Agricultural Drone User Manual

Spider-i UAV

spider-i

Model: H32X

Model: H40X

Model: H120

Model: H160

ZhongXinZhi Hangzhou Innovation Technology Co.,Ltd.

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Safety Precautions

Flight Precautions

1. Before the drone's first flight, it is essential to calibrate the magnetic compass and compass.

   To calibrate the magnetic compass of the drone, you must rotate it clockwise with the drone as the center of the rotation, rather than rotating around yourself. Quickly toggle the mode switch during this process. The drone's tail LED will turn long yellow when it's ready for calibration. After calibration, set the mode switch to the middle GPS position. During calibration, two people should lift the drone evenly to maintain a consistent height. After lifting, rotate the drone clockwise. When the LED turns green, place the drone down, then lift it again with the drone's head facing downward. Continue rotating it clockwise until the LED changes from green to fast flashing, indicating successful calibration. Power off the drone after the light stops flashing, then you can turn on the drone and power it up again. If the LED turns red, it signifies a failed calibration, and the process must be restarted.

2. It's best to wait for the drone to complete its self-check before taking off. After self-check, only a flashing green light indicates the self-check is passed.

3. For models requiring propeller installation, ensure the propellers and their rotation direction match the motor's rotation direction. Do not use damaged propellers, as this can cause imbalance and crash the drone.

4. Remember to turn on the remote control first before powering the drone. The remote control should be turned on first and off last. Power off the drone before turning off the remote control after flight.

5. Check the remote control's battery each time before use. Replace the battery immediately if it is low before proceeding with further operations.

6. When powering the drone with a battery having separate black and red wires, connect the black wire first, then the red wire. When disconnecting, remove the red wire first, then the black. For batteries with yellow plugs, ensure correct polarity, partially insert the plug, then push it fully to avoid sparking. If a battery adapter is needed, connect it to the battery before attaching it to the drone.

7. When changing the battery, first insert the battery and check its charge level using the BB sound indicator. Always use two batteries at a time, and before replacing them, ensure that their charge levels are similar. If the charge levels of the two batteries differ significantly, do not use them together. Using two batteries with the same charge level is crucial to prevent the risk of the drone crashing during flight due to a significant discrepancy in battery power.

8. Always monitor the drone's flight status and battery level. If abnormalities are detected, land immediately in a clear area, check for issues, and only continue if everything is fine. Drone battery levels can be checked using the BB sound or

observing the tail LED lights; alternating green and yellow flashing indicates low battery. If freshly charged batteries show this pattern, it may indicate interference. Be cautious during flight.

9. During takeoff, landing, and flight, maintain a distance of at least 10 meters from people and avoid crowds. Be aware of obstacles and control the flight distance to prevent collisions. Keep a safe distance from interference sources like high-voltage lines, poles, and towers, and adjust the drone's flight immediately if there are any anomalies.

10. For optimal signal, place the remote control antenna horizontally. It's best to stand to the left rear of the drone during flight for better signal reception.

11. When adding pesticides to the tank, use a filter at the inlet to prevent blockages in the nozzle or pump from debris or unevenly mixed chemicals. Be careful to avoid splashing the drone when adding chemicals.

12. After daily operations, add clean water to the tank and spray it out using the pump to clean residual chemicals from the tank and tubes. Detach and clean the nozzle and its internal filter separately. If the pump is clogged or the pumping capacity decreases, remove and clean it before re-installing.

13. After spraying, clean the drone's body, landing gear, propellers, arms, or chemical tank surface from any splashed chemicals or dust with a towel or soft cloth to prevent oxidation and extend the drone's lifespan. Ensure the cloth isn't too wet.

14. The GPS should be placed at the forefront according to the indicated arrow and must not be skewed.

15. Do not operate the drone in rainy weather as rain and thunder can cause interference.

16. Be cautious not to expose the drone's battery and connections to water to avoid short circuits and potential hazards. Always store the battery in a dry, normal temperature environment away from flammable materials and direct sunlight. Ensure the battery isn't subject to external pressure during storage and transport.

17. Clean the drone's battery connectors and those on the drone with high-grade alcohol to remove stains and prevent overheating or melting during flight.

18. New batteries need activation and should not be charged with a high current the first few times.

19. Avoid overcharging or deep discharging the batteries. Damaged batteries should not be used. For long-term storage, charge the battery to around 3.85V per cell.

20. When charging the battery, use the dedicated charger and accurately set the number of individual cells in the battery pack (charging voltage). Carefully observe the charger's display during the first few minutes of charging, as it will show the number of cells or the voltage of the battery pack. If you are unsure about these settings, you should not proceed with charging or use a charger that you are more familiar with.

21. Do not charge the battery unattended to prevent fire or explosion risks

associated with lithium batteries.

22. Do not puncture the battery. If it's swollen, especially during charging, stop charging immediately and move it to a safe place.

23. Avoid exposing the battery to impacts, as this can cause internal short-circuiting, leading to safety hazards. (There have been previous instances where battery damage from impacts resulted in dangerous situations.}

24. Charge in well-ventilated, open areas. If a battery bursts, it can emit smoke and melted material, so having sand ready for extinguishing any fire is effective and necessary.

25. In low temperatures, all lithium batteries experience a notable decrease in charge capacity and reduced battery life. This reduction occurs because the activity of lithium ions diminishes in colder conditions, resulting in shorter battery life during winter compared to summer.

26. For drones with ground stations, do not remove the ground station antenna from the drone when not in use. It's recommended to minimize the use of ground stations, as their use can increase the risk of drone crashes.

27. Ensure there are no obstructions between the drone and the remote control during operation. If the crops are tall, the operator should stand at an elevated position to maintain a clear line of sight with the drone. Avoid flying the drone blindly, as obstructions or excessive distance can affect the remote control signal and the drone's stability.

28. Maintain a sufficient flight height during operations to ensure effective spraying and to avoid damaging the drone or crops due to uneven crop height.

29. When switching modes during flight, the throttle must be in the neutral position.

30. When using the AB point operation, switch the mode from autonomous to GPS to regain manual control. Clear the AB points only after the drone has landed; do not clear them mid-air. After clearing, ensure the AB point switch is turned off.

31. Before flying a drone with folding propellers, check that the propeller blades are neither too loose nor too tight.

32. After flying, or if the drone crashes due to improper use or operational errors, immediately lock the motors using the remote control to prevent the propellers from continuing to spin. Check for any visible deformation in the propeller clamps and replace them if the drone's stability is compromised during flight.

To unlock: pull the controls inward and downward

To lock: pull the controls outward and upward

33. After each day's work, check the drone's body, arms, folding parts, propellers, GPS, motor, and other components for any loose or worn screws. Tighten what needs tightening and replace what needs replacing.

34. Be careful not to hover without spraying when fully loaded. If you need to hover without spraying, add less liquid. Always pay attention to battery level.

35. Fruit Tree Operations: When spraying fruit trees, stand at an elevated position or on top of a vehicle to be at the same level as the tree tops, preventing signal blind spots due to angles.

36. Field Edges: During takeoff, landing, and line changes, keep a safe distance from the field edges. Due to the drone's size and braking distance, maintain at least a 10-meter safety distance.

37. Mapping and Calibration: When conducting field mapping and drone calibration, avoid areas near high-voltage lines, transformers, houses, or under trees, as these can interfere with signal quality and lead to inaccuracies. When using a mapping device, connect it and then allow it to locate itself for three to five minutes in an open area. During this positioning phase, do not move the mapping device and ensure there are no sources of interference nearby. There should be no obstructions directly above the device. Hold the mapper vertically without tilting it. Proceed with mapping only when the ground station display shows good or excellent signal strength.

    - Important note: When marking points with the mapper (RTK controller), make sure the drone is powered off. Do not connect the drone to a power source during this process, as it will prevent the use of RTK mode for accurate point collection.

38. Several key points to check when the water pump experiences insufficient pressure include the nozzle, spray core, pressure relief valve, flow meter, and the pump itself.

    - The pump should be cleaned on both top and bottom sides. Clean one side, reassemble it, then clean the other side. Avoid disassembling both sides simultaneously, as it complicates reassembly.

    - When cleaning the pressure relief valve, pay attention to cleaning its gasket

with warm water.

- If bubbles are found at the water outlet, remove the inlet pipe, cut about one centimeter off, and reinsert it firmly to the end. The insertion depth should also be about one centimeter.

39. Be vigilant about checking the arms, especially under the propellers. There have been instances of crashes due to unnoticed cracks or breakage in the propeller clamps, and injuries to the arms caused by the propellers due to missing fixing screws. The centrifugal force exerted when a propeller is thrown off can cause small cracks in the carbon fiber of the arm. Once cracked, carbon fiber can break, so it's essential to carefully inspect the carbon fiber tubes.

40. Pay close attention to the color of the indicator lights during autonomous flight. If the lights indicate interference (refer to the indicator light comparison chart), stop using the autonomous mode and switch to attitude mode instead.

41. If the drone exhibits unusual behaviors such as significant wobbling or body rotation during autonomous flight, this could be a sign of interference. In such cases, stop using autonomous mode and switch to attitude mode. These signs may appear individually or together, and regardless of the situation, the mode should be switched to attitude mode.

42. During fully autonomous flight, if you notice that the tank still has pesticides but the flow meter indicates an empty tank and causes the drone to hover, or if the tank is empty but the flow meter fails to detect this, the first step is to disassemble and clean the flow meter. If the issue persists after cleaning, it may be necessary to replace the flow meter with a new one.

43. Battery Contacts:
Keep the contacts on both the drone and the battery clean. Regularly clean them with high-proof alcohol to ensure there's no dirt or grime. Before inserting a battery, check and clean the other power connector on the drone. This is important because the drone uses a parallel distribution board, and water inside one connector could cause a short circuit and fire.

44. GPS and Screws:
Before flight, manually check the GPS mount for any looseness. The GPS must be securely fastened to ensure accurate drone navigation. Tighten all screws on the drone every two days to ensure they are secure.

45. Propeller Clamp Screw Replacement:
For drones using x8 power, replace the propeller clamp screws approximately every seven days.
For clamps with 31/13 power attached to the motor, replace the four screws after about 1000 acres of flight.
Apply thread-locking fluid each time the screws are replaced.

46. Do not keep the drone on standby with the battery inserted or during pesticide loading. Power the drone only after all checks and loading are completed. Power up before flight and disconnect immediately after landing. Clear the area before

powering up and disconnect the batteries quickly and efficiently. After powering up, move away from the drone and return to a safe area.

47. Always operate the drone strictly according to the instructions provided in the manual.

Pesticide Use

1. When handling pesticides, always adhere to the safety instructions provided by the pesticide manufacturer.

2. Avoid using powdered pesticides as much as possible, as they may affect the lifespan of the spraying system.

3. Pesticides are toxic. Use them cautiously and follow the safety guidelines for pesticide application.

4. Be careful of spillage when mixing pesticides to prevent residual chemicals on the drone from harming people.

5. Use clean water for mixing pesticides. After mixing, filter the solution before adding it to the operational tank to prevent impurities from clogging the filter. If a blockage occurs during application, clean it promptly before continuing.

6. Ensure that personnel are upwind during pesticide application to avoid harm from drifting chemicals.

7. Wear protective gear when applying pesticides to prevent direct contact with the skin; after application, wash skin thoroughly and clean the drone and remote control.

8. Avoid contaminating rivers and drinking water sources during pesticide application.

9. Do not use strong acids, strong alkalis, high-temperature liquids, or other prohibited pesticides.

Transport and Handling

When transporting the drone, ensure it is kept level and the folding sections are securely fixed to prevent unforeseen damage caused by severe jolting (for long-distance transport, it's advisable to use an aviation case for packaging). When carrying the drone, do not lift it by the outer carbon tube parts of the folding sections. Instead, lift it near the central plate to avoid reducing the machine's lifespan or even causing damage due to excessive force.

Installation

After opening the package, extend the folded arms and lock them in place by tightening the black threaded sleeves at the folding joints.

Operational Differences of Large Payload V.S. Small Agricultural Drones

1. **Braking Distance:** Larger drones have a longer braking distance. Keep a minimum 10-meter distance from field edges and obstacles when marking.

2. **Flight Speed:** Do not exceed 7 meters per second; optimal speed is between 5-7 meters per second to manage braking distance effectively.

3. **Spray Width:** Ensure a minimum lateral spray movement of 4 meters, with 6-10 meters being most effective.

4. **Flight Height:** Maintain a minimum height of 3.5 meters. In windless conditions, 3.5-4 meters is recommended. In windy conditions, it can be lowered to 2.5 meters.

5. **Component Wear:** Replace arm screws, propeller clamps, and blades of heavy drones after about 10,000 acres due to increased wear.

6. **Battery Load:** With heavy drones, set no-spray points within 50 meters of the takeoff point due to high battery load during full-load flights.

7. **Water Pump Settings:** Do not set the water pump to alternate between front and rear spraying; it is advised to set the flow rate to the maximum. The application rate per acre can be adjusted based on the set flight speed and spray width.

8. **Data Transmission Line:** Seal the data transmission line after every use.

9. **Application Rate:** The application rate should not be less than 2 liters per acre, with 2.5 to 3 liters per acre being optimal. For international customers, it should not be less than 30 liters per hectare, with 37.5 to 45 liters per hectare being ideal.

10. **Plug Maintenance:** Replace the drone end plug after 150 uses. Keep contacts clean and use anhydrous alcohol for daily cleaning.

Product Description

Features

1. **Modular Design of Functional Components:** The design facilitates easy maintenance and upgrades.

2. **Quick-Plug Tank:** Features a pesticide tank that can be quickly attached and detached for efficient refilling.

3. **Spraying & Spreading Dual System:** The drone is equipped with a versatile dual system that allows for both spraying and spreading applications, enhancing its functionality for various agricultural tasks.

4. **High-Pressure Brushless Water Pump with Full Waterproofing:** The drone uses a high-pressure brushless water pump, and the electronic speed controller (ESC) is fully waterproof.

5. **Carbon fiber + 7075 Aviation Aluminum Materials**: The drones are made of Carbon fiber and 7075 aviation-grade aluminum, known for its strength and lightweight properties.

6. **Intelligent Plug-in Battery:** The drone utilizes an intelligent battery system that can be easily plugged in and out.

7. **Closed Fuselage Design:** The drone features a closed design for its fuselage, effectively preventing pesticides from entering the flight control system and ensuring safety during long-term operations.

8. **Built-in GPS and Compass Module:** Equipped with GPS and a compass module, the drone offers fixed-height and fixed-point flight capabilities, allowing it to maintain precise spray heights and routes during operation.

9. **Adjustable Height and Speed Limits for Spraying:** The drone allows for setting specific height and speed limits for spraying operations. Its high-pressure spraying system ensures effective coverage, and the drug mist, aided by the aircraft's wind pressure, penetrates effectively onto the surfaces of leaves.

Functions

1. Automatic Row Change Spraying (Cyclic Spraying): The drone can automatically switch rows during spraying, allowing for continuous, cyclic spray operations.

2. AB Point Automatic Flight Spraying: After manually flying and recording a path once, the drone can autonomously perform spraying operations following the recorded AB points.

3. Autonomous Flight Spraying with Plot Planning: The ground station sets the area and terrain of the plot, and the drone autonomously flies and performs spraying tasks accordingly.

4. One-Button Recording of No-Spray Points: During spraying, when the pesticide

runs out, the drone automatically records the no-spray point and returns to the takeoff point to refill.

5. One-Button Return to No-Spray Point: After refilling the pesticide, the drone automatically returns to the last no-spray point. It avoids spraying until it reaches the uncompleted area, preventing double spraying.

6. Low Voltage Automatic Return: The drone records the no-spray point when the battery runs low during spraying, then returns to the takeoff point for a battery change. After changing the battery, it resumes from the last no-spray point, avoiding repetition.

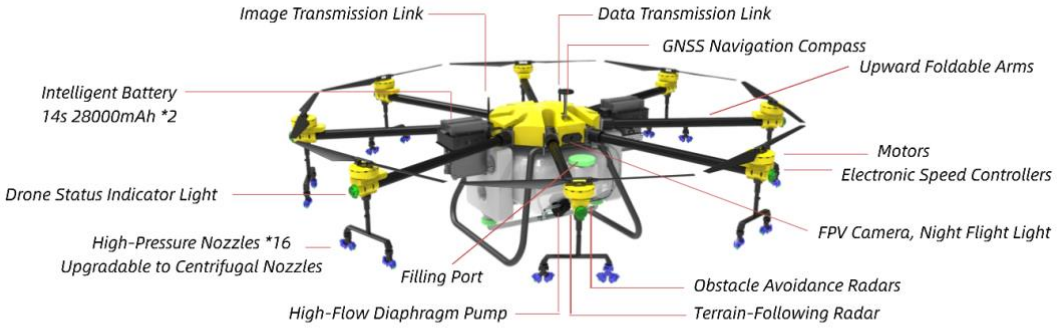
7. Attitude and GPS Operation Modes: In case of operator error, the drone automatically returns to the takeoff point and hovers safely in the sky to prevent crashes or accidents.

8. Radar Terrain-Following Altitude Control: The drone adjusts its height above the crops automatically based on terrain changes during spraying, once the crop distance and spray height are set.

9. Automatic Obstacle Avoidance: The drone can automatically detect and avoid obstacles during autonomous operation.

Drone Parts

Component Names of a Quadcopter (4-Axis Drone)



Component Names of a Octocopter (8-Axis Drone)

Operating Instructions

Flight mode

Flight Control Modes	Control Method	Features	Notes
Altitude Hold Mode	Remote Control	With the joystick centered, the drone autonomously maintains its attitude. Mid-throttle can maintain altitude, but precise point hovering is not achievable and requires manual correction.	
Position Hold Mode	Remote Control	When satellite signals are strong, enables high-precision stationary hovering and speed limitations.	
GNSS Assist Mode	Remote Control	With strong satellite signals, allows for high-precision stationary hovering and angle restrictions.	
Return to Home Mode	Remote Control	Reliant on satellites, flies from the current position to the home location and hovers.	
Full Autonomous Mode	Autonomous	Flies autonomously following a mission route set by the ground station, relying on satellite signals.	Throttle can still control altitude; centering the throttle will maintain current altitude.
AB Point Mode	Semi-Autonomous	Semi-autonomous flight between preset A and B points, dependent on satellite signals.	Throttle can still control altitude; centering the throttle will maintain current altitude.

Unlocking and Locking

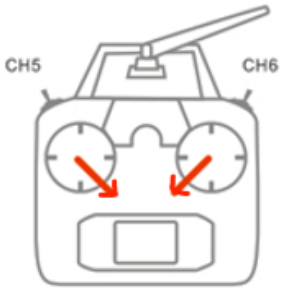
Modes That Can Be Unlocked

- Altitude Hold Mode
- GNSS Assist Mode
- Position Hold Mode

Modes That Can Be Locked

- Altitude Hold Mode
- GNSS Assist Mode
- Position Hold Mode

Unlocking Method

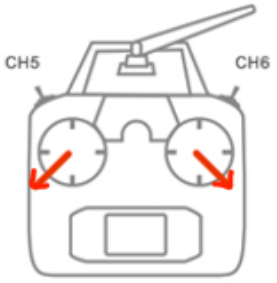


Maximize pitch, minimize throttle, fully turn the rudder to the right, roll fully to the left; the status indicator light flashing changes to steady, indicating successful unlocking.

Unlocking Requirements: Altitude Hold Mode can be unlocked after self-check completion; GNSS Assist Mode/Position Hold Mode require satellite positioning, indicated by a green light flashing.

After unlocking, the motors enter idle mode.

Locking Method



Maximize pitch, minimize throttle, fully turn the rudder to the left, roll fully to the right; locking is immediate, indicated by the status light starting to flash, signifying successful locking.

- Immediate Locking: In all control modes, once the motors are started, performing the following stick action will immediately lock the motors.
    - Caution: Do not perform the above stick action during flight, as the motors will stop immediately.
- Automatic Locking:
    - In any flight mode, if the drone is unlocked but not taken off, with the throttle at the lowest, and no action is taken within 3 seconds, the motors will automatically lock.
    - Except in Attitude-Stabilization mode, all flight modes have an automatic landing detection feature that controls the motors to stop.

- Except in Attitude-Stabilization mode, pulling the throttle to the lowest during flight will not cause the motors to stop.

Compass Calibration

- If the drone is moved more than 200 kilometers, recalibrate the compass.
- Steps for calibration:

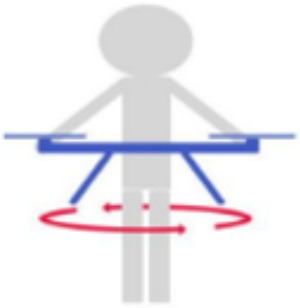
  a. Quickly toggle the "Mode Channel" switch more than 6 times. When the status light flashes red and blue alternately, it indicates the drone has entered horizontal compass calibration mode.

  b. Rotate the drone horizontally and smoothly 360° until the green light stays on, indicating horizontal calibration is complete.

  c. Point the drone's head vertically downwards. Wait until the red and blue lights cycle flashing, indicating vertical compass calibration mode.

  d. Rotate the drone again smoothly 360° until the status light stops flashing, and the blue light stays on, indicating vertical calibration is complete.

  e. After calibration, power off and reconnect the drone before using it.
- Note:
  - If the red light stays on during calibration, indicating a failure, restart the calibration from step one after powering off.
  - The calibration process should be continuous without prolonged pauses.



Horizontal Rotation 360°

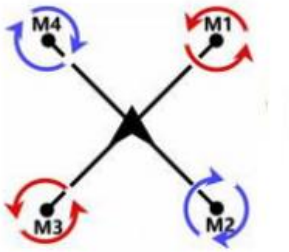
Vertical Rotation 360°

Accelerometer Calibration

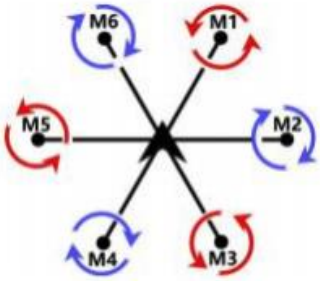
The accelerometer of the drone is calibrated at the factory, and under normal circumstances, it does not require recalibration. However, in certain specific situations, recalibrating the accelerometer is necessary to ensure stability and flight safety. The calibration method is as follows:

1. Enter the "Device Calibration—Accelerometer" page and click the "Calibrate" button, following the prompt, position the drone/flight controller horizontally.
2. Click the button and, following the prompt, position the drone/flight controller on its left side.
3. Click the button and, following the prompt, position the drone/flight controller on its right side.
4. Click the button and, following the prompt, position the drone/flight controller with the nose down.
5. Click the button and, following the prompt, position the drone/flight controller with the nose up.
6. Click the button and, following the prompt, flip the drone/flight controller over.

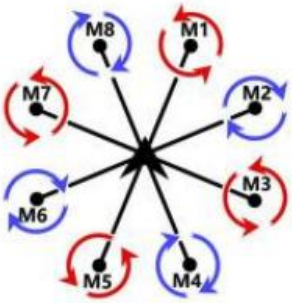
Motor Rotation Direction for Different Models



X-Type Quadcopter (4-axis)



X-Type Hexacopter (6-axis)



X-Type Octocopter (8-axis)

Operation Modes

AB Point Mode

To meet the demands for autonomous spraying on small and regularly shaped plots, and to effectively reduce the operator's workload, the system offers a very practical "AB Point Mode." This mode controls the drone to execute an L-shaped flight path, where each row changes and the subsequent spray line forms a "flight unit." This mode satisfies the requirements for quick operations while ensuring uniformity of spraying.

Automatic AB Point Mode

Takeoff Preparation: Set all channels on the remote control to the lowest position, fill the medicine tank with liquid, and control the drone to take off.

Recording Preparation: After flying the drone to point A, switch to "Position Hold Mode" or "GNSS Assist Mode."

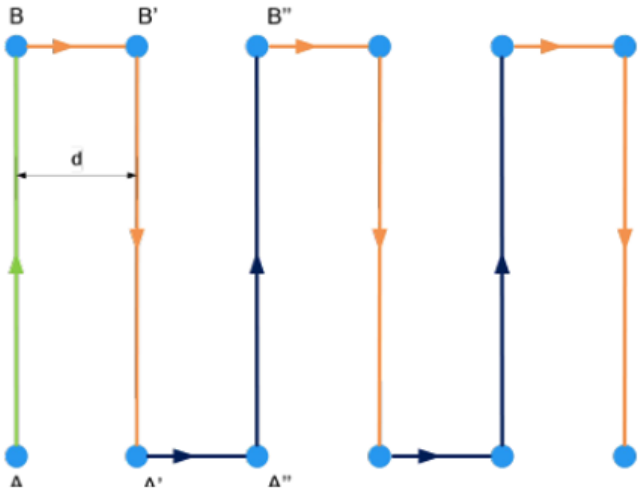
1. **Recording Point A:** Move channel 8 on the remote control to the highest position to record point A. After successful recording, the flight indicator light will flash blue and white alternately 4 times, and the ground station will mark "Point A." Manually turn on the water pump.

2. **Recording Point B:** Move channel 8 to the lowest position to record point B. After successful recording, the flight indicator light will flash green and white alternately 4 times, and the ground station will mark "Point B." Manually turn off the water pump.

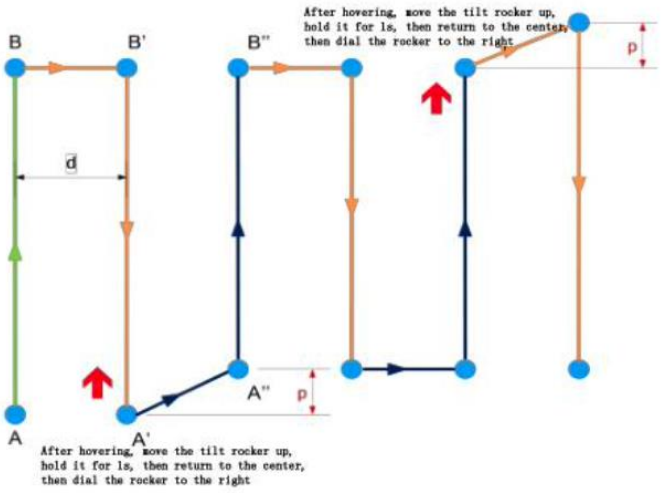
3. **AB Point Mode:** Once AB points are successfully planned and the current position is within 100 meters of either point A or B, the drone will execute AB Point Mode. It will fly towards the nearest point A or B, then hover, waiting for forward/backward fine-tuning or row change commands. The drone enters operational readiness.

4. **Starting Operations:** Based on operational needs, move and hold the roll joystick left/right for more than 1 second and then center it; the drone will change rows in the respective direction and fly parallel to the AB line, autonomously turning on the water pump.

5. **Row Change Operations:** During AB point flight, move and hold the roll joystick for 1 second; the drone directly changes rows upon reaching the next point of the spray line and flies to the next point. If the roll channel is not moved during flight, the drone will hover at the end of a single spray line, waiting for a row change command. After issuing a row change command using the roll joystick, the drone continues the spray task. Note: Row change commands are effective only when manual row change is enabled and manual obstacle avoidance is not activated.



6. **Position Adjustment:** To meet the spraying needs of plots with non-parallel boundaries and to enhance the adaptability of the AB Point Mode, a position adjustment feature is provided. When the drone completes a single L-shaped flight line and hovers, move and hold the pitch (forward/backward) joystick for more than 1 second, then center it. Move the roll (left/right) joystick; after changing rows, the drone continues the spraying operation, and the starting point of the next row is adjusted according to the direction of the pitch joystick movement.



7. **Resume from Breakpoint:** During flight, if the liquid runs out (detection enabled), battery voltage is low (detection enabled), or the remote control's lost control protection is triggered, the drone will automatically add a breakpoint and return. Manual breakpoints can also be added by repeatedly moving channel 8 on the remote control. Note: The record breakpoint function must be in the unlocked state to be effectively recorded; restarting the water pump in the unlocked state will automatically overwrite the last recorded breakpoint.

8. **Clearing AB Points:** It is recommended to clear AB points before setting new ones or after completing operations. With the drone landed and locked, quickly move channel 8 on the remote control from "low to high to low" twice. If successfully cleared, the indicator light will flash red and blue alternately 4 times.

9. **Overwriting AB Point Records:** If there is an error in the AB point records or if there's a need to re-record them, users don't need to clear the AB points in the locked state and then take off to re-mark. Instead, they can directly re-record points A and B on the existing basis. The new points A and B will overwrite the original ones.

Manual AB Point Mode

The manual AB point operation mode offers more flexibility and adaptability for irregular and small plots in plant protection operations, but it requires significantly more manual input than the automatic AB point mode.

The marking operation for manual AB points is the same as for automatic AB points. After entering autonomous mode, row changes are made using roll operations, and forward or backward flight is controlled through pitch operations. During flight, except for automatic heading maintenance, all other controls are manually managed by the pilot:

- The flight speed is determined by the extent of pitch input on the remote control, but it won't exceed the set speed limit.
- The timing of row changing is decided by the pilot's roll input, provided that the drone's speed is less than 1m/s at that time.
- The breakpoint function and generation in manual AB point mode are the same as in automatic AB point mode.
- The method for clearing manual AB points is identical to that for automatic AB points.

The default setting is for automatic AB points. Only one of the two modes, automatic or manual AB points, can be selected for operation. Please confirm the mode of operation in the system settings under Agriculture Settings - AB Points before starting the operational flight.

AB Point Distance Correction

- When flying from point A to point B:
  - Pushing the pitch joystick up will extend the distance to point B by 1 meter.
  - Pulling the pitch joystick down will shorten the distance to point B by 1 meter.
- When flying from point B to point A:
  - Pushing the pitch joystick up will shorten the distance to point A by 1 meter.
  - Pulling the pitch joystick down will extend the distance to point A by 1 meter.

No-Pesticide Alarm

- Pesticide Level Detection:

The pesticide level detection function is activated only in AB Point or Full Autonomous modes. The action taken upon pesticide depletion is selectable as

either "Return Home or Hover." In AB Point or Full Autonomous modes, when the pesticide is depleted, the drone will record the breakpoint and either return home or hover. This action can be reconfirmed through the "Execution Action Settings."

Return to Home (RTH)

Return to Home is one of the key safety features for secure flying. The RTH process involves the drone climbing 2 meters (default, adjustable) from its current position, then flying horizontally to a safe point and hovering, waiting for further instructions.

Automatic Return to Home Mode

This mode provides a safety guarantee for long-distance flights and loss of control protection.

1. Working Conditions

   Once satellite acquisition is complete and positioning accuracy meets the requirements (LED not flashing red or flashing red once), the flight controller records the current location as the return point each time the user unlocks the drone. When entering Automatic RTH mode, the LED rapidly flashes green.

2. Operating Instructions

   Automatic RTH can be triggered by the joystick or loss of control protection. When the remote controller's CH6 mode switch is set to the one-key return position or the flight controller enters loss of control protection, and if the drone is more than 2 meters from the home point, it will ascend to a set altitude (or continue at its current altitude if it’s higher than the set return altitude) and return home without manual joystick intervention. Upon reaching the return point, the drone hovers for about 3 seconds before slowly descending. At this point, the remote control can guide the drone (except for the throttle), allowing it to find a more suitable landing spot. The drone will automatically lock after it lands completely. If the drone is less than 2 meters from the return point, it will land in place and lock automatically.

Note:

1. Automatic RTH assumes that the drone's return point has been recorded. To use Automatic RTH, unlock the drone only after GPS satellite acquisition is complete. Refer to the appendix for LED tri-color light status and meanings.

2. It's advisable not to engage Automatic RTH mode when the drone is very close to people to avoid accidents.

Low Battery Protection and Low Voltage Protection

This feature provides a voltage protection function based on adjustable voltage values. Users can modify the voltage values measured by the flight controller through the ground station (if there is a discrepancy between the actual and measured values, this function can be used to correct the measurements). The flight controller monitors the voltage of each cell and implements protection accordingly.

When the flight controller detects that the battery voltage has reached the first-level warning voltage, the LED light on the flight controller will flash yellow three times, indicating the need to immediately return and land to replace the battery.

When the detected voltage reaches the second-level warning voltage, the yellow light will flash rapidly, indicating that the drone's battery is nearly depleted.

Indicator Light

Num.	RGB Status	Fault States	Troubleshooting
1	Red and Blue Alternating Flash	Device Not Calibrated	Check and calibrate the remote control, compass, and accelerometer.
2	Red, Blue, and Green Alternating Flash	Device Calibration or Testing	Conduct motor and ESC (Electronic Speed Controller) tests.
3	Yellow Single Flash	Remote Control Fault, Low Voltage Level 1 Protection, No Pesticide Protection	Check the remote control, battery level, and medicine tank status.
4	Yellow Fast Flash	Low Voltage Level 2 Protection	Immediately land and replace the battery to prevent power failure during flight.
5	Purple Single Flash	Compass Fault	Check and calibrate the compass.
6	Blue Single Flash	No GPS, Not Unlocked	Check GPS signals, ensure an open environment without interference.
7	Blue Steady	No GPS, Unlocked	Check the GPS module and ensure proper connection.
8	Green Single Flash	GPS Available, Not Unlocked	Ensure stable GPS signal before unlocking the drone.

9	Green Steady	GPS Available, Unlocked	Ensure stable GPS signal; the drone is functioning normally.
10	Green Fast Flash	High Precision GPS Positioning	Ensure accurate GPS positioning for precision operation tasks.

Remote Control

Notice: The potential risks associated with incorrect operation of this product are explained as follows:

- Failure to follow instructions may result in property damage and minor injury.
- Failure to adhere to the instructions could lead to significant incidents, serious injury, and property damage.

Warning: Read the entire user manual and familiarize yourself with the product's features before operating it. Incorrect operation of this product can cause serious harm to yourself or others, as well as damage to the product and property loss. This product is complex and requires a period of familiarization for safe use. Basic knowledge and a strong safety awareness are necessary for operation. Improper use can lead to product damage, property loss, or even severe injury to yourself or others. This product is not suitable for children. Do not use parts not provided or recommended by Yunzhuo. Strictly adhere to guidelines for using the product.

Specifications

Remote Control Specifications

Specification	Details
Product Model	H12
Number of Channels	12
Working Voltage	4.2V
RF Power	20DB@CE / 23DB@FCC
Frequency Band	2.400-2.483GHz
Frequency Hopping	New FHSS (Frequency Hopping Spread Spectrum) Tuning
Upgrade Method	APP Online Upgrade
Weight	530g
Dimensions	190*152*94 mm
Battery	10000mA/H

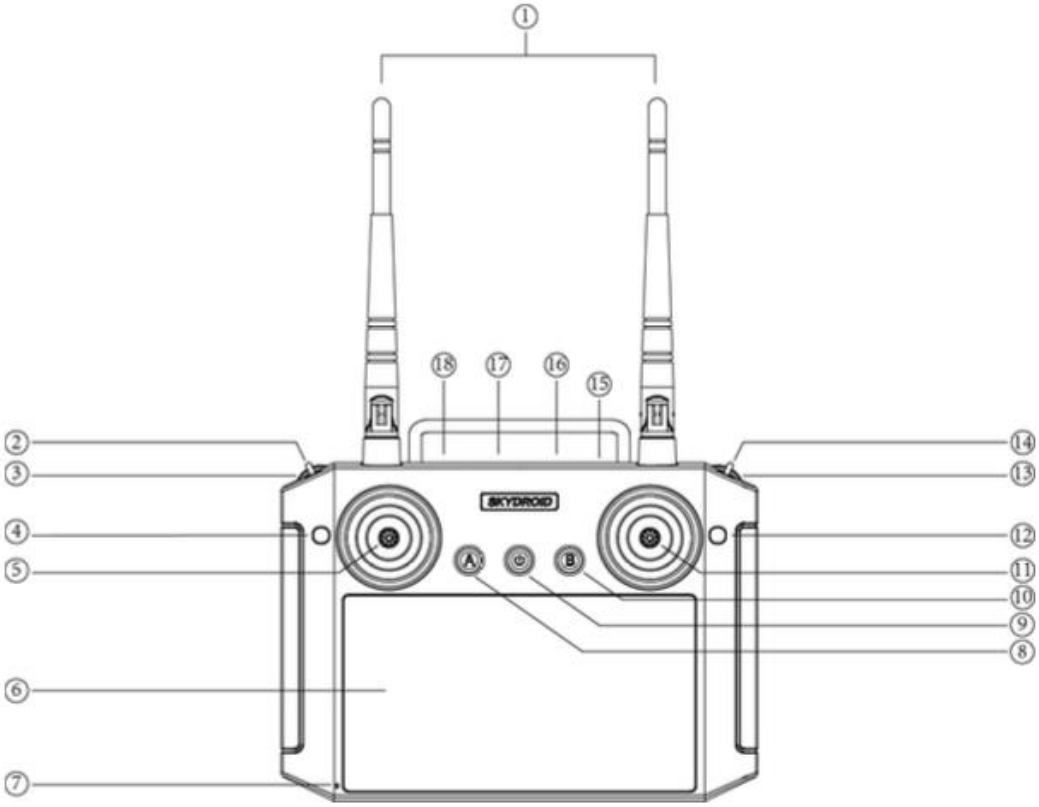
Battery Life	6-20 hours
Charging Interface	TYPE-C
Applications	Helicopter, Fixed-wing, Multirotor, Car, Boat

Receiver Specifications

Specification	Details
Product Model	R12
Number of Channels	12
Working Voltage	4.5-5.5V
Working Current	140MA@5V
Dimensions	51*41*13 mm
Weight	14g

Structure

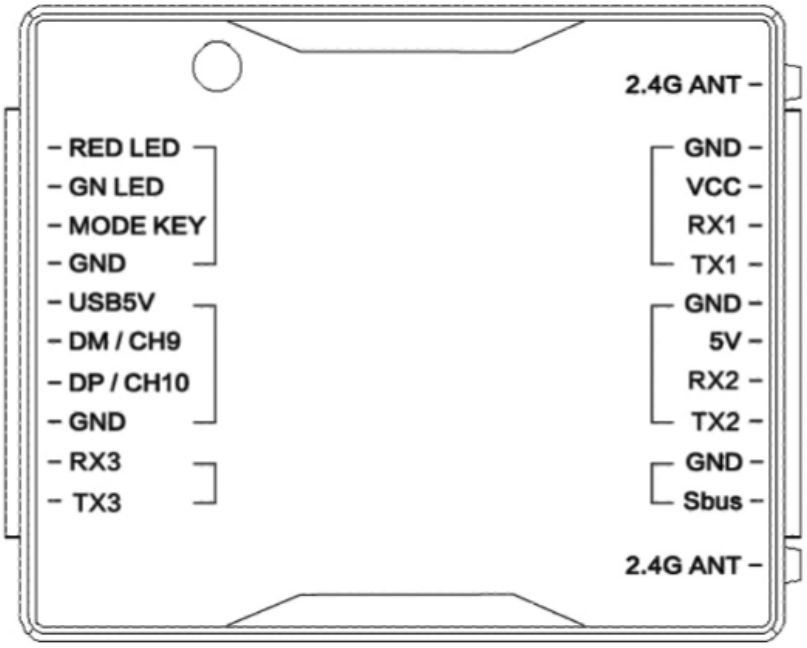
Structure of Remote Control



Num.	Components	Function	Num.	Components	Function
1	**2.4G 3dB Antenna**	The antenna used for transmitting and receiving radio signals between the remote controller and the drone.	**6**	**5.5-inch Screen**	A display screen that may show telemetry data, live video feed, or settings menus.
2	**Three-Position Switch E**	A switch that can be set to one of three positions, typically used for changing flight modes	**14**	**Three-Position Switch F**	A switch that can be set to one of three positions, typically used for adjusting the water pump's opening degree or flow rate
5	**Joysticks X1, Y1**	Used to control the drone's forward, backward, left turn,	**11**	**Joysticks X2, Y2**	Used to control the drone's ascent, descent,

		and right turn movements:			left strafe, and right strafe
8	**Button A**	Return to home button	**10**	**Button B**	Used for marking points in AB point mode
9	**Power Switch**	The switch to turn the remote controller on or off.	**16**	**SIM Card Slot**	A slot to insert a SIM card, enabling cellular connectivity for data transmission or remote communication.
3	**Dial G**	A wheel that can be rotated to adjust settings such as camera angle or gimbal tilt.	**13**	**Dial H**	An adjustable dial that can control various aspects of the drone or camera.
4	**Button C**	Reserved function button	**12**	**Button D**	Engineering mode switch: Enables a special mode for testing or configuring the drone's settings, often used by developers or technicians.
7	**MIC Port**	A port for connecting a microphone, possibly used for voice commands or communication.	**15**	**Speaker**	Used to emit audio signals, alerts, or voice feedback.
17	**Charging Port**	The input port for recharging the controller's battery.	**18**	**PPM Output**	External headphone jack

Structure of Receiver



Name	Annotation	Name	Annotation
RED LED	Red Light	2.4 ANT	Antenna
GN LED	Green Light	GND	Camera Interface
MODE KEY	Button	VCC	
GND	Ground Wire	RX1	
USB 5V	USB Upgrade Interface	TX1	
DM/CH9		GND	Data Transmission Interface/CBUS
DP/CH10		5V	
GND		RX2	
RX3	Expansion Interface	TX2	
TX3		GND	SBUS
		SBUS	

		2.4G ANT	Antenna

Indicator Lights	Receiver Status
Green Steady Light	Communication is normal.
Green Slow Flash	Disconnected from the controller.
Green Fast Flash	Pairing mode.
Red Steady Light	C.BUS mode.
Red Slow Flash	Updating
Red Fast Flash	Self-check failed, please retry or return to factory.

Operating Conditions

Environmental Conditions for Use

- Operating Temperature: -10°C to +55°C
- Storage Temperature: -25°C to +70°C
- Relative Humidity: Not to exceed 85%
- Atmospheric Pressure: 86 kPa to 106 kPa
- The location of use should not have an explosive hazard, should not contain corrosive metals or gases that degrade insulation or conductive media, and should not be filled with water vapor or have severe mold presence.
- The site should have facilities to protect against rain, snow, wind, sand, and ash.

Power Supply and Precautions

- The H12 ground unit has a built-in integrated rechargeable lithium battery, compatible with the standard Micro USB interface. It can be charged using a 5V power adapter (such as those used for smartphones, cameras, and other digital products).
- If smoking, an odor, or leakage occurs during charging, do not continue charging the ground unit. Please send it to our company for repair.
- Do not charge this product in areas where infants can reach, to avoid the danger of electric shock. Do not charge this product in environments exceeding 60°C.

Safety Warning

- Beginners, please pay special attention to the following safety matters! Please read carefully! Do not fly when tired, drunk, or in poor physical condition!
- Do not fly in adverse weather conditions such as rain or strong wind!
- Do not fly near high-voltage lines, communication base stations, crowded places, or areas where people gather or move!
- Do not fly at airports or other explicitly prohibited places!
- Do not operate flying models in crowded places, parking areas, or other areas that could cause property damage or personal injury.
- Before flying, perform equipment checks on the aircraft to ensure that the transmission system and aircraft are functioning normally.
- Use a professional charger with a guarantee to charge the battery.

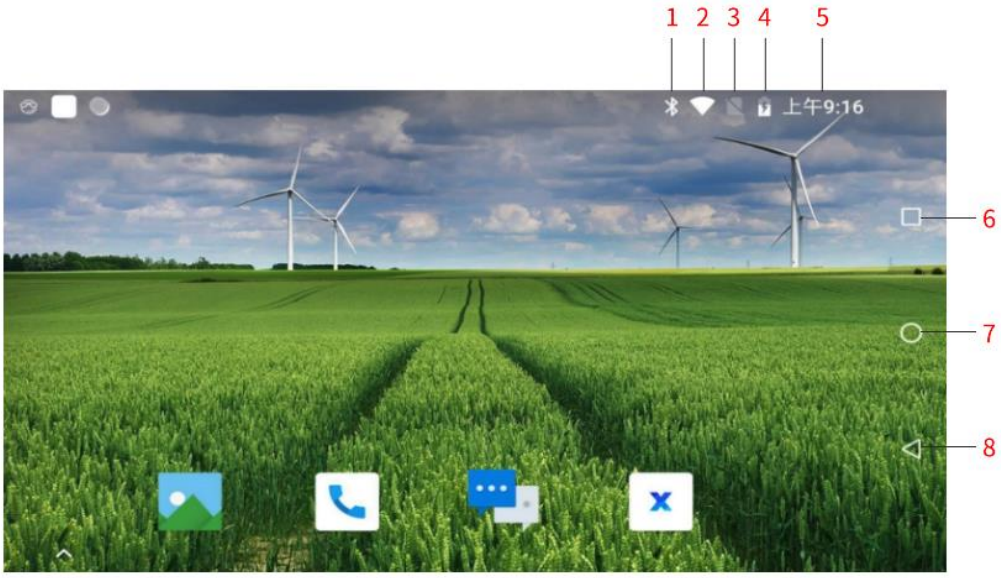
The antenna of this product is a fragile component; avoid excessive force that could cause damage.

Use and Operation

1. Preparations and Checks Before Use
    - Always check the remote controller's battery is fully charged before use.
    - Ensure the antenna is positioned as recommended for optimal performance before use.
    - For first-time use, make sure the firmware is updated to the latest version.
    - Users should ensure they are not under the influence of alcohol or drugs while operating the device.
2. Method of Use
    a. **Language Settings**

    Change the language by going to Settings > System > Language & Input Method.

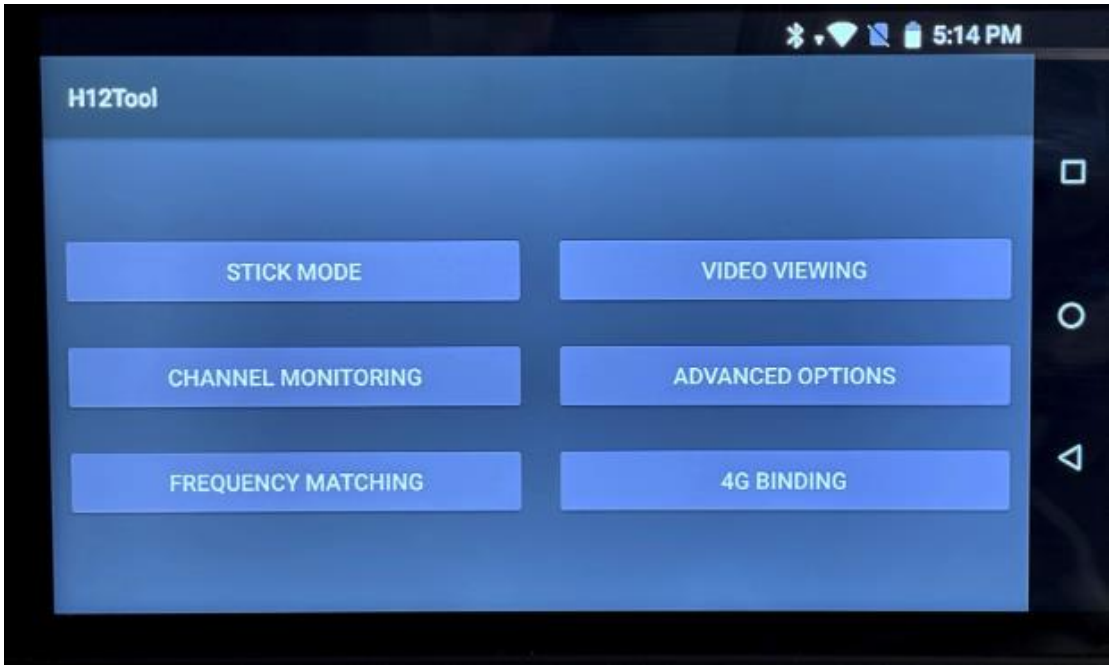
    b. **Status Bar**



Annotations of Status Bar:

- **Bluetooth Activation Prompt:** Indicates when Bluetooth is enabled.
- **Wireless Signal Strength:** Displays the strength of the wireless signal.
- **SIM Card Prompt:** Shows the status of the SIM card (the image indicates no SIM card is inserted).
- **Battery Level Display:** Shows the battery level (the image indicates charging status).
- **Time Display:** Displays the current time.
- **Background Process Viewer:** Allows viewing of processes running in the background.
- **Return to Main Page:** Button to go back to the main screen of the interface.
- **Return to Previous Action:** Button to go back to the previous step or action.

c. **H12 Assistant Introduction**

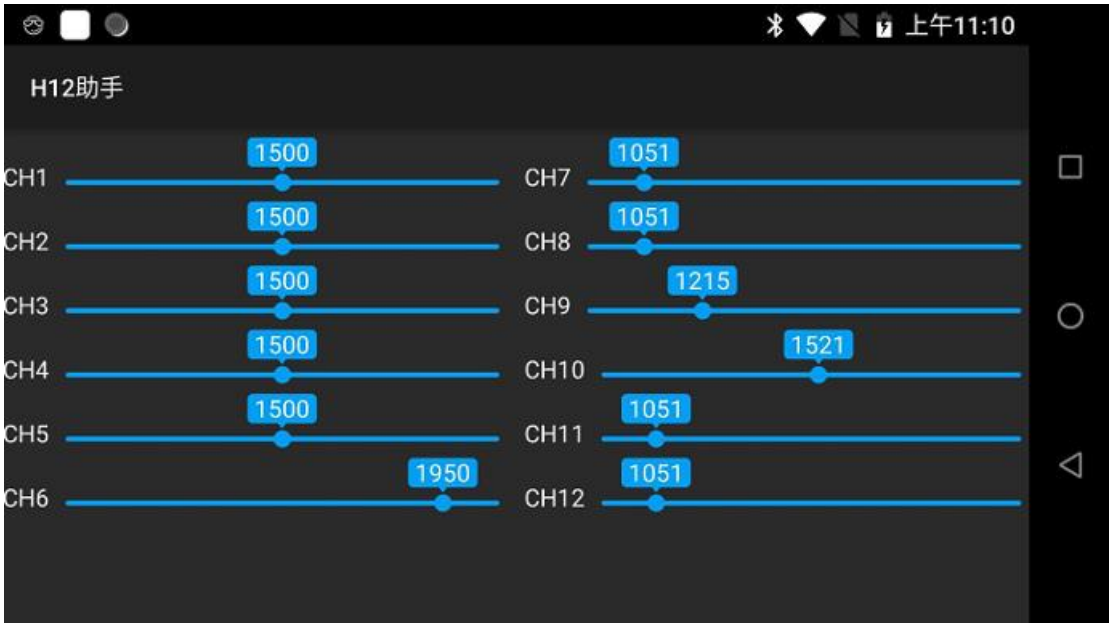


- **STICK MODE:** Switch Flight Hand Mode, Used for changing the mode of controlling the flight.
- **CHANNEL MONITORING:** View Remote Controller Stick Values, Allows viewing the values of the controller's sticks or joysticks.
- **FREQUENCY MATCHING:** Pairing the Remote Controller with Other Receivers
- **VIDEO VIEWING:** View Camera Feed, Used to view the images transmitted back from the camera.
- **ADVANCED OPTIONS:** In this section, you can adjust channel settings, update joystick firmware, view signal strength, and modify the baud rate of the receiver's serial port (password required from technical staff).

d. Pairing (Frequency Matching) Operation

Initiating Pairing Mode on the Receiver:

- With the receiver powered on, short-circuit the GND and MODE KEY to make the green light flash rapidly. Open the H12 Assistant on the remote controller, click on 'Pairing', and then start the pairing process. Once pairing is successful, the receiver's green light will remain steady.
- Rapidly power on the receiver five times; on the sixth time, it will enter pairing mode with the green light flashing. Open the H12 Assistant on the remote controller, click on 'Pairing', and start the pairing process. After successful pairing, the receiver's green light will remain on steadily.



e. **Joystick Calibration**

- Preparation for Calibration:
- Set dials G and H to the middle position, and then turn off the remote controller.
- Press and hold the D button while turning on the power button. After the controller turns on, release the D button.
- To calibrate the joystick, open the 'Stick Value View' in the H12 Assistant for assistance with calibration.
- Long-press the D button to enter calibration mode. The remote controller will emit continuous sounds.
- Sequentially move the joysticks and dials to their maximum and minimum values. Once done, long-press the D button to confirm.
- Restart the remote controller.

Common Problems and Solutions

1. Can other apps be installed on the remote controller?

The remote controller is fully open in terms of permissions, with no restrictions on installing or uninstalling any specific or third-party software.

2. Data Transmission Not Connecting

Check if the ground station is using the UDP type to connect to the remote controller, and ensure the listening port is 14551. Verify if the baud rate is normal. Check if RX and TX are reversed (correct connection is RX to TX, TX to RX).

3. The Remote Controller is Constantly Beeping

This happens when the remote controller fails to connect successfully with the receiver, and it will keep giving an alert alarm.

4. The Ground Station's Sound is Too Low to Hear Clearly

You can adjust the volume in the sound settings found in the system settings.

5. What are the uses of the TYPE-C port besides charging?

Besides charging, the TYPE-C port can be used to connect to a computer for file management.

6. How many ways can the remote controller connect to a network?

It can connect to a network via a SIM card or by connecting to WiFi.

Maintenance and Repair

Long-term Storage Maintenance

Store the remote controller in a dry, ventilated area, away from direct sunlight to prevent battery overheating.

If storing for more than three months, the recommended storage temperature range is 22 to 28 degrees Celsius. Do not store the battery in places below -20 degrees Celsius or above 45 degrees Celsius.

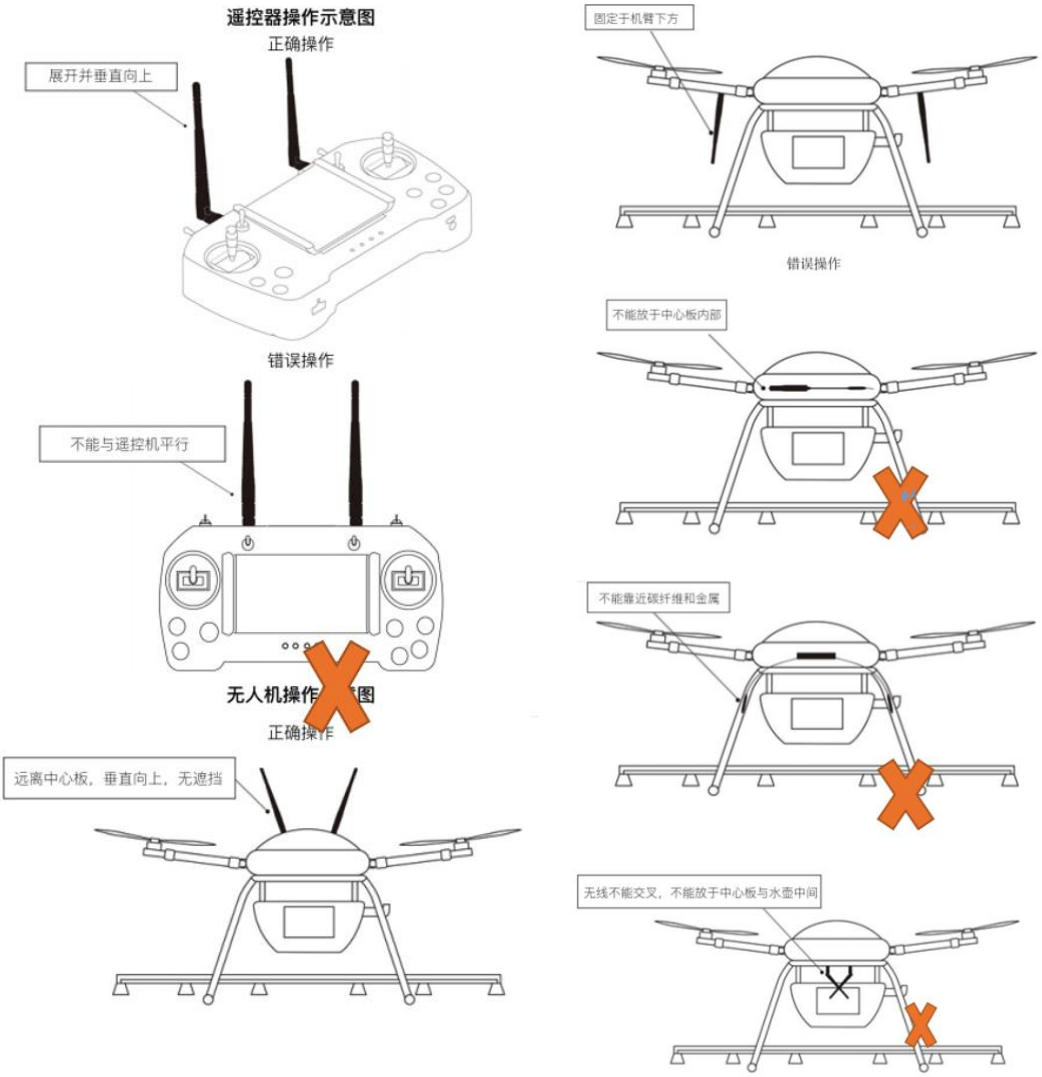
Transport and Storage

Warning: To avoid potential injury and damage, please adhere to the following: Since wires and small parts may pose a danger to children, keep these remote controller parts out of children's reach.

(1) Do not immerse the remote controller in water. If it gets wet, wipe it promptly with a soft, dry cloth and turn off the power immediately.

(2) Avoid mechanical impact, crushing, piercing the battery, and do not drop the battery.

Correct V.S. Incorrect Operation Comparison



Smart App

The Smart Ground Station is an APP that integrates functions such as flight debugging, calibration, parameter adjustment, route planning, and status monitoring.

Installation Environment

Compatible with mobile phones or remote controllers running Android 7.0 or higher versions.

Pairing Devices

Activate the Bluetooth function on the phone or remote controller. With the flight controller powered on, turn on the Bluetooth connection switch, then search for and pair with the corresponding device name on the phone. The default pairing password is “1234”.

Registration and Login

Click on the register button on the login page to enter the registration channel. The APP provides registration functions for both plant protection teams and pilots. Users fill in the necessary information, and after successful registration, they can log in and use the APP.

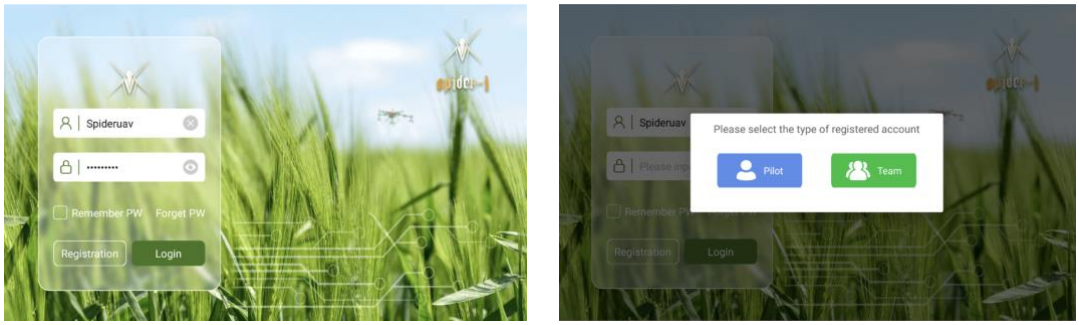


Figure 1 Account Registration

If you forget your password, you can click on "Forget Password" and enter the registered phone number/email to retrieve it.

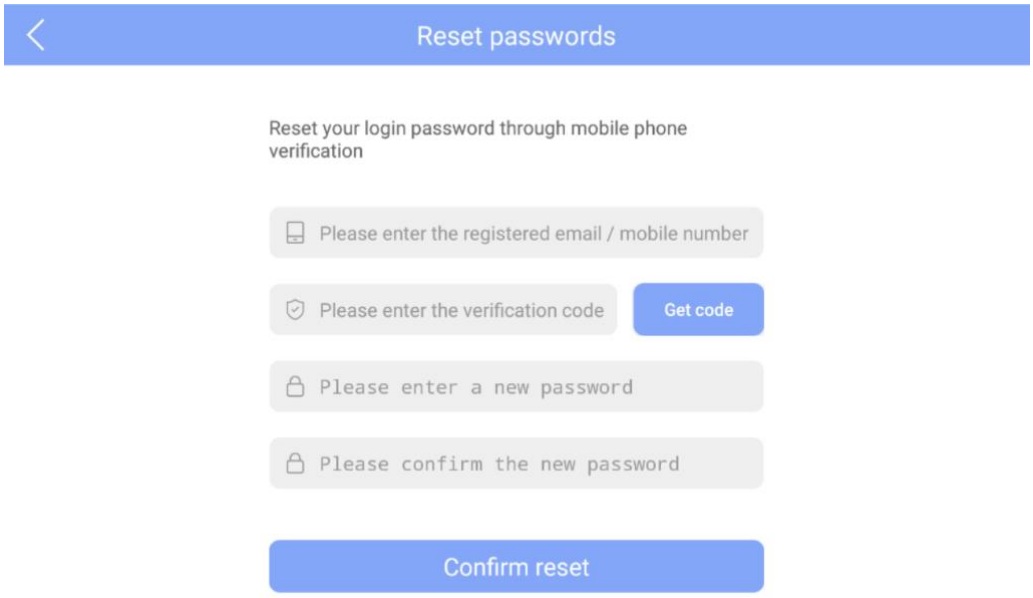


Figure 2 Password Reset

Connecting Devices: Mode Selection

After logging into the APP, you need to select the operating mode, which includes spraying mode and spreading mode.

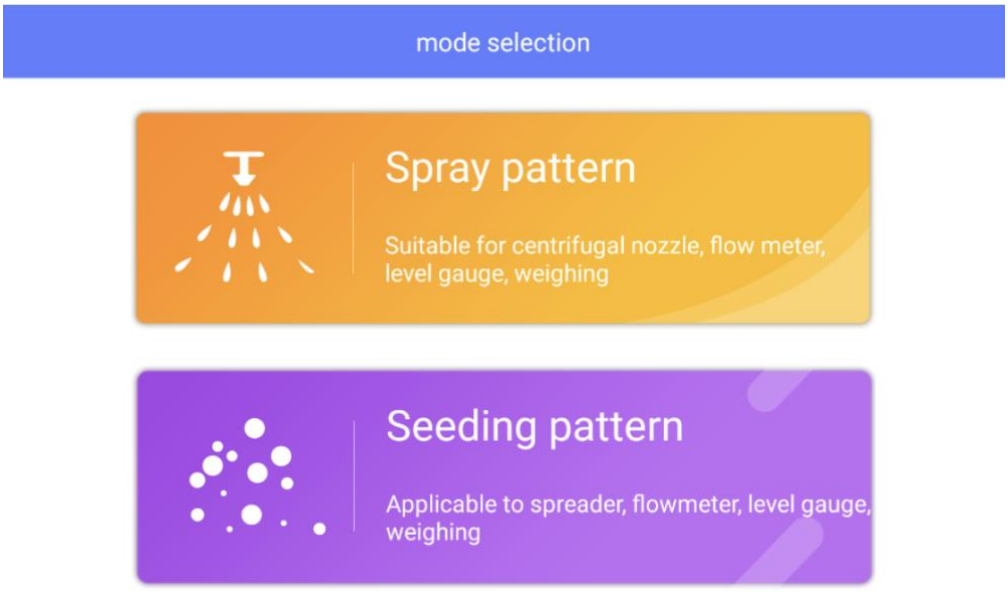


Figure 3 Mode Selection Page

Device Connection Types

Once in the respective working mode, click on the 'Not Connected' section on the main interface to bring up the connection page. Devices are categorized into four main types: drones, RTK surveying, single-point surveying, and RTK devices. Users can choose to connect to devices as needed. When connecting to a drone, select the connection method; for other devices, simply select the device type.

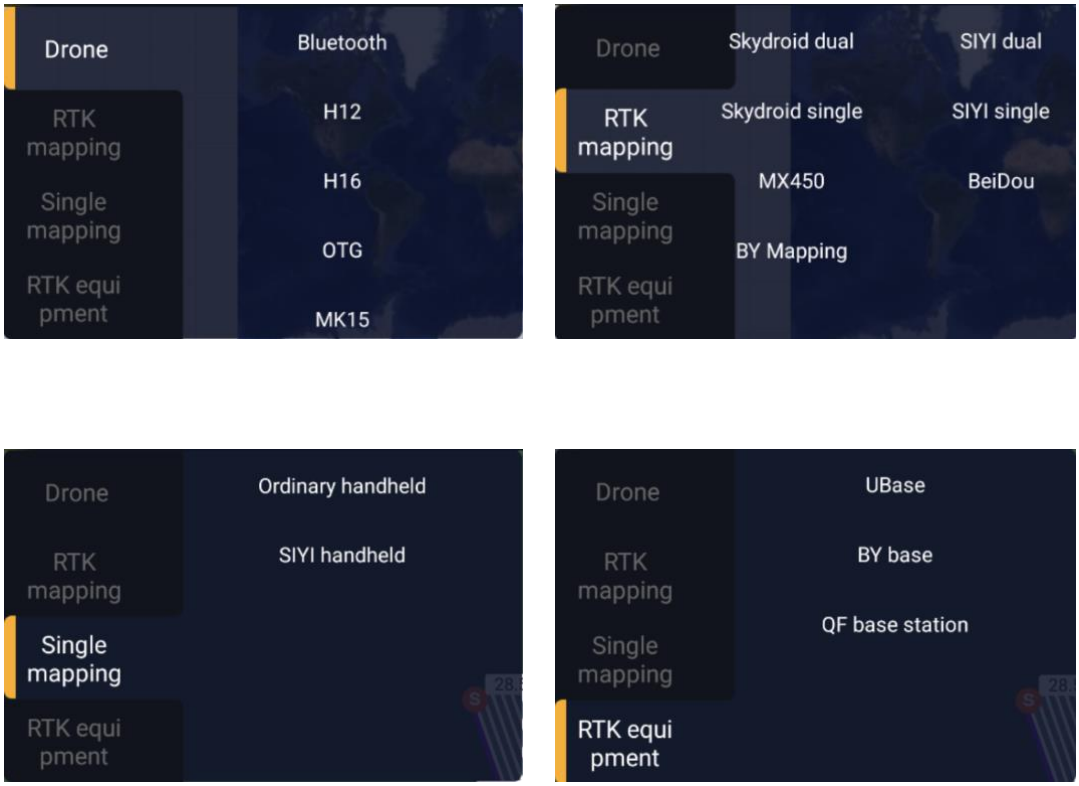


Figure 4 Connecting Device Types

The interface for connecting to a drone is as follows:

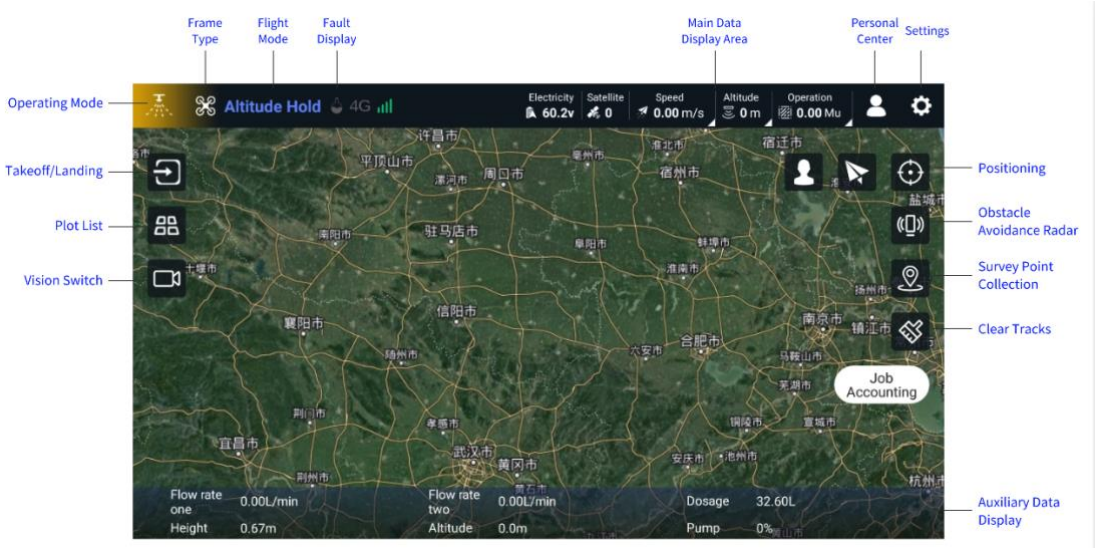


Figure 5 Main Interface

Figure 5 shows the display page after connecting the flight controller in spraying mode. Swipe up or click on the auxiliary data display area to show the custom data display settings page. Users can enable the types of data they wish to display, with a maximum of 6 items. Clicking on the upper left corner of the flight mode area pops up a disconnection prompt. Clicking on the speed, radar altitude, and operation data area allows setting parameters like AB point speed, application rate, centrifugal, and

turning methods. If a smart battery is used, the battery level will display as a percentage. Clicking on the battery percentage area will pop up a smart battery information display box. Figure 6 shows common parameter settings.

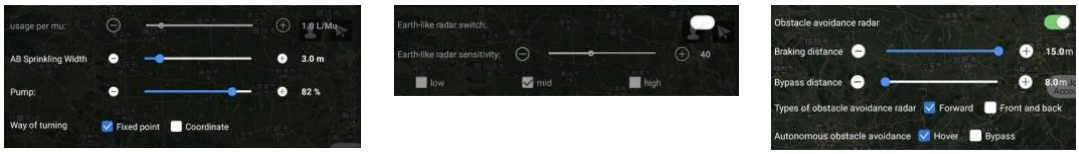


Figure 6 Common Parameter Settings

In operation parameter adjustments, you need to enable flow speed control or flow rate control in the settings page for the application rate parameter to be adjustable. Different operation modes have different ranges for application rate adjustment; adjusting the water pump opening requires disabling the speed-spray function in the settings page.

Click on the obstacle avoidance radar function button to make real-time adjustments in the popped-up options. By setting the emergency stop distance, users can set the stopping distance from obstacles after braking based on the different weights and axle distances of the plane, enhancing the safety of obstacle avoidance operations. You can also choose front-only or front-and-back obstacle avoidance radar based on actual installation.

Clicking the video window switch button on the main page enables quick opening or closing of the video window; you can also click on the video window area to switch between the map and the video window.

When sensors and peripherals malfunction, the corresponding fault icon will appear in the upper left corner of the interface. Enable the contractor in the settings page to display the contractor's status. The following are the fault sensor icons and explanations that may appear at the top of the main page:

Figure 7 Fault Icons

4G Indication Status on the Ground Station:

This indication status applies only to 4G firmware versions 3803 and above.

- A red icon for the contactor indicates disconnection, while a green icon indicates engagement.

Survey Point Collection:

Click the point collection button on the main interface and select the desired survey point collection method to enter the plot naming interface. Users can also skip entering a name and directly proceed to the survey point collection interface. After completing the point collection, name the plot. If choosing aircraft point collection, it must be done under good GPS positioning conditions.

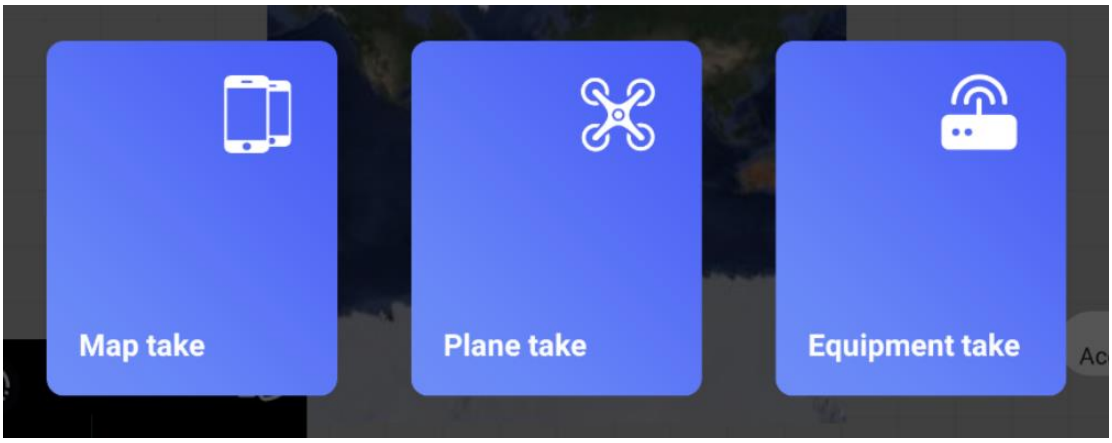


Figure 8 Point Collection Types

During the survey point collection process, different types of points can be switched at will. The point types are divided into: area points, obstacle points, and waypoints. Obstacle areas include two types: polygonal obstacle areas and circular obstacle areas, and users can choose the obstacle area type according to their needs. Currently, up to 128 area points and 10 obstacle area points are supported, with no limit on the number of obstacle areas.

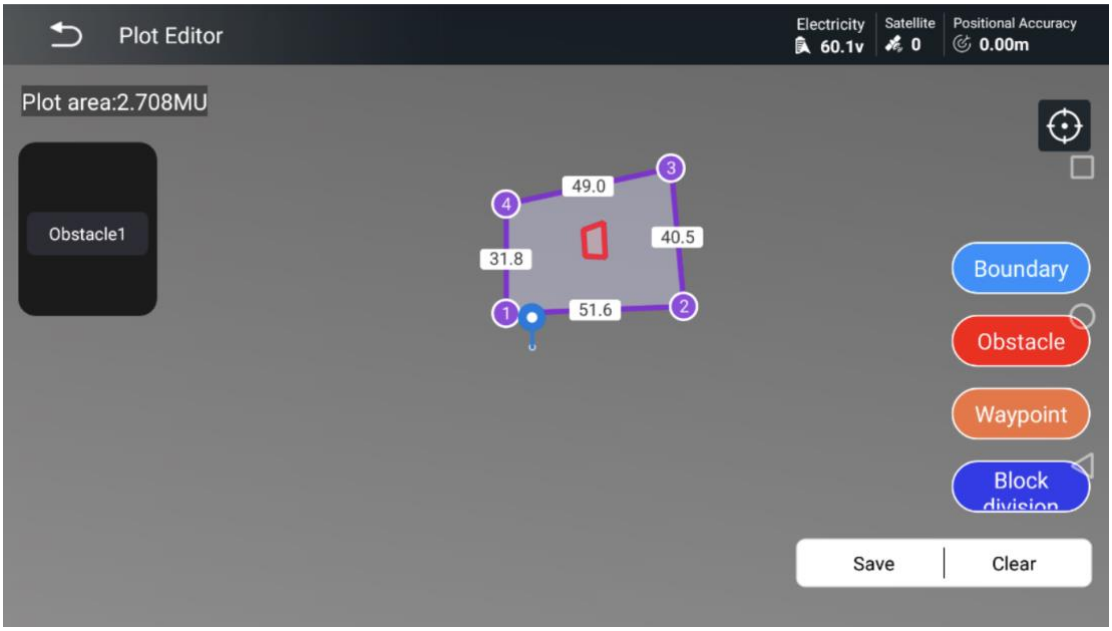


Figure 9 Survey Point Collection

Note that planning for obstacle area points and boundaries outside of the work area is not supported, so do not plan obstacle areas outside the work area.

For area points, the maximum limit is 128, and it requires firmware version V3.5.1 or above. If the firmware version is below V3.5.1 and there are more than 32 area points, the flight route cannot be uploaded.

The obstacle point exchange feature allows for adjustment operations in polygonal obstacle areas. After selecting an obstacle area, click one of the obstacle points to be swapped, then select another point to swap with in the popup, and the exchange can be done.

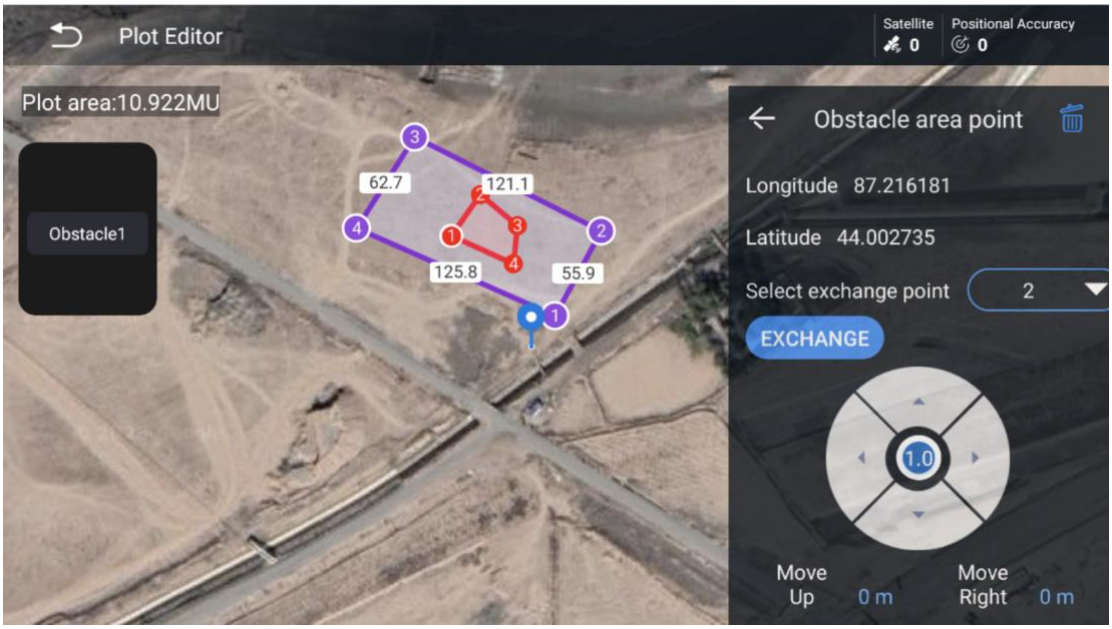


Figure 10 Obstacle Point Exchange

If directly surveying waypoints, the work area must be set in advance, and waypoints must be set within the work area. When adding waypoints, the actual elevation of each waypoint is also added. Users operating in fruit tree mode need to use RTK survey equipment to add waypoints, and the elevation of these waypoints is the same as the elevation measured by the RTK equipment at the time of surveying.

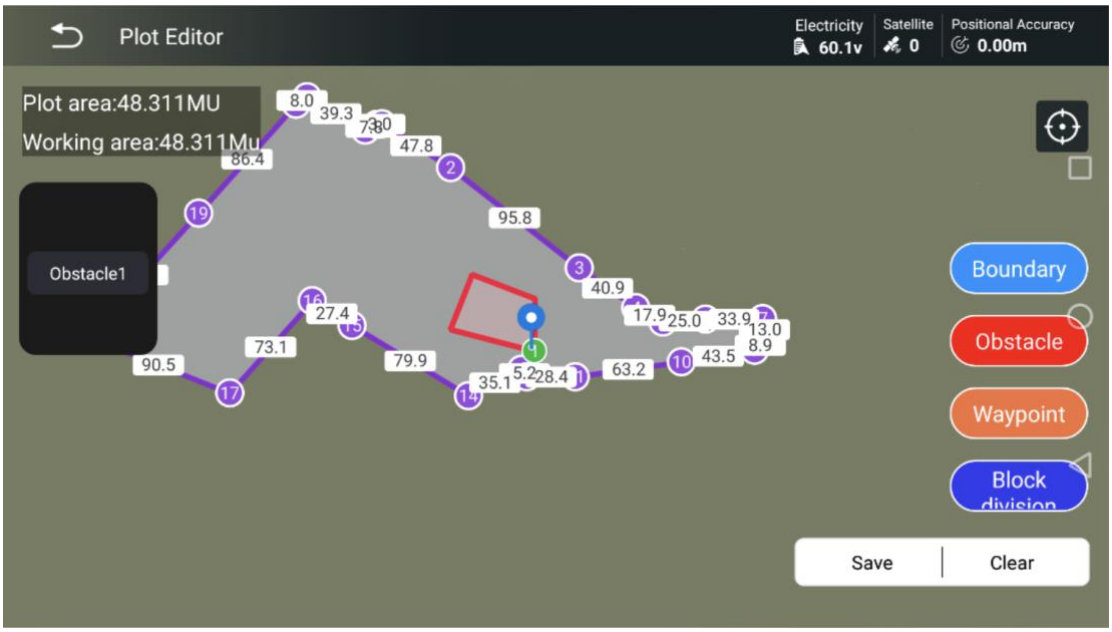


Figure 11 Fruit Tree Point Collection

This elevation value can be changed, and the waypoint elevation is only effective when the flight route planning is switched to fruit tree mode. Due to the significant discrepancy in elevation data obtained from non-RTK devices compared to actual elevation, users who have not used RTK survey equipment but still need to use fruit tree mode should be cautious. Users using fruit tree mode must ensure the accuracy of waypoint elevation data to avoid danger during operation. Users not operating in fruit tree mode do not need to focus on waypoint elevation data.

Plot Feature

Plot Sharing

The system offers both local and cloud directories for plot management. Plots are initially saved to the local directory. Users can customize and upload plots to the cloud directory by clicking the upload button, allowing these plots to be shared with all users within the same plant protection company. The content of the cloud plot list is consistent with the plot management information on the web version. Users also have the option to directly delete plot files from the local directory. Swiping left on a file displays options to upload, edit, or delete the plot.

The plot sharing feature enables sharing the same plot between different accounts. To share a plot, switch to the cloud tab and click the share button. Enter the account name or phone number of the pilot or plant protection team with whom you want to share the plot. The recipient can then view the shared plot under the cloud data of their current account.

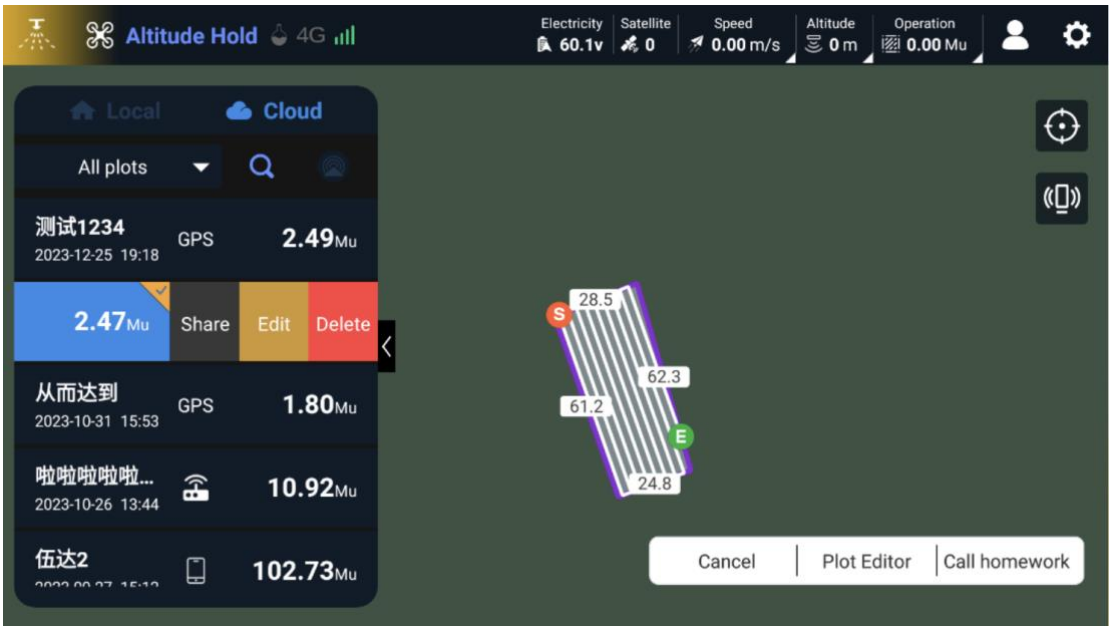


Figure 12 Plot Sharing

Nearby Plots

The "Nearby Plots" feature is accessible under the cloud directory. To use this feature:

- Switch to Cloud Directory: First, switch to the cloud directory in the app or the control interface.
- Plot Sharing Functionality: There is a plot sharing function button within the cloud directory. When this button is blue, it indicates that plot sharing is active. In this state, the search range encompasses all plots uploaded to the cloud by any user. If the button is grey, plot sharing is deactivated, limiting the search range to plots uploaded by your specific plant protection company.

- Search Area: The search area for nearby plots is defined as a circular region with a radius of 5 kilometers centered around the current device's location.
- Usage: When in the cloud directory, switch to the 'Nearby Plots' section. The system will automatically search for and filter out plots that meet the criteria. The results are displayed in pages, with each page showing up to 5 plots. On the map, you can view all 5 plots from the current page simultaneously. Clicking on any plot area displayed on the map will prompt the system to automatically switch to that particular plot for further action or analysis.

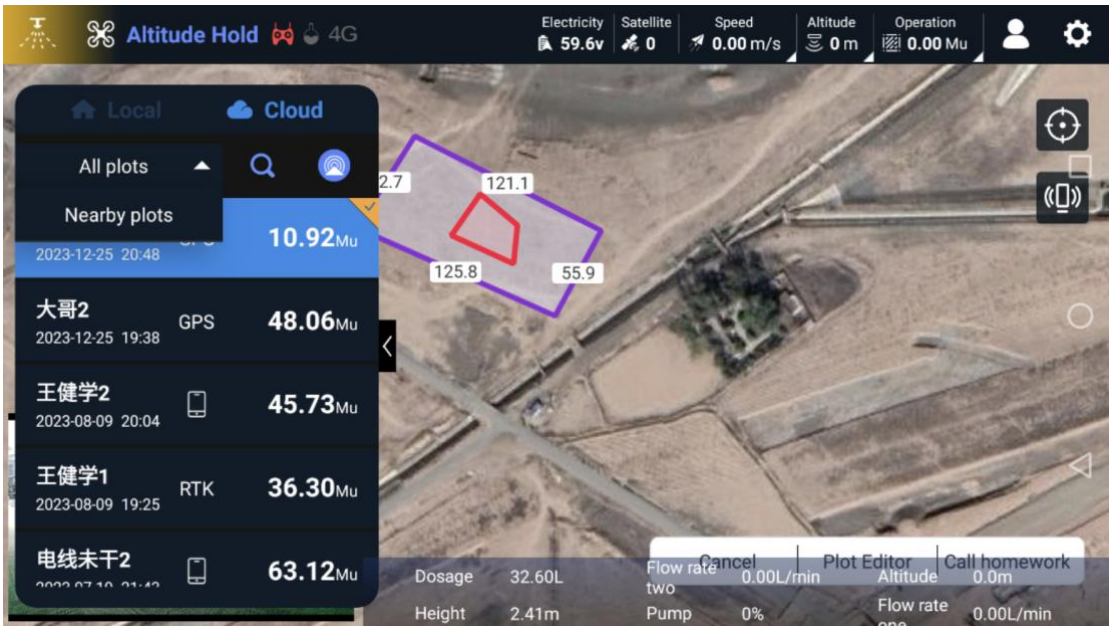


Figure 13 Nearby Plots

Types of Survey and Mapping

Users can differentiate plot types through plot indicators, with three survey and mapping types available:

Survey and Mapping Points	Aircraft Points	Screen
Collecting points through surveying	Using drone for point collection	designating points on digital map

Plot Preview

This feature significantly aids users in locating plots. By entering keywords into the search box, users can search for and pinpoint plots that meet the search criteria, including image display. The system supports fuzzy search for precise location

identification.

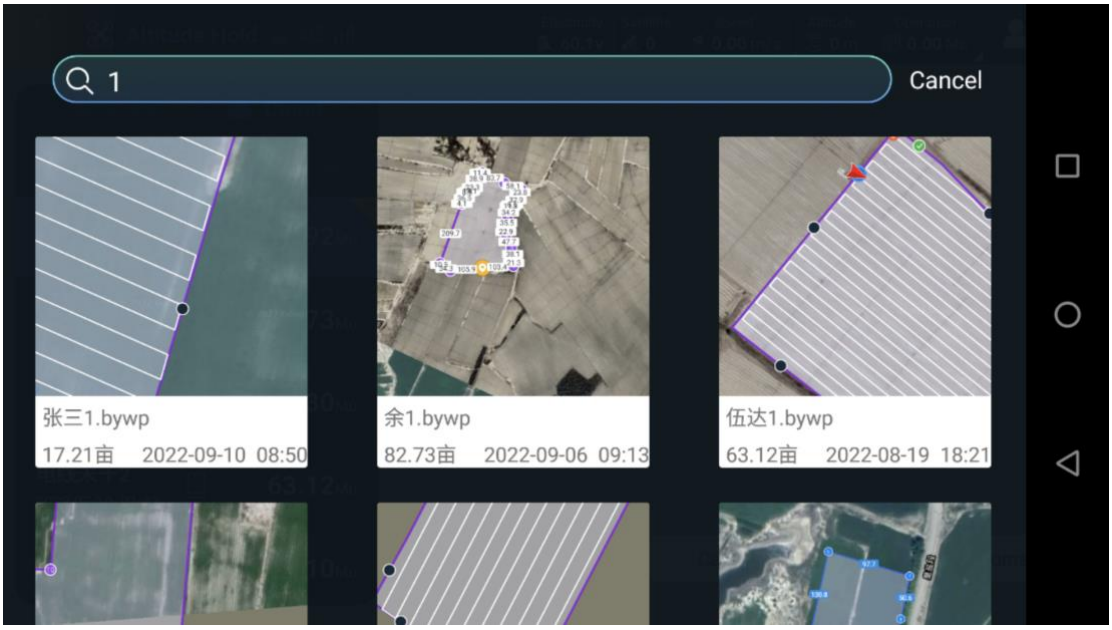


Figure 14 Plot Preview

Plot Editing

After opening the plot list, clicking on the plot edit button allows users to enter the plot editing page. This page is similar to the survey and mapping page and enables adding, deleting, or moving points in the working area or any obstacle area. The left side of the page includes options for selecting obstacle areas, allowing users to edit specific obstacle areas as needed.

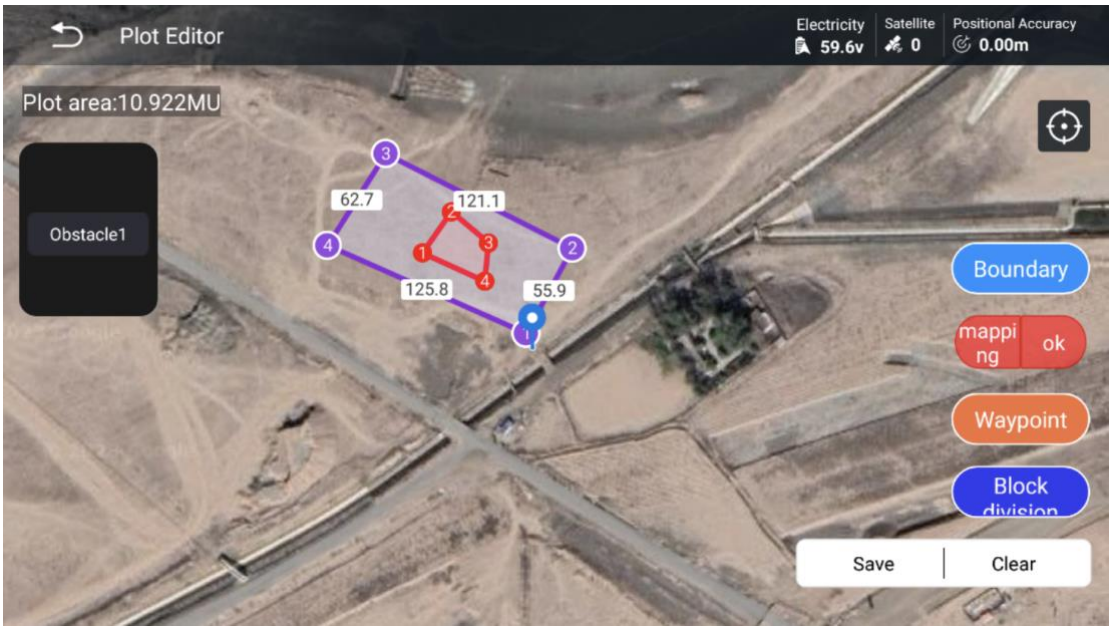


Figure 15 Plot Editing

During the plot editing process, if there is a need to add new points between two existing points, the "Insert Area Point" feature can be used. Firstly, select an area

point where the new point is to be inserted. Then, by clicking the insert button, a new area point can be added before the selected point. This update is done without altering the existing surveyed area points and synchronously updates the numbering of all area points.

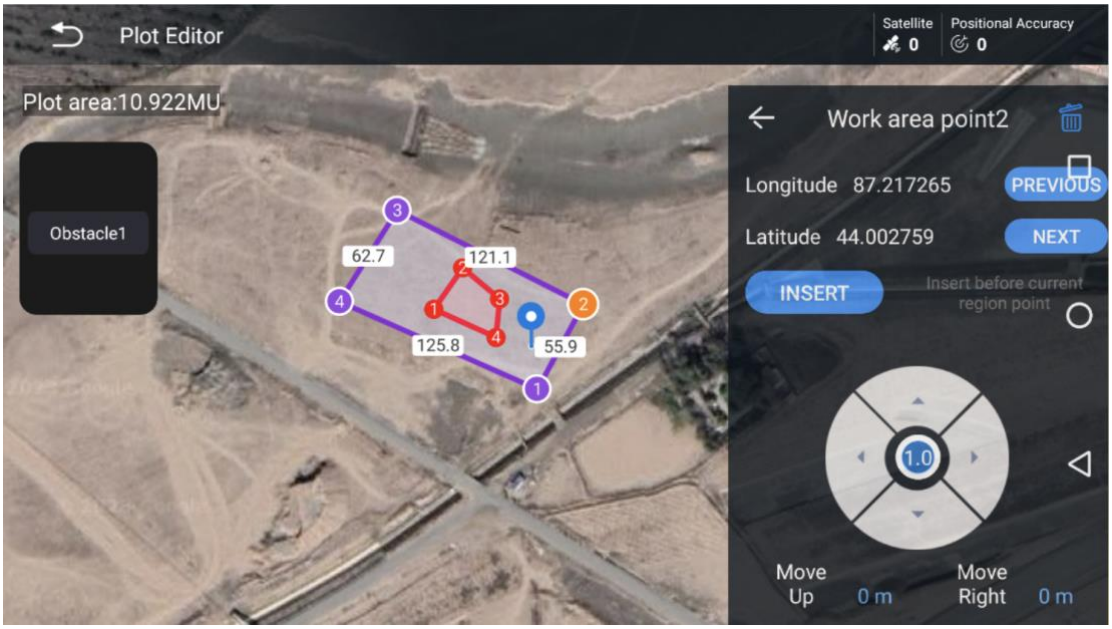


Figure 16 Selecting Insertion Point

As shown in the figure above, when you select Area Point 2 and determine the insertion point's location, clicking on 'Insert' will add a new area point before the original Point 2. The positions of previously surveyed points will remain unchanged, and their numbering will be automatically updated.

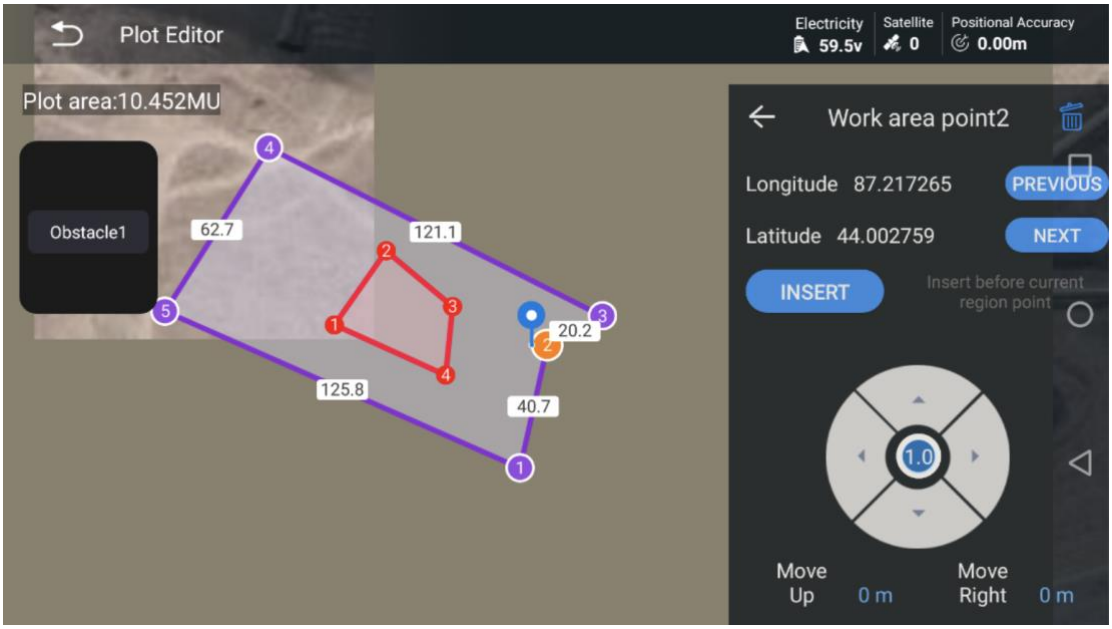


Figure 17 Inserting Area Points

Route Planning

Plot Planning

In the plot list, select any plot and click the 'Call Operation' button in the bottom right corner to enter the flight route planning page. 'S' represents the starting point, and 'E' represents the endpoint, as shown below.

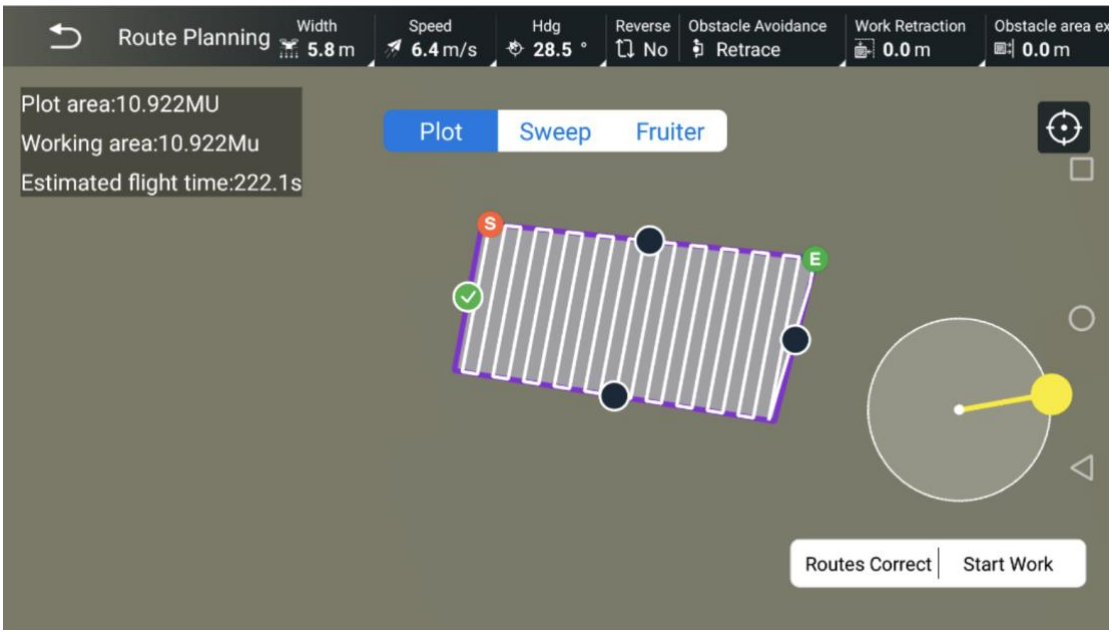


Figure 18 Route Planning

- **Confirming the Heading Angle:** You can select a specific boundary, and the heading angle will align with the selected boundary.
- **Confirming the Starting Point:** To change the starting point, click the reverse button at the top.
- **Working Area Inward Shrinkage / Obstacle Area Outward Expansion:** Adjust the working and obstacle areas by choosing to shrink the working area inward or expand the obstacle area outward. The maximum adjustment range is 15 meters. Working area inward shrinkage can be done on one side only.
- **Route Correction:** Correct already planned routes to minimize location errors that occur during plot surveying, greatly facilitating user operations. After completing route planning, place the aircraft at a calibration point, click on route correction, and the entire area and route will shift to position the aircraft's location as the first waypoint. Then, click on 'Start Operation' to upload the route to the flight controller.

Note: The maximum distance for route correction should not exceed 10 meters.

When a local plot's planned route is uploaded to the flight controller, the plot in the plot list will automatically change to the plot with the added route and will be uploaded to the cloud. If the route is replanned and uploaded again, the old plot plan will be overwritten by the new plan.

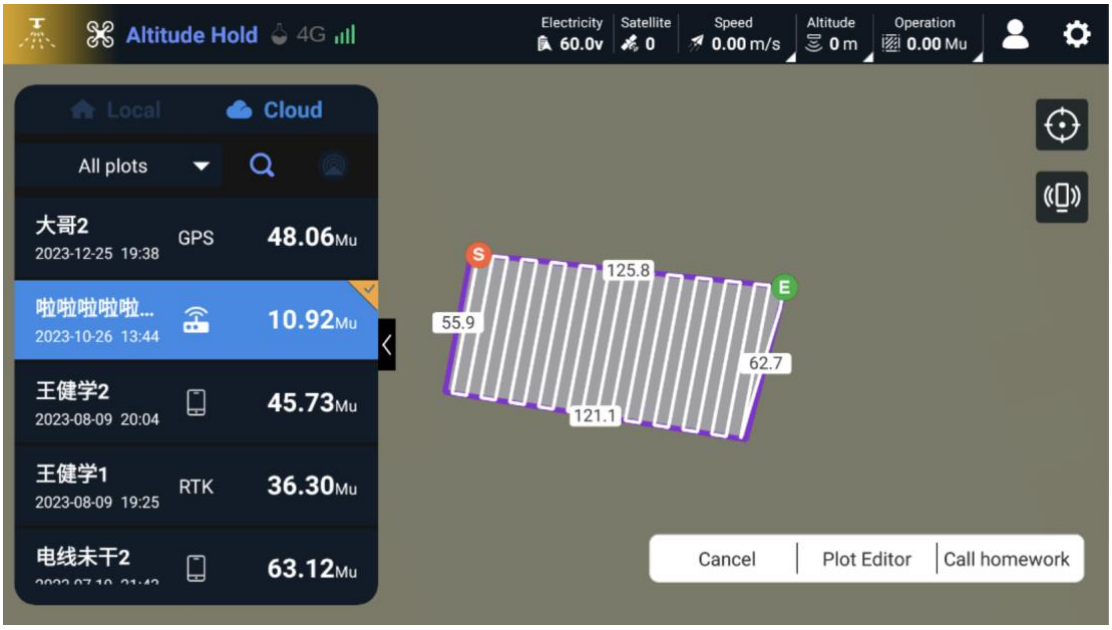


Figure 19 Plot Route Style Generation

If you choose not to replan when recalling a route, once you enter the route planning page, changes to planning parameters other than flight speed will be ineffective.

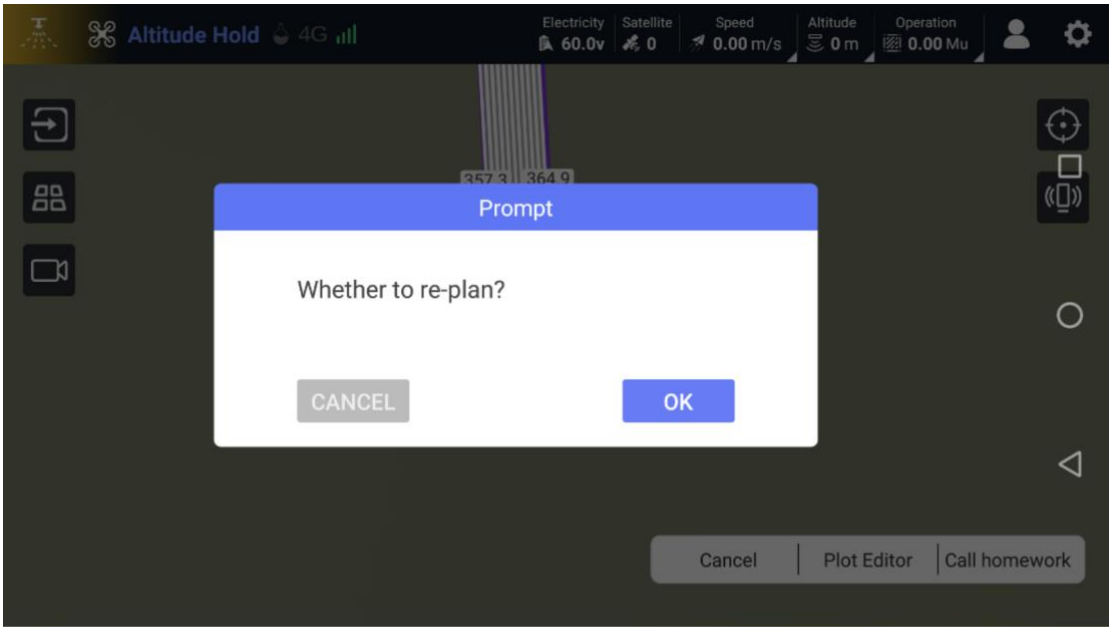


Figure 20 Reinvoke Operation

Edge Sweeping Mode:

After selecting the Edge Sweeping Mode, the number of circles for edge flight operations can be set. Additionally, users can adjust the entire edge flight path or just a single side, as required. Parameters such as flying speed and spray width can also be set, with all flight parameters adjusted in the same manner as in regular flight path operations. When operating in Edge Sweeping Mode, the default flight direction is set to point towards the next waypoint.

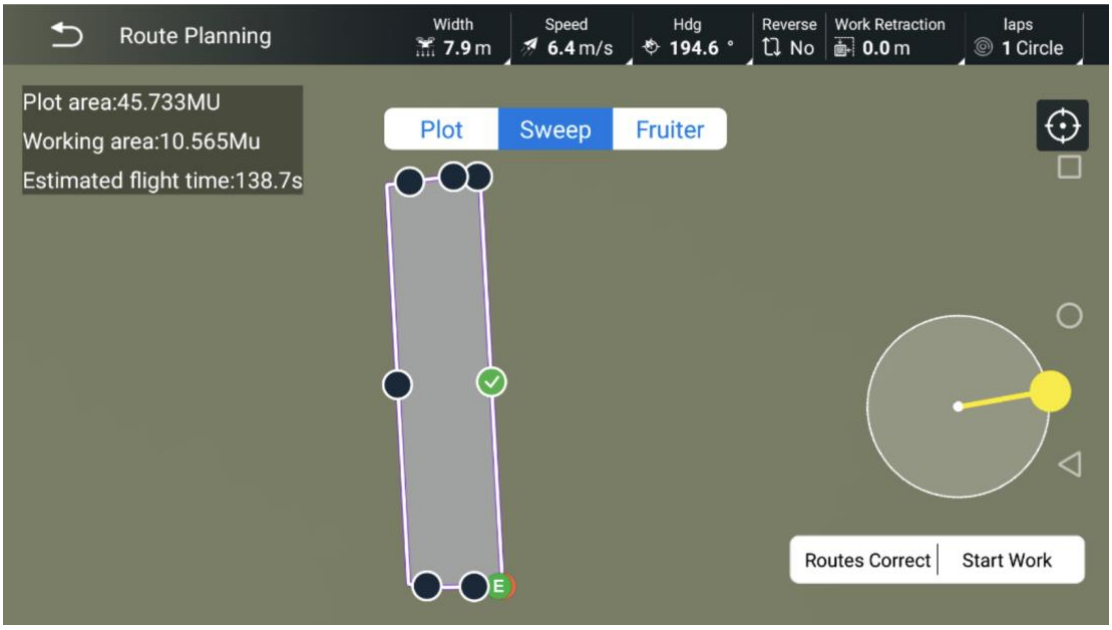


Figure 21 Edge Scanning Mode

Fruit Tree Mode

After selecting the surveyed fruit tree waypoints and the plot, call for operation, cancel re-planning, and then select the fruit tree mode in the flight route planning page. Users should read a few important notes about fruit tree mode and then proceed with its function settings:

- **Speed:** Adjust the speed of the flight route in fruit tree mode.
- **Height Increment:** In fruit tree mode, this adjusts the distance from all fruit tree waypoints' altitude to the actual operation height, enabling adjustment of the safe height of the aircraft above the crops during actual operations.
- **Waypoint Actions:** Set unified waypoint actions as hovering, spinning, or circling. When the spraying method is set to waypoint mode, use this setting. For hovering, set the hovering spray time; for spinning and circling, set the number of rotations; for circling, set the radius of the circle.
- **Spraying Method:** Choose between waypoint mode or route mode. In waypoint mode, spraying occurs only at waypoints, whereas in route mode, spraying occurs throughout the entire route.
- **Height Change Method:** Can be set to slope or fixed point. Slope mode means the height changes synchronously with the position; fixed point means the height and position change asynchronously. Users need to flexibly choose the height change method according to the terrain differences to prevent accidents.

The following are a few important parameter settings for fruit tree mode:

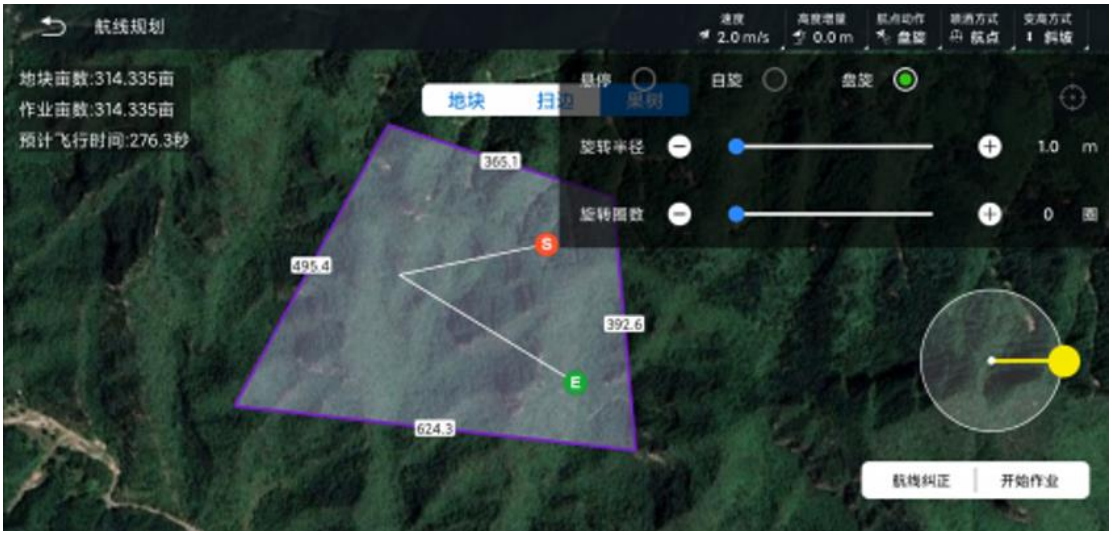


Figure 22 Waypoint Actions

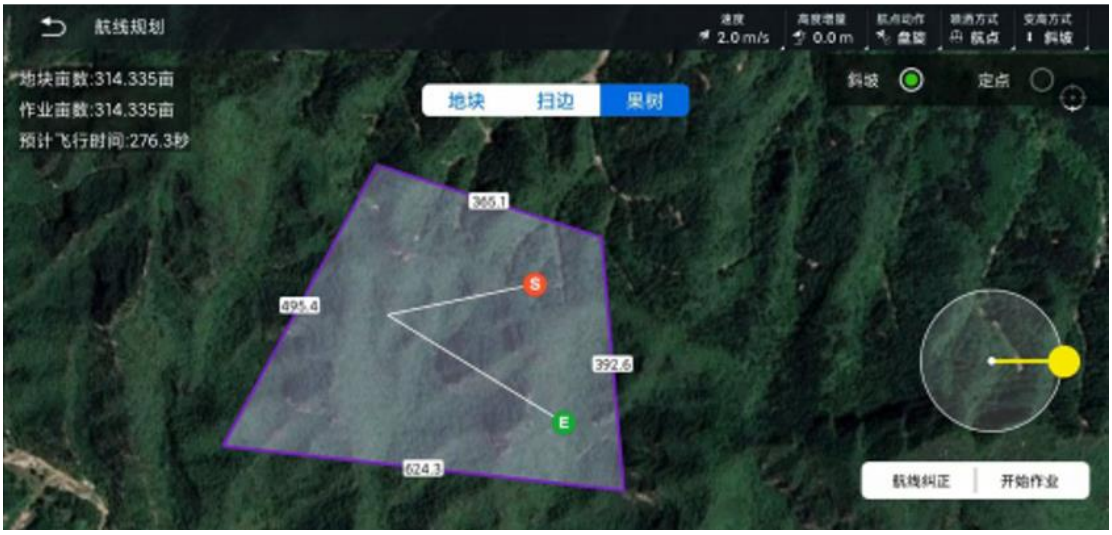


Figure 23 Altitude Change Method

Figure 24 Spraying Method

Regardless of the operation mode chosen, after planning the flight route, it is

necessary to click the "Start Operation" button, confirm the start and end points of the work area, and upload the flight route to the flight controller.

Note: The fruit tree mode requires specialized firmware support. If you need to use RTK survey equipment for fruit tree waypoint collection and operation, please contact technical support to obtain the necessary firmware.

App Settings

Agricultural Settings: It is recommended that users adjust parameters based on their actual needs.

Common Settings:

- Pesticide medium
- Return to home altitude increment
- Return to home speed
- Motor idle speed
- Execution action settings
- Manual obstacle avoidance
- Pointing to the next waypoint
- AB point settings: Auto line change, manual AB point, AB-T

Position Hold Mode:

- Speed limit
- Speed response
- Brake response

Autonomous Operation:

- Autonomous takeoff height
- Autonomous flight line speed response coefficient

Flow Meter (Spraying Mode):

- Flow meter measurement coefficient
- Flow meter closed-loop control proportional coefficient
- Flow meter closed-loop control integral coefficient
- Flow meter protection switch
- Flow speed control
- Number of flow meters

Liquid Level Meter:

- Liquid level meter protection switch
- Liquid level protection action

Weight Sensor:

- Mass protection switch
- Mass protection set value
- Flow control
- Overweight unlock check
- Overweight set value
- Flow meter closed-loop control proportional coefficient
- Flow meter closed-loop control integral coefficient

Pump Parameter Settings (Spraying Mode) / Spreader (Spreading Mode):

- Speed-dependent spraying/spreading
- Turn off the pump/port 1 when changing lines
- Front and rear pumps/port 1-1, 1-2
- Port setting (AUX1-4)
- Minimum flow speed/amount
- Maximum flow speed/amount
- Pump/port 1 delay start time
- Centrifuge/port 2 delay off time
- Pump/port 1 speed adjustment range
- Speed range of the drone.

Red font indicates parameter names displayed after enabling advanced settings

The pesticide medium function is mainly used to save the calibration results of the flow meter or spreader, facilitating easy retrieval by users when needed.

When there is no pesticide medium option, in spraying mode, changing the flow meter measurement coefficient and pump parameter setting for maximum flow speed, or in spreading mode changing the spreader's maximum amount, allows the creation of a new pesticide medium. After naming the pesticide medium, it can be saved.

After calibrating the flow meter in spraying mode, a popup for creating a new medium appears, where you can directly name and save the calibration results. Users can also delete the current pesticide medium parameters. The pesticide medium is only displayed in the saved parameters of the current operation mode, with spraying and spreading modes being independent.

If the same pesticide medium name appears, the later named file will overwrite the

existing one.

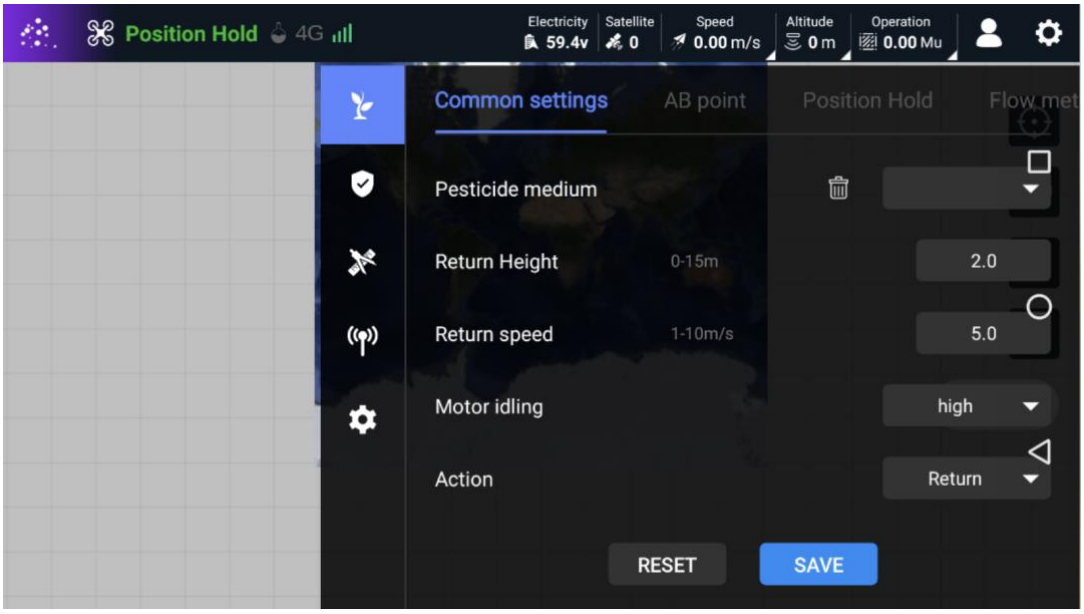


Figure 25 Pesticide Medium

Port Customization: This feature allows users to flexibly configure connections for pumps, centrifugal nozzles, spreaders, and spinner disks to the flight controller. The APP supports setting functions for AUX1, AUX2, AUX3, and AUX4 ports, with AUX1/2 corresponding to the main control NOZ/PUMP (short/long) ports, and AUX3/4 corresponding to standard expansion dock pump 1/pump 2 ports. Users can connect pumps, centrifuges, spreaders, and spinner disks to any port and assign names and functions in the APP.

In spraying mode, AUX1-4 ports can be freely assigned as front pump, rear pump, front centrifuge, or rear centrifuge. For example, in spraying mode, if front and rear pumps are connected to the flight controller PUMP and expansion dock pump 1 ports, and front and rear centrifugal nozzles are connected to the flight controller NOZ and expansion dock pump 2 ports, AUX1 can be defined as the front pump, AUX3 as the rear pump, AUX2 as the front centrifuge, and AUX4 as the rear centrifuge.

In spreading mode, AUX1-4 can be assigned as 1-1, 1-2, 2-1, 2-2. For instance, users can connect the outlet valve and spinner disk to two of these ports, defining them accordingly and turning off the front and rear pump functions for spreading.

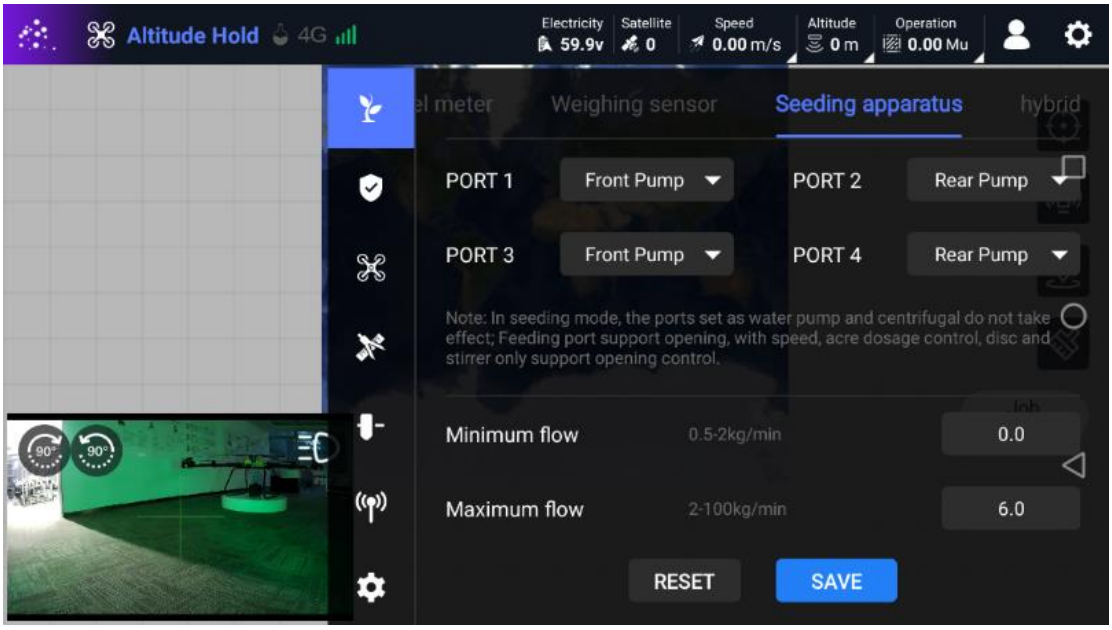


Figure 26 Custom Port Settings

Port names like front pump, rear pump (spraying), and 1-1, 1-2 (spreading) support opening degree and speed-dependent spraying functions; front centrifuge, rear centrifuge, 2-1, 2-2 only support opening degree control. When assigning port functions, choose based on actual needs.

In spraying mode, you can opt for flow control under the flow meter or mass control under weighing. In spreading mode, only mass control under weighing can be used for control per acre.

Safety Settings:

Battery

Using a smart battery, both the voltage and capacity alarm thresholds set in the ground station are activated, with the alarm action triggered in the order of battery level or voltage warning. Low voltage alarm battery type settings are for non-smart batteries to correctly trigger the low voltage alarm function. If using non-smart batteries like 13S, 14S, 16S, 18S, 24S, 28S, etc., it needs to be set, and the parameters need to be written in and the flight controller restarted to take effect.

This setting is for users of non-smart batteries. Ensure to set the corresponding parameters, otherwise, the voltage alarm function will be abnormal.

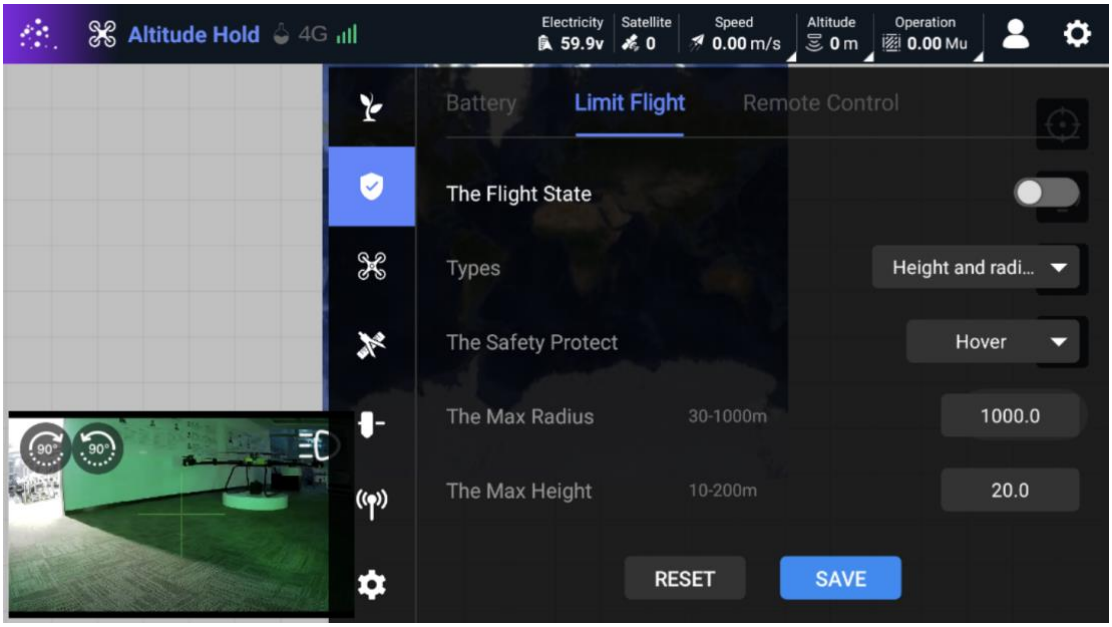


Figure 27 Flight Restrictions

Flight Restrictions

In flight restriction settings, if flight restrictions are not activated, the maximum flight height of the aircraft defaults to 30 meters. When activated, it will follow the set parameters. Unlock permission settings are added in flight restrictions; set to "Low" for unlocking when the aircraft is not in RTK status and not using RTK heading, "Medium" requires entering RTK status before unlocking, and "High" requires both entering RTK status and normal RTK heading for unlocking.

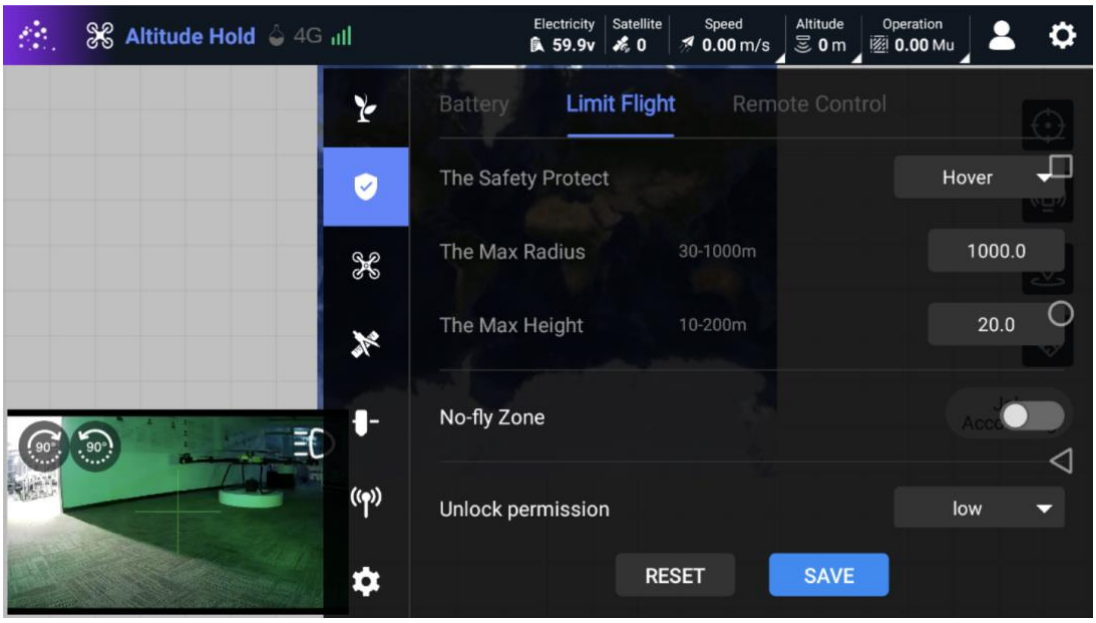


Figure 28 Unlocking Permissions

Frame Settings

- Provides settings for eleven common frame types and a motor test function. After

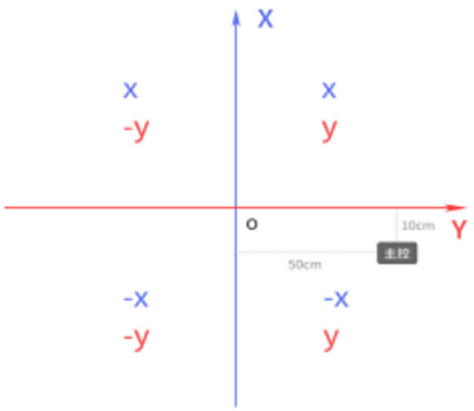
switching the frame type, the flight controller needs to be restarted.

- During motor testing, if a motor does not spin, try increasing the throttle for testing.

Do not use the motor test function without removing the propellers.

Installation Settings

- Supports settings for attitude angle, main control installation direction, and yaw correction.
- Corrections for the installation positions of GPS, main control, and RTK antennas, with the unit in meters, precision of 0.01, and a range from -1 to 1 meter. The reference is based on the aircraft's coordinate system, with the positive direction being the front of the aircraft (X-axis) and the right side of the aircraft (Y-axis).
- To view and adjust these parameters, the advanced settings need to be enabled.



The correction values, both positive and negative, depend on the relative positions of the main controller, GPS, and RTK positioning antenna (right side) to the center of the aircraft. As illustrated in the left image, with '0' representing the center of the aircraft, the correction parameters for the main controller should be set as -0.1m for the X-axis and 0.5m for the Y-axis.

Calibration Settings

Calibration settings include calibration for the remote controller, accelerometer, level correction, dynamic balance testing, flow meter calibration, and weight calibration.

Remote Controller Calibration

- In the remote controller calibration interface, users can choose and change the control mode (American or Japanese mode), and set the flight mode for the 5th channel's three-stage switch, with 3 modes available for selection.
- Before calibrating the remote controller, it's necessary to ensure each channel's position and range is fixed at 1050-1950.
- The control mode (American or Japanese) can be changed via the app. Before use, confirm if the remote controller's firmware supports this change.

Flow Meter Calibration

- In spray mode, before calibrating, click the reset button on the current data in the job statistics on the main page to reset the current medication volume data to zero.
- Add medication to the medicine tank and start spraying until all the medication is dispensed.
- After spraying is completed, enter the accurate volume of the medication added and click 'Calibrate' to complete the calibration process.

Weight Calibration

- Before calibrating, first click on the tare function to exclude the container's weight. Then place the known weight on the weighing sensor and enter the actual weight of the calibration weight in kilograms (kg). Finally, click 'Calibrate' to complete the process.
- When preparing for operation, it's important to tare the container's weight before adding the medium to the medicine box or feed tank. Only after this, you should add the medication medium and start the operation.
- The upper limit for tare weight is the weight of the medicine tank plus 1 kg. Accurate weight of the medicine tank must be entered before performing the tare operation.

Control Sensitivity

- The system supports sensitivity adjustments for roll, pitch, yaw, height, throttle, and remote controller.
- This feature is suitable for users familiar with flight control sensitivity parameters. Novice users are advised to adjust and use this under the guidance of technical support for safety and accuracy.

System Settings

- About: Displays information about the ground station, flight control firmware, as well as the flight controller number and usage time.
- Firmware Upgrade: Firmware upgrades for the flight controller can be done in two ways: via WeChat files and server download.
    - The WeChat method involves upgrading using firmware files typically saved in the WeChat file path. When this option is selected, the app automatically opens the default WeChat file path.

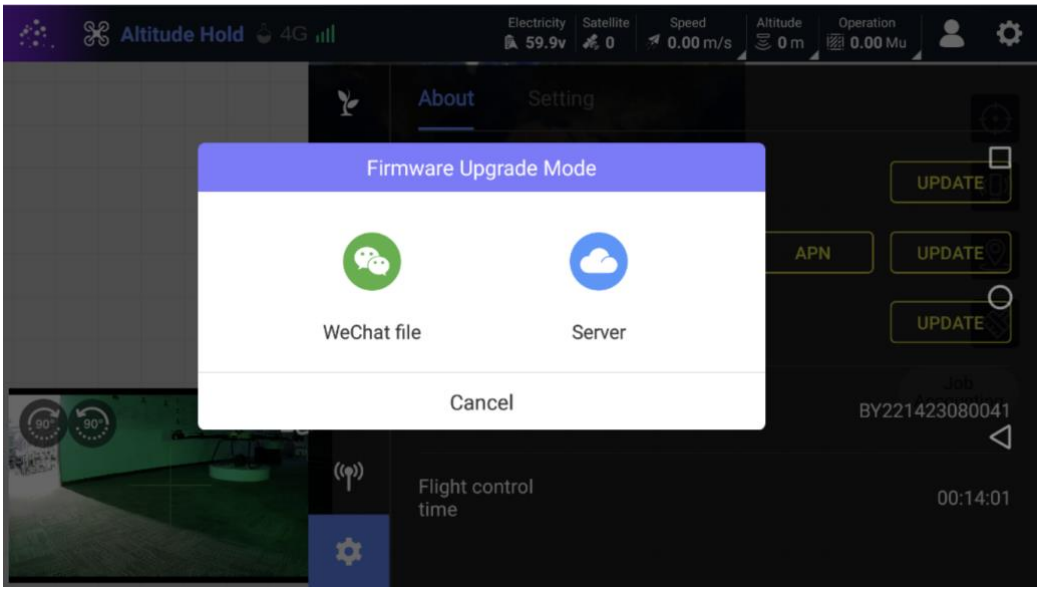


Figure 29 Firmware Update Channel Selection

- Server upgrades automatically fetch and update the latest firmware. The time taken for an automatic update may vary depending on link quality. Do not interrupt the upgrade process; if interrupted or failed, the upgrade must be redone for use. When new flight control firmware or 4G firmware versions are available, update prompts and content will pop up automatically. Do not change the default WeChat file directory when upgrading firmware using WeChat files.
    - Firmware upgrade supports devices such as T12, H12, MK15, etc. If in doubt about the upgrade, please contact technical support for confirmation of the device model.

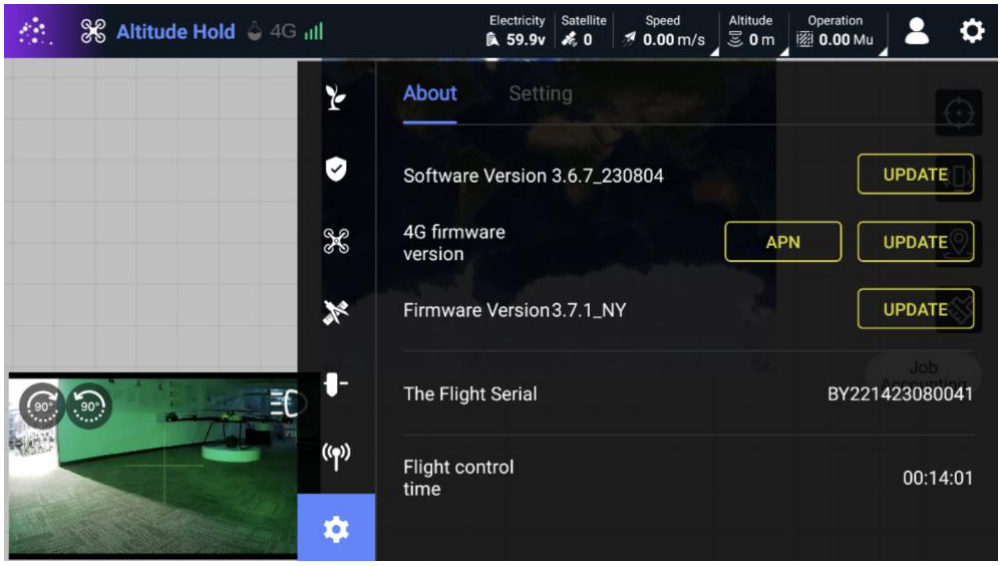


Figure 30 Automatic Update Reminder

- Settings:
    - Advanced Settings: When enabled, more tuning information is available.
    - Contactor: If a contactor is installed on the aircraft, this function can be

activated. Once on, the status of the contactor can be viewed via the contactor icon on the main page. The contactor's on/off status will also be displayed.

- Aircraft Position Lock: Allows the aircraft to be fixed at the center of the screen.
- Map Choice: Options to choose between Amap or Google Maps.
- Area Unit: Supports multiple area units, including mu (亩), hectares, square meters, fen (分 - Taiwan), and rai (RAI - Thailand).

Personal Center

The Personal Center page links all information associated with the APP login account and some flight control related functions. To access, click the personal center icon at the top right corner of the homepage

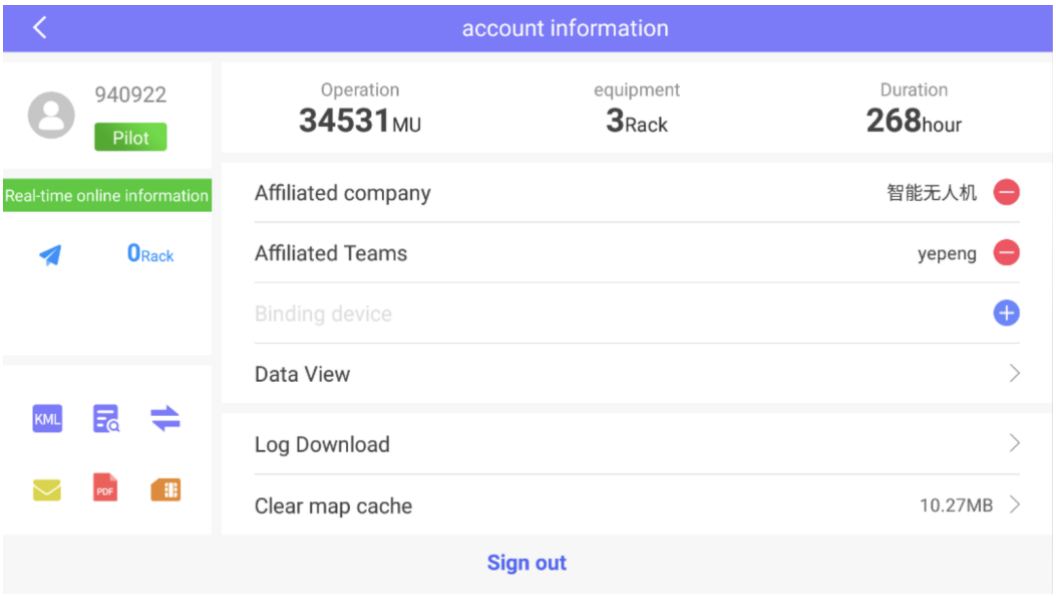


Figure 31 Personal Center

Personal Information: Click the avatar area at the top left of the page to enter the personal information editing page. Here, you can modify personal information, account passwords, and upload attachments.

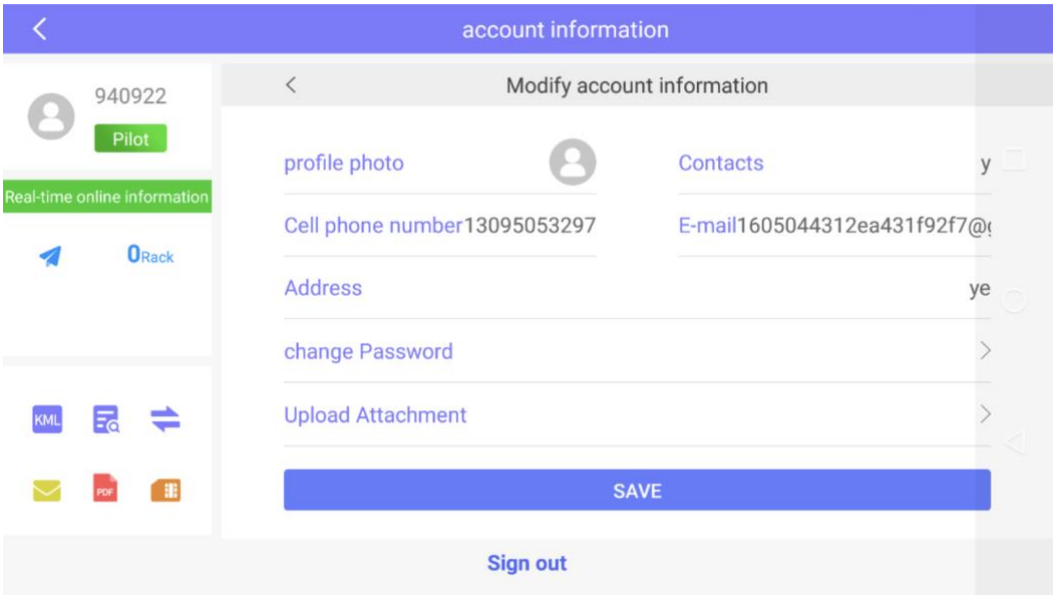


Figure 32 Edit Information

- **Apply to Join a Team:** After registering a pilot account, one must successfully apply and join a company to access its plant protection team. If a pilot is already registered under a company, the plant protection team will review their application. Applications to join a plant protection team are directly reviewed by the company.

- To join a company or team, click the corresponding add button next to the company or team name, enter the account/phone number to submit an application. The respective plant protection company or team will receive the application. Once the company or team approves, the addition is successful.

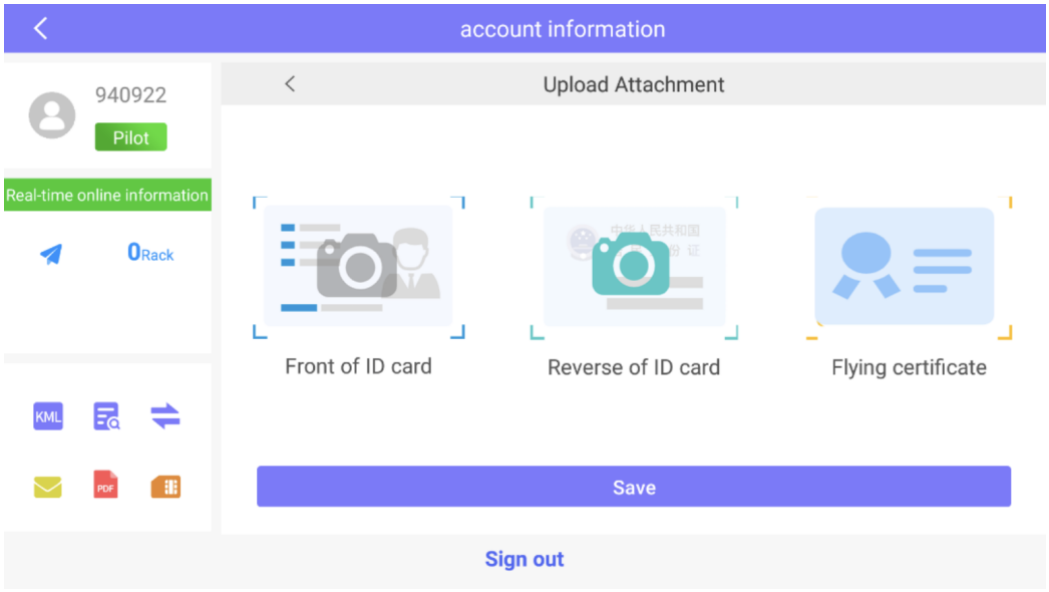


Figure 33 Upload Attachments

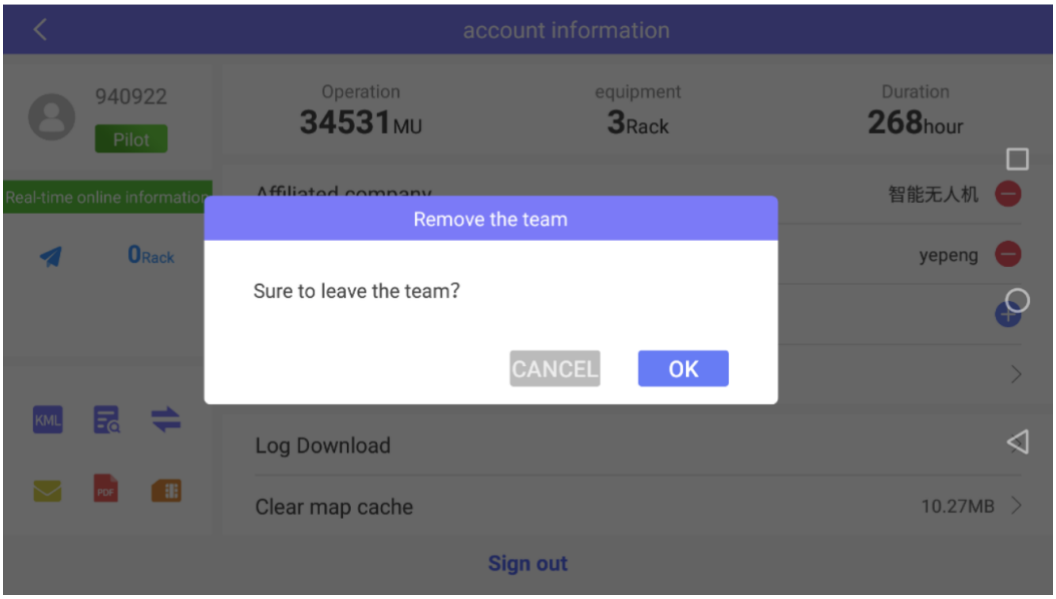


Figure 34 Request to Join Team

Data Viewing

- **Accessing Work Data:** Click on 'Work Data' in the Personal Center to enter the work data interface. After selecting the desired time period, you can view all work data associated with the account's connected devices. The default view is in list mode, as shown below:

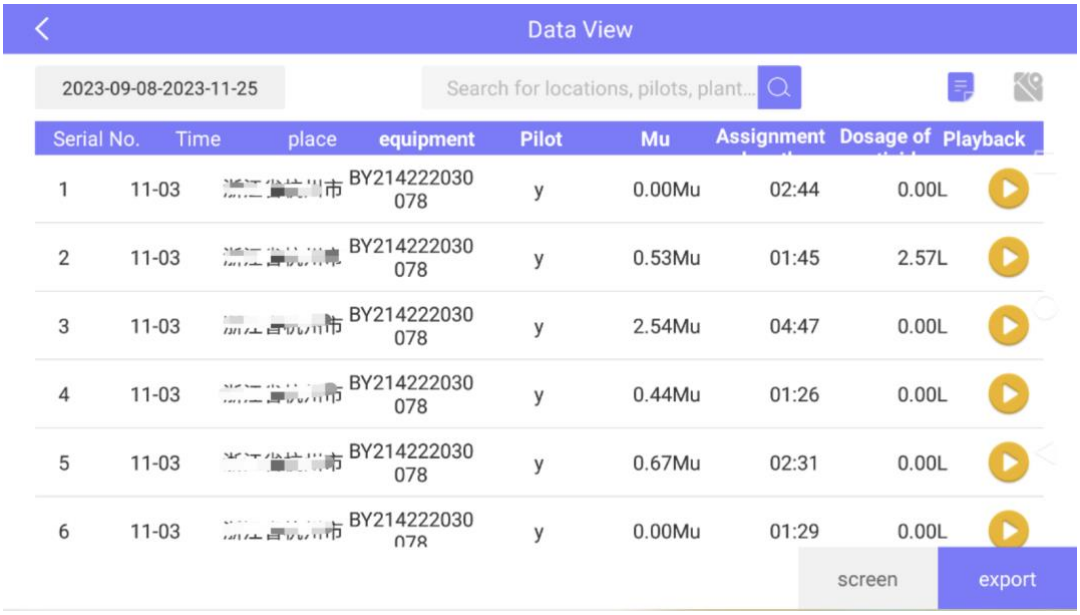


Figure 35 Operation Data

- **Map Mode:** Switch to map mode to view overall flight paths.

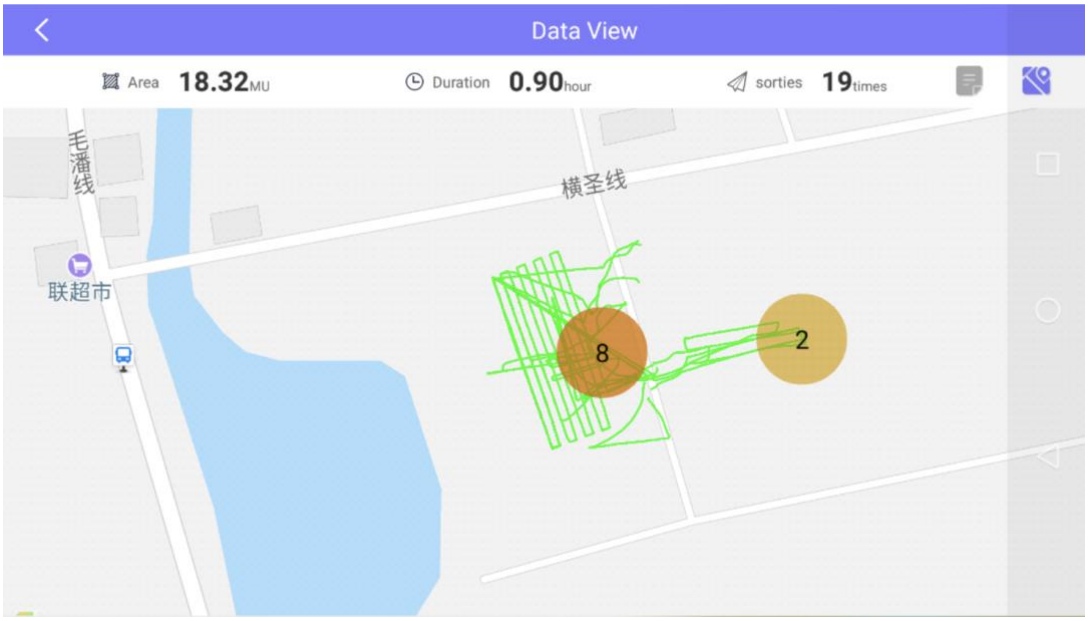


Figure 36 Work Data

- This feature displays all operations of all aircraft under the account. In the work list, you can filter and search for specific operations and export them in EXCEL format. Switching to the map tab shows the trajectory of all operations listed. Clicking 'Show' enters a page for detailed information about a single operation.

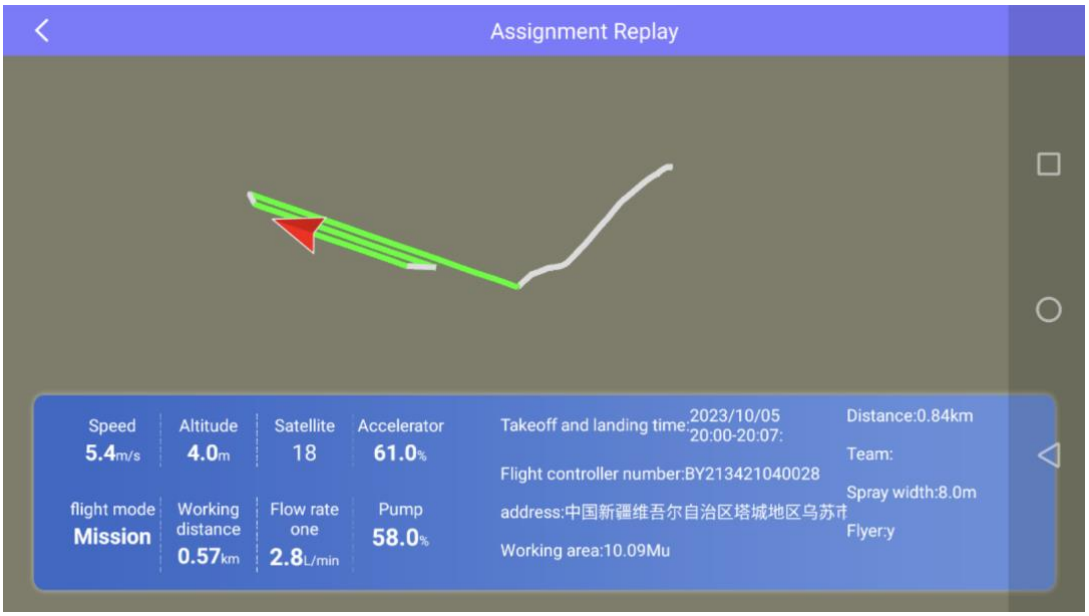


Figure 37 Detailed Information

Log Download:

- Version V3.6 adds an APP log download feature. In the Personal Center, click on 'Log Download' to access the download list. Select a log file to download and confirm. During log download, the aircraft cannot be unlocked; if the aircraft is unlocked, log download is not possible. After downloading, the flight control must be restarted.

- The download speed depends on the remote controller and link device used. The H12 remote controller supports high-speed downloads, while other devices use standard download rates.
- This feature requires flight control firmware version 3.5.1 or higher.
- If the download is interrupted, please restart the download.
- Downloaded log files are saved in the device file path BoyingGCS_DroneLogs by default.
- Offline Maps: When using Google Maps, offline map mode is enabled by default. When the network is smooth, the current display area's map files are automatically cached. Even without a network, the cached map areas can be loaded. You can clear the map cache if necessary.

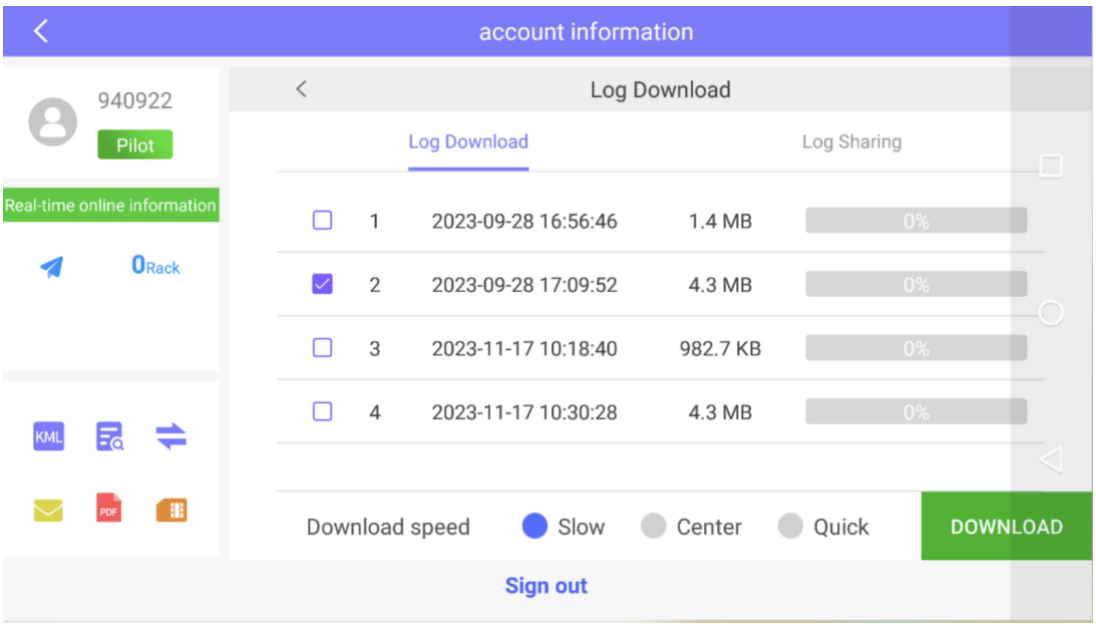


Figure 38 Log Download

Flight Requirements

Operational Environment Requirements

- Flight Environment: Always maintain a safe distance from crowds.
  - The pilot should be more than 10 meters away from the drone.
  - Ground crew should maintain a distance of more than 15 meters from the drone.
  - It's strictly prohibited for spectators to be within 100 meters of the drone!
- Proximity to Hazards: Drones should take off and land far away from high voltage lines, transformers, steel structures, crowds, roads, etc.

Flight Restrictions and No-Fly Zones

- Sensitive Areas: Military bases, special agency locations, nuclear power plants, border lines, political center areas, and military exercise areas are considered sensitive from a national security perspective. For safety and legality, avoid operating in these areas to prevent accidents.
- No-Fly Zones: Airports, where commercial planes frequently take off and land, are sensitive areas. The presence of a drone can cause flight delays or even accidents.
  - According to laws and regulations, drones must fly within designated airspaces both domestically and internationally. Based on airspace protection regulations, a 10 km radius on either side of a runway and 20 km at runway ends is considered a protected area where flying is prohibited.

Pre-Flight Checks

Aircraft Inspection and Operation: Pay attention to the following before flight:

- If the drone has been idle for a long time or moved over a long distance, perform a compass calibration to avoid anomalies.
- Before taking off, confirm the joystick mode to prevent errors.
- Ensure the remote control and battery are fully charged to avoid losing control due to low battery.
- Before taking off, make sure that the arms and propellers of the drone are properly deployed. The more thorough the pre-flight check, the lower the probability of encountering problems.

Maintenance

Daily Maintenance of Agricultural Drones

1. Medicine Tank: Fill the tank with clean water or soapy water, fully spray it out, and repeat this washing process three times.
2. Propeller Blades: Wipe the blades with a damp cloth, check for any cracks, and then dry them with a dry cloth to remove any water stains.
3. Battery: Clean the battery and its connectors with a cotton swab dipped in alcohol, ensuring all surface contaminants are removed.
4. Drone Body: Clean the body with a soft brush or damp cloth, and then dry it with a dry cloth to remove any water stains.
5. Propeller Clamps and Motor: Use a soft brush or damp cloth for cleaning, and then dry with a dry cloth.
6. Filter and Nozzle: Remove the filter and nozzle from the medicine tank, clean them to ensure they are not clogged, and then soak them in clean water for 12 hours.

Hazard and Risk Overview and Mitigation Measures

Hazards of Pesticides

Hazards of Pesticides	1. Environmental hazard (environmental pollution)
	2. Hazards to human health
Dangers	1. Acute poisoning can occur if pesticides are ingested, inhaled, or come into contact with the body in large amounts.
	2. During the spraying process, pesticides can enter the body through inhalation and skin penetration.
	3. Long-term contact with objects contaminated with pesticide residues can lead to accumulation in the body, posing a health threat.
	4. Some pesticides are corrosive and should be avoided from direct contact with the skin.
	5. The edges of the propeller blades are sharp; caution is needed even when they are stationary to prevent cuts.
	6. The propellers have strong cutting force when rotating at high speed; maintain a safe distance during flight to avoid accidental injuries.

Mitigation Measures

- Control the disposal of pesticide packaging waste to minimize environmental pollution.
- Adjust the structure, method, and amount of pesticide application to avoid misuse and unscientific use.
- Use appropriate protective gear such as gas masks and chemical protective suits during application, and ensure personal cleanliness after spraying.
- Limit daily spraying to no more than 6 hours, avoid spraying in high temperatures at noon, and prevent accidental ingestion or prolonged contact with pesticides.
- In case of pesticide poisoning, move the patient away from the contaminated area to a cool, ventilated place. For oral poisoning, induce vomiting if the patient is

conscious; avoid inducing vomiting if unconscious. Get the patient to a hospital as soon as possible.

- Replace the propeller immediately if it is damaged or has notches, and do not continue flying.
- Use protective gear during operation, ensure the ground is even, and there are no strong winds or electromagnetic interference. Maintain a safe distance between people and the drone to prevent accidental injuries.
- Do not touch the drone during flight; if cut by the propeller, treat the wound promptly, and seek hospital treatment for serious injuries.

Spider-i UAV

Welcome to the world of advanced agriculture with Spider-i UAV

Embark on a journey of agricultural innovation with your Spider-i UAV. Designed for precision and efficiency in plant protection, our drone is your ally in modern farming. Should you need any guidance or support, our expert team is just a call away, committed to enhancing your farming experience.

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