

# Intelligent Multi-rotor Plant Protection UAV

## User Manual

2020.04

V1.0



E-A2020 Economic Version

Suzhou Eavision Robotic Technology Co.,Ltd.

Address: Unit 1-A, No.3 Workshop, 28 Xiasheng Road, SIP, Suzhou, China

Website: [www.eav.top](http://www.eav.top)

Tel: 4008002872

## **FCC STATEMENT :**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

**Warning:** Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

## **FCC Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

# Content

<b>1. Product Overview .....</b>	<b>1</b>
<b>2. Disclaimer .....</b>	<b>3</b>
<b>3. UAV System .....</b>	<b>4</b>
<b>3.1 UAV Composition .....</b>	<b>5</b>
<b>3.2 UAV Parts Composition .....</b>	<b>6</b>
<b>4. Technical Parameters .....</b>	<b>7</b>
<b>4.1 Frame Parameter .....</b>	<b>7</b>
<b>4.2 Spray Parameter .....</b>	<b>7</b>
<b>4.3 Battery Parameter .....</b>	<b>8</b>
<b>4.4 Charger Parameter .....</b>	<b>8</b>
<b>4.5 Remote Control Parameter .....</b>	<b>8</b>
<b>5. Check List before Use.....</b>	<b>10</b>
<b>5.1 Materials.....</b>	<b>10</b>
<b>5.2 Remote Control .....</b>	<b>10</b>
<b>5.3 UAV .....</b>	<b>10</b>
<b>5.4 Battery .....</b>	<b>9</b>
<b>6. Operating Instructions.....</b>	<b>11</b>
<b>6.1 APP Installation .....</b>	<b>11</b>
<b>6.2 Function Check .....</b>	<b>12</b>
<b>6.3 Debug during Flight.....</b>	<b>22</b>
<b>6.4 Task-setting .....</b>	<b>26</b>
<b>7. Data Management.....</b>	<b>40</b>
<b>7.1 Data Downloading and Firmware Upgrading .....</b>	<b>40</b>
<b>7.2 Account Permission.....</b>	<b>40</b>
<b>8. Account Management.....</b>	<b>41</b>
<b>8.1 Device Management .....</b>	<b>41</b>

8.2 Team Management .....	45
8.3 Employee Management.....	46
8.4 Plot Management.....	48
8.5 Work Detail .....	52
8.6 Task Management.....	53
9. Offline Operation Procedure.....	55
9.1 Connect to the Remote Control.....	57
9.2 Mapping .....	57
9.3 Operating .....	57
10. Maintenance Instructions.....	55
10.1 Content and Cycle of Maintenance .....	57
10.2 Recommended Replace Time of Parts .....	57
10.3 Battery Maintenance and Cautions .....	58
11. Warranty Services.....	60
11.1 Application Range of Warranty Services.....	60
11.2 Part List of Warranty Services.....	61
12. Nameplate .....	62

# 1. Product Overview

E-A2020 Series full-scope perception intelligent plant protection UAV is an intelligent multi-rotor plant protection UAV released by Suzhou Eavision Robotic Technologies Co., Ltd. Based on the industry-leading stereovision technology, the UAV can complete plant protection services of various fields crops and cash crops. It has the following functions:

- Intelligent Terrain-following: It can complete plant protection services in plains, hills, mountains, wetlands or other complex terrains;
- Quick Plan: No need to survey the plot with clear boundary. Users can draw the map by their hands to confirm the plot boundary, which improves survey efficiency.
- Positioning precision can reach centimeter-level. RTK components are included in the flight control system;
- Precise Spraying: It can adjust the flow rate by itself according to user' s needs to realize intelligent spray control;
- Foldable Design: Both the arms and propellers of UAV are foldable, which is convenient for storage and transportation;
- User Friendly: User can send commands (such as taking off, hovering or returning) to the UAV just by tapping a button in the ground station. Beginners can learn basic operations in half an hour, reducing the dependence on professional operators.
- High Safety: The UAV can fly safely autonomously for 1 minute even if the satellite signal is lost.

- Data Management: The supporting agricultural data management system can help improve operation management efficiency and increase economic value.
- Intelligent Battery: 3C fast-charging is available, and the battery can be maintained autonomously. Battery charging and maintenance more convenient than the previous generation.

We have completed plant protection services of tens of thousands of hectares in total for crops such as rice, corn, wheat, apple, sugarcane, banana, pitaya, grapefruit, orange, bean and dates in many places in China. Our UAV can provide plant protection services for different crops in different terrains.

## 2. Disclaimer

Thank you for choosing the E-A16 series full-scope perception intelligent plant protection UAV developed and manufactured by Suzhou Eavision Robotic Technologies Co., Ltd. (hereinafter referred to as "EAVision"). In order to make you familiar with the operation and maintenance of this equipment, please read and abide by the relevant requirements of this manual carefully, operate in strict accordance with the instructions in actual operation process and maintain in a timely and detailed manner.

Please read this statement carefully before using the product. Once you use the product, you will be deemed to have approved and accepted the whole content of this statement.

This product is not suitable for people under 18. Before using this product, please accept the formal training of EAVision and obtain the qualification certificate. While using the product, the user promises to be responsible for his/her actions and all consequences arising therefrom. EAVision shall not bear all losses caused by the user's failure to use the product in accordance with this document and user manual, and shall not be liable for any indirect, consequential, punitive, incidental, special or punitive damages.

The user promises to use the product for legitimate purposes only and agrees to abide by this clause and any relevant policies or guidelines formulated by EAVision. The excellent performance of this product depends on the original accessories of EAVision. EAVision shall not be liable for any loss or injury caused by not using the original accessories.

This UAV is a controlled aircraft. Please read the relevant regulations of national

UAV management regulations and local airspace control regulations carefully before use. Once you use this product, you will be deemed to have read the relevant regulations and documents. EAVision will not be responsible for any legal liability arising from the use of this product in violation of the laws and regulations.

While using the UAV, please ensure that the power supply system works well and arms of UAV are in the right position. Keep the UAV away from crowd and dangerous articles.

It is strictly prohibited for operators to operate the UAV after drinking, drug taking or drug anesthesia, or when the operator is in dizziness, fatigue or other poor physical and mental conditions. New operator without enough flight training shall not operate the UAV independently outside the training site.

Don't operate the UAV in bad weather such as rainy days, snowy days or windy days (wind speed 19mph or above)

Do not operate the UAV in magnetic field interference area and radio interference area (such as high-voltage tower, large-scale power equipment, radio and television transmission tower and mobile phone base station, etc). If it is really necessary, please ensure that there are no other people within 200m of the operation area.

This statement is very important for the safe use of the product and your legitimate rights and interests. Suzhou Eavision Robotic Technologies Co., Ltd reserves the right to update this disclaimer. Thank you again for choosing our product.

**Warning:**



- **Do not get close to the propeller or motor when they are working.**
- **The product is not suitable for people under 18.**



### 3.1 UAV Composition

E-A2020 Series full-scope perception intelligent plant protection UAV can plan the flight route in real time through intelligent algorithm, and it can operate with high efficiency. With GPS/RTK positioning technology, the positioning precision of E-A2020 series can reach centimeter-level. The structure of the UAV is as follows:

Figure 1 UAV Parts

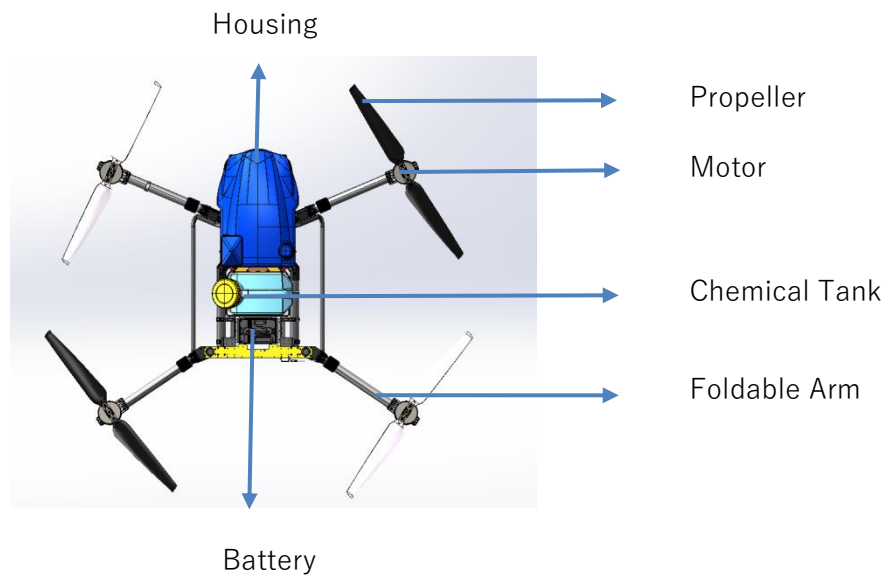


Figure 2 UAV Parts

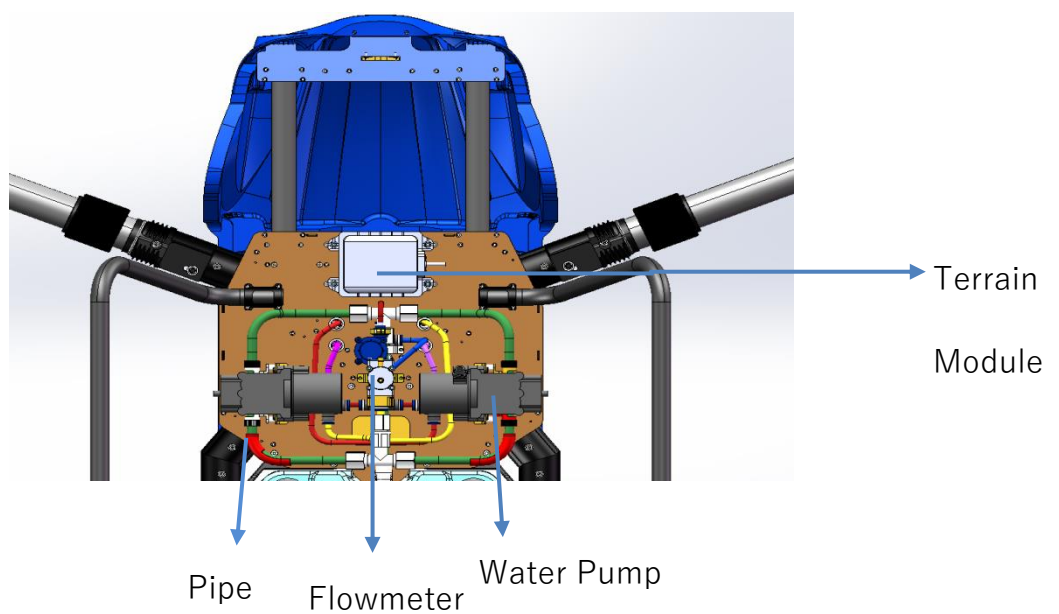
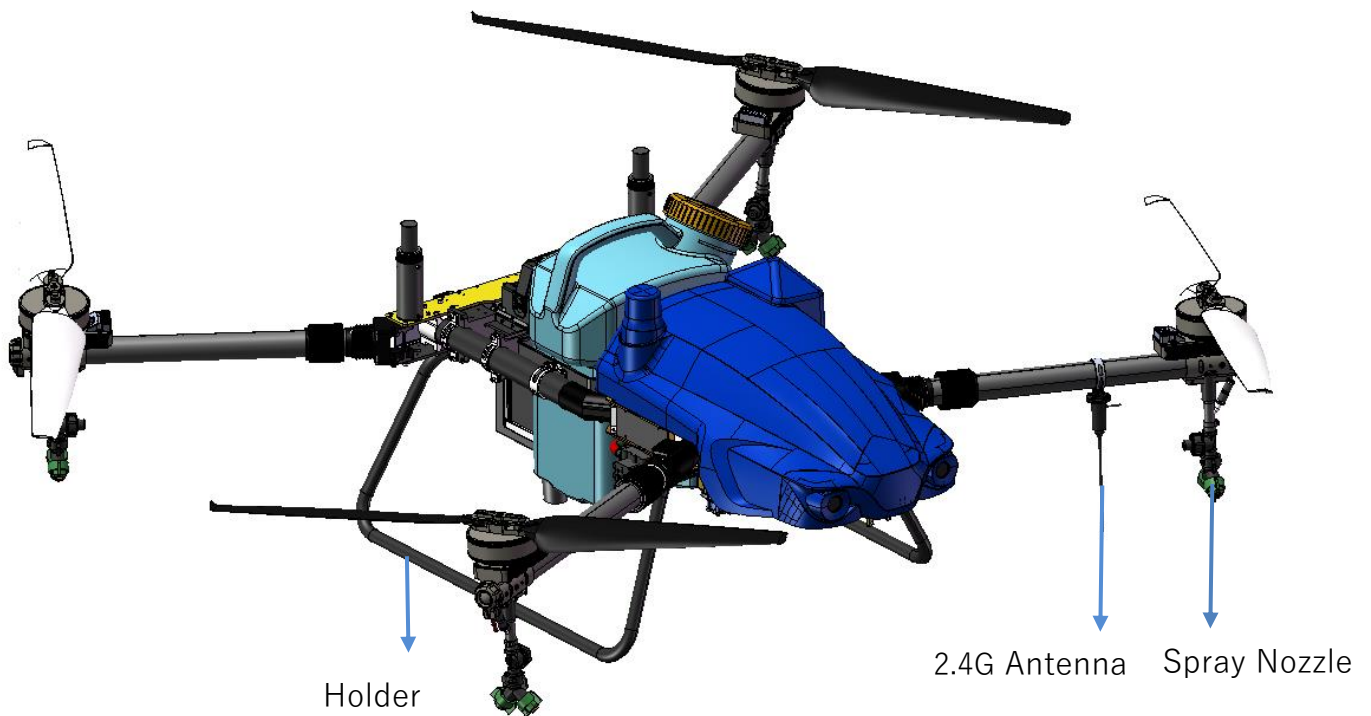


Figure 3 UAV Parts



### 3.2 UAV Parts Composition

The integrated remote control is a UAV intelligent data link system integrating the functions of high-definition digital image transmission, remote control data transmission and centimeter-level positioning. It integrates ESC calibration, voice broadcast, one-button parameter-setting and other practical functions to improve work efficiency and reduce complex setting. The integrated remote control is much easier to debug and use.

Figure 4 Integrated Remote Control



## 4. Technical Parameters

### 4.1 Frame Parameter

- Wheelbase: 1085mm@front & back
- Dimensions (exclude propeller) :  $\Phi 1820 \times 510$  (mm)
- Arm Length: 506mm
- Size (folded): 920\*650\*510 (mm)
- Weight (no load): 24.1kg (including 8 spray nozzles)

### 4.2 Spray Parameter

- Chemical Tank Capacity: 15L
- Droplet Size: 70-150 $\mu$ m
- Spray Type: Pressure
- Flow Rate: 1.8-4L/min

- Operating Height: 1-4m
- Nozzle Quantity: 8 (double-nozzle)
- Spray Range: 1~5 (m)
- Operating Area Per Time: 1.3 Ha

### 4.3 Battery Parameter

- Suitable for EAVision E-A2020
- Battery Type: Lithium Battery 13S
- Voltage: 48.75V
- Power: 975Wh
- Weight: About 6.7Kg
- Max Charging Power: 3032W
- Working Temperature: 0--45°C (environment temperature)
- Charging Temperature: 0--45°C (environment temperature)
- Charging Time:
  - Fast-charging: 20min
  - Slow-charging: 60min

### 4.4 Charger Parameter

- Battery Model: JM1-20000mAh-48.75V
- Input Voltage/Frequency: 90-264VAC/50-60Hz
- Charging Voltage: 55.9V
- Output Voltage: 30-55.9VDC
- Weight: About 12kg
- Working Temperature: -5--50°C (environment temperature)

### 4.5 Remote Control Parameter

- Dimensions: L194.5mm×W172.5mm×H114mm
- Communication Frequency: 2.4G
- Transmission Distance: 2000m

- Battery Capacity: 8000mAh

## **5. Check List before Use**

### **5.1 Materials**

- Integrated Remote Control
- E-A2020 Series Full-scope Perception Intelligent Plant Protection UAV
- EAVISION Agriculture APP
- Battery
- Charger (remote control charger, main battery charger)

### **5.2 Remote Control**

- Check whether the remote control antenna is damaged and whether the screws are loose.
- Open the remote control and check the battery power. Please charge the remote control in time if the battery power is lower than 50%.
- The remote control can connect to the UAV.

### **5.3 UAV**

- Check the screws of the UAV arms, motor and propellers. Please tighten the screws if they are loose.
- Check the status of the UAV holder. Please replace it in time if there is deformation.
- Check whether there is blockage inside the spray nozzle. Please clean it in time if there is blockage.

## 5.4 Battery

- Check the battery power before operation.
- Check the battery. In case of any abnormality, don' t use it.
- Check whether the battery charging port is clean. If there are foreign materials, please use alcohol pad or clean insulation to wipe the electrodes (don' t wipe two electrodes at the same time), or the battery charging port will be melted.

## 6. Operating Instructions

### 6.1 APP Installation

The EAVISION Agriculture APP can run in Android 4.2 version and above. Scan the QR code to download the APP and install it.

Figure 5 QR Code for APP Installation



After the installation, you can register on the APP

## 6.2 Function Check

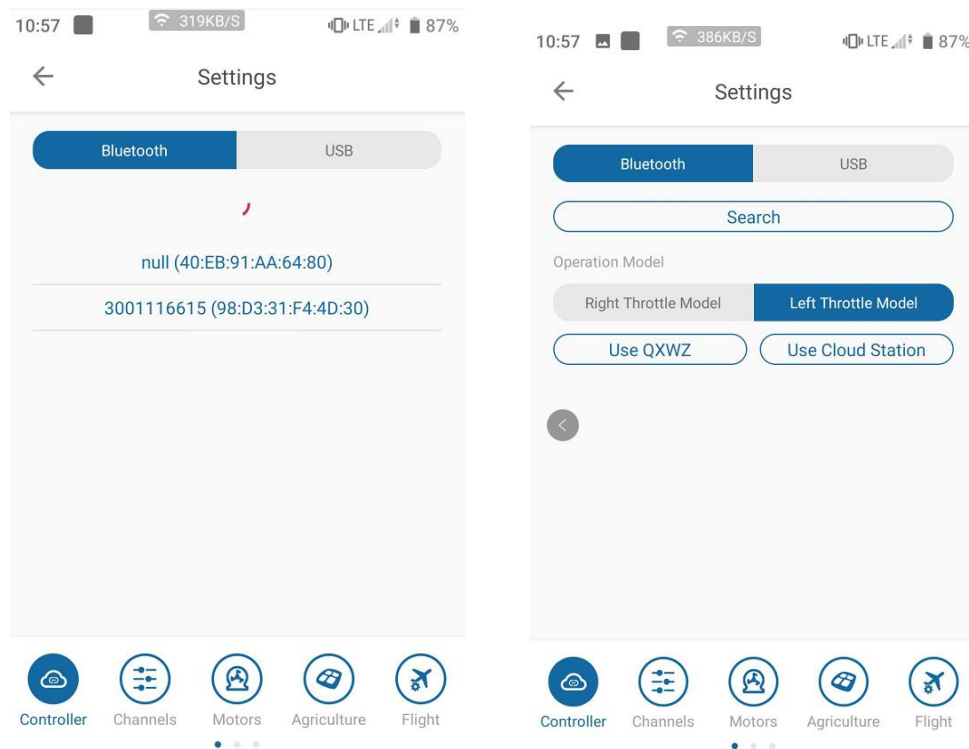
After connecting the wire of the system module, it is necessary to check whether the links and functions of each module are normal. The function check must be completed when the propeller are unloaded. The steps are as follows:

### 6.2.1 Communication Check

Turn on the power of the UAV and the remote control (the communication mode of the remote control should be switched to the mode that is compatible with VK-fly, you can set it on the remote control APP). Enter EAVISION Agriculture APP, tap Settings → Controller → Bluetooth. Select the Bluetooth of the remote control (start with 300) and the operation model (left throttle model). There will be voice broadcast “the remote control has been connected” if the remote control is connected. You can see the amount of rudder travel of the remote control channels in the “Channels” page; you can see the status of the Flight Control in the “Debug” page.

Figure 6 Connect to the Remote Control





### 6.2.2 Remote Control Calibration

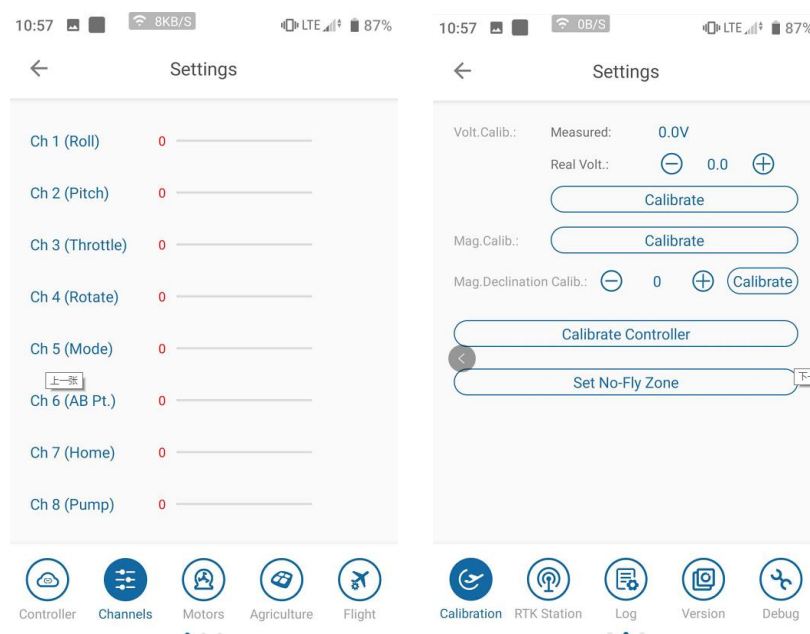
Compare with the amount of rudder travel of the remote control channels on the APP and confirm whether the amount of rudder travel of the remote control channels need to be reversed. If the definition of pros and cons of the channel is not in accordance with what the APP displays, then the amount of rudder travel need to be reversed in the debug software of the remote control. Check whether the rudder travel range of channel 1-4 are from 100 to 200, and whether the rudder travel range of channel 5-8 are from 110 to 190. The channel error should be no more than 3%. If it is more than 3%, the remote control should be calibrated. The calibration steps are as follows:

- Set the pros and cons of each channel and return all the rockers of the remote control to zero. Set all the channel curves to default.

- Put the rocker and the key in the middle position, tap “Calibrate Controller” in the “Calibration” page on the APP or toggle Channel 7 for 6 times to enter calibration mode, the LED light will become purple and it will flash 3 times, which means that it has entered calibration mode. Then push the corresponding rocker or key of all channels (Channel 1-8) to make it move to the maximum working range and repeat several times.
- Then tap “Confirm” on the APP interface or toggle Channel 7 for 6 times again to exit calibration mode. When the LED light flashes as normal (purple light goes out), it means the calibration is completed.

When the calibration is completed, you can check whether the setting and calibration is correct according to the description on the APP.

Figure 7 Channel Check of the Remote Control



### 6.2.3 Motor Check

#### 1) ESC Calibration

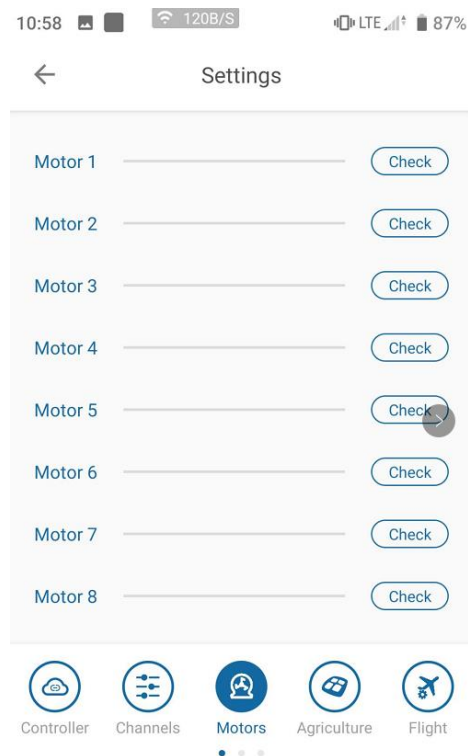
Remove the blades, push the aileron and accelerator of the remote control to the maximum at the same time, and then power on the flight control and the ESC concurrently, the flight control will enter the ESC calibration mode, purple light flashes 4 times. The ESC will make a dripping sound. It means that the ESC has entered the calibration mode. Return the aileron to the middle and pull the throttle to the lowest level, the ESC will make a dripping sound again, which means that ESC calibration is completed.

**Warning: The calibration must be conducted after the blades were removed.**

#### 2) Motor Check

Turn on the main battery to enter the "Motors" page. Tap the "Check" button of Motor 1 to Motor 4 in order to check the steering of the motor. When the motor was being checked, if the signal was shown on the APP, but the motor didn't work, adjust the idling level of the motor to a higher level in "Advanced → Algorithm" .

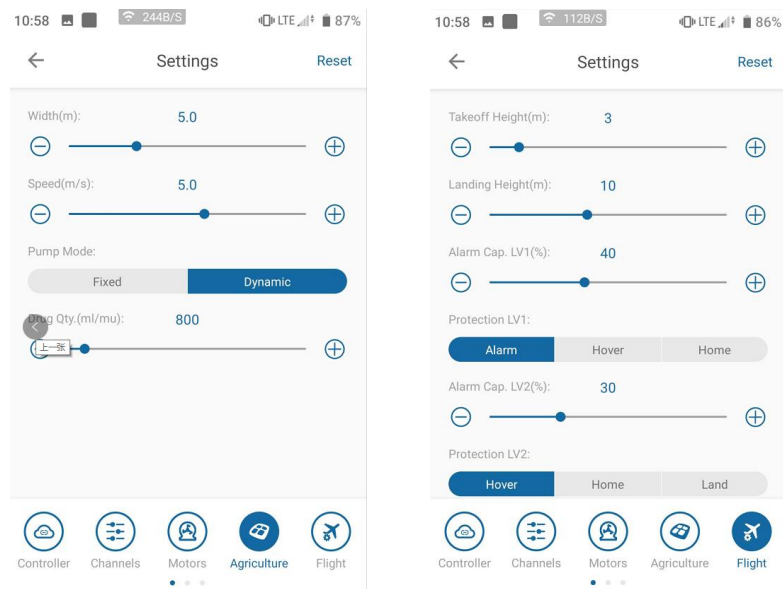
Figure 8 Steering Check of the Motor



## 6.2.4 Flight Settings

Complete plant protection and flight settings as the figures below.

Figure 9 Plant Protection and Flight Settings

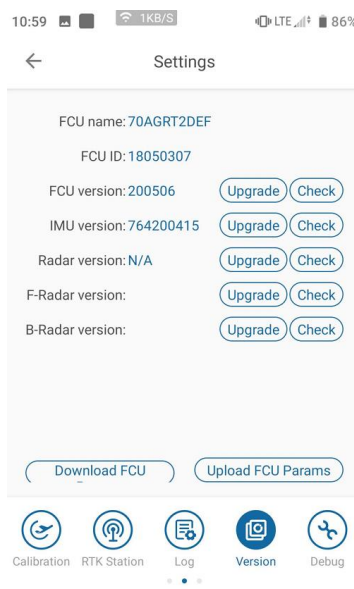




## 6.2.5 Firmware Check

Check the firmware version. Make sure the firmware is the latest version.

Figure 10 Firmware Version Check



## 6.2.6 Water Pump/Flowmeter Test

In order to achieve precise spray, the flowmeter and water pump should be calibrated before use.

Before calibrating the water pump / flowmeter, check the spray system first. For example, add 10L chemical into the chemical tank first, turn on the water pump, and check whether the spray system works normally. If there is air bubble in the water pipe, check whether the pipeline joint is loose. Then, check the exhausting function of the solenoid valve. The pressure of spray system will be different if different chemicals were sprayed. If the solenoid valve leaks water in the spraying process, it can be solved by adjusting the regulator valve.

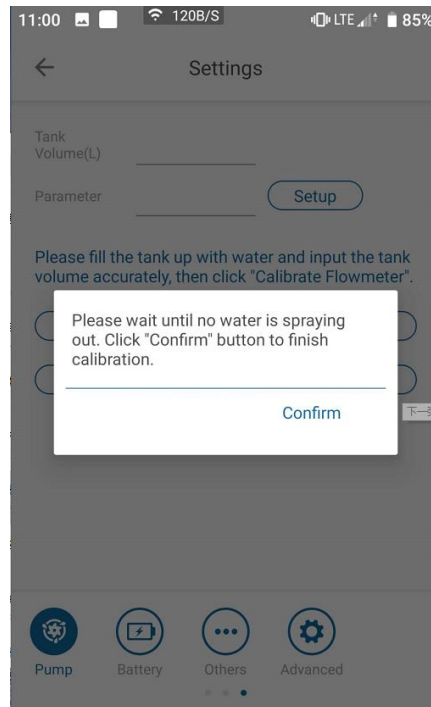
#### 1) Flowmeter Calibration

Fill the chemical tank with water. For example, if the chemical tank is 10L, fill the tank accurately to 10L. Enter the "Pump" page, fill in 10 for the tank capacity and 0 for the coefficient, and then tap "Calibrate Flowmeter", the water pump will spray water automatically, wait for the water pump to stop automatically after all the water in the tank is sprayed, and then tap the "Settings" button to complete the flowmeter calibration.

#### 2) Water Pump Calibration

Fill the chemical tank with water, and then tap "Calibrate Water Pump", a popup will appear: the water pump is ready for calibration. Please ensure that there is water in the chemical tank during the calibration process, otherwise the accuracy of calibration will be affected. After the calibration, the water pump will close automatically. Tap the "Confirm" button in the popup.

Figure 11 Water Pump Calibration



### 6.2.7 Flight Calibration

#### 1) Voltage Calibration

The main battery voltage detected by the flight control system may deviate from the actual battery voltage. At this time, you need to calibrate the voltage. Fill in the real battery voltage on the "Real Voltage" of "Flight Calibration" page, and then tap "Calibrate" to complete the voltage calibration.

#### 2) Horizontal Calibration

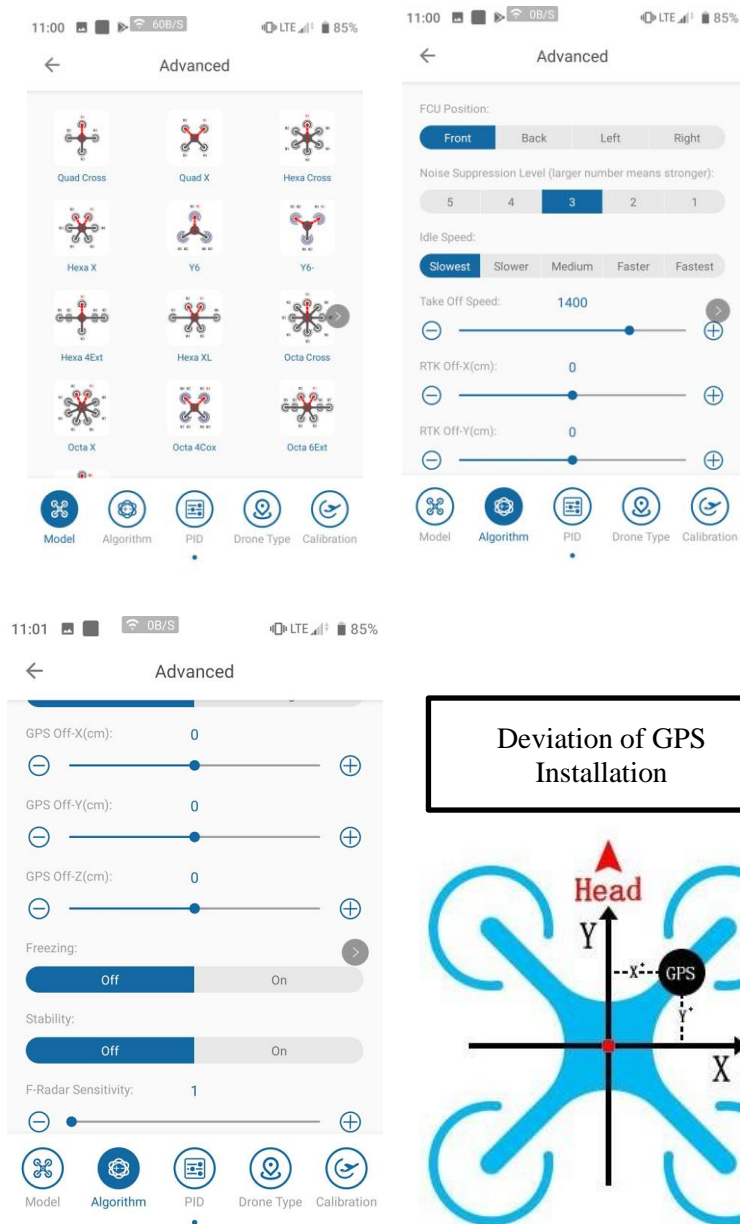
Since there may be some deviation between the plane of flight control installation and the plane of UAV body, horizontal calibration is required, otherwise the flight performance will be affected. Place the UAV on a horizontal plane, if the angle of the UAV has a deviation of more than 2 degrees, horizontal calibration is required. Enter "Advanced" > "Flight Calibration" > "Confirm", then you will find that the previous angle deviation will be cleared. The horizontal calibration is completed.

### **6.2.8 Preliminary Parameter Setting**

Parameter setting is very important, setting error will directly lead to crash accident. Enter "Advanced" , select the four-axis X-shaped plant protection UAV model on the machine model setting page; enter "Algorithm" , and ensure that the flight control installation mode is consistent with the actual installation. For the "Noise Suppression" , you can select default 3 before the first flight; the GPS installation deviation is the distance from the GPS installation position to the UAV center: for X-axis, right is positive; for Y-axis, front is positive; for Z-axis, up is positive.



Figure 12 Parameter Setting



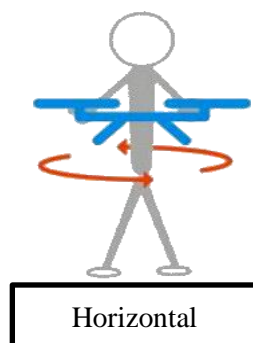
## 6.3 Debug during Flight

### 6.3.1 Magnetic Compass Calibration

After finishing the installation check, the UAV can be tested in the field.

Magnetic compass calibration should be completed before the flight. The calibrating method is as follows:

- Toggle the Channel 5 of the remote control for 8 times consecutively or enter the "Flight Calibration" page on the APP. Tap "Geomagnetic Calibration" button, the LED indicator light will turn green, and the UAV will enter horizontal calibration mode.



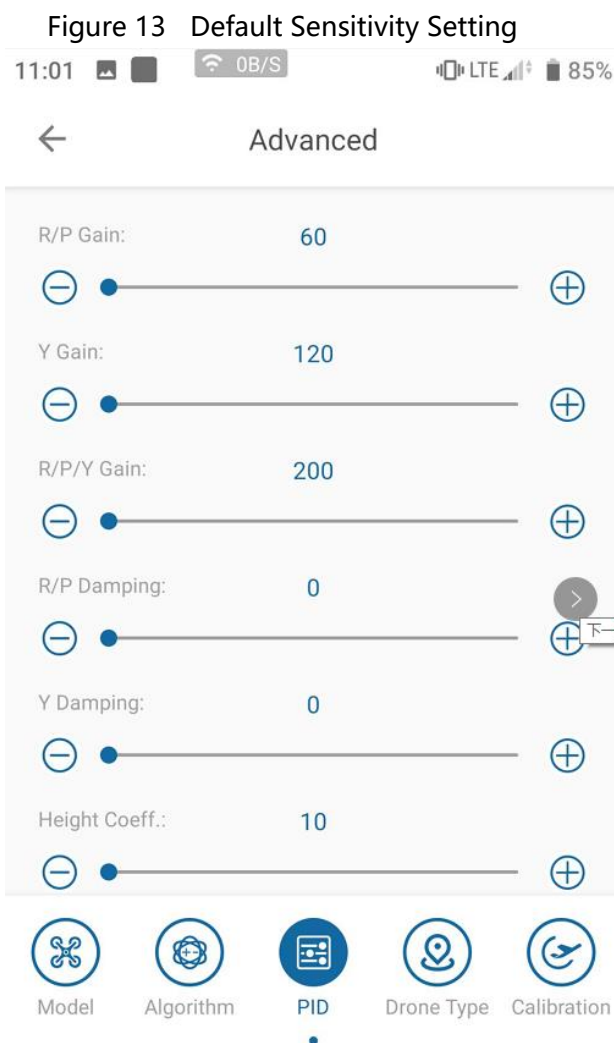
- Rotate the UAV horizontally to calibrate until the LED indicator light turns blue. Then the UAV will enter vertical calibration mode.



- Rotate the UAV with the head points up. If the indicator light (blue) flashes, it means calibration succeeded; if the indicator light turns red, it means calibration failed, and the UAV needs to be calibrated again.

### 6.3.2 Debug of Sensitivity

For the first flight, please confirm whether the angle of the UAV is correct. Unlock it in the attitude mode to test whether the corresponding relation between the steering gear and the motor is normal. For the first flight, try to debug in the attitude mode, so as to optimize the UAV performance.



Description:

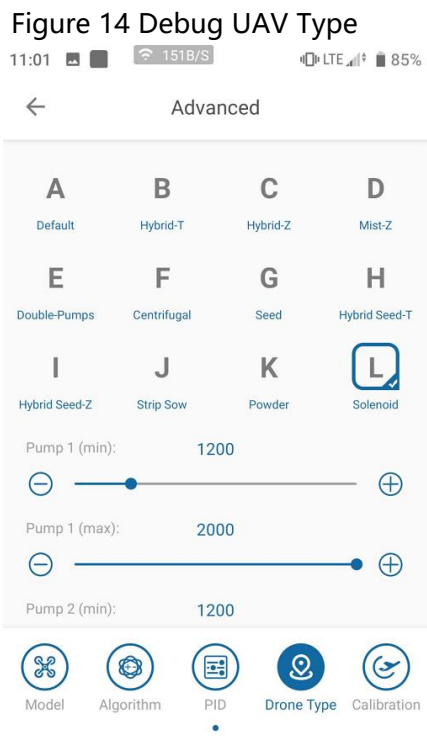
- ① R / P Gain: adjust the gain in the attitude mode first. The default value of 120 can be adopted (please set this parameter to 100 for the UAV whose blades are more than 30 inches). In the attitude mode, don't move the bar, observe the self-stability ability of the UAV. A simple method is to hit the bar back slightly to see whether the UAV can return to horizontal place quickly. If not, increase the value by adding 5 each time. Increase the gain until the UAV shakes slightly, and then reduce the gain by 20%. The gain should not exceed 180, otherwise there will be a greater risk of vibration.
- ② Y Gain: the adjustment method of the gain of heading is similar to that of the gain of roll / pitch. This parameter can be increased by manually turning the heading. Generally speaking, the default value of 260 can meet the flight requirements. If the self-stability of heading is not good enough (the heading turns left and right a little in windy day), the parameter can be increased by adding 10 each time.
- ③ R / P / Y Gain: Gain is a parameter to adjust the speed of the UAV following the flight instructions, that is, the maneuverability performance of the UAV during flight. Under the condition that the gain is well adjusted, make a quick stroke / full rudder stroke to see whether the UAV can make a quick angle response (the maximum angle in the attitude mode is limited to 20 degrees). If the response of the UAV is slow after making the stroke, increase the parameter. The gain should not exceed 600.
- ④ R / P Damping: This coefficient is to increase the stability of the UAV and prevent

vibration of the UAV to a certain extent. If the gain in the basic parameters can't restrain the shake of the UAV, try to set this parameter to 0. Generally, 3 or 4 can meet the flight requirements. This value can be increased steadily only after slight shaking occurs in the middle position when turning the angle back in the attitude mode. Increase 1 each time. The parameter should be no more than 10.

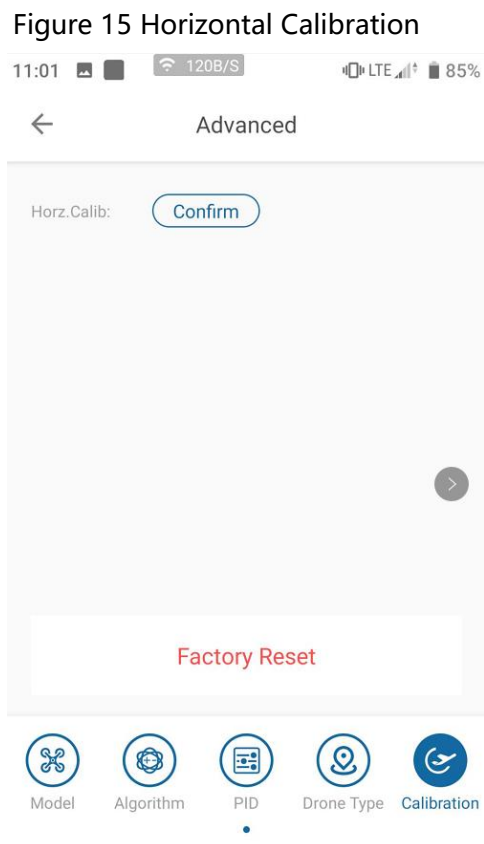
- ⑤ Y Damping: this coefficient is to increase the stability of the heading channel. 3 or 4 can meet the flight requirements.
- ⑥ Height Coefficient: the default value 20 can meet the requirements. If the vibration of the UAV leads to the abnormal rotation of the motor, these two parameters can be reduced to 15 or 10.
- ⑦ Vertical Speed Coefficient: adjust the response speed of the throttle. The larger the sensitivity is, the faster the throttle response is. The smaller the sensitivity is, the slower the response is. Generally, the value 350 can meet the requirements.
- ⑧ Horizontal Speed Damping: if the UAV has poor wind resistance during hovering, this parameter can be increased (no more than 50).
- ⑨ Horizontal Speed Coefficient: the default value is 120. In GPS position mode, if the speed follow response is not enough, this parameter can be increased (no more than 150); if the speed follow overshoot, this parameter can be reduced (no less than 80). In GPS mode, if the braking angle is too large, reduce this parameter; if the braking angle is too small, increase this parameter.

Brake Coefficient: the default coefficient is 20. The greater the coefficient, the more sensitive the brake, and vice versa.

### 6.3.3 Debug of UAV Type

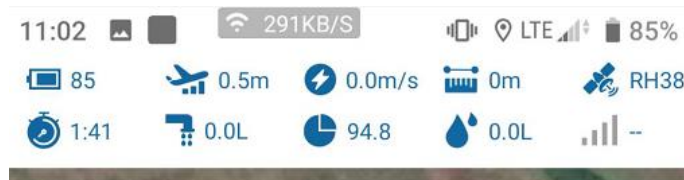


### 6.3.4 Horizontal Calibration



## 6.4 Task-setting

Figure 16 Display of Flight Information



The current status of UAV is displayed in the front of the operation interface. The button functions are: battery power, flight altitude, flight speed, distance from HOME point, GPS signal, flight time, flow rate, area that has been sprayed, dosage that has been used, and remote control signal strength.

The lower left corner shows the current flight mode.

#### 6.4.1 AB Mode

After A point and B point are defined by the user, AB mode automatically copies AB route for flight. In AB mode, the length of AB route is adjustable during the flight; the flight height and the direction of nose can be adjusted manually.

##### 6.4.1.1 Operating Process of AB Point

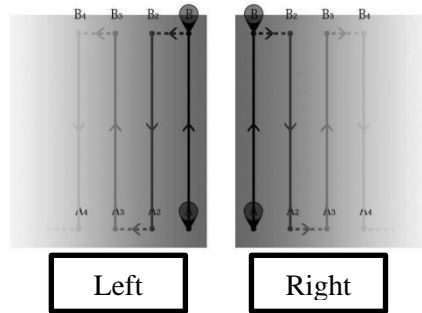
- Toggle Channel 6 back and forth or tap the “Clear AB Point” button in the “Manual Operation” interface on APP to clear the AB point information of the last time, so as to ensure that there is no AB point in the UAV (if there is AB point, the LED light will flash purple).
- Take off manually and fly to the first starting point. Record the coordinates of point A when Channel 6 switch is turned to point A in GPS hovering mode. After point A is recorded, the LED light will flash purple.
- When the UAV flies to point B, the water pump will turn on automatically during the flight. When the Channel 6 switch is turned from point A to point B in GPS

hovering mode, record the coordinates of point B. After the point B is recorded successfully, the LED will flash twice with purple light.

- When the recording is completed, toggle Channel 5 switch to AB mode, and then the roll channel gives a left / right full stroke action. At this time, the UAV starts to execute AB mode, and it will fly left / right continuously.
- To exit AB mode, Channel 5 switch needs to be toggled to GPS mode / attitude mode (at this time, Channel 6 is in point B, recommend to restore it to the default position). To re-record AB point, you need to toggle Channel 6 for more than 4 times or tap the “Clear AB Point” button in the manual operation interface of APP to clear the last AB point. When the AB point is cleared, the purple light in AB point will go out, indicating that the removal is successful.



Figure 17 Operating along AB Point



### 6.4.1.2 Real-time Adjustment during the Flight in AB Mode

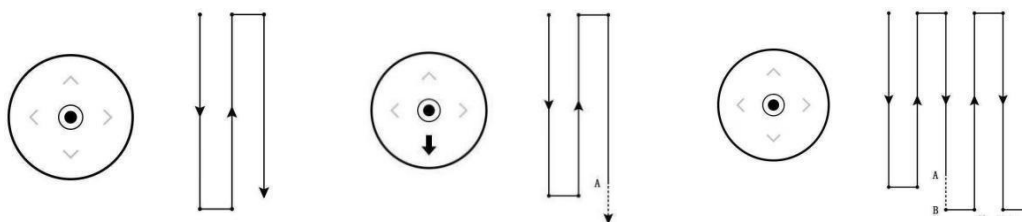
#### 1) Adjust the Length

In order to meet the need of irregular plots, the length of AB point can be adjusted in real time through the pitch rocker during the flight.

The operation is as follows:

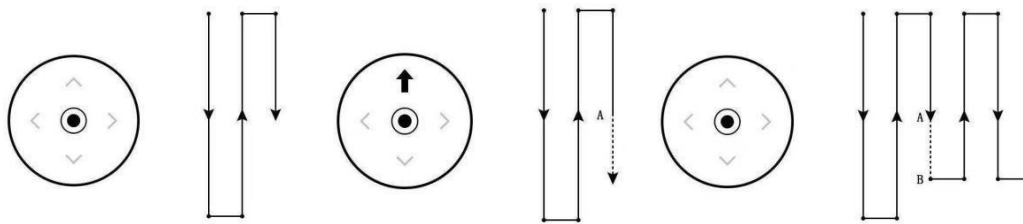
- **Extension of AB Point:** when the UAV flies to the edge, move the pitch rocker (push or pull, push at the far end, pull at the near end), and the UAV will fly forward slowly at the speed of 2m / s. When it reaches the extended position, return the pitch rocker to zero, the UAV will stop, and then start to copy the corresponding route. Extension of point AB is completed.

Figure 18 Extension of Flight Route of AB Point



- Shorten of AB Point: when the UAV flies to the place that is close to the shorten position, move the pitch rocker (push or pull, push at the far end, pull at the near end), and the UAV will fly forward slowly at the speed of 2m / s. When it reaches the extended position, return the pitch rocker to zero, the UAV will stop, and then start to copy the corresponding route. Shorten of AB point is completed.

Figure 19 Shorten of Flight Route of AB Point



## 2) Adjust the Height

During the flight, if the UAV is in the middle position of the throttle, it will fly at a fixed height (it will follow the terrain to fly over the ground at a fixed height), the height will rise when the throttle is pushed up, and the height will fall when the throttle is pulled down.

## 3) Adjust the Direction

During the flight, return the nose to the middle of the direction, the UAV will be locked for flight. If you push left in the direction, the nose will turn left. If you push right in the direction, the nose will turn right.

### 6.4.1.3 Breakpoint Resuming in AB Mode

When the UAV exits AB mode due to some reasons during the flight, and the AB mode needs to be continued after re-preparation, the following steps should be followed to execute breakpoint resuming in AB mode.

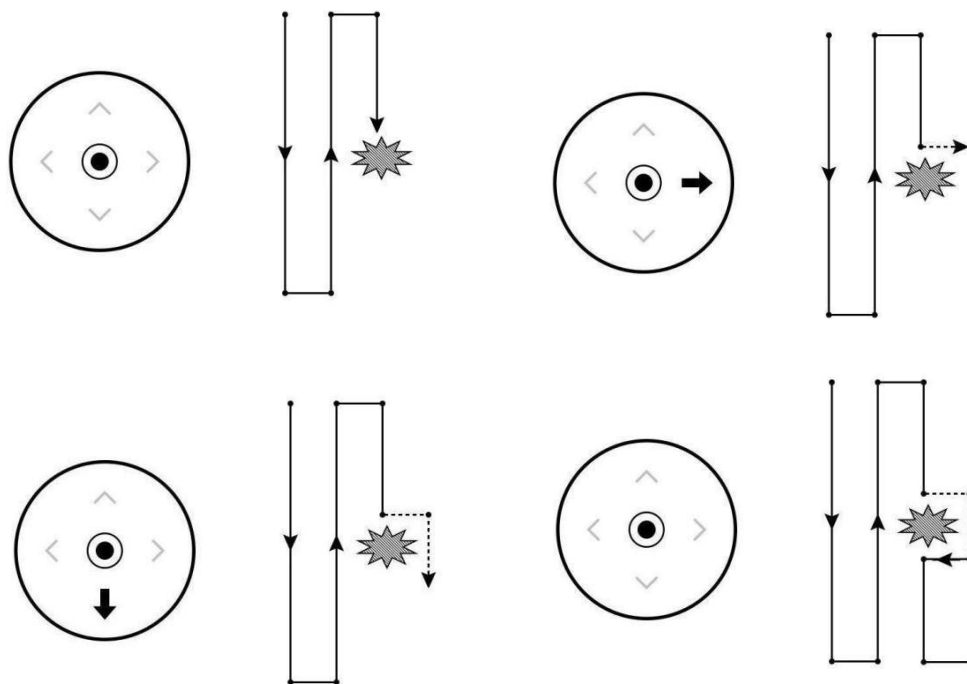


#### 6.4.1.4 Obstacle Avoidance in AB Mode

##### 1) Avoid Obstacle Manually

When the UAV is operating in AB mode, if it encounters obstacles in front, move the roll bar, the UAV will stop. Then move the roll bar horizontally to a safe value, you can operate the pitch bar. After bypassing obstacles and returning all the bars to the original position, the UAV will automatically return to AB mode and continue subsequent operation.

Figure 21 Obstacle Avoidance in AB Mode



## 6.4.2 Independent Route-planning Mode

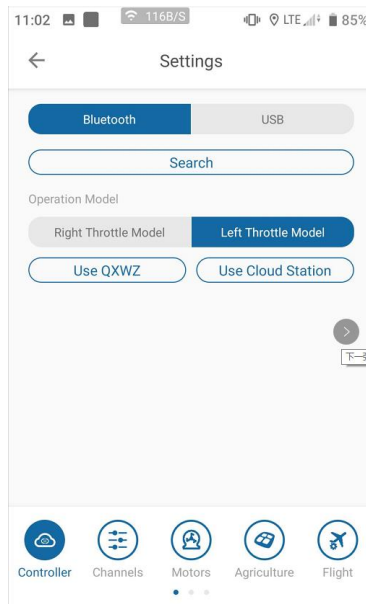
### 6.4.2.1 Plot Planning

4 planning methods, including mobile phone / remote control / UAV / RTK base station / map are available in EAVision Agricultural System, among which remote control / UAV can use RTK high-precision dotting (if the UAV is configured with RTK).

- 1) Remote Control RTK Dotting: if the remote control is configured with RTK, you can access Qianxun SI or the cloud service of mobile base station to realize high-precision positioning.

Access to Qianxun SI: enter EAVISION Agriculture APP, enter "Controller" page, select "Bluetooth" , tap the "Search" button, and then select the remote control. When the remote control is connected with mobile phone through Bluetooth, select Qianxun. If Qianxun service is available to the remote control, the Qianxun SDK account will be displayed in the page as shown in the following figure:

Figure 22 Connect to Qianxun Service



Exit “Controller” , enter “Mapping” page, tap the “Settings” button in the lower right corner, and then select “Controller” , the Qianxun SI RTK high-precision mapping is available.

During the mapping, you can enter the fine-tuning mode to adjust mapping point / obstacle point / calibration point by tapping the boundary point icon, as shown in the following figure:

Figure 23 Fine-tuning of Mapping Point



After completing the mapping point, obstacle point (not necessary) and calibration point (not necessary), tap the “Upload” button to upload the plot to the server.

#### 6.4.2.2 Flight Route Planning

##### 1) Flight Route Parameters


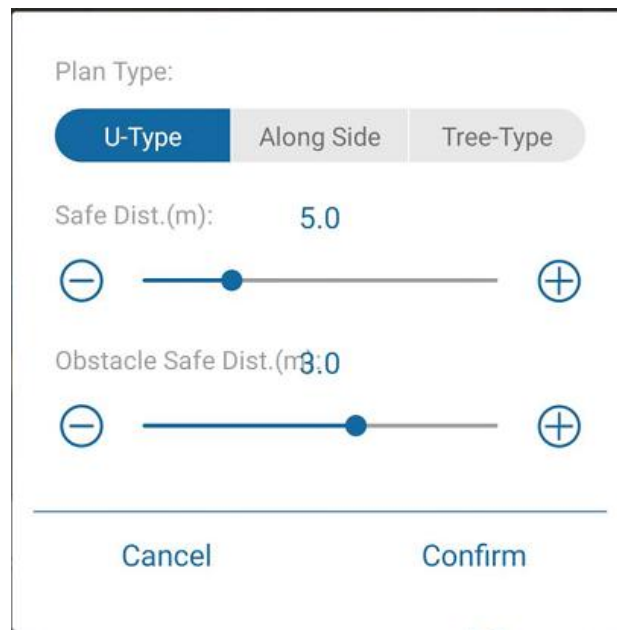
- After planning the plot, edit it to generate a flight route. The flight route can also be edited.
- You can tap  to set route mode, the safe distance between the surrounding routes and the plot, and the safe distance to avoid obstacles.

Figure 24 Set Safe Distance



- Select different sides (side 1 / side 2...), the planned route will be parallel to the selected edge (orange light on). A safe distance can be set in each side, and the safe distance can be set by tapping the increase and decrease buttons, or by entering numbers directly.
- Any vertex of the plot can be selected as the starting point of the route, and the "S" and "E" on the track mark the starting point and the ending point of the route. The user can tap on the map to select the point, and the remote control will plan the starting point and the ending point according to the tapped place.


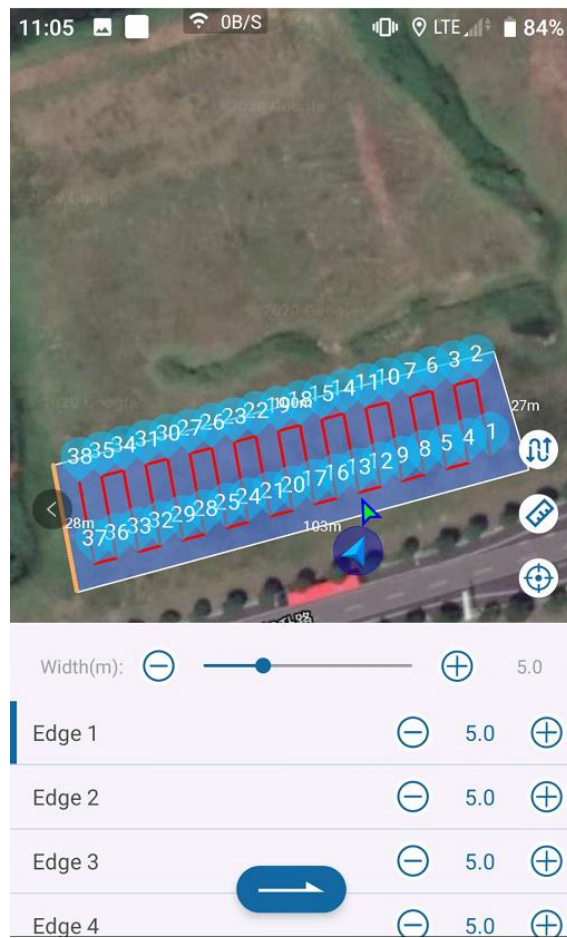
Tap  to open the "Intelligent Planning Mileage" , and the route will divide the whole plot into several sub-routes according to the designed mileage, and each sub-route will execute corresponding return / hover action after the operation; if the intelligent planning mileage is set to 0, the intelligent planning function will be closed, as shown in the following figure.



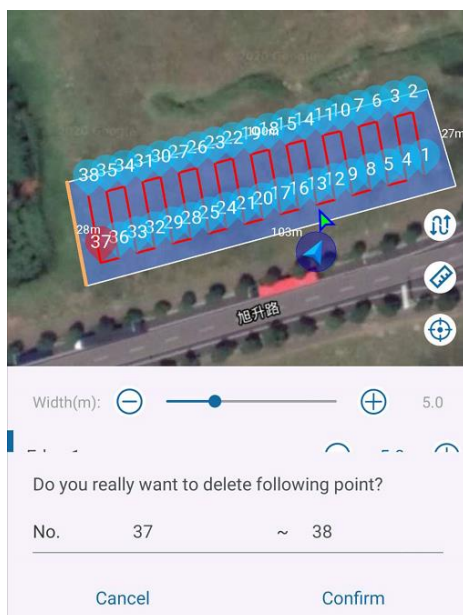
Figure 25 Intelligent Planning Mileage



## 2) Delete Waypoints

In the actual operation process, there may be several routes in the middle of a plot that do not need to be operated. You can delete the routes that do not need to be operated by deleting the waypoints. The specific operation is: tap to delete the starting point of the route, enter the ending point of the route to be deleted in the pop-up, and then tap "Confirm", as shown below:

Figure 26 Delete Waypoints

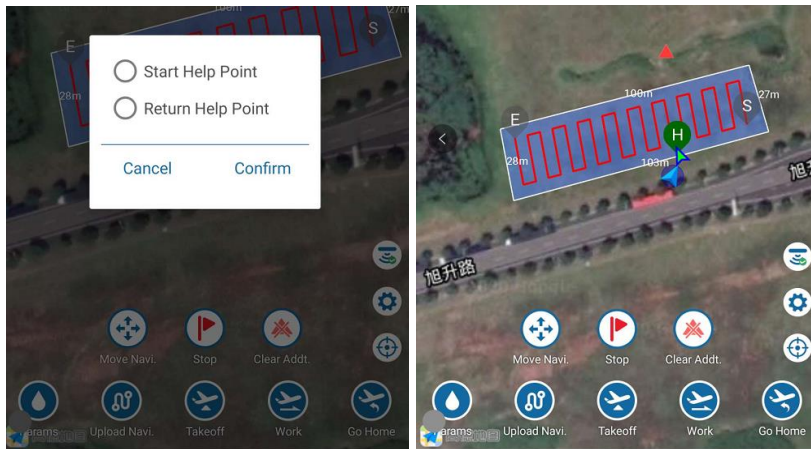


## 3) Set Help Point

If there is an obstacle between the take-off point and waypoint 1, or between the take-off point and the returning point, you can set take off / return on the map. Operation: long press the map, a red triangle will be displayed on the map after one second, indicating that the help point has been set. Help point needs to be set in advance before flying to one point and before returning. Upload the flight route

again or tap “Clear Help Point” to clear the help point.

Figure 27 Set Help Point



#### 6.4.2.3 Fly Autonomously

After setting the flight height and uploading the flight route in the “Flight Monitoring” page, tap “Takeoff” -> “Work”, the UAV will fly to waypoint 1 for operation. Attention should be paid to the followings in the process of autonomous flight:

- Each time after uploading the flight route and tapping “Work”, the UAV will fly to waypoint 1 first; if the flight route is not uploaded, tap “Work”, the UAV will fly to the breakpoint of the last route.
- The obstacle avoidance function is closed on its way to waypoint 1.
- Emergency stop / breakpoint resuming function are available during the flight.
- You can select quarter turning or U-bend in the turning mode.
- Real-time throttle / heading adjustment and obstacle avoidance through remote control are available during the flight. See Chapter 3.1.4 for the specific

operation.

- The flow rate can be set as fixed water pump output or automatic adjustment of flow rate per hectare.

## **7. Data Management**

### **7.1 Data Downloading and Firmware Upgrading**

The storage device in the flight control system will record the flight data in real time, and one-time unlocking and locking constitute the starting and ending of a complete sortie. You can enter Settings > Log > Read Log to read the flight data of the latest sortie, and then upload it to the server. In case of an accident, it is necessary to read the log and upload it to the server as soon as possible, and notify relevant technicians of the supplier for support.

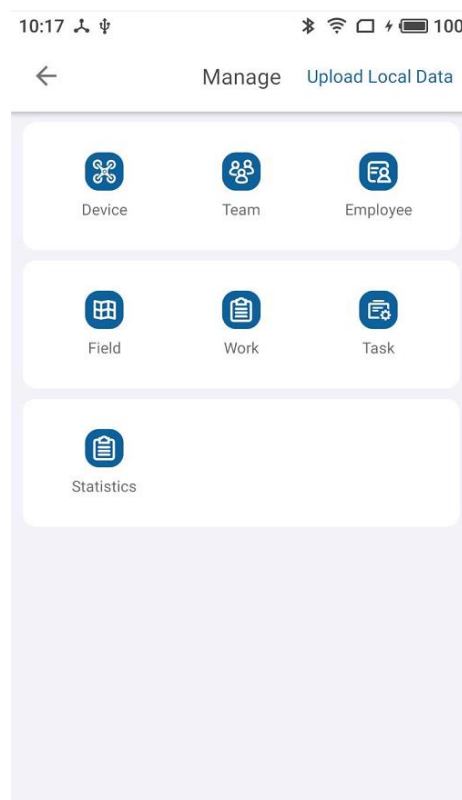
### **7.2 Account Permission**

The operation information / plot planning / team management / device management of individual operator can be queried on the management page, and different accounts have difference permissions.

## 8. Account Management

Here is the detailed introduction to the management of enterprise operator account.

Figure 28 Management Page of Enterprise Operator



The content of account management of the enterprise operator includes: device management, team management, employee management, plot management, plot operation record, task management and orders.

### 8.1 Device Management

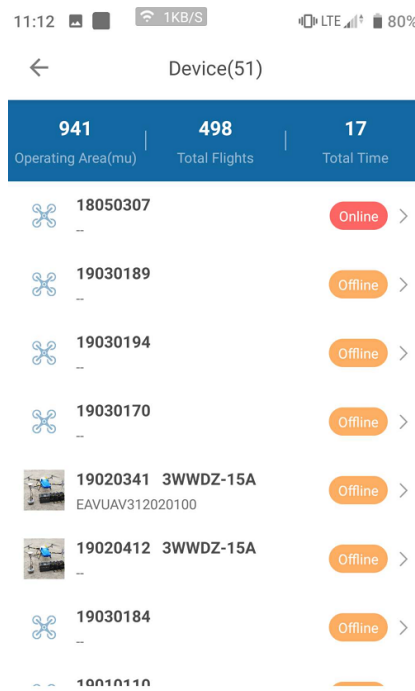
### 8.1.1 Activate Process

A new UAV must be activated before the device can be bound to a specific account. The specific steps are: power on the UAV, connect to the APP, enter "Management" - > "Device Management" , tap "Activate New Device" , and the following page will display the flight control ID information of the UAV. Tap the UAV number and then tap "Confirm" in the confirmation page to activate the device. This step is completed in the manufacturer.

Enter "Device Management" , and you can see all the activated UAVs in the account. The statistics above are operated area, flight sorties and operated hours. These statistics are calculated from the date of registration of this account.

- For new UAV, the activation date is the registration date.
- For second-hand UAV, the time of transfer to this account is the registration date.

Figure 29 Device Management



Tap any UAV in the list to view the details of the UAV.

Figure 30 Basic Details

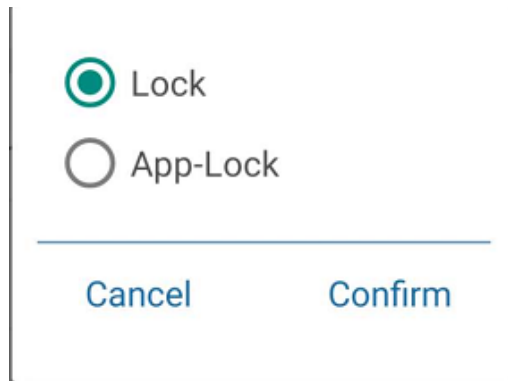


### 8.1.2 Lock and Unlock

For the UAV under the account authority, tap the lock / unlock button in "Details" to lock or unlock the UAV remotely. Please note that if the UAV is

locked, flight operation will be unavailable even if the UAV is powered on.

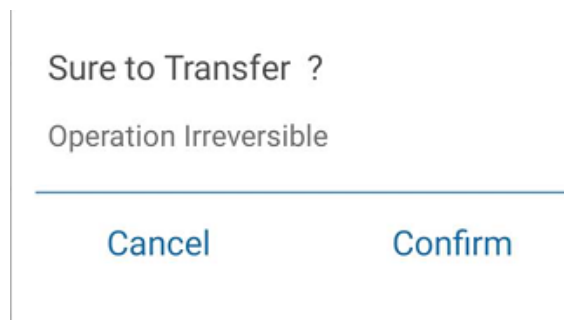
Figure 31 Lock/Unlock the Device



### 8.1.3 Transfer

Tap "Transfer" in "Details" , a transfer dialog box will pop up. Tap "Confirm" to scan the QR code of the transferee' s account, and the UAV will be transferred to the transferee.

Figure 32 Device Transfer

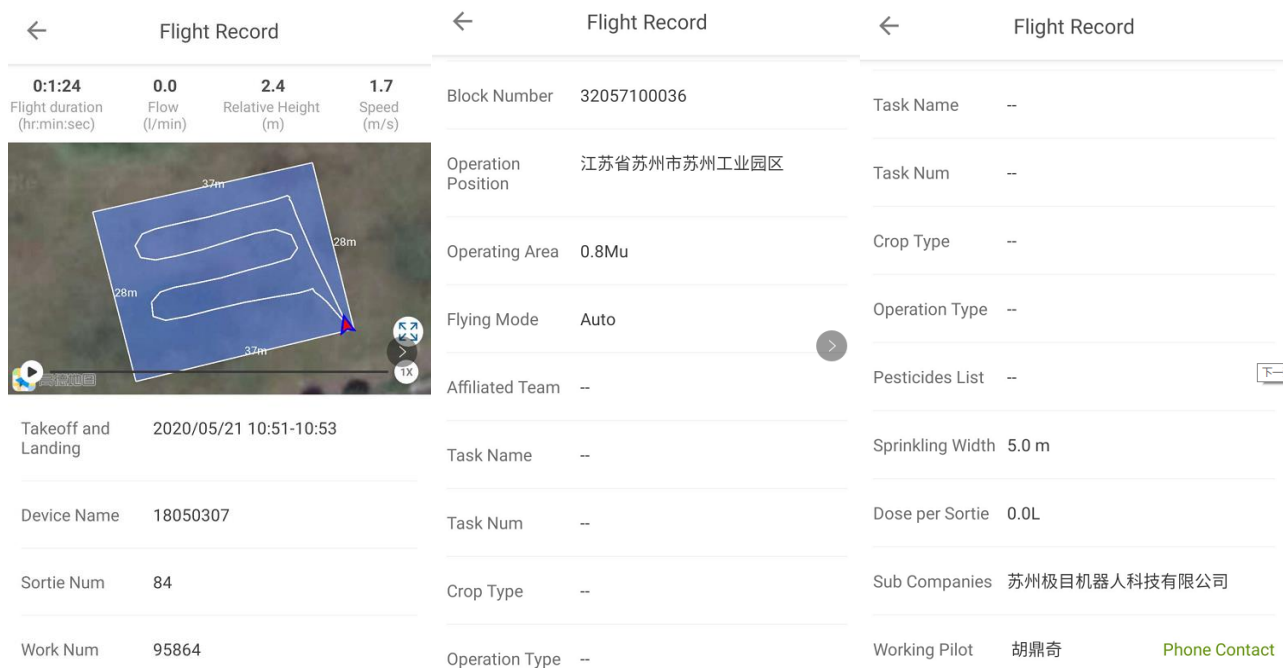






### 8.1.4 Flight Record

Tap "Flight Record" in the list to enter flight record details page.

Figure 33 Flight Record



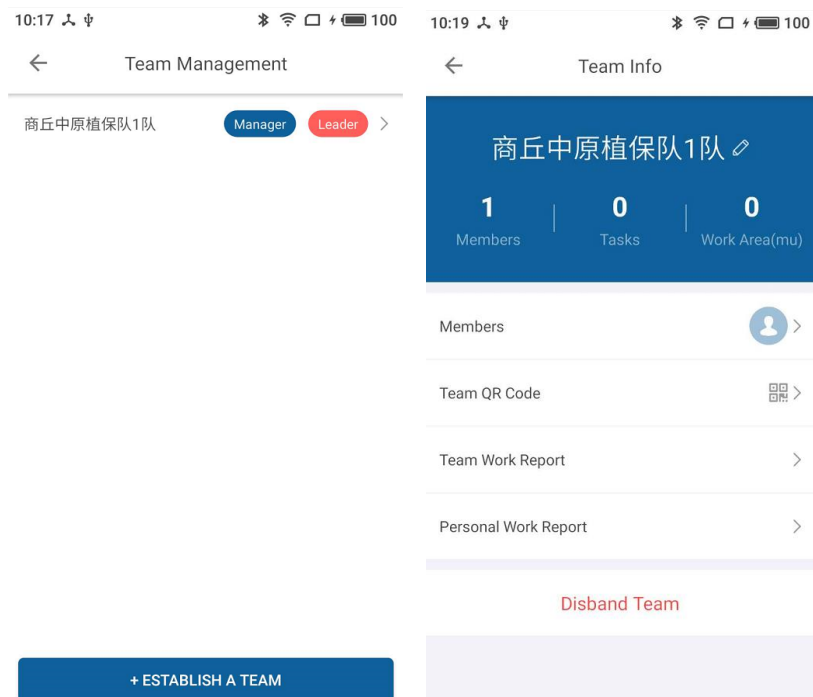


Tap  in the figure to zoom in the track view; tap  to replay the UAV status in ; tap  to adjust the playback speed, which can be as fast as 8 times.

## 8.2 Team Management

In order to better manage the plant protection service team and optimize the data statistics, we have established the team management mode. Enter “Team Management” page, you can create your own team in “Eatablish a Team” at the bottom of the page, as shown in the figure.

Figure 34 Team Management



In the figure, the role of the operator account in “商丘中原植保队1队” is administrator and team leader.

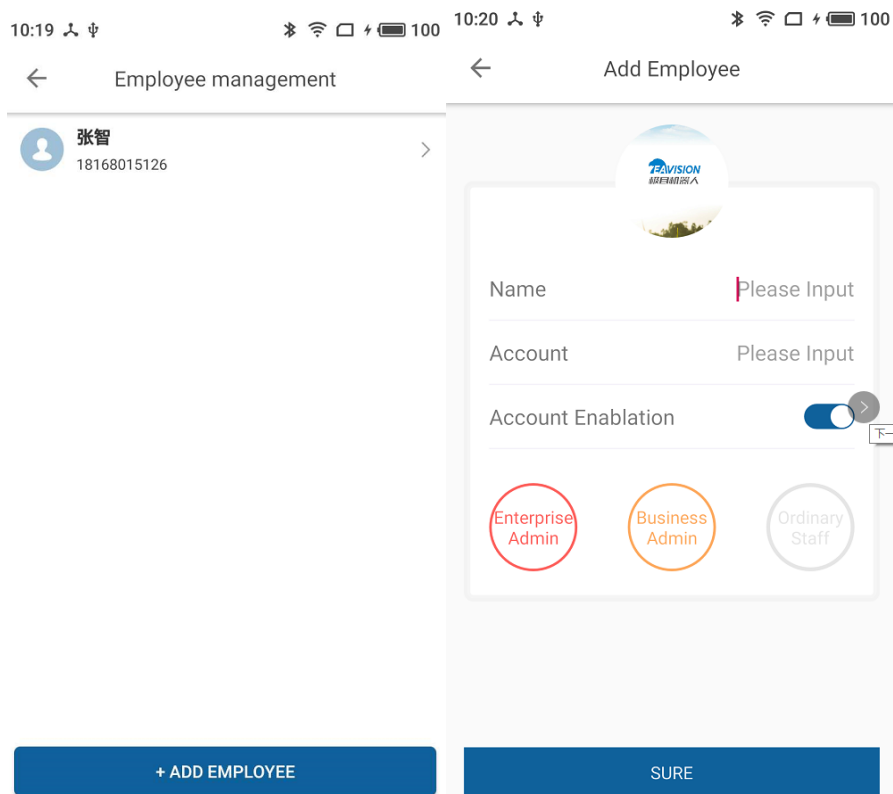
- The plot planned by team members can be seen by the whole team.
- Team leader can view the detailed operation information of anyone in the team
- The team leader can transfer his/her position to any member of the team at any time, or delete any member of the team.
- Other operators can join the team by scanning the team QR code.
- Team members can only see the total data of the team and the individual operation report.

### 8.3 Employee Management

The enterprise administrator can add employees by tapping “Add


Employee” at the bottom of the page.

Figure 35 Employee Management



Name: Name of the employee

Account: Phone number of the employee

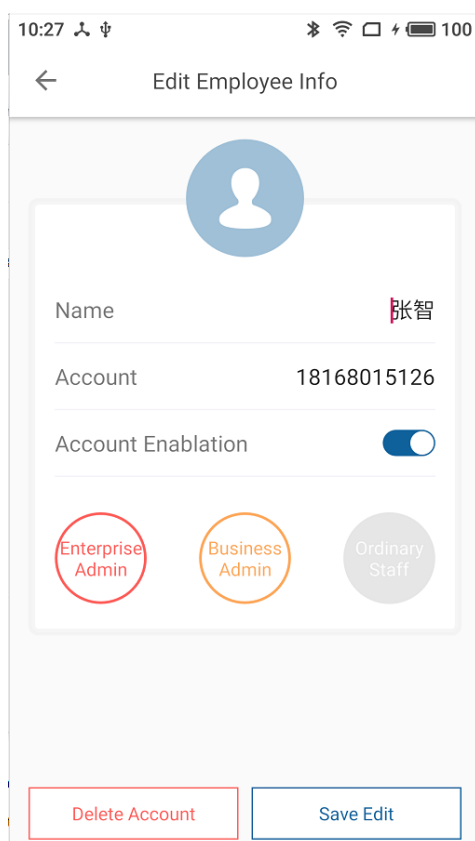
Account Enablation: Turn on the button, input the phone number of the employee to get the verification code, and then input the verification code and login the APP. You can change the password in “Settings”  in the upper right corner of “My Center” .

In Addition: the enterprise administrator account can directly modify the employee information on the platform, allowing the employee to login the APP by entering the account and password.

Tap the employees in “Employee List” to enter “Edit Employee Info” page (as Figure 37), and then you can edit “Name” , “Account” , “Account Enablation” and “Position” again.

Authority Level: Enterprise Administrator > Business Administrator > Ordinary Employee

Figure 36 Edit Employee Information



## 8.4 Plot Management

Tap “Plot Management” to enter plot management page, as shown in the figure below:

Figure 37 Main Page of Plot Management



## 1) New Plot:


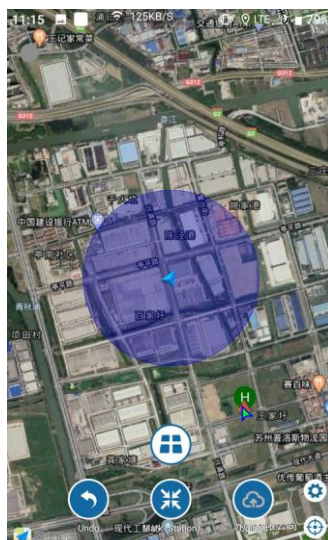
Tap "New Plot" , select a team. After confirming the team, enter the mapping page and walk to the turning point of the plot boundary with the mapping device. Tap  on the page, a boundary point will be displayed on the map, as shown in the following figure:

Figure 38 Mapping the Plot







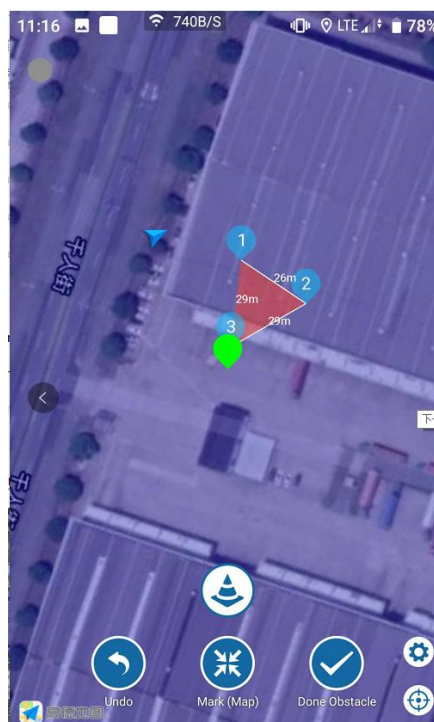
After determining all the boundary points and boundary lines, tap , and the icon will turn to . Then you can mark the obstacle. Move to the obstacle with the mapper, tap , the obstacle point will appear on the map, as shown in the following figure. After all the obstacle points are marked and all the boundary lines of the obstacle are confirmed, tap  to confirm.

Figure 39 Mapping the Obstacle Points







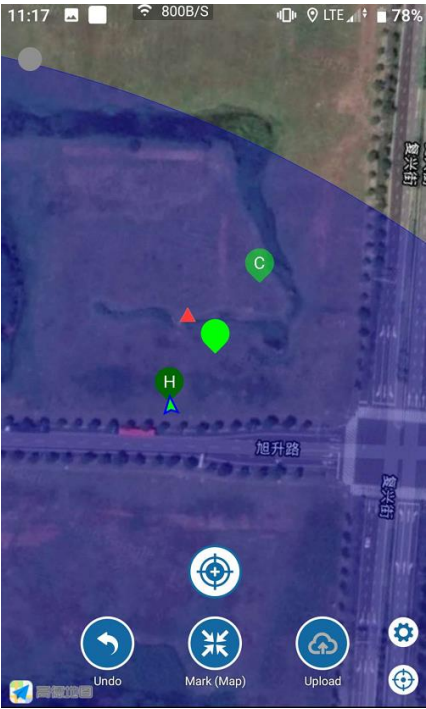
Tap the  icon again. When it turns to , the calibration point can be marked. For example, in Figure 40,  is the calibration point. If the plot has been edited, tap the  icon at the bottom of the map, enter the "Plot Name" , and then tap "Confirm" , the plot information is in the "Plot List" .

Figure 40 Mapping the Calibration Points



Enter the plot in the list, such as “巴西” . Enter the “Plot Detail” of “巴西” , as shown in the figure below.

Figure 41 Plot Detail



Modify: Modify the plot shape and add calibration points and obstacles.

Delete: Delete plot information.

Share: Share a plot to another account.

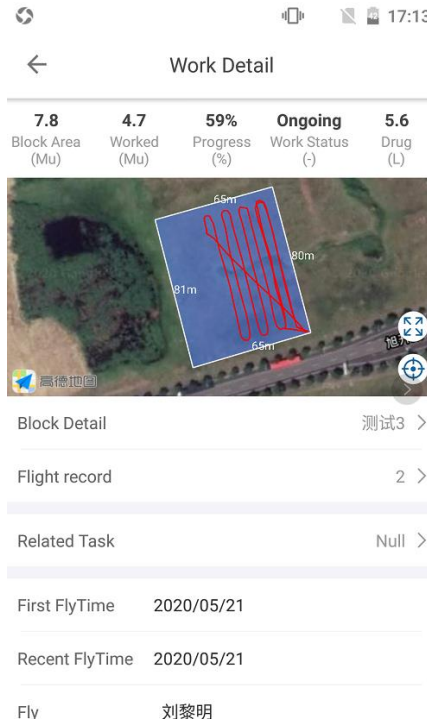
Cut: Unavailable at the moment.

## 8.5 Work Detail

Tap the “Work Detail” to enter the list of plot operation records. Select any plot to view the operation information of the plot, as shown in the following figure. Plot area, operated area, operating progress, operating status and dosage are the integration of all data of the plot for 7 days, which is calculated by the first takeoff (with plot operation record). If the UAV flies in this plot again and regenerates a plot operation record after 7 days, the name of the new plot operation record remains the same, but it can be distinguished from the time in the list.

Figure 42 Work Detail





## 8.6 Task Management

Tap to enter “Task Management” page, and then tap “Create a New Task” to create a new task, as shown in the following figure.

Figure 43 Create a New Task

**New Task**

Start Time: Please choose ▾

Task Name: Please Input 0/20

Country: China >

Geograp: Please choose >

☒ Detailed: Fill in provincial and district information repeatedly

Estimate: Please Input Mu

Estimated Area

Crops: Please choose >

Operate: Please choose >

**SAVE**

Start Time: the time to start the task (sufficient preparation time);

Task Name: It can be edited according to your needs;

Location: Select the scope of province, city and district;

Detailed Information: Detailed location information in the district;

Estimated Area: fill in the estimated area according to the actual situation;

Crops: Field crops (such as wheat, rice and corn) and cash crops can be selected according to the actual situation;

Operate: Insect control, weed control, fertilization, sterilization and other purpose can be selected according to the actual situation.

After creating a new task, tap the created task in the list to view the task details, as shown in the following figure. The estimated area, operated area, operating progress, operated plot and dosage at the top of the figure belongs to the total data of the task;

Assign a Team: Assign a team to perform this task;

Add a Plot: Associate the plot to be operated to this task;

Add Supervising Account: Add the personnel that can supervise the task, but the task can only be view and can't be changed;

Operation Record List: The operation data sheet of all plots in the task;

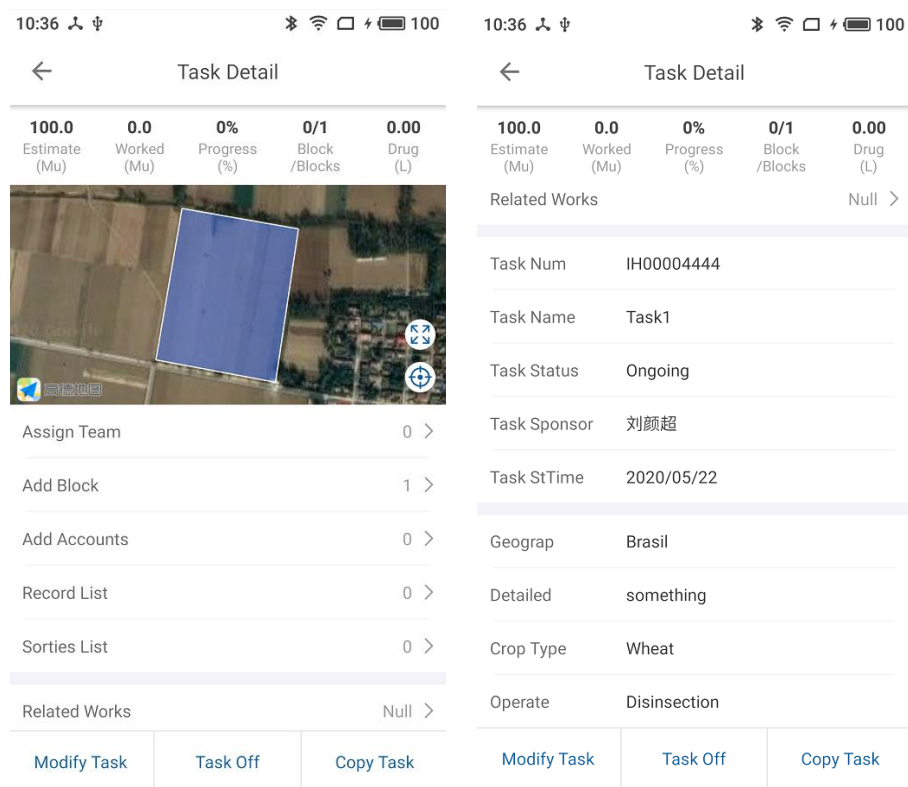
Sortie Report: The flight sortie records of all plots in the task;

Modify Task: Modify the task;

Complete the Task: Complete all the plots in the task. Then the task can't be changed;

Copy Task: Convenient for users to directly release the same task information during the next several rounds of operation.

Figure 44 Task Details



## 9. Offline Operation Procedure

### 9.1 Connect to the Remote Control

Enter the EAVISION Agriculture APP first, then tap "Settings" , select the device whose number starts with "300" (remote control), tap "Connect" , then your phone will be connected to the remote control.

## 9.2 Mapping

Enter EAVISION Agriculture APP, search for the base station. Find the base station which the device name starts with "HC" , tap "Connect" to connect your phone to it. After it is connected, choose "Enter Location Mode" . Tap "Mapping" in the interface and then go to the plot with your phone, remote control and the base station. When you arrive at the plot, tap "Record Boundary Point" to start mapping. After all the boundary points were recorded, upload the plot.

## 9.3 Operating

After uploading the plot, tap "Enter Station Mode with Current Location" , and then fix the base station (don' t move the base station anymore). Enter manual operation mode and check two things: 1. the nose direction of the UAV should be consistent with the nose direction in the APP map (if the two directions are consistent, the arrow in the APP that represents the UAV nose is green, otherwise the arrow is red). 2. Check the pitch angle of the UAV (Lift up the UAV nose and observe the value of UAV nose on the APP. If the value is positive, it means that there is no problem). When the check is done, enter auto operation mode interface, select the plot you have just mapped to plan the flight route, and then upload the flight route. When the flight route is uploaded, tap "Takeoff" , the UAV will take off and hover in the air. Then tap "Work" , the UAV will operate according to the planned flight route. When the operation is over, the UAV will go back to the starting point and land safely.

## 10. Maintenance Instructions

In order to ensure flight safety and keep the UAV in the best status, users should regularly maintain the plant protection UAV.

### 10.1 Content and Cycle of Maintenance

- Every 5 ~ 10 Sorties
  - Check whether the strainer and pipe are blocked. If there are, please clean the strainer and the pipe.
  - Check whether the screws of the propellers are loose.
  - Check whether the arm sleeves are loose.
- Every day
  - Clean the chemical tank, spray nozzles and all the pipes. Clean the housing, arms and propellers.
- Every Week
  - Fix the propeller screws and motor screws.
  - Check the carbon fiber pipe of the UAV. Replace it if there are cracks in the pipe.
- Every Month
  - Check whether the UAV parts are damaged.
  - Check whether the output plug of the ESC is loose or has been corroded.

### 10.2 Recommended Replace Period of Parts

- Main Battery: Replace it when the charge and discharge cycles exceed 560 or the battery has been used for 12 months.
- Water Pump: Replace it when the total operating area reaches 120 Ha.
- Pressure Spray Nozzle: Replace it when the total operating area reaches 120 Ha.
- Motor: Replace it when the total flight time reaches 200 hours.

### **10.3 Battery Maintenance and Cautions**

Maintenance:

- The battery has the function of self-maintenance. Under static environment, the voltage difference is  $\geq 50\text{mV}$ , and the battery starts to balance with the 100mA current. The balance maintenance is closed when the voltage difference is  $< 50\text{mV}$ .
- When the battery is fully charged and stored for more than 10 days, the battery will automatically discharge to about 65% battery power for storage.
- If the battery is idle for a long time, please charge it every 3 months. Please use slow charge to make up the battery power.

Cautions:

- Battery Storage Conditions: ambient temperature  $20 \sim 27\text{ }^{\circ}\text{C}$ , ambient humidity  $\leq 75\% \text{ RH}$ .

- Don't use any unofficial charger for charging.
- Don't use or store the battery near fire, heat source, inflammable, explosive, corrosive and other articles.
- For long-term storage, please fully charge the battery and charge it every 3 months to maintain the stability of the battery.
- Before installing or unplugging the battery from the UAV, please make sure the power is off.
- Please make sure the battery is turned off before charging.
- Don't squeeze or impact the battery, otherwise there will be a risk of fire.
- Don't short circuit the charging and discharging ports or use wires or any metal to connect the positive and negative poles of the battery.
- Don't soak the battery in liquid or wet the battery.
- Don't disassemble or repair the battery.
- Don't place it in low or high temperature for a long time. It is recommended to preheat it to 5 °C and above before taking off in low temperature.
- Take good care of the earth environment. Don't discard the waste batteries at will.

## **11. Warranty Services**

### **11.1 Application Range of Warranty Services**

1. Products with free warranty service must meet the following conditions:

- Function well within the specified product warranty period;
- Product performance failure and other quality reasons;
- The UAV code, factory label and other marks are consistent with the information in the order confirmation sheet, and there is no sign of tear or alteration;
- Provide legal and valid purchase certificate (contract or invoice) and warranty card.

2. Any damage or failure of warranty parts caused by the following reasons shall not be covered by the free warranty:

- Equipment failure or damage caused by the user or operator's self-disassembly of flight control, GPS and communication module, ESC module and power motor;
- Equipment failure or damage caused by abnormal factors such as water inflow;
- Damage caused by the user or operator not following the instructions or operating procedures;
- Fault or damage caused by forced use of the product by users or



operators beyond normal use conditions;

- Users or operators modify or add equipment that does not meet the requirements of official instructions and guidance;
- Any manmade reason or external force reason that is not Party A's responsibility;
- Direct or indirect fault or loss caused by flight under unseaworthy conditions (such as equipment alarm, bad weather, etc.);
- Direct or indirect faults or losses caused by force majeure such as natural disasters, wars, terrorist attacks, riots and coups;
- All losses of leased equipment due to theft, robbery and other reasons;
- Other faults or damages caused by problems other than product design, manufacturing and quality;
- UAV damage or losses caused by the falling due to non-product quality reasons.

3. In case of failure of product parts not covered by the warranty, the user shall have the right to consult Party A for repair or replacement, and the cost of repair and replacement shall be determined by both parties through consultation.

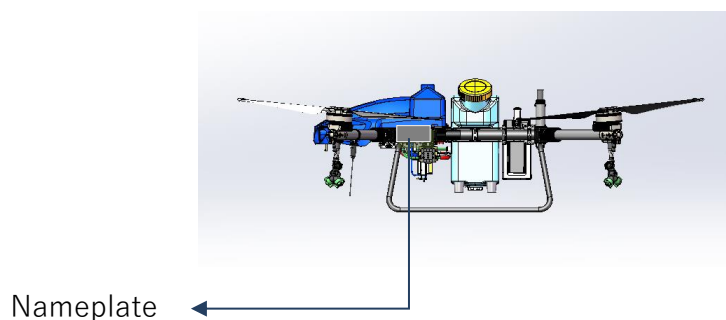
4. When the company introduces other preferential sales policies, the specific provisions shall be implemented.

## **11.2 Part List of Warranty Services**

No.	Part Name	Warranty Period
1	FC Module	12 months
2	Chemical Tank	12 months
3	Remote Control (including receiver)	12 months
4	Frame	12 months
5	Main Battery	560 cycles or 12 months, whichever comes first
6	Main Battery Charger	12 months
7	ESC Module	12 months
8	Motor	200 hours (total working hours) or 6 months, whichever comes first
9	Standby Battery	6 months
10	Spray Nozzle and Water Pump	120 Ha
11	Wire, Spray System (excluding spray nozzle and water pump), Hardware, Paddle and Plastic Parts	No Warranties

## 12. Nameplate

Please refer to the nameplate for serial number and model



Before printing, the technical data and instructions in this manual have been checked as necessary. However, in order to continuously develop and improve this product and this manual to meet the needs of customers, we reserve the right to make changes if necessary without notice. Thank you for using our products.

Published by Suzhou Eavision Robotic Technologies Co., Ltd

Suzhou Eavision Robotic Technologies Co., Ltd All rights reserved.

Version: 202004V1.0



EAVision Official Wechat Account