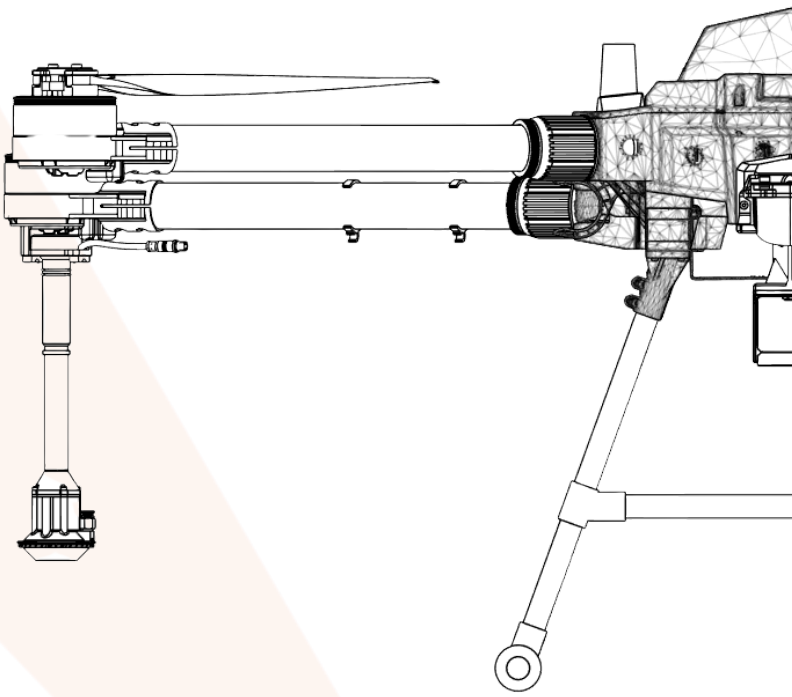
ABZ INNOVATION

WE BUILD DRONES.



M12

OPERATOR MANUAL

Version 3.0

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.

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

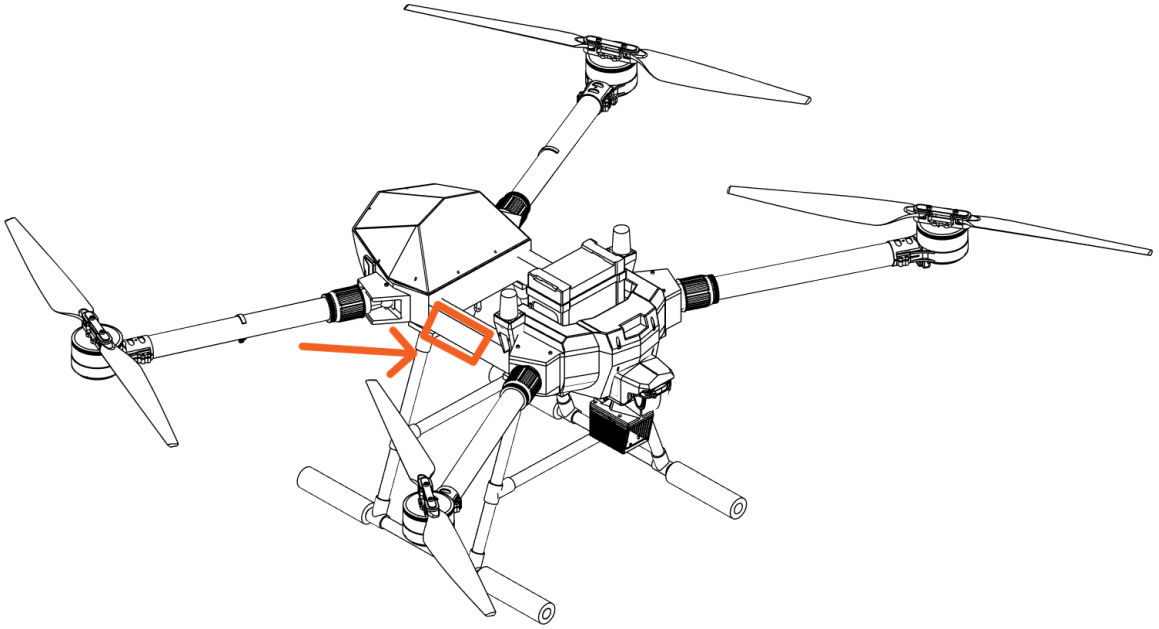
Please read this notice and the manual provided for your ABZ Innovation M12 drone before use.
If you have any questions, please contact ABZ Innovation customer service before use.
The contact details can be found at the end of this document. By using the drone, you declare that you have read this manual, 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.

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To identify an M12, locate the serial number label on the right side of the drone frame.

ABZ INNOVATION M12		RID/SN: 1759FABZL10M12
		Date of manufacture: 2025.09.21.
		Input: Battery - 44.4V⎓ 55A
		This device complies with:
Make - model - series: ABZ Innovation - L10 - M12		ASTM F3411-22a-RID-B and and 14 CFR Part 89
Manufacturer: ABZ Innovation Kft.		This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
Made in Hungary (EU)		
Address: Kalászi út 3, Szentendre, 2000, Hungary		
This device contains FCC IDs:		
FCC ID: XPYANNAB4	FCC ID: 2ABCB-RPI5	
FCC ID: 2AZBB-MK15RX	FCC ID: RID-LR101H	
Safety warning: Hazardous moving parts, keep clear!		

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device contains the following FCC-certified modules: FCC ID: XPYANNAB4, FCC ID: 2AZBB-MK15RX, FCC ID: RID-LR101H, FCC ID: 2ABCB-RPI5

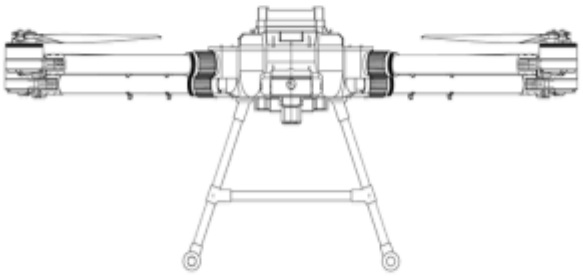
This device complies with Part 15 of the FCC Rules for Class A digital devices. NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Responsible Party:

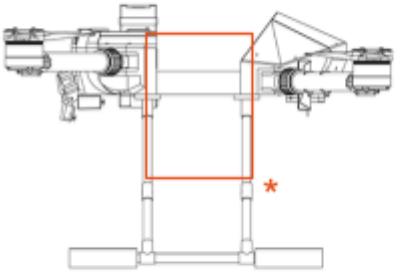
Drone Nerds 5553 Anglers Ave, Suite #109, Ft. Lauderdale, FL 33312 Phone:(786) 708-7807, Email: sales@dronenerds.com

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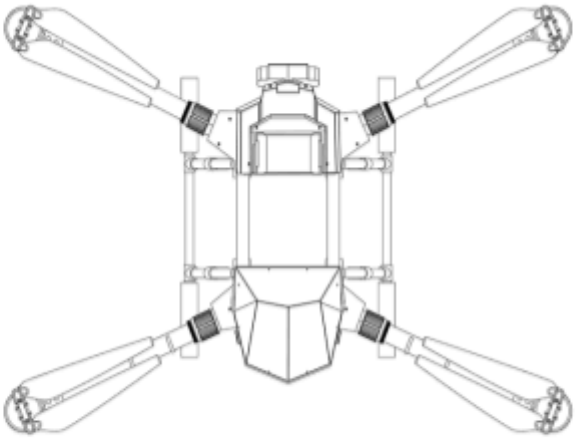
ABZ Innovation M12 drone



Front



Side

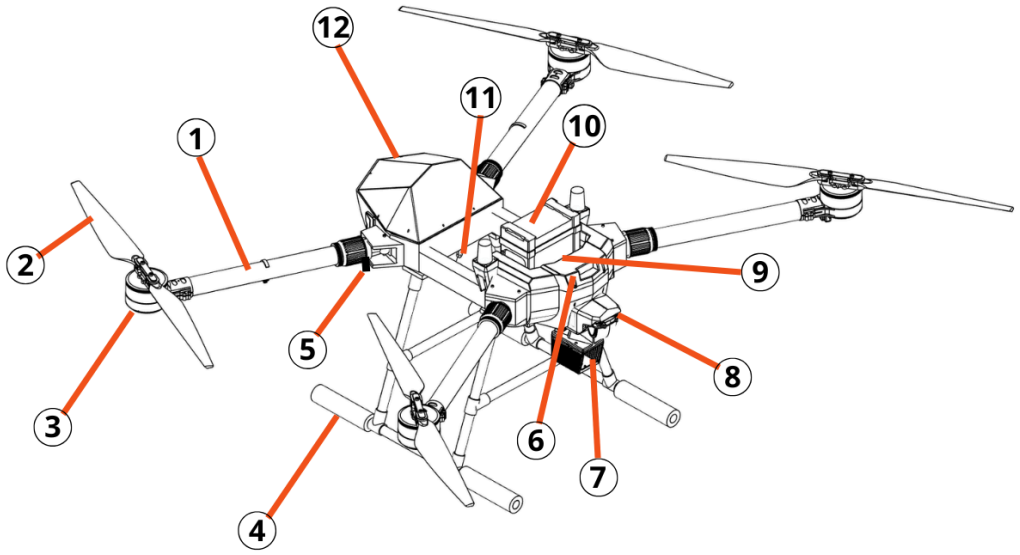


Top

* Optimal payload area

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Drone main parts



1: Arms

2: Propellers

3: Motors

4: Landing gear

5: RC antennas

6: Front cover

7: LiDAR (Optional)

8: Camera

9: Battery connector

10: Battery

11: Optimal payload area

12: Rear cover

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

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Specifications

General specifications		
	EU	**US**
Payload	9.1 kg	20 lbs
Max. take-off weight	24.9 kg	54.9 lbs
Total weight (with battery) *	15.8 kg	34.8 lbs
Total weight (without battery) *	11.6 kg	25.6 lbs
Maximum characteristic dimension **	2300 mm	90.5 in
Dimensions (arms & propellers unfolded) (L x W x H)	2060 x 1600 x 600 mm	81.1 x 63 x 23.6 in
Dimensions (arms and propellers folded) (L x W x H)	770 x 540 x 600 mm	30.3 x 21.3 x 23.6 in
Effective signal range of RC	~3.5 km	~2.17 mi
Payload connections		
Power source	5V, 12V, Battery voltage	5V, 12V, Battery voltage
Communication ports	I2C, UART, CAN, USB	I2C, UART, CAN, USB
Signal inputs/outputs	PWM, GPIO	PWM, GPIO
Frequency bands		
Radio Control and Telemetry	2.4GHz	2.4GHz
WLAN	2.4GHz	2.4GHz
Flight		
Max. operating flight speed	8 m/s	17.9 mi/h
Max. level speed	15 m/s	33.5 mi/h
Max. tolerable wind speed	10 m/s	22.4 mi/h

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Packing list

The M12 drone standard package contains:

- M12 drone
- ABZ Innovation MK15 remote controller with sticks and antennas
- Charger cable for remote controller
- 20 W fast charger and cable for remote controller
- US/EU plug converter for the fast charger
- Carrying case for the remote controller

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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

- It is forbidden to operate the drone or any of its components in an enclosed space.
- Fly only in places where there are no buildings or other obstacles.
- Do not fly over or near people.
- 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).
- Rain and foggy weather might affect the performance of the LiDAR, and consequently, the performance of altitude hold and obstacle sensing.
- Do not fly in rain, hail, or in higher relative humidity than 80%.
- During lightning, flight is prohibited.
- During adverse weather conditions, such as heavy rain, snow, and icing, flight is prohibited.
- 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.
- 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.
- In all flight modes including take-off and landing, the pilot must comply with all safety requirements and the technical conditions must be met.

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- 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.

Operation

- The drone may only be switched on and operated in accordance with the "Flight Protocol" chapter.
- 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 43.5 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.

  If, during the return, the battery voltage reaches the critical threshold (42 V), the drone will automatically initiate landing. For further information, see the Battery Failsafe section.
- The ABZ Control battery indicator icon serves only as an indicator and shows an approximate value.

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- Never fly closer than 100 m (328 ft) to a high-voltage power line or high-power radio emitters (e.g. Radar, TV/Radio station).
- Never fly closer than 30 m (100 feet) 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.
- Significant dust and stains on the optical window will affect the performance of the LiDAR sensor (Optional).
    - If it is necessary to clean the sensor, first use compressed or canned air. DO NOT wipe a dusty optical window, as it will only cause more damage.
    - If the optical window has visible stains after dusting, it is necessary to wipe it as well.
    - DO NOT wipe using a dry lens tissue, as it will scratch the surface of the optical window. Use a lens tissue with isopropyl alcohol. Wipe slowly to remove the dirt instead of redistributing it on the surface of the optical window.
    - If the optical window is still dirty, a mild soap solution can be used to gently wash the window. Repeat Step 2 to remove any remaining soap residue.
- Never take pictures of the LiDAR while it is operating. The laser pulses emitted by the LiDAR may damage the mobile phone's camera sensor.
- 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 (32°F), as 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 inspected monthly and discharged and recharged every three months during storage.

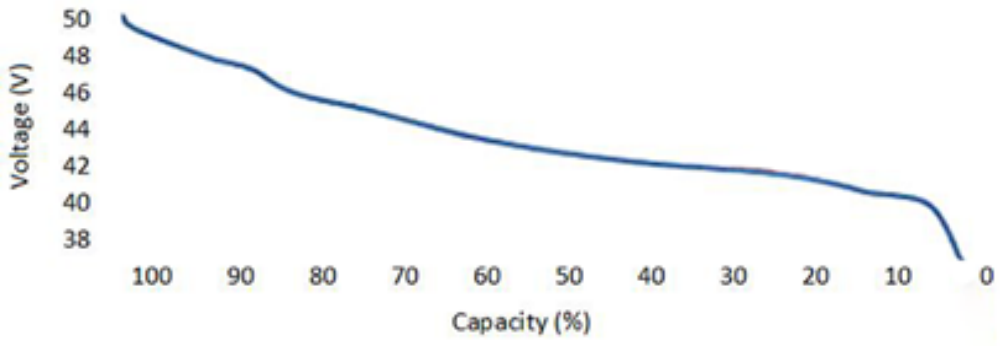
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- After long-term storage:
    - Every battery must be inspected and fully charged before use.
    - The drone's motors must be inspected for free rotation.

Drone handling and use precautions

- Before commencing each flight, 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,
    - when planning, the correct cornerpoint/route spacing,
    - wind speed,
    - flight altitude,
    - 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 temperature, so 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 (41°F and 113°F) ambient temperatures, while the battery's temperature remains between 10°C and 60°C (50°F and 140°F).
- 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:



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- The maximum masses of accessories/batteries/payloads combined, fitted to the drone must not exceed (29.1 lbs / 13.2 kg), thereby the drone's overall mass must not exceed the Maximum Take-off Mass (MTOM) 54.9 lbs / 24.9 kg.
- 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 are highly influenced by the payloads or accessories, especially if those are installed further away from the Optimal payload area (shown on page 3). 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.

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In case of loss of signal and communication

General Failsafe

The ABZ Innovation M12 V2 drone's software is equipped with safety features that ensure safe operation at all times. These include possible loss of signal and communication. This can occur when the drone signal is out of range, obstructed by a hill or building, or affected by interference from nearby equipment, electronic devices, or magnetic sources. In these cases, the drone will communicate clear instructions to the operator while the software initiates safety functions. The safety features can be set before take-off, telling the drone what to do if the drone loses signal.

These options can also be set with the following:

- Returning to the starting point (Return to Launch – RTL)
- Landing
- continuing Auto mission

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 Manual (Loiter) mode).

Low Power Condition

Battery Failsafe

The M12 drone is equipped with battery safety procedures to ensure that the drone operates only within safe battery voltage levels.

The Battery Failsafe system consists of three stages:

- **Stage I – User-Configurable Battery Threshold**
  The threshold can be configured by the pilot under **Settings > Safety**. When

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the battery voltage reaches the configured threshold, the configured battery failsafe action is activated.

- Range: 30-40 %
- Available Actions: **Warning**, Switch to **Manual** mode

- **Stage II – User-Configurable Battery Threshold**
  The threshold can be configured by the pilot under **Settings > Safety**. When the battery voltage reaches the configured threshold, the configured battery failsafe action is activated.
  - Range: 20-29 %
  - Available Actions: **Warning**, Switch to **Manual** mode, **Land**
- **Stage III – Automatic Failsafe Mode**
  When the battery voltage reaches **the critical threshold of 42 V,** the drone will immediately **initiate an automatic landing.**

Stage	Threshold	Available Failsafe Actions
Stage I (User-configurable)	30–40%	Warning, Manual, RTL
Stage II (User-configurable)	20–29%	Warning, Manual, Land, RTL
Stage III (Automatic)	42 V (critical)	Automatic Landing

List of Actions:

- **Warning:** The system provides a visual and audible notification when the battery reaches the warning threshold.
- **Land:** The drone automatically performs a controlled descent and landing. In Land Mode, the pilot can only provide forward, rearward (pitch), left, and right (roll) stick inputs to help ensure a safe landing.
- **Manual:** The drone switches to Manual Flight Mode and awaits pilot input.
- **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.

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Regardless of the battery failsafe system in place, the pilot must continuously monitor the battery voltage during flight. The voltage should remain above 43.5 V, even when operating at Maximum Take-Off Mass (MTOM).

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!

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Mandatory Remote identification with Dronetag

For security reasons, remote identification of drones is mandatory in the United States and the European Union. All drones must be equipped with a Remote Identification device to locally transmit information about the operating drone.

The M12 drone comes equipped with a Dronetag DRI Remote ID module and meets the requirements of the legislation requirements of the European Union[1] and the United States[2].

The Remote ID of your drone is its serial number, which is broadcast from the device during flight. The drone's system prevents takeoff if the Remote ID is not functioning.

The **RID icon** shows the operational status of the Remote ID system. If the icon is green, the Remote ID is broadcast correctly.



If the RID icon is red, it indicates that the Remote ID broadcast is not functioning properly.

[1] Commission Implementing Regulation (EU) 2019/947 (https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0947)
[2] 14 CFR Part 89 – Minimum Performance Requirements for Standard Remote Identification of Unmanned Aircraft (https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-89)

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By clicking on the icon, you can check the health of the systems providing the necessary data for the Remote ID module.



The **ARM STATUS** field provides feedback about the proper functioning of the location source hardware and software of the drone. In the case of a malfunction, this icon will turn red, and consequently, the Remote ID icon will also turn red, indicating a malfunction in the Remote ID system. The drone will also provide an error message stating that the Open Drone ID has encountered a problem (e.g., not receiving a location message).

The **GCP GPS** field provides feedback about the proper functioning of the Transmitter radio GPS (hardware and software). In the case of a malfunction, this icon will turn red, and

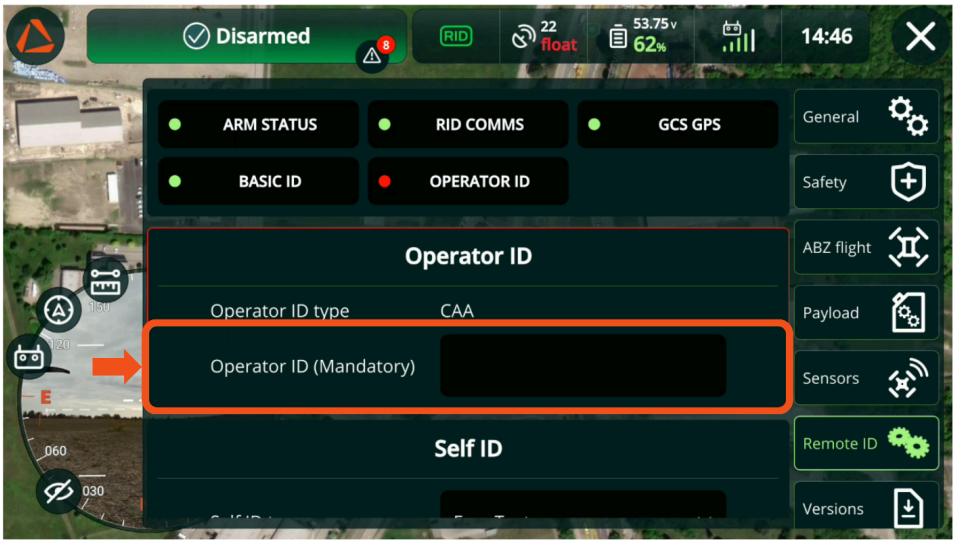
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consequently, the Remote ID icon will also turn red, indicating a malfunction in the Remote ID system. The drone will also provide an error message stating that the Open Drone ID has encountered a problem (e.g., not receiving a location message).

The **RID COMMS** field provides feedback on the proper connection between the Remote ID module and the drone.

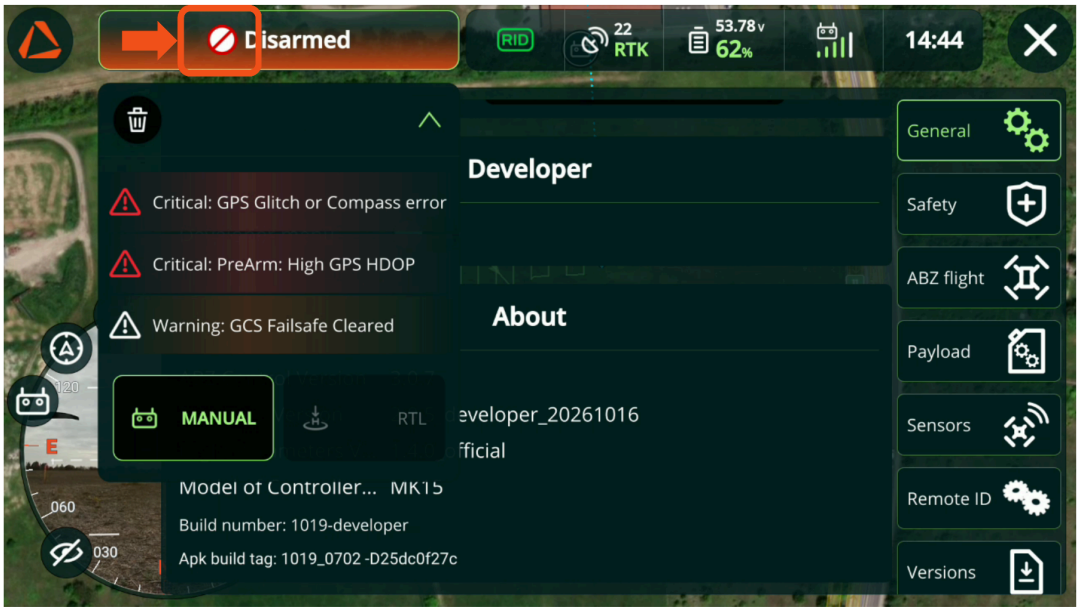
The **BASIC ID** field should always be green, indicating that the drone's serial number has been set up as Remote ID and is broadcasting.

If you are flying in the **European Union**, the **Operator ID** field should be visible, and your Operator ID must be entered into the system. In the European Union, it is mandatory to register as a drone operator on the official website of your National Aviation Authority. After registration, you will receive a registration ID number, which you can enter under *Settings > Remote ID*.



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If the Remote ID system experiences an error due to insufficient GPS coverage on the drone or the remote controller, or a hardware malfunction, the drone prevents arming.



The drone continuously monitors the Remote ID functionality **from takeoff to shutdown** and provides a **notification of any malfunction or failure** in the top bar of the ABZ Control application. If the Remote ID system detects an error during flight, the RID icon will turn red, and the drone will provide an error message stating that the Open Drone ID has encountered a problem
(e.g., not receiving a location message).

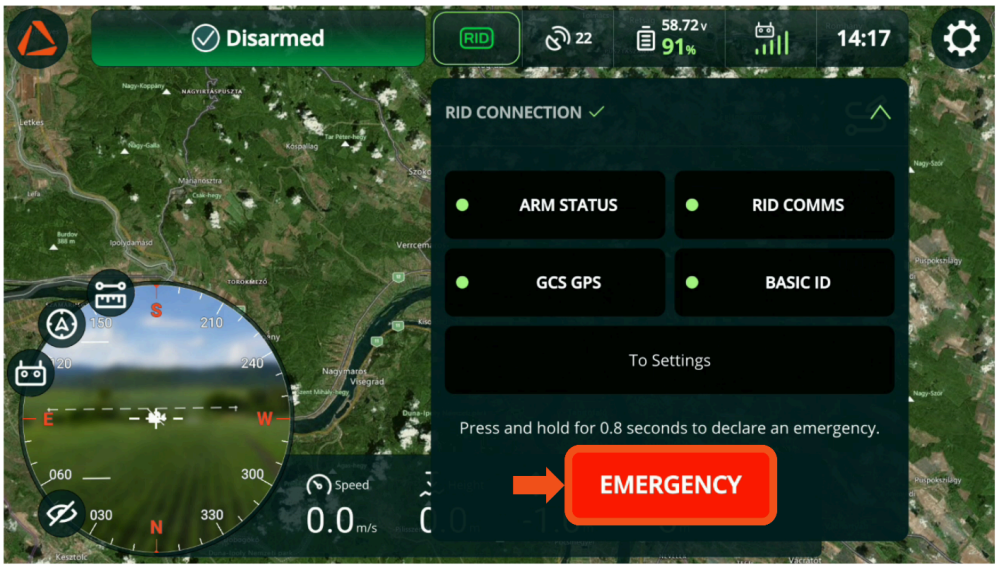
If the Remote ID system experiences an error during operation, the unmanned aircraft is no longer broadcasting the message elements of the standard Remote ID. The pilot must [3] land the unmanned aircraft as soon as practicable.

[3] in accordance with 14 CFR Part 89 (Minimum Performance Requirements for Standard Remote Identification of Unmanned Aircraft:https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-89)

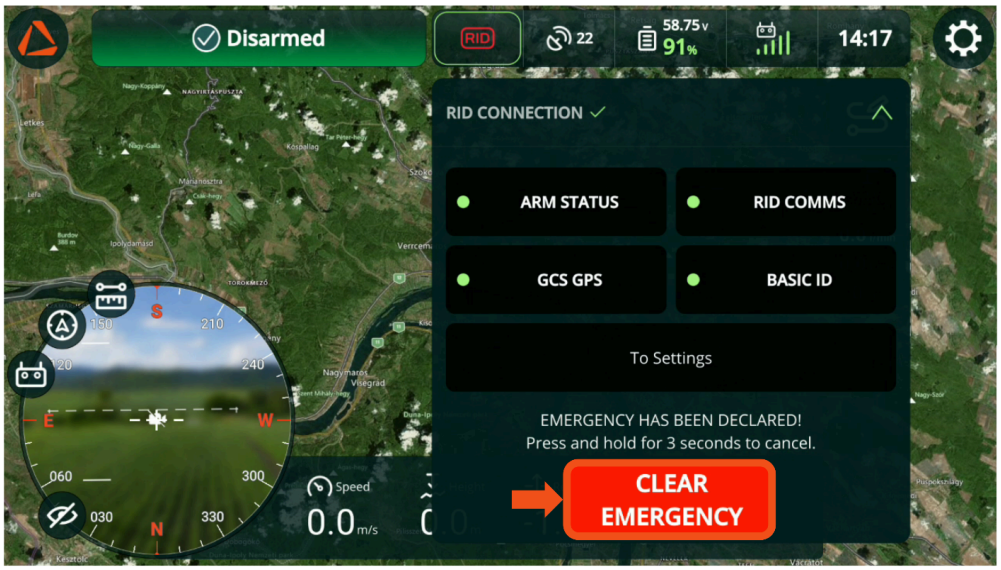
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Declaring an Emergency

In the Remote ID interface, the pilot can click on the **Declare Emergency** button. To declare an emergency, you need to **press and hold the button for 3 seconds.** This function may be employed in situations such as loss of control, potential threats to persons or property, or in other emergency scenarios, at the pilot's discretion.



When an emergency is declared, the drone will broadcast the emergency status.
To clear the emergency, press and hold the same button (which now displays the text **'Clear Emergency') for 3 seconds.**



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Remote Controller

The M12 is compatible only with the controllers provided by ABZ Innovation with specialized ABZ Control software. All 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 and, therefore prohibited to use with the drone.

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.



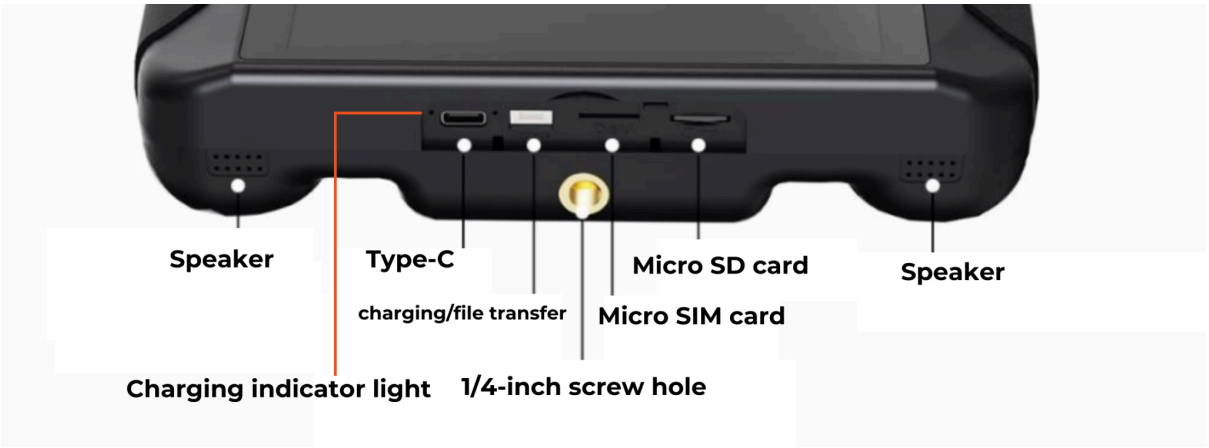
If the remote controller is turned off, you can check the battery charge of the remote controller by a short push of the power button. The blue LEDs indicate the charge level. The single LED in front

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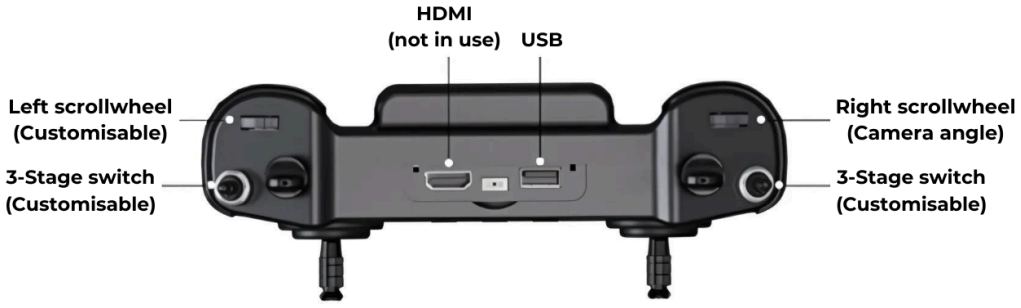
of them gives feedback about the connection between the drone and the remote controller. When the LED is green, the drone and the remote controller are connected.

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).

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 (connector Type-C) 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.

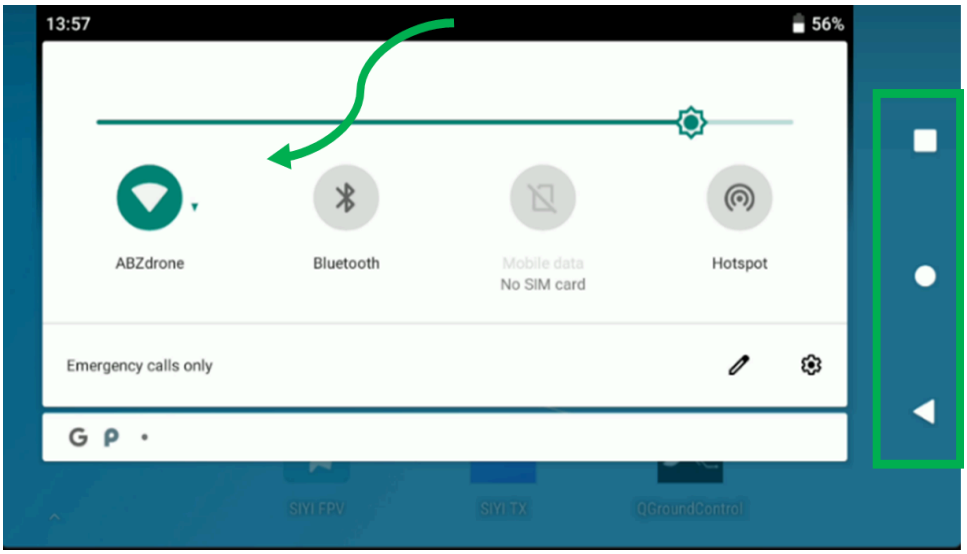


If you push the power button once short, the screen will turn off (power saving mode). If you push the button for 1 second, you can choose between the options of powering off the remote controller or taking a screenshot.

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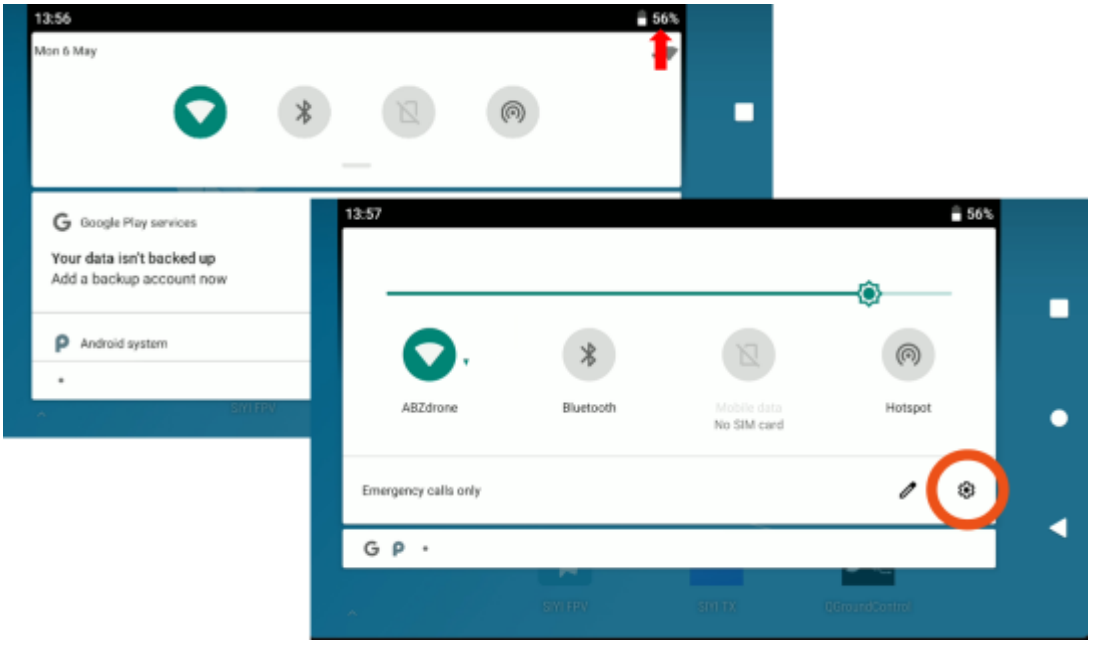
Remote Controller Settings

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).

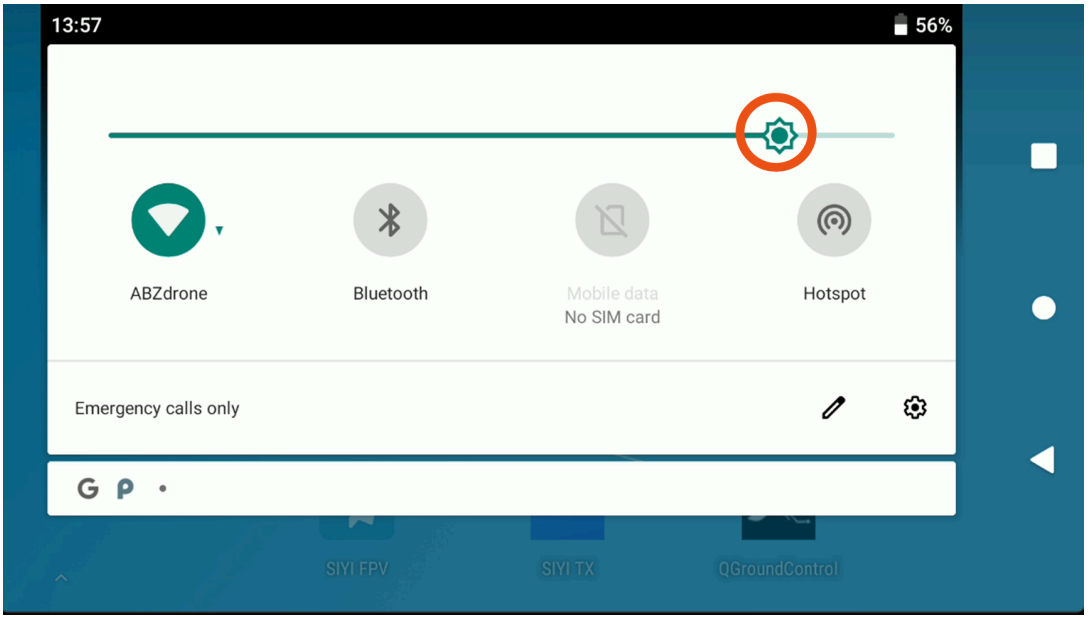
The remote controller battery status is displayed in the Android menu (by swiping down from the top of the screen).



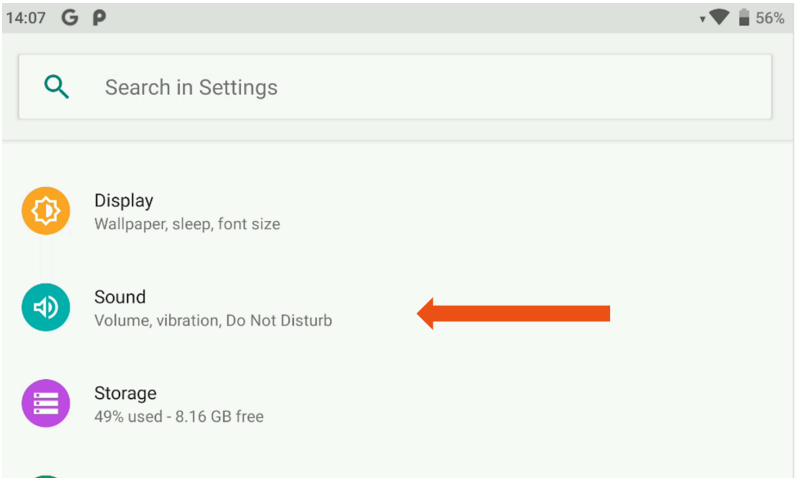
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Set the **display brightness** and **sound volume** always according to environmental conditions (light conditions and noise level)! Setting the display brightness and sound volume is always accessible (even when operating the ABZ Control software) 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.



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Media volume controls the ABZ Control application's alerts and information volumes.
We highly recommend keeping it set to maximum volume at all times.



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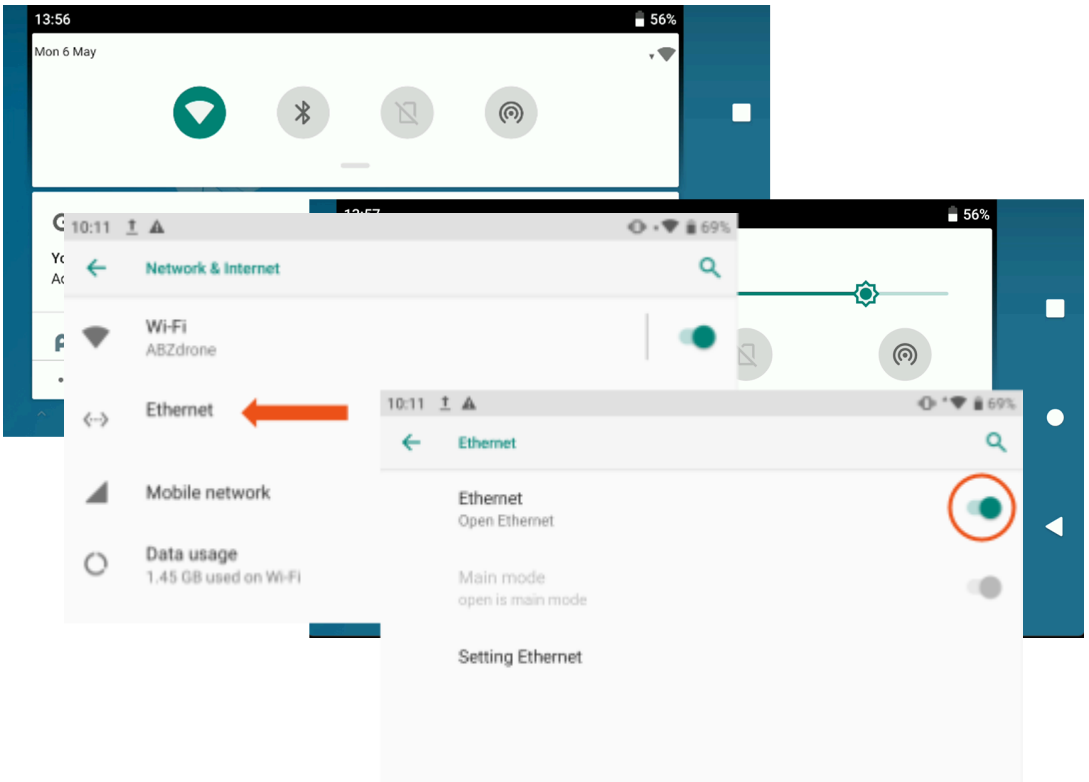
Network settings

To ensure the proper functioning of the ABZ Control application, the Ethernet connection must always be turned on. This setting is available under *Android Settings > Network & Internet.*

Internet connection

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's Settings menu (by swiping down from top), by long pressing the Wi-Fi or Bluetooth icon, or by tapping the gear icon.

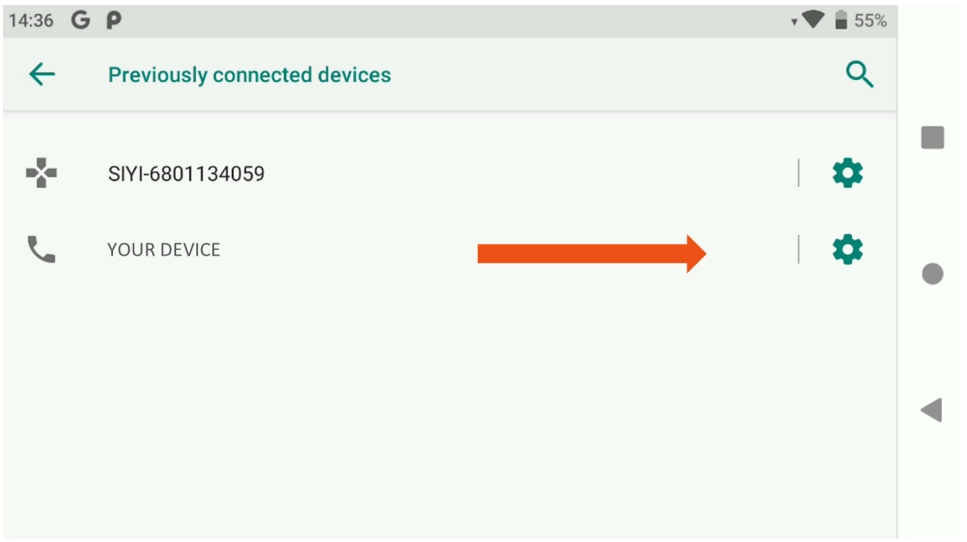


In the submenu the function can be switched on/off and the available devices can be connected. Wi-Fi only works on 2.4GHz networks. If the controller does not recognize the Wi-Fi from your mobile device, using Bluetooth connection for internet access is recommended.

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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.
5. Tap on the gear icon next to the device name, then turn on the Internet access.



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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:

- **Manual (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 GPS coordinated position.

- **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.

- **(AltHold flight mode (WITHOUT GPS positioning - *DevMode)**:** By default, this manual flight mode is **disabled** on the RC. To enable it, go to *ABZ Control > Settings > ABZ Flight > Advanced*. Once enabled, AltHold mode can be activated with the ***C* button**.

  In this mode, flight, braking, and stopping must be controlled manually with the sticks.The drone does not maintain its position, and the pilot must counteract wind forces. The drone maintains altitude using only its barometric pressure sensor, so the pilot must pay attention to altitude changes caused by atmospheric and weather conditions.)[4]

Emergency stop: In case of emergency, push the C button and D button simultaneously for at least 1 second. The motors will stop immediately, and the drone will crash into the ground.

[4] Only applicable for service flights

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The drone’s pitch and roll angles, turning radius, climb, and descent 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.



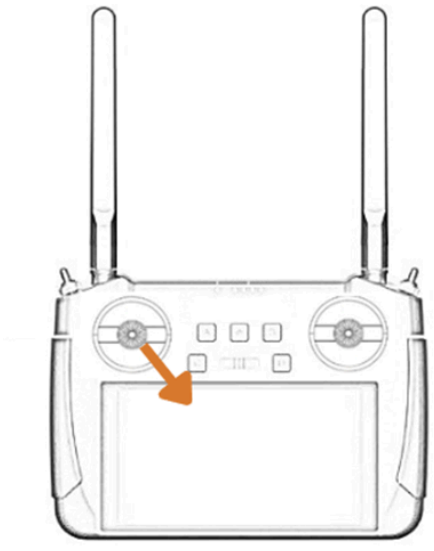
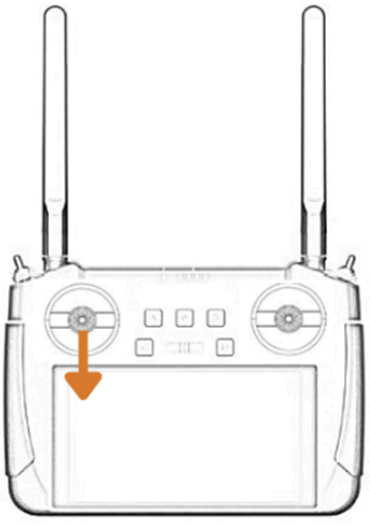


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- **Takeoff:** Switch to “Armed” mode by pushing the left control stick fully to the down-right position until “Armed” is shown on display, then release it.
- After the motors are started and **have reached operating speed**, fly the drone manually using the left stick in **Mode 2** (default), and **take off to a safe height (at least 3 m/9.8 ft).**
- **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 immediately, otherwise the system will detect your action as accidental and switch back to the mode previously selected.

Arm	Disarm
	

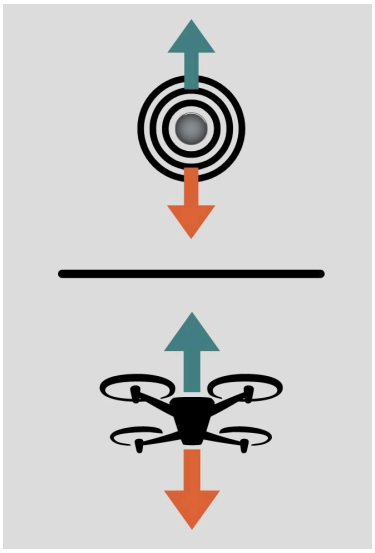
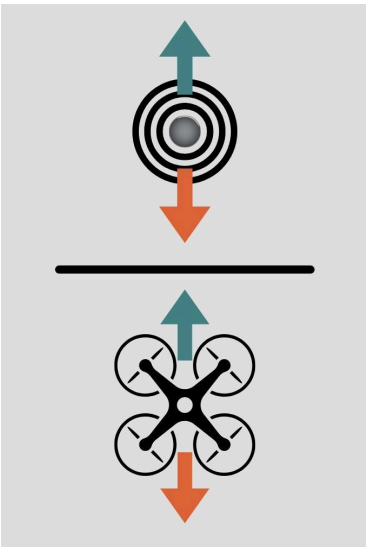
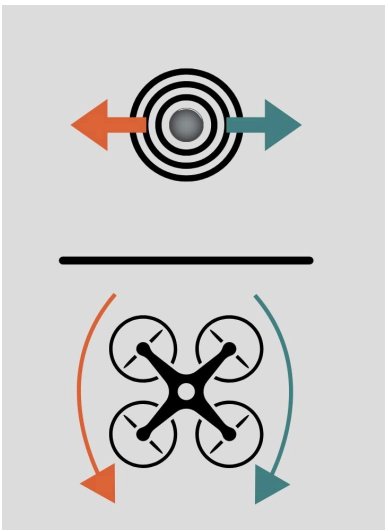
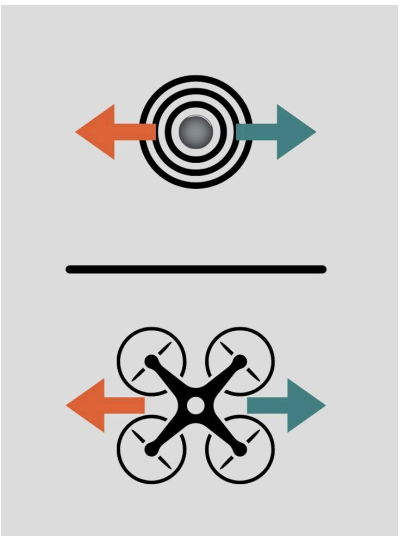
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When you arm or disarm the drone, a large orange text appears on the screen, notifying you of the drone's status change. If audio is enabled, a voice notification will announce the same:



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Default control (mode 2)

Left stick  **Up/down** **(Throttle)**	**Right stick**  **Forward/backward** **(Pitch)**
 **Rotation** **(Yaw)**	 **Left/right** **(Roll)**

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ABZ Control Software Overview

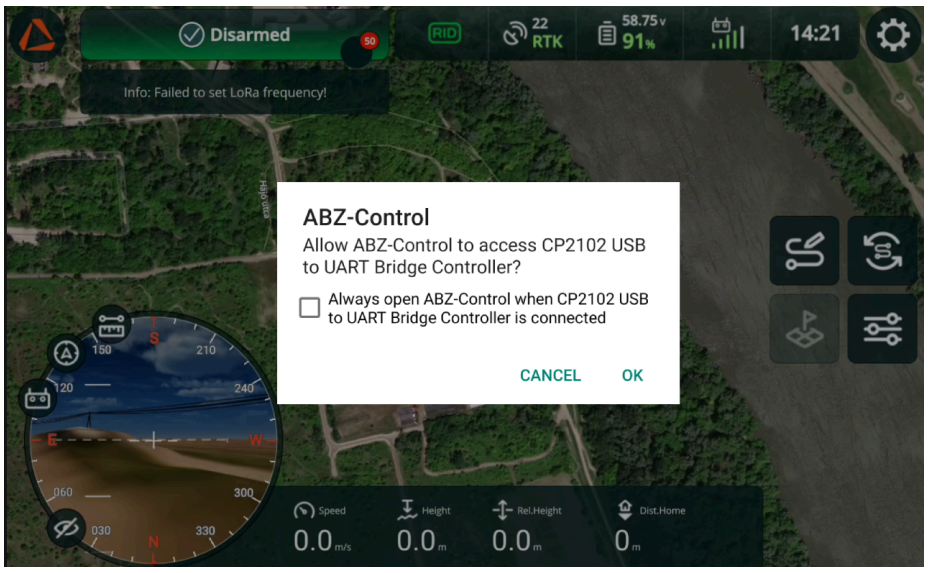
The M12 is compatible only with the controllers provided by ABZ Innovation with specialized ABZ Control software. Other devices or applications are not compatible for controlling the drone and, therefore prohibited to use with the drone.

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.

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

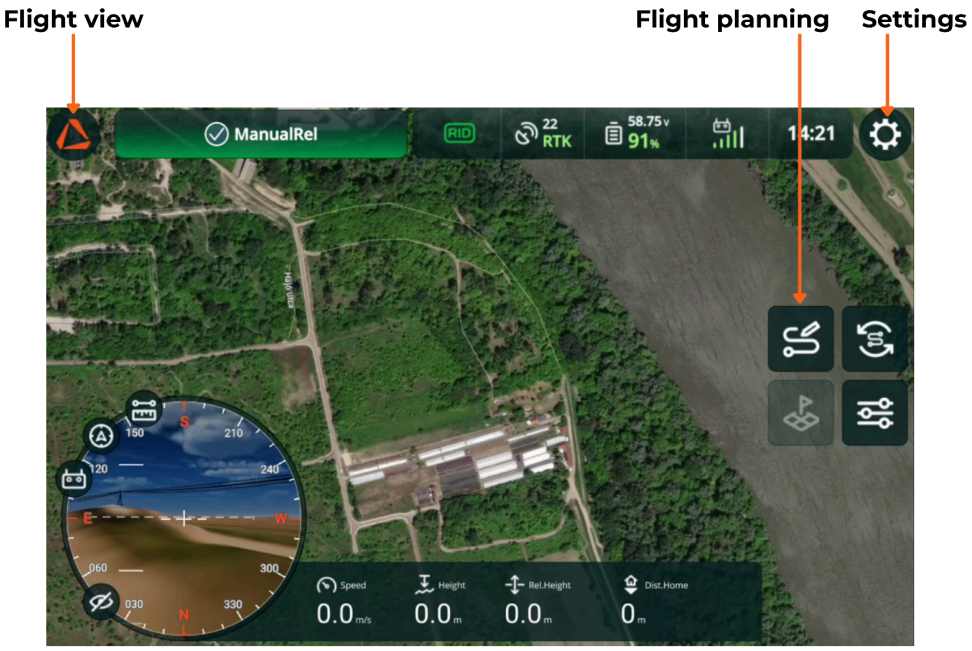


After starting the ABZ Control application, you will receive a pop-up window with the message: Allow ABZ Control to access USB to UART Controller. Click on OK.



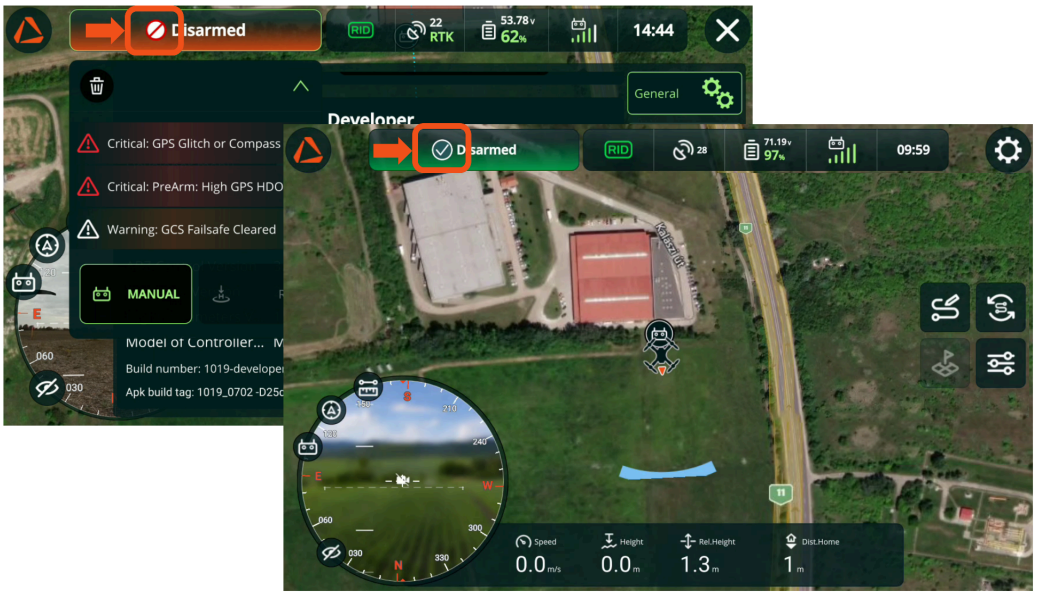
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After launching the application, the following screen will be displayed. In the top menu bar, you will find icons representing the main views. In the left corner, the ABZ Innovation icon navigates to the Fly View.



In the right corner of the top bar, you can access the Settings (gear icon) and the Flight Planning view.

After powering on and connecting the drone, you will see status icons at the top, including: Vehicle Messages, Remote ID Status, GNSS Status, Drone Battery Status, GCS failsafe.



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On the left side of the top bar, a red no-entry sign indicates that the drone is still preparing its systems for flight. If the icon changes to a green check mark, the drone is ready and can be armed.



1: Vehicle messages

2: Systems ready

- Not ready to fly
- Ready to fly

3: Flight mode and altitude hold method

4: Remote ID (RID) Status

- RID healthy
- RID unhealthy

5: GNSS status

Above: Number of satelites

Below: RTK connection feedback

6: Drone battery status

Above: Battery voltage

Below: Charge percentage

7: Remote controller battery status

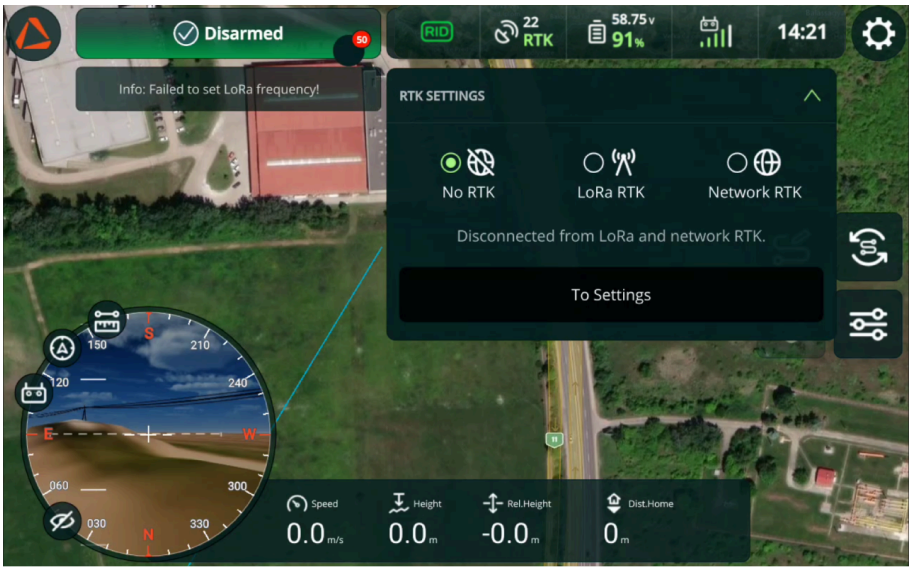
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The RID icon shows the operational status of the Remote ID system. If the icon is green, the Remote ID is broadcast correctly. By clicking on the icon, you can check the health of the systems providing the necessary data for the Remote ID module. For further information regarding Remote Identification, see [Mandatory Remote identification with Dronetag].



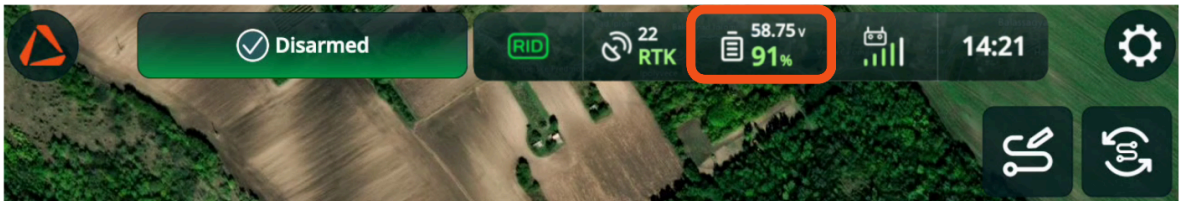
In the event of a Remote ID system error caused by insufficient GPS coverage on the drone or the remote controller, or by a hardware malfunction, the drone prevents arming!

By clicking on the GPS icon, you can enable the RTK connection and select the RTK source. For further adjustments, click the **To Settings** button to access the **Settings > RTK** menu.



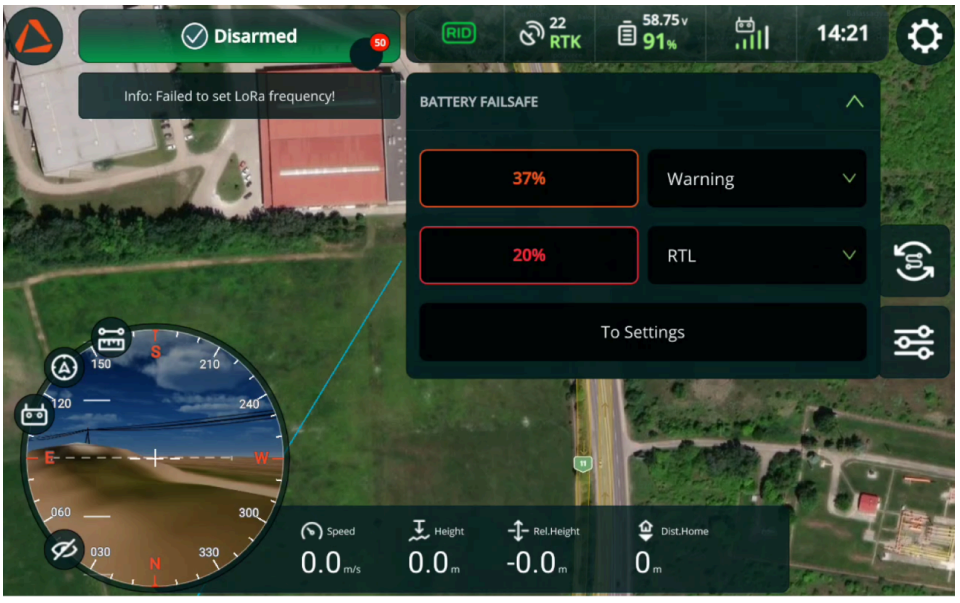
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Next to the drone battery icon, you will see the charge percentage and battery voltage. During the flight, you must continuously monitor the battery voltage, which should remain above 43,5V, even when flying at the Maximum Take-Off Mass (MTOM).



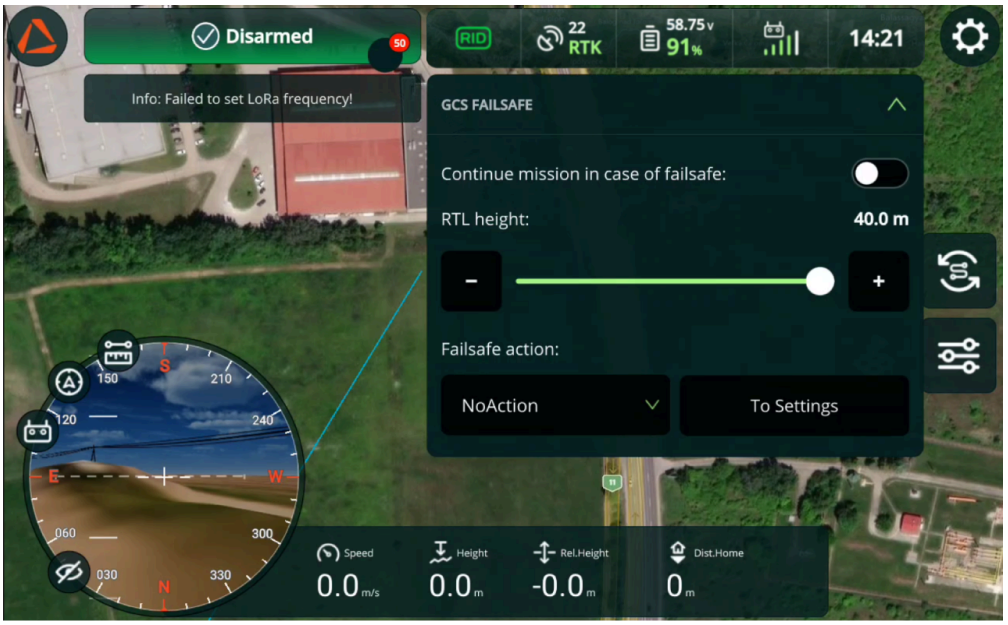
The state of the drone battery should also be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge.

By clicking on the battery icon, you can change the Battery Failsafe settings. For further adjustments, click the To Settings button to access the settings menu.



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By clicking on the RC icon, you can adjust the GCS Failsafe Settings (Height and Action). For further adjustments, click the **To Settings** button to access the **Settings > Safety** menu.



In the Flight status bar, you can see information about the altitude hold method (Follow terrain with LiDAR or Relative) and the actual flight mode of the drone.

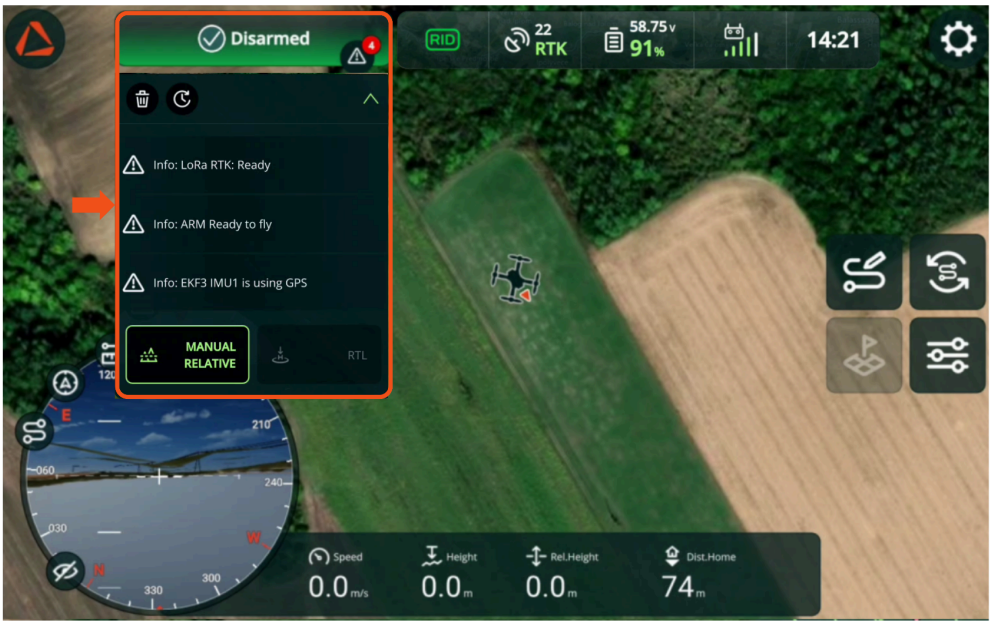


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It can show the following statuses:

- Disarmed
- ManualRel: Manual (Manual (Loiter)) – Relative mode
- AutoTerr: Auto mode – Follow terrain
- AutoRel: Auto mode – Relative mode
- RTL (Return to Launch mode)

Only fly the drone if the green check mark is visible, and the **Manual (Loiter) flight mode** is selected.



Click on the status bar to display the system messages. You can choose between **Manual** and **RTL** (Return to Launch) flight mode. When you select RTL the drone will immediately return to the launch point—without asking for confirmation—based on the settings defined under **Settings > Safety > Return to Launch**.

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1: Camera View
2: Operation Window
3: Telemetry Window

In the Fly view, with a mission uploaded to the drone, you will see three windows: the **Camera View** (1), the **Telemetry Window** (3), and the **Operation Window** (2).



The **Camera View** contains an artificial horizon, compass and home point marker. For a full screen camera view, click on the camera view window.

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When the full screen camera view is selected the map view displays in the small window at the bottom left corner. Rotate the dial to zoom in and out.

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On the **Camera view** window there are four function buttons:



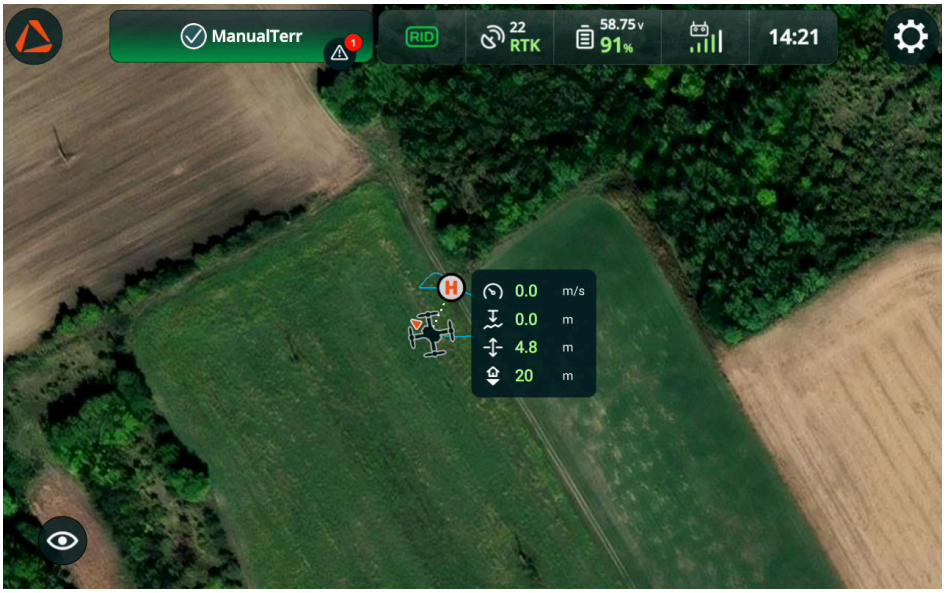
1: Measuring instrument
2: Drone position lock
3: Remote control position lock
4: Hide view

- Measuring instrument (1): Click on the icon to activate this function. Select locations on the map to measure distance, perimeter and area.



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- Drone position icon (2): Click on the icon to center the map on the **drone**.
- Remote control position icon (3) Click on the icon to center the map either on the **remote controller** or on your **mission**.
- Hide view icon (4): Click on the icon to **hide** the **Camera View** and the **Telemetry Window**. When this function is activated the telemetry data displays in a small window next to the drone icon. Click on the drone icon to hide the small telemetry display.



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The **Telemetry Window** displays real-time telemetry data, including operational information and drone measurements.



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

- **Speed** → The current speed of the drone.
- **Height** → The current height from the ground measured by the LIDAR.
- **Rel. Height** → The relative altitude from the takeoff point.
- **Dist. Home** → The distance from the Home point (takeoff point).

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If a mission was uploaded to the drone, the **Operation window** displays the upcoming steps for the pilot and provides access to essential functions throughout the automatic flight.

After arming the drone and taking off manually, the **Mission Start** button becomes available.



If the drone is in **Auto Mission mode**, this button will change to **Pause Mission**. When you click on Pause, the drone switches to Manual (Loiter) Mode.

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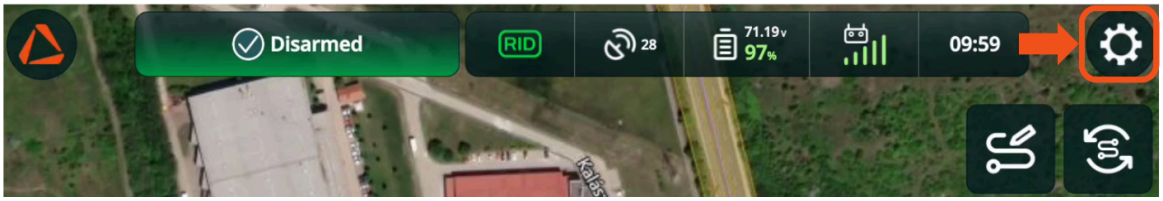
1: Go to operation button
2: Servo options button
3: Exit mission button

In the **Operation window**, you can access the Go To Operation (1), Servo Options (2) and Exit mission (3) buttons.

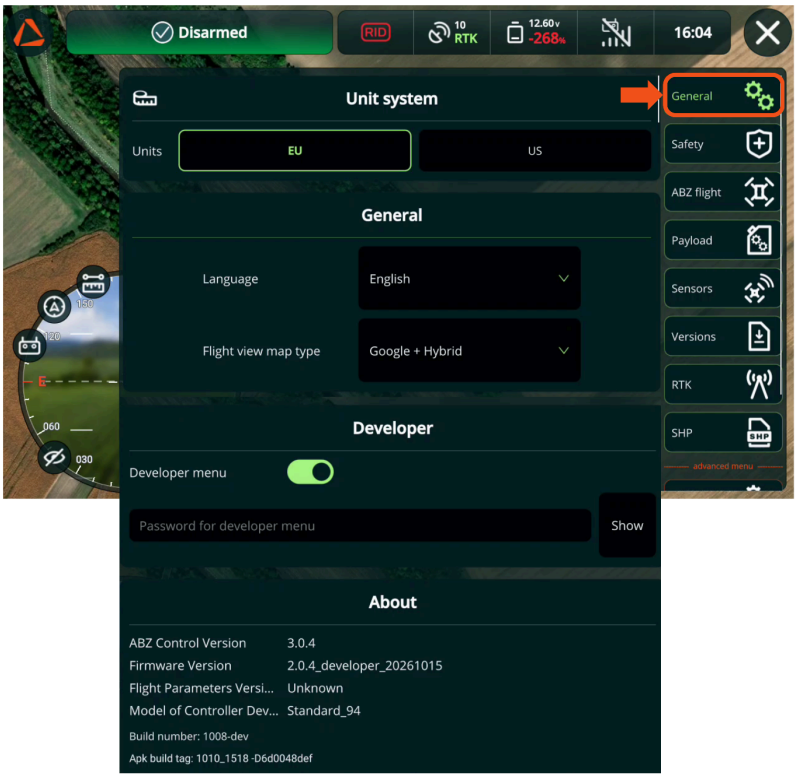
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Settings

In the **Settings** menu, you can change the user interface settings (e.g., language or units of measurement), configure the Failsafe and Mission-related behavior of your drone, set up the Obstacle Avoidance system, manage the shapefiles used during planning, configure the RTK correction, and adjust the default behavior of your drone. To access the Settings, tap the gear icon in the top-right corner of the screen.



In the General Menu, you can configure various settings, including the default measurement units used in the ABZ Control interface and on the online map used as the background of the Fly view.



The current software version of your drone is displayed at the bottom of this page.
If you contact our Support Center with an inquiry regarding your drone, you will be required to provide this information. The same details are also accessible via the *Settings > Versions* menu.

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Safety – Setting up FailSafe

When using a UAS, unexpected events may occur that require intervention. The FailSafe settings are required by law, primarily to prevent personal injury and property damage.

Under *Settings > Safety*, always check and configure the FailSafe settings before every new flight or mission.

- **General failsafe triggers:** 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.
  - Return at specific altitude: decide the altitude at which the drone flies in Return-to-Launch mode.
  - Return speed: decide the speed at which the drone flies in Return-to-Launch mode.
- **GeoCage:** you can set virtual boundaries that the drone will not fly over.
  - Circle Centered on Home means the drone will stop if it reaches the desired radius from the Home position.
  - Maximum Altitude means the drone will not fly over the desired altitude relative to the takeoff position.

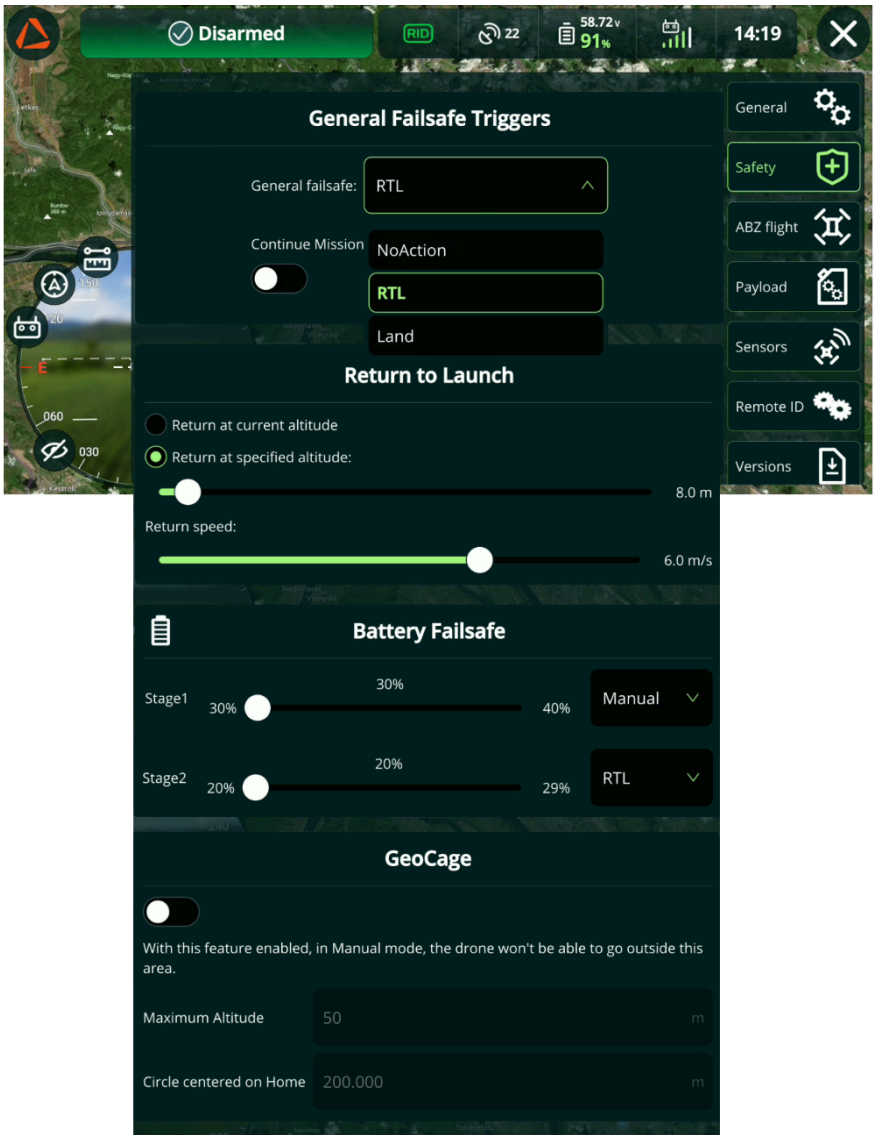
    For more safety instructions when you use the Geocage with AltHold flight mode, see Brake mode.

You can also configure the drone's heading behavior and flight speed during Return-to-Launch mode. To adjust these settings, go to *Settings > ABZ Flight > Heading behavior during RTL*.

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.

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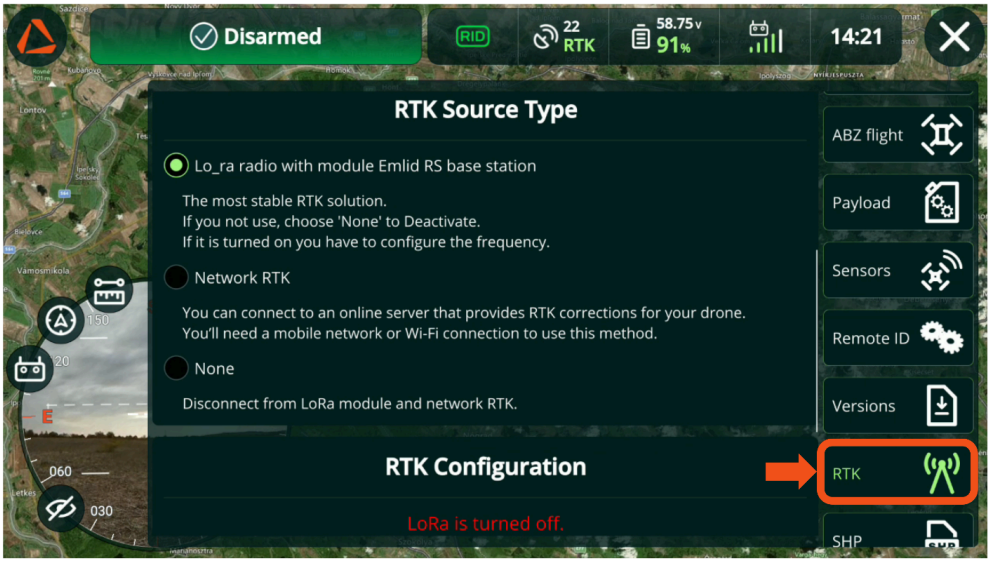


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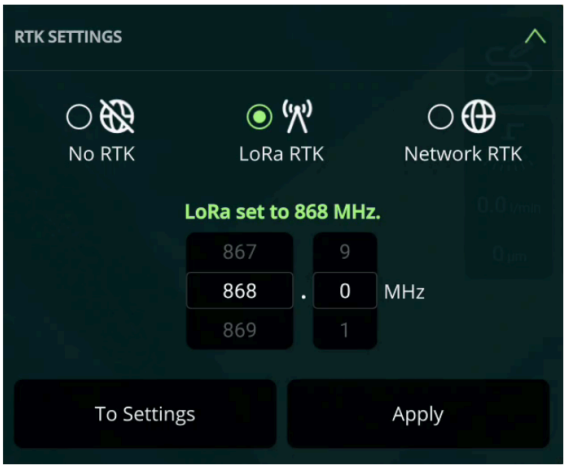
RTK configuration

In the **RTK** menu, you can connect to an RTK correction data source to achieve centimeter-level positioning accuracy during flight. You can connect either to:

- an online server server that provides RTK for your drone(Network RTK),
- an **Emlid base station** via **LoRa radio**[5], local **NTRIP, or NTRIP (via the Emlid Caster)**.



If using an **Emlid RS base station with LoRa**, make sure it is configured to **Output: LoRa**, and that the frequency matches the Base output value specified in the Emlid flow app.

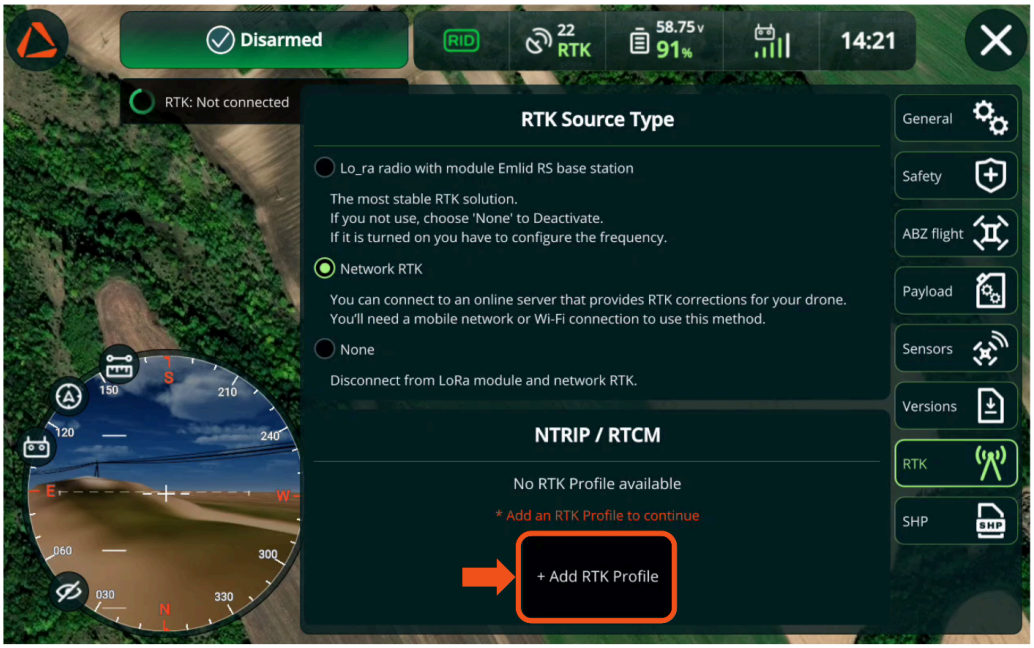


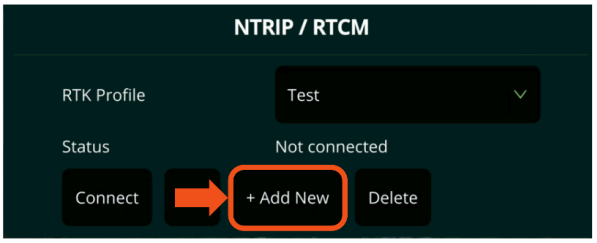
[5] **The LoRa connection to the Emlid base station is only applicable for drones equipped with LoRa modul.**

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Under **Network RTK**, you can connect to a Network RTK environment, or to the nearest Continuously Operating Reference Station (CORS) through an NTRIP Caster. You can also connect to your Emlid base station through **Local NTRIP** or **NTRIP**. (For more information about connecting to the Emlid base station,Emlid RTK section).

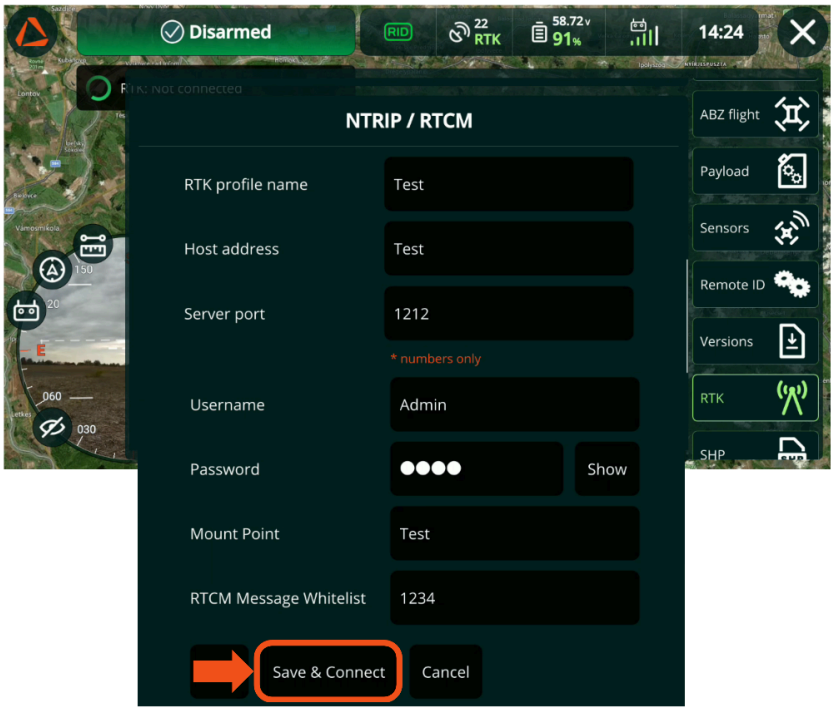
To receive corrections from a Network RTK provider, connect to the internet with your mobile device as a hotspot.



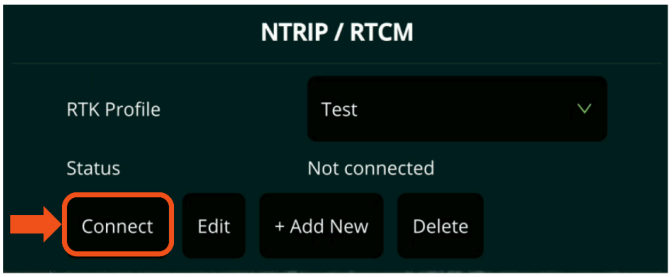


To receive corrections through NTRIP connection, make a profile by clicking **Add RTK Profile** or **Add new**. After you give a name to the profile, enter the credentials given by your NTRIP service provider. Click on **Save & Connect**.

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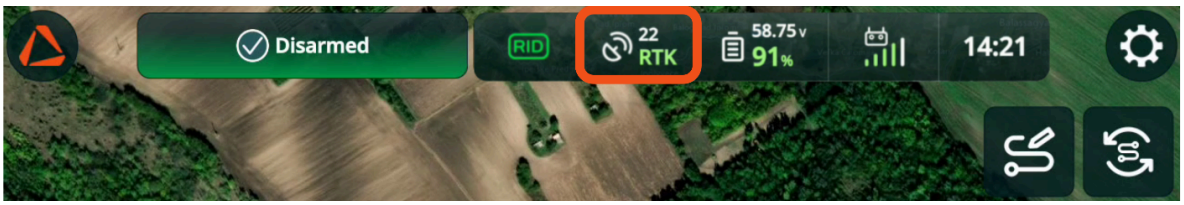
You can save multiple RTK profiles. To connect to an RTK Profile, select it from the list and click Connect.



To edit the Credentials of an RTK Profile, click on **Edit**. To delete an RTK Profile, Click **Delete**.

If you choose to fly with an RTK source, the system will only allow you to arm the drone if the correction data is accurate enough to ensure proper drone positioning.

If RTK correction is available and accurate, the "RTK" status will appear next to the GNSS icon in the top bar.



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Settings: SHP

In the SHP menu, you can import Point, Polygon, or Polyline shapefiles to use as a boundary, mission route, or visual guide for mission planning.

To successfully import a shapefile, make sure that:

1. You select a folder that directly contains the shapefile folder or a `.zip` archive.
2. The shapefile folder includes all the required files: `.shp`, `.shx`, and `.dbf`.
3. The folder name matches the filenames.

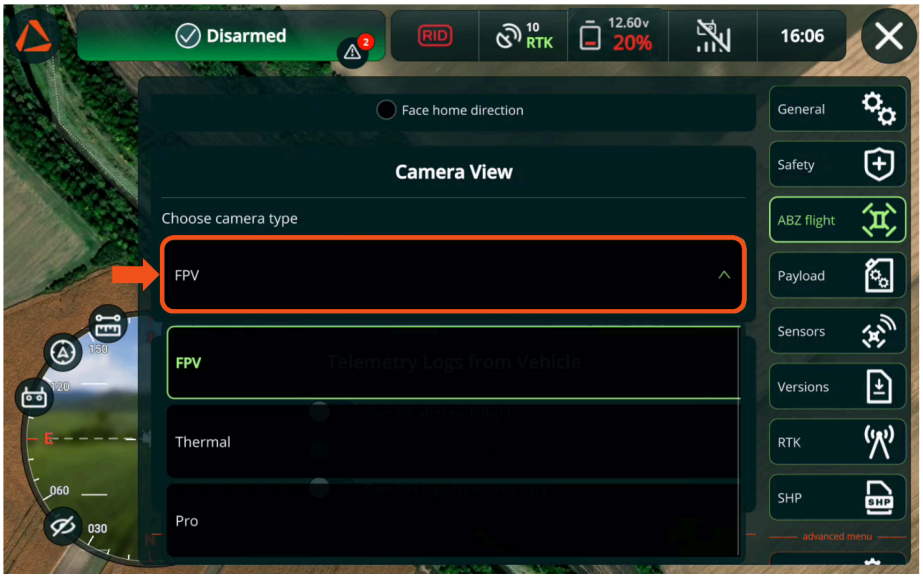
For further information, see the To import a shapefile into ABZ Control section.

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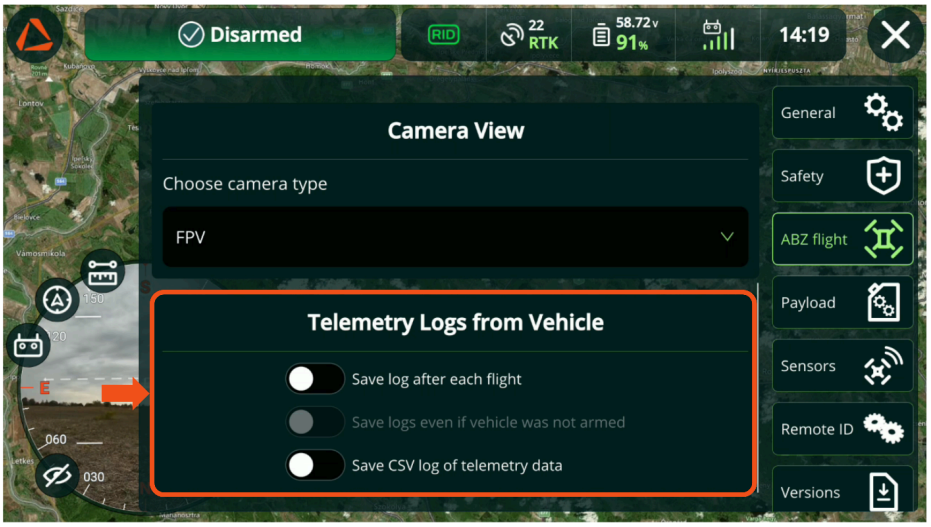
Abz Flight

In the **ABZ Flight** menu, you can enable **Obstacle Avoidance** for both Automatic and Manual (Loiter) flight modes, and configure the drone's mission-related behavior.

Under the Camera View section, you can see the camera type used by ABZ Control. The default setting is FPV.



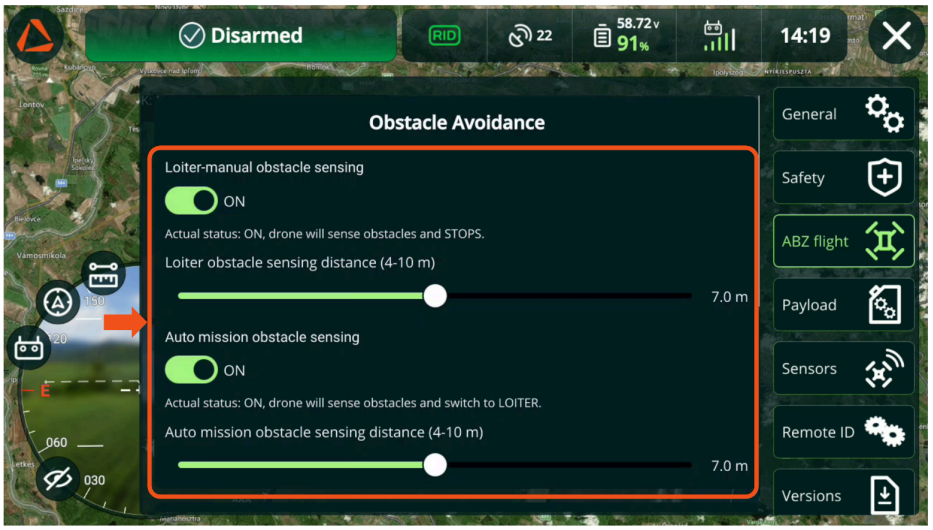
You can save the telemetry log files of your flights by checking in the Save log after each flight. The data will be saved to the folder under *ABZ Control > Telemetry* folder.



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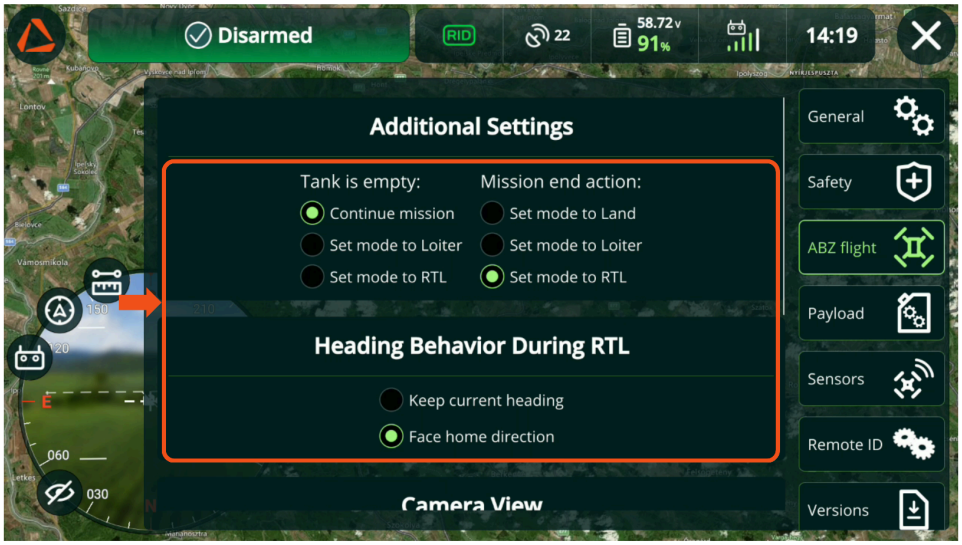
Adjusting the Obstacle Avoidance Options (only for drones equipped with LiDAR)

Under the **ABZ Sense** section, Obstacle Avoidance can be enabled for both **Manual** (Loiter) and **Auto Flight** modes (including waypoint-based automated missions and Go To operations). You can also specify the obstacle sensing distance, which determines how far the drone should stay from obstacles. For more information about the ABZ Sense Obstacle Avoidance system, section.



Additional Settings in ABZ Flight

Under the **Additional Settings**, you can configure the drones automatic behaviour during Mission. You can decide what the drone should do when the Tank is empty and when it finished the Mission.



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- **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 Manual (Loiter) or returning to launch (RTL).
- **Tank is empty:** 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 ABZ Control software.
- **Heading behavior during RTL:** You can choose the direction the drone should face when returning to its home point. The drone can either maintain its current heading or orient itself toward the home location.

IMU - Compass calibration

Under the IMU option, the **Compass Calibration** can be carried out. **The calibration should only be performed if requested by the software or instructed by the Support Center.**

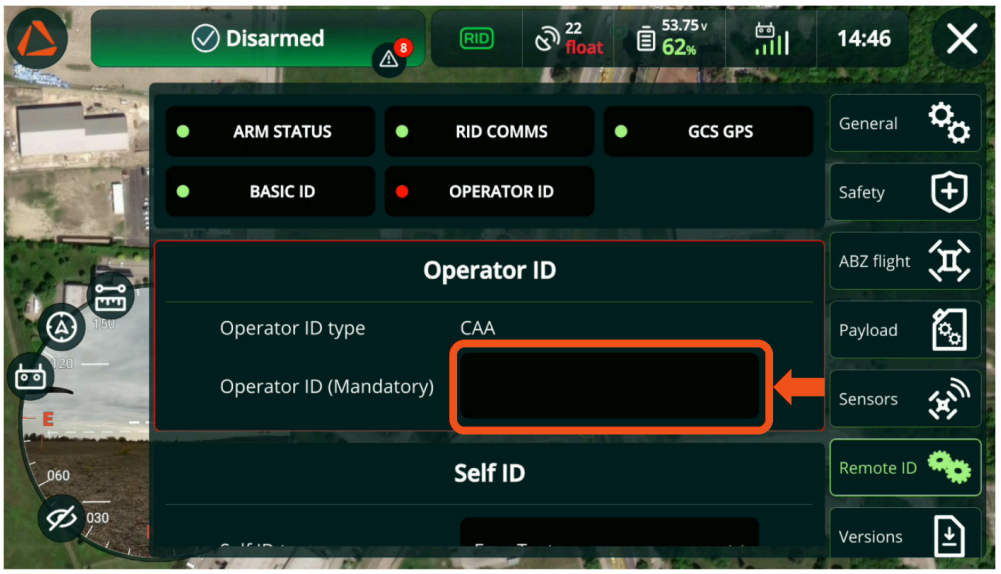
For further instructions, see Compass Calibration section.

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Remote ID

In the **Remote ID** section, you can set the **SELF-ID** to transmit during operation. Use this function if you want to show your identification, the flight task, or both. This helps to make persons feel safe when the UA operates near them.

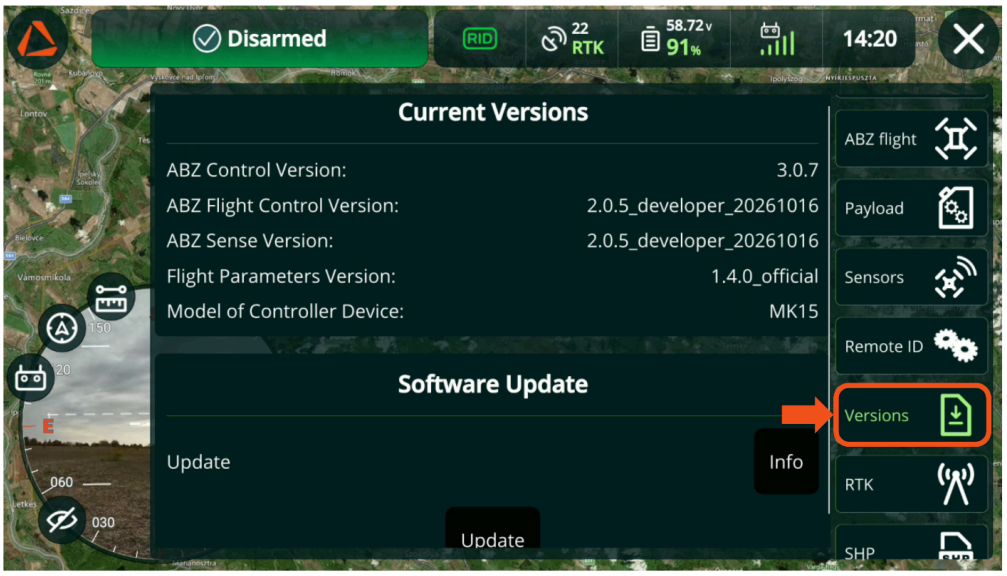
If you operate the drone in the European Union, you must register as a drone operator on the official website of your National Aviation Authority. After you register, you receive a registration ID number. Enter this number in the **Operator ID** field.



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Software versions and Update

You can check the current **drone firmware** and **ABZ Control software** versions under **Settings > Versions.** If you contact our Support Center with an inquiry regarding your drone, you will be required to provide this information.



ABZ Innovation communicates all new software releases via email. Only perform updates when instructed to do so by ABZ Innovation.

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ABZ Sense (only for drones equipped with LiDAR)

Obstacle Avoidance with ABZ sense (only for drones equipped with LiDAR)

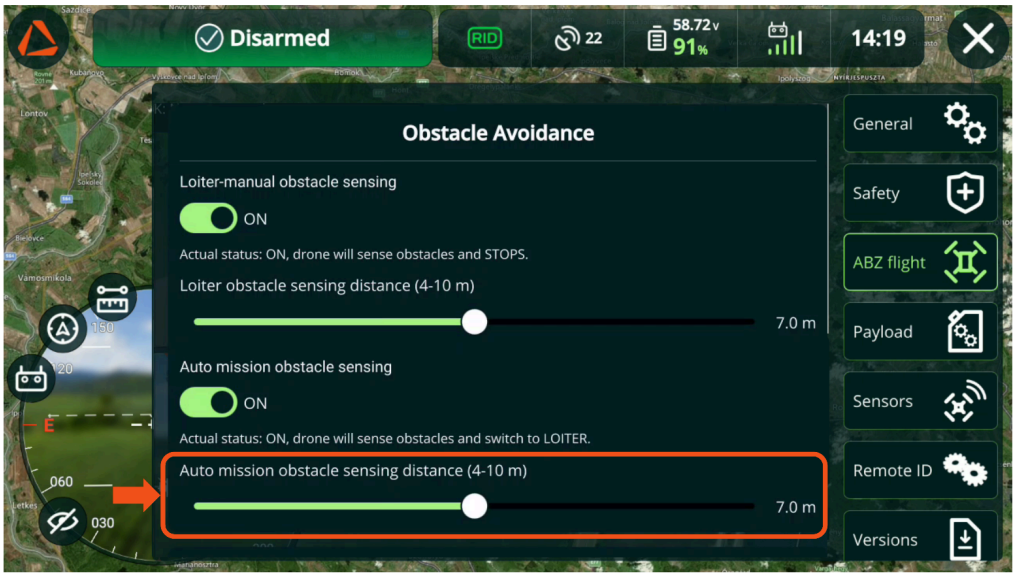
The ABZ Innovation M12 drone uses the Multi beam LiDAR based ABZ Sense system to provide reliable obstacle avoidance, ensuring safe and efficient drone operations.

The Obstacle Avoidance (OBA) function is available in both manual (Loiter) and automatic flight modes. By default, it is enabled in manual mode and disabled in automatic mode. The obstacle avoidance is NOT FUNCTIONING when flying home with the „Return to Launch - RTL" function.

You can enable or disable Obstacle Avoidance via **Settings > ABZ Flight.**

When flying with obstacle avoidance enabled, the drone constantly analyzes its environment using its multi-beam LiDAR system. If an obstacle is detected, the drone stops at the distance defined as the obstacle avoidance distance.

The obstacle avoidance distance can be set between 4 m (13.1 ft) and 10 m (32.8 ft), and can be considered outside of the drone's braking distance (you do not need to consider the braking distance when defining it). The drone consistently preserves the set distance from obstacles, actively pulling back when necessary.



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If flying with obstacle avoidance enabled, you will see a blue arc moving at a fixed distance in front of the drone, indicating the scanning range. If the distance between the drone and the arc decreases, an obstacle has been detected.



Never rely exclusively on the obstacle avoidance system.

Always pay attention and observe the drone and its surroundings closely during flight.

Using obstacle avoidance, which is an additional safety feature, does not eliminate the need for pre-mapping obstacles, as executing missions with pre-mapped obstacles is always more time-efficient and precise.

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What to do if the drone stopped because of an obstacle?

1. If flying an automated mission with OBA enabled, the drone will switch to Manual (Loiter) mode after detecting an obstacle and stopping at the defined distance.
2. If the drone has stopped, manually navigate it parallel to the obstacle until you reach the end of it.
3. Define a return point on the mission's route by clicking on the map.
   Tap the X button to modify the position of the return point.
4. Tap the checkmark to continue with the mission.
5. In the pop-up window, reconfirm the mission settings. The drone will fly to the designated return point and continue the mission from there.



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Go To Operation

The **Go To** function allows the pilot to command the drone to fly to a specified location at a selected relative altitude and speed. To start a Go To Operation,

1. Arm and take off with the drone.
2. In the **Fly view**, click the **Go to** icon.



3. **Define the target position** by tapping the desired location on the map. Use the map view to improve the accuracy of the selected position.



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Warning: Be aware of the inevitable inaccuracy of the background map, which can be several meters off!

3. In the pop up window, set flight speed and the altitude of the Go To Operation.



- **New altitude:** The drone uses **relative altitude control**, with the launch point defined as **0 m**.

  When selecting the altitude, consider the terrain and all potential obstacles along the route and at the target location.

  The drone will rise gradually until it reaches the value defined under New altitude. If the altitude is changed, define the new position from at least **5 meters from the actual position of the drone.**

- **Set the flight Speed** for the route.

4. Click **Apply** to start the Go To operation.

   After confirmation, the drone will proportionally ascend or descend to the specified altitude and then maintain the selected altitude using relative altitude control based on barometric and GPS data. It will then proceed toward the target position at the configured speed.

Warning: Before starting the Go To operation, the pilot must verify that the selected target position and the planned flight path are safe and free of obstacles.

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Servo Options

You can manually activate payloads connected to the servo outputs of your drone. To adjust the PWM value of a servo output, go to **Fly View** and click the **Servo** button.



Set the desired PWM values and click **Apply** to send the value to your Payload(s).
The **Servo Option** is available in **Manual Flight** mode and during **Go To** Operations.

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Altitude control

Based on the characteristics of the working area (terrain and plant coverage) and the requirements of the spraying mission, you can choose between three altitude control methods.

- Follow terrain (LiDAR based)
- Relative
  - Barometer based
  - GPS based

In most cases, it is recommended to use the Follow Terrain altitude hold method, which relies on the ABZ Sense system. The multi-beam LiDAR continuously scans the environment and, based on a temporary real-time map generated from the point cloud, continuously and precisely adjusts the drone's altitude. This method is ideal for challenging terrains and plantations with significant height differences, such as vineyards and orchards.

If flying in Relative Altitude Hold mode, the drone's altitude is maintained relative to the takeoff point.

In **Return to Launch (RTL)** mode and during automatic return-to-mission procedures, the drone uses the **Relative Altitude Hold** method to control altitude.

By default, Relative Altitude Hold mode uses barometric measurements as the primary height source. The drone's altitude is maintained relative to the takeoff point. The pilot must be aware of altitude variations caused by atmospheric and weather changes. This mode is best suited for uniform plantations and flat terrains.

If you are flying with an **Emlid base station or Network RTK source using correction data,** the drone relies on GPS information as Primary Height source. This is the optimal solution in conditions where the LiDAR's normal operation is limited—such as when flying over water bodies, glass surfaces, or other reflective materials.

In automatic flight mode, you can predefine the altitude hold method for the mission in the Mission settings.

If Relative Altitude is selected, the drone relies on either barometer data or GNSS for altitude control, depending on the use of RTK correction. If GNSS data becomes unreliable, the drone will switch back to barometric altitude hold.Always define the mission altitude measured from the highest point of the plants you will be flying over.

In Return to Launch (RTL) flight mode, Go To Operations, and during Return to mission, the drone will use the relative altitude hold method.

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Flight planning

You can access the drones Flight planning features from the flight view page.



1: Flight planning
2: Load mission
3: Advanced planning

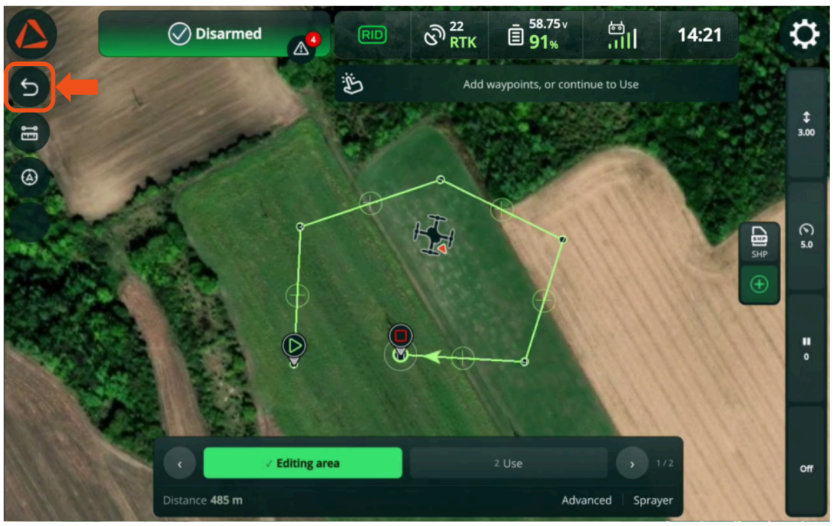
To load previously saved missions click on the **Load mission** button (2).

To plan a new mission click on the **Flight planning** button (1), then click on the **Advanced planning** button (3).

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For safety reasons, if your location or flight plan changes, clear the previous mission from the drone using one of the following methods:

- Click **Exit** in the **Operation** window under **Fly View**.



- Click **Back** on the **Flight Planning** page.



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Waypoint based Flight Planning

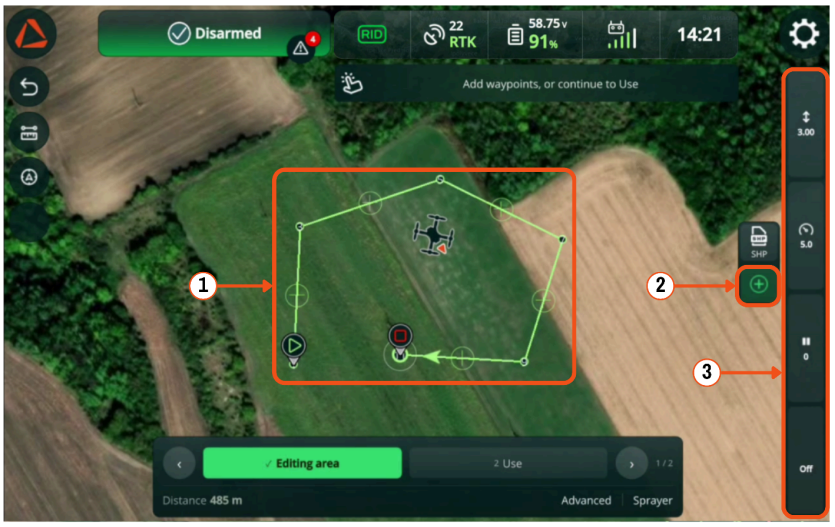
Advanced Planning

Advanced Planning is a mission planning interface designed for creating complex tasks—such as differential applications or spot treatments—by providing full control over the drone's flight paths. Unlike Manual Planning or Area Drawing, where boundaries must be set, this feature gives you complete control over the drone's flight routes.

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.

Waypoint mission planning process

To enter the **Advanced Planning** select the **Mission Planning** icon. See the Flight planning section.

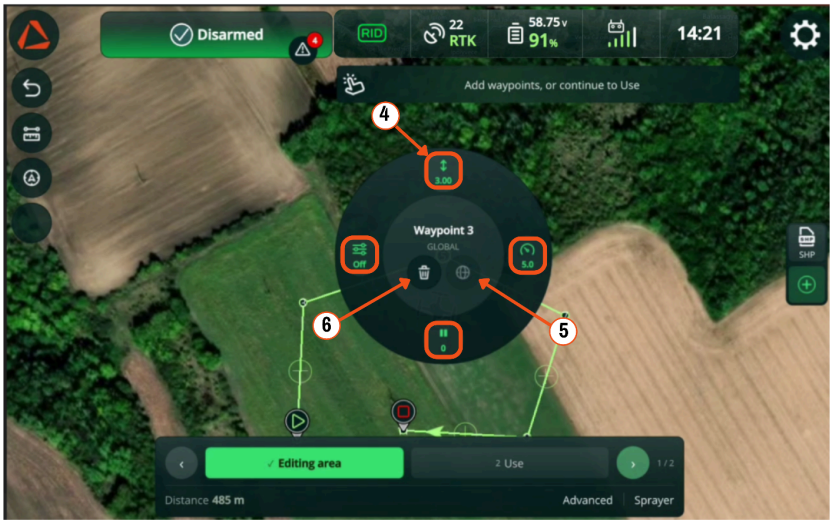


1: Drone's route
2: Add waypoint icon
3: Global settings

Activate the **Add waypoint** option by clicking on the icon (2). You can set specific waypoints by tapping on the remote controller's screen to create the drone's route.(1). Grab and move the points to reposition them.
You can add visual guides to the map to help you with the accurate placement of the waypoints by clicking the SHP icon. It offers several options: Point, Polyline (Lineshape file), or Polygon. For further information, see the Using shapefiles as visual guides section.

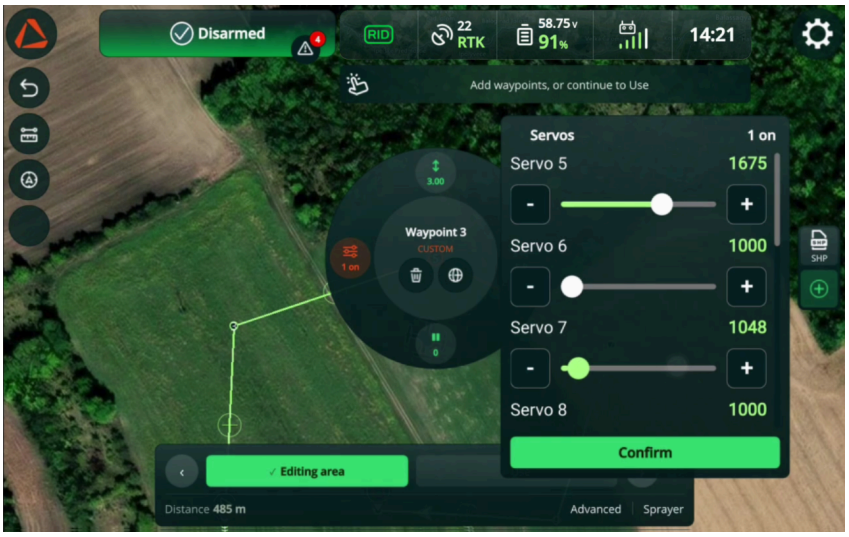
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You can also open a Polyline shape to configure it as a Waypoint mission.
After adding the waypoints, set the global settings parameters (3) such as altitude and mode, speed, hold and servo settings.



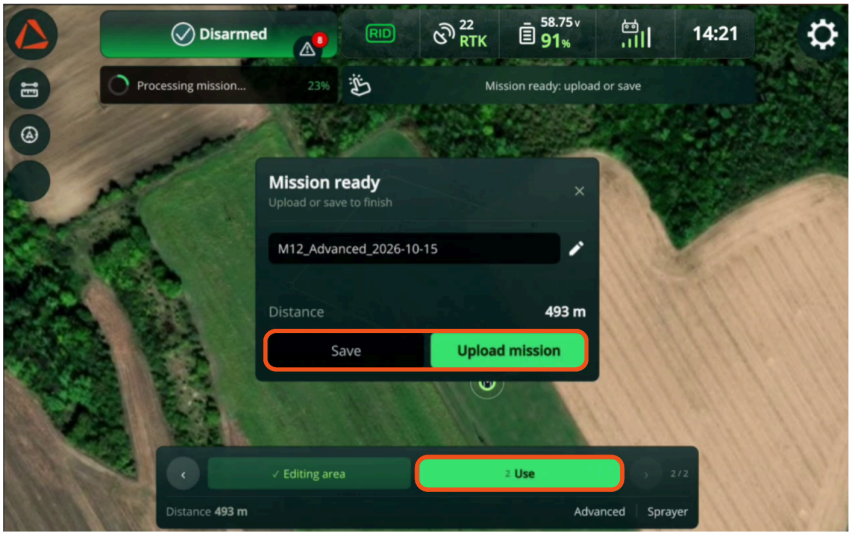
4: Flight parameters
5: Globe icon
6: Delete waypoint icon

You can adjust the flight parameters (4), including altitude and speed, individually for each waypoint.
Click the globe icon (5) to restore the global settings or the bin icon (6) to delete the waypoint.

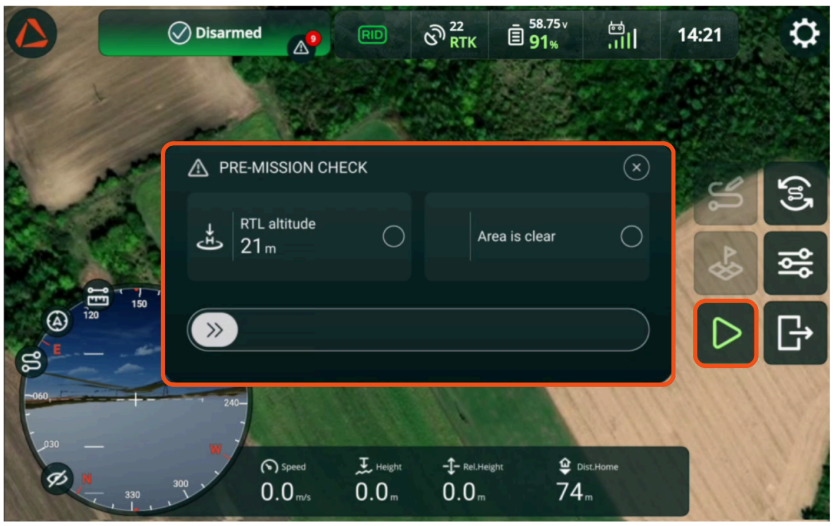


Custom parameters remain active until the next waypoint. Any new waypoint added to this section inherits these custom settings.

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After editing the mission, click on **Use** and **Save**. To transfer the planned route to the drone, click **Upload mission**.



To start the mission, tap on the **'Start Mission'** button in the Operation window after manually flying the drone to a safe altitude.
The system prompts you to confirm the RTL altitude setting and verify that the area is clear. Confirm both using the slider. The mission starts automatically after confirmation.
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.

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Using shapefiles for mission planning

The ABZ Control supports polygon, polyline, and point-based shapefiles. You can use a shapefile in two distinct ways:

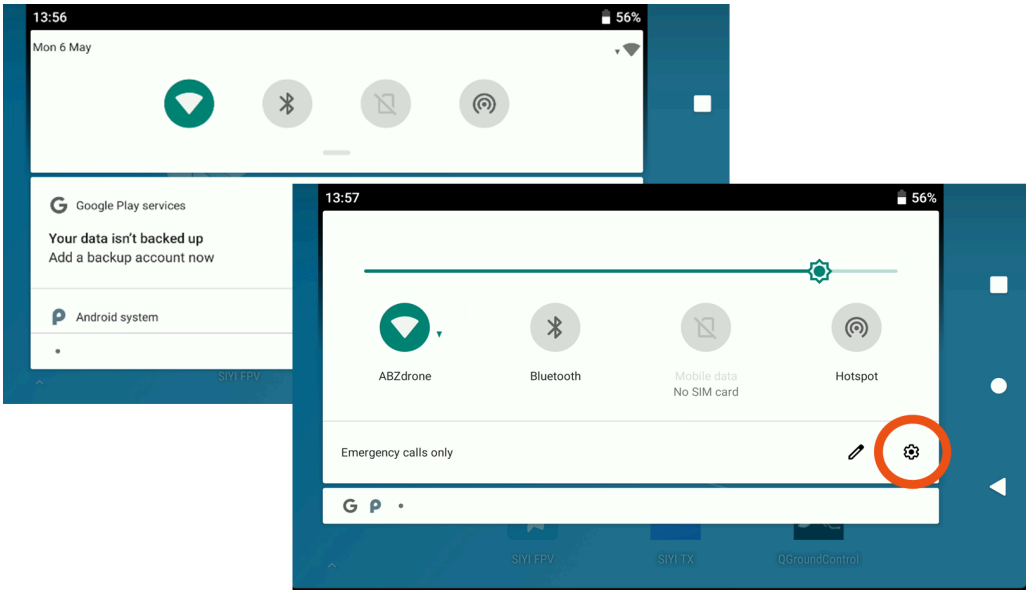
- To define **flight paths** (for further information see Planning a mission by loading a Polyline (lineshape) file
- To serve as a guide for precisely positioning the points of a boundary or waypoints

To import a shapefile into ABZ Control:

1. Make sure, **all** the needed shapefile parts are included in the .zip archive or shapefile folder (the files with extensions **.shp, .shx and .dbf** are present).
2. Ensure that the folder/archive has the **same filename** as the individual files.
3. Insert the SD card to the Remote Controller or copy the files to its internal storage with a cable:
   - ➢ If using an SD card:

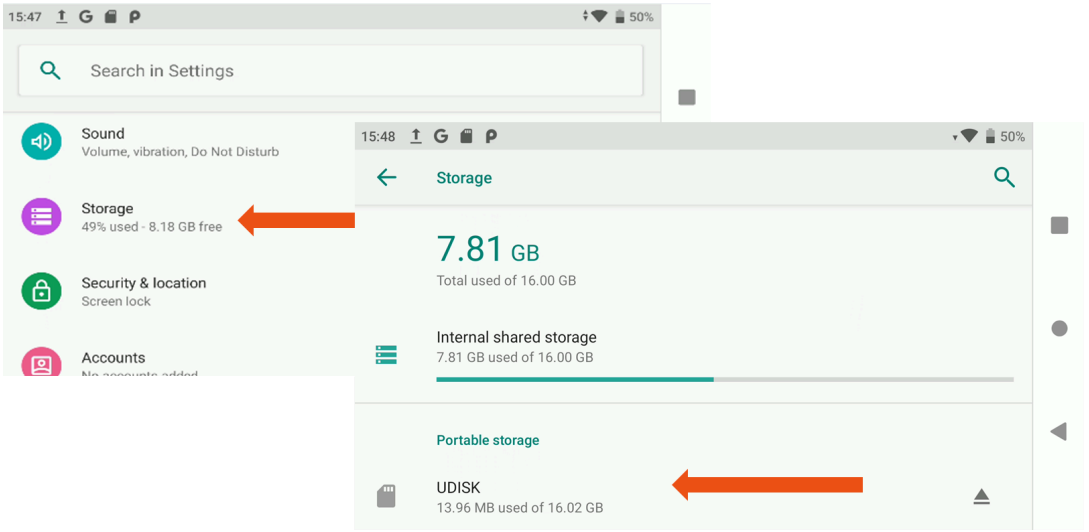
   A, insert the card into the SD card slot. Only MicroSD cards with a maximum of 32 GB capacity are supported. You can decide to import the files directly from the SD card or copy them to the Remote Controller:

   B, To copy them, wipe down from the top of the screen to access the Android menu, where you must press the gear (**Settings**) icon.

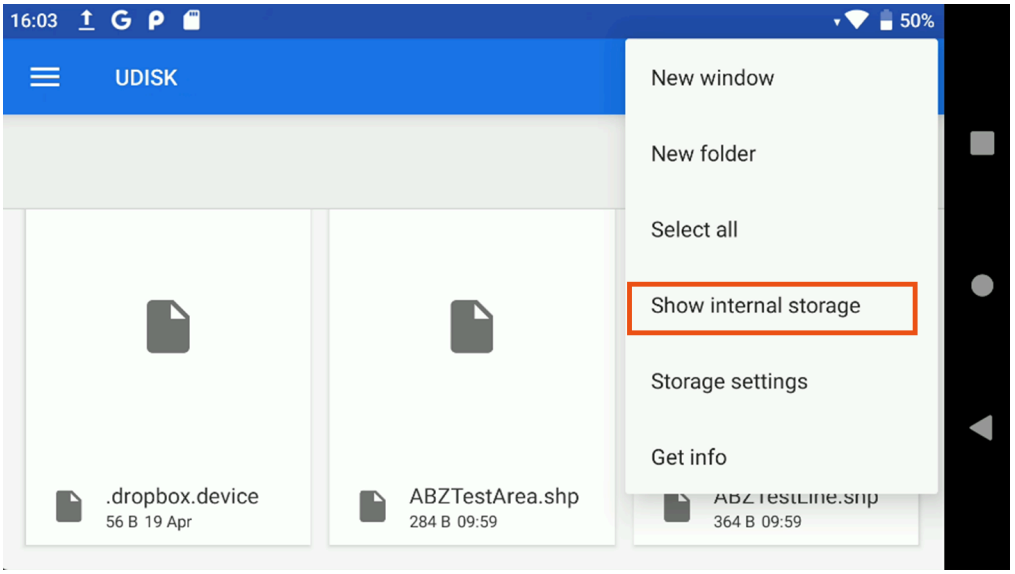


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B, In this menu, scroll down to Storage, where you can select to open the SD Card.

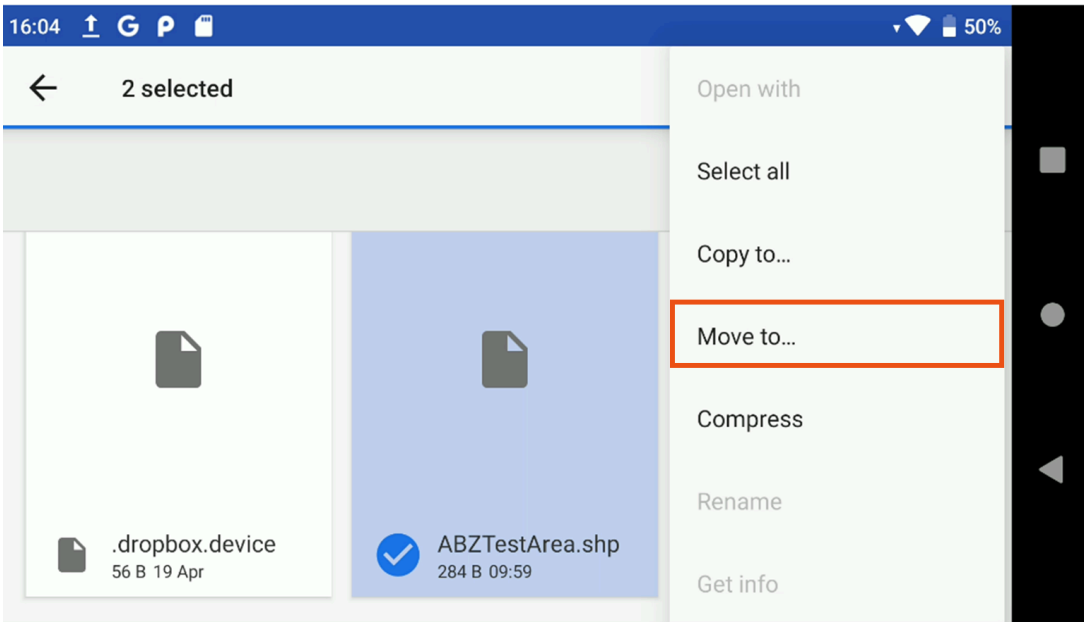


C, Tap the top right Others (3 vertical dots icon) menu, then **Show internal storage**.

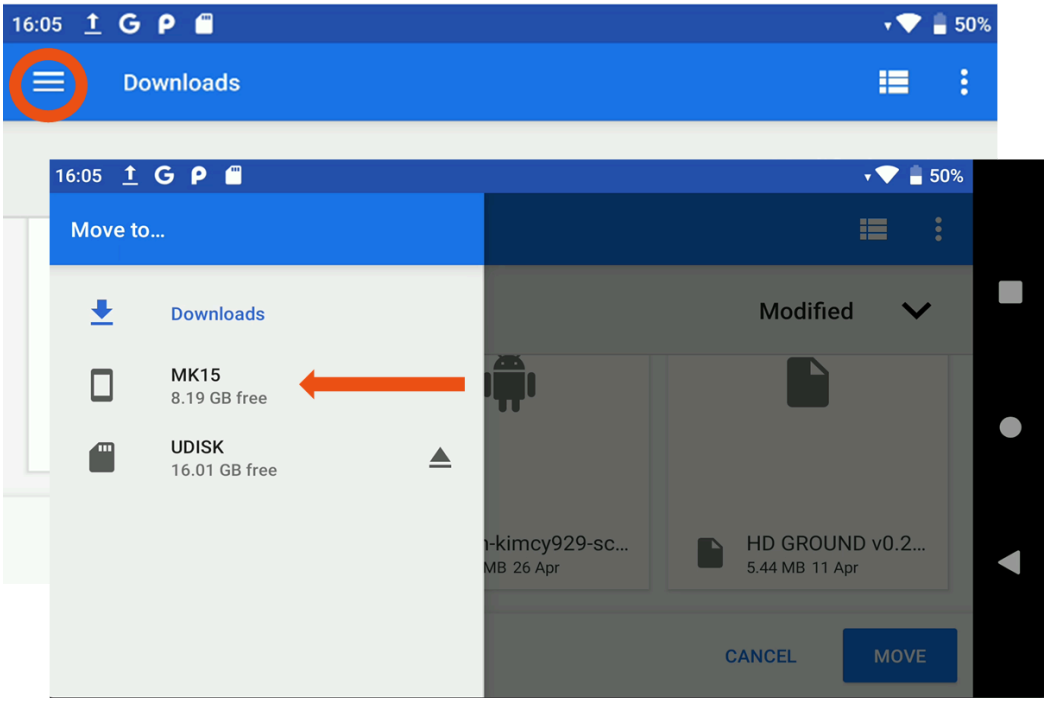


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D, Select the required files on the SD card (tap and hold), then click on the Others (3 vertical dots icon) menu in the right corner of the screen, and select Move to...



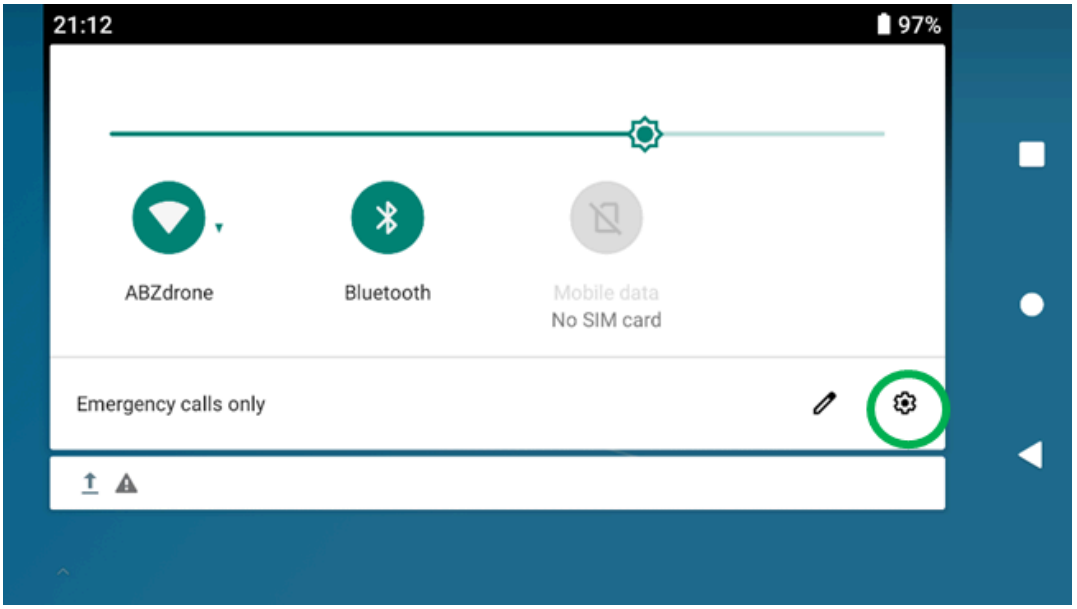
E, Click on the three lines on the left to open the navigation bar. Select MK15, then open the folder (e.g. Downloads) where you want to store your shapefiles. Click the bottom right Move button to move the files to the controller.



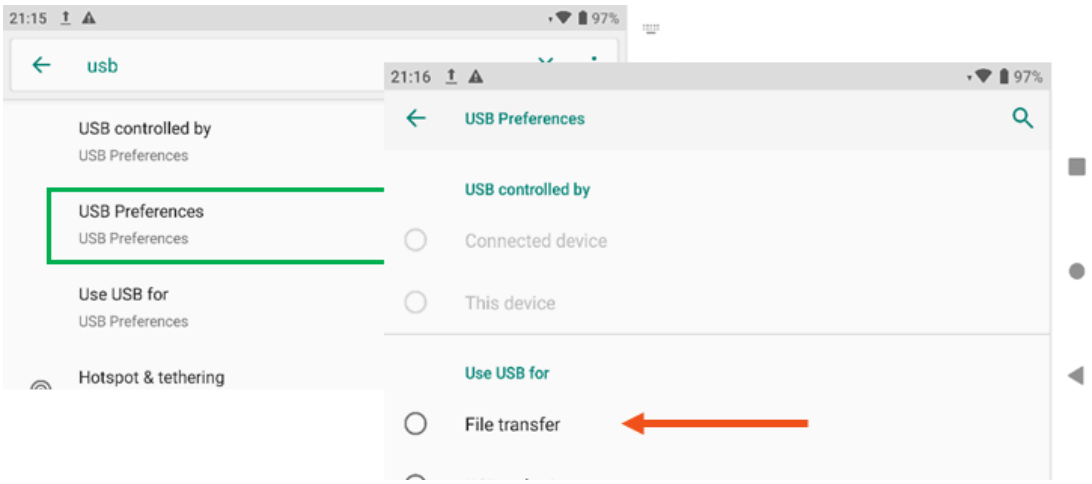
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➢ If you use a cable, connect the cable to the USB-C port of the remote controller and the computer.

A, Open the Android Settings by swiping down from the top of the screen.



B, In the search bar, enter “USB”. Look for the option USB preferences. Click on File transfer.

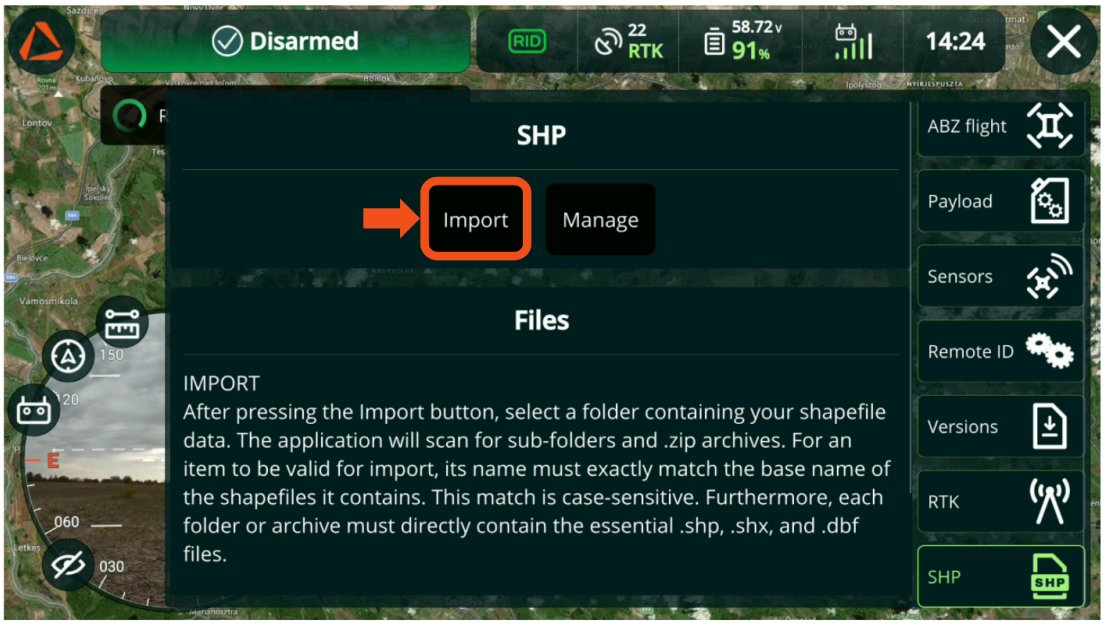


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C, On your computer, the device MK15 appears. Copy the shapefile to the Controller.

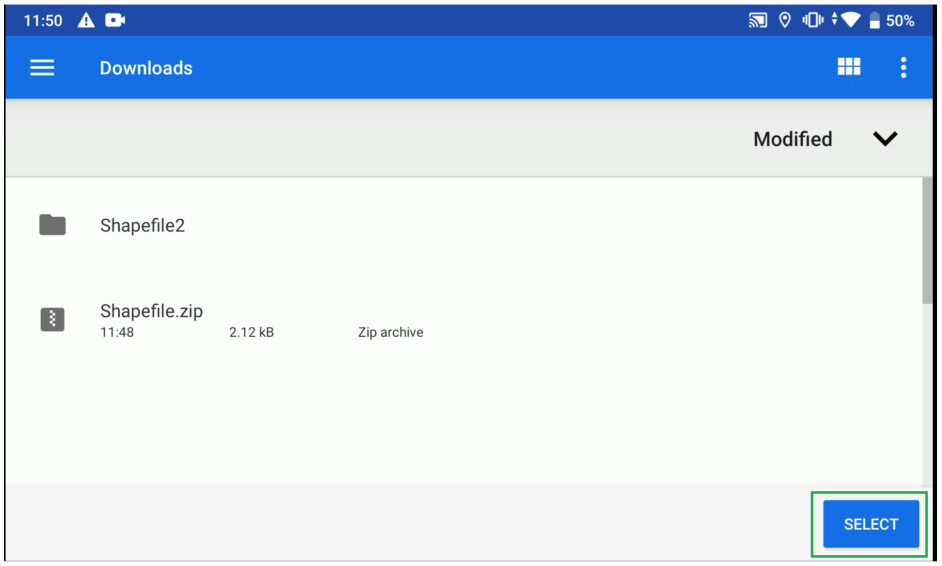
D, You can disconnect the cable.

4. Launch the ABZ Control, and open the *Settings* > *SHP* Option.
5. Click **Import**.



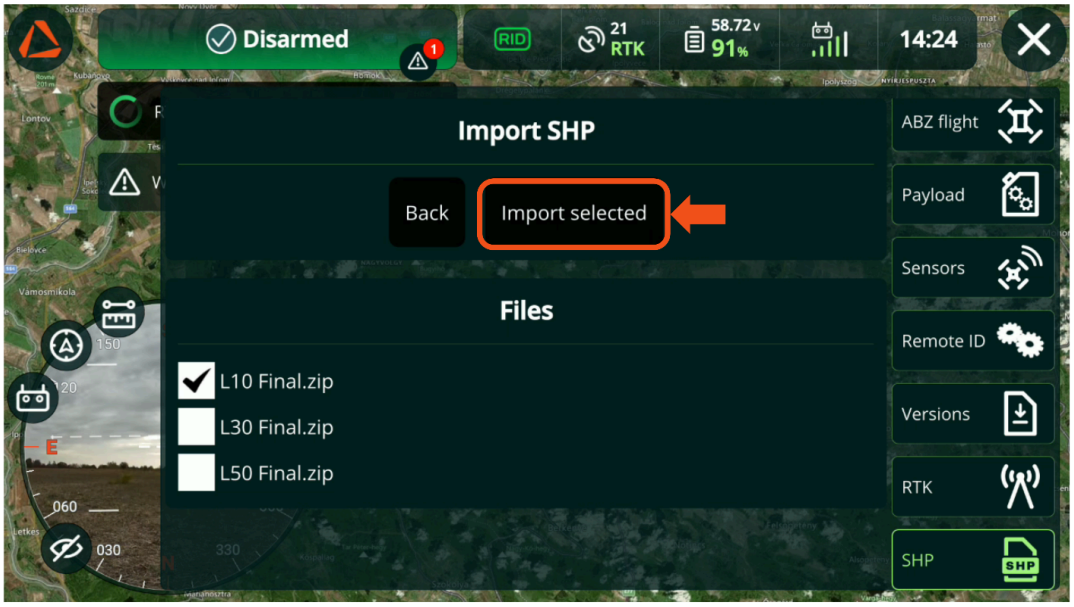
6. In the browser window, navigate to your shapefile folder/ZIP archive file. (Do not open it!)

7. Click on **Select**.

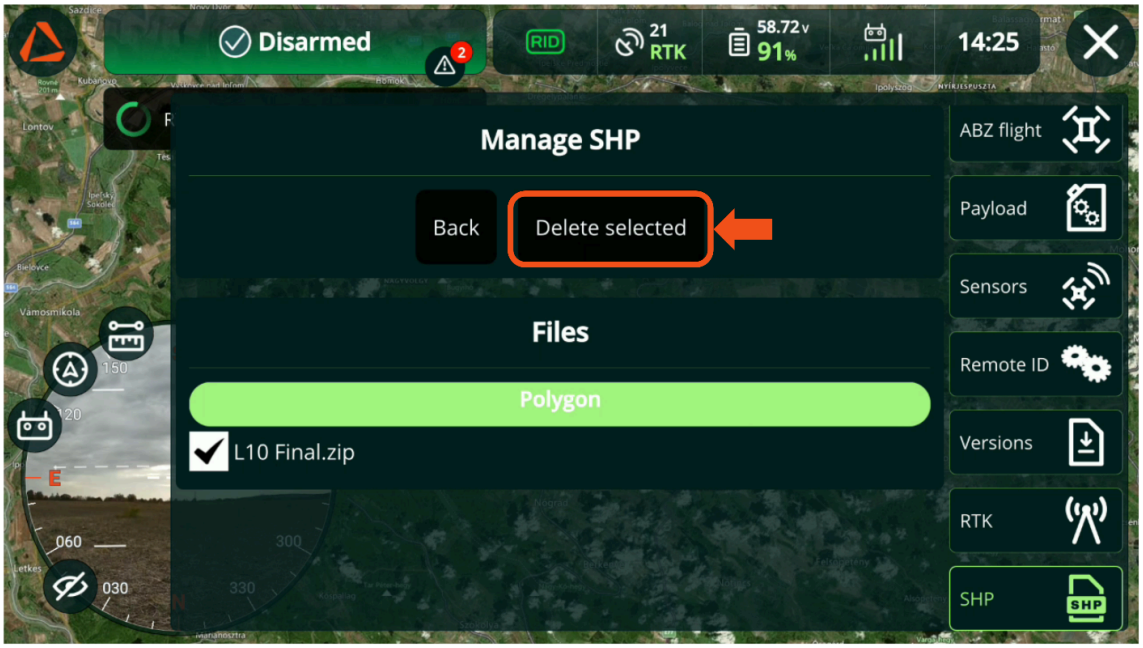


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8. Mark the needed shapefiles with a checkmark, and click on **Import selected**.



To Delete an imported shapefile, click on Manage. You will find the imported files grouped by their geometry. Select the files you wish to delete, and click on **Delete selected**.



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You can open the imported shapefiles to add them as a work route (polyline-based mission), or a visual guide:

- by clicking on Flight planning then selecting the **Advanced planning** option. For further information on the use of a shapefile as a polyline based mission, see the section Planning a mission by loading a Polyline (lineshape) file.
- For information on using shapefiles as visual guides, see the Using shape files as visual guides section.

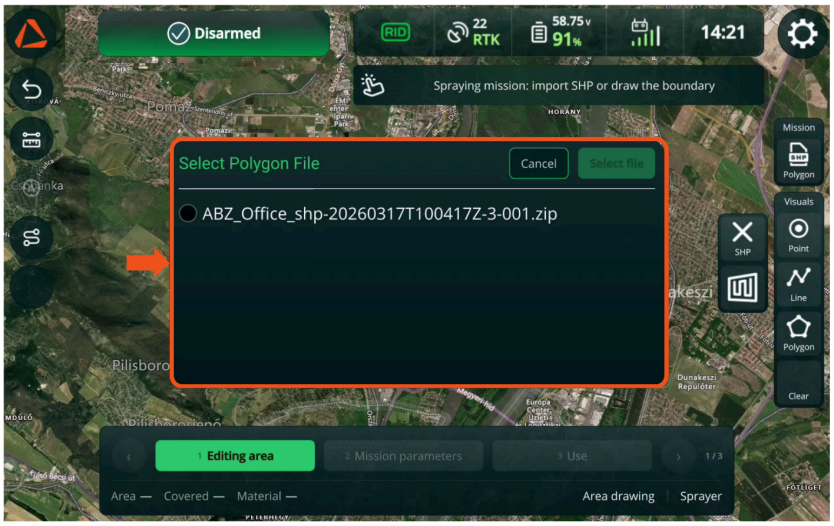
Using shape files as visual guides

In ABZ Control, you can insert point, polyline, and polygon shapefiles as a layer to support precise planning. This function is available in the **Advanced Planning** functions.

To open a shapefile as a visual guide, click on the shapefile icon. You can choose whether you want to use a point-, polygon-, or polyline-based shapefile as a Visual Guide.

After selecting one of the options, you will see the corresponding files previously imported to the controller.

Mark the needed file and click on Select File.



The shapefile will appear in the background, allowing you to use it for the precise placement of your waypoints waypoints (for more information about waypoint-based planning, see the Advanced Planning section). It is possible to use multiple shapefiles of different geometry types simultaneously.

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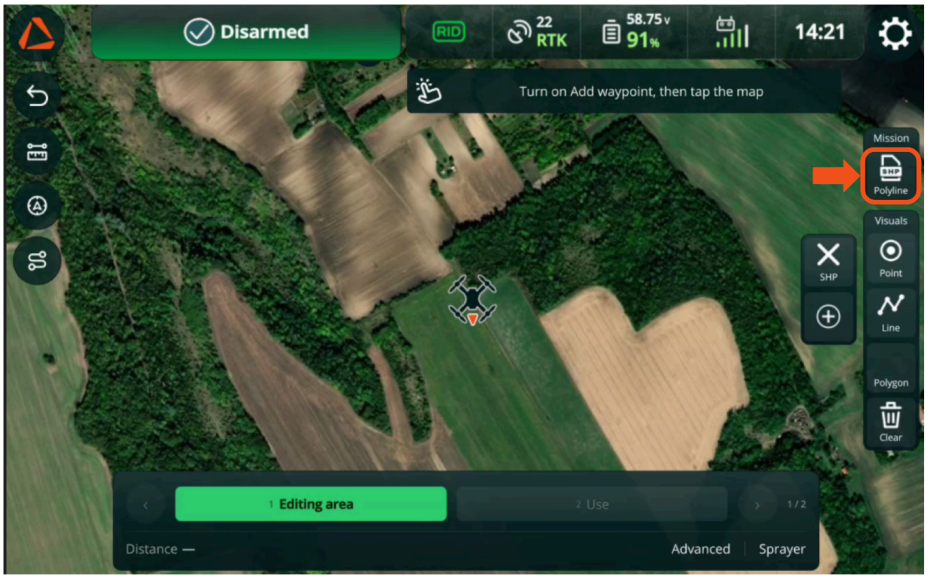
Planning a mission by loading a Polyline (lineshape) file

The files must be imported to the ABZ Control (Settings > SHP). For further instructions, see the To import a shapefile into ABZ Control section.

1. To Load a Polyline mission in ABZ Control, you need to open the **Advanced Planning** from the Mission Planning Page.

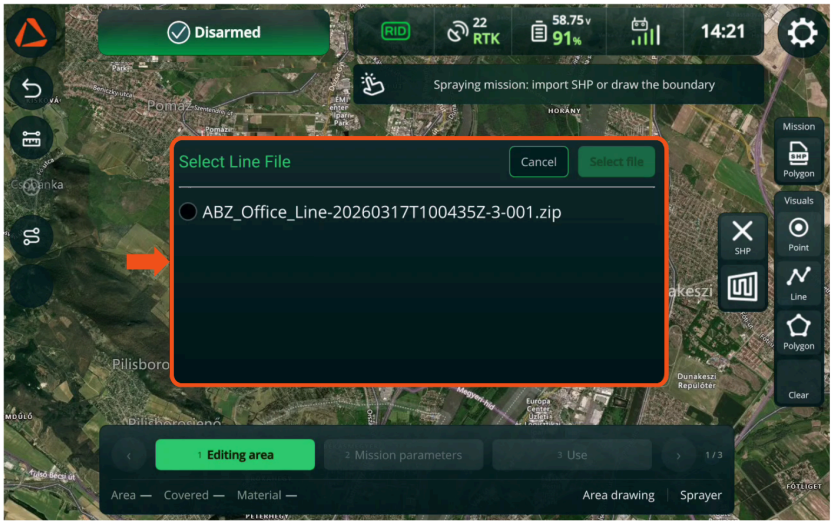


2. Click on the **Polyline button**.

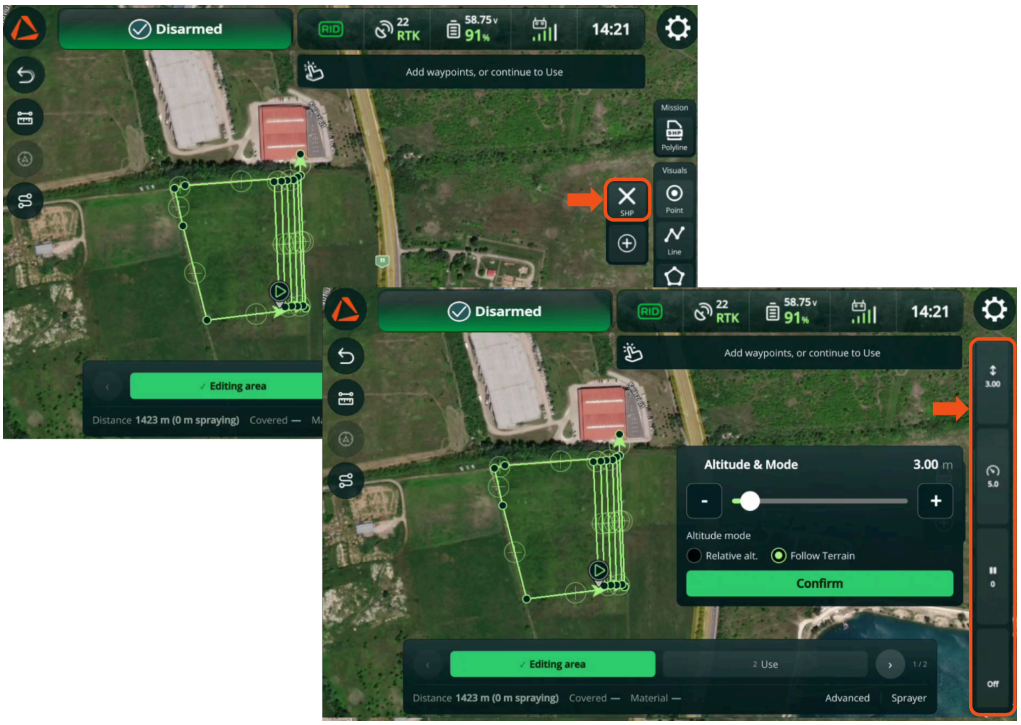


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3. In the pop-up window choose the file you want to open and click on **Select file**.

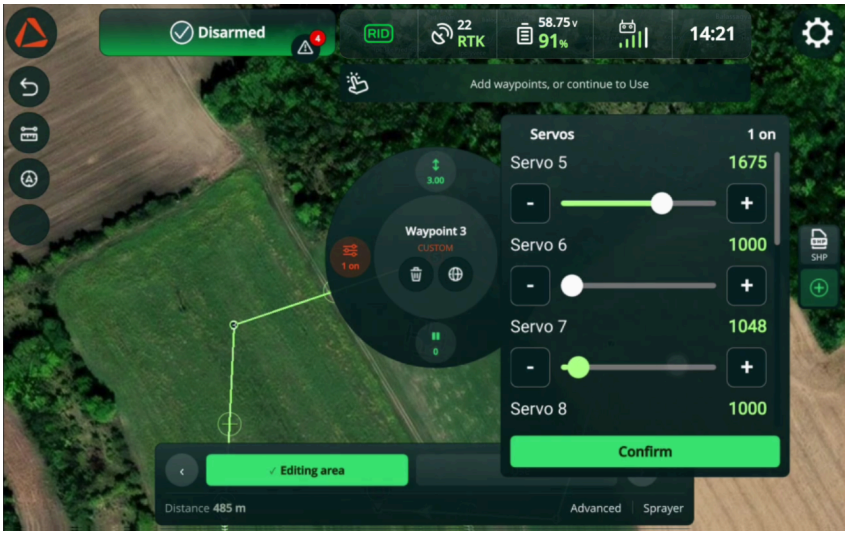


4. The editor shows the routes and waypoints on the map. Click the close SHP button to access the editor for the global settings. Set the global parameters for the waypoints.



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5. You can also configure the flight and payload parameters for each waypoint individually. Use the sliders to activate and set the **servos** for each individual waypoint. Custom parameters remain active until the next waypoint. Any new waypoint added to this section inherits these custom settings. Click the globe icon to restore the global settings or the bin icon to delete the waypoint.



6. After configuring the mission settings, click **Use**, then select **Save** to save the mission or **Upload mission** to transfer the planned route to the drone.

7. To start the mission tap on the **'Start Mission'** button in the Operation window after manually flying the drone to a safe altitude. The spraying will begin automatically.

8. Clicking the **Back** button to exit the planning page clears the mission from both the editor and the drone. If you have saved the mission, the file remains on the remote controller. To reopen it, click **Load mission**.

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Loading a previously saved mission

If you have saved a mission plan using 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 the Mission Settings in the Mission Panel, if needed. 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 **Fly 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 **Fly View** tap on the **'Start Mission'** button 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:

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Flight

Before flight, check **Failsafe settings** and adjust them according to the actual flight task and surroundings.

In case of unexpected operation, switch to Manual (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 Fly View to start the flight, switching to "Armed" mode.

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

After arming the drone, wait about 4 seconds for the motors to reach full speed before take-off. 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.

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** (Manual 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.

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Irregular operational conditions

In case of any abnormal behavior of the drone during automatic flight, immediate switching to Manual (A button) or if enabled 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.

Please operate the drone smoothly when flying at low altitudes and fly above 3m.

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 **Manual** (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, and the pilot must land the drone.



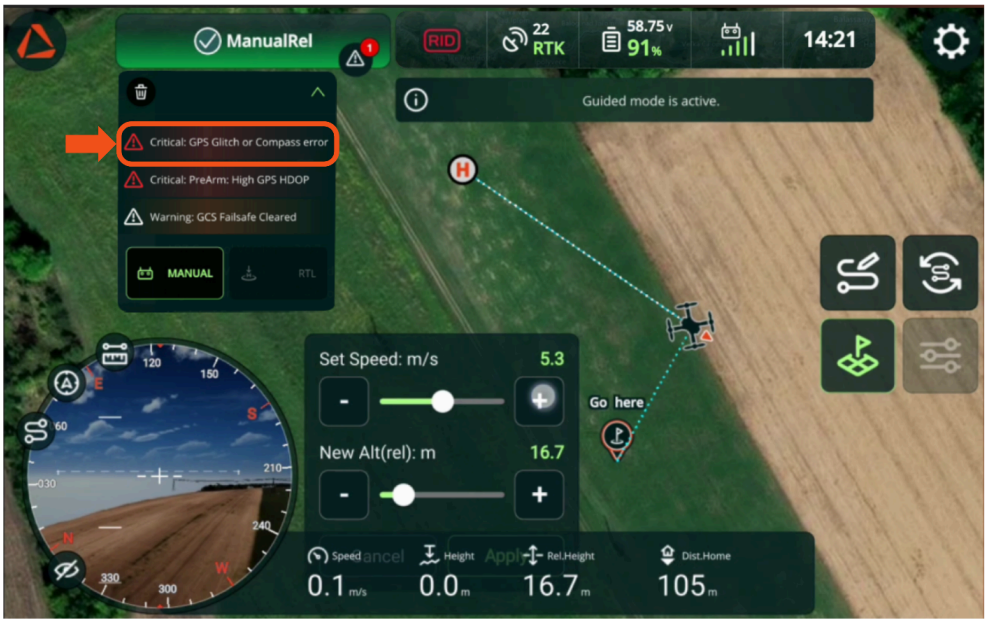
In emergency situations, the pilot must operate the drone manually in the safest available manner, specifically taking care of personal and property security. The pilot must fly the drone away from potential risks, applying careful, slow stick inputs and flight speeds, find a safe area, and land the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

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Loss of navigation systems

If the GPS system fails during flight, the "GPS glitch" pop-up message will be shown on the screen, and the pilot must land the drone.



If a total failure of the navigation system occurs, the drone automatically does a controlled descent and landing. In land mode, the pilot can only give forward, rearward (pitch), left, and right (roll) stick inputs to make sure that the landing is safe.

Brake mode

When you fly in **Altitude Hold** mode with the **Geocage** enabled, in rare scenarios, the drone can cross the boundary of the **Geocage**. **This activates a safety protocol that switches the drone to Brake mode, and the drone stops at the boundary of the Geocage.**

In **Brake mode**, the drone does not respond to control stick inputs, and you cannot activate the **Return to Launch** mode. To exit **Brake mode**, the pilot must switch to **Manual (Button R1)** mode to get full control.[6]

[6] Only applicable for Service Flights

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Error in Remote Identification System

The drone continuously monitors the Remote ID functionality from takeoff to shutdown and provides a notification of any malfunction or failure in the top bar of the ABZ Control application. If the Remote ID system detects an error during flight, the RID icon will turn red, and the drone will provide an error message stating that the Open Drone ID has encountered a problem (e.g., not receiving a location message).

If the Remote ID system experiences an error during operation, the unmanned aircraft is no longer broadcasting the message elements of the standard Remote ID. The pilot must, in accordance with 14 CFR Part 89 (Minimum Performance Requirements for Standard Remote Identification of Unmanned Aircraft)[7], land the unmanned aircraft as soon as practicable.



[7] https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-89

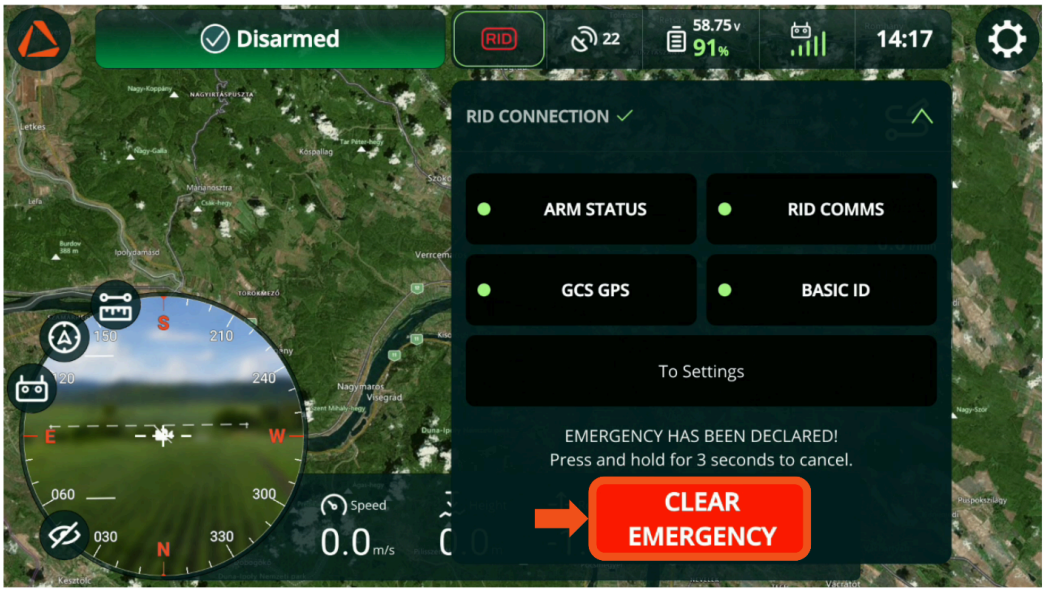
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Declaring an Emergency

In the Remote ID interface, the pilot can click on the **Declare Emergency** button. To declare an emergency, you need to **press and hold the button for 3 seconds.** This function may be employed in situations such as loss of control, potential threats to persons or property, or in other emergency scenarios, at the pilot's discretion.



When an emergency is declared, the drone will broadcast the emergency status. To clear the emergency, press and hold the same button (which now displays the text **'Clear Emergency') for 3 seconds.**



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Accessories

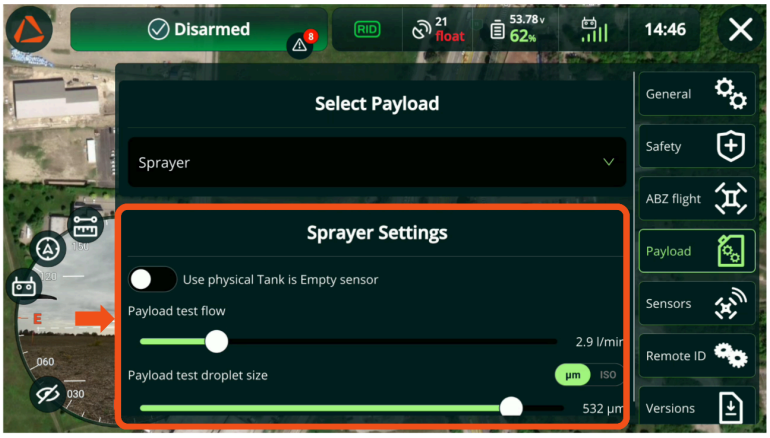
Payloads

ABZ Innovation does not limit the type of payloads to be used with the M12. 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 and accessories that are approved and compatible for drone use. It is the pilot's responsibility not to exceed the maximum combined weight of accessories, batteries, and payload, which is 13.3 kg (29.3 lbs), and not to exceed the MTOM of the fully equipped drone, which is 24.9 kg (54.8 lbs). To remain under 55 lbs (25 kg) in weight, the payload must not exceed 20 lbs / 9.1 kg.

The payloads significantly affect the drone's center of mass, especially, when 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.





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Emlid RTK

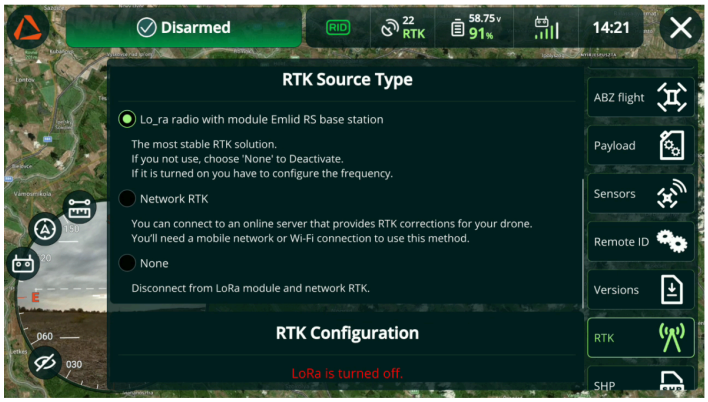
The M12 drone comes with the Emlid LoRa system, which can be connected with Emlid RS+ or RS2+ RS3+ base stations for RTK positioning at centimeter precision.

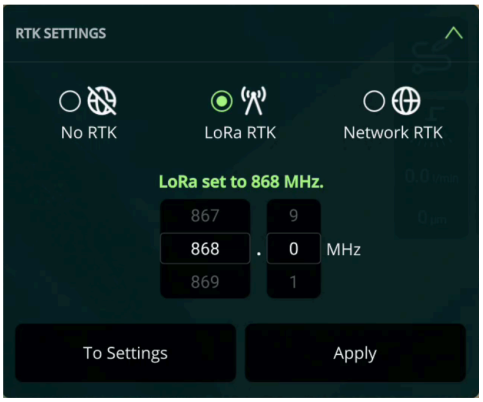
An RTK base station is a high-precision GNSS (Global Navigation Satellite System) device used to provide real-time kinematic (RTK) corrections for enhanced positional accuracy. It works by receiving satellite signals and transmitting correction data to the drone.

Setting up the RS2+ or RS3 base is documented at Emlid's support pages:

- Introduction | Reach RS3
- Introduction | Reach RS2/RS2+

- If you connect to the RS2+ or RS3 base with **LoRa**[8], make sure it is configured to **Output: LoRa**, and that the frequency entered in the **Setting > RTK > Lora radio module Emlid RS base station** matches the Base output value specified in the Emlid flow app.





[8] **The LoRa connection to the Emlid base station is only applicable for drones equipped with LoRa modul.**

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- If you connect to the RS2+ or RS3 base with **Local NTRIP**, set the base output to **Local NTRIP.**
    1. Connect the controller to the hotspot of the base station with the credentials given in the Emlid Flow application.
       During operation, keep the Remote Controller in close proximity to the Emlid base station (within 10 meters).
    2. In ABZ Control, in **Settings > RTK > Network RTK**, enter the NTRIP credentials that are given in the Emlid Flow application.
- If you connect to the **RS2+ or RS3** through the Emlid Caster, set the Base Output to **NTRIP.** Connect the Remote Controller to the internet with a hotspot, and enter the Credential from **Emlid Caster** in **Settings > RTK >Network RTK.**
  For more information about the Emlid Caster, refer to **emlid.com/ntrip-caster/**.

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

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Batteries and chargers

Battery:

Only use batteries purchased directly from ABZ Innovation distributors! This ensures safe operations, full compatibility, and appropriate data connection to the drone.
Using 3rd party batteries void the drone's warranty.

General information about the Smart Battery for L10/S20/M12/C10 drone (A001402.01):

- 43,5V nominal voltage
- min. 25000mAh capacity
- 25C discharge value
- 12 Cells
- Integrated Smart battery management system with automatic storage mode

Charger:

Only use the original ABZ Smart Charger 3000! This ensures safe charge, full compatibility, and appropriate data connection to the batteries.
Using 3rd party chargers void the batteries' warranty.

- Power output: max. 60A/3000W
- Power Input: 16A/110-230V
- Capable of multiple charges at the same time
- Slow, Normal, Fast charge speed options. **Do NOT use the Fast mode!**
- Storage mode option
- To ensure long battery life, we highly recommend using balance charging.

Let the batteries rest after charging before using them.

For continuous drone operation, use a set of four batteries. In the field, you can charge two batteries simultaneously while operating the drone with the other two (one in use and one on standby).

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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.

Before take-off, tasks and inspections

- Weather conditions are suitable for the task:no lightning, appropriate 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.
- The drone and all its accessories are in clean condition.
- The landing gear and any accessories are securely fastened.
- Unfold the drone’s arms and tighten the fasteners,
- Unfold the propellers symmetrically
- The propellers are clean, undamaged, properly fastened, and positioned.
- 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.
- NEVER leave batteries connected for prolonged periods.

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- Before arming the drone, leave enough free space, stand at least 10 m (35 ft) away from it.
- Perform compass calibration if necessary.
- Check the video signal on the display.
- 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 3 m/9.8 ft.
- 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.
- 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.
  If, during the return, the battery voltage reaches the critical threshold (42 V), the drone will automatically initiate landing. For further information, see Battery Failsafe.
- Switch off the engines after landing (disarm function)
- End of mission.

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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.

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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 DRI is correctly broadcasting your Remote ID.

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).
- Whether the drone is in Manual (Loiter) mode (if not, press button A to switch).
- You are at a safe distance (at least 10 m / 35 ft) 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 releases the stick.
- After arming the drone, wait about 4 seconds for the motors to reach full speed before take-off.
- Take off to a safe height (at least 3 m / 9.85 ft).

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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.
  If, during the return, the battery voltage reaches the critical threshold (42 V), the drone will automatically initiate landing. For further information, see Battery Failsafe.
- The ABZ Control battery indicator icon serves only as an indicator and shows an approximate value.
- 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.

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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: A001402.01
- Propeller CW: M001233.01
- Propeller CCW: M001234.01

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Replacing the propellers:

Tools for replacement:

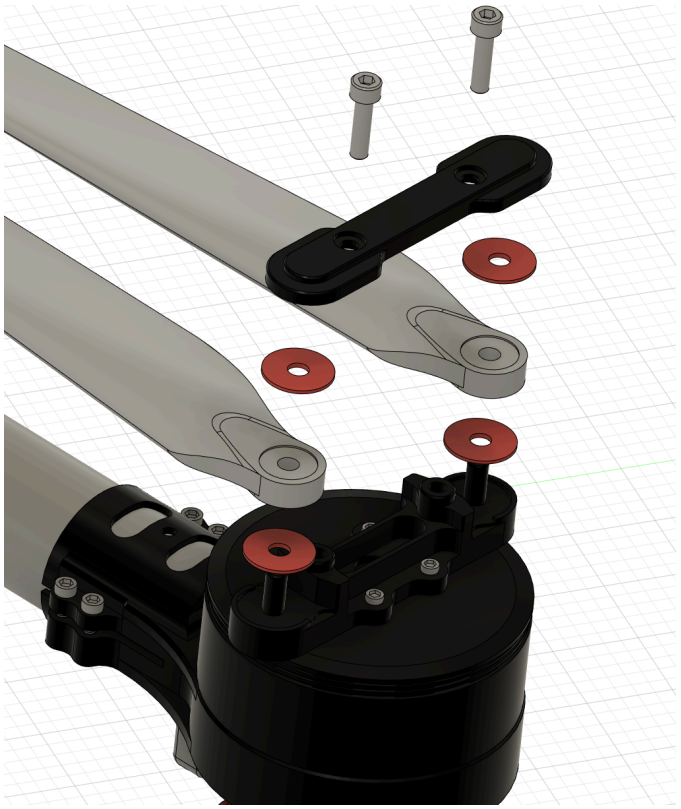
- HEX 4 key
- Threadlocking fluid (e.g. Loctite 243)
- Original ABZ Innovation M12 propellers



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

1. Unscrew the two 4mm HEX screws,
2. Disassemble the fixing cap of the propellers
3. Remove the propeller’s upper washers.
4. Remove the propellers and install new propellers.
5. Reinstall the upper washer and fixing cap.
6. Clean the 4mm HEX screws from threadlocking residues and apply new threadlocking material (according to the manufacturer’s instruction).
7. Tighten the screws until the propellers have zero axial and radial play, but still easy to fold and unfold them.

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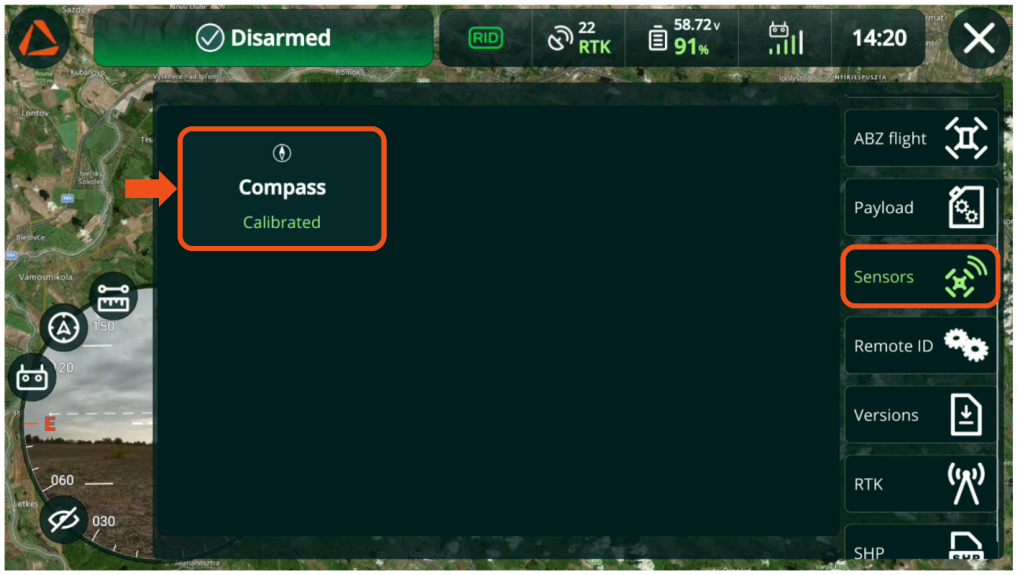


Obtain disposal information directly from local ABZ Innovation Distributors or Resellers. Always follow local regulations regarding disposal and recycling. If a part has ended life cycle or faulty/broken, it must be ensured not to be allowed to be used again, which can be carried out by an ABZ Innovation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

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Compass calibration

To calibrate the compass, go to **Settings > Sensors > Compass**.



The calibration should only be performed if requested by the software or instructed by the Support Center.

- Turn on the drone and make sure it is **disarmed**.
- Remove all metal objects (such as keys and coins) and electronic devices from your pockets.
- Place the drone on open, level ground, away from vehicles and metal objects. The drone can face any direction but must remain stationary.
- Click **START** to begin the calibration.
- Wait for the heading to stabilize. This process can take up to 5 minutes.

Warning: Calibration changes important flight settings. If you are unsure about the procedure, contact ABZ Support.

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Table of contents

General Information **3**
Specifications 7
Packing list **8**
Safety requirements **9**
General Failsafe 14
Battery Failsafe 15
Mandatory Remote identification with Dronetag **17**
Declaring an Emergency 22
Remote Controller 23
Network settings **28**
Internet connection 28
Controlling the drone 29
Default control (mode 2) 34
ABZ Control Software Overview **35**
Settings **48**
Safety – Setting up FailSafe 49
RTK configuration 51
Abz Flight 56
Adjusting the Obstacle Avoidance Options (only for drones equipped with LiDAR) 57
Additional Settings in ABZ Flight 57
IMU - Compass calibration 58
Remote ID 59
Software versions and Update 60
ABZ Sense (only for drones equipped with LiDAR) **61**
Obstacle Avoidance with ABZ sense (only for drones equipped with LiDAR) 61
What to do if the drone stopped because of an obstacle? 63
Servo Options 66
Altitude control 67
Flight planning **69**
To import a shapefile into ABZ Control: 77
Flight **92**
Irregular operational conditions **93**
Loss of navigation systems 94
Declaring an Emergency 96
Accessories **97**
Payloads 97
Emlid RTK 98
Batteries and chargers 100
Flight Protocol **101**
Before flight, tasks and inspections 101
Before take-off, tasks and inspections 101

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After take-off, tasks 102
During mission, tasks 102
After landing, tasks and inspections 103
Checklists **104**
Before first take-off 104
Before every take-off 104
After take-off 105
After landing 105
Troubleshooting **106**
Compass calibration **109**

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

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