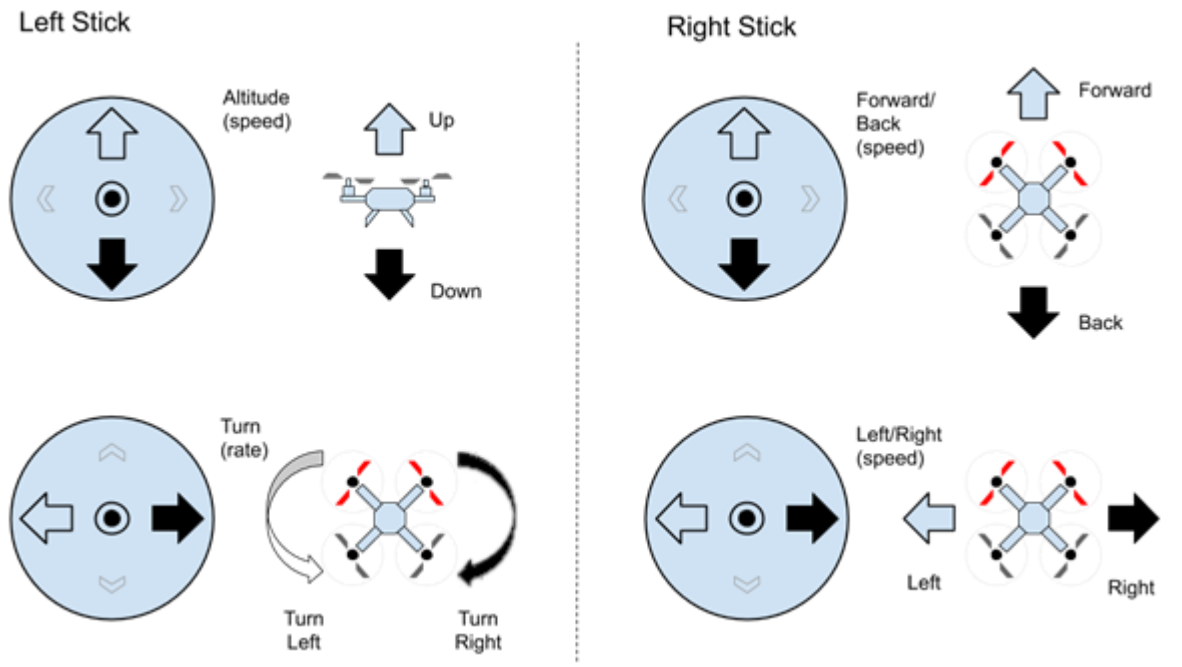
	Only use the RC and GCS software starcopter provided you with.



① Directional antenna	⑥ Power button	⑫ Upper right button
② Omni-directional antenna	⑦ Home button	⑬ Upper Left Wheel
③⑩ Joystick	⑧ Button C	⑭ Micro SD card slot
④ Button A	⑨ Button D	⑮ Micro USB
⑤ Button B	⑪ LCD screen	⑯ Status LED

2.3.5.1 Buttons and Stick Designation

The RC buttons and sticks have been configured to Mode 2 where the left stick controls throttle and yaw, while the right stick controls pitch and roll.



Button/Joystick	Description
③ **Stick (left)**	X-axis: Yaw Y-axis: Throttle
⑩ **Stick (right)**	X-axis: Roll Y-axis: Pitch
④ **Button A**	Position Mode
⑤ **Button B**	Altitude Mode
⑥ **Power button**	Turn on/off the RC
⑦ **Home button**	Return to Launch (RTL)
⑧ **Button C**	Kill
⑨ **Button D**	No function
⑫ **Upper right button**	No function
⑬ **Upper Left Wheel**	No function

2.3.5.2 *Charging the Remote Control device*

To charge your ground station, connect a USB to micro-USB cable to the USB port on the charger and the micro-USB port located at the bottom of the radio controller.

While charging, the LED indicator next to the left joystick will show the current charge level based on the values listed in the table below.

Use a 5 V / 2 A power source for optimal charging.

Color	Description
Red	Low battery power (0 % to 9 %)
Yellow	Medium battery power (10 % to 89 %)
Green	High battery power (90 % to 100 %)

2.3.5.3 Optimal Performance of the RC: Guidelines on Software Version Stability

Once starcopter provides you with the remote control, it is important that you should not update the software, including Auterion Mission Control, or the current Android version. The device comes pre-configured with a stable and tested setup, ensuring optimal performance during your operation. We will inform you about any necessary updates for the software and firmware and provide you with detailed instructions on the update process.

🛑	Do not perform any software updates on the remote control yourself.

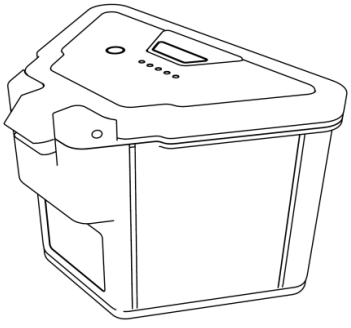
2.3.6 Battery

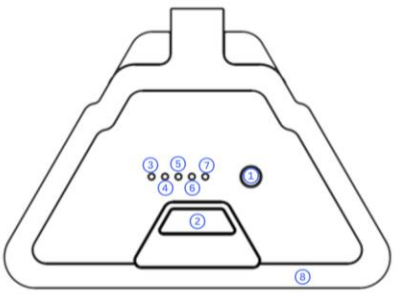
The UAV is powered by a set of six independent 24 V HIGHDRA Power Packs. Their charging, discharging, balancing, discharge rate, engagement, and health monitoring operations are internally managed by the Battery Management System (BMS) circuitry and software.

Each battery is equipped with a type label, stating the Set-ID. You must always use batteries with the same Set-ID to ensure safe flight operations.

For better visibility the battery packs are also coded with a color at the front of their handles.

🛑	Never mix batteries with different Set-IDs or color-codes.
🕮	During flight, you can assess the battery charge level as shown in 3.1.1 UAV Status Bar



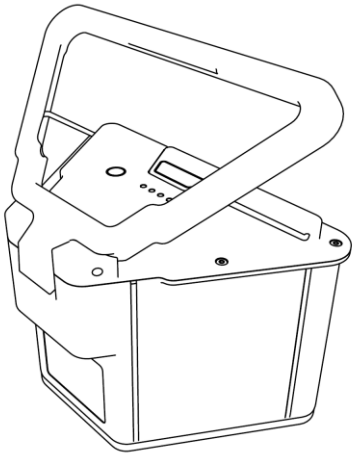


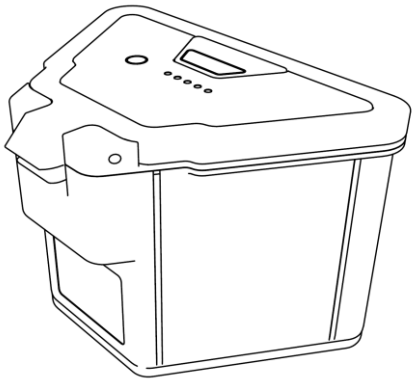
① Power button ② Unlocking button ③④⑤⑥ Battery charge level LEDs
⑦ Battery status LED ⑧ Lock handle

2.3.6.1 Inserting / Removing the Battery

To install the batteries into the UAV, first press the battery unlocking button so that the handle is lifted. Gently lower it into the one of the free battery slots and press the handle down until it locks into place.

⚠ Make sure there is no gap between the battery and the battery slots after pressing the lock handle down.





To remove the battery, press the battery unlocking button so that the handle is lifted. Gently take the battery out of the copter using the battery handle.

2.3.6.2 Powering the batteries On / Off

The batteries can be engaged within the charger or copter. To power the batteries on, hold the power button for a second. The battery statuses are explained in 0 . Powering on a single battery in the UAV or charger will also turn on all other batteries.

To deactivate the batteries, remove them from the UAV or charger and they will revert to the idle state.

Battery Handling and Status. Powering on a single battery in the UAV or charger will also turn on all other batteries.

To deactivate the batteries, remove them from the UAV or charger and they will revert to the idle state.

2.3.6.3 Battery Handling and Status

Proper battery management is crucial for safe UAV operation. The battery status can indicate various states: idle, standby, engaged or error. Understanding these states ensures optimal performance and safety during usage.

2.3.6.3.1 Idle State

When the pack is outside the copter or charger, it is in the idle state. The LEDs will be off, and the output is disabled. The pack's state of charge can be displayed by pressing the button. The battery charge level LEDs will show the (voltage-based) state of charge in white color. The battery status LED will remain off.

Pattern	State of Charge
○●●●●	≤ 25%
○○●●●	≤ 50%
○○○●●	≤ 90%
○○○○●	> 90%

After the button is released, the pack will revert to the idle state after one second.

2.3.6.3.2 Standby

When the pack is **inside the copter or charger**, it initially is also in idle state. It can be activated by holding the power button pressed for one second. The battery status LED will light up as soon as the button is pressed to provide visual feedback to the user.

Pattern	Description
●●●●●	Idle
●●●●○	Button pressed

The pack will transition to standby state when the button is pressed for a second. In standby state, the pack provides limited output power. The battery status LED will turn amber, indicating the user can release their finger from the button.

The pack will precharge the charger/copter, which will cause the other packs to also enter standby. Once voltage levels have stabilized and no short-circuit was detected, all packs will transition to engaged state.

Pattern	State
●●●●●	Standby

2.3.6.3.3 Engaged

In engaged state, the pack is fully operational. The main power FETs are active, and the pack is ready for flight operations or charging. The LEDs will show the state of charge on the four leftmost LEDs and the battery status LED will be green.

Pattern	State	State of Charge
○●●●●	Engaged	≤ 25%
○○●●●	Engaged	≤ 50%
○○○●●	Engaged	≤ 90%
○○○○●	Engaged	> 90%

2.3.6.3.4 Battery Error Messages

When the pack detects an error, it will enter the error state and display an error pattern on the LEDs. The pack will remain in error state until the pack is removed from the copter/charger.

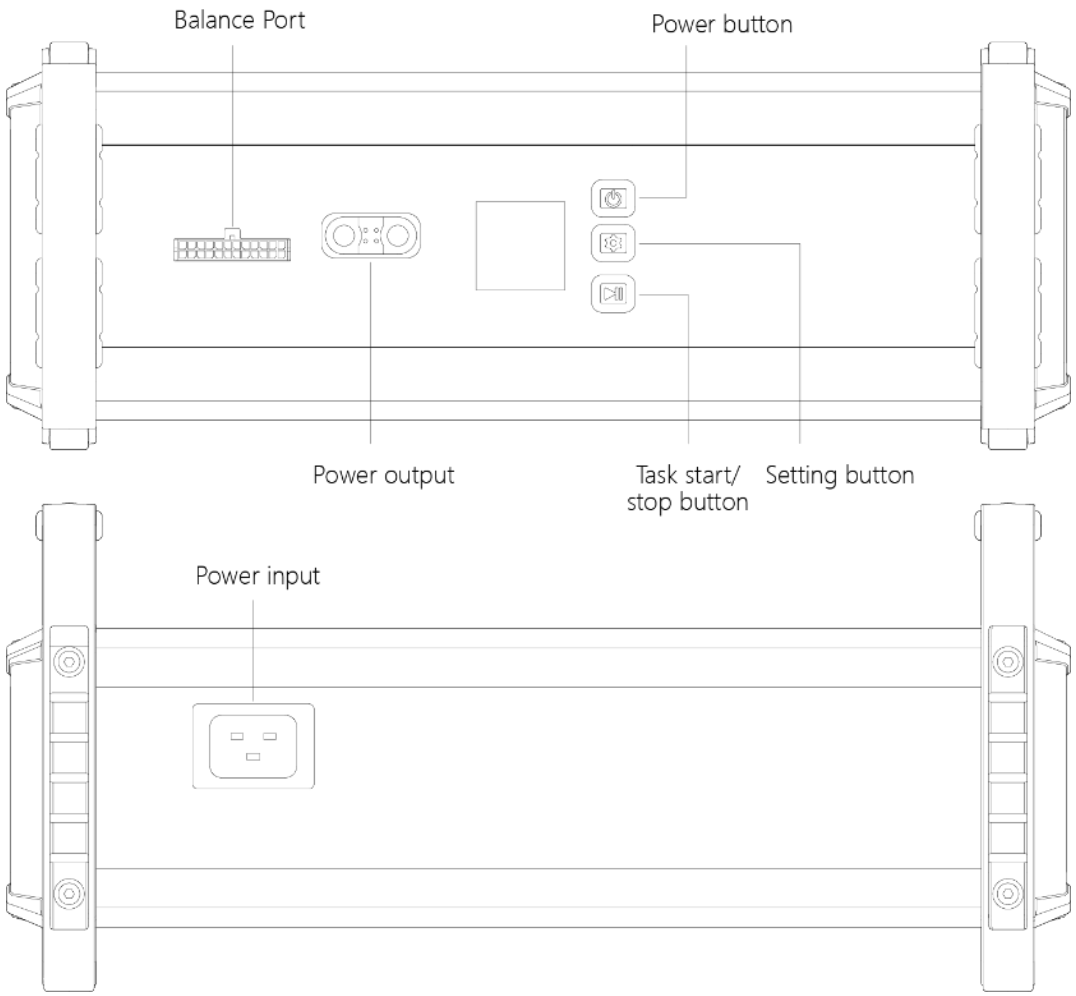
The meaning of each pattern is described in the table below.

Pattern	State	Description
●●●●●	Overvoltage	Pack voltage has exceeded a safe threshold, likely while charging.
●●●●●	Overload	Charge or discharge current has exceeded the safe operating area.
●●●●●	Other	Catch-all for undefined errors. This includes short circuit protection.

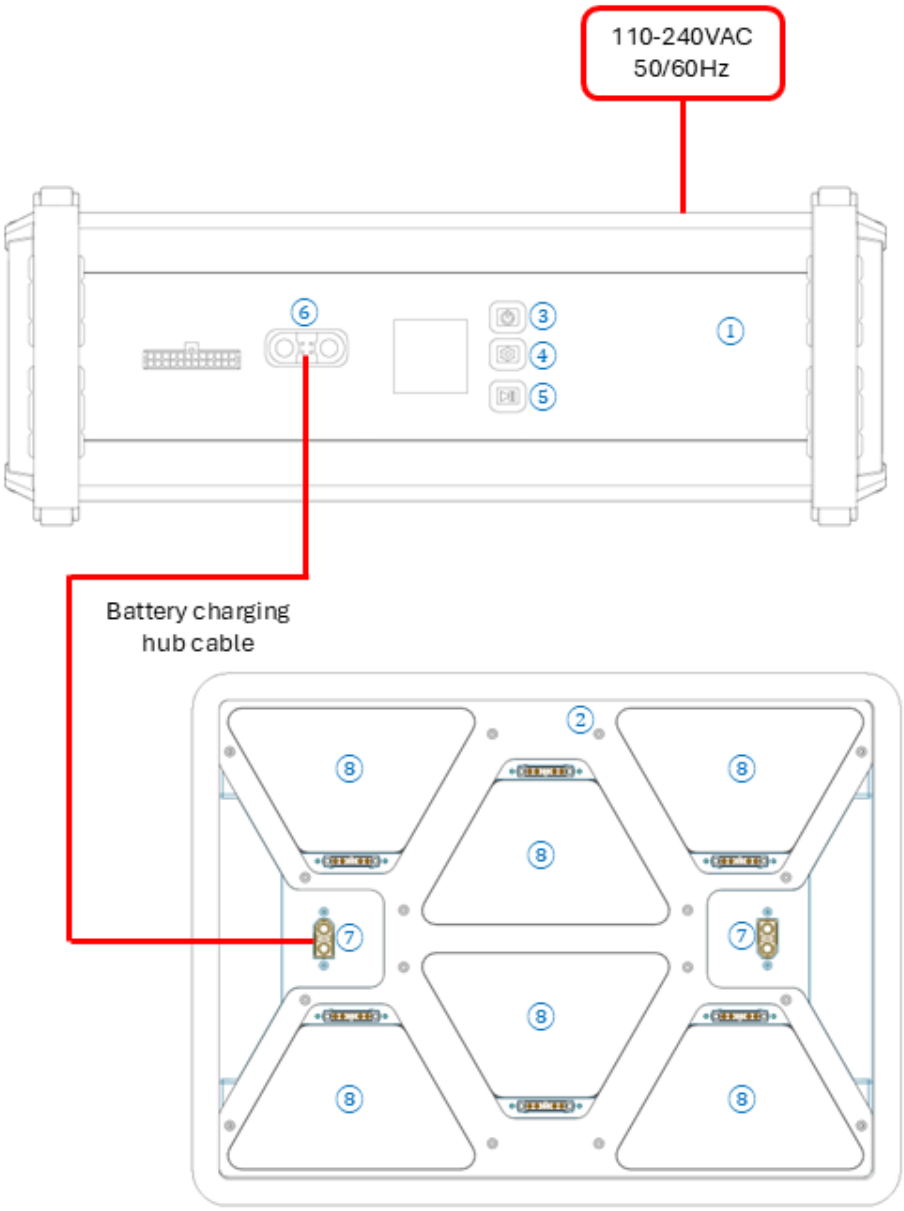
2.3.7 Battery Charging Station

starcopter provides a battery charging station capable of charging one set of batteries simultaneously. The station includes three main components: the battery charger, the battery charging hub, and a set of power cables. This efficient setup ensures the whole battery set can be charged at once, streamlining your operations.

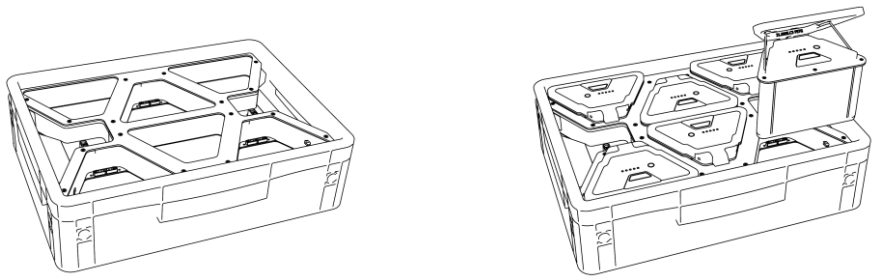
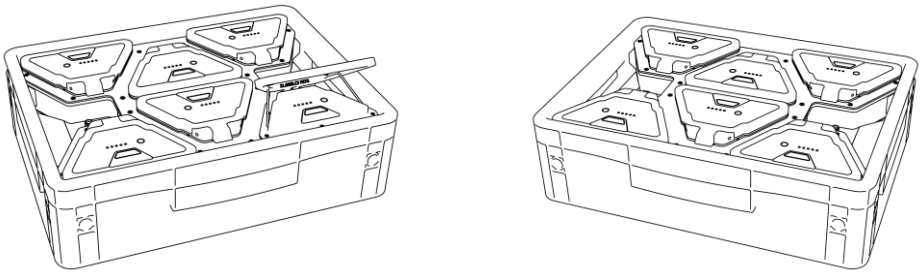
Never mix batteries with different Set-IDs or color-codes.



2.3.7.1 Charging Procedure



① Battery charger
② Battery charging hub
③ Power button
④ Setting button
⑤ Task start / stop button
⑥ Charger DC Connector
⑦ Charging Hub DC Connector
⑧ Battery slot

Step 1: Make sure the charger and the charger box are correctly connected. The charger box must be connected to a power source as specified above.
Step 2: Insert six batteries into the available battery slots (8) of the Battery charging hub (2)


Step 3: Power on the batteries as instructed in Powering the batteries On / Off. Make sure all batteries are activated, and status LED indications are normal.
Step 4: Press and hold the Power button (3) to turn on the battery charger. The display on the battery charger (1) will illuminate
Step 5: Make sure the correct charging mode is selected in the Battery charger (1) display. Press the Setting button (4) until the correct Charging Mode is displayed.
Step 6: Initiate the charging process by pressing the Task start / stop button (5)
Step 7: Wait until the charging process is complete. The battery charger will give off a ringing noise and show a green symbol, when then charging current drops below 5A. However, the charging process is not complete at this point. Wait until the current drops to 0A.
Step 8: Press and hold the Power button (3) to turn off the Battery charger (1). Remove the Batteries from the Battery charging hub (2)

You must follow the charging procedures accordingly to avoid accidents and battery damage.

2.3.7.2 Battery Charging Modes

The Battery Charging Modes are designed to ensure optimal performance, safety, and longevity of your UAV batteries. These modes allow you to manage the charging process according to your operational needs. Understanding the different charging modes is essential for maintaining the reliability and lifespan of your batteries, ensuring they perform efficiently during flight.

2.3.7.2.1 Fast Charge Mode

Parameter	Value
Chemistry	LiPo
Cells	12 S
Full Charge Voltage	4.20 V
Charge Current	55 A
Balance	OFF

Use the Fast Charge Mode to quickly recharge the batteries. The charging process will take approx. one hour with this mode.

When using the **Fast Charge Mode,** no other devices must be plugged into the same Power Outlet. The maximum power could be exceeded resulting in tripping the fuse.

2.3.7.2.2 Normal Charge Mode

Parameter	Value
Chemistry	LiPo
Cells	12 S
Full Charge Voltage	4.20 V
Charge Current	35 A
Balance	OFF

Use the Normal Charge Mode when other devices are connected to the power outlet. The charging time will increase when using this Mode. The charging process will take approx. one and a half hours with this Mode.

2.3.7.2.3 Storage Charge Mode

Parameter	Value
Chemistry	LiPo
Cells	12 S
Full Charge Voltage	3.80 V
Charge Current	35 A
Balance	OFF

Use the Storage Charge Mode when the batteries are stored for long periods of time or before shipping the batteries. When the battery's voltage is higher than 3.8 V per cell the pack will be discharged accordingly.

2.3.7.3 Troubleshooting

Error	Action
The device does not turn on	Make sure the Power Cord is plugged into the Battery Charger and the Power Outlet correctly. Press and hold the Power Button.
The device outputs a ringing noise after starting the charging process	An Error occurred during the charging process. Read the Error description on the Battery Charger Display. Press the start / stop button to turn off the ringing noise.
Display shows error 0x8 Task Start	• turn on the batteries in the charging hub or • connect charging box to charger or • disable balancing
Display shows error 0x2 BatteryRevers	Pause the charging task by pressing the Task start / stop button and restart the process
Display shows error 0xc Disconnection TaskStart	Pause the charging task by pressing the Task start / stop button and restart the process
Display shows error 0x80 CellOverVol	Pause the charging task by pressing the Task start / stop button and restart the process

One or more battery packs display an error state as described in 2.3.6.3.4	Pause the charging task by pressing the Task start / stop button. Remove the battery packs that display an error state and insert them again. Restart the process.
Any or all of the batteries show a red error pattern on their LED display	Stop the charging process, take out all battery packs from the charging hub and start again like described in 2.3.7.1 Charging Procedure.

If any errors occur that are not described here, please contact starcopter for further support.

2.3.8 Payload

The Starcopter HIGHDRA is designed to accommodate standalone payload systems within specific weight and dimensional limits. While functional integration with the UAV is not currently offered, the payload mount allows secure attachment via an adapter tailored to the payload. Starcopter configures and provides detailed instructions for payload installation, ensuring safety and compatibility with the UAV's energy supply.

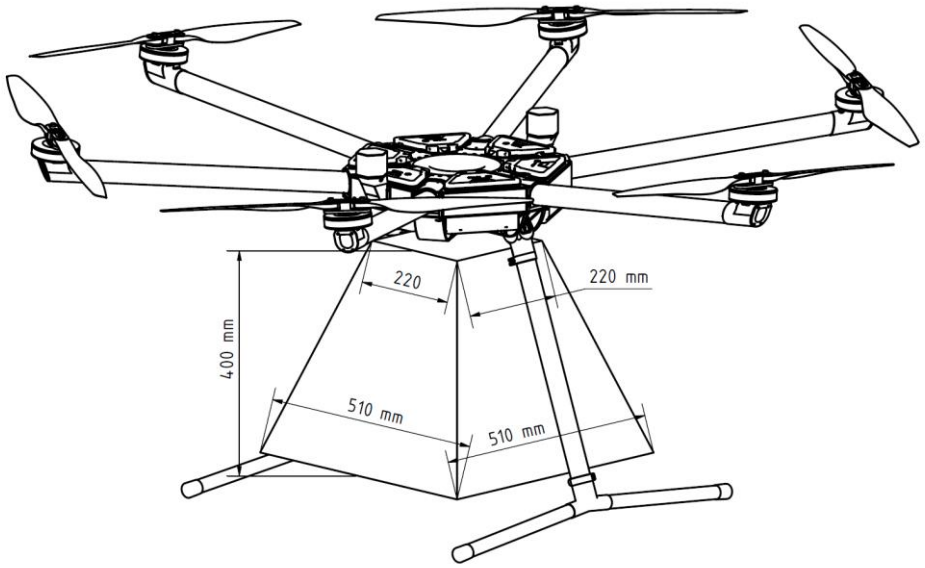
2.3.8.1 Approved Payloads

The starcopter HIGHDRA is currently compatible with standalone payloads within the specified maximum weight and dimensions below. While there is no functional compatibility with the UAV at the moment, the UAV's energy supply can also power the standalone payload.

2.3.8.1.1 Maximum dimensions and weight

With a payload mount, the UAV can carry a payload with specifications below.

Parameter	Value
Max. Weight	7.49 kg



2.3.8.1.2 Integration instructions

The starcopter HIGHDRA can be equipped with various standalone payload systems that are within the specified dimensions and weight. The UAV has a payload mount below that starcopter will configure for you before the rental, so that you can secure your payload via a payload adapter specified for your payload. starcopter will provide you with specific instructions for your payload.

2.3.8.1.3 Functional compatibility

Currently, starcopter does not offer functional compatibility and only relies on standalone payload systems.

2.3.8.2 Maximum mass of accessories, payloads and batteries not included in the original

Starcopter does not offer any accessories or different batteries. Payloads can be configured for customers on demand before the rental period.

2.3.8.3 MTOM warning or statement

Warning: Do not attempt to fly the aircraft with a takeoff mass higher than the maximum limit. An excessive payload mass may lead to loss of control and potential accidents.

📖 The maximum takeoff mass is specified in 2.2 Specifications

2.4 Software Updates and UAV Upgrades by starcopter

starcopter will exclusively manage all software updates for you. In case of critical safety updates, starcopter will notify you via email, perform a guided update with you and handle all occurring software update issues.

2.5 Other Generalities

The starcopter HIGHDRA is only available in one configuration, therefore, there is no list of UA configurations. Similarly, there is no list of items since the only thing that can be attached is the payload. Consequently, there is also no list of UAS combinations. Since the starcopter HIGHDRA is our only available product, there is no need for instructions on how to distinguish similar products with different class identifiers. Starcopter does not provide additional devices like virtual reality headsets or similar auxiliary equipment that provide supplementary information to the remote pilot.

3 Auterion Mission Control

Discover the power of Auterion Mission Control. This section guides you through the key features, enabling seamless mission planning and execution for your drone. Master this central hub for optimized drone operations.

Auterion Mission Control (AMC) is a ground station application designed for UAV pilots. It enables a wide range of functionalities, including piloting the UAV, mission planning, mission execution, and aircraft configuration.

AMC provides a complete solution for safe, reliable, and compliant flying by offering:

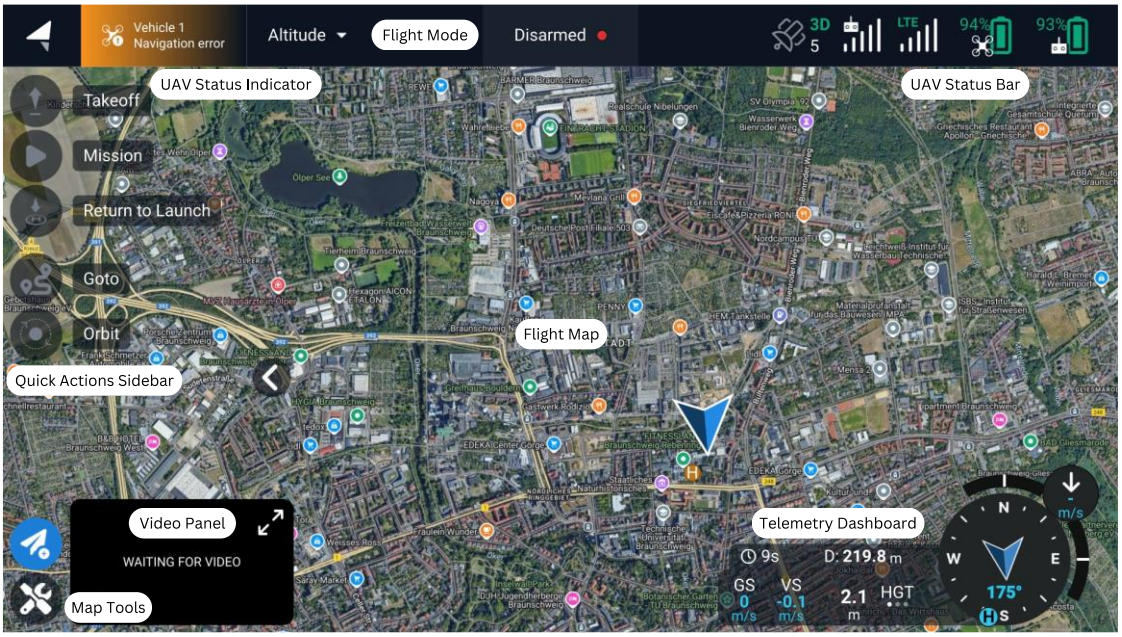
1. **Pre-flight and safety checklists** to ensure all necessary preparations are complete before flight.
2. **Flight controls and telemetry** that allows direct UAV operation without the need for an RC controller, including tasks such as takeoff, navigation, image capture and landing.
3. **Autonomous mission planning and monitoring**, enabling the creation of complex missions with intuitive graphical tools. This includes surveying irregular areas, vertical structures, and corridor paths like roads.
4. **In-flight warnings** presented clearly with guidance for pilots on the appropriate actions to take.

3.1 Fly View

Fly View functions as a command and monitoring hub for UAV operations during flight. It automatically appears as the default view upon launching the application.

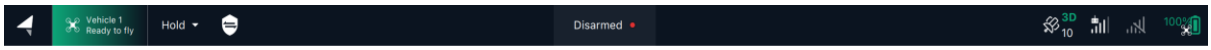
Within this view, you have the capability to:

1. Execute an automated pre-flight checklist.
2. Manage missions, including starting, continuing, pausing, and resuming.
3. Direct the UAV to perform actions such as arming/disarming/emergency stopping, takeoff/landing, altitude adjustments, navigation to a specific location, orbiting, and Return to Launch (RTL).
4. Toggle between a map view and a video view (if available).
5. Showcase video, mission, telemetry, and other pertinent information for the current UAV.

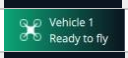
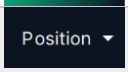
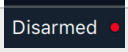
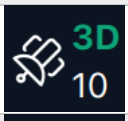
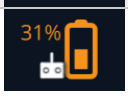


3.1.1 UAV Status Bar

The top bar is used to monitor the UAV's status, flight mode and connectivity.

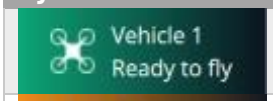
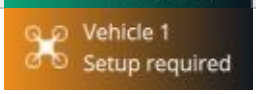
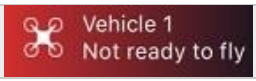


The UAV status bar also indicates the GPS status, Radio Link quality, LTE connectivity, and the aircraft battery status in the upper right corner. Additional details can be accessed by tapping on the corresponding status icons.

Icon	Action	Description
	Menu	Application menu: access Fly, Plan, Vehicle Overview, Controller, Photos, Application Settings and User Log in.
	UAV Status	Status of the current UAV (color and status description).
	Mode	Show the current flight mode. Choose to activate a manual flight mode.
	Connection Manager	Pairing status.
	Armed/Disarmed State	Display or select the armed state. The states include Armed (motors spinning), Disarmed (motors stopped), and Emergency Stop (motors stopped in flight, potentially causing the UAV to crash).
	GPS Status	GPS count and GPS Satellite lock.
	Link Quality	The bars indicate the strength of the link signal between UAV and RC. A greater number of lines corresponds to a stronger signal.
	Cellular Indicator	The bars indicate the strength of the cellular signal. A greater number of lines corresponds to a stronger signal.
	UAV Battery Status	Remaining capacity of the UAV batteries.
	RC Battery Status	Remaining battery capacity (percentage) of the RC. The Status is displayed in red at the 30 % mark and below, which indicates RC battery low level.

3.1.2 UAV Status Indicator

The status indicator located at the top left of the application bar offers clear and immediate color-coded notifications, providing visibility into the UAV's readiness for flight and its in-air flight state. Additionally, this indicator showcases details about the presently controlled UAV and offers descriptive text conveying its status or any encountered issues.

Symbol	Description
	UAV is ready to arm and takeoff.
	UAV not ready to take off for a known reason: • System requires setup (e.g. compass calibration). • Active warning of condition preventing takeoff (e.g. no position lock).
	Unknown fault preventing takeoff.

3.1.3 Flight Mode Selector

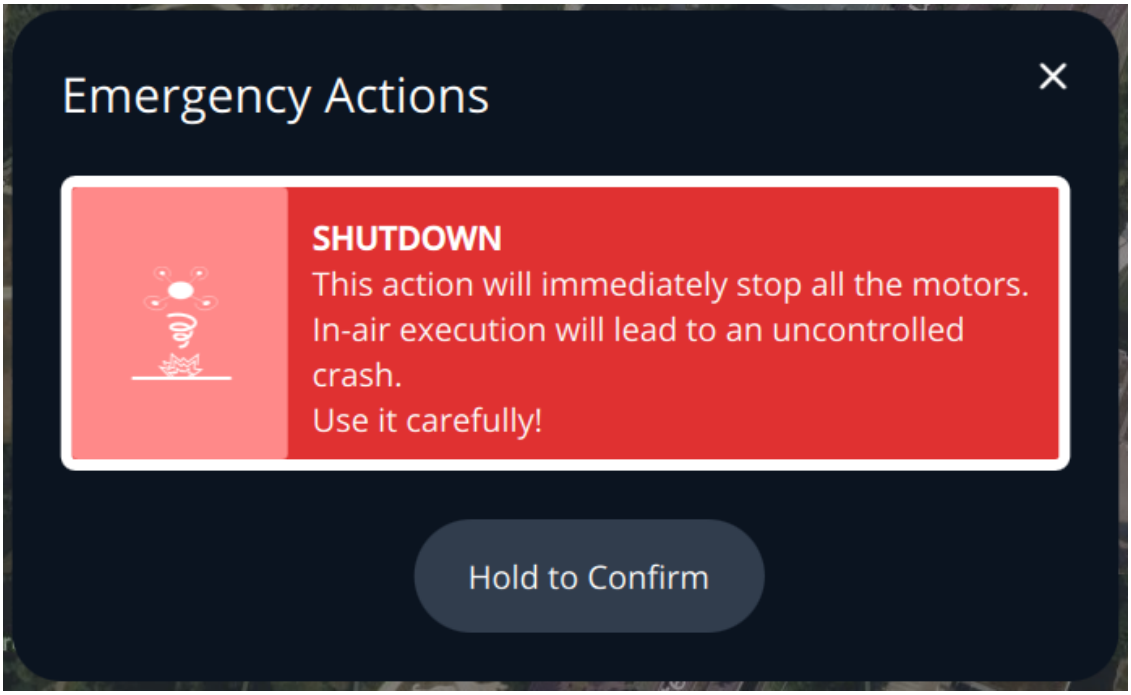
The Flight Mode Selector displays the current flight mode, automatically adjusting when an operation like takeoff, landing, or starting a mission is executed.

Users can also manually choose from the two safest and most user-friendly flight modes supported by PX4: Position Mode and Altitude Mode.

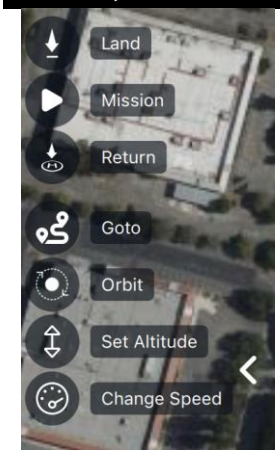
For an in-depth explanation of all flight modes, please refer to 4 Flight Modes

3.1.4 Emergency Actions

In the event of hazardous situations, it is feasible to promptly deactivate the UAV's motors while in-flight. This action will lead to an uncontrolled descent. Ensure that this is employed only when no other alternatives are available.



3.1.5 Quick Actions Sidebar



Auterion Mission Control empowers pilots to command an UAV through Quick Actions such as takeoff, flying to a location, orbiting, Returning to Launch and landing, accessible from the left sidebar. The toolbar dynamically presents valid tool options based on the current UAV state, automatically concealing, or greying out invalid choices.

- Buttons not applicable to the current UAV state are either disabled or hidden (e.g. takeoff is a prerequisite for other operations).
- Use the arrow to expand the sidebar, revealing titles next to each icon.

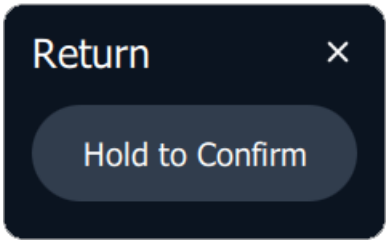
3.1.5.1 Basic Flight Operations

Before execution, actions require confirmation. Confirmation prompts will be presented in the bottom center of the map. If an altitude setting is applicable for an operation, a vertical slider will simultaneously appear.

Icon	Action	Description
	Takeoff	Do not use this action! Enable UAV arming and initiate takeoff to a designated altitude (option visible when the UAV is landed).
	Land	Descend and land the UAV at its present location, followed by disarming (option visible during flight).
	Return	Navigate to a secure location. The path and landing behavior are contingent on the UAV's configuration.
	Mission	Only use this action in midair! Initiate the uploaded mission on the UAV. If a waypoint was previously selected, commence the mission from that specific waypoint.
	Hold	Pause the ongoing operation and maintain the current position.

⚠ Warning! Do not use the takeoff button and the Mission button before takeoff!

As an illustration, the Return Confirmation is displayed below.



3.1.5.2 Flight Tools

The frequently used flight operations can be displayed on the left toolbar by selecting in the lower-left corner and initiated by pressing the corresponding button.

Icon	Action	Description
	POI	Set a Point of Interest (POI) on the map to orient the Gimbal in this direction (available only with Gimbal).
	Goto	Instructs the UAV to navigate to a particular location (can also be employed within a mission, while pausing the ongoing mission).
	Orbit	Directs the UAV to orbit around a designated location.
	Set Altitude	Adjust the altitude at which the UAV is currently flying.
	Change Speed	Adjust the speed at which the UAV is currently flying.

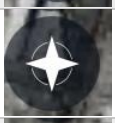
Each of the above-mentioned actions will require user confirmation prior to execution.

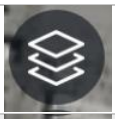
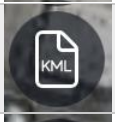
To modify the radius, speed, and rotation direction of an orbit for UAV's, Joystick inputs are necessary:

Left Stick	Right stick
• **up/down: ascent/descent speed (center to lock altitude).** • **left/right: no effect.**	• up/down: orbit radius decrease/increase (center to lock radius). • left/right: orbit acceleration CW/CCW (center to lock current speed).

3.1.5.3 Map Tools

The map tools help you to easily interact with the map. The frequently used map tools can be displayed on the left toolbar by selecting in the lower-left corner.

Icon	Action	Description
	Center Map	Centers the map on the UAV.
	Marker	Place markers on the map with various shapes and colors.
	Clear Path	Clears the red path shown on the AMC Fly View.

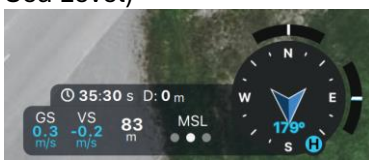
	Map Layers	Select from various map layers.
	Load KML overlay	Load KML files.
	Measure	Measure distance or area on the map.
	Show/Hide Restriction	Show or hide restricted and controlled airspace in AMC.

3.1.6 Telemetry Dashboard

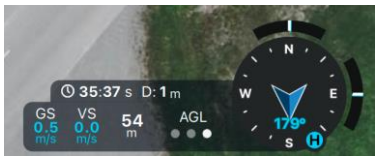
The Telemetry Dashboard presents details regarding the UAV, such as speed, position and attitude, as well as information about the flight, including the distance travelled. The altitude can be switched between three different reference systems by simply clicking on the abbreviation: HGT, MSL and AGL.

HGT (Altitude relative to Launch altitude)

MSL (Altitude above Mean Sea Level)

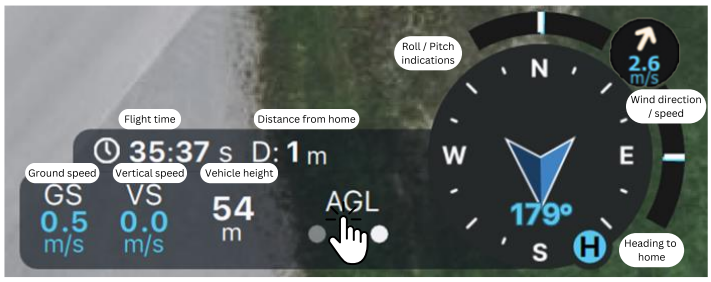


AGL (Altitude above terrain)



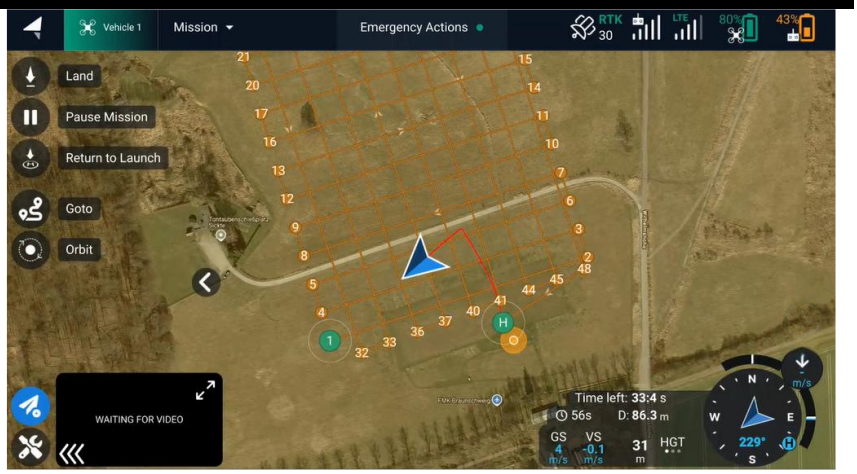
Understanding and correctly utilizing these altitude references are essential for safe and precise drone operations, helping operators navigate varying landscapes and comply with airspace regulations.

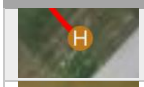
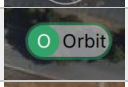
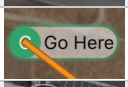
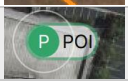
The following display on the right outlines the function of each field in the Telemetry Dashboard.



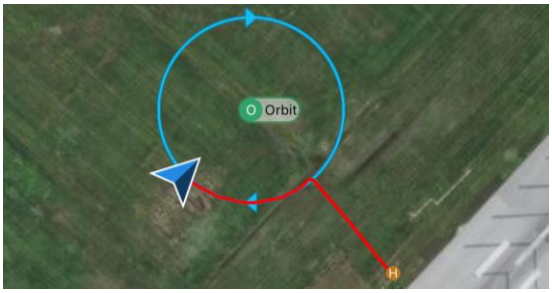
3.1.7 Flight Map

Interaction with the map is achievable through standard panning and zooming gestures.



Icon	Action	Description
	Home	Home position is where the UAV first achieves a reliable position lock, usually the arming or takeoff point.
	Remote Pilot	Remote Pilot position defines the pilot's location during operation for communication and control of the UAV.
	UAV	The orientation icon shows the UAV's location and orientation, providing real-time awareness and aiding control.
	Waypoint	A waypoint is an advanced flight planning feature that enables the creation and automatic execution of flight paths.
	Orbit	Orbit map-action target (center of planned orbit).
	Go Here	Goto map-action target location.
	POI	Position mode POI target location.

The map displays the UAV's present position, home location, the orientation it is facing (which may differ from its heading), the recent flight path (in red), and the anticipated path if defined (such as a Goto or orbit destination, or the mission path).



3.1.8 Geo-Awareness

For safe and compliant UAV operations, it is essential that both the UAV and the operator are aware of airspace restrictions. These restrictions vary by location and can be retrieved from the aviation authorities of EASA member states. To prevent airspace violations, operators must ensure they have the latest airspace data uploaded before every flight.

⚠ Airspace restrictions must be checked prior to every flight to ensure safe and legal flight operations.

The geo-awareness function of the system relies on accurate airspace limitation data. This data must be gathered in ED-318 format, converted for use in Auterion Mission Control (AMC), and then uploaded to the Herelink. The following sections outline the necessary procedures.

3.1.8.1 Preparation of Airspace Limitation Data

To enable geo-awareness, the operator must first obtain and upload the latest airspace limitation data. Airspace data provided by EASA member states is available in ED-318 geoJSON format. Before it can be used in AMC, it must be converted into a compatible format.

To simplify this process, starcopter provides an AMC Geozone Converter, which can be accessed under: https://ed-318.starcopter.de/

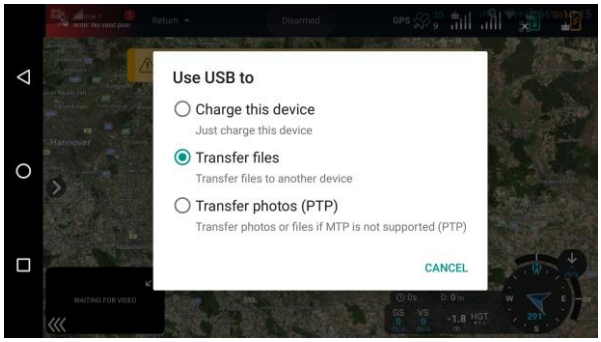
You can use the AMC Geozone Convert as follows:

1. Click on Browse files
2. Select your file and upload it.
3. The data is being converted
4. Click on ‘Download converted AMC GeoJSON File

A map preview is displayed to verify that the correct geozones have been selected. After downloading the correct file, it can now be transferred to the Herelink for use in AMC.

3.1.8.2 Transfer of Airspace Limitation Data to the Herelink

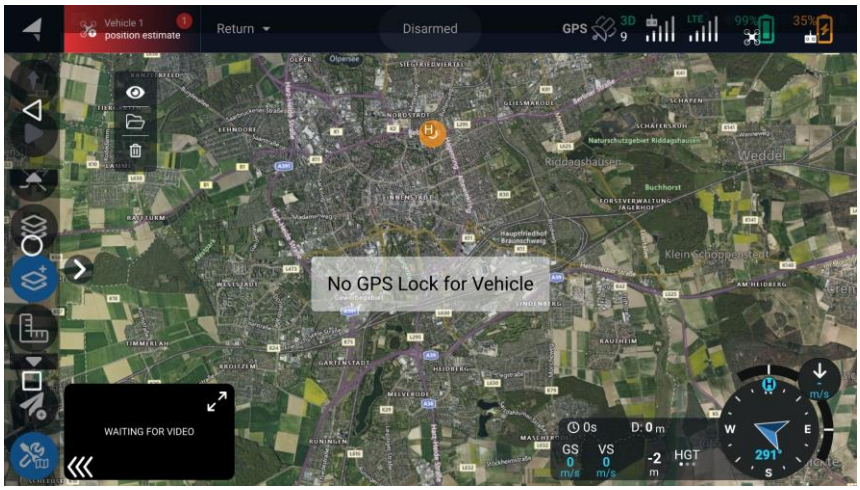
1. Connect the Herelink to your computer via USB cable.
2. Swipe down on the Herelink screen to access the **Notification Panel**.
3. Locate the notification from the Android System: **"USB charging this device"**, and tap **"Tap for more options"**.
4. Select **"Transfer Files"** to enable file transfer mode.



5. Your computer will now detect the Herelink.
6. Copy the **converted ED-318 to AMC geoJSON file** into the **Downloads folder** on the Herelink's Internal Shared Storage.
7. Once the file transfer is complete, safely disconnect the Herelink from your computer.

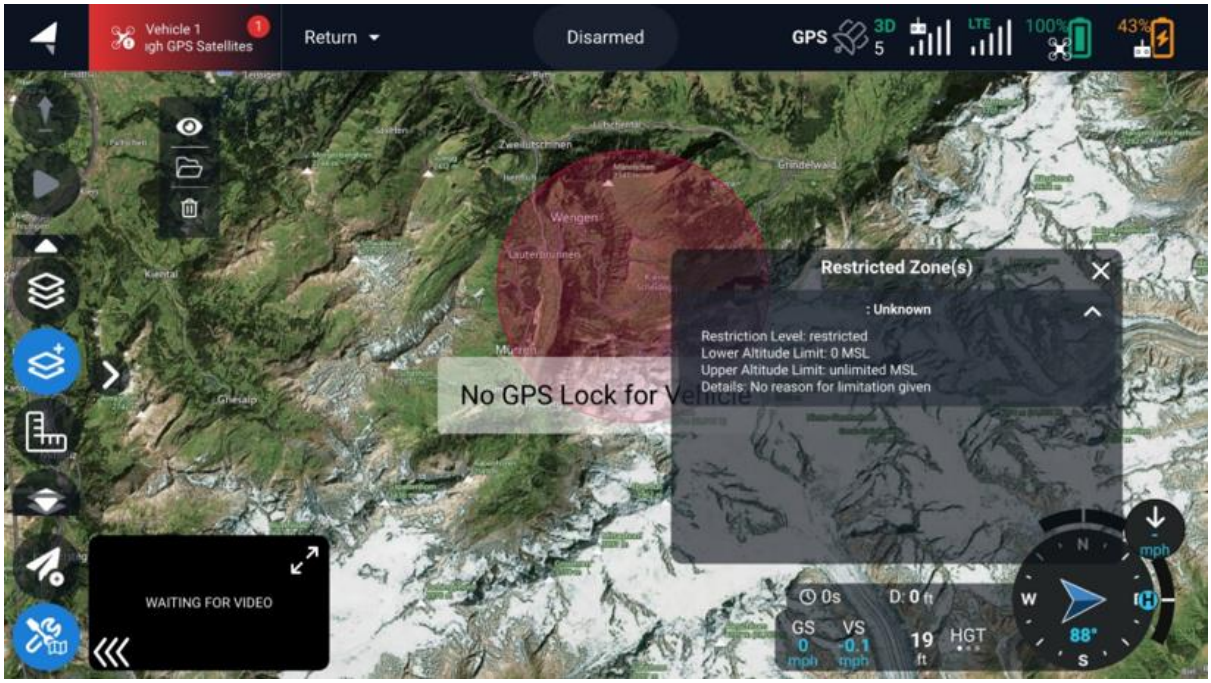
3.1.8.3 Setting Airspace Limitation Data in AMC

1. Open Auterion Mission Control (AMC) and navigate to Fly View.
2. Click on the Map Tools button and select "Map Overlays".
3. Click on the Folder symbol and navigate to the Downloads folder inside "Optimus".
4. Select the converted geoJSON file.
5. AMC will load and display the airspace limitation data.



3.1.8.4 Geo-Awareness in AMC

The geo-awareness function in AMC provides visual warnings when approaching restricted airspace providing you with the information about an impending breach. AMC will issue a visual warning at least 4 seconds before an impending airspace breach. If a breach occurs, the UAV remains fully under pilot control, ensuring no automatic override in case of emergency operations. A visual warning is issued on breach informing the pilot of the airspace entry. AMC will also issue a warning if GPS signal quality is insufficient, as this may impact geo-awareness functionality, stating that the Geo-awareness function is impaired since no GPS is available.



⚠ The geo-awareness function provides warnings but does not intervene in flight control. Operators are fully responsible for maintaining compliance with airspace regulations.

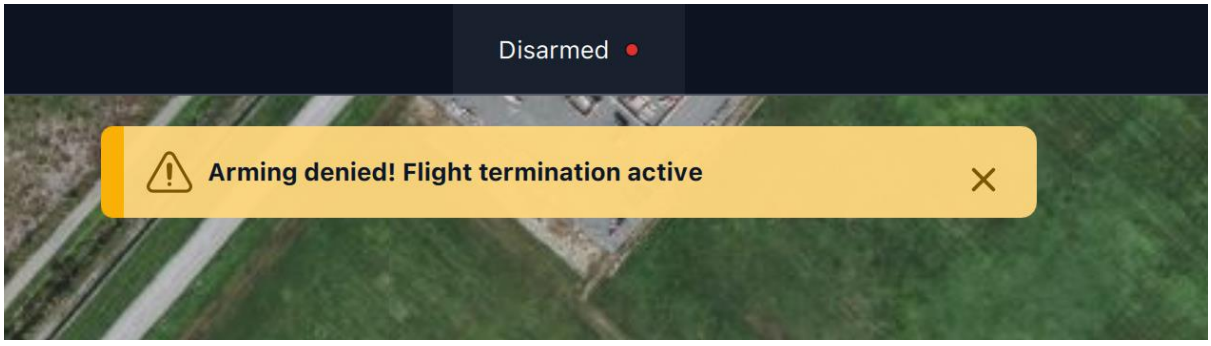
- Clicking on a geozone will display additional details about its restrictions.
- **AMC does not handle time-based restrictions**—all zones are treated as permanently active.
- **AMC does not consider vertical limitations**, meaning zones are displayed as restricted from ground level to infinity. The vertical limits set for the airspace limitation will still be provided.

Operators can control the visibility and availability of geozones within AMC:

- Click the **Eye** button to toggle visibility of airspace data.
- Click the **Trashcan** icon to remove airspace data from AMC.

3.1.9 Warnings & Notifications

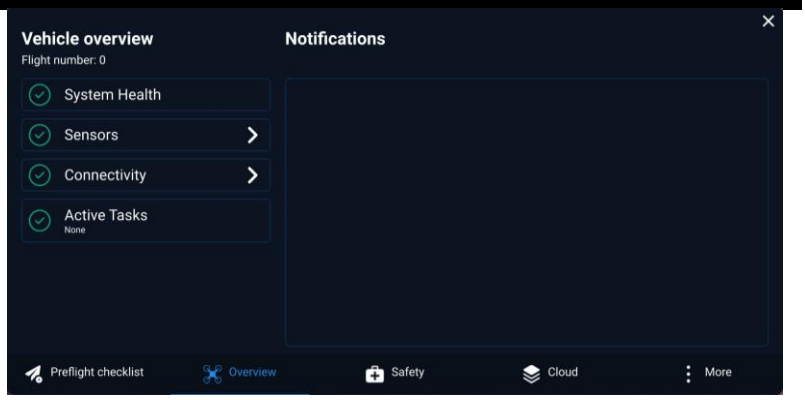
Critical notifications from the UAV are presented in a prominently visible popup. Whenever feasible, these notifications provide information on the root cause of an issue and recommended actions to be taken.

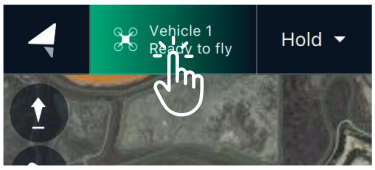


Warning	Instruction
Preflight Fail: Kill Switch engaged	Disengage the kill switch.
Preflight Fail: No connection to the ground control	The UAV is not connected to ground control. Please perform a restart of the UAV.
Preflight Fail: GPS PDOP too high	Wait for improved satellite geometry for better GPS accuracy. Relocate the UAV to a more open area if needed.
Preflight Fail: Compass 1 uncalibrated	Recalibrate Compass.
Preflight: Strong magnetic interference detected	Relocate the UAV to an open area, away from magnetic interference sources such as power lines or metal structures.
Failure: Manual control lost	The drone will automatically enter RC Loss Failsafe.
Switching to mode "Position control" is currently not possible	Remain in Altitude Mode and switch to Position Mode once GPS fix is restored.
Please check orientations and recalibrate	Recalibrate Compass.
ERROR: invalid orientation	This occurs during compass calibration. Please place the UAV in one of the shown orientations.
Operation timeout, aborting transfer	Retry uploading the mission to the UAV.
Mission rejected: previous mission is uploaded	The UAV will not execute the mission if it is outside its range. Please upload the mission within the UAV's range.
Geofence violation for waypoint	Before uploading waypoints to the UAV, ensure none of them violate any geofences.
Arming denied! Global position required	Ensure global position (3D or RTK) is acquired to arm the UAV.
Arming denied! Flight termination active	Deactivate flight termination to arm.
Arming Denied: vehicle is in failsafe mode. Switch flight mode first	Switch to Position or Altitude Mode to arm the UAV.
Arming denied: Resolve system health failures first	A notification will pop up. If you click on the vehicle status and click on System Health, the issue will be described.
Geofence exceeded	The UAV will return to the geofence entry point immediately. The operator will regain control upon changing the flight mode.
Geofence: maximum altitude above home reached	The UAV will return to the maximum altitude above home if exceeded.
Entered airspace	The UAV has entered restricted or controlled airspace. Ensure safe operation and comply with airspace restrictions.
Heading towards airspace	The UAV is approaching airspace based on its current heading. Warning issued in advance.
Low battery level, return advised	Return to Launch is advised.
Critical battery level, executing RTL in 5 seconds	After 5 seconds, the UAV will initiate RTL at critical battery level. The operator can still take control.
Battery Emergency Level	The UAV will land at critical battery level, and the operator can no longer take control.
WARNING: Waiting for terrain data	Ensure stable LTE connection for downloading terrain data.

3.1.10 Vehicle Overview Menu

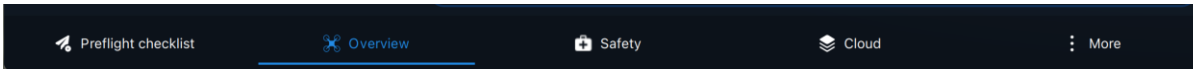
The Vehicle Overview Menu offers operators a convenient pathway to perform Preflight Checklist, explore a comprehensive vehicle overview with critical notifications, manage Safety settings, access Cloud Page and use More functionalities.



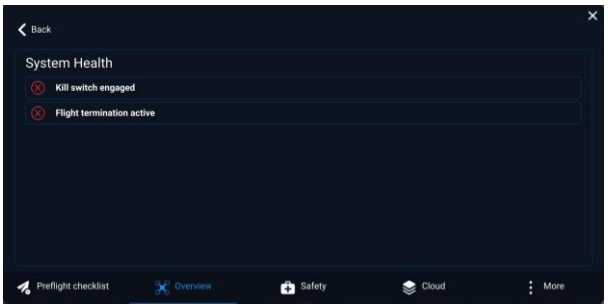


Access the vehicle overview menu by tapping the UAV icon in the top bar. This menu encompasses the vehicle notification page and additional submenus on the left side, including System Health, Sensors, Connectivity and Active Tasks.

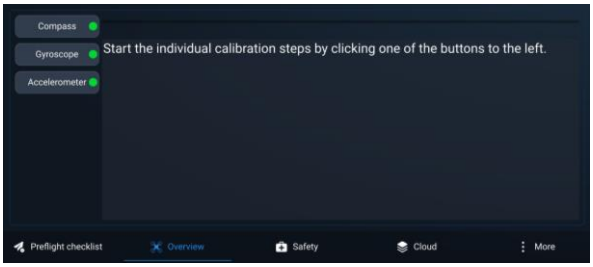
Further submenus including Preflight Checklist, Safety settings, Cloud Page and More can be found at the bottom.



AMC includes a **System Health** feature that enables operators to monitor the real-time status of key drone components for safe and reliable operations. It tracks critical indicators such as GPS and compass accuracy, sensor functionality and communication link quality. System health alerts prompt corrective actions when any parameter deviates from safe limits, supporting proactive maintenance and enhancing operational safety.



In the **Sensor** Submenu you will find a comprehensive guide on calibrating the Compass, Gyroscope and Accelerometer. Follow the step-by-step instructions to ensure the successful calibration of each sensor when required. A green Status Circle serves as an indicator, symbolizing a functional and already calibrated sensor.



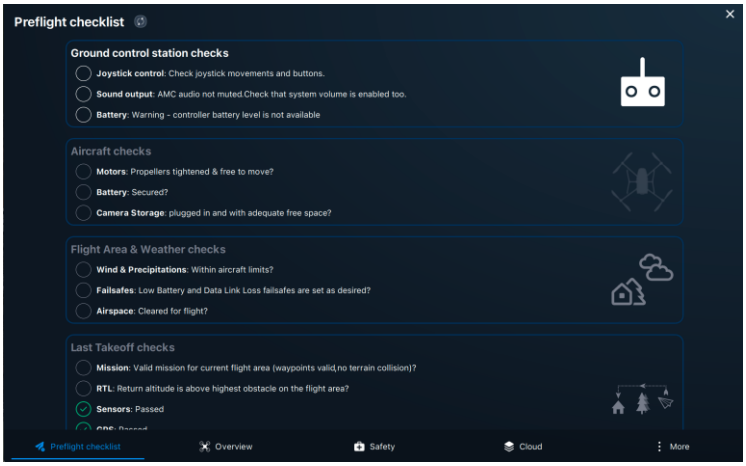
In the **Connectivity** Submenu, operators can monitor and establish a connection between the UAV and either a Wi-Fi or LTE network. By default, an LTE network is preconfigured and ready for use.

The Active Tasks Tab presents an interface enabling you to observe ongoing activities. Notifications deliver in-flight information to pilots, and a more detailed log is uploaded to Auterion Suite for analysis.

3.1.10.1 Preflight Checklist

The Preflight Checklist should be run before every flight to verify that the vehicle and planned flight path are safe to fly. A more detailed Checklist from starcopter can be found within the 6.4 Pre-flight Chapter.

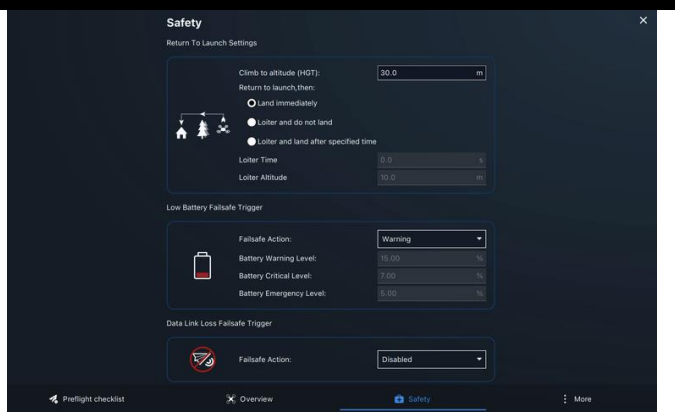
The AMC checklist comprises fundamental sanity tests to ensure the UAV's readiness and safety for flight, along with confirming the overall safety of the planned flight. While some tests, like sensor calibration and GPS lock, are automatic, others, such as verifying securely attached batteries, require manual confirmation from the user. The checklist is organized into distinct sections, with the requirement that all tests within one section must be passed before proceeding to the next section.



Auterion Suite records checklist results as a measure of pilot compliance.

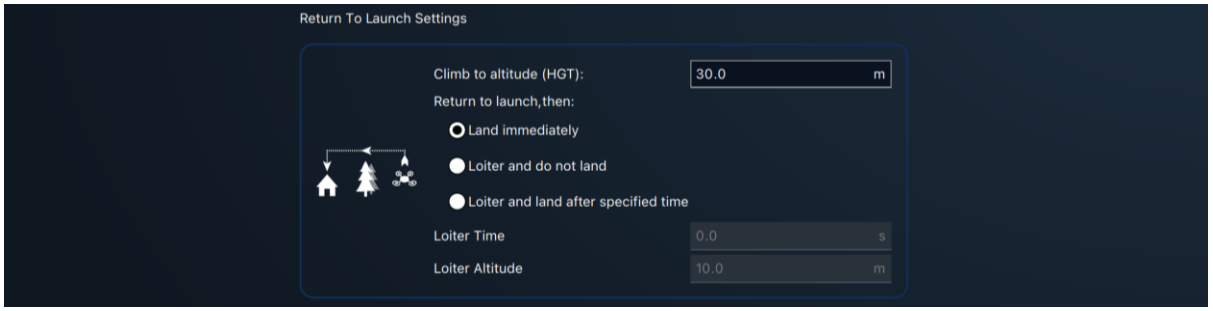
3.1.10.2 Safety

Within the safety menu, you have the option to configure your personalized safety settings.



3.1.10.2.1 Return to Launch

Activating the **RTL** initiates the UAV to ascend to a secure altitude and navigate to a safe destination, where it may hover and/or proceed with landing. This section provides the option to specify the return height and landing behavior for both rally point and home location landings.



Setting	Description
Climb to altitude (HGT)	The UAV ascends to this minimum height (if below it) for the return flight.
Return to Launch	Upon return, the options include landing, loitering without landing, or loitering and landing after a specified time.
Loiter Time	The duration for loitering before landing, applicable when the return to launch action is set to "Loiter and land after a specified time."
Loiter Altitude	Defined vertical position maintained by the UAV during a hovering.

3.1.10.2.2 Low Battery Failsafe

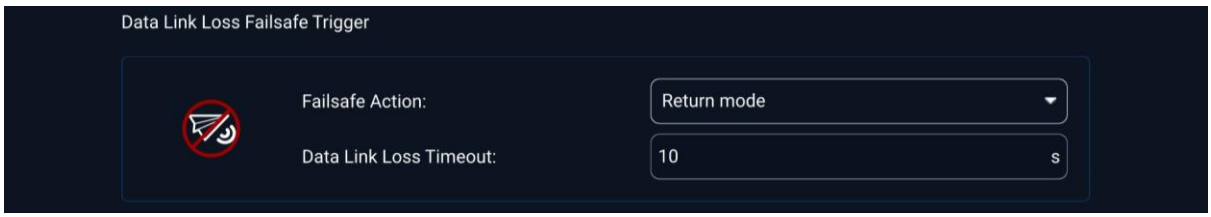
The low battery failsafe activates, when the battery capacity falls below one (or more) specified warning level values.

Typically, the standard configuration involves setting the action to **Return mode** at critically low levels and **Land mode** at the current position if dangerously low levels are reached.

Setting	Description
Failsafe Action	• **Warning.** Warn (notification only) if capacity drops below Battery Failsafe Level. • Initiate **Return Mode** at critically low levels and **Land Mode** at the current position if dangerously low levels are reached. This triggers a warning, Return Mode, and Land Mode at the respective levels.
Battery Warn Level	Percentage capacity for Warnings if Warning action enabled.
Battery Failsafe Level	Percentage capacity for Return Mode action when it is enabled.
Battery Emergency Level	Percentage capacity for Land Mode action when it is enabled.

3.1.10.2.3 Data Link Loss Failsafe

Configure the response action and speed of the UAV in the event of Data Link Loss (loss of communication to the ground station).



Setting	Description
Failsafe Action	Disabled and Return mode.
Data Link Loss Timeout	Time after data link loss before the Failsafe Action is triggered.

3.1.10.2.4 Geofence Failsafe

The Geofence Failsafe establishes a virtual cylinder centred around the home position. If the flight controller detects that the UAV has exited this cylinder, the designated failsafe action will be triggered.

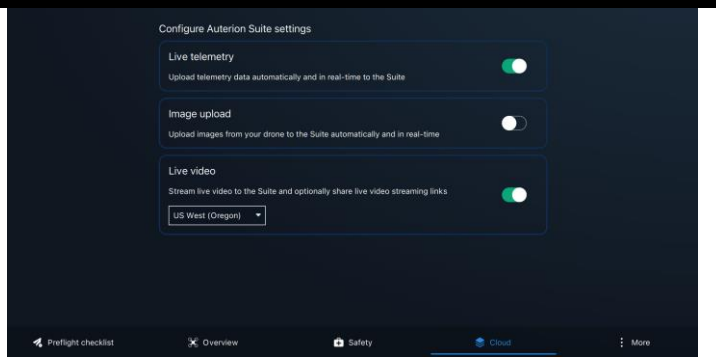
⚠ Despite its name, the Geofence Failsafe is **not** a geofence function; it operates as an independent system. Do not confuse it with a standard geofence function.

Setting	Description
Action on Breach	None, Warning, hold mode and Return mode.
Max Radius	Horizontal radius of geofence cylinder. Horizontal geofence disabled if value is set to 0.
Max Altitude (HGT)	Height of geofence cylinder, relative to home position. Altitude geofence disabled if value set to 0.

📖 The maximum height limitation function set through the Max Altitude is explained in 4.3.1 Maximum Height Limitation Function.

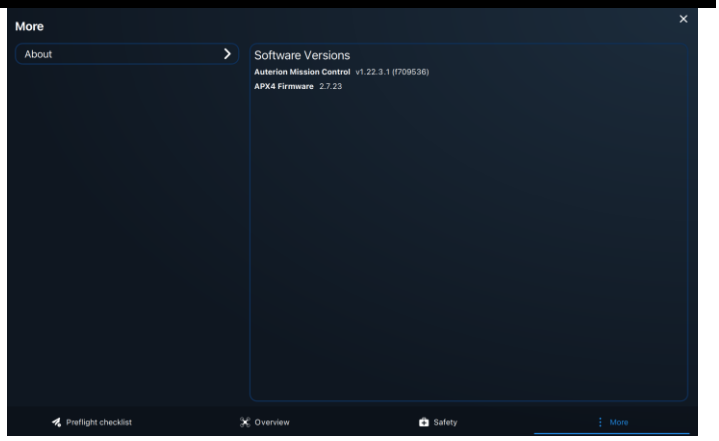
3.1.10.3 Cloud Page

Adjust Auterion Suite settings within the Cloud tab, accessible through the vehicle menu only when an internet connection is present. The vehicle cloud functionality is activated by default.



3.1.10.4 More

You can find all the information about your software version.

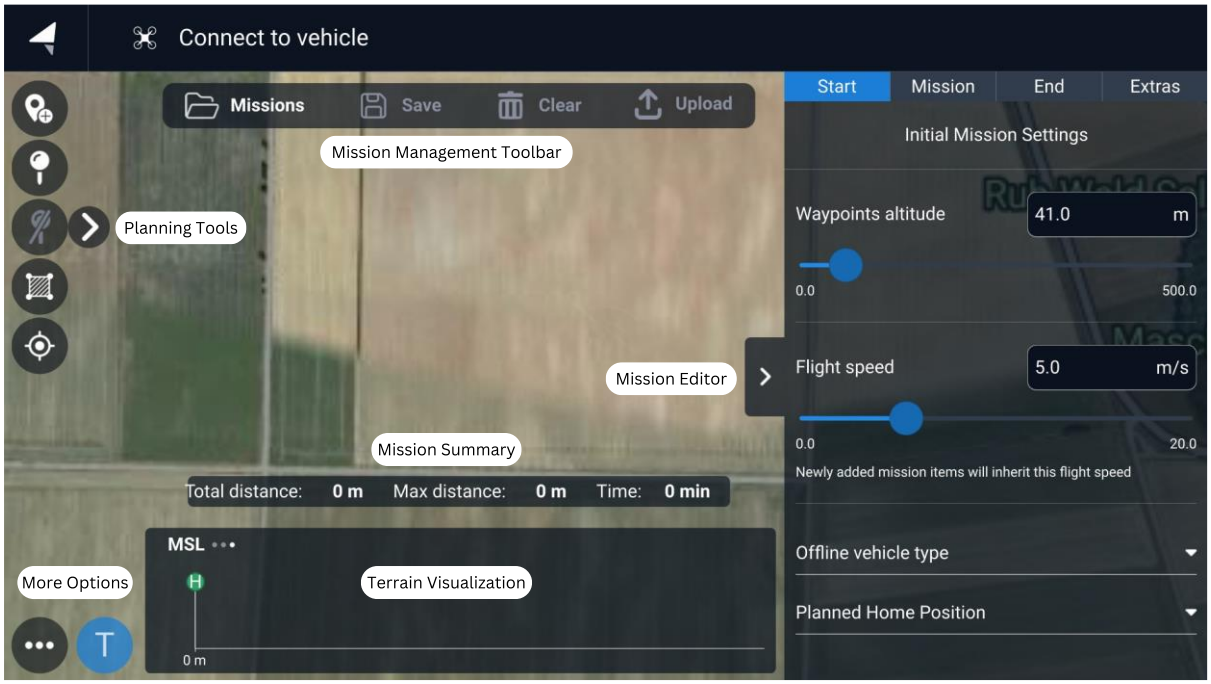


3.2 Plan View

The content in this section presents an overview of the Plan View user interface and offers more detailed guidance on each plan and survey type.

Plan View is used for creating autonomous flights that may include:

1. Waypoints: Including Points of Interest (POI).
2. Missions: Autonomous Waypoint Mission, including Survey and Corridor Scan.
3. Rally Point: Alternative safe destinations when in Return to Launch Mode.



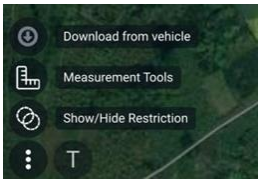
3.2.1 Mission Management Toolbar

The Mission Management toolbar allows the User to manage and control missions. Using this interface, the operator can open templates or load previously saved missions from the remote control or Auterion Cloud Suite. The toolbar includes icons too:

Icon	Action	Description
	Mission	Access mission templates or saved missions.
	Save	Save the current mission for future use.
	Clear	Remove the current mission from the Plan View.
	Upload	Upload the mission to the UAV.

3.2.2 Planning Tools

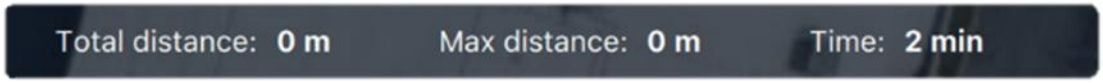
The Planning Tools Sidebar offers swift actions for managing autonomous missions, such as adding waypoints, Points of Interest and inserting survey/corridor scan patterns. Some of these options are visible only when working on a specific type of mission or clicking on the ⋮ More Options button. Press the arrow button to make the descriptions visible. Press it again to hide them and return to the compact view with icons only.



Icon	Action	Description
	Waypoint	Choose to activate the option for adding new waypoints to the map.
	POI	Choose to enable the addition of a Point of Interest on the map. The camera/gimbal will orient towards the most recently created POI.
	Cancel POI	Cancel previously added POIs.
	Survey Pattern	Add or load a survey pattern: Survey or Corridor Scan.
	Center	Recenter the map on the mission, home, UAV, all items, or a designated location.
	More Options	Open this to access the following options below.
	Download from Vehicle	Download saved waypoints from vehicle.
	Measurement Tools	Measure distance or area on the map.
	Show/Hide Restriction	Show or hide restricted and controlled airspace in AMC.

3.2.3 Mission Summary

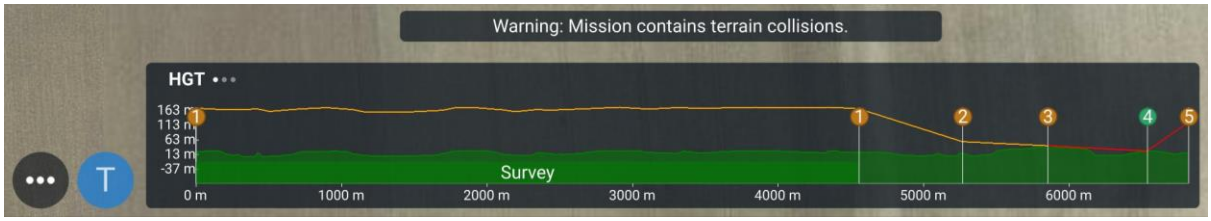
The Mission summary box provides details about the entire mission, assisting you in evaluating whether you have sufficient battery power and telemetry range to successfully complete it.



Field	Description
Distance	Total distance of mission.
Max. Distance	Maximum distance from ground station (must not exceed telemetry radio range).
Time	Expected/calculated time to complete mission

3.2.4 Terrain Visualization

Terrain Visualization is employed to confirm that waypoints are positioned above ground level. You can show or hide it by toggling the **T** button, located next to the More Options button.



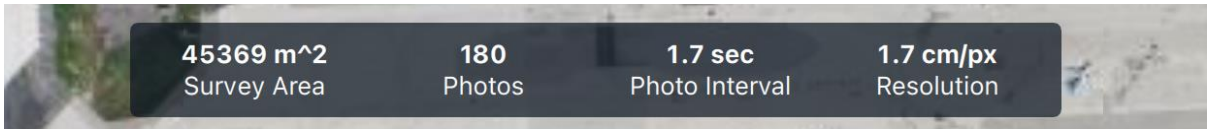
The indicator shows the altitudes of planned waypoints and the terrain:

- The green line indicates the terrain of the Survey.
- The orange line indicates the flight path of the UAV.

⚠ The red line indicates below-ground waypoints with a WARNING: Mission contains terrain collisions.

3.2.5 Statistic Panel

The Statistics Panel displays the calculated survey area, photo count/interval and resolution.



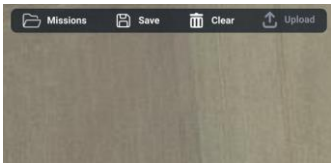
3.2.6 Waypoint Mission

A waypoint mission is an automated mission where the flight path is explicitly defined by the operator on the map using waypoint mission items. The map displays the mission path and direction, featuring numbered circles for waypoints. Other important points are identified with labeled markers (e.g. **T** for takeoff, **H** for start point). To edit a mission item, it can be selected directly from the map, appearing highlighted with a larger filled green circle and a description, and its editor opens in the list.

Most mission item types are added by selecting the associated Planning tools and then choosing the desired position for the item on the map. These items include takeoff items, waypoints, points of interest, survey/scan patterns and return points. The "Upload" button facilitates the uploading of missions to the UAV. Users can then switch to Fly View and execute the mission.

3.2.6.1 Create a Waypoint Mission

The following steps will explain how to create an end-to-end waypoint mission, covering takeoff, configuring waypoints and setting a landing action at the end of a Waypoint mission:



1. Open the Plan View.
2. From the Plan View, click on the bin icon in the Mission Management Toolbar, this will clear any existing mission.
3. Select Planning Tools > **Waypoint** to enable adding waypoints.
4. Select a point on the map to add a **Waypoint,** it will automatically generate a waypoint item to the Mission Editor.

5. Verify that the settings in the Mission Editor are accurate for the intended flight, especially ensuring that the altitude is sufficiently high to avoid obstacles when moving towards the initial waypoint. Please make all necessary changes to ensure the flight is safe.
6. Add as many waypoints as necessary along the intended path on the map and edit them in the Mission Editor.
7. To add waypoints between existing ones, choose the mission item just before where the new item should be inserted, either on the map or in the Mission Editor and select the marker on the line connecting them.
8. To end a mission, either use the Return button in Fly View or choose a Mission End action from the End of Mission Editor:
   Hold: The UAV will hover at its current position and altitude.
   Land: The UAV is landing at its current position.
   Return to Launch: It establishes a route back to the initial take-off point of the mission.
9. Check the Terrain Visualization to confirm that none of the waypoints are below ground level. Use the Mission Summary to check if the mission is executable.
10. If all configurations are in place, proceed to click the "**Upload**" button.
11. After successfully uploading the mission, go to Fly View and execute the mission.

> i You have the capability to relocate waypoints and various items on the map through drag-and-drop, delete items and add patterns for Survey or Corridor Scan.

3.2.6.2 Create a Point of Interest

A Point of Interest (POI) item defines a location (including position and altitude) that the camera will track.

A POI mission item is generated by clicking on the map when the Planning Tools > **POI** button is activated. The position of the item can be adjusted through drag-and-drop on the map and the altitude is configurable in the editor.

Setting	Description
Altitude	Altitude for the region of interest, relative to the home/takeoff point, is initially set to the altitude of the preceding mission item.

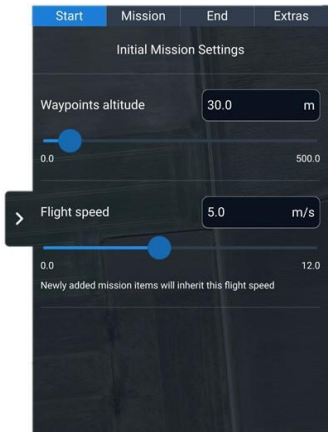
The camera will follow the designated point from the previous waypoint destination until either a **Cancel POI Mission** Item is added into the mission or the mission ends.

A Cancel POI item is generated by selecting the button: Planning Tools > **Cancel POI** (the button becomes available when a POI is enabled). The new item is added next to the current mission item. The Cancel POI Editor does not offer additional specific settings.

3.2.7 Mission Editor

The Mission Editor on the right allows the operator to adjust mission settings, including speed, waypoint altitude, and end-of-mission actions.

Press the arrow button to open the Mission Editor and press it again to collapse it, providing more space for mission planning.

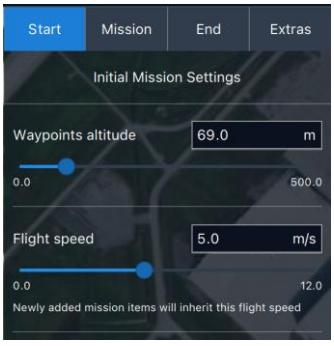


The settings are categorized into four distinct sections, each dedicated to a specific aspect of the mission:

- Start Mission Editor
- Waypoint Mission Editor
- End of Mission Editor
- Extras Section

3.2.7.1 Start Mission Editor

The Start Mission Editor is used to specify settings that apply to the whole mission (e.g. launch position) and settings for the first mission item (e.g. the altitude). It can also be used to reset the altitude and flight speed for all mission items. Additional mission items are added using the Planning Tools (Waypoints, Takeoff, Return, etc.) and removal is facilitated through the bin icon in their associated editors.



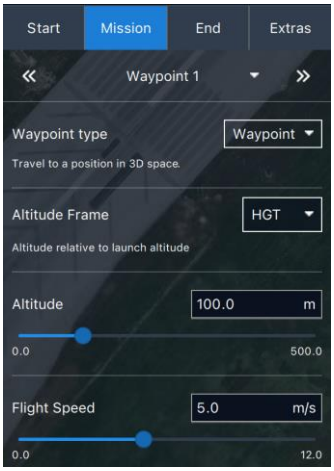
Setting	Description
Waypoint altitude	The initial altitude is set for the first mission item added to a Waypoint Mission, and subsequent items inherit their initial altitude from the preceding one. This feature can also be used to uniformly modify the altitude for all items in a Mission to a specified value, and users will be prompted if the value is changed.
Flight speed	Set a flight speed for the mission.

There is no need to add a takeoff item, as the takeoff location is automatically set based on the vehicle's position when it powers on.

3.2.7.2 Waypoint Mission Editor

This segment of the Mission Editor enables the operator to further adjust waypoint settings individually.

Waypoints are created by choosing the desired location(s) on the map when the Planning Tools> **Waypoint** button is activated. The positions of items can be adjusted through drag-and-drop on the map, while altitude changes are made in the corresponding editor. Waypoints can be relocated, but not generated, when the Waypoint button is switched off. By default, the front of the UAV will yaw towards the next waypoint.



Setting	Description
Altitude Frame	Sets the altitude reference for missions, with options for HGT, AGL, and MSL.
Altitude	Altitude for the waypoint, relative to the home/takeoff point, is initially set to the altitude of the previous waypoint.
Flight Speed	Set a flight speed for the mission.

It is possible to switch between the different waypoints.

Waypoint items define positions (both in terms of location and altitude) along the UAV's path and may include optional camera settings for the subsequent travel segment. They are linked on the path by lines connecting to the previous and next waypoints. The current waypoint is highlighted in green on the map, and its editor is expanded in the mission list.

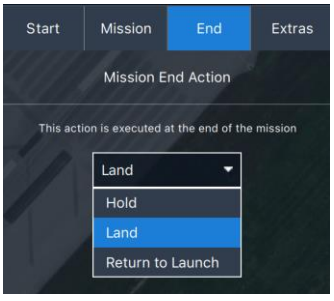
The Camera Panel specifies camera action/triggering and gimbal positioning from the current waypoint until the next waypoint (the next waypoint inherits the camera action by default).

Setting	Description
Camera triggering	No change (continuing current action). Take photos (time). Take photos (distance). Stop taking photos. Start recording video. Stop recording video.
Mode	Camera mode: Photo, Video, Survey.
Gimbal	Enables gimbal fields: Pitch and Yaw.

3.2.7.3 End of Mission Editor

The End of Mission Editor defines a location (position and altitude) for the UAV to land. By default, the UAV will execute a Return to Launch action at the end of the mission.

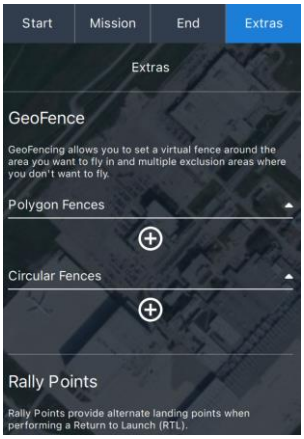
The land position may be changed through drag-and-drop on the map, and the altitude is changed in the associated editor.



Setting	Description
Hold	The UAV will hover at its current position and altitude.
Land	The UAV is landing at its current position.
Return to Launch	It establishes a route back to the initial take-off point of the mission.

3.2.7.4 Extras Section

This section of the Mission Editor allows you to add Inclusion Zones and Rally Points.



Setting	Description
Inclusion Zone	Defines an area that the UAV with boundaries for the UAV.
Rally Point	Alternate secure landing or waiting sites for the UAV.

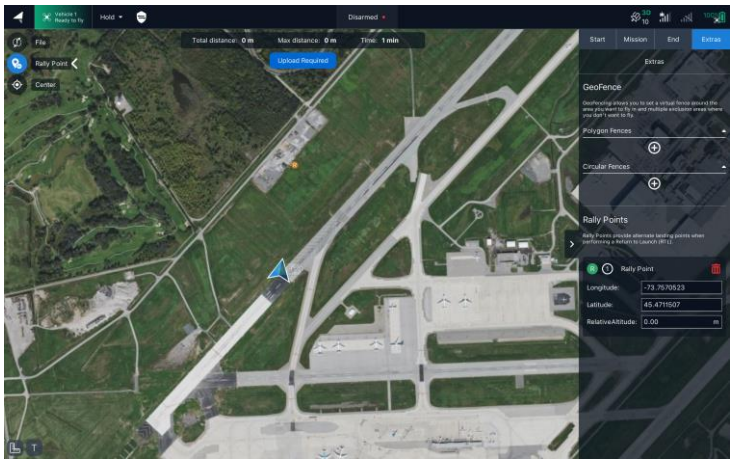
⚠ Although the inclusion zone is listed under GeoFence, it **is not** a GeoFence. The system does not currently feature a GeoFence. The inclusion zone functions independently. Despite the headline, no GeoFence capabilities are implemented at this time.

3.2.7.4.1 Rally Point

Rally points serve as alternate safe landing or waiting locations for the UAV in Return Mode. The UAV typically navigates to the nearest rally point or returns Home, with the precise behavior contingent on the UAV's configuration.

ⓘ Rally points prove beneficial when the takeoff point ("**home location**") is not a secure landing spot or when a UAV might lack sufficient power to return home.

Rally points are displayed on the map as circles containing the letter R. The selected rally point is indicated by an orange circle and adjustments can be made in the Rally Point Editor panel located on the right.
The rally points are generated in Plan View and subsequently uploaded to the UAV, along with the Waypoint Mission and GeoFence definitions.



To create Rally Points:

1. Open the Plan View and select the **Rally** button above the editor on the right.
2. Select/Enable the **Rally Point** tool.
3. Choose the map location where you want to add a rally point. A new point will appear on the map as an orange circle with the label R.
4. If necessary, utilize the Rally Point Editor on the right-hand side to define an exact latitude, longitude and altitude.
5. Add as many points as needed.
6. Rally points already present on the map can be selected and relocated through drag-and-drop and modified or removed using the rally point editor.
7. When finished, press the **Upload** button to save the points to the UAV.

3.2.8 Survey Pattern

Various patterns can be used to insert surveys and scans into a mission plan. The Survey and Scan tools can be accessed from the Mission Planning Toolbar, as illustrated below.

After an option is selected, a basic pattern of the selected type is added to the map and to the Mission Editor. This can be edited to the desired shape:

> i Survey and Corridor Scans provides a simpler and more flexible way to define a survey over an arbitrary region than manually adding waypoints.

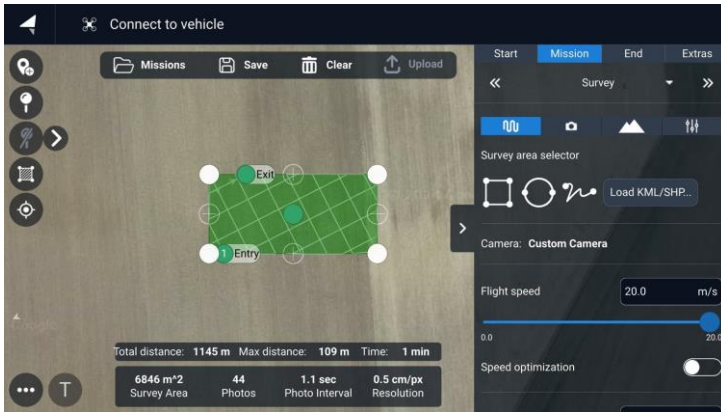
Pattern	Description
Survey	A survey pattern designed to capture a randomly complex shaped polygonal region. This enables the specification of the polygon, grid, and camera settings suitable for capturing geotagged images.
Corridor Scan	A survey pattern that traces a polyline (e.g. for surveying a road or railway).

3.2.8.1 Survey

A Survey is a Waypoint Mission that includes at least one survey pattern, which consists of a grid flight path over an arbitrary polygonal area, flown at a specified altitude and utilizing a designated camera or camera settings.

The survey area is outlined by a polygon or circle highlighted on the map. The green circular markers, numbered sequentially, signify the points where the UAV enters and exits the pattern.

A Survey Editor item in the mission item list on the right is employed to configure the grid angle, spacing, and other properties. It is also used to specify the relevant camera settings for capturing geotagged images.
This section shows the process of creating a survey mission and outlines the diverse settings that can be configured in the Survey Editor.



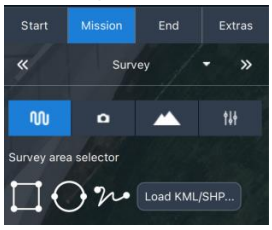
3.2.8.2 How to Create a Survey Mission

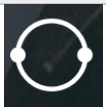
The easiest way to define a survey mission is to open Plan View, select the Survey Pattern button and choose **Survey**. This generates a template for a simple end-to-end survey mission.

Defining the Survey area is all the user needs to do; any items requiring configuration are highlighted with a red border in the Waypoint Mission Editor. If a more complex mission is required, the basic mission can be expanded by adding other items before the return item.

To create a survey mission, you can follow these steps:

1. Open the Plan View and select the Survey Pattern button and then **Survey**. This creates a basic Survey Mission and clears any existing mission.
2. Ensure that the settings for the Mission Editor item are accurate for the intended survey. Specifically, confirm that the altitude (Waypoint altitude) is sufficiently high to avoid obstacles when travelling to the survey.
   From the Mission Editor select the Waypoint Mission Editor tab to edit the Survey. With the survey area selector, you can change the shape (basic, circular and trace) of the survey area:



Icon	Shape	Description
	Basic	Generate a polygon starting from a rectangle. The filled vertices can be repositioned as needed using the map. Additional vertices can be created by selecting the markers between existing vertices and then relocating them.
	Circular	The filled circles at the center and on the circumference can be shifted on the map to change the circle's position and size.
	Trace	Trace around the shape of the target region. While tracing, the filled circles can be adjusted on the map; however, the center point cannot be moved, and new vertices cannot be created.

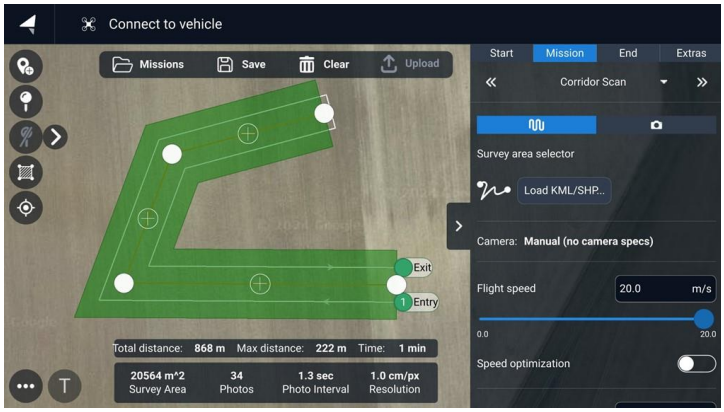
3. Select the End of Mission Editor to choose the action to execute at the end of the Survey mission.
   - **Hold**: The UAV will hover at its current position and altitude.
   - **Land**: The UAV is landing at its current position.
   - **Return to Launch**: It establishes a route back to the initial take-off point of the mission.

3.2.8.3 Corridor Scan

A Corridor Scan is a Waypoint Mission designed for surveying roads, rivers, and other path-like ground features. It establishes a grid flight pattern that follows a polyline.

A Corridor Scan mission requires at least one Corridor Scan pattern. The corridor represents a path outlined on the map (shaded in green above), with the white line indicating the grid flight path. The green circular markers signify entry and exit points for the UAV.

The Mission Editor on the right is utilized to configure corridor settings such as width, altitude, required image resolution, and other properties. It also allows users to specify camera settings suitable for generating geotagged images.
This section provides guidance on setting up a corridor scan mission and explores the various configurations available in the Survey Editor.



3.2.8.4 How to Create a Corridor Mission

The easiest way to define a survey mission is to open Plan View and select the Survey Pattern button and choose Corridor Scan. This generates a template for a simple end-to-end survey mission.

Defining the Corridor Scan area is all the user needs to do; any items requiring configuration are highlighted with a red border in the mission item list. If a more complex mission is required, the basic mission can be expanded by adding other items before the return item.

To create a Corridor Scan, the following steps can be performed:

1. Open the Plan View and select the Survey Pattern button and then **Corridor Scan**. This creates a basic Corridor Scan Mission and clearing any existing mission.
2. Ensure that the settings for the Start Mission Editor are accurate for the intended survey. Specifically, confirm that the Waypoint altitude is sufficiently high to avoid obstacles when travelling to the survey.
3. From the Mission Editor select the Waypoint Mission Editor tab to edit the Corridor Scan.
4. Select the End of Mission Editor to choose the action to execute at the end of the Survey mission.
   - **Hold**: The UAV will hover at its current position and altitude.
   - **Land**: The UAV is landing at its current position.
   - **Return to Launch**: It establishes a route back to the initial take-off point of the mission.

The green section of the line represents the scanned area, while the white line indicates the proposed flight path.

Drag-and-drop a filled vertex at one end of the line to the starting point of the intended path and do the same for the other end.

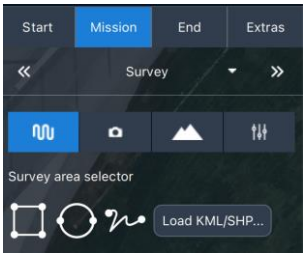
Select the unfilled circle positioned between the two vertices to generate a new vertex. Move this vertex to the initial point in the path where the direction changes. Continue this process, creating new vertices and placing them along the desired path. Repeat as needed.

> The camera settings are ***the same*** as for Surveys Scans. For more information see: Camera Setup.

3.2.8.5 KML or Shape File for Mission Planning

Detailed flight planning is made easier with the use of KML and Shape (SHP) files. These files provide the flexibility to plan missions based on predefined boundaries from another application, such as Google Earth. Complex areas can be automatically extracted from polygon KML files, eliminating the need to draw the area polygon in AMC. This function is only available for Survey missions and Corridor Scan.

1. Copy a KML or SHP File to your internal storage of your Remote Control.



2. Open Plan View and select the Survey Pattern button and choose **Survey** or **Corridor Scan**.
3. Once the Survey or Corridor Scan was created, there will be an Option available (only when the Mission is selected) in the Grid Settings within the Mission Editor to upload a KML or SHP file.
4. Navigate to your internal storage, locate your KML/SHP file, and select it.
5. AMC will automatically create an end-to-end survey mission in the shape of your predefined KML/SHP file.
6. Once the mission from the KML/SHP file was created, the flight planning parameters can be modified to match your requirements.

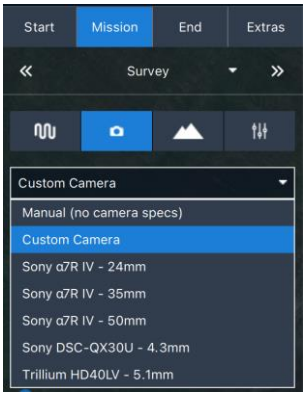
3.2.9 Survey Editor

The Survey Editor is used to customize Camera and Grid settings and enables the saving and reuse of Presets. Configuring camera settings should be prioritized, before adjusting the grid, as the capabilities of the camera directly impacts the grid settings.

3.2.9.1 Camera Setup

Triggering of the survey camera relies on factors such as the camera's capabilities and orientation, survey altitude, desired image resolution, grid density, and trigger distance. Choose from the options of selecting a predefined camera from the list, configuring a custom camera, or manually inputting camera settings without specifications.

> Whenever possible, choose between a predefined or custom camera, as this enables the automatic recalculation of the survey grid, balancing considerations such as desired image overlap, image resolution, and survey altitude.



Predefined Camera

Using a predefined or known camera allows automatic calculation and recalculation of an optimal survey grid pattern, considering the desired image overlap, image resolution and survey altitude.

Custom Camera

The Custom Camera feature defines settings for a "custom" camera, enabling users to take advantage of dynamic grid recalculation, even if their camera is not predefined. The custom settings mirror those of a predefined camera but incorporate additional fields for camera definition.

Manual Camera

Users also have the option to select Manual settings. In this case, the Grid settings will provide choices for configuring the survey altitude, trigger interval, and grid spacing.

i However, it is worth noting that this method is less convenient compared to using camera settings. Any alteration to a value or the camera requires manual recalculation of other settings.

Setting	Description
Camera Selector	Select the camera from the list.
Landscape/Portrait	The orientation of the camera concerning the "normal" orientation of the UAV is an optional setting. This option is applicable only to cameras equipped with asymmetric sensors, allowing them to be mounted in various orientations.
Sensor Width/Height (Custom Camera)	Camera image sensor size (mm).
Image Width/ Height (Custom Camera)	Camera image resolution (pixels).
Focal Length (Custom Camera)	Camera focal length (mm).

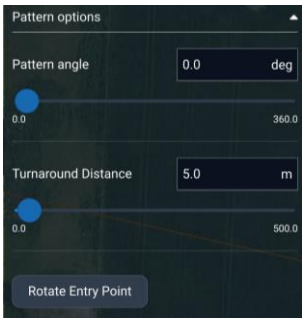
3.2.9.2 Grid Settings

The Grid tab is used to set the properties of the scan.

The **Grid Settings** enable the operator to fine-tune mission parameters, including Overlap, Altitude, and Ground Sampling Distance (GSD, automatically calculating the other value).

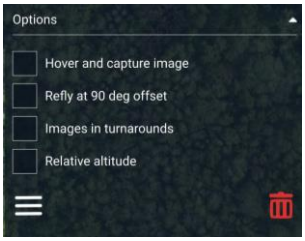
Setting	Description
Flight Speed	Set a flight speed for the mission and option to optimize the Speed.
Overlap	The amount of overlap between each image capture, which can be configured independently for flying along grid lines (Front Overlap) or across them (Side Overlap).
Altitude	Survey altitude. The GSD field is automatically adjusted, based on the resolution required for the entered altitude.
Ground Sampling Distance	GSD for each image. The Altitude field is dynamically adjusted to the minimum value required to achieve the entered resolution.
Trigger Distance	Only applicable to Manual Cameras: distance over the ground between each camera shot.
Spacing	Only applicable to Manual Cameras: distance between flight path lines across the survey area.

The **Pattern Settings** are used for grid configurations that are not tied to the camera. Adjustments made to these settings are immediately reflected on the map.



Setting	Description
Angle	The orientation of the grid lines (in degrees) relative to North (only for Survey Missions).
Width	Set the width of the scan around the polyline that defines the path (Only for Corridor Scan).
Turnaround distance	Extra distance added beyond the survey area to allow the UAV to turn around.
Rotate Entry Point	The button toggles between the survey entry and exit points.

Additional Settings are available in the **Checkbox Options**.



Option	Description
Hover and capture image	Hover and capture images
Refly at 90° offset	Refly the whole pattern at 90° offset, creating a double grid.
Images in turnarounds	Capture images during turns or outside the grid.
Relative altitude	Specify that the grid is relative to home (or above mean sea level - AMSL).

3.2.9.3 Terrain Follow

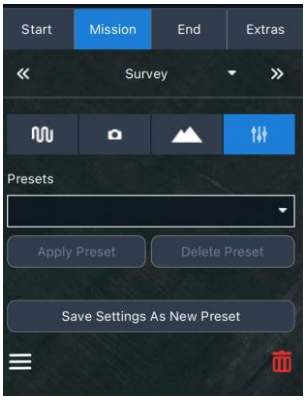
Terrain Following ensures that the UAV maintains a consistent height relative to the ground during the survey. By default, a flying UAV follows the survey path at a fixed altitude. Terrain Following is advisable when there is significant variation in terrain height within the survey area.

For this feature, Terrain following utilizes terrain heights obtained from AirMap servers.

Setting	Description
Vehicle follows terrain	Check to enable terrain following.
Tolerance	The accepted deviation in altitude from the target altitude.
Max. Climb Rate	Maximum climb rate when following terrain.
Max. Descent Rate	Maximum descent rate when following terrain.

3.2.9.4 Presets

The Presets section enables surveys to reuse frequently specified camera and grid settings.



> Survey presets are stored within the plan file and can be loaded onto the current ground station only. If loaded onto another ground station, the outcome will be unpredictable.

Setting	Description
Presets (list)	List of user-created saved presets for selection.
Save Setting as New Preset	Saves the existing settings as a preset with a specified name.
Delete Preset	Delete the currently selected preset.
Apply Reset	Apply currently selected preset to survey.

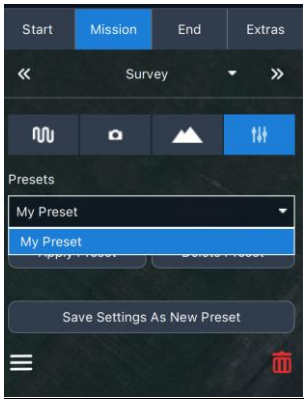
To save or delete the current set of presets:

Save

1. Choose the "Save Settings as New Preset" option. This will open the Save Preset dialog on the right.
2. Enter a Preset Name.
3. Select Save.

Delete

1. Select the preset in the Presets list.
2. Select Delete Preset.



4 Flight Modes

Flight modes define the various operational settings of the UAV, allowing it to perform different tasks and respond to specific flight conditions with the appropriate control behavior.

The starcopter HIGHDRA offers a variety of flight modes, which are categorized into **Pilot-Controlled Modes** and **Automatic Modes**.

Pilot-Controlled Modes, as the name suggests, require direct input from the UAV operator to control the drone. These modes include **Position Mode** and **Altitude Mode**.

In contrast, **Automatic Modes** allow the UAV to operate automatically, but the operator must always be prepared to take control in case of an emergency. The Automatic Modes include **Mission Mode**, **Return to Lauch**, **Takeoff**, **Hold**, and **Land Mode.**

Flight modes can be changed either using hotkeys on the RC device or through the user interface of the Auterion Mission Control.

4.1 Pilot-controlled Modes

In **Pilot-controlled Modes**, the drone responds in real-time to commands and inputs from the pilot via the remote control. These modes allow the pilot to manipulate the drone's orientation, altitude, and speed, offering a high level of flexibility and adaptability.

Pilot-Controlled Modes are essential for tasks that require dynamic decision-making, precision, and immediate adjustments during flight. Unlike automatic modes, which operate independently, Pilot-Controlled Modes rely on the pilot's real-time skills and judgment to ensure safe and effective drone operation.

4.1.1 Position Mode

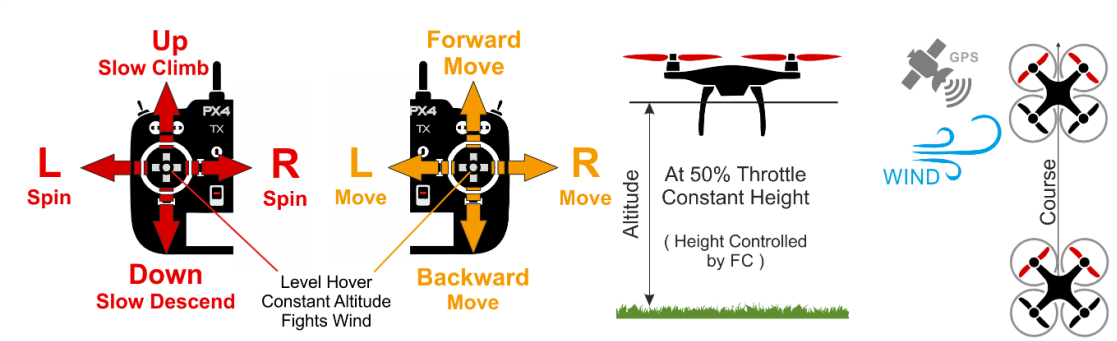
Position Mode helps maintain the UAV'S horizontal and vertical position using GPS and barometric sensors. It also assists with lateral movements by controlling lateral speed. The mode derives its name from the UAV's ability to hover in place when the control sticks are centred.

To engage Position Mode, a GPS signal is required. If the GPS signal is interrupted, the UAV will remain in the previously selected flight mode. Should the GPS signal disrupt during flight, the UAV will automatically switch from Position Mode to Altitude Mode, which may lead to unexpected flight behaviour. Therefore, it is advisable to avoid flying in areas with poor GPS coverage.

The throttle stick controls vertical speed (climb/descend rate) and orientation (yaw rate). Pushing the throttle stick forward causes the UAV to ascend, while pulling it back initiates descent. Moving the stick left results in a counterclockwise rotation, and moving it right causes a clockwise rotation. The further the stick is deflected from its centre position, the greater the vertical speed and yaw rate.

Horizontal movements relative to the ground are controlled by the roll/pitch stick. Pushing it forward moves the UAV forward, while pulling it back moves it backward. Lateral movements of the roll/pitch stick result in left and right manoeuvres, with the speed of these movements depending on the amount of stick deflection.

The diagram below visually illustrates the mode behaviour:



[1]: https://github.com/PX4/PX4-user_guide/blob/main/assets/flight_modes/position_mc.png
[2]: https://github.com/PX4/PX4-user_guide/blob/main/LICENSE
[3]: https://creativecommons.org/licenses/by/4.0/

⚠ The UAV will come to a stop when the sticks are centered, avoiding drifting with the wind.

When moving the control sticks during Automatic Modes, the UAV will automatically switch to Position Mode.

Standard Condition for this flight mode	Value
Hover	Drone hovers in place without stick inputs.
Minimum radius of turn	0 m
Max. Tilt Angle	36°
Max. Climb Rate	4.5 m/s
Max. Descent Rate	3 m/s
Max. Vertical Speed at landing	1 m/s
Max. Horizontal Speed	12 m/s

This section provides essential guidance for safe takeoff procedures, smooth operation, and effective troubleshooting during flights in Position Mode. By following these tips, you can ensure stable flight, minimize the risk of issues, and respond appropriately if problems arise.

1. **Smooth Control Movements**: Operate the sticks smoothly to avoid abrupt inputs. Avoid flicking or making unnecessary adjustments, especially when flying at Maximum Takeoff Mass (MTOM). In Position Mode, the maximum speed is limited to 12 m/s, which helps maintain precise control and stability.
2. **Takeoff and Landing**: Always choose a flat, open area for takeoff and landing. A recommended safe radius of at least 15 meters should be maintained from obstacles or people. The takeoff should be performed quickly to minimize the risk of instability. Ensure the UAV is not experiencing any downwash.

⚠ During arming, confirm that all propellers are spinning uniformly before initiating takeoff. If any issue is noticed, abort the takeoff immediately and disarm the UAV.

3. **Position Mode Unavailable**: If Position Mode is unavailable, troubleshoot the issue or relocate the UAV to a better position with improved GPS coverage before attempting again.
4. **Flight Stability**: If the UAV behaves unexpectedly during flight, switch to Altitude Mode and take control. Ensure the UAV is stable before switching back to Position Mode. If issues persist, land the UAV in a safe location.

5. **Flight Mode Switching**: Never switch flight modes while the UAV is in motion. Always bring the UAV to a stable hover before changing modes.

⚠ Hand catching the UAV can result in severe injury and is therefore strongly discouraged.

4.1.2 Altitude Mode

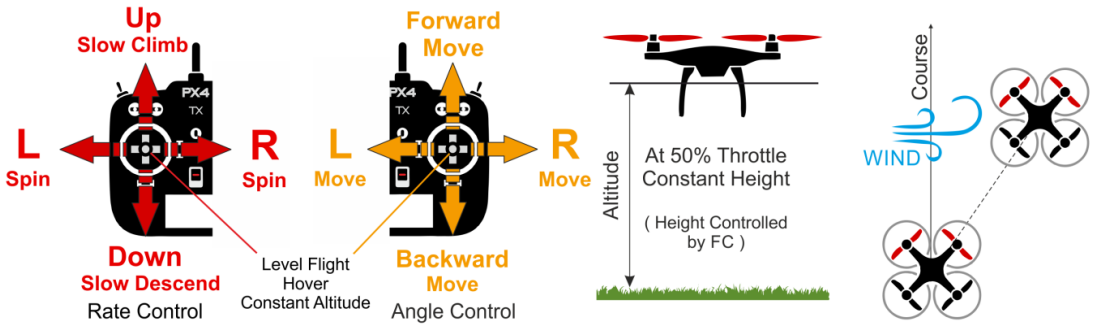
Altitude Mode allows the operator to control the horizontal movements of the UAV while maintaining its vertical position. Keeping both sticks centered maintains the UAV's altitude and a level attitude, but it will continue moving forward with existing momentum until slowed by air resistance and it may drift in response to wind and other forces. By default, altitude is measured above mean sea level and does not account for terrain changes or obstacles.

This mode uses GPS and barometric pressure to maintain the UAV's height. If the GPS signal is lost, Altitude mode will still function, but with reduced vertical accuracy. Like Position Mode, the throttle stick controls ascent and descent speeds. Pushing it forward raises the UAV, pulling it back lowers it.

The yaw rate (rotation) is controlled by lateral movements of the throttle stick. Moving the stick left results in a counterclockwise rotation, while moving right causes a clockwise rotation. The further the stick is deflected from its center position, the higher the vertical speed and yaw rate.

The roll/pitch stick controls the roll and pitch angle of the UAV. Pushing the stick forward tilts the UAV forward, pulling it back tilts it backward. Lateral movements of the stick create left and right tilts at a speed proportional to the stick's movement. This differs from Position Mode, where the stick controls speed over ground; in Altitude Mode, it controls the tilt angle in the corresponding direction.

The diagram below shows the mode behavior visually:



[1]: https://github.com/PX4/PX4-user_guide/blob/main/assets/flight_modes/position_mc.png
[2]: https://github.com/PX4/PX4-user_guide/blob/main/LICENSE
[3]: https://creativecommons.org/licenses/by/4.0/

Standard Condition for this flight mode	Value
Hover	Drone drifts with the wind.
Minimum radius of turn	0 m
Max. Tilt Angle	36°
Max. Descent Rate	3 m/s
Max. Vertical Speed at landing	1 m/s
Max. Horizontal Speed	No inherent limit; speed depends on tilt angle, wind conditions, and other system

	pararameters. Testing has reached **23 m/s** in low wind conditions.

This section provides essential guidance for safe takeoff procedures, smooth operation, and effective troubleshooting during flight in Altitude Mode. By following these tips, you can ensure stable flight, minimize the risk of issues, and respond appropriately if problems arise.

1. **Smooth Control Movements:** Be mindful that any momentum will cause the UAV to drift horizontally, as Altitude Mode only maintains vertical stability. Operate the sticks smoothly to avoid abrupt inputs. Avoid flicking or making unnecessary adjustments, especially when flying at Maximum Takeoff Mass (MTOM). In Altitude Mode, the maximum speed is determined by the tilt angle and can exceed 20 m/s. However, it is recommended not to fly faster than 15 m/s to maintain control and safety.
2. **Takeoff and Landing:** Takeoff in Altitude Mode is forbidden and strongly not recommended. Landing in Altitude Mode should only be performed in case of an emergency. Altitude Mode is not designed for takeoff or landing due to its potential for instability. Always use Position Mode for these maneuvers to ensure better control. If you must land in Altitude Mode during an emergency, ensure a flat, open area and check that the UAV is not drifting. Always confirm that all propellers are spinning uniformly before initiating takeoff or landing. If any issue is noticed, abort the maneuver immediately.

⚠ Avoid operating the UAV in high winds while in Altitude Mode, as this can lead to instability and difficulty in controlling the UAV.

3. **Flight Stability:** Since Altitude Mode only stabilizes vertical position and does not control horizontal movement, any momentum will cause the UAV to drift. If the UAV behaves unexpectedly or drifts uncontrollably, switch to Position Mode or manually take control. If issues persist, land the UAV in a safe location.
4. **Flight Mode Switching:** Never switch flight modes while the UAV is in motion. Always bring the UAV to a stable hover before changing flight modes. This helps ensure smooth transitions and prevents unintended movement.

⚠ Hand catching the UAV can result in severe injury and is therefore strongly discouraged.

4.2 Automatic Modes

The automatic mode refers to a predefined set of flight parameters and actions that the UAV can execute without direct manual input from an operator. In this mode, the drone relies on its onboard sensors, GPS technology and pre-programmed instructions to carry out specific tasks or follow a predetermined flight path.

It allows tasks such as waypoint navigation, surveying and surveillance to be conducted with minimal human intervention. This feature is particularly useful in scenarios where consistent and repeatable flight patterns are required, enabling drones to perform complex missions autonomously. Additionally, automatic mode contributes to safer operations by reducing the risk of human error and enabling more accurate and reliable execution of tasks.

4.2.1 Hold

Hold Mode allows the UAV to hover in place, maintaining its current GPS position and altitude. Once activated, it functions automatically, requiring no further input from the pilot to hold its position. If the UAV loses its position estimate while in Hold Mode, it will automatically initiate a failsafe to ensure safety. Disarmed UAVs can enter Hold Mode even without a valid position estimate, but they cannot arm until the estimate is restored. To activate it manually during a mission, use the Quick Actions Sidebar, select "Hold," and then press and hold the "Hold to Confirm" button to finalize the operation. Once in Hold Mode, the UAV will remain stable until further action is taken. Moving the RC sticks will typically switch the UAV to Position Mode unless the UAV is responding to a critical battery failsafe.

⚠ Once activated, keep an eye on the UAV's performance, especially in environments with poor GPS signal and be prepared to intervene if necessary.

4.2.2 Mission Mode

Mission Mode enables a UAV to autonomously execute a predefined flight plan or mission. Mission Mode operates automatically, requiring no user intervention once engaged, but it does allow manual overrides if necessary.

To engage Mission Mode, the UAV must be armed and have a GPS connection. If this is not met, the mode cannot be activated. It is possible to resume a mission after an interruption by clicking the prompt to resume the mission in AMC Fly View or by clicking **Resume Mission** in the Quick Actions Sidebar.

There are several types of Missions, such as Survey and Corridor Scan. In a Waypoint Mission, the UAV flies along a path of waypoints that the pilot must set beforehand. The pilot can add other mission commands, such as image captures, as well.

In Survey Missions, the UAV flies over an area defined by an arbitrary polygon to survey it. In Corridor Scan, the UAV follows a polyline to survey it.

A thorough description of mission planning can be found in 3.2 Plan View and its subchapters.

The following section provides essential guidance for safe and smooth operation in Mission Mode. By following these tips, you can ensure stable flight, minimize the risk of issues, and respond appropriately if problems arise.

1. **Pre-Mission Checks**: Before starting a mission, complete the UAV Pre-Flight Preparation and confirm a reliable GPS connection. Verify that all waypoints and mission commands are correctly set and reviewed. Check for obstacles or restricted areas within the mission path.
2. **Mission Speed**: The default speed in Mission Mode is 12 m/s. It is essential to adjust this speed to suit the specific needs of your mission. For Survey and Corridor Scan, the maximum speed is limited to 12 m/s. Operators should always ensure that the speed is appropriate for the mission type to maintain control and ensure data accuracy.
3. **Mission Monitoring**: Although Mission Mode operates automatically, actively monitor the UAV's progress during the mission. Use the telemetry data to ensure the UAV is following the predefined flight plan without issues.
4. **Manual Overrides**: Be prepared to intervene if necessary. Mission Mode allows manual overrides to ensure the safety of the UAV and surrounding environment. Familiarize yourself

with the Quick Actions Sidebar in AMC Fly View to quickly access the Hold Mode or other critical controls (RTL).

5. **Flight Speed and Altitude**: Set mission speeds and altitudes appropriate for the mission type and environmental conditions. For example, lower speeds and altitudes may be required for precision surveys, while higher altitudes may be suitable for broader scans.
6. **Interruption Handling**: If the mission is interrupted (e.g. due to GPS loss or a user override), you can resume the mission from the point of interruption. Use the "Resume Mission" option in the Quick Actions Sidebar to continue the mission safely.
7. **Post-Mission Review**: After completing a mission, review the data collected to ensure the mission objectives were achieved. Check the UAV for any signs of wear or damage.
8. **Safety Considerations**: Always ensure a safe distance from people, buildings, or other obstacles during Mission Mode. Avoid flying in areas with poor GPS coverage or high wind conditions that might disrupt the UAV's automatic flight.

⚠ Only start the mission once the UAV is in the air. Do not use the takeoff action (see Quick Actions Sidebar) in AMC.

🛑 Do not set mission items below 10 meters AGL or HGT due to potential inaccuracies in elevation models, which could pose a safety risk.

4.2.3 Return to Launch (RTL)

Return Mode enables the UAV to automatically navigate back to a designated home location or a pre-set safe landing point, known as a Rally Point. The home location is automatically established each time the UAV is armed, while Rally Points can be configured in the Rally Point Menu.

This mode requires a valid GPS signal to function. Upon activation, the UAV ascends to the Return Altitude specified in Return to Launchto avoid obstacles. If the UAV is already above this altitude, it maintains its current height. Once at the designated height, the UAV flies directly to the nearest safe landing location, descends to the set descent altitude, pauses briefly, and then lands. Operators must ensure that no obstacles above the UAV are lower than the Return Altitude to prevent collisions.

Return Mode can be activated manually via the Home button on the RC, or automatically in response to specific failsafe conditions, such as loss of control link or low battery. It can also be programmed to execute upon mission completion. Any joystick movement during Return Mode will typically switch the UAV to Position Mode unless handling a failsafe scenario. In cases where RTL was triggered by a failsafe, the UAV can still be switched back to Position Mode using the RC as specified in Buttons and Stick Designation.

This mode provides a reliable and efficient way to bring the UAV back to safety, ensuring smooth operation even in challenging scenarios. By following these tips, you can maximize the effectiveness of RTL Mode for a safe and efficient return to the designated location.

1. **Pre-Flight Setup**: Verify the Home Location is correctly established when arming the UAV. Set the appropriate Return Altitude in Return to Launch, ensuring it is high enough to avoid obstacles in the flight path. If using Rally Points, confirm they are correctly configured in Rally Point.

2. **Activation and Monitoring**: RTL Mode can be manually activated using the Home button on the remote controller or triggered automatically during failsafe conditions such as low battery or loss of control link. Actively monitor the UAV's behavior during RTL Mode to ensure it is returning as expected and avoiding obstacles.
3. **Obstacle Awareness**: Ensure the set Return Altitude is high enough to avoid any obstacles in the UAV's flight path.

> If the UAV is already above the Return Altitude, it will maintain its current height while navigating back.

4. **Control During RTL**: Any joystick input during RTL Mode will switch the UAV to Position Mode, except in some failsafe scenarios. Be cautious when intervening and ensure you are prepared to take manual control. If RTL was triggered by a failsafe, switching back to Position Mode is possible via the RC. Refer to Buttons and Stick Designation for specific instructions.
5. **Failsafe Conditions**: RTL Mode is an essential failsafe for scenarios like control link loss or critical battery levels. Ensure these triggers are appropriately configured before flight. Be aware of how the UAV behaves in RTL Mode during different failsafe conditions and be ready to take over if necessary.
6. **Safe Landing Considerations**: Upon reaching the Home Location or Rally Point, the UAV will descend with a pre-set descending speed (0,5 m/s) which will be reduced before landing.
7. **Mission Integration**: If using RTL at the end of a mission, ensure the UAV's path to the Home Location or Rally Point is clear and safe. Review the mission plan to avoid triggering RTL Mode unnecessarily during the mission.
8. **Environmental Conditions**: Avoid using RTL Mode in areas with poor GPS coverage or strong winds that could affect the UAV's ability to navigate accurately.

> Always ensure the landing area is clear of obstacles and within a safe distance from people or property.

4.2.4 Takeoff

Using the takeoff action from the Quick Actions Sidebar is strictly prohibited. The operator must arm the UAV using the remote controller and perform a manual takeoff in Position Mode.

> Do not use the Takeoff Mode.

4.2.5 Land

Land Mode is an automatic flight mode that directs the UAV to descend and land at the location where the mode was engaged. Upon completing the landing sequence, the vehicle will disarm automatically by default, ensuring a safe and controlled landing.

When activated by a failsafe, a GPS signal is optional. If no GPS signal is available, the UAV might drift horizontally due to winds during the descent. Despite this, Land Mode operates automatically, with minimal need for user intervention. However, the operator can override the mode by moving the RC control sticks, which will usually switch the UAV to Position Mode unless a critical failsafe condition, such as a low battery, prevents it.

To manually engage Land Mode, the operator can select "Land" in the Quick Actions Sidebar and confirm the operation by pressing and holding the "Hold to Confirm" button. The UAV shall be

hovering when this mode is engaged. When manually activated, moving the RC sticks will return the UAV to Position Mode. If Land Mode is triggered by a failsafe, RC stick movements will not override the operation, but the operator can switch to another flight mode using the RC control buttons.

Land Mode simplifies the landing process by automating the descent and disarm procedures. This makes it a reliable and user-friendly option for safely completing UAV operations. The UAV will descend at a rate of 0.5 m/s and, when near the ground, slow to a crawl rate of 0.3 m/s for a soft landing.

1. **Pre-Landing Considerations**: Ensure the UAV is in a clear and safe area for landing, free from obstacles that may interfere with its descent. While Land Mode operates automatically, a safe landing location is critical for preventing accidents.
2. **Land Mode Activation**: Always engage Land Mode manually through the Quick Actions Sidebar. To initiate, press and hold the "Hold to Confirm" button. Avoid using the mode in uncontrolled environments or when immediate manual control is required.
3. **Failsafe Conditions**: If Land Mode is triggered by a failsafe (e.g. Battery Emergency Level), the UAV may not respond to RC stick inputs. In this case, the UAV will continue its automatic descent and landing sequence. Make sure to stay calm and allow the UAV to complete its procedure safely.
4. **Manual Override**: While Land Mode operates automatically, the operator can override it by moving the RC control sticks. However, this will typically switch the UAV to Position Mode unless a failsafe condition prevents it. If immediate intervention is needed, switch to a more appropriate flight mode.
5. **Horizontal Drift (No GPS Signal)**: In the absence of a GPS signal during a failsafe, the UAV might drift horizontally due to wind. Be prepared for possible drift and monitor the descent closely.
6. **Descent Rate**: The UAV will descend at a rate of 0.5 m/s, slowing to 0.3 m/s near the ground for a smooth and soft landing. Keep an eye on the descent and be ready to intervene if needed.
7. **After Landing**: Once the UAV lands, it will automatically disarm. Ensure the area around the landing site is clear to avoid any potential hazards.

⚠ Always land the UAV on a non-moving, level surface.

By following these tips, you can ensure a smooth and safe landing using Land Mode, making the process of returning your UAV to the ground as efficient and controlled as possible.

4.3 Optional Flight Mode limitations

The optional flight mode limitations ensure operational safety by restricting the UAV's behavior under specific conditions, such as breaching a maximum height. These limitations apply across various flight modes, automatically adjusting the UAV's actions to maintain compliance and protect against unintended violations.

4.3.1 Maximum Height Limitation Function

If a maximum height is set in 3.1.10.2.4 Geofence Failsafe the Safety Menu, the drone’s maximum height limitation function will activate once the set height is breached. In the Open Category, the height must not exceed 120 meters above takeoff point.

📖 In the Specific Category, the height must not exceed the value specified in Specification.

When the maximum height limit is reached, the drone will automatically trigger the height limitation function. Regardless of the flight mode – whether in Position, Altitude, RTL or Mission Mode – the drone will switch to Hold Mode if it ascends past the limit. If the UAV overshoots the limit due to high velocity by a few meters, it will return to the set height and hover there.

The pilot can regain control by switching to another flight mode. For example, if the breach occurs in Position Mode, the pilot can switch to Altitude Mode, and then reselect Position Mode to resume normal flight.

5 Operational Limitations

Understand the boundaries for safe and effective drone use in our Operational Limitations section. Learn about constraints and guidelines to ensure responsible and compliant operation.

5.1 Remote Pilot Competency

The responsibility for issuing Remote Pilot competency certificates for the 'open' category or standard scenarios lies with the National Aviation Authority (NAA). These certificates are valid for a period of five years. The safe and effective operation of a UAV is significantly dependent on the competency of the remote pilot. To ensure operational safety, remote pilots must undergo the required training and certification relevant to their specific UAV operation category. This includes a comprehensive understanding of airspace regulations, emergency procedures, and safe handling practices.

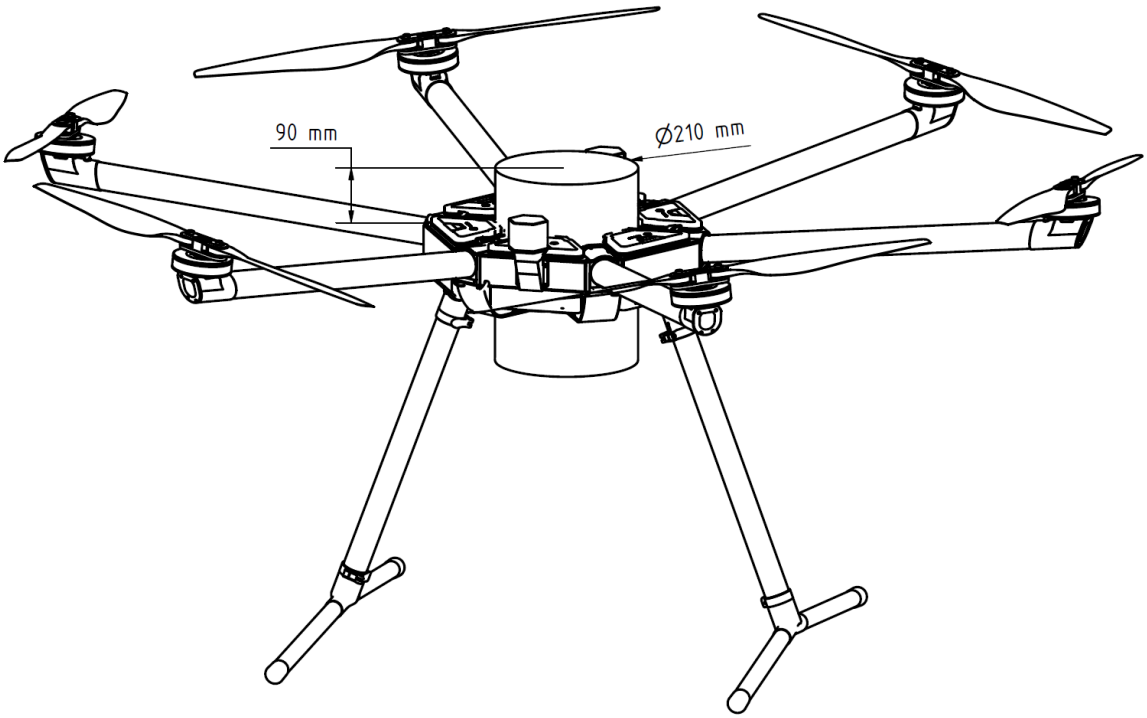
A remote pilot must be proficient in operating all UAV controls and possess a thorough knowledge of the system's functionalities. Ongoing training and periodic proficiency assessments are essential to keep pilots updated with current best practices, helping them stay well-prepared to handle any potential issues or unexpected situations that may arise during flight. These measures help to ensure that remote pilots always operate with the highest level of safety and efficiency.

5.2 UAV Mass and balance

UAV mass and balance are critical factors in ensuring the safe and efficient operation of unmanned aerial vehicles. Proper mass and balance are essential for maintaining stability, controllability, and optimal flight performance.

For the UAV Mass refer to Specifications.

The balance can be assessed with the illustration below:



5.3 Speed and Height Limitations

When flying in the Open Category, pilots must ensure that the UAV does not exceed the 120-meter altitude limit. The service ceiling depends on the payload being carried. When operating with a payload of up to 2.5 kg, the UAV can reach a maximum altitude of 3500 meters above mean sea level (AMSL). However, when flying at maximum takeoff mass (MTOM), the service ceiling is restricted to 1500 meters AMSL.

📖 The speed limits depend on the flight mode and can be seen in chapter 4 Flight Modes and its subchapters for each individual flight mode.

5.4 Type of approved operations

The UAV is approved for specific operational types, with guidelines in place to ensure safe and compliant usage. These guidelines define the conditions under which flights may be conducted, including requirements for lighting, visibility, and location-specific limitations. Understanding and adhering to these operational restrictions is essential for safe and effective UAV deployment.

5.4.1 Lighting and visibility conditions

UAV operations must be conducted in conditions that ensure the remote pilot always maintains clear visibility of the vehicle. For night flights, ensure the take-off and landing area is well-lit. During daylight operations, avoid looking directly into the sun to maintain good visibility. Clear visibility is essential for safe manoeuvring, particularly during take-off, landing, and when near obstacles. Ensure that you are always operating the UAV within VLOS.

5.4.2 Specific flying limitation

Certain locations and environmental features impose additional limitations on UAV operations.

5.4.2.1 Ground Elevation

Be mindful of changes in ground elevation that can affect altitude readings and height compliance.

5.4.2.2 Proximity of high voltage electro duct, high intensity radiation fields and horizontal distance to buildings.

Maintain a safe distance of at least 30 meters from high voltage power lines or high-intensity radiation fields, such as those generated by radio towers. Maintain a horizontal distance from buildings of at least 30 meters. Beware of regulatory limitations that require a larger distance to infrastructure.

5.5 Wind Limits

Always check local wind conditions before each flight and avoid operating the UAV if wind speeds approach or exceed the maximum specified limit. Be particularly cautious in open areas, over water, or near elevated terrain, where wind patterns may change quickly. Adhering to these wind limits ensures optimal performance, enhances operational safety, and protects the longevity of the UAV.

Condition	Maximum Wind Speed (Steady)	Maximum Gust Speed	Notes
Sensitive Operations	2 m/s	4 m/s	For precise tasks like mapping or inspections.

Normal Operations	5 m/s	7 m/s	Typical conditions for safe UAV flight.
Emergency Conditions	7 m/s	10 m/s	Only for unavoidable situations, such as unexpected weather changes.

Do not start a flight in emergency conditions. Use emergency limits only as an additional safety buffer and only to land the UAV safely.

5.6 Performance Limitations

The UAV's performance may vary under different conditions, which can impact flight endurance, stability, and overall reliability. Understanding these limitations is essential to ensure safe and effective operation.

5.6.1 Battery Performance Variation

Flight time is dependent on battery performance. A battery with a high number of charging cycles, high age, low temperature or which has been stored or handled improperly may lead to reduced flight times.

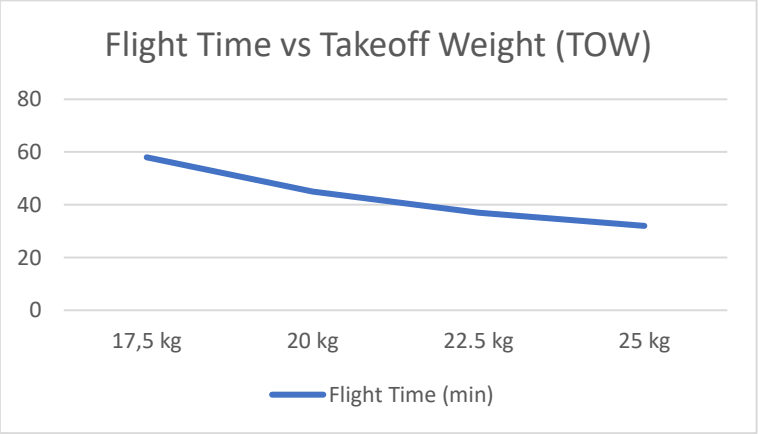
To achieve the best battery performance, adhere to the following:

- Make sure to keep batteries around room temperature: In warm conditions, do not store the battery packs in direct sunlight, and in cold weather make sure to keep the batteries warm before flight.
- Do not store the batteries at low levels of charge or fully charged. After each flight, charge the batteries to avoid long-term damage.

A degraded battery will lead to reduced flight time. However, it still will be completely safe to use.

5.6.2 Change of endurance due to installation of accessories or payloads

Adding payloads to the UAV reduces endurance and flight time due to the additional weight. Increased power consumption can lead to shorter flight durations, so plan flights with these adjustments in mind. The following estimates were achieved in continous flight with low winds.



5.6.3 Change of flight behaviour in the presence of external payloads

External payloads impact the UAV's balance and flight performance. Increased mass requires greater thrust for takeoff and hover and can reduce responsiveness, making the UAV slower to react to control inputs. This can affect handling, stability, and manoeuvrability, particularly in windy conditions, where maintaining control becomes more challenging.

Only attach external Payloads according to 5.2 UAV Mass and balance If the Payload's center of gravity lies outside the specified area, stable and safe flight operations cannot be guaranteed.

5.7 Environmental limitations

To ensure safe and optimal performance, the UAV should only be operated, transported, and stored within specific environmental conditions. These limitations help protect the UAV and its components from environmental stressors that could impair functionality or safety.

5.7.1 Altitude

📖 Altitude Limits for operation are defined in 6.4.1 Limits for allowed height.

Transport and storage are not affected by these limits.

5.7.2 Temperature and Humidity

Temperature / Humidity		0% to 50%	50% to 80%	80% to 95%	>95 %
		Dry Conditions	**Normal operation**	**Increased moisture**	**Extreme Humidity, mist or fog present**
-10°C to 2°C	**Very Cold**	Normal flight	Avoid clouds, fog, mist.	High risk of icing. Avoid flying	High risk of icing. Reduced visibility. Avoid flying
2°C to 5°C	**Cold**	Normal flight	Normal flight	Potential for condensation on sensors and electronics.	High risk of condensation. Medium Risk of icing. Reduced visibility. Avoid flying
5°C to 30°C	**Standard**	Normal flight	Normal flight	Potential for condensation on sensors and electronics.	High risk of condensation, reduced visibility. Avoid flying

⚠ In temperatures between 30°C to 40°C, avoid high-load scenarios (e.g. max. payload at high speed), and keep the batteries cool before flying.

🛑 Do not operate the system in temperatures above 40°C.

🛑 Do not operate, transport and store the UAV in extreme heat conditions.

🛑 Do not operate, transport and store the UAV in extremely humid conditions.

5.7.3 Precipitation

The UAV is not intended for operation in precipitation. Rain, ice, hail, and fog can interfere with sensors, reduce visibility, and damage electrical components. Only operate the UAV in dry conditions.

5.7.4 Other Operating Conditions

Flying near saltwater is permissible, but ensure all components are thoroughly cleaned after exposure to prevent salt corrosion on metal parts. In areas with high organic activity, store the UAV in clean, dry environments to prevent fungal growth on components. Never operate the UAV during thunderstorms, as lightning and strong winds pose severe safety risks. Avoid flying near bird flocks to prevent collisions that could endanger both the UAV and wildlife. Sand can damage motors, sensors, and other critical components; therefore, do not operate in sandy or dusty conditions, and ensure storage environments are free from fine particulate matter.

5.8 General System Limitations

The UAV has specific system limitations that ensure safe and efficient performance. Adhering to these guidelines is essential to maintain optimal functionality and extend the lifespan of the UAV's components.

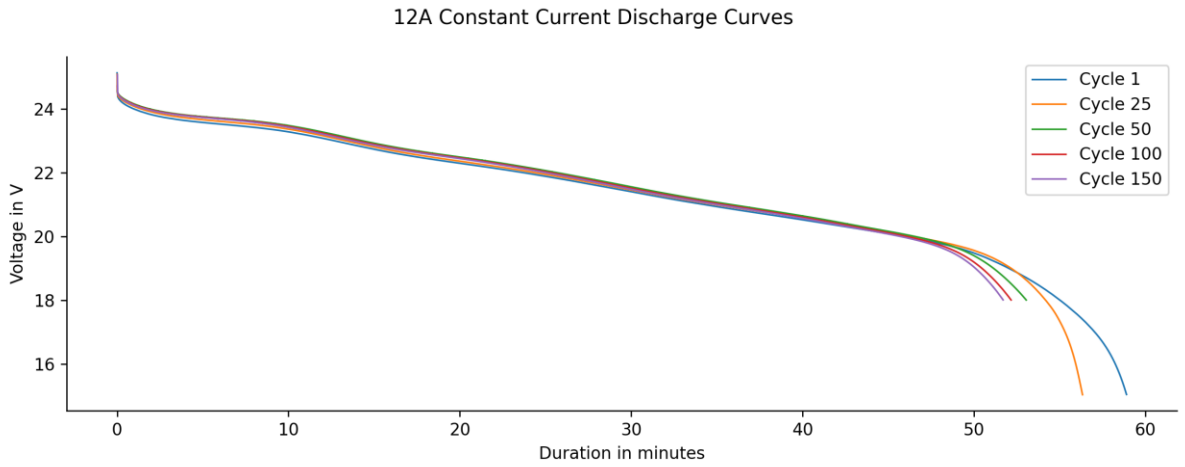
5.8.1 Charge and Discharge Specifications

To ensure safe battery performance and prevent damage, follow the charging and discharging guidelines provided below.

Parameter	Condition	min	typ.	max	Unit
Voltage		18.0	21.6	25.2	V
Charge		12.0	12.6		Ah
Energy		264	272	279	Wh
Charge Current			12	18	A
Charge Temperature		0	25	40	°C
Charge Duration	12 A, 25.2 V, 150 mA cutoff		1:25		H:MM
Discharge Current	continuous		12	24	A
Peak Discharge Current	10 second pulse			60	A
Discharge Temperature		0	20	40	°C
Storage Temperature		-40	20	60	°C
Storage Voltage		21.0	22.5	24.0	V

i For optimal charging conditions only use the Charging Station with preconfigured Charger provided by starcopter.

Avoid overcharging, undercharging, or charging batteries at temperatures outside the specified range, as this can lead to reduced battery life. Only use approved chargers and monitor batteries during the charging process. Similarly, avoid fully depleting the battery during operation, as this can permanently reduce capacity.



5.8.2 Other Critical UA Systems Limitations:

The UAV's critical systems, including its propulsion, navigation, and communication systems, have specific operational limitations that must be respected. Do not exceed the recommended operational load or payload capacity, as doing so may affect stability, control, and overall system integrity.

6 Operational Instructions

Operational instructions provide detailed guidance on how to safely and effectively operate the UAV.

This guide is designed to provide clear and detailed instructions on every aspect of UAV operation. From transportation and Storage, UAV preparation, pre-flight checklists to post-flight protocols, we are aiming for an efficient workflow and handling of our UAVs. Safety, precision, and optimal performance are the priorities of these instructions, empowering the full capabilities of our UAV technology.

Ground handling is an integral aspect of responsible UAV operations. Adhering to the guidance provided in this chapter ensures that the UAV and the associated equipment are handled with care, promoting safety, longevity, and optimal performance throughout their operational life. By incorporating these best practices into ground handling procedures, operators contribute to the overall safety and reliability of UAV operations.

6.1 Direct Remote Identification

To legally operate the Starcopter HIGHDRA in the OPEN category, the system must have an active direct remote identification system. For this purpose, starcopter has developed the Dronetag Agent, featuring a simple web-based interface accessible from the remote control.

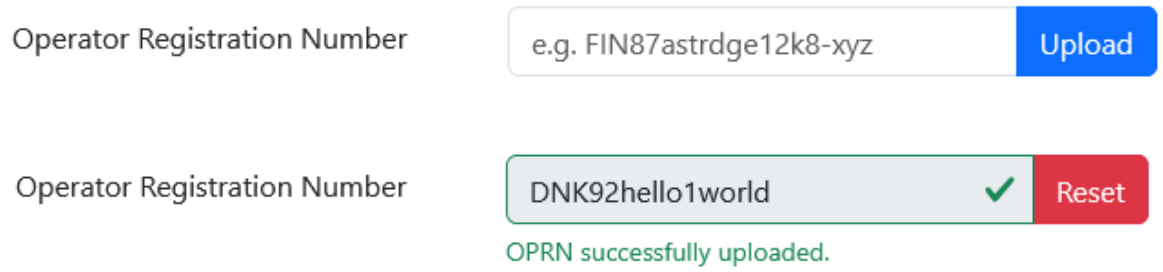
The web UI runs on the HIGHDRA and is only accessible when the drone is powered on. To access it on the Herelink controller, use the Dronetag Agent bookmark in Google Chrome or manually enter the following address:
http://192.168.144.20/apps/com.starcopter.dronetag-agent/

6.1.1 Uploading the Operator Registration Number

The web UI provides a dedicated input field for the Operator Registration Number (OPRN). The operator must enter their OPRN and click the Upload button to store it on the drone. This process is required only once, as the drone will retain the OPRN until it is manually reset.

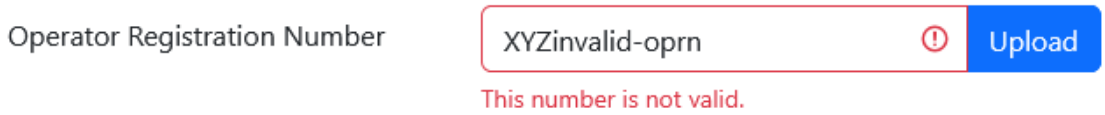
The Operator Registration Number (OPRN) is a unique identifier for the operator. It consists of a three-charactor country code, followed by 13 *public* alphanumeric characters and a *private* part consisting of three alphanumeric characters.

The complete OPRN must be entered into the input field, but only the public part will be displayed for security reasons. The private part should never be shared.



The Dronetag Agent will validate the OPRN upon upload. If the entry is incorrect, the upload will fail, and an error message will appear. Possible reasons for failure include:

- An invalid or non-EU country code
- Incorrect OPRN format
- Missing private part
- A checksum mismatch

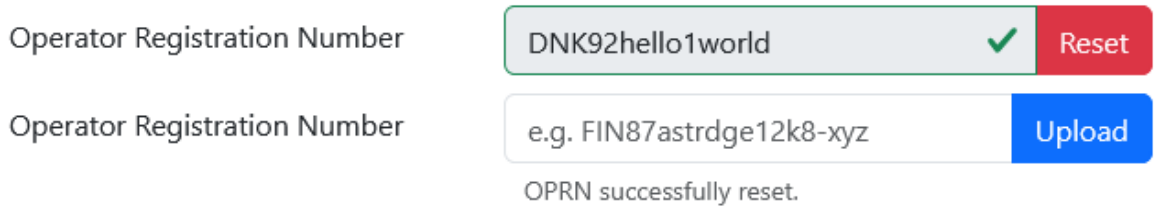


Remote ID shall be verified to function properly before each flight. Your UAV with registered UAS Operator ID should be discoverable using the Drone Scanner app or similar DRI receiver apps.

⚠ Make sure Remote ID works before each flight!

6.1.2 Resetting the OPRN

If the drone is returned to Starcopter or transferred to a new operator, the OPRN must be reset. This can be done by pressing the large red "Reset" button in the web UI, which will remove the OPRN from the drone's memory.



6.2 Crew Health Precautions

To ensure the safety of UAV operations, specific health precautions and regulatory guidelines must be followed. The key regulations—EU Regulation 2019/945, EU Regulation 2019/947, and prEN 4709-001—set standards for physical readiness, cognitive health, and operational safety.

Remote pilots must be physically and mentally fit for duty, confirmed through regular health assessments covering vision, hearing, and cognitive functioning. Before each shift, pilots should perform self-checks to ensure they're well-rested and hydrated. During operations, breaks should be scheduled to prevent fatigue.

In emergencies, standby personnel should be available to relieve pilots if needed. Training includes first aid and emergency protocols to support pilot well-being during unexpected health issues, maintaining compliance with these essential health standards for safe and effective drone operation.

6.3 Ground Handling

📖 The ground handling is described in 6.4 Pre-flight Operations and 6.6 Post-flight Procedures.

6.4 Pre-flight Operations

Before every flight, operators should systematically go through a Pre-flight Checklist and adjust the Failsafe Settings. This process helps identify potential issues, ensuring that the UAV is in optimal condition and can operate safely in the intended environment.

6.4.1 Limits for allowed height

The limits for allowed height are listed in 5.3 Speed and Height Limitations.

6.4.2 Flight path definition related to density of population

When planning flight paths for the starcopter HIGHDRA, consider the population density of the area to ensure safety and regulatory compliance:

Population Density	Operational Guidelines
Low-Population Areas	Flexible flight paths allowed. Emergency landing zones must be planned. Beware of the limits of the open category.
Moderately Populated Areas	Additionally, emergency scenarios should be planned. Beware of the limits of the open category.
High-Population Areas	Additionally, stricter risk assessments required. Use designated flight corridors and maintain higher altitudes. Additional permissions, safety measures, and insurance may be required, especially for BVLOS operations.

Always ensure compliance with local and EU regulations, and perform thorough pre-flight checks, including risk assessments and documentation.

⚠	Conducting compliant operations is under the responsibility of the operator.

6.4.3 Additional local limitations

The different EASA member states might all have differing local limitations that the remote pilot has to be aware of. The remote pilot is responsible for checking where the pilot is allowed to fly and where not. For the DACH region, we have linked the countries and where the zones can be assessed below. All other EASA countries can be checked under:

https://www.easa.europa.eu/en/domains/civil-drones/naa

Country		Where you are allowed to fly
	Germany	https://dipul.de/homepage/en/information/geographical-zones/
	Austria	https://utm.dronespace.at/avm/#p=7.28/47.751/13.23
	Switzerland	https://www.bazl.admin.ch/bazl/de/home/drohnen/general/drone-maps.html

⚠	The remote pilot must always check for NOTAMS and other limitations in the area of operation before the flight.

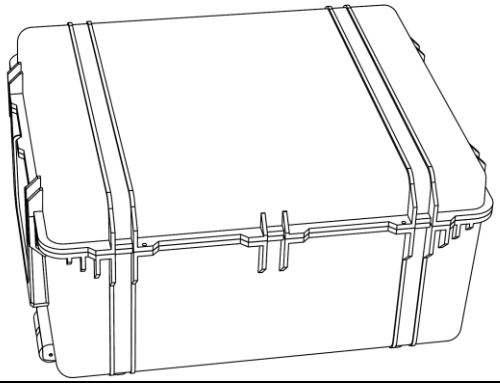
6.4.4 UAV Pre-Flight Preparation

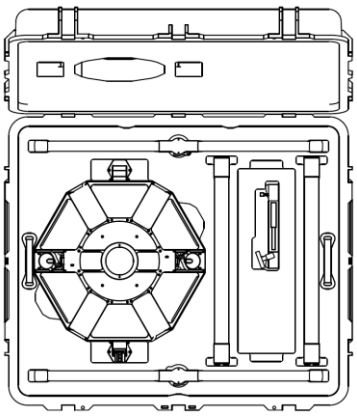
Before flight, assemble the UAV securely, ensuring all components are properly connected. Perform a visual and functional checklist to inspect for damage and test key systems. Verify fail-safe settings, such as Return-to-Launch and low-battery failsafe, to ensure safety during operation.

6.4.4.1 Unboxing and Assembling of the UAV

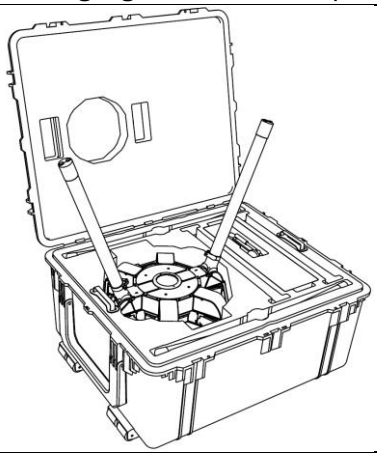
The UAV parts and equipment are disassembled and placed in boxes designed and provided by starcopter for transportation and storage of the UAV. The RC is also included. Follow the steps below to unbox and assemble the UAV.

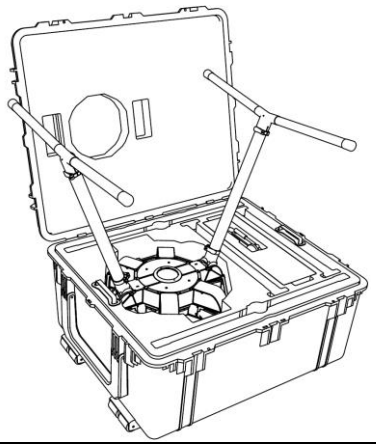
Step 1: To open the transport case, unlock all the seven closures of the transport case and open the lid.



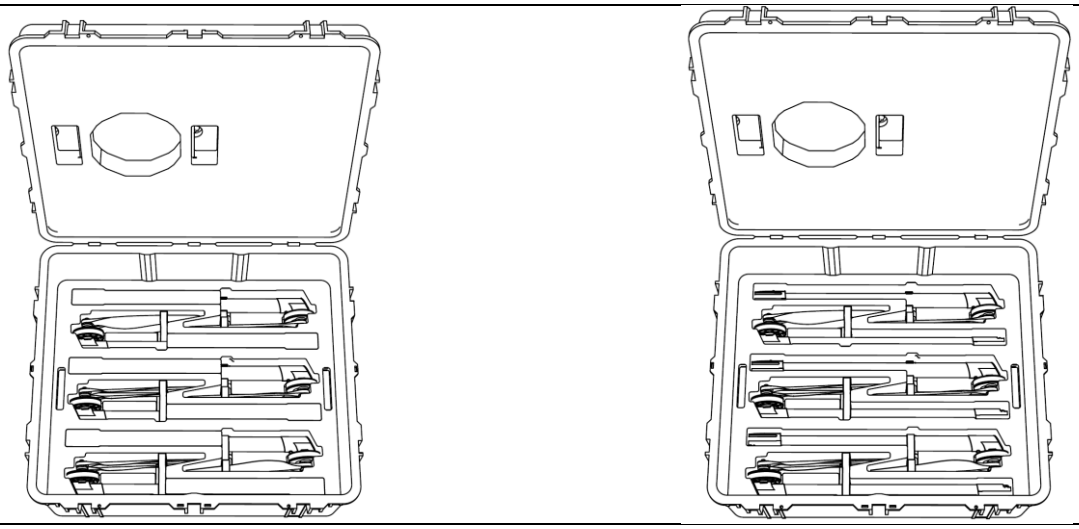


Step 2: To prepare the landing legs, first unlock the leg fasteners on the UAV body. Take the vertical piece of the landing leg out and insert it into the body. Secure the landing leg. Repeat this step for the second vertical piece of the landing leg. Now attach the horizontal parts of the landing legs to the vertical parts and make sure the fasteners are secured.

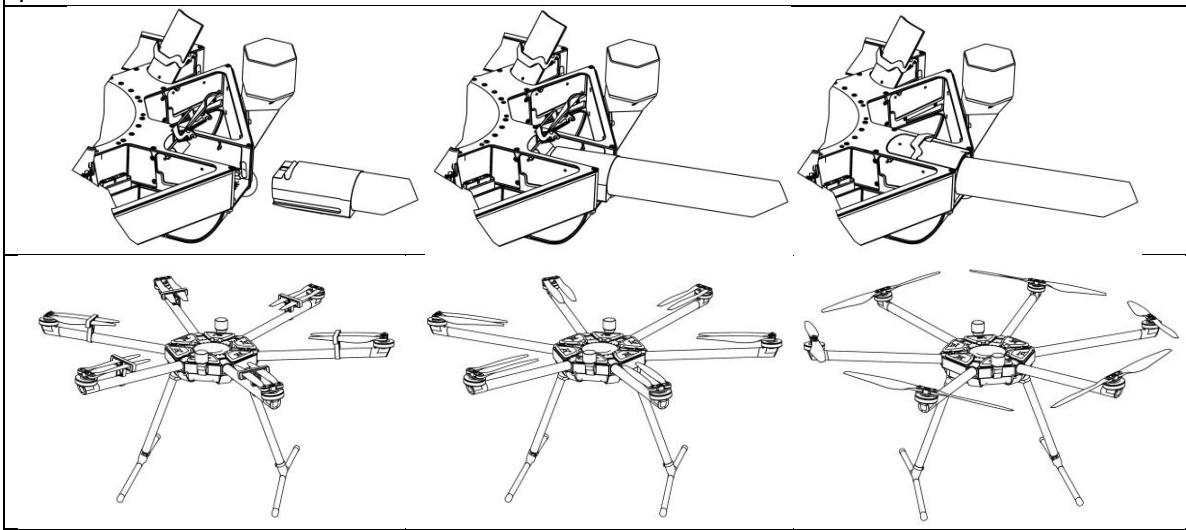




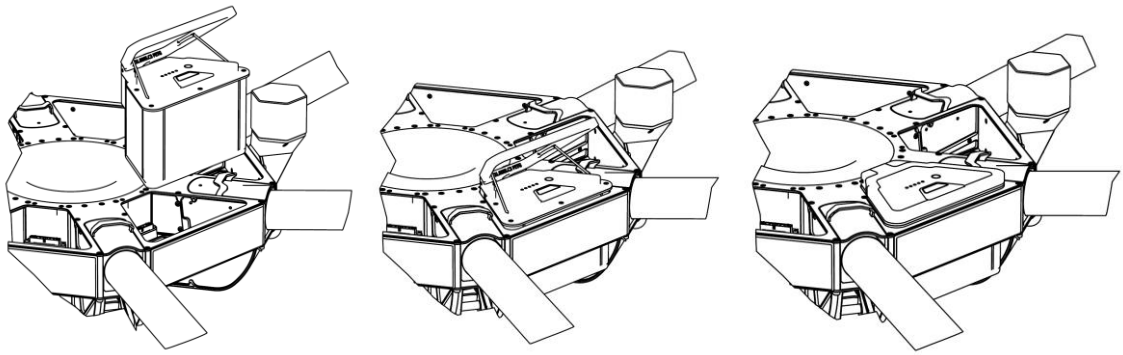
Step 3: Remove the UAV from the transport box and place it on the landing legs. Make sure you pull the UAV out level to remove it being blocked or getting damaged. Remove the top layer of the transport box that the UAV was in to access the arms and propellers. Remove the transport foam that is on the arms.

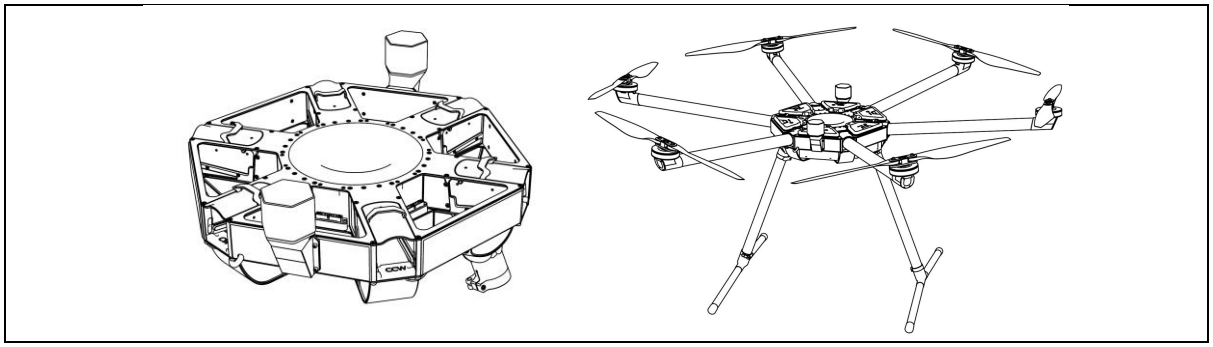


Step 4: To install the arm into the body, open the arm lever, take an arm from the copter case, check the number on the arm, and insert it into the slot with the corresponding number on the UAV body. The arm has to be inserted very flatly and not angled, otherwise it won't be able to be inserted. Gently press the arm into place and press down the handle to fasten it. Repeat this process for all arms.



Step 5: Retrieve the batteries from the battery transport case and ensure that each battery pack you use has the same Set-ID as the other batteries. Press on the button to lift the handle, gently insert it into the UAV and close down the handle. Repeat for all batteries.





6.4.4.2 Visual Checklist

Ensuring the safety and reliability of your UAV starts with a thorough visual inspection. This checklist is designed to help identify any issues that could compromise your UAV's performance or safety during flight. Each step focuses on critical components, ensuring they are in optimal condition before take-off.

Component	Preparation Step	Check
UAV Body	Inspect for visual damage	☐
Landing Gear	Verify no visual damage. Ensure landing gear is correctly installed and securely fitted.	☐
Arms	Check for visual damage. Confirm locking mechanism is engaged and arms are firmly secured.	☐
Propellers	Remove protective caps and unfold propellers. Inspect for visual damage. Ensure propellers are firmly attached and spin freely without obstruction.	☐
Payload	Inspect for visual damage. Check for secure attachment.	☐
Batteries	Check batteries for visual damage. Ensure each battery is correctly inserted and securely connected.	☐
MTOM	Confirm that total UAV weight is ≤ 24.99 kg.	☐
Remote Control	Inspect for visual damage.	☐
Battery	Inspect for any damage, swelling, or other abnormalities.	☐

ℹ Complete each item thoroughly to ensure safe, reliable operation.

6.4.4.3 Booting of the UAV

Step 1: Turn on the batteries, wait until all of them are engaged.
Step 2: Turn on the Dronetag Beacon. While charging, it lights blue. Click the button on the bottom for a second and it will light green and orange. Wait until it flashes white.
Step 3: Turn on the RC.
Step 4: Navigate to the AMC Safety Setup. Click on the AMC Button on the top left. Click on System Overview. Click on Safety. Ensure that the values align with 6.4.4.3.1 Failsafe Settings.
Step 4: Navigate to the AMC Pre-Flight Checklist. Click on the AMC Button on the top left. Click on System Overview. Click on Safety. Ensure that you complete every point.
Step 5: Go through the functional checklist 6.4.4.4 Functional Checklist and verify that you check all items.
Step 6: Ensure that the takeoff area is clear of people, obstacles or animals. Ensure that the conditions follow named limitations in this manual and legal compliance. Arm the copter with

the arming gesture. Take the left stick to the bottom right and hold it there for a second. Once the copter is armed, gently move the stick to the middle position. You can now perform the mission.
Step 7: After landing safely, disarm the copter using the disarm gesture, take the left stick to the bottom left and hold it there for a few moments.

6.4.4.3.1 Failsafe Settings

The failsafe settings MUST be set according to table below. For Return to Launch setting, the climb altitude should vary according to the tallest structures in the flying area.

Failsafe	Setting	
Return to Launch	Climb to altitude (HGT): **(please set a value)** m. (depends on tallest structures in the flying area)	
Low Battery Failsafe	Failsafe Action: Return to Launch Battery Warning Level: 30 % Battery Critical Level: 25% Battery Emergency Level: 10%	
Data Link Loss Failsafe	Failsafe Action: Return mode. Data Link Loss Timeout: 10 seconds	
Land Mode Settings	Landing Descent Rate: 0.5 m/s Disarm After: 1 seconds	

6.4.4.4 Functional Checklist

Component	Booting Step	Check
UAV	Power on.	☐
RC Transmitter	Power on the RC transmitter and check the battery level.	☐
UAV Power	Power on the UAV. Confirm that all batteries are engaged.	☐
Controllability Lights	Check the colors of the controllability lights for correct indicators.	☐
Data Link	Verify that the data link is established.	☐
Battery Voltage	Read the voltage levels of all UAV batteries.	☐
LTE Connection	Confirm LTE connection is established.	☐
Data Link Signal Strength	Check data link signal strength.	☐
GPS Connection	Ensure a GPS fix is established.	☐
RTK GPS Heading	Verify that the “RTK” indicator is green, confirming RTK GPS heading is active.	☐
Sound Output	Confirm that sound output is audible.	☐
AMC Safety Menu	Ensure that the safety settings are set to 6.4.4 UAV Pre-Flight Preparation	☐
AMC Pre-Flight Checklist	Complete the AMC pre-flight checklist.	☐
Dronetag DRI	Verify that the DRI is functioning	☐

6.5 Flight Operations

6.5.1 Flight Operations in standard conditions

Flight Operations in standard conditions are defined for the different flight modes in 4 Flight Modes and its subchapters.

6.5.2 Arming and Disarming

The starcopter HIGHDRA can be armed and disarmed. When disarmed, the motors and actuators are completely unpowered, ensuring the UAV is safe to handle. In contrast, when armed, the UAV is fully powered, and the motors or propellers begin spinning, making this state potentially dangerous.

To arm or disarm the UAV, the remote controller can be used with specific **arming gestures**:

- To **arm**, move the left stick to the bottom-right position.
- To **disarm**, move the left stick to the bottom-left position.

For additional safety, the UAV features an **automatic disarming system**. If the UAV does not take off within a set period after being armed, it will automatically disarm. Similarly, after landing, if the UAV is not manually disarmed, it will automatically power down after a short delay. These precautions minimize the risks associated with leaving an armed UAV stationary on the ground.

6.5.3 Kill Switch

When the kill switch is activated, the UAV cannot be armed. If the UAV is already armed, activating the kill switch will immediately cut all motor outputs, bringing the UAV to an abrupt stop. To restore motor function, the kill switch must be pressed again within five seconds. If no action is taken within this window, the UAV will automatically disarm.

It is critical **not** to activate the kill switch while the UAV is in flight, as this will result in an immediate loss of control and a crash. The kill switch is designed strictly for emergency situations where an immediate shutdown is necessary to ensure safety. It should only be used when disarming the UAV is the safest course of action.

6.5.4 Contingency and Emergency Operations

In this section, you will learn about the emergency operations procedures designed to ensure your safety and the protection of your UAV in unexpected situations. Understanding these protocols is essential for responding effectively to emergencies such as signal loss, battery depletion, or other critical issues that may arise during flight. By familiarizing yourself with these procedures, you can enhance your confidence and preparedness, ensuring a safer flying experience.

6.5.4.1 Low Battery Failsafe

Low Battery Failsafe Mode is designed to prioritize safety during flight operations. When the battery level drops to 30 %, a warning will appear on the screen accompanied by an audio alert.

The Auterion Mission Control will announce the current battery level every few percent after the initial warning appears. If the battery level continues to decrease and reaches 25 %, the UAV will automatically initiate a Return-to-Launch (RTL) procedure after a 5-second delay. When the battery level drops to 10 %, the UAV will switch to Land Mode after another 5-second delay. Both RTL and Land Modes will be announced by on-screen notifications and audio alerts.

- It is forbidden to change the failsafe action for the low battery in the safety menu.
- Pilots should only intervene in these automated manoeuvres during emergencies and at their own risk.
- Information on RTL and Land can be found in their respective chapters 4.2.3 Return to Launch (RTL) and 4.2.5 Land.

6.5.4.2 RC Low Battery

The **RC Low Battery Procedure** ensures safe flight operations when the remote controller (RC) battery level is low. When the RC battery level drops to 30 %, the RC Battery Status as described in 3.1.1 UAV Status Bar will turn red, indicating a low battery warning. In this case, the UAV should be landed safely as soon as possible to prevent loss of control. Before resuming operations, the RC must be recharged, and the UAV should only be flown if the RC has sufficient charge for safe flight operations.

- If the warning is disregarded and the RC battery becomes fully depleted, the RC will turn off, resulting in a C2 link loss, as described in 6.5.4.8 Loss of C2 Link.

6.5.4.3 Loss of Orientation

If you lose orientation of your UAV during flight, it is crucial to follow a clear procedure to regain control safely. Start by checking the heading of the UAV in AMC, if available. The heading indicator will provide you with the UAV's orientation relative to your position, helping you identify which direction the vehicle is facing.

If the heading is not visible in AMC, switch the UAV to **Position Mode**. This mode stabilizes the vehicle’s flight, making it easier to regain control. From there, begin gradually adjusting the yaw, pitch, and roll controls. By doing this slowly, you can observe the UAV’s response and determine its actual orientation. For instance, if moving the roll stick to the right causes the UAV to drift to the left, it indicates that the UAV is facing towards you.

6.5.4.4 Unexpected UAV Behavior

If the UAV behaves strangely, neutralize controls by centering the throttle/yaw and pitch/roll. If the UAV exhibits unusual behavior, first neutralize the controls by centering the throttle, yaw, pitch, and roll sticks, then observe the UAV's response. If the UAV continues to fly erratically, either in **Altitude** or **Position** mode, immediately initiate a safe landing. Once on the ground, carefully inspect the UAV and check AMC for any warnings or errors. Address any issues before attempting further flight.

6.5.4.5 Loss of GPS

The UAV will automatically switch to Altitude mode in the event of loss of GPS signals. The UAV operator will be alerted by this mode transition through AMC notification display and sound. The UAV shall be landed as soon as possible, if the GPS cannot be recovered.

6.5.4.6 Loss of Data Link

The **Data Link** refers to the data connection between the drone and the ground station, used to transmit telemetry and other critical data such as position, battery status, and sensor information. If the data link is lost, the ground control station can no longer receive telemetry data or send mission commands; however, the drone can still be controlled manually via the remote controller if the RC connection remains active.

When the UAV is armed, the remote pilot receives both an audio and visual warning shortly after. The UAV then attempts to restore the connection for ten seconds. If the connection is not reestablished within this time, the UAV will automatically initiate the Return to Launch (RTL) procedure. If the UAV is not armed, only an audio warning is issued.

The failsafe action must not be intercepted, overridden or changed.

6.5.4.7 Loss of Control Link

The Control Link refers to the signal between the drone and the physical remote controller, enabling real-time manual control of the drone's movements. If this connection is lost, the pilot is unable to manually operate the drone. Common causes for control link loss include range issues, interference or equipment malfunction.

When the UAV is armed and a control link loss occurs, the system issues both an audio and visual warning. The UAV will attempt to reestablish the connection, but if the link is not restored within two seconds, it will automatically initiate the Return to Launch procedure. If the UAV is not armed, only an audio warning is issued.

The failsafe action must not be intercepted, overridden or changed.

6.5.4.8 Loss of C2 Link

In the event of a C2 Link loss, the UAV will automatically execute the Loss of Data Link failsafe procedure. The most likely cause of a C2 Link loss is the Herelink system shutting down. When this occurs, no warnings or alerts will be displayed, as the Herelink is offline; only the failsafe will be executed.

From the moment the user powers on the Herelink until it is ready to accept inputs, approximately 30 seconds will pass. If the C2 Link is reacquired during this time, the failsafe procedure will continue uninterrupted to ensure the safety and integrity of the operation.

6.5.4.9 Simultaneously GPS and C2 Link Loss

If both the C2 Link and GNSS fail simultaneously or within overlapping time frames, it is most likely due to the Herelink being offline. In such cases, there will be no warnings or alerts displayed, as the Herelink system is not operational. The UAV will autonomously execute the designated failsafe procedure.

Without GNSS data, the UAV cannot determine its global position and will automatically activate **Land Mode** to descend and land at its current location.

6.5.4.10 Emergency Stop

As a last resort, if it becomes impossible to land, control or mitigate the emergency procedures outlined above, the operator can manually perform an **Emergency Stop** using the RC joystick or

via the Auterion Mission Control app. After the emergency stop has been activated, the UAV must be restarted before it can be used again.

⚠ If performed while flying, this will cause the UAV to crash. Perform the Emergency Stop as far as possible from people.

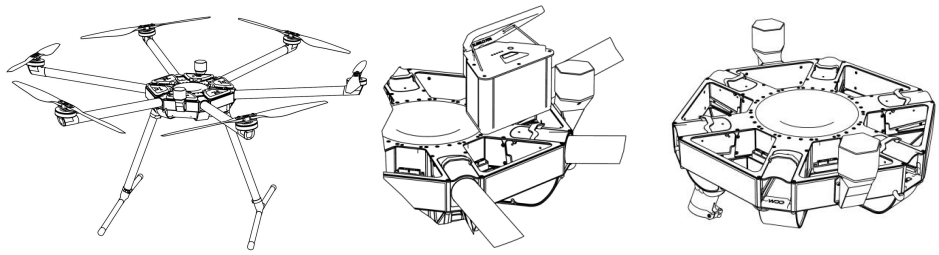
6.6 Post-flight Procedures

Post-flight procedures for an UAV operation are crucial to ensure the proper maintenance, data retrieval, and overall efficiency of the system. These procedures involve several key steps, including data management, equipment cleaning and disassembly.

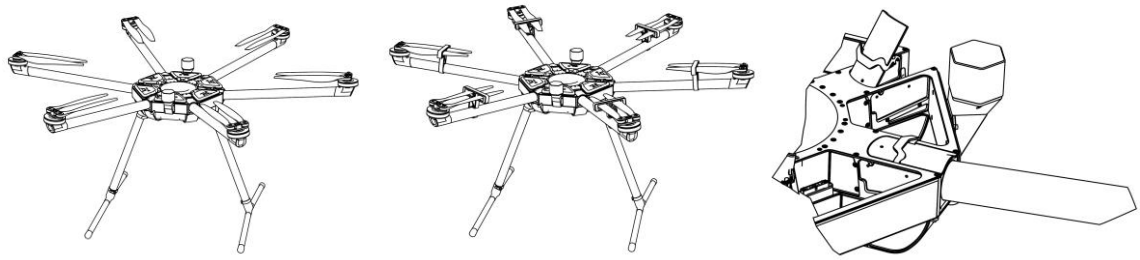
6.6.1 Disassembly

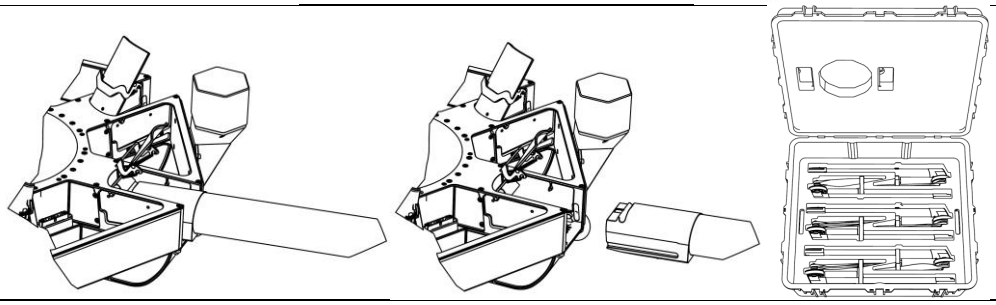
The UAV parts and equipment are disassembled and placed in boxes designed and provided by starcopter for transportation and storage of the UAV. The RC is also included. Follow the steps below to unbox and assemble the UAV.

Step 1: To disassemble the UAV, first remove the batteries from the copter. To do that, first press the battery handle button so that the handle is released. Pull the battery out vertically using the handle and place the battery in the box and close the handle. Repeat for all batteries.

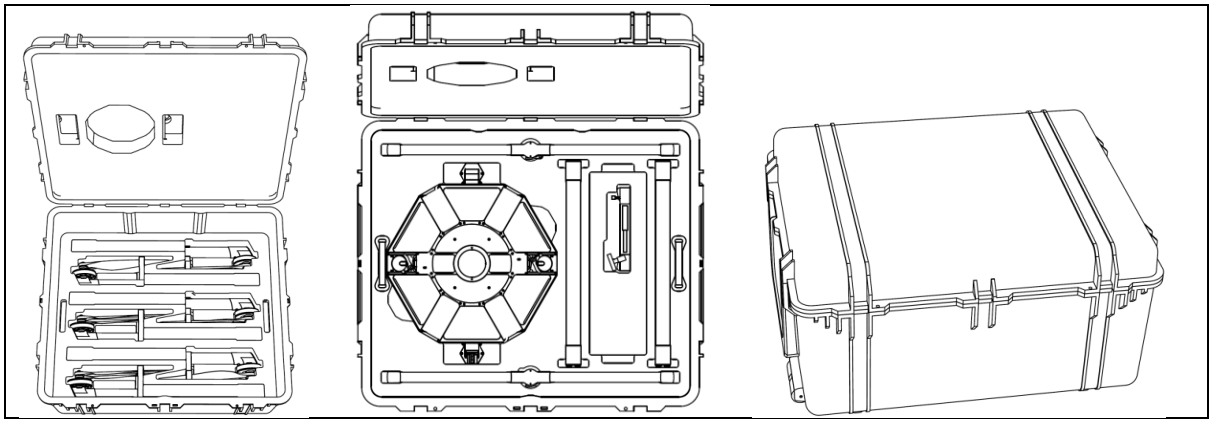


Step 2: Fold the propellers and attach the propeller guards to the propellers. To remove the propeller, click on the mechanism and gently open it up while holding the arm. Gently remove the arm from the body and put it into the transport box. Repeat for all arms. Close all locking mechanisms. Remove the payload according to the payload information sheet.





Step 3: Add the foam propeller transport protectors and put them on the arms again. Ensure that all propellers are not higher than the surrounding foam layer. Add the top layer of the transport box again. Put the body back into the transport box. Insert it as level as possible to prevent damage. Remove the legs from the body, disassemble them and place everything, including the RC, back in the transport box. Close the transport box.



6.6.2 Data Retrieval and Analysis

After disassembling the UAV, ensure the payload is carefully removed and stored. Retrieve the data by connecting the payload to a compatible device or storage medium. Always handle components gently and ensure the system is powered off to avoid data loss or damage.

6.7 Operating conditions

The operating conditions for the starcopter HIGHDRA outline essential procedures for safe and effective UAV use, including details on flight modes, takeoff and landing, as well as transportation and storage. Adhering to these guidelines ensures operational safety and maintains the integrity of the UAV and its components.

6.7.1 Manual or automated modes

Information about pilot controlled and automated modes can be found in 4.1 Pilot-controlled Modes and 4.2 Automatic Modes.

6.7.2 Take-off and landing

Takeoff and landing are critical phases of UAV operation that require precision and attention to safety.

Takeoff should always occur from a flat, stable surface free of obstacles, with the operator ensuring the UAV's systems are functioning properly during pre-flight checks. Maintain a safe distance of at least 15 meters from the UAV during takeoff. Gradually increase throttle to lift the UAV smoothly into the air, maintaining a stable hover before proceeding with the flight mission.

Landing should be executed on a similar obstacle-free surface. Descend gradually and align the UAV to land evenly, avoiding abrupt movements. Ensure you remain at least 15 meters away from the UAV during the landing process. If operating in challenging conditions, ensure the landing area is well-lit and visible. Always monitor the UAV's stability during these operations and take corrective actions if necessary.

6.7.3 Transportation and storage the UA, the equipment to control the UA remotely and the batteries

Always assemble and disassemble the UAV as specified in this manual to ensure safe and proper operation. For transport and storage, the complete system, including batteries and the remote control, must only be carried in the designated official cases. This protects the equipment from damage and ensures compliance with safety standards.

7 Maintenance Instructions

Maintenance instructions outline the necessary procedures to ensure the UAV remains in optimal working condition.

7.1 GENERALITIES

7.1.1 General UA description with component location

A general UA description with component locations can be found in 2.3 Components and its sub-chapters.

7.1.2 Cleaning and refurbishment

For optimal performance, clean the drone after each use by gently wiping the exterior surfaces with a soft, damp cloth to remove dirt and debris. Avoid using harsh chemicals or submerging any components in water. Ensure all sensors and camera lenses are free from smudges or obstructions

Any necessary repairs or refurbishments will be carried out by our service team.

Do not attempt to refurbish the copter

7.1.3 Inspection of structures, engines, propellers and electrical system including connectors and wirings, antennae

The following components should be visually inspected for any signs of damage, such as chips, cracks, deep scratches or deformities

- Propellers
- Propeller mounting screws
- Arms, motors, and navigation lights
- Landing legs
- Peripheral electronic components (GPS modules, antennas, etc.)
- Payload dampers
- Battery housing and locking mechanism
- Surface of the chassis

7.1.4 Instructions to replace parts

As the UAV is built modularly, some parts can be replaced when issues occur. These parts shall be sent back to starcopter and replacement parts can be send to you.

7.1.5 List of spare and replacement parts identified by Manufacturer and Part Number

It is possible to replace the landing legs, both the horizontal and vertical pieces. The arms, motors, and propellers can be replaced as well. It is also possible to replace batteries. The component numbers can be found in 8.4 Component numbers

7.1.6 SW update procedures

starcopter will exclusively manage all software updates for you. In case of critical safety updates, starcopter will notify you via email and perform a guided update with you and handle all occurring software update issues.

7.1.7 Life limited parts

As starcopter, we ensure that all life-limited components of the UAV are monitored, maintained, and replaced according to our stringent quality standards. In our rental model, customers are not required to manage or track these parts.

Our dedicated maintenance team oversees the inspection and replacement of life-limited parts, ensuring the UAV meets all safety and performance requirements before each rental. This process guarantees that the system is always in optimal condition for reliable operation.

7.1.8 Shelf life limitations

At starcopter, we are dedicated to providing reliable drone solutions, including proactive management of shelf-life limitations for specific components. Most of our drone components are designed without strict shelf-life limitations; however, special attention is required for certain components, such as batteries and the remote control.

When storing batteries for longer periods of time, make sure to charge the batteries with the “Storage Charge Mode” as described in 2.3.7.2.3 in the Operating Manual before storing them. After twelve months of storage, the batteries must be checked for their SoC. The internal circuitry consumes small amounts of power, even when the batteries are not in use. To avoid complete depletion due to internal power consumption, make sure to check the batteries SoC every twelve months and recharge if necessary.

The batteries and the remote control should be stored in appropriate conditions to ensure their longevity as specified in 6.7.3 Transportation and storage the UA, the equipment to control the UA remotely and the batteries.

7.1.9 Return to Service after storage including long term storage

When a UAV is returned to service after a period of storage, including long-term storage, we conduct a comprehensive inspection and maintenance process to ensure it is fully operational and safe for use. This process includes checking the batteries for charge levels, signs of wear, or performance issues, and recharging or replacing them as necessary. All critical components, such as motors, propellers, sensors, and electronic systems, are carefully inspected for any damage, wear, or signs of corrosion that could have developed during storage.

Additionally, the UAV and its remote control are updated to the latest firmware and software versions to guarantee optimal functionality and compatibility. Essential systems, including GPS, IMU, and compass, are recalibrated to maintain precise flight control. Before the UAV is deployed, we perform a functional test to confirm connectivity, assess its responsiveness, and ensure it meets our strict performance standards.

Customers can be confident that the UAV is in excellent condition when returned to service, regardless of how long it was stored.

7.1.10 Disposal instructions

Parts for dispoal must be returned to starcopter for proper disposal or recycling in line with local regulations.

Customers are responsible for safely packaging the parts before shipping them back. Use the original delivery boxes to ensure secure transportation. Proper labeling of the package is required to avoid any confusion during transit.

For any questions regarding the return process or disposal guidelines, customers can contact starcopter's support team for assistance. Please send all parts to the designated address provided by starcopter. Following these steps helps us maintain safety and sustainability throughout the lifecycle of our products.

starcopter GmbH
Rebenring 31
38106 Braunschweig
Germany

7.1.11 Instructions for logging flight operational and maintenance data

With the starcopter highdra, every flight is automatically logged by our Flight Management Unit. The flight data is uploaded to https://suite.auterion.com. Upon request, we can provide our customers with the tracked data if needed.

Since all maintenance is done by starcopter, our customers do not need to log maintenance data. starcopter drones undergo checks upon return from each client. By actively inspecting the drones after each rental, we can catch mistakes and anomalies at an early stage. Recording maintenance data is part of our internal processes that ensure that our clients receive equipment that is consistently in optimal condition, maximizing the efficiency and effectiveness of our customers' operations.

7.1.12 Tools and instruments to be used

None

7.2 Software Configurations

7.2.1 List of approved SW configurations

The starcopter HIGHDRA shall only be operated with the software configuration that we have set for you. For component and software numbers, see 8.4 Component numbers

7.2.2 Update procedures for SW configuration

To ensure compliance and maintain operational integrity, customers are not authorized to perform software updates on their own. As the manufacturer, we manage all software updates to guarantee that they meet regulatory and safety standards.

For customers requiring critical updates, we offer a guided update process. This involves clear, step-by-step instructions provided by our support team or automated tools. Customers will follow these instructions under supervision, ensuring the update is completed correctly without compromising the product's compliance or functionality.

7.3 Traceability

This chapter outlines the processes and guidelines ensuring transparency and control over software updates and configuration changes for the starcopter HIGHDRA. It details how operators are notified of updates and provides comprehensive methods for maintaining accurate records of hardware, software, and operational configurations. These practices ensure reliability, safety, and informed decision-making throughout the UAV's lifecycle.

7.3.1 Guidelines for Ensuring Traceability and Managing Configuration Updates

To ensure the safety, performance, and compliance of our UAVs in the rental system, we handle all configuration updates and maintain comprehensive records of hardware and software versions, release dates, and operational information. Operators do not need to manage updates themselves. Any necessary updates or changes are communicated to operators by our team, along with relevant safety notes. This ensures that all UAVs in the fleet are always up-to-date and compliant with regulatory requirements.

7.3.2 Operator Notification Procedures for Software Updates

Software updates will only be performed when the drone is at starcopter or through guided updates conducted by our team. Operators will be notified in advance of any required updates via email, including the reason for the update and any necessary steps they may need to take. All updates will be carried out by us to ensure proper functionality, compliance, and safety, minimizing any impact on the operator's usage of the UAV.

7.4 End of life of service parts

At the end of a service part's lifecycle, it is essential to handle its disposal responsibly. To ensure compliance with environmental standards, all damaged, malfunctioning or end-of-life service parts must be returned to starcopter for proper disposal or recycling in line with local regulations.

Customers are responsible for safely packaging the parts before shipping them back. Use the original delivery boxes to ensure secure transportation. Proper labeling of the package is required to avoid any confusion during transit.

For any questions regarding the return process or disposal guidelines, customers can contact starcopter's support team for assistance. Please send all parts to the designated address provided by starcopter. Following these steps helps us maintain safety and sustainability throughout the lifecycle of our products.

starcopter GmbH
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38106 Braunschweig
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8 Appendix

Supplementary information
to support the understanding
and proper use of the UAV system.

8.1 TROUBLESHOOTING

The troubleshooting section will outline errors, their conditions, possible reasons and actions to mitigate the problems. Follow these guidelines to resolve problems or contact starcopter for further help.

8.1.1 No Function

UAV:

If the UAV shows no response when pressing the power button, start by checking the batteries. Press the power button on each battery. If no LED lights appear, the batteries may be completely depleted; in this case, replace them with fully charged batteries and try powering on the UAV again.

If the battery LEDs do light up, indicating some charge, check that all batteries are securely connected to the UAV and properly seated in their compartments. Inspect the battery terminals and connectors for any dirt or debris that might interfere with the connection. Clean the contacts carefully with a soft, dry cloth if needed.

If the batteries are charged, connected, and clean but the UAV still does not respond, perform a manual reset by removing the batteries, waiting for 10 seconds, and reinserting them before trying to power on the UAV again. If there is still no response, try another set of fully charged batteries to rule out battery issues. If the problem persists, contact starcopter for further assistance.

Remote Control:

If the Remote Control does not respond when you attempt to power it on, connect it to a power bank. If the red charging LED turns on after a few minutes, the battery was likely depleted and is now charging. Allow it to fully charge, then power it on to verify functionality. If the Remote Control still shows no function after charging, contact starcopter for assistance.

Navigation and Conspicuity Lights:

If one or more Navigation and Conspicuity Lights do not light up after powering on the UAV, turn off the UAV and disconnect the affected arm. Inspect the power and communication connectors for any dirt or obstruction. Clean if necessary, reconnect the arm, and turn the UAV back on. The light should illuminate and display the correct pattern. If the light still does not function, contact starcopter for an arm replacement.

8.1.2 Power-on and start up problems

If the Remote Control is unresponsive after powering on, turn it off, wait 10 seconds, and turn is back on. The Remote Control shall start responding after a few moments and be usable again.

If the Remote Control does not connect to the UAV, power off the Remote Control, wait 10 seconds, and turn it back on. If the issue persists, remove the batteries from the copter, wait 10 seconds, and reinsert them into the copter. Power on the UAV again and check if the connection can be established. If that is not the case, repeat he procedure a few times. If the issue persists, contact starcopter for support.

8.1.3 Software update issues

starcopter will exclusively manage all software updates for you. In case of critical safety updates, starcopter will notify you via email and perform a guided update with you and handle all occurring software update issues.

8.1.4 Procedures to reset to factory default or last known working configuration

The UAV is supplied with optimal settings, and it is crucial that, under no circumstances, it undergoes a reset to factory defaults or the last known working configuration. For any uncertainties or issues, please reach out to the starcopter support team for assistance under support@starcopter.com.

	Do not perform a factory reset or a reset to last known working configuration

8.1.5 Shutdown and power-off problems

The UAV is powered exclusively by its batteries, and removing all batteries will automatically power it down. To turn off the Remote Control, press and hold the power button for 2 seconds, then select "Power Off" to shut it down.

8.1.6 Detection and handling of known unsafe conditions resulting from abusal or incorrect storage

Batteries:

If a battery has been long-term stored without regular charging and the charge level indicator does not light up after pressing the button on the battery, the battery might have been deeply discharged. In this case, starcopter has to be notified and the batteries cannot be used anymore.

UAS:

To detect unsafe conditions, follow and 6.4.4.2 Visual Checklist and 6.4.4 UAV Pre-Flight Preparation. This will help detect unsafe conditions. The conditions shall be handled according to 8.1 Troubleshooting. If the issues persist, contact starcopter for support.

8.2 Description of risks

This chapter explores risk categories inherent to UAV operations, addressing causes, mitigations, risks, and actions to enhance operational safety and efficiency. It outlines factors such as technical malfunctions, environmental variables, and human error as primary causes of risks in UAV operations.

8.2.1 Risk Categories

This section outlines the major risks associated with Unmanned Aircraft operations in the open category and provides essential safety instructions to mitigate these risks. Each phase of UA operation presents unique safety considerations, and adhering to the following guidelines is crucial for maintaining safety and compliance.

8.2.1.1 Pre-Flight and Post-Flight Operations

Risk of Non-Compliance with Height and Airspace Restrictions:	
Description:	Operating the UAV beyond permissible height limits or in restricted airspace, which may lead to violations, fines, or endanger nearby aircraft.
Mitigation:	Set the UAV's altitude limits to comply with the allowable maximum height for the area. Confirm that the flight path avoids restricted zones, such as airports or other controlled airspaces, to avoid airspace violations. Use geofencing features to set automatic boundaries for safer compliance.

Risk of Overflight in Densely Populated Areas	
Description:	Flying over people or crowded areas creates risks of harm to individuals in the event of a malfunction or fall.
Mitigation:	Plan a flight path that strictly avoids populated zones, high-traffic areas, gatherings, and proximity to people. Conduct flights over unpopulated or designated safe areas whenever possible. This minimizes potential injury risks to bystanders.

Risk of Operating in Unsafe Weather Conditions:	
Description:	Adverse weather, including high winds, rain, or extreme temperatures, can destabilize the UAV, impair control, and lead to accidents.
Mitigation:	Assess weather conditions thoroughly before each flight, considering factors such as wind speed, temperature, and precipitation. Avoid flying in unsafe weather and ensure the UAV is rated for the specific conditions of the day.

Risk of Non-Compliance with Additional Local Restrictions:	
Description:	Additional local or temporary restrictions (e.g., event no-fly zones or municipal limitations) may be in effect, leading to inadvertent violations.
Mitigation:	Verify any local restrictions that may be in place for the flight area, including temporary no-fly zones or other legal considerations. Adjust the flight path to remain within legal limits, ensuring full compliance with local regulations.

Risk of Equipment Failure (UAV and Remote Control):	
Description:	Physical or functional failure of the UAV or Remote Control due to undetected wear, damage, or loose components, leading to mid-flight malfunctions.
Mitigation:	Conduct a visual and functional inspection of the UAV and the Remote Control using the pre-flight checklist.

8.2.1.2 Flight Operations

Risk of Pilot Incompetency or Misjudgement:	
Description:	Insufficient experience or competency of the remote pilot may lead to poor decision-making, incorrect responses, or hazardous manoeuvres.
Mitigation:	Confirm that the remote pilot is certified and trained on the starcopter HIGHDRA and its control systems, as well as on handling in varying environmental conditions. Conduct regular competency assessments and refresher training to ensure skills remain current.

Risk of Unstable Flight due to Improper Mass and Balance:	
Description:	Improper load distribution or exceeding the UAV's maximum weight limit can destabilize flight, impacting control, efficiency, and safety.
Mitigation:	Pre-flight, verify the UAV's mass and balance, ensuring that all payload is secure and within prescribed weight limits. Adjust payload if necessary to meet the UAV's balance and weight specifications for stable operation.

Risk of Collision Due to High Wind or Adverse Environmental Conditions:	
Description:	High wind speeds, precipitation, or other adverse conditions can destabilize the UAV, increasing the likelihood of collisions or emergency landings.
Mitigation:	Limit flight operations to within specified environmental conditions, including wind speed, temperature, and humidity limits. Use a wind meter or rely on accurate weather data and avoid flying in adverse conditions that exceed the UAV's performance limitations.

Risk of Performance Degradation Due to System Limitations:	
Description:	Exceeding the UAV's operational capacity (e.g., excessive range, altitude, or system strain) may lead to degraded performance, loss of control, or system overload.
Mitigation:	Keep operations within the UAV's known performance limitations, including range, altitude, and data link capabilities. Avoid stressing the system by flying close to its maximum performance limits and adjust the mission scope if operational limits are approached.

Risk of Collision with Nearby Aircraft or Obstacles:	
Description:	Failure to detect and avoid nearby obstacles or low-flying aircraft increases the risk of mid-air collisions.
Mitigation:	Maintain a visual line of sight with the UAV at all times and monitor the surrounding airspace. Exercise caution when operating near low-flying aircraft, tall buildings, or trees.

8.2.1.3 Maintenance Operations

Risk of Component Degradation Due to Improper Cleaning Methods:	
Description:	Using harsh chemicals or abrasive materials can degrade the UAV's structure, sensors, or propellers, impacting performance or lifespan.
Mitigation:	Follow manufacturer guidelines on cleaning materials and methods. Use only approved, non-abrasive cleaning agents and soft cloths to prevent damage to delicate components like sensors.

Risk of Mechanical Failure Due to Propeller Wear:	
Description:	Undetected wear or damage to propellers can lead to decreased performance, imbalanced flight, or sudden failure during operation.
Mitigation:	Regularly inspect engines and propellers for signs of wear, such as chipping, corrosion, or loss of smooth rotation. Contact starcopter for replacement of impaired propeller.

Risk of Overlooking Small Defects During Routine Maintenance:	
Description:	Small defects in hard-to-reach or less obvious areas, such as hairline cracks or corrosion, may go unnoticed during routine maintenance, leading to larger issues over time.
Mitigation:	Pay particular attention to hard-to-reach areas, such as engine mounts and under propeller hubs. Use a flashlight, magnifying glass, or borescope to identify defects in difficult areas.

8.2.1.4 Transportation

Risk of Structural Damage from Improper Handling	
Description:	Rough handling, dropping, or placing heavy items on the UAV during transport may cause structural damage to critical components, such as the frame, arms, or landing gear.
Mitigation:	Transport the UAV in the official transport case designed for the model to prevent jostling or impact damage. Ensure all components are secured and avoid placing any heavy objects on top of the UAV during transportation.

Risk of Electrical or Mechanical Damage Due to Loose Components:	
Description:	If parts like propellers, batteries, or payload attachments are left attached during transport, they may become loose or damaged, leading to performance issues or potential safety risks.
Mitigation:	Detach propellers, batteries, and other removable parts before transportation. Secure them in designated compartments within the carrying case to prevent movement and reduce risk of damage.

Risk of Loss or Theft of UAV or Components:	
Description:	Loss or theft during transit could lead to operational disruptions and potential security risks if the UAV contains sensitive information or configurations.
Mitigation:	Keep the UAV and equipment secured and attended to at all times during transportation.

Risk of Physical Damage from Inadequate Securing in Transit Vehicles:	
Description:	If the UAV and its case are not adequately secured in a vehicle, they may shift, fall, or be impacted by other items during transit, leading to potential damage.
Mitigation:	Secure the UAV case in the transport vehicle using straps or restraints to prevent movement. Place the UAV case on a stable, flat surface and avoid stacking other objects on top of it to minimize potential damage.

8.2.1.5 Shelf Storage

Risk of Corrosion or Material Degradation from Humidity or Dust Exposure:	
Description:	Exposure to humidity, dust, or airborne contaminants can cause corrosion on metal parts, buildup on sensors, or deterioration of sensitive materials, potentially affecting performance.
Mitigation:	Store the UAV and equipment in a clean, dry environment, preferably in sealed or dust-proof cases. Consider using desiccant packs in the storage case to absorb moisture and reduce the risk of corrosion in humid environments.

Risk of Physical Damage from Inadequate Securing in Transit Vehicles:	
Description:	If the UAV and its case are not adequately secured in a vehicle, they may shift, fall, or be impacted by other items during transit, leading to potential damage.
Mitigation:	Secure the UAV case in the transport vehicle using straps or restraints to prevent movement. Place the UAV case on a stable, flat surface and avoid stacking other objects on top of it to minimize potential damage.

8.2.2 Security instructions for Software integrity

To protect your drone's software from risks during data transfers, it's essential to follow secure practices. When downloading videos and images using external devices or internet connections, ensure these devices and networks are trustworthy. Avoid using unverified devices or public networks, as they may expose your drone's system to malware or unauthorized access. Software updates are restricted to starcopter only. Do not attempt to perform updates on your own, as unauthorized updates may compromise the integrity and security of the drone's software.

8.2.3 Information related to privacy rights

If equipped with a camera, your drone can capture images or videos, which may inadvertently include people who haven't given permission to be filmed. Be mindful that these recordings could impact individuals' privacy rights. Avoid filming in sensitive areas or focusing on individuals unless you have explicit consent. It's essential to understand and respect privacy regulations to avoid unintentionally violating anyone's right to privacy. Familiarize yourself with local rules to ensure that any footage captured complies with privacy standards.

Furthermore, be mindful that any actions involving harassment, stalking, or defamation may violate privacy and publicity laws. Adhering to these guidelines promotes responsible drone use and helps you comply with legal requirements regarding privacy.

8.2.4 Registration of UAV Operators

If your drone is equipped with sensors that can capture personal data—such as cameras or other data-capturing devices—you are required by law to register as a UAS operator. This registration is necessary to ensure responsible and transparent use of drones that have the potential to collect sensitive information. Please check local registration requirements and complete any mandatory

registration steps before operating a sensor-equipped drone to stay compliant with data protection laws.

8.3 SAFEGUARDS

The safeguard features of your C3-class drone are designed to ensure safe, secure, and responsible operation at all times. These safeguards include both hardware and software protections that help prevent accidents, maintain data security, and respect privacy rights. In this section, you'll find a comprehensive list of safeguards, detailed instructions for proper installation and regular testing, and essential personal safety measures. By understanding and implementing these safeguards, you can minimize risks to yourself, others, and the environment, ensuring compliance with safety and regulatory standards.

8.3.1 List of all safeguards

The following safeguards are essential to ensure safe and compliant operation of the starcopter HIGHDRA:

Safeguard	Reference
Return to Launch (RTL) Functionality	4.2.3 Return to Launch (RTL)
Low Battery Failsafe	6.5.4.1 Low Battery Failsafe
Emergency Stop	0 Without GNSS data, the UAV cannot determine its global position and will automatically activate **Land Mode** to descend and land at its current location. Emergency Stop
Maximum Height Limitation Function	5.3 Speed and Height Limitations
Geo-Awareness	3.1.8 Geo-Awareness
Automatic Landing	4.2.5 Land
Hold Mode	4.2.1 Hold

8.3.2 Instructions how to install safeguards and to verify proper functioning

Safeguard	Installation Reference	Verify proper functioning
Return to Launch (RTL) Functionality	4.2.3 Return to Launch (RTL)	Set the preferred RTL Height and activate the RTL function. Beware of compliance limitations when testing.
Low Battery Failsafe	6.5.4.1 Low Battery Failsafe	Fly the drone in a safe environment until the low battery failsafe activates. Verify failsafe activation and let the drone land.
Emergency Stop	0 Without GNSS data, the UAV cannot determine its global position and will automatically activate **Land Mode** to descend and land at its current location. Emergency Stop	Familiarize yourself with the location and activation method of the emergency stop button or command. Test its function while the drone is grounded to ensure an immediate response.
Maximum Height Limitation Function	5.3 Speed and Height Limitations	Set the preferred height limits in accordance with your flight area. Test by flying towards the maximum height to

		verify the activation. Beware of compliance limitations when testing.
Geo-Awareness	3.1.8 Geo-Awareness	Test in a controlled area with known restrictions to ensure the system accurately alerts you of restricted zones. Do not breach into the geo-zone.
Automatic Landing	4.2.5 Land	To test, fly the drone and activate the automatic landing to verify it initiates a safe descent. Beware of the surface for landing.
Hold Mode	4.2.1 Hold	Engage Hold Mode during a hover flight to verify that the drone can maintain its position and altitude effectively. Ensure it resumes normal operation smoothly upon manual reactivation.

8.3.3 Personal health and safety procedures and mitigation actions

To ensure safe drone operation and minimize risks, always adhere to the recommended health and safety procedures. When handling the drone, wearing gloves is advised to protect against cuts or scrapes from sharp edges, especially during setup, maintenance, and when installing propellers. Additionally, maintaining a safe distance of 15 meters from the drone during takeoff, flight, and landing is essential. Be sure the launch and landing area is clear of bystanders, animals, and any obstacles, as this will reduce the risk of accidental contact.

Before every flight, perform a thorough inspection of the drone. Check that all propeller guards are secure, battery levels are sufficient, and all safeguard settings are properly configured (please refer to UAV Pre-Flight Preparation). Ensure that the flight area is free from unexpected hazards such as cables, uneven ground, or strong winds, which could interfere with safe operation.

In the event of an emergency, be prepared to quickly activate the Emergency Stop, Return-to-Launch (RTL), or Automatic Landing functions as appropriate. It's important to have a clear backup plan in place to retrieve the drone if it needs to make an emergency landing.

By following these guidelines and using gloves as recommended, you can help prevent injuries and create a safer and more controlled flight experience.

8.4 Component numbers

Component numbers are unique identifiers for UAV parts, crucial for tracking, inventory, and maintenance. They ensure correct part usage and compatibility during repairs or replacements and help with ordering spare parts and maintaining safety standards.

8.4.1 UAV Parts

Part	Part Number
Clockwise (CW) propeller	90.0164
Counterclockwise (CCW) propeller	90.0165
Clockwise (CW) Arm	20.0001
Counterclockwise (CCW) Arm	20.0002
Battery Set	30.0002
Landing Leg horizontal part	11.0088
Landing Leg vertical Part	11.0089
Remote Control (RC)	90.0105

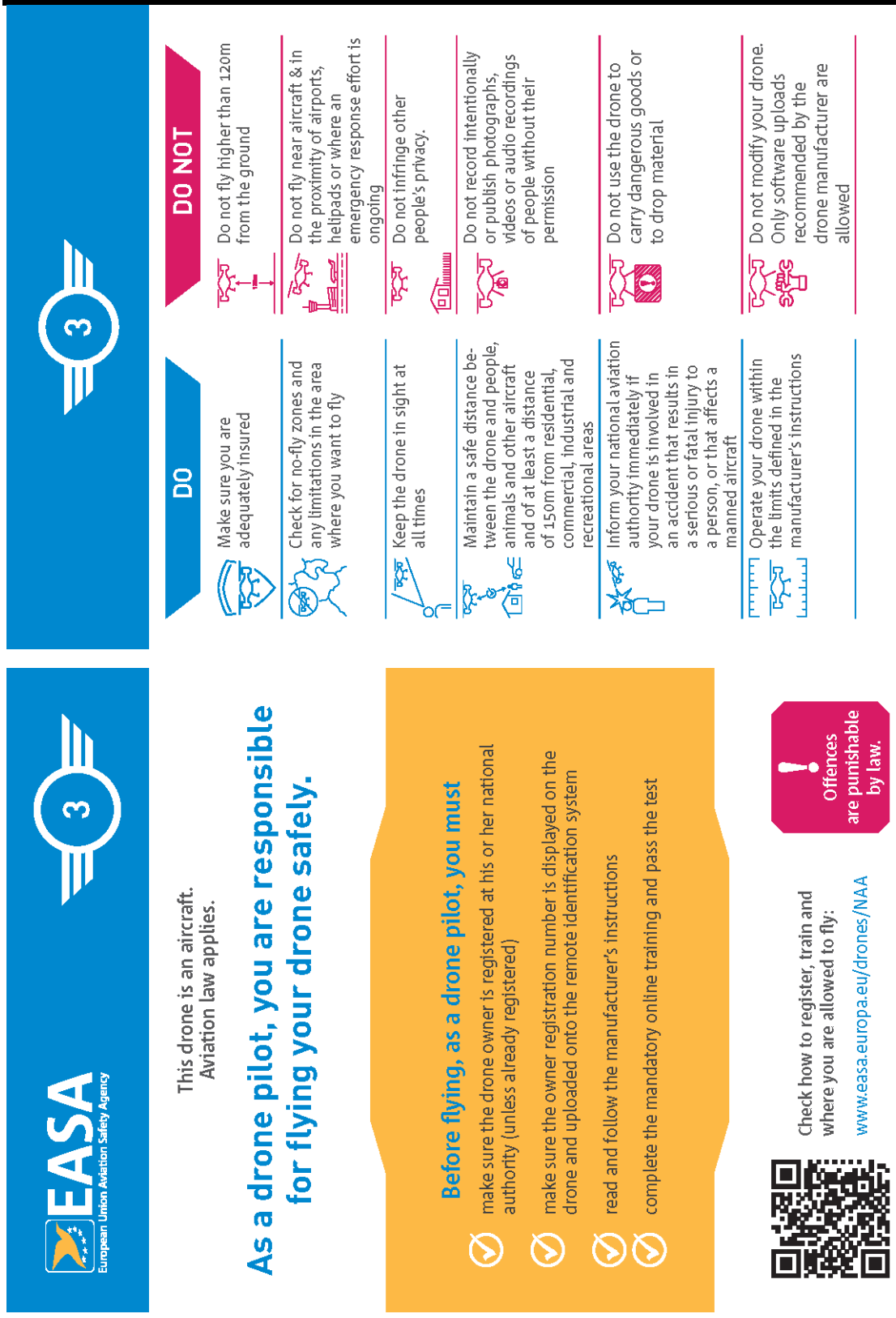
8.4.2 starcopter's Electronic Component

Name	Qty.	Hardware ver.	Software ver.
Motherboard	1	C.3	1.2.0
Battery Management System	6 per battery set	D.1	0.4.0
Motor Mount Board	6	C.4	1.1.1

8.4.3 Third-party Electronic and Software

Name	Manufacturer	Type	Electronic HW ver.	Software ver.
Auterion Mission Control (AMC)	Auterion	Mission control	n/a	1.32.7
Skynode		FMU & Companion Computer	2.0	3.5.13
APX4		FMU software	n/a	3.1.0
Myxa	Zubax	Electronic Speed Controller	1.6	v1.0
H-RTK F9P Ultralight	Holybro	GPS module	n/a	n/a
Herelink	CubePilot	Telemetry radios	1.1	AU01230714
		Remote control & display	1.1	RU01240301
Dronetag DRI	Dronetag	Direct Remote Identification	3b	3.2.2

8.5 EASA Information Notice



📖 EASA Information Notices in additional languages can be viewed at https://www.easa.europa.eu/en/document-library/general-publications/drones-information-notices.