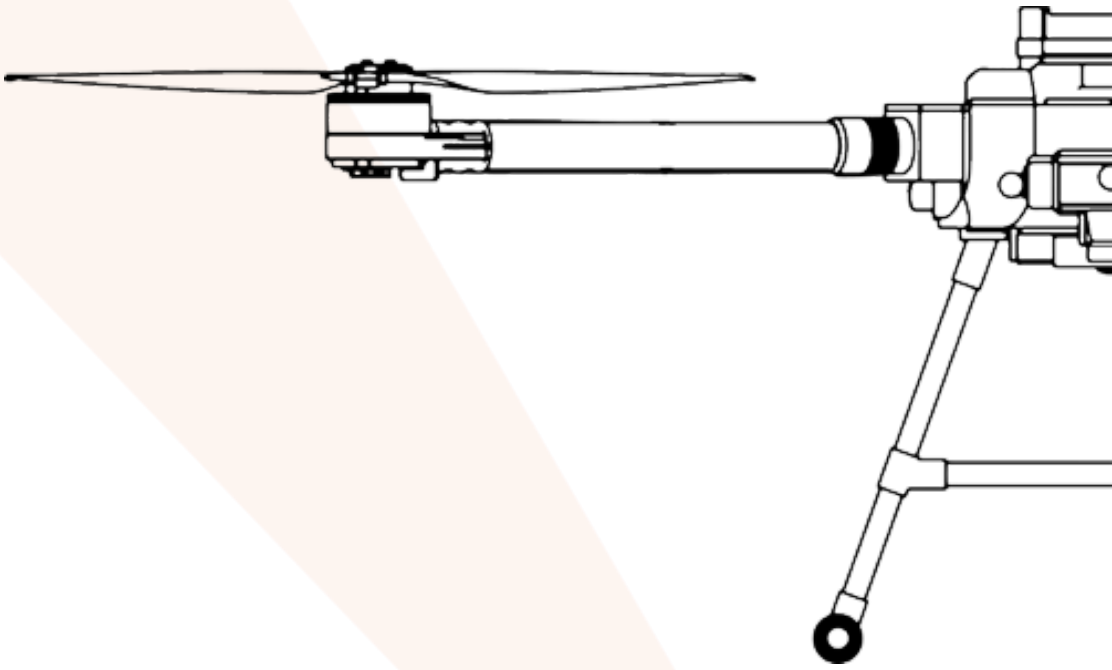
ABZ INNOVATION

WE BUILD DRONES.



M12

OPERATOR MANUAL

Version 1.1.4

General Information

Overview

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

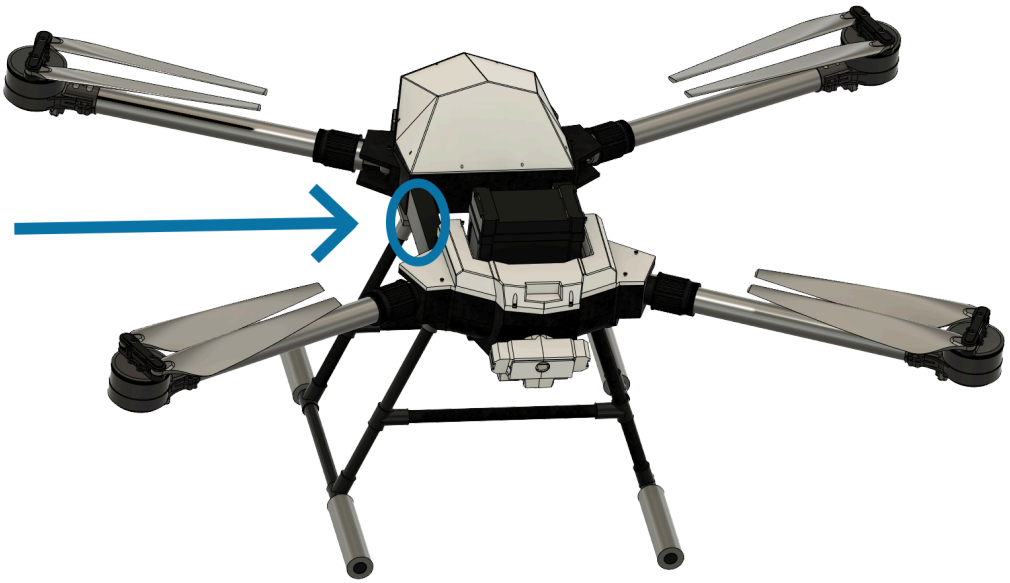
The drone and its accessories may only be operated in accordance with the instructions in this manual.

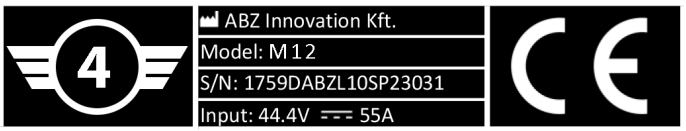
Please read this notice and the manual provided for your ABZ Innovation M12 drone before use.
If you have any questions, please contact ABZ Innovation customer service before use.
The contact details can be found at the end of this document. By using the drone, you declare that you have read this manual,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

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

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

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





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

EASA
European Union Aviation Safety Agency

4

This drone is an aircraft.
Aviation law applies.

As a drone pilot, you are responsible for flying your drone safely.

Before flying, as a drone pilot, you must

- make sure the drone owner is registered at his or her national authority (unless already registered)
- make sure the owner registration number is displayed on the drone
- read and follow the manufacturer's instructions
- complete the mandatory online training and pass the test

Check how to register, train and where you are allowed to fly:

www.easa.europa.eu/drones/NAA

! Offences are punishable by law.

4

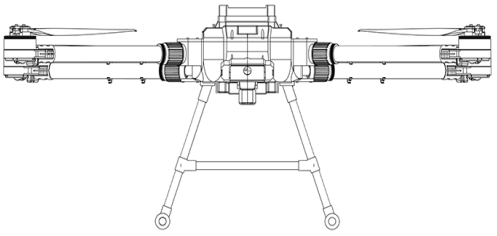
DO

- Make sure you are adequately insured
- Check for no-fly zones and any limitations in the area where you want to fly
- Keep the drone in sight at all times
- Maintain a safe distance between the drone and people, animals and other aircraft and of at least a distance of 150m from residential, commercial, industrial and recreational areas
- Inform your national aviation authority immediately if your drone is involved in an accident that results in a serious or fatal injury to a person, or that affects a manned aircraft
- Operate your drone within the limits defined in the manufacturer's instructions

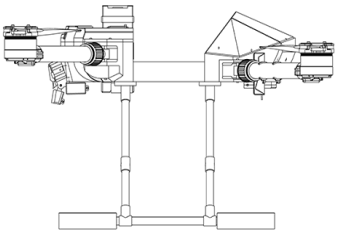
DO NOT

- Do not fly higher than 120m from the ground
- Do not fly near aircraft & in the proximity of airports, helipads or where an emergency response effort is ongoing
- Do not infringe other people's privacy.
- Do not record intentionally or publish photographs, videos or audio recordings of people without their permission
- Do not use the drone to carry dangerous goods or to drop material
- Do not modify your drone. Only software uploads recommended by the drone manufacturer are allowed

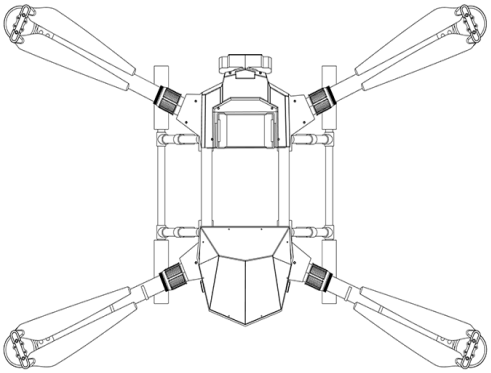
ABZ Innovation M12 drone



Front

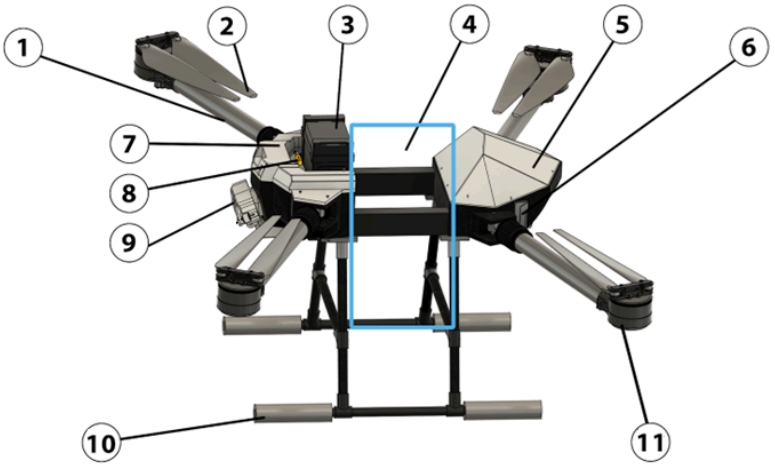


Side



Top

Drone main parts



1: Arms

2: Propellers

3: Battery

4: Optimal payload area

5: Rear cover

6: RC antennas

7: Front cover

8: Battery connector

9: Cameras

10: Landing gear

11: Motors

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

Packing list

The M12 drone standard package contains:

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

Specifications

UAS category classification	C4
Dimensions arms, propellers unfolded	1460 x 1020 x 610 [mm]
Dimensions arms unfolded, propellers folded	1380 x 940 x 610 [mm]
Dimensions arms and propellers folded	780 x 500 x 610 [mm]
Max. Take-off Mass (MTOM)	24.9 kg
Max. payload weight	8.44 kg
Max. summarized weight of accessories and batteries and payloads	12.64 kg
Flight precision	GPS/RTK
Battery integration	quick connector
Intrusion protection	Limited water and dust resistance
Drone frame	Folding frame
Range	3,5km
Sensor	LiDAR
Flight speed (working)	15m/s
Airspeed (maximum)	20m/s
Max. tolerable wind speed	10m/s
Radio Control and Telemetry band	2,4 GHz
WLAN frequency band	2.4 GHz

Safety requirements

Child protection provisions

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

Operating conditions

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

Operation

- The drone may only be switched on and operated in accordance with the "Flight Protocol" chapter starting on page 37.
- Only use the drone in full compliance with the checklists.
- Stay away from rotating propellers and motors.
- Do not exceed the maximum combined accessories and batteries, and payload weight in any case. Otherwise, the drone may be damaged and the flight might pose danger.
- Always keep track of the drone's flight, be ready for manual control. Manually avoid obstacles at a safe distance. Never rely exclusively on the ABZ Control app. It is important to check or set the correct Failsafe and RTL altitude before each flight.
- Always keep the drone within visual line of sight (VLOS) and keep an eye on it.
- Don't get distracted by using your mobile phone or any other activities.
- Don't fly under the influence of alcohol, drugs, or medicines. Fly only when you are mentally and physically capable of safely controlling the drone, including paying attention to its surroundings.
- If the drone or remote controller battery is low, land the drone in a safe place. The state of the drone battery should be monitored before the flight using the charging indicator LEDs on the battery. We recommend starting the flight with a minimum of 80% battery charge.
- During the flight, the pilot must monitor the battery voltage, which should always be above 43.5V, even when flying with the Maximum Take-off Mass (MTOM). The ABZ Control battery indicator icon serves only as an indicator and shows an approximate value.
- Never fly closer than 100m of a high voltage power line or high-power radio emitters (e.g. Radar, TV/Radio station).
- Never fly closer than 30m horizontal distance to buildings.
- After landing, switch off the motors, switch off the drone by disconnecting the battery, and then switch off the remote controller.
- In case of loss of remote controller signal, the drone can automatically switch to Failsafe RTL mode.

Maintenance and storage

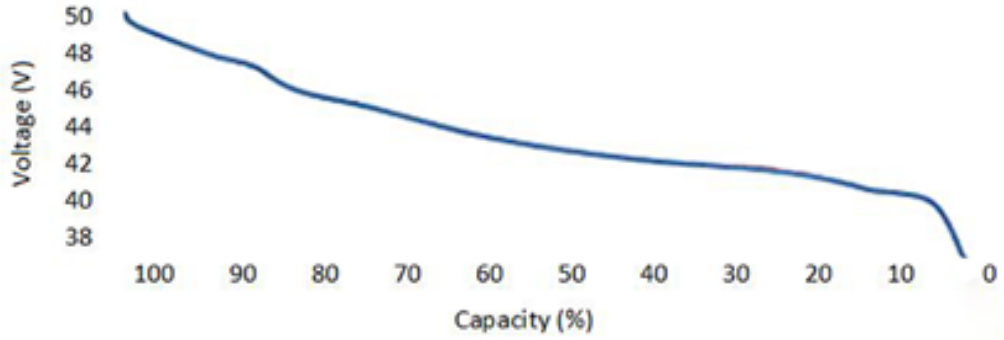
- Do not use damaged, broken, or aged propellers.
- Regularly check the condition of the drone and make a flight log.
- To avoid damage to the drone’s landing gear, remove payloads, accessories and the battery before transportation.
- Clean the drone, especially the propellers, after use.
- Recommended storage temperature: between 5°C and 40°C (41°F and 104°F) applicable for the drone, as well as the remote controller and the batteries.

- Never store the remote controller or the drone’s batteries below 0°C, it will cause excessive degradation to the battery cells.
- Store the drone, remote controller, and batteries below 60% relative humidity.
- The remote controller and the drone’s batteries must be stored at about 60% charge.
- Batteries deplete after extended storage. The remote controller and the drone’s batteries must be discharged and recharged every 3 months of storage.
- After long-term storage:
    - Every battery must be inspected and fully charged before use.
    - The drone’s motors must be inspected for free rotation.

Drone handling and use precautions

- Before commencing each flight, pay attention to the following:
    - working at a suitable time of day,
    - weather conditions,
    - environmental influences (such as sunlight),
    - drifting of the drone in case of wind,
    - wind speed,
    - flight altitude,
    - 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, always pay attention to this phenomenon and follow the battery’s instruction manual. Operate or charge the batteries only between 5°C and 45°C ambient temperatures, while the battery’s temperature remains between 10°C and 60°C.

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



- The maximum masses of accessories/batteries/payloads combined, fitted to the drone must not exceed 12.64 kg, thereby the drone's overall mass must not exceed the Maximum Take-off Mass (MTOM) 24.9kg .
- Maximum flight time with one battery is mostly dependent on the Take-off Mass, which is highly related to installed accessories and payloads. The difference in safe maximum flight time between an unequipped M12 and a fully loaded M12 at MTOM can be as high as 10 minutes.
- The drone's agility and balance is highly influenced by the payloads or accessories, especially if those are installed further away from the Optimal payload area (shown on page 6). If a heavier device is installed offset from the drone's center of gravity, the pilot must fly with extreme caution to the altered controllability and potential of slower deceleration, acceleration, turning, elevation and descent speeds.

Information about transport

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

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

In case of loss of signal and communication

The ABZ Innovation M12 drone and the remote controller communicate directly through an assigned 2.4GHz radio signal. The drone's software is equipped with safety features that ensure safe operation at all times, including possible loss of signal and communication. This can occur in cases where the drone signal is out of range (for the ABZ Innovation M12 this is 3,5 kilometres), or when there is interference from equipment, devices, or magnetic interference in the vicinity of the drone. In these cases, the drone will communicate clear instructions to the operator while the software initiates safety functions. The safety features need to be set before take-off, programming the drone's behavior if the signal is lost. The method to set these is detailed in the „Setting up FailSafe" section.

These options can also be set with the following:

- Returning to the starting point (Return to Launch – RTL)
- Stopping at the point of signal loss
- Keeping the height
- Landing
- Climbing to the set altitude and returning home

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.

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

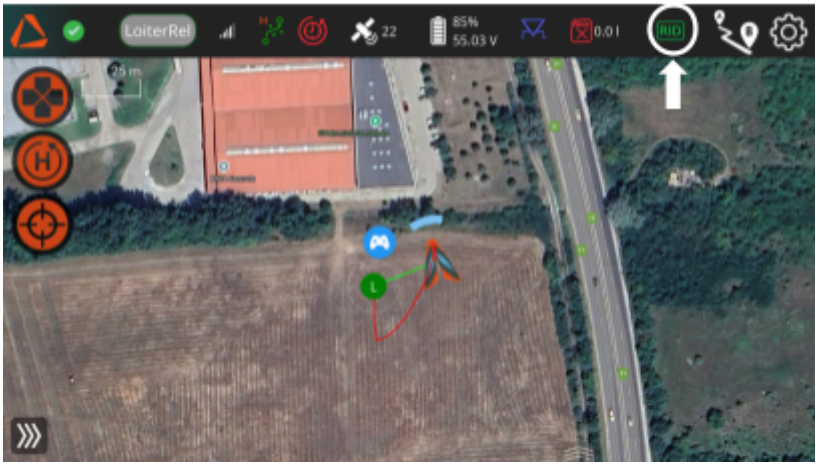
Mandatory Remote identification with Dronetag

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 L30 V2 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.

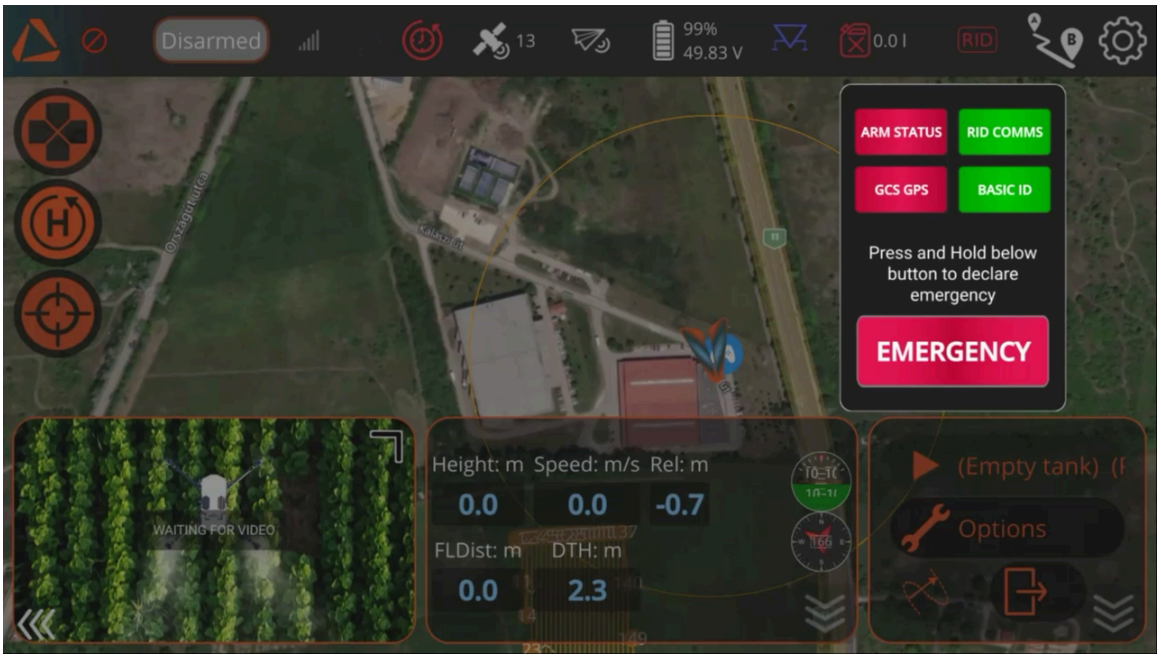
The **RID icon** shows the operational status of the Remote ID system. If the icon is green, the Remote ID is broadcast correctly.



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)

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



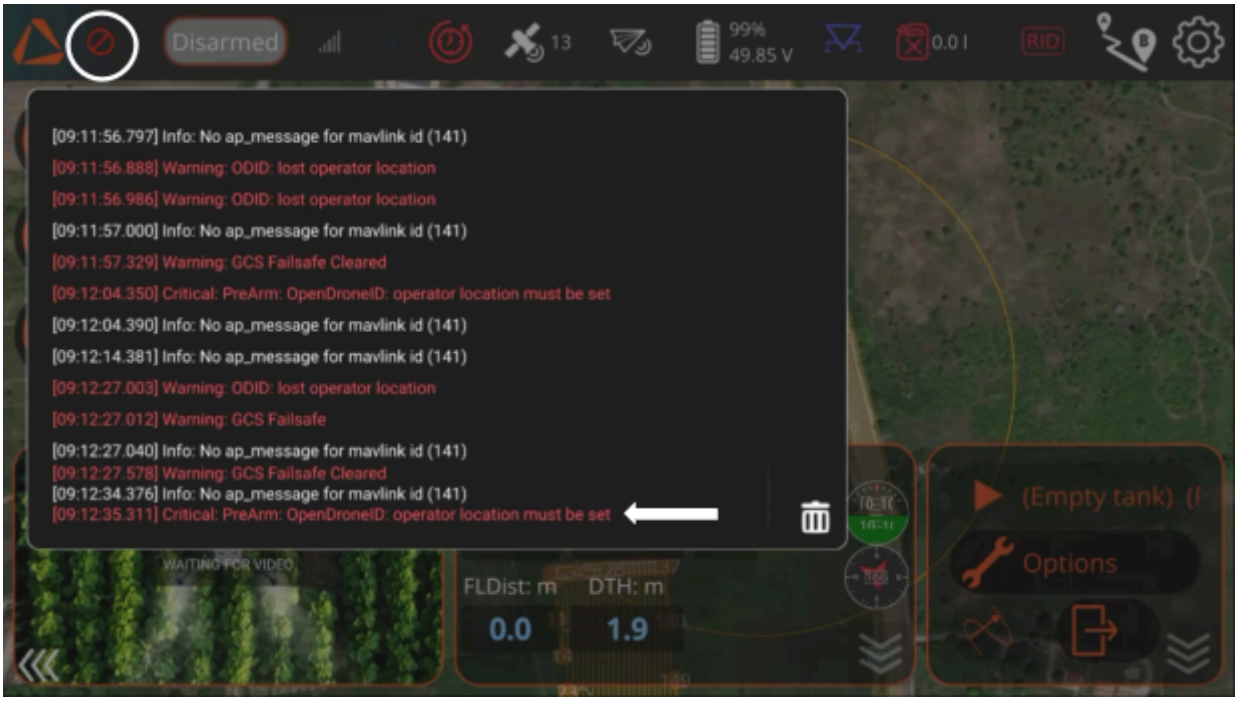
The **ARM STATUS** field provides feedback about the proper functioning of the location source hardware and software of the drone. In the case of a malfunction, this icon will turn red, and consequently, the Remote ID icon will also turn red, indicating a malfunction in the Remote ID system. The drone 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 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 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.

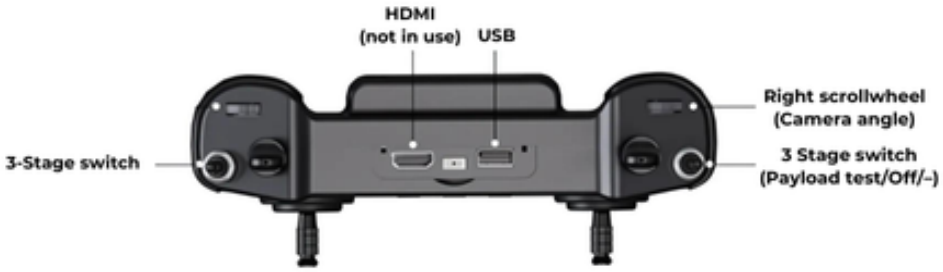
[3] in accordance with 14 CFR Part 89 (Minimum Performance Requirements for Standard Remote Identification of Unmanned Aircraft: https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-89)

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.**

Remote Controller

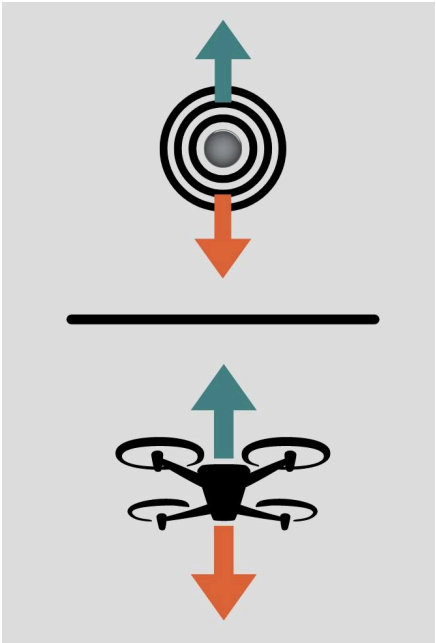


You can only charge the remote controller when it is powered off and only with the supplied fast Charger. The RC cannot be charged while working.

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

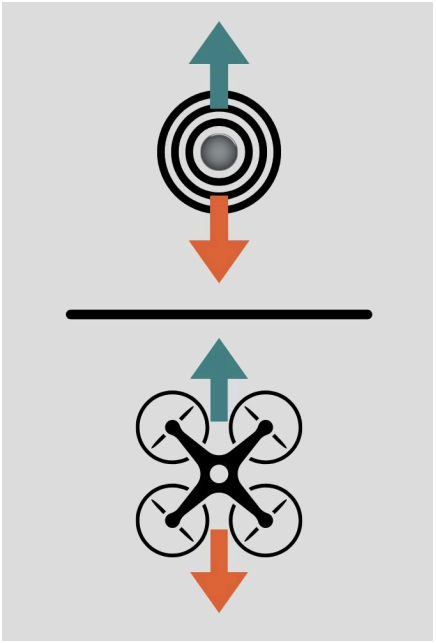
Default control (mode 2)

Left stick

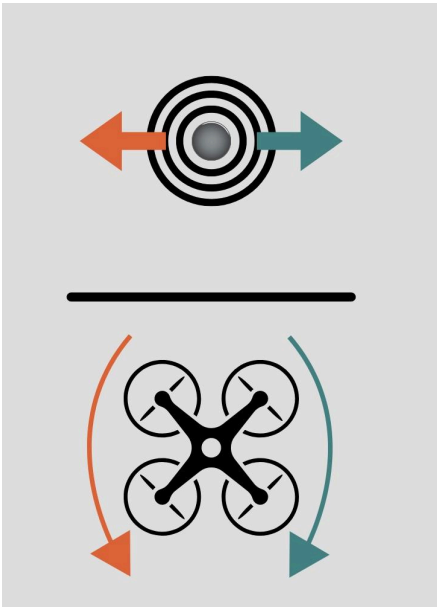


Up/down

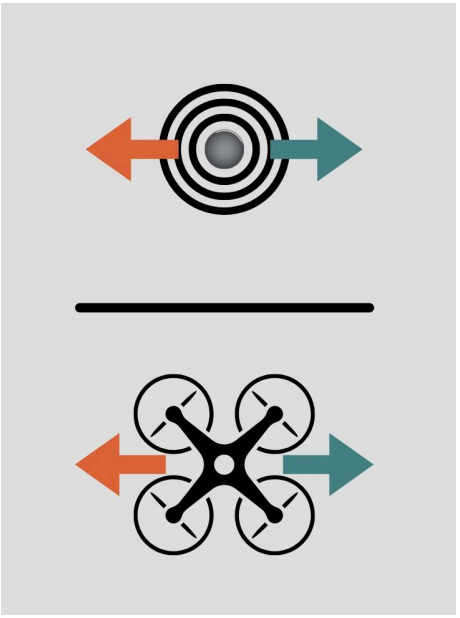
Right stick



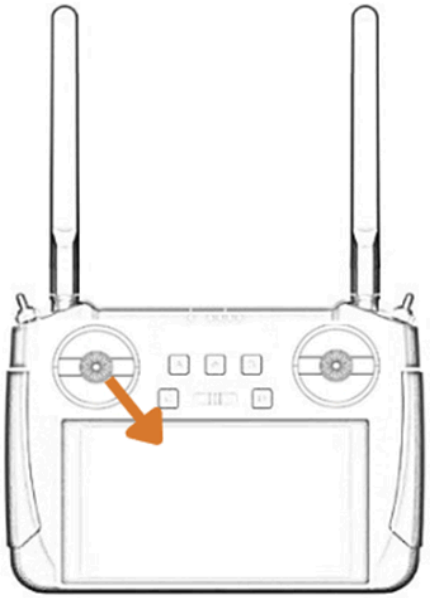
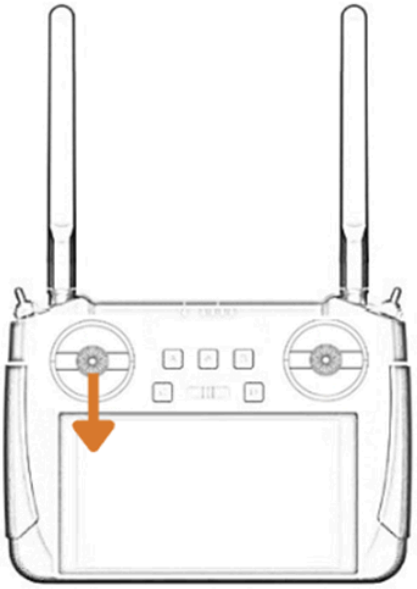
Forward/backward



Rotation



Left/right

Arm	Disarm
	

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

- ABZ Innovation MK15

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

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

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

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

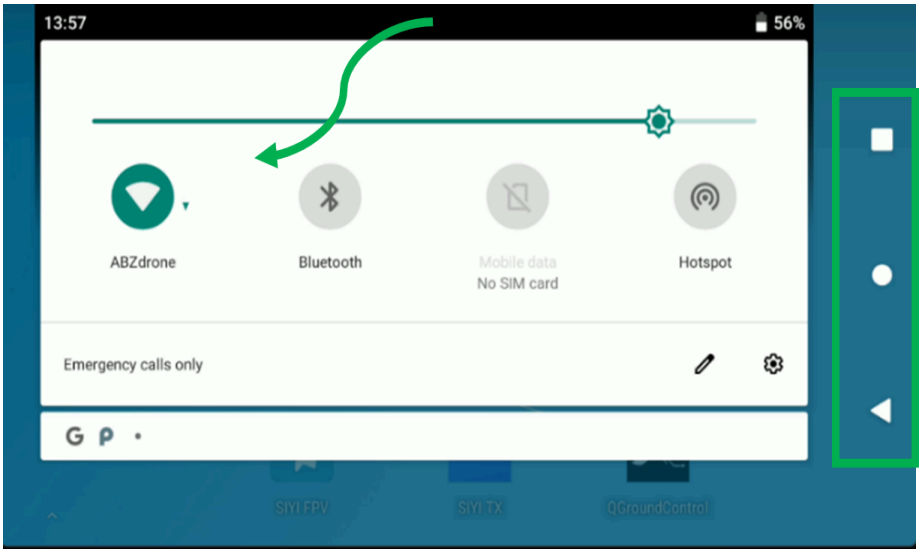
The MK15 remote controller is an Android operation system-based device, with an integrated system for communicating through radio signals with the drone. It runs the ABZ Control application to control the drone and let the pilot access all telemetry data.

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

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

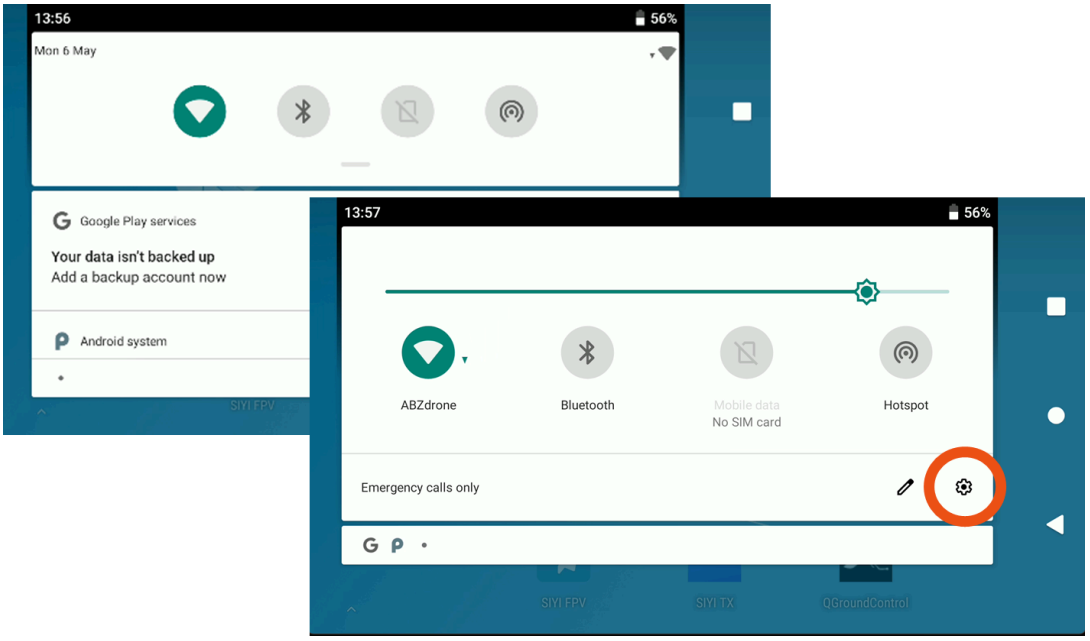
If you push the power button once short, the screen will turn off (power saving mode). If you push the button for 1 second, you can choose between the options of powering off the remote controller or taking a screenshot.

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



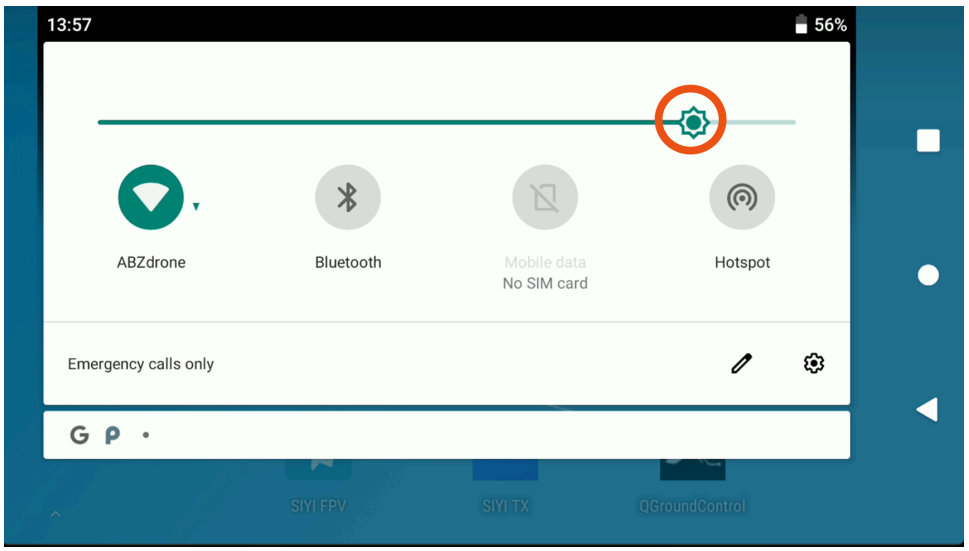
The rectangular icon allows you to switch between applications. The circular icon takes you to the main screen. The triangular icon lets you go back to the previous screen (note: this function is not supported in ABZ Control).

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

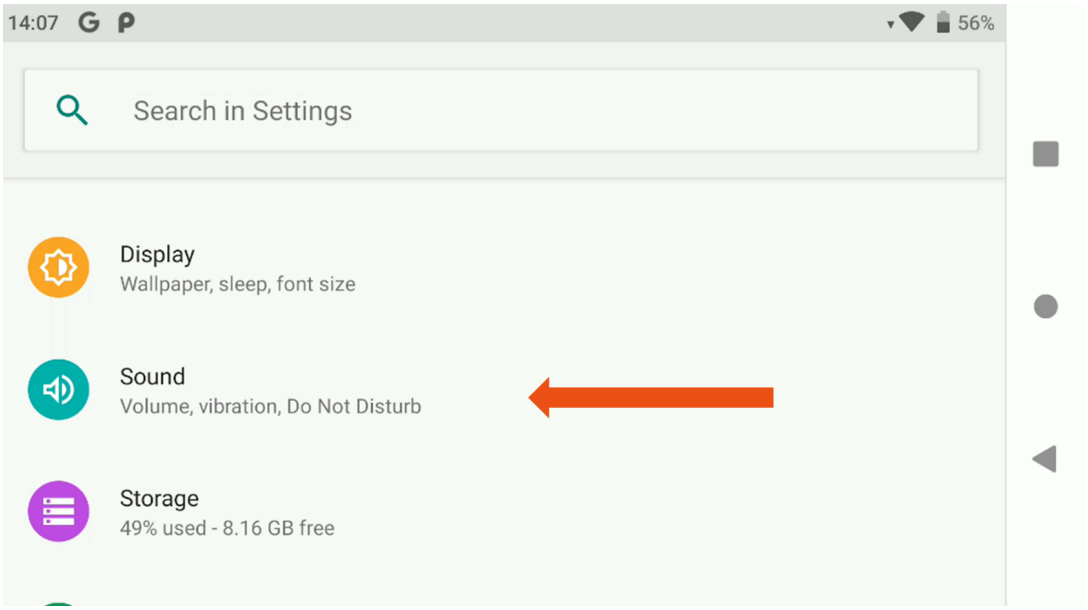


Set the **display brightness** and **sound volume** always according to environmental conditions (light conditions and noise level)! Setting the display brightness and sound volume is always accessible (even when operating the ABZ Control software) from the basic Android menu, swiping down from the top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

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

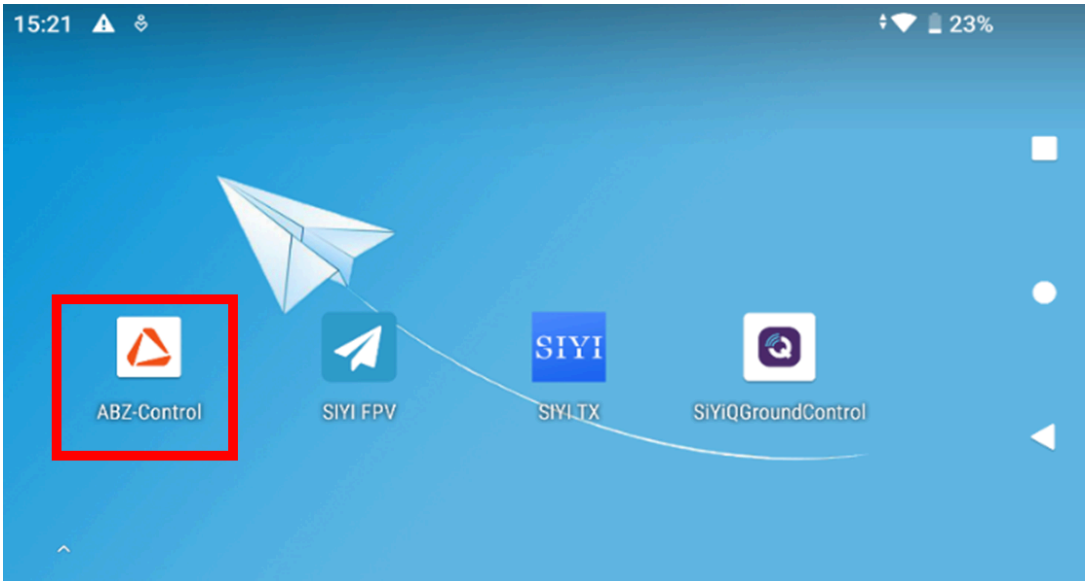


Click on **Settings (gear icon),** then scroll down to the **Sound** menu and tap on it to show the sliders for volume control functions.

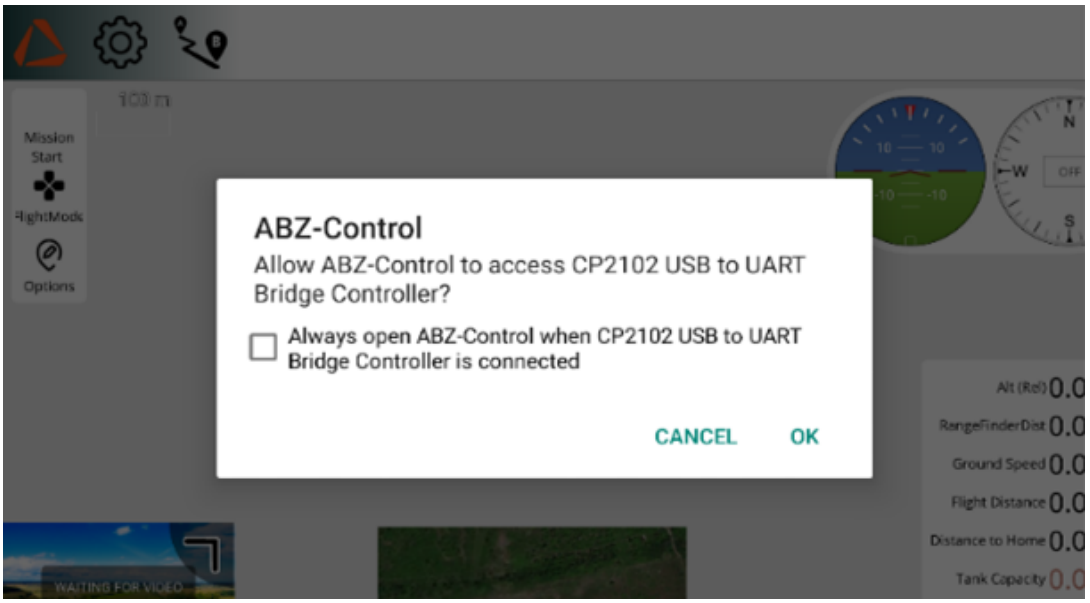


Media volume controls the ABZ Control application's alerts and information volumes. We highly recommend keeping it set to the maximum level.

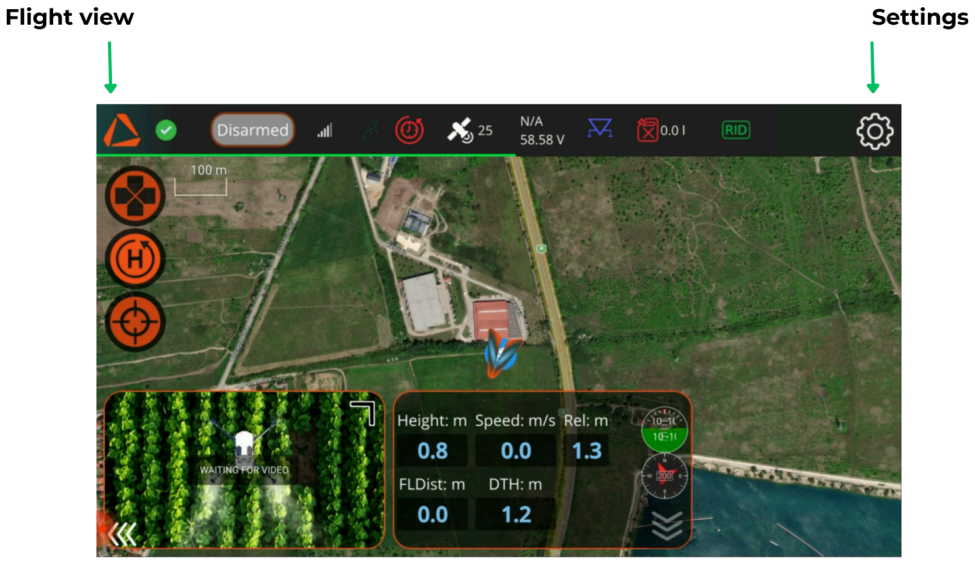
Start the ABZ Control flight control application by clicking on its icon on the home screen.



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.

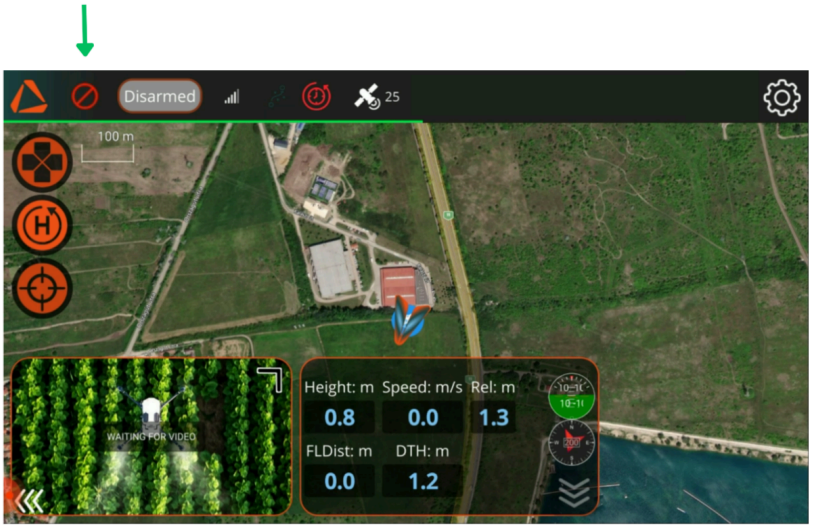


After launching the application, the following screen will be displayed:



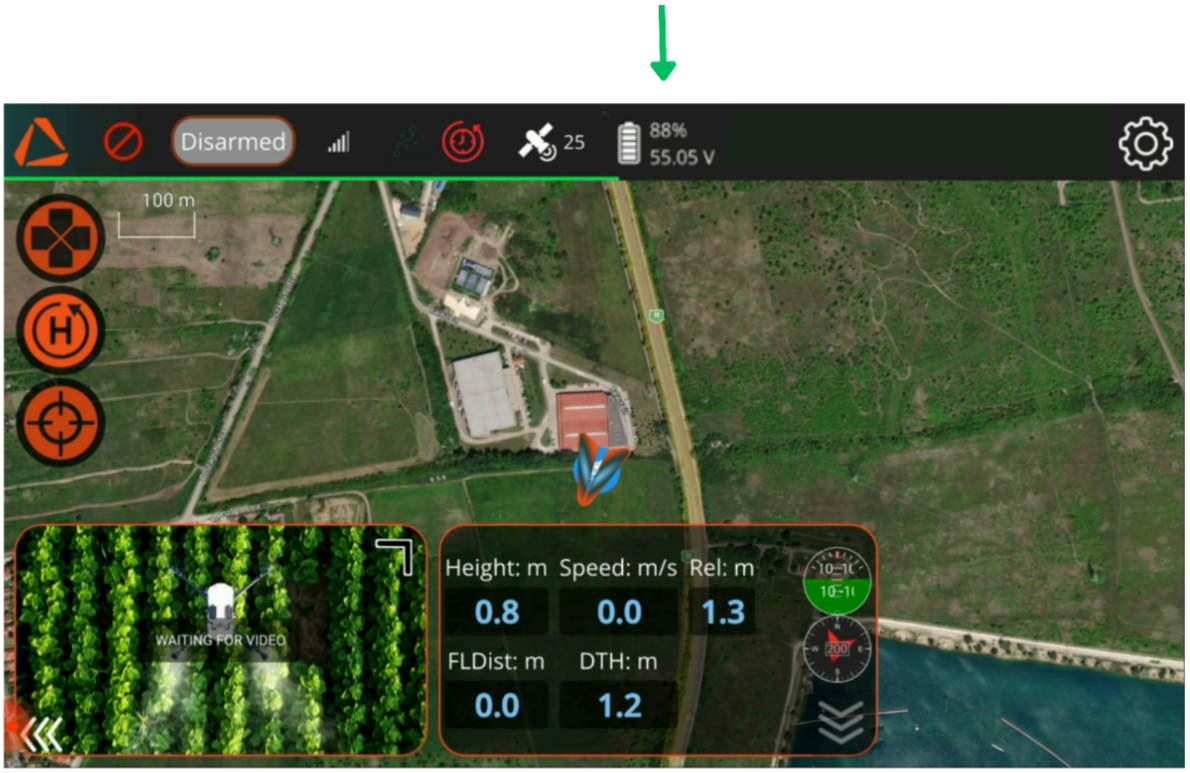
In the top menu bar, you will see the icons **Flight view and Settings**.

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



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

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



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

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

Only fly the drone if the green check mark is visible, there are at least 7 satellite connections, the HDOP value is below 1.1, and the LOITER flight mode is selected.The telemetry data (real-time information and measurements of the drone during operation) is displayed in a white panel on the right side. During the flight, you must monitor the battery voltage status here.

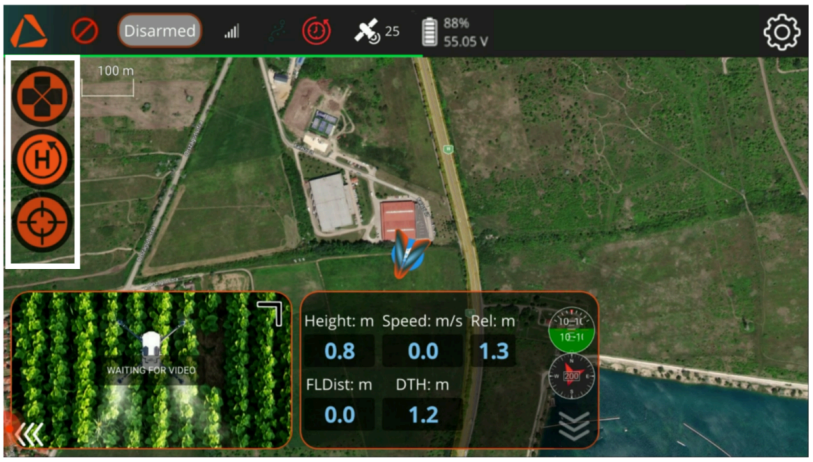
Ensure that the battery remains above 43.5 V throughout the entire flight, regardless of any payload condition. When the battery voltage level drops under 43.5 V, start returning and landing the drone.

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

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

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

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



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

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

Setting up FailSafe

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

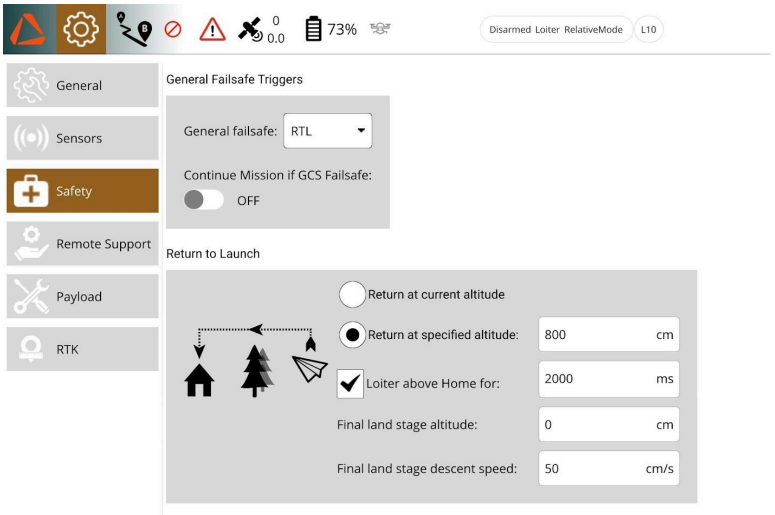
Access path: **Settings / Safety**

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

- **Return to Launch:** set parameters for automatic return to home
  - Specify if current or specified altitude is desired.
  - Specify if the drone should wait and loiter above the takeoff position before landing.
  - Final land stage altitude should NOT be other than 0.
  - Specify the final land stage descend speed (limited by the drone's limitations).
- **GeoCage:** you can set virtual boundaries that the drone will not fly over. Circle GeoFence means, the drone will stop if it reaches the desired radius from the takeoff position. Altitude GeoFence means the drone will not fly over the desired altitude relative to the takeoff position.
- **Prearm checks:** Arming checks are meant to check all the functions and systems necessary for arming and flying the drone safely. All the prearm checks listed in this section are essential and mandatory for safe operation; do not change these settings.

Action functions:

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



Controlling the drone

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

- **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.
- **AltHold flight mode: C button** (WITHOUT GPS positioning). The flight, braking, and stopping must be controlled manually with the sticks; the drone does not keep its position, and the pilot must counteract wind forces, too. The drone keeps its altitude relying on its barometric pressure sensor only. The pilot must pay attention to the altitude changes resulting from atmospheric and weather changes.
- **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.

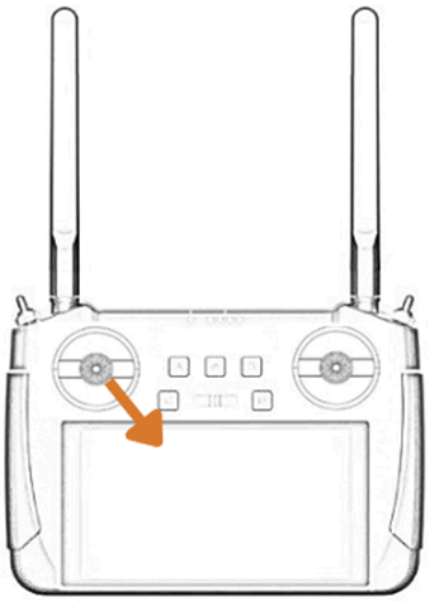
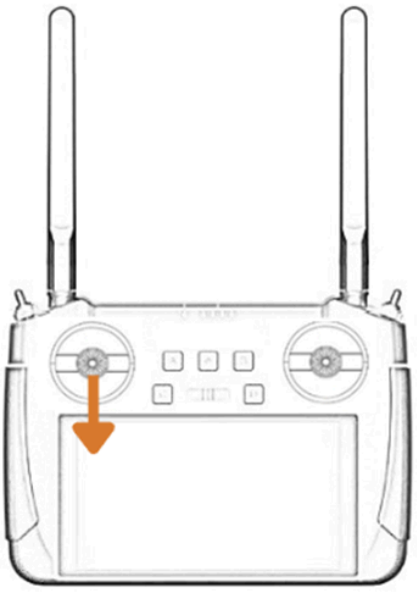
Emergency stop: In case of emergency, push the **C button and D button** simultaneously for at least 2 seconds. The motors will stop immediately, and the drone will crash into the ground.

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

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

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

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

Arm	Disarm
	

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

Flight

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

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

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

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

Every flight must be carried out fully in accordance with all Checklists (page 39).

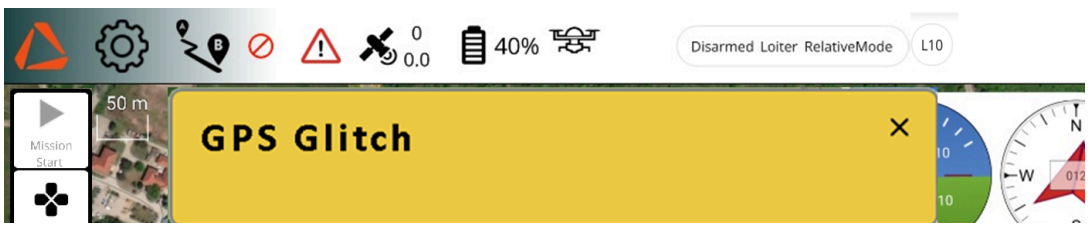
Every flight mode can be interrupted at any time by changing the flight mode, e.g. by pressing **Button C** (AltHold mode - the drone will hover in position) or **Button B** (RTL – Return to launch) mode, the drone will fly back to the take-off position, so that settings can be modified, or the battery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

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

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

If any flight system errors occur during the flight, the controller shows a pop-up message with information about abnormalities. If any of these happen, the pilot must safely land the drone.

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

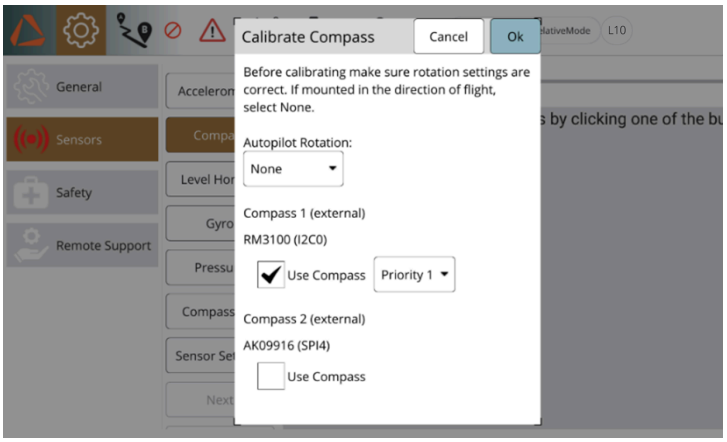


In emergency situations, the pilot must operate the drone manually in the safest available manner, specifically taking care of personal and property security. The pilot must fly the drone away from potential risks, applying careful, slow stick inputs and flight speeds, find a safe area, and land the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

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

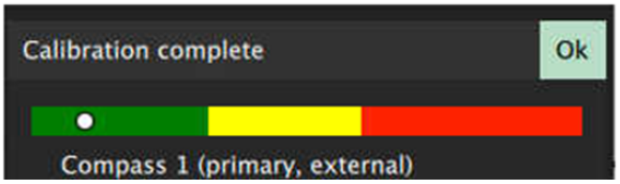
Compass calibration

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



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

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



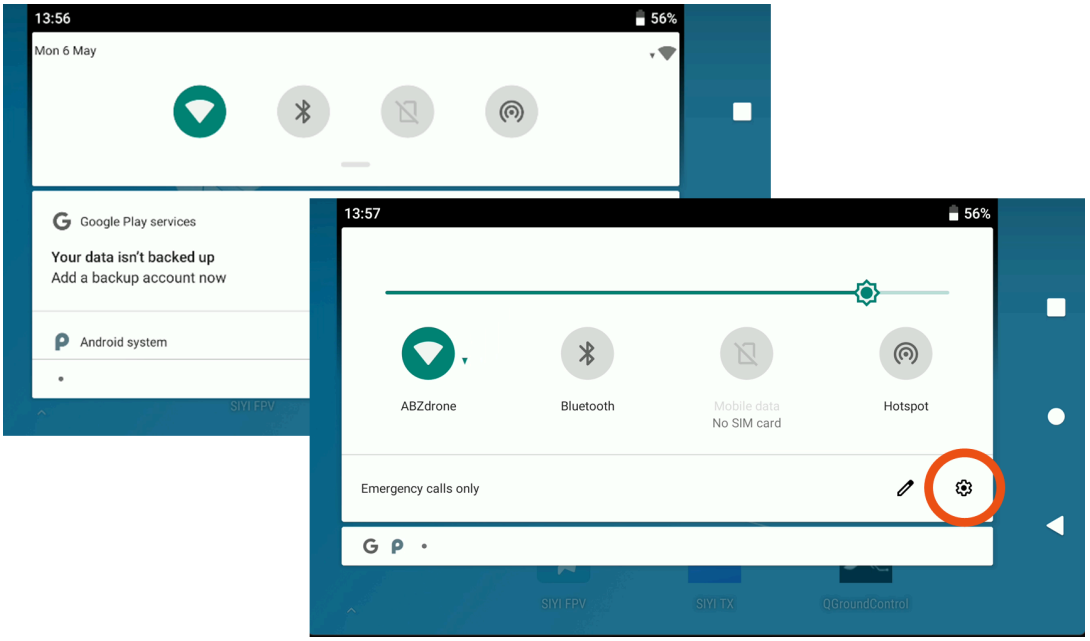
- The result of the calibration is shown by the calibration quality feedback:
  - Green: good quality calibration
  - Yellow: medium quality calibration, consider recalibrating
  - Red: not acceptable; please recalibrate

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

Network settings

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

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



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

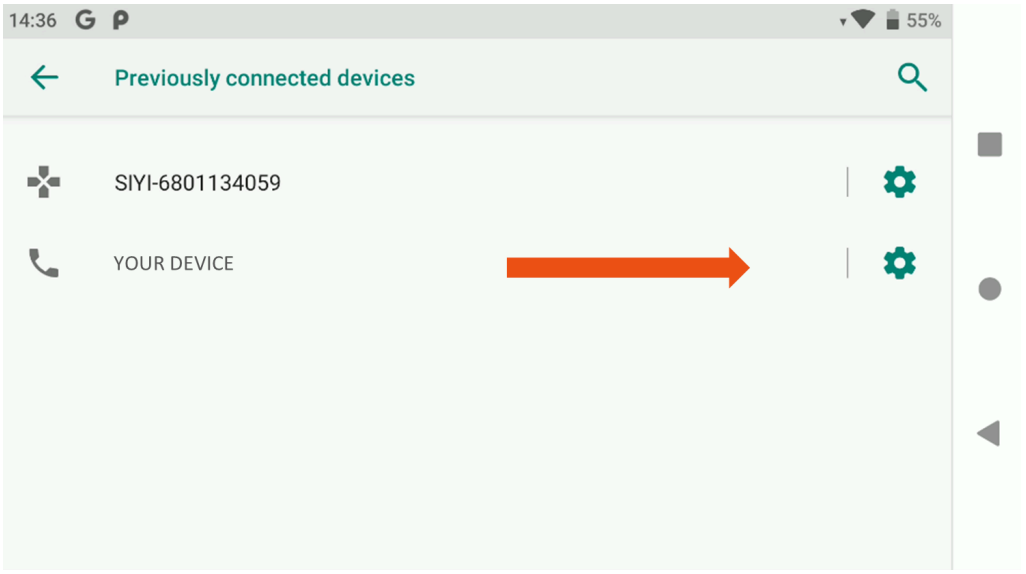
To set up the Bluetooth connection for internet access:

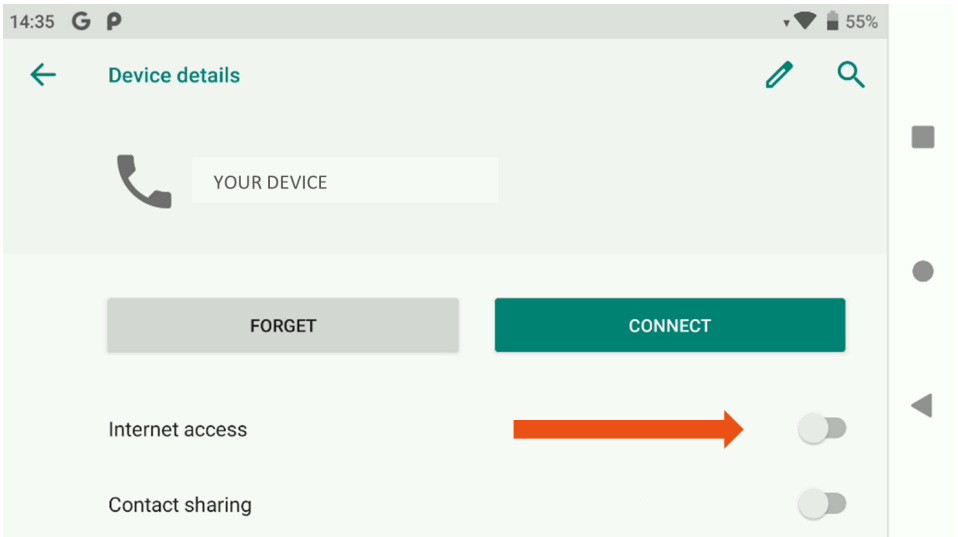
1. Turn off Wi-Fi on the controller.

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

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

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





Flight Protocol

Before flight, tasks and inspections

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

Before take-off, tasks and inspections

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

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

After take-off, tasks

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

During Flight, tasks

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

After landing, tasks and inspections

- Switch off professional equipment if necessary.
- Switch off the drone by unplugging the battery from the connector.
- Switch off the remote controller.
- Clean the drone thoroughly (batteries, tools, camera, etc.).
- Disassemble, clean, check, and store all professional equipment properly.
- In the flight log, record the flight and any significant events. Accurate completion of this document is mandatory to monitor the operation and lifetime of the drone, and to facilitate properly scheduled servicing (every 300 flight hours).
- Record the nominal voltage remaining in the batteries used. After returning from the field, remove the batteries from the storage box and store them in a cool and well-ventilated place.
- DO NOT STORE batteries overcharged or fully discharged for extended periods of time.

Checklists

Before first take-off

- General structural, mechanical inspection
- Inspection of propellers one by one, even if there is only minor damage, takeoff is prohibited.
- Tightness of the drone arms' fasteners
- Propellers in an unfolded state
- Switch on the remote controller, and launch the ABZ Control app.
- When ABZ Control is waiting for the connection, turn on the drone by connecting the battery (the plug must be fully plugged in).

Before every take-off

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

After take-off

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

After landing

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

Accessories

Emlid RTK (Optional)

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

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

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

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

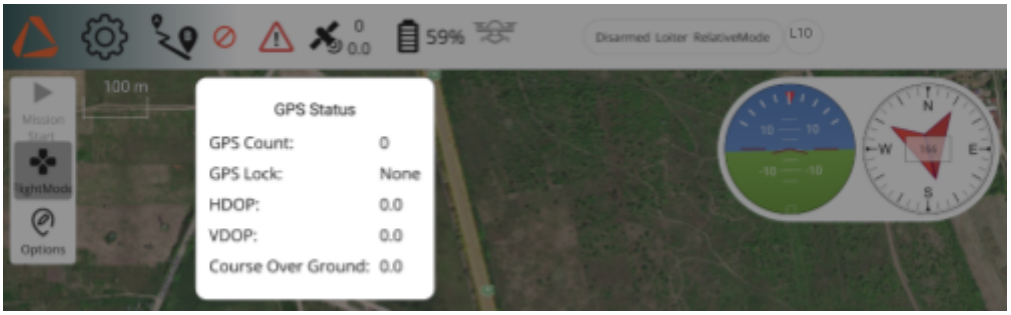
Setting up the RS+ or RS2+ base is documented at Emlid's support pages:

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

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

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

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



Recommended batteries and chargers

Battery requirements:

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

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

Battery charger requirements:

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

  Examples:
  - SkyRC PC2500
  - SkyRC PC3000

Payloads

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

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

It is the pilot's responsibility not to exceed the maximum combined accessories and batteries and payload weight, which is 12.64 kg, thereby not to exceed the MTOM with the fully equipped drone, which is 24.9 kg.

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

Troubleshooting

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

abzinnovation.com/authorized_services/

Replacement parts

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

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

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

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

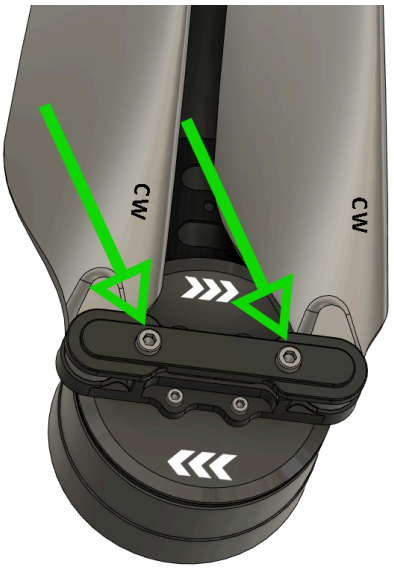
List of spare parts and part numbers:

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

Replacing the propellers:

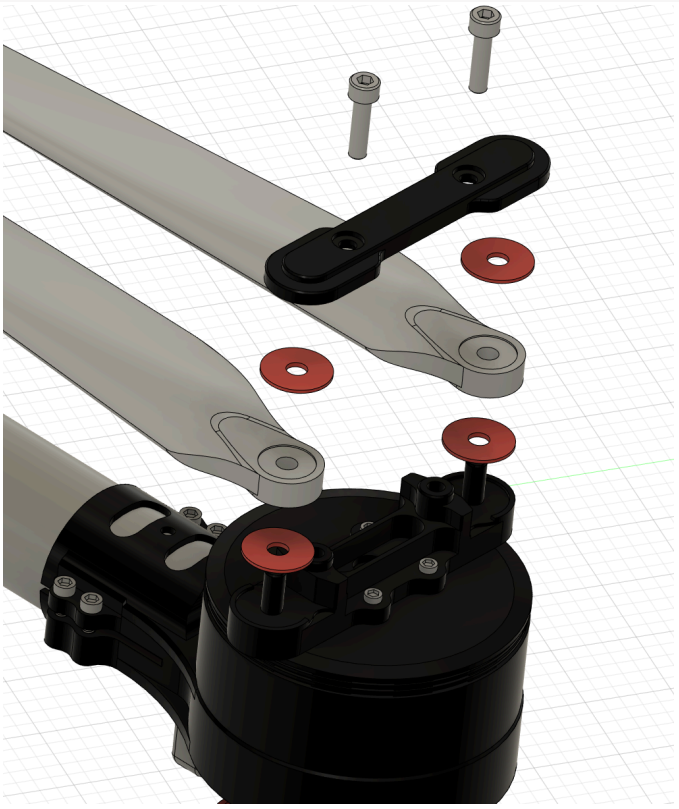
Tools for replacement:

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



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

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



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

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

ABZ Innovation Ltd. - www.abzinnovation.com