ABZ INNOVATION

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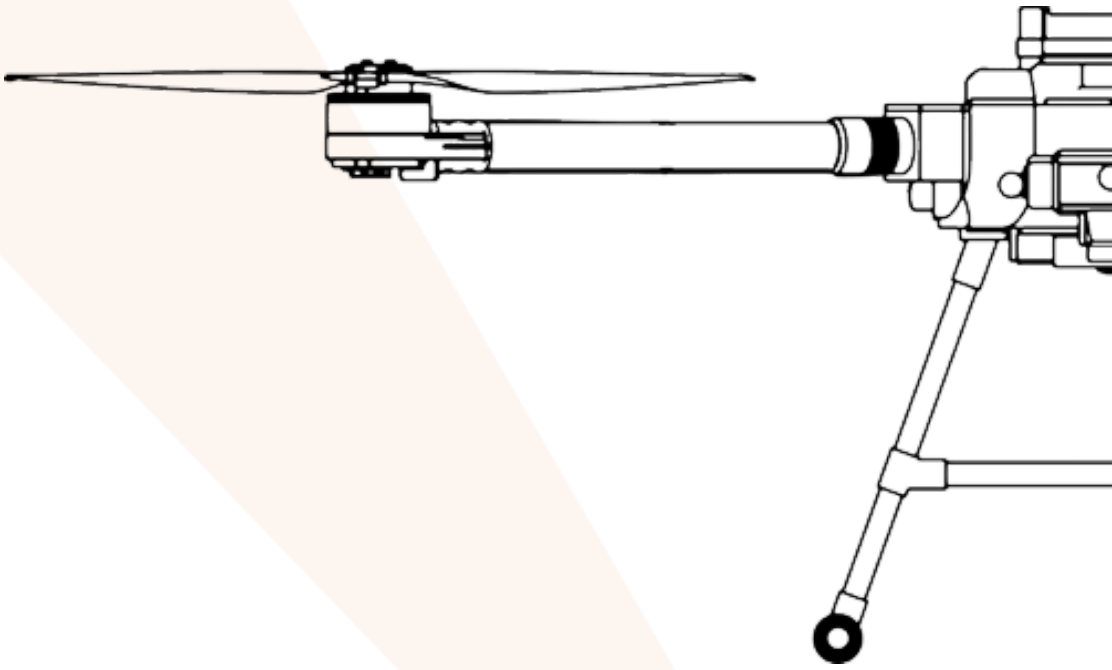


# M12

# OPERATOR MANUAL

**Version 1.1.4**

# General Information

## Overview

This manual is for the ABZ Innovation M12 industrial, multi-payload drone, which can be upgraded with a wide range of payloads, thanks to its universal design. This drone complies with the class identification C4.

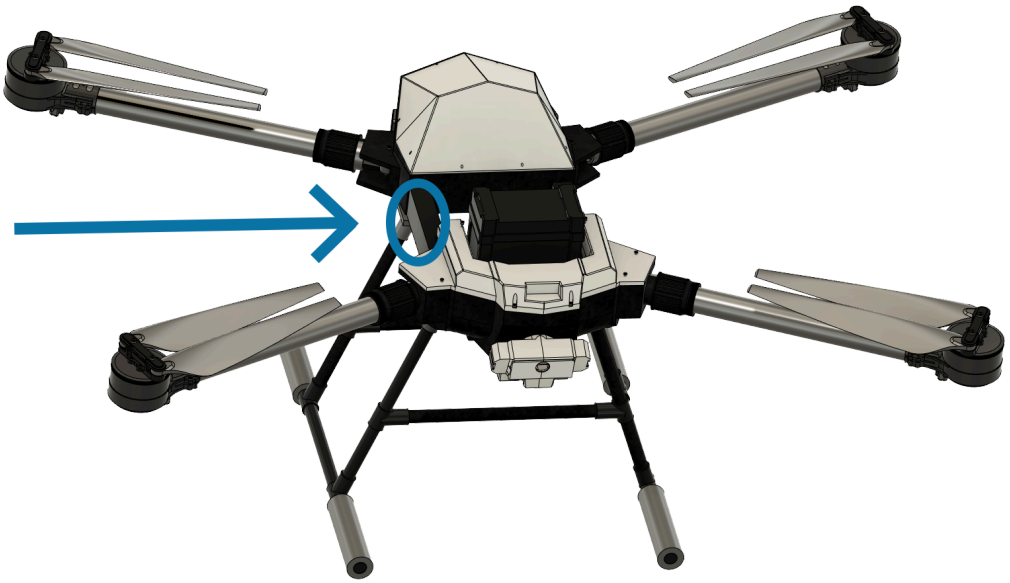
The drone and its accessories may only be operated in accordance with the instructions in this manual.

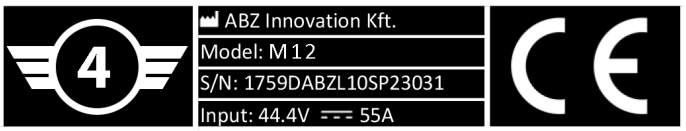
Please read this notice and the manual provided for your ABZ Innovation M12 drone before use. If you have any questions, please contact ABZ Innovation customer service before use. The contact details can be found at the end of this document. By using the drone, you declare that you have read this manual, that you understand and acknowledge the information contained herein, and that you consent to use the drone only under proper conditions, in full compliance with applicable laws and the instructions in this manual. Furthermore, you agree that you are now exclusively responsible for the drone and its operation, and for any direct or indirect legal consequences arising from its operation.

The ABZ Innovation M12 drone is NOT a toy and is to be used only with care. Improper use of the drone poses a serious risk and can cause damage to the drone and its surroundings, severe personal injury or death. The drone may only be used by qualified pilots. The ABZ Innovation M12 is a technical, industrial device.

Any modification to the drone, its components or software will immediately void the warranty.

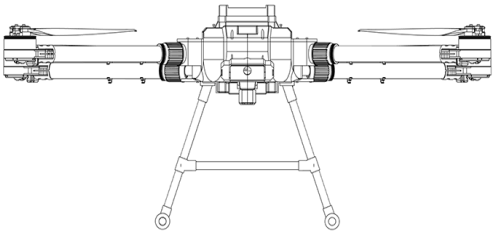
The M12 drone is a single-variant-only model of ABZ Innovation, no other model combinations are available, no configuration changes are applicable to this drone model.



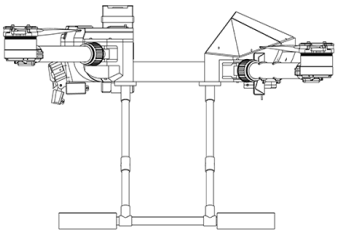



To identify an M12, locate the serial number label on the right side of the drone frame and check if the „Model” is M12 and the Class Identification label is C4.

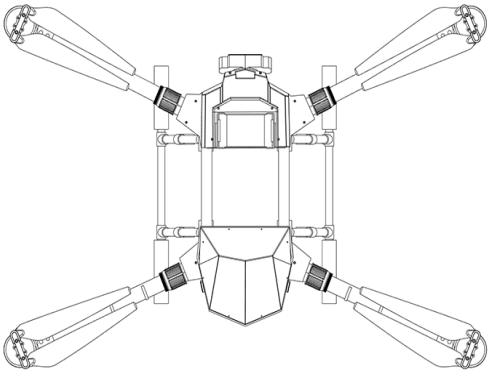
**ABZ Innovation M12 drone**



Front

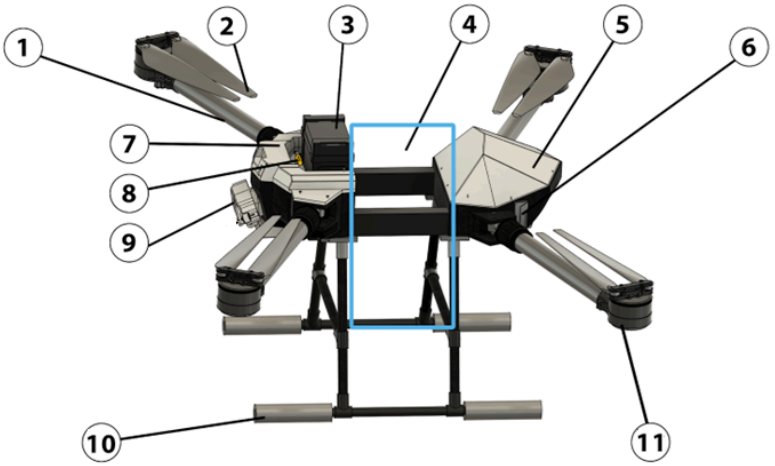


Side



Top

## Drone main parts




1: Arms

2: Propellers

3: Battery

4: Optimal payload area

5: Rear cover

6: RC antennas

7: Front cover

8: Battery connector

9: Cameras

10: Landing gear

11: Motors

The drone is available from the manufacturer only in one hardware and software configuration, without any additional payload.

## Packing list

The M12 drone standard package contains:

- M12 drone
- ABZ Innovation MK15 remote controller with sticks and antennas
- Charger cable for remote controller

## Specifications

| | |
|---|---|
| UAS category classification | Specific/C4 |
| Dimensions arms, propellers unfolded | 1460 x 1020 x 610 [mm] |
| Dimensions arms unfolded, propellers folded | 1380 x 940 x 610 [mm] |
| Dimensions arms and propellers folded | 780 x 500 x 610 [mm] |
| Flight planning and flight precision | GPS/RTK |
| Battery integration | quick connector |
| Intrusion protection | Limited water and dust resistance |
| Drone frame | Folding frame |
| Range | 3,5km |
| Sensor | LiDAR |
| Flight speed (working) | 15m/s |
| Airspeed (maximum) | 22m/s |
| Max. tolerable wind speed | 10m/s |
| Radio Control and Telemetry band | 2,4 GHz |
| WLAN frequency band | 5GHz |

**Weight specifications depending on category**

| | **Specific Category** | **Open Category (C4)** |
|---|---|---|
| Max. Take-off Mass (MTOM) | 29 kg | 24.9 kg |
| Max. payload weight | 12.54 kg | 8.44 kg |
| Max. summarized weight of accessories and batteries and payloads | 16.74 kg | 12.64 kg |

# Safety requirements

## Child protection provisions

- This equipment is not suitable for use in places where children are likely to be present.
- The equipment must be kept out of the reach of children.
- The equipment operates rotating parts that are dangerous for children and must be kept out of the reach of children!

## Operating conditions

- The pilot must have the A1/A3 'open' category license.
- It is forbidden to operate the drone or any of its components in an enclosed space.
- In all flight modes including take-off and landing, the pilot must comply with all safety requirements and the technical conditions must be met.
- Fly only in places where there are no buildings or other obstacles.
- Do not fly over or near people.
- When recording a video or picture, the privacy and property rights must be met. Recordings are only allowed with authorization of every involved person, including private property.
- In case of using sensors capable of personal data detection, the UAS operator needs to be registered to meet the legal requirements. Especially in these cases, calculate the permitted distance using Detection-Recognition-Identification metrics and fly only where recordings are only in Detection and/or Recognition range and not in the Identification range.
- For Open category flights or specific category flights including personal data detection, the operator must use a Drone Remote Identification (RemoteID) device to comply with legal requirements.
- Maintain 150m horizontal distance from uninvolved people and urban areas.
- Maintain flight altitude below 120m above ground level.
- Do not fly above 4.5 km (14 763 feet) above sea level.
- Fly only in moderate weather conditions, between temperatures of 5°C and 45°C (41°F and 113°F).
- Do not fly in rain, hail, or in higher relative humidity than 80%.
- Avoid contact with any solid objects or animals during flight, even smaller particles (excessive sand, dust, or swarm of insects) can cause damage to the propellers, when contacting at high (rotational) speed.
- The pilot must ensure that during the entire flight, VLOS conditions are assured. Flight in excessive fog, dust, etc. is prohibited.
- In dark lighting conditions the pilot must reduce the maximum flight distance to a limit, where the drone and its orientation is safely determined based on the light of the LEDs.

- Your flying activities must not violate any applicable laws or regulations. You must have all necessary permits. Contact the appropriate government agency or authority before flying to ensure that you are operating your drone in compliance with laws and regulations.
- It is prohibited to use automatic missions when flying in the C4 Open category.

## Operation

- The drone may only be switched on and operated in accordance with the "Flight Protocol" chapter starting on page 62.
- Only use the drone in full compliance with the checklists.
- Stay away from rotating propellers and motors.
- Do not exceed the maximum combined accessories and batteries and payload weight in any case. Otherwise, the drone may be damaged and the flight might pose danger.
- Always keep track of the drone's flight, be ready for manual control. Manually avoid obstacles at a safe distance. Never rely exclusively on the ABZ Control app. It is important to check or set the correct Failsafe and RTL altitude before each flight.
- Always keep the drone within visual line of sight (VLOS) and keep an eye on it.
- Don't get distracted by using your mobile phone or any other activities.
- Don't fly under the influence of alcohol, drugs or medicines. Fly only when you are mentally and physically capable of safely controlling the drone, including paying attention to its surroundings.
- If the drone or remote controller battery is low, land the drone in a safe place. The state of the drone battery should be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge.
- During the flight, the pilot must monitor the battery voltage, which should always be above 43.5V, even when flying with the Maximum Take-off Mass (MTOM). The ABZ Control battery indicator icon serves only as an indicator and shows an approximate value.
- Never fly closer than 100m of a high voltage power line or high-power radio emitters (e.g. Radar, TV/Radio station).
- Never fly closer than 30m horizontal distance to buildings.
- After landing, switch off the motors, switch off the drone by disconnecting the battery, and then switch off the remote controller.
- In case of loss of remote controller signal, the drone can automatically switch to Failsafe RTL mode.

## Maintenance and storage

- Do not use damaged, broken, or aged propellers.
- Regularly check the condition of the drone and make a flight log.

- To avoid damage to the drone's landing gear, remove payloads, accessories and the battery before transportation.
- Clean the drone, especially the propellers, after use.
- Recommended storage temperature: between 5°C and 40°C (41°F and 104°F) applicable for the drone, as well as the remote controller and the batteries.
- Never store the remote controller or the drone's batteries below 0°C, it will cause excessive degradation to the battery cells.
- Store the drone, remote controller, and batteries below 60% relative humidity.
- The remote controller and the drone's batteries must be stored at about 60% charge.
- Batteries deplete after extended storage. The remote controller and the drone's batteries must be discharged and recharged every 3 months of storage.
- After long-term storage:
    - Every battery must be inspected and fully charged before use.
    - The drone's motors must be inspected for free rotation.

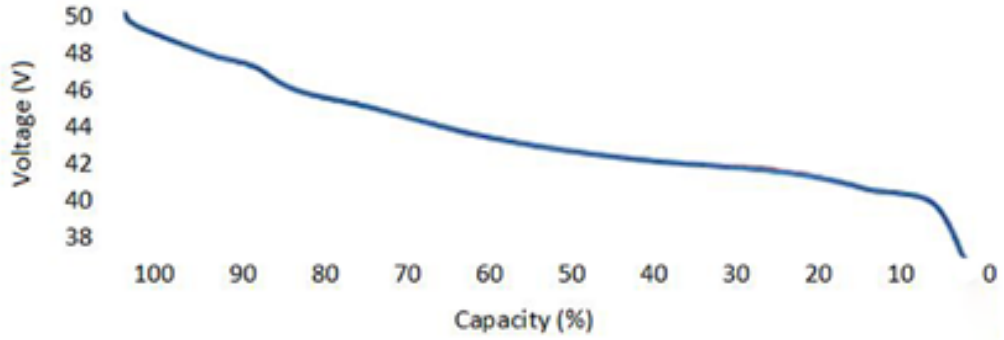
## Drone handling and use precautions

- Before commencing each flight, plan your drone's flight path with care and attention. Pay attention to the following:

    - working at a suitable time of day,
    - weather conditions,
    - environmental influences (such as sunlight),
    - drifting of the drone in case of wind,
    - wind speed,
    - flight altitude,
    - when planning, the correct line spacing,
    - turning points,
    - obstacles in the work area.

- The equipment is powered by a replaceable battery. Make sure the batteries are in good condition and fully charged. Do not use faulty or damaged batteries. To learn about proper use and storage, please read the battery's instruction manual.
- The batteries can be charged using an external battery charger. To use this, please refer to the battery charger's instructions for use.
- The battery performance varies by the temperature, always pay attention to this phenomenon and follow the battery's instruction manual. Operate or charge the batteries only between 5°C and 45°C ambient temperatures, while the battery's temperature remains between 10°C and 60°C.

- Battery discharge is not linear, depending on load, temperature, internal resistance, and condition of cells. This figure shows the typical discharge curve for a drone battery in 90% state of health, at 40°C at 7,5C load:




- The maximum masses of accessories/batteries/payloads combined, fitted to the drone must not exceed 16.46 kg (specific category)/ 12.64 kg (open category), thereby the drone's overall mass must not exceed the Maximum Take-off Mass (MTOM), 29 kg (specific category)/24.9kg (open category).
- Maximum flight time with one battery is mostly dependent on the Take-off Mass, which is highly related to installed accessories and payloads. The difference in safe maximum flight time between an unequipped M12 and a fully loaded M12 at MTOM can be as high as 10 minutes.
- The drone's agility and balance is highly influenced by the payloads or accessories, especially if those are installed further away from the Optimal payload area (shown on page 4). If a heavier device is installed offset from the drone's center of gravity, the pilot must fly with extreme caution to the altered controllability and potential of slower deceleration, acceleration, turning, elevation and descent speeds.

## Information about transport

The drone is designed for outdoor work. The drone can be delivered to the site in the trunk of a vehicle, in the loading area of a truck or in a trailer. Always apply the protective foam fixations to the propellers before moving the drone with folded arms. Proper anchorage is an important prerequisite for the safe transport of the drone, as it is done on uneven road surfaces and on various terrain. Securing the drone improperly can cause damage such as deformation and ultimately breakage of the propellers, damage, punctures, damage to the fastenings, payloads, etc...

Transporting the equipment requires extra care and attention. Improperly secured equipment and accessories necessary for its operation (drone, drone batteries, battery charger, generator, etc...) can lead to damage, which may ultimately lead to total equipment failure. Therefore, please carefully secure the drone during transport and store its accessories in a suitable place.

## In case of loss of signal and communication

The ABZ Innovation M12 drone and the remote controller communicate directly through an assigned 2.4GHz radio signal. The drone's software is equipped with safety features that ensure safe operation at all times, including possible loss of signal and communication. This can occur in cases where the drone signal is out of range (for the ABZ Innovation M12 this is 8 kilometres), or when there is interference from equipment, devices or magnetic interference in the vicinity of the drone. In these cases, the drone will communicate clear instructions to the operator while the software initiates safety functions. The safety features need to be set before take-off, programming the drone's behavior if the signal is lost. The method to set these is detailed in the „Setting up FailSafe" section.

These options can also be set with the following:

- Returning to the starting point (Return to Launch – RTL)
- Stopping at the point of signal loss
- Keeping the height
- Landing
- Climbing to the set altitude and return home
- continuing Auto mission (if flying in specific category)

If the drone loses signal from the remote controller, or the communication between these are interrupted, on the remote controller's screen the following message will appear „COMMUNICATION LOST" and it will read it out loud (if the volume is not muted).

The drone and the remote controller will try to recover the connection automatically. However, if possible, it is highly recommended for the pilot to move the remote controller closer to the drone, especially if any obstacles (e.g. building, tree, or a hill) are in between, and also if the communication between the remote controller and the drone is recovered, take back manual control of the drone (e.g. switching to Loiter mode.

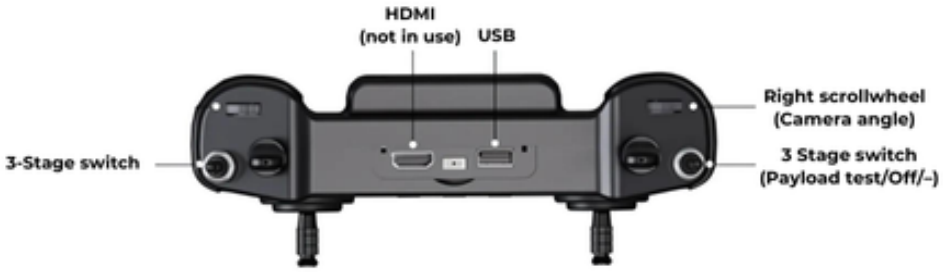
In the event of a crash, the drone typically disarms itself. However, if the rotors are still spinning, the pilot should attempt to activate the Motor emergency stop (by pressing the C and D buttons simultaneously), even if the 'Communication Lost' message is displayed. Never approach an armed drone.

## Mandatory drone identification with Dronetag

For security reasons, in the United States and the European Union, the remote identification of drones is mandatory. All drones must operate with a remote identification (RemoteID) device, ensuring the local transmission of information about the operating drone. The M12 drone comes equipped with a Dronetag BS remote ID module. You can set up and manage the Dronetag BS in the Dronetag Toolbox App (available for Android and iOS) or after a free registration either in the dronetag.app web application or in the Dronetag App (available for Android and iOS).

To comply with the legislation, you must upload your drone operator ID into one of the applications mentioned above. After the initial setup, your drone operator ID will be broadcasted from the device during flight, which you can verify using the Drone Scanner application. For further information and help, please refer to the Dronetag website.

# Remote Controller

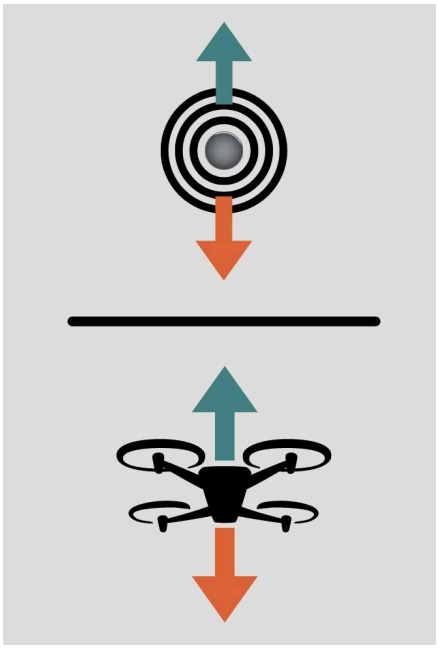




You can only charge the remote controller when it is powered off and only with the supplied fast Charger. The RC cannot be charged while working.

1. Connect the remote controller to the fast charger and plug it into the power supply.
2. The charging indicator lights are red when the ground unit is charging.
3. The charging indicator lights are green when charging is finished.

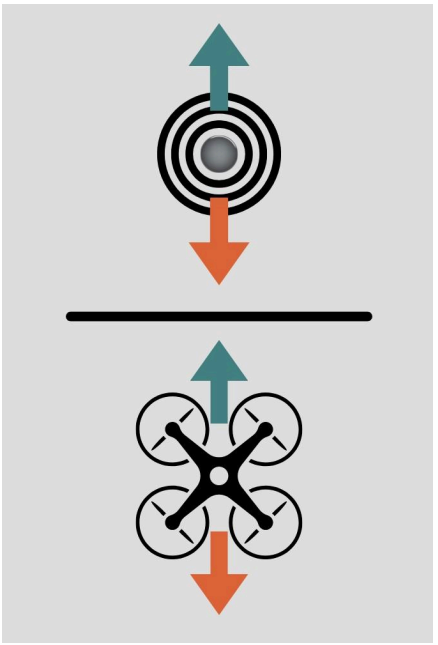
## Default control (mode 2)

**Left stick**

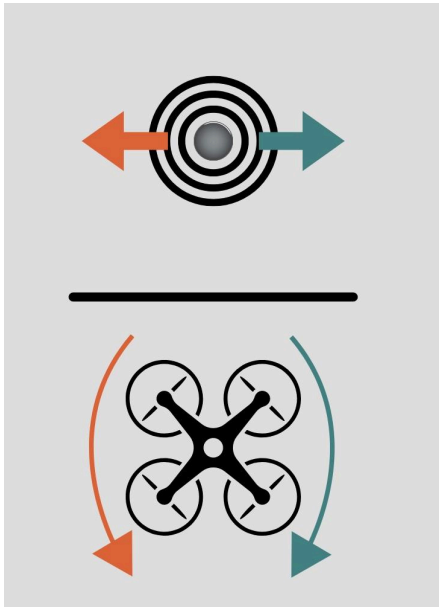


**Up/down**

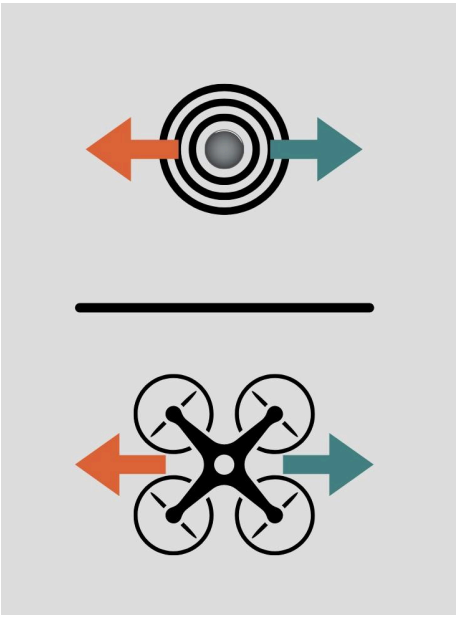
**Right stick**



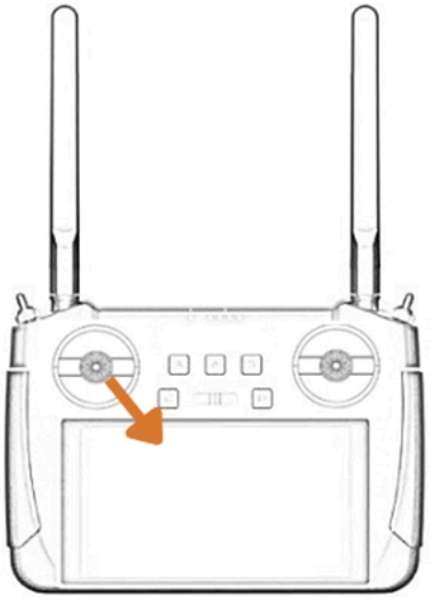
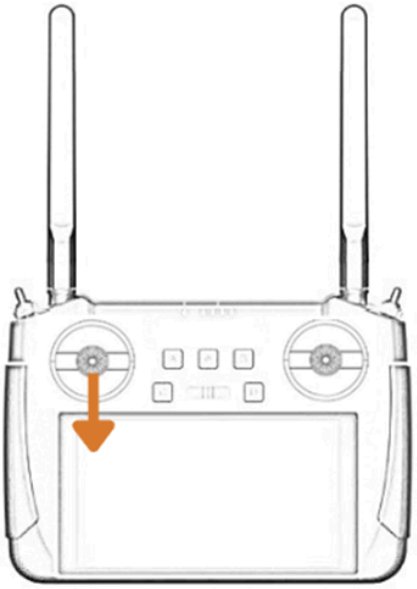
**Forward/backward**



**Rotation**



**Left/right**

| Arm | Disarm |
| --- | --- |
|  |  |

The M12 is compatible only with the controllers provided by ABZ Innovation with specialized ABZ Control software. Every firmware/software combinations are compatible with the drone. The available remote controller unit:

- ABZ Innovation MK15

Other devices or applications are not compatible for controlling the drone, therefore prohibited to use with the drone.

No software update is needed before and during operating the drone, future updates are only optional. Any future software updates will not affect the control and flight functions. Software update procedures are explained and guided in the documentation of the update package. All information and files are available at: abzinnovation.com/updates.

Please check this website if you are looking for software or firmware update options.

Use only the links and files provided directly by ABZ Innovation for data security. Never let remote connections online to the computer connected to the drone to avoid external manipulation of the drone's software or settings.

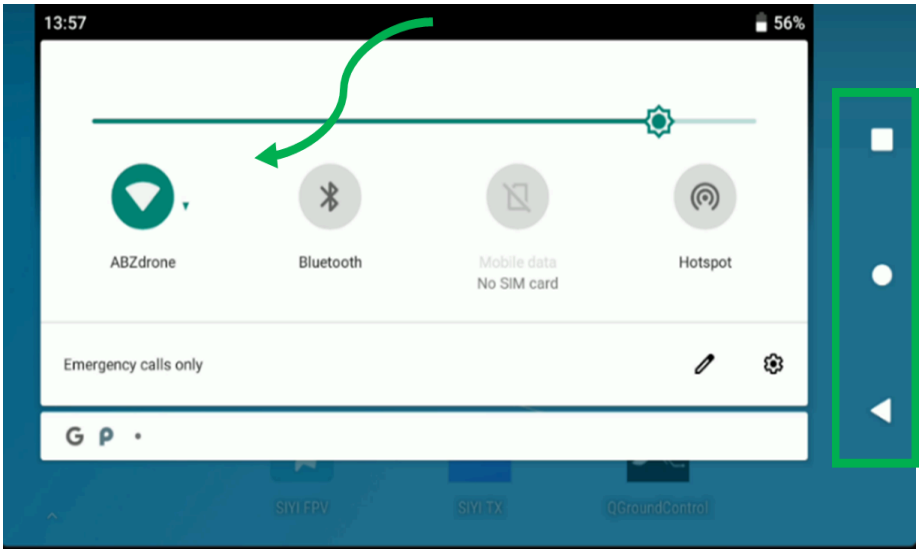
The MK15 remote controller is an Android operation system-based device, with an integrated system for communicating through radio signals with the drone. It runs the ABZ Control application to control the drone and let the pilot access all telemetry data and advanced flight planning.

If the remote controller is turned off, you can check the battery charge of the remote controller by a short push of the power button. The blue LEDs indicate the charge level. The single LED in front of them gives feedback about the connection between the drone and the remote controller. When the LED is green, the drone and the remote controller are connected.

**To switch on the remote controller, push the power button once briefly and then once more for a longer duration (until you hear the system's sound signal).**

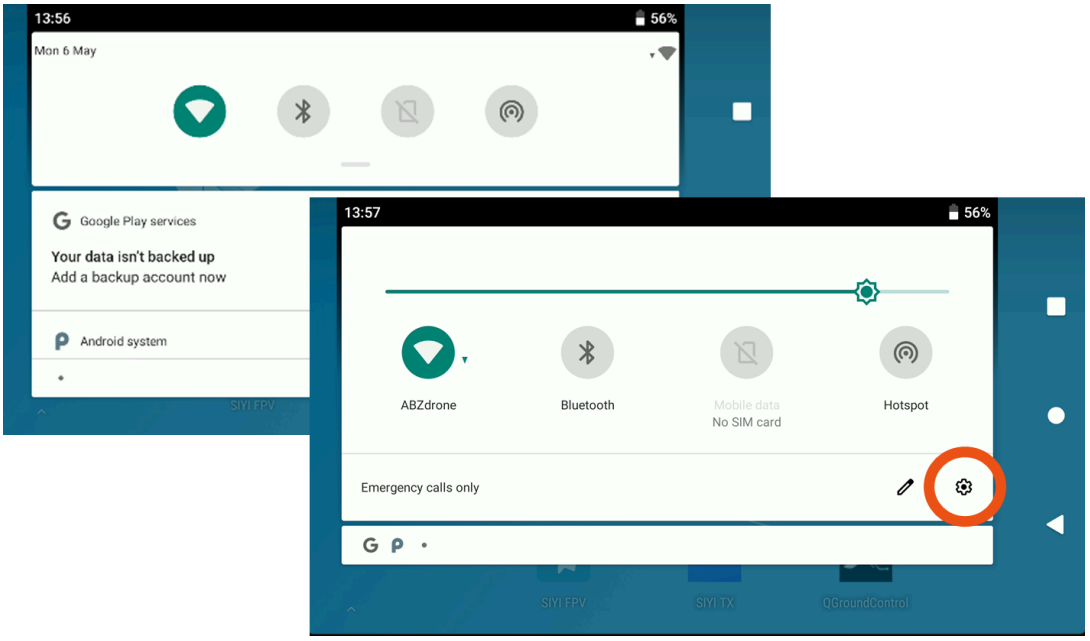
If you push the power button once short, the screen will turn off (power saving mode). If you push the button for 1 second, you can choose between the options of powering off the remote controller or taking a screenshot.

You can access the Android navigation bar by swiping down from the top of the screen or swiping from the right side of the screen.



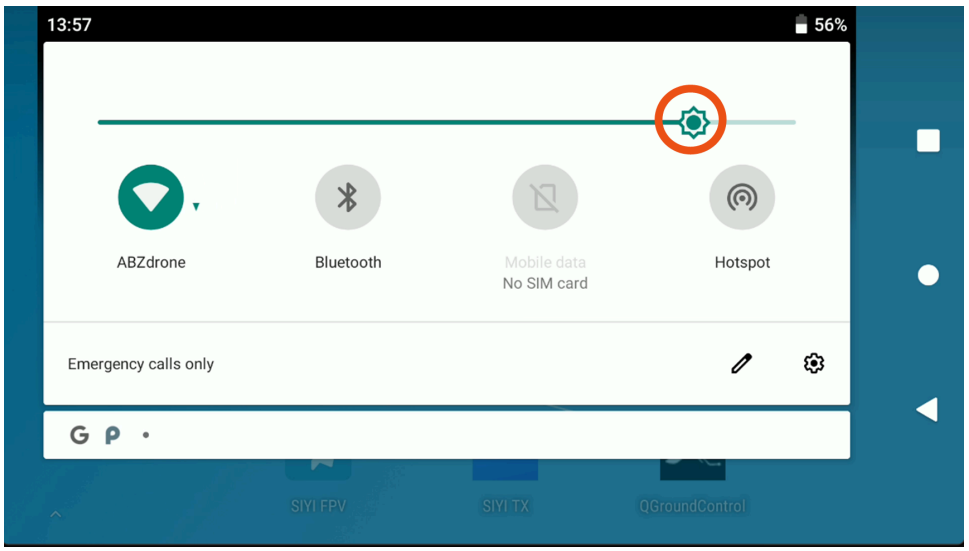

The rectangular icon allows you to switch between applications. The circular icon takes you to the main screen. The triangular icon lets you go back to the previous screen (note: this function is not supported in ABZ Control).

The remote controller battery status is displayed in the Android menu (by swiping down from the top of the screen).

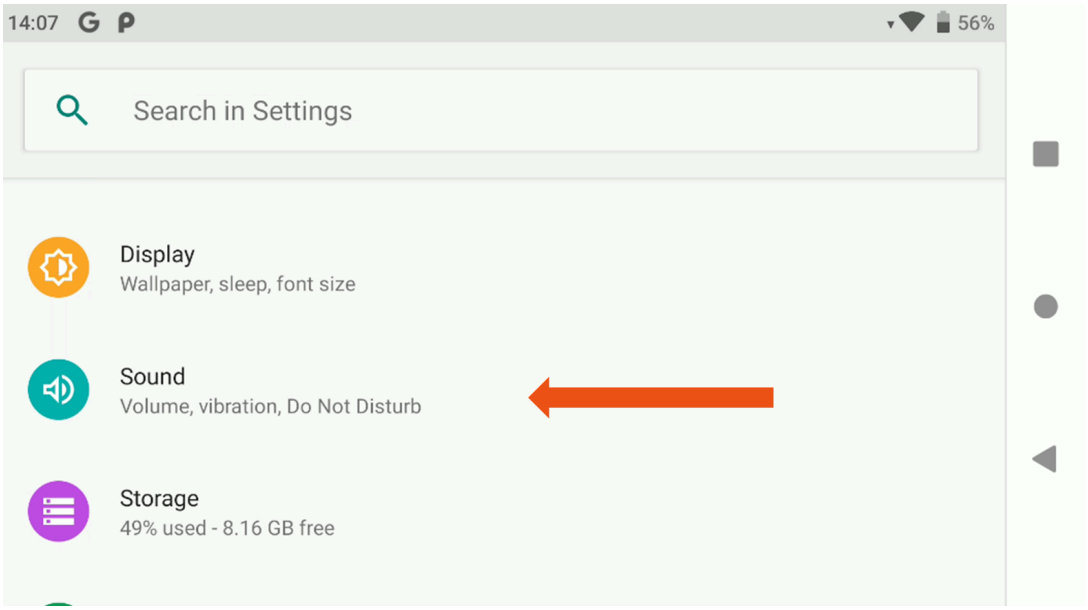



Set the **display brightness** and **sound volume** always according to environmental conditions (light conditions and noise level)! Setting the display brightness and sound volume is always accessible (even when operating the ABZ Control software) from the basic Android menu, swiping down from the top of the touch screen once, where the general Android quick menu appears.

Swiping down from the top of the touch screen once more, the slider for the display brightness setting appears:

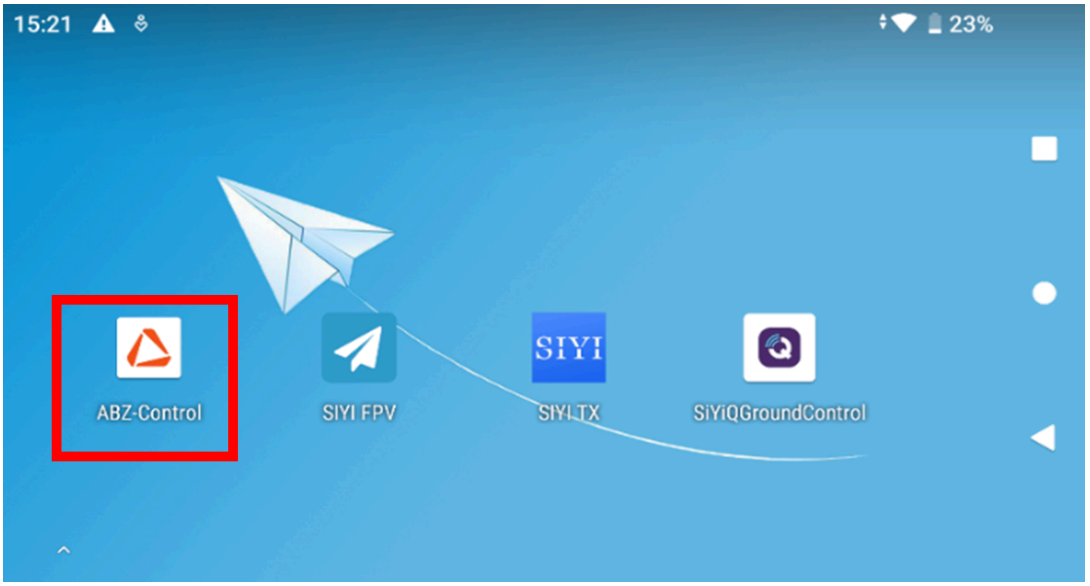


Click on **Settings (gear icon)** then scroll down to the **Sound** menu and tap on it to show the sliders for volume control functions.

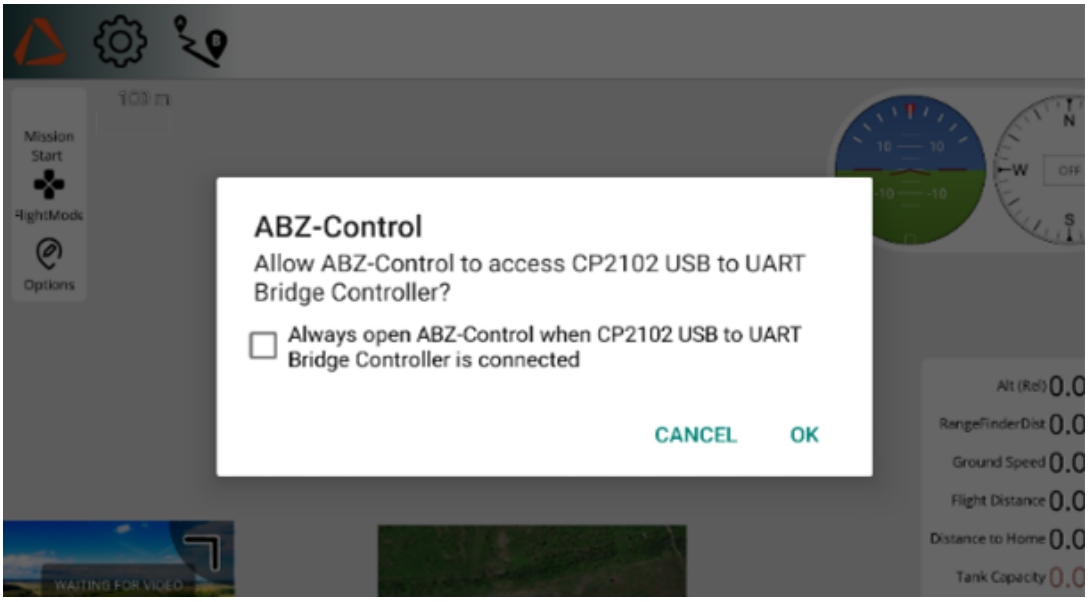



**Media volume** controls the ABZ Control application's alerts and information volumes. We highly recommend this always be set to the maximum volume.

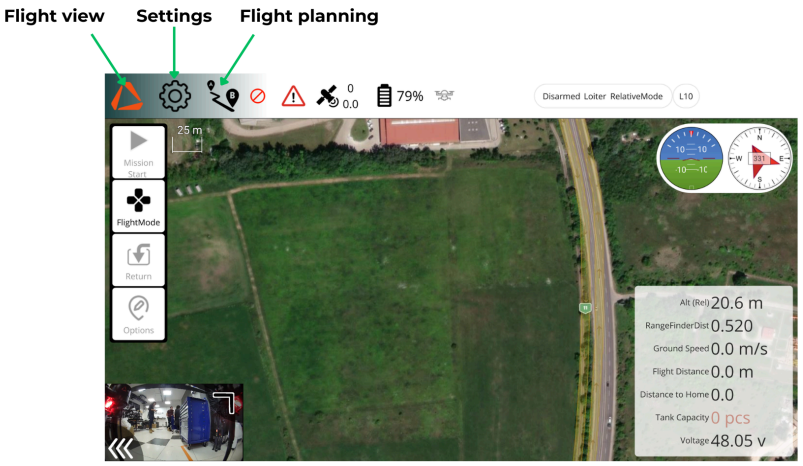
Start the ABZ Control flight control and planning application by clicking on its icon on the home screen.




After starting the ABZ Control application, you will receive a pop-up window with the message: Allow ABZ Control to access USB to UART Controller. You can click on OK.



After launching the application, the following screen will be displayed:

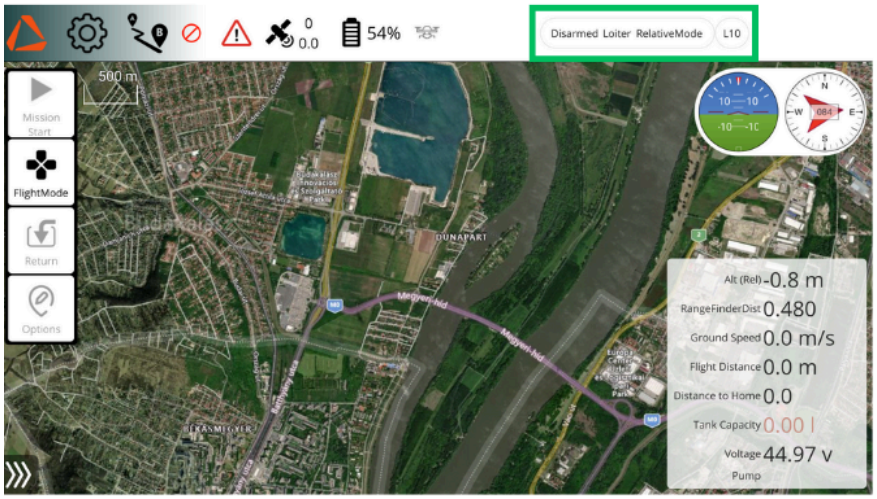



In the top menu bar, you will see the icons **Flight view, Settings, Flight planning** in the following order.

After turning on and connecting the drone, you will find additional status icons at the top: vehicle messages, GPS status (above: number of connected satellites, below: HDOP value), Drone Battery status, Payload status. On the left side of the top bar, a red no-entry sign indicates that the drone is still preparing its systems for the flight. If the icon changes to a green check mark, the drone is ready and can be armed.

The drone battery icon serves only as an indicator and shows an approximate value. During the flight, the pilot must monitor the battery voltage, which should always be above 43.5 V, even when flying with the Maximum Take-off Mass (MTOM).

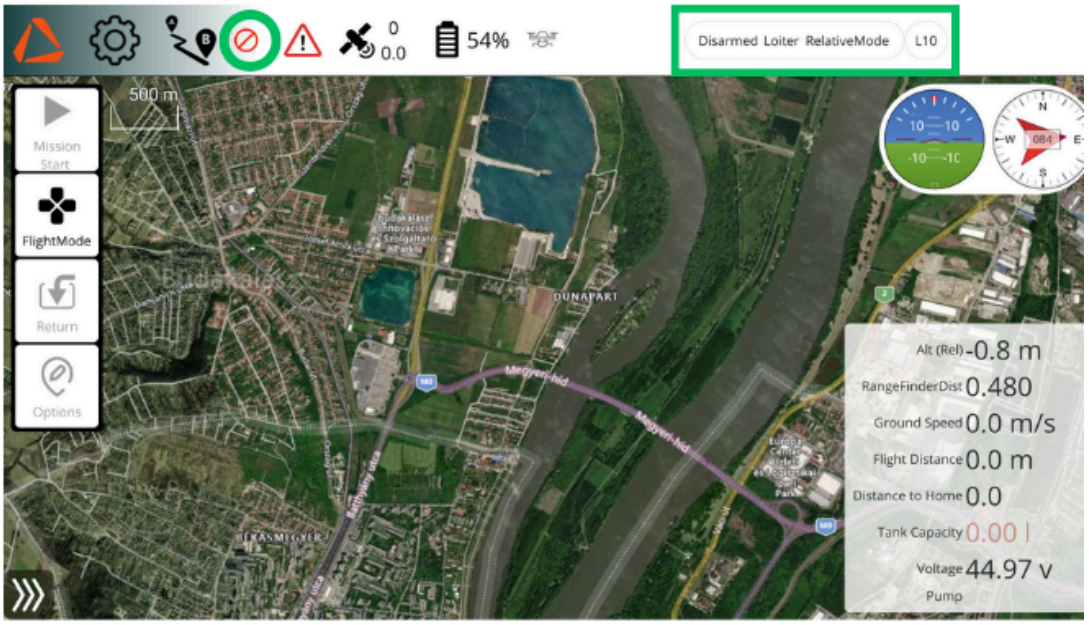
The state of the drone battery should also be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge.




In the Flight status bar, you can see information about the altitude hold method (Follow terrain with LiDAR or Relative with barometric measurements) and the actual flying mode of the drone. It can show the following statuses:

- Disarmed
- Armed
- Loiter – Follow terrain mode
- Loiter – Relative mode
- Auto mode – Forest mode
- Auto mode – Follow terrain
- Auto mode – Relative mode
- RTL (Return to Launch mode)
- Altitude hold mode.

**Only fly the drone if the green check mark is visible, there are at least 7 satellite connections, the HDOP value is below 1.1, and the LOITER flight mode is selected.**




The telemetry data (real-time information and measurements of the drone during operation) is displayed in a white panel on the right side. During the flight, you must monitor the battery voltage status here.

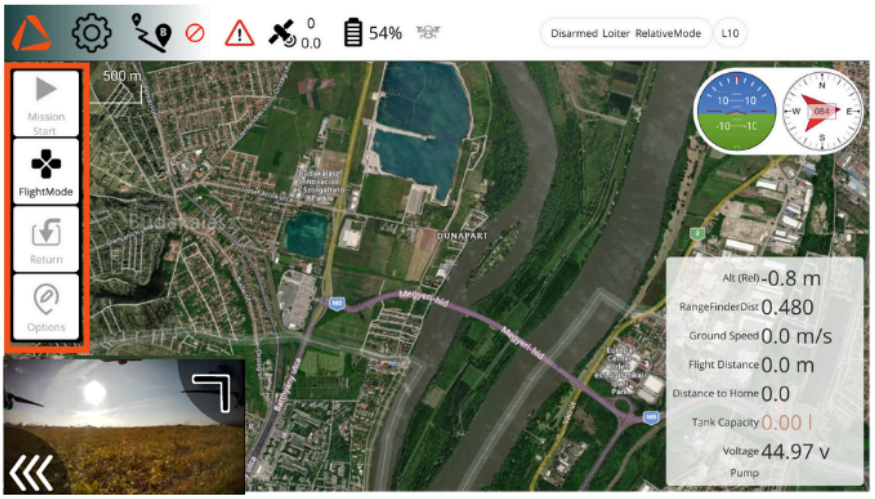
Ensure that the battery remains above 43.5 V throughout the entire flight, regardless of any payload condition. When the battery voltage level drops under 43.5 V, start returning and landing the drone.

In the telemetry window, you can monitor the following data during flight:

- Alt(rel) → It is the relative altitude from the takeoff point.
- RangeFinderDist. → The Actual height from the ground measured by the LIDAR.
- Ground Speed → The current speed of the drone.
- Flight Distance → The distance that the drone has flown from the takeoff point.
- Distance from Home → The distance from the Home point( takeoff point).
- Voltage → It shows the voltage of the battery.

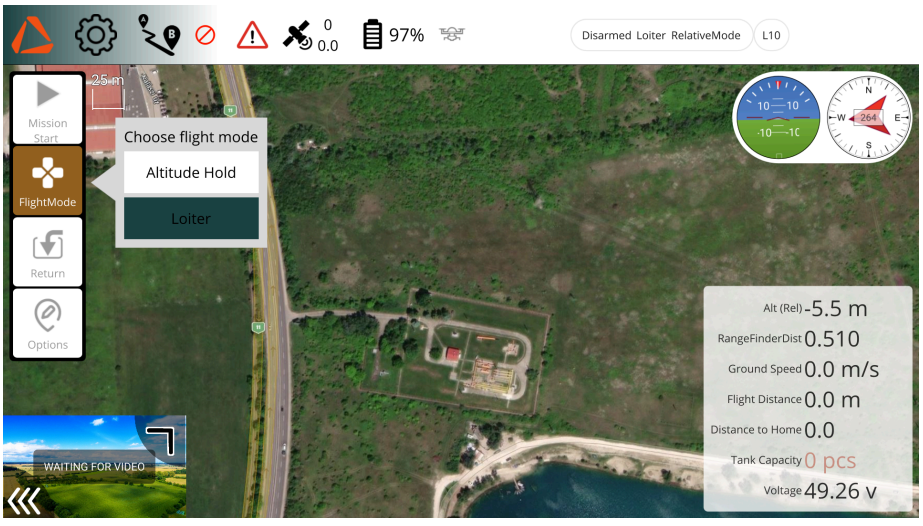
In the bottom-left corner, you can see the camera image. You can enlarge it by dragging the corners of the window. You can adjust the camera angle with the right scrollwheel on the remote controller.

On the left side, you can see the **Flight function buttons**.




If no mission is loaded, the **Mission Start** is greyed out. If you have an active Mission with the Mission Start, you can turn on the Start mission slider after manually flying the drone to a safe height. If the drone is in Auto Mission mode, this button will change to **Pause Mission**. When you click on Pause Mission, the drone switches to Loiter Mode.

With the **Flight Mode** button, you can change the flight mode. You can choose between Altitude Hold and Loiter.



Using the **Return** button, you can switch the flight mode to Return to Launch (RTL). The drone will then fly back to the launch point based on the settings defined under **Settings > Safety > Return to Launch**.

## Setting up FailSafe

Always check and set up failsafe settings before every new flight or mission.

Access path: **Settings / Safety**

**General failsafe:** you can set what the machine should do in case of losing the remote controller's signal

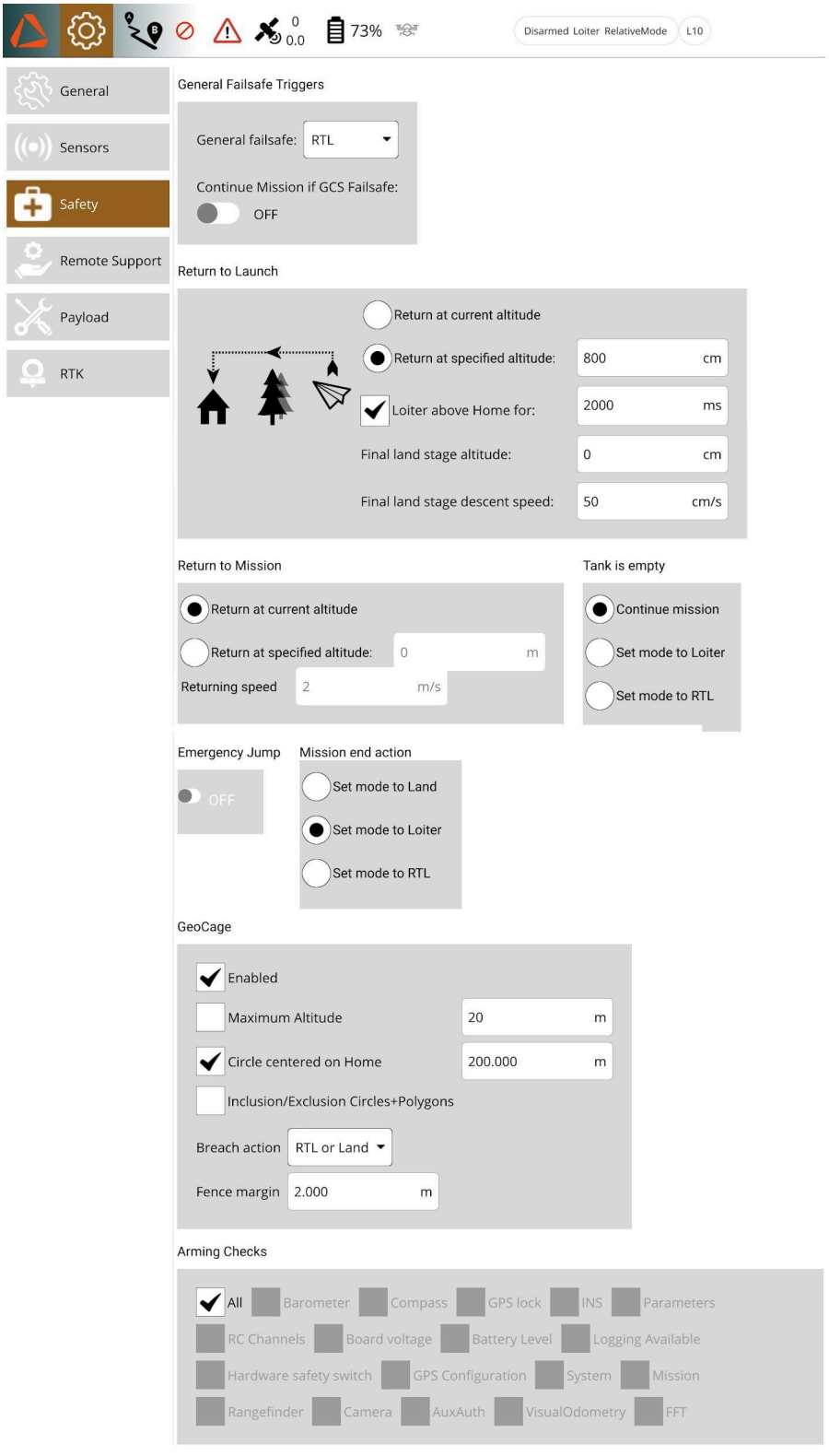
- **Return to Launch:** set parameters for automatic return to home
  - Specify if current or specified altitude is desired.
  - Specify if the drone should wait and loiter above the takeoff position before landing.
  - Final land stage altitude should NOT be other than 0.
  - Specify the final land stage descend speed (limited by the drone's limitations).
- **Return to Mission:** set parameters for returning to interrupted mission
  - Specify whether the current or a specified altitude is desired.
  - The specified altitude should NOT be other than 0.
  - Specify the returning speed (limited by the drone's limitations)
- **Tank is empty:** Only applicable if flying with a payload (spreader or spraying tank). You can decide what the drone should do when the tank runs empty during the mission. If the drone/payload has a physical sensor and you activate it under Settings > Payload, the action will be determined by the sensor's input. Otherwise, the action will take place at the emptying point calculated by the software.
- **GeoCage:** you can set virtual boundaries that the drone will not fly over. Circle GeoFence means, the drone will stop if it reaches the desired radius from the takeoff position. Altitude GeoFence means the drone will not fly over the desired altitude relative to the takeoff position.
- **Emergency Jump:** If this function is turned on, the pilot can manually raise the drone during an automatic flight if he/she identifies an unregistered obstacle or if the drone unexpectedly begins to descend. By default, Emergency Jump is turned off.

  If the Emergency Jump is turned on, the drone will rise as long as the pilot pushes the left control stick up. The other settings (e.g., direction and speed) remain the same as defined in the mission settings. If the pilot releases the stick, the drone remains at the given altitude briefly before returning to the altitude specified for the mission.The Emergency Jump option is only available when flying in the Follow Terrain or Relative Altitude control methods. In Forest Mode, the Emergency Jump function does not work. (For Forest Mode, see Page 36)
- **Mission end action:** you can decide what the drone should do when the mission is completed.You can choose between setting the mode to Land, setting the mode to Loiter or returning to launch (RTL).

- **Prearm checks:** Arming checks are meant to check all the functions and systems necessary for arming and flying the drone safely. All the prearm checks listed in this section are essential and mandatory for safe operation; do not change these settings.

## Action functions:

- **None:** the drone does not take any action itself. It remains in the actual flight mode.
- **Land:** the drone lands at the actual position and disarms itself after landing.
- **RTL:** the drone switches to RTL mode, and following the Return to Launch settings, it flies back to the takeoff position, then lands and disarms itself after landing.



## Controlling the drone

It is only permitted to operate the drone in full compliance with this entire operator's manual and specifically the checklists.

**Manual flight commands** - switching flight modes to choose manual flight control:

- **Loiter flight mode: A button** – (GPS-based) the flight must be controlled manually with the sticks. If both sticks are fully released, the drone will stop and hover at the actual GPScoordinated position.
- **AltHold flight mode: C button** (WITHOUT GPS positioning). The flight, braking, and stopping must be controlled manually with the sticks; the drone does not keep its position, and the pilot must counteract wind forces, too. The drone keeps its altitude relying on its barometric pressure sensor only. The pilot must pay attention to the altitude changes resulting from atmospheric and weather changes.

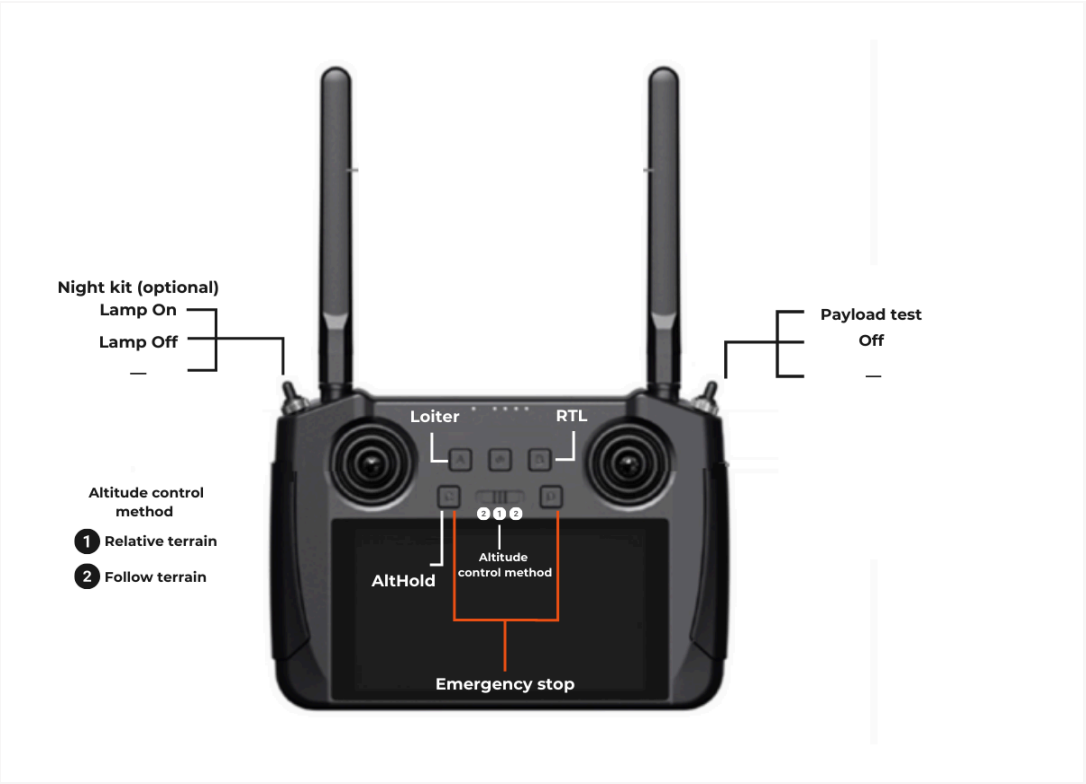
**Automatic flight commands** - switching flight modes to start automated flights:

- **Auto flight mode: slider on the screen – (GPS based)** the drone will fly the mission uploaded to the drone (created by Mission Planner application or created by ABZ Control on the remote controller). Always start the drone manually and fly to a safe height before switching to Auto flight mode.
- **Return To Launch flight mode: B button – (GPS based)** the drone will fly the shortest way to the launch position (if not changed manually, it is the same as the take-off position) at the specified altitude (Settings/Safety/Return to Launch) and then land itself.

Every automated flight can be interrupted at any time, by the pilot's command to switch back to manual flight mode (Loiter or AltHold).

**Emergency stop:** In case of emergency, push the **C button and D button** simultaneously for at least 2 seconds. The motors will stop immediately, and the drone will crash into the ground.

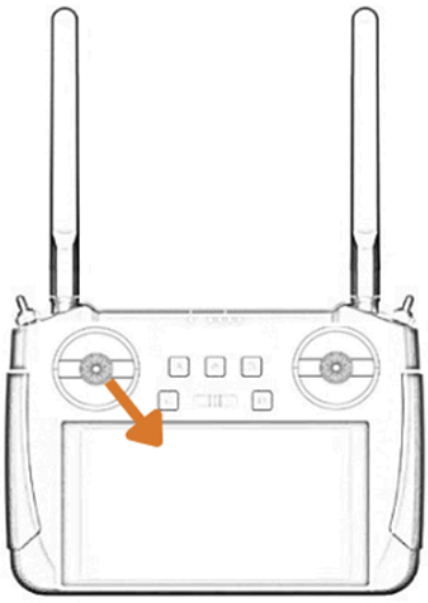
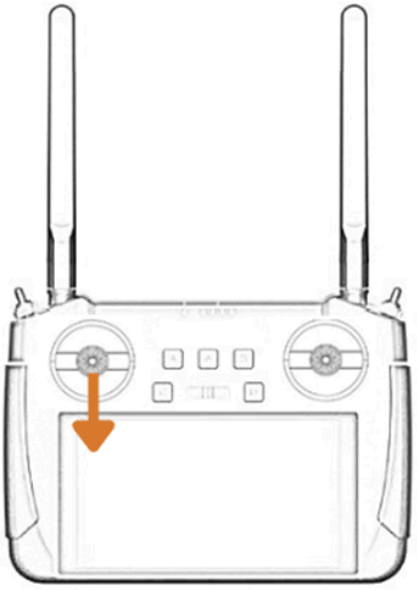
The drone's pitch and roll angles, turning radius, climb, and descend speeds are limited by firmware in order to ensure safe flight. The pilot can safely fly the drone within all possible pilot inputs, no extra limitations are needed to implement manually.



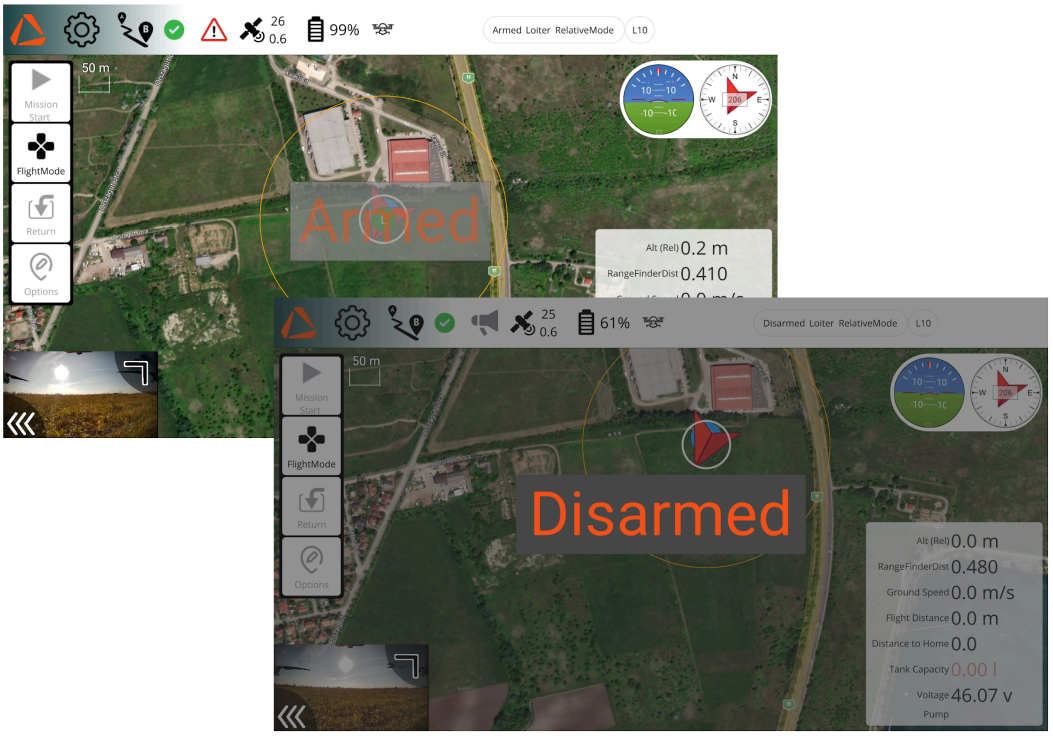

- **Takeoff:** Switch to “Armed” mode by pushing the left control stick fully to the **down-right position** until “Armed” is shown on display, then release.
- After the motors are started, fly the drone manually by controlling it with the left and right sticks in Mode 2 by default and take off to a safe height (at least 2m).
- **Land: Manually** control the descent speed and **slow it down** before reaching ground.

After landing, switch to „Disarmed” mode by pushing the **left control** stick fully to the down position until „Disarmed” is shown on the display and the motors are completely stopped, then release.

**Make sure to release the stick after arm / disarm immediately, otherwise the system will detect your action as accidental and switch back to the mode previously selected.**

| Arm | Disarm |
| --- | --- |
|  |  |

When you arm or disarm the drone, a large orange text appears on the screen, notifying you of the drone’s status change:



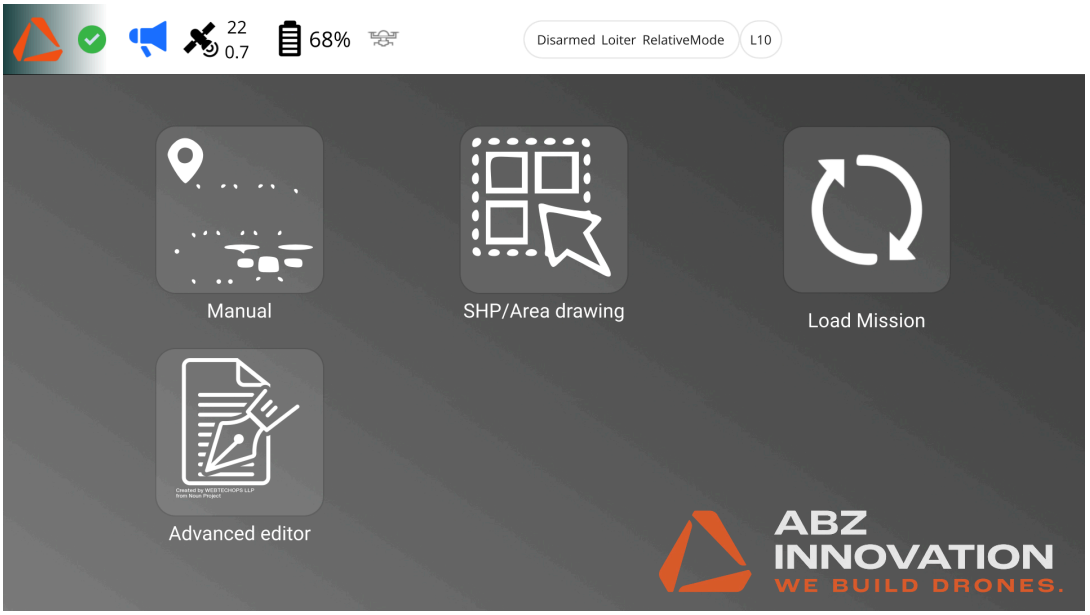

# Flight planning

## Note: It is prohibited to use automatic missions when flying in the C4 Open category.

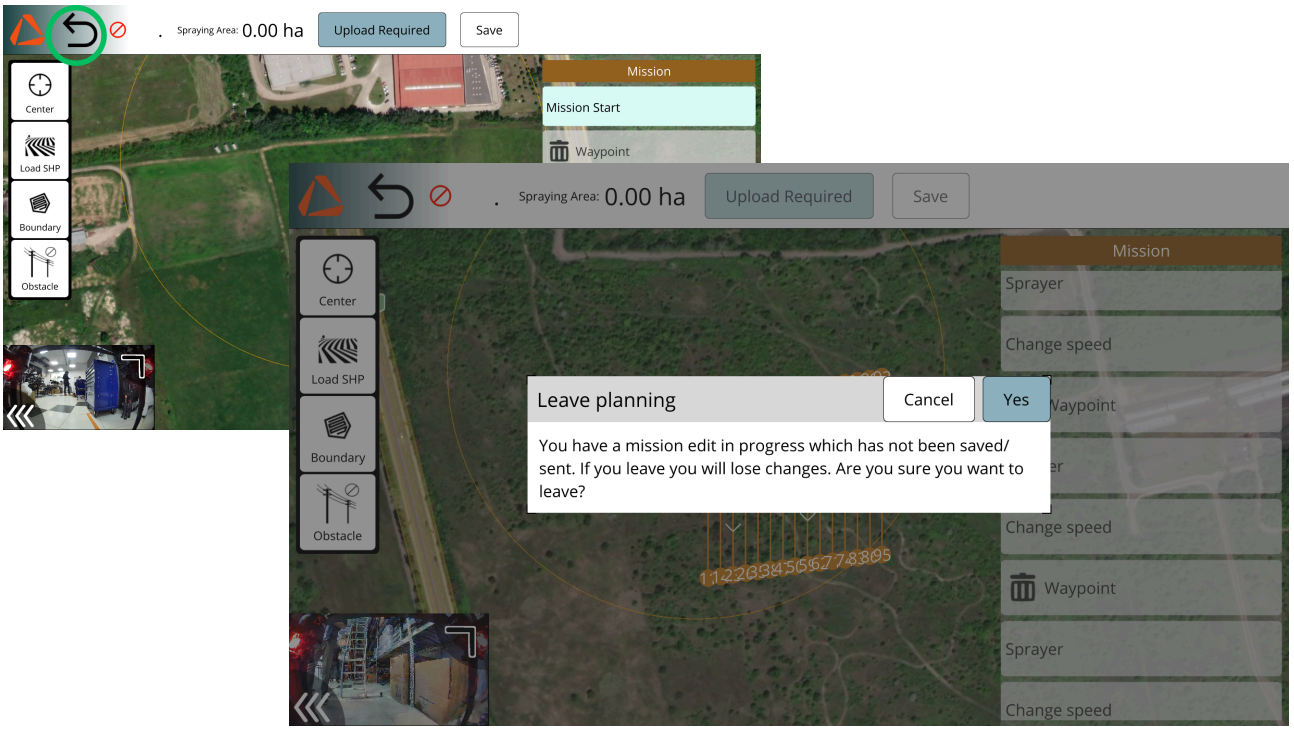
**Each flight plan must include one Boundary (the working area where the drone will execute the automatic mission), and optionally one or more Obstacles (areas the drone will avoid during the mission). You need to select at least three points to outline a boundary or obstacle.**

The Flight planning is accessed by selecting its icon at the top left. After clicking on the icon, you arrive at the mission planning method page. Here you can choose between the following options:

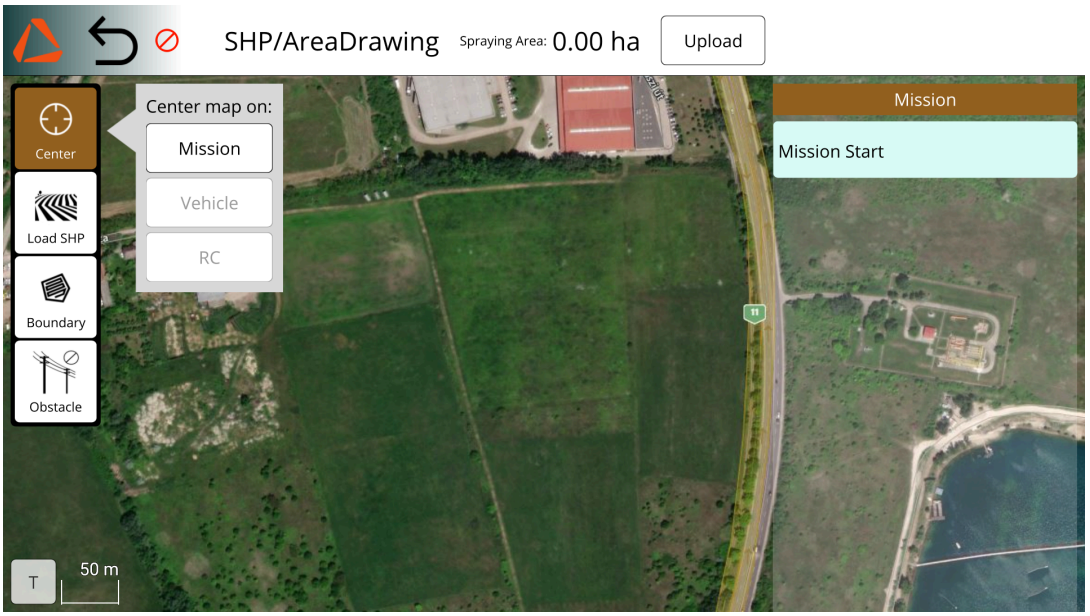
- Manual (Marking the area with drone/with Remote controller)
- Upload Area based SHP files (polygon or multipolygon) or draw Area onto Maps
- Load Mission (Loading a previously saved mission).
- Advanced editor (waypoint based flight route planning).




For safety reasons, if your location or flight plan differs from the previous one, first open the Flight Planning page and click the back button to clear the prior mission from the drone.



With the Center option, you can decide what should be in the central position on the map (the mission, the Drone, or the Remote Controller).

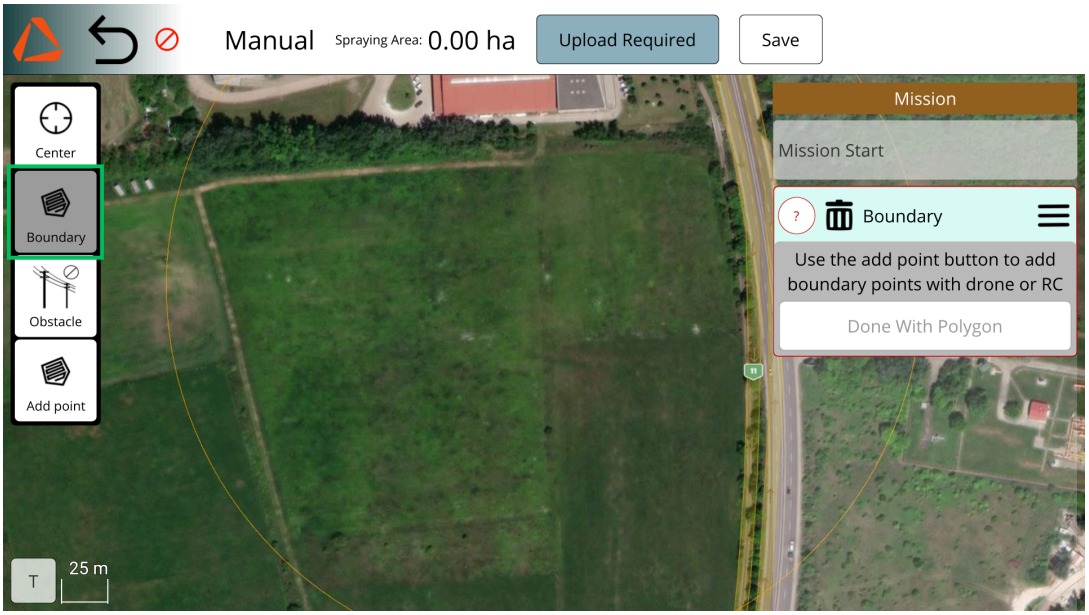



The Mission panel on the right shows the settings for automatic flight missions. To specify the settings and start the automatic mission, follow the instructions from page 36.

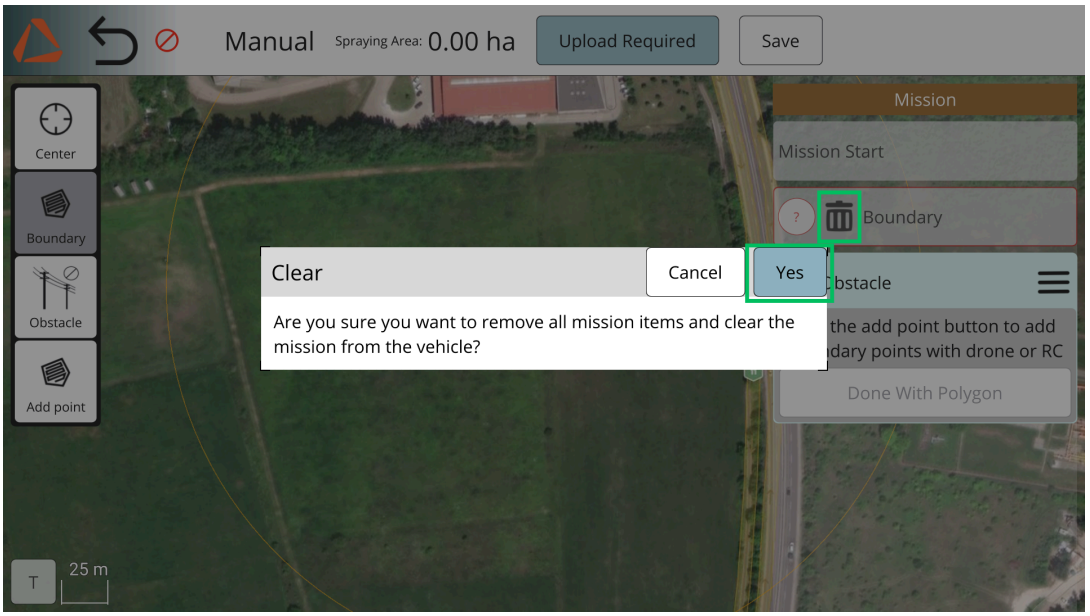
## Planning the field with the drone/ with the remote controller

You can use the drone's camera/the remote controller to mark the points of an area to specify a Boundary or Obstacle.

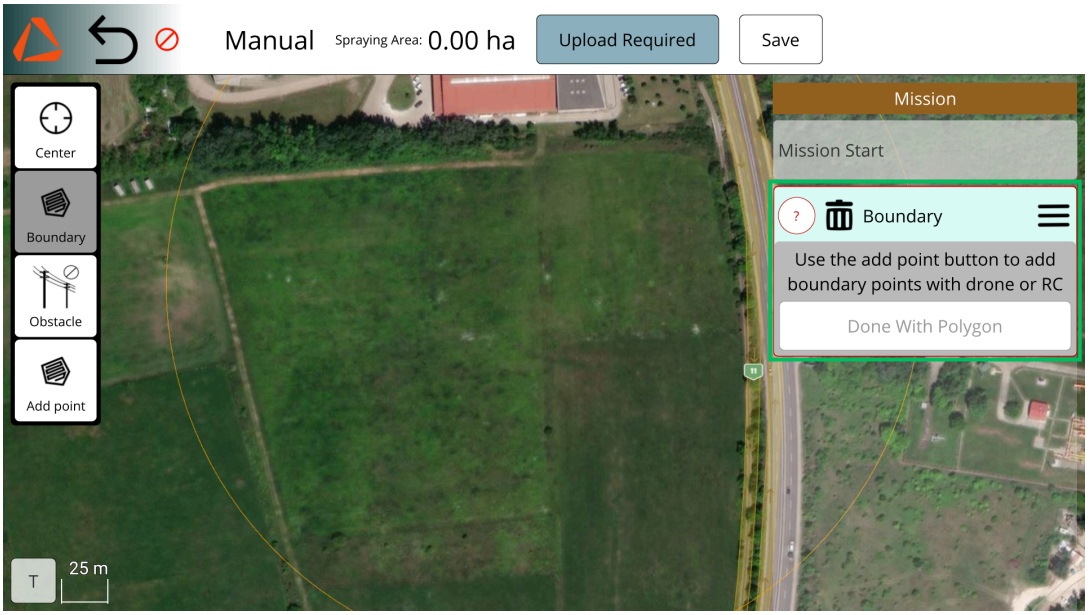
1. To define your working area for a new flight plan, Click on the Boundary option.



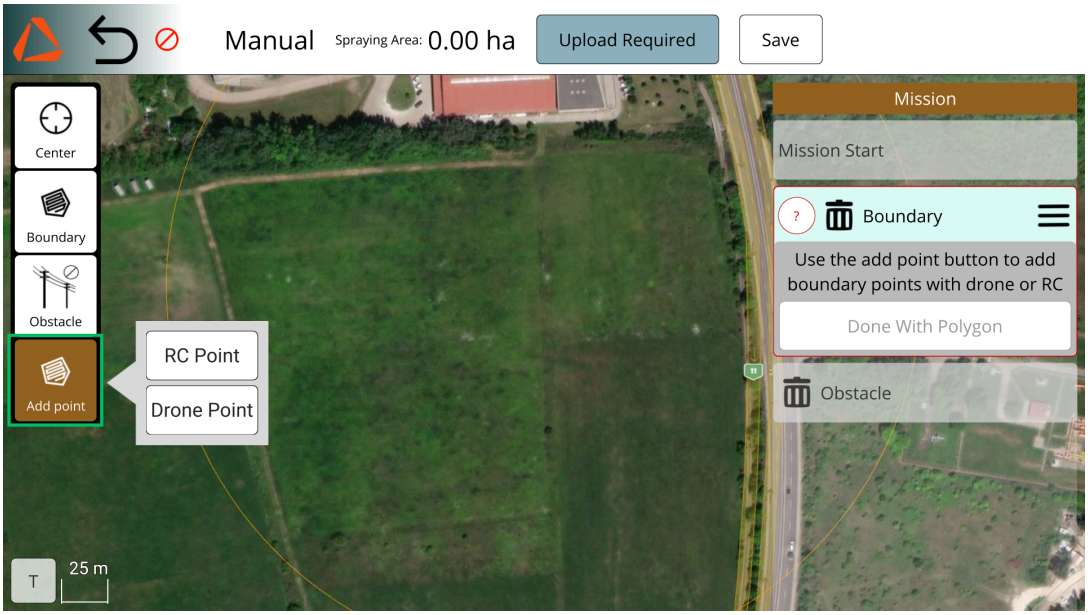

A flight plan can only have one boundary. If you want to create a new one, the old one needs to be cleared.



2. After selecting the Boundary, you can add points to it. To do so, the Boundary element needs to be active on the right side panel.



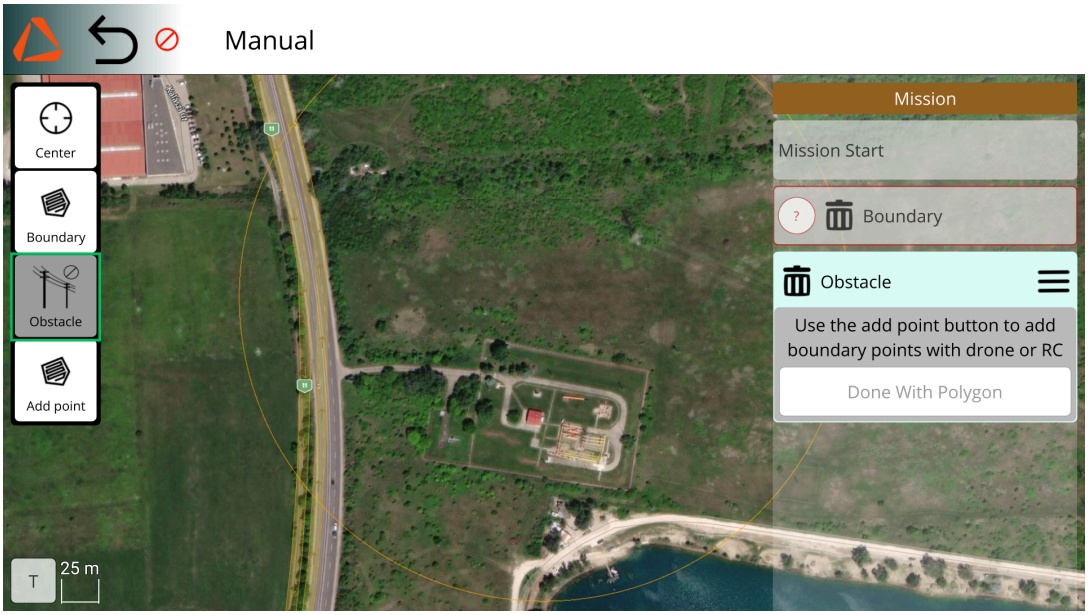

3. Click on **Add Point** in the left side menu. The points can be marked by the Remote Controller (RC Point) or the Drone (Drone Point).



If you want to plan with the drone, fly the drone to the desired points and let it hover. Then click on the Drone Point button on the left of the display to add the desired points. Points can also be manually moved on the display, based on the map, by tapping and dragging. **In this case, you should be aware of the inaccuracy of the map, which can be several meters off!**

If you want to plan with the Remote Controller, take the controller to the desired point. Then click on the RC Point button on the left of the display to add the desired point. If you have defined at least 3 corner points for the boundary, the Mission panel will open up on the right side for additional settings (see page 36).

1. You need to use the Obstacle button to select the areas or obstacles excluded from the flight like above with the drone or with the Remote Controller. If you define several obstacles, the points will be added to the obstacles selected in the Mission panel.




**The drone will avoid only the obstacles marked in the flight plan and only in automatic flight mode.**

In the actual software version, the obstacle avoidance function is only valid DURING automatic routes. It is NOT APPLICABLE when flying to the entry point, or continuing a previously interrupted automatic route, or flying home with the „Return to Launch - RTL" function.

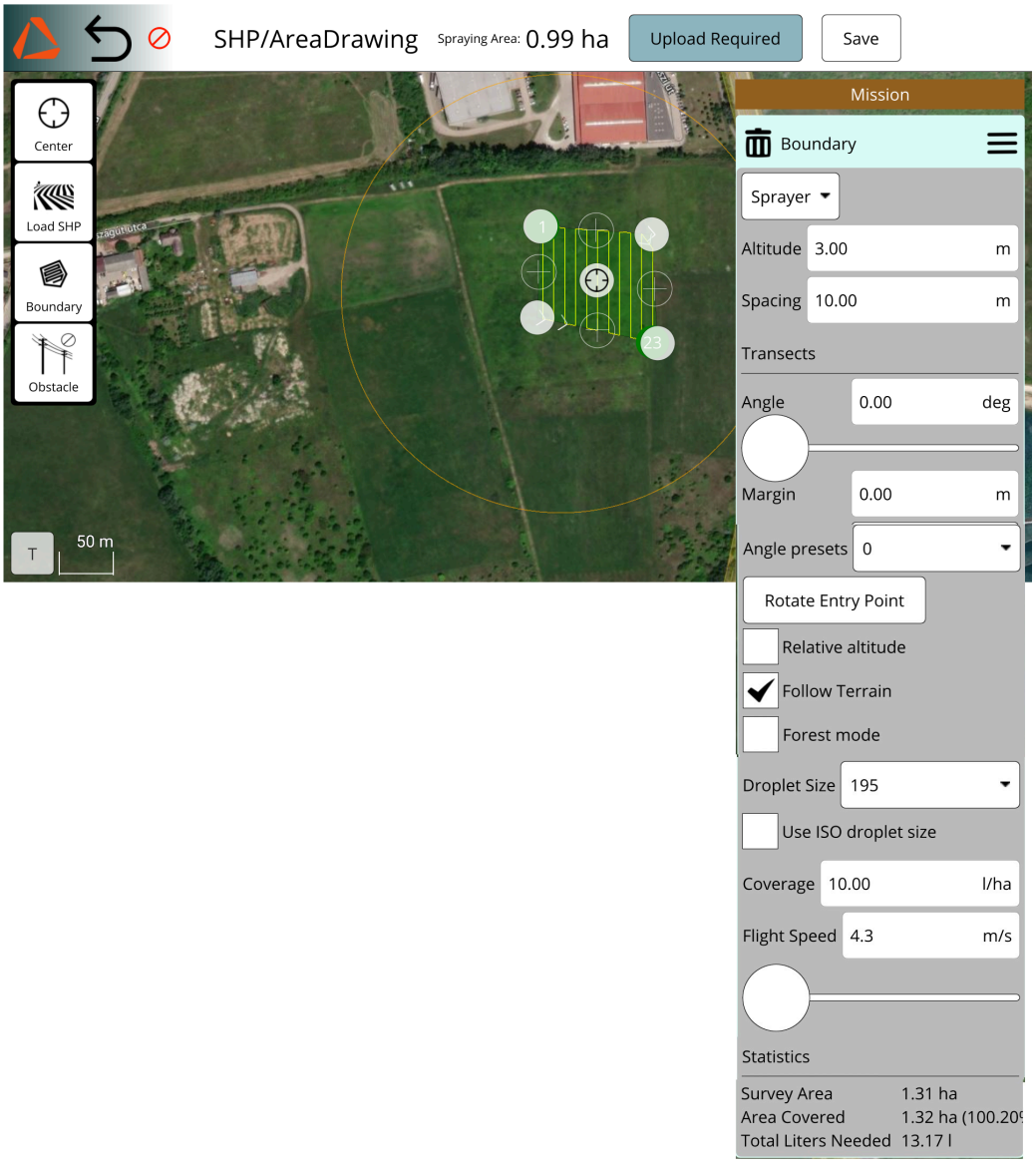
**Pay special attention to this, and if possible, manually fly the drone as close as possible to the desired starting/continuation point!**

After defining a boundary, you can define the automatic mission settings in The Mission panel on the right side of the screen. In this panel, you can adjust the following settings. (The spray-related settings, Droplet sizes and Coverage, you can ignore):

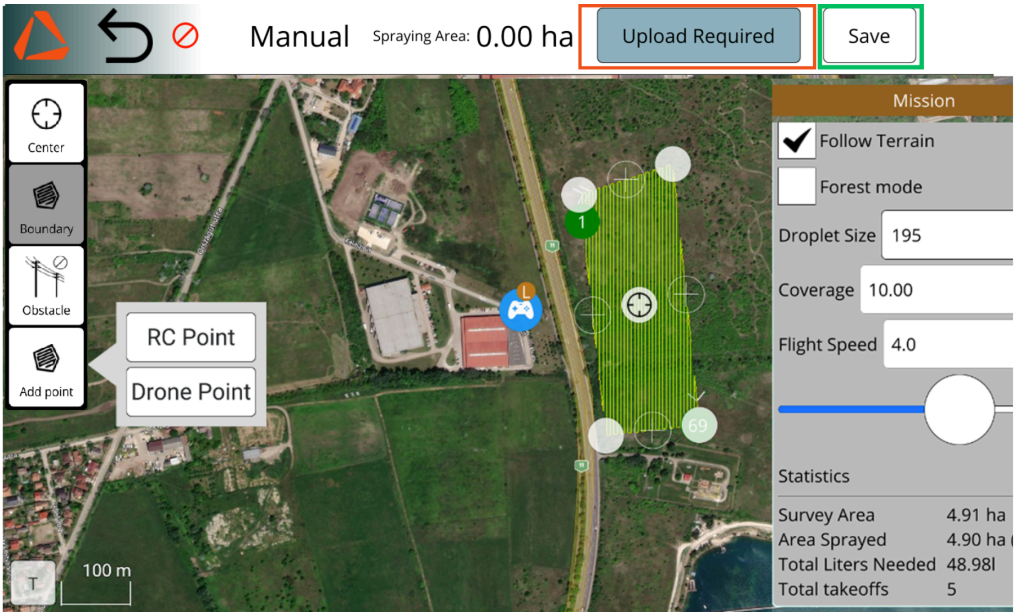
- Flight altitude
- Line spacing
- Angle of flight direction (also adjustable with the slider)
- Margin (distance kept from the edge of the designated area)
- Angle presets (to match the flight direction with the area's edges)
- Rotating the position of the first waypoint (it is recommended to set it the closest distance to the take-off point)
- Flight speed (ground speed, also adjustable with the slider)
- Statistics (calculated data according to the settings, at the bottom)
- Altitude hold method: In most cases, the Follow Terrain must be selected; this is the setting for the LiDAR system.

The **Forest Mode** altitude hold method was developed for difficult terrains and vegetation, where the high variability in environmental conditions makes using LiDAR ineffective. In Forest Mode, the drone flies with Relative Altitude control method, but the actual altitude of the drone depends on the input from the pilot. The pilot can control the altitude of the drone with the left control stick. If the pilot releases the stick, the drone will continue the auto flight at the given altitude.

If you use the forest mode, always pay special attention to the sorrounding of the drone. Choose the appropriate, safe altitude based on the camera picture or the careful observation of the drone's environment.



When you have finished editing, you can save the mission by clicking the **Save** button on the right side of the top menu bar.




To upload the planned route to the drone, click the **Upload Required** or **Upload** button at the top-right corner of the screen.

To start the mission, navigate to the **Flight view** by clicking on the ABZ Innovation logo. If you leave the planning page by clicking on the back button, **your plan will be cleared from the editor and from the drone.** If you have saved your plan, the file remains on the controller and you can open it from the **Load mission** menu.

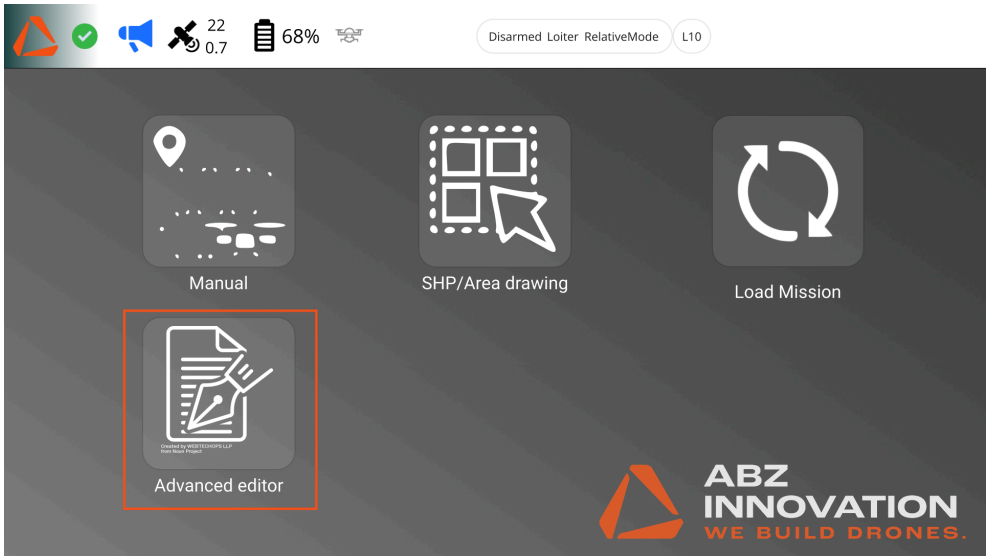
To start a mission, in the Flight view slide the **'Start Mission'** slider after manually flying the drone to a safe altitude.

## Advanced editor: Creating a mission by defining waypoints

The **Advanced Editor** is a mission planning interface designed for creating complex tasks. Unlike manual planning or area drawing, where boundaries must be set, this feature gives you full control over the drone's flight routes.

Another significant difference is that, within a single waypoint mission, you can assign different deployment parameters to various waypoints, such as the drone's speed, altitude, and working width. These capabilities enable the drone to perform tasks with precision as needed.

To enter the Advanced Editor, navigate to the mission planning method page and select **Advanced Editor**.



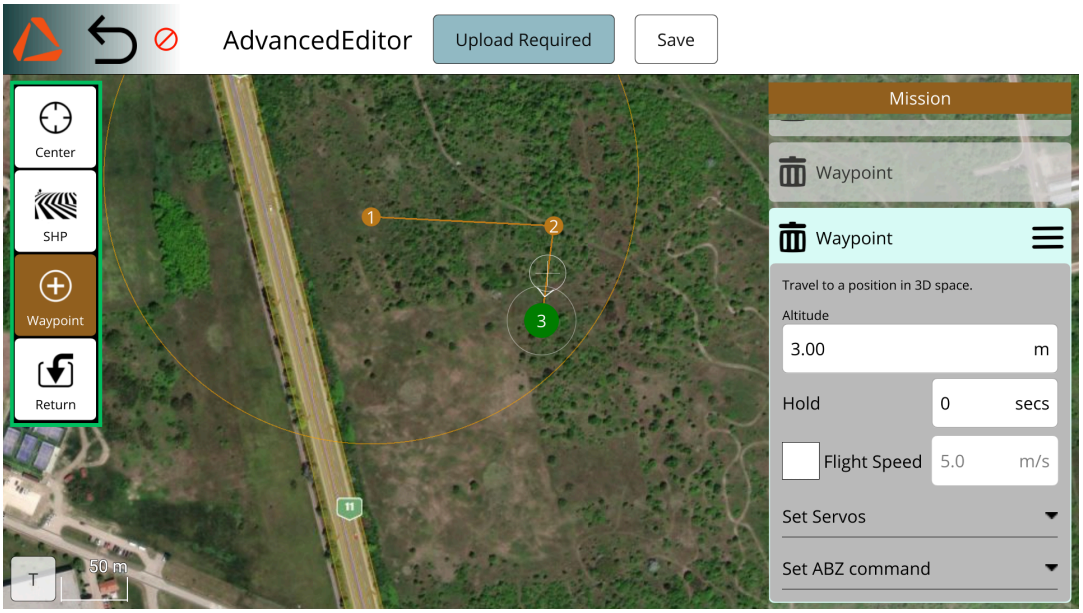

On the left side of the planning page, you will find the following buttons:

**Center**: This button places the mission, the drone's position, or the remote controller's position in the center of the screen with a single click.

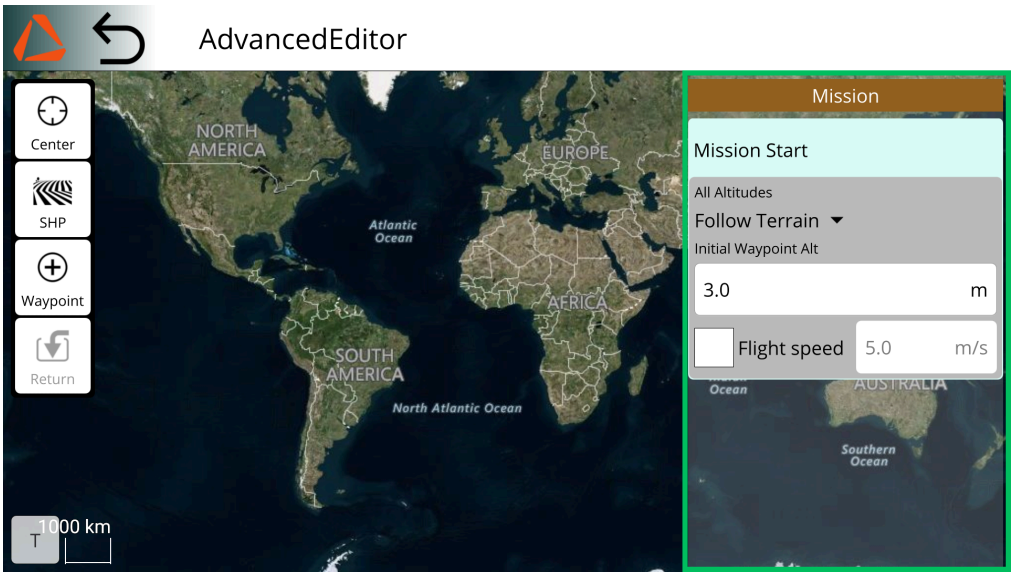
**SHP**: you can add visual guides to the map to help you with the accurate placement of the waypoints. It offers several options: Point, Polyline (Lineshape file), or Polygon. You can also open a Polyline shape to configure it as a Waypoint mission (see page 43).

**Waypoint**: You can set specific waypoints by tapping on the remote controller's screen to create the drone's route. The software automatically connects these points, even if some are removed.

**Return**: activates the return-to-home function once the drone has completed the last waypoint. It is considered part of the mission




On the right side of the planning page, in the mission panel, you can set the Mission start parameters and the parameters of the waypoints. The parameters you define in the mission start section will be inherited by all the waypoints. If you change the setting for any waypoint, the subsequent waypoints will inherit the new setting.

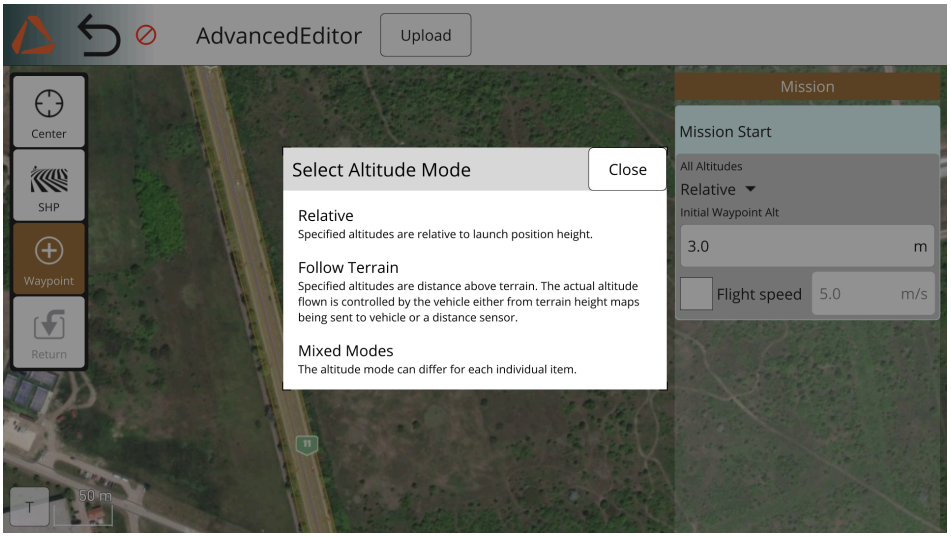


## Waypoint mission planning process

In the **Mission Start** section of the right-hand Mission Panel, define the **Flight Speed** and the **Altitude Hold Mode** for your mission. Make sure to check the box next to the **Flight Speed** value; otherwise, the speed will not be applied.

For **Altitude Hold Mode**, you have three available options:

- **Relative**: The drone's altitude will be relative to the takeoff point, based on barometric measurements.
- **Follow Terrain**: The drone uses LiDAR to maintain altitude, measured as its distance from the ground.
- **Mix Modes**: Allows applying the previous two modes individually for each waypoint.




1. Add the waypoints by tapping on the screen. To avoid inaccuracies in planning caused by the inevitable limitations of online maps, use shapefiles to ensure the precise placement of the waypoints. For further instructions, see page 49. You can grab and move the points to reposition them. You can delete a waypoint by clicking on the bin icon in the Mission Panel.

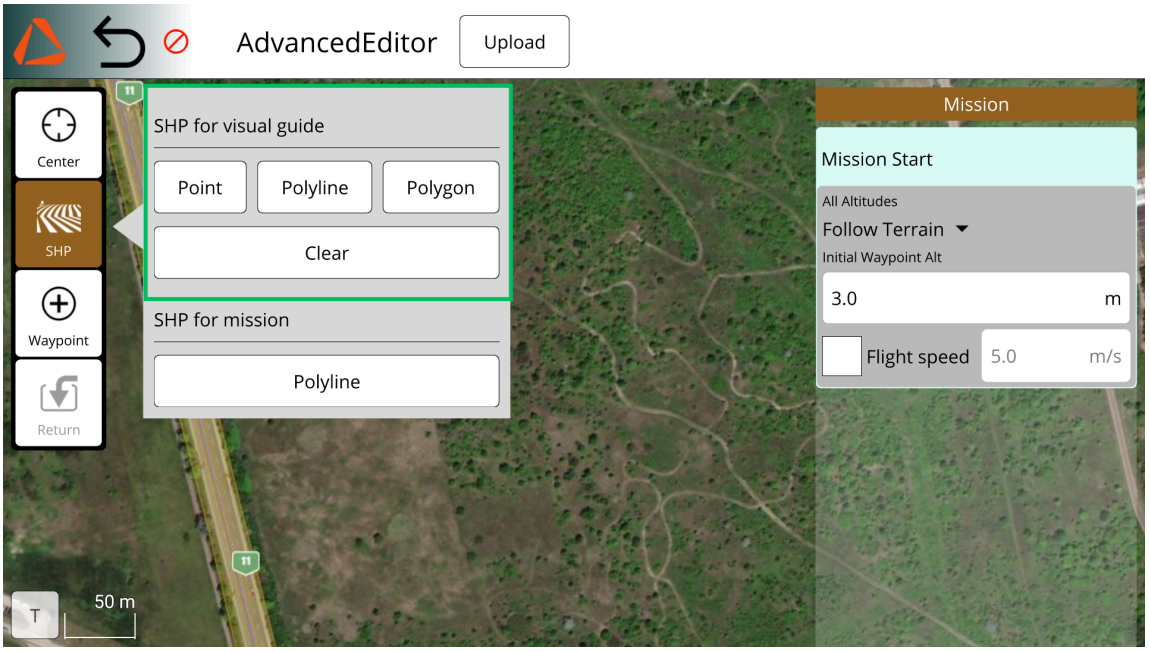
2. In the mission panel, you can adjust the flying parameters, including altitude and speed, individually for each waypoint. The subsequent waypoints will inherit the setting.

3. If you open the **Set ABZ** command window and check the box for **Append ABZ Command**, you can select and adjust the setting for the current payload of the drone.
4. Using the Return button (on the left side), you can instruct the drone to initiate Return to Launch (RTL) at the end of the mission. Otherwise, after reaching the last waypoint, the drone will follow the Mission End Action setting, which can be defined under **Settings > Safety**.
5. When you have finished editing, you can save the mission by clicking the **Save** button on the right side of the top menu bar. To upload the planned route to the drone, click the **Upload Required** or **Upload** button at the top-right corner of the screen.
6. To start the mission, navigate to the **Flight view** by clicking on the ABZ Innovation logo. If you leave the planning page by clicking on the back button, your plan will be cleared from the editor and from the drone. If you have saved your plan, the file remains on the controller and you can open it from the **Load mission** menu.
7. To start a mission, in the Flight view slide the **'Start Mission'** slider after manually flying the drone to a safe altitude.

## Use SHP files as guide for planning

You can use SHP files as a visual guide to mark the exact points where the drone should fly. First, save the shapefiles to the **ABZ Control > Missions** folder. (For further information about this process, see page 45).

Select the SHP icon on the left side of the screen, then choose either Point, Polyline (for line shape files), or Polygon (for area shape files), depending on the geometry of your shape files. Use the Clear button to remove the file from the planning page.




In the pop-up window, select the SHP file you want to use. The Points/Polyline/Polygone appears on the screen, and you can use it as a visual guide to help you place the waypoints on your RC. It is possible to use more/different kinds of shape files simultaneously.

## Planning the field by loading a Polyline (lineshape) file

The files must be copied to the remote controller, into the **ABZ Control>Missions** folder. For further instructions, see page 45.

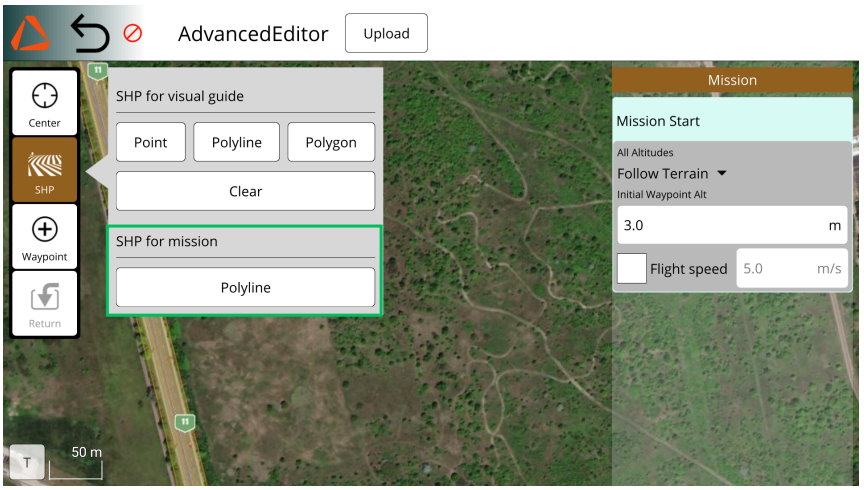
To Load a Polyline mission in ABZ Control, you need to open the **Advanced editor** from the mission planning method page.

1. In the **Mission Start** section of the right-hand Mission Panel, define the **Flight Speed** and the **Altitude Hold Mode** for your mission. Make sure to check the box next to the **Flight Speed** value; otherwise, the speed will not be applied.

   For **Altitude Hold Mode**, you have three available options:

   - **Relative**: The drone's altitude will be relative to the takeoff point, based on barometric measurements.
   - **Follow Terrain**: The drone uses LiDAR to maintain altitude, measured as its distance from the ground.
   - **Mix Modes**: Allows applying the previous two modes individually for each waypoint.

2. On the right side, click on the **SHP** button and choose under the SHP for mission, then click on the Polyline button.

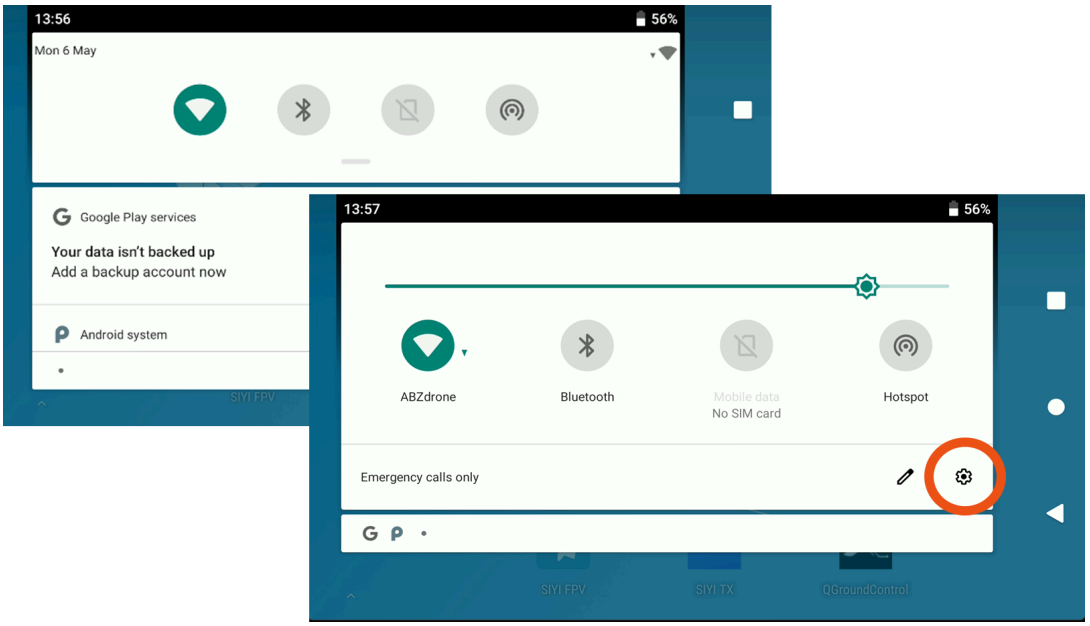



3. In the pop-up window choose the file you want to open.

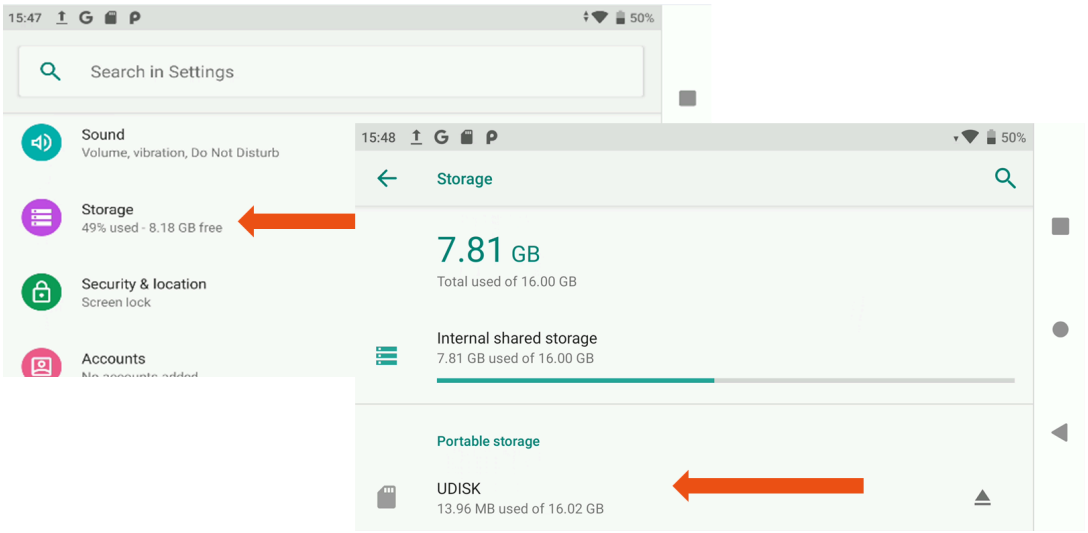
4. The editor will display the routes and waypoints on the map.The waypoints of the mission will be also listed in the mission panel on the right side. Here you can adjust the parameters for each waypoint, and delete them by clicking on the bin icon. If you change the settings for any waypoint, the subsequent waypoints will inherit the new setting.
5. If you open the **Set ABZ** command window and check the box for **Append ABZ Command**, you can select and adjust the setting for the current payload of the drone.
6. If you are ready with the editing, you can save the mission by clicking on the Save button in the right side of the top menu bar. With the upload required button you can upload the mission to the drone.
7. To start the mission, navigate to the **Flight view** by clicking on the ABZ Innovation logo. If you leave the planning page by clicking on the back button, your plan will be cleared from the editor and from the drone. If you have saved your plan, the file remains on the controller and you can open it from the **Load mission** menu.

## Planning the field by loading an area shape file

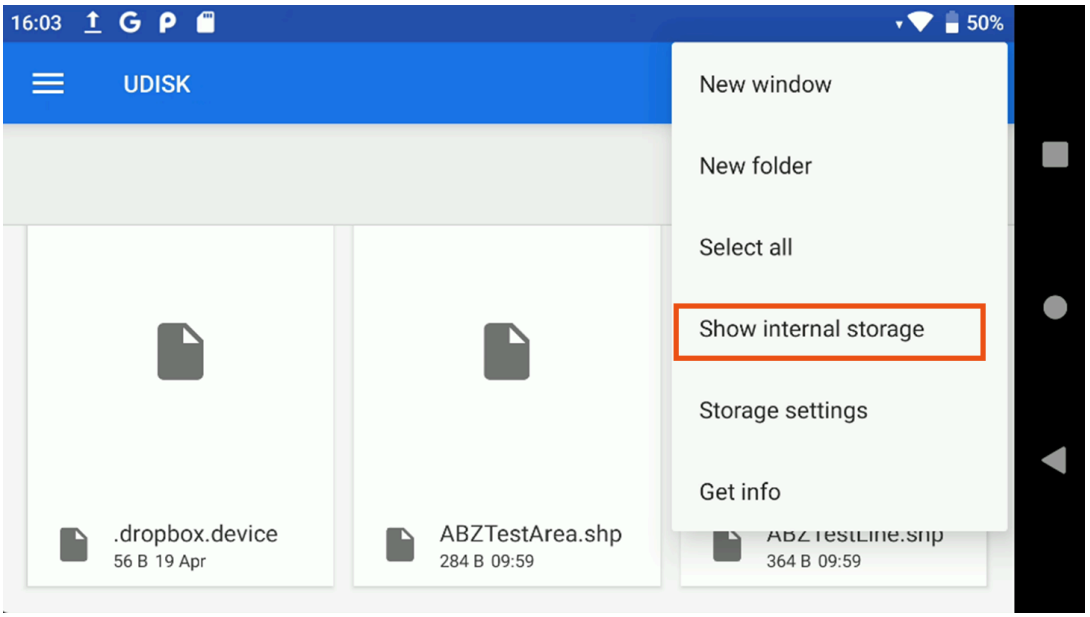
The files must be copied to a MicroSD card and then the card inserted into the remote controller. (Alternatively, you can use a USB stick.) Only MicroSD cards/USB with a maximum of 32 GB capacity are supported. Swipe down from the top of the screen to access the Android menu, where you must press the gear (Settings) icon.



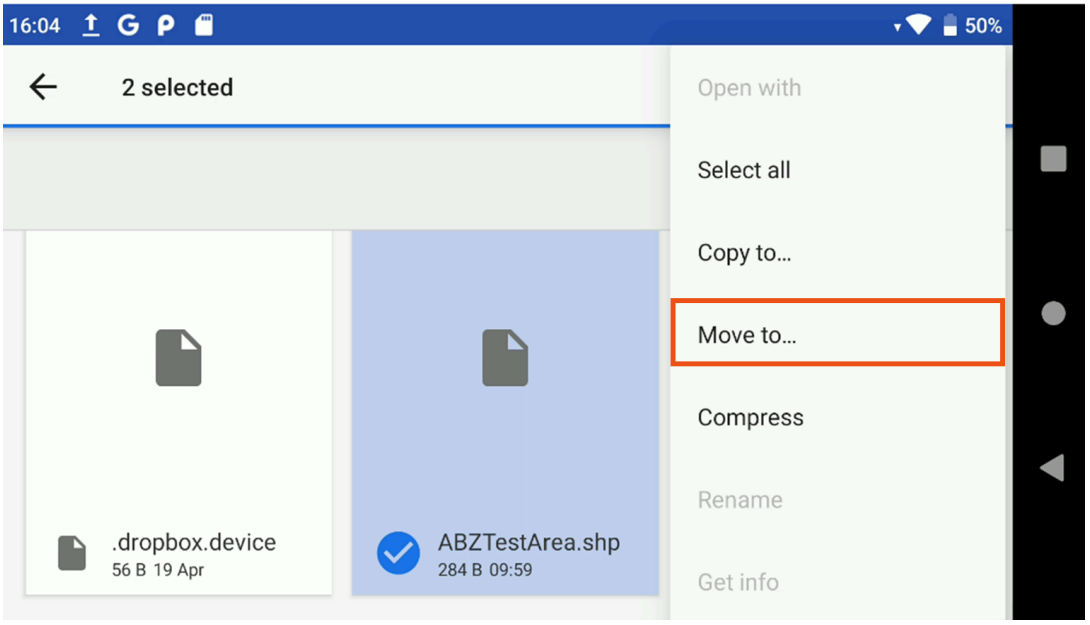
In this menu, scroll down to Storage, where you can select to open the SD Card.



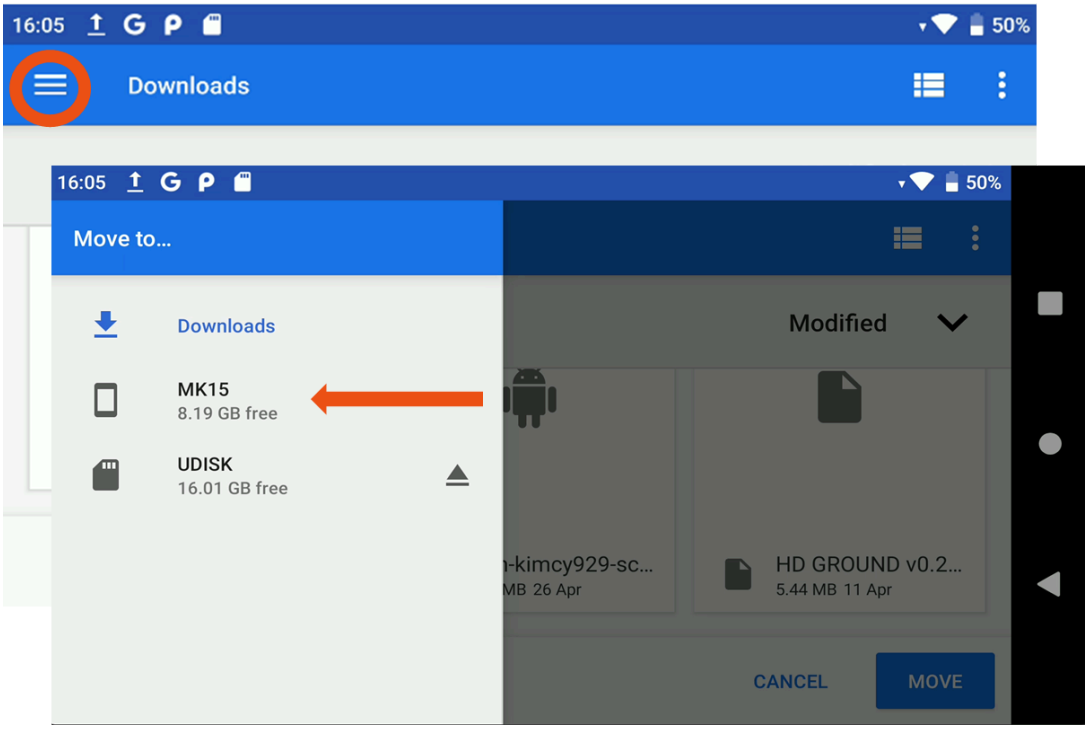

Tap the top right Others (3 vertical dots icon) menu, then Show internal storage.

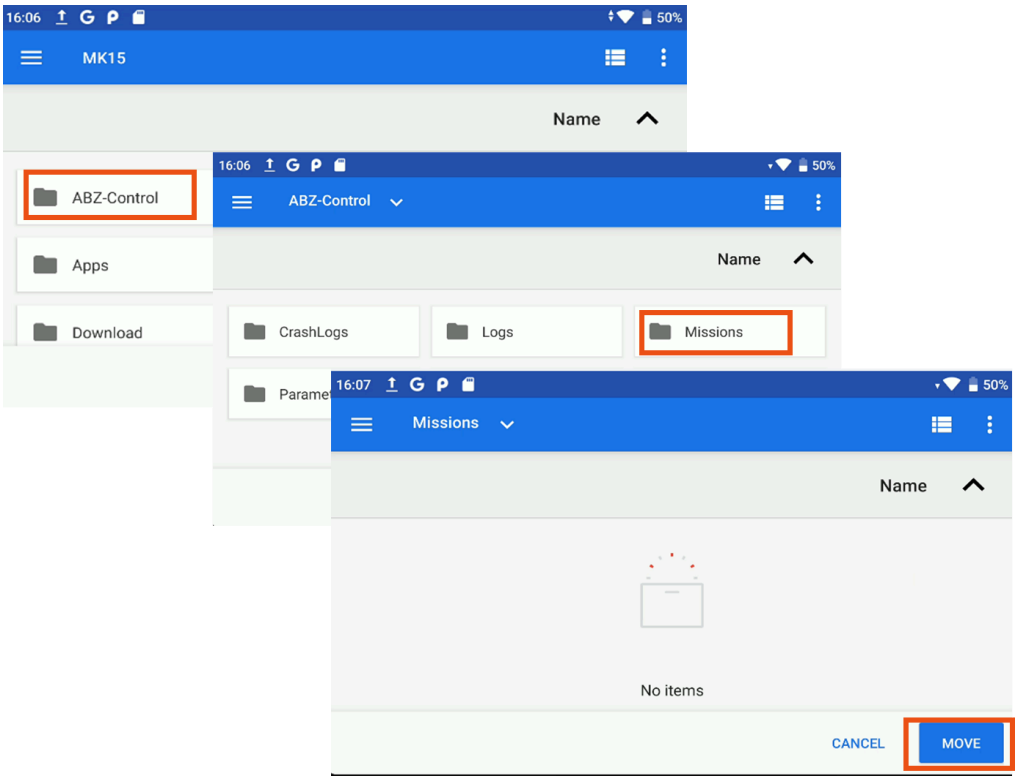



Select the required files on the SD card (tap and hold), then click on the Others (3 vertical dots icon) menu in the right corner of the screen, and select Move to...



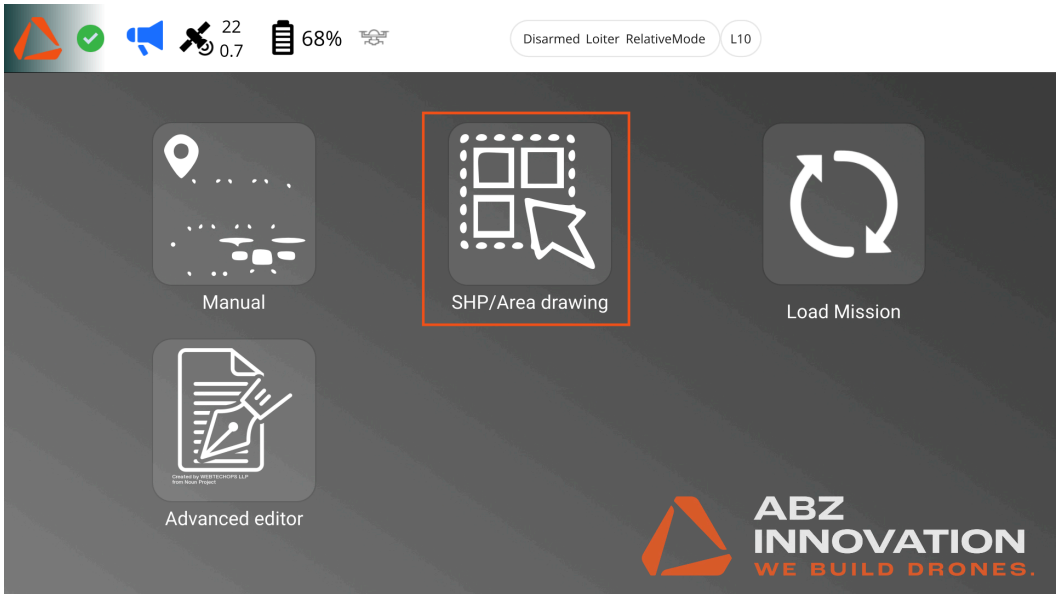

Click on the three lines on the left to open the navigation bar. Select MK15, then open the ABZ Control folder, then the Missions folder. Click the bottom right Move button to move the files to the controller.



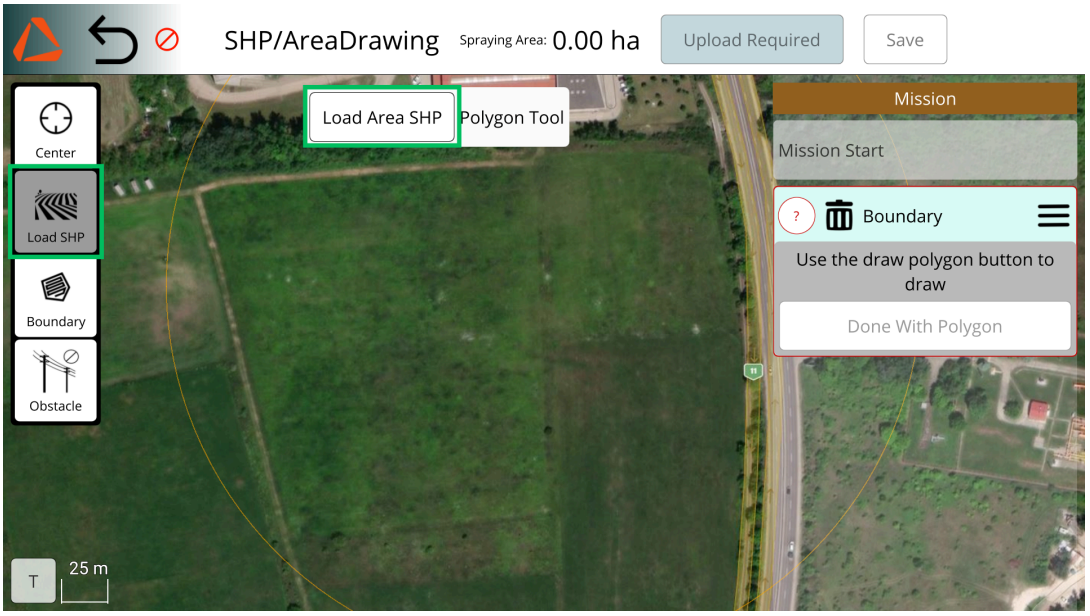



The polyline (lineshape) files shape files copied to this location can be selected in the ABZ Control app by clicking on Flight planning then selecting the Advanced planning option. For further instructions, see page 39.

The area shape files copied to this location can be selected in the ABZ Control app by clicking on Flight planning then selecting the SHP/Area drawing tab SHP/Area drawing tab on the mission planning method page.



Click on the Load SHP button and then on the Polygon tool click on the Load Area SHP button. A list of the files from the Mission folder will be displayed on the screen.




With an SHP file opened, if needed, the edges can also be adjusted by manually moving them (tapping and dragging the pins on the map view). To specify the settings for your Area shape file mission, follow the instructions on page 36.

When you have finished editing, you can save the mission by clicking the **Save** button on the right side of the top menu bar. To upload the planned route to the drone, click the **Upload Required** or **Upload** button at the top-right corner of the screen.

To start the mission, navigate to the **Flight view** by clicking on the ABZ Innovation logo. If you leave the planning page by clicking on the back button, your plan will be cleared from the editor and from the drone. If you have saved your plan, the file remains on the controller and you can open it from the **Load mission** menu.

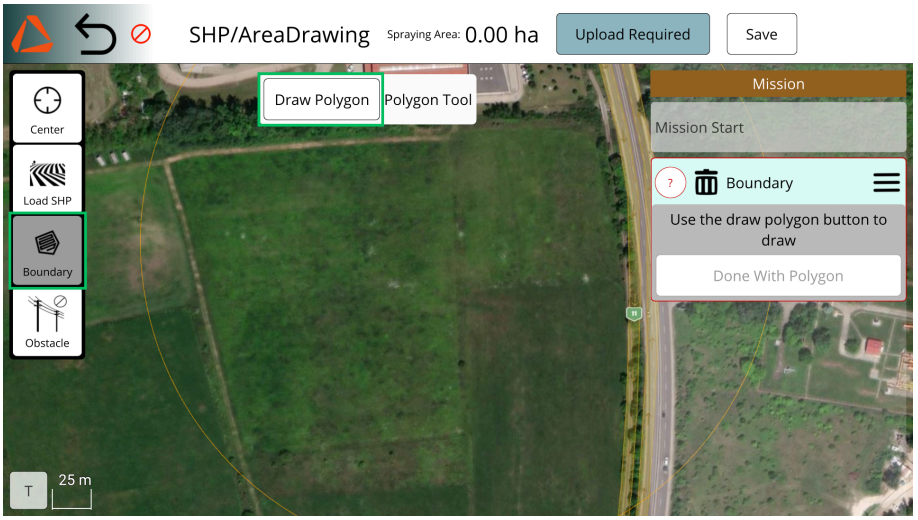
To start a mission, in the Flight view slide the **'Start Mission'** slider after manually flying the drone to a safe altitude.

## Planning the field by drawing an area

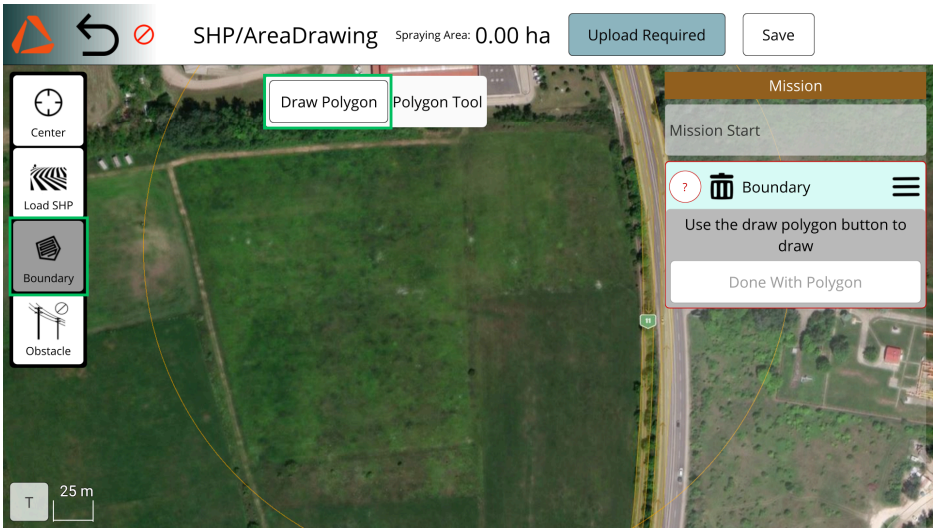
Under the SHP/Area drawing menu, you can manually add and move (by tapping and dragging) corner points on the display based on the map. In this case,

**You should be aware of the map's inaccuracy, which can be several meters off!**

To draw an area, click on the Boundary and then select the Draw Polygon option. An automatic polygon will be generated. You can adjust the corner points of it.




You can add an obstacle the same way.



To specify the settings for your automatic mission, follow the instructions from page 36.

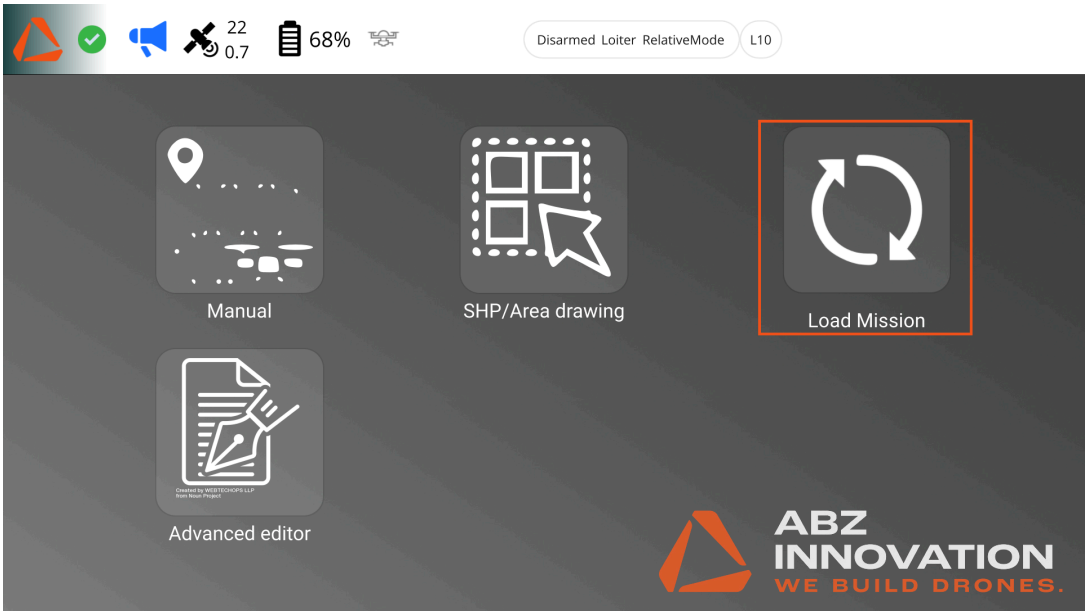
When you have finished editing, you can save the mission by clicking the **Save** button on the right side of the top menu bar. To upload the planned route to the drone, click the **Upload Required** or **Upload** button at the top-right corner of the screen.

To start the mission, navigate to the **Flight view** by clicking on the ABZ Innovation logo. If you leave the planning page by clicking on the back button, your plan will be cleared from the editor and from the drone. If you have saved your plan, the file remains on the controller and you can open it from the Load mission menu.

To start a mission, in the Flight view slide the **'Start Mission'** slider after manually flying the drone to a safe altitude.

## Loading a previously saved mission

If you have saved a mission plan using Manual, Drawing, or Advanced Planning, you can open it by clicking **Load Mission** on the Mission Planning Method page. These saved plans are stored on the remote controller and not on the drone.

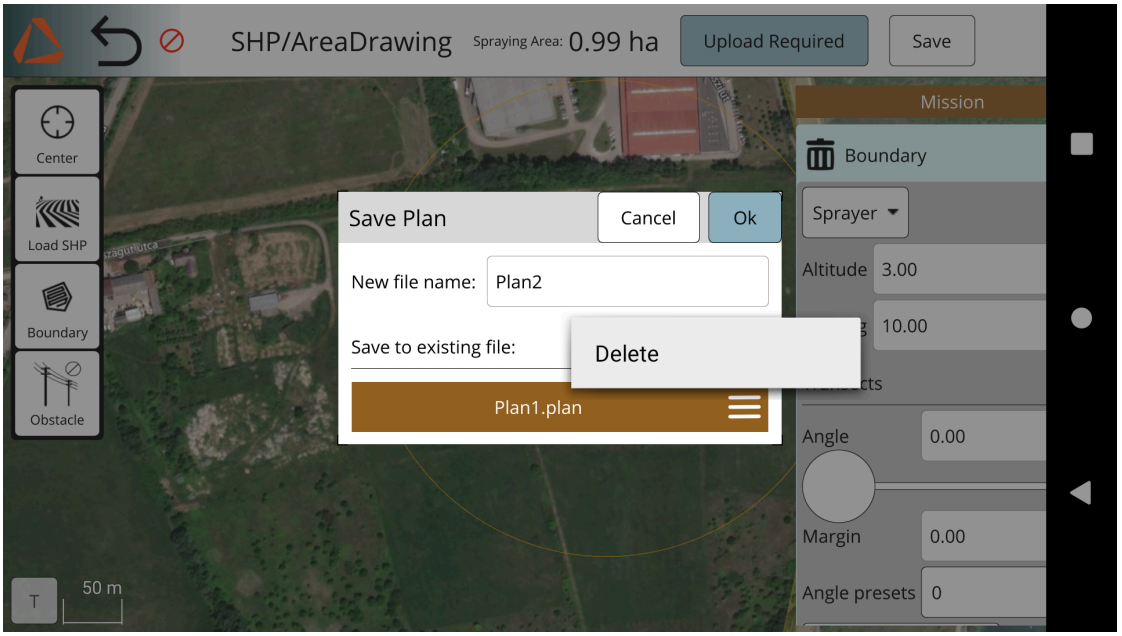



After selecting a mission, you can adjust its settings in the Mission Panel, if needed (see page 36). When you have finished editing, you can save the mission by clicking the Save button on the right side of the top menu bar. To upload the planned route to the drone, click the Upload Required or Upload button at the top-right corner of the screen.

To start the mission, navigate to the **Flight view** by clicking on the ABZ Innovation logo. If you leave the planning page by clicking on the back button, your plan will be cleared from the editor and from the drone. If you have saved your plan, the file remains on the controller and you can open it from the **Load mission** menu.

To start a mission, in the Flight view slide the ‘Start Mission’ slider after manually flying the drone to a safe altitude.

You can **delete** a mission by clicking on the hamburger menu next to the name of the Mission and choosing delete:



# Flight

If needed, check Failsafe settings and adjust them according to the actual flight task and surroundings.

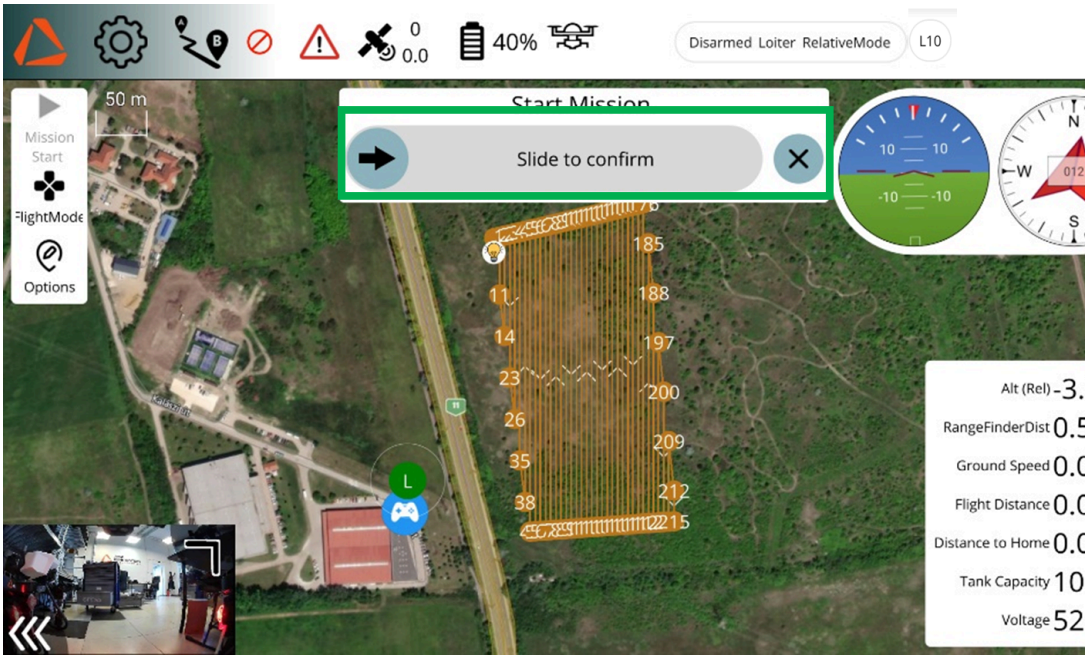
**Always fly in GPS assisted flight mode, if possible (e.g. Loiter). In case of unexpected operation, switch to Loiter mode (pushing the A button) and release the sticks to stop the drone.**

Set the display brightness in accordance with the lighting conditions. Every data on the display should be readable even in direct sunlight. Turn off unnecessary nearby Wi-Fi and radio equipment to minimize interference.

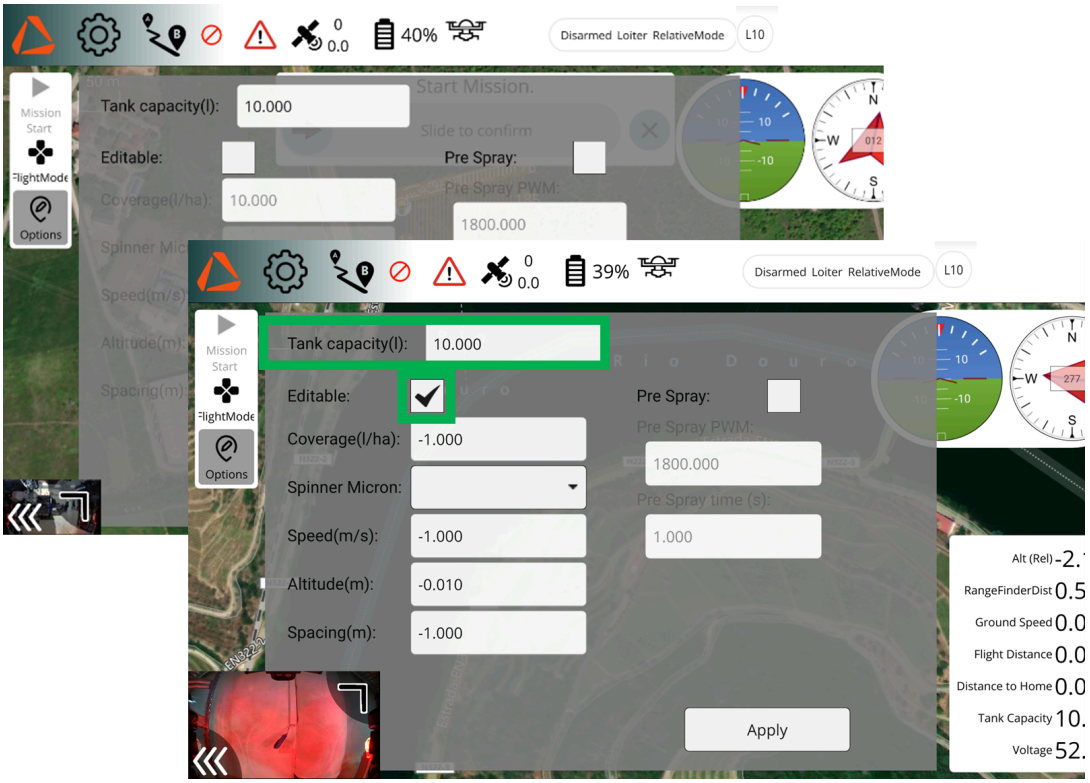
If all the necessary conditions for the flight are ensured, you can then enter the flight view to start the flight, switching to "Armed" mode.

**In this software version manual take-off is required and manual landing is recommended.**

After manual take-off, start the automatic flight by sliding the Start mission - Slide to confirm button. Every flight must be carried out fully in accordance with all Checklists (page 65-66).



If any values must be adjusted in **Flight view > Options**, even during the mission, these values can be applied. By default, the fields are greyed out. Check in the Editable box to turn on the editing option.




The automatic flight, and every other flight mode can be interrupted at any time by changing the flight mode, e.g. by pressing **Button A** (Loiter mode - the drone will hover in position) or **Button B** (RTL – Return to launch) mode, the drone will fly back to the take-off position, so that settings can be modified, or the battery can be replaced.

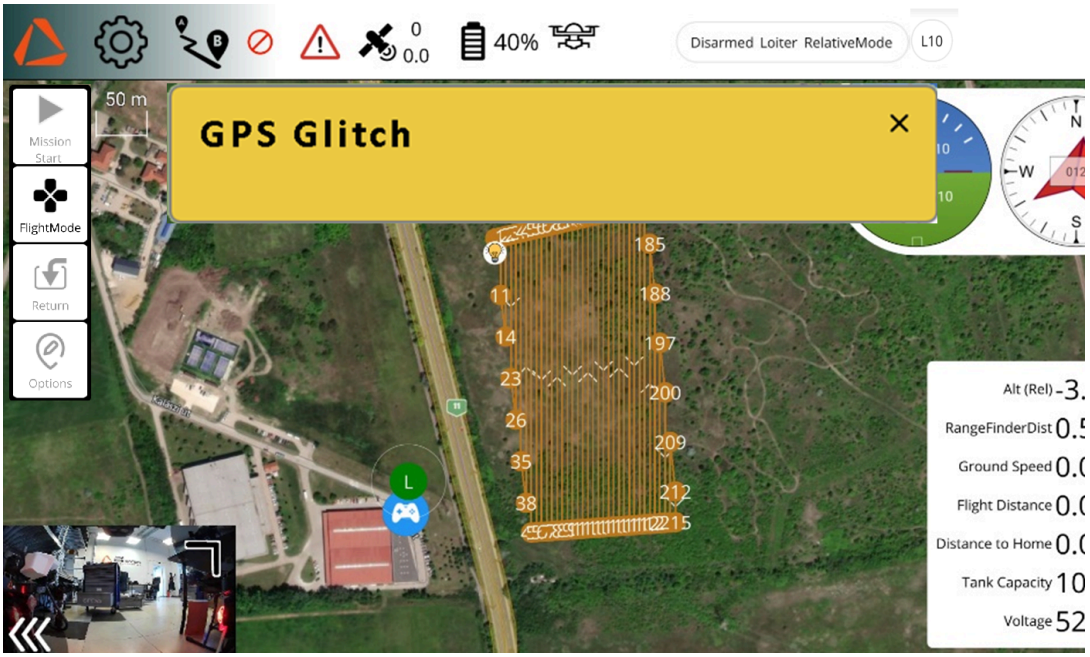
After an interruption of automatic flight, the drone will offer you the **Continue Mission** option. By sliding the slider, the automatic route will continue from the point of interruption.

**In case of any abnormal behavior of the drone during automatic flight, immediate switching to Loiter (A button) or AltHold (C button) mode, in case of abnormality in Loiter mode, immediate switching to AltHold (C button) mode is required by the pilot to take full manual control and to ensure the safe flight and landing of the drone.**

During intensive deceleration and sharp turns, the LiDAR measurement point geometry varies as the drone's horizontal angle changes widely. This can cause the drone to descend. Please operate the drone smoothly when flying at low altitudes and fly above 2m.

If any flight system errors occur during the flight, the controller shows a pop-up message with information about abnormalities. If any of these happen, the pilot must take back manual control, switch back to Loiter flight mode, and safely land the drone.

**If the GPS system fails during flight, the „GPS glitch" pop-up message will be shown on the screen, the pilot must switch back to AltHold flight mode and safely land the drone.**

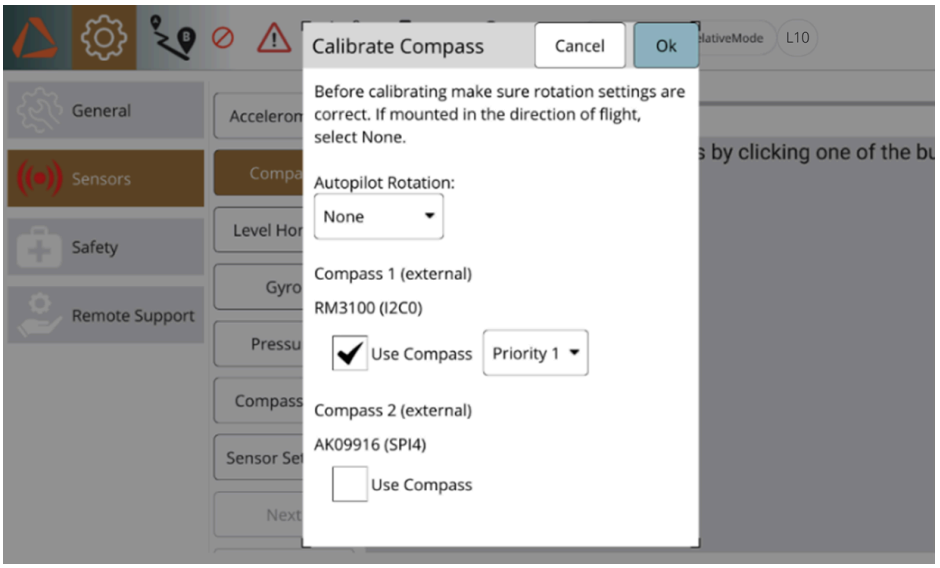



In emergency situations, the pilot must operate the drone manually in the safest available manner, specifically taking care of personal and property security. The pilot must fly the drone away from potential risks, applying careful, slow stick inputs and flight speeds, find a safe area, and land the drone with a slow descent rate.

**In case of a „Potential thrust loss" message, the pilot must land the drone as soon as possible, operating it with slow and smooth motion.**

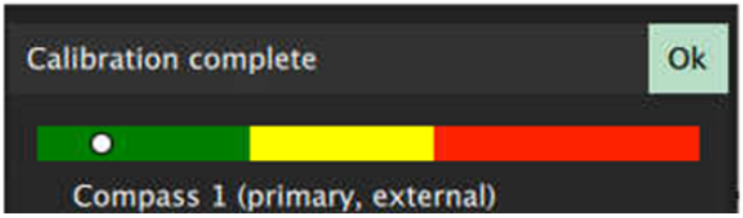
# Compass calibration

Compass calibration can be carried out in Settings/Sensors/Compass, only if the software asks for calibration:




Use calibration only if asked, or if the software requests recalibration.

- The drone must be turned on, in „Disarmed” state.
- Remove any metal (e.g. keys, coins) and electronic objects from your pockets.
- The calibration sequence is initiated by pressing the "OK" button.
- Hold and Rotate the drone by hand 360° around all axes, and in both rotational directions.
- Until the status bar is complete (usually a 1-2 minute operation).
- The result of the calibration is shown by the calibration quality feedback:



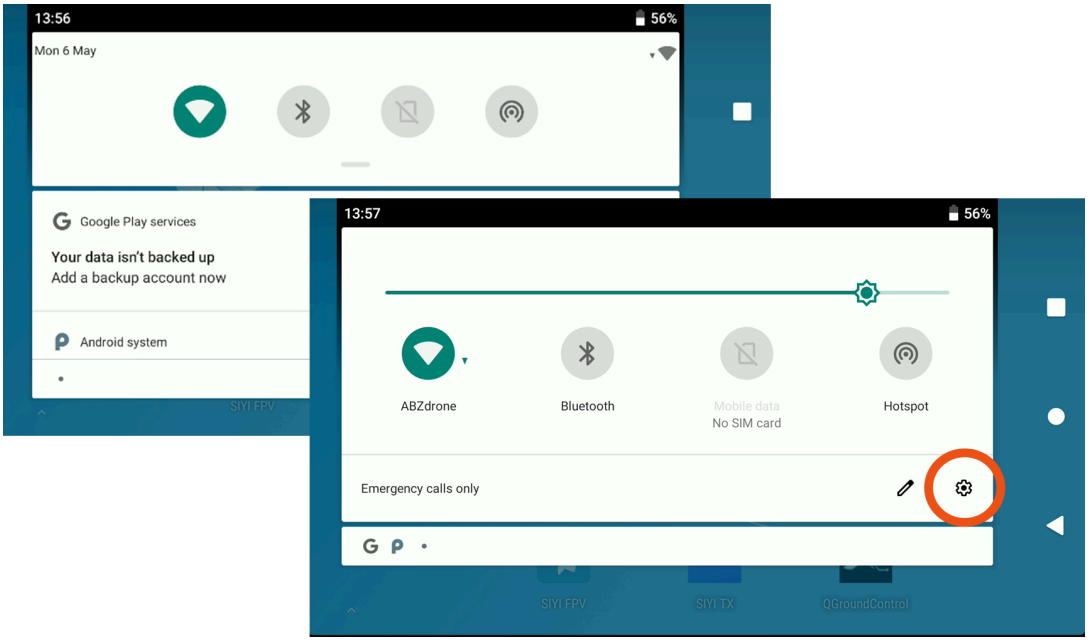

  - Green: good quality calibration
  - Yellow: medium quality calibration, consider recalibrating
  - Red: not acceptable; please recalibrate

After the calibration is done, the restart button on the interface should NOT be pressed, instead the drone should be restarted by disconnecting the battery.

## Network settings

The remote controller can access the internet via Wi-Fi or Bluetooth connection, e.g. shared from a router, mobile phone, tablet, or laptop.

These options are available in the Android settings menu (by swiping down from top), by long pressing the Wi-Fi or Bluetooth icon, or clicking the gear icon.




In the submenu the function can be switched on/off and the available devices can be connected. Wi-Fi only works on 2.4GHz networks. If the controller does not recognize the Wi-Fi from your mobile device, using Bluetooth connection for internet access is recommended.

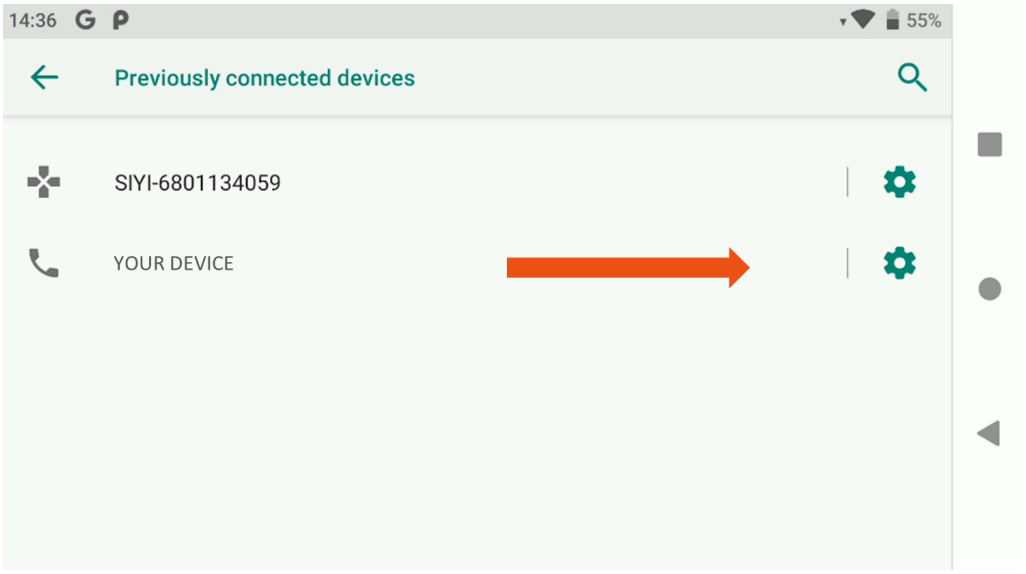
## To set up the Bluetooth connection for internet access:

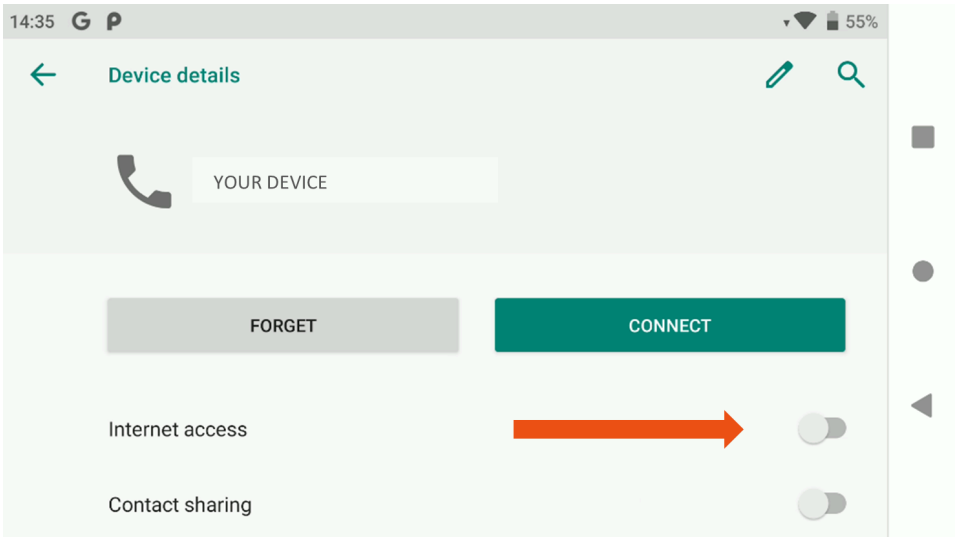
1. Turn off Wi-Fi on the controller.

2. Turn on Bluetooth hotspot / internet sharing on your mobile device.

3. Turn on Bluetooth on the controller and pair the two devices.

4. If your device is connected to the controller, you need to set up the internet connection. Tap on the gear icon next to the device name, then turn on the **Internet access**.



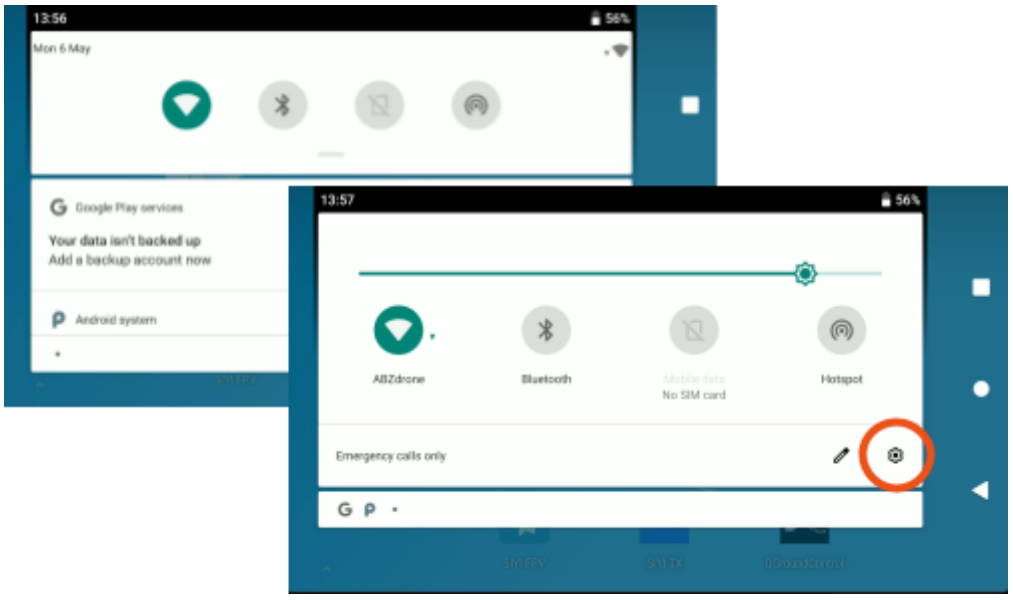



## Creating a Wi-Fi hotspot

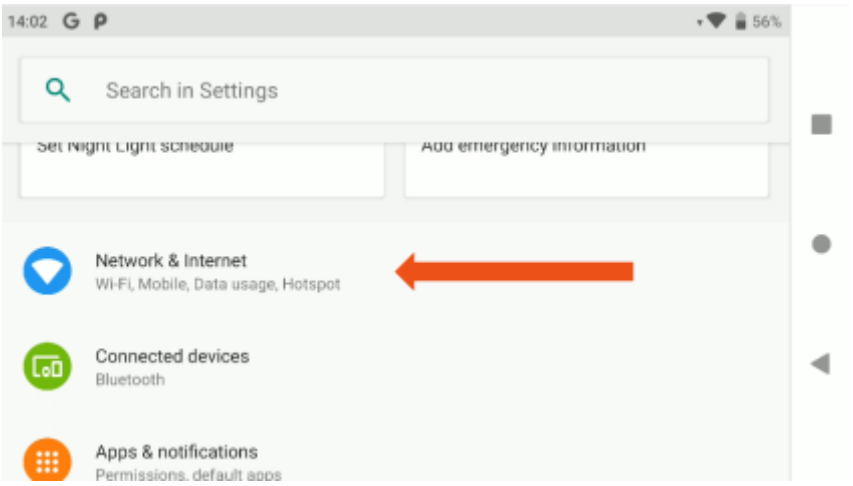
(e.g. to connect Mission Planner and Here RTK):

This option can be accessed from the Android settings menu.

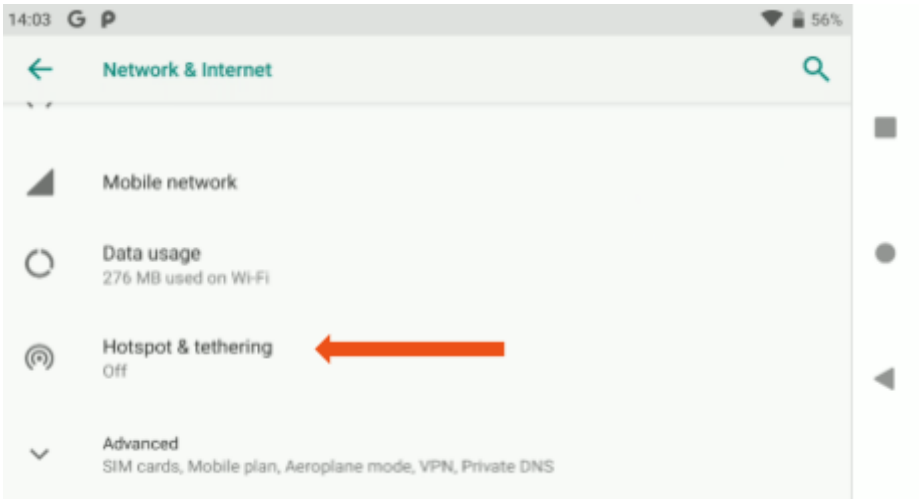
1. Swipe down from the top of the screen twice, then press the gear icon.)



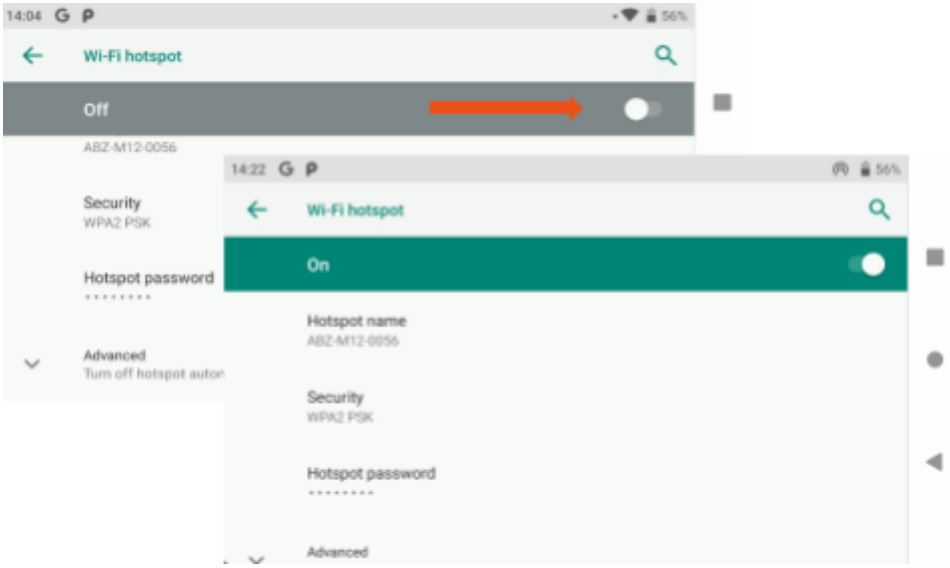

2. Select Network & Internet.



3. Then Hotspot & tethering.




4. Turn on the Wi-Fi hotspot.




Your laptop or tablet now can connect to the Wi-Fi hotspot you've set up.

**IMPORTANT: only devices with a 2.4 GHz connection can show and use the network created by the remote controller!**

Connect to the remote controller's WiFi network:

- Network name: ABZ-M12-0###
  (the last three digits match the serial number of the drone)
- Password: 12345678

Each time the remote controller is restarted, the hotspot function must be reactivated, if necessary.

# Flight Protocol

## Before flight, tasks and inspections

- Drone battery status (The state of the drone battery should be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge).
- Visual inspection of the propellers, paying special attention to possible mechanical damage and whether the propellers are properly fastened.
- General inspection: cables, connections, video connection, payload, etc. Payload condition, arms, base structure condition, and whether the bolts are properly tight.
- Determine the flight location.
- The task to be performed is properly analyzed.
- Permits applied for and obtained.
- Tools and accessories needed for the work are prepared.
- The pilot is fit and ready to work.
- Set the remote controller's sound volume according to the ambient noise.
- Set the remote controller's display brightness according to ambient light conditions.

## Before take-off, tasks and inspections

- Weather conditions are suitable for the task: temperature, visibility, rain, wind speed, etc.
- General visual inspection and condition assessment of the drone.
- Whether the drone is placed on level ground, away from metal surfaces.
- All batteries charged and checked: radio station, drone, video equipment, and accessories.
- The state of the drone battery should be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge.
- Whether the drone and all its accessories are in clean condition.
- Whether the landing gear and any accessories are securely fastened.
- Unfold the drone's arms and tighten the fasteners.
- Unfold the propellers symmetrically.
- Whether propellers are clean, undamaged, properly fastened, and positioned.
- Whether the remote controller is switched on and correctly set. The remote controller must ALWAYS be switched on before the drone battery is connected.
- Check the radio, telemetry, and video antennas.
- Check the remote controller's battery status, charge level.
- Check the live telemetry data on-screen, check button functions.
- NEVER leave batteries connected for prolonged periods.
- Before arming the drone, leave enough free space, stand at least 10 meters away from it.

- Perform compass calibration if necessary.
- Check the video signal on the display.
- Make sure the device has enough satellite connections, at least 7, or more indicated satellites are needed.
- Check that the 'HDOP' value is below 1.1.
- Check that the devices installed are working properly.
- Make sure that the task you have chosen is the one you want to carry out, is planned, and properly analyzed.
- Whether the take-off zone is sufficiently cleared.
- Arm the drone and take off.

## After take-off, tasks

- Stabilize and hold the drone at a height of at least 2m.
- Test the left and right rotation functions, forward/reverse movements, right, left tilting.
- Check that the drone is stable and that there are no abnormal vibrations.
- Check the voltage of the battery.
- Start the mission with the drone

## During mission, tasks

- Regularly check the voltage and charge level of your batteries.
- Check the flight altitude and the maximum allowed distance.
- If the drone or remote controller battery is low, land the drone in a safe place.
- During the flight, the pilot must monitor the battery voltage, which should always be above 43.5 V, even when flying with the Maximum Take-off Mass (MTOM).
- Battery voltage below 43.5 V:
    - When the battery voltage level drops under 43.5 V , start returning and landing the drone.
- Switch off the engines after landing (disarm function)
- End of mission.

## After landing, tasks and inspections

- Switch off professional equipment if necessary.
- Switch off the drone by unplugging the battery from the connector.
- Switch off the remote controller.
- Clean the drone thoroughly (batteries, tools, camera, etc.).
- Disassemble, clean, check, and store all professional equipment properly.
- In the flight log, record the flight and any significant events. Accurate completion of this document is mandatory to monitor the operation and lifetime of the drone, and to facilitate properly scheduled servicing (every 300 flight hours).

- Record the nominal voltage remaining in the batteries used. After returning from the field, remove the batteries from the storage box and store them in a cool and well-ventilated place.
- DO NOT STORE batteries overcharged or fully discharged for extended periods of time.

# Checklists

## Before first take-off

- General structural, mechanical inspection
- Inspection of propellers one by one, even if there is only minor damage, takeoff is prohibited.
- Tightness of the drone arms' fasteners
- Propellers in an unfolded state
- Switch on the remote controller, and launch the ABZ Control app.
- When ABZ Control is waiting for the connection, turn on the drone by connecting the battery (the plug must be fully plugged in).
- If you are operating the drone in a country where the remote identification of drones is mandatory, verify in an appropriate application that the Dronetag BS is correctly broadcasting your drone operator ID before take-off (see on page 11).

## Before every take-off

- Drone battery charge level. The state of the drone battery should be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge.
- Remote controller battery charge level
- When ABZ Control is waiting for the connection, turn on the drone by connecting the battery (the plug must be fully plugged in).
- Check the connection between the remote controller and the drone.
- Verifying **Telemetry** live data (e.g. LiDAR, power consumption) (in case of failure, ABZ Control must be restarted).
- At least 7 satellite connections and HDOP value below 1.1 are shown.
- Whether the drone is in **Loiter** mode (if not, pres**s button A** to switch).
- You are at a safe distance (at least 10 meters) from the drone.
- Switch to "Armed" mode by pushing the **left control stick** to the **down-right position**, until „Armed" is shown on the display, then release the stick.
- After the motors are started, take off to a safe height (at least 2m).

## After take-off

- Compass adjustment by a single 360° rotation around the vertical axis of the drone
- Check the stability and motion of the drone.
- **Check the battery status** and **voltage** frequently during flight.
    - If the drone or remote controller battery is low, land the drone in a safe place.
    - During the flight, the pilot must monitor the battery voltage, which should always be above 43.5 V even when flying with the Maximum Take-off Mass (MTOM). When the battery voltage level drops under 43.5 V, start returning and landing the drone.
- Land the drone carefully and at a safe descent speed.

## After landing

- Switch to „Disarmed" mode by pushing the **left control stick to the down position**, until „Disarmed" is shown on the display and the motors are completely stopped.
- At the end of the flight, first switch off the drone and then the remote controller.
- The drone can then be folded for transport, make sure that the arms' fasteners are not in contact with the arm holder „C" clamps.

# Accessories

## Emlid RTK (Optional)

The M12 drone can be equipped with Emlid Reach M2 and LoRa system, which works as GPS without any further adjustment, or it can be connected with Emlid RS+ or RS2+ for RTK positioning at centimeter precision.

The Reach M2 rover is configured by default as following (Emlid Flow application):

- **SSID:** M12-ReachM2-##
- **Wi-Fi password:** emlidreach
- **Correction input:** LoRa – 868.0MHz 9.11kb/s
- **Base output:** OFF
- **Position streaming 1:** Serial S1 UART at 57600 baud rate, format: ERB

Do not change these settings, as it causes the GPS or RTK not to function.

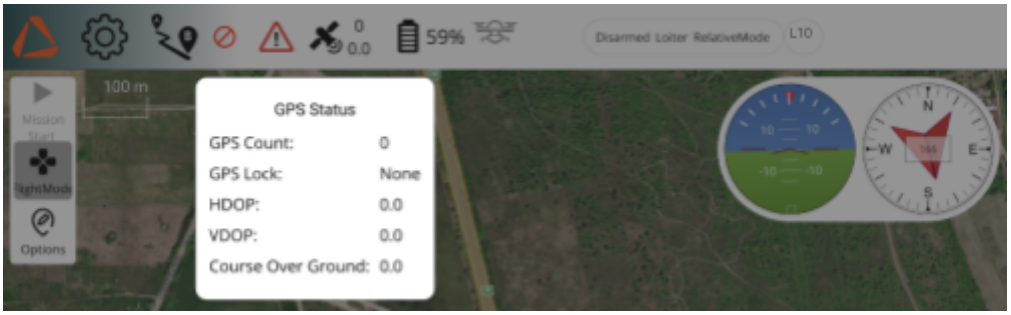
Setting up the RS+ or RS2+ base is documented at Emlid's support pages:

https://docs.emlid.com/reachrs2/
https://docs.emlid.com/reachrs/

When setting up the RS+ or RS2+ base, use exactly the 868.0MHz and 9.11kb/s values as Base output - LoRa settings.

When the system is set up and working correctly, on the drone's controller the GPS Status shows the following based on the accuracy:

- GPS Lock – RTK float
- GPS Lock – RTK fixed



## Recommended batteries and chargers

### Battery requirements:

- 44,4V nominal voltage
- Min. 15C discharge value
- 12 cells
- AS150U-F connector
- Recommendation is 16000mAh capacity

  **Examples:**
  - Tattu Plus 1.0 16000mAh 15C TAA16K12SP15A
  - Tattu Plus Compact 1.0 16000mAh 15C TAA16KP12S15C

### Battery charger requirements:

- Charging controller and voltage for 12 cells batteries
- Power output min. 2000W
- AS150U-M plug
- Balance connector corresponding to the batteries
- Recommendation: Capability of multiple charging at the same time

  **Examples:**
  - SkyRC PC2500
  - SkyRC PC3000

## Payloads

ABZ Innovation does not limit the type of payloads to be used with the M12 drone. Any properly and safely mounted and operated payloads are allowed to attach to, and use with the drone.

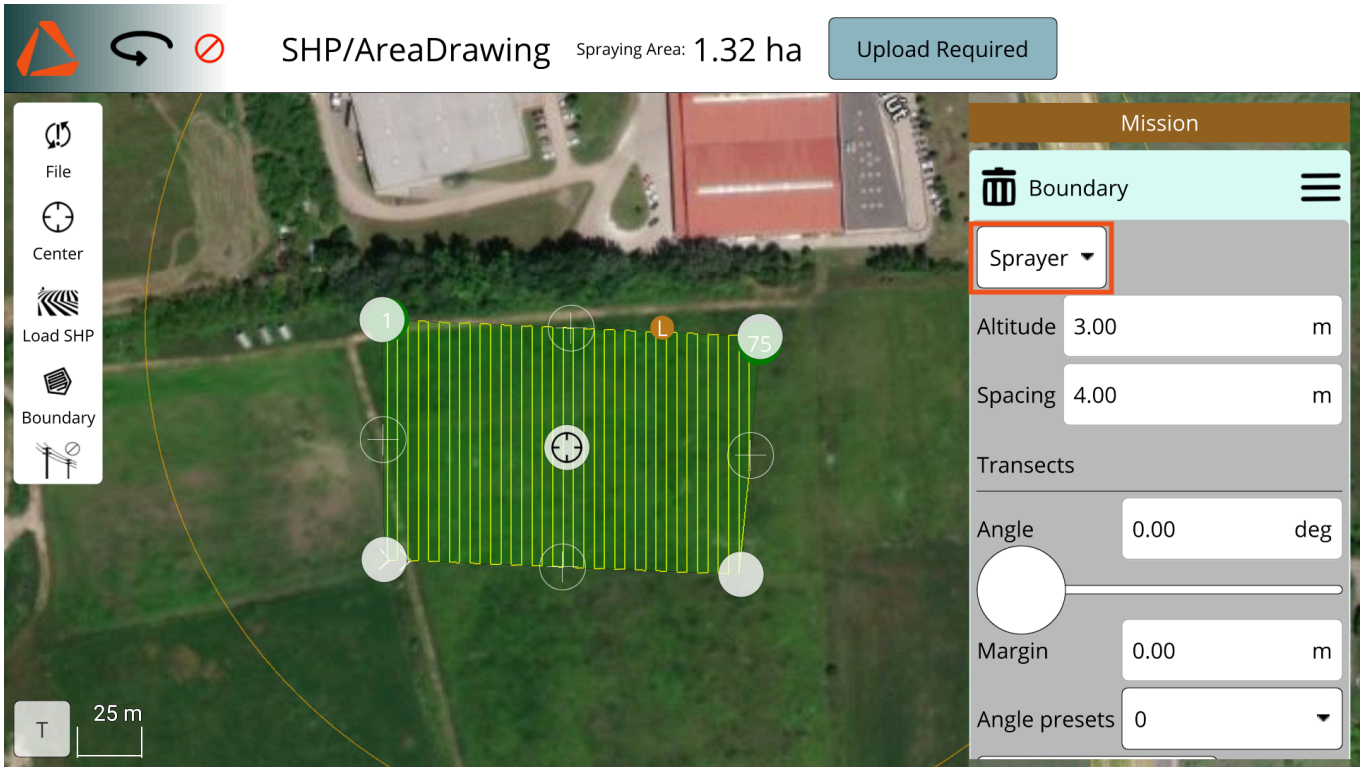
The operator is solely liable for using only properly secured, correctly connected payloads, accessories, which are approved and compatible for drone use.

It is the pilot's responsibility not to exceed the maximum combined accessories and batteries and payload weight, which is 16.46 kg (specific category)/ 12.64 kg (open category),, thereby not to exceed the MTOM with the fully equipped drone, which is 29 kg (specific category)/24.9 kg (open category).

The payloads must not significantly affect the drone's center of mass, especially, when a heavy payload is mounted. It is highly recommended to install the payloads as close as possible to the drone's center.

If you have purchased different types of ABZ Innovation payloads (e.g., spreader or Trichogramma) and your drone is equipped with the necessary connectors, you can switch between them in the **Settings > Payloads** menu.The **Payload Test** switch will activate the selected payload using the test values defined in this menu.

When planning an automatic mission for a specific payload, ensure the payload type is set correctly in the mission panel.



## Troubleshooting

If any malfunction is experienced, contact an ABZ Innovation service center for further instructions. No repair attempts are allowed by the pilot or operator.

abzinnovation.com/authorized_services/

### Replacement parts

Only original replacement parts are qualified, directly from ABZ Innovation.

There are no life-limited parts of the drone, however propellers and motors must be inspected frequently, and in case of abnormalities, replacement is needed.

Other than replacing the propellers and the battery, every repair or replacement should be carried out only at an official ABZ Innovation distributor's service center by a trained and qualified technician.

Never repair any parts of the drone while it is powered on.

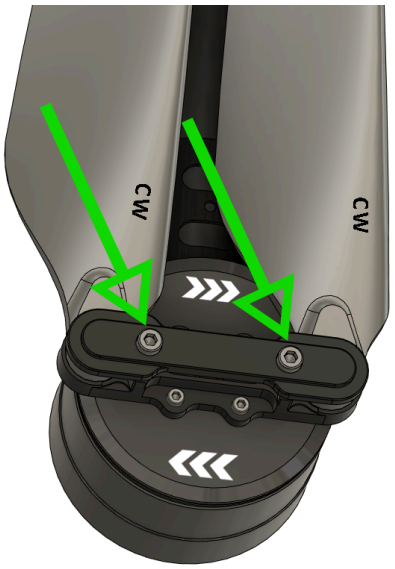
### List of spare parts and part numbers:

- Battery: ABZ-L10-GP-EC-001 (Normal size)
- Battery: ABZ-L10-GP-EC-002 (Compact size)
- Propeller CW: ABZ-L10-EFT-FR-006
- Propeller CCW: ABZ-L10-EFT-FR-007

## Replacing the propellers:

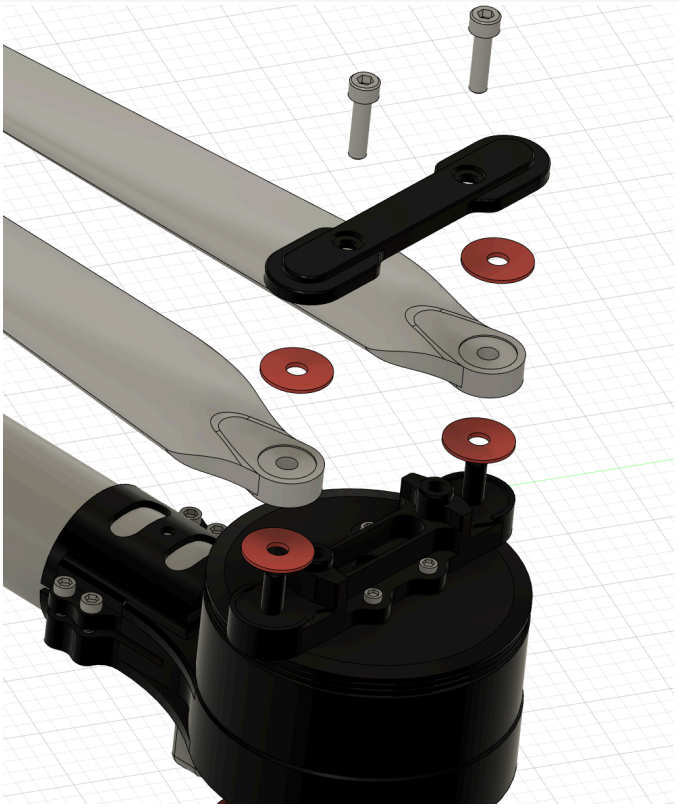
### Tools for replacement:

- HEX 4 key
- Threadlocking fluid (e.g. Loctite 243)
- Original ABZ Innovation L10 propellers




Carefully check the motor and propeller rotational direction. On the motors it is indicated with arrows, on the propellers „CW" or „CCW" are indicated.

Unscrew the two 4mm HEX screws, disassemble the fixing cap of the propellers, remove the propeller's upper washers, remove the propellers and install new propellers, reinstall the upper washer and fixing cap. Clean the 4mm HEX screws from threadlocking residues and apply new threadlocking material (according to the manufacturer's instruction). Tighten the screws until the propellers have zero axial and radial play, but still easy to fold and unfold them.



Obtain disposal information directly from local ABZ Innovation Distributors or Resellers. Always follow local regulations regarding disposal and recycling. If a part has ended life cycle or faulty/broken, it must be ensured not to be allowed to be used again, which can be carried out by an ABZ Innovation Distributor or Reseller.

## Log files

### Tools needed:

- Windows PC with USB-A connector
- MissionPlanner application installed on the PC
- USB-A – MicroUSB cable – or Wi-Fi connection

Connect the drone to the Computer, and open the Mission Planner application

- Using the micro USB cable: choose the corresponding COM (MavLink) port and hit connect (top right corner of the application)


OR

- by creating a Wi-Fi hotspot (see page 60) on the remote controller and turning the drone on, connect the PC to this Wi-Fi network. Run Mission Planner, select the relevant port (UDPCI) and match the baud (57600) “Port” as “19856”. “Server addresses” as “192.168.144.12”. Start the SIYI TX application. The Mission Planner application will connect to the drone.

1. Open the Mission Planner's **Flight Data** screen
2. On the bottom left, select the **"DataFlash Logs"** tab and push the **"Download DataFlash Log Via Mavlink"** button.


3. Select the log you want to download. This will save that log to your **MissionPlanner/logs** directory, in a folder named after the vehicle type, such as QUADROTOR.
4. The corresponding downloaded logs must be selected by its „date created" and moved to a new folder, which is named by the serial number of the drone.

If you have any questions, please contact us: support@abzinnovation.com

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