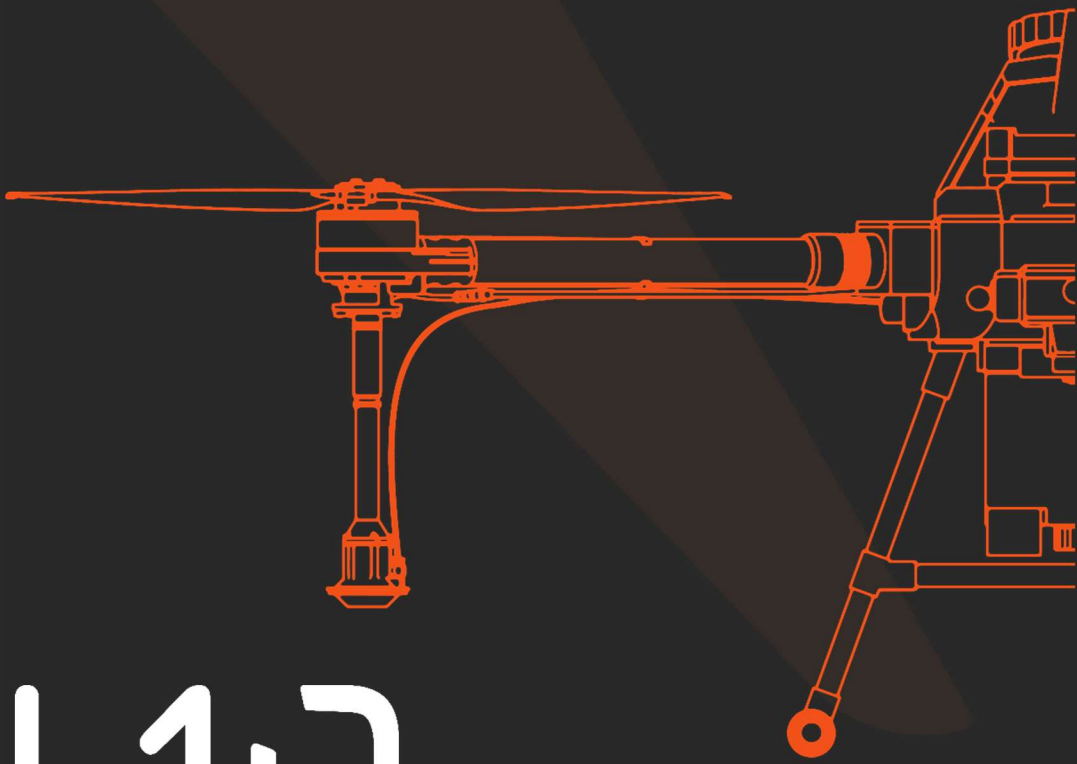
ABZ INNOVATION

WE BUILD DRONES.



L10

OPERATOR'S MANUAL

Version 1.0.1

General Information

Overview

This manual is for the ABZ Innovation L10 and L10 PRO industrial, agricultural drones, equipped with a CDA (controlled droplet application) spraying system designed for the most efficient use. The drone can be upgraded with a wide range of other payloads too, thanks to its universal design.

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

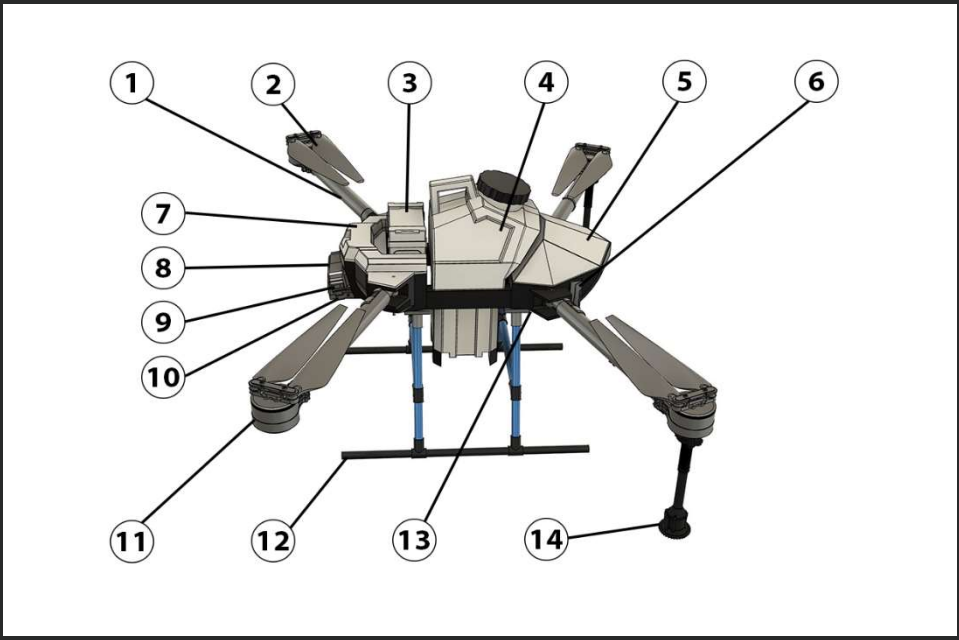
Please read this notice and the manual provided for your ABZ Innovation L10 drone before use. If you have any questions, please contact ABZ Innovation customer service before use, the contact details can be found at the end of this document. By using the drone, you declare that you have read this manual, 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 L10 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 L10 is a technical, agricultural device.

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

To identify an L10 or L10 PRO, locate the serial number label on the right side of the drone frame and check, if the „Model” is L10 or L10 PRO.

Drone main parts



1: Arms
2: Propellers
3: Battery
4: Tank
5: Rear cover
6: RC antennas
7: Front cover
8: Cameras
9: LEDs
10: LiDAR sensor
11: Motors
12: Landing gear
13: Pump
14: CDA sprayers

On the drones delivered after August 2023 the LEDs can be adjusted to face downward by turning them. This helps WORKING and spraying in dark.

The L10 drone standard package contains:

- L10 drone and tank
- Herelink remote controller with sticks and antennas
- Charger cable for remote controller

Specifications

Spray tank capacity	10L
Per hectare performance	12 ha/hr (max.)
Flight planning and flight precision	RTK
Maximum flow rate	4,8l/min
Tank installation	quick-release
Battery integration	quick connector
Intrusion protection	Limited water and dust resistance
Drone frame	Folding frame
Range	8km
Sensor	LiDAR
Total weight	17kg (with battery)
Max. Take-off weight	29kg
Flight time	22 minutes (empty tank) 14 minutes (full tank)
Flight speed (working)	7m/s
Airspeed (maximum)	22m/s
Max. tolerable wind speed	10m/s
Noise level	86dB
GNSS frequency band	1.58GHz
Radio Control and Telemetry band	2.4GHz
WLAN frequency band	5GHz

Safety requirements

Use of plant protection products

- Pesticides are toxic and their use poses high health and safety risks. Use them only as prescribed!
- Do not use strong acids, strong alkalis, high-temperature liquids or pesticides that are prohibited.
- Do not endanger people, animals or the health of environment.
- Pesticides must not be allowed to contaminate rivers and drinking water sources.
- Avoid the use of powder-based pesticides, as they can shorten the life of the spraying system of the device.
- Mix the pesticide with clean water and filter it immediately before use to avoid clogging the filter. Clean the filters of the device before use if noticing deposits.
- If spraying in a windward direction, make sure that the spray does not drift onto you or anyone else on the site. Wear full protective gear to avoid direct contact with the pesticide. Clean the drone and remote controller after spraying.
- The effectiveness of application depends on the density of pesticides, the speed and distance of spraying, the flight speed and is affected by wind speed, wind direction, temperature and humidity. Take all these factors into account when spraying!
- Avoiding unnecessary spraying: accurate planning of the spraying work is necessary to determine the right amount of pesticide to use, so that the amount of excess spray can be minimized. It is recommended to apply the residual spray or water used to wash the drone's system to plants.

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 contains a spray that is dangerous for children and must be kept out of the reach of children!
- In case of contact with the spray, wash off immediately with plenty of water. In case of ingestion of spray, seek medical advice immediately.
- The equipment operates rotating parts that are dangerous for children and must be kept out of the reach of children!

Environmental aspects

- 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 large crowds.
- 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).
- Your flying and spraying 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 54.
- Only use the drone in full compliance with the checklists.
- Stay away from rotating propellers and motors, CDAs.
- 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 QgroundControl 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.
- 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 RTH mode.

Maintenance and storage

- Do not use damaged, broken or aged propellers.
- Clean the drone immediately after spraying.
- Regularly check the condition of the drone and make a flight log.
- To avoid damage to the drone's landing gear, remove or empty the spray tank, remove payloads, accessories and the battery before transportation.
- Only store the drone with the spray system thoroughly emptied, cleaned and flushed.
- 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 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.

Personal precautions

- The temperature of the chemicals in the spray tank cannot exceed 45°C. During use, the working temperature range is between 5°C and 45°C.
- Before starting the spraying work, always carry out an inspection of the condition of the drone (condition of seals, detection of possible leaks, quality of the spraying) with clean water. Make sure that everything is working properly before you start working with chemicals.
- Always prepare the chemicals according to the instructions for use provided by the manufacturer. Adhere to the appropriate mixing or dilution ratio prescribed by the manufacturer. Mixing and dilution at inappropriate ratios is prohibited as it may have adverse effects on humans and the environment, may be harmful to health and may result in insufficient treatment of plants.
- Using protective equipment (safety goggles, rubber gloves, overalls, safety shoes or boots), rinse the spray tank and the spraying system with plenty of water after each operation. Clean the drone after every work session. After cleaning the equipment, wash your hands, change your clothes and store your work clothes and protective equipment in a locked place. After working with chemicals, always take a shower if possible.

Drone handling and use precautions

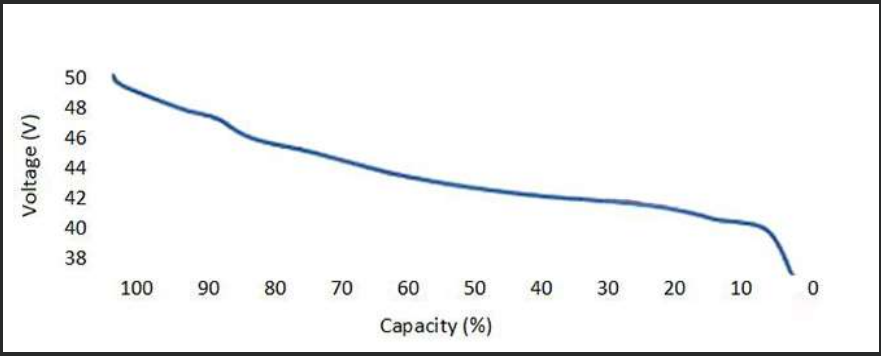
- Before commencing each flight, plan your drone's flight path with care and attention. Pay attention to the following:

  - working at a suitable time of day,
  - weather conditions,
  - environmental influences (such as sunlight),
  - drifting of the drone in case of wind,
  - wind speed,
  - flight altitude,
  - when planning, the correct line spacing,
  - turning points,
  - obstacles in the work area.
- When planning your flight, pay close attention to spray runoff caused by the wind. The degree of runoff depends on:
  - the amount of spray applied,
  - the flight altitude,
  - the airspeed,
  - the droplet size (determined by the combination of impeller speed and pump delivery volume),

- the direction and speed of the wind,

Always factor in the amount of runoff when planning your flight.

- An incorrectly chosen combination of airspeed and altitude will greatly reduce the quality of the work done. Therefore, follow the instructions provided by the chemical manufacturer, choose the correct flight speed, altitude and amount of spray to be applied.
- You can always count on some residue during operation, which is 1% of the spray tank capacity.
- Carefully store any remaining chemicals after the spraying is done.
- The equipment is powered by a replaceable battery. Make sure the batteries are in good condition and fully charged. Do not use faulty or damaged batteries. To learn about proper use and storage, please read the battery's instruction manual.
- The batteries can be charged using an external battery charger. To use this, please refer to the battery charger's instructions for use.
- The battery performance varies by the temperature, always pay attention to this phenomenon and follow the battery's instruction manual. Operate or charge the batteries only between 5°C and 45°C ambient temperatures, while the battery's temperature remains between 10°C and 60°C.
- Battery discharge is not linear, depending on load, temperature, internal resistance, 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 17kg, thereby the drone's overall mass must not exceed the Maximum Take-off Mass (MTOM), 29kg.
- Maximum flight time with one battery is mostly dependent on the Take-off Mass, which is highly related to installed accessories and payloads. Difference in safe maximum flight time between an unequipped L10 and a fully loaded L10 at MTOM can be as high as 8 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. 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 agricultural 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. 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 to the spray tank, punctures, damage to the spraying system, etc...

Transporting the equipment requires extra care and attention. Improperly secured equipment and accessories necessary for its operation (drone, drone batteries, battery charger, generator, spray tank, spraying chemicals, 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 L10 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 in cases where the drone signal is out of range (for the ABZ Innovation L10 this is 8 kilometers), 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 can be set before take-off, telling the drone what to do if:

- the drone detects an obstacle
- battery charge drops below 30%
- the drone loses signal

These options can also be set with the following:

- returning to the starting point (Return to Launch – RTL)
- stopping at the point of signal loss
- keeping the height
- landing
- climbing to the set altitude and return home continuing Auto mission

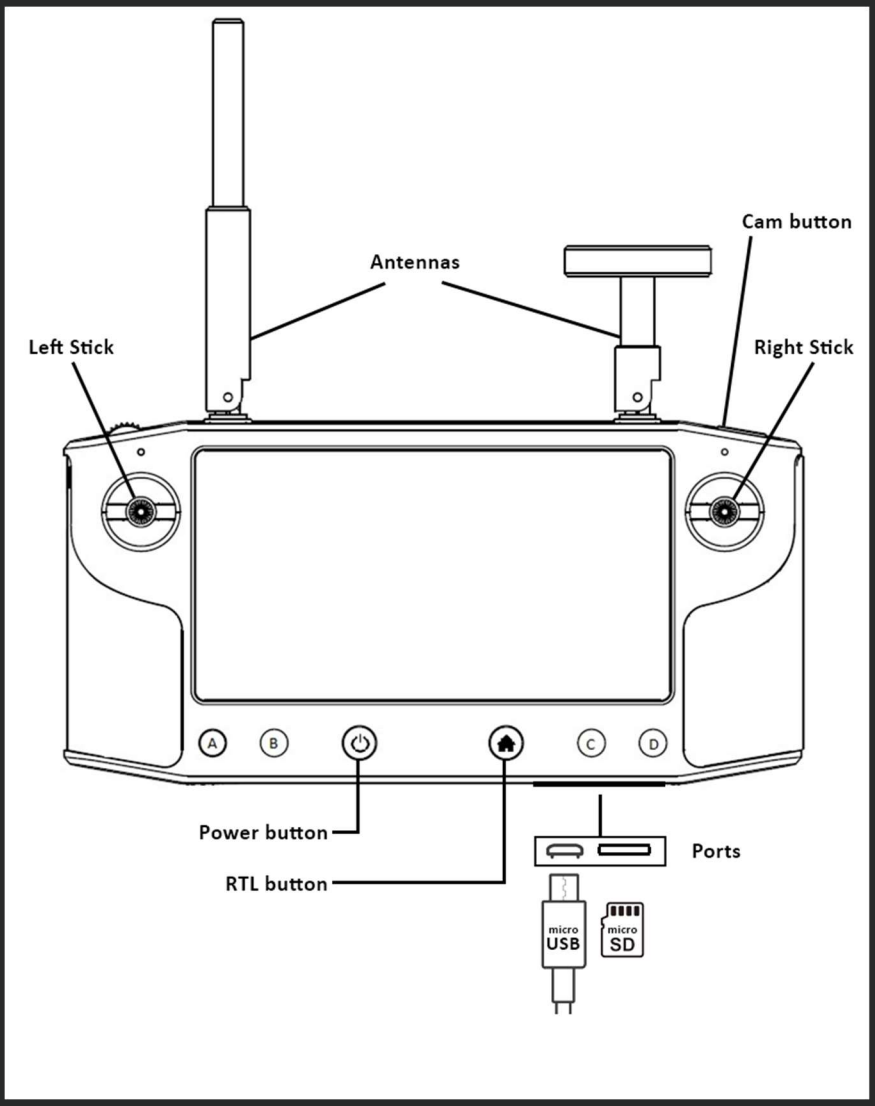
If the drone loses signal from the remote controller, or the communication between these are interrupted, on the remote controller's screen the following message will appear „COMMUNICATION LOST" and it will read it out loud (if the volume is not muted).

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

Mandatory drone identification with Dronetag

For security reasons, in the United States and the European Union, the remote identification of drones is mandatory. All drones must operate with a remote identification (RemoteID) device, ensuring the local transmission of information about the operating drone. The L10 drone comes equipped with a Dronetag BS remote ID module. You can set up and manage the Dronetag BS in the Dronetag Toolbox App (available for Android and iOS) or after a free registration either in the dronetag.app web application or in the Dronetag App (available for Android and iOS).

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



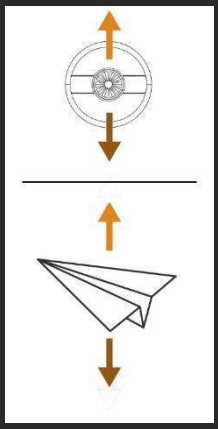
Remote Controller

Assemble the antennas by plugging them in the port matching the pins, push in, rotate 45° clockwise, then release. The antennas can be rotated and tilted 90°.

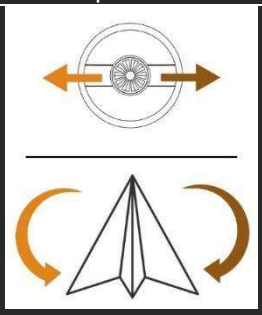
Charge the controller using the microUSB cable (min. 2A power is recommended).

Default control (Mode 2)

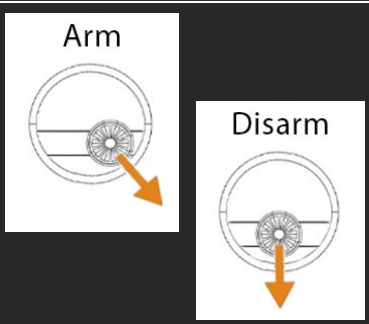
Left Stick



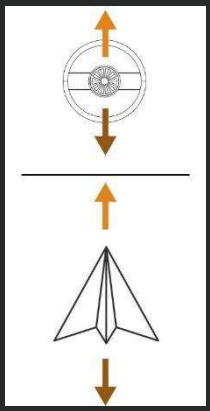
Up/Down



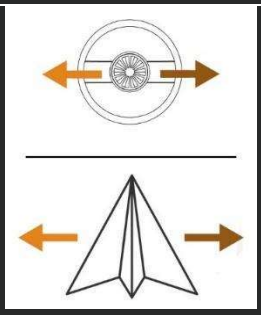
Rotation



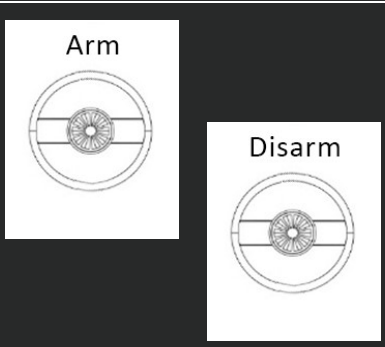
Right Stick



Forward/Backward



Left/Right



The L10 is compatible only with the controllers provided by ABZ Innovation with specialized ABZControl software. Every firmware/software combinations are compatible with the drone. The available remote controller units:

- Herelink HX4-07075
- Herelink HX4-06211

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

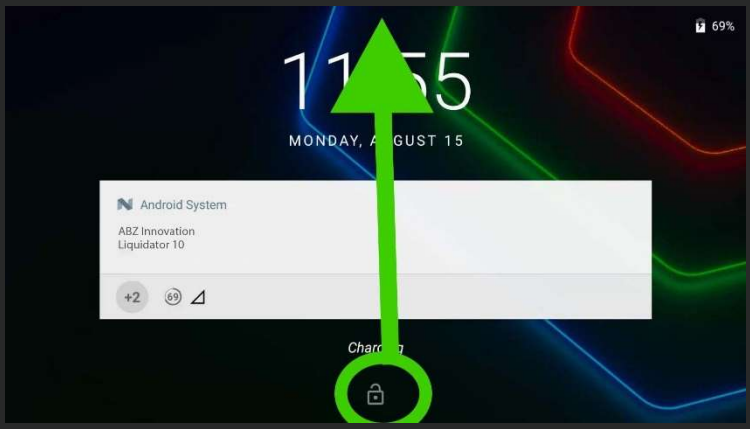
No software update is needed before and during operating the drone, future updates are only optional. Any future software updates will not affect the control and flight functions. Software update procedures are explained and guided in the documentation of the update package. All informations and files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

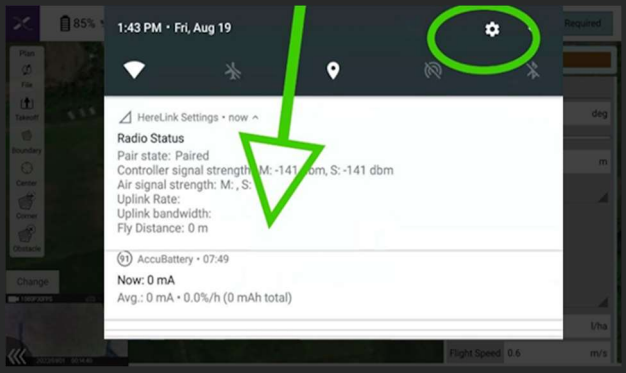
The remote controller is an Android operation system based device, with a HereLink integrated system for communicating through radio signals with the drone. It runs the ABZControl application to control the drone and let the pilot access all telemetry data and advanced flight planning.

After switching on the remote controller by pushing the power button for 4 seconds, check the battery charge of the remote controller, then unlock the Android system screen lock by swiping up from the bottom of the touch screen, the ABZControl flight control and planning application will be launched.

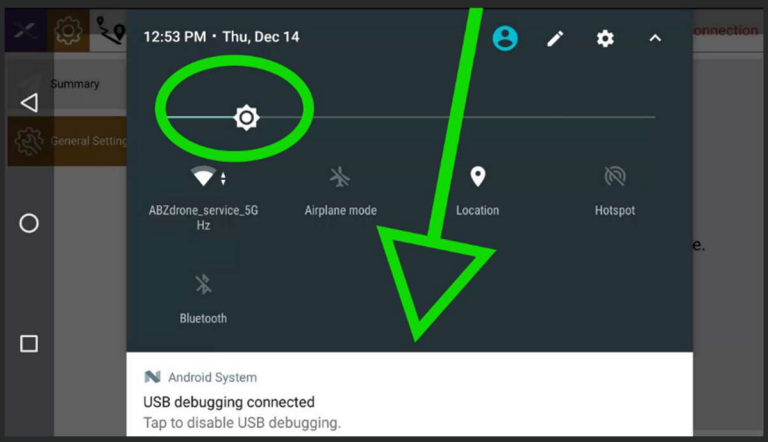


The remote controller battery status is then displayed in the Android menu (by swiping down from the top of the screen). Pushing the power button once short will turn off the screen (power saving mode), or pushing it for 1 second you can choose between Power off or Restart the controller.

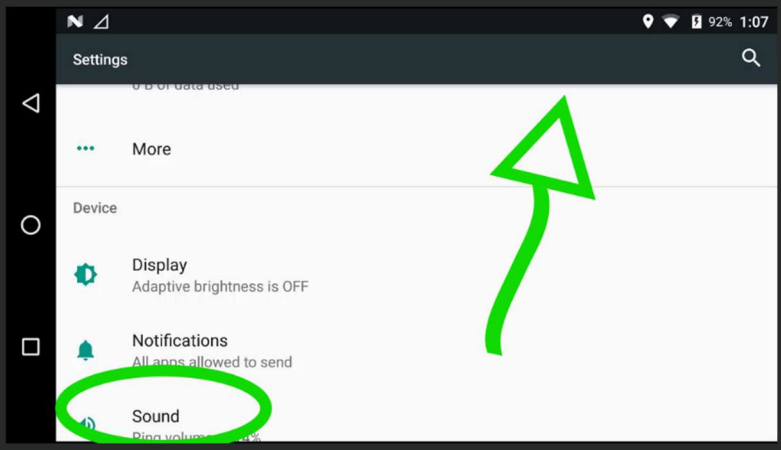
Set the **display brightness** and **sound volume** always according to environmental conditions (light conditions and noise level)! Setting the **display brightness** and **sound volume** is always accessible (even during operating the ABZControl software) from the basic Android menu, swiping down from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



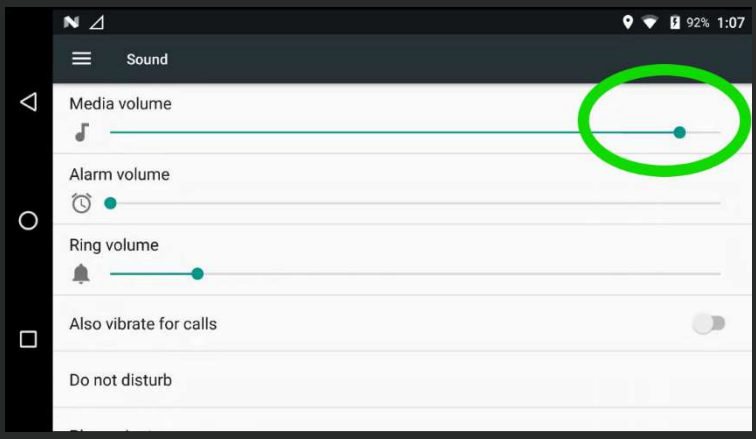
Swiping down from the top of the touch screen once more, the slider for the **display brightness** setting appears:



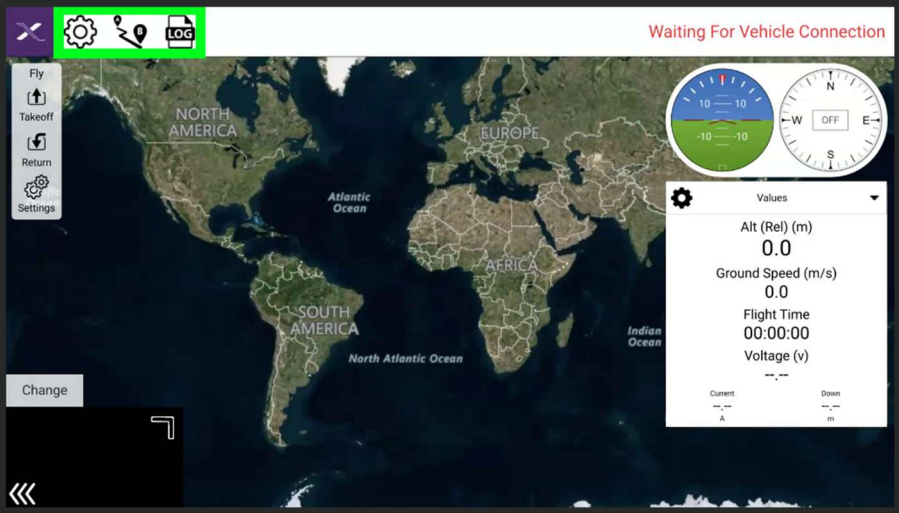
Or clicking on the **Settings** (gear icon at top right corner) then scrolling down to **Sound** menu and tapping on it shows sliders to volume control functions.



Media volume controls the ABZControl application's alerts and informations volumes. We highly recommend this to set to the maximum volume always.

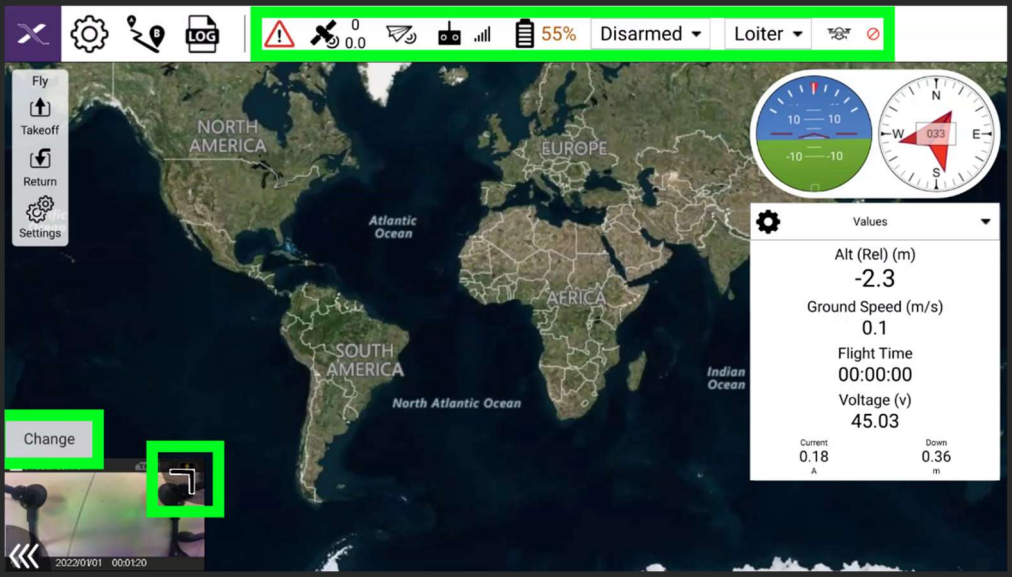


With the Android **Home** button (circle icon on the left side) switch back to the ABZControl application, the following screen will be displayed. In the top menu bar you will see the icons **Flight view, Settings**, **Flight planning**, **Evaluation** in the following order.



After turning on and connecting the drone, you will find additional status icons at the top: vehicle messages, GPS status (above: number of connected satellites, below: HDOP value), Telemetry and RC signal strength, drone battery status.

Top right is the "armed/disarmed" status and the flight mode in a drop down menu.



Before flying the drone, make sure that you can see in the vehicle messages that the IMU0, IMU1, IMU2 "is using GPS" lines are visible, that there are at least 7 satellite connections, HDOP value is below 1.1, and that LOITER flight mode is selected.

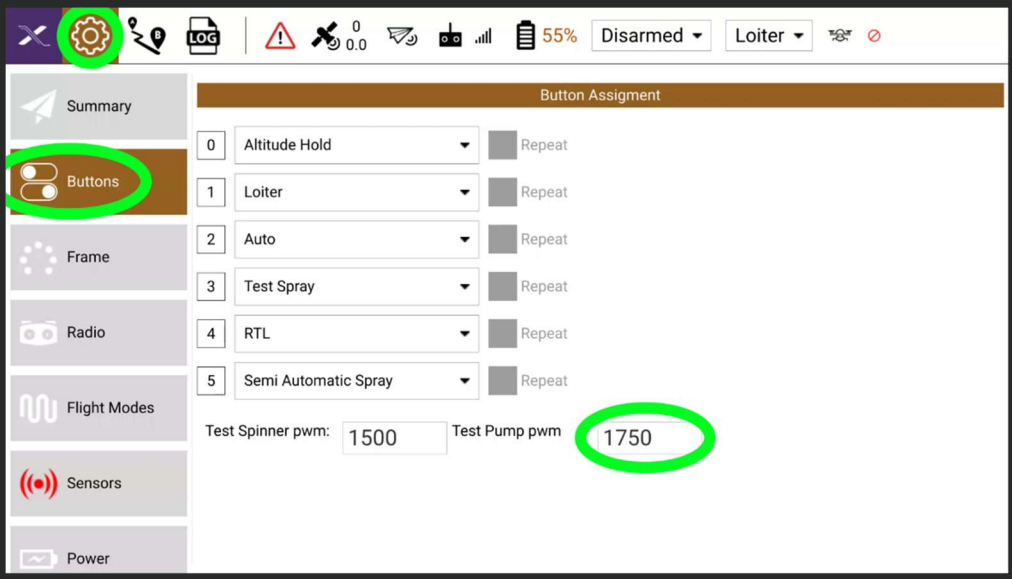
In the very right corner of the top bar, a red no-entry sign indicates that the drone is still preparing its systems for the flight. If the icon changes to a green check mark, the drone is ready and can be armed.

On the right side, the telemetry data are visible in a white panel. During flight, you need to monitor the battery voltage status here.

In the bottom left corner you can see the **camera/map view**, click on it to switch which one to display in full size. You can switch between forward and downward facing camera by clicking on the change button. Switching between cameras can take approximately 30 seconds in this software version. If camera picture is not shown correctly, toggle between the two cameras twice.

If the drone has been filled with liquid for the first time after the tank was completely emptied, to facilitate the dispensing from the empty tubes, the pump can be started manually before take-off. We recommend the following values in the top left **Settings (gear icon)** menu's **Buttons** tab: **test Pump pwm** value at **1900** (after entering the number, press the checkbox on the bottom right), which is the pump's highest delivery rate, and the **Test Spinner pwm** value at **1050** (the CDA does not rotate). The Test Spray **D button** can be pressed to start and stop the process. This function is recommended before automatic flights set for low liquid flow, for higher flow the pump will start very quickly even if the pipes are empty.

In any case, this function is only used **before** pressing the **Upload** button of the automatic flight plan detailed below, if necessary!



Cleaning and flushing the spray system is recommended with Test Pump pwm at 1900 and Test Spinner pwm at 1100 and 1900 (lowest and highest CDA rotation).

Setting up FailSafe

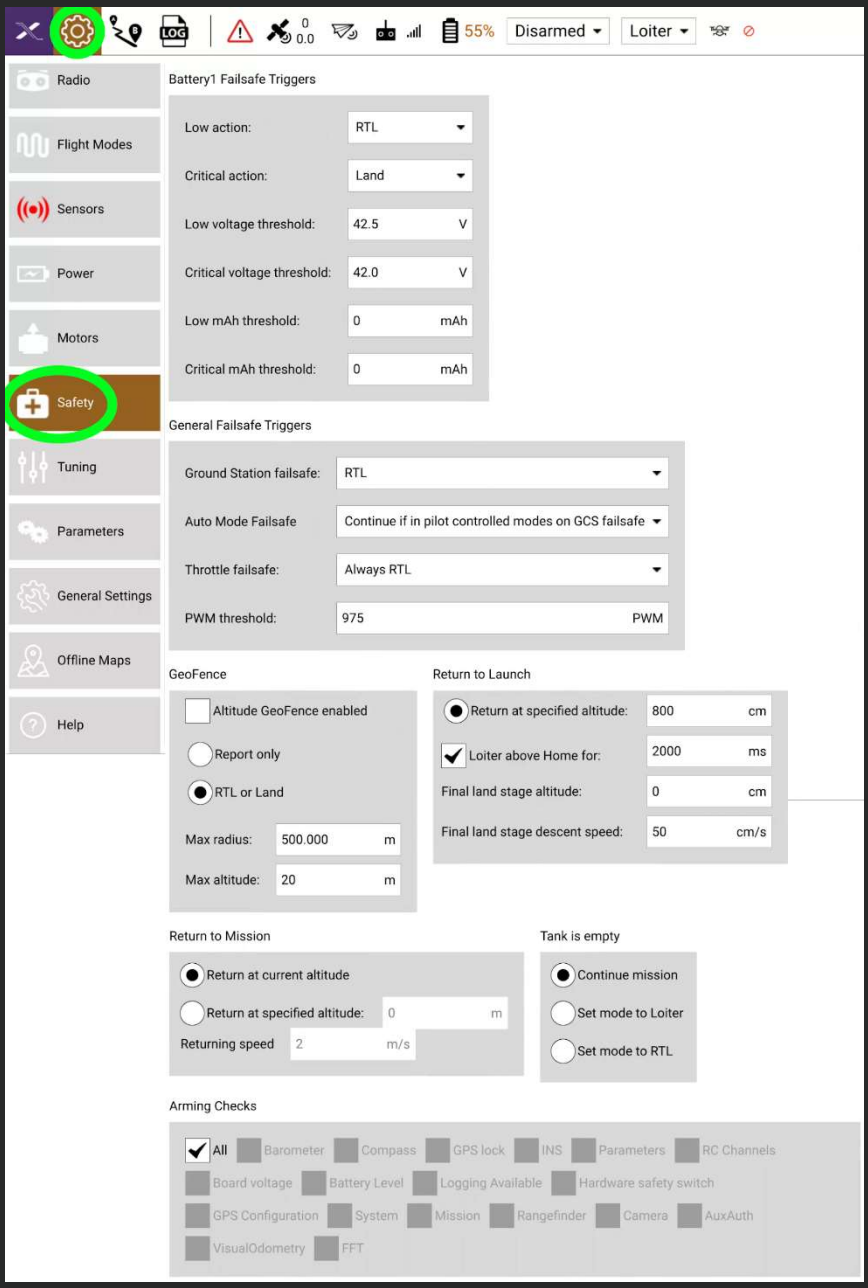
Always check and set up failsafe settings before every new flight or mission.

Access path: **Settings / Safety**

- Battery failsafe: two voltage levels determine what the machine will do in the event of battery discharge. If needed, modify **only the actions** and **NEVER modify the voltage values!**
- General failsafe: you can set what the machine should do in case of losing the remote controller's signal.
- GeoFence: 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.
- 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 takeoff position before landing.
    - Final land stage altitude should **NOT** be other than 0.
    - Specify final land stage descend speed (limited by the drone's limitations).

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 takeoff position, than lands and disarms itself after landing



Controlling the drone

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

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

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

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

- **Auto** flight mode: **C button** – (GPS based) the drone will fly the mission uploaded to the drone (created by Mission Planner application or created by ABZControl on the remote controller).
- **Return To Launch** flight mode: **RTL button** – (GPS based) the drone will fly the shortest way to the launch position (if not changed manually, it is same as the take-off position) at the specified altitude (Settins/Safety/Return to Launch) and then land itself.

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

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 the display, then release.

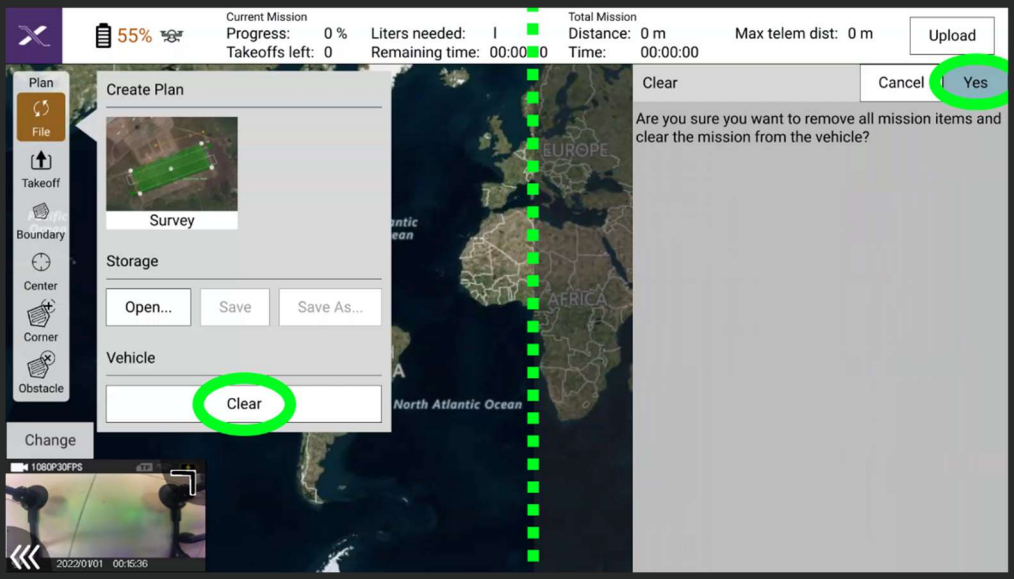
After the motors are started, fly the drone manually by controlling it with the left and right sticks in Mode 2 by default and take off to a safe height (at least 2m).

Land: **Manually control** descend 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.

Flight planning

Flight planning is accessed by selecting its icon at the top left. For safety reasons, if your location or flight plan is different from the last time, first select Clear in the File menu on the left and then Yes on the right to confirm.



On the same interface you can save and open the flight plans (**Open, Save, Save As… buttons**), you can choose from the already saved plans on the right side after selecting the Open button. These saved plans are stored on the remote controller, they are not stored on the drone. When opening a file, after selecting it, you have to wait a few seconds allowing it to load.

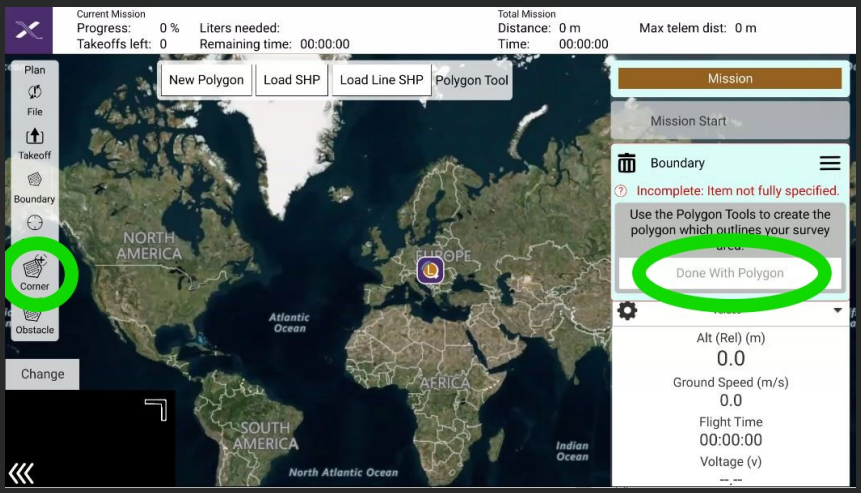
The Survey panel on the right shows the settings for automatic flight mission. To specify the spraying settings, follow the instructions from page 28, paragraph beginning with „The selected area can be finalized with the Done with polygon button

Upload the planned route to the drone by clicking on the **Upload required / Upload** button at the top right.

Planning the field with the drone

The drone's downward-facing camera can be used to mark specific points in the working area.

To select an area for a new flight plan, fly the drone to the desired corner points and let it hover, then use the **Field** button on the left of the display to add the desired points. Points can also be manually moved on the display, based on the map, by tapping and dragging. In this case, you should be aware of the inaccuracy of the map, which can be several metres off!



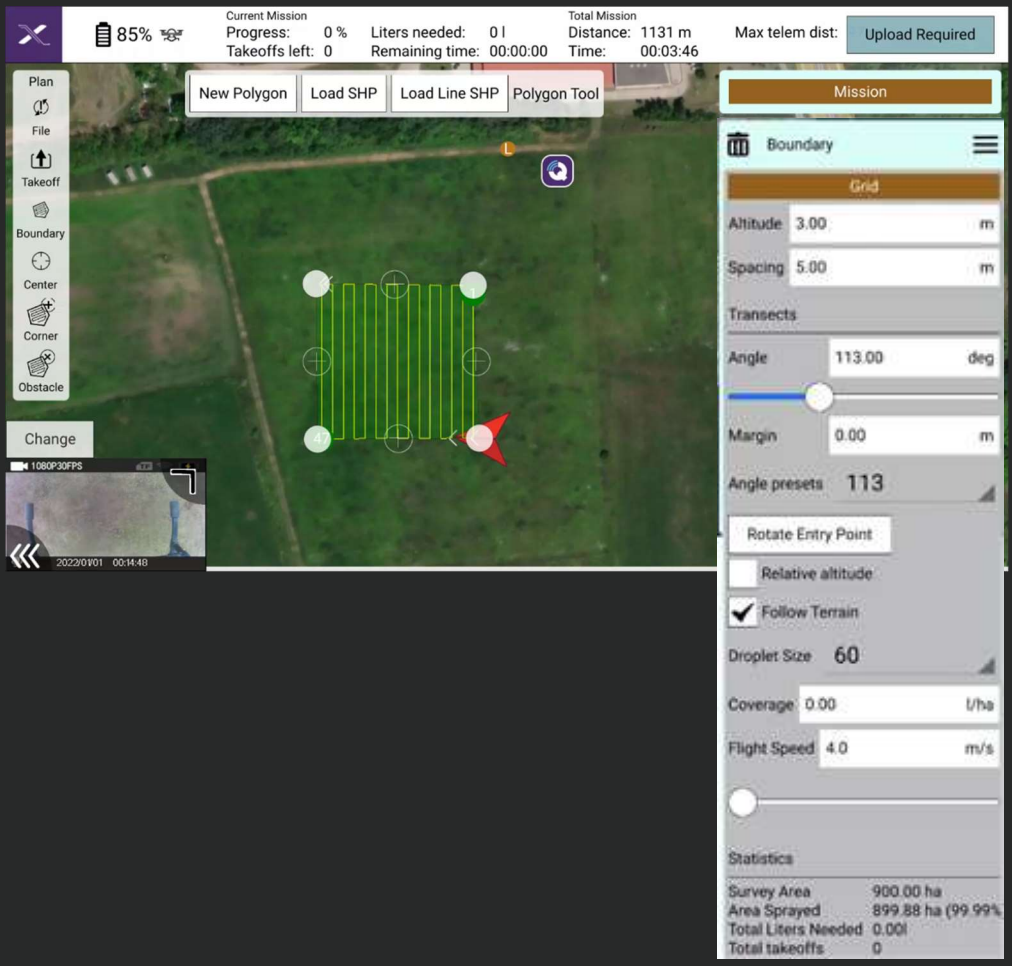
The selected area can be finalized with the **Done with polygon** button, after which you need to use the **Obstacle** button to select the areas or obstacles excluded from the flight in the same way as above with the drone (at least 3 corner points are necessary to define an area or obstacle excluded from the flight).

The drone will avoid only the obtacles marked in the flight plan and only in automatic flying mode.

In the current software version, the obstacle avoidance function is only valid DURING automatic spraying route, it is NOT APPLICABLE when flying to the entry point or continuing a previously interrupted automatic route, or flying home with the „Return to Launch - RTL" function. Pay special attention to this, and if possible, manually fly the drone as close as possible to the desired starting/continuation point!

The Survey panel on the right shows the settings for automatic spraying:

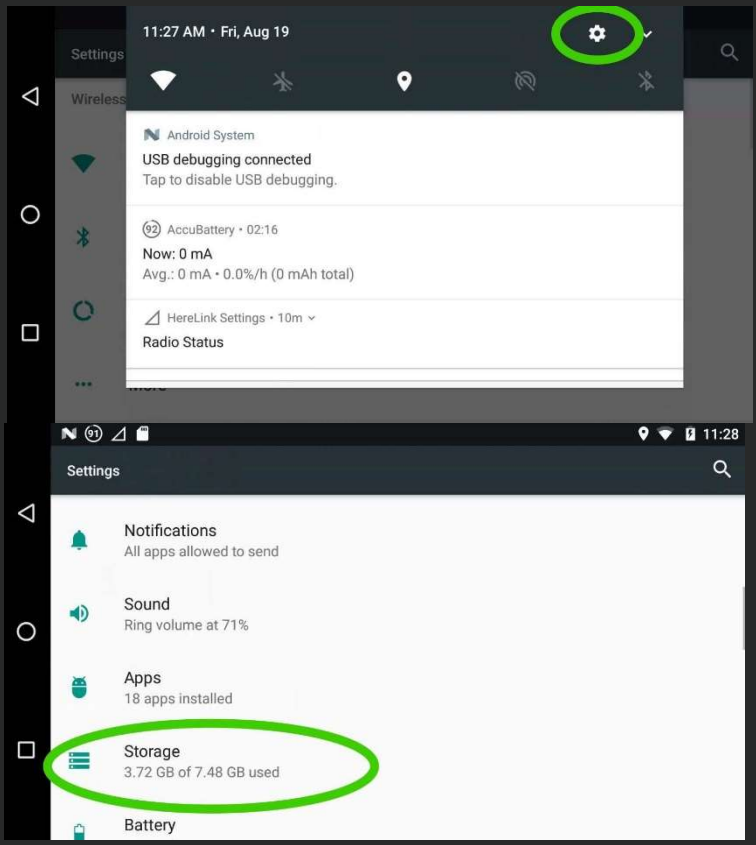
- Flight altitude
- Line spacing
- Angle of flight direction (also adjustable with the slider)
- Margin (distance kept from the edge of the designated area)
- Angle presets (to match the flight direction with the area's edges)
- Rotating the position of the first waypoint (it is recommended to set it the closest distance to the take-off point)
- Altitude hold method (in all cases, **Follow Terrain** must be selected, this is the setting for the LiDAR system)
- Droplet sizes (in microns)
- Coverage (quantity of liquid sprayed)
- Flight speed (ground speed, between applicable extremes depending on spraying rate, also adjustable with the slider)
- Statistics (calculated data according to the settings, at the bottom)

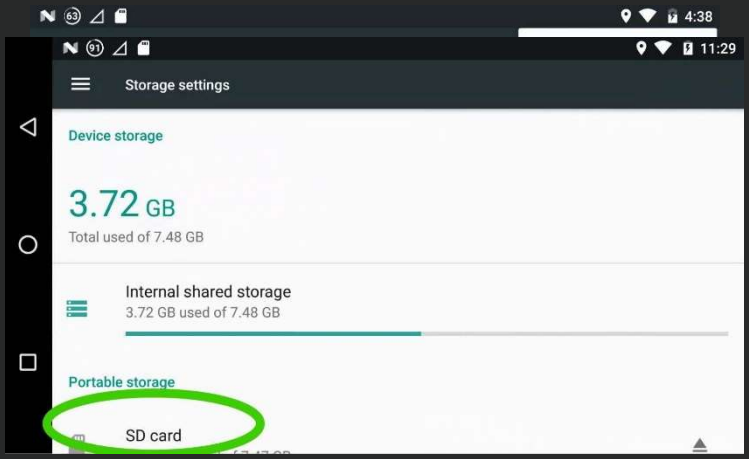


Upload the planned route to the drone by clicking on the **Upload required** / **Upload** button at the top right.

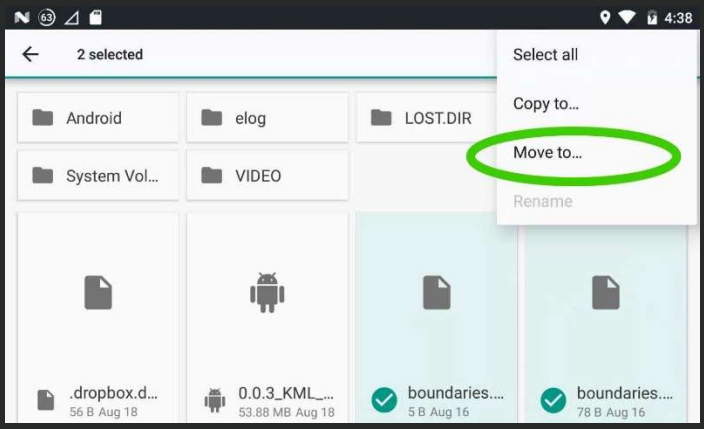
Planning the field by loading a shape file

The files must be copied to a MicroSD card and then the card inserted into the remote controller. Swipe down from the top of the screen to access the Android menu, where you need to press the gear (Settings) icon at the top right. In this menu, scroll down to **Storage**, in which you can select to open the **SD Card.** Tap the top right **Others** (3 vertical dots icon) menu, then **Show internal storage.**

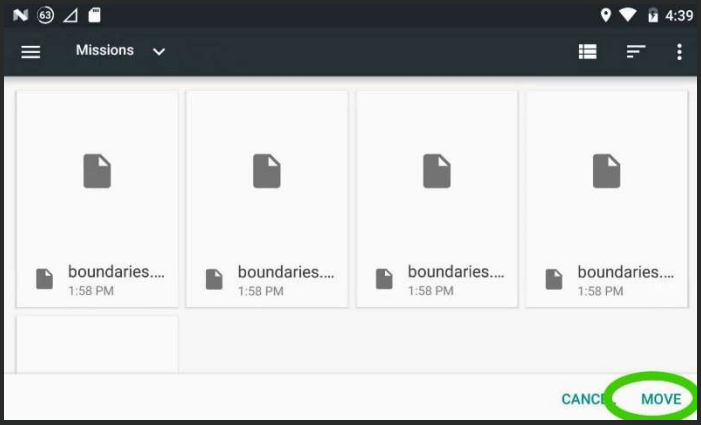




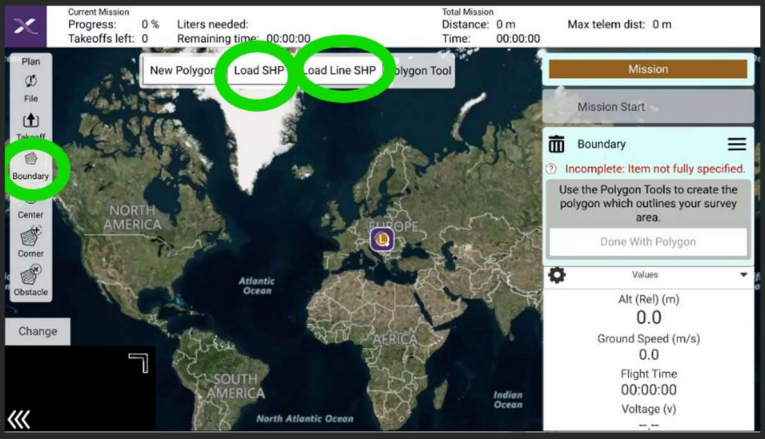
Select the required files on the SD card (tap and hold), then from the Others menu, select **Move to…**, where you have to tap on the **Optimus** tool that appears on the left, then the **ABZControl folder**, then the **Missions folder,** then clicking the bottom right **Move** button will move the files to the remote.



To the following folder: **Optimus** / **ABZControl** / **Missions**



The shape files copied to this location can be selected in ABZControl app by clicking on **Flight planning** then selecting **Boundary** tab on the left side of the screen, then clicking on the **Load KML/SHP** or **Load Line SHP** button, which will display a list of the files on the right side of the screen.



With an SHP file opened, if needed, the edges can be also adjusted by manually moving them (tapping and dragging the pins on the map view). To specify the spraying settings, follow the instructions from page 28, paragraph beginning with „The selected area can be finalized with the **Done with polygon** button”

Flight

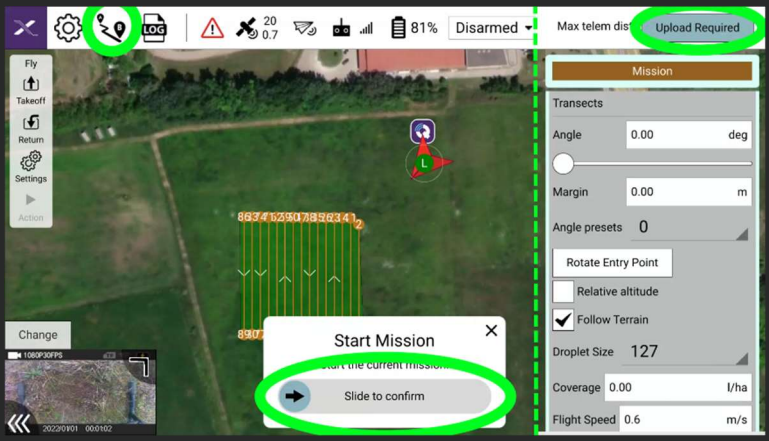
Check Failsafe settings and adjust them, if needed, according to the actual flight task and surroundings.

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

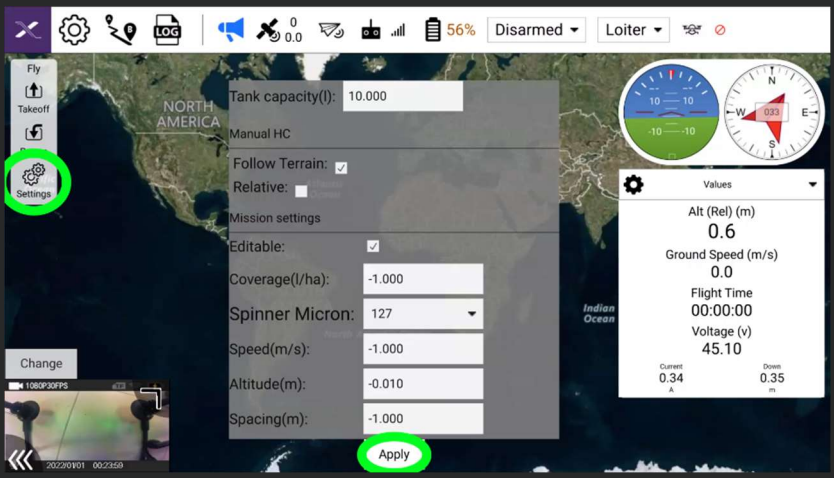
Set the display **brightness** in accordance with the lighting conditions. Every data on the display should be readable even in direct sunlight.

Turn off unnecessary nearby Wi-Fi and radio equipments to minimize interference.

If all the necessary conditions for the flight are ensured, you can then enter the flight view to start the flight, switching to "Armed" mode. In this software version **manual take-off is required** and **manual landing is recommended**. After manual take-off, start the automatic flight by sliding the Start mission - Slide to confirm button. Every flight must be carried out fully in accordance with all **Checklists** (page 57-58).



After sliding start mission, a pop-up window appears to check all spraying setting before mission. If any values must be adjusted, in flight view settings even during mission these values can be applied. Setting an accurate value for the liquid in the tank is needed for the smart tank refill route calculation.



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

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

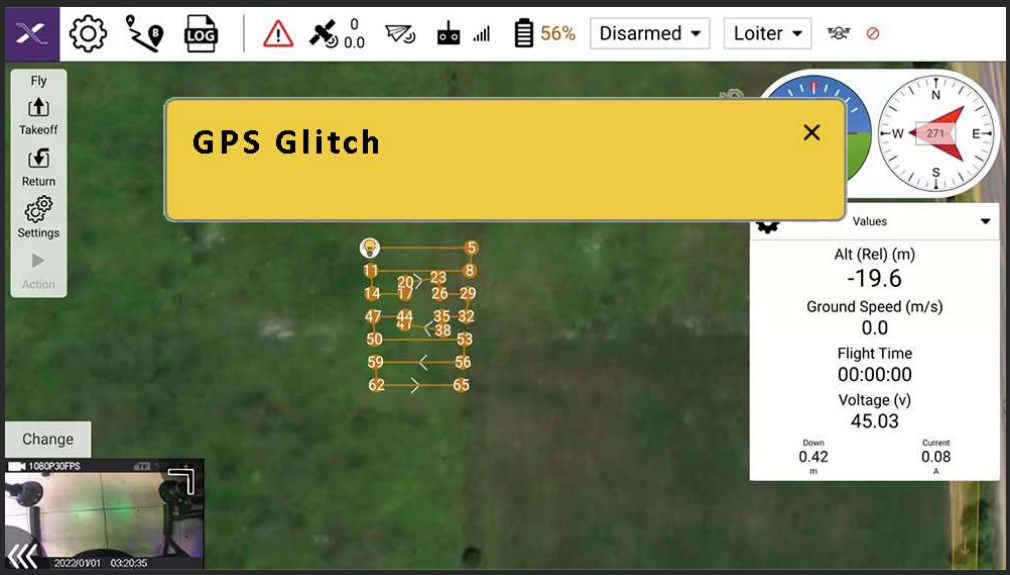
In case of any abnormal behaviour of the drone during automatic flight, immediate switching to **Loiter (B button)** or **AltHold (A button)** mode, in case of abnormality in Loiter mode, immediate switching to **AltHold (A button)** mode is required by the pilot to take full manual control and to ensure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

When spraying in strong tailwind, the droplets can affect the Lidar measurement, causing the drone to decelerate, stop, ascend. Stopping spraying skips this (**CAM button**). It is recommended to spray only in appropriate weather conditions and if needed, plan the spraying crosswinds.

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

If any flight system errors are occuring during flight, the controller shows a pop-up message with informations about abnormalities. If any of these happens, the pilot must take back manual control, switching back to **Loiter** flight mode and safely land the drone.

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

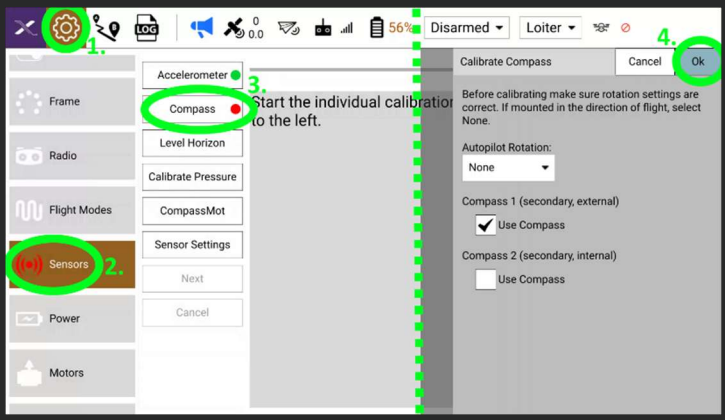


In emergency situations the pilot must operate the drone manually in the safest available manner, specifically taking care of personal and property security. The pilot must fly the drone away from potential risks, applying careful slow stick inputs and flight speeds, find a safe area and land the drone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

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

Compass cabliration

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 object from your pockets.

- The calibration sequence is initiated by pressing the "OK" button.

- Hold and Rotate the drone by hand 360° around all axles 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

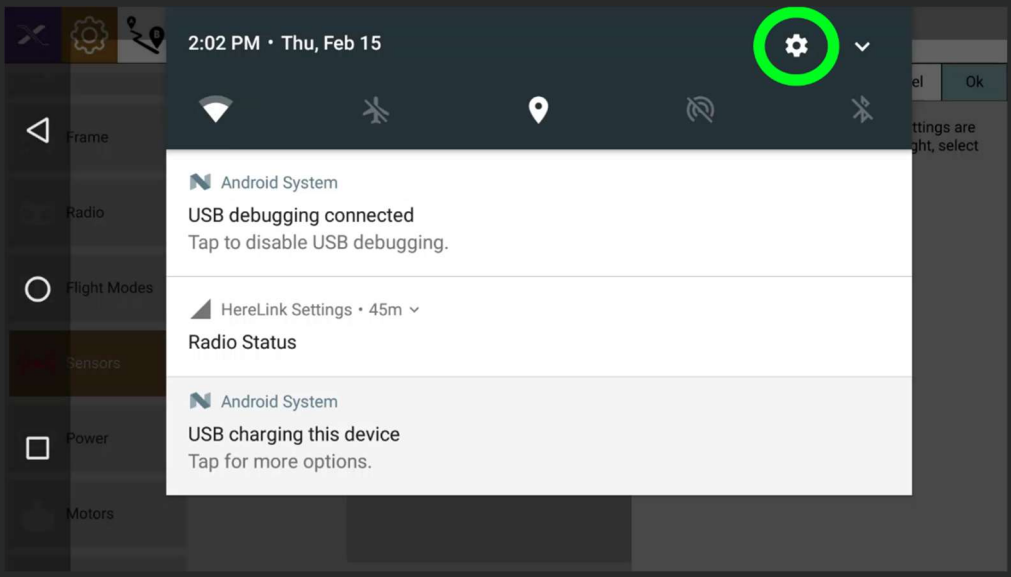
Red: not acceptable, please recalibrate

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.



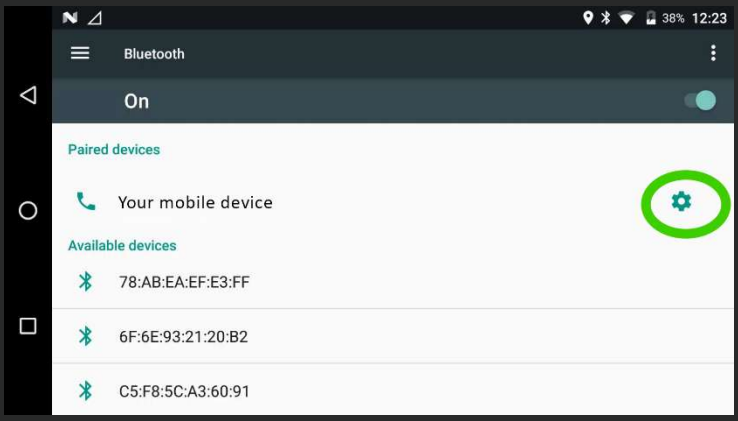
In the submenu the function can be switched on/off and the available devices can be connected.

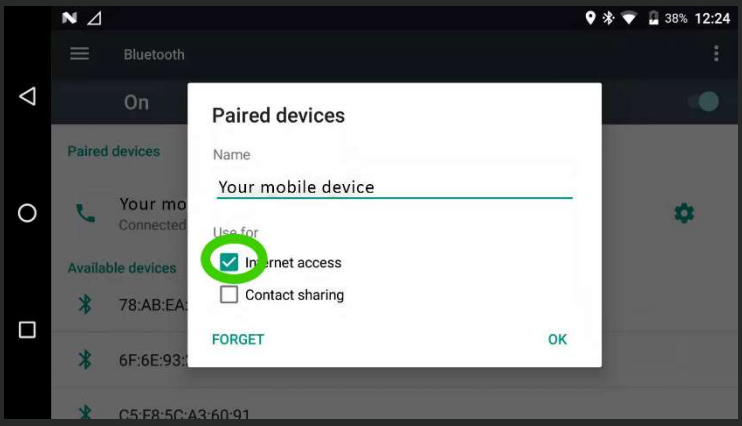
Wi-Fi only works in a limited frequency range, between the 36-48 channels on a 5.2GHz network and between the 149-165 channels on a 5.8GHz network. To connect a network device, one of these specific channels is required and it is recommended to set the network device to either channel 44 or channel 157.

Most mobile devices are not configurable to use specific channel, if the controller does not recognize the Wi-Fi from your mobile device, using Bluetooth connection for internet access is recommended:

Turn off Wi-Fi on the controller if choosing internet through Bluetooth. First, turn on Bluetooth hotspot / internet sharing on your mobile device. Then turn on bluetooth on the controller, pair the two devices.

To connect via Bluetooth internet sharing, after connecting the device, you need to set up the connection by selecting the gear icon next to the device name, then selecting "Internet access".

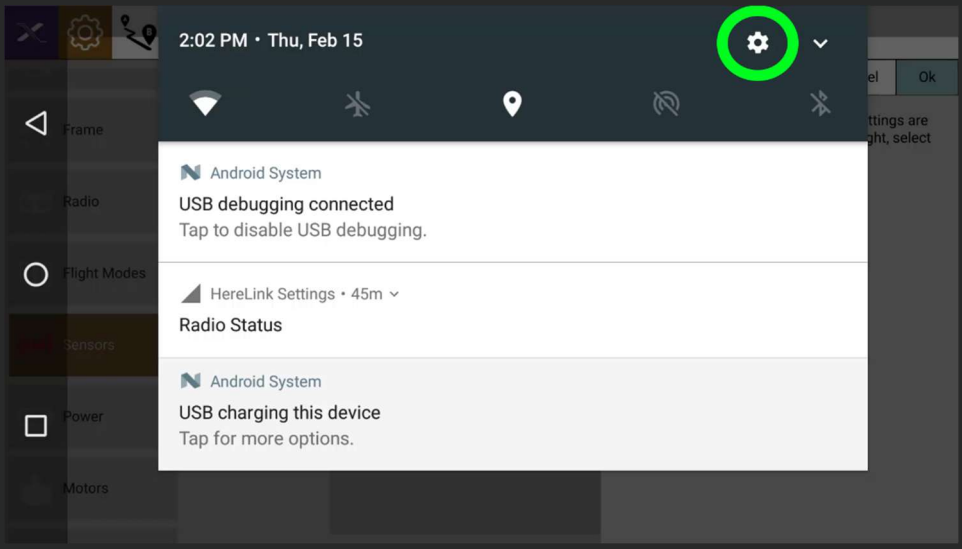




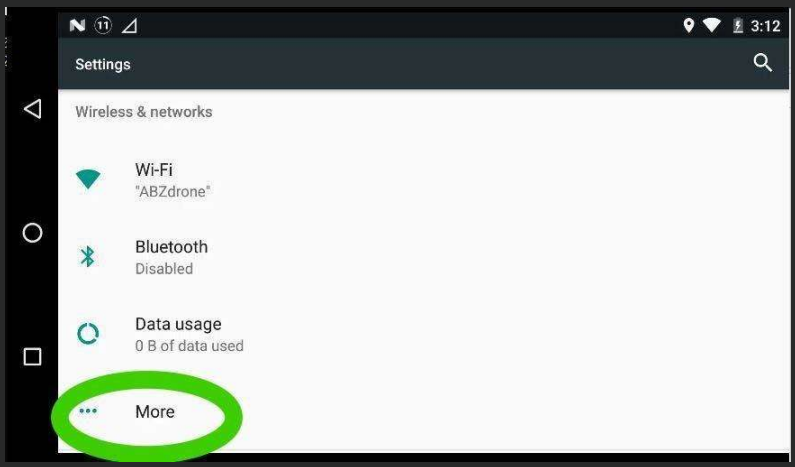
Creating a Wi-Fi hotspot

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

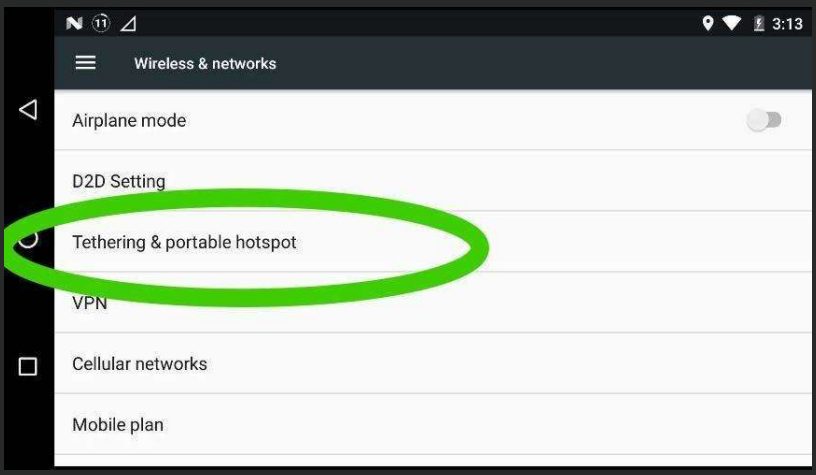
This can be accessed from the Android settings menu (opened by swiping down from the top) by pressing the gear icon.



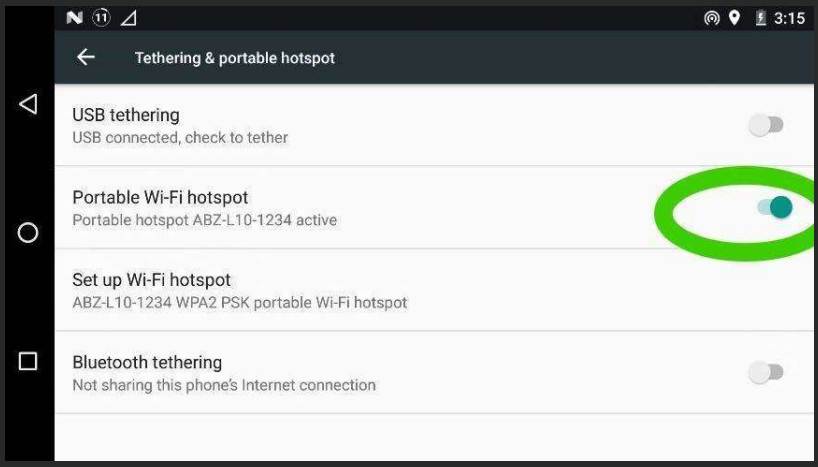
Select Wireless & networks / **More** button,



Then **tethering & portable hotspot**,



Then turn on **Portable Wi-Fi hotspot**.



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

IMPORTANT: only devices with a 5.8 GHz connection can show and use the network created by the remote controller!

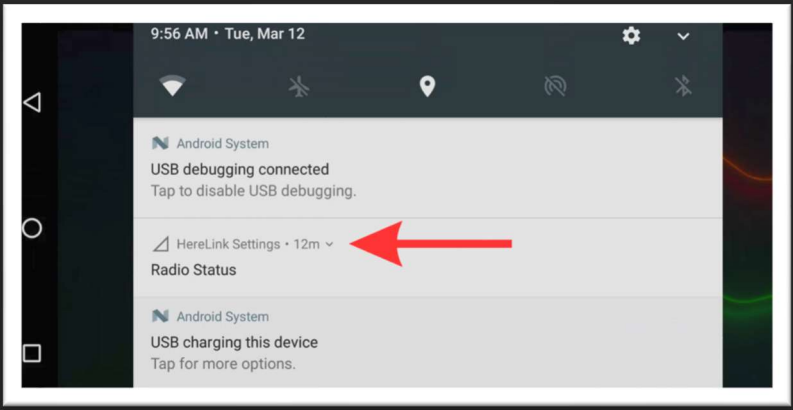
Connect to the remote controller's WiFi network:

- Network name: ABZ-L10-0### (the last three digits match the serial number of the drone
- Password: 12345678

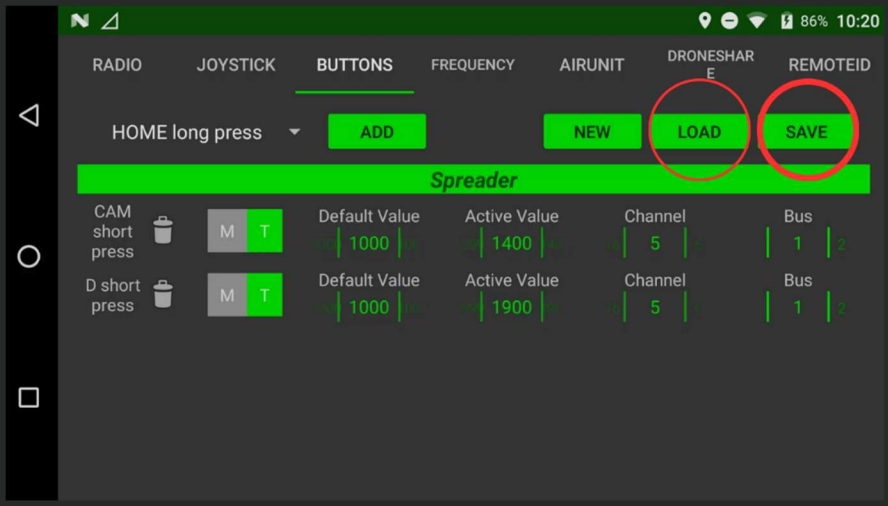
Each time the remote controller is restarted, the hotspot function must be reactivated, if necessary.

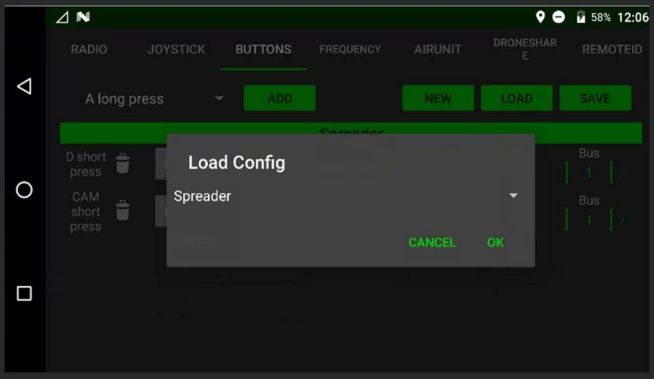
Remote controller setup for the ABZ Innovation Spreader System

1. Open the HereLink Settings: swipe down from the top of the touch screen twice to open the Android Settings. Click on the HereLink Settings (if necessary, twice).

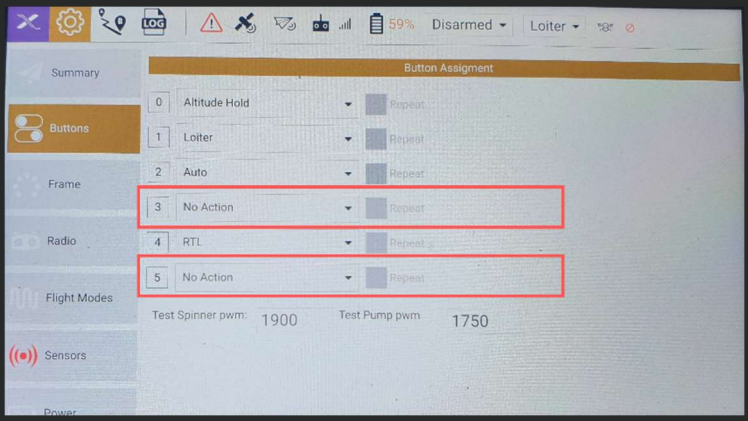


2. Open the Buttons tab. Click on Load, then select the Spreader profile. Confirm by clicking on Save. You can ignore the warning message regarding non-failsafe modes.



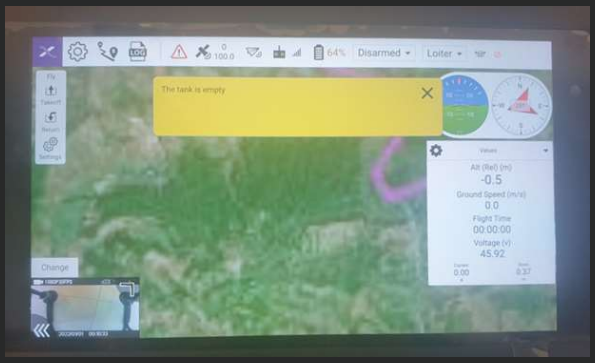


3. Turn on the drone.
4. Open the ABZControl application>Settings>Buttons option. Change the settings for Buttons 3 and 5 to *No action*.

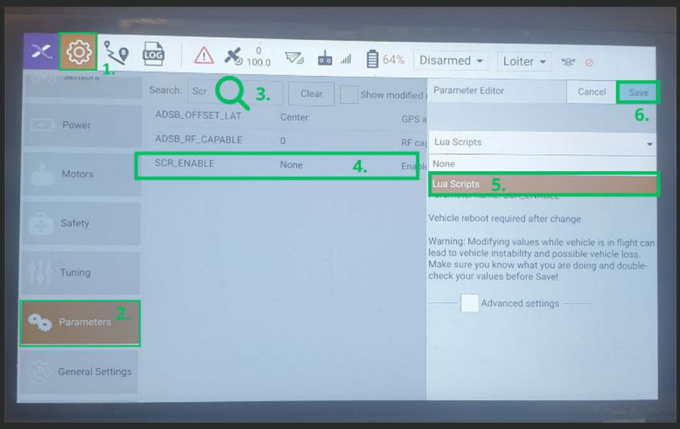


Enabling the empty-tank sensor

To turn on the empty tank sensor, open the ABZControl Settings.

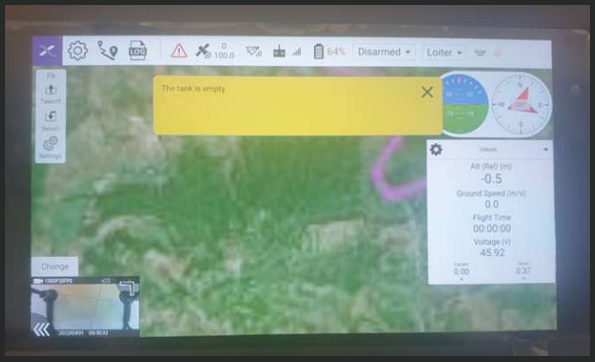


Open the *Settings* and scroll down to the *Preferences* tab. In the search field, type in " scr" and click on the *SCR_ENABLE* option.



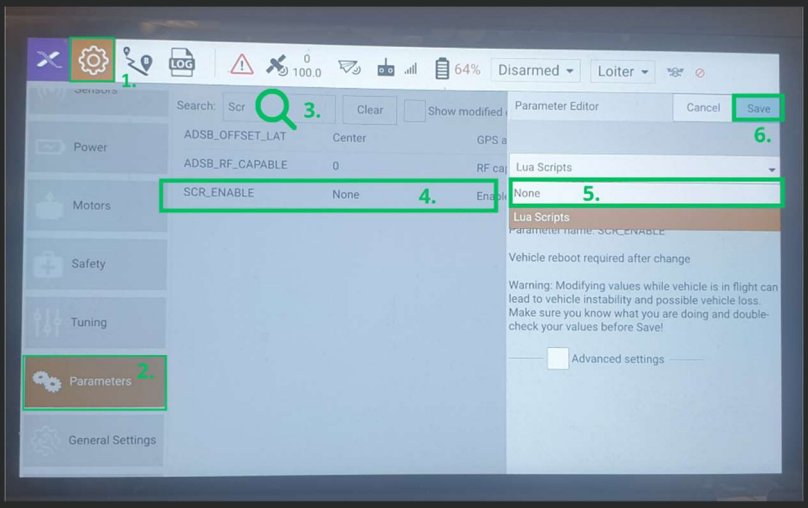
To turn on the empty tank sensor, set the value to Lua Scripts.

After finishing the spreading operation, the empty tank sensor needs to be disabled. Otherwise, the Tank is empty pop-up window will constantly appear on screen.

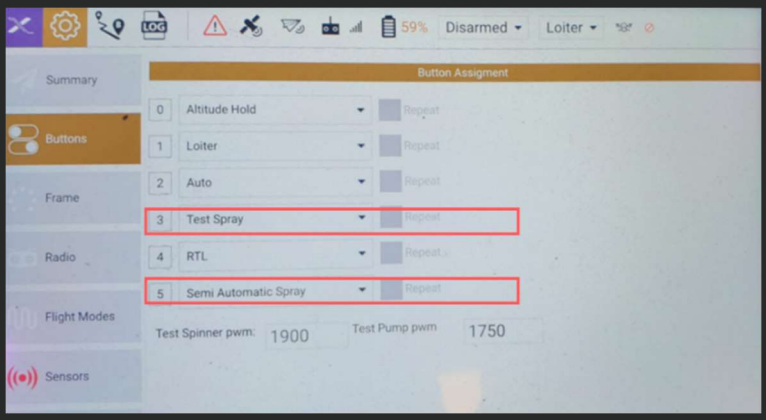


Cover up the sensor or the silver foil in the tank to temporarily prevent the pop-up window.

Open the *Settings>Parameters* and look for scr in the search field. Click on the *SCR_ENABLE* option and set the value to none.



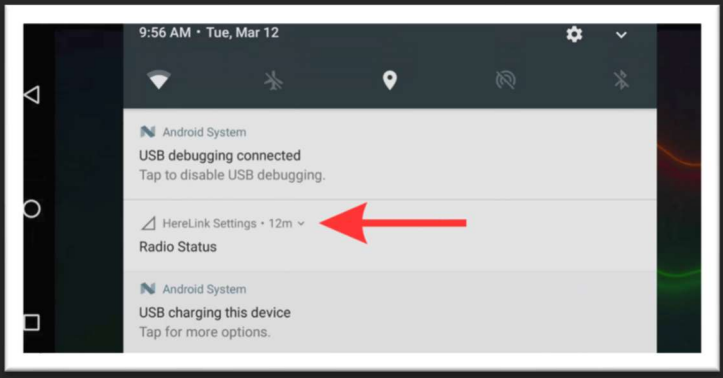
If you equip the drone with the Sprayer, change the settings for the buttons back to the original. *ABZControl application>Settings>Buttons.* Set Button 3 to Test Spray and Button 5 to Semi Automatic Spray.



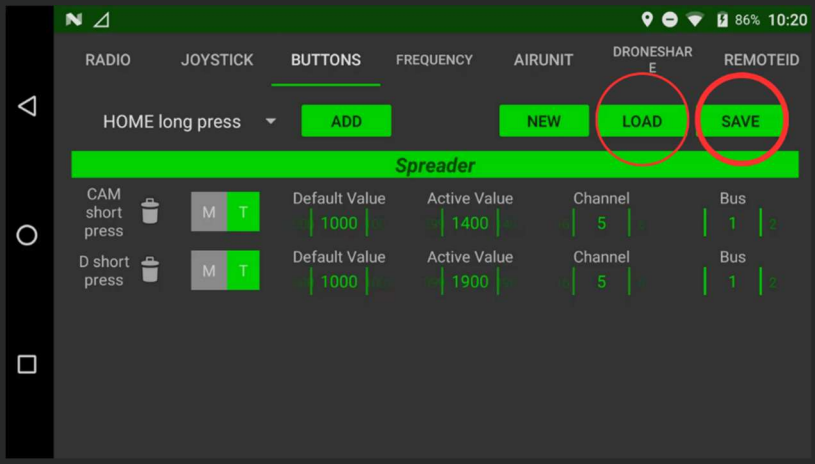
Finally, open the HereLink Settings>Buttons menu and change the Profile back to Sprayer. Click on Save.

Remote controller setup for the Skyinnov Trichogramma spreader

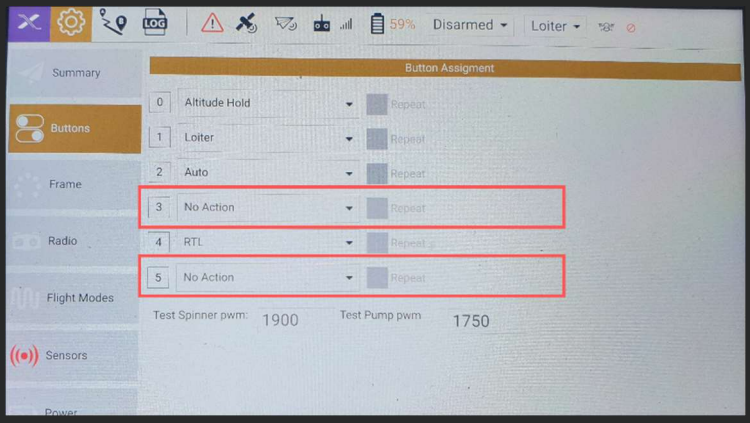
1. Open the HereLink Settings: swipe down from the top of the touch screen twice to open the Android Settings. Click on the HereLink Settings (if necessary, twice).



2. Open the Buttons tab. Click on Load, then select the Trichogramma profile. Confirm by clicking on Save. You can ignore the warning message regarding non-failsafe modes.

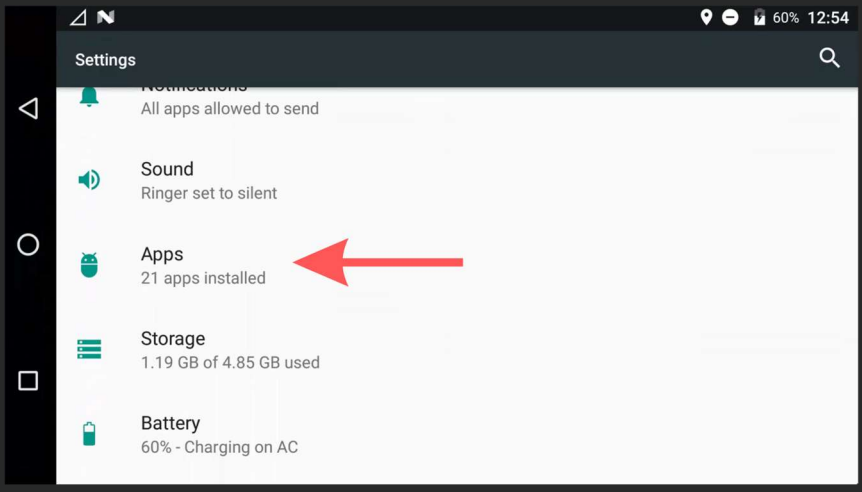


3. Turn on the drone.
4. Open the ABZControl application>Settings>Buttons option. Change the settings for Buttons 3 and 5 to No action.

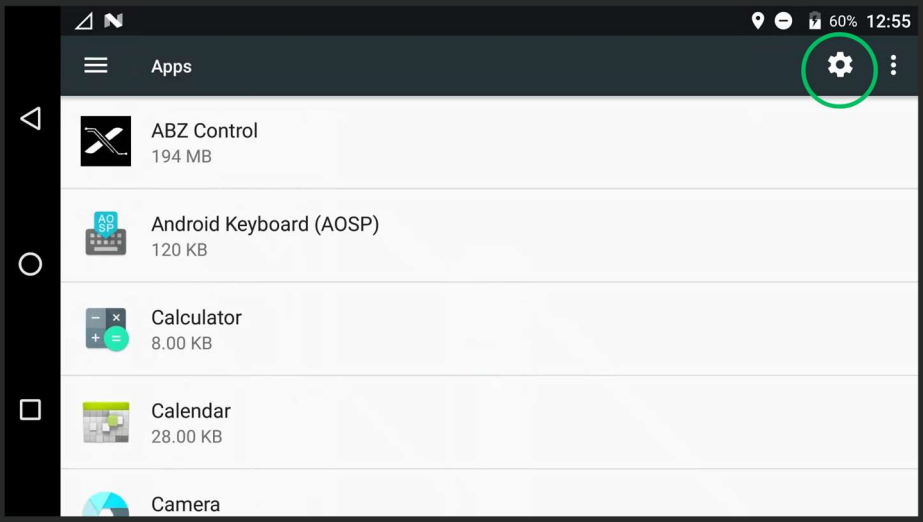


5. To operate the drone with the trichogramma spreader you need to use the **QgrandControl** application. To make the application easily accessible from the Home Screen, some Settings must be changed. Swipe down from the top of the touch screen and open the **Android Settings**.

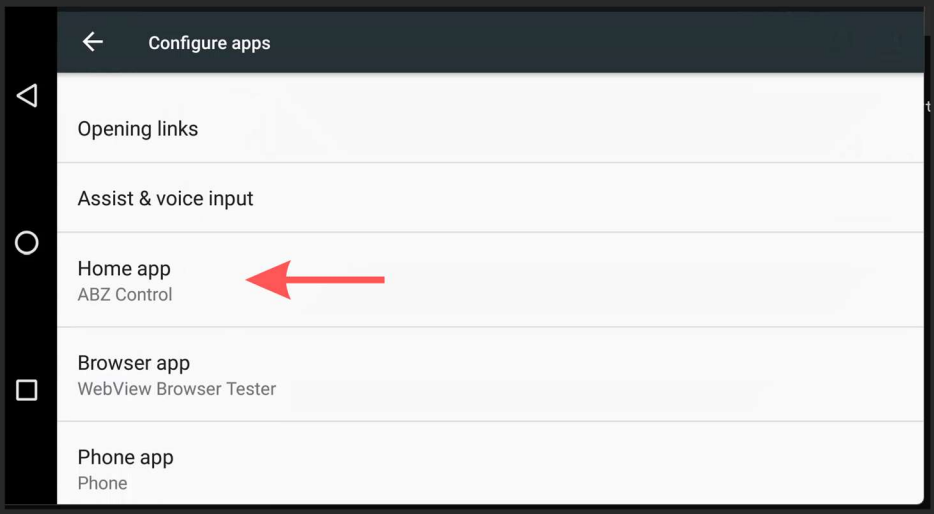
6. Open the **Apps** menu.



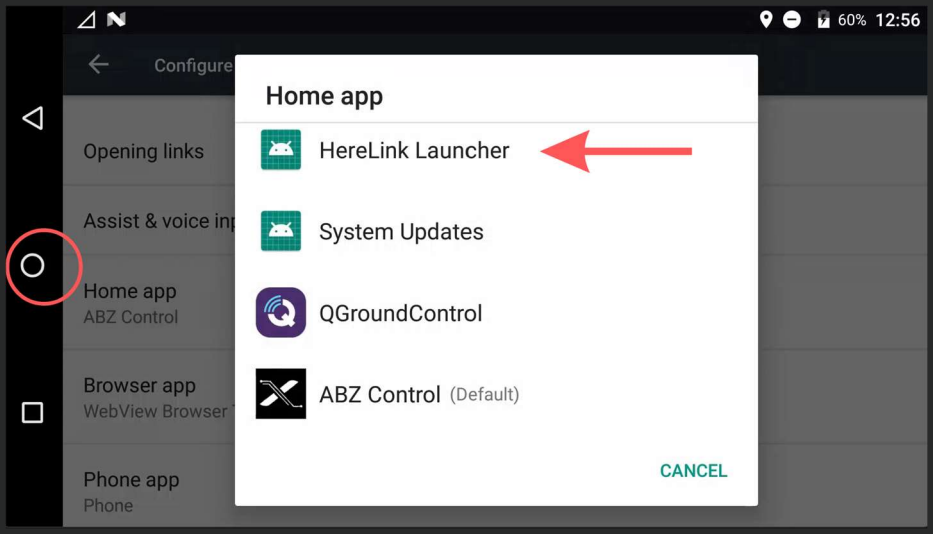
7. Open the apps configuration settings with the **gear icon**.



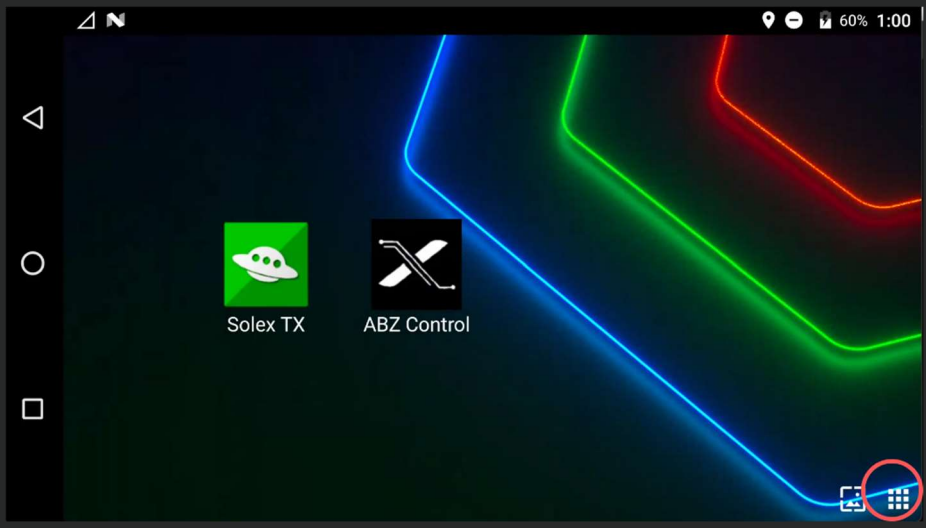
8. Click on the **Home App** option.



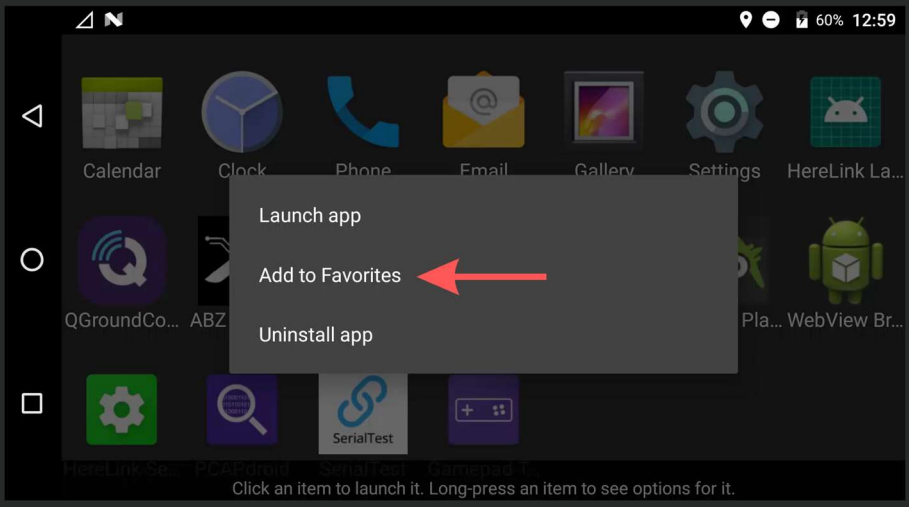
9. Change the Home App to **HereLink Launcher.** Then click on the circle to reach the home screen.



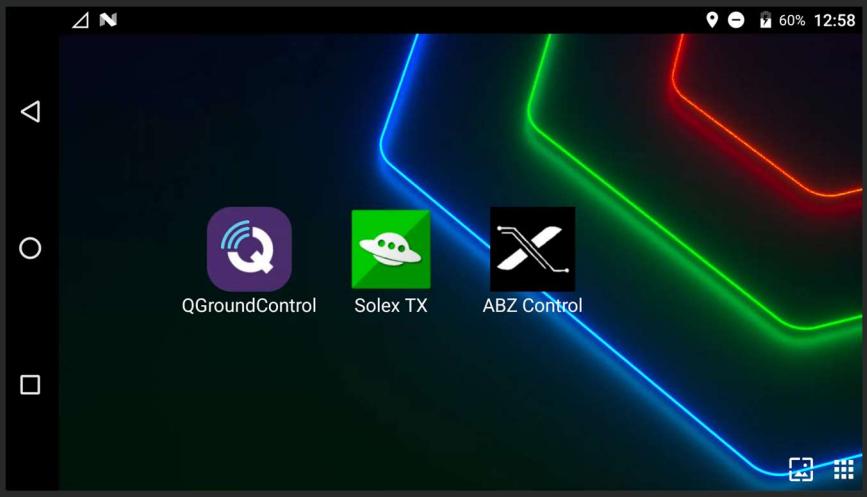
10. You need to add QGroundControl and ABZControl as favorites. To do so, click on the app list icon at the bottom right corner of the screen.



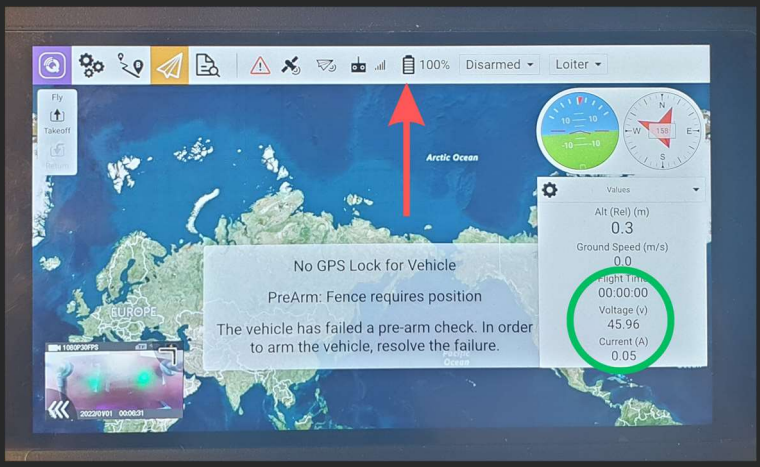
With a long press on the icon of the applications you can set them as favorite.



Now you can reach the QGroundControl (used with Trichogramma spreading) and the ABZControl application (used for spraying and spreading)

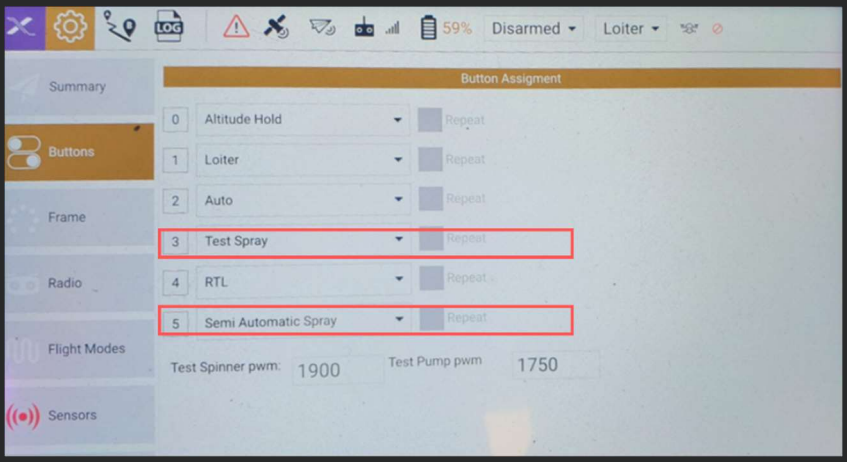


IMPORTANT: In QgrandControl the Battery Charge percentage is reliable only if you use a fully charged battery. The pilot should constantly monitor the battery's **Voltage**. If the Voltage reaches 43 V, you must immediately land the drone.



For further assistance with mission planning and using the Skyinnov Trichogramma Spreader, please refer to SkyInnow's manual.

If you equip the drone with the Sprayer, change the buttons back to the original settings. ABZControl application>Settings>Buttons. Set Button 3 to Test Spray, and Button 5 to Semi Automatic Spray.



Flight Protocol

Before flight, tasks and inspections

- Battery status, charge level.
- 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.
- 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: 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.
- 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.
- NEVER leave batteries connected for prolonged periods.
- Before arming the drone, leave enough free space, at least 10 meters
- 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 'HDOP' value is below 1.1.
- Check that the devices installed are working properly.
- Make sure that liquid level is correct (for spray tank)
- Make sure that the task you have chosen is the one you want to carry out, is planned and properly analyzed.
- Whether the take-off zone is sufficiently cleared.
- Arm the drone and take off.

After take-off, tasks

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

During mission, tasks

- Regularly check the charge level of your batteries.
- Check the flight altitude and the maximum allowed distance.
- Battery charge below 30%: consider returning the drone to the starting point.
- Battery charge below 20%: the drone must be landed.
- Switch off the engines after landing (disarm function)
- End of mission.

After landing, tasks and inspections

- Switch off professional equipment if necessary.
- Switch off the drone by unplugging the battery.
- 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 unfolded state
- Switch on remote controller, launch ABZControl app.
- When ABZControl is waiting for the connection, turn on the drone by connecting the battery (the plug must be fully plugged in).
- If you are operating the drone in a country where the remote identification of drones is mandatory, verify in an appropriate application that the Dronetag BS is correctly broadcasting your drone operator ID before take-off (see on page 14).

Before every take-off

- Drone battery charge level
- Remote controller battery charge level
- When ABZControl 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, ABZControl must be restarted or MissionPlanner must be connected).
- At least 7 satellite connections and HDOP value below 1.1 are shown.
- Whether the drone is in **Loiter** mode (if not, press button B to switch).
- 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.
    - It is recommended to start returning the drone when the battery is at or below 30% charge or the voltage is at or below 43.5V.

  - Battery voltage should not be lower than 43.0V, even under heavy load.
  - Flying the drone is not recommended below 20% battery charge, the drone must be landed.
- 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. .

Emlid RTK (L10 Pro)

The L10 PRO drone comes with the Emlid Reach M2 and LoRa system, which works as GPS without any further adjustment, or it can be connected with Emlid RS+ or RS2+ RS3+ for RTK positioning at centimeter precision.

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

- SSID: L10Pro-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:

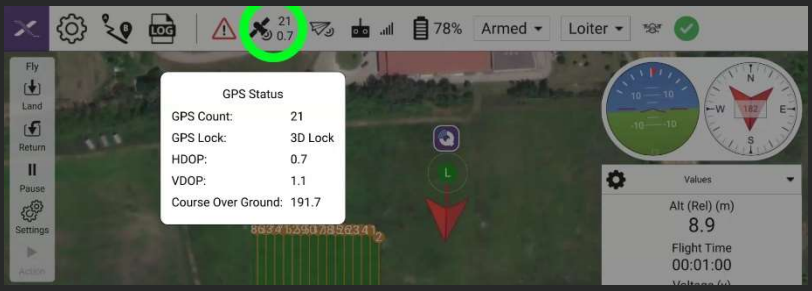
https://docs.emlid.com/reachrs2/

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



Herelink RTK (L10)

The drone comes with the Herelink RTK base system, which can be used according to the following instructions. These hardwares are needed for the whole process:

- Laptop with Windows operating system and a USB-A port
- Herelink RTK package
- L10 drone
- L10 remote controller
- Power source for the laptop, if needed for longer operation

To use RTK, the laptop must be powered on and connected to the L10 remote controller's Wi-Fi hotspot.

1: Install the **MissionPlanner** application on your computer, you can download it from the following link:

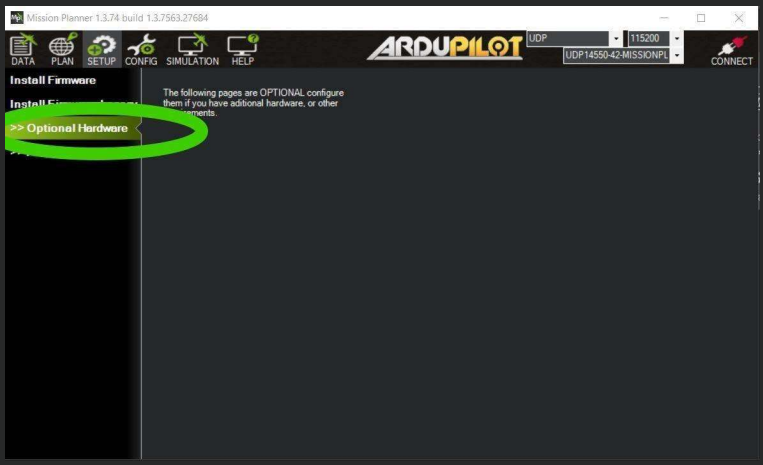
https://firmware.ardupilot.org/Tools/MissionPlanner/MissionPlanner-latest.msi

Manufacturer's guide for installation, if required, can be found here:
https://ardupilot.org/planner/docs/mission-planner-installation.html

2: Assemble the contents of the Herelink RTK box: connect the antenna and the USB cable to the **Here+ RTK** unit, and then connect the USB cable to the computer.

Place the base station in an outdoor environment with sufficient sky coverage to obtain a good satellite signal. Place the base station antenna on a stable and elevated platform, such as a tripod. It is recommended to place it as far away as possible from the laptop and other metal objects or electronic devices (according to the length of the cables), at a location not directly surrounded by trees, buildings or other landmarks.

3: Open the MissionPlanner application and **in the** top left **Setup** menu select **Optional Hardware**, then **RTK/GPS Inject**.



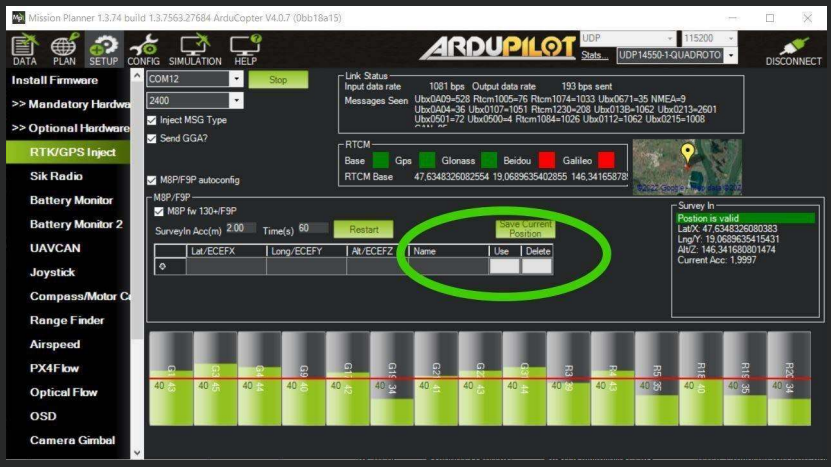
4: From the top drop-down menu, select the **COM** port that corresponds to the RTK base module, then click the **Connect**. All the checkboxes must be checked (if the default setting is different).

5: The **SurveyIn Acc(m)** field is used to set absolute geographic accuracy that you expect, the **Time(s) field** is the minimum survey time you expect.

6: Click on **Restart** button, the base module will start a new round of surveying, after which the system will operate according to the specified values once the required accuracy has been reached within the specified time interval.

7: The inteface displays the number of satellites and the detected signal strength with columns. If the expected values are already within the defined absolute accuracy, the **Position is valid** message is shown on the right, marked in green. Depending on the conditions (e.g. weather, humidity), reaching the absolute accuracy can vary significantly, experience shows that for 2m at least a few minutes and for 30cm about 1 hour may be required even under ideal conditions.

8: To the right, **Current Acc** is the current accuracy, in meters. If you want to work with the RTK in the future on the same field, after a longer period of operation and thus continuously improving accuracy, you can save the current position by clicking **Save current position.** This way, if you mark the exact position of the RTK base and place it in the exact same place later, you will achieve the relative accuracy significantly faster. In the **Name** field, mark the location, which can be used with the **Use** button, and if it is not needed later, it can be deleted with the **Delete** button.



9: It should be noted that the absolute geographic accuracy of the base station here will affect the absolute geographic accuracy of the drone without affecting the relative accuracy between the base station and drone. If your application does not require the drone with high absolute geographic accuracy, you do not need to set the base station's precision too high, resulting in long survey time. Even if the accuracy of the base station is 1.5 to 2 m, the position accuracy of the drone relative to the base station can still reach centimeter level.

10: Connect the drone to the laptop via the Wi-Fi hotspot created on the remote controller, as described on page 41.

11: The MissionPlanner is automatically connecting to the drone, in the top left **Data** menu you can check the telemetry data, which will show the **GPS: RTK Float** or **RTK Fixed** status (if the **Position is valid** status is already shown in the RTK settings).

Accessories

Recommended batteries and chargers

Battery:

- 44,4V nominal voltage
- 16000mAh charging capacity
- 15C discharge value
- 12 cells
- AS150U-F connector

Examples:
Tattu Plus 1.0 16000mAh 15C
Tattu Plus Compact 1.0 16000mAh 15C

Battery charger:

- Battery charger with a power output of at least 2500W
- AS150U-F plug
- Capable of multiple charges at the same time

Examples:
SkyRC PC2500
SkyRC PC3000

Payloads

ABZ Innovation does not limit the type of payloads to be used with the L10 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 17kg, thereby not to exceed the MTOM with the fully equipped drone, which is 29kg.

The payloads must not affect significantly 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.

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.

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 use again, which can be carried out by an ABZ Innovation Distributor or Reseller.

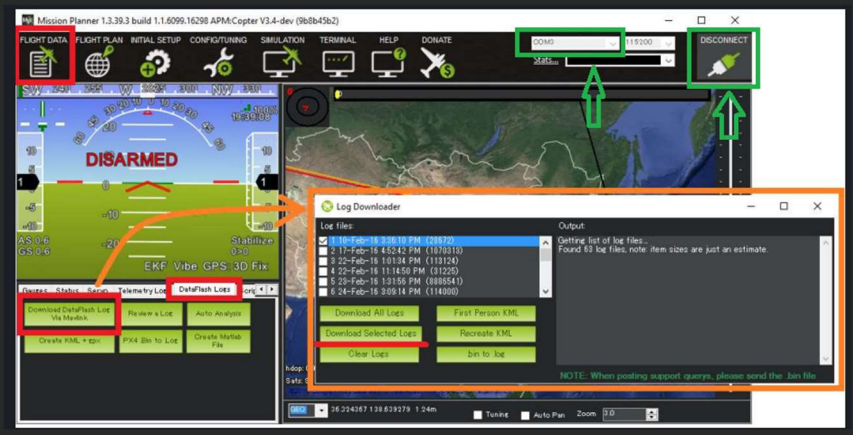
Log files

Tools needed:

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

Connect the drone to the Computer: open MissionPlanner application

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

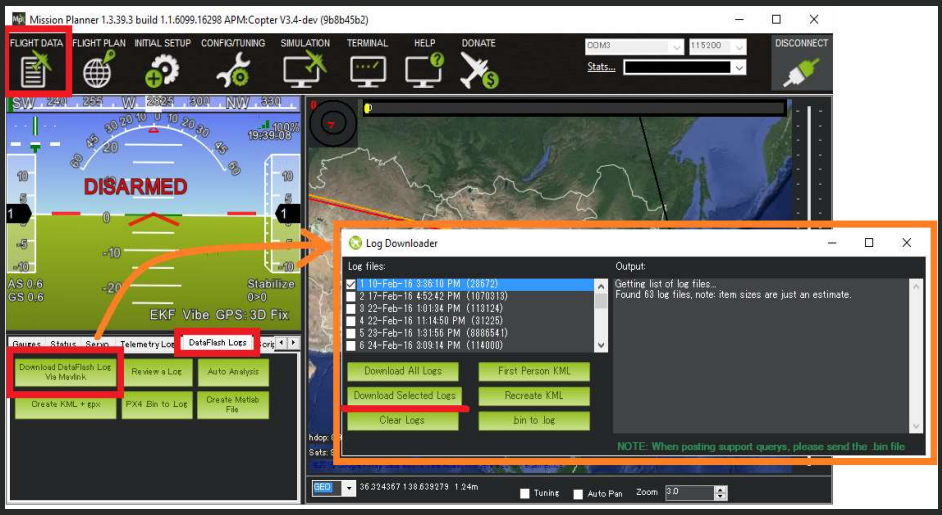


or

- by creating a Wi-Fi hotspot (see page 41) on the remote controller and turning the drone on, connect the PC to this Wi-Fi network, the MissionPlanner application will automatically connect to the drone.

Open the Mission Planner's Flight Data screen

On the bottom left, select the "DataFlash Logs" tab and push the "Download DataFlash Log Via Mavlink" button.



Then, select the log you want to download. This will save that log to your MissionPlanner/logs directory, in a folder named after the vehicle type, such as QUADROTOR.

The corresponding downloaded logs must be selected by its „date created" and moved to a new folder, which is named by the serial number of the drone.

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

ABZ Innovation Ltd. - www.abzinnovation.com